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Dryland Biodiversity Stream

Ethnobotanical Study of Traditional Medicinal Plants of Goma Wereda, Jima Zone of Oromia Region, Ethiopia

By Behailu Etana

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Addis Ababa

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A THESIS SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN BIOLOGY (DRYLAND BIODIVERSITY)

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ABSTRACT

An ethnobotanical study of medicinal plants was conducted to document the indigenous plant-based medical knowledge of the people of Goma Wereda in southwestern Ethiopia from September, 2009 to May, 2010. A total of 100 informants (73 males and 27 females) between the ages of 20 and 80 were selected to collect information on medicinal plant use from ten sampled kebeles. Out of these, 24 key informants (22 males and 2 females) were purposively selected based on recommendation from elders and local authorities. Other informants were selected randomly. Data were collected using semi-structured interviews, field observations and group discussions. Informant consensus, preference ranking, paired comparison, direct matrix ranking, informant consensus factor (ICF) and Jaccard's coefficient of similarity were calculated. A total of 160 plant species: 101 species from wild vegetation and 59 species from home gardens distributed in 124 genera and 58 families were collected and identified. Of these, 121 medicinal plant species were used as cure for 102 ailments. From these, 92 species were recorded for the treatment of human health problems, 12 species for livestock and 17 species for the treatment of both human and livestock. From the total medicinal plants species 54 species of the medicinal plants were herbs, followed by 30 species of shrubs, 26 species of trees and 11 species of climbers. The most frequently used plant parts were leaves (61.66%) followed by roots (13.33%). The most widely used method of preparation was crushing (26.80%) of the different plant parts followed by squeezing (22.68 %) and burning (7.21%). The common route of administration recorded was oral (52.01%) followed by dermal (28.52%) and nasal (8.3 %). The most commonly used application of medicinal plant was drinking (43.37%) followed by painting (10.84%) and put on and washing accounted for 10.84% each. The medicinal plants that are presumed to be effective in treating certain diseases such as Ocimum lamiifolium and Croton macrostachyus have high informant consensus. The disease categories such as rheumatism and stabbing pain as well as the categories of evil eye and evil spirit have higher ICF value of 0.907. Preference ranking showed that people of the area have preference for Acmella caulirhiza for the treatment of tonsillitis. Paired comparison of five species of plants that are used for the same disease showed that Indigofera spicata is the most preferred species by traditional healers for the treatment of insect allergy ('Hadha'). Direct matrix ranking showed Cordia africana as the most utilized species by the community. Agricultural expansion, firewood collection, timber production and construction are major threats to plants in general and medicinal plants in particular in the study area. The participation of the local people, awareness raising through training or education on sustainable utilization and management of plant resources, establishment of forest protected areas should be encouraged.

***Key words*: Ethiopia, Ethnobotany, Goma. homegardens, informant consensus factor**

1. INTRODUCTION

1.1 Background of the Study

Ethnobotany is defined as the study of local people's interaction with the natural environment: how they classify, manage and use plants available around them (Martin, 1995). Over centuries, indigenous people have developed their own locality specific knowledge on plant use, management and conservation (Cotton, 1996). The complex knowledge, beliefs and practices generally known as indigenous knowledge or traditional knowledge develops and changes with time and space, with change of resources and culture. To view this ethnobotanical studies are useful in documenting, analyzing and disseminating knowledge and interaction between biodiversity and human society, how diversity in nature is used and influenced by human activities (Martin, 1995).

Local communities have indigenous experience in categorizations, where they use their perceptions and experiences to categorize plants. From their experience, a number of categorization and classification criteria were developed which is important in plant diversity conservation and management. The common criteria here include plant use, habitat, life form, colour, abundance, morphological characteristics and combinations (Martin, 1995; Cotton, 1996).

Moreover, the use of plants in medicinal sector by local people over the past period takes a huge concern as they have long year’s lineage of utilization and management. This has been achieved through many generations of age old, time-tested practices, and as a consequent accumulation of knowledge through a series of observations, interactions and innovations (Cunningham, 1996).

In Ethiopia, though there has been some organized ethnomedicinal studies, there is limited development of therapeutic products and the indigenous knowledge on usage of medicinal plants as folk remedies are getting lost owing to migration from rural to urban areas, industrialization, rapid loss of natural habitats and changes in life style. In addition, there is a lack of ethnobotanical survey carried out in most parts of the country. In Ethiopia, traditional medicine is faced with a problem of sustainability and continuity mainly due to the loss of taxa of medicinal plants (Ensermu Kelbessa *et al.*, 1992). In view of these, documentation of the traditional uses of medicinal plants is an urgent matter and important to preserve the knowledge (Tilahun Teklehaymanot and Mirutse Giday, 2007). According to Ermias Lulekal *et al.* (2008), the current loss of medicinal plants in the country due to natural and anthropogenic factors links with the loss

of valuable indigenous knowledge associated with the plants. Hence, there exists an accelerated devastation of plant resources with loss of indigenous knowledge.

The lack of conservation actions and activities is observed in Goma Wereda, as is the case in many other areas in Ethiopia. Even though the Wereda is known to have a relatively better plant resource (ILRI, 2007) and hence, the associated traditional knowledge resource is expected to be significant. The current plant use trend shows that the environment is facing problems of resource depletion and loss of indigenous knowledge like other areas of the country. Thus, concerted ethnobotanical research plays a vital role to draw information on plants associated with indigenous knowledge for conservation and sustainable utilization. In addition, right from its beginning, the documentation of traditional knowledge, especially on the medicinal uses of plants, has provided many important drugs of modern day (Balick and Cox, 1996). It was also emphasized that if one is interested in taking a phytochemical approach in ones field work, referring to the chemical and ethnopharmacological literature to discover the existing knowledge about the various species of plants in ones ethnobotanical inventory will avoid wasting time and money unnecessarily (Martin, 1995).

Among rural communities in Goma Wereda, as would be the case elsewhere, traditional medication is believed to be an important healthcare system, which mainly involves the use of locally available medicinal plants. Recently, some studies were done on some localities of Ethiopia. For example, Mirgissa Kaba (1998); Mirutse Giday (1999); Debela Hunde (2001); Endalew Amenu (2007); Etana Tolasa (2007); Fisseha Mesfin (2007); Haile Yineger and Delenasaw Yewhalaw (2007); Tilahun Teklehaymanot and Mirutse Giday (2007); Ermias Lulekal *et al*., (2008); Haile Yineger *et al.,* (2008); Seyoum Getaneh (2009); Zewdie Kassa (2009) and others more. Nevertheless, no study was done to include medicinal plants and indigenous knowledge of the local communities of Goma Wereda in the medicinal records of Ethiopia. This study is believed to add up to the country database of medicinal plants and in documenting local knowledge of the people.

