PLANT DIVERSITY AND ETHNOBOTANY OF MEDICINAL AND WILD EDIBLE PLANTS IN AMARO DISTRICT OF SOUTHERN NATIONS, NATIONALITIES AND PEOPLES REGION AND GELANA DISTRICT OF OROMIA REGION, SOUTHERN ETHIOPIA

Getu Alemayehu Legesse

Addis Ababa University

Addis Ababa, Ethiopia

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Getu Alemayehu Legesse

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This is to certify that the thesis prepared by Getu Alemayehu Legesse, entitled: *Plant Diversity and Ethnobotanicay of Medicinal and Wild Edible Plants in Amaro District of Southern Nations, Nationalities and Peoples Region and Gelana District of Oromia Region, Southern Ethiopia* and submitted in fulfillment of the requirements for the Degree of Doctor of Philosophy (Biology: Botanical Science) complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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Name	Signature	Date
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2. Prof. Sileshi Nemomissa (Examiner)	_____	_____
3. Prof. Zemede Asfaw (Advisor)	_____	_____
4. Dr. Ermias Lulekal (Advisor)	_____	_____
5. Prof. Ensermu Kelbessa (Advisor)	_____	_____
_____		_____

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Abstract

Plant Diversity and Ethnobotany of Medicinal and Wild Edible Plants of Amaro District of Southern Nations, Nationalities and Peoples Region and Gelana District of Oromia Region, Southern Ethiopia

Getu Alemayehu Legesse, PhD Dissertation
Addis Ababa University, 2017

This research was conducted in Amaro and Gelana districts in southern Ethiopia to study the plant diversity and traditional medicinal and wild edible plants. The study was carried out between August 2013 and April 2016. Vegetation data were collected from 140 relevés using a square plot of 400 m^2 (20 m x 20 m) for trees; 5 m x 5 m and 1 m x 1 m subplots for shrubs and herbs respectively within each relevés. Ethnobotanical data were collected by interviewing 380 informants (200 males and 180 females) aged 18-75 years where 120 were key informants. Ethnobotanical knowledge of traditional plants used as human and veterinary medicine and food was obtained using semi-structured interview administered through face-to-face interaction with the informants. Agglomerative hierarchical classification in R package version R 3.3.2 software was used to identify plant communities and synoptic values were used for identification of the dominant species for naming each plant community. Shannon-Weiner diversity index was applied to quantify species diversity and richness. Quantitative analytical tools for ethnobotanical methods including simple preference ranking, pair-wise ranking, direct matrix ranking, informant consensus factor (ICF) and fidelity level (FL) were employed. Ethnobotanical knowledge held by different informant categories was compared. One hundred eighty species belonging to 121 genera and 58 families were documented of which 140 and 107 were from Amaro and Gelana districts respectively. Out of the whole plant species, eight were found Ethiopian endemic. The Asteraceae and Fabaceae stood first contributing 15 (8.33%) species each followed by the Lamiaceae (12, 6.66%). Five plant community types were identified in each District. A total of 147 plant species were recorded that are used to treat 66 human and 28 livestock ailments in the two districts. Of the total species, 90 (61.22%) of them were obtained from natural habitats. The families best represented were Fabaceae and Lamiaceae 12 (8.16%) species each followed by Asteraceae (11, 7.48% *species). Of the total number of medicinal plants, 112 (76.19%) species were reported to be used to treat human ailments and 42 (28.57%) for livestock ailments. Herbs were the most widely used plants, accounting for 63 (42.85%) species. Common diseases in the study area were wound for which 19 (7.88%) species were reported and 15 (6.22%) species for stomachache. The local people of Amaro and Gelana districts use Myrica salicifolia to treat the highest number (10, 4.14%) of ailments followed by Phytolacca dodecandera and Solanum incanum 7 (2.90%) each. The most frequently used plant parts were leaves (93, 38.58%) followed by roots (41, 17.01%). The most widely used method of preparation of traditional herbal medicines was decoction (58, 24.06%). The majority (216, 89.62%) of remedies were prepared from freshly collected plant parts. The common route of administration was oral (133, 53.18%) followed by dermal (77, 31.95%). The most cited medicinal plants were Acmella caulirhiza 51 (3.58%) and Agarista salicifolia 44 (3.09%). Highest ICF values were recorded in Amaro District for rabies; and the highest FL values of human medicinal plants were recorded for Echinops kebericho (100%) against breast cancer. In Gelana District, the ailments bleeding and hypertension scored the highest ICF value (0.96) and the highest FL values were obtained for Rumex abyssinicus (100%) against Ascariasis. Myrica salicifolia was the most preferred species to treat stomachache of human beings while Hagenia abyssinica was the most utilized medicinal plant species in Amaro District. Most of the medicinal plants were not widely traded for medicinal purposes, but mostly for other non-medicinal uses. The highest average number of medicinal plants was cited by men (77, 52.38%), by older people (84, 57.14%) and by illiterate people (76, 51.70%). The highest Shannon-Wiener diversity range values of medicinal species were 3.90 and 3.67 for community III and IV in Nekora and Dance forest, respectively. The two districts furnished 80 plant species consumed wild by the community and the plant species belong to 52 genera and 32 families. The Fabaceae with ten (12.5%) and Tiliaceae with five (6.25%) species were the most represented families with high number of WEPs. Most of the WEPS were shrubs represented with 34 (42.50%) species. Fruit was found to be the most edible plant part, accounting for 54 (67.50%) species, and mostly taken as raw. Of the reported medicinal and wild edible plant species, 63 species were reported for more than two uses. The group discussions and pair wise ranking results indicated that agricultural expansion was the principal factor threatening medicinal and WEPs in the study area. The forests, medicinal and wild edible plants in Amaro and Gelana districts are under pressure due mainly to ever-increasing anthropogenic influences. There is an urgent need for establishment of community based forest priority area (park) in the districts for conservation of forest in general and medicinal and wild edible plants in particular.*

Key words: Amaro, ethnobotany, floristic composition, fidelity level, Gelana, informant consensus, wild edible plants

Dedication

This thesis is dedicated to the people of Amaro and Gelana districts (Southern Ethiopia) who maintained their rich ethnobotanical knowledge associated with the medicinal and wild edible plants for generations.

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LIST OF ACRONYMS

AWHO	Amaro Wereda Health Office
AWARDO	Amaro Wereda Agriculture and Rural Development Office
CSA	Central Statistical Agency
DAs	Development Agents
DMPs	Department of Medicinal Plants
FL	Fidelity Level
GWHO	Gelana Wereda Health Office
GPS	Geographical Positioning System
GWARDO	Gelana Wereda Agriculture and Rural Development Office
IBC	Institute of Biodiversity Conservation
ICF	Informant Consensus Factor
IK	Indigenous Knowledge
MOA	Ministry of Agriculture
MPs	Medicinal Plants
NFPAs	National Forest Priority Areas
NGOs	Nongovernmental Organizations
SNNPRS	Southern Nations, Nationalities and Peoples Regional State
UNESCO	United Nations Educational, Scientific and Cultural Organization
WEPs	Wild Edible Plants
WHO	World Health Organization

CHAPTER ONE

1. INTRODUCTION

1.1. Background

Ethiopia is an important regional center for biological diversity due to its wide ranges of altitude, its great geographical diversity with high and rugged mountains, flat-topped plateaus and deep gorges, incised river valleys and rolling plains (Ensermu Kelbessa and Sebsebe Demissew, 2014). These factors strongly influence Ethiopia's extraordinary range of terrestrial and aquatic ecosystems, and have contributed to a high diversity and rate of endemism (Tesfaye Awas *et al.,* 2003). The existence of such diverse ecosystems has endowed Ethiopia with diverse vegetation types. Ethiopia being the land where the first humans probably evolved, its vegetation has been exposed to various human induced impacts that may have diminished its diversity for a longer period.

The biological history and biodiversity dynamics of the country has also contributed to the current diversity of the country (Mulugeta Kebede *et al*., 2007; Tigist Wondimu *et al*., 2014; Abel Gizaw *et al.,* 2016). Such millennia old plant/community evolution and major geological changes are the major driving forces that may have shaped the current plant diversity of Ethiopia as a whole. Ethiopia is the fifth major country in tropical Africa in terms of the diversity of flora (Ensermu Kelbessa and Sebsebe Demissew, 2014)**.** In addition**,** it is known worldwide as one of the global centers of biodiversity where much of this biodiversity is associated with forest resource (Yonas Yemshaw, 2004). The Ethiopian flora contains approximately 6000 species of higher plants of which about 10% are endemic (Ensermu Kelbessa and Sebsebe Demissew, 2014). Forest and other woody vegetation resources of Ethiopia were estimated to cover greater than 11.7 percent of the land, of woodlands cover about 4.5 percent of the total land of Ethiopia (EPA, 1997).

The livelihoods of the rural communities of Ethiopia, such as economic development, food security and basic necessities, depend on nature (Alemneh Dejene, 2003; Demel Teketay, 2001). The existing rural livelihood–natural resources nexus in the country has resulted in a dramatic decrease in the forest cover over relatively short decades. Although historical sources claim that the forest cover of Ethiopia to be 35%, a recent national forest cover estimate is about 15.5 percent based on the adopted forest definition REDD+ Secretariat (MEFCC) (2015). The FAO (2010) estimates that 141,000 ha of forest have been lost annually between 1990 and 2010 and that the average annual

deforestation rate, based on forest cover change from 2005-2010, amounts to 1.11% of total forest cover. Although such a high magnitude of changes in the forest cover leads to having a limited biodiversity and changes habitat quality and size, loss of ethnobotanical knowledge is one of the manifestations of deforestation. Therefore, it is timely and urgent to record the indigenous knowledge on the vegetation, the plants, and their traditional uses and management in different corners of the country. This ethnobotanical study is, therefore, very crucial to reveal the medicinal and wild edible plant resource potential of forests.

Plant-based traditional medicine plays a key role in the advancement of modern scientific research and serves as a starting point for the development of novelties in drug discovery (Wright, 2005). Humans have used plants for medicine and managed them for millennia. In the course of this time, they have acquired generations old ethnobotanical knowledge innovations through trial and errors and a series of observations (Cunningham, 1996). In the Ethiopian context, such trend in the extinction of this valuable knowledge was previously reported by Dawit Abebe and Ahadu Ayehu, (1993). It is with this intention that the current ethnobotanical study was carried out.

Ethnobotanical studies of plants of Ethiopia have flourished over a short time of during the last decade whereby various studies have reported the medicinal uses and food values from parts of the country. Some examples of these studies include Dawit Abebe (1986), Dawit Abebe and Ahadu Ayehu (1993), Asfaw Debela *et al.* (1999), Teferi Gedif and Hahn (2003), Debela Hunde *et al.* (2004), Fisseha Mesfin *et al.* (2009) and Ermias Lulekal *et al.* (2013). Although there are immense effort to expand modern medicine across the different parts of Ethiopia, traditional medicine is the primary health care system for almost 80% of the populations of the country with 95% of these medicines derived from plants (Dawit Abebe, 2001). Yet, more basic scientific studies are required given the expanse of the country and its cultural diversity.

In addition, wild edible plants play a critical role in ensuring food and livelihood security for countless families and communities around the world (Ermias Lulekal *et al.,* 2011). In many parts of developing countries like Ethiopia, hundreds of wild edible plants are known to be sporadically consumed by rural communities (Getachew Addis *et al.,* 2013). Wild edible plants of Ethiopia used as supplementary, seasonal or survival food sources in many cultural groups, and hence plays a role in combating food insecurity (Ermias Lulekal *et al.,* 2011). Traditional knowledge of wild plants in Ethiopia also in danger of being lost, as habits, value systems and the natural environmental change.

There is a widespread decline in knowledge about wild food plants as well as about medicinal plants, especially among young people. Cunningham (1996) pointed out that saving plant species and documenting and preserving indigenous knowledge are both fundamental urgent issues. For this reason, this study was initiated to record and document ethnobotanical knowledge of medicinal and wild edible plants of Amaro and Gelana districts and implications on conservation and management, sustainable use and improvement for their better utilization.

1.2. Statement of the problem

Amaro and Gelana districts are located in Southern Ethiopia and traditional medicine is the major part of their primary healthcare system. In these areas, people treat human and livestock ailments by using their generation long knowledge of medicinal uses of plants. Their knowledge of plants of their area is also directly related to wild plants of nutritional values. As in other parts of Ethiopia, the human pressure on natural resources (AWARDO, 2013; GWARDO, 2013) is driving deforestation and forest degradation the resulting in potential local loss of plants of high traditional and potential values and loss of associated knowledge in these districts. The direct relationships of loss of forest and the wellbeing of communities have been reported before (e.g. Cunningham 1990 cited in Frankel *et al.,* 1995; Alemayehu Wassie, 2008). A study which aims at documenting the uses of plants of these areas in traditional medical practices and as a supplemental source of food is required to understand the threats to the survival of the plants with their means of protection and preservation of the knowledge. Furthermore, a study of the plant communities of the forests of the study areas will result in understanding the biological values in harboring plants of high traditional medicinal and food values. The results of this study has also a potential to (1) trigger further modern scientific and socio economic research and serves as a precursor for development of plant-based drugs and food, and (2) ensure the conservation of the last pockets of remnant natural forests. Therefore, this study aimed at finding out about species richness and diversity among different plant communities along with the ethnobotanical knowledge associated with the medicinal and wild edible plants used by the people in Amaro and Gelana districts.

1.3. Research questions, hypotheses and objectives

1.3.1. Research questions

The following major research questions were considered in this study:

1. What are the floristic composition, community type and diversity of plant species in the study area?
2. What are the medicinal plant species and higher taxa used by indigenous people living in Amaro and Gelana districts to treat various human and livestock ailments?
3. How do community members use traditional medicinal plants to treat ailments? How are herbal remedies prepared and administered?
3. Which of the medicinal plants used in the area are best-agreed by community members on their efficacy to treat particular human or livestock ailments?
4. What are the wild edible plants used by people in Amaro and Gelana districts?
5. Are there medicinal and edible plant species, which are traded in market places?
6. Where do the medicinal and wild edible plants grow in the study area? (Are they found in the wild, in home gardens? Are traditional medicinal and edible plants harvested for uses other than their medicinal and food value?
7. How is traditional botanical knowledge distributed and transferred among different classes of community members and social groups in the area? What major socioeconomic and cultural factors affect this traditional knowledge in the study area?
8. What are the main threatening factors to medicinal and wild edible plants and associated indigenous knowledge in the area? What are the conservation practices of the community?

1.3.2. Hypotheses to be tested

1. The natural forests of the study area have high species diversity and different plant community types and serve as reservoirs of useful plants.

2. The study area has diverse medicinal plants used for treating different health problems of humans and livestock and wild edible plants that serve as sources of food.

3. The two community members inhabiting the study area have blended ethnobotanical knowledge since they have lived in the same area and interacted for a long time.

4. Indigenous knowledge on use of medicinal and wild edible plants varies based on age, gender and educational level of community members.

5. Local ethnobotanical knowledge loss is driven by habitat loss, oral-based knowledge transfer and modernization.

6. Traditional practices and cultures have contribution to the management and conservation of medicinal and wild edible plant diversity in the study area.

1.3.3. Objectives of the study

General objective

- The general objective of this study was to find out about vascular plant species richness and diversity along with the ethnobotanical knowledge associated with the medicinal and wild edible plants used by the people in Amaro and Gelana districts.

Specific objectives

The specific objectives were:

1. To describe the floristic composition and major plant community types of the study area;
2. To analyze species richness, evenness and diversity among different plant community types of the districts;
3. To identify and document plant species those are used as medicines and as food with the associated indigenous knowledge in Amaro and Gelana districts;
4. To identify and document the plant parts used for medicine and food, the method of medicine preparation and route of administration as adopted by the local people of the study area;
5. To record the medicinal and wild edible plants sold in the local markets of the study area;
6. To determine indigenous knowledge dynamics on use of medicinal and wild edible plants by different social groups in the study area; and
7. To find out the threats and the methods used by the local indigenous people to conserve the vegetation as well as the medicinal and wild edible plants.

CHAPTER TWO

2. LITERATURE REVIEW

2.1. Vegetation of Ethiopia

Vegetation is an assemblage of plants growing together in a particular area, or in other words, the collective plant cover of an area (Jennings *et al*., 2003). Vegetation types may be characterized either by their component species or by the combination of structural and functional attributes that typify them. Vegetation structure is the organization in space of the individuals that form a community and by extension a vegetation type or plant association (Muller-Dombois and Ellenberg, 1974). It is the spatial pattern of growth forms in a plant community, especially in relation to their height, abundance or coverage within the individual layer (Jennings *et al*., 2003). Vegetation formation is influenced by a combination of many factors, such as climate, geology, edaphic factors and biotic factors, including interference by humans during ecological succession. Vegetation is dynamic, that is, it is constantly changing. Reasons for the changes can be ecological or evolutionary processes, climatic change, human land use, and interaction between abiotic and biotic factors (Skarpe, 1991).

Climatic heterogeneity is a general characteristic of Ethiopia and these climatic elements include precipitation, temperature, humidity, sunshine and wind, which are affected by geographic location and altitude. Temperature and rainfall are the most important climatic factors for agricultural production in Ethiopia. Altitude is a factor that determines the distribution of climatic factors and land suitability; the influence the crops to be grown, rate of crop growth, natural vegetation types and their species diversity (Alemayehu Mengistu, 2003).

Ethiopia is endowed with wide range of vegetations formations or types ranging from afro-alpine to desert vegetation. Different authors have studied and described the vegetation types of the country at different times. Among these scholars have attempted to classify the vegetation of Ethiopia are Ensermu Kelbessa *et al*. (1992); Zerihun Woldu (1999); Friis and Sebsebe Demissew (2001). There are twelve vegetation types in Ethiopia (Friis *et al.,* 2010). These major vegetation types include; Desert and Semi desert scrubland Forest; Acacia - Commiphora woodland and bushland; Wooded grassland of the Western Gambela region; Combretum - Terminalia woodland and wooded grassland; Dry Evergreen Afromontane forest and grassland complex; Moist

Evergreen Afromontane forest and bushland; Transitional rain forest; Ericaceous belt; Afro-alpine belt; Riverine vegetation; Fresh - water lakes; and Salt Lakes vegetation (Friis *et al.,* 2010). Out of these vegetation types, the present study area was carried out in the Moist Evergreen Afromontane forests.

Moist Evergreen Afromontane forests vegetation type is the most diverse vegetation type in composition, structure and habitat types (NBSAP, 2005); consequently, it is rich in biodiversity with a number of endemic species. The characteristic plant species include the largest and commercially most important tree species; *Podocarpus falcatus, Celtis africana, Millettia ferruginea, Croton macrostachyus, Albizia gummifera, Ficus vasta, Syzygium guineense* subsp. *afromontanum* and *Olea europaea subsp. cuspidata.* The shrubs include *Ehretia cymosa, Calpurnia aurea* and *Carissa spinarum*.

Other plant species such as *Cyperus assimilis, Cyphostemma niveum, Echinops amplexicaulis, Indigofera spicata, Pentas schimperiana, Priva adharens, Stephania abyssinica, Tetradenia riparia, Xanthium spinocum, Ajuga integrifolia, Bidens pilosa, Epilobium hirsutum, Helichrysum splendidum, Ampelocissus bombycina, Tragia cinerea* and *Zehneria scabra* predominate in the herb layer and the common grass species include *Cynodon dactylon*. This pattern of distribution and vertical stratification change is attributed to varied climatic conditions, soil types, latitude and topography of the area, which in turn influence the distribution and types of plant and animals in the forest (Mueller-Dombois and Ellenberg, 1974).

2.2. Importance of forest and forest resources

The services provided by forests cover a wide range of ecological, economical, social and cultural considerations and processes. There are a number of to broad range of services that forests provide in addition to their values of basic goods. According to Daily (1997), the major services provided by forests includes: regulation of water regimes, modulating climate, maintenance of soil quality, carbon sequestration, maintenance of biodiversity and as a habitats for other species, and cultural services. Particularly a forest is much more than a storehouse for man's material needs (Farb, 1963). Forests play crucial role in soil and water conservation, watershed protection, nutrient recycling, nitrogen fixation, wildlife habitat, gene conservation, regulating the concentration of gases in the air (making it 'breathable'), and sequestering carbon dioxide from the atmosphere (Demel Teketay, 2001).

Farb (1963) indicated that the vegetable products and game meats from forests have served human beings for centuries. Various sources (Abbiw, 1990; Balick and Cox, 1996; Cotton 1996; Aumeeruddy-Thomas and Shengji. 2003; Bussmann *et al.,* 2006) have also indicated the importance of forests as a source of non-timber plant products (NTPPs) for human beings survival and economic developments. Identifying resource use as conservation strategy for forests has led to a revived interest in non-timber forest products (FAO, 1991).

Forests and woodlands of Ethiopia act as sources of raw materials for wood-based energy, home construction, wood-based industries, farm implements, fuelwood and employment opportunities (Legesse Negash**,** 1995; Getachew Desalegn *et al*., 2003; Getachew Desalegn and Wubalem Tadesse, 2004). Non-timber forest products includes coffee, spices, honey, medicinal products, animal fodder, wild edible plants (Girma Deffar, 1998; Demel Teketay, 2001; Getachew Desalegn and Wubalem Tadesse, 2004). Medicine is one of the non-timber plant products and traditional medicine has an important place in the health care of the Ethiopian population; where an estimated 80% of the people in Ethiopia rely on some form of traditional medicine for their primary health care needs (Dawit Abebe and Ahadu Ayehu, 1993; Girma Deffar, 1998).

Since time immemorial, human beings have been collecting and consuming edible plants that are available from the wild (WCMC, 1992) and this culture of gathering wild edible plants has still continued in many parts of the world today (ASC, 2003). It is estimated that, about 75,000 to 80,000 species are believed to be edible throughout the world (WCMC, 1992). Zemede Asfaw and Mesfin Tadesse (2001) noted that about 5% of the total plants in the world are used for human consumption. It is also believed that only about 20 to 30 crops are providing the world's nutritional need and most of plants with significant nutritional values exist in the wild or in underutilized state (Eckholm, 1978). The varied ecological and climatic conditions of Ethiopia are home to some of the most diverse flora and fauna in Africa. Ethiopia has a large honey production potential especially from forests and woodlands diverse plant species that provide surplus nectar and pollen to foraging bees (Girma Deffar, 1998).

2.3. Plant biodiversity

2.3.1. Concept of plant biodiversity

Biodiversity refers to the many different forms of life that exist within a given ecosystem, biome. The term biodiversity reflects the number, variety and variability of living organisms. It includes

diversity within species (genetic diversity), between species (species diversity), and between ecosystems (ecosystem diversity). Diversity also incorporates human cultural diversity, which can be affected by the same drivers as biodiversity, and which has impacts on the diversity of genes, species and ecosystems (Whittaker, 1975). The concept also covers how this diversity changes from one location to another over time and space. Indicators such as the number of species in a given area can help to determine certain aspects of biodiversity.

Plant diversity is a subset of biodiversity that refers to the number of plants within a given area. Plant diversity is the variability among living plants from all sources, including, inter alia, terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part of this includes diversity within plant species, between species and between ecosystems. Plant diversity is one of the major groups of biological diversity. Plant diversity can be affected by different biotic and abiotic factors. The plant communities and their component species are exposed to changes in the environmental, physical, biological, technological, economic or social factors (Frankel *et al.,* 1995). Globally, patterns of plant species diversity are influenced by latitudinal, altitudinal and soil gradients (Whittaker, 1975). Locally, in mountainous ecosystems the high rate of change in altitude, slope and moisture gradients, temperature, rainfall and drainage, the diversity of plants may also change within a short distance (Lovett, 1990). So, the fate of plant communities in a given area can be as aresult of these and other different factors. In this case, diversity and distribution patterns of species must be studied to clarify the plant diversity in a certain area and to determine major factors influencing this diversity.

Ethiopia is one of the tropical countries with varied ecological and climatic conditions making the country home to diverse flora and fauna. Among the different types of agro-ecological zones in the country, to dry land type, which has arid and semi-arid environmental conditions represents about 620,000 km^2 (Mulgeta Limenih and Demel Teketay, 2004). This huge land mass is dominated by dry deciduous woodland and bushland and its area is estimated to be 25 million hectares (Abeje Eshete, 2002). The representative genera inhabiting these dry deciduous woodland and wooded grassland ecosystems of the country are *Boswellia, Commiphora, Acacia, Balanites*, other different species of shrubs, grasses and other plant forms (Oba *et al.*, 2000; Abeje Eshete, 2002).

Traditional botanical knowledge of indigenous communities relating to the uses and managements of medicinal plants resources is extensive (Cotton, 1996). For most part of Ethiopia, the rich biological

diversity and indigenous knowledge of this diversity is not adequately documented although there have been few attempts (Amare Getahun, 1974). The need to conserve the biological diversity and its associated indigenous knowledge has been emphasized in contemporary studies of ethnobotany (Rossato, 1999).

In order to understand the ecological relationship between flora and the surrounding environment, the first step is determining the array of species that occupy a certain area. Only then can one begin to observe the complex interactions between plants on an individual, communal, and environmental scale. Through this, one can begin to distinguish the key players that shape a community. In order to do this, it is important to document the various plant species growing in that region, and create a database of the observed biodiversity. However, plant community interactions are not only limited to the plants, but also extends to the natural world around them, in addition to human influences. A joint study of both biodiversity and ethnobotany can be performed by investigating plant use by locals through collecting samples and carrying out on plant uses interviews.

2.3.2. Species diversity, evenness and similarity

Floristic description of community involves the analysis of species diversity, evenness and similarity (Whittaker, 1975). Species diversity is one of the most important indices used for evaluating the sustainability of forest communities. Diversity and evenness of species in a given vegetation community is used to interpret the relative variation among and within the community and help to explain the underlying reasons for such a difference (Kent and Coker, 1992). Species diversity is described based on two concepts (factors), the total number of species in the community (species richness) and the relative abundance of species (species evenness) within the sample or community. Richness is a measure of the number of different species in a given site and can be expressed in a mathematical index to compare diversity between sites. Evenness is a measure of abundance of the different species that make up the richness of the area Whittaker (1975), on the other hand expressed this concept as equitability. Species diversity is measured by recording the number of species and their relative abundance. These two components of species diversity may be examined separately or combined into some forms of indices. A commonly applied index for measuring the species diversity is the Shannon diversity index (Kent and Coker, 1992). Normally, Shannon diversity index varies between 1.5 and 3.5 and rarely exceeds 4.5 **(**Magurran, 1988; Kent and Coker, 1992).

2.4. Importance and trends in ethnobotany

Ethnobotany is a distinct branch of natural science that combines various aspects such as anthropology, archaeology, botany, ecology, systematics, religious studies, forestry, agroforestry, economics and medicine, cultural and several other disciplines. Ethnobotany is defined simply as "the study of the relationships between plants and people (Balick and Cox, 1996). Martin (1995) conceptualized ethnobotany as the study of how local people classify, manage and use plants available in their surroundings. Ethnobotany helps us in identifying conservation issues such as cases where a rate of harvest exceeds the rates of re-growth. There is an urgent need of conserving the medicinal and wild food plants that are over harvested so that in future the coming generations could benefit from the precious plants that are a real gift of nature for the humankind (Qureshi *et al.,* 2009). It is a collaborative venture between people in local communities and various scientists and specialists. In modern times, ethnobotanical knowledge is disappearing very fast. Westernization, breakdown of traditional cultures and even the extinction of complete tribal groups are responsible. One chief goal of such a study is to ensure that local natural history becomes a living tradition in communities where it has been transmitted orally for many years. The results of this work can later be applied to biodiversity conservation and community development (Martin, 1995).

Ethnobotany is a key subject for conservation and sustainable development. Capacity building on Applied Ethnobotany is urgently needed in developing countries because of the intimate links between rural people and local plants. It should take in to account that ethnobotanical studies are useful, for not only documenting, analyzing and disseminating indigenous knowledge of local people but also indicate the interaction between biodiversity and human society, including how biodiversity is valued in different societies and how it is influenced by human activities (Martin, 1995).

Peoples of all cultures have always depended on plants for their primary needs (food, shelter, medicines, etc.), and have indigenously learned diverse applications of plants (Pharmacotherapy Group, 2009). The investigation of plants and their uses is one of the most primary human concerns and has been practiced by all cultures for tens, if not hundreds, of thousands of years. Athough it was not called 'Ethnobotany' then, Ethnobotany is taken as the scientific study of plant lore and agricultural customs of a people, for example ethnobotany plays a crucial role in the study of traditional medicine (Pei, 2005). Given their extensive knowledge of medicinal plants, indigenous peoples remain the ultimate resource for retrieving this information for the purpose of application,

particularly in modern medicine (Pharmacotherapy Group, 2009). Therefore, ethnobotany is a rapidly growing science that attracts people with widely varying academic background and interests.

2.5. Contribution of ethnobotany to the conservation of plant diversity in Ethiopia

The discipline of ethnobotany can be a novel form of science that can create a partnership between indigenous peoples and researchers aiming for the conservation of biodiversity (Laird, 2002). It can do so by integrating indigenous culture into sustainable conservation strategies (Turner, 2000). Ethnobotany focuses on documenting, analyzing and using of indigenous knowledge, beliefs and practices related to plant resources (Martin 1995; Balick and Cox, 1996; Zemede Asfaw, 1997; Aumeeruddy-Thomas and Shengji, 2003).

Ethnomedicine, that encompasses indigenous knowledge, besides studying the actual medicinal values of plants, plays a great role for the conservation of biodiversity. Studies conducted in Ethiopia have found out some cultural believes and traditional practices are so vital in contributing to the conservation of medicinal plants in particular and biodiversity as a whole. For example, Etana Tolosa (2007) listed out various local beliefs and cultural traditions used for the conservation of medicinal plants in Gimbi Wereda (Western Wellega). Fisseha Mesfin *et al.* (2009) also documented cultural and spiritual beliefs used for the conservation of medicinal plants in Wonago Wereda (SNNPR). Alemayehu Wassie (2008) also noted the role of Ethiopian Orthodox Church (EOC), in northern part of Ethiopia, for the conservation of biodiversity. Thus, if ethnobotany is strengthened and if ethnobotanists work together with the stakeholders, including the local communities, governments, educators, NGOs, etc., it can address future environmental degradations and accelerating loss of cultural knowledge and language (Hamilton *et al.,* 2003).

2.6. Useful plants and plant use categories

Humans derive food, medicines and a number of ecosystem services such as air purification, origin and recharge of water bodies, nitrogen fixation, cycling of nutrients as well as many other products from plant biodiversity (Khanal, 2006). Tigist Wondimu *et al.* (2006) in similar way explained that, plants serve as sources of drinking water, which is part of food. However, the perception and relative importance of useful plants are related to cultural factors such as human behavior, social and economic constraints, besides several other factors (Pelto *et al.* 1989 cited in Toledo *et al.,* 2007). In addition, patterns of plant use by human communities may depend on environmental constraints. For

example, some patterns can be related to local species richness, or to the regional abundance of some useful plants (Toledo *et al.,* 2007). The use of plants and plant products for different purposes such as food, wood, medicine, fiber, oil, fodder, aroma, ornamental and other miscellaneous uses can be traced as far back as the beginning of human civilization (Khanal, 2006). Nevertheless, in this study overall focus was given to the useful plant sources that provided mainly medicine and wild foods.

2.6.1. Traditional medicinal plants

2.6.1.1. Traditional medicine in Ethiopia

Traditional medicine is a complex medical system that is based on a community's culture, religion, beliefs, and natural environment. It is the sum total of the knowledge, skills and practices based on the theories, beliefs and experiences indigenous to different cultures, whether explicable or not, used in the maintenance of health, as well as in the prevention, diagnosis, improvement or treatment of physical and mental illnesses. The vast majority of the rural populations of Ethiopia depend on Traditional medicine and its practitioners (Messeret Shiferaw, 1996). Many species of Ethiopian medicinal plants have a long history of use as remedies. As in other developing country, plants are thus the major sources of medicine used by the majority of the population in Ethiopia. Dawit Abebe and Ahadu Ayehu (1993) reported that 80% of the Ethiopian population depends on traditional medicine for their health care.

The indigenous knowledge on the use of many medicinal plants is however, undocumented and thus an expensive effort will be required to document and utilize this knowledge. The majority of traditional medicines used in developing countries have not been evaluated for quality, safety, and efficacy to the same standards of those main stream medicines in developed countries. Nevertheless, there are some remarkable claims made for their effectiveness especially some traditional medicines that are used to treat burns (Sebsebe Demissew and Ermias Dagne, 2001). Indeed, there is growing recognition that revitalization and promotion of traditional health practices alongside modern health services is the most promising means for ensuring affordable and sustainable healthcare for poor communities throughout Africa (Akerele, 1987).

2.6.1.2. Contributions of traditional herbal medicines for drug development

WHO estimate that 70-80% of people in developing countries including Africa depend on traditional medicines for their health care (Cunningham, 1993). This is not only because of poverty, when people cannot afford to buy expensive modern drugs, but traditional systems are also more culturally

acceptable, and meet the psychological needs in away modern medicine does not (Brown, 1994). The integration of modern health system and traditional medicine will provide a better public health service. Evidently, traditional knowledge of medicinal plants is important in development of new modern drugs. Currently many drugs are from plant resources (e.g. aspirin from *Ulmaria* (Rosaceae), quinine from *Cinochona pubescens* (Rubiaceae), morphine from *Papaver somniferum* (Papaveraceae) and ephedrine from (*Ephedra sinica*) prescribed in the North America and Europe.

Some photochemical studies have demonstrated that there is a better probability of encountering active compounds from plants when an ethnobotanical approach is used rather than a random survey (Balick and Cox, 1996). Preliminary test of medicinal plants form central America in which in vitro anti-HIV screen was detected as being active 25% of these plants species were those classified as "powerful plants" by herbal healers, on the other hand only 6% randomly collected species were active (Balick and Cox, 1996). Another useful method is a photometric survey where researchers choice close relatives of plants known to produce useful compounds (Balick and Cox, 1996). This approach might increasing the probability of encountering active compounds but unlike ethnobotanical information, little is known about their efficacy and safety, as they are not practical tested time and again through years. According to Balick and Cox (1996), the history of drug discovery shows that the ethnobotanical approach is the most productive of the plant survey methods for discoveryof novel medicinal products.

2.6.2. Wild food plant resources

Millions of people in many developing countries do not have enough food to meet their daily requirements and a further more people are deficient in one or more micronutrients. Thus, in most cases rural communities depend on wild resources including wild edible plants to meet their food needs in periods of food crisis. Indigenous people are endowed with knowledge of seasonal availability of WEPs and of these plants to climate change adaptations. The available information on the seasonal availability and their contribution to climate change adaptation was poorly documented in Ethiopia.

Over 70% of the wild edible plants were consumed during times of food scarcity and starvation from where the stored cultivated food crops are declining progressively (Tilahun Teklehaymanot and Mirutse Giday, 2010). On the other hand, Getachew Addis *et al*. (2005) stated that wild plants in Ethiopia are used as source of food both at times of plenty and of food shortage. Despite the fact that

agricultural societies primarily rely on crop plants, the tradition of eating wild plants has not completely disappeared, their nutritional role and health benefits being reported in many surveys worldwide (Pardo-de-Santayana *et al*., 2007)**.** Thus, wild edible plants still play an important role in human nutrition especially in the time of hunger (Khanal, 2006).

Wild food plants with high nutritional content such as protein, vitamin B2, and vitamin C, are used as alternatives to conventional vegetables in the human diet **(**Fentahun Mengistu and Herbert, 2008). According to many sources, the amount of vitamins, minerals and other nutrients in food is on the average greater in foods than in domesticated foods (Hinnawi, 2010)**.** Research reports that some of these foods, as part of an overall healthful diet, have the potential to delay the onset of many age-related diseases. Ethiopia possesses one of the richest flora in Africa. Much of this floristic wealth is reflected in the fact that it is one of the Vavilov's centers of crop origin and/or diversity for many domesticated plants and their wild food plants (Bell, 1995 cited in Guinand and Dechassa Lemessa, 2000). However, little has been systematically documented on wild food plants (Giday Yirga, 2010). Information on wild edible plants of Ethiopia is scattered in botanical monographs, glossaries and informal notes as well as in the rich oral tradition of different communities (Zemede Asfaw and Mesfin Tadesse, 2001). In addition, Kebu Balemie and Fassil Kebebew (2006) identified 66 wild edible plant species classified among 54 genera and 34 families. Ermias Lulekal *et al.* (2011) compiled 413 wild edible plants belonging to 224 genera and 77 families.

2.7. Threats to Ethiopian vegetation

The Ethiopia vegetation formations, particularly the forests resources are under severe pressure because of growing need for farmlands and grazing lands. There is fuel wood gap in the country; which leads to depletion of the standing stock and, hence, further degradation of the remaining forest stands (EPA, 1997). The loss of forests resource is severe in the Ethiopian highlands where most of the vast mountain massifs in the heart of the country lie above 1500 m elevation (Deriba Geleti, 2006).

These highlands cover about 44% of land area;and accommodate 88% of the total population because of their agricultural potential and low prevalence of diseases. They also contain about 95% cultivated land and more than 67% of the livestock (EFAP, 1994). The location of these high forests, the dense human population and their unique ecology make them endangered and more susceptible to strong deforestation (Shiferaw Dessie and Taye Bekele, 2002). Another threat is the conversion of

these high forest sites to coffee and tea plantations. Currently a number of investors have filed applications for forestland with the regional authorities. In the process of decision, making on these requests, in most cases, little consideration is given to ecological impacts in general and biodiversity conservation in particular.

2.8. Conservation and management of medicinal and wild food plants in Ethiopia

The bulk of plant matter used for medicinal and wild food purposes is collected from natural vegetation (Melakeselam Dagnachew, 2001). However, as time goes by, the widely occurring medicinal and wild edible plant species and the associated traditional knowledge are being eroded. In addition, the practice of using plant remedies by a community to treat different ailments has been declining from time to time mainly because of continued deforestation in the study area. This in turn has brought about local loss of important medicinal plants (Tesfaye Awas, 2004). Furthermore, the studies conducted on the traditional medicinal plants in Ethiopia are limited when compared with the multi-ethnic cultural diversity and the magnitude of the diverse flora of Ethiopia (Fisseha Mesfin *et al.,* 2009).

In addition, many wild edible species are endangered due to genetic erosion (IBC, 2005). These phenomena are more pronounced in countries like Ethiopia where high rate of human population growth is compounded by insufficient documentation and conservation of biota, that can safeguard promising plant taxa (Zemede Asfaw and Mesfin Tadesse, 2001). With the routine underestimation of wild foods, comes the danger of neglecting the provisioning ecosystems and supportive local knowledge systems that sustain these food chains (Grivetti and Ogle 2000). Getachew Addis *et al*. (2005) also stated that in spite of the role of edible wild plants in bridging periods of food shortages and providing dietary variety, very little attention has been given to the inventory and conservation of these species.

Despite their importance, WEPs in Ethiopia face serious anthropogenic and environmental threats. Many threats are similar to those that affect plant diversity as a whole. The most common threats reported were agricultural expansion, overgrazing/overstocking, deforestation and urbanization (Ensermu Kelbessa *et al.*, 1992). The reported anthropogenic pressures in the country have resulted in a loss of thousands of hectares of forest that harbor useful WEPs. This loss was also reported to limit benefits gained from the plants and loss of indigenous knowledge associated with these plants. The continuity of knowledge on the utilization of WEPs has also faced problems because of change

in the feeding culture of the people (Tilahun Teklehaymanot and Mirutse Giday, 2010). The reviewed research outputs on WEPs of the country indicate the need for conservation as well as documentation (Kebu Balemie and Fassile Kibebew, 2006; Tilahun Teklehaymanot and Mirutse Giday, 2010). Therefore, the need to carry out the current study.

CHAPTER THREE

3. MATERIALS AND METHODS

3.1. The study area

3.1.1. Location

Amaro is one of the districts in Segen Area People Zone of Southern Nations, Nationalities and Peoples Regional State (SNNPRS). The Administrative center of Amaro is Kele town found at 478 km south of Addis Ababa, the capital of Ethiopia. Geographically, the district is located between 5^0 35'- 5^0 59' N and 37^0 32'-38^0 00' E. The land district's area is estimated at 1, 597.20 square kilometers, and is bordered to the north and east by the Oromia Region (Gelana District), to the south by Burji Special District, to the east by Bule Hora and Derashe to the west (Fig. 1). The district is further divided into 36 'kebeles' (the smallest administrative unit) (Amare Tazeze, 2011; AWARDO, 2013).

Gelana is one of the districts in Borena Zone, Oromia Regional State, Ethiopia. The administrative center of Gelana is Tore found at 418 km south of Addis Ababa, the capital of Ethiopia. Gelana District is located at the northern tip of Borana Zone that extends between 6° 14' - 6° 25' N and 37° 45' - 38° 15' E. The district's total area approximately 547sq. km or 187,134 hectares, and this comprises about 2.2% of the total area of the zone. The district is boarded by South Nations, Nationalities and Peoples of Regional State (Amaro) to the south and east, Lake Abaya to the north and west and Abaya District in the North and Kochere District of Gedeo Zone to the east (Fig.1). The district is further divided into 18 'kebeles' (GWARDO, 2013).

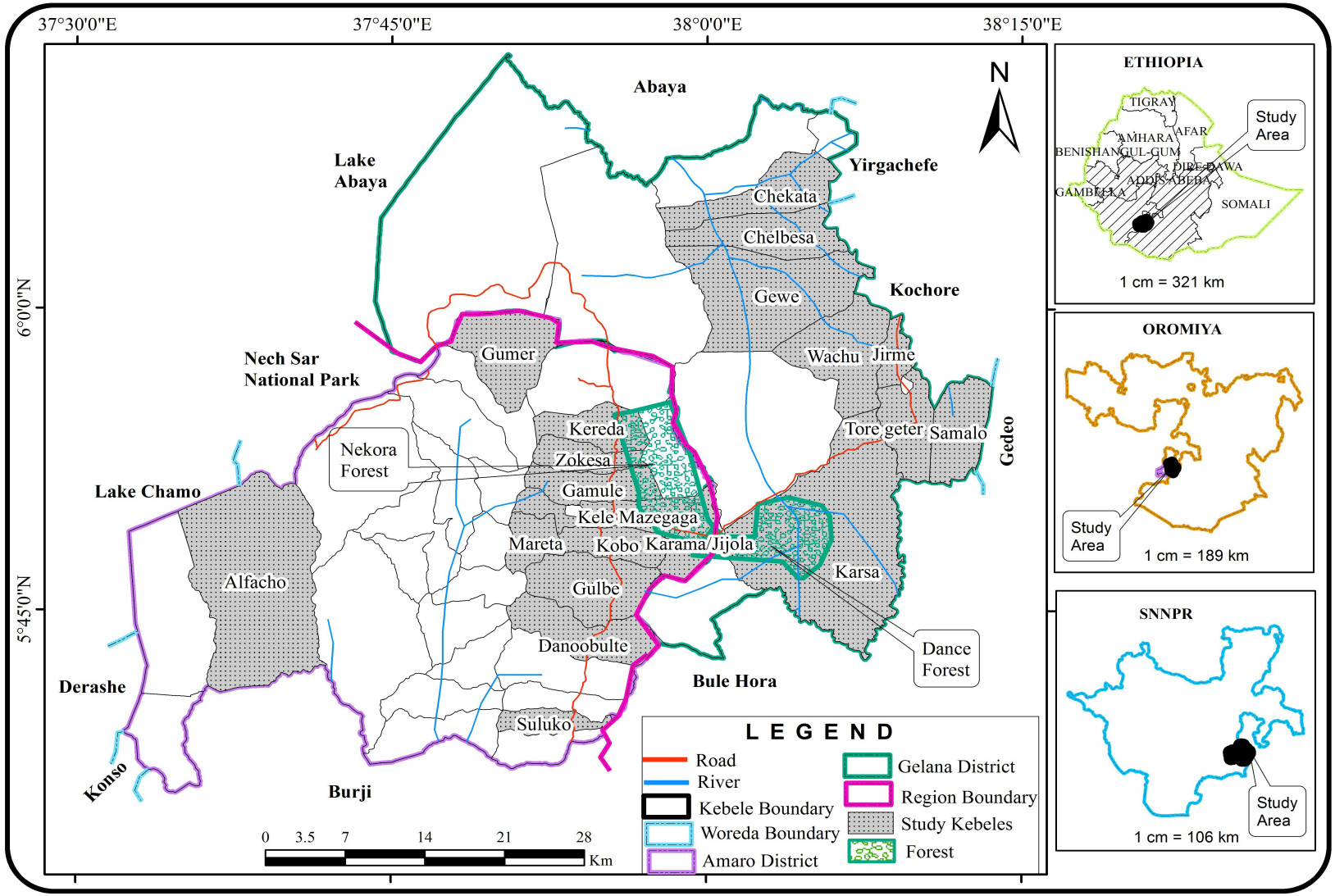

Fig. 1. Map of Ethiopia showing the study area (Data source: GIS data Ethio-GIS 2004 and CSA 2007)

3.1.2. Climate and soils

Climate data of the study area was obtained from the national meteorological service agency and showed that the highest mean annual temperature over fifteen years (between 2000-2014) was 30.9ºC recorded in February, whereas the lowest was 16.5ºC recorded in July (Fig. 2A). The highest mean annual rainfall of the study area during the last fifteen years (between 2000-2014) was 149 mm recorded in May, whereas the lowest was 15.7 mm recorded in January. The topography of the area makes the district to have different soil types including red soil, brown soil and black soil (AWARDO, 2013).

The climate data of the study area was obtained from the national meteorological service agency showed that the highest mean annual temperature over fifteen years (between 2000-2014) was 26.6ºC in February and March, whereas the lowest was 11.8ºC recorded in July (Fig. 2B). The highest mean annual rainfall of within fifteen years was 238 mm recorded in May, whereas the lowest was 26.5 mm recorded in January. Even though its proportion is not displayed in the written form, there are different soil types in the study District including red soil, brown soil and black soil (GWARDO, 2013).

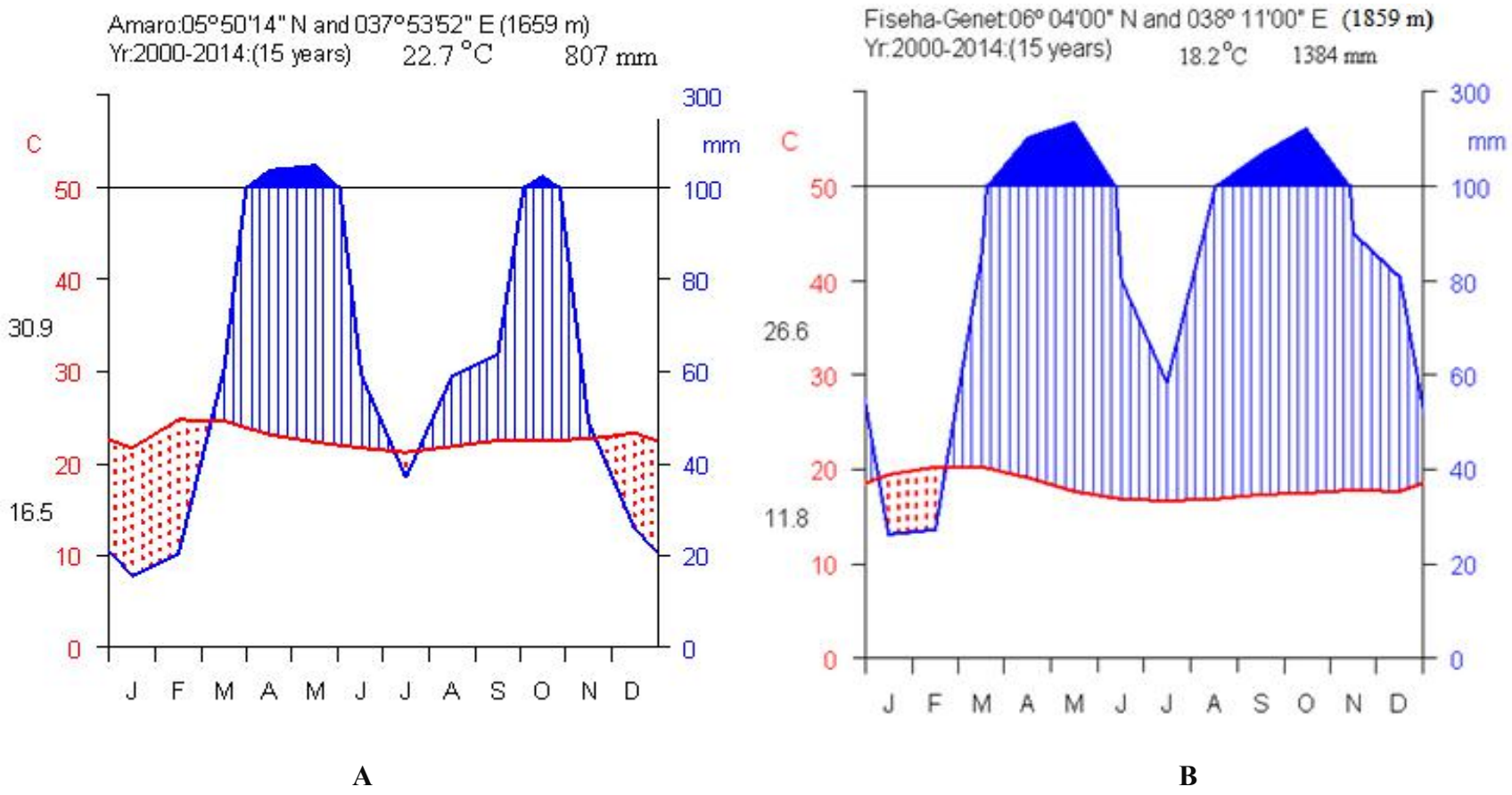

Fig. 2. Climadiagram of the study area based on climate data from 2000-2014 A) Amaro station (1659 m.a.s.l) representing Amaro District; B) Fisseha Genet station (1859 m.a.s.l) representing Gelana District (Data source: National Meteorological Service Agency)

3.1.3. Topography and agro-ecology

Amaro District is characterized by plain, mountainous and undulated terrain. The altitude ranges from 1200 to 3240 m.a.s.l. The Amaro mountain chain, Dello Mountain being the highest peak, drops southeast and gently northwest until it reaches the lowest elevation at Gelana river and Chamo Lake respectively.

The district is endowed with vast water resources including underground and surface waters by virtue of having many rivers. The Dello mountain range divides the district into two parts and serves as a main source of the rivers flowing in to different directions. Rivers that flow to the western side include Sarmale river, Gayyo river, Mole river, Dakase river, Dure river, Salle river, Barka river and many others. Rivers, which flow to the eastern side, include Asa river, Du'ano river, Magga river, Kondilcho river, Bewwaye river, Lambase river, Sero, Lakka and many others (Amare Tazeze, 2011).

Amaro District has three agro-ecological zones, namely Dega, Woina Dega and Kola. Dega (also known as ALE in local language) is agro ecological zone of high land area with cool climatic condition. Woina Dega Agro ecological zone with moderate climatic condition and locally named as GIDDA ALE. Kola Also (GADHA in local language) is agro ecological zone, which experience hot climatic condition. Dega accounts to 30%, Woina Dega to 32% and Kola to 38% of the total land area. However, it was found that most kebeles encompass both the Kolla, Dega and Woina Dega agro-ecological zones together (Amare Tazeze, 2011).

The altitudinal range of the Gelana District is between 800 to 2300 meters above sea level (GWARDO, 2013). The topography is characterized by diverse geomorphologic features distributed over the three major agro-ecological zones, BADDA (Dega) - refers to highlands of the area that is characterized by cool climatic condition. BADDA DAREE (Woina dega) - refers to the middle lands characterized by warm climatic conditions. It is the predominant agro climatic zone in the district favoring most of the agricultural production GAMOJJI (Kola) - refers to low lands of the district like Jirme which is characterized by hot climatic condition. Unpublished data from the district administration office indicates that topography of the district has mountains and hills (45.5%), flat area (34.25%) and undulating parts cover (20.25%) of the district.

3.1.4. Vegetation types

The main vegetation type of the study area is moist evergreen afromontane forest and the *Combretum terminalia* ecosystems while the low land of Amaro and Gelana districts are categorized under semi desert scrubland. Data obtained from agricultural and rural development office of the study districts and field observation confirmed that the area is with scattered vegetation dominated by *Acacia etbaica, Euphorbia abyssinica, Opuntia ficus-indica, Euclea racemosa* and *Dodonaea angustifolia.*

3.1.5. Demographics

The Koore people mainly inhabit the Amaro District. The statistical data of the district administration reveals that 95 percent of the total population is the Koore ethnic group/ the Koore community and spoke the Koorete language. The remaining 5% of the population belongs to different language groups. These include the Oromo, the Amhara, Gamo, Gurage, Burji and Wolayta. About 52% of people in Amaro belong to Protestants, whereas 35% practiced traditional beliefs (include belief in spirits), and 10% practice Ethiopian Orthodox Christianity. Demographic figures published by the Central Statistical Agency in 2007 (CSA, 2007) showed that this District has an estimated total population of 139,743 of which 49.97% are males and the remaining 50.03% are females.

Statistical data of the Gelana District administration reveals that 86.49% of the total population is the Oromo community, 11.47% the Gedeo and 1.18% the Amhara, all other ethnic groups made up 0.86% of the population. Oromiffa is spoken as a first language by 75.86%, while 22.64% spoke Gedeo and 1.18% spoke Amharic; the remaining 0.32% spoke other primary languages. About 76.47% of people in Gelana belongs to Protestants, whereas 16.28% of practiced traditional believes, 4.09% practiced Ethiopian Orthodox Christianity and 1.72% was Muslim. According to Central Statistical Agency administrative report (CSA, 2007), Gelana District has a total population of 71, 369 of which 36, 032 (50.48%) are males and 35, 337 (49.51%) are females.

3.1.6. Socio economic information and land use in the study area

Agriculture is the mainstay of the economy in Amaro District. It is a source of employment and subsistence for about 94.2% of the total population while the 5.8% of the people base their livelihood on governmental employment, trade and other activities. Agriculture is traditional small-

scale type using human labor and is mainly dependent on the rainfall and hence; its productivity is determined by the amount and seasonality of rainfall.

The area is suitable for growing a variety of crops. This is because the area has different agro ecological zones ranging from Kolla to Dega and therefore these zones create a favorable condition for growing different crop types. The district has two main seasons. These are Meher (locally called *SILA)* and Belg (*GABBA*). During these seasons, different seasonal and perennial crops grow such as fruits, enset, vegetables, cereal crops, coffee, root crops, oil seeds and others.

Some of the seasonal crops grown here include teff (*Eragrostis tef*), wheat (*Tritircum aestivum*), barley (*Hordeum vulgare*), maize (*Zea mays*), sorghum (*Sorghum bicolor*), chickpeas (*Cicer arietinum*), bean (*Vicia faba*), potatoes (*Solanum tuberosum*), linseed (*Linum usitatissimum*), sweet potato (*Ipomoea batatas*), and others. Some of the perennial crops include coffee (*Coffea arabica*), enset (false banana) (*Ensete ventricosum*), papaya (*Carica papaya*), mango (*Mangifera indica*), orange (*Citrus sinensis*), sugar cane (*Saccharum officinarum*) and others (Table 1). Coffee (*Coffea arabica*) is the main cash crop and is known for its aroma of high cup quality. The use of improved agricultural technologies is low. Besides, the productivity of the land has been declining which may be attributed to deteriorating farm management practices. Mixed farming is widely practiced. In the highlands, the concentration of the settlements is said to be higher than the lowlands that induced migration of people to lowlands in search of productive farmland (AWARDO, 2013).

On land use type, about 18% (32, 848 ha) of the total land area of Amaro District is under cultivation, whereas 15% (25, 003 ha) is covered with vegetation (high forests, plantations, woodland and bush lands), 7% (11, 600 ha) is pastureland, and about 35% (60, 638 ha) constituted with mountain cliffs, gorges and river courses (AWARDO, 2013).

Livestock keeping is a major occupation in the districts and the major types of animals includes cattle, goats, sheep, horses, mules, donkeys and camels. Cattle, goats and sheep account for about 42%, 22.8% and 14.4% respectively (AWARDO, 2013). Beekeeping is another source of income generation and food to the family within the district. AWARDO (2013) reported that there were 77 modern beehives, 7, 421 traditional beehives in the year 2013 in the district (AWARDO, 2013).

Table 1. Major food crops grown in the study area

Crop category	Scientific name	English name	Local name (Koorete)
Cereals	*Sorghum bicolor*	Sorghum	TINKISHA
	Zea mays	Maize	BEKELO
	Eragrostis tef	Teff	TAFE
	Hordeum vulgare	Barley	SOA
	Triticum aestivum	Wheat	DINE
Vegetables	*Capsicum annuum*	Chili	KARA
	Allium cepa	Shallot	TUMA
	Lycopersicon esculentum	Tomato	TIMATIM
	Cucurbita pepo	Pumpkin	BAKULA
	Allium sativum	Garlic	TUMA
Fruits	*Carica papaya*	Papaya	PAPAYA
	Citrus aurantifolia	Lime	LOME
	Citrus sinensis	Orange	BURTUKAN_
	Malus sylvestris	Apple	APPLE
	Mangifera indica	Mango	MANGO
	Persea Americana	Avocado	ABUKATO
	Psidium guajava	Guava	ZEYTUNE
Stimulants	*Catha edulis*	Chat	CHAATE
	Coffea Arabica	Coffee	BUNO
Pulses	*Cicer arietinum*	Chickpea	SHINBERE
	Pisum sativum	Pea	ATARA
	Vicia faba	Broad Bean	BAKELA
Oil crops	*Linum usitatissimum*	Lin seed	TELBA
	Brassica carinata	Kale seed	SHANA
	Guizotia abyssinica	Niger seed	NOUG
Root crops	*Ipomoea batatas*	Sweet potato	MATATESA
	Solanum tuberosum	Potato	DINCHA
	Beta vulgaris	Sugar beet	KAYISIR
	Daucus carota	Carrot	CAROT

Source: (AWARDO, 2013)

Data obtained from the Gelana District agriculture and rural development office up to the year 2013, showed that small-scale agriculture is practiced in the district, and is based on traditional way of farming using human labor and is mainly dependent on the rainfall. In the district the major crops grown are maize (*Zea mays*), wheat (*Triticum aestivum*), barley (*Hordeum vulgare*), beans (*Vicia faba*), sorghum (*Sorghum bicolor*), teff (*Eragrostis tef*) and in ensete (*Ensete ventricosum*) in that order. Coffee (*Coffea arabica*) is an important cash crop; with over 5,000 hectares under the crop. According to the district's agricultural and rural development office (2013), 41% of the area is cultivable, 28.7% was under annual crops, 35% pastureland, 15% forest, and the remaining 9% is considered swampy, degraded or unusable.