This study has been initiated to conduct ethnobotanical study of medicinal plants in Goma Wereda and to compile and document indigenous plant based medical knowledge of the people.

1.2 Objectives

1.2.1 General objective

- To conduct ethnobotanical study of traditional medicinal plants in Goma Wereda, Jima Zone of Oromia Region, southwestern Ethiopia; and to compile and document indigenous plant based medical knowledge of the people.

1.2.2 Specific objectives

The specific objectives of the study were:

- To identify plant species used for medicinal purposes in treating human and livestock health problems in Goma Wereda;
- To gather, record, and document indigenous knowledge of the people on medicinal plants in the study area;
- To identify plant parts used to treat diseases, method of preparation and route of administration as implemented by the local people in Goma Wereda;
- To assess the role of traditional practices and indigenous knowledge in maintaining medically important plant species; and
- To find out the threats and local methods used by indigenous people to conserve medicinal plants.

2. LITERATURE REVIEW

2.1 Origin and Development of Ethnobotanical Study

John Harshberger in 1895 brought up the term ethnobotany for the first time (Harshberger, 1896; cited in Cotton, 1996). He defined ethnobotany as “the use of plants by aboriginal people". Martin (1995) broadly defined ethnobotany as the subject dealing with the study of direct interactions between humans and plants. Balick and Cox (1996) included the use of plants as food, medicinal, forage and for any other economic purpose within field of ethnobotany. According to Cotton (1996), ethnobotany encompasses all studies that concern the mutual relationships between plants and traditional people.

As stated by Martin (1995) to achieve more detailed and reliable information of plants and plant use, ethnobotanical study needs involvement of specialists from various disciplines, such as plant taxonomists, plant ecologists, anthropologists, linguists, economic botanists, pharmacologists and others. With such interdisciplinary and multidisciplinary approaches, ethnobotany is aimed at gathering and documenting indigenous botanical knowledge, cultural practice, use and management of botanical resources and discovers benefits from plants. Ethnobotanical studies are often significant in revealing locally important plant species especially for the discovery of drugs.

2.2 Indigenous Knowledge and Medicinal Plants

Indigenous knowledge refers to the accumulation of knowledge, rule, standards, skills, and mental sets, which are possessed by local people in a particular area (Quanash, 1998). It is the result of many generations’ long years’ experiences, careful observations and trial and error experiments (Martin, 1995). Traditional people around the world possess unique knowledge of plant resources on which they depend for food, medicine and general utility including tremendous botanical expertise (Martin, 1995). Over centuries, indigenous people of different localities have developed their own specific knowledge on plant resource use, management and conservation (Cotton, 1996).

Systematic application of indigenous knowledge is important for sustainable use of resources and sustainable development (Thomas, 1995). Various animal and mineral products contribute to human welfare; the plant kingdom is most essential to human well being especially in supplying basic human needs. Since ancient times, human beings used plants for the purpose of disease

control and prevention. It was believed to be the result of many generations long year's experiences, careful observations and trial and error experiments that early humans acquired the knowledge on the utilization of plants for disease prevention and curative purposes (Sofowora, 1982; Martin, 1995). So, the knowledge and application of traditional medicine is one of the widely used indigenous knowledge systems. This implies that humans are dependent on other organisms for their life. This close interaction and dependency of humans on plants is studied under the field of ethnobotany. Such knowledge, known as ethnomedicinal knowledge involves traditional diagnosis, collection of raw materials, preparation of remedies and its prescription to the patients. The documentation of traditional knowledge, especially on the medicinal uses of plants, has provided many important drugs of modern day (Balick and Cox, 1996).

Indigenous knowledge on remedies in many countries including Ethiopia, passes from one generation to the other generation verbally with great secrecy. Such secrete makes indigenous knowledge or ethnomedicinal knowledge vulnerable to distortion and in most cases, some of the lore is lost at each point of transfer; hence, there is a need for systematic documentation of such useful knowledge through ethnobotanical research.

2.3 The Role of Medicinal Plants

According to Fassil Kibebew (2001), about 75-90 % of the rural population in the world (excluding western countries) relies on traditional medicines as their only healthcare system. The majority of the population in developing countries (for instance, 80% of the population in Africa) primarily rely on traditional medicinal plants for their healthcare (WHO, 2002). In northern Ethiopia, the major portion (87%) of the parts used in traditional medicine come from plant sources, while animal parts and minerals contribute only a small supply (Dawit Abebe and Ahadu Ayehu, 1993). More than 35,000 plant species are being used around the world for medicinal purposes (Lewington, 1993) and, in Ethiopia there are 800 or more plant species employed as medicinal agents (Tesema Tanto *et al.*, 2002); which according to the data base of the National Herbarium has grown to 1000 and more will be added to the list as new studies bring as new medicinal plants from various cultures.

Traditional medicine remains the main resource for a large majority (80%) of the people in Ethiopia to treat their illnesses and maintain their health and a traditional medical consultancy including the consumption of the medicinal plants has a much lower cost than modern medical

attention (Asfaw Debela *et al.*, 1999). However, this is not only because of poverty where people cannot afford to buy expensive modern drugs, but traditional systems are also more culturally acceptable and meet the psychological needs in a way modern medicine does not. So, medicinal plants are the main source of traditional medicine for the rural population and are of high demand in the healthcare systems of this population when compared to modern medicine, ethnomedicine activities need special consideration and back-up (Abbiw, 1996).

Apart from their use in the traditional system of medical care at the local level, medicinal plants are currently used in the production of modern drugs as a source of direct therapeutic agents, as raw materials for the manufacture of complex semi-synthetic compounds and as taxonomic markers in the search for new compounds (WHO, 1998). Most pharmaceutical companies recently have developed mechanisms to involve indigenous people collect plant samples on the recommendation of traditional practitioners. This approach is reported to be more successful than random collection of sample of medicinal plants (Balick and Cox, 1996; Alexiades, 1996; Asfaw Debela *et al.*, 1999).

Medicinal plants have got special attention and regional offices were established by World Health Organization to coordinate basic and applied research activities on medicinal plants (WHO, 1978). This was linked to the establishment to record medicinal plants to improve accessibility and dissemination of information on medicinal plants (Tsige Gebre Mariham and Kaleab Asres, 2001).

2.4 Medicinal Plants in Ethiopia

Plants have played crucial role as a source of traditional medicine in Ethiopia from the time immemorial to combat different ailments and human sufferings (Asfaw Debela *et al.*, 1999). It was the only system available for healthcare prior to the introduction of modern medicine for prevention, diagnosis and treatment of social, mental and physical illness (Dawit Abebe, 1986). To date traditional medicine has become an integral part of the culture of the Ethiopian people due to its long period of practice and existence (Mirgisa Kaba, 1998).

The antiquity of the traditional use of medicinal plants in Ethiopia could never be disregarded (Pankhurst, 1990; Mirutse Giday, 1999). Due to acceptability, accessibility and biomedical benefits there is a large magnitude of use and interest of medicinal plants in Ethiopia (Dawit Abebe, 2001). The long history of use of medicinal plants in Ethiopia is reflected in various

medico- religious manuscripts produced on parchments and believed to have originated several centuries ago (Fassil Kibebew, 2001). Reviews of medical textbooks that have been written in Geez or Arabic between 17th and 18th centuries indicated that the majority of Ethiopians, with the exception of few privileged groups, starting from the time of the Italian occupation, have been depending almost entirely on the traditional medicine (Pankhurst, 1990).

2.4.1 Medicinal plants in human healthcare system

Plant diversity remains crucial for human well-being and still provides a significant number of remedies required in healthcare. Medicinal plants played a pivotal role in the treatment of various afflictions in Ethiopia (Fekadu Fullas, 2007). For the role-played by plant-derived products in human and livestock health, systematic scientific investigation is vital (WHO, 1998). Pharmaceutical industries and western researchers on plant-based drugs have now rediscovered that plants have much to contribute to the discovery of new, effective, safe and profitable therapeutic agents (Pistorius and Van Wiik, 1993). Plants play a major role in providing prototype molecules for possible development into conventional drugs by the pharmaceutical industry (Fekadu Fullas, 2007). However, only small fractions of the world's plants have been investigated scientifically so far, but, human kind has already reaped enormous benefits from it (Farnsworth *et al*., 1985).

2.4.2 Plants in ethnoveterinary medicine

In Ethiopia as well as in most developing countries, animal disease remains one of the principal causes of poor livestock performance, leading to an ever increasing gap between the supply of, and the demand for, livestock products (Teshale Sori *et al*., 2004). Pharmacotherapy is one of the most important means of controlling livestock diseases, but it is possible only if livestock owners can afford to cover the cost of treatments. Cost of treatment is therefore an important determinant of the usefulness of veterinary drugs. Livestock owners cannot rely on veterinary services for control of various important livestock diseases. A practical solution to this problem is to develop socially acceptable and effective remedies from reasonably inexpensive sources that can complement modern medicine (Ibrahim, 1986). The practice of traditional veterinary medicine provides such a short cut.

In Ethiopia people have used traditional veterinary methods to treat livestock diseases for generations. Plants comprise the largest component of the diverse therapeutic elements of

traditional livestock healthcare practices. Herbal medicine is the branch of traditional medical practices that is most amenable to scientific investigation. Plants are also invaluable subjects of international development. Knowledge of medicinal plants can empower livestock owners to solve animal health problems cost-effectively.

2.5 Threats and Conservation of Medicinal Plants in Ethiopia

2.5.1 Threats to traditional medicinal plants

Ethiopia's traditional medicine as elsewhere in Africa is faced with problems of continuity and sustainability (Ensermu Kelbessa *et al.*, 1992). Nowadays herbal practitioners have to walk greater distances for herb collections that once grew in the vicinity of their homes. This is because of availability of plants in general and medicinal plants in particular have been affected by a dramatic decrease in areas of native vegetation (Cunninghum, 1996). The primary causes of this problem are loss of taxa of medicinal plants, loss of habitats of medicinal plants and loss of indigenous knowledge (Ensermu Kelbessa *et al*., 1992). In support of this Mirutse Giday (1999) found out that the practice of using plant remedies by Zay people to treat different ailments has been declining from time to time mainly as a result of continued deforestation in the area. In addition, Zemede Asfaw (2001) argues that medicinal plants are considered to be at conservation risk due to over use and destructive harvesting (roots and barks collection). The problem is further compounded by the fact that traditional knowledge on traditional medicine is also being lost at an alarming rate (Tewolde Berhan Gebre Egziabher, 1991).

There are two sources of threats to medicinal plants, i.e. human-made and natural causes. Rapid increase in population, the need for fuel, urbanization, timber production, over harvesting, destructive harvesting, invasive species, commercialization, honey hurvesting, degradation, agricultural expansion and habitat destruction are human caused threats to medicinal plants. Likewise, natural causes include recurrent drought, bush fire, disease and pest out breaks (Ensermu Kelbessa *et al*., 1992). In addition to this, most of the medicinal plants utilized by Ethiopian people are harvested from wild habitats (Mirutse Giday, 1999). Hence, this aggravates the rate of loss of taxa with related indigenous knowledge and loss of widely occurring medicinal plant species. The consequence is also bad in such a way that, when the plants that have been serving as the raw material for the preparation of different remedies are being destroyed, the traditional practices associated with them would also diminish.

2.5.2 Threats to indigenous knowledge on medicinal plants

Traditional herbal practitioners are important custodians of indigenous knowledge on the utilization of medicinal plants. Moreover, as a result of their experience they are skilled 'botanists' and have a great talent for locating the correct plant among the many plants species found around them. But, many are less cooperative to show their knowledge and skill on traditional medicine to others. According to Pankhurst (1990), the knowledge on medicinal plants and method of use circulated mainly among practitioners and the beneficiaries of such practice. Because of the impact of modern education, increase in health coverage and urbanization, indigenous knowledge and usage of medicinal plants are being lost globally at a fast rate (WHO, 2002). This has made the knowledge and skill on traditional medicinal plants and traditional medicine more hidden and less available to the public (Abbink, 1995). The issue is being even more serious in developing countries where such important information is not recorded in writing but passed on from one generation to the other orally; few are available in written records. To make matters worse, the younger generations of today, unfortunately, often have different ambitions and priorities. As a result, this traditional skill is doomed to be lost even faster than the plants themselves (Sofowora, 1982).

Considering the role-played by plant-derived products in human and livestock health, the effective conservation of medicinal plants and associated indigenous knowledge, needs to be initiated as a matter of urgency.