3.1.7. Status of human health services in the districts

In 2013, the Amaro District had 7 clinics, 9 functional health posts, and one health center giving service to a total of 139, 743 people (AWARDO, 2013). There were 84 health professionals composed of two health officers, two sanitarians, sixty-four senior nurses, four junior nurses, seven laboratory technicians, two pharmacy technicians and three health assistants working in the district (AWHO, 2013). The top ten human diseases in the area included wounds, malaria, stomachache, amoeba, diarrhea, ringworms, snakebites, breast cancer, general malaise and earaches (AWHO, 2013).

Again in 2013, the Gelana District health office (GWHO, 2013), the district had five health centers and 17 health posts giving service to 83, 260 people. There was neither a hospital nor a higher clinic in the district. There are 110 health professionals composed of ten health officers, ten midwifery, thirty four clinical nurse, two sanitarians, thirteen senior nurses, three junior nurses, two laboratory technicians, one pharmacy technicians, one druggist and thirty-four health assistants working in the district (GWHO, 2013). The top ten human diseases in the area included stomachache, wounds, diarrhea, toothache, breast cancer, skin rash, evil eye, influenza, tonsillitis and rabies (GWHO, 2013).

3.1.8. Status of veterinary services in the districts

The population livestock is relatively high in Amaro and Gelana Districts. However, their productivity is very low as in most places in the country. Their livestock resources of Amaro and Gelana District have not yet been exploited. Their performance (milk, meat, egg, honey production) and contribution to the regional and national economy is very low mainly due to poor management, low genetic potential due to inbreeding, inadequate and low quality feed supply, and the prevalence of various animal diseases (AWARDO, 2013). The population of livestock in the Amaro District was estimated at 177, 841 heads of cattle, 109, 999 goats, 98,795 chicken, 48, 579 sheep, 1487 donkeys, 5, 235 horses and 1204 mules in the year 2013 (AWARDO, 2013). The district at present has sixteen rural veterinary clinics. Moreover, there were only twenty veterinarians working in the district in 2013 (AWARDO, 2013). Lumpy skin disease, blackleg, foot and mouth disease are reported as the most common disease types affecting livestock resources of Amaro District (AWARDO, 2013).

Livestock population in Gelana District was estimated at 266,156 heads of cattle, 44,152 goats, 115,650 chicken, 5,160 sheep, 11,926 donkeys, 377 horses and 277 mules in the year 2013 (GWARDO, 2013). The district had seven rural veterinary clinics and only fourteen veterinarians working in 2013 (GWARDO, 2013). This was insufficient to provide proper health services for more than 443, 698 heads of livestock present in the district (GWARDO, 2013). Blackleg, foot and mouth disease (FMD), tuberculosis, and fashiolosis disease are reported as the most common disease types affecting the district (GWARDO, 2013).

3.2 Methods of data collection and analysis

3.2.1. Reconnaissance survey

Reconnaissance survey was conducted at first to have a mental picture of the study area. It was conducted from August 11-20, 2013 in order to obtain an impression about medicinal, wild edible plants and a general understanding of the characteristics of the study areas and to identify the different forest sites. During the survey, general information about the districts was obtained.

3.2.2. Vegetation and ethnobotanical data collection

3.2.2.1. Vegetation data collection

Ten transect lines were laid from top of the mountain to the bottom where human interference was very low. The transects were laid 500 m apart from each other; and the distance between consecutive plots was 300 m down altitudinal gradient. But in cases where the line transects fall along in accessible deep gorges, sampling was done in areas lying about 10 m from the transect line. A total of 70 relevés were sampled from each District using a square plot of 400 m2 (20 m x 20 m) for trees. For shrubs and herbs 5 m x 5 m and 1 m x1 m subplots were laid, respectively, within each quadrat.

All plant species including herbs, shrubs, trees, ferns, climbers and lianas in each quadrate were recorded. In the study area, physiographic variables such as altitude, longitude, latitude and aspect were measured for each quadrate using altimeter, GPS, and compass. Cover was calculated as the area of the ground within a quadrate which is occupied by the above ground parts of each species when viewed from above (canopy cover) visually estimated as percentage. Percentage cover abundance was estimated and later converted into modified Braun Blanquet scale (Van der Maarel, 1979).

Fig. 3. Demarcation and establishment of plots

3.2.2.2. Specimen collection and identification

Collection of voucher specimens was made with the help of informants and local field assistants. At times, the field activities included taking notes on plants and the associated indigenous knowledge. Photographic records were also taken in the field to capture the field sites, plants and other useful information. The collected voucher specimens were taken to the National Herbarium of Ethiopia (ETH), Addis Ababa University, where they were air-dried, numbered, labeled, pressed, and heater-dried, deep-frzen, identified and deposited at the Herbarium (ETH). Preliminary identification of specimens was performed in the field to family level and some cases to species levels. Further identification was made using the modern Flora of Ethiopia and Eritrea at ETH using taxonomic keys and by comparison with authenticated herbarium specimens. The nomenclature of the scientific names of the species followed the volumes of the Flora of Ethiopia and Eritrea. Plants were arranged alphabetically by family name, vernacular name, ethno medicinal uses, source, growth form, plant parts used, ailment treated, methods of preparation and application, route of administration and condition of plant part uses and collection number.

3.2.3. Ethnobotanical data collection

3.2.3.1. Site selection, sample size determination and selection of informants

Site selection

A total of 20 localities or kebeles were selected; 12 from Amaro District and 8 from Gelana District, based mainly on vegetation cover and the availability of 82 traditional healers identified with the

assistance of District and Kebele authorities. The administrative town was selectively included to represent an urban setting. The following kebeles were selected in the two districts, Kele mazegaga, Gamule, Kereda, Kobo, Gulbe, Danooubulte, Alfacho, Karma/jijola, Suluko, Gumer, Mareta and Zokesa in Amaro District and Wachu, Jirme, Gewe, Chalbesa, Chekata, Tore geter, Karsa and Samalo in Gelana District.

Sample size determination

From twenty sampled kebeles, informants from aged 18 and above were selected to collect information on medicinal and wild edible plants knowledge of the community. In this study, 370 household from each kebele were randomly selected for the survey, by assign random numbers to the households (as lottery methods), in total 7,400 sample households were selected from a total of 34,000 household (26,750 in Amaro and 7,250 in Gelana) (Table 2). The required sample size was 380 (Number of respondents). Sample size for each kebele was calculated using proportion of the number of households of two the districts. Therefore, the sample size of one of the kebeles in each district was 19 (370 X380/7400). Same calculation used for the other study kebeles.

The sample size for quantitative data, was determined using Cochran's (1977) formula as indicated by Bartlett and Higgins (2001) as follows:

n=N/1+N (e)
n= sample size for the research, N= total number of households in all twenty kebeles
e= maximum variability or margin of error 5% (0.05)
1=the probability of event occurring.

Selection of informants

A total of 380 informants (200 males and 180 females) from Amaro and Gelana districts were selected. Two hundred sixty (140 males and 120 females) of the total informants were randomly selected during random walk made to houses in the selected households. This was done by tossing a coin and using him/her as informant whenever head of the coin is up if he/she volunteered to participate (as lottery methods). In addition to the household interviews, information was collected from 120 key informants (60 males and females for each) who were selected purposefully based on

recommendations from the local people, local authorities, and development agents (DAs) at each study sites.

Table 2. List of kebeles with number of informants in Amaro and Gelana districts

Districts	Kebeles	Total household	Number of General informants			Number of Key informants			Total informants		
			M	F	T	M	F	T	M	F	T
Amaro	Kele mazegaga	370	7	6	13	3	3	6	10	9	19
	Gamule	370	7	6	13	3	3	6	10	9	19
	Kereda	370	7	6	13	3	3	6	10	9	19
	Kobo	370	7	6	13	3	3	6	10	9	19
	Gulbe	370	7	6	13	3	3	6	10	9	19
	Danooubulte	370	7	6	13	3	3	6	10	9	19
	Alfacho	370	7	6	13	3	3	6	10	9	19
	Karma/Jijola	370	7	6	13	3	3	6	10	9	19
	Suluko	370	7	6	13	3	3	6	10	9	19
	Gumer	370	7	6	13	3	3	6	10	9	19
	Mareta	370	7	6	13	3	3	6	10	9	19
	Zokesa	370	7	6	13	3	3	6	10	9	19
Gelana	Wachu	370	7	6	13	3	3	6	10	9	19
	Jirme	370	7	6	13	3	3	6	10	9	19
	Gewe	370	7	6	13	3	3	6	10	9	19
	Chalbesa	370	7	6	13	3	3	6	10	9	19
	Chekata	370	7	6	13	3	3	6	10	9	19
	Tore geter	370	7	6	13	3	3	6	10	9	19
	Karsa	370	7	6	13	3	3	6	10	9	19
	Samalo	370	7	6	13	3	3	6	10	9	19
		7400	**140**	**120**	**260**	**60**	**60**	**120**	**200**	**180**	**380**

3.2.3.2. Methods of ethnobotanical data collection

Ethnobotanical data were collected during six different field visits within twenty kebeles in Amaro and Gelana districts between 11 August 2013 and 12 April 2016. Plant diversity along with the ethnobotanical knowledge associated with the medicinal and wild edible plants used by the people in the two districts were recorded. Ethnobotanical data were collected by closely interacting with informants using a semi-structured interview, guided field walk, group discussion, market survey, preference ranking, pair-wise comparisons and direct matrix ranking. Two medical and veterinary

doctors were consulted to find equivalent medicinal terms in English for each of the local disease names, although for some local terms, corresponding to English names could not been found.

Interviews were based on a semi-structured checklist of topics consisting 33 questions for the medicinal and 18 main questions related to use of wild edible plants in the area (Appendix1**).** Interviews with informants were largely conducted in their local language (Koorete and Affan Oromo) with the help of six translators (all were males) who had good knowledge of the local flora and all the informants in each Kebele, and responses were recorded in English.

The questions were prepared with the following main components: (a) personal data of the respondents including name, address, age, and gender b) with the consents the informants were asked to give their knowledge about local names of medicinal and wild edible plants used, habitat of the species, marketability of species, degree of management (wild/cultivated), abundance, parts used, condition of plant part used (fresh/dried) c) methods of remedy preparation, remedy storage, dosage prescriptions, routes of remedy administration, beliefs related to collection and use of plants, method of indigenous knowledge transfer and other uses of medicinal plant species, existing threats and traditional conservation practices (Plate 1).

Plate 1. Interview being carried out with Amaro (A, B, C) and Gelana (D, E and F) informants(Photo taken by Getu Alemayehu, 2013).

All semi-structured interviews were followed by independent walk-in-the-woods for about 32 km, which gave an opportunity for more discussion with the informant and the practical identification of traditionally used medicinal and wild edible plants in the natural environment. Guided field interviews were made with informants and all relevant data including the vernacular names of plants, habit, habitat of the plant, the parts used as well as the strategies used for the conservation of

medicinal and wild edible plants and the preservation of the indigenous knowledge on medicinal and wild edible plants were recorded (Plate 2).

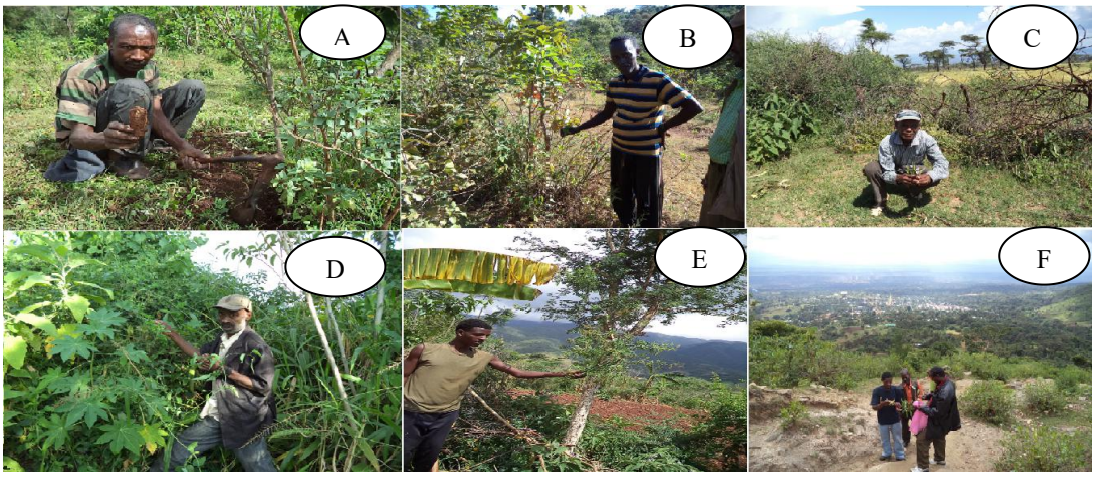

Plate 2. Guided field interview being carried out with informants of Amaro (A, B and C) and Gelana districts (D, E and F) (Photo taken by Getu Alemayehu, 2013).

Ten group discussions (one-group discussions per two neighbor kebeles in the district) were conducted. The discussions were conducted with five to seven informants at each kebele to gain further information on medicinal and wild edible plants knowledge of the community, and their management. This was in order to know how knowledge is maintained and transferred from one generation to other generations and prove the reliability of the data collected through semi-structured interviews (Plate 3). Moreover, discussions took place based on the checklist of questions prepared in advance in English and translated to Amharic.

Plate 3. Group discussion being carried out with informants of Amaro (A, B), Gelana (C) (Photo taken by Getu Alemayehu, 2013).

Three daily and five weekly markets from seven kebeles were randomly selected for market survey, local markets in Amaro (i.e. Kele, Danobultu, Jijola/Kerma, jalo and Kereda) and those in Gelana District (Alfacho, Karsa, Gewe) were surveyed (Plate 4). Market survey recorded the varieties and amount of herbal drugs and wild foods sold in the market of the study area.

Plate 4. Vender selling medicinal plants in Karsa market of Gelana District (Photo taken by Getu Alemayehu, 2013).

During the survey, informants were asked to mention (list) the kinds of plants found in the study area. The number of times a particular species mentioned by each informant was recorded. The informant consensus was helpful to see how frequently a particular species was mentioned by and was helpful in analyzing that a particular plant mentioned by all informants is also the most widely used plant by the community. It was used to confirm the authenticity of information by comparing it with other information given by other informants.

The Informant consensus factor (ICF) was calculated for main disease categories (12 category for human and 11 categories for livestock ailments) to identify the agreements of the informants on the reported cures for the group of ailments. The ICF was calculated as follows: number of use citations in each category (nur) minus the number of species used (nt), divided by the number of use citations in each category minus one (Heinerich *et al.,* 1998). The factor provides a range of 0 to 1, where a high value acts as a good indicator for a high rate of informant consensus.

$$ICF = \frac{n_{ur} - n_t}{n_{ur} - 1}$$

Where: ICF is informant Consensus Factor

nur is number of use citation

nt is number of species used

Preference ranking was made following Martin (1995). According to this method, doing preference ranking involved asking each selected informants to arrange some items, usually five to seven, in accordance to their perceived degree of importance in their community. In Amaro District, five key informants (Four males and one female informant) were used to rank seven medicinal plants in treating stomachache of human being based on high frequency of report disease by informants with several alternative plants. Thus, seven medicinal plants species (*Myrica salicifolia, Ajuga integrifolia, Brassica carinata*, *Allium sativum, Citrus aurantifolia, Nigella sativa* and *Aframomum corrorima* were short-listed and ranked by five key informants based on their efficacy following the procedure explained by Martin (1995) and Cotton (1996).

In Gelana District, preference ranking of 6 medicinal plants that were reported against wound based on high frequency of report disease by informants. The informants were asked to compare the given medicinal plants *Hibiscus diversifolius, Leucas discolor*, *Guizotia scabra*, *Agave sisalana* and *Abutilon angulatum* based on their efficacy, and to give the highest number (5) for the medicinal plant which they thought most effective in treating wound and the lowest number (1) for the least effective plant in treating wound. In the same District, preference ranking of 5 ethnoveternary medicinal plants that were reported against rabies was conducted after selecting 5 key informants. The informants were asked to compare the given medicinal plants *Jasminum grandiflorum, Nicotiana tabacum, Cucumis prophetarum*, *Dombeya torrida* and *Lepidium sativum* based on their efficacy, and to give the highest number (5) for the medicinal plant which they thought most effective in treating adisease and the lowest number (1) for the least effective plant.

In Amaro District, five key informants were used to rank five wild edible plants according to their taste quality they perceived. Thus, six wild edible plant species were short listed (*Physalis lagascae, Rubus steudneri*, *Arisaema schimperianum*, *Cordia africana* and *Ximenia americana*) and ranked by five key informants based on their personal preference.

A comparison was done for threat factors of wild edible plants (firewood collection, charcoal making, construction and tools, grazing and agricultural expansion) as perceived and reported by

informants. The possible numbers of pairs were calculated using the formula n (n-1)/2; where n are the threat factors. The five key informants that were chosen randomly for the preference ranking exercise were also asked to give their responses independently. An overall rank for the species was given by adding up these values for all respondents. Based on the total score of each species the ranks were determined to infer the most threatening factors in the study area. In Gelana District, six key informants were involved to rank five medicinal plants (*Catha edulis, Commelina latifolia, Cordia africana, Terminalia schimperiana* and *Euclea racemosa*) in treating diarrhea of human being based on their efficacy.

In Amaro District, five commonly reported multipurpose medicinal plant species (*Hagenia abyssinica, Erythrina brucei, Dichrostachys cinerea, Cordia Africana* and *Combretum collinum*), and five use-categories were involved in direct matrix ranking exercise in order to evaluate their relative importance to the local people and the extent of the existing threats related to the species. Four key informants were randomly chosen and were asked to assign numerical scale individually as (5 = best, 4 = very good, 3 = good, 2 = less used, 1= least used and 0 = not used). The list of attributes included medicinal, firewood collection, construction, charcoal making and fencing. By adding the scores, it was possible to compare the species based on their use diversity, in the same District; direct matrix ranking was done for five multipurpose wild edible plants in order to evaluate their relative importance to the local people and the extent of the existing threats related to their use values. Four key informants were randomly chosen and were asked to assign numerical scale individually.

3.2.3.3. Ethical consideration

Permission was first obtained from the district and kebele administrative offices to conduct the study by showing different official letters wrote from the academic department and presenting the purpose of the study. In addition, discussions were made with the informants in each selected area and they were used as entry doors for development of positive relationships with the local people. During data collection, an effort was made to encourage the informants that their cooperation was of great benefit to the country. No data from this study were shared with other third parties. Additionally, informed consent was obtained from the participants to ensure their willingness.

3.2.4. Data analysis and presentation

3.2.4.1. Vegetation data analysis

Plant community determination

Hierarchical Agglomerative Clustering was done using R package version R 3.3.2 software with similarity Ratio (SR) in R to come up with plant communities separately for the Nekora and Dance forests. Reclassification of the table was done to obtain new Cluster IDs using libraries (cluster and vegan) and then synoptic tables were separately produced using the new Cluster IDs for the two forests. The plant communities were named as 'type' by dominant characteristic species after one, two or three species with high synoptic values (the mean values of the species cover/abundance of cluster groups in the table).

Plant diversity analysis

Shannon and Wiener (1949) index of species diversity were applied to quantify species diversity and richness. The two main indices of measuring diversity are richness and evenness. Richness is a measure of the number of different species in a given site and can be expressed as a mathematical index to compare diversity between sites. It is the method most widely used in measuring the diversity of species.

3.2.4.2. Ethnobotanical data analysis

Descriptive statistical methods

Descriptive data analysis (simple and percentage frequency) method was employed to summarize some of the ethnobotanical data obtained from the interviews on reported medicinal and wild edible plants and associated knowledge. Data was then entered in an Excel spreadsheet and analyzed using descriptive statistics to identify the number and percentage of medicinal and wild edible plant species, genera and families of medicinal and wild edible plants, their growth forms and percentage of commonly utilized plant parts. Data on informants' backgrounds and medicinal plants used in Amaro and Gelana districts were entered in an Excel spreadsheet and organized for statistical analysis. Traditional knowledge dynamics on use of medicinal plants by men and women, young (18-30 years) and elderly (>30 years); literate (completed at least primary education) and illiterate; knowledgeable (key) and local (General) was compared using t-test and one way ANOVA at 95% confidence level.

Quantitative analytical methods

In this study a total of four preference ranking activities were carried out following Martin (1995). Preference ranking was performed to rank medicinal plants in treating stomachache and wound of human beings, in treating rabies of livestock as perceived by informants and to rank wild edible plants according to their taste quality they perceived.

Pair's wise comparison was used to analyze the major threat factors to medicinal and wild edible plants and to analyze those medicinal plants used in treating diarrhea of human being in the study area. Use diversity ranking was done to rank up medicinal and wild edible plants reported frequently with various ethnobotanical roles.

Informant consensus values (ICVs). A good measure of determining plant species with various medicinal use values is the use of informant consensus value. This can be done in such a way that agreements of the people on the medicinal values of each species is tested by calculating percentage of informant consensus values (ICVs). The relative popularity of medicinal and wild edible plant species is then evaluated based on the proportion of informants who independently report it's medicinal and food supplements (informant consensus).

Informants consensus factors (ICF). This method is used especially when healers and other randomly used informants claim a particular MP to be used for some general disease categories. ICF is a good measure of assessing efficacy of MPs for categorical disease at least in the context of the indigenous people of the area, and it is a means to find out the most common disease of the study area in the context of their experience. In order to evaluate the reliability of information recorded during the interview, informants were contacted at least two times for the same ideas and the validity of the information was proved and recorded. Consequently, if the idea of the informant deviated from the original information, it was rejected since it was considered irrelevant information. As a result, only the relevant ones were taken into account and statistically analyzed. This method was adopted from Alexiades (1996).

Fidelity level index

Fidelity level index quantifies the importance of a given species for a particular purpose in a given cultural group (Friedman *et al*., 1986; cited in Cotton, 1996). Fidelity level shows the percentage of informants claiming the use of a certain plant species for the same major purpose. FL (%) = Np/N ×

100, Where, Np is the number of informants that claim a use of a plant species used for a particular purpose/disease and N is the number of informants that use the plants as a botanic/medicine to fill/treat any given demand/disease (Alexiades, 1996).

Jaccard's coefficient of similarity

Jaccard Coefficient of Similarity (JCS) was used to compare degree of similarity in the composition of medicinal and wild edible plants among the study area. JCS was automatically computed using PC-ORD software (McCune and Melford, 1999). It was calculated between paired habitats A and B (the study area with other areas studied by other researchers in different parts of the country). Finally, JCS was multiplied by 100 in order to obtain the percentage similarity in species composition between the study areas with other areas (Kent and Coker, 1992).

Use diversity of medicinal and wild edible plants data analysis

Traditionally, local people have their own way of categorizing important plant species in their area according to the value they provide. The local communities in the study area have traditionally classified and used the plant species products for centuries through their long-term accumulated knowledge. Data obtained on local uses of multipurpose medicinal and wild edible plants, through semi-structured interviews, focus group discussions and walks-in-the-woods (Martin, 1995; Cotton, 1996).

CHAPTER FOUR

4. RESULTS

4.1. Plant diversity

4.1.1. Floristic composition

A total of 180 species belonging to 148 genera and 68 families were collected and identified in Nekora and Dance forests of Amaro and Gelana districts, respectively (Appendix 2). About 8 (4.44%) species of the total plant species in Nekora and Dance forests are endemic to Ethiopia. A total of 140 species belonging to 121 genera and 58 families were collected and identified in Nekora forest of Amaro District whereas, 107 species belonging to 92 genera and 51 families were identified in Dance forest of Gelana District (Appendix 3).

Of all the plant families, the Asteraceae and Fabaceae had the highest number of plant species accounting for 15 (8.33%) species each; and Lamiaceae that had 12 (6.66%) species, followed by Euphorbiaceae and Rosaceae 6 (3.33% species) each. Two (2.94%) of the reported families, i.e. Anacardiaceae and Vitaceae were represented by five species each, whereas others 7 (10.29%), i.e. Boraginaceae, Capparidaceae, Combretaceae, Malvaceae, Oleaceae, Rubiaceae and Solanaceae were represented by four species each. Eleven (16.17%) of the families were represented by three species each, whereas others 12 (17.64%) of the families were represented by two species each. Each of the remaining 31 families had single-species representation (Appendix 3). But the dominance of the family is different for both forests.

In Amaro District, Asteraceae and Fabaceae had the highest number of plant species accounting for 12 (8.57%) species each, and Lamiaceae that had 10 (7.14%) species followed by Euphorbiaceae and Rosaceae 5 (3.57% species) each. Six (10.34%) of the reported families, i.e. Anacardiaceae, Boraginaceae, Capparidaceae, Combretaceae, Euphorbiaceae and Oleaceae were represented by four species each, whereas others 7 (12.06%), i.e. Commelinaceae, Cucurbitaceae, Moraceae, Myrsinaceae, Rhamnaceae, Rubiaceae and Vitaceae were represented by three species each. Sixteen (27.58%) of the families were represented by two species, whereas the remaining 25 (43.10%) families only had single-species representation. Likewise, in Gelana District, Fabaceae was represented by the highest number of plant species accounting for 9 (8.41%) species, followed by Lamiaceae 8 (7.47%), Asteraceae 7 (6.54%), Rosaceae 5 (4.67%), and Anacardiaceae, Euphorbiaceae, Malvaceae and Oleaceae 4 (3.73% species) each. Three (5.88%) of the reported

families, i.e. Flacourtiaceae, Polygonaceae and Solanaceae were represented by three species each. Twelve (23.52%) of the families were represented by two species, whereas the remaining 23 (45.09%) families only had single-species representation.

4.1.2. Growth forms of plants

Analysis of growth forms of these plants reveals that shrubs were the most dominant growth forms constituting 67 (37.22%) species followed by herbs 61 (33.88%), trees 49 (27.22%), climbers 2 (1.11%) and lianas 1 (0.55%) species each (Fig. 4). In Amaro District, shrubs were best represented consisting of 53 (37.85%) species followed by herbs 46 (32.85%), trees 38 (27.12%), climbers 2 (1.42%) and 1 (0.71%) liana. Although a similar pattern was found in Gelana District, the number of species for each growth form is different from Amaro District, i.e, shrubs constituted 42 (39.25%) species followed by trees 34 (31.77%), herbs 30 (28.03%) and 1 (0.93%) liana (Fig. 4).

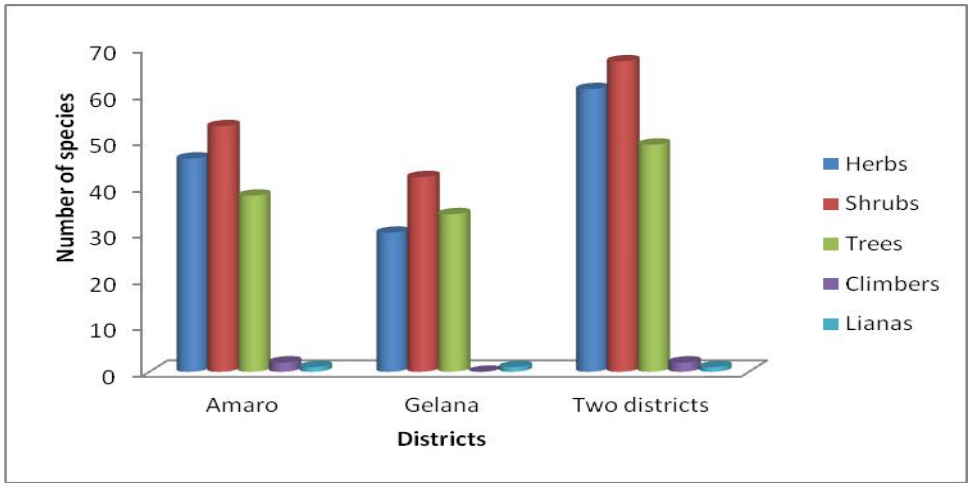

Fig 4. Number and proportion of habits of plants in the study area

4.1.3. Plant community types in Nekora and Dance forests

4.1.3.1. Nekora forest

A total of 140 species were recorded from 70 sample plots and were used in determining plant community types. Mean cover abundance values of indicator species encountered in each community type were given in Table 3. Five plant communities were identified (Fig. 5). Plant communities were named as 'types' after one, two or three species with greater synoptic cover/abundance values (Table 4).

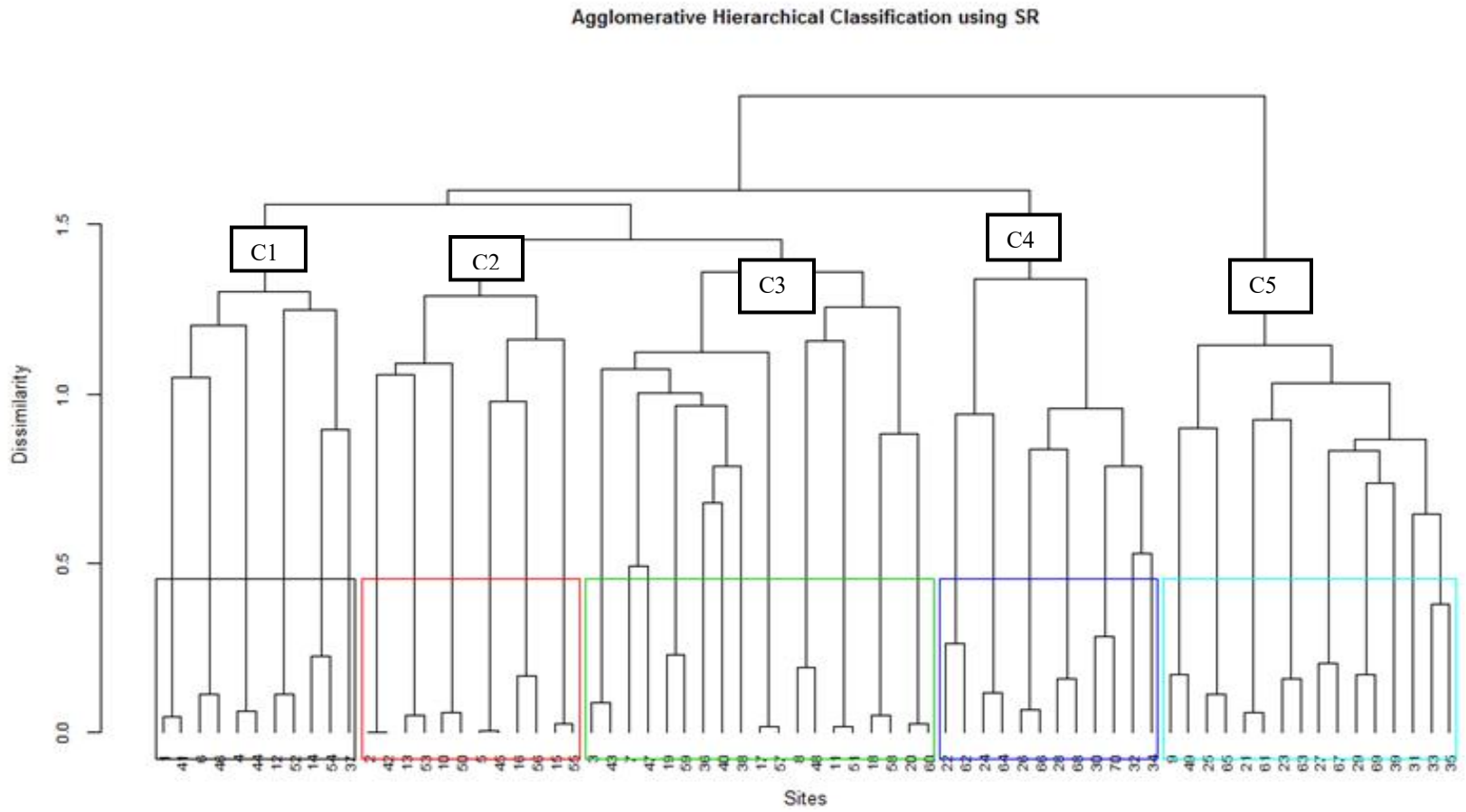

Fig 5. Dendrogram showing the five-plant community types in Nekora forest

Table 3. High synoptic cover abundance values of species in Nekora forest

	Community				
Species name	I	II	III	IV	V
Croton macrostachyus	**2.67**	0.86	1.85	1.00	0.40
Rhus glutinosa	**2.56**	0.86	0.92	1.71	1.20
Faurea speciosa	**2.33**	1.43	0.62	0.33	1.20
Tamarindus indica	**1.89**	0.00	0.62	1.17	1.40
Pterolobium stellatum	**0.83**	0.14	0.77	0.33	0.33
Lippia adoensis	**0.40**	0.29	0.31	0.32	0.33
Euclea racemosa	0.56	**4.00**	2.00	0.00	1.20
Calpurnia aurea	2.33	**3.20**	1.00	2.00	1.00
Olea europaea subsp. cuspidata	1.15	**3.00**	0.77	0.00	0.00
Bidens pilosa	1.00	**2.14**	1.31	0.83	0.60
Stachys alpigena	0.33	**0.43**	0.31	0.00	0.00
Terminalia schimperiana	0.22	**0.33**	0.31	0.17	0.00
Rubus steudneri	1.33	1.60	**3.46**	2.13	1.40
Vernonia amygdalina	0.56	1.00	**1.23**	0.17	0.20
Periploca linearifolia	1.00	0.57	**1.11**	0.67	0.00
Osyris quadripartite	0.67	0.57	**1.00**	0.33	0.60
Phyllanthus ovalifolius	0.56	0.67	**0.86**	0.00	0.40
Maesa lanceolata	0.11	0.43	1.31	**3.17**	2.13
Albizia gummifera	0.67	0.71	1.54	**2.15**	0.20
Flueggea virosa	0.44	0.43	0.92	**1.33**	0.80
Abutilon angulatum	0.67	0.29	0.69	**0.83**	0.80
Pappea capensis	0.44	0.43	0.46	**0.83**	0.80
Ehretia cymosa	1.00	1.00	1.85	0.83	**4.00**
Olinia rochetiana	0.67	0.29	1.69	0.83	**3.00**
Dodonaea angustifolia	1.31	1.86	0.46	2.20	**2.67**
Boscia salicifolia	0.78	0.29	0.54	1.67	**2.20**

Table 4. Number of plots, altitudinal range of each plant community in Nekora forest

Plant community	Plots in each plant community	Number of plots	Altitude (m)
Croton macrostachyus-Rhus glutinosa	1, 41, 6, 46, 4, 44, 12, 52, 14, 54, 37	11	1509 - 2453
Euclea racemosa-Calpurnia aurea	2, 42, 13, 53, 10, 50, 5, 45, 16, 56, 15, 55	12	1900 - 2221
Rubus steudneri-Vernonia amygdalina	3, 43, 7, 47, 19, 59, 36, 40, 38, 17, 57, 8, 48, 11, 51, 18, 58, 20, 60	19	1610 - 2300
Maesa lanceolata-Albizia gummifera	22, 62, 24, 64, 26, 66, 28, 68, 30, 70, 32, 34	12	1700 - 2400
Ehretia cymosa - Olinia rochetiana - Boscia salicifolia	9, 49, 25, 65, 21, 61, 23, 63, 27, 67, 29, 69, 39, 31, 33, 35	16	1899 - 2263

The five plant community types in Nekora forest were:

***C1. Croton macrostachyus - Rhus glutinosa* community type**

This community was located between the altitudinal ranges of 1509 - 2453 m.a.s.l. The community has experienced a high level of anthropogenic disturbance. The domonant tree species in the upper canopy were *Croton macrostachyus, Cordia monoica, Hagenia abyssinica, Millettia ferruginea, Faurea speciosa, Tamarindus indica* and *Ximenia americana* which were a well-known emergent tree in all the community types. The shrubs are *Clerodendrum myricoides, Leonotis ocymifolia, Lippia adoensis, Nicandra physaloides, Pergularia daemia, Pterolobium stellatum, Rhus glutinosa* and *Solanecio gigas.* The herb layer was inhabited by *Cyperus assimilis*, *Cyphostemma niveum*, *Echinops amplexicaulis*, *Indigofera spicata*, *Pentas schimperiana*, *Priva adharens*, *Stephania abyssinica*, *Tetradenia riparia* and *Xanthium spinocum* dominating the field layer. The common climber in this community type was *Acidenthra laxiflora*.

***C2. Euclea racemosa - Calpurnia aurea* community type**

This community type was predominantly found within the altitudes of 1900 - 2221 m.a.s.l. The domonant tree species were *Agarista salicifolia, Ficus vasta, Myrica salicifolia, Olea europaea* subsp *cuspidata, Rhamnus prinoides, Stachys alpigena, Terminalia schimperiana* and *Ziziphus mucronata*. Shrubs dominate and hence the community name was derived from these shrub species. *Euclea racemosa, Arundinaria alpina, Calpurnia aurea, Flacourtia indica, Rhus natalensis* and

Rumex nervosus were the dominant shrubs especially in the open canopies. *Ozora insignis* was found in wet and plane areas between two consecutive slopes with complete exposure to the sun. This community experienced a high level of anthropogenic disturbance. The dominant herbs of this community type were *Ajuga integrifolia, Bidens pilosa, Cucumis ficifolius, Epilobium hirsutum* and *Helichrysum splendidum*. *Cheilantes farinosa* was the dominant fern found throughout this community.

***C3. Rubus steudneri - Vernonia amygdalina* community type**

This community was found between 1610 - 2300 m.a.s.l. and contained 126 species. Scattered trees were found in the open canopy. Some of the trees in this community type were *Terminalia polycarpa* and *Juniperus procera. Rumex abyssinicus, Lantana trifolia* and *Laggera crispata* were most common in the herbaceous layer of this community. The common shrubs in this community include *Myrsine africana, Rubus volkensis, Rubus apetalus, Vernonia amygdalina, Senna occidentalis, Ocimum lamiifolium, Rubus steudneri, Phyllanthus ovalifolius, Pavetta oliveriana* and *Osyris quadripartita* while the common climber was *Periploca linearifolia*.

***C4. Maesa lanceolata - Albizia gummifera* community type**

There were 104 species associated with this plant community. These include *Maesa lanceolata, Albizia gummifera, Brucea antidysenterica, Pappea capensis, Phoenix reclinata, Pittosporum abyssinicum, Zanthoxylum chalybeum* were dominant tree species, while *Abutilon angulatum, Erica arborea, Flueggea virosa, Grewia ferruginea, Hypericum quartinianum, Jasmnium stans, Lobelia giberroa, Psydrax schimperiana, Rhus vulgaris, Rosa abyssinica, Withania sominifera* were dominant shrubs. The herb layer was mainly covered by *Zehneria scabra, Cynodon dactylon, Cissus quadrangularis, Cynoglossum lanceolatum, Justicia flava* and *Scadoxus multiflorus.*

***C5. Ehretia cymosa - Olinia rochetiana - Boscia salicifolia* community type**

There were 116 species associated with this plant community. In addition to *Ehretia cymosa* and *Olinia rochetiana, Ficus sycomorus, Ficus sur, Entada abyssinica, Boscia salicifolia*, *Boscia angustifolia* were found to be indicator tree species. *Fagaropsis angolensis, Dovyalis abyssinica* and *Dodonaea angustifolia* were both dominant and indicator shrub species. *Senecio cineraria, Commelina diffusa, Commelina latifolia* and *Asparagus africanus* were some of the herbs, which covered the ground layer while the common climber was *Clematis simensis*. *Fagaropsis angolensis,*

Dovyalis abyssinica and *Dodonaea angustifolia* were among the species, which are found only in this community. *Cheilantes farinosa* was the dominant fern found throughout this community.

4.1.3.2. Dance forest

A total of 107 species were recorded in Dance forest. Mean cover abundance values of indicator species encountered in each community type were given in Table 5. Five plant communities were identified (Fig. 6). Plant communities were named as 'types' after one, two or three species with greater synoptic cover/abundance values (Table 6).

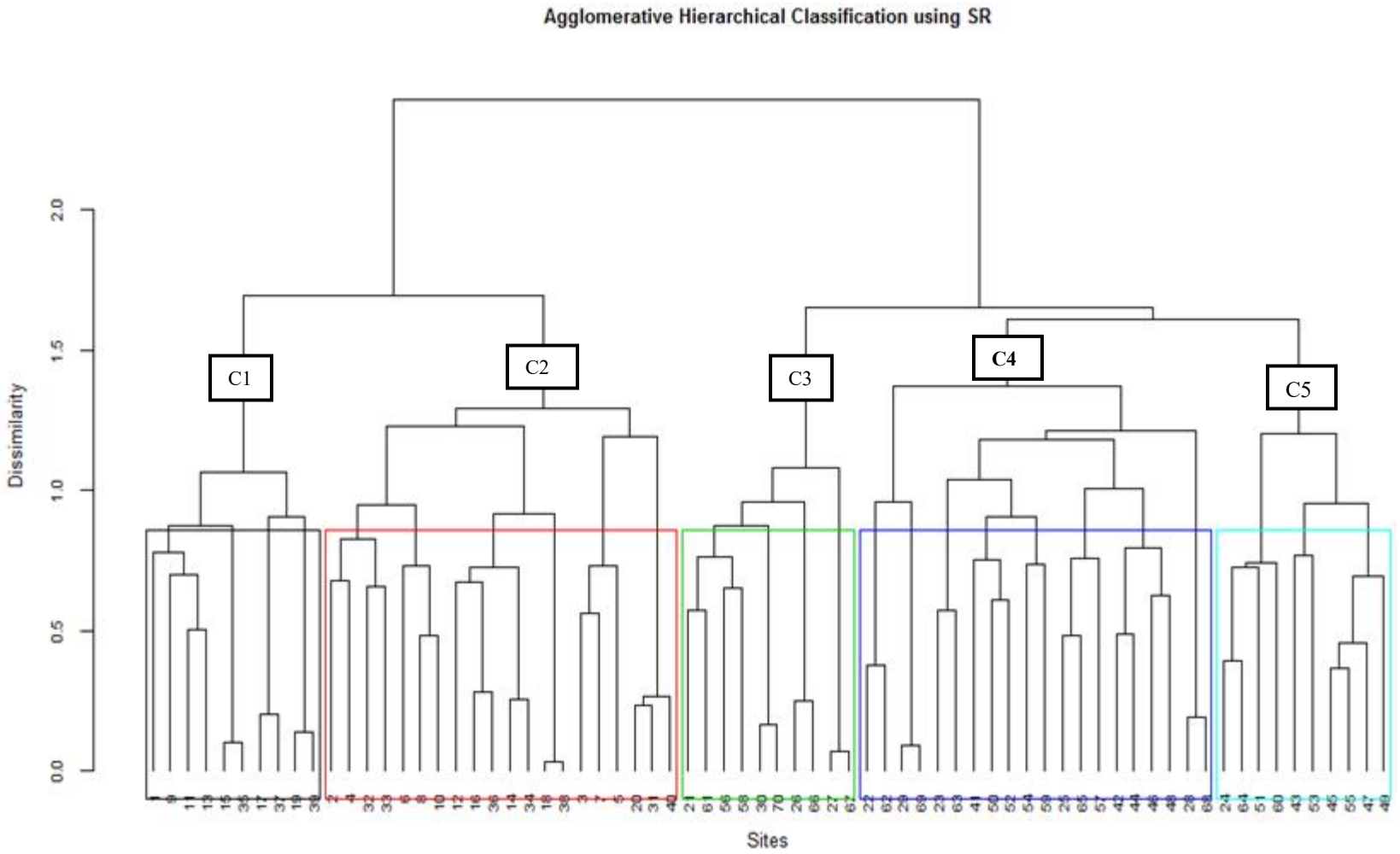

Fig 6. Dendrogram showing the five-plant community types in Dance forest

Table 5. High synoptic cover abundance values of species in Dance forest

Species name	Community				
	I	II	III	IV	V
Rhus natalensis	**3.39**	1.13	0.50	1.80	0.00
Acokanthera schimperi	**2.59**	0.38	1.00	1.00	0.75
Acanthus sennii	**2.35**	0.50	0.83	1.20	0.50
Phytolacca dodecandra	**1.35**	1.00	0.17	0.60	0.00
Myrica salicifolia	**0.35**	0.13	0.17	0.00	0.00
Oxalis radicosa	**0.29**	0.00	0.00	0.00	0.00
Priva adhaerens	**0.24**	0.00	0.17	0.00	0.00
Dodonaea angustifolia	3.71	**3.75**	2.33	2.40	1.25
Croton macrostachyus	2.59	**3.25**	0.83	3.20	0.00
Guizotia scabra	0.41	**1.00**	0.17	0.40	0.25
Cyphostemma adenocaule	0.41	**0.50**	0.33	0.40	0.00
Rhus glutinosa	2.18	0.13	**3.33**	2.20	0.00
Cordia Africana	1.65	0.88	**2.33**	0.00	1.50
Bidens pilosa	1.71	0.38	**1.83**	1.60	0.00
Ocimum lamiifolium	0.29	0.25	**0.33**	0.20	0.00
Helichrysum schimperi	0.12	0.00	**0.17**	0.00	0.00
Carissa spinarum	2.59	0.63	1.17	**3.40**	0.00
Jasminum grandiflorum	1.29	0.50	0.00	**3.00**	0.00
Nuxia congesta	1.41	1.13	0.00	**2.60**	0.75
Chenopodium murale	1.00	0.50	1.17	**1.40**	0.75
Pappea capensis	0.35	0.25	0.33	**0.60**	0.00
Bersama abyssinica	1.76	1.00	1.33	0.20	**3.25**
Olea europaea subsp. Cuspidate	0.65	0.38	0.17	0.00	**3.00**
Millettia ferruginea	1.76	0.38	0.83	0.20	**2.00**
Sida rhombifolia	0.47	1.38	0.00	0.00	**1.50**
Entada abyssinica	0.35	0.13	0.17	0.00	**0.00**

Table 6. Number of plots, altitudinal range of each plant community in Dance forest

Plant community	Plots in each plant community	Number of plots	Altitude (m)
Rhus natalensis - Acokanthera schimperi	1, 9, 11, 13, 15, 35, 17, 37, 19, 39	10	1500 – 1989
Dodonaea angustifolia - Croton macrostachyus	2, 4, 32, 33, 6, 8, 10, 12, 16, 36, 14, 31, 34, 18, 38, 3, 7, 5, 20, 40	20	1754 - 2177
Rhus glutinosa	21, 61, 56, 58, 30, 70, 26, 66, 27, 67	10	1776 - 2074
Carissa spinarum – Jasminum grandiflorum	22, 62, 29, 69, 23, 63, 41, 50, 52, 54, 59, 25, 65, 57, 42, 44, 46, 48, 28, 68	20	1640 – 2100
Bersama abyssinica - Olea europaea subsp.cuspidata	24, 64, 51, 60, 43, 53, 45, 55, 47, 49	10	1899 - 2263

The five plant community types in Dance forest:

C1. *Rhus natalensis - Acokanthera schimperi* community type

This plant community occurs between 1500 – 1989 m.a.s.l. and comprised of 87 species. *Boscia angustifolia, Dracaena afromontana, Myrica salicifolia, Phoenix reclinata, Plectranthus caninus, Podocarpus falcatus, Protea gaguedi, Syzygium guineense* Subsp *afromontanum, Toddalia asiatica,* were important tree species of the group. Characteristic shrubs of this community are *Acanthus sennii, Acokanthera schimperi, Rhus natalensis, Clutia abyssinica, Grewia mollis, Indigofera hochstetteri, Jasmnium stan, Phytolacca dodecandra, Premna schimperi, Schrebera alata, Solanum villosum, Vernonia amygdalina* and *Vernonia hochstetteri, Rubus apetalus, Rubus volkensii.* The dominant herb species were *Acmella caulirhiza, Commelina latifolia, Hibiscus macranthus, Oxalis radicosa, Pentas schimperiana, Physalis peruviana, Priva adhaerens, Rumex abyssinicus, Rumex nervosus, Tragia cinerea* and *Verbascum sinaiticum.* This community experienced a high level of anthropogenic disturbance.

***C2. Dodonaea angustifolia - Croton macrostachyus* community type**

The dominant species (mainly based on cover abundance value) were *Dodonaea angustifolia* and *Croton macrostachyus.* A total of 101 species and occurs between 1754 - 2177 m.a.s.l. The main tree species found were *Croton macrostachyus* and *Tamarindus indica*. The common shrubs include

Calpurnia aurea, Dodonaea angustifolia, Dombeya torrida and *Rosa abyssinica*. The herbaceous species were dominated by *Ajuga integrifolia, Asparagus africanus, Cyphostemma adenocaule, Glysine wightii, Guizotia scabra* and *Lantana trifolia*.

***C3. Rhus glutinosa - Cordia africana* community type**

This community type was located at an altitudinal range of 1776 - 2074 m.a.s.l. The community had a total of 91 species. The herbaceous comprised, *Bidens pilosa, Helichrysum schimperi, Rhoicissus tridentata* were also very dominant in the herb layer. The associated trees of this plant community were *Cordia africana, Rhus glutinosa*, *Terminalia schimperiana* while the dominant shrubs were *Ocimum lamiifolium* and *Rubus steudneri*. Although the result showed as *Rhus glutinosa* as an indicator species of this community, this species itself has, the least indicator species compared to those of the remaining two communities reported in this study different species of the community co-exist together and have similar affinity for specific environmental conditions (e.g. altitudinal gradients and topographic factors). The community was found under intense human impacts such as logging trees for timber and construction purposes.

***C4. Carissa spinarum – Jasminum grandiflorum* community type**

This community was dominated by *Carissa spinarum* and *Jasminum grandiflorum*. It occurs between 1640 – 2100 m a s l. The plant community had a total of 103 species. The main associated characteristic tree species were *Acacia abyssinica, Albizia gummifera, Buckollia volubilis, Maesa lanceolata, Nuxia congesta, Pappea capensis* and *Syzygium guineense subsp macrocarpum. Carissa spinarum, Clematis hirsute, Dovyalis abyssinica, Ehretia cymosa, Euclea racemosa, Flacourtia indica, Grewia ferruginea, Oncoba spinosa* were dominant in the shrub layer. The herbaceous and the grass species were dominated by *Chenopodium murale, Cyathula cylindrica, Hibiscus diversifolius, Jasminum grandiflorum* and *Rumex nepalensis*. Climbers included, for example, *Jasmium abyssinicum*.

***C5. Bersama abyssinica - Olea europaea subsp.cuspidata* community type**

This community occurs between 1899 - 2263 m a.s.l. and comprised of 98 species. The dominant tree species were *Bersama abyssinica, Celtis africana, Entada abyssinica, Erythrina brucei, Ficus sycomorus, Millettia ferruginea* and *Olea europaea subsp. cuspidata. Abutilon angulatum, Rhus ruspolii, Rhus vulgaris, Sida rhombifolia* and *Withania somnifera* were dominant in the shrub layer.

The ground flora (herb layer) of this group was dominated by *Berchemia discolor, Cardamine trichocarpa, Chenopodium schraderianum* and *Galium simense*. *Acidenthera laxiflora* and *Clematis simensis* were the common climber species covered the stems of large trees.

4.1.4. Species diversity, richness and equitability

Nekora forest

Based on the outcome of the Shannon-Weiner diversity index analysis, the highest diversity was recorded for community type III and relatively the least was for community type I (Table 6). The highest evenness was recorded for the community type IV. Community type III also had the highest species richness while community I exhibited the least species richness comparatively.

Table 7. Overall species richness, diversity and evenness values of the five plant communities identified in Nekora forest

Community types	Altitudinal range	Species richness (S)	Shannon-Wiener Diversity Index (H`)	Shannon's evenness index (J)
I	1509 – 2453	99	4.39	0.93
II	1900 – 2221	101	4.42	0.94
III	1510 – 2300	126	4.76	0.95
IV	1700 – 2400	114	4.57	0.96
V	1899 – 2263	116	4.56	0.94

Note: Eveness (J) = H`/H`max where H`max= lnS

The highest value of medicinal plant species richness, Shannon-Wiener Diversity (62), was recorded for *Ehretia cymosa - Olinia rochetiana - Boscia salicifolia* community type. Some of the major medicinal plants were *Acokanthera schimperi, Ajuga integrifolia, Boscia angustifolia, Carissa spinarum, Chenopodium murale, Clerodendrum myricoides, Combretum collinum, Commelina latifolia, Commelina diffusa, Dodonaea angustifolia, Ehretia cymosa, Entada abyssinica* and *Olinia rochetiana*. High Shannon's diversity (3.90) was recorded for *Rubus steudneri-Vernonia amygdalina* community type whereas; highest medicinal plant species evenness (0.94) was recorded for *Croton macrostachyus - Rhus glutinosa* and the lowest medicinal species evenness (0.92%) was recorded for *Maesa lanceolata - Albizia gummifera* community type in Nekora forest (Table 8). Although there is no direct relationship between overall species richness of the plant communities and the diversity of medicinal plants, a community with the least species richness has also exhibited the lowest species diversity**.**

Table 8. Species richness, evenness and Shannon-Weiner diversity index of medicinal plants in the plant communities of Nekora forest

Community types	Species richness (S)	Shannon-Wiener Diversity Index (H`)	Evenness
Croton macrostachyus - Rhus glutinosa	47	3.54	0.94
Euclea racemosa - Calpurnia aurea	54	3.75	0.94
Rubus steudneri - Vernonia amygdalina	59	3.90	0.93
Maesa lanceolata - Albizia gummifera	61	3.80	0.92
Ehretia cymosa - Olinia rochetiana - Boscia salicifolia	62	3.79	0.93

Dance forest

Based on the outcome of the Shannon-Weiner diversity index analysis, community type III exhibited the highest diversity value; relatively the least value was recorded for community I. However, the most species rich community was community type IV (Table 9). There is a correspondence between least species richness and lowest diversity value, for example, community types I.

Table 9. Overall species richness, diversity and evenness values of the five plant communities identified in Dance forest

Community types	Altitudinal range	Species richness (S)	Shannon Diversity Index (H`)	Shannon's evenness index (J)
I	1500 – 1989	87	4.08	0.91
II	1754 – 2177	101	4.31	0.93
III	1776 – 2074	91	4.42	0.93
IV	1640 – 2100	103	4.22	0.97
V	1760 – 2300	98	4.19	0.92

The highest value species richness for (49) medicinal plants was recorded for *Dodonaea angustifolia-Croton macrostachyus* community type. *Ajuga integrifolia, Calpurnia aurea, Croton macrostachyus, Cyphostemma adenocaule, Discopodium penninervium, Dodonaea angustifolia, Dombeya torrida, Guizotia scabra* and *Tamarindus indica* were among the most cited species available. High Shannon's diversity (3.67) was recorded for *Carissa spnarum - Jasminum grandiflorum* community type whereas; highest medicinal plant species evenness (0.94) was recorded for *Rhus natalensis - Acokanthera schimperi* community type in Dance forest (Table 10).

Evenness did not also show a clear pattern with regard to medicinal plants, i.e., the highest evenness value did not necessarily show the highest diversity of medicinal plants.

Table 10. Species richness, evenness and Shannon-Weiner diversity index of medicinal plants in the plant communities of Dance forest

Community types	Species richness (S)	Shannon Index (H`)	Evenness
Rhus natalensis - Acokanthera schimperi	41	3.43	0.94
Dodonaea -angustifolia - Croton macrostachyus	49	3.59	0.87
Rhus glutinosa - Cordia africana	39	3.25	0.88
Carissa spnarum - Jasminum grandiflorum	48	3.67	0.93
Bersama abyssinica - Olea europaea subsp.cuspidata	30	3.06	0.90

4.2. Ethnomedicinal plant species used by local people

4.2.1. Diversity of medicinal plants

A total of 147 plant species belonging to 128 genera and 62 families were recorded in the study area (Appendix 4). The greater numbers of the medicinal plants were collected from the natural environment 90 species (61.22%) and about 57 species (38.57%) in cultivated area. The local people were found using 5 (3.40%) endemic plant species of Ethiopia for the preparation of traditional herbal medicines.

Proportion all 90 species of medicinal plants belonged to 83 genera and 42 families were recorded from Amaro District while 79 medicinal plant species that belong to 77 genera and 48 families were gathered and documented from Gelana District (Appendix 5). In Amaro, 62 of these are used to treat human ailments and the remaining 28 for livestock diseases. Similarily, a higher number of plants (61) were used to treat human and lower number (18) livestock ailments in Gelana District. In both cases, much less numbers of plants are used for ethnoveterinary.

In Amaro District a total of 52 (57.77%) medicinal plant species were obtained from natural habitats (Nekora forest) and 38 species (42.22%) were obtained from cultivated area. In Gelana District, Dance forest accounted for 51 species (64.55%) and 28 species (35.44%) were collected from cultivation. The local people of Amaro and Gelana used 4 (4.44%) and 2 (2.57%) endemic plant species of Ethiopia for the preparation of traditional herbal medicines respectively.