2.5.3 Conservation of traditional medicinal plants

There are some conservation actions that have been undertaken around the world designed to protect threatened medicinal plants from further damage (Cunninghum, 1996). This includes *in-situ* and *ex-situ* conservation measures. Both *in-situ* and *ex-situ* conservation efforts are implemented to capture medicinal plant genetic resources. *In-situ* conservation is conservation of species in their natural habitat. Some traditional medicinal plants have to be conserved *in-situ* due to difficulty for domestication and management (Zemede Asfaw, 2001). Medicinal plants can also be conserved by ensuring and encouraging their growth in special places, as they have been traditionally (Zemede Asfaw, 2001), this can be possible in places of worship (churches, mosques, grave yards, etc), scared grooves, farm margins, river banks, road sides, live fences of gardens and fields.

2.5.3.1 Conservation of medicinal plants in homegardens

Large concentrations of the useful plants found in Ethiopia are located in homegardens. Homegardens are agricultural spaces that typically contain wide plant diversity, including crops with excellent micronutrient properties. They are usually located close to the homestead; homegardens can accommodate women's food production and household responsibilities (FAO, 2005). The homegarden agroecosystem in Ethiopia maintains a wide range of taxa of perennial and annual crop plants. According to Zemede Asfaw (2001), medicinal plants can be conserved using appropriate conservational methods in gene banks and botanical gardens. This type of conservation of medicinal plants can also be possible in homegardens, as the homegarden is strategic and ideal farming system for the conservation, production and enhancement of medicinal plants. For poor rural people, medicinal plants represent affordable and locally available resources to address many diseases and health problems.

3. DESCRIPTION OF THE STUDY AREA

3.1 Geographic Location

Goma Wereda, is found in Jima Zone, Oromia Regional State, southwestern Ethiopia, that extends between 7^0 40'-8^0 04'N and 36^0 17'-36^0 46' E. It is located 390 km south west of Addis Ababa and about 50 km west of the Jima town. It ranges from an altitude of 1387 to 2870m a.s.l. Most parts of the Wereda lay between 1387 and 1643 m; and 1849 and 2067 m a.s.l. However, some areas of the Wereda have altitudes ranging from 2229 to 2870 m a.s.l. The total area of the Wereda is 96,361.72 ha (963.62 km^2). It is situated in the centre of the Zone bordered with Gumaye Wereda in the north, Limmu Kossa Wereda in the east, Manna Wereda in the southeast, Seka-chokersa in the south and Gera Wereda in the west. Currently, the Wereda undertakes its administrative duties and responsibility in 36 peasant associations and 3 urban centres (Keso-heti, Limmu-shaye and Choche towns). Totally, this Wereda comprises 39 kebeles.

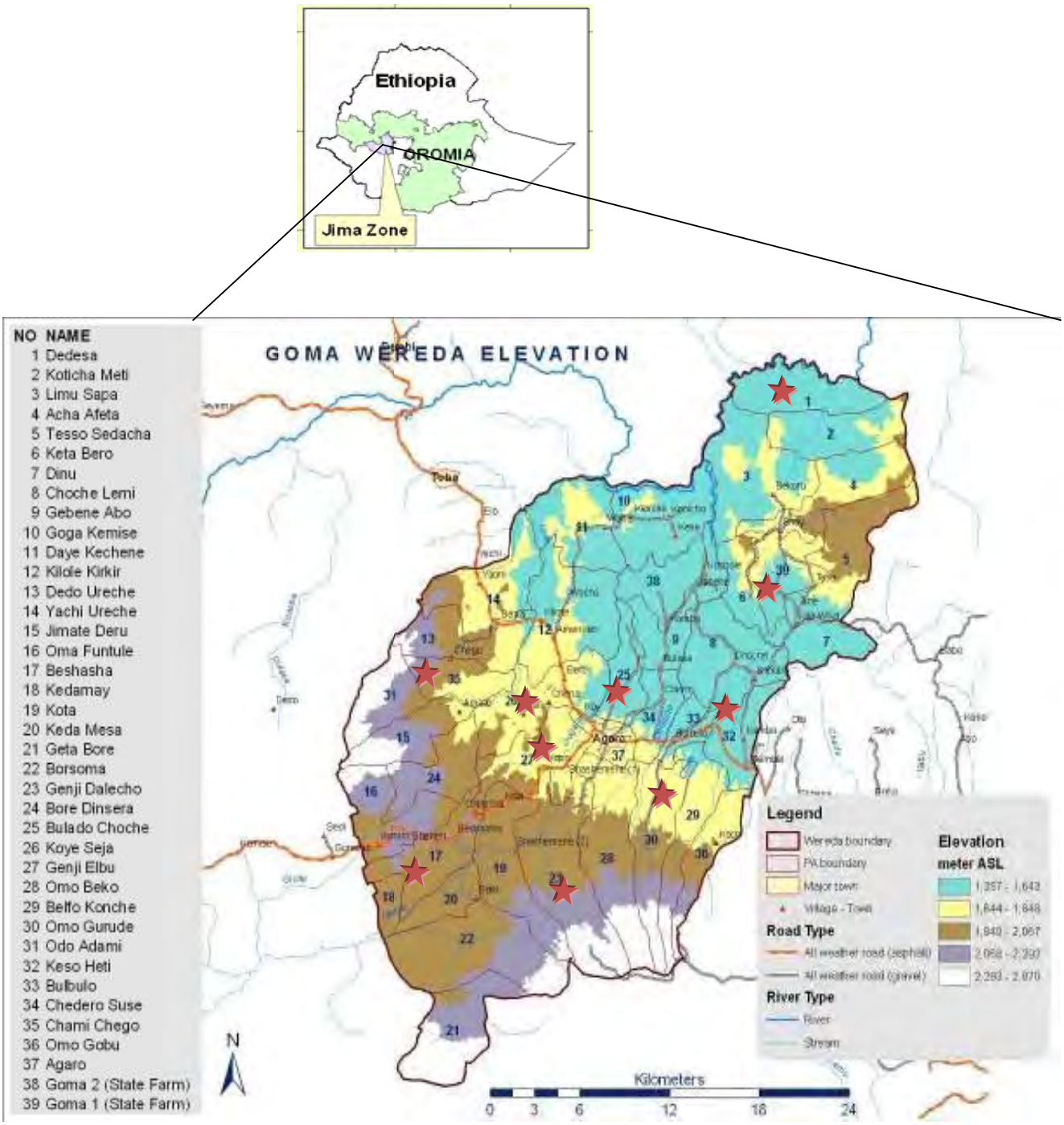

Figure 1 Map of Goma Wereda (Source ILRI, 2007)

Key: With ★s are the ten sampled areas

Lower altitudinal areas (1387-1643 m a.s.l) (Dedesa, Choche, Keso-heti and Bulado-choche)

Medium altitudinal areas (1644-1848 m a.s.l) (Koye-seja, Genji-elbu and Omo-gurude)

Higher altitudinal areas (1850-2870 m a.s.l) (Beshasha, Genji-dalecho and Cami-chego)

3.2 Soils and Drainage

The three dominant soil types in the area are Eutric Vertisols, Humic alisols and Humic Nitosols (ILRI, 2007). Among these soil types, Nitosols is the most abundant covering about 90% of the Wereda. These soils are young soils and are generally acidic soils. However, farmers grow crops that are acid tolerant. The pH of the soils in Goma ranges between 4.5 and 5.5. All the soils types in the area have good agricultural potential (ILRI, 2007).

The topography, vegetation and rainfall pattern in the Wereda encourages the existence of many perennial rivers. The rivers drain to Ghibe/Omo to the east and Dedesa River in the north. Currently there are many small rivers (Didesa, Awetu, Temsa, Colombos, Naso, Dogaja, Melkayida, Chiseche, Loga,) that have been providing an irrigational function under traditional system.

3.3 Climate

Goma Wereda enjoys well distributed annual rainfall. Based on 15 years weather data obtained from National Meteorological Service Agency, it indicates that the average annual rainfall is 1524 mm and in the vast area of the Wereda annual rainfall varies between 1700 - 2100 mm. The annual rainfall variability is very low. All in all, there are about 7 rainfall months in the Wereda. However, rainfall is sometimes received even during the other months. Hence, crop and livestock production is not constrained by the amount and distribution of rainfall as in other parts of the country. Dry spell months in the Wereda are few. Agroecologically, Goma Wereda is classified as 96% wet Weina Dega (wet-midland) and 4% kolla (lowland). The average mean annual temperature of the area is 20.8^0C (Figure 2).

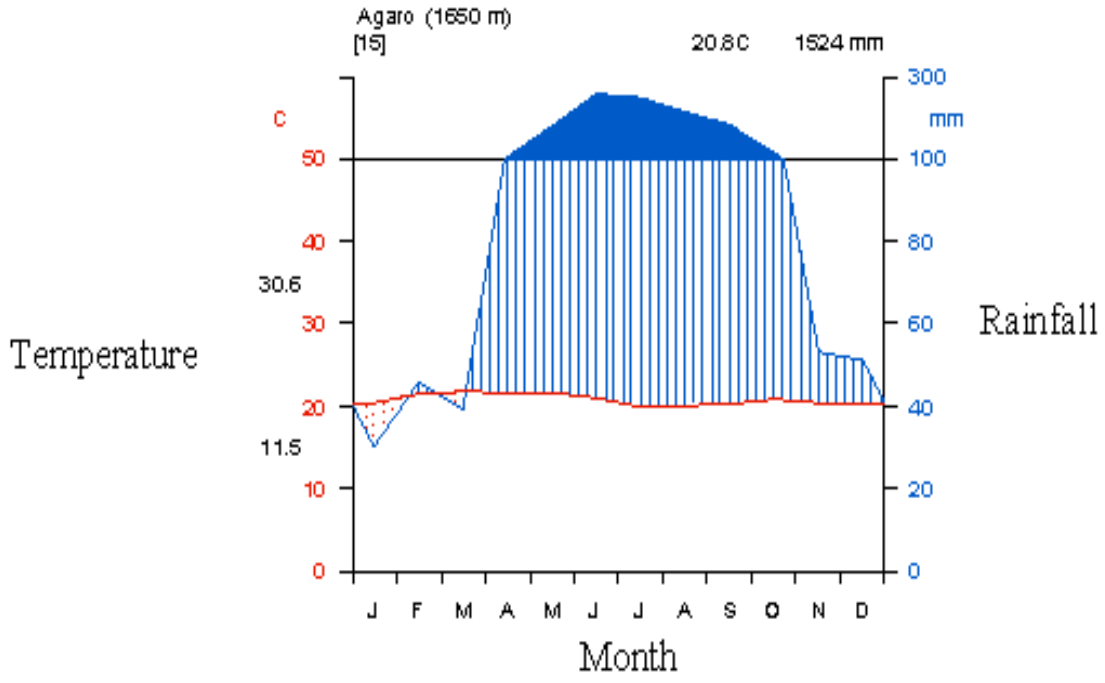

Figure 2 Climadiagram showing rainfall distribution and temperature variation from 1992 – 2007 at Agaro station. (**Data Source:** National Meteorological Service Agency)

3.4 People, Population and Healthcare Status

The total population of the Wereda was 243,376 in 2006/07, of whom 123,354 were men and 120,022 women; 39,663 or 16.3% of its population were urban dwellers. The five largest ethnic groups reported in Goma were Oromo (79.11%), Amhara (7.28%), Dawro (4.2%), Silte (2.6%), and Keficho (2.04%); all other ethnic groups made up 4.77% of the population. Afan oromo was spoken as a first language by 78.78%, 14.22% spoke Amharic, 2.43% Dawro, 1.14% Silte and 1.12% spoke Kefa; the remaining 2.31% spoke all other primary languages. The majority of the inhabitants were Muslim. While the number of rural households in the Wereda is 45,567 (35,533 male and 10,034 female). There are 36 peasant associations and 3 towns' associations (ILRI, 2007).

Historically, the name Goma was derived from the name of local chief called "Goomma" who administered the current area. Goma Wereda is one of the foundation and origin lands of Arabica coffee. One of the coffee biodiversity centre (Choche) in Ethiopia is found in this Wereda. The agroecology of Goma is favourable for coffee production. It is known for predominantly growing

coffee. The life of the people in this Wereda is directly or indirectly connected with coffee production (ILRI, 2007).

According to Goma Wereda Health Office report, the first ten major diseases in the area are: rheumatic pain, upper respiratory tract infection (URTI), malaria, diarrhea, internal parasites, gastritis, eye disease, anaemia, toothache and skin infection respectively. In the Wereda, there is one health centre, eight clinics, two health stations and seven private clinics. The health service given is below the needs of more than two hundred thousand people. These conditions and others force people to be served by traditional health practitioners and traditional means of treatment.