With regard to plant families, Fabaceae and Lamiaceae had the highest species richness consisting of 12 species (8.16%) each, followed by Asteraceae 11 (7.48%) and Solanaceae 8 (5.44%). Three families or about 5% i.e. Cucurbitaceae, Euphorbiaceae and Malvaceae were represented by five species each, whereas others 5 families (8.06%), i.e. Anacardiaceae, Boraginaceae, Combretacea, Rubiaceae and Rutaceae were represented by four species each. Four (6.45%) of the families were represented by three species each, whereas others 11 (17.74%) of the families were represented by two species each. Each of the remaining 35 (8. 86%) families had single-species representation in both districts (Appendix 5).

In Amaro District, Fabaceae contributed the highest number of species 10 species (11.11%), followed by Lamiaceae 9 (10.00%), Asteraceae 8 (8.88%), Solanaceae 6 (6.66%) and Boraginaceae 4 (4.44%). Three (7.14%) of the families, i.e. Cucurbitaceae, Euphorbiaceae and Rutaceae were represented by three species each. Each of the remaining 10 (23.80%) of the families had two-species representation. Similarly, Lamiaceae had the highest number consisting of 7 species (8.86%) followed by Asteraceae, Malvaceae, Rubiaceae and Solanaceae 4 (5.06% species) each. Three of the reported families, i.e. Cucurbitaceae, Euphorbiaceae and Fabaceae were represented by three species each. Each of the remaining 9 (18.75%) of the families had two-species representation in Gelana District. Seven of the genera had five to twelve species, 5 genera recorded four species each, 4 genera recorded three species each and 9 genera recorded two species each. Each of the remaining 35 genera had single-species representation in both districts (Appendix 5).

4.2.1.1. Medicinal plant species used to treat human ailments

The numbers of ethnomedicinally important plant species that are used to treat human ailments recorded in two districts were 112, belonging to 99 genera and 53 families (Appendices 6 and 7). Sixty-two medicinal plant species belonging to 57 genera and 32 families were reported from Amaro District whereas, 61 medicinal plant species belonging to 43 families and 58 genera were reported from Gelana District. In the study area, 33 (53.22%) and 38 (62.29%) human medicinal plants were collected from wild in Amaro and Gelana districts respectively.

Family Lamiaceae was represented by the highest number of species contain 10 (8.92% species, followed by Asteraceae 9 (8.03%), Fabaceae 8 (7.14%) and Malvaceae 5 (4.46%). Five (9.43%) of the reported families, i.e. Anacardiaceae, Combretacea, Euphorbiaceae, Rubiaceae and Rutaceae were represented by four species each, whereas others 4 (7.54%), i.e. Brassicaceae, Poaceae,

Rananculaceae and Solanaceae were represented by three species each. Eight (15.09%) of the families were represented by two species, whereas the remaining 16 (37.20%) families only had single-species representation.

In Amaro District Lamiaceae was represented by the highest number comprising 7 (11.29%) species, followed by Asteraceae and Fabaceae 6 (9.67% species) each, and Rutaceae 3 (5.17%). Twelve (37.50%) of the families were represented by two species, whereas the remaining 16 (50%) families only had single-species representation (Appendix 6). Likewise, family Lamiaceae stood first contributing 6 (9.83%) species, followed by Malvaceae 4 (6.55%), Asteraceae and Rubiaceae 3 (4.91%) each. Six of the reported families, i.e. Anacardiaceae, Combretaceae, Euphorbiaceae, Fabaceae, Myrtaceae and Solanaceae were represented by 2 species each. Each of the remaining 16 families had single-species representation from Gelana District (Appendix 7).

4.2.1.2. Medicinal plant species used for ethnoveternary

Medicinal plants that were collected and identified in the study area which were reported to treat livestock health problems were counted forty-two species belonging to 41 genera and 25 families (Appendices 8 and 9). Twenty-eight ethnoveterinary medicinal plant species belonging to 28 genera and 17 families were identified in Amaro District whereas, 18 species belonging to 18 genera and 15 families were reported from Gelana District.

Family Solanaceae was represented by the highest number contain 5 (11.90%) species; followed by Fabaceae (4, 9.52% species), Asteraceae and Cucurbitaceae 3 (7.14% species) each in the two districts (Table 11). In Amaro District, the highest number of species was recorded for family Fabaceae and Solanaceae 4 species (14.28%) each. Five of the reported families, i.e. Asteraceae, Boraginaceae, Cupressaceae, Lamiaceae and Sapindaceae were represented by 2 species each. Each of the remaining 10 families had one-species representation (Table 11). From Gelana District families Cucurbitaceae, Capparidaceae and Solanaceae were represented by the highest number 2 species (11.11%) each. Each of the remaining 14 (93.33%) families had one-species representation (Table 11).

Table 11. Families of ethnoveternary medicinal plant species

Family	Districts, genera, species and percentage								Two districts			
	Amaro				Gelana							
	Genera	%	Species	%	Genera	%	Species	%	Genera	%	Species	%
Solanaceae	4	14.28	4	14.28	2	11.11	2	11.11	4	9.75	5	11.90
Fabaceae	4	14.28	4	14.28	1	5.55	1	5.55	4	9.75	4	9.52
Asteraceae	2	7.14	2	7.14	1	5.55	1	5.55	3	7.31	3	7.14
Cucurbitaceae	1	3.57	1	3.57	2	11.11	2	11.11	2	4.87	3	7.14
Boraginaceae	2	7.14	2	7.14	1	5.55	1	5.55	2	4.87	2	4.76
Capparidaceae	-	-	-	-	2	11.11	2	11.11	2	4.87	2	4.76
Cupressaceae	2	7.14	2	7.14	-	-	-	-	2	4.87	2	4.76
Euphorbiaceae	1	3.57	1	3.57	1	5.55	1	5.55	2	4.87	2	4.76
Lamiaceae	2	7.14	2	7.14	1	5.55	1	5.55	2	4.87	2	4.76
Sapindaceae	2	7.14	2	7.14	-	-	-	-	2	4.87	2	4.76
Adiantaceae	1	3.57	1	3.57	-	-	-	-	1	2.43	1	2.38
Alliaceae	1	3.57	1	3.57	-	-	-	-	1	2.43	1	2.38
Anacardiaceae	1	3.57	1	3.57	-	-	-	-	1	2.43	1	2.38
Balanitaceae	1	3.57	1	3.57	-	-	-	-	1	2.43	1	2.38
Brassicaceae	-	-	-	-	1	5.55	1	5.55	1	2.43	1	2.38
Chinopodiaceae	1	3.57	1	3.57	-	-	-	-	1	2.43	1	2.38
Dracaenaceae	-	-	-	-	1	5.55	1	5.55	1	2.43	1	2.38
Ericaceae	1	3.57	1	3.57	-	-	-	-	1	2.43	1	2.38
Melianthaceae	-	-	-	-	1	5.55	1	5.55	1	2.43	1	2.38
Oleaceae	-	-	-	-	1	5.55	1	5.55	1	2.43	1	2.38
Phytolaccaceae	1	3.57	1	3.57	-	-	-	-	1	2.43	1	2.38
Rosaceae	-	-	-	-	1	5.55	1	5.55	1	2.43	1	2.38
Rubiaceae	-	-	-	-	1	5.55	1	5.55	1	2.43	1	2.38
Sterculiaceae	-	-	-	-	1	5.55	1	5.55	1	2.43	1	2.38
Vitaceae	1	3.57	1	3.57	-	-	-	-	1	2.43	1	2.38
Total	**28**	**100**	**28**	**100**	**18**	**100**	**18**	**100**	**41**	**100**	**42**	**100**

4.2.2. Growth forms of medicinal plant species

Figure 7 shows the dominant growth forms among the reported medicinal plant species cited to treat human and livestock ailments in both districts. Herbs were found the dominant growth forms covering 63 species (42.85%), followed by trees 50 (34.01%), shrubs 32 (21.76%), climbers and lianas 1 (0.68%) each (Fig. 7).

In Amaro District, herbs constituted the largest category, with 39 species (43.33%), followed by trees 28 (31.11%), shrubs 21 (23.33 %), climbers and liana 1 (1.11%) each. Likewise, in Gelana District herbs constituted of 31 (39.24%) species followed by trees 25 (31.64%), shrubs 20 (25.31%), climbers 2 (2.53%) and liana 1 (1.26%).

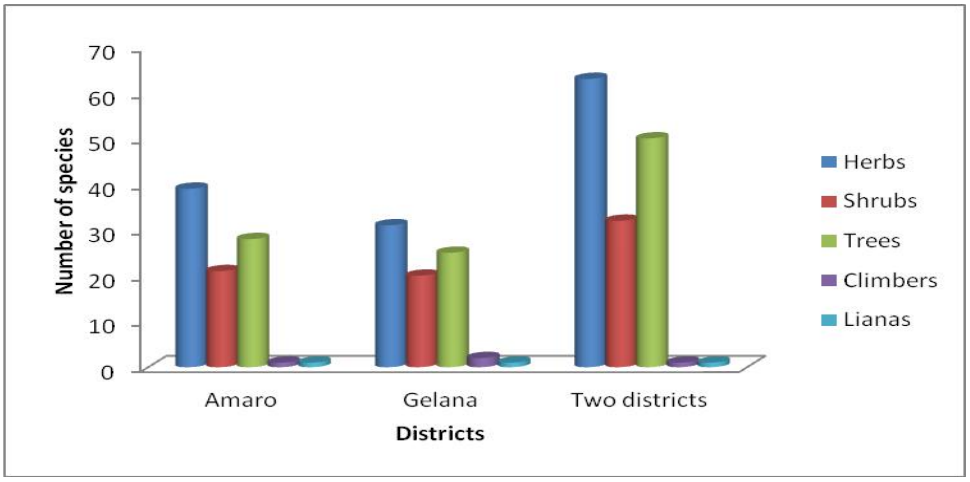

Fig 7. Growth forms of medicinal plants of the study area

4.2.2.1. Growth forms of medicinal plant species used to treat human diseases

The most represented life forms of human medicinal plants in the study area were herbs consisted of 47 species (41.96%), more than trees 35 (31.25%), or shrubs 27 (24.10%), climbers 2 (1.78%) and lianas 1 (0.89%) (Fig.8). Herbs were the most common and stood first with 28 species (45.16%), followed by trees 19 (30.64%), shrubs 13 (20.96%), climbers and lianas 1 (1.61%) each in Amaro District. Likewise herbs were the most common consisted of 23 species (37.70%); followed by trees 19 (31.14%), shrubs 18 (29.50%) and climber 1 (1.63%) each in Gelana District too (Fig.8).

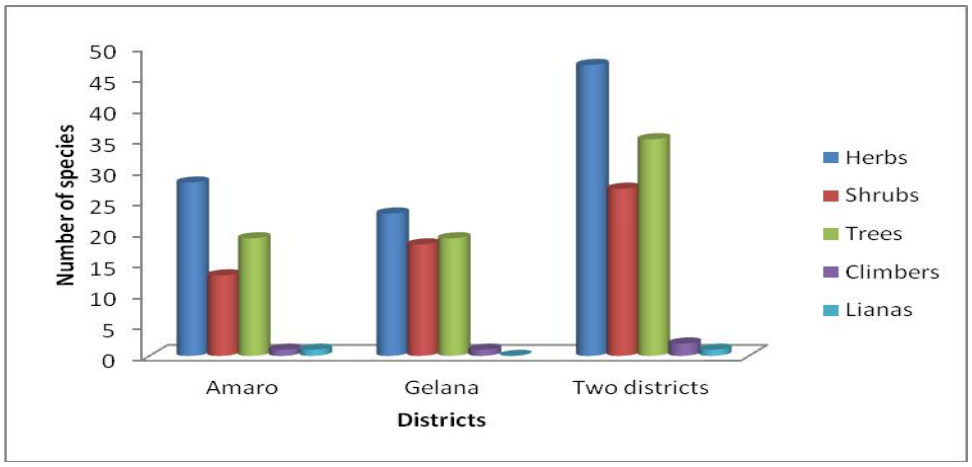

Fig 8. Growth forms of medicinal plant species used to treat human ailments

4.2.2.2. Growth forms of medicinal plant species used to treat livestock diseases

Medicinal plants that were reported to be used for ethnoveterinary health problems were herbs comprising of 17 species (40.47%), followed by trees 15 (35.71%) and shrubs 10 (23.80%) (Fig.9). In Amaro District, there were more herbs consisted of 11 species (39.28%), followed by trees 9 (32.14%) and shrubs 8 (28.57%), in the same way, herbs covered 8 species (44.44%), followed by trees 7 (38.88%), and shrubs 3 (16.66%) in Gelana District (Fig. 9).

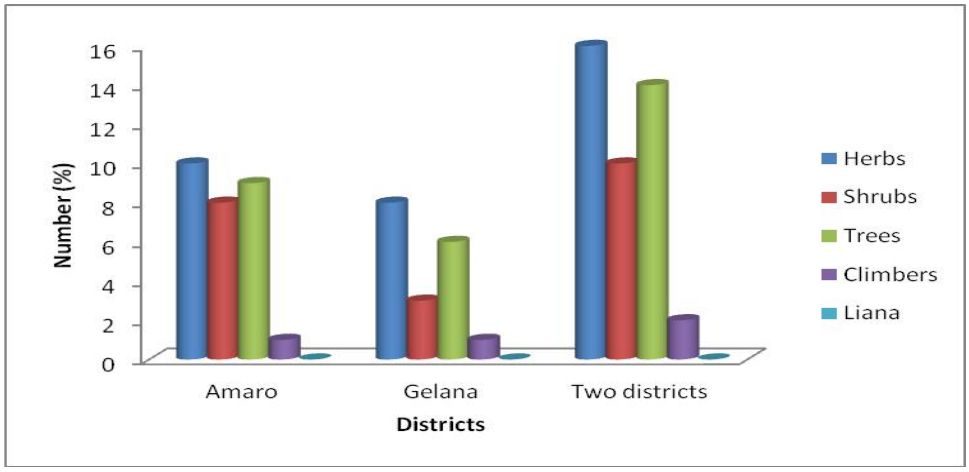

Fig 9. Growth forms of medicinal plant species used to treat livestock health problem

4.2.3. Major human and livestock diseases and the plant species used by local people

4.2.3.1. Major human and livestock diseases

A total of 66 human and 28 livestock ailment types were identified in the area and 147 plant species were used (Appendix 10). Stomachache, diarrhea and intestinal parasites were the most commonly reported health problems under the gastro-intestinal disease category, whereas wound was most frequently reported under the dermatological disease group. Commonest disease affecting human and livestock in the study area were wounds which was reported to be treated by 19 (7.88%) species followed by stomachaches by 15 (6.22%), diarrhea by 14 (5.80 %); evil eye, malaria, rabies and ring worms by 7 (2.48%) species each. Six of the reported diseases, i.e. amoeba, breast cancer, intestinal parasite, skin rash, snakebites and toothaches were cited to be treated by 6 (2.48%) species each (Fig. 10).

In Amaro District, stomachache, intestinal parasite, diarrhea, jaundice, abdominal pain and gastritis were the most commonly reported human health problems under the gastro-intestinal disease category, whereas wound, lamp skin disease, skin rash and ring worms were the most frequently

reported ailment under the dermatological disease group. Wound was the most commonly reported disease which was mentioned to be treated by 13 (9.09%) species, followed by diarrhea by 8 (5.59%) species, stomachache by 7 (4.89%), intestinal parasite and snake bite by 5 (3.49%) species each (Fig. 10).

In Gelana District the major and most widespread diseases according to the informants include stomachache, wound, diarrhea, evil eye, skin rash, toothache, rabies, placenta retention and ring worm. Stomachache was the most commonly reported disease which was mentioned to be treated by 8 (8.16%) species, followed by diarrhea, rabies and wound treated by 6 (6.12%) species each; evil eye treated by 5 (5.10%) species; skin rash and toothache treated by 4 (4.08%) species. Two of the reported diseases, i.e. breast cancer and placenta retention were cited to be treated by 3 (3.06%) species each (Fig. 10).

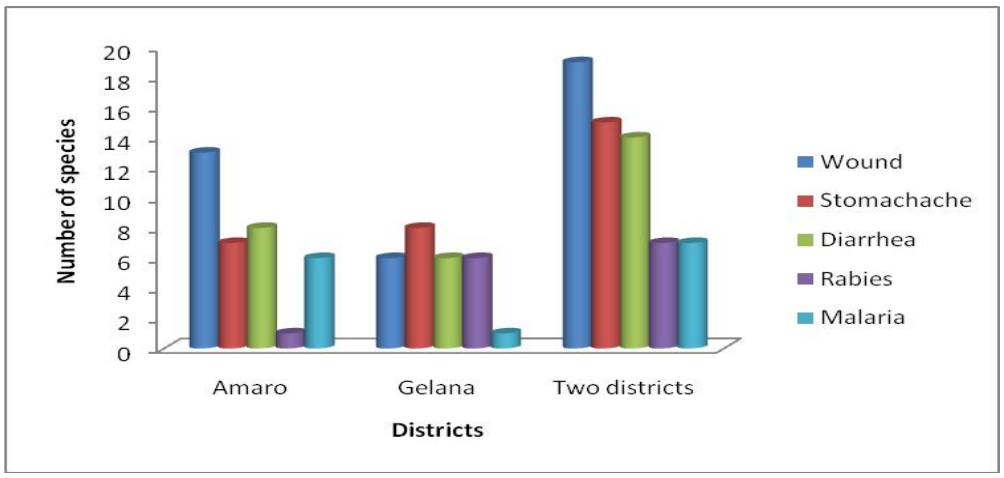

Fig 10. Commonest diseases of human and livestock

Major human diseases

One hundred twelve identified human medicinal plants in Amaro and Gelana districts were found to treat 66 types of ailments. Highest number of medicinal plants was used to treat wound and stomachache were reported to be treated by 14 (7.52%) species followed by diarrhea 10 (5.37%) species; ring worms by 7 (3.76%) species; breast cancer, malaria and toothache by 6 (3.22%) species each; amoeba and skin rash by 5 (2.68%) species each; earache, influenza, snake bite and tonsillitis by 4 (2.15%) species each; evil eye and general malaise by 3 (1.61%) species each. Eighteen of the reported diseases treated by 2 (1.07%) species each (Table 13).

It was found that, a total of 62 (68.88%) medicinal plant species belonging to 57 genera and 32 families were reported to be used for treating 52 types of human ailments in Amaro District. The major and most widespread diseases include wound which was treated with 9 (8.49%) species; stomachache and malaria by 6 (5.66%) species each; amoeba, diarrhea and ring worms by 5 (4.71%) species each; snake bite 4 (3.77%) species; breast cancer, epistaxis and general malaise 3 (2.83%) species each; earache, glandular swelling, gonorrhea, headache, influenza, intestinal parasite, jaundice, rheumatic pain, skin cancer, skin rash, sudden illness, tape worm, tonsillitis and toothache by 2 (1.88%) species each.

Likewise, in Gelana District, 44 different human ailments were recorded to be treated by 61 (77.21%) traditional medicinal plants. The major and most widespread diseases include stomachache which was treated with 8 (10.00%) species; diarrhea and wound by 5 (6.25%) species each; toothache by 4 (5.00%) species; breast cancer, skin rash and evil eye by 3 (3.75%) species each (Table 12).

Table 12. Frequency of ailments treated with two or more human medicinal plant

Health problems	Frequency of ailments					
	Amaro		Gelana		Two districts	
	Frequency	%	Frequency	%	Frequency	%
Wound	9	8.49	5	6.25	14	7.52
Malaria	6	5.66	-	-	6	3.22
Stomachache	6	5.66	8	10.00	14	7.52
Amoeba	5	4.71	-	-	5	2.65
Diarrhea	5	4.71	5	6.25	10	5.37
Ring worms	5	4.71	2	2.50	7	3.76
Snake bite	4	3.77	-	-	4	4.65
Breast cancer	3	2.83	3	3.75	6	3.22
Epistaxis	3	2.83	1	1.25	4	4.65
General malaise	3	2.83	-	-	3	1.61
Earache	2	1.88	2	2.50	4	4.65
Glandular swelling	2	1.88	-	-	2	1.07
Gonorrhea	2	1.88	-	-	2	1.07
Headache	2	1.88	-	-	2	1.07
Influenza	2	1.88	2	2.50	4	4.65
Intestinal parasite	2	1.88	-	-	2	1.07
Jaundice	2	1.88	-	-	2	1.07

Physically weaken	2	1.88	-	-	2	1.07
Rheumatic pain	2	1.88	-	-	2	1.07
Skin cancer	2	1.88	-	-	2	1.07
Skin rash	2	1.88	3	3.75	5	2.65
Sudden illness	2	1.88	-	-	2	1.07
Tape worm	2	1.88	-	-	2	1.07
Tonsillitis	2	1.88	2	2.50	4	4.65
Toothache	2	1.88	4	5.00	6	3.22
Bone cancer	-	-	2	2.50	2	1.07
Bone fracture	-	-	2	2.50	2	1.07
Eczema	-	-	2	2.50	2	1.07
Evil eye	-	-	3	3.75	3	1.61
Eye disease	-	-	2	2.50	2	1.07
Gastritis	-	-	2	2.50	2	1.07
Lung cancer	-	-	2	2.50	2	1.07
Rabies	-	-	2	2.50	2	1.07
Spider poison	-	-	2	2.50	2	1.07

Major livestock diseases

A total of 28 livestock ailments were identified in the area and 42 plant species were reported to be used for the treatment of the different ailments. Common diseases affecting livestock's health in the study area were wound which was reported to be treated by 5 (9.09%) species; cough, diarrhea and rabies 4 (7.27%) species each; bloat, evil eye, intestinal parasite, trypanosomiasis and FMD by 3 (5.45%) species each; body swelling, anthrax and placenta retention by 2 (5.45%) species each (Table 13).

In Amaro District, compared to human diseases, livestock diseases were mentioned to be treated with a few number of plant species. Twenty-two livestock diseases were found to be treated with 28 plant species. Wound ranked first since reported treated with 4 (10.81%) species; bloat, cough, diarrhea, intestinal parasite and trypanosomiasis were reported to be treated with 3 (8.10%) species each; body swelling and FMD treated with 2 (5.40%) species; anthrax, blackleg (ABASENGA), ecto-parasite, eye disease, fashiolsis, jaundice, leech infestation, shivering, stomachache and sudden illness treated by 1 (2.70%) species each (Table 13).

In Gelana a total of 13 livestock ailments were identified that mentioned to be treated by 18 traditional medicinal plants. Ailments affecting livestock's health in the study area were rabies

treated by 4 (22.22%) species; evil eye and placenta retention treated by 2 (11.11%) species each. The other ten, species were reported to be used as remedies against ten kinds of cattle disease such as, anthrax, cough, diarrhea, fashiolsis, FMD, madness, skin rash, tuberculosis, urine retention and wound (Table 13).

Table 13. Frequency of ailments treated by ethnoveterinary medicinal plant

Health problems	Frequency of ailments					
	Amaro		Gelana		Two districts	
	Frequency	%	Frequency	%	Frequency	%
Wound	4	10.81	1	5.55	5	9.09
Cough	3	8.10	1	5.55	4	7.27
Diarrhea	3	8.10	1	5.55	4	7.27
Rabies	-	-	4	22.22	4	7.27
Bloat	3	8.10	-	-	3	5.45
Evil eye	1	2.70	2	11.11	3	5.45
FMD	2	5.40	1	5.55	3	5.45
Intestinal parasite	3	8.10	-	-	3	5.45
Trypanosomiasis	3	8.10	-	-	3	5.45
Anthrax	1	2.70	1	5.55	2	3.63
Body swelling	2	5.40	-	-	2	3.63
Fashiolsis	1	2.70	1	11.11	2	3.63
Placenta retention	-	-	2	11.11	2	3.63
Black leg	1	2.70	-	-	1	1.81
Ecto-parasite	2	5.40	-	-	2	3.63
Eye disease	1	2.70	-	-	1	1.81
Jaundice	1	2.70	-	-	1	1.81
Leech infestation	1	2.70	-	-	1	1.81
Shivering	1	2.70	-	-	1	1.81
Snake bite	1	2.70	-	-	1	1.81
Stomachache	1	2.70	-	-	1	1.81
Sudden illness	1	2.70	-	-	1	1.81
Yedero kinkine	1	2.70	-	-	1	1.81
Madness	-	-	1	5.55	1	1.81
Skin rash	-	-	1	5.55	1	1.81
Tuberculosis	-	-	1	5.55	1	1.81
Urine retention	-	-	1	5.55	1	1.81
Total	**37**	**100**	**18**	**100**	**55**	**100**

4.2.3.2. Medicinal plant species used by local people to treat ailments

The local people of Amaro and Gelana districts use *Myrica salicifolia* to treat the highest number 10 (4.14%) of human and livestock ailments followed by *Phytolacca dodecandera* and *Solanum incanum* 7 (2.90%) each (Appendix 11).

The finding showed that the number of ailments treated by each plant species varies from plant to plant. Accordingly, *Myrica salicifolia* was reported to treat the highest number of ailments (10, 6.99%), followed by *Foeniculum vulgare* and *Phytolacca dodecandera* treating 6 (4.19%) ailments each in Amaro District. Likewise, *Commelina latifolia* and *Solanum incanum* were found most frequently reported used to treat the highest number of ailments in Gelana District, which accounted for 4 (4.08%) ailments each, followed by *Rumex abyssinicus* treating 3 (3.06%) ailments and *Ajuga integrifolia, Albizia gummifera, Clematis hirsuta, Cordia africana, Hibiscus diversifolius, Lens culinaris, Olinia rochetiana, Rhoicissus tridentata, Terminalia schimperiana, Toddalia asiatica* and *Ximenia americana* treating 2 (2.04%) ailments each.

Medicinal plants used by local people to treat human ailments

Myrica salicifolia was commonly used to treat the highest number of human ailments 10 (9.43%), followed by *Foeniculum vulgare* 6 (5.66%), *Buddleja polystachya, Citrus aurantifolia* and *Faurea speciosa* 4 (3.77%) human ailments each in Amaro District (Table 14). In Gelana area, *Commelina latifolia* and *Solanum incanum* were reported to be used in treating the highest number of human ailments, which accounted for 4 (5.00%) ailments each (Table 14).

Table 14. Frequency medicinal plants used to treat human ailments

Plant species	Amaro		Gelana		Two districts	
	Treated human ailments		Treated human ailments			
	Frequency	%	Frequency	%	Total	%
Myrica salicifolia Hochst ex A. Rich	10	9.43	-	-	10	5.37
Foeniculum vulgare Mill.	6	5.66	-	-	6	3.22
Buddleja polystachya Fresen.	4	3.77	-	-	4	2.15
Citrus aurantifolia (Christm.) Swingle	4	3.77	-	-	4	2.15
Faurea speciosa Welw.	4	3.77	-	-	4	2.15
Solanum incanum L.	3	2.83	4	5.00	7	3.76
Clematis simensis Fresen.	3	2.83	-	-	3	1.61
Scadoxus multiflorus (Matyn) Raf.	3	2.83	-	-	3	1.61

Zingiber officinale Roscoe.	3	2.83	-	-	3	1.61
Ajuga integrifolia Buch.Ham	2	1.88	2	2.50	4	2.15
Cordia africana Lam.	2	1.88	2	2.50	4	2.15
Ajuga alba L.	2	1.88	-	-	2	1.07
Aloe debrana Christian.	2	1.88	-	-	2	1.07
Coffea arabica L.	2	1.88	-	-	2	1.07
Dichrostachys cinerea (L.) Wight and Arn.	2	1.88	-	-	2	1.07
Euphorbia tirucalli L.	2	1.88	-	-	2	1.07
Moringa stenopetala (Bakf.) Cufed.	2	1.88	-	-	2	1.07
Ocimum lamiifolium Hochst.ex Benth.	2	1.88	-	-	2	1.07
Rumex nervosus Vahl.	2	1.88	-	-	2	1.07
Tamarindus indica L.	2	1.88	-	-	2	1.07
Terminalia macroptera Guill and Perr.	2	1.88	-	-	2	1.07
Zanthoxylum chalybeum Engl.	2	1.88	-	-	2	1.07
Commelina latifolia Hochst.ex.A	-	-	4	5.00	4	2.15
Rumex abyssinicus Jacq.	-	-	3	3.75	3	1.61
Olinia rochetiana A. Juss.	-	-	2	2.50	2	1.07
Albizia gummifera (J.f.Gmell.)	-	-	2	2.50	2	1.07
Clematis hirsuta Perr and Guill.	-	-	2	2.50	2	1.07
Hibiscus diversifolius A.Rich.	-	-	2	2.50	2	1.07
Lens culinaris Medik.	-	-	2	2.50	2	1.07
Rhoicissus tridentata (L.f) Wild and Drum	-	-	2	2.50	2	1.07
Terminalia schimperiana Hochst.	-	-	2	2.50	2	1.07
Toddalia asiatica (L.) Lam.	-	-	2	2.50	2	1.07
Ximenia americana (L.)	-	-	2	2.50	2	1.07
Total	**106**	**100**	**80**	**100**	**186**	**100**

Medicinal plants used by local people to treat livestock ailments

The local people of Amaro District use *Phytolacca dodecandera* to treat the highest number 6 (16.21%) of livestock ailments (Intestinal parasite, bloat, body swelling, diarrhea and evil eye); followed by *Allium sativium*, *Capsicum frutescens*, *Cucumis ficifolius* and *Vernonia amygdalina* treating 2 (5.40%) livestock ailments (Table 15).

The local people of Gelana District use *Lepidium sativum, Nicotiana tabacum, Cucumis prophetarum, Dombeya torrida* and *Jasminum grandiflorum* to treat rabies*; Acmella caulirhiza* and *Lagenaria siceraria* were used to treat placenta retention; *Bersama abyssinica* and *Clutia abyssinica* were used to treat evil eye; *Cyphostemma adenocaule, Entada abyssinica, Ehretia*

cymosa, Prunus africana, Dracaena afromontana, Coffea arabica, Boscia angustifolia, Teradenia riparia, Discopodium penninervium were reported to treat anthrax, cough, diarrhea, fashiolsis, FMD, madness, tuberculosis, skin rash and wound 1 (5.55%) ailment each (Table 15).

Table 15. Frequency of medicinal plants used to treat livestock ailments

Plant species	Amaro		Gelana		Two districts	
	To treat livestock ailments		To treat livestock ailments			
	Frequency	%	Frequency	%	Total	%
Acacia mellifera (Vahl) Benth.	1	2.70	-	-	1	1.81
Acmella caulirhiza Del.	-	-	1	5.55	1	1.81
Adiantum caudatum Var. Hirsutum auct.	1	2.70	-	-	1	1.81
Aeschnomene elaphroxylon Guill	1	2.70	-	-	1	1.81
Agarista salicifolia (Comm.ex Lam.) Hook.f.	1	2.70	-	-	1	1.81
Allium sativium L	2	5.40	-	-	2	3.63
Ampelocissus bombycina (Bak.) Planch	1	2.70	-	-	1	1.81
Balaintes aegyptiaca (L.) Del.	1	2.70	-	-	1	1.81
Bersama abyssinica Fresen.	-	-	1	5.55	1	1.81
Boscia angustifolia A. Rich.	-	-	1	5.55	1	1.81
Calpurnia aurea (Ait.).Benth	1	2.70	-	-	1	1.81
Capsicum frutescens L.	2	5.40	-	-	2	3.63
Chenopodium murale L.	1	2.70	-	-	1	1.81
Clutia abyssinica Jaub.and Spach.	-	-	1	5.55	1	1.81
Coffea arabica L.	-	-	1	5.55	1	1.81
Cordia monoica Roxb.	1	2.70	-	-	1	1.81
Croton macrostachyus Del.	1	2.70	-	-	1	1.81
Cucumis ficifolius A.Rich.	2	5.40	-	-	2	3.63
Cucumis prophetarum L.	-	-	1	5.55	1	1.81
Cupressus lustanica Mill.	1	2.70	-	-	1	1.81
Cyphostemma adenocaule (Steud. ex A. Rich)	-	-	1	5.55	1	1.81
Discopodium penninervium Hochst.	-	-	1	5.55	1	1.81
Dodonaea angustifolia L. f.	1	2.70	-	-	1	1.81
Dombeya torrida (J. F. Gmel.) P. Bamps	-	-	1	5.55	1	1.81
Dracaena afromontana Mildbr.	-	-	1	5.55	1	1.81
Ehretia cymosa Thom.	1	2.70	1	5.55	2	3.63
Entada abyssinica Steud.ex A.Rich.	1	2.70	1	5.55	2	3.63
Epilobium hirsutum L.	1	2.70	-	-	1	1.81

Helminthotheca echioides (L.) Holub	1	2.70	-	-	1	1.81
Jasminum grandiflorum L.	-	-	1	5.55	1	1.81
Juniperus procera Endle	1	2.70	-	-	1	1.81
Lagenaria siceraria (Molina) Standl	-	-	1	5.55	1	1.81
Lepidium sativum L.	-	-	1	5.55	1	1.81
Nicandra physaloides (L.) Gaerin.	1	2.70	-	-	1	1.81
Nicotiana tabaccum L.	1	2.70	1	5.55	2	3.63
Pappea capensis Eckl. and Zeyh	1	2.70	-	-	1	1.81
Phytolacca dodecandera L. Herit.	6	16.21	-	-	6	10.90
Prunus africana (Hokk. f.) Kalkm.	-	-	1	5.55	1	1.81
Solanum villosum Mill.	1	2.70	-	-	1	1.81
Stephania abyssinica (Dillon. and .Rich.Walp.	1	2.70	-	-	1	1.81
Tetradenia riparia (Hochst.in C. Krauss) Codd	1	2.70	1	5.55	2	3.63
Vernonia amygdalina Del.	2	5.40	-	-	2	3.63
Total	**37**	**100**	**18**	**100**	**55**	**100**

4.2.4. Plant parts used for medicinal purposes

The pattern of plant parts use in remedy preparation was similar in all the two districts. Although different plant parts were used for remedy preparation, the most frequently employed plant parts were leaves, which accounted for 93 (38.58%) preparations, followed by roots 41 (17.01%) and bark 28 (11.61%) (Table 16).

In Amaro District, leaves were the most common plant parts in the preparation of remedies, which accounted for 46 (32.16%) of the total record of medicinal plants preparations, followed by roots 30 (20.97%), bark 23 (16.08%), fruit 16 (11.18%), latex 9 (6.29%). Likewise, in Gelana, the local communities mostly use leaves in the preparation of remedies which accounted for 47 (47.95%) followed by roots 11 (11.22%), other plant parts were also used to prepare traditional medicine, i.e., fruit 6 (6.12%), seed 7 (7.14%), bark 5 (5.00%), latex 4 (4.08%), stem, bark and root, bud accounted 2 (2.04%) each and flower, root and leaf, whole plant part, seed and leaf, leaf and fruit, leaf and bark, leaf and flower, root and fruit, contributed 1 (1.02%) each (Table 16).

Table 16. Number of plant parts used for medicinal purpose

No	Parts used	Districts					
		Amaro		Gelana		Two districts	
		Frequency	%	Frequency	%	Frequency	%
1	Leaf	46	32.16	47	47.95	93	38.58
2	Root	30	20.97	11	11.22	41	17.01
3	Bark	23	16.08	5	5.10	28	11.61
4	Fruit	16	11.18	6	6.12	22	9.12
5	Latex	9	6.29	4	4.08	13	5.39
6	Seed	3	2.09	7	7.14	10	4.19
7	Stem	3	2.09	2	2.04	5	2.07
8	Root and leaf	7	4.89	1	1.02	8	3.31
9	Leaf and stem	1	0.69	4	2.04	5	2.97
10	Root and flower	1	0.69	-	-	1	0.41
11	Seed and fruit	1	0.69	-	-	1	0.41
12	Whole part	3	2.09	1	1.02	4	1.65
13	Seed and leaf	-	-	1	1.02	1	0.41
14	Bark and root	-	-	2	2.04	2	0.82
15	Bud	-	-	2	2.04	2	0.82
16	Leaf and fruit	-	-	2	2.04	2	0.82
17	Flower	-	-	1	1.02	1	0.41
18	Leaf and bark	-	-	1	1.02	1	0.41
	Total	**143**	**100**	**98**	**100**	**241**	**100**

4.2.4.1. Plant parts used to treat human ailments

Leaves were the most commonly used plant part for the preparations of remedy, which accounted for 64 (34.40%), followed by roots 35 (18.81%) and bark 25 (13.44%). The least medicinally cited plant part was bark and root, bud, seed and leaf, flower, leaf and fruit, root and flower 1 (0.53%) in both districts (Table 17).

In Amaro, the largest proportion of plant parts utilized for medicinal preparations were leaves accounted for 27 (25.23%) preparations, followed by roots 26 (24.29%), similarly in Gelana the majority 37 (46.25%) preparations were from leaves, followed by roots 9 (11.25%) of the total recorded, the other parts include fruits and seed 6 (7.5%) each; bark 5 (6.25%), latex and leaf and stem (4, 5%) each; stem 2 (2.5%) **(**Table 17).

Table 17. Frequenency of human medicinal plants parts used in remedy preparations

Parts used	Districts					
	Amaro		Gelana		Two districts	
	Frequency	%	Frequency	%	Total	%
Leaf	27	25.47	37	46.25	64	34.40
Root	26	24.29	9	11.25	35	10.81
Bark	20	18.69	5	6.25	25	13.14
Fruit	12	11.21	6	7.50	18	9.67
Latex	9	9.34	4	5.00	13	6.98
Seed	3	2.80	6	7.50	11	5.91
Root and leaf	2	1.86	1	1.25	3	1.61
Leaf and stem	1	1.86	4	5.00	5	2.68
Stem	3	2.80	2	2.50	5	2.68
Bark and root	-	-	1	1.25	1	0.53
Bud	-	-	1	1.25	1	0.53
Seed and leaf	-	-	1	1.25	1	0.53
Whole part	1	1.86	1	1.25	2	1.07
Flower	-	-	1	1.25	1	0.53
Leaf and fruit	-	-	1	1.25	1	0.53
Root and flower	1	1.86	-	-	1	0.53
Seed and fruit	1	1.86	-	-	1	0.53
Total	**106**	**100**	**80**	**100**	**186**	**100**

4.2.4.2. Plant parts used for ethnoveterinary remedy preparation

The most frequently utilized plant parts were leaves accounting for 29 (52.72%) of the total record of ethnoveterinary medicinal plants preparations, followed by roots 6 (10.90%) (Table 18). Despite different plant parts reported to be used for remedy preparation by the community of Amaro area, the majority 19 (51.35%) preparations were found to be from leaves alone, followed by, root and leaves 5 (13.51%) each, root and fruit 4 (10.81%) each; bark 3 (8.10%) and whole plant alone 2 (15.38%). Likewise, in Gelana District, 10 (55.55%) of the preparations were from leaves and 2 (11.11%) preparations were from root, bark and root, leaf and bark, leaf and flower, leaf and seed, and bud 1 (5.55%) preparation each (Table 18).

Table 18. Frequenency of ethnoveterinary medicinal plants parts used in remedy preparations

Parts used	Districts					
	Amaro		Gelana		Total in two districts	
	Frequency	%	Frequency	%	Total	%
Leaf	19	51.35	10	55.55	29	52.72
Root	4	10.81	2	11.11	6	10.90
Bark	3	8.10	-	-	3	5.45
Fruit	4	10.81	-	-	4	7.27
Seed	-	-	1	5.55	1	1.81
Root and leaf	5	13.51	-	-	5	9.09
Bark and root	-	-	1	5.55	1	1.81
Bud	-	-	1	5.55	1	1.81
Seed and leaf	-	-	1	5.55	1	1.81
Whole part	2	5.40	-	-	2	3.63
Leaf and bark	-	-	1	5.55	1	1.81
Leaf and flower	-	-	1	5.55	1	1.81
Total	**37**	**100**	**18**	**100**	**55**	**100**

4.2.5. Modes of preparation, condition of preparation, route of administration of medicinal plants

4.2.5.1. Modes of preparation of medicinal plants

In both districts the greater part of remedies were prepared from single plant species 194 (80.49%) and few 47 (19.50%) were reported to be prepared from different plant species, which were combinations of two or more medicinal plants. The major modes of remedy preparation were boiling the decoction 58 (24.06%), followed by crushing and homogenizing with cold water 42 (17.42%) (Table 19).

The main forms of preparation of plant medicines in Amaro District include boiling the decoction 37 (25.87%), followed by crushing and homogenizing with cold water 27 (18.88%) and the combination of each methods. Similarly, in Gelana District, the principal methods of plant parts remedy preparation were boiling the decoction which accounted for 21 preparations (21.42%), followed by pasting a freshly crushed part 20 (20.40%); extract the juice/oil/latex 16 (16.32%) (Table 19).

Table 19. Modes of preparation of human and livestock medicinal plants

Modes of preparation	Amaro		Gelana		Two districts	
	Frequency	%	Frequency	%	Total	%
Boiling and drinking the decoction when cool	37	25.87	21	21.42	58	24.06
Crushing, homogenizing with cold water and drink	27	18.88	15	15.30	42	17.42
Crushing and pasting a freshly crushed part	18	12.58	20	20.40	38	15.76
Eat the part	18	12.58	9	9.18	27	11.20
Extract the juice/oil/latex and pour or paint it	17	11.88	16	16.32	33	13.69
Crush and sniff the freshly crushed part	8	5.59	1	1.02	9	3.73
Boil and do steam bath	5	3.49	2	2.04	7	2.90
Crush, heat/ burn or boil the part and inhale its smoke or steam	4	2.79	6	6.12	10	4.14
Grind, paste the crushed part and tie	4	2.79	1	1.02	5	2.07
Drink the concoction	3	2.09	3	3.06	6	2.48
Hold with teeth	2	1.39	4	4.08	6	2.48
Total	**143**	**100**	**98**	**100**	**241**	**100**

Modes of* remedy preparations *used to treat human ailments

The greater part of remedies were prepared from single plant species 194 (80.49%) and few 47 (19.50%) were prepared from different plant species. The major methods of plant parts remedy preparation were reported to be boiling the decoction, which accounted for 58 preparations (31.18%), followed by crushing 33 (17.74%), extracting the juice/oil/latex and eating the part 26 (13.97%) each (Table 20).

In Amaro District, the result showed that boiling the decoction, accounted for 37 preparations (34.90%), and followed by eating the part 17 (16.03%), crushing and pasting freshly crushed part 15 (14.15%). In the same way, in Gelana, the principal methods of plant parts remedy preparation were reported boiling the decoction accounting for 21 preparations (26.25%), followed by crushing plant parts 18 (22.5%). Over all the major methods of remedy preparation were boiling the decoction in both districts (Table 20).

Table 20. Modes of preparation of human medicinal plants

Modes of preparation	Frequency within two District					
	Amaro		Gelana		Two districts	
	Frequency	%	Frequency	%	Total	%
Boil and drink the decoction when cool	37	34.90	21	26.25	58	31.18
Eat the part	17	16.03	9	11.23	26	13.97
Crushing and pasting a freshly crushed part	15	14.15	18	22.50	33	17.74
Extract the juice/oil/latex and pour or paint it	11	10.37	15	18.75	26	13.97
Crush and sniff the freshly crushed part	8	7.54	1	1.25	9	4.83
Crushing, homogenizing with cold water and drinking	6	5.66	5	6.25	11	5.91
Boil and do steam bath	3	2.83	1	1.25	4	2.15
Crush, heat/ burn or boil the part and inhale its smoke or steam	3	2.83	3	3.75	6	3.22
Grind, paste the crushed part and tie	3	2.83	1	1.25	4	2.15
Hold with teeth	2	1.88	4	5.00	6	3.22
Drink the concoction	1	0.94	2	2.50	3	1.61
Total	**106**	**100**	**80**	**100**	**186**	**100**

Modes of remedy preparation to treat livestock health problems

The main methods of plant preparation were crushing, homogenizing with cold water and drink, which accounted for 31 (56.36%), followed by extracting the juice/oil/latex and paint it 7 (12.72%) (Table 21).

In Amaro District crushing, homogenizing preparation with cold water and so as the patient drunk it was found to be the major mode of remedy preparation accounted for 21 (56.75%), followed by extracting the juice/oil/latex and paint it 6 (16.21%), similarly in Gelana District, crushing, homogenizing with cold water was found to be the major mode of remedy preparation 10 (55.55%), followed by crushing, heating/burning or boiling the part and inhaling its smoke or steam 3 (16.66%), crushing and pasting the freshly crushed part 2 (11.11%) (Table 21).

Table 21. Modes of preparation of livestock medicinal plants

Modes of preparation	**Amaro**		**Gelana**		**Two districts**	
	Frequency	%	Frequency	%	Total	%
Crushing, homogenizing with cold water and drink	21	56.75	10	55.55	31	56.36
Extract the juice/oil/latex and pour or paint it	6	16.21	1	5.55	7	12.72
Crushing and pasting a freshly crushed part	3	8.10	2	11.11	5	27.77
Boil and do steam bath	2	5.40	1	5.55	3	5.45
Drink the concoction	2	5.40	1	5.55	3	5.45
Crush, heat/ burn or boil the part and inhale its smoke or steam	1	33.33	3	16.66	4	7.27
Eat the part	1	33.33	-	-	1	1.81
Grind, paste the crushed part and tie	1	33.33	-	-	1	1.81
Total	**37**	**100**	**18**	**100**	**55**	**100**

4.2.5.2. Conditions of preparation of herbal remedies in the study area

The result in the conditions of plant part used indicated that 216 (89.62%) were used in fresh form while 25 (10.37%) were reported to be used in dried form of preparation (Table 22). In Amaro District 130 (90.90%) were used in fresh form and 13 (9.09%) in dried forms of preparation. Likewise, in Gelana District 86 (87.75%) were used in fresh form and 12 (12.24%) in dried forms of preparation (Table 22).

Table 22. Conditions of plants materials used for medicinal purposes

Condition	Amaro		Gelana		Two districts	
	Frequency	**%**	Frequency	**%**	Total	**%**
Fresh	130	90.90	86	87.75	216	89.62
Dried	13	9.09	12	12.24	25	10.37
Total	**143**	**100**	**98**	**100**	**241**	**100**

Condition of preparation of remedy used to treat human ailments

In the present study it was found that 168 (90.32%) remedies were reported to be used in fresh form while 18 (9.67%) were reported to be used in dried forms. The result in conditions of preparations of plant part used in Amaro District, indicated that 95 (89.62%) were used in fresh form and 11

(10.37%) in dried forms. Likewise in Gelana District, 73 (91.25%) were used in fresh form and 7 (8.75%) in dried forms (Table 23).

Some informants reported that, they preserve the plant material that they could not find in nearest area, in the dry or rainy season by various ways like pounding and saving the powder and/or hanging the intact plant material in the kitchen by rolling by plastic bags, leaves of KOCHO (*Ensete ventricosum*) or pieces of AGOBER (Mosquito net), bottles, papers and horns for example, *Myrica salicifolia* pounding and saving the powder by leaves of KOCHO (*Ensete ventricosum*) for several seasons because it is not available in nearest area (Plate 5).

Plate 5. Healers store traditional medicinal plants

Remedy preparations often evolved some sort of spiritual or ritual procedure. According to one Amaro informant, for example, for rabies treatment the patient had to physically see *Stephania abyssinica* before taking remedy prepared from roots of *Phytolacca dodecandra.* There were also some beliefs by informants, for example, if paste prepared from leaves of *Ocimum lamiifolium* turns red in the presence of patient who is suspected of MICH, then everybody is confident that the person is suffering from the illness.

Table 23. Conditions of plants materials used for medicinal purposes to treat human ailments

Condition	Amaro		Gelana		Two districts	
	Frequency	%	Frequency	%	Total	%
Fresh	95	89.62	73	91.25	168	90.32
Dried	11	10.37	7	8.75	18	9.67
Total	**106**	**100**	**80**	**100**	**186**	**100**

Condition of preparation of medicinal plants used to treat livestock ailments

In Amaro District it was found that 35 (94.59%) preparations were used in fresh forms while the remaining 2 (5.4%) of remedies were reported to be prepared in dry form. Likewise, in Gelana District the community reported that 13 (72.22%) preparations in fresh forms and 5 (27.77%) used in dry form. Over all in both districts, the result in conditions of preparations of plant part used, indicated that fresh form were the dominant one (Table 24).

Table 24. Conditions of plants materials used for medicinal purposes to treat livestock ailments

Condition	Amaro		Gelana		Two districts	
	Frequency	%	Frequency	%	Total	%
Fresh	35	94.59	13	72.22	48	87.27
Dried	2	5.40	5	27.77	7	12.72
Total	**37**	**100**	**18**	**100**	**55**	**100**

4.2.5.3. Route of administration and dosage of traditional herbal remedies

Medicinal plant preparations were administered through different routes. In the study area, oral administration was the dominant route with 133 (53.18%), followed by dermal 77 (31.95%) (Table 25). The dosage varied between age and patient's capacity as judged by healers. The measurements used to determine the dosages were not standardized except categorization by age, physical appearance and health conditions.

In Amaro District, the most popular way of administration of herbal medicines was oral which accounted for 84 (58.74%), followed by dermal 42 (29.37%), nasal 14 (9.79%), tooth surface 2 (1.39%) and ocular 1 (0.69) administration. Correspondingly, oral administration was the principal route with 49 (50.00%) of the preparation, followed by dermal 35 (35.71%), nasal 7 (7.14%), tooth surface 4 (4.08%) and ocular 3 (3.06%) each in Gelana area (Table 25).

Table 25. The routes of administration of human and livestock medicinal plants

Routes of Administration	Amaro		Gelana		Two districts	
	Frequency	%	Frequency	%	Frequency	%
Dr	42	29.37	35	35.71	77	31.95
Na	14	9.79	7	7.14	21	8.71
Oc	1	0.69	3	3.06	4	1.65
Or	84	58.74	49	50.00	133	53.18
Ts	2	1.39	4	4.08	6	2.48
Total	**143**	**100**	**98**	**100**	**241**	**100**

Routes of administration and dosage of human medicinal plants

In the study area oral administration was the main route with 98 (52.68%) of the preparation, followed by dermal 63 (33.87%), nasal 15 (8.06%), tooth surface 6 (3.22%) and ocular 4 (2.15%) (Fig.11). In Amaro District oral administration was the leading route with 60 (56.60%) of the preparations, followed by dermal 31 (29.24%), nasal 12 (11.32%), tooth surface 2 (1.88%) and ocular 1 (0.94%). Likewise, of the total Gelana remedies, oral administration covered 38 (47.50%) followed by dermal 32 (40%), tooth surface 4 (5.00%), nasal and ocular 3 (3.75%) each (Fig.11).

In Amaro District, one plant species (root of *Cucumis ficifolius*) was reported to be kept in the house to repel snake. The mode of applications of one remedy, *Withania somnifera* for example, was reported to be fumigated in the house of the sick person in order to minimize the transmission of the disease to others, while dried seed of *Lepidium sativum* powder, mixed with water and spray to the surface to repel evil spirit. Some of the application modes had spiritual values in the area. Informants confirmed that the bark, seed and leaves of *Dracaena afromontana, Lepidium sativum* and *Entada abyssinica* were crushed together and sprayed early in the mornings and evenings around animal cages, in house and on utensils. This act was believed to keep away or remove evil or bad spirits that for example, could make the cows uncontrolled and dislike their young. Moreover, in the area it was widely believed that having one *Dracaena afromontana* near the house or fence is a guaranty to prevent lightning from the house and animal cage.

Moreover, some healers reported that some medicines could be prepared to be applied in different forms to the single problem. For instance, the root of *Buddleja polystachya* was reported to be used for getting rid of impotency either through taking it orally, brushing the teeth by its root or simply carrying the root in the pocket. Such flexible options enable the patient to select the method that she/he prefers. The existence of such diversified methods of application was indicative of the fairly wider knowledge of the people in the area in using medicinal plants.

The traditional healers use different measurements for dosage, mostly they use their finger lines for the measurement of the amount to be taken and different measuring materials like spoon, coffee cup, tea cup, and glass cups were commonly reported for those remedies which were mentioned to be taken orally. However, these measurements were not accurate enough to determine the precise amount. Children were given less than adults, such as, one fourth of a coffee cup (2–5 ml) whereas; an adult was given up to one glass (approximately 250 ml) depending on the type of illness. It was

commonly measured by number of young leaves (6, *Calpurnia aurea*), number of seeds (10, *Cucurbita pepo*) and length of roots (about 3 cm, *Croton macrostachyus*).

According to the discussion made the informants of Amaro District never, accustomed to administer remedies that were reported to be taken internally to patients who belong to groups of pregnant women, or children below six months of age and people under coma. The informants indicated that they use antidotes for adverse effects of some traditional medicines like eating cooked teff flour. For instance, they reported to use bark *of Myrica salicifolia* for the treatment of gonorrhea, its bark is powdered placed on water overnight, filtered and eaten. During that diarrhea follows, as an antidote the local healers administer the patient to eat cooked teff flour to stop.

In Gelana District, some plants do have different applications for different disease types. For example, leaf of *Bersama abyssinica*, *Croton macrostachyus* and *Calpurnia aurea* were reported to be heated on charcoal and paste on affected area and finally kept on twin road for Joints and bone pains. This preparation was reported to be used for different diseases through diverse application techniques. For instance, putting the leaves on tooth surface was reported to be used to cure toothache, to tie the leaves on swollen body part was reported to be used to cure swelling, sniffing the vapor was also reported to cure AYENETILA, epistaxis (nasal bleeding), common cold, influenza and headache, tying the leaves on neck (infected body part) with cloth was mentioned to be used to treat bone fracture, tonsillitis, wound on head and an allergy.

Doses of liquid remedies administered to humans were usually measured using tea or coffee glasses or plastic cups or by number of drops. In many cases, amounts of plant part to be processed were roughly estimated and therefore, lack precision. For example, many informants during interviews used phrases such as, many leaves, some leaves, and few leaves, to describe their doses.

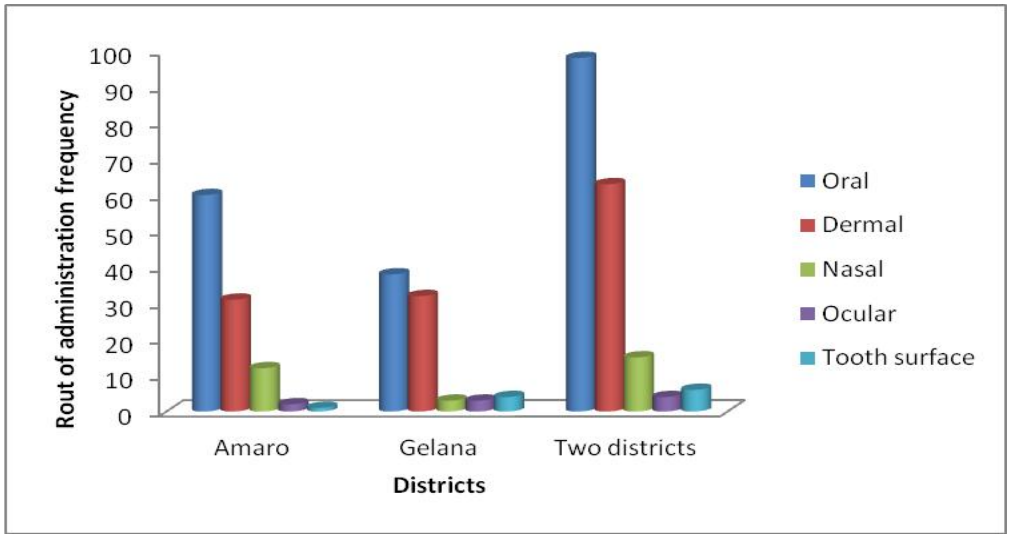

Fig 11. Route of administration of medicinal plants that used for human ailments

Routes of administration and dosage of livestock medicinal plants

It was found that the local people of the two districts employed about three ways of remedy administration with varying frequencies to treat livestock ailments. Of the total, 36 (65.45%) prescriptions were mainly cited to be applied through oral route, followed by dermal 13 (26.63%) and nasal 6 (10.96%) (Fig. 12).

Oral application was the most-cited route of administration accounting for 24 (64.86%), followed by 11 dermal preparations (29.07%) and 2 nasal preparations (5.40%) the Amaro District. Correspondingly, in Gelana area, oral application was the most-cited route of administration with 12 preparations (66.66%) followed by 4 nasal preparations (22.22%) and 3 dermal preparations (16.16%) (Fig.12).

Some traditional practitioners reported to use beer bottles, plastic containers originally made for packing drinking water, glasses, coffee cups or spoons, number of fruits, leaves, tubers, whole herbs and length of roots and drops to determine dosage for some medicinal preparations, while others reported to use a handful or finger-sized preparation to treat ailments. However, no strict standardized doses of herbal preparations was known for modern veterinary medicine reported by traditional healers for any of the preparations used to treat livestock ailments in both districts.

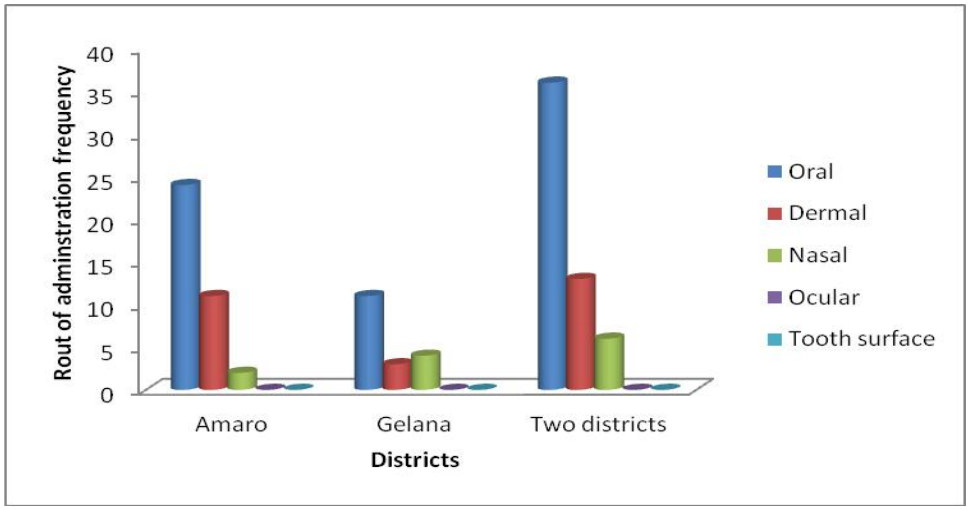

Fig 12. The routes of administration of ethnoveterinary medicinal plants

4.2.6. Most important medicinal plants

4.2.6.1. Informant consensus

Informant consensus results could be useful in prioritizing medicinal plants for further studies. The outcome of this study showed that some medicinal plants were found popular than some others and highest informant consensus went to *Acmella caulirhiza* and *Agarista salicifolia* which were cited by 51 (3.58%) and 44 (3.09%) informants in the study area (Appendix 12). The popularity of these medicinal plants was due to people preference for the species to treat different human and livestock diseases in the community.

Informant consensus of human medicinal plants

From the reported medicinal plants in Amaro District, *Myrica salicifolia* took the lead where it was cited by 40 (7.06%) informants for its medicinal value for treating different types of human ailments. *Buddleja polystachya, Ajuga alba, Clerodendrum myricoides,* were cited by 36 (6.40%), 32 (5.65%) and 30 (5.30%), informants ranking 2nd, 3rd and 4th, respectively (Table 26).

In Gelana District, *Allium sativum* was the most popular, cited by 44 informants (9.48%) for its medicinal value, followed by *Croton macrostachyus, Phytolacca dodecandera* and *Solanum incanum,* mentioned by 40 (8.62%), 30 (6.46%) and 27 (5.89%) informants respectively (Table 26).

Table 26. List of human medicinal plants with the relatively higher (Percentage ≥ 2) informant consensus values in Amaro and Gelana districts

District	Scientific name	No. of informants	%
Amaro	*Myrica salicifolia* Hochst ex A. Rich	40	7.06
	Buddleja polystachya Fresen.	36	6.40
	Ajuga alba L.	32	5.65
	Clerodendrum myricoides (Hochst) R.Br.ex	30	5.30
	Echinops kebericho Mesfin	26	4.59
	Commelina latifolia Hochst.ex.A	24	4.24
	Lepidium sativum L.	22	3.91
	Citrus aurantifolia (Christm.) Swingle	20	3.53
	Clematis simensis Fresen.	18	3.18
	Solanum incanum L.	16	2.83
	Moringa stenopetala (Bakf.) Cufod.	14	2.43
	Olinia rochetiana A. Juss.	12	2.12
Gelana	*Allium sativum* L.	44	9.48
	Croton macrostachyus Del.	40	8.62
	Phytolacca dodecandera L. Herit.	30	6.46
	Solanum incanum L.	27	5.89
	Vernonia auriculifera Hiern	22	4.74
	Cordia africana Lam.	11	2.40
	Capsicum annuum L.	10	2.15
	Guizotia scabra (Vis.) Chiov.	10	2.15

***Informant consensus of* ethnoveterinary medicinal plants**

Agarista salicifolia was the most popular, cited by 44 informants (17.95%) for its ethnoveterinary medicinal value, followed by *Croton macrostachyus, Allium sativum* and *Vernonia amygdalina, Phytolacca dodecandera, Cucumis ficifolius* and *Entada abyssinica* reported by 33 (34.46%), 14 (6.51%), 10 (4.65%) and 8 (3.72%) informants respectively in Amaro District whereas, in Gelana District, *Acmella caulirhiza* was the most popular, cited by 51 informants (27.41%) for its medicinal value, followed by *Cucumis prophetarum, Prunus africana, Boscia angustifolia*, *Coffea arabica*, *Entada abyssinica* and *Clutia abyssinica* mentioned by 38 (20.43%), 35 (18.81%), 9 (4.83%), 6 (3.22%) and 5 (2.68%) informants respectively (Table 27).

Table 27. List of livestock medicinal plants and the corresponding informants in the study area

Scientific name	Amaro		Gelana		Two districts	
	TNC	%	TNC	%	TNC	%
Acacia mellifera (Vahl) Benth.	3	1.39	-	-	3	0.74
Acmella caulirhiza Del.	-	-	51	27.41	51	12.71
Adiantum caudatum Var. Hirsutum auct.	1	0.46	-	-	1	0.24
Aeschnomene elaphroxylon Guill	1	0.46	-	-	1	0.24
Agarista salicifolia (Comm.ex Lam.) Hook.f.	44	17.95	-	-	44	10.97
Allium sativum L.	14	6.51	-	-	14	3.49
Ampelocissus bombycina (Bak.) Planch	6	2.79	-	-	6	1.49
Balaintes aegyptiaca (L.) Del.	2	0.93	-	-	2	0.49
Bersama abyssinica Fresen.	-	-	4	2.15	4	0.99
Boscia angustifolia A. Rich.	-	-	9	4.83	9	2.24
Calpurnia aurea (Ait.).Benth	7	3.25	-	-	7	1.74
Capsicum frutescens L.	6	2.79	-	-	6	1.49
Chenopodium murale L.	4	1.86	-	-	4	0.99
Clutia abyssinica Jaub.and Spach.	-	-	5	2.68	5	1.24
Coffea arabica L.	-	-	6	3.22	6	1.49
Cordia monoica Roxb.	3	1.39	-	-	3	0.74
Croton macrostachyus Del.	33	13.46	-	-	33	8.22
Cucumis ficifolius A.Rich.	8	3.72	-	-	8	1.99
Cucumis prophetarum L.	-	-	38	20.43	38	9.47
Cupresus lusitanica Mill.	3	1.39	-	-	3	0.74
Cyphostemma adenocaule (Steud. ex A. Rich)	-	-	4	2.15	4	0.99
Discopodium penninervium Hochst.	-	-	4	2.15	4	0.99
Dodonaea angustifolia L. f.	5	2.32	-	-	5	1.24
Dombeya torrida (J. F. Gmel.) P. Bamps	-	-	3	0.53	3	0.74
Dracaena afromontana Mildbr.	-	-	3	0.53	3	0.74
Ehretia cymosa Thonn.	2	0.93	2	1.07	4	0.99
Entada abyssinica Steud.ex.A.Rich	8	3.72	6	3.22	14	3.49
Epilobium hirsutum L.	4	1.86	-	-	4	0.99
Helminthotheca echioides (L.) Holub	3	1.39	-	-	3	0.74
Jasminum grandiforium L.	-	-	5	2.68	5	1.24
Juniperus procera Endle	3	1.39	-	-	3	0.74
Lagenaria siceraria (Molina) Standl	-	-	5	2.68	5	1.24
Lepidium sativum L.	-	-	2	1.07	2	0.49
Nicandra physaloides (L.) Gaerin.	2	0.93	-	-	2	0.49
Nicotiana tabaccum L.	4	1.86	3	0.53	7	1.74

Pappea capensis Eckl. and Zeyh	3	1.39	-	-	3	0.74
Phytolacca dodecandera L. Herit.	10	4.65	-	-	10	2.49
Prunus africana (Hokk. f.) Kalkm.	-	-	35	18.81	35	8.72
Solanum villosum Mill.	8	3.72	-	-	8	1.99
Stephania abyssinica (Dillon. and Rich.Walp.)	8	3.72	-	-	8	1.99
Teradenia riparia (Hochest)	6	2.79	1	0.53	7	1.74
Vernonia amygdalina Del.	14	6.51	-	-	14	3.49
Total	**215**	**100**	**186**	**100**	**401**	**100**

4.2.6.2. Informant consensus factors

Diseases reported in the study area were grouped in to different categories based on the site of occurrence of the disease, condition of the disease as well as treatment resemblances. The informant consensus factor was calculated for each category (Table 28). In this study, the informant consensus of medicinal plant usage resulted in ICF ranging from 0.96 to 0.75 per disease category for human health problems and 1.00 to 0.75 for livestock health problems. The factor provides a range of 0 to 1, where a high value acts as a good indicator for a high rate of informant consensus.

Informant consensus factors for human health problems

About twelve disease categories were identified from the total of 52 various human ailments reported in Amaro District. Amongst these, the categories with the highest informant consensus factor (ICF) values were rabies which scored the highest value (1), followed by bone fracture and cancer that scored the second highest values (0.92) and sense organs like eye and ear problems and reproductive and sexual organs scored the third and fourth highest value (0.89) and (0.87) respectively (Table 28). In this study, the lowest ICF value (0.4) was recorded for the category of diseases that belong to bleeding and hypertension. In Gelana District, twelve disease categories were identified from the total of 44 various human ailments. Informant consensus of medicinal plant usage resulted in ICF ranging from 0.75 to 0.96 per disease category. As the result shows bleeding and hypertension, scored the highest informant consensus factor of (0.96), followed by bone fracture and cancer (0.94), respiratory diseases (0.93), dermal diseases, spider, snake, and scorpion poisons and bites, (0.85) each (Table 28). The lower informant consensus factor (0.75) in this study scored for the diseases sense organs like eye and ear problems.

Table 28. Results of informants consensus factor (ICF) for human health problems in Amaro and Gelana districts

Disease category	Amaro			Gelana		
	Species	Use citation	ICF	Species	Use citation	ICF
Bleeding and hypertension	4	6	0.40	2	27	0.96
Rabies	1	2	1.00	3	40	0.94
Respiratory diseases (asthmatic reactions, cough, common cold and tonsillitis)	5	12	0.63	4	49	0.93
Reproductive and sexual organs	4	25	0.87	2	11	0.90
Febrile illness, headache, anemia, brain tension and malaria	10	48	0.80	2	11	0.90
Spider, snake, and scorpion poisons and bites	6	36	0.85	4	21	0.85
Dermal diseases (wound and skin diseases)	15	89	0.84	13	86	0.85
Organ diseases (diabetes, heart problem, jaundice, kidney infection, pneumonia, urinary problem)	8	28	0.74	5	27	0.84
Gastrointestinal disorders	21	147	0.86	18	103	0.83
General disease (tension, epidemic and undefined diseases)	10	62	0.85	5	21	0.80
Bone fracture and cancer	8	91	0.92	14	53	0.75
Sense organs like eye and ear problems	3	20	0.89	3	9	0.75
Total	95	566	100	75	458	100

ICF=Nuc-Ns/Nuc-1

Informants consensus factors (ICF) for ethnoveterinary health problems

Results depicted that in Amaro District, dermal diseases, scored the highest informant consensus factor (0.94), and followed by general disease (0.93), anthrax, cancer and black leg (0.9), respiratory diseases (0.85), organ diseases (0.83) respectively. Likewise, in Gelana District, the following four categories: anthrax and cancer; respiratory diseases; sense organs like eye and ear problems and gastrointestinal disorders categories scored the highest informant consensus factor of (1), followed by reproductive and sexual organs (0.98) (Table 29**)**.

Table 29. Results of informants consensus factor (ICF) for livestock health problems of the Amaro and Gelana districts

Disease category	Amaro			Gelana		
	Species	Use citation	ICF	Species	Use citation	ICF
Anthrax, blackleg, cancer	2	11	0.90	1	4	1.00
Respiratory diseases	4	21	0.85	1	6	1.00
Sense organs like eye and ear problems	3	11	0.80	1	3	1.00
Gastrointestinal disorders	8	33	0.78	1	2	1.00
Reproductive and sexual organs	-	-	-	2	56	0.98
Organ diseases (kidney infection, urinary problem, fashiolsis)	4	19	0.83	3	82	0.97
General disease (evil eye, physically weaken, shivering and undefined diseases)	3	30	0.93	3	15	0.85
Rabies	-	-	-	4	13	0.75
Dermal diseases (wound and skin diseases)	5	71	0.94	2	5	0.75
Snake, and scorpion poisons and bites	4	16	0.80	-	-	-
External parasites, beating with stick and sun stroke	2	4	0.66	-	-	-
Total	35	216	100	18	186	100

4.2.6.3. Relative healing potential of medicinal plants

Relative healing potential of medicinal plants used for treating human ailments

Echinops kebericho against (breast cancer), *Solanum incanum* against (snake bite), *Cordia africana* against (wound), *Rumex nervosus* against (diarrhea), *Zingiber officinale* against (epilepsy), and *Ocimum lamiifolium* against (headache) were Amaro human medicinal plants that scored the highest Fidelity Level (FL) values. In Gelana District, *Rumex abyssinicus* showed the highest fidelity level value (100%) for ascariasis, followed by *Teradenia riparia* (88.88%) for skin rash (Table 30).

Table 30. Fidelity level values of medicinal plants cited by informants against the corresponding human ailment

District	Medicinal plant	Ailment	Ip	Iu	FL value (%)
Amaro	*Echinops kebericho*	Breast cancer	26	26	100.00
	Solanum incanum	Snake bite	14	16	87.50
	Cordia Africana	Wound	9	11	81.81
	Rumex nervosus	Diarrhea	3	4	75.00
	Zingiber officinale	Epilepsy	6	8	75.00
	Ocimum lamiifolium	Headache	3	5	60.00
	Moringa stenopetala	Abdominal pain	8	14	57.14
	Citrus aurantifolia	Stomachache	11	20	55.00
	Faurea speciosa	Breast cancer	6	15	40.00
	Buddleja polystachya	Lung cancer	12	36	33.33
	Foeniculum vulgare	Jaundice	3	12	25.00
Gelana	*Rumex abyssinicus*	Ascariasis	6	6	100.00
	Teradenia riparia	Skin rash	8	9	88.88
	Commelina latifolia	Vomiting	7	8	87.50
	Terminalia schimperiana	Diarrhea	5	6	83.33
	Albizia gummifera	Urine retention	9	11	81.81
	Bersama abyssinica	Evil eye	6	8	75.00
	Cyanotis barbata	Eczema	5	7	71.42
	Hibiscus diversifolius	Spider poison	4	6	66.66

FL= Fidelity Level, Ip = Number of informants who independently cited the importance of a species for treating a particular disease,
Iu = Total number of informants who reported the plant for any given disease.

Relative healing potential of medicinal plants used for treating livestock ailments

The medicinal plants that were widely reported by the Amaro people for treating livestock ailments showed highest FL values. On the other hand, medicinal plants that were known as remedies of a single ailment had 100% fidelity level than those that were reported as remedies for more than one type of ailment. For example, *Vernonia amygdalina, Capsicum frutescens* and *Nicotiana tabaccum,* were cited for their uses in treating trypanosomiasis (GANDY), intestinal parasite and leech infestation respectively, thus scored the highest FL values (100%), followed by that of *Phytolacca dodecandera* (against bloat) with FL value of 80% (Table 31).

In Gelana District highest fidelity level values were obtained for *Teradenia riparia* (83.33%) in dermatological disease category and *Prunus africana* (80%) in the gastrointestinal disease category (Table 31).

Table 31. Fidelity level values of medicinal plants commonly reported against a given veterinary ailment

District	Medicinal plant	Ailment	Ip	Iu	FL value (%)
Amaro	*Vernonia amygdalina*	Trypanosomiasis (Gandi)	14	14	100.00
	Phytolacca dodecandera	Bloat	8	10	80.00
	Capsicum frutescens	Intestinal parasite	6	6	100.00
	Nicotiana tabaccum	Leech infestation	4	4	100.00
Gelana	*Lagenaria siceraria*	Placenta retention	4	6	66.66
	Prunus africana	Fashiolsis	6	8	80.00
	Teradenia riparia	Skin rash	5	6	83.33

FL= Fidelity level, Ip = number of informants who independently cited the importance of a species for treating a particular disease, Iu = total number of informants who reported the plant for any given disease

4.2.6.4. Importance of medicinal plants

Preferences for human medicinal plants

Preference ranking for seven medicinal plants used to treat stomachache of human beings in Amaro District (Table 32) showed that *Myrica salicifolia* ranked first followed by *Ajuga integrifolia, Brassica carinata*, *Allium sativum, Citrus aurantifolia.* The least preferred species were *Nigella sativa* and *Aframomum corrorima*.

Table 32. Preference ranking of seven medicinal plants used to treat stomachache of human beings in Amaro District

Respondents Labeled 1-5	Medicinal plants						
	Ajuga integrifolia	*Nigella sativa*	*Myrica salicifolia*	*Brassica carinata*	*Citrus aurantifolia*	*Allium sativum*	*Aframomum corrorima*
I1	2	1	5	4	1	4	1
I2	3	2	3	4	2	3	2
I3	4	1	3	2	3	1	1
I4	3	3	5	1	2	1	2
I5	3	1	1	1	1	1	1
Total	14	8	17	12	9	10	7
Rank	2nd	6th	1st	3rd	5th	4th	7th

In Gelana District, the result revealed that *Hibiscus diversifolius,* was the most preferred one, followed by *Leucas discolor*, *Guizotia scabra*, *Agave sisalana* and *Abutilon angulatum* based on their efficacy for wound healing in humans (Table 33).

Table 33. Preference ranking of five medicinal plants that were reported to be used against human wound in Gelana District

Respondents Labeled 1-5	Medicinal plants				
	Leucas discolor	*Hibiscus diversifolius*	*Guizotia scabra*	*Abutilon angulatum*	*Agave sisalana*
I1	4	5	1	0	3
I2	3	4	5	2	0
I3	3	3	4	1	2
I4	5	4	0	1	2
I5	3	5	4	1	2
Total	18	21	14	5	9
Rank	2nd	1st	3rd	5th	4th

Preferences for ethnoveterinary plants

In Gelana District, simple preference ranking exercise was used to compare five medicinal plants against rabies (Table 34). As indicated in the table *Jasminum grandiflorum* ranked first followed by *Nicotiana tabaccum, Cucumis prophetarum, Dombeya torrida* and *Lepidium sativum*.

Table 34. Preference ranking of five medicinal plants against livestock ailment of rabies in Gelana District

Respondents Labeled 1-5	Medicinal plants				
	Nicotiana tabacum	*Lepidium sativum*	*Jasminum grandiflorum*	*Cucumis prophetarum*	*Dombeya torrida*
I1	2	1	5	4	1
I2	3	2	3	4	2
I3	4	1	3	2	3
I4	3	3	5	1	2
I5	3	1	1	1	1
Total	14	8	17	12	9
Rank	2nd	5th	1st	3rd	4th

4.2.6.5. Most preferred medicinal plants

In Gelana District, six informants practiced paired comparison of five medicinal plants reported against diarrhea (Table 35). *Catha edulis, Commelina latifolia, Cordia africana*, *Terminalia schimperiana* and *Euclea racemosa* were ranked 1st, 2nd, 3rd, 4th and 5th respectively.

Table 35. Paired comparisons of six medicinal plants used to treat diarrhea

Plant species	Respondents							
	R1	**R2**	**R3**	**R4**	**R5**	**R6**	Total	Rank
Cordia africana	3	2	1	4	4	2	16	3rd
Catha edulis	4	4	3	5	2	3	21	1st
Commelina latifolia	3	5	3	2	3	4	20	2nd
Terminalia schimperiana	2	2	3	3	2	2	14	4th
Euclea racemosa	3	2	1	1	2	3	12	5th

4.2.6.6. High ranking of medicinal plants

Ranks of human medicinal plants

Five commonly reported multipurpose species and five use-categories were involved in direct matrix ranking exercise in order to evaluate their relative importance to the local people of Amaro District and the extent of the existing threats related to their use values (Table 36). Among the very common medicinal plants the direct matrix ranking showed that *Hagenia abyssinica* was found most threatened, followed by *Erythrina brucei, Dichrostachys cinerea, Cordia africana* and *Combretum collinum*.

Ranks of multi-purpose medicinal plants

Results of 4 informants (R_1-R_4) against five use values other than their food use. 0=no use, 5=best, MD=medicines, FW=Fire wood, C=Charcoal, Fo= Fodder, Ct=Construction and tools, Tc=Total number of informants, Gc=Grand total, Ra=Rank.

Table 36. Direct matrix ranking of five plant species by four informants based on five use criteria (5 = best; 4 = very good; 3 = good; 2 = less used; 1 = least used and 0 = no value)

Use category	Medicinal plants																			
	Dichrostachys cinerea				*Hagenia abyssinica*				*Erythrina brucei*				*Combretum collinum*				*Cordia africana*			
	Informants (1-4)				I				I				I				I			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
MD	1	3	2	1	4	4	1	1	5	3	2	2	1	0	1	1	4	3	0	1
FW	5	5	5	4	5	4	1	4	2	4	3	4	4	3	1	1	2	3	4	1
C	0	1	0	1	3	5	4	4	1	0	1	1	3	3	2	2	0	1	0	0
Ct	3	3	1	1	5	5	4	3	4	4	4	1	2	2	0	1	3	3	5	2
Fo	1	2	1	2	3	3	1	1	4	2	2	1	0	1	1	1	1	3	0	1
Tc	10	14	9	9	20	19	14	10	16	13	12	9	10	9	5	6	10	13	9	5
Gc	42				63				50				30				36			
Rank	3rd				1st				2nd				5th				4th			

4.2.7. Medicinal plants used both in treatment of human and livestock aliments

Out of 42 ethnoveterinary medicinal plants reported in this study, 9/42 species (21.42%) were also reported for their uses as human medicinal plants and the remaining 33/42 species (78.57%) were used solely as ethnoveterinary medicinal plants. In other words, out of 112 human medicinal plants, 103/112 species (91.96%) were used to treat human ailments alone and the rest 9/112 species (8.03%) were used to treat both human and livestock ailments (Appendix 12).

4.2.8. Marketability of medicinal plants

Surveys were made in two daily and four weekly local markets from seven kebeles (Kele, Danobultu, Jijola, Jalo and Kereda in Amaro and Kersa in Gelana). Plants such as, BORSE (*Echinops kebericho*), SIBECA (*Lepidium sativum*), KULBO (*Zingiber officinale*), TUMA *(Allium sativium*), and materials made from SOBO (*Combretum molle*), DERGILE (*Terminalia macroptera*) and ZERGETE (*Rhus glutinosa*) were found common in the market place sold basically for food or spice and other non medicinal purposes. BORSE (*Echinops kebericho*), SIBECA (Lepidium sativum), TIKURE DUBA (*Cucurbita pepo*), TSETELA (*Ruta chalepensis*), BUNDO (*Myrica salicifolia*) were also found on markets being sold and purchased entirely for the purposes of their non-medicinal applications. In addition, parts of different medicinal plants were also marketed for their medicinal value and for their uses as spice such as *Lepidium sativum* (Plate 6A), *Nigella sativa* (Plate 6C). *Echinops*

kebericho (Plate 6D) and *Allium sativum* (Plate 6F). The respondents explained that most healers prepare and sell traditional medicinal plants at their homes rather than in an open market.

Plate 6. Market survey of Kele (A, B), Danobultu (C), Jijola (D), jalo (E) and Kereda (F) kebeles (Photo taken by Getu Alemayehu, 2013).

4.2.9. Similarity in species composition and use of the reported medicinal plants between Amaro and Gelana districts.

Of the total 147 medicinal plants, 32 were common to both ethnic groups (Koore and Oromo). Regarding similarity of medicinal plant use, each of the following five medicinal plants were used in the same way by the two ethnic groups (koore and Oromo) for example, *Ajuga integrifolia* against stomachache, *Commelina latifolia* against ringworms, *Eucalyptus globulus* against influenza, *Ocimum lamiifolium* against general malaise (MICH) and *Solanum incanum* against epstaxis.

4.2.10. Indigenous knowledge transfer and medicinal plant collection

The majority of informants were agree in that most ailments were treated at family level with self-prepared remedies. When required, people could consult other knowledgeable people in their respective local community with little or no charge. The majority of the interviewees, accounting for 80% and 75% in Amaro and Gelana districts respectively, respond that they keep their medicinal plant knowledge secret and further transfer of knowledge could only take place within family members. For the proper transfer, the owner of the knowledge in a family (mostly a father or mother) select one of his or her children (usually as son) which he or she thinks, fulfils his or her own set of criteria the most. The selected child starts training around the age of 10 and continuous his or her apprenticeship until the age of 18, the time when the transfer of the knowledge is expected to be more or less complete. Most of the informants agreed that transfer of knowledge to

people outside the family circle could only take place on substantial payment. Only very few practitioners had the experience of teaching the indigenous medical knowledge and showing the medicinal plants to all members of their family. Some of the traditional medical practitioners were also not willing to pass on their plant use knowledge even to their families. Very few (10%) informants reported that knowledge was revealed to them by God in their dreams.

The majority (80%) of Amaro and Gelana informants expressed their concern that vertical transfer of knowledge on traditional medicine was currently not taking place very effectively unlike it was before due to the lack of interest by the younger generation to learn and practice it mainly due to acculturation. According to the information from most of the respondents (90%), the indigenous plant use knowledge transfer was mainly by word of mouth rather than through a well-organized written script.

The perception of the local people with regard to the time of medicinal plant collection was very diverse. Consequently, there was no unanimously accepted fixed time for collection and this differed from person to person and hence was highly dependent on individual beliefs. Some (30%) said collection should be done before 4:00 p.m. While others (70%) preferred the morning time up until 9:00 a.m. or afternoon after 4:00 p.m. The morning or night times were convenient for others. Still others argued that the best time of collection was early in the morning or early afternoons.

Medical practitioners of the study area adhered to certain beliefs while collecting and applying medicinal plants. For instance, the medicinal plants were collected or given only by single females or a male only since it was reported that it relates to healers' beliefs that doing it otherwise would reduce the efficacy of the herbal medicine.

4.3. Ethnobotany of wild edible plants

4.3.1. Wild plants reported for use as food

A total of 80 wild edible plants were recorded in the study area and these plants were found distributed in 52 genera and 32 families (Appendix 13). From the total wild edible plant species two of them (*Urtica simensis* and *Rhus glutinosa*) were found endemic to Ethiopia. Sixty-four species distributed in 47 genera and 33 families were identified by local communities within Amaro District as wild edible plants whereas, fifty five wild plant species belonging to 35 genera and 25 families were reported as food sources in Gelana District.

Of all the families family Fabaceae was represented with 10 (12.5%) species, had the highest proportion of edibles followed by Tiliaceae 5 (6.25% species); Anacardiaceae, Moraceae, Rhamnaceae, Rosaceae and Solanaceae 4 (5.00% species) each. Five of the reported families, i.e. Amaranthaceae, Boraginaceae, Lamiaceae, Myrsinaceae and Myrtaceae were represented by three species each. Eight (25%) of the families were represented by two species each. Each of the remaining 14 (43.75%) families had single-species representation in both districts (Table 37).

In Amaro District, with respect to the diversity of the species gathered, the highest number of wild edible plants were recorded in the family Fabaceae 7 (10.93% species), followed by Anacardiaceae, Rosaceae and Tiliaceae 4 (6.25% species) each; and Boraginaceae, Myrtaceae, Rhamnaceae had 3 (4.68% species) each. Whereas, in Gelana District family Fabaceae represented by 5 (9.09% species), followed by Moraceae, Rosaceae and Tiliaceae 4 (7.25% species) each; Anacardiaceae, Myrtaceae, Rhamnaceae and Solanaceae 3 (5.45% species) each; Apocynaceae, Boraginaceae, Brassicaceae, Flacourtiaceae, Myrsinaceae, Polygonaceae and Verbenaceae 2 (1.81% species) each (Table 37).

Table 37. Number of composition of wild edible plant species with respect to their families, genera and species

Family	Districts, genera, species and percentage								Two districts			
	Amaro				Gelana							
	Genera	%	Species	%	Genera	%	Species	%	Genera	%	Species	%
Acanthaceae	2	4.25	2	3.12	-	-	-	-	2	3.77	2	2.5
Amaranthaceae	1	2.12	1	1.56	3	8.57	1	1.81	1	1.88	3	3.75
Anacardiaceae	2	4.25	4	6.25	1	2.85	3	5.45	2	3.77	4	5.00
Apocynaceae	2	4.25	2	3.12	2	5.71	2	3.63	2	3.77	2	2.5
Araceae	1	2.12	1	1.56	-	-	-	-	1	1.88	1	1.25
Arecaceae	1	2.12	1	1.56	1	2.85	1	1.81	1	1.88	1	1.25
Asparagaceae	1	2.12	1	1.56	-	-	-	-	1	1.88	1	1.25
Balanitaceae	1	2.12	1	1.56	-	-	-	-	1	1.88	1	1.25
Boraginaceae	2	4.25	3	4.68	2	5.71	2	3.63	2	3.77	3	3.75
Brassicaceae	1	2.12	1	1.56	2	5.71	2	3.63	2	3.77	2	2.5
Cactaceae	1	2.12	1	1.56	-	-	-	-	1	1.88	1	1.25
Capparidaceae	2	4.25	2	3.12	1	2.85	1	1.81	2	3.77	2	2.5
Commelinaceae	1	2.12	1	1.56	-	-	-	-	1	1.88	1	1.25
Cucurbitaceae	1	2.12	1	1.56	1	2.85	1	1.81	1	1.88	1	1.25

Ebenaceae	-	-	-	-	1	2.85	1	1.81	1	1.88	1	1.25
Euphorbiaceae	1	2.12	1	1.56	1	2.85	1	1.81	1	1.88	1	1.25
Fabaceae	3	6.38	7	10.93	2	5.71	5	9.09	3	5.66	10	12.5
Flacourtiaceae	2	4.25	2	3.12	2	5.71	2	3.63	2	3.77	2	2.5
Lamiaceae	2	4.25	2	3.12	1	2.85	1	1.81	3	5.66	3	3.75
Loranthaceae	1	2.12	1	1.56	1	2.85	1	1.81	1	1.88	1	1.25
Moraceae	1	2.12	1	1.56	1	2.85	4	7.25	1	1.88	4	5.00
Moringaceae	1	2.12	1	1.56	-	-	-	-	1	1.88	1	1.25
Myrsinaceae	2	4.25	2	3.12	2	5.71	2	3.63	3	5.66	3	3.75
Myrtaceae	1	2.12	3	4.68	1	2.85	3	5.45	1	1.88	3	3.75
Olacaceae	1	2.12	1	1.56	1	2.85	1	1.81	1	1.88	1	1.25
Polygonaceae	1	2.12	1	1.56	1	2.85	2	3.63	1	1.88	2	2.5
Rhamnaceae	2	4.25	3	4.68	2	5.71	3	5.45	3	5.66	4	5.00
Rosaceae	2	4.25	4	6.25	2	5.71	4	7.25	2	3.77	4	5.00
Rubiaceae	2	4.25	2	3.12	-	-	-	-	2	3.77	2	2.5
Santalaceae	1	2.12	1	1.56	-	-	-	-	1	1.88	1	1.25
Solanaceae	2	4.25	2	3.12	3	8.57	3	5.45	3	5.66	4	5.00
Tiliaceae	1	2.12	4	6.25	1	2.85	4	7.25	1	1.88	5	6.25
Urticaceae	1	2.12	1	1.56	1	2.85	1	1.81	1	1.88	1	1.25
Verbenaceae	1	2.12	1	1.56	1	2.85	2	3.63	1	1.88	2	2.5
	47	100	64	100	35	100	55	100	53	100	80	100

4.3.2. Distribution of wild edible plants

Of the total wild edible plants recorded, 52 (65.00%) species were obtained from wild vegetation and 28 (35.00%) species were obtained from cultivation. Thus, the majority of wild edible plants were found out from wild vegetation (Appendix 13). In Amaro District of the total wild edible plants species 44 (68.75%) were find from natural habitat (Nekora forest) and 20 (1.25%) species were obtained from cultivation whereas, in Gelana District, Dance forest accounted 38 (69.09%) of the wild edible species and 17 (30.90%) species were obtained from cultivation.

4.3.3. Habit

Thirty-four (42.50%) of the reported wild edible plants were shrubs, followed by trees 25 (31.25%), herbs 20 (25%) and climbers 1 (1.25%) species. Of the recorded WEPs in Amaro area, shrubs were the highest growth forms with 33 (51.56%), followed by trees 18 (28.12%) and herbs 12 (18.75%). Correspondingly, in Gelana District, 23 (41.81%) of the reported wild edible plants were shrubs, followed by trees 16 (29.09%), herbs 15 (27.27%) and climbers 1 (1.81%) (Fig. 13).

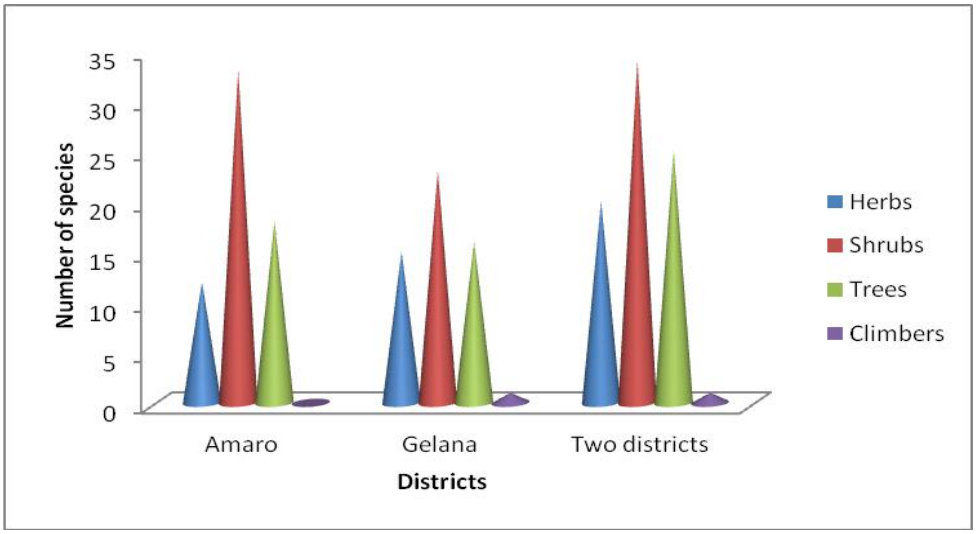

Fig 13. Habit of wild edible plants

4.3.4. Plant parts used and mode of consumption

4.3.4.1. Plant parts used as food

Fruits, leaves and gum were found the most widely used wild edible plant parts in the study area Eight plant parts were indicated as edible, fruits accounted for 54 (67.50%), followed by gum 9 (11.25%), leaves 8 (10%), flower nectar, whole plant parts and root 2 (2.55%) each; seed, seed and leaf, fruit and leaf 1 (1.25%) each (Table 38).

In Amaro District the majority of the edible plant parts was fruit which consist of 46 (71.87%), followed by leaves 7 (10.93%), gum 6 (9.37%), whole plant 2 (3.12%), roots 1 (1.51%), seed and flower nectar shared the lowest edibility report in the same way, in Gelana District, the most widely consumed plant parts were fruit 37 (67.27%), followed by gum 6 (10.90 %), leaves 5 (9.09%), seed and leaf and whole plant parts 2 (3.63%), and seed, root 1 (1.92%). Generally, fruits were found the most widely used plant parts that were reported for high edibility in both districts.

Table 38. Plant parts of wild edible plants used as food

Parts used	Districts

	Amaro		Gelana		Two districts	
	Frequency	%	Frequency	%	Total	%
Leaves	7	10.93	5	9.09	8	10.00
Flower nectar	1	1.58	1	1.81	2	2.50
Fruit	46	71.87	37	67.27	54	67.50
Gum	6	5.37	6	10,90	9	11.25
Whole plant	2	3.12	2	3.63	2	2.50
Root	1	1.58	1	1.81	2	2.50
Seed	1	1.58	1	1.81	1	1.25
Seed and Leaf	-	-	2	3.63	2	2.50
Total	64	100	55	100	80	100

4.3.4.2. Mode of consumption

In this study, 69 (86.25%) lists were counted as unprocessed whereas 11 (13.75% species) were consumed cooked or processed. Processed type, edible plants were consumed after cooking process including preserve, powder and heat pass (Plate 7).

Plate 7. The wild edible plants *Solanum nigrum* (ADUA) harvested, cooked and eaten by local people (Photo taken by Getu Alemayehu, 2014).

In Amaro District, about 57 (89.06%) species of these fruits were reported to be eaten raw, whereas 7 (10.93% species) were consumed cooked or processed. Likewise, in Gelana District, about 47 (85.45% species) of these fruits were reported to be eaten raw, whereas (8, 14.54% species) were consumed cooked or processed (Table 39).

Table 39. Mode of consumption of wild food plants in the study area

	Districts, mode of consumption, number of consumption and percentage					
	Amaro		Gelana		Two districts	
Mode of consumption	Frequency	%	Frequency	%	Total	%
Raw	57	89.06	47	85.45	69	86.25
Cooked	7	10.93	8	14.54	11	13.75

4.3.5. Food plants used as traditional medicine

Out of the total wild edible plants, twenty-one (26.25%) nutraceutical wild plants were used to treat 17 (80.95%) human and 4 (19.04%) livestock ailments (Appendix 14). The most commonly encountered families used as traditional medicine were Fabaceae and Boraginaceae in both districts. Out of the total wild edible plants, fourteen (9.89%) nutraceutical wild plants were used to treat 13 (76.47%) human and 4 (23.52%) livestock ailments in Amaro District (Appendix 15). For instance, *Acokanthera schimperi, Balaintes aegyptiaca, Cordia africana, Datura stramonium, Ehretia cymosa, Acacia mellifera* and *Moringa stenopetala, Rumex nervosus, Senna occidentalis, Tamarindus indica* were the most commonly used nutraceutical plants reported for their wider use in the study area. Likewise, in Gelana District, eight nutraceutical wild plants were used to treat 10 (90.90%) for human and 1 (9.09%) livestock ailment (Appendix 16).

From the wild edible plants used as traditional medicine trees accounted for 9 (42.85% species) followed by shrubs 8 (38.09% species) and herbs 4 (19.04% species). In Amaro District, trees were the most dominant growth forms represented by (6, 42.85% species), followed by shrubs 5 (35.71% species) and herbs 3 (21% species) whereas, in Gelana District shrubs were the leading growth form consisted of 4 (50% species) followed by trees 3 (37.5%) and herbs 1 (12.5% species).

4.3.6. Diseases treated using nutraceutical wild plants

In Amaro District, a total of 10 human and 4 livestock ailments were identified to be treated by 14 wild edible plants whereas, in Gelana, a total of 10 human and 1 livestock ailments were identified to be treated by 8 wild edible plants. The most commonly reported ailments to be addressed by nutraceutical plants were Abdominal pain, amoeba, evil spirit, eye disease, insect allergy, intestinal parasite, malaria, ring worms, shivering of cattle, skin rash, snake bite, toothache and wound in Amaro District in the same way, ascariasis, breast cancer, diarrhea, ear problem, gastritis, heart faller, liver disease and skin rash were the most common ailments in Gelana District (Table 40).

Table 40. Disease treated using nutraceutical wild edible plants

Diseases treated	Amaro		Gelana		Two districts	
	Human medicine species	Livestock medicine	Human medicine	Livestock medicine	Human medicine	Livestock medicine
Insect allergy	1	-	-	-	1	-
Eye disease	-	1	-	-	-	1
Wound	2	1	-	-	2	1
Skin rash	1	-	1	-	2	-
Shivering of cattle	-	1	-	-	-	1
Abdominal pain	1	-	-	-	1	-
Malaria	2	-	-	-	2	-
Ear problem	-	-	1	-	-	1
Liver disease	-	-	1	-	-	1
Heart faller	-	-	1	-	-	1
Gastritis	-	-	1	-	-	1
Ascariasis	-	-	1	-	-	1
Tonsillitis	-	-	1	-	-	1
Snake bite	-	1	1	-	1	1
Toothache	1	-	-	-	1	-
Ring worms	2	-	-	-	2	-
Intestinal parasite	1	-	-	-	1	-
Amoeba	1	-	-	-	1	-
Evil spirit	1	-	-	-	1	-
Diarrhea	-	-	1	1	1	1
Breast cancer	-	-	1	-	1	-
Total	**13**	**4**	**10**	**1**	**17**	**11**

4.3.7. Importance of WEPs

4.3.7.1. Preference for WEPs

Selection and ranking of the most preferred wild edible plants, based on their taste quality was performed in Amaro District. The results of this study showed that, the most preferred species in decreasing order of their taste quality were *Physalis lagascae, Rubus steudneri*, *Arisaema schimperianum*, *Cordia africana* and *Ximenia americana* respectively (Table 41).

Table 41. Preference ranking of wild edible plants based on their taste quality

Respondants Labelled 1-5	Wild edible plants				
	Rubus steudneri	*Physalis lagascae*	*Arisaema schimperianum*	*Ximenia americana*	*Cordia africana*
I1	2	5	4	1	4
I2	3	3	4	2	3
I3	4	3	2	3	1
I4	3	5	1	2	1
I5	3	1	1	1	1
Total	15	17	12	9	10
Rank	**2nd**	**1st**	**3rd**	**5th**	**4th**

4.3.7.2. Factors threatening WEPs

In Amaro District, comparison of five threatening factors of wild edible plants was conducted using 7 key informants. The results (Table 42) indicated that agricultural expansion stood first, followed by firewood collection, charcoal making, construction and tools and grazing were management problems of plant resources respectively (Table 42).

Table 42. Paired comparison of factors affecting wild edible plants in the study area

Preferred item	Respondents							Total	Rank
	R1	R2	R3	R4	R5	R6	R7		
Construction and tools	1	2	3	1	2	3	3	15	4th
Grazing	4	0	1	0	4	1	1	11	5th
Charcoal making	2	1	5	3	1	2	5	19	3rd
Agricultural expansion	5	3	4	5	3	5	4	29	1st
Fire wood collection	3	5	2	4	5	4	2	26	2nd

4.3.7.3. High ranking of WEPs

In Amaro District, five commonly reported multipurpose species and five use-categories were used for in direct matrix ranking exercise. Among the very common wild edible plants DMR showed that *Cordia africana* (most threatened) followed by *Acacia mellifera, Balanites aegyptiaca, Carissa spinarum, Tamarindus indica* were found to be most important in their multiple utility value respectively (Table 43).

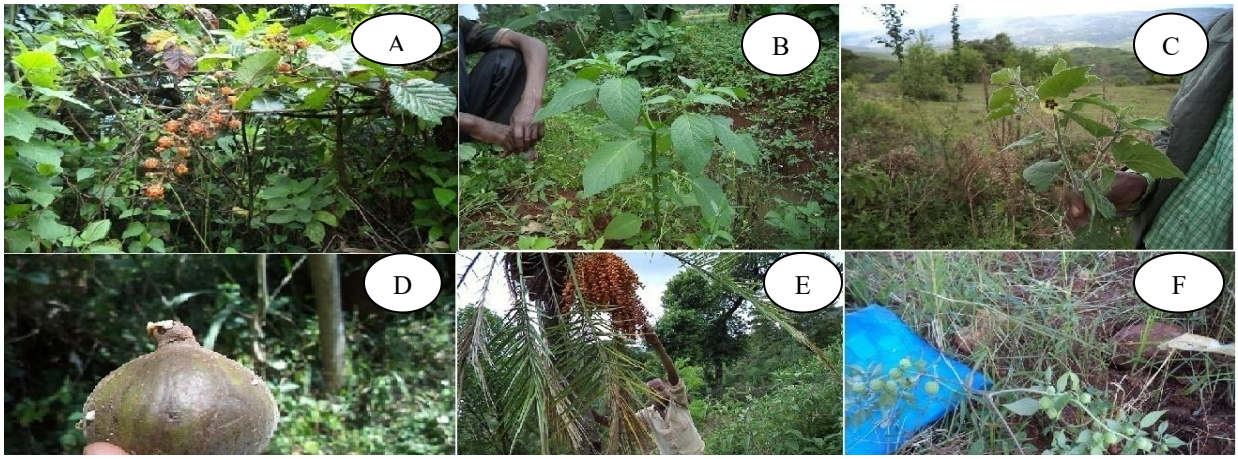

Plate 8. Some WEPs of the study area (A= *Rubus steudneri*, B= *Solanum nigrum*, C= *Physalis peruviana*, D= *Ficus sur*, E= *Phoenix reclinata*, F= *Physalis lagascae*) (Photo taken by Getu Alemayehu, 2014).

Table 43. Direct matrix ranking of five WEPs by four informants based on five use criteria (5 = best; 4 = very good; 3 = good; 2 = less used; 1 = least used and 0 = no value)

Use categories	Wild edible plants																			
	Carissa spinarum				*Cordia Africana*				*Acacia mellifera*				*Balanites aegyptiaca*				*Tamarindus indica*			
	Informants (I1-4)				I				I				I				I			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
MD	3	1	1	2	2	4	1	1	5	3	2	2	1	0	1	1	4	3	0	1
FW	5	5	4	5	4	5	4	1	2	4	3	4	4	3	1	1	2	3	4	1
C	1	0	1	0	5	3	4	4	1	0	1	1	3	3	2	2	0	1	0	0
Ct	3	3	1	1	5	5	4	3	4	4	4	1	2	2	0	1	3	3	5	2
Fo	2	1	2	1	3	3	1	1	4	2	2	1	0	1	1	1	1	3	0	1
Inf. total	14	10	9	9	19	20	14	10	16	13	12	9	10	9	5	6	10	13	9	5
Gc	42				63				50				30				36			
Rank	3rd				1st				2nd				5th				4th			

4.3.8. Marketability of WEPs

Three daily and two weekly markets from twenty kebeles were selected for market survey. During the study, three major markets in Amaro District (i.e., namely, Kele, Danobultu, Kerma/Jijola) and two major markets in Gelana District (Karsa, Gewe) were observed. Many of the wild edible plants were reported to be consumed raw and outdoors (in agricultural fields, during cattle keeping and travelling), and some other parts that require processing were brought home for preparation prior to

consumption. However, there was one wild edible plant sold in the market of Gelana District (*Solanum nigrum)* (ADUA) (Plate 9)**.**

Plate 9. Local communities sold *Solanum nigrum* in Gewe market of Gelana District (Photo taken by Getu Alemayehu, 2014).

4.4. Similarity of Amaro and Gelana districts with five other areas with respect to wild edible plants composition

The results of the comparison of wild edible plant utilization analysed using Jaccard coefficient of similarity indicated that the highest degree of similarity was observed with the study conducted in Semi-arid lowlands of Southern Ethiopia (21.66%) followed by Derashe and Kucha districts (13.63%) followed by Konso Ethnic Community (11.81%), then the least similarity were observed with the study conducted in Omo River Valley (10.52%) (Table 44).

Table 44. The Jaccard coefficient of similarity of Amaro and Gelana districts with five other areas with respect to wild edible plants composition

Study place	**Alt range**	**A**	**b**	**c**	**% JCS**
Amaro and Gelana districts	900-3240	80			
Konso Ethnic Community	650 – 2650	127	97	30	11.81
Semi-arid lowlands of Southern Ethiopia	1200–1500	30	17	13	21.66
Omo River Valley	403 -575	38	30	8	10.52
Derashe and Kucha Districts	250–2600	66	48	18	13.63

4.5. Other uses of medicinal and wild edible plants

Some plants were reported to have uses other than their medicinal and nutritional values. Different parts of these medicinal and wild edible plants reported to be used for building material, beeforage,

fire wood, household tools, toothbrush, charcoal, detergent, fodder, smoking gourds, cloth, perfume, religious ceremonies, spices and tanning leather. In this study area, a total of 63 medicinal and wild edible plant species belonging to 54 genera and 37 families were identified for one or more uses across sixteen different major use categories for diverse uses other than their medicinal and edibility use reports (Appendix 17). In Amaro District, 54 medicinal and wild edible plant species belonging to 44 genera and 31 families and, in Gelana District nine species of plants belonging to 9 genera and 9 families were identified for multiple utility.

Of the reported medicinal and wild edible plant species, 63 documented species were cited for at least two uses or more, building material uses contributed approximately 16 (25.39%) out of the total uses, food and medicinal uses 14 (22.22%), beeforage 7 (11.11%), household tools and tooth brush 4 (6.34%) each, farm implements 3 (4.76%) species. In Amaro District, the result indicates that 14 (25.92%) species were used for construction purpose, 13 (24.07%) species used as food and medicinal, 6 (11.11%) species as beeforage, 4 (7.40%) plant species each as household tools; farm implement, tooth brush, 3 (5.55%) species each; charcoal 2 (3.70%) species and 1 (1.85%) species each were used as, cloth, detergent, fodder, firewood, perfume, spice, religion ceremonies and tanning leather. Similarly, in Gelana District 2 (14.28%) species were reported to be used as building material followed by bee forage, food and medicine, firewood, charcoal, tooth brush, detergent and spices 1 (6.34%) species each.

4.5.1. Building materials

Building material constituted 25.39% (16 species, in 14 genera and 11 families) of the medicinal and wild edible flora of Amaro and Gelana districts. The local people of Amaro and Gelana districts use different growth habits of the plants to build their shelters. Shrubs 8 (50%) and trees 8 (50%) were the dominant growth forms. The family Fabaceae with six species and the other ten families with one species were the families commonly used. The importance of these plants was based on their part used in constructing the house. Thus, 9 (56.25%) stem and 7 (43.75%) branches were used as component elements during house construction used for making of doors and window.

4.5.2. Bee forage

Bee forage constituted 11.11% (7 species, in 6 genera and 6 families) of the medicinal and wild edible flora of Amaro and Gelana districts. The study shows that families Moraceae with two species followed by Acanthaceae, Asteraceae, Fabaceae, Flacourtiaceae and Rosaceae with one

species each were the major source of nectar/pollen used as bees forage in the study area (Table 45). Regarding the growth habit, shrubs and tree scored the highest 3 (42.85 %) each followed by herbs 1 (14.28%). Therefore, in the study area, shrubs were the main source of nectar and pollen for bees but herbs contribute less.

Table 45. Families of plant species used as honey beeforage in the study area

Family	No. of species	Percentage
Acanthaceae	1	14.28
Asteraceae	1	14.28
Fabaceae	1	14.28
Flacourtiaceae	1	14.28
Moraceae	2	28.57
Rosaceae	1	14.28

4.5.3. Household tools

The local people of Amaro and Gelana districts use plants for making household tools such as high quality furniture, doors, widows, chairs, beds, containers, cabinet making, mortars and pestles. The result shows that *Cordia africana*, *Hagenia abyssinica, Millettia ferruginea* and *Myrica salicifolia* were the major plant species used for making of household tools in the study area. Tree was the main growth habit for making of household tools.

4.5.4. Farm implements

The agricultural implements including plough, yoke, axe and DIGGER were made from several plant parts supplemented with locally made metal instruments. Families used as farm implements Agavaceae, Combretaceae and Moraceae with one species, each were the most widely used plant families. The widely used growth forms of these species are trees. Forest materials for farm implements are the backbone of the livelihood of the farming community. Hence, of the total medicinal and wild plants collected 4 plants species were used as farm implements. As it is indicated in the result, 2 (66.66%) stems and 1 (33.33%) branches were commonly used as farming tools in the study area.

4.5.5. Firewood plants

Myrtaceae and Fabaceae were the most widely used firewood plant family in the study area. The local people harvest different growth forms of plants from the study area for firewood. Tree was the most widely growth forms. The plant parts stem was mainly used.

4.5.6. Charcoal producing plants

Family Fabaceae with two species and Rutaceae with one species were commonly used in charcoal production process in the study area. The study revealed that those plants harvested for charcoal production were in the growth habits of trees with 2-stem part.

4.6. Indigenous knowledge of the communities and different informant groups

A total of 380 informants from each ethnic group were selected (Appendices 18 and 19). The gender distribution of respondents was 200 (52.63%) and 180 (47.36%) for males and females, respectively. The male informants reported 77 (52.38%) of medicinal plants than the female informants. Regarding age distribution of respondents, out of 380 informants, 259 (68.15%) informants were older than 30 years, 121 (31.84%) of the informants were found between the ages 18-30.

The numbers of medicinal plants reported by first age groups (>30 age groups) were more than that of the second (18-30 age groups). Informants older than age 30 mentioned 84 (57.14%) of the medicinal plants species than the younger ones. There was a significant difference ($P< 0.05$) in the number of medicinal plants reported by aged members of the community (>30 years) and young aged members (18-30 years) (Table 46). Regarding educational status of respondents, more informants were not well educated the largest percent from the total informants 231 (60.78%) were illiterate peoples and 149 (39.21%) literate informants. Illiterate peoples mentioned 76 (51.70%) of medicinal plants species than the literate one. The key informants were found to be more knowledgeable than most of the general informants in the study area.

In Amaro District, a total of two hundred twenty-eight informants involved both in medicinal and wild edible plants. Of these, 120 (52.63%) were males and 108 (47.36%) were females (Appendix 18). Female informants reported remedies to diseases associated with children such as ‘MICH', febrile illness, stomachache, tonsillitis and babies' sickness (loss of appetite). The male informants reported 55 (61.11%) of medicinal plants than the female informants. More medicinal plants ($P < 0.05$) were reported by male than by female (Table 46). According to the results illiterate peoples were reported more number 58 (64.44%) of the medicinal plants than by 91 (49.56%) literate informants. Although more medicinal plants were reported by illiterate there was no significant

difference (P> 0.05) for the average number of medicinal plants reported by literate and illiterate informants (Table 46).

Regarding wild edible plants, males knew more wild edible plants than females from the total mention. Women frequently collect wild-food when they were on their way to fetch water, to collect firewood, to go to the market and when walking home from their fields. Much knowledge of wild edible plants in the study area was obtained from elder informants, when compared with the young people. This was evidenced in that informants older than age 30 mentioned 50 (62.50%) wild edible plants out of the total wild edible plant species. There was a significant difference (P< 0.05) in the number of wild edible plants reported by aged members of the community (>30 years old) and young aged members (18-30 years old). At times of food shortage, however, all ages and both sexes consume equally. However, young boys do not eat wild-food simply to satisfy their need for additional sustenance but also because there exists a traditional obligation and social group pressure at a certain age (from the end of childhood to the beginning of teen age) to collect and eat wild fruits together with children of the same age.

Table 46. Statistical test of significance on average number of medicinal and WEPs among different informant groups in Amaro and Gelana districts

Districts	Parameters	Informant groups	N	Mean±SD	t -value**	p –value
Amaro	Gender	Male	120	3.81±1.06	5.62	0.0001
		Female	108	3.00±0.98		
	Age	18_30	75	2.80±1.22	10.55	0.0001
		>30	153	4.71±2.41		
	Literacy level	Literate	91	3.18±1.41	0.56	0.572
		Illiterate	137	3.79±1.55		
	Informant category	Key informant	72	5.83±1.51	17.77	0.0001
		General informant	156	2.31±1.30		
Gelana	Gender	Male	80	4.82±1.47	5.27	0.0001
		Female	72	3.58±0.96		
	Age	18_30	46	3.98±0.67	14.45	0.0001
		>30	106	4.83±1.58		
	Literacy level	Literate	58	3.86±0.65	-2.73	0.008
		Illiterate	94	4.46±0.78		
	Informant category	Key informant	49	8.19±0.71	38.91	0.0001
		General informant	103	2.36±0.69		

*Significant difference ($p<0.05$); ** t (0.05) (two tailed), df = 228, 152 and 380 (for Amaro, Gelana, and the two Districts combined respectively), N = number of respondents. N= number of respondents.

4.7. Threats and conservation of indigenous knowledge associated with the medicinal and wild edible plants

Since the local people of Amaro and Gelana districts have an intimate relationship towards their natural environment, they were familiar with the threats on medicinal and wild edible plants. Therefore, during both group and individual discussions, key informants identified five major threats to medicinal and wild edible plants by priority ranking in the study area.

According to informants' response, the most mentioned threats to medicinal plants of the study area were agricultural expansion (75%), firewood (15%), charcoal production (5%), timber production (3%) and construction (2%), and thus have effects in threatening the medicinal plants and associated indigenous knowledge of the study area.

Modernization and refusal to practice or inherit the indigenous knowledge by new generation can lead to loss of this knowledge. As reported by the informants, the expansion of modern health institutions, schools some environmental and cultural modifications were among the reasons for the loss of the knowledge on medicinal plants of the area. The knowledge on herbal remedies was held by elders, who were above 30 years of age. There is a rapid loss of traditional herbalists and a decline in authentic knowledge in traditional treatment, as a result of death of many aged healers. The decline in the use of medicinal plants by younger generation may gradually lead to the fading away of the indigenous knowledge associated with the plants. The indigenous plant use knowledge transfer was mainly by word of mouth rather than through a well-organized written script. This by itself was a major factor for the fragmentation and loss of the indigenous knowledge system.

The conservation of medicinal and wild edible plants in Amaro and Gelana districts were limited except in area dominated by *Juniperus* - *Eucalyptus* and *Podocarpous* - *Cordia* plantation, which were the only protected area in Golbe and Samalo kebeles in Amaro and Gelana districts respectively. Some traditional practitioners had started to conserve medicinal plants by cultivating in homegardens. Included in this category were *Allium sativum*, *Artemisia abyssinica*, *Echinops kebericho, Nicotiana tabaccum*, *Ocimum lamiifolium*, *Ruta chalepensis*, *Zingiber officinale, Cucurbita pepo, Citrus limon, Rhamnus prinoides, Coffea arabica* and *Carica papaya.* The

abundances of two Amaro medicinal plants BUNDO (*Myrica salicifolia*) and BOLA (*Cordia africana*) were, however, reported to be rapidly declining from time to time due to selective cutting and/or deforestation.