3.5 Livestock

Livestock population is relatively high in Goma Wereda. However, their productivity is very low as in most places in the country. The livestock resources of Goma Wereda 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. Even though there is ample vegetation, including grasses suitable for feeding, the livestock are not in good condition (Goma Wereda Agriculture development office).

According to the same report above, the numbers of livestock in the Wereda include: cattle 105,122; sheep 24,751; goats 11,177; poultry 209,096; mules 2,623; horses 2,030 and donkeys 2,640. In the Wereda, livestock make a substantial contribution to the rural economy. Most rural farming, transport and source of income do directly or indirectly link with them.

The most important animal diseases in Goma Wereda include: bacterial infections (black leg, pastureolosis, anthrax, mastitis, fowl typhoid and avian salmonellosis), endoparasites (fascioliasis, paramphitomiasis, strongyliasis), ectoparasites (ticks, mites, lice and insect flies), viral infections (rabies, african horse sickness AHS, foot and mouth disease) and protozoal infections (trypanosomiasis, babesiasis, coccidiosis) (ILRI, 2007).

3.6 Land Use and Agriculture

The Wereda has a total area of 96,361.72 ha (963.62 km^2) of which 80 % is under cultivation for growing both annual and perennial crops, while 20% of the total land area is occupied by forest and grassland. The general land-uses are given in Table 1. Average land holding of the households is between 0.5 and 1.0 ha (ILRI, 2007).

Table 1 Land resources by use of Goma Wereda (in hectares)

Land under crops			Cultivable land	Uncultivable land	Grazing land	Forest		Fallow land	Settlement	Coffee state farms	Others
Annual	Perennial					Manmade	Natural				
	Coffee	Others									
25,258.9	22,561.82	290.01	7698.25	7400	7850	2296.1	2209.2	100	11,912.72	2704	6080.72
Total area										96,361.72	

Data source: - Goma Wereda Agricultural Development Office

Goma Wereda has an ideal agro-ecology for agriculture such as crop production, livestock rearing and cultivating different annual and perennial plants such as coffee. The major food crops grown in the area are given in Table 2. Mixed farming is a common practice prevailing in the Wereda as a result the livelihood of the rural population is depended on coffee production, crop production and livestock rearing. Priority marketable livestock commodities are: apiculture, small ruminant fattening (mainly sheep), cattle fattening and poultry. Among these livestock commodities, apiculture has been suggested to be very important. There are 2 agro-ecological zones (lowland and highland) and hence crops grown are also diversified.

Table 2 Major Food crops grown in the study area

Crop category	**Scientific name**	**English name**	**Local name (Or.)**
Cereals	*Sorghum bicolor*	Sorghum	Boobee
	Zea mays	Maize	Boqqolloo
	Eragrostis tef	Tef	Xaafii
	Eleusine coracana	Finger millet	Daagussaa
	Hordeum vulgare	Barley	Garbuu
	Triticum aestivum	Wheat	Qamadii
Vegetables	*Capsicum frutescens*	Chili	Barbaree
	Allium cepa	Shallot	Qullubbii
	Lycopersicon esculentum	Tomato	Timaatimii
	Cucurbita pepo	Pumpkin	Buqqee nyaataa
	Allium sativum	Garlic	Qullubbii adii
	Brassica oleracea	Cabbage	Raafuu
Fruits	*Citrus sinensis*	Orange	Burtukaana
	Citrus limon	Lemon	Loomii
	Musa x paradisiaca	Banana	Muuzii
	Mangifera indica	Mango	Maangoo
	Carica papaya	Papaya	Paapaayaa

	Persea americana	Avocado	abukaado
Pulses	*Pisum sativum* *Phaseolus vulgaris* *Vicia faba*	Field peas Haricot beans Horse beans	Atara Adenguare Baaqelaa
Cash crops	*Coffea arabica* *Saccharum officinarum* *Catha edulis*	Coffee Sugar cane Khat	Buna Shonkoraa Caatii
Oil crops	*Linum usitatissimum* *Guizotia abyssinica* *Brassica napus*	Lin seed Niger seed Kale seed	Talbaa Nuugii Sanyii raafuu
Root crop	*Ipomoea batatus*	Sweet potato	Sukaaree

Source: Goma Wereda Agriculture Development Office (2007)

3.7 Vegetation

The major forest tree species in Goma Wereda include *Acacia abyssinica, Albizia gummifera, Albizia schimperiana,Brucea antidysentrica, Cordia africana, Croton macrostachyus, Ficus* species, *Millettia ferruginea*, *Sapium ellipticum, Syzygium guineense, Vernonia* species, and different shrubs and herbs. However, there is very fast encroachment of the forest areas due to high population pressure. Evidence from some reports indicates that the natural resources (vegetation, wildlife and soils) are facing indiscriminate depletion mainly due to expansion of croplands (Regional Government of Oromia, 2003).

It is becoming hard to find large areas under conserved natural forests. Currently, the Wereda has about 2209.2 ha of natural forest and 2296.1 ha of human made forest cover (GDFED, 2009). These vegetation covers represent 2.3 and 2.5% of the total Wereda respectively.

Major types of natural vegetation such as forest, wood land and shrubs cover 8.88% of the total area of the Wereda and these accounts for 8316.81 hectares. There is a community protected *Juniperus* forest located in Genji-elbu area such approximately covers 60 hectares.

4. MATERIALS AND METHODS

4.1 Reconnaissance Survey and Selection of Study Sites

A reconnaissance survey of the study area was conducted from September 15 to 25, 2009. The study sites are selected. Thus, the study was carried out in three altitudinally varying ten sites. These are: areas with higher altitude (1850-2870 m a.s.l) (Beshasha, Genji-dalecho and Cami-chego), medium altitudinal areas (1644-1848 m a.s.l) (Koye-seja, Genji-elbu and Omo-gurude) and lower altitudinal areas (1387-1643 m a.s.l) (Dedesa, Choche, Keso-heti and Bulado-choche).

4.2 Sampling of Informants

A total of 100 individuals in the ages of 20 and above were selected from ten kebeles. Out of these, 24 key informants were purposively selected based on recommendation from elders and local authorities (Development Agents and kebele administration leaders). The choice of key informants is following the suggestion made by Martin (1995). The other 76 informants were selected randomly from the local people of the study area to see the general knowledge of medicinal plants in the people. This was done by tossing a coin and using him/her as informant whenever head of the coin was up and if he/she volunteered to participate.