In the study area some cultural believes and traditional practices associated with traditional medicines were found to contribute much to the conservation of medicinal plants in their natural habitat. For example, the claim by traditional healers that "medicinal plants are effective only if collected and administered by knowledgeable persons and healers" is a helpful attitude relative to the conservation of medicinal plants. The local community manages vegetation of the area for their medicinal attributes. Some healers of Gelana District cultivate medicinal plants in homegardens as well as a fence in coffee plantation and residential areas. About 11 (13.92%) of the medicinal plants collected were reported as found cultivated at homegardens in Gelana District. The local communities in Gelana area had various indigenous management strategies of conservation of wild edible plants. Due to their diverse uses, wild edible plants were left to widely grow in farmlands (e.g., *Moringa stenopetala*), farm boundaries and watershed areas. Secrecy, respect of cultural forest, preference of leaves for remedy preparation and collecting of deadwood for fire wood were some of traditional practices used for conservation.

CHAPTER FIVE

5. DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1. Discussion

5.1.1. Vegetation of Nekora and Dance forests

5.1.1.1. Plant species composition

Nekora and Dance forests in Amaro and Gelana districts were rich in species composition as shown by the presence of 180 species distributed in 148 genera and 68 families respectively. Nekora forest is a rich reservoir of 52 traditional medicinal plant species and 44 traditional edible plants; in the same way, Dance forest is a rich reservoir of 51 traditional medicinal plant species and 38 traditional edible plants. The findings show the pattern that most tropical forests can act as sources of vital traditional medicinal plants, and even serve as the basis for at least 25% of modern drugs (Jin-Ming *et al*., 2003).

The forests had higher number of species as compared to other similar forests like Gedo Dry Evergreen Montane Forest, which had 140 species (Birhanu Kebede, 2010); Yangudi-Rassa National Park Vegetation with 70 plant species in Northeastern Ethiopia (Semere Beyene, 2010); Chato Natural Forest with 154 species in Horo Guduru Wollega Zone, West Ethiopia (Feyera Abdena, 2010); Sese Forest, Oromia National Regional State, Southwest Ethiopia with 133 vascular plant species, (Shiferaw Belachew, 2010); Menagesha Suba Forest with 112 species in Central Highlands of Ethiopia (Dinkissa Beche Benti, 2011). The forests had less number of species as compared to other similar forests like that of Bibita Forest (Gura Ferda), southwest Ethiopia 196 plant species belonging to 170 genera and 74 families Dereje Denu (2006) and elsewhere in the rest of the world in Southeast Brazil 242 species, 163 genera, and 58 families (Lopes *et al.,* 2012).

The highest representation of species from the families Asteraceae and Fabaceae 15 (8.33%) species each and Lamiaceae 12 (6.66%) in the forests could be due to the fact that these families are among the largest in the Ethiopian flora (Mesfin Tadesse, 2004). Asteraceae was also shown to be well represented in other forests in Ethiopia including Dereje Denu (2006) (13 species); Birhanu Kebede (2010) (36 species) and Lema Etefa (2011) (24%) in terms of diversity and richness. Shrubs were the dominant species in forests when compared to the other growth forms. This could be partly due to interference and opening up of the forest for resource extraction. This observation disagree with

dominance of herbaceous species in other Ethiopian forests including Bibita Forest (Gura Ferda) (Dereje Denu, 2006); Yangudi-Rassa National Park (Semere Beyene, 2010).

5.1.1.2. Species diversity

Based on the Shannon-Weiner diversity index analysis, community type III had the highest species diversity followed by communities IV, V, II and I respectively in Nekora forest. Community III had the highest species richness while community I exhibited the least species richness comparatively. The highest Shannon-Wiener diversity for medicinal species were 3.90 and 3.67 for community III and IV in Nekora and Dance forest respectively. The reason why community III has the highest species richness and diversity indices is that it is relatively better protected in the district, due to less disturbances, for example there are relatively less number of roads crossing through it. The lowest number of species was recorded in community I and can be associated with high disturbances, open canopy and many small roads crossing through it. Overall, the possible reasons for variability of each value between each community type could be differences in number of species, cover abundance values, degree of disturbance, open canopy and many small roads crossing the forest. This is in agreement with work of (Abate Zewdie, 2007; Abiyou Tilahun, 2009) who also reported the highest species richness and diversity indices observed for the community, which are almost homogenous and less disturbed.

5.1.2. Ethnomedicinal plant species used by people of Amaro and Gelana districts

Results of the study indicated that traditional medicine is still playing a role in meeting the basic healthcare needs of the peoples of Amaro and Gelana. The fact that the Amaro and Gelana people are closer to each other in terms geographic location this may have contributed to the higher degree of similarity in species composition and use pattern of their medicinal plants. Good vegetation cover, acceptance of traditional medicine and limited access to modern healthcare facilities could be among the factors that have made people be more reliant on local medicinal plants. This survey was important in many aspects. It represents one of the pioneer efforts to document the folk medicinal plants of Ethiopia as most of the available medicinal plants (eg. Dawit Abebe, 1986; Dawit Abebe and Ahadu Ayehu, 1993; Asfaw Debela *et al*., 1999) were devoted to the plants which the authors themselves had put into use.

A total of 147 plant species were recorded from the study area. The Amaro community used 90 (61.22%) medicinal plant species and Gelana community used 79 (53.74%) species. On the basis of

plant family, Fabaceae and Lamiaceae have accounted for the highest number 12 (8.6%) of medicinal plants each followed by Astraceae 11 (7.48%) and this could be attributed to the species richness of these families as shown by the results of vegetation analysis. Other studies conducted elsewhere in the country by Mirutse Giday and Gobena Ameni (2003) revealed the highest contribution of these families to the Ethiopian medicinal flora.

It was found that 112 (76.19%) of medicinal plant species in the study area were used against human ailments and 42 (28.57%) against livestock diseases. It showed that less number of plants were used to treat livestock diseases compared to those used for human disease. The local people of the study area found alternative medicines for their ailments first and then try to search for their livestock ailments. Similar finding were reported by (Endalew Amenu, 2007; Ermias Lulekal *et al*., 2008; Tesfaye Hailemariam *et al*., 2009; Behailu Etana, 2010; Nurya Abdurhman, 2010; Eskedare Abebe, 2011; Moa Megersa *et al.,* 2013 and Alemayehu Kefyalew *et al.,* 2015) who also reported more number of medicinal plant use for human ailments than for livestock.

Most of the medicinal plant species collected and identified in these study area were also used in other parts of Ethiopia. For example, of the 90 medicinal plants collected from Amaro District 36 of them were reported by Endalew Amenu (2007); 47 by Etana Tolasa (2007); 33 by Haile Yineger *et al*. (2007); 33 by Seyoum Getaneh (2009) and 29 by (Fisseha Mesfin *et al.,* 2009), as important to cure human and livestock diseases. Such widespread report on the use of these plants by different groups of societies in different areas could be attributed to the different cultural groups, which could validate the medicinal properties of these species. Therefore, people of Ethiopia over, wide area, have the tendency to use the same medicinal plants because of the wider distribution of medicinal plants in the country and to a certain extent to their efficacy.

Some communities in Ethiopia and elsewhere were reported to use more medicinal plants than the community in current study. These includes; the community in Jibat, Gedo and Chilimo Forests, West Shewa Zone of Oromia Region who used 172 medicinal plant species (Tena Regassa, 2016) and in Mana Angetu District, southeastern Ethiopia, and ethnomedicinal use of 230 plant species was documented (Ermias Lulekal *et al.,* 2008). This may be an indication of the fact that traditional medicinal plants are being eroded in the study community as compared to the above communities where greater number of ethnomedicinal plants consumption is reported or it may depend on variation in ethnoecological and medicinal flora diversity in these communities and the study community. However,

since the sizes of the areas and the population are not known, the factors causing them may be much more complex.

The Amaro and Gelana communities utilize more medical flora as compared to other communities in Ethiopia, for example, the Gedeo community in Wonago Woreda, SNNPR, Ethiopia who use 72 species (Fisseha Mesfin *et al*., 2009), the Bench ethnic group of Ethiopia who use 35 Bench medicinal plants (Mirutse Giday *et al.,* 2009) and in South Omo Zone of Southern Nations, Nationalities and Peoples Regional State, Ethiopia who use 91 plants (Ketema Tolossa *et al.,* 2013). This could indicate greater dependence of the study community on traditional medicinal plants for their primary healthcare needs. It may also indicate that traditional medicinal plants and the associated knowledge is less eroded in the study area as compared to those communities where less number of medicinal plants was reported. Some plant families contributed more plant species used for herbal medicine than others did for example the, family Asteraceae, Fabaceae and Lamiaceae had the highest number of medicinal plants. Earlier researchers found that the Asteraceae is the most used plant family in Wonago District, southern Ethiopia (Fisseha Mesfine *et al.,* 2009).

The local people were used 5 (3.40%) endemic plant species of Ethiopia for the preparation of traditional herbal medicines. The endemic plant species found among the documented in to current study medicinal plant species were four (4) in Amaro District and two (2) in Gelana District. According to the IBCR (2009), Ethiopians use mostly 887 plants for medicinal purpose out of the medicinal plants known to occur in Ethiopia.

5.1.2.1. Diversity of human medicinal plants

Results of the current study showed that Amaro District is rich in medicinal plant diversity as shown by the presence of 62 (68.88%) species for treating human ailments. The number of medicinal plants harvested in Amaro District is found to be far higher than that of other areas in the country investigated for their ethnomedicinal wealth (Endalew Amenu, 2007; Abrha Tesfay, 2008; Mirutse Giday *et al*., 2009; Sintayehu Tamene, 2011). The medicinal plant species used to treat human ailments in Amaro area are also used as remedies in other parts of Ethiopia. Among the total 62 human medicinal plant species investigated in this study, 8 species were mentioned by Ermias Lulekal *et al.* (2013); 23 species were identified by Mathewos Agize *et al.* (2013*)*; 12 species by Moa Megersa *et al.* (2013); about 20 species by Alemayehu Kefyalew *et al.* (2015); and 14 species were identified by Genene Bekele and Ramachandra (2015).

In Gelana District a total of 61 (77.21%) medicinal plant species were reported to be used for treating human ailments. Among the total human medicinal plant species investigated in the current study, six species were mentioned by Abrha Tesfay (2008); 10 species by Eskedar Abebe (2011); 9 species were mentioned by Sintayehu Tamene (2011); thirteen species by Ermias Lulekal *et al.* (2013) and twenty five species by Getnet Chekole *et al*. (2015).

5.1.2.2. Diversity of ethnoveterinary medicinal plants

Medicinal plants that were collected and identified in the study area and are used for livestock health problems were forty-two (42) species treating twenty-eight (28) reported diseases. They are grouped in forty-one (41) genera and twenty-six (26) families. Some of the surveyed traditional medicine plant species in Amaro and Gelana districts were recorded in other parts of the country and other countries for example: *Boscia angustifolia*, in Woredas of Tigray region (Gebremedhin Gebrezgabiher *et al.,* 2013); *Vernonia amygdalina,* in and around Alamata, Southern Tigray (Giday Yirga, 2010); in South East Ethiopia (Wabe *et al*., 2011); in Ankober Amhara Region (Ermias Lulekal *et al.,* 2013) and in sub humid zone of northern Nigeria (Alawa *et al*., 2002); *Nicotiana tabaccum* in Borana Pastoralists, Southern Ethiopia (Teshale Sori *et al*., 2004) and in Botswana Moreki (2013).

Results of this study are comparable with those of studies conducted on ethnomedicinal plant knowledge in Ejaji area (Chelya woreda) West Shoa, by Endalew Amenu (2007); where a total of 89 species of medicinal plants within 75 genera and 46 families. Moreover, the diversity of medicinal plant species use is also comparable to Mana Angetu Distirict people, southern Ethiopia, who used 27 species (Ermias Lulekal *et al*., 2008). The study by Haile Yineger *et al*. (2007) at Bale Mountains National Park and adjacent areas also recorded seventy four (74) veterinary medicinal plant species that were distributed among 64 genera and 37 families for treating a total of 25 livestock ailments; the study by Seyoum Getaneh (2009), in Debrelibanos Wereda North Shoa Zone of Oromia Region, Ethiopia also documented 12 plant species from the total of 90 medicinal plant species; in four districts of Jimma zone, Ethiopia. Yared Yigezu *et al.* (2014) reported the use of 74 plant species in the treatment of 22 different livestock ailments. Overall, the reviews of past literature show that naturally, Ethiopia is endowed with plenty of medicinal plants fairly distributed throughout its regions.

5.1.3. Growth forms of medicinal plants used

From the current study among the medicinal plants collected, the majority of the medicinal plants were herbs covering 63 (42.85%) species, followed by trees 50 (34.01%). This could relate to the fact that they are more easily accessible from the nearby areas than trees and shrubs that are often harvested from the distant forests in the study area. This observation agrees with findings of Mirutse Giday *et al*. (2009), who found that the most frequent growth forms of the medicinal species were herbs followed by trees in a study conducted in Bench District, southwestern Ethiopia. The common use of herbaceous medicinal plants was also reported in studies carried out elsewhere in Ethiopia (Bayafers Tamene *et al*., 2000; Mirutse Giday *et al*., 2003; Gemedo Dalle *et al*., 2005; Etana Tolosa, 2007; Tilahun Teklehaymanote and Mirutse Giday, 2007; Tesfaye Awas and Sebsebe Demissew, 2009; Mathewos Agize *et al*., 2013). Hiwa (2016) indicates that herbs at 75% of the total plant types sampled were the most abundant plants utilized by traditional healers to treat various disorders and ailments in local area of Sulaymaniyah Province, Kurdistan, Iraq. However, a study conducted in Mana Angetu District, Oromia Region of Ethiopia, reported the dominance of shrubs in medicinal plant preparations (Ermias Lulekal *et al.,* 2008). Other reports showed that shrubs made the dominant growth form among the reported medicinal plants represent 12 (52.17%) species by a study conducted in Erob and Gulomeheda districts, Eastern Zone of Tigray Region, Ethiopia (Tadesse Beyene, 2015).

These findings also agree with the general pattern of dominance of herbaceous species as seen in most medicinal plant inventories in other countries for example in a study in Mabira Central Forest Reserve, Uganda, (Patience *et al.*, 2016), herbs made up the highest proportion of medicinal plants species (41%), followed by trees (28%), shrubs (22%), climbers and grasses (4%). this is contrary to findings of Julia *et al*. (2015) in Ilkisonko Maasai community in Kenya where the most utilized growth form were trees followed by shrubs.

5.1.4. Habitats and abundance of medicinal plants

The majority 90 (61.22%) of medicinal plant species were not under cultivation indicating that natural habitats are the main sources of medicinal plants as described in other studies (Ermias Lulekal *et al.,* 2008; Fisseha Mesfin *et al.,* 2009; Tesfaye Hailemariam *et al*., 2009; Ermias Lulekal *et al.,* 2013 and Moa Megersa *et al.,* 2013). This finding also agrees with the general pattern seen in many investigations in Ethiopia in which more medicinal plants are collected from the wild than

homegardens (Haile Yineger and Delenasaw Yewhalaw, 2007; Behailu Etana, 2010; Nigusse Amsalu, 2010; Eskedare Abebe, 2011; Sintayehu Tamene, 2011 and Alemayehu Kefyalew *et al.,* 2015). Therefore, wild habitats are the major pool of medicinal plant resources for the local communities. The fact that most of the medicinal plants are found in the wild also poses a threat to their existence if habitats are destroyed.

From the current study, of the total medicinal plant species 52 (57.77%) and 51 (64.55%) species were obtained from natural habitat of Amaro and Gelana districts respectively. The source of the medicinal plant species, of the total human medicinal plants studied 32 species (51.61%) and 37 (60.65%) species were not cultivated in Amaro and Gelana districts respectively. Most of the Amaro and Gelana medicinal plants were harvested from the wild which is in agreement with results of many studies conducted elsewhere in the country (for example, Worku Abebe, 1984, Teferi Gedif and Hahn, 2003; Debela Hunde *et al.,* 2004; Fisseha Mesfin *et al.,* 2009; Tesfaye Hailemariam *et al.*, 2009; Giday Yirga, 2010; Sintayehu Tamene, 2011 and Ermias Lulekal *et al.,* 2013). From other parts of the world, this is similar to results of studies by Patience *et al*. (2016), around Mabira Central Forest Reserve, Uganda, who reported that of the recorded medicinal plants, 56% were from the forest, 14% were cultivated 12% grow in grasslands/woodlands and farmlands (18%).

Results show that some plants had high relative importance values while others had low (RIV) which revealed the degree of diversity of medicinal plant applications. *Hagenia abyssinica, Erythrina brucei, Dichrostachys cinerea, Cordia africana* and *Combretum collinum* have found as the highest relative importance value. Almeida *et al.* (2006) and Mirutse Giday *et al.* (2009) found some medicinal plant species had high relative importance values and others are low relative importance their study. Thus, these were the most scares medicinal plant species in Amaro District. Deforestation and selective cutting were the main factors that led to the depletion of these plants. In the study area, deforestation is taking place at an alarming rate due to agricultural expansion. Thus, the long-term survival of the top ranked species are under question, as the daily demand of the local society is usual and continuous with lesser rate of re-plantation.

5.1.5. Plant parts used for medicinal purposes

The most utilized plant parts for traditional drug preparation were leaves accounted for 93 (38.58%) preparations, followed by roots (41, 17.01%) in both districts as compared to other parts. Many studies conducted elsewhere in Ethiopia also showed the dominance of leaves in the preparation of remedies (Mirutse Giday and Gobena Ameni, 2003; Haile Yineger and Delnesaw Yehuwalaw, 2007; Abraha Teklay *et al.,* 2013 and Tadesse Beyene, 2015) and in other part of the world (Hassan *et al.,* 2014; Süleyman *et al.*, 2015; Hiwa, 2016; Dawang *et al.*, 2016, Patience *et al.* 2016), agrees with the finding leaves were the most frequently used parts in preparing herbal remedies. The preference of leaves to other plant parts could be due to ease of preparation and the chemical constituents of leaf for the treatment of diseases since many secondary compounds are produced in it. Remedy preparation that involves roots, seeds, fruit, latex, barks, stems or whole plant have effects that pose a lasting danger to the continuity of an individual plant compared to leaves. In this study area, the fear of high threat of medicinal plants due to plant parts used for the purpose of medicine is minimal as leaves were the most harvested plant parts used in the area, which has little effect on the survival of mother plant.

Meanwhile, other reports showed roots to be the most used parts (Endalew Amenu, 2007; Ermias Lulekal *et al*., 2008; Fisseha Mesfin *et al.,* 2009; Genene Bekele and Ramachandra, 2015 and Alemayehu Kefyalew *et al.,* 2015). On the other hand, a study conducted in India (Cheikhyoussef *et al*., 2011) indicated that roots were the most commonly utilized parts followed by leaves.

5.1.6. Modes of preparation of medicinal plants

Traditional medicine preparation was also varied in plant species compositions. In this study, the preparations using a single or multiple species have different percentages for instance from a single species 194 (80.49%) and from multiple plant species 47 (19.50%) were prepared. Thus, wide use of single plant species for the preparation of local medicines in the study area is agree with findings in (Mirutse Giday, 1999; Bayafers Tamene *et al.,* 2000; Balcha Abera, 2003; Debela Hunde *et al*., 2004; Kebu Balemie *et al.,* 2004; Mirutse Giday, 2007) and in other part of the world (Mandahar, 1995; Milliken and Albert, 1996). Similar studies were conducted by Sintayehu Tamene (2011) in Wondo Genet Natural Forest and Adjacent Kebeles, Sidama Zone, SNNP Region, Ethiopia where most remedies were prepared from a single plant (88.77%) and preparation from combined plant species was about (11.23%).

The local people including the healers reported that they prepare herbal medicine in different ways including boiling the decoction; crushing, homogenizing with cold water; eating the part; extracting the juice/oil/latex and pouring; drinking the concoction; holding with teeth and the combination of each method and as unprocessed plus other forms in the study area. The major modes of remedy preparation were decoction (24.06%); crushing, homogenizing with cold water (17.42%) and crushed and put on the freshly crushed part (15.76%). Decoction was also reported as one of the dominant ways of remedy preparation in ethnomedicinal inventory of other socio-cultural groups in the country (Haile Yineger *et al*., 2007; Fisseha Mesfin *et al*., 2009; Ermias Lulekal *et al*., 2013). The dominant use of medicinal plant decoctions for various ailments might be related to their proven effectiveness over many years of trial and indigenous knowledge accumulated on efficacy of such preparations.

5.1.7. Condition of preparation of plant medicines

The result indicated that 216 (89.62%) herbal medicine preparation were used in fresh form and 25 (10.37%) in dried forms of preparation. Freshly harvested plant parts were the dominant ones used in remedy preparation in the study area. The recurrent use of freshly harvested medicinal plant could be attributed to the widespread traditional belief of attaining high efficacy from fresh remedies due to the higher presence of active ingredients in the form of secondary metabolites in the cases of fresh plant parts which community members thought could be lost on drying. Other studies conducted elsewhere also indicated the wider use of fresh materials (Mirutse Giday *et al.,* 2003; Tizazu Gebre, 2005; Endalew Amenu, 2007; Ermias Lulekal *et al*., 2013).

Conditions of preparations of plant part used indicated that 130 (90.90%) were used in fresh form and 13 (9.09%) in dried forms of preparation in Amaro District in the same way, in Gelana District indicated that 86 (87.75%) were used in fresh form and 12 (12.24%) in dried forms of preparation. As fresh materials are harvested directly and used soon with its extra deterioration with some chance of preservation, i.e. some medicinal plants stored for later use. The result is in agreement with findings of Moa Megersa *et al*. (2013), the majority of the remedies (74.2%) in Wayu Tuka District were prepared from fresh parts of medicinal plants followed by dried form (20.7%) and (5%) prepared either from dry or fresh plant parts. This finding is also consistent with the finding of Haile Yineger *et al.,* 2007; Giday Yirga, 2010; Tadesse Beyene, 2015; who reported that the majority of the remedy preparations were in fresh form. The result is in agreement with findings of Endalew

Amenu (2007) which reported that the majority of the remedy preparations were in fresh form. Similarly, a study conducted by Teshale Sori *et al*. (2004) in Borana, Oromia Reginal State, South Western Ethiopia, showed that using fresh materials for different health problems is more commonly used than dry materials, dry, or fresh. During group discussion sessions some informants reported that, they preserve the plant material that they could not find in nearest area, in the dry or rainy season by various ways like pounding and saving the powder and/or hanging the intact plant material in the kitchen by rolling by plastic bags or leaves of KOCHO (*Ensete ventricosum*) or pieces of AGOBER (Mosquito net). This finding is also consistent with the finding of (Dawit Abebe and Ahadu Ayehu, 1993; Worku Abebe, 1984); drugs are stored usually in containers such as bottles, papers, pieces of cloth, leaves and horns and were kept anywhere at home.

5.1.8. Route of administration and dosage of the traditional medicinal plants

In the study area, oral administration was the dominant route with 133 (53.18%) preparation followed by dermal (77, 31.95%). In Amaro District, the most popular way of administration of herbal medicines were oral which accounted for 84 (58.74%), followed by dermal (42, 29.37%), similarly, in Gelana area oral administration is the principal route with 53 (50.96%) of the cases followed by dermal (36, 34.61%). These results are consistent with findings of various ethnobotanical researches elsewhere in Ethiopia and other countries such as that of (Mirutse Giday *et al.,* 2003; Haile Yinger *et al.,* 2008; Fisseha Mesfin *et al.,* 2009; Ketema Tolossa *et al.,* 2013 and Patience *et al.,* 2016). Ermias Lulekal *et al*. (2013) indicated oral application was the best represented and most commonly used route of administration, which accounted for (181 preparations, 55.01%) followed by topical or dermal application (81 preparations, 25%) in Ankober District, North Shewa Zone. From other parts of the world, this is similar with the works of Patience *et al*. (2016), oral route contributed (61%) of the total species, followed by herbal bath (28 %), rubbing leaves on affected parts (14%) and inhalation of smoke (5%). The least used route of herbal administration was steam bath (2%). Similar result were reported in studies conducted in Rakhaing Indigenous Community of Cox's Bazar District of Bangladesh (Shaikh *et al.,* 2013), the maximum number of applications are orally administered or internal application. The Rakhaing community prefers it because they believe that entering medicine into the body is most effective.

Both oral and dermal routes permit rapid physiological reaction of the prepared medicines with the pathogens and increase their curative power (Fisseha Mesfin *et al.,* 2009). As in various parts of

Ethiopia, the knowledge of traditional healers in Amaro and Gelana districts, the use of measurement of dosage to treat various diseases was poor. Healers use different measurements for dosage and these measurements were not exact enough to determine the precise amount. The result is consistent with findings in (Mersha Ashagre *et al.,* 2016), dosage is not always well measured in most of the traditional medicine practitioner. The works of (Amare Getahun, 1976; Dawit Abebe, 1986; Dawit Abebe and Ahadu Ayehu, 1993) indicated lack of accuracy and standardization is negative aspect for the use and recognition of traditional herbal medicinal use.

The traditional healers use different measurements for dosage, mostly they use their finger lines for the measurement of the amount to be taken and different measuring materials like spoon, coffee cup, tea cup, and glass cups are common for those remedies which are taken orally. But, these measurements are not accurate enough to determine the precise amount, for example during group discussion informants in Amaro District response that there were variations in dosage of remedies, unit of measurement of remedies, duration and time that were prescribed for the same kind of health problems. The dosage depends on the age, physical fitness, and stage of illness, pregnancy and presence or absence of any disease. Children are given less than adults, such as, one fourth of a coffee cup (2–5 ml) whereas; an adult is given up to one glass (approximately 250 ml) depending on the type of illness. It is measured by number of young leaf (6, *Calpurnia aurea*), number of seed (10, *Cucurbita pepo*) and length of root (about 3 cm, *Croton macrostachyus*). For medicinal plants that are taken topically, they do not have clear-cut dosage. The local healers and knowledgeable elders simply recommended or prescribe small amount such as drops, tea cups, hand palms, 1/4, 1/2 coffee cups and for larger dosage water glasses or other local materials that are used for drinking. Dosage lacks of precision of doses among informants of the study area on certain remedies were also frequently noted, which is also frequent phenomenon elsewhere (Mirutse Giday *et al.,* 2003; Mirutse Giday and Gobena Ameni, 2003; Kebu Balemie *et al.,* 2004). This study agreed with study made by Abraha Teklay *et al.* (2013) in Kilte Awlaelo District, Eastern zone of Tigray region of Ethiopia showed no agreement in measurement or unit used among informants.

5.1.9. Major human and livestock ailments and plant species used by the local people to treat these ailments

Relatively higher numbers of plants were reported to have been used for the treatments of wound and stomachache than was dermatological and gastro-intestinal disease categories respectively. In

this study, 66 different human and 28 livestock ailments were recorded. As in other parts of the country (Getnet Chekole *et al.,* 2015), *Buddleja polystachya* was used for treatment of four diseases; *Solanum incanum* used for treatment of nine (9) diseases; *Foeniculum vulgare* for treatment of three (3) diseases; *Myrica salicifolia* for treatment of two (2) diseases. These similarities indicate the wide use of medicinal plant species and the existence of associated knowledge shared among ethnic groups in Ethiopia. The fact that some of the reported plants have similar uses elsewhere in the world supports their likely pharmacological effectiveness in different area by different cultures (Tesfaye Hailemariam *et al*., 2009). It was found from this study that similar medicinal plant species used by the healers of this community were also used by the healers in different parts of Ethiopia.

5.1.9.1. Major human diseases and plant species used by local people

A total of 66 types of ailments were identified and 112 species were used against human ailments in the study area. These shows large numbers of diseases have solution by traditional medicine in Amaro and Gelana districts when compared to different investigations in Ethiopia. For example, Endalew Amenu (2007) reported 47 human diseases were treated with 48 plant species, Etana Tolasa (2007) reported 77 plant species were used to treat 49 diseases of humans; and Seyoum Getaneh (2009) reported 78 plant species that were used to treat 50 human diseases.

Various studies indicate traditional medicinal plant species were used to treat various human ailments, for example, 92 plant species, treated about 70 types of human ailments by local people in Goma Wereda, Jima Zone of Oromia Region, Ethiopia (Behailu Etana, 2010); 75 plant species, treat about 40 types of human ailment in Farta Wereda, South Gonder Zone of Amhara Region, Ethiopia (Nigussie Amsalu, 2010); 82 plant species, treat about 55 types of human ailments by local people in Ofla Wereda, Southern Zone of Tigray Region, Ethiopia (Nurya Abdurhman, 2010); 88 plant species, treat about 63 types of human ailments by Local Communities in Debark Woreda, North Gondar Zone, Amhara Regional State, Ethiopia (Eskedare Abebe, 2011); 54 plant species, treated about 40 types of human ailments in Wondo Genet Natural Forest and Adjacent Kebeles, Sidama Zone, SNNP Region, Ethiopia (Sintayehu Tamene, 2011).

Identified medicinal plants in Amaro District were found to treat 52 types of ailments. One species can treat a single disease or a number of diseases. Similarly, one ailment can be treated with combination of plant species or single plant. Intestinal parasite, stomachache, amoeba, abdominal

pain and gastritis were the most commonly reported human health problems under the gastro-intestinal disease category, whereas wound, ring worms, lamp skin disease and skin rash were the most frequently reported ailments under the dermatological disease group in the districts. According to Dawit Abebe and Ahadu Ayehu (1993), a certain complaint with several alternative drugs might indicate a predominance of that particular health problem. *Myrica salicifolia* and *Foeniculum vulgare* were the most frequently used species for remedies against variety of complaints in the area, whereas in Gelana District *Commelina latifolia* and *Solanum incanum* were found to be used in treating the highest number of human ailments. In this regard, the results agree with findings of Mirutse Giday (2001).

5.1.9.2. Major livestock diseases and plant species used by local people

In the study area 28 livestock ailments were identified and 42 (28.57%) plant species were used for the treatment. Common diseases affecting Livestock's health in the study area were wound, treated by 5 (9.09%) species; cough, diarrhea and rabies which were reported to be treated by 4 (7.27%) species. This finding relates with the work of Endalew Amenu (2007) who reported 27 livestock problems.

In Amaro District, twenty-two livestock diseases were found to be treated with 28 plant species and 8 preparations whereas, in Gelana District a total of 13 livestock ailments were identified that are treated by 18 traditional medicinal plants. As compared to human diseases, livestock diseases were treated with a few number of plant species. Medicinal plants are important for rural communities for the treatment of livestock disease (Berhane Kidane *et al.,* 2014). The number of livestock ailments treated by plant species also varies from plant to plant species in the study districts, for example, *Phytolacca dodecandera,* was used to treat the highest number of livestock ailments that accounted for 6 (16.21%), followed by *Allium sativum, Capsicum frutescens, Cucumis ficifolius* and *Vernonia amygdolina* 2 (5.40%) each were reported to treat livestock ailments in Amaro area. The type and number of medicinal plant species used to treat each livestock ailments also varied from ailments to ailments as wound, cough, diarrhea and rabies were treated by the various plant species in Amaro and Gelana districts respectively. This showed that some livestock ailments have opportunities to be treated by more plant species in the study districts. The work of Verma (2014) in Tikamgarh District of Bundelkh and, Central India showed few plant species were used to manage various livestock disease. Some of the plants documented during the current study are used elsewhere in

Ethiopia and other part of the world to treat same/similar livestock diseases (Gebremedhin Gebrezgabiher *et al.,* 2013; Ermias Lulekal *et al.,* 2013 and Najma *et al.,* 2015). These include *Nicotiana tabaccum* (used to treat leech infestation); *Phytolacca dodecandera* (used against lice infestation of cattle/Ecto-parasite); *Allium sativum* and *Capsicum frutescens* (used to treat cough and intestinal parasite respectively).

5.1.10. Side effect and antidotes of administered human herbal medicines

Most of the herbal preparations used to treat human ailments had no reported side effects. According to group discussions made the healers of Amaro District never, administer treatments that are taken internally to pregnant women except that of *Cucurbita pepo* that is given for pregnant women for the treatment of Tapeworm, and for children below six months of age. Local healers and knowledgeable elders have special care for pregnant women and physically weak persons and therefore impose restrictions to prescribe traditional medicine. For example, pregnant women and physically weak persons are not given those medicines that have observable adverse effects such as vomiting and diarrhea, which may lead to other side effect (Ragunathan and Solomon Maquanente, 2009). Finally, when patients did not recover and show any sign of recuperation, they are referred to modern health services. Similar results were obtained in the study by (Haile Yinger and Delenassaw Yahalaw (2007); Ermias Lulekal *et al.* (2008) and Mirutse Giday *et al.* (2009).

In many instances, no adverse effects of traditional medicines after administration were mentioned by the traditional healers however some of the preparations were reported to have some adverse effects, for example diarrhea. Traditional healers indicated that they also use antidotes for the adverse effects of some traditional medicines like eating cooked teff flour. For instance, in the use of *Myrica salicifolia* for the treatment of gonorrhea, its bark is powdered and placed in water overnight, filtered and eaten. During that diarrhea follows, as an antidote the local healers administer the patient to eat cooked teff flour to stop. In general, most of remedies were reported to have no serious adverse effects. The majority of the remedies that were used elsewhere in Ethiopia to treat ailments had no adverse effects on patients (Haile Yinger and Delenesaw Yewhalaw, 2007; Haile Yinger *et al.,* 2008).

5.1.11. Medicinal plants as the base for development of modern drugs

Using informants' consensus the study showed that *Myrica salicifolia, Buddleja polystachya, Ajuga alba, Clerodendrum myricoides, Echinops kebericho, Commelina latifolia, Lepidium sativum, Citrus aurantifolia, Clematis simensis* and *Solanum incanum i*n Amaro District and *Allium sativium, Croton macrostachyus, Phytolacca dodecandra, Solanum incanum, Vernonia auriculifera, Cordia africana, Capsicum annum, Guizotia scabra, Agave sisalana* and *Carica papaya* were the most cited medicinal plants in Gelana District. *Solanum incanum* and *Clerodendrum myricoides* were cited by the highest number of informants in Amaro and Gelana districts to treat human ailments respectively. Some medicinal plants were more popular because they were more familiar to informants due to the wide distribution in the locality. Other species may have received higher consensus scores due to local wider abundance and easy access by locals.

Rabies scored the highest informant consensus factor of (1) followed by bone fracture and cancer scored the second highest value (0.92) in Amaro District. Correspondingly, in Gelana District, plants used against bleeding and hypertension scored the highest informant consensus factor (0.96), followed by rabies scored the second highest value (0.94). A high value of ICF (Close to 1) indicates that relatively few species are used by a large proportion of people, while a low value indicates that the informants disagree on the taxa to be used in the treatment with in category of disease (Canales *et al.,* 2005). It is essential to estimate use variability of the medicinal plants and to determine which plants are particularly good in the search such as bioactive compounds. ICF done inside and outside of the country by different authors such as (Behailu Etana, 2010; Tilahun Teklehaymanot and Mirutse Giday, 2010, Alemayehu Kefyalew *et al.,* 2015 and Hiwa, 2016).

Calculated fidelity level (FL) values showed the most frequently utilized medicinal plants, with healing potentials were *Echinops kebericho* against (breast cancer), *Solanum incanum* against (snake bite) and *Cordia africana* against (wound) were the Amaro medicinal plants that scored the highest FL values. *Rumex abyssinicus* showed the highest fidelity level value (100%) against ascariasis, followed by *Teradenia riparia* showed the second highest fidelity level value (88.88%) against skin rash in Gelana District. The fact that these medicinal plants had the highest FL values could be an indication of their good healing potential at least with the local population. According to Trotter and Logen (1998), plants that are used repeatedly are more likely to be biologically active

as medicinal plants. Fidelity level (FL) was calculated for Ethiopia by different authors such as (Endalew Amenu, 2007; Tilahun Teklehaymanote and Mirutse Giday, 2007; Haile Yinger *et al.*, 2008 and Alemayehu Kefyalew *et al.,* 2015). Thus, these results would call for pharmacological investigations on these plants since high percentage of informants agreed on their curative values.

Preferences of ten human ailments treated with *Myrica salicifolia* in Amaro District and two human ailments treated with *Hibiscus diversifolius*; in Gelana District following the approach of Martin (1995) by 5 key informants of each District was done and the result showed that *Myrica salicifolia* was more preferred to treat stomachache by the local people of Amaro District and *Hibiscus diversifolius* was the most preferred to treat wound by the local people of Gelana District. Furthermore, preference of medicinal plant species curing rabies for livestock ailments in Gelana District showed that *Jasminum grandiflorum* was the most preferred to treat rabies. The result of preference ranking showed particular medicinal plant is more preferred by the local people to treat particular ailment. The most favored species to treat particular disease reflects the most efficacious, at least in the local area of the people who use it. The finding also showed that the preference of particular medicinal plant species against particular ailment is not necessarily the same, it varied from district to district. Preference ranking has been tried in Ethiopia by several authors to see the choice of the local people as seen in (Mirutse Giday and Gobana Amani 2003; Ermias Lulekal *et al*., 2008; Behailu Etana, 2010; Eskedar Abebe, 2011 and Alemayehu Kefyalew *et al.*, 2015).

Pair wise ranking of medicinal plants treating human for diarrhea was also done and showed *Catha edulis* was the most preferred plant species in Gelana District. The results of paired comparison tested the preference of medicinal plant species of the local people of the study area to treat particular ailments. Some studies made in Ethiopia using pair wise ranking where informants made their choices on individual basis include the works of Gebremedhin Hadera (2000); Debela Hunde *et al.* (2004) and Getu Alemayehu *et al.* (2015). Further biological studies should also be conducted on the reported medicinal plant species of the study area to utilize them in drug development.

5.1.12. Indigenous knowledge transfer and medicinal plant collection

The greater number of the informants do not document any traditional medicinal practice in a written form in both districts. The knowledge sources on how to use herbal medicine, dosage and antidotes, especially traditional medicinal use, vary from person to person. The findings showed

that the sources of ethnobotanical knowledge are basically the family members (father, mother, brother and sister) friends and neighbors. On the same note, most of the informants around Gimbi town (Western Ethiopia) acquired traditional knowledge on medicinal plants from their parents and/or close relatives (Etana Tolasa, 2007). The desire of the local people to transfer and share their knowledge vary from one place to another in the study area as most were interested to transfer their knowledge to all their children and others to the first son, brothers and sisters, or friends. On the other hand, most of the key informants from both districts were willing to share their knowledge on use of traditional medicinal plants to the first son while few to all their children. In general, traditional healers show maximum secrecy in handling medicinal plant knowledge and the tendency of the local people to transfer the traditional medicinal practices knowledge is mostly to a chosen close person. According to Abbink (1995), traditional health professionals in Ethiopia believed that traditional medicine is effective if done within a family or close with relatives.

Like any other traditional societies in Africa (Fekadu Fullas, 2001), ethnobotanical knowledge of medicinal plants of the study area was shown to be transferred from the older people to younger generations at household level. This knowledge is not existent in written form, their losses or distortion at every transfer is inevitable. Likewise, the use indigenous knowledge on medicinal plants shows a gradual decline. This could be attributed to the impact of modernization (access to school and modern health facilities) and the very poor system of sharing indigenous knowledge on medicinal plants with the younger generation. It is obvious that those people who went to school consider traditional use of medicinal plants as harmful and backward and prefer to go to modern health facilities. The finding is similar for other cultural groups in Ethiopia (Mirutse Giday, 2001; Debela Hunde *et al*., 2004; Tesfaye Awas and Sebsebe Demissew, 2009; Tesfaye Hailemariam *et al*., 2009; Ermias Lulekal *et al*., 2013 and Berhane Kidane *et al*., 2014).

There was no universally accepted fixed time for collection of plantsand this differed from person to person and hence was highly dependent on individual beliefs. Some said collection should be done before 4:00 p.m. Some others preferred the morning time up until 9:00 a.m. or afternoon after 4:00 p.m. In all, most informants in the two districts agreed that there was no special preference to a particular maturity level, time of the day or season in harvesting medicinal plants. However, from studies conducted by Teferi Gedif and Hahn (2003) in Addis Ababa and Butajira, and by Worku Abebe (1984) in Gonder, Ethiopia, most of interviewed healers believed that the collection time of

different plants should vary; some of the informants reported that medicinal plant are effective when collected in the morning.

5.1.13. Wild edible plants reported used as food

5.1.13.1. Diversity

Amaro District is generally endowed with diverse and rich sources of wild edible plants and these serve the local communities as food sources and other multipurpose values. These plants belong to 64 species, 47 genera and 33 families. The wild edible plants consumed in Amaro District were also eaten in other parts of Ethiopia (Amare Getahun, 1974; Guinand and Dechassa Lemessa, 2000; Zemede Asfaw and Mesfin Tadesse, 2001; Ermias Lulekal *et al*., 2011; Kebu Balemie and Fassil Kebebew, 2006; Getachew Addis *et al*., 2013). The families of Fabaceae, Tiliaceae, Anacardiaceae and Rosaceae had the highest number of wild edible plant species. These results are in agreement with those Demel Teketay *et al*. (2000), who found that Fabaceae had the highest number of species, followed by Tiliaceae comprised 32% and 18% wild edible plants, respectively. In Amaro District, of the total wild edible plants species 44 (68.75%) were found from natural habitat (Nekora forest). The finding is similar to those by Mersha Ashagre *et al.* (2016) and that the local users collected most of these plants from the wild.

Results showed that Amaro District was richer with wild food plants than Gelana. This wild food species recorded in this study were edible in normal times as well as at times of food shortage and are used to prevent starvation and sustain life during prolonged drought and social unrest. The role of wild food plants mainly during unfavorable times were well documented by (Cotton, 1996; Cunningham, 1996, 2001; Zemede Asfaw, 1997 and Getachew Addis *et al*., 2005).

In Gelana, fifty-five wild plant species were distributed among 25 families and 35 genera. The number of species identified in the present study is comparable with the number used by a Borena pastoralists (27) by Gemedo-Dalle *et al*. (2005) in southern Ethiopia. However, the number slightly higher than the one of 46 species reported from northwest part of the country by Fentahun Mengistu and Hager (2008). Moreover, the number of species in the present study is in agreement with the number of common edible wild plants in the country published in a book by Demel Teketay *et al*. (2010) and as a contained in a comprehensive review by Ermias Lulekal *et al*. (2011).

The current study findings were compared with those from semiarid areas of Ethiopia (Debela Hunde *et al.,* 2011). The results of the comparison using Jaccard coefficient of similarity indicated that the highest degree of similarity was observed with data from Semi-arid lowlands of Southern Ethiopia. The reason could be both studies yielded good numbers of wild edible plants which increase the likelihood of having shared species or this may probably due to socio-cultural factors that could contribute to a common knowledge base of by the two peoples. High level of dissimilarity was observed with Omo River Valley (10.52) and Konso Ethnic Community (11.81). One reason could be the location in different altitudinal ranges or due to vegetation difference of the two study area and cultural difference of the two groups of people.

5.1.13.2. Habit, Plant parts used and mode of consumption

Of the recorded wild edible plants in Amaro area, shrubs were the highest growth forms with 33 (51.56%) species while in Gelana District twenty-three (41.81%) were shrubs, in Gelana District. Shrubs make up the highest proportion of the edible species in two districts. Demel Teketay *et al*. (2000) also reported that shrubs accounted for the highest part. Similarly the findings agrees with the report from Derashe and Kucha districts by Kebu Balemie and Fassil Kebebew (2006), which showed that wild edible materials were largely collected from shrubs.

Fruits, leaves and gum were the parts used widely by the two social communities in the study area. Although different plant parts were consumed in Amaro District 46 (71.87%) of the edible plant parts were fruits, followed by 7 (10.93%) leaves. In Gelana District, seven plant parts were given as edible; 37 (67.27%) fruits, followed by 6 (10.90%) gum. Therefore, fruits were the most important edible plant parts. This is in line with the work of Zemede Asfaw and Mesfin Tadesse (2001); Getachew Addis *et al*. (2005; Kebu Balemie and Fassil Kebebew (2006); Tilahun Teklehaymanot and Mirutse Giday (2010) and Getachew Addis *et al*. (2013. This finding is similar to that of Hussien Adal (2004), who found that fruit accounted for 80 % of edible wild food.

In Amrao District 57 (89.06% species) of these fruits were reported to be eaten raw, whereas 7 (10.93% species) were consumed cooked or processed and 47 (85.45% species) of these fruits were reported to be eaten raw whereas 8 (14.54% species) were consumed cooked or processed in Gelana District. This study revealed that most of the recorded wild edible plant species or their parts were consumed as raw/fresh without further processing. Only 11 (13.75%) species were reported to be cooked before consumption. The high percentage of raw edibles may be due to them prioritized as

food items for collecting and use at home compared with cultivated food plant products. This is consistent with other findings including those of Guinand and Dechassa Lemessa (2000); Kebu Balemie and Fassil Kebebew (2006) and Tigist Wonidmu *et al.* (2006); However, this is contrasted with findings of Tilahun Teklehaymanot and Mirutse Giday (2010) whose studies in southern Ethiopia, indicated that sixteen (41%) wild edible plants were used as vegetables being harvested for their leaves, upper parts (leaf and stem) were consumed after cooking.

5.1.13.3. Food plants used as traditional medicine

Out of the total wild edible plants, twenty-one (26.25%) nutraceutical wild plants were used for 17 (80.95%) human and 4 (19.09%) livestock primary health care system. Some communities in Ethiopia and elsewhere in the rest of the world, were reported to use more or less similar numbers of edible plants used as a medicine as found in current study. In Semiarid East Shewa, Ethiopia, 20 nutraceutical plants were identified (Debela Hunde *et al*., 2011) and elsewhere in the rest of the world in *Chiru* Tribe of Manipur, India who use 69 species (Rajkumari *et al.,* 2013). The most commonly encountered families were the Fabaceae and Boraginaceae. The findings of this study are similar to those of Julia *et al.* (2015) in Ilkisonko Maasai community in Kenya, who found that most common encountered families used as traditional medicine were Fabaceae. Among the wild edible plants used as traditional medicine trees, accounts 9 (42.85% species) followed by shrubs 8 (38.09%) and herbs 4 (19.04%) were the dominant growth forms of the wild edible plants used as traditional medicine in the study area. The findings are in agreement with those of Julia *et al.* (2015) that trees (47%) were dominant followed by shrub (33%) and herb (20%).

The inhabitants of Amaro District also used species in the present investigation to cure various ailments. Out of the total wild edible plants, fourteen (9.89%) nutraceutical wild plants were used to treat 13 (76.47%) human and 4 (23.52%) livestock primary health care system. For instance, *Acokanthera schimperi, Balaintes aegyptiaca, Cordia africana, Datura stramonium, Ehretia cymosa, Acacia mellifera, Moringa stenopetala, Rumex nervosus, Senna occidentalis* and *Tamarindus indica* were the most commonly used nutraceutical plants as analyzed from the report of the local people in the area. Among the wild edible plants used as traditional medicine trees accounted for 6 (42.85%), followed by shrubs 5 (35.71%) and herbs 3 (21%) as the dominant growth forms of the wild edible plants also used as traditional medicine in the area. In Gelana, a total of 8 nutraceutical wild plants were used to 10 (90%) human 1 (9.09%) for livestock primary

health care system. Shrubs 4 (50%) followed by trees 3 (37.5%) and herbs 1 (12.5%) were the dominant growth forms of the wild edible plants used as traditional medicine in the area. This finding is at variance with the finding of Nestel (1989), who reported that leaves were the least part for Maasai community possibly because the Maasai are known to consume very little vegetable in their diet.

5.1.13.4. Preferences and ranks of WEPs

As indicated by the results of paired comparison of factors affecting plant resources in the study area, all informants almost similarly reported that agricultural expansions stood first. The above results are also reported in different area by Kebu Balemie and Fassil Kebebew (2006); Assegid Assefa and Tesfaye Abebe (2011) and Debela Hunde *et al*. (2011).

In Amaro District, among the very common wild edible plants, *Cordia africana* was the most threatened followed by *Acacia mellifera, Balanites aegyptiaca, Carissa spinarum* and *Tamarindus indica* respectively. This scarcity of *Cordia africana* is due to over harvesting for not only for food but also for other uses. There is high rate of loss of *Cordia africana* in the area. Even though the rank is given, all of the species particularly the top ranked ones are in the long-term their survival are under question, because as the livelihood of some people in the society depends on these species. *Cordia africana* was found to be most important in its multiple utility value similar to findings in (Behailu Etana, 2010; Debela Hunde *et al*., 2011).

5.1.14. Indigenous knowledge and other uses of medicinal and wild edible plants

Some plants were reported to other uses apart from medicinal and nutritional uses. Sixty three (63) medicinal and wild edible plants in Amaro and Gelana districts were playing multipurpose roles and were cited for various uses across sixteen different major use categories. Different parts of these plants were used for building material, beeforage, fire wood collection, household tools, tooth brush, charcoal making, detergent, fodder, smoking gourds, cloth, making perfume, religion ceremonies, spices and tanning leather. Overharvesting of multipurpose medicinal plant species for making agricultural tools, construction materials, lumbering and firewood purposes were the factors responsible for aggravating depletion of the species in the area. Thus, the results indicates there is need for an urgent complementary conservation action to save the fast-eroding multipurpose medicinal plant species of the area. Exploitation of multipurpose medicinal plants for

uses other than their traditional medicinal purpose was also reported by Haile Yineger *et al*. (2007) and Ermias Lulekal *et al.* (2013).

The local people of Amaro and Gelana districts use different growth forms of the plants to build their shelters. The importance of these plants is based on the parts used in constructing the house. Thus, 9 (56.25%) stem and 7 (43.75%) branches were used as component elements during house construction used for making of doors and window. This is similar to other parts of Ethiopia (Getachew Desalegn *et al*., 2003) in general and southern part of Ethiopia in particular where the style of house construction requires the use of a large amount of wood (TFAP, 1996).

The study shows that Moraceae (with two species) followed by Acanthaceae, Asteraceae, Fabaceae, Flacourtiaceae and Rosaceae (with one species each) were the major source of nectar/pollen used as bees forage in the study area. Regarding the growth forms, shrubs and tree scored the highest 3 (42.85 %) followed by herbs 1 (14.28%). Therefore, in the study area, shrubs were the main source of nectar and pollen for bees but herbs contribute less. The forests and woodlands of the country contain diverse plant species that provide surplus nectar and pollen to foraging bees (Girma Deffar, 1998).

The families Myrtaceae and Fabaceae were the most widely used for firewood in Amaro and Gelana districts. The local people harvest different growth forms of plants for firewood. Trees were the most widely growth forms and regarding the plant parts used stem was mainly used. During the study a total of 58 plants were identified 57 as fuelwood which is closed to the 66 fuelwood plants collected by Gebremedhin Hadera (2000). It is generally known that the vast majority of rural households in Ethiopia depend on wood or farm residues as fuel for cooking and heating. The family Fabaceae (with two species) and Rutaceae (with one species) were commonly used in charcoal production in the study area. This study revealed that the plant growth forms harvested for charcoal production were mostly in stem used trees.

5.1.15. Comparison of knowledge on medicinal and wild edible plant within different informant groups

This study revealed that male informants of Amaro District reported more medicinal plants on average (3.81 ± 1.06) than women (3.00 ± 0.98) and this could probably be due to the reason that boys are usually selected for the proper transfer of the knowledge. This may show there is un equal access

to indigenous knowledge on traditional medicine because knowledge is mostly transferred from father to the first-born son or other well-behaved son. This finding agrees with the finding of Tizazu Gebre (2005). Other studies conducted elsewhere demonstrated similar results Costentinose Berhe *et al*. (1995); Begossi *et al.* (2002), Collins *et al*. (2006). Costentinos Berhe *et al*. (1995) reported that the practice of traditional medicine in Ethiopia has been dominated by men. Teferi Gedife and Hahn (2002) reported that parents in Ethiopia prefer to pass their traditional medical knowledge more to sons than daughters. This is because the traditional knowledge in the family or community is passed from male parent to his first-born son.

The distribution of informants with respect to age classes in the study area shows that, the majority of knowledgeable people are found in the age group of older than 30 years followed by age group between 18-30 years the 2nd age group respectively. The numbers of medicinal plants reported by first age groups (>30 age groups) were more than from the second (18-30 years age groups). The significant difference ($P<0.05$) on average number of medicinal plants reported by different age groups compared in this investigation showed that indigenous knowledge on use of medicinal plants is still stronger with elderly people (4.71 ± 2.41) than in the younger generation (2.80 ± 1.22). Informants' older than age 30 mentioned more number of medicinal plant species. This shows that the elders were rich with indigenous knowledge or more knowledgeable on traditional medicine practice. This confirms that young people do not have much knowledge compared with elders. That is an indication of decline of the knowledge of traditional medicine in addition to secrecy. Moreover, the observed extremely significant difference ($p=0.0001$) showed the gap between generations and the decline of indigenous knowledge on medicinal plants down generations. This is comparable with findings of Mirutse Giday (2001) who found that those above 40 identified more medicinal plants among the Zay people of Ethiopia. This confirms that young people do not have much knowledge compared with elders. That is an indication of decline of the knowledge of traditional medicine in addition to secrecy.

A positive (direct) linear relationship between age and knowledge in the study area indicates that knowledge on medicinal plant depends on age. In general, the knowledge of the local people on traditional medicinal plants varies according to different age levels. As the age of people increased, they become more knowledgeable on traditional medicinal plants use, i.e., the knowledge of youngsters on traditional medicinal plants becomes less compared to the adults and older ones. In

all study sites more medicinal plants were reported by participants over 30 years of age than by younger ones. Medicinal plants knowledge and use increased with age increment was also reported by Bayafers Tamene *et al.* (2000; Mirutse Giday and Gobana Amani (2003); Hussien Adal (2004); Endalew Amenu (2007); Mirutse Giday (2007); Ermias Lulekal *et al*. (2008); Tesfaye Awas and Sebsebe Demissew (2009); Behailu Etana (2010); Nurya Abdurhman (2010); Eskedar Abebe (2011; Moa Megersa *et al.* (2013) and Alemayehu Kefyalew *et al.* (2015). Another study carried out in Ransu Dayak village, in West Kalimantra, Indonesia, revealed that older people are more knowledgeable than young ones (Caniago and Siebert, 1998). Result of another study conducted in India (Uniyal *et al*., 2006) also indicated that information on the medicinal uses of plants nowadays seems to have mostly been confined to older people (above 30 years of age). However, Haile Yineger and Delenesaw Yewhalaw (2007) and Seyoum Getaneh (2009) reported a statistically insignificant correlation between age and the number of medicinal plants by the local people in Jimma Zone, south-western Ethiopia and in Chencha District; Gamo Gofa, southern Ethiopia respectively.

The study indicated that younger people in the study area have limited medicinal plants knowledge as compared to older ones and this could indicate that the transfer or handover of the knowledge has not been taking place in a proper manner which could, in turn, be attributed to the lack of interest from the younger generation to learn and practice it due to the ever increasing influence of modernization. In Nepal, for example, the impact of modernization has been so widespread that only older people have knowledge of traditional medicine (Manandhar, 1995). Results of other studies conducted elsewhere revealed similar findings (Bogossi *et al.,* 2002; Teferi Gedif and Hahn, 2003; Debela Hunde *et al*., 2004).

According to the data obtained from the study, more informants were not well educated where the largest percent from the total informants 137 (60.08%) were illiterate peoples reported more number of medicinal plants than by 91 (49.56%) literate informants. A majority of the interviewees (60.08%) were illiterate while (49.56%) of the respondents had no formal education. This indicates that non-educated informants handle much knowledge of traditional medicine than educated informants. This confirms that modern education limits the knowledge on traditional medicine. Literate people in the study area were found to have less knowledge on the use of medicinal plants as compared to illiterate once due to better exposure of the former to modernization. Similar result were reported in

studies conducted elsewhere (Wester and Yongvanit, 1995; Teferi Gedif and Hahn, 2003). A study conducted in Northeastern Thailand found that people who had less formal education had better traditional knowledge than those who had formal education (Western and Yongavanit, 1995).

A negative linear relationship between education and knowledge indicates that modern education affects the knowledge on medicinal plants in the study area. The knowledge of the illiteracy and lower grade of the local people on traditional medicinal plants have been found superior compare to the modern educated individuals i.e., weak association between education and knowledge. The finding clearly indicated the knowledge on traditional medicinal plant is affected by different factors linked with modernization such as expansion of school, cultural exchange. The study of Tesfaye Awas and Sebsebe Demissew (2009) indicated that illiterate once had better knowledge of medicinal plants use as compared to literate once. Medicinal plant knowledge and use was independent of the educational level (Haile Yinger and Delenesaw Yewhalaw, 2007; Haile Yinger *et al.,* 2008).

The key informants were found to be more knowledgeable than most of the general informants in the study area. They had well-developed knowledge on plant species used to treats ailments, ingredients and diluents used to prepare herbal medicine. However, it was also found that some of the key informants were not willing to mention all the ingredients used to prepare particular herbal medicine. It was seen that the ingredient that could not be mentioned by one key informant was mentioned by another to prepare herbal medicine for the same ailments.

Much of the knowledge of wild edible plants in the study area obtained from elder informants, when compared with the young people. This was evidenced from that informant older than age 30 mentioned more number of wild edible plant species. Males knew more wild edible plants than females, implying males are more familiar with wild edible plants because of their day-to-day activities, mainly carried out in the field. Young males of Ethiopian rural area have been reported to consume more wild edible fruits (Zemede Asfaw and Mesfin Tadese, 2001). However, the present results show youngsters know relatively less wild edible fruits than elders. Less familiarity of the youngsters disagrees with previous assumptions that considers children and youngsters to be more familiar to wild edible plants than elders because of their frequent appearance in the field and experiences in different landscapes (Fentahun Mengistu and Hager, 2008).

5.1.16. Marketability of medicinal and wild edible plants

As the information's provided about marketability, some medicinal plants, were found common in the market place sold basically for food or spice, medicinal, for farm implement and other purpose. BORSE (*Echinops kebericho*), SIBECA (*Lepidium sativum*), TIKURE DUBA (*Cucurbita pepo*), TSETELA (*Ruta chalepensis*), BUNDO (*Myrica salicifolia*) were found on markets being sold and purchased entirely for the purposes of their non-medicinal applications**.** In addition, parts of different medicinal plants are also marketed for their medicinal value and for use as spice (*Allium sativum, Lepidium sativum* and *Nigella sativa*). The remaining reportedly marketable medicinal plants were mainly sold for their non-medicinal uses but occasionally applied as medicine when the need arise Behailu Etana (2010; Nigusse Amsalu (2010); Nurya Abdurhman (2010); Eskedare Abebe (2011); Sintayehu Tamene (2011); Moa Megersa *et al.* (2013) and Getu Alemayehu *et al*. (2015).

Regarding wild edible plants, there was one wild edible plant sold in the market of Gelana District (*Solanum nigrum)* (ADUA)**.** The justification of informants showed that, the limitation of marketable wild food plants were related to reduce accessibility of the sources due to of deforestation taking place from time to time. This was proved from the observation of markets and the discussion with merchants. In addition, the second reason reported by the informant is that wild food selling is culturally prohibited or considered shame by the family members, even children are not allowed to do so. A few numbers of wild foods sold in the market were also reported by other studies made in Ethiopia **(**Zemede Asfaw, 1997; Bayafers Tamene *et al.*, 2000; Kebu Balemie and Fasil Kibebew, 2006**).** Generally, most of the informants stated that the local people give less emphasis to wild edible plants, but highly over-harvested for different purposes. Due to this reason, most of the wild edible plants were scarce. This was also pointed out by (Bayafers Tamene *et al.,* 2000; Tigist Wondimu *et al.,* 2006).

5.1.17. Threats and conservation of indigenous knowledge associated with the medicinal and wild edible plants

In Amaro and Gelana districts, various factors were recorded as the main threats for medicinal and wild edible plants in the area. There was loss of plants because of agricultural expansion, firewood collection; charcoals making, timber, construction material were contributing factors for the loss of plant species in general and medicinal plants in particular. in the Amaro and Gelana districts, agricultural expansion was the main threat to medicinal and wild edible plant availability. Similar

results were obtained in a different investigation in Ethiopia Endalew Amenu (2007) that showed that need for agricultural land and population pressure severely threatened plant species in general and medicinal and wild edible plants in particular. Similar study conducted in Eastern Nuba Mountains, Sudan, by Salih and Hassan (2014) revealed that harvesting for timber-based utilizations in addition to agricultural expansion and overgrazing were the principal threats to wild edible food producing trees in the area. On the other hand the findings did not agree with those of another study done in the country such as deforestation for agricultural expansion is not serious current problem leading to the reduction of medicinal plants (Tadesse Beyene, 2015).

The indigenous plant use knowledge transfer was mainly by word of mouth rather than through a well-organized written script as a result of death of many aged healers there is a rapid decline in authentic knowledge in traditional treatment. All of the informants agreed that expansion of modern education; health institutions, cultural modifications and very poor conservation efforts threatened medicinal and wild edible plant survival in the area. According to Debela Hunde *et al.* (2004) and Miruts Giday *et al.* (2009), the immediate and serious threat to the local medical practice and transfer in Ethiopia arise from the increasing influence of modernization such as increasing modern education, industrialization; change in life style and migration from rural to urban area. Besides, cultural transformation occurring before the documentation of medicinal plant use knowledge is an important challenge in the conservation of medicinal plants that ethnobotanical research is concerned about (Balick and Cox, 1996).

It was also found that traditional healers show maximum secrecy in handling medicinal plant knowledge, a trend which is also reported for other ethnic groups in the country (Mirutse Giday *et al*., 2009; Tilahun Teklehaymanot, 2009). Moreover, the observed secrecy by knowledgeable healers not to leak medicinal plant knowledge beyond the specific family circle might be taken as a guarantee for social respect and means of securing charges from patients. These facts, show the threat on continuity in indigenous medicinal plant knowledge down the generation ladder in the Districts.

As far as conservation status is concerned, most of the medicinal plants in the study area have no protection since they are harvested from the wild with no evident conservation practices except some traditional practitioners had started to conserve medicinal plants by cultivating in homegardens. In some cases some cultural believes and traditional practices that were associated

with traditional medicines were found to contribute much to the conservation of medicinal plants in their natural habitat. Similar results were obtained in the study made by (Behailu Etana, 2010; Sintayehu Tamene, 2011) showed that some traditional practitioners had started to conserve medicinal plants by growing them in homegardens.

5.2. Conclusions

5.2.1. Floristic composition

A total of 180 species belonging to 148 genera and 68 families were collected and identified of which 140 and 107 were from Amaro and Gelana districts respectively. Out of the plants identified in this study, 8 were endemic species to Ethiopia. Of all the families family Asteraceae and Fabaceae had the highest number of plant species accounting for 15 (8.33%) species each; followed by Lamiaceae that had 12 (6.66%) species. Shrubs were the dominant species out number in forests when compared to the other growth forms. This could be related partly to interference and opening up of the forest due to resource extraction. The Amaro and Gelana people are partly dependent on medicinal and wild edible plants to fulfill their day-to-day health care needs and food supply. Amaro and Gelana districts are an important area for medicinal and wild edible plants and associated local knowledge; the natural vegetation being the most important reservoir for the majority of the medicinal and wild edible plants. Nekora and Dance forests are a reservoir of 90 traditional medicinal plant species and 52 wild edible plants.

5.2.2. Medicinal plants of the study area

Amaro and Gelana districts are relatively rich in medicinal plant diversity and they have contributed to the higher degree of similarity in species composition and use pattern of their medicinal plants. A total of 147 plant species belonging to 128 genera and 62 families were recorded from the study area. Regarding similarity of medicinal plant use, each of the following five medicinal plants were used in the same way by the two ethnic groups (koore and Oromo) for example, *Ajuga integrifolia* against stomachache, *Commelina latifolia* against ringworms, *Eucalyptus globulus* against influenza, *Ocimum lamiifolium* against general malaise (mich) and *Solanum incanum* against epstaxis. The Amaro community uses 90 medicinal plant species and Gelana community uses 79 species. The greater numbers of the medicinal plants were collected from the natural environment. From the collected medicinal plant species in the study area 112 were used against human ailments and 42 against livestock diseases. In Amaro, 62 of these are used to treat human ailments and the remaining 28 for livestock diseases. Similarly, higher number of plants (61) are used to treat human and lower number (18) livestock ailments in Gelana District. Less number of livestock diseases and medicinal plants were reported compared with humans. The local people of the study area found alternative medicines for their ailments first and then try to

search for the cure for their livestock ailments. With regard to family level species richness, Fabaceae and Lamiaceae had the highest number of species. Herbs were found the dominant growth forms. A total of 66 human and 28 livestock ailment types were identified in the area. Stomachache, diarrhea and intestinal parasites were the most commonly reported health problems under the gastro-intestinal disease category, whereas wound was most frequently reported under the dermatological disease group. The local people of Amaro and Gelana districts use *Myrica salicifolia* to treat the highest number of human and livestock ailments followed by *Phytolacca dodecandera* and *Solanum incanum*.

The most frequently employed plant parts were leaves. In both districts, the greater parts of remedies were prepared from single plant species and few were reported to be prepared from different plant species. The major modes of remedy preparation were boiling the decoction followed by crushing and homogenizing with cold water. The result in the conditions of plant part used indicated that the majority were prepared in fresh form. In the study area oral administration was the dominant route with followed by dermal. Both the dominant routes of administration (oral and dermal) routes permit rapid physiological reaction of the prepared medicines with the pathogens and increase the curative power. The measurements used to determine the dosages were not standardized except categorization by age, physical appearance and health conditions. In many cases, amounts of plant part to be processed were roughly estimated and therefore, lack precision. For example, many informants during interviews used phrases such as, many leaves, some leaves, and few leaves, to describe their doses. *Acmella caulirhiza* and *Agarista salicifolia* were cited by highest number of informants in the study area. The popularity of these medicinal plants was due to people preference for the species to treat different human and livestock diseases in the community.

5.2.3. Mode of transfer of medicinal plant knowledge

The majority of the interviewees respond that they keep their medicinal plant knowledge secret and further transfer of knowledge could only take place within family members. The desire of the local people to transfer and share their knowledge vary from one to another in the study area in that, most of the key informants from both districts were willing to share their knowledge on use of traditional medicinal plants to the first son than to their daughters and this might be one factor for the limited number of female professional traditional practitioners. In general, the tendency of the

local people to transfer the traditional medicinal practices knowledge is mostly to a chosen person. On top of this many practitioners are less willing to show their knowledge and skills.

5.2.4. Wild edible plants in the two districts

A total of 80 wild edible plants were recorded in the study area and these plants were distributed in 53 genera and 34 families. From the total wild edible plant species two of them (*Urtica simensis* and *Rhus glutinosa*) endemic species to Ethiopia were being used as food by the local people of Amaro and Gelana districts. Sixty-four species distributed in 47 genera and 33 families were identified by local communities within Amaro District as wild edible plants whereas, fifty five wild plant species belonging to 35 genera and 25 families were reported as food sources in Gelana District. Of the total wild edible plants recorded the majority were obtained from wild vegetation.

Of all the families the family Fabaceae represented with 10 species, had the highest proportion of edibles followed by Tiliaceae, Anacardiaceae, Moraceae, Rhamnaceae, Rosaceae and Solanaceae in both districts. The result of growth forms was more or less similar in the two districts that shrubs were the highest proportion of the edible species followed by trees. Fruit is found to be the most edible plant part and mostly taken as raw. Out of the total wild edible plants, twenty one (26.25%) nutraceutical wild plants were used to treat 17 (80.95%) human and 4 (19.04%) for livestock primary health care system. As indicated by the results of paired comparison of factors affecting plant resources in the study area, all informants almost similarly reported that agricultural expansions stood first. *Cordia africana* was found to be most important in its multiple utility value (most threatened) among wild edible plants.

5.2.5. Comparison of knowledge on medicinal and wild edible plant within different informant groups

The study revealed that men have better medicinal plants knowledge than women. Older informants mentioned 84 (57.14%) of medicinal plants species than the younger ones. According to the data obtained from the study, non-educated informants handle much knowledge of traditional medicine than educated informants. Illiterate peoples mentioned 76 (51.70%) of medicinal plants species than the literate ones, this confirms that modern education limits the knowledge on traditional medicine. The key informants were found to be more knowledgeable than most of the general informants in the study area.

5.2.6. Marketability of medicinal and wild edible plants

Most of the medicinal plants are not widely traded for medicinal purposes, but mostly for other different uses for food or spice purposes, for farm implement and other purpose. Regarding wild edible plants, there was one wild edible plant sold in the market of Gelana District (*Solanum nigrum*) (ADUA)**.** The reason reported by the informants is that wild food selling is culturally prohibited or considered shame by the family members, even children are not allowed to do so.

5.2.7. Threats and conservation of medicinal and wild edible plants and the associated indigenous knowledge

The indigenous people of the study area reported that medicinal and wild edible plants were highly threatened by agricultural expansion and firewood collection. Generally, in connection to population growth the demand for wood material, agricultural expansion and urbanization are increased and thus have effects in threatening the medicinal plants and associated indigenous knowledge of the study area.

The knowledge on herbal remedies is held by elders, who were above 30 years of age. There is a rapid loss of traditional herbalists and a decline in authentic knowledge in traditional treatment, as a result of death of many aged healers. The decline in the use of medicinal plants by younger generation may gradually lead to the fading away of the indigenous knowledge associated with the plants.

The other reason for the loss of the knowledge on medicinal plant is modernization and refusal to practice or inherit the knowledge by new generation. As reported by the informants, the expansion of modern health institutions, schools some environmental and cultural modifications were among the reasons for the loss of the knowledge on medicinal plants of the area. The study exposed that Amaro and Gelana districts were rich in medicinal and wild edible plants diversity and associated indigenous knowledge. However, anthropogenic factors coupled with acculturation and very poor conservation efforts threaten medicinal and wild edible plant survival in the area.

Generally, threats that erode indigenous knowledge emanate from secrecy, oral based knowledge transfer, i.e. absence of documented sources of this knowledge, reluctance of young generation to gain the knowledge, unavailability of the species, influence of modern education and awareness factors are the major ones. Therefore, awareness creation campaigns are timely needed to improve local community's knowledge on the importance and management of medicinal plants and

awareness raising should be made among the healers to avoid erosion of the indigenous knowledge and to ensure its sustainable use.

Even though there are many problems facing medicinal plants, the local people of the study area know the importance of conserving the plants under both ex-situ and in-situ conservation methods, though the actual effort on the ground is minimal. For instance, some people and the districts Agriculture Offices have started conserving the plants by in-situ method (in their natural habitat), fence or in protected pasturelands, different places of worship (churches and mosques) in their farm fields or farm margins. Some local people are also conserving medicinal plants by ex-situ method by planting them in their home gardens. In the study area some cultural believes and traditional practices that associated with traditional medicines were found to contribute much to the conservation of medicinal plants in their natural habitat. For example, the claim by traditional healers that “medicinal plants are effective only if collected and administered by knowledgeable persons and healers” is a helpful attitude relative to the conservation of medicinal plants.

5.3. Recommendations

- Community-based forest priority areas (park) need to be demarcated and effectively protected in the districts for the conservation of forest in general and medicinal and wild edible plants in particular.

- Formal and non-formal education systems should be designed to create positive attitudes among the young by integrating tested and verified indigenous knowledge in to the curricula about the traditional uses of plants in general and medicinal and wild edible plants in particular.

- Most of the traditional healers might have given little attention to the indigenous knowledge transfer thus, training from zonal offices and nongovernmental organizations should be given as awareness raising efforts targeting healers to improve capturing of the knowledge and minimize its loss.

- In-situ and ex-situ conservation of medicinal plants should be practiced in the districts by training model herbal medicine practitioners (farmers) and the elders to ensure the continuity of scarce medicinal plants. For this priority areas should be the two forests particularly plant community (I) that registered highly threatened.

- Supporting the activities of plantations of medicinal and WEPs in degraded and degrading areas through forming youth association is recommended and priority species include (plants with more diversified medicinal and food values) such as *Hagenia abyssinica, Cordia africana* and *Acacia mellifera.*

- Culture and Tourism Offices of the districts should encourage people to protect some cultural believes and traditional practices associated with traditional medicines.

- Phytochemical and toxicological studies need to be carried out on medicinal plants (especially on those with high informant consensus and fidelity values (*Agarista salicifolia*, *Acmella caulirhiza*, *Solanum incanum, Allium sativium, Myrica salicifolia, Buddleja polystachya, Ajuga alba, Clerodendrum myricoides, Echinops kebericho, Commelina latifolia, Lepidium sativum* and *Citrus aurantifolia*) to gain more information about the possibilities of identifying the active ingredients for production of drugs.

- The most gathered wild edible plants were from wild habitats and this calls for urgent research on the possibility of adapting, growing and intentionally managing some of the commonly consumed wild edible plants such as *Physalis lagascae, Rubus steudneri*, *Arisaema schimperianum*, *Cordia africana* and *Ximenia americana* under IBC's efforts in its ex-situ conservation sites. Furthermore, further research on the toxicity and nutritional composition of the reported wild edible plants is recommended to ensure safety of consumption.

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APPENDICES

Appendix 1. Checklist of questions raised during interviews with informants.

I. Socio-demographic information

1. Date of interview
2. Name of the interview site
3. Name of the informant
4. Age of the informant
5. Sex of the informant

   Female ☐ Male ☐

6. Ethnic group to which the informants belongs

   Koore ☐ Oromo ☐ Amhara ☐ other ☐

7. Religion of the informants

   Orthodox ☐ Muslim ☐ Protestant ☐ Catholic ☐ Traditionalist ☐ other ☐

8. Level of education

   Literate (able to read and write) ☐ illiterate (unable to read and write) ☐;

II. Information related to the medicinal use of the plants

1. Do you use medicinal plants? Which species do you use? About how many plants do you use in all your treatments?
2. What are the most common diseases of humans in your area? ----------
3. What are the most common diseases of livestock's in your area? ----------
4 Mention plant types used to treat a given disease in the area (give local names).
   4.1 Plant used to treat only human diseases
   4.2 Plants used to treat only livestock diseases
5. What part/ parts of the medicinal plant (s) is/are used? (Mark an "X" on one of the give alternatives)

   Flower (Fl) ☐ Latex (Lt) ☐

   Fruit (Fu) ☐ Whole plant (WP) ☐

   Seed (Se) ☐ Leaf (L) ☐

   Sap (Sp) ☐ Root (R) ☐

   Bark (B) ☐ Stem (St) ☐

6. What is the habit of the plant?

   Tree (T) ☐ Shrub (S) ☐

   Climber (Cl) ☐ Herb (H) ☐

7. Where do the medicinal plants grow? (Place of collection?

7.1. In home gardens ☐

7.2. Fallowed land ☐

7.3. Arable land ☐

7.4. In the forest ☐

8. What is the method of preparation of medicinal plants? (Mark"X" from the alternatives).

Fresh (F) ☐ Dried (D) ☐

Crushed (C) ☐ Powdered (P) ☐

Used alone (Ua) ☐ Exudation (Ex) ☐

Concoction (Cn) ☐ Mixed with others or water (Mw) ☐

9. Does the amount used (dose) vary among age groups, sex? If yes, state for each age groups and sex.

10. Is there any noticeable adverse effect (side effect) caused by the medicine? If yes, is/ are there any antidote (s) for those adverse effects?

11. How are the prepared remedies taken by the patient (s)/routes of administration? (Mark"X" from the alternatives).

Dermal (D) ☐

Anal (A) ☐

Nasal (N) ☐

Oral (O) ☐

Ear (E) ☐

12. Which Season of preferred for collection of medicinal plants in your area?

12.1. Wet season ☐

12.2. Dry season ☐

12.3. All-the-year round ☐

13. How is the plant part collected? (Including the amount collected at a time)

14. Do you store the medicine? If yes, how and for how long?

15. Are there conditions (example like pregnancy, menstruation …) that forbids the patient taking the medicine

16. Are there schedule /course of therapy in the use of medicinal plants?

17. Are there members of the community who frequently use the medicinal plants?

18. Are there economic groups who mostly or occasionally use these medicinal plants?

19. Is/Are the medicinal plant (s) marketable? If so,
  19.1 Which age group sells and exchanges them most often?
  19.2 Which plant species are more common on a market?
  19.3 Where are their sources?
  19.4 What are their benefits?
20. Is the medicinal plants easily accessible? If not, why?
21. How abundant is medicinal plants, its trends when compared to the past ten years (is it increasing?; how far are you travel to get the medicinal plants in the past and now?
22. Is there any interference between modernization and traditional medicinal plant use in the area? If so, how does modernization interfere with traditional medicinal system?
23. Are there community members who frequently depend more on traditional medicinal plants as compared to modern medicine? Why?
24. Are there taboos in the utilization of some medicinal plants in the locality? (Time of collection, method of collection, sex, age, storage etc… What do the taboos imply? If any)
25. Are there threat to the medicinal plants? If so what are the major problems associated with them in the area?
26. Are there traditional medicinal plants conservation methods in the area? If so include the management practices by the indigenous people
  27. How do people prevent and control a given disease in the area? _____
  28. Availability of medicinal plants as compared to the past: More_____, Same_____, and Less_____
29. Does the medicinal plants have any use other than medicine? If yes, state
30. What are threatening factors of medicinal plants in your area? For medicinal _____, Food_____, Firewood collection_____, Charcoal making_____, Fence_____, Construction_____, Furniture_____, Edible fruit_____
  31. Which medicinal plants species is commonly threatened in study area? _____

III. Information related to the wild edible plants
1. List out the local name of wild edible plants in the area.
2. Where do these wild edible plants grow in the study area? (Place of collection? (Mark an "X" on one of the give alternatives)

  2.1. In home gardens ☐

  2.2. Fallowed land ☐

  2.3. Arable land☐

  2.4. In the forest ☐.

3. What part do wild edible trees and shrubs play in household food security?

  Flower (Fr) ☐ Latex (Lt) ☐

  Fruit (Ft) ☐ Whole plant (WP) ☐

Seed (Sd) ☐ Leaf (L) ☐

Sap (Sp) ☐ Root (R) ☐

Bark (B) ☐ Stem (St) ☐

4. Are there members of the community who frequently use wild edible plants?
5. Are there economic groups who mostly or occasionally use these wild edible plants?
6. Is/ Are the wild edible plant (s) marketable? If so,
6.1 Which age group sells and exchanges them most often?
6.2 Which plant species are more common on a market?
6.3 Where are their sources?
6.4 What are their benefits?
7. Is the wild edible plants easily accessible? If not why?
8. Are there community members who frequently depend more on wild edible plants? Why?
9. Which plant species is the most preferred? Why?
10. Are there taboos in the utilization of some wild edible plants in the locality? (Time of collection, method of collection, sex, age, storage etc… What do the taboos imply? If any)
11. Are there treats to wild edible plants? If so what are the major problems associated with them in the area?
12. Which season of preferred for collection of wild edible plants in your area?

12.1. Wet season ☐

12.2. Dry season ☐

12.3. All-the-year round ☐

13. Are there wild edible plants conservation methods in the area? If so include the management practices by the indigenous people.
14. How is the effort made by the government and other organizations other than the local people to conserve the wild edible plants in the area are explained?
15. Is/ are the wild edible plants currently in the study area?
16. How abundant is the wild edible plant, its trends when compared to the past ten years (is it increasing? How far you are travel to get the wild edible plants in the past and now?
17. Do you have any information on other use of the plant besides its edibility (value)?
18. How is the mode of consumption of wild foods? Fresh, cooked, after putting in other some place for some times, after piling, washed with water, specify?
19. Issue of preference of some WEPs over the others
20. Do you use any mentioned wild food plant as medicine?

IV. Additional information
1. How do the local people manage and conserve medicinal and wild food plant species through their traditional practices?

2. What is the floristic composition of the study area?
3. What are the factors affecting the practice of indigenous knowledge on medicinal plants in the study area?
4. How is the knowledge of medicinal and wild edible plants use transferred from elders to younger's in the study area?
5. What type of plant communities exist in Nekora and Dance forests of Amaro and Gelana districts, respectively?

Appendix 2. Floristic list of Nekora and Dance forests

Key: Habit (Ha.): Herb (H); Shrub (Sh); Tree (T); Climber (Cl); Liana (Li); Collection number (Coll.No), Local name (Lo.na), K= koorete, Or= Oromiffa, Absent (X), Present (+), **endemic) NB. Endemic status checked by referring to the species account in the Flora of Ethiopia and Eritrea.

No	Scientific name	Family	Local name in koorete and Oromiffa	Ha	Altitude	Coll. No GA	Nekora	Dance
1	*Abutilon angulatum* (Guill and Perr.) Mast.	Malvaceae	Hincinnii adii (Or)	Sh	1865-1947	092	+	+
2	*Acacia abyssinica* Hochst. ex Benth.	Fabaceae	Waacho adii (Or)	T	1997-2011	026	X	+
3	*Acanthus sennii* Chiov. **	Acanthaceae	Kosero (K)	Sh	1810-1900	114	+	X
4	*Acidenthera laxiflora* Bake	Iridaceae	Merero (K)	Cl	1802-1989	191	+	+
5	*Acmella caulirhiza* Del.	Asteraceae	Jilokeda (Or)	H	1843-2015	206	+	+
6	*Acokanthera schimperi* (A.Dc.) Schweninf.	Apocynaceae	Wato (K)	Sh	1783-1989	219	+	+
7	*Adiantum caudatum* Var. Hirsutum auct.	Adiantaceae	Bisa (K) ... (Or)	H	1933-1999	220	+	X
8	*Aeschnomene elaphroxylon* Guill	Fabaceae	Qanqalcha (Or)	Sh	1849-2001	151	+	X
9	*Agarista salifolia* (Comm.ex.Lam.) Hook.f.	Ericaceae	Gesso (K)	T	1932-2100	027	+	X
10	*Ajuga integrifolia* Buch.Ham	Lamiaceae	Anamiro (K), Harma Gusaa (Or)	H	1917-2221	062	+	+
11	*Albizia gummifera* (J.f.Gmell.)	Fabaceae	Gorbii (Or)	T	1772-2400	061	+	+
12	*Ampelocissus bombycina* (Bak.) Planch	Vitaceae	Hareg (K), Raajaa (Or)	H	1922-2210	093	+	X
13	*Arisaema schimperianum* Schott	Araceae	Sise (K)	H	2260-2295	060	+	X
14	*Arundinaria alpina* K. Schum.	Poaceae	Weyeshe (K), Qarkahaa (Or)	H	2031-2113	065	+	X
15	*Arundo donax*L.	Poaceae	Tela (K), Shanbakoo (Or)	H	2032-2125	194	+	X
16	*Asparagus africanus* Lam.	Asparagaceae	Saretii (Or)	Sh	1983-2053	059	+	X
17	*Berchemia discolor* (Klotzsch) Hemsl.	Rhamnaceae	Jajjabaa (Or)	H	1761-1983	028	X	+
18	*Bersama abyssinica* Fresen.	Melianthaceae	Tibiro (Or)	T	1760-1834	195	X	+
19	*Bidens pilosa* L.	Asteraceae	Hadaa (Or)	H	1756-1866	196	+	X

20	*Boscia angustifolia* A. Rich.	Capparidaceae	Qanqalcha (Or)	T	1900-2263	118	+	+
21	*Boscia salicifolia* Oliv.	Capparidaceae	Necho (K), Qanqalcha (Or)	Sh	1942-2253	024	+	X
22	*Brucea antidysenterica* J.F.Mill.	Simaroubaceae	Shudede (K)	T	1943-2011	120	+	X
23	*Buckollia volubilis* (Schlter.) Venter and R.L.Verh.	Asclipidaceae	Urura (Or)	T	1340-1543	003	X	+
24	*Calpurnia aurea* (Ait.) Benth.	Fabaceae	Chekata (K), Cheektaa (Or)	Sh	1750-1877	156	+	+
25	*Capparis tomentosa* Lam.	Capparidaceae	Kufo (K), Gooraa (Or)	Sh	1754-1846	198	+	+
26	*Carduus nyassanus* (S. Moore) R.E. Fries	Asteraceae	.....	H	1909-1999	104	+	+
27	*Carissa spinarum L.*	Apocynaceae	Agam (K), Hankokaa (Or)	Sh	1640-1817	067	+	+
28	*Celtis africana Burm.*f	Ulmaceae	Kewet (K), Motoqomaa (Or)	T	1762-1877	057	X	+
29	*Cheilantes farinosa* (Forssk) Kulin.	Polypodiaceae	Bisa (K), ...(Or)	H	1904-2019	095	+	X
30	*Chenopodium murale* L.	Chenopodiaceae	Amadmaado (Or)	H	2007-2103	199	+	+
31	*Chenopodium schraderianum* Schult.	Chenopodiaceae	Siniyn (Or)	H	2017-1125	202	X	+
32	*Cissus quadrangularis* L.	Vitaceae	Yezehone anjete (K)	H	1903-1969	023	+	X
33	*Clematis hirsuta* Perr and Guill.	Ranunculaceae	Hidda fitii (Or)	Sh	1814-1877	204	X	+
34	*Clematis simensis* Fresen.	Ranunculaceae	Yazohareg (K), Butii (Or),	Cl	2151-2189	113	+	X
35	*Cleom scaposa* Dc.	Capparidaceae	Ketso (K)	H	1929-1997	203	+	X
36	*Clerodendrum myricoides* (Hochst) Vatke	Lamiaceae	Shochegufe (K), Misrchii (Or)	Sh	1940-2008	205	+	+
37	*Clutia abyssinica* Jaub.and Spach.	Euphorbiaceae	Mukadigaa (Or)	Sh	1823-1900	056	X	+
38	*Combretum molle* R. Br. ex G. Don	Combretaceae	Sobo (K), Biqaa (Or),	T	1899-1904	208	+	X
39	*Commelina diffusa* Burm.f.	Commelinaceae	Galgie (K), Weha akure (Am)	H	2154-2200	123	+	X
40	*Commelina imberbis* Ehrenb.ex Hassk.	Commelinaceae	Weha akur (Am)	H	1890-1900	209	+	X
41	*Commelina latifolia* Hochst.ex A.Rich.	Commelinaceae	Lalimicha (Or)	H	1829-1988	121	+	+
42	*Cordia africana* Lam.	Boraginaceae	Bola (K), Wadeessa (Or),	T	1831-1986	055	+	+
43	*Cordia monoica* Roxb.	Boraginaceae	Madeda (K)	T	2155-2200	159	+	X
44	*Crinum abyssinicum* Hochest. ex A. Rich.	Amarylidiaceae	Bute (K)	H	2157-2200	210	+	X
45	*Croton macrostachyus* Del.	Euphorbiaceae	Harpa (K), Makenissa (Or),	T	1509-2177	031	+	+
46	*Cucumis ficifolius* A.Rich.	Cucurbitaceae	Kuro/Tsiyaa (Or)	H	2005-2057	160	+	X
47	*Cupressus lusitanica* Mill.	Cupressaceae	Tid (Am)	T	2008-2094	097	+	X
48	*Cyathula cylindrica* Moq.	Amaranthaceae	Hincinii addi (Or)	H	1841-1934	098	X	+
49	*Cyathula uncinulata* (Schrad.) Schin	Amaranthaceae	Baaldoo (O)	H	1840-1910	054	X	X

50	*Cynodon dactylon* (L.) pers.	Poaceae	Sare (K)	H	2010-2047	161	+	X
51	*Cynoglossum lanceolatum* Forssk.	Boraginaceae	Chemide (K)	H	2015-2055	124	+	X
52	*Cyperus assimilis* Steud.	Cyperaceae	Gichigila (K), Enegicha (Am)	H	2247-2286	213	+	+
53	*Cyphostemma adenocaule* (Steud. ex A. Rich)	Vitaceae	.....	H	2013-2076	053	X	+
54	*Cyphostemma niveum* (Hochst. ex Schweinf.)	Vitaceae	Keta (K)	H	1957-2005	125	+	X
55	*Discopodium penninervium* Hochst.	Solanaceae	Mararo (Or)	T	1851-1899	214	X	+
56	*Dodonaea angustifolia* L. f.	Sapindaceae	Sengera (K), Itacha (Or)	Sh	1754-1954	112	+	+
57	*Dombeya torrida* (J. F. Gmel.) P. Bamps	Sterculiaceae	Danse (K), Talalo (Or)	Sh	1859-1921	221	X	+
58	*Dovyalis abyssinica* (A.Rich) Warb.	Flacourtiaceae	Dahugo (Or)	Sh	1860-1913	126	+	+
59	*Dracaena afromontana* Mildbr.	Dracaenaceae	Motta zaf (Am)	T	1861-1925	021	X	+
60	*Echinops amplexicaulis* Oliv.	Asteraceae	.....	H	2009-2077	216	+	X
61	*Ehretia cymosa* Thonn.	Boraginaceae	Ulagaa (Or)	Sh	1860-1960	099	+	+
62	*Embelia schimperi* Vatke	Myrsinaceae	Hanqu (Or)	Sh	2014-2089	217	+	+
63	*Englerina woodfordioides* (Schweinf.)	Loranthaceae	Telkokamo (K)	Sh	2015-2111	215	+	X
64	*Entada abyssinica* Steud.ex A.Rich.	Fabaceae	Dersase (K)	T	2012-2094	127	+	+
65	*Epilobium hirsutum L.*	Onagraceae	.....	H	2001-2114	163	+	X
66	*Erica arborea* L.	Ericaceae	Adayle (K)	Sh	2400-2489	128	+	X
67	*Erythrina brucei* Schweinf. **	Fabaceae	Boro (K)	T	2021-2098	032	+	+
68	*Euclea racemosa* Murr.	Ebenaceae	Mi'essa (Or)	Sh	1870-1900	164	+	+
69	*Fagaropsis angolensis* (Engl.) Dale.	Rutaceae	Bisa (K)	Sh	1958-2013	165	+	X
70	*Faurea speciosa* Welw.	Proteaceae	Gere (K)	T	2000-2100	223	+	X
71	*Ficus sur* Forssk.	Moraceae	Harbuu (Or)	T	2020-2120	224	+	+
72	*Ficus sycomorus* L.	Moraceae	Odaa (K)	T	1875-1934	111	+	+
73	*Ficus vasta* Forssk.	Moraceae	Gahee (Or)	T	1999-2117	167	+	X
74	*Flacourtia indica* (Burm.f.) Merr.	Flacourtiaceae	Hagalaa (Or)	Sh	1948-2009	052	+	+
75	*Flueggea virosa* (wild.) Voigt	Euphorbiaceae	Shegime (K)	Sh	2010-2136	226	+	X
76	*Galium simense* Fresen.	Rubiaceae	Ashekit (Am)	H	2100-2211	252	X	+
77	*Glysine wightii* (Weght and Arn.) Verdc.	Fabaceae	Kelela (K)	H	1952-2017	051	X	+
78	*Grewia ferruginea* Hochst ex A.Rich	Tiliaceae	Benine (K), Haarorresa (Or)	Sh	1957-2066	254	+	+

79	*Grewia mollis* Juss.	Tiliaceae	.....	Sh	1960-2117	169	X	+
80	*Guizotia scabra* (Vis.) Chiov.	Asteraceae	Hadabuti (Or)	H	1969-2131	101	X	+
81	*Hagenia abyssinica* (Bruce) J.F.Gmel.	Rosaceae	Zoyra (K)	T	2134-2453	170	+	X
82	*Helichrysum schimperi* (Sch.Bip.ex A.Rich) Moeser	Asteraceae	.....	H	1905-2214	072	+	X
83	*Helichrysum splendidum* (Thunb.) Less.	Asteraceae	.....	H	2105-2225	129	+	+
84	*Hibiscus diversifolius* A.Rich.	Malvaceae	Hincinni (Or)	H	1973-2003	171	X	+
85	*Hibiscus macranthus* Hochst. ex A. Rich.	Malvaceae	Key hechine (Or)	H	1970-2119	172	X	+
86	*Hypericum quartinianum* A.Rich.	Hypericaceae	Tselkete (K)	Sh	1918-2103	255	+	X
87	*Indigofera hochstetteri* Bak.	Fabaceae	Ejesisa (Or)	Sh	1975-2017	050	X	+
88	*Indigofera spicata* Forssk.	Fabaceae	……	H	1919-2100	130	+	X
89	*Jasminum grandiflorum* L. **	Oleaceae	Amesaa (Or)	H	1977-2114	131	+	+
90	*Jasmnium stan* Pax.	Oleaceae	Chire (K)	Sh	1978-2100	257	+	+
91	*Juniperus procera* Endle	Cupressaceae	Bibire (K)	T	2185-2213	004	+	X
92	*Justicia flava* (Vahl) Vahl	Acanthaceae	Gichigla (K)	H	2190-2211	258	+	X
93	*Kalanchoe marmorata* Bak.	Crassulaceae	.....	H	2145-2209	259	+	X
94	*Laggera crispata* (Vahl) Hepper and Wood	Asteraceae	.....	H	2200-2278	091	+	X
95	*Lantana trifolia* L.	Verbenaceae	Kefakosa (K), Hantite (Or)	H	1989-2057	249	+	+
96	*Leonotis ocymifolia* (Burm.f.) Iwarsson	Lamiaceae	Ras Kimir (Am)	Sh	1978-2087	005	+	X
97	*Lippia adoensis* Hochst ex Walp. **	Verbenaceae	Kishira (K)	Sh	1990-2093	049	+	+
98	*Lobelia giberroa* Hems.	Lobeliaceae	.....	Sh	2262-2299	034	+	X
99	*Maesa lanceolata* Forssk.	Myrsinaceae	Gecha (Or)	T	1700-1918	174	+	+
100	*Maytenus obscura* (A. Rich.) Cuf.	Celasteraceae	.....	Sh	1993-2086	228	+	X
101	*Millettia ferruginea* (Hochest) Bak. **	Fabaceae	Zagi (K), Dadatu (Or)	T	2000-2077	018	+	+
102	*Myrica salicifolia* A. Rich.	Myricaceae	Bundo (K)	T	2177-2201	074	+	+
103	*Myrsine africana* L.	Myrsinaceae	Eurch (K)	Sh	1967-2055	090	+	X
104	*Nicandra physaloides* (L.) Gaerin.	Solanaceae	Mazie (K)	Sh	2257-2298	247	+	X
105	*Nuxia congesta* R.Br.ex Fresen.	Loganiaceae	Udessa (Or)	T	2008-2114	246	X	+
106	*Ocimum lamiifolium* Hochst.ex Benth.	Lamiaceae	Qoricha mich (Or)	Sh	2010-2093	134	+	+
107	*Ocimum urticifolium Roth*	Lamiaceae	Anchabi (K)	Sh	2009-2120	048	+	X

108	*Olea europaea* L. *subsp. cuspidata* (Wall. ex G. Don) Cif.	Oleaceae	Gulta (K), Ejersa (Or)	T	2011-2300	075	+	+
109	*Olinia rochetiana* A. Juss.	Oliniaceae	Qdida (Or)	T	1899-1975	177	+	+
110	*Oncoba spinosa* Forssk.	Flacourtiaceae	Hagela (Or)	Sh	1763-1944	178	X	+
111	*Osyris quadripartita* Salzm.ex Decn.	Santalaceae	Wato (K)	Sh	1968-2037	098	+	X
112	*OXalis radicosa* A. Rich.	Oxalidaceae	.....	H	1788-1977	136	X	+
113	*Ozora insignis* Del.	Anacardiaceae	Sahela (K)	Sh	2199-2213	244	+	X
114	*Pappea capensis* Eckl.and Zeyh.	Sapindaceae	Bika (K)	T	2013-2121	135	+	+
115	*Pavetta oliveriana* Hiern	Rubiaceae	Tolkokamo (K)	Sh	1983-2027	243	+	X
116	*Pentas schimperiana (*A.Rich.) Vatke	Rubiaceae	Chunfa (K)	H	2163-2218	242	+	+
117	*Pergularia daemia* (Forssk.) Chiov.	Asclepiadaceae	Melishe (K)	Sh	1900-2204	105	+	X
118	*Periploca linearifolia* Quart-Dill. and A.Rich.	Asclepiadaceae	Dedemerashe (K)	Li	1985-2100	229	+	X
119	*Phoenix reclinata* Jacq.	Arecaceae	Ele (K)	T	2000-2112	179	+	+
120	*Phyllanthus ovalifolius* Forssk.	Euphorbiaceae	Ere (K)	Sh	1100-2220	076	+	X
121	*Physalis peruviana* L.	Solanaceae	Yeferenje Timatim (K)	H	2015-2096	047	X	+
122	*Phytolacca dodecandra* L. Herit.	Phytolaccaceae	Harenja (K)	Sh	2016-2088	088	X	+
123	*Pittosporum abyssinicum* Del.	Pittosporaceae	Erba (K)	T	2000-2193	137	+	X
124	*Plectranthus caninus* Roth	Lamiaceae	Sugete (K)	Sh	2000-2091	149	X	+
125	*Plectranthus punctatus* (L.f.) L.Her.	Lamiaceae	Sheba (K)	H	2007-2095	087	+	X
126	*Podocarpus falcatus* (Thunb.) R. B. ex. Mirb.	Podocarpaceae	Birbirsa (Or)	T	2019-2074	138	X	+
127	*Premna schimperi* Engl.	Lamiaceae	Tulenga (K), Urgessa (Or)	Sh	2022-2085	230	X	+
128	*Priva adhaerens* (Forssk.) Chiov.	Lamiaceae	Hacha (K)	H	2009-2091	241	+	+
129	*Protea gaguedi* J.F.Gmel.	Proteaceae	.....	T	2014-2077	106	X	+
130	*Protea madiensis* Oliv.	Proteaceae	Gere (K)	T	1700-1812	046	+	X
131	*Prunus africana* (Hook . f.) Kalkm.	Rosaceae	Suke (Or)	T	2026-2094	008	X	+
132	*PsydraX schimperiana* (A.Rich.) Bridson	Rubiaceae	Gellelo (Or)	Sh	2011-2096	231	+	+
133	*Pterolobium stellatum* (Forssk.) Brenan.	Fabaceae	Kontir (Or)	Sh	2111-2176	139	+	X
134	*Rhamnus prinoides* L'Herit.	Rhamnaceae	Gesho (Or)	T	2008-2110	181	+	X
135	*Rhoicissus tridentata* (L.f) Wild and	Vitaceae	.....	H	1899-1999	182	X	+

	Drummand							
136	*Rhus glutinosa* A. Rich. **	Anacardiaceae	Zergete (K), xaaxxessaa (Or)	Sh	1776-2453	183	+	+
137	*Rhus natalensis* Berha. ex Krauss	Anacardiaceae	Tsisano (K), Debobisa (Or)	Sh	1500-2037	140	+	+
138	*Rhus ruspolii* Engl.	Anacardiaceae	Titaye (Or)	Sh	2038-2084	009	X	+
139	*Rhus vulgaris* Meikle	Anacardiaceae	Kimo (Or)	Sh	2010-2083	184	+	+
140	*Ricinus communis* L.	Euphorbiaceae	Tsema (Or)	Sh	1900-2122	086	+	+
141	*Rosa abyssinica* Lindley	Rosaceae	Gorra (K)	Sh	1921-2119	016	+	+
142	*Rubus apetalus* Poir.	Rosaceae	Gorra (K)	Sh	1922-2121	077	+	+
143	*Rubus steudneri* schweinf	Rosaceae	Gorra (K)	Sh	1510 - 2300	045	+	+
144	*Rubus volkensii* Engl.	Rosaceae	Yedega enjory (K)	Sh	1788-1882	107	+	+
145	*Rumex abyssinicus* Jacq.	Polygonaceae	Dhangagoo (Or)	H	2056-2101	148	+	+
146	*Rumex nepalensis* Spreng.	Polygonaceae	Tulte (Or)	H	2074-2108	010	X	+
147	*Rumex nervosus* Vahl	Polygonaceae	Enbacho (Or)	H	2017-2144	232	+	+
148	*Scadoxus multiflorus* (Matyn) Raf.	Amaryrllidaceae	Buti (K), Kuleme (Or)	H	2148-2212	038	+	X
149	*Schrebera alata* (Hochst.) Welw.	Oleaceae	Uraga (Or)	Sh	2059-2177	147	X	+
150	*Sencio hadiensis* Forssk.	Asteraceae	Welkabisa (K).	T	2060-2111	239	X	+
151	*Senecio cineraria* DC.	Asteraceae	Tuleta (K)	H	1999-2007	078	+	X
152	*Senna occidentalis* (L.)	Fabaceae	Gelese (K)	Sh	1991-2028	015	+	X
153	*Senna petersiana* (Bolle.) Lock	Fabaceae	Zoyra (K)	Sh	2000-2066	238	+	X
154	*Sida rhombifolia* L.	Malvaceae	Lichekeraba (Or)	Sh	2016-2099	044	X	+
155	*Sisymbrium erysimoides* Desf.	Brassicaceae	Aserko (K)	H	1753-1877	234	+	X
156	*Solanecio gigas* (Vatke.) C. Jeffrey	Asteraceae	Welkabissa (K)	Sh	1998-2100	235	+	X
157	*Solanum villosum* Mill.	Solanaceae	.....	Sh	1766-1845	143	+	+
158	*Stachys alpigena* T.C.E.Fr.	Fabaceae	Roka (K)	T	1994-2031	039	+	X
159	*Stephania abyssinica* (Dillon.and A.Rich.Walp.	Lamiaceae	.....	H	1997-2057	185	+	X
160	*Syzygium guineense* (Willd.) DC. subsp *afromontanum* F. White	Myrtaceae	Baddeessaa (Or)	T	2000-2098	011	+	+
161	*Syzygium guineense* (Willd.) DC. subsp *macrocarpum* (Engl.) F. White	Myrtaceae	Oche (K), Baddeessaa (Or)	T	2024-2095	083	+	+

162	*Syzygium guineense* (Willd.) DC. subsp. *Guineense*	Myrtaceae	Baddeessaa (Or), Oche (K)	T	2063-2101	043	+	+
163	*Tagetes minuta* L.	Asteraceae	Shidamaga shito (K)	Sh	2024-2107	144	+	X
164	*Tamarindus indica* L.	Fabaceae	Yebereha lomi (Am), Roqa (Or)	T	1500-1745	014	+	+
165	*Teradenia riparia* (Hochest)	Lamiaceae	Bana (K)	H	1978-2005	237	+	+
166	*Terminalia macroptera* Guill and Perr.	Combretaceae	Dergile (K)	T	1971-2065	079	+	X
167	*Terminalia polycarpa* Engl. and Diels	Combretaceae	Dergile (K)	T	1509-1694	082	+	X
168	*Terminalia schimperiana* Hochst.	Combretaceae	Debeka (Or)	T	2120-2184	186	+	+
169	*Toddalia asiatica* (L.) Lam.	Rutaceae	Silu (K)	T	2069-2113	108	X	+
170	*Tragia cinerea* (Pax.) Gilbert and Rodel-Smith**	Euphorbiaceae	Lalisa (K)	H	2054-2122	081	+	+
171	*Urtica simensis* Steudel**	Urticaceae	.....	H	2023-2091	040	X	+
172	*Verbascum sinaiticum* Benth.	Scrophulariaceae	.....	H	2100-2179	187	+	+
173	*Vernonia adoensis* Sch. Bip. ex Walp.	Asteraceae	Sooyyama (Or)	Sh	2033-2089	013	X	+
174	*Vernonia amygdalina* Del.	Asteraceae	Buzena (K), Ebichaa (Or)	Sh	1909-2300	110	+	+
175	*Withania somnifera* (L.) Dunal.	Lamiaceae	Tero (K), Teresa (Or)	Sh	2034-2105	189	+	+
176	*Xanitum spinocum* L.	Asteraceae	Dehanekaye (Am)	H	2015-2188	080	+	X
177	*Ximenia americana* L.	Olacaceae	Huda (K)	T	1899-1991	236	+	+
178	*Zanthoxylum chalybeum* Engl.	Rutaceae	Denbie (K)	T	1744-1895	190	+	+
179	*Zehneria scabra* (Linn. f.) Son	Cucurbitaceae	.....	H	1997-2010	109	+	X
180	*Ziziphus mucronata* Willd.	Rhamnaceae	Wekerura (K), Geba (Or)	Sh	1999-2063	146	+	+

Appendix 3. List of families with number of genera and species of Nekora and Dance forests

No	Family	Districts, genera, species and percentage								Two forests			
		Nekora forest				Dance forest							
		Genera	%	Species	%	Genera	%	Species	%	Genera	%	Species	%
1	Acanthaceae	2	1.65	2	1.42	-	-	-	-	2	1.35	2	1.11
2	Adiantaceae	2	1.65	2	1.42	-	-	-	-	1	0.67	1	0.55
3	Amaranthaceae	-	-	-	-	1	1.08	1	0.93	1	0.67	2	1.11
4	Amarylidiaceae	2	1.65	2	1.42	-	-	-	-	2	1.35	2	1.11
5	Anacardiaceae	2	1.65	4	2.85	1	1.08	4	3.73	2	1.35	5	2.77
6	Apocynaceae	2	1.65	2	1.42	2	2.17	2	1.86	2	1.35	2	1.11
7	Araceae	1	0.82	1	0.71	-	-	-	-	1	0.67	1	0.55
8	Arecaceae	1	0.82	1	0.71	1	1.08	1	0.93	1	0.67	1	0.55
9	Asclepiadaceae	2	1.65	2	1.42	1	1.08	1	0.93	3	2.02	3	1.66
10	Asparagaceae	1	0.82	1	0.71	-	-	-	-	1	0.67	1	0.55
11	Asteraceae	11	9.09	12	8.57	6	6.52	7	6.54	12	8.10	15	8.33
12	Boraginaceae	3	2.47	4	2.85	2	2.17	2	1.86	3	2.02	4	2.22
13	Brassicaceae	1	0.82	1	0.71	-	-	-	-	1	0.67	1	0.55
14	Capparidaceae	3	2.47	4	2.85	2	2.17	2	1.86	3	2.02	4	2.22
15	Celasteraceae	1	0.82	1	0.71	-	-	-	-	1	0.67	1	0.55
16	Chenopodiaceae	1	0.82	1	0.71	1	1.08	2	1.86	1	0.67	2	1.11
17	Combretaceae	2	1.65	4	2.85	1	1.08	1	0.93	2	1.35	4	2.22
18	Commelinaceae	1	0.82	3	2.14	1	1.08	1	0.93	1	0.67	3	1.66
19	Crassulaceae	1	0.82	1	0.71	-	-	-	-	1	0.67	1	0.55
20	Cucurbitaceae	2	1.65	2	1.42	-	-	-	-	2	1.35	2	1.11
21	Cupressaceae	2	1.65	2	1.42	-	-	-	-	2	1.35	2	1.11
22	Cyperaceae	1	0.82	1	0.71	1	1.08	1	0.93	1	0.67	1	0.55
23	Dracaenaceae	-	-	-	-	1	1.08	1	0.93	1	0.67	1	0.55
24	Ebenaceae	1	0.82	1	0.71	1	1.08	1	0.93	1	0.67	1	0.55

25	Ericaceae	2	1.65	2	1.42	-	-	-	-	2	1.35	2	1.11
26	Euphorbiaceae	5	4.13	5	3.57	4	4.34	4	3.73	6	4.05	6	3.33
27	Fabaceae	11	9.09	12	8.57	9	9.78	9	8.41	13	8.78	15	8.33
28	Flacourtiaceae	2	1.65	2	1.42	3	3.26	3	2.80	3	2.02	3	1.66
29	Hypericaceae	1	0.82	1	0.71	-	-	-	-	1	0.67	1	0.55
30	Iridaceae	1	0.82	1	0.71	1	1.08	1	0.93	1	0.67	1	0.55
31	Lamiaceae	9	7.43	10	7.14	8	8.69	8	7.47	10	6.75	12	6.66
32	Lobeliaceae	1	0.82	1	0.71	-	-	-	-	1	0.67	1	0.55
33	Loganiaceae	-	-	-	-	1	1.08	1	0.93	1	0.67	1	0.55
34	Loranthaceae	1	0.82	1	0.71	-	-	-	-	1	0.67	1	0.55
35	Malvaceae	1	0.82	1	0.71	3	3.26	4	3.73	3	2.02	4	2.22
36	Melianthaceae	-	-	-	-	1	1.08	1	0.93	1	0.67	1	0.55
37	Moraceae	1	0.82	3	2.14	1	1.08	2	1.86	1	0.67	3	1.66
38	Myricaceae	1	0.82	1	0.71	1	1.08	1	0.93	1	0.67	1	0.55
39	Myrsinaceae	3	2.47	3	2.14	2	2.17	2	1.86	3	2.02	3	1.66
40	Myrtaceae	1	0.82	3	2.14	1	1.08	3	2.80	1	0.67	3	1.66
41	Olacaceae	1	0.82	1	0.71	1	1.08	1	0.93	1	0.67	1	0.55
42	Oleaceae	2	1.65	3	2.14	3	3.26	4	3.73	3	2.02	4	2.22
43	Oliniaceae	1	0.82	1	0.71	1	1.08	1	0.93	1	0.67	1	0.55
44	Onagraceae	1	0.82	1	0.71	-	-	-	-	1	0.67	1	0.55
45	Oxalidaceae	-	-	-	-	1	1.08	1	0.93	1	0.67	1	0.55
46	Phytolaccaceae	-	-	-	-	1	1.08	1	0.93	1	0.67	1	0.55
47	Pittosporaceae	1	0.82	1	0.71	-	-	-	-	1	0.67	1	0.55
48	Poaceae	3	2.47	3	2.14	-	-	-	-	3	2.02	3	1.66
49	Podocarpaceae	-	-	-	-	1	1.08	1	0.93	1	0.67	1	0.55
50	Polygonaceae	1	0.82	2	1.42	1	1.08	3	2.80	1	0.67	3	1.66
51	Polypodiaceae	1	0.82	1	0.71	-	-	-	-	1	0.67	1	0.55
52	Proteaceae	2	1.65	2	1.42	1	1.08	1	0.93	2	1.35	3	1.66

53	Ranunculaceae	1	0.82	1	0.71	1	1.08	1	0.93	1	0.67	2	1.11
54	Rhamnaceae	2	1.65	2	1.42	2	2.17	2	1.86	3	2.02	3	1.66
55	Rosaceae	3	2.47	5	3.57	3	3.26	5	4.67	4	2.70	6	3.33
56	Rubiaceae	3	2.47	3	2.14	3	3.26	3	2.80	4	2.70	4	2.22
57	Rutaceae	2	1.65	2	1.42	2	2.17	2	1.86	3	2.02	3	1.66
58	Santalaceae	1	0.82	1	0.71	-	-	-	-	1	0.67	1	0.55
59	Sapindaceae	2	1.65	2	1.42	2	2.17	2	1.86	2	1.35	2	1.11
60	Scrophulariaceae	1	0.82	1	0.71	1	1.08	1	0.93	1	0.67	1	0.55
61	Simaroubaceae	1	0.82	1	0.71	-	-	-	-	1	0.67	1	0.55
62	Solanaceae	2	1.65	2	1.42	3	3.26	3	2.80	4	2.70	4	2.22
63	Sterculiaceae	-	-	-	-	1	1.08	1	0.93	1	0.67	1	0.55
64	Tiliaceae	1	0.82	1	0.71	1	1.08	2	1.86	1	0.67	2	1.11
65	Ulmaceae	-	-	-	-	1	1.08	1	0.93	1	0.67	1	0.55
66	Urticaceae	-	-	-	-	1	1.08	1	0.93	1	0.67	1	0.55
67	Verbenaceae	2	1.65	2	1.42	2	2.17	2	1.86	2	1.35	2	1.11
68	Vitaceae	3	2.47	3	2.14	2	2.17	2	1.86	4	2.70	5	2.77
		121	**100**	**140**	**100**	**92**	**100**	**107**	**100**	**148**	**100**	**180**	**100**

Appendix 4. List of medicinal plants and their distribution in Amaro and Gelana districts, Habit (Ha.): Herb (H); Shrub (Sh); Tree (T); Climber (Cl); Liana (Li); Habitat (Hab.): Homegarden (Hg), Forest (Fo), Cultivated filed (Cf), * Indicate the cultivated species

No	Scientific name	Family	Local name in koorete and Oromiffa	Ha	Hab.	Coll.no GA
1	*Abutilon angulatum* (Guill and Perr.) Mast.	Malvaceae	Hincinnii adii (Or)	Sh	Fo	092
2	*Acacia tortilis* (Forssk.) Bayne*	Fabaceae	.....	T	Cf	102
3	*Acacia mellifera* (Vahl) Benth*	Fabaceae	Tsurura (K), Omedla (Or),	T	Cf	063
4	*Acidenthera laXiflora* Bake	Iridaceae	Merero (K), Chobe (Or)	Cl	Fo	191
5	*Acmella caulirhiza* Del.	Asteraceae	Jilokeda (K)	H	Fo	206
6	*Acokanthera schimperi* (A.DC.) Schweinf.	Apocynaceae	Wato (K)	Sh	Fo	219
7	*Adiantum caudatum* Var. Hirsutum auct.	Adiantaceae	Bisa (K), Fern (Or)	H	Fo	220
8	*Aeschnomene elaphroxylon* Guill	Fabaceae	Kenkelcha (Or)	Sh	Fo	151
9	*Aframomum corrorima* (Braun) Jansen*	Zingiberaceae	Korarima (K)	H	Hg	251
10	*Agarista salifolia* (Comm.ex.Lam.) Hook.f.	Ericaceae	Geso (K)	T	Fo	027
11	*Agave sisalana* Perrine ex Engel. *	Agavaceae	.....	T	Cf	116
12	*Ajuga alba* L. *	Lamiaceae	Anamiro (K), Harma bussee (Or)	H	Cf	207
13	*Ajuga integrifolia* Buch-Ham ex. D. Don.	Lamiaceae	Anamiro (K), Harma bussee (Or)	H	Fo	062
14	*Albizia gummifera* (J.f.Gmell.)	Fabaceae	Gorbie (Or)	T	Fo	061
15	*Allium sativum* L. *	Alliaceae	Tuma (K), Kulbe adi (Or)	H	Hg	193
16	*Aloe debrana* Christian. *	Aloaceae	Chole (K), Eret (Or)	H	Cf	025
17	*Ampelocissus bombycina* (Bak.) Planch	Vitaceae	Hareg (K), Raje (Or)	H	Fo	093
18	*Artemisia abyssinica* Sch. Bip. ex. A. Rich. *	Asteraceae	Aneno (K), Natera (Or)	H	Cf	152
19	*Artemisia afra* Jacq. ex Willd. *	Asteraceae	Arity (K)	H	Cf	153
20	*Arundinaria alpina* K. Schum.	Poaceae	Weyeshe (K), Kerkeha (Or)	H	Fo	065
21	*Balaintes aegyptiaca* (L.) Del. *	Balanitaceae	Bedena (K)	T	Cf	119
22	*Bersama abyssinica* Fresen.	Melianthaceae	Tibero (Or)	T	Fo	195
23	*Bidens pilosa* L.	Asteraceae	Hada (Or)	H	Fo	196
24	*Boscia angustifolia* A. Rich.	Capparidaceae	Kankalcha (Or)	T	Fo	118