4.3 Data Collection

Ethnobotanical data were collected in two trips the first one from December 1 to December 30, 2009 and the second from March 20 to April 20, 2010. The techniques employed for data collection were group discussion, semi-structured interviews, field observations or guided field walks with informants was employed to obtain indigenous knowledge of the local community on health, local classification, use, conservation and threats of medicinal plants.

4.4 Specimen Collection

At the end of the interview, sample specimens of the plants cited for their medicinal use were collected, numbered, pressed and dried for identification.

4.5 Specimen Identification

Preliminary identification was done in the field. In addition, identification of unidentified specimens was done in February and April 2010, using Flora of Ethiopia and Eritrea and also by comparison with authentic specimens, illustrations and taxonomic keys and with the assistance of experts at Addis Ababa University, National Herbarium. Voucher specimens with scientific

names, vernacular names, families and collection numbers for all medicinal plants and plants recorded from the study area, homegardens were stored at the National Herbarium.

4.6 Vegetation Description

Two approaches were used in describing the vegetation of the study area. On one hand, information was gathered from informants following the emic categorization technique i.e. categorization by indigenous people based on their own indigenous knowledge. On the other hand, it was described and classified through repeated curious visual observation following the etic classification technique of ethnobotany as described by Martin (1995). In the latter case, morphological characteristics or general appearance of vegetation such as growth and life forms of the dominant or co-dominant plants were focused upon.

4.7 Data Analysis

4.7.1 Descriptive statistics

A descriptive statistical method such as percentage and frequency was employed to analyze and summarize the data on medicinal plants, use and associated knowledge. The most useful information gathered on medicinal plants reported by local people: medicinal value, application, methods of preparation, route of application, disease treated, parts used and habit was analyzed through descriptive statistics. Facilities in MS Excel spread sheet were utilized to make simple calculations, determine proportions and draw bar graphs.

4.7.2 Informant consensus

In order to evaluate the reliability of information 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 deviates from the original information, it was rejected since it is considered as unreliable. Only the relevant ones were statistically analyzed. This method was adopted from Alexiades (1996).

The Informant Consensus Factor (ICF) is calculated for each category to identify the agreements of the informants on the reported cures for the group of ailments. The ICF were calculated as follows: number of use citations in each category (n_{ur}) minus the number of species used (n_t), 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

n_{ur} is number of use citation

n_t is number of species used

4.7.3 Preference ranking

Preference ranking was computed following Martin (1995). Ten key informants have been selected to assess the degree of effectiveness of seven medicinal plants against tonsillitis. The medicinal plant believed to be most effective to treat the illness has got the highest value (7), and the one with the least effective got the lowest value (1). The value of each species was summed up and the rank for each species was determined based on the total score. This helped to indicate the most effective medicinal plants used by the community to treat the disease.

4.7.4 Paired comparison

Paired comparison can be used for evaluating the degree of preferences or levels of importance of certain selected plants/ parts of plants (Nemarundwe and Richards, 2002). Paired comparisons to indicate the efficacy and popularity of five medicinal plant species used to treat insect allergy were employed as described by Martin (1995). In such a way that seven key informants were randomly selected by flipping coins and allowed to show their responses independently for pairs of five traditional medicinal plants that are noted for treating insect allergy. A list of the pairs of selected items with all possible combinations was made and sequence of the pairs and the order within each pair was randomized before every pair is presented to selected informants and their responses will be recorded, total value summarized and rank made based on the report of the informants.

4.7.5 Direct matrix ranking

Direct matrix ranking was conducted in order to compare multipurpose medicinal plants commonly reported by informants following Cotton (1996). Based on the relative benefits obtained from each plant, six multipurpose tree species were selected out of the total medicinal plants and seven use diversities of these plants were listed. Four key informants were chosen to assign use values to each attribute (5 = best, 4 = very good, 3 = good, 2 = less used, 1 = least used and 0 = not used). The seven use-values include medicinal, fodder, firewood, construction,

charcoal, fencing, and furniture making. Based on information gathered from informants, average value of each use-diversity for a species was taken and the values of each species summed up and ranked.

4.7.6 Jaccard's coefficient of similarity

Jaccard Coefficient of Similarity (JCS) was conducted to determine species composition similarity among five different areas. It was calculated between paired habitats (the study area with other areas which were studied by others in different parts of the country). JCS calculated as follows (Kent and Coker, 1992).

$$JCS = \frac{c}{a+b+c}$$

Where JCS = Jaccard's Coefficient of Similarity

a = Number of species found only in habitat A

b = Number of species found only in habitat B and

c = Number of common species found in habitat A and B

5. RESULTS AND DISCUSSION

5.1 Knowledge of Local People on Health

People of Goma Wereda give great value for their health. In the discussion with elders, the community expressed the value of their health by using different proverbs among them**:**

‘‘Fayyaa fi farsootu firra qabaa.’’ meaning a healthy person and the common local drink ‘tella’ would have friends.

‘‘Fayyaan culullee dha.’’ meaning a healthy person is like a kite. This is to say that just like a kite can get whatever it wants by flying here and there, the same holds true for a healthy person. A healthy person can do things he wants to do.

‘‘Fayyaan haajiraatu.’’ meaning wishing healthy life.

These proverbs indicate that, the local people of Goma Wereda confer great value for their health. Health is a great asset for them.

The same study carried out in indigenous people of Gimbi Wereda, Western Wellega by Etana Tolasa (2007) and a study carried out by Endalew Amenu (2007) at Cheliya Wereda in West Shewa have reported that the people of the study areas expressed the value of health by using different proverbs like that of Goma Wereda people. This might be the dominance of the people in these study areas are from the same ethnic group (Oromo) as a result there might be such a culture in Oromo society.

5.2 Local Beliefs on Medicinal Plants

The local people exploit their shared knowledge in order to manage health problems at home by using different plants found around them before looking for other options regardless of the type of health problem and its intensity. There is a saying in the community that the majority of people agree that regarding medicinal plants by saying **‘‘Qoricha biyya tokkotti yaala biyya tokkotti baala’’** meaning leaves used as medicine in one area are just leaves in another area. This emphasizes the importance of knowledge of plants. If there is knowledge it is used as medicine if not, leaves are simply leaves. For Goma Wereda people, the traditional systems regarding a medicinal plant play a vital role in their healing strategies and in the local primary healthcare systems.

According to the respondents of the study area, the preference of traditional medicine was as a result of lack of substitutes, that is, they would not get better medications for some of the diseases

in modern health services. For example, diseases like: insect allergy, evil eye, evil spirit, fibrile illness, diseases believed to be caused by urine of bat, spider poison in addition to that of easy access and low cost of treatment for traditional medicine.