25	*Brassica carinata* A.Br. *	Brassicaceae	Gomen zer (Am)	H	Hg	154
26	*Brassica nigra* (L). Koch. *	Brassicaceae	Senafiche (K)	H	Hg	066
27	*Buddleja polystachya* Fresen. *	Loganiaceae	Belunda (K)	T	Cf	058
28	*Calpurnia aurea* (Ait.) Benth.	Fabaceae	Chekata (K), Digita (Or)	Sh	Fo	156
29	*Capparis tomentosa* Lam.	Capparidaceae	Kufo (K), Gora (Or)	Sh	Fo	198
30	*Capsicum annuum* L. *	Solanaceae	Karya (K)	H	Hg	029
31	*Capsicum frutescens* L. *	Solanaceae	Datane (K)	H	Hg	197
32	*Carica papaya* L. *	Caricaceae	Papaya (Or)	T	Hg	002
33	*Carissa spinarum* L.	Apocynaceae	Agam (K), Hankako (Or)	Sh	Fo	067
34	*Catha edulis* (Vahl.) Forssk. ex Endl. *	Celastraceae	Chatae (K)	Sh	Hg	200
35	*Celtis africana* Burm.f	Ulmaceae	Kewet (K), Motokoma (Or)	T	Fo	057
36	*Chenopodium murale* L.	Chinopodiaceae	Amedmado (Or)	H	Fo	199
37	*Citrus aurantifolia* (Christm.) Swingle*	Rutaceae	Lomie (K)	T	Hg	201
38	*Clematis hirsuta* Perr and Guill.	Ranunculaceae	Hidda feetii (Or)	Sh	Fo	204
39	*Clematis simensis* Fresen.	Ranunculaceae	Yazohareg (Am), Bute (Or)	Cl	Fo	113
40	*Clerodendrum myricoides* (Hochst) Vatke	Lamiaceae	Shochegufe (K), Misrch (Or)	Sh	Fo	205
41	*Clutia abyssinica* Jaub.and Spach.	Euphorbiaceae	Mukadiga (Or)	Sh	Fo	056
42	*Coccinia grandis* (L.) Voight*	Cucurbitaceae	Harege (K)	Li	Cf	158
43	*Coffea arabica* L. *	Rubiaceae	Bune (K)	T	Hg	068
44	*Combretum adenogonium* Steud. ex A. Rich. *	Combretaceae	Rukensa (Or)	T	Cf	096
45	*Combretum collinum* Fresen. *	Combretaceae	Gelase (K)	T	Cf	122
46	*Commelina latifolia* Hochst.ex A. Rich.	Commelinaceae	Galge (K), Weha akur (Or)	H	Fo	121
47	*Commelina diffusa* Burm.f.	Commelinaceae	Galge (K), Weha akur (Or)	H	Fo	123
48	*Cordia africana* Lam.	Boraginaceae	Bola (K), Wodessa (Or)	T	Fo	055
49	*Cordia monoica* Roxb.	Boraginaceae	Madeda (K)	T	Fo	159
50	*Croton macrostachyus* Del.	Euphorbiaceae	Harpa (K), Mekenissa (Or)	T	Fo	031
51	*Cucumis ficifolius* A.Rich.	Cucurbitaceae	Kuro/Tsea (Or)	H	Fo	160
52	*Cucumis prophetarum* L. *	Cucurbitaceae	.....	H	Cf	022

53	*Cucurbita pepo* L. *	Cucurbitaceae	Tikure duba (K)	H	Hg	211
54	*Cupressus lusitanica* Mill.	Cupressaceae	Tid (K)	T	Fo	097
55	*Cuscuta epilinum* Weihe*	Cuscutaceae	.....	H	Cf	212
56	*Cyathula uncinulata* (Schrad.) Schinz	Amaranthaceae	Baldo (Or)	H	Fo	054
57	*Cynodon dactylon* (L.) pers.	Poaceae	Sare (K)	H	Fo	161
58	*Cynoglossum lanceolatum* Forssk.	Boraginaceae	Chemide (K)	H	Fo	124
59	*Cyperus assimilis* Steud.	Cyperaceae	Gichigila (K), Enegecha (Or)	H	Fo	213
60	*Cyphostemma adenocaule* (Steud. ex A. Rich)	Vitaceae	.....	H	Fo	053
61	*Datura stramonium* L. *	Solanaceae	Kobo (K), Qobo churuko (O)	H	Cf	162
62	*Dichrostachys cinerea* (L.) Wight and Arn. *	Fabaceae	.....	T	Cf	069
63	*Discopodium penninervium* Hochst.	Solanaceae	Merero	T	Fo	214
64	*Dodonaea angustifolia* L. f.	Sapindaceae	Sengera (K), Itacha (Or)	Sh	Fo	112
65	*Dombeya torrida* (J. F. Gmel.) P. Bamps	Sterculiaceae	Danse (K),Telelo (Or)	Sh	Fo	221
66	*Dracaena afromontana* Mildbr.	Dracaenaceae	Motta zaf (Or)	T	Fo	021
67	*Echinops amplexicaulis* Oliv.	Asteraceae	.....	H	Fo	216
68	*Echinops kebericho* Mesfin*	Asteraceae	Boresie (K), Keberecho (Or)	H	Hg	218
69	*Ehretia cymosa* Thonn.	Boraginaceae	Ulagaa (Or)	Sh	Fo	099
70	*Entada abyssinica* Steud.ex A.Rich.	Fabaceae	Dersase (K)	T	Fo	127
71	*Epilobium hirsutum L.*	Onagraceae	.....	H	Fo	163
72	*Erythrina brucei* Schweinf.	Fabaceae	Boro (K)	T	Fo	032
73	*Eucalyptus globulus* Labill. *	Myrtaceae	Baherzaf (Am), Akaakltii adii (Or)	T	Cf	070
74	*Euclea racemosa* Murr.	Ebenaceae	Miessa (Or)	Sh	Fo	164
75	*Euphorbia candelabrum* Kotschy*	Euphorbiaceae	Akire (K)	T	Cf	222
76	*Euphorbia tirucalli* L. *	Euphorbiaceae	Anonotu (K)	Sh	Cf	020
77	*Ficus vasta* Forssk.	Moraceae	Gehe (Or)	T	Fo	167
78	*Foeniculum vulgare* Mill. *	Apiaceae	Abseta (K)	H	Hg	100
79	*Galium simense* Fresen.	Rubiaceae	.....	H	Fo	252
80	*Gardenia volkensii* K.Schum. *	Rubiaceae	Gambela (Or)	T	Cf	225

81	*Gossypium barabadense* L. *	Malvaceae	Fato (K)	H	Hg	253
82	*Guizotia scabra* (Vis.) Chiov.	Asteraceae	Hadabuti (Or)	H	Fo	101
83	*Hagenia abyssinica* (Bruce) J.F.Gmel.	Rosaceae	Zoyra (K)	T	Fo	170
84	*Helichrysum schimperi* (Sch.Bip.ex A.Rich)	Asteraceae	.....	H	Fo	072
85	*Helminthotheca echioides* (L.) Holub*	Asteraceae	Tudo (K)	H	Cf	019
86	*Hibiscus diversifolius* A.Rich.	Malvaceae	Hincinni (Or)	H	Fo	171
87	*Hibiscus macranthus* Hochst. ex A. Rich.	Malvaceae	Key hechine (Or)	H	Fo	172
88	*Indigofera spicata* Forssk.	Fabaceae	…….	H	Fo	130
89	*Jasminum grandiflorum* L.	Oleaceae	Amesa (Or)	H	Fo	131
90	*Juniperus procera* Endle	Cupressaceae	Bibire (K)	T	Fo	004
91	*Lagenaria siceraria* (Molina) Standl*	Cucurbitaceae	.....	H	Cf	260
92	*Leucas discolor* Sebald*	Lamiaceae	.....	Sh	Cf	173
93	*Lens culinaris* Medik. *	Fabaceae	Define miser (Am)	H	Cf	073
94	*Lepidium sativum* L. *	Brassicaceae	Sibeca (K), Feto (Or)	H	Cf	132
95	*Linum usitatissimum* L. *	Linaceae	.....	H	Cf	248
96	*Lippia adoensis* Hochst ex.Walp.	Verbenaceae	Kishira (K)	Sh	Fo	049
97	*Maesa lanceolata* Forssk.	Myrsinaceae	Gecha (Or)	T	Fo	174
98	*Mangifera indica* L. *	Anacardiaceae	Mango (K)	T	Hg	227
99	*Millettia ferruginea* (Hochest) Bak.	Fabaceae	Zagi (K), Dadatu (Or)	T	Fo	018
100	*Moringa stenopetala* (Bakf.) Cufed. *	Moringaceae	Haleko (K)	T	Cf	133
101	*Musa x paradisiaca* L. *	Musaceae	Muse (K)	H	Hg	175
102	*Myrica salicifolia* Hochst ex A. Rich.	Myricaceae	Bundo (K)	T	Fo	074
103	*Nicandra physaloides* (L.) Gaerin.	Solanaceae	Mazie (K)	Sh	Fo	247
104	*Nicotiana tabaccum* L. *	Solanaceae	Tanbo (K)	H	Cf	006
105	*Nigella sativa* L. *	Ranunculaceae	Tikure azmude (Am)	H	Hg	176
106	*Ocimum lamiifolium* Hochst.ex Benth.	Lamiaceae	Qoricha mich (Or)	Sh	Fo	134
107	*Ocimum urticifolium* Roth	Lamiaceae	Anchabi (K)	Sh	Fo	048
108	*Olea europaea* L. *subsp. cuspidata* (Wall. ex	Oleaceae	Gulta (K), Ejersa (Or)	T	Fo	075

	G. Don) Cif.					
109	*Olinia rochetiana* A. Juss	Oliniaceae	Qdida (Or)	T	Fo	177
110	*Pappea capensis* Eckl.and Zeyh	Sapindaceae	Bika (K)	T	Fo	135
111	*Pavonia cristata* Schinz.ex Gurke*	Malvaceae	Lologo (K)	Sh	Cf	007
112	*Persea americana* Mill. *	Lauraceae	Abukato (K)	T	Hg	017
113	*Phytolacca dodecandera* L. Herit.	Phytolaccaceae	Reje (K)	Sh	Fo	088
114	*Plectranthus caninus* Roth	Lamiaceae	Sugete (K)	Sh	Fo	149
115	*Priva adharens* (Forssk) Chiov.	Lamiaceae	Hacha (K)	H	Fo	241
116	*Protea madiensis* Oliv.	Proteaceae	Gere (K)	T	Fo	046
117	*Prunus africana* (Hokk. f.) Kalkm.	Rosaceae	Suke (Or)	T	Fo	008
118	*Psidium guajava* L. *	Myrtaceae	Zeytune (Or)	T	Hg	180
119	*Psydrax schimperiana* (A.Rich) Bridson	Rubiaceae	Gellelo (Or)	T	Fo	231
120	*Rhoicissus tridentata* (L.f) Wild and Drummand	Vitaceae	.....	H	Fo	182
121	*Rhus glutinosa* A. Rich.	Anacardiaceae	Zergete (K), xaaxxessaa (Or)	Sh	Fo	183
122	*Rhus natalensis* Berha. ex Krauss	Anacardiaceae	Tsisano (K), Debobisa (Or)	Sh	Fo	140
123	*Rumex abyssinicus* Jacq.	Polygonaceae	Dhangagoo (Or)	H	Fo	148
124	*Rumex nervosus* Vahl.	Polygonaceae	Enbacho (Or)	H	Fo	232
125	*Ruta chalepensis* L. *	Rutaceae	Tsetela (K)	Sh	Hg	141
126	*Saccharum officinarum* L. *	Poaceae	.....	H	Cf	085
127	*Salvia nilotica* Jacq. *	Lamiaceae	.....	H	Cf	240
128	*Scadoxus multiflorus* (Matyn) Raf.	Amaryllidaceae	Buti (K), Kuleme (Or)	H	Fo	038
129	*Sclerocarya birrea* (A.Rich) Hochest. *	Anacardiaceae	Yebereha lomi (Am), Roqa (Or)	T	Cf	233
130	*Solanecio gigas* (Vatke.) C. Jeffrey	Asteraceae	Welkabissa (K)	Sh	Fo	235
131	*Solanum incanum* L. *	Solanaceae	Bulo (K), Hidie (Or)	Sh	Cf	084
132	*Solanum villosum* Mill.	Solanaceae	.....	Sh	Fo	143
133	*Stephania abyssinica* (Dillon.and .Rich.Walp.	Lamiaceae	.....	H	Fo	185
134	*Tamarindus indica* L.	Fabaceae	Yebereha lomi (Am), Roqa (Or)	T	Fo	014

135	*Teradenia riparia* (Hochest)	Lamiaceae	Bana (K)	H	Fo	237
136	*Terminalia macroptera* Guill and Perr.	Combretaceae	Dergile (K)	T	Fo	079
137	*Terminalia schimperiana* Hochst.	Combretacea	Debeka (Or)	T	Fo	186
138	*Toddalia asiatica* (L.) Lam.	Rutaceae	Silu (K)	T	Fo	108
139	*Tragia unicinata* M. Gilbert*	Euphorbiaceae	Lalisa (Or)	H	Cf	145
140	*Verbascum sinaiticum* Benth.	Scrophulariaceae	.....	H	Fo	187
141	*Vernonia amygdalina* Del	Asteraceae	Ebichaa (Or), Maze (K)	Sh	Fo	110
142	*Vernonia auriculifera* Hiern*	Asteraceae	Reeje (Or)	Sh	Cf	188
143	*Viscum album* L. *	Loranthaceae	Erto (Or)	H	Cf	042
144	*Withania somnifera* (L.) Dunal	Lamiaceae	Tero (K),Teresa (Or)	Sh	Fo	189
145	*Ximenia americana* (L.)	Olacaceae	Huda (K)	T	Fo	080
146	*Zanthoxylum chalybeum* Engl.	Rutaceae	Denbie (K)	T	Fo	190
147	*Zingiber officinale* Roscoe. *	Zingiberaceae	Kulbo (Or)	H	Hg	041

Appendix 5. Number of composition of medicinal plant species with respect to their families, genera and species

Family	Districts, genera, species and percentage								Two districts			
	Amaro				Gelana							
	Genera	%	Species	%	Genera	%	Species	%	Genera	%	Species	%
Adiantaceae	1	1.20	1	1.11	-	-	-	-	1	0.78	1	0.68
Agavaceae	-	-	-	-	1	1.29	1	1.26	1	0.78	1	0.68
Alliaceae	1	1.20	1	1.11	1	1.29	1	1.26	1	0.78	1	0.68
Aloaceae	1	1.20	1	1.11	-	-	-	-	1	0.78	1	0.68
Amaranthaceae	-	-	-	-	1	1.29	1	1.26	1	0.78	1	0.68
Amaryrlidaceae	1	1.20	1	1.11	-	-	-	-	1	0.78	1	0.68
Anacardiaceae	2	2.40	2	2.22	2	2.59	2	2.53	3	2.34	4	2.72
Apiaceae	1	1.20	1	1.11	-	-	-	-	1	0.78	1	0.68
Apocynaceae	2	2.40	2	2.22	-	-	-	-	2	1.56	2	1.36
Asteraceae	7	8.43	8	8.88	3	3.89	4	5.06	9	7.03	11	7.48
Balanitaceae	1	1.20	1	1.11	-	-	-	-	1	0.78	1	0.68
Boraginaceae	3	3.61	4	4.44	2	2.59	2	2.53	3	2.34	4	2.72
Brassicaceae	2	2.40	2	2.22	2	2.59	2	2.53	2	1.56	3	2.04
Capparidaceae	-	-	-	-	2	2.59	2	2.53	2	1.56	2	1.36
Caricaceae	-	-	-	-	1	1.29	1	1.26	1	0.78	1	0.68
Celastraceae	-	-	-	-	1	1.29	1	1.26	1	0.78	1	0.68
Chinopodiaceae	1	1.20	1	1.11	-	-	-	-	1	0.78	1	0.68
Combretacea	2	2.40	2	2.22	2	2.59	2	2.53	2	1.56	4	2.72
Commelinaceae	1	1.20	2	2.22	1	1.29	1	1.26	1	0.78	2	1.36
Cucurbitaceae	3	3.61	3	3.33	3	3.89	3	3.79	4	3.12	5	3.40
Cupressaceae	2	2.40	2	2.22	-	-	-	-	2	1.56	2	1.36
Cuscutaceae	-	-	-	-	1	1.29	1	1.26	1	0.78	1	0.68
Cyperaceae	-	-	-	-	1	1.29	1	1.26	1	0.78	1	0.68

Dracaenaceae	-	-	-	-	1	1.29	1	1.26	1	0.78	1	0.68
Ebenaceae	1	1.20	1	1.11	1	1.29	1	1.26	1	0.78	1	0.68
Ericaceae	1	1.20	1	1.11	-	-	-	-	1	0.78	1	0.68
Euphorbiaceae	2	2.40	3	3.33	3	3.89	3	3.79	4	3.12	5	3.40
Fabaceae	10	12.04	10	11.11	3	3.89	3	3.79	11	8.59	12	8.16
Iridaceae	-	-	-	-	1	1.29	1	1.26	1	0.78	2	1.36
Lamiaceae	7	8.43	9	10	7	9.09	7	8.86	10	7.81	12	8.16
Lauraceae	-	-	-	-	1	1.29	1	1.26	1	0.78	1	0.68
Linaceae	-	-	-	-	1	1.29	1	1.26	1	0.78	1	0.68
Loganiaceae	1	1.20	1	1.11	-	-	-	-	1	0.78	1	0.68
Loranthaceae	-	-	-	-	1	1.29	1	1.26	1	0.78	1	0.68
Malvaceae	1	1.20	1	1.11	3	3.89	4	5.06	4	3.12	5	3.40
Melianthaceae	-	-	-	-	1	1.29	1	1.26	1	0.78	1	0.68
Moraceae	-	-	-	-	1	1.29	1	1.26	1	0.78	1	0.68
Moringaceae	1	1.20	1	1.11	-	-	-	-	1	0.78	1	0.68
Musaceae	-	-	-	-	1	1.29	1	1.26	1	0.78	1	0.68
Myricaceae	1	1.20	1	1.11	-	-	-	-	1	0.78	1	0.68
Myrsinaceae	-	-	-	-	1	1.29	1	1.26	1	0.78	1	0.68
Myrtaceae	1	1.20	1	1.11	2	2.59	2	2.53	2	1.56	2	1.36
Olacaceae	1	1.20	1	1.11	1	1.29	1	1.26	1	0.78	1	0.68
Oleaceae	-	-	-	-	2	2.59	2	2.53	2	1.56	2	1.36
Oliniaceae	1	1.20	1	1.11	1	1.29	1	1.26	1	0.78	1	0.68
Onagraceae	1	1.20	1	1.11	-	-	-	-	1	0.78	1	0.68
Phytolaccaceae	1	1.20	1	1.11	1	1.29	1	1.26	1	0.78	1	0.68
Poaceae	2	2.40	2	2.22	1	1.29	1	1.26	3	2.34	3	2.04
Polygonaceae	1	1.20	1	1.11	1	1.29	1	1.26	1	0.78	2	1.36
Proteaceae	1	1.20	1	1.11	-	-	-	-	1	0.78	1	0.68
Ranunculaceae	2	2.40	2	2.22	1	1.29	1	1.26	2	1.56	3	2.04

Rosaceae	1	1.20	1	1.11	1	1.29	1	1.26	2	1.56	2	1.36
Rubiaceae	1	1.20	1	1.11	4	5.19	4	5.06	4	3.12	4	2.72
Rutaceae	3	3.61	3	3.33	1	1.29	1	1.26	4	3.12	4	2.72
Sapindaceae	2	2.40	2	2.22	1	1.29	1	1.26	2	1.56	2	1.36
Scrophulariaceae	-	-	-	-	1	1.29	1	1.26	1	0.78	1	0.68
Solanaceae	5	6.02	6	6.66	4	5.19	4	3.79	6	4.68	8	5.44
Sterculiaceae	-	-	-	-	1	1.29	1	1.26	1	0.78	1	0.68
Ulmaceae	-	-	-	-	1	1.29	1	1.26	1	0.78	1	0.68
Verbenaceae	1	1.20	1	1.11	-	-	-	-	1	0.78	1	0.68
Vitaceae	1	1.20	1	1.11	2	2.59	2	2.53	3	2.34	3	2.04
Zingiberaceae	2	2.40	2	2.22	1	1.29	1	1.26	2	1.56	2	1.36
Total	**83**	**100**	**90**	**100**	**77**	**100**	**79**	**100**	**128**	**100**	**147**	**100**

Appendix 6. List of medicinal plants used for human ailments in Amaro District: scientific name; family; local name; source; growth form; plant parts used; ailment treated; methods of preparation and application, route of administration, number of plants, total number of citation, condition of plant part uses. Key: Source (Sou.): Forest (F), Homegarden (Hg), Cultivated fields (Cf), Habit (Ha.): Herb (H); Shrub (Sh); Tree (T); Climber (Cl). Parts used (Pu) (Bark, Ba; Latex, La; Root, R; Leaf, L; Fruit, Fu.; Flower, Fl; Seed, Se.; Stem, S.; Bulb, Bu.; Whole plant, Wp.). At= ailment treated; MRPA=mode of remedy preparation and application (1= Boil and do steam bath; 2=Crush, homogenize with cold water and drink; 3= Boil and drink the decoction when cool; 4= Crushed and put on the freshly crushed part; 5= Crush and sniff the freshly crushed part; 6= Crush, heat/ burn or boil the part and inhale its smoke or steam; 7= Grind and paint the powder or crushed part; 8= Extract the juice/oil/latex and pour or paint it; 9= Hold with teeth; 10= Drink the concoction; 11= Eat the part; 12= Grind, and tie on the powder or crushed part); Route of Administration (Route); Oral (or), Nasal (Na), Dermal (Dr), Ocular (Oc), Anal (An) Tooth surface (Ts), Conditions of part used (CPU) (Dry, Dr; Fresh, Fr).

Scientific name	Family	Lo. na (Koorete)	Sou	Ha	Pu	At	MRPA	Rt Ad	No sp	TNC	Cpu.
Acokanthera schimperi (A.DC.) Schweinf.	Apocynaceae	Wato	Fo	Sh	Fu	Insect allergy	4	Dr	1	8	Fr
Aframomum corrorima (Braun) Jansen	Zingiberaceae	Korarima	Hg	H	Se	Stomachache	2	Or	2	8	Dr
Ajuga alba L.	Lamiaceae	Harmagusa	Cf	H	R	Amoeba	10	Or	1	32	Dr
Ajuga integrifolia Buch-Hamex. D. Don.	Lamiaceae	Anamiro	Fo	H	R	Stomachache	11	Or	1	6	Fr
					R	Diarrhea	11	Or	1	5	Fr
Aloe debrana Christian.	Aloaceae	Chole	Cf	H	La	Malaria	3	Or	1	4	Fr
					La	Wound	8	Dr	1	5	Fr
Artemisia abyssinica Sch. Bip. ex. A. Rich.	Asteraceae	Aneno	Cf	H	L	Tonsillitis	3	Or	1	3	Fr
Artemisia afra Jacq. ex Willd.	Asteraceae	Arity	Cf	H	L	General malaise	5	Na	1	10	Fr
Arundinaria alpina K. chum.	Poaceae	Weyeshe	Fo	H	L	Wound	4	Dr	1	4	Fr
Biden pilosa L.	Asteraceae	Hacha	Fo	H	L	Ring worms	8	Dr	1	3	Fr
Brassica carinata A.Br.	Brassicaceae	Gomen zer	Hg	H	R	Stomachache	11	Or	1	5	Fr

Buddleja polystachya Fresen.	Loganiaceae	Belunda	Cf	T	R	Dibetics	3	Or	3	6	Fr
					R	Lung cancer	3	Or	1	12	Fr
					Ba	Ayenetila	5	Na	1	8	Fr
					R	Impotency	2	Or	1	10	Fr
Carissa spinarum L.	Apocynaceae	Hankako	Fo	Sh	Fu	Intestinal parasite	11	Or	1	5	Fr
Citrus aurantifolia (Christm.) Swingle	Rutaceae	Lomie	Hg	T	Fu	Skin rash	8	Dr	1	1	Fr
					Fu	Stomachache	2	Or	1	11	Fr
					Fu	Wound	8	Dr	1	7	Fr
					Fu	Epistaxis	4	Na	1	1	Fr
Clematis simensis Fresen.	Ranunculaceae	Yazohareg	Fo	Cl	L	Amoeba	3	Or	1	3	Fr
					R	Diarrhea	11	Or	1	11	Dr
					R	Intestinal parasite	11	Or	1	4	Dr
*Clerodendrum myricoides (*Hochst) R.Br.ex	Lamiaceae	Shochegufe	Fo	Sh	S	Toothache	9	Ts	1	30	Fr
Coccinia grandis (L.) Voight	Cucurbitaceae	Harege	Cf	Li	R	Snake bite	12	Dr	1	5	Fr
Coffea arabica L.	Rubiaceae	Bune	Hg	T	Fu	Wound	4	Dr	1	5	Fr
					Fu	Diarrhea	3	Or	1	4	Fr
Combretum collinum Fresen.	Combretaceae	Gelase	Cf	T	Ba	Malaria	3	Or	1	5	Fr
Commelina latifolia Hochst.ex.A	Commelinaceae	Galge	Fo	H	La	Ring worms	8	Dr	1	24	Fr
Commelina diffusa Burm.f.	Commelinaceae	Galge	Fo	H	La	Earache	4	Dr	1	6	Fr
Cordia africana Lam.	Boraginaceae	Bola	Fo	T	L	Wound	4	Dr	1	9	Fr
					La	Skin rash	8	Dr	1	2	Fr
Cucurbita pepo L.	Cucurbitaceae	Tikure duba	Hg	H	Se, Fu	Tape worm	11	Or	1	7	Dr
Cynodon dactylon (L.) pers.	Poaceae	Sare	Fo	H	R	Snake bite	3	Or	2	3	Fr
Cynoglossum lanceolatum Forssk.	Boraginaceae	Chemide	Fo	H	R	Amoeba	3	Or	1	3	Fr

Datura stramonium L.	Solanaceae	Kobo	Cf	H	R, L	Wound	4	Dr	1	4	Fr
Dichrostachys cinerea (L.) Wight and Arn.	Fabaceae	.....	Cf	T	Ba	Spider poison	4	Dr	1	1	Fr
					Ba	Bite of scorpion	4	Dr	1	1	Fr
Echinops kebericho Mesfin	Asteraceae	Borse	Hg	H	R	Breast cancer	3	Or	1	26	Fr
Erythrina brucei Schweinf.	Fabaceae	Boro	Fo	T	Fu	Rheumatic pain	3	Or	1	4	Fr
Eucalyptus globulus Labill.	Myrtaceae	Baherzaf	Cf	T	L	Influenza	6	Na	1	3	Fr
Euclea racemosa Murr.	Ebenaceae	.....	Fo	Sh	L	Epistaxis	5	Na	1	3	Fr
Euphorbia candelabrum Kotschy	Euphorbiaceae	Akire	Cf	T	S	Rabies	11	Or	1	2	Fr
Euphorbia tirucalli L.	Euphorbiaceae	Anonotu	Cf	Sh	R	Glandular swelling	3	Or	1	2	Fr
					L	Spine	3	Dr	1	2	Fr
Faurea speciosa Welw.	Proteaceae	Gere	Fo	T	R, FL	Breast cancer	12	Dr	1	6	Fr
					R	Goiter	12	Dr	1	4	Fr
					R	Abortion	3	Or	1	2	Fr
					Ba	Malaria	11	Or	1	3	Fr
Foeniculum vulgare Mill.	Apiaceae	Abseta	Hg	H	L	Physically weaken	3	Or	1	3	Fr
					L	Jaundice	3	Or	1	3	Fr
					L	Skin cancer	3	Or	1	2	Fr
					L	Hypertension	3	Or	1	1	Fr
					L	Malaria	3	Or	1	1	Fr
					L	Kidney disease	11	Or	2	2	Fr
Gossypium barbdense L.	Malvaceae	Fato	Hg	H	La	Ear ache	4	Dr	1	2	Fr
Hagenia abyssinica (Brace)	Rosaceae	Zoyra	Fo	T	Se	Tape worm	3	Or	1	3	Fr

J.F.Gmel.											
Helichrysum schimperi (Sch.Bip.ex A.Rich)	Asteraceae	.....	Fo	H	La	Ring worms	8	Dr	1	2	Fr
Indigofera spicata Forssk.	Fabaceae	…….	Fo	H	R, L	Sudden illness	11	Or	1	5	Fr
Jasminum grandiflorum L.	Oleaceae	Chigdeda	Fo	H	S	Toothache	9	Ts	1	2	Fr
Lepidium sativum L.	Brassicaceae	Sibeca	Cf	H	Se	Shivering	1	Dr	1	22	Fr
Lippia adoensis Hochst ex.Walp.	Verbenaceae	Kishira	Fo	Sh	L	Gonorrhea	3	Or	1	4	Fr
Mangifera indica L.	Anacardiaceae	Mango	Hg	T	La	Ring worms	8	Dr	2	4	Fr
Millettia ferruginea (Hochest) Bak.	Fabaceae	Zagie	Fo	T	L	Body swelling	4	Dr	1	3	Fr
Moringa stenopetala (Bakf.) Cufed.	Moringaceae	Haleko	Cf	T	R	Malaria	3	Or	1	6	Fr
					L	Abdominal pain	3	Or	2	8	Fr
Myrica salicifolia Hochst ex A. Rich	Myricaceae	Bundo	Fo	T	Ba	Common cold	4	Na	1	3	Fr
					Ba	Gonorrhea	11	Or	2	9	Dr
					Ba	Headache	4	Na	1	8	Fr
					Ba	Skin cancer	4	Dr	2	1	Fr
					Ba	Rheumatic pain	3	Or	1	1	Fr
					Ba	Stomachache	3	Or	1	2	Fr
					Ba	Amoeba	11	Or	1	2	Dr
					Ba	Diarrhea	2	Or	1	1	Dr
					Ba	Paralyze	2	Or	1	6	Dr
					Ba	Breast cancer	4	Dr	1	7	Fr
Nigella sativa L.	Ranunculaceae	Tikure azmude	Hg	H	Fu	Stomachache	3	Or	1	8	Fr
Ocimum lamiifolium Hochst. ex Benth.	Lamiaceae	Ymich ketel	Fo	Sh	L	General malaise	8	Dr	1	2	Fr
					L, S	Headache	3	Or	1	3	Fr
Ocimum urticifolium Roth.	Lamiaceae	Anchabi	Fo	Sh	L	Influenza	5	Na	2	2	Fr

Olinia rochetiana A. Juss.	Oliniaceae	.....	Fo	T	L	Eye disease	4	Oc	1	12	Fr
Priva adharens (Forssk) Chiov.	Lamiaceae	Darunsa	Fo	H	R	Snake bite	3	Or	2	4	Fr
Rumex nervosus Vahl.	Polygonaceae	.....	Fo	H	La	Ringworm	8	Dr	1	1	Fr
					R	Diarrhea	2	Or	1	3	Fr
Ruta chalepensis L.	Rutaceae	Tsetela	Hg	Sh	Wp	Evil eye	5	Na	3	9	Fr
Salvia nilotica Jacq.	Lamiaceae	.....	Cf	H	L	General malaise	3	Or	1	3	Fr
Scadoxus multiflorus (Matyn) Raf.	Amaryrllidacea e	Buti	Fo	H	R	Wound	1	Dr	1	1	Fr
					R	Elephantiasis	4	Dr	1	1	Fr
					Ba	Ascariasis	11	Or	3	3	Fr
Sclerocarya birrea (A.rich) Hochest.	Anacardiaceae	Yebereha lomi	Cf	T	Ba	Physically weaken	6	Na	1	6	Dr
Senna occidentalis (L.)	Fabaceae	Gelese	Fo	Sh	L	Amoeba	3	Or	1	7	Fr
Solanecio gigas (Vatke.) C. Jeffrey	Asteraceae	Welkabissa	Fo	Sh	L	Gastritis	11	Or	1	7	Fr
Solanum incanum L.	Solanaceae	Bulo	Cf	Sh	R	Sudden illness	11	Or	1	1	Fr
					R	Snake bite	11	Or	1	14	Fr
					L	Epistaxis	5	Na	1	1	Fr
Tamarindus indica L.	Fabaceae	Yebereha lomi	Fo	T	Fu	Malaria	3	Or	1	3	Fr
					Ba	Evil spirit	6	Na	2	1	Dr
Terminalia macroptera Guill. and Perr.	Combretaceae	Dergile	Fo	Sh	Ba	Jaundice	3	Or	1	4	Fr
					Ba	Wound	8	Dr	1	4	Fr
Zanthoxylum chalybeum Engl.	Rutaceae	Denbie	Fo	T	Fu	Glandular swelling	3	Or	1	3	Fr
					L	Wound	1	Dr	1	7	Fr
					L	Poisoning	3	Or	1	1	Fr
Zingiber officinale Roscoe.	Zingiberaceae	Kulbo	Hg	H	R	Epilepsy	3	Or	3	6	Fr
					R	Tonsillitis	3	Or	2	1	Fr
					R	Vomiting	3	Or	1	1	Fr

Appendix 7. List of medicinal plants used for human ailments in Gelana District: scientific name; family; local name; source; growth form; plant parts used; ailment treated; methods of preparation and application, route of administration, number of plants, total number of citation, condition of plant part uses. Key: Source (Sou.): Forest (F), Homegarden (Hg), Cultivated fields (Cf), Habit (Ha.): Herb (H); Shrub (Sh); Tree (T); Climber (Cl). Parts used (Pu) (Bark, Ba; Latex, La; Root, R; Leaf, L; Fruit, Fu.; Flower, Fl.; Seed, Se.; Stem, S.; Bulb, Bu.; Whole plant, Wp.). At= ailment treated; MRPA=mode of remedy preparation and application (1= Boil and do steam bath; 2=Crush, homogenize with cold water and drink; 3= Boil and drink the decoction when cool; 4= Crushed and put on the freshly crushed part; 5= Crush and sniff the freshly crushed part; 6= Crush, heat/ burn or boil the part and inhale its smoke or steam; 7= Grind and paint the powder or crushed part; 8= Extract the juice/oil/latex and pour or paint it; 9= Hold with teeth; 10= Drink the concoction; 11= Eat the part; 12= Grind, and tie on the powder or crushed part); Route of Administration (Route); Oral (Or), Nasal (Na), Dermal (Dr), Ocular (Oc), Anal (An), Tooth surface (Ts), Conditions of part used (CPU) (Dry, Dr; Fresh, Fr).

Scientific Name	Family	Lo.na (Oromiffa)	So u	Ha	Pu	At	M RP A	Rt Ad	No sp.	TN C	Cp u.
Abutilon angulatum (Guill and Perr.) Mast.	Malvaceae	Hincinnii adii	Fo	Sh	L	Wound	4	Dr	1	5	Fr
Acidenthera laxiflora Bake	Iridaceae	Merero	Fo	Cl	L, Fu	Rabies	3	Or	1	4	Fr
Agave sisalana Perrine ex Engel.	Agavaceae	Kacha	Cf	T	La	Wound	8	Dr	1	9	Fr
Ajuga integrifolia Buch.Ham	Lamiaceae	Anaamiro	Fo	H	L	Stomachache	3	Or	2	2	Fr
					R	Amoeba	3	Or	2	1	Fr
Albizia gummifera (J.f.Gmell.)	Fabaceae	Gorbe	Fo	T	L	Urine retention	3	Or	1	7	Fr
					Ba	Stomachache	3	Or	1	1	Fr
Allium sativium L	Alliaceae	Kurbi adie	Hg	H	Bu	Influenza	6	Na	1	44	Fr
Brassica nigra (L). Koch.	Brassicaceae	Senafiche	Hg	H	Se	Stomachache	11	Or	3	8	Fr
Carica papaya L.	Caricaceae	Papaya	Hg	T	Se	Malaria	3	Or	2	9	Fr
Capparis tomentosa Lam.	Capparidaceae	Gooraa	Fo	Sh	Fu	Evil eye	3	Or	2	3	Fr
Capsicum annuum L.	Solanaceae	Karya	Hg	H	Fu	Internal parasite	11	Or	2	10	Fr
Catha edulis (Vahl.) Forssk. ex Endl.	Celastraceae	Chatae	Hg	Sh	L	Diarrhea	3	Or	2	5	Fr
*Celtis africana Burm.*f	Ulmaceae	Motoqomaa	Fo	T	R	Bone cancer	4	Dr	1	6	Fr

Clematis hirsuta Perr and Guill.	Rananculaceae	Hidda fitii	Fo	Sh	R, L	Tonsillitis	4	Dr	1	2	Fr
					L	Eczema (Chiffea)	4	Dr	1	1	Fr
*Clerodenrum myricoides (*Hochst) R.Br.ex	Lamiaceae	Misrchi	Fo	Sh	R	Toothache	9	Ts	1	8	Dr
Combretum adenogonium Steud. ex A. Rich.	Combretaceae	Rukensa	Fo	T	Ba	Gonorrhea	3	Or	2	4	Fr
Commelina latifolia Hochst.ex A.Rich.	Commelinaceae	Lalimicha	Fo	H	La	Ear ache	8	Dr	1	1	Dr
					Se	Vomiting	2	Or	1	1	Fr
					L	Ring worm	4	Dr	1	1	Fr
					L	Diarrhea	2	Or	2	3	Fr
Cordia Africana Lam.	Boraginaceae	Wadeessa	Fo	T	La	Breast cancer	8	Dr	1	2	Fr
					Ba, R	Diarrhea	3	Or	1	9	Fr
Croton macrostachyus Del.	Euphorbiaceae	Makenissa	Fo	T	L	Lamp skin disease	8	Dr	1	40	Fr
Cucurbita pepo L.	Cucurbitaceae	Tikure duba	Hg	H	Se, L	Stabbing pain (Wugat)	10	Or	1	8	Dr
Cuscuta epilinum Weihe	Cuscutaceae	.....	Cf	H	Wp	Tinea nigra	8	Dr	1	7	Dr
Cyathula uncinulata (Schrad.) Schinz	Amaranthaceae	Baaldoo	Fo	H	L	Skin rash	4	Dr	1	4	Fr
Cyperus assimilis Steud.	Cyperaceae	Enegecha	Fo	H	L	Placenta retention	4	Dr	2	7	Fr
Dodonaea angustifolia L. f.	Sapindaceae	Itacha	Fo	Sh	L	Evil eye	2	Or	2	4	Fr
Euclea racemosa Murr.	Ebenaceae	Miessa	Fo	Sh	L	Diarrhea	11	Or	1	2	Fr
Eucalyptus globulus Labill.	Myrtaceae	Akaakltii adii	Cf	T	L	Influenza	1	Dr	2	2	Fr
Ficus vasta Forssk.	Moraceae	Qiltu	Fo	T	L	Brest cancer	8	Dr	1	7	Fr
Galium simense Fresen.	Rubiaceae	.....	Fo	H	Fu	Body Swelling	4	Dr	1	9	Fr
Gardenia volkensii K.Schum.	Rubiaceae	Gambela	Cf	T	Ba	Toothache	9	Ts	2	8	Fr
Guizotia scabra (Vis.) Chiov.	Asteraceae	Hadabuti	Fo	H	L	Wound	4	Dr	1	10	Fr
Hibiscus diversifolius A.Rich.	Malvaceae	Hincinni	Fo	H	L	Spider poison	4	Dr	1	4	Fr

					R	Wound on head	4	Dr	1	1	Fr
Hibiscus macranthus Hochst. ex A. Rich.	Malvaceae	Key hechine	Fo	H	L	Bloat	3	Or	3	5	Fr
Leucas discolor Sebald	Lamiaceae	.....	Cf	Sh	L	Wound	4	Dr	1	6	Fr
Lens culinaris Medik.	Fabaceae	Define Miser	Cf	H	Se	Spider poison	4	Dr	1	7	Fr
					Se	Evil eye	11	Or	1	2	Fr
Linum usitatissimum L.	Linaceae	Telba	Cf	H	Se	Eye disease	4	Oc	1	4	Fr
Maesa lanceolata Forssk.	Myrsinaceae	Gecha	Fo	T	L	Snake bite	8	Dr	1	3	Fr
Musa x paradisiaca L.	Musaceae	Muse	Hg	H	La	Blood clotting	8	Dr	1	4	Fr
Ocimum lamiifolium Hochst.ex Benth.	Lamiaceae	Qoricha mich	Fo	Sh	L	General malaise (Mich)	8	Dr	1	2	Fr
Olea europaea L. *subsp. cuspidata* (Wall. ex G. Don) Cif.	Oleaceae	Ejersa	Fo	T	L	Lung cancer	3	Or	2	7	Fr
Olinia rochetiana A. Juss	Oliniaceae	Qdida	Fo	T	L, S	Skin cancer	8	Dr	1	1	Fr
					S	Toothache	9	Ts	1	1	Fr
Pavonia cristata Schinz.ex Gurke	Malvaceae	Lologo	Cf	Sh	Fl	Ring worm	8	Dr	1	3	Fr
Persea americana Mill.	Lauraceae	Abukato	Hg	T	Fu	Constipation	3	Or	2	2	Fr
Phytolacca dodecandra L. Herit.	Phytolaccaceae	Harenja	Fo	Sh	R	Rabies	3	Or	1	30	Fr
Plectranthus caninus Roth	Lamiaceae	Sugete	Fo	Sh	L	Stomachache	3	Or	2	2	Fr
Psidium guajava L.	Myrtaceae	Zeytune	Hg	T	L	Skin rash	8	Dr	3	3	Fr
Psydrax schimperiana (A.Rich) Bridson	Rubiaceae	Gellelo	Fo	T	L	Bone fracture	12	Dr	1	3	Dr
*Rhoicissus tridentata (*L.f) Wild and Drummand	Vitaceae	.....	Fo	H	R	Tape worm	3	Or	1	2	Fr
					L	Eczema	8	Dr	1	2	Fr
Rhus glutinosa Hochst.	Anacardiaceae	xaaxxessaa	Fo	Sh	Fu	Liver disease	10	Or	3	8	Fr
Rhus natalensis Berha. ex Krauss	Anacardiaceae	Debobisa	Fo	Sh	L, S	Ear ache	4	Oc	1	6	Fr
Rumex abyssinicus Jacq.	Polygonaceae	Dhangagoo	Fo	H	L, S	Heart faller	3	Or	1	1	Fr
					L, S	Gastritis	3	Or	1	1	Fr
					R	Ascariasis	11	Or	2	4	Dr
Saccharum officinarum L.	Poaceae	.....	Cf	H	S	Gastritis	12	Or	1	8	Fr
Solanum incanum L.	Solanaceae	Hidie	Cf	Sh	Fu	Mangite	3	Or	1	1	Fr

					L	Glanular swelling	4	Dr	1	2	Fr
					L	Epistaxis	6	Na	1	23	Fr
					L	Bone cancer	11	Or	1	1	Fr
Terminalia schimperiana Hochst.	Combretaceae	Debeka	Fo	T	Ba	Stomach ache	2	Or	1	1	Fr
					Ba	Diarrhea	3	Or	1	8	Fr
Toddalia asiatica (L.) Lam.	Rutaceae	.....	Fo	T	L	Toothache	9	Ts	1	1	Fr
					L	Lung cancer	11	Or	1	2	Fr
Tragia unicinata M. Gilbert	Euphorbiaceae	Lalisa	Cf	H	L	Bone fracture	4	Dr	1	3	Fr
Verbascum sinaiticum Benth.	Scrophulariaceae	.....	Fo	H	L	Eye disease	4	Oc	1	4	Fr
Vernonia amygdalina Del.	Asteraceae	Ebichaa	Fo	Sh	R	Stomachache	11	Or	1	3	Fr
Vernonia auriculifera Hiern	Asteraceae	Reeje	Cf	Sh	L	Stomachache	11	Or	1	22	Fr
Viscum album L.	Loranthaceae	Erto	Cf	H	L	Breast cancer	8	Dr	1	3	Fr
Withania somnifera (L.) Dunal	Lamiaceae	Teresa	Fo	Sh	L	Evil spirit	6	Na	2	3	Dr
Ximenia americana (L.)	Olacaceae	Huda	Fo	T	L	Skin rash	8	Dr	1	3	Fr
					L	Tonsilities	2	Or	1	1	Fr
Zingiber officinale Roscoe.	Zingiberaceae	Kulbo	Hg	H	R	Stomachache	11	Or	1	1	Fr

Appendix 8. List of medicinal plants used for livestock ailments in Amaro District: scientific name; family; local name; source; growth form; plant parts used; ailment treated; methods of preparation and application, route of administration, number of plants, total number of citation, condition of plant part uses. Key: Source (Sou.): Forest (F), Homegarden (Hg), Cultivated fields (Cf), Habit (Ha.): Herb (H); Shrub (Sh); Tree (T); Climber (Cl). Parts used (Pu) (Bark, Ba; Latex, La; Root, R; Leaf, L; Fruit, Fu.; Flower, Fl.; Seed, Se.; Stem, S.; Bulb, Bu.; Whole plant, Wp.). At= ailment treated; MRPA=mode of remedy preparation and application (1= Boil and do steam bath; 2=Crush, homogenize with cold water and drink; 3= Boil and drink the decoction when cool; 4= Crushed and put on the freshly crushed part; 5= Crush and sniff the freshly crushed part; 6= Crush, heat/ burn or boil the part and inhale its smoke or steam; 7= Grind and paint the powder or crushed part; 8= Extract the juice/oil/latex and pour or paint it; 9= Hold with teeth; 10= Drink the concoction; 11= Eat the part; 12= Grind, and tie on the powder or crushed part); Route of Administration (Route); Oral (Or), Nasal (Na), Dermal (Dr), Ocular (Oc), Anal (An) Tooth surface (Ts), Conditions of part used (CPU) (Dry, Dr; Fresh, Fr).

Scientific name	Family	Lo. na (Koorete)	Sou	Ha	Pu	At	MRPA	Route	No sp	TNC	Cpu.
Acacia mellifera (Vahl) Benth.	Fabaceae	Tsurura	Cf	T	L, R	Snake bite	2	Or	1	3	Fr
Adiantum caudatum Var. Hirsutum auct.	Adiantaceae	Bisa	Fo	H	Wp	Body swelling	12	Dr	1	1	Fr
Aeschnomene elaphroxylon Guill	Fabaceae	.....	Fo	Sh	R	Trypanosomosis	2	Or	1	1	Fr
Agarista salicifolia (Comm.ex Lam.) Hook.f.	Ericaceae	Geso	Fo	T	L	Wound	1	Dr	1	44	Fr
Allium sativum L.	Alliaceae	Tuma	Hg	H	Fu	Cough	11	Or	1	8	Fr
					L	Stomachache	2	Or	1	6	Fr
Ampelocissus bombycina (Bak.) Planch	Vitaceae	Hareg	Fo	H	Wp	Cough	10	Or	2	6	Fr
Balanites aegyptiaca (L.) Del.	Balanitaceae	Bedena	Cf	T	Ba	Eye disease	4	Dr	1	2	Fr
Calpurnia aurea (Ait.).Benth	Fabaceae	Cheketa	Fo	Sh	L	Diarrhea	10	Or	1	7	Fr
Capsicum frutescens L.	Solanaceae	Datane	Hg	H	Fu	Trypanosomosis	2	Or	1	5	Fr
					Fu	Intestinal parasite	2	Or	1	1	Fr
Chenopodium murale L.	Chinopodiaceae	Amedmado	Fo	H	L	Yedero kinkine	8	Dr	1	4	Fr
Cordia monoica RoXb.	Boraginaceae	Madeda	Fo	T	L	Wound	8	Dr	1	3	Dr
Croton macrostachyus Del.	Euphorbiaceae	Harpa	Fo	T	R	Sudden illness	2	Or	1	33	Fr
Cucumis ficifolius A.Rich.	Cucurbitaceae	.....	Fo	H	Fu	Cough	2	Or	1	3	Fr

					L	Wound	4	Dr	1	5	Fr
Cupresus lusitanica Mill.	Cupressaceae	Tid	Fo	T	L	FMD/Foot and mouth disease	8	Dr	1	3	Dr
Dodonaea angustifolia L. f.	Sapindaceae	Sengera	Fo	Sh	L	Intestinal parasite	8	Na	1	5	Fr
Ehretia cymosa Thom.	Boraginaceae	Ulaga	Fo	Sh	L	Shivering of cattle	2	Or	1	2	Fr
Entada abyssinica Steud.ex.A.Rich	Fabaceae	Dersase	Fo	T	Ba	Jaundice	2	Or	1	8	Fr
Epilobium hirsutum L.	Onagraceae	.....	Fo	H	Ba	Diarrhea	2	Or	1	4	Fr
Helminthotheca echioides (L.) Holub	Asteraceae	Tudo	Fo	H	L	Ecto-parasite	8	Dr	2	3	Fr
Juniperus procera Endle	Cupressaceae	Bibire	Fo	T	L	Bloat	2	Or	1	3	Fr
Nicandra physaloides (L.) Gaerin.	Solanaceae	Mazie	Fo	Sh	L	Bloat	2	Or	1	2	Fr
Nicotiana tabaccum L.	Solanaceae	Tanbo	Fo	H	L	Leech infestation	6	Na	1	4	Fr
Pappea capensis Eckl. and Zeyh	Sapindaceae	Bika	Fo	T	L	Anthrax	2	Or	1	3	Fr
Phytolacca dodecandera L. Herit.	Phytolaccaceae	Reje	Fo	Sh	L	Intestinal parasite	2	Or	1	2	Fr
					L, R	Bloat	2	Or	1	1	Fr
					R	Evil eye	2	Or	1	2	Fr
					L, R	Body swelling	2	Or	1	2	Fr
					L, R	Diarrhea	2	Or	1	2	Fr
					L, R	Lice infestation	8	Dr	1	1	Fr
Solanum villosum Mill.	Solanaceae	.....	Fo	Sh	R	Blackleg	2	Or	1	8	Fr
Stephania abyssinica (Dillon.and .Rich.Walp.	Lamiaceae	.....	Fo	H	L	Fashiolsis/Yegubettile beshita	2	Or	1	8	Fr
Tetradenia riparia (Hochst.in C. Krauss) Codd	Lamiaceae	Bana	Fo	H	L	FMD	2	Or	1	6	Fr
Vernonia amygdolina Del	Asteraceae	Maze	Fo	Sh	L	Wound	4	Dr	1	7	Fr
					L	Trypanosomiasis	1	Dr	1	7	Fr

Appendix 9. List of medicinal plants used for livestock ailments in Gelana District: scientific name; family; local name; source; growth form; plant parts used; ailment treated; methods of preparation and application, route of administration, number of plants, total number of citation, condition of plant part uses. Key: Source (Sou.): Forest (F), Homegarden (Hg), Cultivated fields (Cf), Habit (Ha.): Herb (H); Shrub (Sh); Tree (T); Climber (Cl). Parts used (Pu) (Bark, Ba; Latex, La; Root, R; Leaf, L; Fruit, Fu.; Flower, Fl.; Seed, Se.; Stem, S.; Bulb, Bu.; Whole plant, Wp.). At= ailment treated; MRPA=mode of remedy preparation and application (1= Boil and do steam bath; 2=Crush, homogenize with cold water and drink; 3= Boil and drink the decoction when cool; 4= Crushed and put on the freshly crushed part; 5= Crush and sniff the freshly crushed part; 6= Crush, heat/ burn or boil the part and inhale its smoke or steam; 7= Grind and paint the powder or crushed part; 8= Extract the juice/oil/latex and pour or paint it; 9= Hold with teeth; 10= Drink the concoction; 11= Eat the part; 12= Grind, and tie on the powder or crushed part); Route of Administration (Route); Oral (Or), Nasal (Na), Dermal (Dr), Ocular (Oc), Anal (An) Tooth surface (Ts), Conditions of part used (CPU) (Dry, Dr; Fresh, Fr).

Scientific Name	Family	Lo. na (Oromiffa)	Sou.	Ha	Pu	At	MRPA	Rou te	No. sp	TN C	Cpu.
Acmella caulirhiza Del.	Asteraceae	Jilokeda	Fo	H	L, Fl	Placenta retention	2	Or	2	51	Fr
Bersama abyssinica Fresen.	Melianthaceae	Tibiro	Fo	T	L	Evil eye	4	Na	1	4	Fr
Boscia angustifolia A. Rich.	Capparidaceae	Qanqalcha	Fo	T	L	Tuberculosis	2	Or	3	9	Fr
Clutia abyssinica Jaub.and Spach.	Euphorbiaceae	Mukadigaa	Fo	Sh	L	Evil eye	6	Na	1	5	Dr
Coffea arabica L.	Rubiaceae	Buna	Hg	T	Se	Madness	6	Na	1	6	Fr
Cucumis prophetarum L.	Cucurbitaceae	Tsea	Cf	H	R	Urine retention	2	Or	2	38	Dr
Cyphostemma adenocaule (Steud. ex A. Rich)	Vitaceae	.....	Fo	H	L	Anthrax	2	Or	3	4	Fr
Discopodium penninervium Hochst.	Solanaceae	Mararo	Fo	T	L	Wound	4	Dr	1	4	Fr
Dombeya torrida (J. F. Gmel.) P. Bamps	Sterculiaceae	Talalo	Fo	Sh	L	Rabies	10	Or	2	3	Fr
Dracaena afromontana Mildbr.	Dracaenaceae	Motta zaf	Fo	T	L, Ba	FMD	8	Dr	1	3	Fr
Ehretia cymosa Thonn.	Boraginaceae	Ulagaa	Fo	Sh	L	Diarrhea	2	Or	2	2	Dr
Entada abyssinica Steud.ex A.Rich.	Fabaceae	Dersase	Fo	T	L	Cough	6	Na	1	6	Fr
Jasminum grandiflorum L.	Oleaceae	Amesaa	Fo	H	R	Rabies	2	Or	3	5	Fr

Lagenaria siceraria (Molina) Standl	Cucurbitaceae	.....	Cf	H	L, Se	Placenta retention	3	Or	1	5	Fr
Lepidium sativum L.	Brassicaceae	Feto	Cf	H	Bu	Rabies	2	Or	1	2	Fr
Nicotiana tabacum L.	Solanaceae	Tenbolene	Cf	H	L	Rabies	2	Or	3	3	Dr
Prunus africana (Hokk f.) Kalkm.	Rosaceae	Suke	Fo	T	Ba, R	Fashiolsis	2	Or	2	35	Dr
Teradenia riparia (Hochest)	Lamiaceae	Bana	Fo	H	L	Skin rash	1	Dr	1	1	Fr

Appendix 10. Common diseases of human and livestock and number of species used

Health problems	Frequency of ailments									
	Amaro				Gelana				Two districts	
	Treated human ailment		Treated livestock ailment		Treated human ailment		Treated livestock ailment			
	Plant species	%	Plant species	%	Plant species	%	Plant species	%	Total	%
Wound	9	8.49	4	10.81	5	6.25	1	5.55	19	7.88
Stomachache	6	5.66	1	2.70	8	10.00	-	-	15	6.22
Diarrhea	5	4.71	3	8.10	5	6.25	1	5.55	14	5.80
Evil eye	1	0.94	1	2.70	3	3.75	2	11.11	7	2.90
Malaria	6	5.66	-	-	1	1.25	-	-	7	2.90
Rabies	1	0.94	-	-	2	2.50	4	22.22	7	2.90
Ring worms	5	4.71	-	-	2	2.50	-	-	7	2.90
Amoeba	5	4.71	-	-	1	1.25	-	-	6	2.48
Breast cancer	3	2.83	-	-	3	3.75	-	-	6	2.48
Intestinal parasite	2	1.88	3	8.10	1	1.25	-	-	6	2.48
Skin rash	2	1.88	-	-	3	3.75	1	5.55	6	2.48
Snake bite	4	3.77	1	2.70	1	1.25	-	-	6	2.48
Toothache	2	1.88	-	-	4	5.00	-	-	6	2.48
Bloat	-	-	3	8.10	1	1.25	-	-	4	1.65
Body swelling	1	0.94	2	5.40	1	1.25	-	-	4	1.65
Cough	-	-	3	8.10	-	-	1	5.55	4	1.65
Ear ache	2	1.88	-	-	2	2.50	-	-	4	1.65
Epistaxis	3	2.83	-	-	1	1.25	-	-	4	1.65
Eye disease	1	0.94	1	2.70	2	2.50	-	-	4	1.65
General malaise	3	2.83	-	-	1	1.25	-	-	4	1.65
Influenza	2	1.88	-	-	2	2.50	-	-	4	1.65
Tonsillitis	2	1.88	-	-	2	2.50	-	-	4	1.65
FMD	-	-	2	5.40	-	-	1	5.55	3	1.24
Gastritis	1	0.94	-	-	2	2.50	-	-	3	1.24

Glandular swelling	2	1.88	-	-	1	1.25	-	-	3	1.24
Gonorrhea	2	1.88	-	-	1	1.25	-	-	3	1.24
Jaundice	2	1.88	1	2.70	-	-	-	-	3	1.24
Lung cancer	1	0.94	-	-	2	2.50	-	-	3	1.24
Placenta retention	-	-	-	-	1	1.25	2	11.11	3	1.24
Skin cancer	2	1.88	-	-	1	1.25	-	-	3	1.24
Spider poison	1	0.94	-	-	2	2.50	-	-	3	1.24
Sudden illness	2	1.88	1	2.70	-	-	-	-	3	1.65
Tape worm	2	1.88	-	-	1	1.25	-	-	3	1.24
Trypanosomiasis	-	-	3	8.10	-	-	-	-	3	1.24
Anthrax	-	-	1	2.70	-	-	1	5.55	2	0.82
Ascariasis	1	0.94	-	-	1	1.25	-	-	2	0.82
Bone cancer	-	-	-	-	2	2.50	-	-	2	0.82
Bone fracture	-	-	-	-	2	2.50	-	-	2	0.82
Evil spirit	1	0.94	-	-	1	1.25	-	-	2	0.82
Eczema	-	-	-	-	2	2.50	-	-	2	0.82
Fashiolsis	-	-	1	2.70	-	-	1	11.11	2	0.82
Headache	2	1.88	-	-	-	-	-	-	2	0.82
Physically weaken	2	1.88	-	-	-	-	-	-	2	0.82
Rheumatic pain	2	1.88	-	-	-	-	-	-	2	0.82
Shivering	1	0.94	1	2.70	-	-	-	-	2	0.82
Urine retention	-	-	-	-	1	1.25	1	5.55	2	0.82
Vomiting	1	0.94	-	-	1	1.25	-	-	2	0.82
Abdominal pain	1	0.94	-	-	-	-	-	-	1	0.41
Abortion	1	0.94	-	-	-	-	-	-	1	0.41
Ayenetila	1	0.94	-	-	-	-	-	-	1	0.41
Bite of scorpion	1	0.94	-	-	-	-	-	-	1	0.41
Black leg	-	-	1	2.70	-	-	-	-	1	0.41
Blood clotting	-	-	-	-	1	1.25	-	-	1	0.41
Common cold	1	0.94	-	-	-	-	-	-	1	0.41

Constipation	-	-	-	-	1	1.25	-	-	1	0.41
Dibetics	1	0.94	-	-	-	-	-	-	1	0.41
Ecto-parasite	-	-	2	5.40	-	-	-	-	2	0.82
Elephantiasis	1	0.94	-	-	-	-	-	-	1	0.41
Epilepsy	1	0.94	-	-	-	-	-	-	1	0.41
Goiter	1	0.94	-	-	-	-	-	-	1	0.41
Heart faller	-	-	-	-	1	1.25	-	-	1	0.41
Hypertension	1	0.94	-	-	-	-	-	-	1	0.41
Impotency	1	0.94	-	-	-	-	-	-	1	0.41
Insect allergy	1	0.94	-	-	-	-	-	-	1	0.41
Kidney disease	1	0.94	-	-	-	-	-	-	1	0.41
Lamp skin disease	-	-	-	-	1	1.25	-	-	1	0.41
Leech infestation	-	-	1	2.70	-	-	-	-	1	0.41
Liver disease	-	-	-	-	1	1.25	-	-	1	0.41
Madness	-	-	-	-	-	-	1	5.55	1	0.41
Mangite	-	-	-	-	1	1.25	-	-	1	0.41
Paralyze	1	0.94	-	-	-	-	-	-	1	0.41
Poisoning	1	0.94	-	-	-	-	-	-	1	0.82
Spine	1	0.94	-	-	-	-	-	-	1	0.41
Stabbing pain	-	-	-	-	1	1.23	-	-	1	0.41
Tinea nigra	-	-	-	-	1	1.25	-	-	1	0.41
Tuberculosis	-	-	-	-	-	-	1	5.55	1	0.41
Yedero kinkine	-	-	1	2.70	-	-	-	-	1	0.41
Total	**106**	**100**	**37**	**100**	**80**	**100**	**18**	**100**	**241**	**100**

Appendix 11. Frequency of medicinal plants used to treat human and livestock ailments

Plant species	**Frequency of medicinal plants**									
	Amaro				**Gelana**				**Two districts**	
	To treat human ailment		To treat livestock ailment		To treat human ailment		To treat livestock ailment		Total	%
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Total	%
Myrica salicifolia Hochst ex A. Rich	10	9.43	-	-	-	-	-	-	10	4.14
Phytolacca dodecandera L. Herit.	-	-	6	16.21	1	1.25	-	-	7	2.90
Solanum incanum L.	3	2.83	-	-	4	5.00	-	-	7	2.90
Foeniculum vulgare Mill.	6	5.66	-	-	-	-	-	-	6	2.48
Commelina latifolia Hochst.ex.A	1	0.94	-	-	4	5.00	-	-	5	2.07
Ajuga integrifolia Buch.Ham	2	1.88	-	-	2	2.50	-	-	4	1.65
Buddleja polystachya Fresen.	4	3.77	-	-	-	-	-	-	4	1.65
Citrus aurantifolia (Christm.) Swingle	4	3.77	-	-	-	-	-	-	4	1.65
Cordia africana Lam.	2	1.88	-	-	2	2.50	-	-	4	1.65
Faurea speciosa Welw.	4	3.77	-	-	-	-	-	-	4	1.65
Zingiber officinale Roscoe.	3	2.83	-	-	1	1.25	-	-	4	1.65
Allium sativium L	-	-	2	5.40	1	1.25	-	-	3	1.24
Clematis simensis Fresen.	3	2.83	-	-	-	-	-	-	3	1.24
Coffea arabica L.	2	1.88	-	-	-	-	1	5.55	3	1.24
Ocimum lamiifolium Hochst.ex Benth.	2	1.88	-	-	1	1.25	-	-	3	1.24
Olinia rochetiana A. Juss.	1	0.94	-	-	2	2.50	-	-	3	1.24
Rumex abyssinicus Jacq.	-	-	-	-	3	3.75	-	-	3	1.24
Scadoxus multiflorus (Matyn) Raf.	3	2.83	-	-	-	-	-	-	3	1.24
Vernonia amygdalina Del.	-	-	2	5.40	1	1.25	-	-	3	1.24
Ajuga alba L.	2	1.88	-	-	-	-	-	-	2	0.82

Albizia gummifera (J.f.Gmell.)	-	-	-	-	2	2.50	-	-	2	0.82
Aloe debrana Christian.	2	1.88	-	-	-	-	-	-	2	0.82
Capsicum frutescens L.	-	-	2	5.40	-	-	-	-	2	0.82
Clematis hirsuta Perr and Guill.	-	-	-	-	2	2.50	-	-	2	0.82
*Clerodendrum myricoides (*Hochst) R.Br.ex	1	0.94	-	-	1	1.25	-	-	2	0.82
Croton macrostachyus Del.	-	-	1	2.70	1	1.25	-	-	2	0.82
Cucumis ficifolius A.Rich.	-	-	2	5.40	-	-	-	-	2	0.82
Cucurbita pepo L.	1	0.94	-	-	1	1.25	-	-	2	0.82
Dichrostachys cinerea (L.) Wight and Arn.	2	1.88	-	-	-	-	-	-	2	0.82
Dodonaea angustifolia L. f.	-	-	1	2.70	1	1.25	-	-	2	0.82
Ehretia cymosa Thom.	-	-	1	2.70	-	-	1	5.55	2	0.82
Entada abyssinica Steud.ex A.Rich.	-	-	1	2.70	-	-	1	5.55	2	0.82
Eucalyptus globulus Labill.	1	0.94	-	-	1	1.25	-	-	2	0.82
Euclea racemosa Murr.	1	0.94	-	-	1	1.25	-	-	2	0.82
Euphorbia tirucalli L.	2	1.88	-	-	-	-	-	-	2	0.82
Hibiscus diversifolius A.Rich.	-	-	-	-	2	2.50	-	-	2	0.82
Jasminum grandiflorum L.	1	0.94	-	-	-	-	1	5.55	2	0.82
Lens culinaris Medik.	-	-	-	-	2	2.50	-	-	2	0.82
Lepidium sativum L.	1	0.94	-	-	-	-	1	5.55	2	0.82
Moringa stenopetala (Bakf.) Cufed.	2	1.88	-	-	-	-	-	-	2	0.82
Nicotiana tabaccum L.	-	-	1	2.70	-	-	1	5.55	2	0.82
Rhoicissus tridentata (L.f) Wild and Drummand	-	-	-	-	2	2.50	-	-	2	0.82
Rumex nervosus Vahl.	2	1.88	-	-	-	-	-	-	2	0.82
Tamarindus indica L.	2	1.88	-	-	-	-	-	-	2	0.82
Terminalia macroptera Guill. and Perr.	2	1.88	-	-	-	-	-	-	2	0.82
Terminalia schimperiana Hochst.	-	-	-	-	2	2.50	-	-	2	0.82

Tetradenia riparia (Hochst.in C. Krauss) Codd	-	-	1	2.70	-	-	1	5.55	2	0.82
Toddalia asiatica (L.) Lam.	-	-	-	-	2	2.50	-	-	2	0.82
Ximenia americana (L.)	-	-	-	-	2	2.50	-	-	2	0.82
Zanthoxylum chalybeum Engl.	2	1.88	-	-	-	-	-	-	2	0.82
Abutilon angulatum (Guill and Perr.) Mast.	-	-	-	-	1	1.25	-	-	1	0.41
Acacia mellifera (Vahl) Benth.	-	-	1	2.70	-	-	-	-	1	0.41
Acidenthera laxiflora Bake	-	-	-	-	1	1.25	-	-	1	0.41
Acmella caulirhiza Del.	-	-	-	-	-	-	1	5.55	1	0.41
Acokanthera schimperi (A.DC.) Schweinf.	1	0.94	-	-	-	-	-	-	1	0.41
Adiantum caudatum Var. Hirsutum auct.	-	-	1	2.70	-	-	-	-	1	0.41
Aeschnomene elaphroxylon Guill	-	-	1	2.70	-	-	-	-	1	0.41
Aframomum corrorima (Braun) Jansen	1	0.94	-	-	-	-	-	-	1	0.41
Agarista salicifolia (Comm.ex Lam.) Hook.f.	-	-	1	2.70	-	-	-	-	1	0.41
Agave sisalana Perrine ex Engel.	-	-	-	-	1	1.25	-	-	1	0.41
Ampelocissus bombycina (Bak.) Planch	-	-	1	2.70	-	-	-	-	1	0.41
Artemisia abyssinica Sch. Bip. ex. A. Rich.	1	0.94	-	-	-	-	-	-	1	0.41
Artemisia afra Jacq. ex Willd.	1	0.94	-	-	-	-	-	-	1	0.41
Arundinaria alpina K. chum.	1	0.94	-	-	-	-	-	-	1	0.41
Balaintes aegyptiaca (L.) Del.	-	-	1	2.70	-	-	-	-	1	0.41
Bersama abyssinica Fresen.	-	-	-	-	-	-	1	5.55	1	0.41
Biden pilosa L.	1	0.94	-	-	-	-	-	-	1	0.41
Boscia angustifolia A. Rich.	-	-	-	-	-	-	1	5.55	1	0.41
Brassica carinata A.Br.	1	0.94	-	-	-	-	-	-	1	0.41
Brassica nigra (L). Koch.	-	-	-	-	1	1.25	-	-	1	0.41
Calpurnia aurea (Ait.).Benth	-	-	1	2.70	-	-	-	-	1	0.41
Capparis tomentosa Lam.	-	-	-	-	1	1.25	-	-	1	0.41

Capsicum annuum L.	-	-	-	-	1	1.25	-	-	1	0.41
Carica papaya L**.**	-	-	-	-	1	1.25	-	-	1	0.41
Carissa spinarum L.	1	0.94	-	-	-	-	-	-	1	0.41
Catha edulis (Vahl.) Forssk. ex Endl.	-	-	-	-	1	1.25	-	-	1	0.41
Celtis africana Burm.f	-	-	-	-	1	1.25	-	-	1	0.41
Chenopodium murale L.	-	-	1	2.70	-	-	-	-	1	0.41
Clutia abyssinica Jaub.and Spach.	-	-	-	-	-	-	1	5.55	1	0.41
Coccinia grandis (L.) Voight	1	0.94	-	-	-	-	-	-	1	0.41
Combretum adenogonium Steud. ex A. Rich.	-	-	-	-	1	1.25	-	-	1	0.41
Combretum collinum Fresen.	1	0.94	-	-	-	-	-	-	1	0.41
Commelina diffusa Burm.f.	1	0.94	-	-	-	-	-	-	1	0.41
Cordia monoica Roxb.	-	-	1	2.70	-	-	-	-	1	0.41
Cucumis prophetarum L.	-	-	-	-	-	-	1	5.55	1	0.41
Cupresus lusitanica Mill.	-	-	1	2.70	-	-	-	-	1	0.41
Cuscuta epilinum Weihe	-	-	-	-	1	1.25	-	-	1	0.41
Cyathula uncinulata (Schrad.) Schinz	-	-	-	-	1	1.25	-	-	1	0.41
Cynodon dactylon (L.) pers.	1	0.94	-	-	-	-	-	-	1	0.41
Cynoglosum lanceolatum Forssk.	1	0.94	-	-	-	-	-	-	1	0.41
Cyperus assimilis Steud.	-	-	-	-	1	1.25	-	-	1	0.41
Cyphostemma adenocaule (Steud. ex A. Rich)	-	-	-	-	-	-	1	5.55	1	0.41
Datura stramonium L.	1	0.94	-	-	-	-	-	-	1	0.41
Discopodium penninervium Hochst.	-	-	-	-	-	-	1	5.55	1	0.41
Dombeya torrida (J. F. Gmel.) P. Bamps	-	-	-	-	-	-	1	5.55	1	0.41
Dracaena afromontana Mildbr.	-	-	-	-	-	-	1	5.55	1	0.41
Echinops kebericho Mesfin	1	0.94	-	-	-	-	-	-	1	0.41
Epilobium hirsutum L.	-	-	1	2.70	-	-	-	-	1	0.41

Erythrina brucei Schweinf.	1	0.94	-	-	-	-	-	-	1	0.41
Euphorbia candelabrum Kotschy	1	0.94	-	-	-	-	-	-	1	0.41
Ficus vasta Forssk.	-	-	-	-	1	1.25	-	-	1	0.41
Galium simense Fresen.	-	-	-	-	1	1.25	-	-	1	0.41
Gardenia volkensii K.Schum.	-	-	-	-	1	1.25	-	-	1	0.41
Gossypium barbadense L.	1	0.94	-	-	-	-	-	-	1	0.41
Guizotia scabra (Vis.) Chiov.	-	-	-	-	1	1.25	-	-	1	0.41
Hagenia abyssinica (Brace) J.F.Gmel.	1	0.94	-	-	-	-	-	-	1	0.41
Helichrysum schimperi (Sch.Bip.exA.Rich)	1	0.94	-	-	-	-	-	-	1	0.41
Helminthotheca echioides (L.) Holub	-	-	1	2.70	-	-	-	-	1	0.41
Hibiscus macranthus Hochst. ex A. Rich.	-	-	-	-	1	1.25	-	-	1	0.41
Indigofera spicata Forssk.	1	0.94	-	-	-	-	-	-	1	0.41
Juniperus procera Endle	-	-	1	2.70	-	-	-	-	1	0.41
Lagenaria siceraria (Molina) Standl	-	-	-	-	-	-	1	5.55	1	0.41
Leucs *discolor* Sebald	-	-	-	-	1	1.25	-	-	1	0.41
Linum usitatissimum L.	-	-	-	-	1	1.25	-	-	1	0.41
Lippia adoensis Hochst ex.Walp.	1	0.94	-	-	-	-	-	-	1	0.41
Maesa lanceolata Forssk.	-	-	-	-	1	1.25	-	-	1	0.41
Mangifera indica L.	1	0.94	-	-	-	-	-	-	1	0.41
Millettia ferruginea (Hochest) Bak.	1	0.94	-	-	-	-	-	-	1	0.41
Musa x paradisiaca L.	-	-	-	-	1	1.25	-	-	1	0.41
Nicandra physaloides (L.) Gaerin.	-	-	1	2.70	-	-	-	-	1	0.41
Nigella sativa L.	1	0.94	-	-	-	-	-	-	1	0.41
Ocimum urticifolium Roth.	1	0.94	-	-	-	-	-	-	1	0.41
Olea europaea L. subsp. cuspidata (Wall. ex G. Don) Cif.	-	-	-	-	1	1.25	-	-	1	0.41
Pappea capensis Eckl. and Zeyh	-	-	1	2.70	-	-	-	-	1	0.41
Pavonia cristata Schinz.ex Gurke	-	-	-	-	1	1.25	-	-	1	0.41

Persea americana Mill.	-	-	-	-	1	1.25	-	-	1	0.41
Plectranthus caninus Roth	-	-	-	-	1	1.25	-	-	1	0.41
Priva adharens (Forssk) Chiov.	1	0.94	-	-	-	-	-	-	1	0.41
Prunus africana (Hokk. f.) Kalkm.	-	-	-	-	-	-	1	5.55	1	0.41
Psidium guajava L.	-	-	-	-	1	1.25	-	-	1	0.41
Psydrax schimperiana (A.Rich) Bridson	-	-	-	-	1	1.25	-	-	1	0.41
Rhus glutinosa Hochst.	-	-	-	-	1	1.25	-	-	1	0.41
Rhus natalensis Berha. ex Krauss	-	-	-	-	1	1.25	-	-	1	0.41
Ruta chalepensis L.	1	0.94	-	-	-	-	-	-	1	0.41
Saccharum officinarum L.	-	-	-	-	1	1.25	-	-	1	0.41
Salvia nilotica Jacq.	1	0.94	-	-	-	-	-	-	1	0.41
Sclerocarya birrea (A.rich) Hochest.	1	0.94	-	-	-	-	-	-	1	0.41
Senna occidentalis (L.)	1	0.94	-	-	-	-	-	-	1	0.41
Solanecio gigas (Vatke.) C. Jeffrey	1	0.94	-	-	-	-	-	-	1	0.41
Solanum villosum Mill.	-	-	1	2.70	-	-	-	-	1	0.41
Stephania abyssinica (Dillon.and Rich.Walp.	-	-	1	2.70	-	-	-	-	1	0.41
Tragia unicinata M. Gilbert	-	-	-	-	1	1.25	-	-	1	0.41
Verbascum sinaiticum Benth.	-	-	-	-	1	1.25	-	-	1	0.41
Vernonia auriculifera Hiern	-	-	-	-	1	1.25	-	-	1	0.41
Viscum album L.	-	-	-	-	1	1.25	-	-	1	0.41
Withania somnifera (L.) Dunal	-	-	-	-	1	1.25	-	-	1	0.41
Total	**106**	**100**	**37**	**100**	**80**	**100**	**18**	**100**	**241**	**100**

Appendix 12. List of human and livestock medicinal plants and the corresponding informants (Percentage ≥ 2) in Amaro and Gelana districts Grand total citations=562, 458 respectively for human medicinal plants and 215 and 186 respectively for livestock ailments).

Scientific name	**Amaro**				**Gelana**				**Two districts**	
	Human		Livestock		Human		Livestock			
	TNC	%	**TNC**	%	**TNC**	%	**TNC**	%	**TNC**	%
Abutilon angulatum (Guill and Perr.) Mast.	-	-	-	-	5	1.07	-	-	5	0.35
Acacia mellifera (Vahl) Benth.	-	-	3	1.39	-	-	-	-	3	0.21
Acidenthera laxiflora Bake	-	-	-	-	4	0.86	-	-	4	0.28
Acmella caulirhiza Del.	-	-	-	-			51	27.41	51	3.58
Acokanthera schimperi (A.DC.) Schweinf.	8	1.41	-	-	-	-	-	-	8	0.56
Adiantum caudatum Var. Hirsutum auct.	-	-	1	0.46	-	-	-	-	1	0.07
Aeschnomene elaphroxylon Guill	-	-	1	0.46	-	-	-	-	1	0.07
Aframomum corrorima (Braun) Jansen	8	1.41	-	-	-	-	-	-	8	0.56
Agarista salicifolia (Comm.ex Lam.) Hook.f.	-	-	44	17.95	-	-	-	-	44	3.09
Agave sisalana Perrine ex Engel.	-	-	-	-	9	1.93	-	-	9	0.63
Ajuga alba L.	32	5.65	-	-	-	-	-	-	32	2.25
Ajuga integrifolia Buch-Ham ex. D. Don.	11	1.94	-	-	3	0.65	-	-	14	0.98
Albizia gummifera (J.f.Gmell.)	-	-	-	-	8	1.72	-	-	8	0.56
Allium sativum L.	-	-	14	6.51	44	9.48	-	-	58	4.08
Aloe debrana Christian.	9	1.59	-	-	-	-	-	-	9	0.63
Ampelocissus bombycina (Bak.) Planch	-	-	6	2.79	-	-	-	-	6	0.42
Artemisia abyssinica Sch. Bip. ex. A. Rich.	3	0.53	-	-	-	-	-	-	3	0.21
Artemisia afra Jacq. ex Willd.	10	1.77	-	-	-	-	-	-	10	0.70
Arundinaria alpina K. chum.	4	0.71	-	-	-	-	-	-	4	0.28
Balaintes aegyptiaca (L.) Del.	-	-	2	0.93	-	-	-	-	2	0.14
Bersama abyssinica Fresen.	-	-	-	-	-	-	4	2.15	4	0.28
Biden pilosa L.	3	0.53	-	-	-	-	-	-	3	0.21
Boscia angustifolia A. Rich.	-	-	-	-	-	-	9	4.83	9	0.63

Brassica carinata A.Br.	5	0.88	-	-	8	1.74	-	-	13	0.91
Buddleja polystachya Fresen.	36	6.40	-	-	-	-	-	-	36	2.53
Calpurnia aurea (Ait.).Benth	-	-	7	3.25	-	-	-	-	7	0.49
Capparis tomentosa Lam.	-	-	-	-	3	0.64	-	-	3	0.21
Capsicum annuum L.	-	-	-	-	10	2.15	-	-	10	0.70
Capsicum frutescens L.	-	-	6	2.79	-	-	-	-	6	0.42
Carica papaya L.	-	-	-	-	9	1.93	-	-	9	0.63
Carissa spinarum L.	5	0.88	-	-	-	-	-	-	5	0.35
Catha edulis (Vahl.) Forssk. ex Endl.	-	-	-	-	5	1.07	-	-	5	0.35
*Celtis africana Burm.*f	-	-	-	-	6	1.29	-	-	6	0.42
Chenopodium murale L.	-	-	4	1.86	-	-	-	-	4	0.28
Citrus aurantifolia (Christm.) Swingle	20	3.53	-	-	-	-	-	-	20	1.40
Clematis hirsuta Perr and Guill.	-	-	-	-	3	0.64	-	-	3	0.21
Clematis simensis Fresen.	18	3.18	-	-	-	-	-	-	18	1.26
Clerodendrum myricoides (Hochst) R.Br.ex	30	5.30	-	-	8	1.74	-	-	38	2.67
Clutia abyssinica Jaub.and Spach.	-	-	-	-	-	-	5	2.68	5	0.35
Coccinia grandis (L.) Voight	5	0.88	-	-	-	-	-	-	5	0.35
Coffea arabica L.	9	1.60	-	-	-	-	6	3.22	15	1.05
Combretum adenogonium Steud. ex A. Rich.	-	-	-	-	4	0.86	-	-	4	0.28
Combretum collinum Fresen.	5	0.88	-	-	-	-	-	-	5	0.35
Commelina latifolia Hochst.ex.A	24	4.24	-	-	6	1.31	-	-	30	2.11
Commelina diffusa Chiov.	6	1.06	-	-	-	-	-	-	6	0.42
Cordia africana Lam.	11	1.94	-	-	11	2.40	-	-	22	1.54
Cordia monoica Roxb.	-	-	3	1.39	-	-	-	-	3	0.21
Croton macrostachyus Del.	-	-	33	13.46	40	8.62	-	-	73	5.13
Cucumis ficifolius A.Rich.	-	-	8	3.72	-	-	-	-	8	0.56
Cucumis prophetarum L.	-	-	-	-	-	-	38	20.43	38	2.67
Cucurbita pepo L.	7	1.24	-	-	8	1.74	-	-	15	1.05

Cupresus lusitanica Mill.	-	-	3	1.39	-	-	-	-	3	0.21
Cuscuta epilinum Weihe	-	-	-	-	7	1.50	-	-	7	0.49
Cyathula uncinulata (Schrad.) Schinz	-	-	-	-	4	0.86	-	-	4	0.28
Cynodon dactylon (L.) pers.	3	0.53	-	-	-	-	-	-	3	0.21
Cynoglosum lanceolatum Forssk.	3	0.53	-	-	-	-	-	-	3	0.21
Cyperus assimilis Steud.	-	-	-	-	7	1.50	-	-	7	0.49
Cyphostemma adenocaule (Steud. ex A. Rich)	-	-	-	-	-	-	4	2.15	4	0.28
Datura stramonium L.	4	0.71	-	-	-	-	-	-	4	0.28
Dichrostachys cinerea (L.) Wight and Arn.	2	0.35	-	-	-	-	-	-	2	0.14
Discopodium penninervium Hochst.	-	-	-	-	-	-	4	2.15	4	0.28
Dodonaea angustifolia L. f.	-	-	5	2.32	4	0.86	-	-	9	0.63
Dombeya torrida (J. F. Gmel.) P. Bamps	-	-	-	-	-	-	3	0.53	3	0.21
Dracaena afromontana Mildbr.	-		-	-	-	-	3	0.53	3	0.21
Echinops kebericho Mesfin	26	4.59	-	-	-	-	-		26	1.82
Ehretia cymosa Thonn.	-	-	2	0.93	-	-	2	1.07	4	0.28
Entada abyssinica Steud.ex.A.Rich	-	-	8	3.72	-	-	6	3.22	14	0.98
Epilobium hirsutum L..	-	-	4	1.86	-	-	-	-	4	0.28
Erythrina brucei Schweinf.	4	0.71	-	-	-	-	-	-	4	0.28
Eucalyptus globulus Labill.	3	0.53	-	-	2	0.43	-	-	5	0.35
Euclea racemosa Murr.	3	0.53	-	-	2	0.43	-	-	5	0.35
Euphorbia candelabrum Kotschy	2	0.35	-	-	-	-	-	-	2	0.14
Euphorbia tirucalli L.	4	0.71	-	-	-	-	-	-	4	0.28
Ficus vasta Forssk.	-	-	-	-	7	1.50	-	-	7	0.49
Foeniculum vulgare Mill.	12	2.12	-	-	-	-	-	-	12	0.84
Galium simense Fresen.	-	-	-	-	9	1.93	-	-	9	0.63
Gardenia volkensii K.Schum.	-	-	-	-	8	1.72	-	-	8	0.56
Gossypium barbadense L.	2	0.35	-	-	-	-	-	-	2	0.14
Guizotia scabra (Vis.) Chiov.	-	-	-	-	10	2.15	-	-	10	0.70

Hagenia abyssinica (Brace) J.F.Gmel.	3	0.53	-	-	-	-	-	-	3	0.21
Helichrysum schimperi (Sch.Bip.eXA.Rich)	2	0.35	-	-	-	-	-	-	2	0.14
Helminthotheca echioides (L.) Holub	-	-	3	1.39	-	-	-	-	3	0.21
Hibiscus diversifolius A.Rich.	-	-	-	-	5	1.07	-	-	5	0.35
Hibiscus macranthus Hochst. ex A. Rich.	-	-	-	-	5	1.07	-	-	5	0.35
Indigofera spicata Forssk.	5	0.88	-	-	-	-	-	-	5	0.35
Jasminum grandiforium L.	2	0.35	-	-	-	-	5	2.68	7	0.49
Juniperus procera Endle			3	1.39	-	-	-	-	3	0.21
Lagenaria siceraria (Molina) Standl	-	-	-	-	-	-	5	2.68	5	0.35
Leucas discolor Sebald	-	-	-	-	6	1.29	-	-	6	0.42
Lens culinaris Medik.	-	-	-	-	9	1.93	-	-	9	0.63
Lepidium sativum L.	22	3.91	-	-	-	-	2	1.07	24	1.68
Linum usitatissimum L.	-	-	-	-	4	0.86	-	-	4	0.28
Lippia adoensis Hochst ex.Walp.	4	0.71	-	-	-	-	-	-	4	0.28
Maesa lanceolata Forssk.	-	-	-	-	3	0.64	-	-	3	0.21
Mangifera indica L.	4	0.71	-	-	-	-	-	-	4	0.28
Millettia ferruginea (Hochest) Bak.	3	0.53	-	-	-	-	-	-	3	0.21
Moringa stenopetala (Bakf.) Cufed.	14	2.47	-	-	-	-	-	-	14	0.98
Musa x paradisiaca L.	-	-	-	-	4	0.86	-	-	4	0.28
Myrica salicifolia Hochst ex A. Rich	40	7.06	-	-	-	-	-	-	40	2.81
Nicandra physaloides (L.) Gaerin.	-	-	2	0.93	-	-	-	-	2	0.14
Nicotiana tabaccum L.	-	-	4	1.86	-	-	3	0.53	7	0.49
Nigella sativa L.	8	1.42	-	-	-	-	-	-	8	0.56
Ocimum lamiifolium Hochst. ex Benth.	5	0.88	-	-	2	0.43	-	-	7	0.49
Ocimum urticifolium Roth.	2	0.35	-	-			-	-	2	0.14
Olea europaea L. *subsp. cuspidata* (Wall. ex G. Don) Cif.	-	-	-	-	7	1.50	-	-	7	0.49
Olinia rochetiana A. Juss.	12	2.12	-	-	2	0.43	-	-	14	0.98

Pappea capensis Eckl. and Zeyh	-	-	3	1.39	-	-	-	-	3	0.21
Pavonia cristata Schinz.ex Gurke	-	-	-	-	3	0.64	-	-	3	0.21
Persea americana Mill.	-	-	-	-	2	0.43	-	-	2	0.14
Phytolacca dodecandera L. Herit.	-	-	10	4.65	30	6.46	-	-	40	2.81
Plectranthus caninus Roth	-	-	-	-	2	0.43	-	-	2	0.14
Priva adharens (Forssk) Chiov.	4	0.71	-	-	-	-	-	-	4	0.28
Faurea speciosa Welw.	11	1.94	-	-	-	-	-	-	11	0.77
Prunus africana (Hokk. f.) Kalkm.	-	-	-	-	-	-	35	18.81	35	2.46
Psidium guajava L.	-	-	-	-	3	0.64	-	-	3	0.21
Psydrax schimperiana (A.Rich) Bridson	-	-	-	-	3	0.64	-	-	3	0.21
*Rhoicissus tridentata (*L.f) Wild and Drummand	-	-	-	-	4	0.86	-	-	4	0.28
Rhus glutinosa Hochst.	-	-	-	-	8	1.72	-	-	8	0.56
Rhus natalensis Berha. ex Krauss	-	-	-	-	6	1.29	-	-	6	0.42
Rumex abyssinicus Jacq.	-	-	-	-	6	1.29	-	-	6	0.42
Rumex nervosus Vahl.	4	0.71	-	-	-	-	-	-	4	0.28
Ruta chalepensis L.	9	1.59	-	-	-	-	-	-	9	0.63
Saccharum officinarum L.	-	-	-	-	8	1.72	-	-	8	0.56
Salvia nilotica Jacq.	3	0.53	-	-	-	-	-	-	3	0.21
Scadoxus multiflorus (Matyn) Raf.	5	0.88	-	-	-	-	-	-	5	0.35
Sclerocarya birrea (A.rich) Hochest.	6	1.06	-	-	-	-	-	-	6	0.42
Senna occidentalis (L.)	7	1.24	-	-	-	-	-	-	7	0.49
Solanecio gigas (Vatke.) C. Jeffrey	7	1.24	-	-	-	-	-	-	7	0.49
Solanum incanum L.	16	2.83	-	-	27	5.89	-	-	43	3.02
Solanum villosum Mill.	-	-	8	3.72	-	-	-	-	8	0.56
Stephania abyssinica (Dillon.and .Rich.Walp.	-	-	8	3.72	-	-	-	-	8	0.56
Tamarindus indica L.	4	0.71			-	-	-	-	4	0.28
Teradenia riparia (Hochest)	-	-	6	2.79	-	-	1	0.53	7	0.49
Terminalia macroptera Guill. and Perr.	8	1.41	-	-	-	-	-	-	8	0.56

Terminalia schimperiana Hochst.	-	-	-	-	9	1.93	-	-	9	0.63
Toddalia asiatica (L.) Lam.	-	-	-	-	3	0.64	-	-	3	0.21
Tragia unicinata M. Gilbert	-	-	-	-	3	0.64	-	-	3	0.21
Verbascum sinaiticum Benth.	-	-	-	-	4	0.86	-	-	4	0.28
Vernonia amygdalina Del.	-	-	14	6.51	3	0.64	-	-	17	1.19
Vernonia auriculifera Hiern	-	-	-	-	22	4.74	-	-	22	1.54
Viscum album L.	-	-	-	-	3	0.64	-	-	3	0.21
Withania somnifera (L.) Dunal	-	-	-	-	3	0.64	-	-	3	0.21
Ximenia americana (L.)	-	-	-	-	4	0.86	-	-	4	0.28
Zanthoxylum chalybeum Engl.	11	1.94	-	-	-	-	-	-	11	0.77
Zingiber officinale Roscoe.	8	1.41	-	-	1	0.21	-	-	9	0.63
	566	**100**	**215**	**100**	**458**	**100**	**186**	**100**	**1425**	**100**

Appendix 13. Wild edible plants list collected from Amaro and Gelana districts (Fr = fruit, Ro= root, S= stem, L=leaf, Fn= flower nectar, Gu=gum, Se=seed, Wp=whole plant, Hg=Homegarden, Fo=Forest, Cf=Cultiated filed, Absent (X), Present (+), * Indicate the cultivated species

No	Scientific name	Family name	Ln (Koorete and Oromiffa)	Pu	Ha	Mo.con	Dis.	Amaro	Gelana	Coll.no GA
1	*Acacia abyssinica* Hochst. ex Benth.	Fabaceae	Wacho adii (Or)	Gu	T	Raw	Fo	X	+	026
2	*Acacia albida* Del. *	Fabaceae	Bate girare (K)	Gu	T	Raw	Cf	+	X	115
3	*Acacia etbaica* Schweinf. *	Fabaceae	Sebunu (K)	Gu	T	Raw	Cf	+	X	064
4	*Acacia mellifera* (Vahl) Benth. *	Fabaceae	Tsurura (K)	Gu	T	Raw	Cf	+	X	063
5	*Acacia senegal* L. *	Fabaceae	Chiewe (K)	Gu	T	Raw	Cf	+	+	150
6	*Acacia seyal* Del. *	Fabaceae	Shema (Or)	Gu	T	Raw	Cf	X	+	192
7	*Acacia tortilis* (Forssk) Hayne*	Fabaceae	Mutse (Or)	Gu	T	Raw	Cf	X	+	102
8	*Acanthus sennii* Chiov.	Acanthaceae	Ankula (K)	Fr	Sh	Raw	Fo	+	X	114
9	*Acokanthera schimperi* (A.DC.) Schweinf.	Apocynaceae	Wato (K)	Fr	Sh	Raw	Fo	+	+	219
10	*Amaranthus caudatus* L. *	Amaranthaceae	.....	Se, L	H	Cooked	Cf	+	+	094
11	*Amaranthus dubius* Thell. *	Amaranthaceae	Rafu (Or)	Se, L	H	Cooked	Cf	X	+	117
12	*Amaranthus spinosus* L. *	Amaranthaceae	Rafu (Or)	Fr, L	H	Cooked	Cf	X	+	103
13	*Arisaema schimperianum* Schott	Araceae	Sise (K)	Rt	H	Cooked	Fo	+	X	060
14	*Asparagus africanus* Lam.	Asparagaceae	Serity (K)	Fr	Sh	Raw	Fo	+	X	059
15	*Balanites aegyptiaca* (L.) Del. *	Balanitaceae	Bedeno (K)	Fr	T	Raw	Cf	+	X	119
16	*Barleria quadrispina* Lindau*	Acanthaceae	Tsetselko (K)	Fr	Sh	Raw	Cf	+	X	155
17	*Berchemia discolor* (Klotzsch) Hemsl.	Rhamnaceae	Jajjabaa (Or)	Fr	H	Raw	Fo	X	+	028
18	*Capparis tomentosa* Lam.	Capparidaceae	Kufo (K)	Fr	Sh	Raw	Fo	+	X	198
19	*Cardamine trichocarpa* A. Rich. *	Brassicaceae	.....	L	H	Cooked	Cf	+	+	157
20	*Carissa spinarum* L.	Apocynaceae	Agamsa (K)	Fr	Sh	Raw	Fo	+	+	067
21	*Cleome gynandra* L. *	Capparidaceae	Shemuda (K)	L	H	Cooked	Cf	+	+	030
22	*Clerodendrum myricoides* (Hochst)	Lamiaceae	Shochegufe (K)	Fr	Sh	Cooked	Fo	+	X	205

	Vatke									
23	*Coccinia abyssinica* (Lam.) Cogn. *	Cucurbitaceae	Tikure duba (K)	Fr	Cl	Cooked	Hg	+	+	001
24	*Commelina latifolia* Hochst.ex A. Rich.	Commelinaceae	.....	L	H	Raw	Fo	+	X	121
25	*Cordia africana* Lam.	Boraginaceae	Bola (K), Wodessa (Or)	Fr	T	Raw	Fo	+	+	055
26	*Cordia monoica* Roxb.	Boraginaceae	Madeda (K)	Fr	T	Raw	Fo	+	X	159
27	*Datura stramonium* L. *	Solanaceae	Kobo (K), Qobo churuko (Or)	Fn	H	Raw	Cf	+	+	162
28	*Dovyalis abyssinica* (A.Rich) Warb	Flacourtiaceae	.....	Fr	Sh	Raw	Fo	+	+	126
29	*Ehretia cymosa* Thonn.	Boraginaceae	Ulaga (K)	Fr	Sh	Raw	Fo	+	+	099
30	*Embelia schimperi* Vatke	Myrsinaceae	Aserko (K), Enkoko (Or)	Se	Sh	Raw	Fo	+	+	217
31	*Englerina woodfordioides* (Schweinf.)	Loranthaceae	Telkokamo (K)	Fr	Sh	Raw	Fo	+	+	215
32	*Euclea racemosa* Murr.	Ebenaceae	Miessa (Or)	Fr	Sh	Raw	Fo	X	+	164
33	*Ficus ingens* (*Miq.*) Miq. *	Moraceae	.....	Fr	T	Raw	Cf	X	+	166
34	*Ficus sur* Forssk.	Moraceae	Bobo (K)	Fr	T	Raw	Fo	+	+	224
35	*Ficus sycomorus* L.	Moraceae	Odaa (K)	Gu	T	Raw	Fo	+	+	111
36	*Ficus vasta* Forssk.	Moraceae	Gahee (K)	Gu	T	Raw	Fo	+	+	167
37	*Flacourtia indica* (Burm.f).Merr.	Flacourtiaceae	Hagela (Or)	Fr	Sh	Raw	Fo	+	+	052
38	*Grewia bicolor* Juss. *	Tiliaceae	Benine (K), Haroresa (Or)	Fr	Sh	Raw	Cf	+	+	033
39	*Grewia erythraea* Schweinf. *	Tiliaceae	Benine (K)	Fr	Sh	Raw	Cf	+	X	168
40	*Grewia ferruginea* Hochst ex A.Rich	Tiliaceae	Benine (K), Haroresa (Or)	Fr	Sh	Raw	Fo	+	+	254
41	*Grewia mollis* Juss.	Tiliaceae	.....	Fr	Sh	Raw	Fo	X	+	169
42	*Grewia villosa* Willd. *	Tiliaceae	Andereko (K), Ogomdie (Or)	Fr	Sh	Raw	Cf	+	+	071

43	*Hypoestes forskolii* (Vahil.) R.Br. *	Anacardiaceae	Gichigela (K)	L	H	Raw	Cf	+	X	256
44	*Lantana camara* L. *	Verbenaceae	Hamarreessa (Or)	Fr	H	Raw	Cf	X	+	250
45	*Lantana trifolia* L.	Verbenaceae	Kefakosa (K), Hantite (Or)	Fr	H	Raw	Fo	+	+	249
46	*Maesa lanceolata* Forssk.	Myrsinaceae	Gecha (Or)	Fr	T	Raw	Fo	X	+	174
47	*Moringa stenopetala* (Bak. f.) Cufed. *	Moringaceae	Haleko (K)	L	T	Cooked	Cf	+	X	133
48	*Myrsine africana* L.	Myrsinaceae	Eurch (K)	Fr	Sh	Raw	Fo	+	X	090
49	*Ocimum americanum* L. *	Lamiaceae	Dikito (K)	Wp	H	Raw	Hg	+	X	035
50	*Opuntia ficus indica* (L.) Millere*	Cactaceae	Akre (K)	Fr	Sh	Raw	Cf	+	X	245
51	*Osyris quadripartita* Salzm.ex Decn.	Santalaceae	Wato (K)	Fr	Sh	Raw	Fo	+	X	089
52	*Pavetta oliveriana* Hiern	Rubiaceae	Tolkokamo (K)	Fr	Sh	Raw	Fo	+	X	243
53	*Phoenix reclinata* Jacq.	Arecaceae	Ele (K), Metti (Or)	Fr	T	Raw	Fo	+	+	179
54	*Physalis lagascae* Roem. and Schult. *	Solanaceae	Kurpakurpo (K)	Fr	H	Raw	Cf	+	X	036
55	*Physalis peruviana* L.	Solanaceae	Yeferenje timatime (Or)	Fr	H	Raw	Fo	X	+	036
56	*Premna schimperi* Engl.	Lamiaceae	Gellelo (K)	Fr	Sh	Raw	Fo	X	+	047
57	*Psydrax schimperiana* (A.Rich.) Bridson	Rubiaceae	Gellelo (Or)	Fr	Sh	Raw	Fo	+	X	231
58	*Raphanus raphanistrum**	Brassicaceae	Yewef gomen (Or)	Fr	H	Cooked	Cf	X	+	037
59	*Rhamnus prinoides* L'Herit.	Rhamnaceae	Gesho (Or)	Fr	T	Raw	Fo	+	X	181
60	*Rhus glutinosa* A. Rich.	Anacardiaceae	Zergete (K), xaaxxessaa (Or)	Fr	Sh	Raw	Fo	+	+	183
61	*Rhus natalensis* Berah. ex. Krauss	Anacardiaceae	Tsisano (K)	Fr	Sh	Raw	Fo	+	+	140
62	*Rhus vulgaris* Meikle	Anacardiaceae	Kimo (Or)	Fr	Sh	Raw	Fo	+	+	184
63	*Ricinus communis* L.	Euphorbiaceae	Tsema (Or)	Fr	Sh	Raw	Fo	+	+	086
64	*Rosa abyssinica* Lindley	Rosaceae	Gorra (K)	Fr	Sh	Raw	Fo	+	+	016

65	*Rubus apetalus poir.*	Rosaceae	Yedega enjory (K)	Fr	Sh	Raw	Fo	+	+	077
66	*Rubus steudneri* schweinf	Rosaceae	Gorra (K)	Fr	Sh	Raw	Fo	+	+	045
67	*Rubus volkensis* Engl.	Rosaceae	Dhangagoo (Or)	Wp	Sh	Raw	Fo	+	+	107
68	*Rumex abyssinicus* Jacq.	Polygonaceae	Enbacho (Or)	Rt	H	Raw	Fo	X	+	148
69	*Rumex nervosus* Vahl	Polygonaceae	.....	Wp	H	Raw	Fo	+	+	232
70	*Senna occidentalis* (L.)	Fabaceae	Gelese (K)	Fr	Sh	Raw	Fo	+	X	015
71	*Senna petersiana* (Bolle.) Lock	Fabaceae	Zoyra (K)	Fr	Sh	Raw	Fo	+	X	238
72	*Solanum nigrum* L. *	Solanaceae	Adua (Or)	L	H	Cooked	Hg	X	+	142
73	*Syzygium guineense* (Wild) DC. *Subsp afromontanum*	Myrtaceae	.....	Fr	T	Raw	Fo	+	+	011
74	*Syzygium guineense* (Wild) DC. *Subsp macrocarpum*(Engl.) F. White	Myrtaceae	Oche (K)	Fr	T	Raw	Fo	+	+	083
75	*Syzygium guineense* (Willd.) DC. subsp. *guineense*	Myrtaceae	Oche (K)	Fr	T	Raw	Fo	+	X	043
76	*Tamarindus indica* L.	Fabaceae	Yebereha lomi (K), Roqa (Or)	Fr	T	Raw	Fo	+	+	014
77	*Urtica simensis* Steudel	Urticaceae	.....	L	H	Raw	Fo	+	+	040
78	*Ximenia americana* L.	Olacaceae	Huda (Or)	Fr	T	Raw	Fo	+	+	236
79	*Ziziphus mucronata* Willd.	Rhamnaceae	Wekerura (K)	Fr	Sh	Raw	Fo	+	+	146
80	*Ziziphus spina-christi* (L.) *	Rhamnaceae	Kurqura (K)	Fr	Sh	Raw	Cf	+	+	012

Appendix 14. Food plants used as traditional medicine in Amaro and Gelana districts

No	**Scientific name**	**Family**	**Habit**
1	*Acacia mellifera* (Vahl) Benth.	Fabaceae	T
2	*Acokanthera schimperi* (A.DC.) Schweinf.	Apocynaceae	Sh
3	*Balanites aegyptiaca* (L.) Del.	Balanitaceae	T
4	*Carissa spinarum* L.	Apocynaceae	Sh
5	*Clerodenrum myricoides* (Hochst) R.Br.ex	Lamiaceae	Sh
6	*Commelina latifolia* Hochst.	Commelinaceae	H
7	*Cordia africana* Lam.	Boraginaceae	T
8	*Cordia monoica* RoXb.	Boraginaceae	T
9	*Datura stramonium* L.	Solanaceae	H
10	*Ehretia cymosa* Thonn.	Boraginaceae	Sh
11	*Euclea racemosa* Murr	Ebenaceae	Sh
12	*Ficus vasta* Forssk.	Moraceae	T
13	*Maesa lanceolata* Forssk.	Myrsinaceae	T
14	*Moringa stenopetala* (Bak. f.) Cufed.	Moringaceae	T
15	*Rhus glutinosa* A. Rich.	Anacardiaceae	Sh
16	*Rhus natalensis* Berah. ex. Krauss	Anacardiaceae	Sh
17	*Rumex abyssinicus* Jacq.	Polygonaceae	H
18	*Rumexnervosus* Vahl.	Polygonaceae	H
19	*Senna occidentalis* (L.)	Fabaceae	Sh
20	*Tamarindus indica* L.	Fabaceae	T
21	*Ximenia americana* L.	Olacaceae	T

Appendix 15. Food plants used as traditional medicine in Amaro District. Habit (Ha.): Herb (H); Shrub (Sh); Tree (T); Climber (Cl); used for (Uf): Human (Hu); Livestock (Li); Parts used (Pu) (Bark, Ba; Latex, La; Root, R; Leaf, L; Fruit, Fu.; Flower, F.; Seed, Se.; Stem, S.; Bulb, Bu.; Above ground, Ag; Whole plant, Wp.). MRPA=mode of remedy preparation and application (1= Crush, homogenize with cold water and drink; 2= Extract the juice/oil/latex and pour or paint it; 3=Crushed and put on the freshly crushed part; 4= Grind and paint the powder or crushed part; 5= Eat the part; 6= Hold with teeth; 7= Crush, heat/ burn or boil the part and inhale its smoke or steam)

Scientific name	Family	Habit	Uf	Pu	At	MRPA
Acacia mellifera (Vahl) Benth.	Fabaceae	T	Ls	R, L	Snake bite	1
Acokanthera schimperi (A.DC.) Schweinf.	Apocynaceae	Sh	Hu	Fr	Insect allergy	3
Balaintes aegyptiaca (L.) Del.	Balanitaceae	T	Ls	Ba	Eye disease	3
Carissa spinarum L.	Apocynaceae	Sh	Hu	Fr	Intestinal parasite	5
Clerodenrum myricoides (Hochst) R.Br.ex	Lamiaceae	Sh	Hu	La	Ring worms	2
Commelina latifolia Hochst.	Commelinaceae	H	Hu	St	Toothache	6
Cordia africana Lam.	Boraginaceae	T	Hu	L	Wound	2
			Hu	La	Skin rash	2
Cordia monoica RoXb.	Boraginaceae	T	Ls	L	Wound	3
Datura stramonium L.	Solanaceae	H	Hu	R, L	Wound	4
Ehretia cymosa Thom.	Boraginaceae	Sh	Ls	L	Shivering of cattle	1
Moringa stenopetala (Bakf.) Cufed.	Moringaceae	T	Hu	R	Malaria	1
			Hu	L	Abdominal pain	1
Rumex nervosus Vahl.	Polygonaceae	H	Hu	La	Ringworm	2
Senna occidentalis (L.)	Fabaceae	Sh	Hu	L	Amoeba	1
Tamarindus indica L.	Fabaceae	T	Hu	Fr	Malaria	1
			Hu	Ba	Evil spirit	7

Appendix 16. Food plants used as traditional medicine in Gelana District. Habit (Ha.): Herb (H); Shrub (Sh); Tree (T); Climber (Cl); used for (Uf): Human (Hu); Livestock (Li); Parts used (Pu) (Bark, Ba; Latex, La; Root, R; Leaf, L; Fruit, Fu.; Flower, F.; Seed, Se.; Stem, S.; Bulb, Bu.; Above ground, Ag; Whole plant, Wp.). MRPA=mode of remedy preparation and application (1= Crush, homogenize with cold water and drink; 2= Extract the juice/oil/lateX and pour or paint it; 3= Eat the part; 4= Crush, heat/ burn or boil the part and inhale its smoke or steam)

Species name	Family	Habit	Uf	Pu	At	MRPA
Ehretia cymosa Thonn.	Boraginaceae	Sh	Ls	L	Diarrhea	1
Euclea racemosa Murr	Ebenaceae	Sh	Hu	L	Diarrhea	1
Ficus vasta Forssk.	Moraceae	T	Hu	L	Brest cancer	2
Maesa lanceolata Forssk.	Myrsinaceae	T	Hu	L	Snake bite	1
Rhus glutinosa Hochst.	Anacardiaceae	Sh	Hu	Fr	Liver disease	1
Rhus natalensis Berha. ex Krauss	Anacardiaceae	Sh	Hu	St, L	Earache	4
Rumex abyssinicus Jacq.	Polygonaceae	H	Hu	St, L	Heart faller	3
			Hu	St, L	Gastritis	3
			Hu	R	Ascariasis	3
Ximenia americana (L.)	Olacaceae	T	Hu	L	Skin rash	1
			Hu	L	Tonsillitis	1

Appendix 17. Multipurpose medicinal and wild edible plants in Amaro and Gelana districts BK=beekeping, Bm= Building material, Fw=firewood, Ch=charcoal making, Bm=construction, FM= food and medicinal, BF=beeforage, Fod=fodder, Fe=fencing, Fi=farm implement, De=detergent, Tb=tooth brush, Sp=spice, Ht= household tools, Per= perfume, Fw=firewood, Rc=religious ceremony, Sg= smoking gourds, Cl=cloth, Tl= tanning leather; Absent (X), Present (+).

No	Scientific name	Family	Habit	Use	Amaro	Gelana
1	*Acacia albida* Del.	Fabaceae	T	Ch	+	X
2	*Acacia etbaica* Schweinf.	Fabaceae	T	Bm	+	X
3	*Acacia mellifera* (Vahl) Benth.	Fabaceae	T	Bm	+	X
4	*Acacia senegal* L.	Fabaceae	T	Ch	+	X
5	*Acacia seyal* Del.	Fabaceae	T	Fw	+	X
6	*Acacia tortilis* (Forssk) Hayne	Fabaceae	T	Bm	+	X
7	*Acokanthera schimperi* (A.DC.) Schweinf. (Wi. and Med)	Apocynaceae	Sh	FM	+	X
8	*Agave sisalana* Perrine ex Engel.	Agavaceae	T	Fi	+	X
9	*Balanites aegyptiaca* (L.) Del.	Balanitaceae	T	Bm	+	X
10	*Barleria quadrispina* Lindau	Acanthaceae	Sh	Bf	+	X
11	*Bersama abyssinica* Fresen.	Melianthaceae	T	Bm	X	+
12	*Brassica carinata* A.Br.	Brassicaceae	H	De	+	X
13	*Brassica nigra* (L). Koch.	Brassicaceae	H	Sp	X	+
14	*Calpurnia aurea* (Ait.).Benth	Fabaceae	Sh	Bm	+	X
15	*Carica papaya* L.	Caricaceae	T	De	X	+
16	*Carissa spinarum* L. (Wi. and Med)	Apocynaceae	Sh	FM	+	X
17	*Clerodendrum myricoides (*Hochst) Vatke	Lamiaceae	Sh	Tb	+	X
18	*Commelina latifolia* Hochst. (Wi. and Med)	Commelinaceae	H	FM	+	X
19	*Cordia africana* Lam.	Boraginaceae	T	Ht	+	X
20	*Cordia monoica* Roxb.	Boraginaceae	T	FM	+	X
21	*Datura strmonium* L. (Wi. and Med)	Solanaceae	H	FM	+	X
22	*Dichrostachys cinerea* (L.) Wight and Arn.	Fabaceae	T.	Bf	+	X
23	*Dodonaea angustifolia* L. f.	Sapindaceae	Sh	Bm	+	X
24	*Dombeya torrida* (J. F. Gmel.) P. Bamps	Sterculiaceae	Sh	Sg	+	X
25	*Dovyalis abyssinica* (A. Rich.) Warb.	Flacourtiaceae	Sh	Bf	+	X
26	*Ehretia cymosa* Thonn.	Boraginaceae	Sh	Bm	+	X
27	*Entada abyssinica* Steud.ex A.Rich.	Fabaceae	T	Bm	+	X
28	*Eritryna brucie* Schweinf.	Fabaceae	T	Bm	+	X
29	*Eucalyptus globulus* Labill.	Myrtaceae	T	Fw	X	+

30	*Euclea racemosa* Murr.	Ebenaceae	Sh	Bm	+	X
31	*Euphorbia tirucalli* L.	Euphorbiaceae	Sh	Tb	X	+
32	*Ficus sur* Forssk.	Moraceae	T	Fi	+	X
33	*Ficus sycomorus* L.	Moraceae	T	Bf	+	X
34	*Ficus vasta* Forssk.	Moraceae	T	Bf	+	X
35	*Foeniculum vulgare* Mill.	Apiaceae	H	Per	+	X
36	*Gossipum barbdense* L.	Malvaceae	H	Cl	+	X
37	*Grewia ferruginea* Hochst ex A. Rich	Tiliaceae	Sh	Bm	+	X
38	*Guizotia scabra* (Vis.) Chiov.	Asteraceae	H	Bf	X	+
39	*Hagenia abyssinica* (Brace) J.F.Gmel.	Rosaceae	T	Ht	+	X
40	*Lepidium sativum* L.	Brassicaceae	H	Rc	+	X
41	*Lippia adoensis* Hochst ex.Walp.	Verbenaceae	Sh	Foo	+	X
42	*Maesa lanceolata* Forssk. (Wi. and Med)	Myrsinaceae	T	FM	+	X
43	*Millettia ferruginea* (Hochest) Bak.	Fabaceae	T	Ht	+	X
44	*Moringa spenopetala* (Bak. f.) Cufed. (Wi. and Med)	Moringaceae	T	FM	X	+
45	*Myrica salicifolia* Hochst ex A. Rich	Myricaceae	T	Ht	+	X
46	*Myrsine africana* L.	Myrsinaceae	Sh	Bm	+	X
47	*Ocimum americanum* L.	Lamiaceae	H	Sp	+	X
48	*Olinia rochetiana* A. Juss	Olinaceae	T	Tb	+	X
49	*Osyris quadripartita* Decn.	Santalaceae	Sh	Bm	+	X
50	*Phoenix reclinata* Jacq.	Arecaceae	T	Tb	+	X
51	*Prunus africana* (Hokk. f.) Kalkm.	Rosaceae	T	Bm	X	+
52	*Rhus glutinosa* A. Rich. (Wi. and Med)	Anacardiaceae	Sh	FM	+	X
53	*Rhus natalensis* Berah. ex. Krauss (Wi. and Med)	Anacardiaceae	Sh	FM	+	X
54	*Rosa abyssinica* Lindley	Rosaceae	Sh	Bf	+	X
55	*Rumex abyssinicus* Jacq. (Wi. and Med)	Polygonaceae	H	FM	+	X
56	*Rumex nervosus* Vahl. (Wi. and Med)	Polygonaceae	H	FM	+	X
57	*Senna occidentalis* (L.) (Wi. and Med)	Fabaceae	Sh	FM	+	X
58	*Solanum incanum* L.	Solanaceae	Sh	Tl	+	X
59	*Tamarindus indica* L. (Wi. and Med)	Fabaceae	T	FM	+	X
60	*Terminalia macroptera* Guill. and Perr.	Combretaceae	T	Fi	+	X
61	*Toddalia asiatica* (L.) Lam.	Rutaceae	T	Ch	X	+
62	*Ximenia americana* L. (Wi. and Med)	Olacaceae	T	FM	+	X
63	*Ziziphus mucronata* Willd.	Rhamnaceae	Sh	Bm	+	X

Appendix 18. Socio-demography of the informants in Amaro District

		Age		Sex		Educational level		Informants category		Total
		18_30	>30	M	F	Lit	Ilit	Key	General	
Age	18_30			43	44	37	50	8	79	87
	>30			77	64	54	87	64	77	141
Sex	M	43	77			57	63	36	84	120
	F	44	64			34	50	36	48	108
Educational level	Lit	37	54	57	34			29	62	91
	Ilit	50	87	63	50			43	70	137
Informant category	Key	8	64	36	36	29	43			72
	General	79	77	84	48	62	70			156
Total		87	141	120	108	91	137	72	156	228

Appendix 19. Socio-demography of the informants in Gelana District

		Age		Sex		Educational level		Informants category		Total
		18_30	>30	M	F	Lit	Ilit	Key	General	
Age	18_30			28	26	20	34	12	42	54
	>30			52	46	38	60	36	62	98
Sex	M	28	52			36	40	24	52	80
	F	26	46			22	34	24	32	72
Educational level	Lit	20	38	36	22			18	40	58
	Ilit	34	60	40	34			30	44	94
Informant category	Key	12	36	24	24	18	30			48
	General	42	62	52	32	40	44			104
Total		54	98	80	72	58	94	48	104	152