Some healers connect the knowledge with spiritualism. One traditional healer among the informants beliefs that ‘‘I get the medicine when the patient comes and asks the medicine, otherwise I do not remember the leaves and all other things. I will ask my sprit to let me know the medicine for that particular disease and only after that I will collect the medicine for the patient in need.’’ This might indicate the secrecy of traditional medicinal knowledge, not to let others know about it. Another healer expressed it as follows ‘‘ if I collect the medicine myself it will serve as medicine; if another person harvests it the parts on my behalf do the medicine does not work as I will share whatever I will get with my God .’’ This type of beliefs might probably help to restrict others not to join in this kind of business.

According to the traditional healers, extensive indigenous plant use knowledge was retained and transferred orally to a selected family member. Most of the traditional healers reported that modernization had effect on the transfer of the indigenous knowledge to the next generations.

The proportion of healers who used to transfer their knowledge and those who did not use to transfer was also similar. This reveals that some of the traditional healers might have given much attention to the indigenous knowledge transfer while others kept the knowledge with them for the sake of secrecy or they might have little concern regarding the value of indigenous knowledge.

5.3 Indigenous Knowledge on Soil, Landform, and Botanical Classification

5.3.1 Soil classification by indigenous people

The local people of Goma Wereda classify soil (‘Biyyoo’ in local Afan oromo language) based on soil characteristics, colour of the soil, fertility of the land, and other criteria. The following soil types have been identified by local people:

- **Biyyoo kotichaa**: - This soil type refers to black soil and with better fertility for crop production in comparison to other soil types. The people use this soil to grow crops like teff, sorghum, maize and others.
- **Biyyoo diimaa**: - This soil is red sandy soil type; it has less fertile in comparison to the black soil. But, it can enable to grow crops of various types by applying fertilizer and/or if it contains remnants of plants it can be used for coffee plantation.

- **Biyyoo osoo**: - This soil type is characterized by high quantities of organic matter such as plant residues. Mostly the local people prefer this type of soil for coffee plantation.
- **Biyyoo suphe**: - This type of soil is not suitable for cultivation because rain water does not percolate. It is used for brick production. But, according to some key informants plants that grow in this soil type have great medicinal value.
- **Biyyoo Xaa'o**:- This is soil type created as a result of erosion. It is a very fertile soil and there is no need for fertilizer use in this soil type for crop cultivation.
- **Biyyoo seefoo**: - This soil type is characterized as unproductive without the application of fertilizer.
- **Biyyoo borale**: - This type of soil is white soil which is not suitable for crop production as well as for vegetation.

The report of a study carried out in Cheliya Wereda in West Shewa by Endalew Amenu (2007) showed that there is similarity of soil classification with the people of Goma Wereda. They classify the soil depending on the colour, texture and suitability for cropping. For example, in Cheliya Wereda 'Biyyoo Koticha' is given to black fertile soil and the red clay soil they call it 'Biyyoo diimillee' which is similar with 'Biyyoo diimaa' in Goma Wereda in which the name is given depending on the colour of the soil. This might be due to language as well as cultural similarity of the two groups of peoples.

5.3.2 Landform classification

5.3.2.1 Use based land classification

Indigenous people of Goma Wereda classify land based on the use of the land as agricultural land, grazing land, forestland, marshland, residential area, etc.

- **Lafa qonnaa**: - This is agricultural land that serves for cultivation of different crops.
- **Lafa bosanaa**: - This is forest land where different plant species are found.
- **Lafa caffee**: - This is marshland which is suitable for livestock grazing as well as some agricultural activities to take place.
- **Lafa horrii /Lafa walliinii/ Lafa kallo**: - is an open grazing land left aside by community for common livestock grazing.
- **Lafa bunaa**: - This is land used for coffee plantation.
- **Lafa dhagaa**: - rocky areas where stones are extracted and sold.

- **Lafa manaa**: - residential land where the community has settled. They make fences around and restricted cropping for vegetable cultivation as homegarden.

In a similar study carried out by Endalew Amenu (2007) the local people of Cheliya Wereda classify landforms depending on grazing land, agricultural land, forestland, river bank, residential area and marshland, which shows the same bases for classification of land forms in Goma. For example, from the given land form classification ‘‘lafa qonnaa, lafa bosanaa, lafa caffee and lafa manaa’’ have been expressed in the same way by the two groups of people. Whereas, in Jeldu Wereda the classification criteria are based on soil characteristics, fertility of land and physiographic features of the land (Zewdie Kassa, 2009). So, local people of Goma Wereda classify land based on its uses.

5.3.2.2 Topographic land classification

The local people of the study area classify their land based on topographic land setting.

The local people classify their land topographically as:

- **Tabba**: - This refers to land forms with some elevation which is suitable for forest plantation. But, now in the area some agricultural activities can be performed.
- **Erkataa**: - This refers to land forms with very low elevation in comparison to the first type on which agriculture and grazing can takes place.
- **Diriraa (Bakkee)**:- This refers to plain land on which settlement, agricultural activities as well as livestock grazing are practiced.
- **Dhibu**: - This refers to land which is found in between elevated land forms; a valley.

Topographic classification of lands is also reported in Cheliya Wereda in which land forms with low elevation call it ‘tabba’ like Goma people. Other classifications like ‘Tullu’ for mountainous area that lack in Goma Wereda; ‘Goodaa’ is an area with low elevation and left aside for grazing (Endalew Amenu, 2007). But, in Jeldu Wereda ‘Goodaa/Dirree’ represented a plain land (Zewdie Kassa, 2009) whereas, plain land in Goma is known as Diriraa/Bakkee; ‘lafa ciisaa’ the name given to plain land in Cheliya (Endalew Amenu, 2007). Even though, there is a difference in the word they use, an agreement may exist among these people because one might be the synonym of the other.

5.3.3 Indigenous vegetation classification

The local communities categorized the vegetation of the study area into:

- **Bosanaa:** refers to densely forested lands composed of ranges of large trees. Now-a-days this type of vegetation has declined in the study area because of agricultural expansion and overharvesting.
- **Caffee**: refers to herbaceous vegetation growing in wetlands (marshy or water logged areas) in which some grasses and *Cyperus* species are more frequent and it is evergreen throughout the year.
- **Dagala**: refers to complex plant association in the wild, road side as well as for those plants grown in garbage area. The majority of plants observed in these areas are herbs and shrubs. According to informants the plants grown in this category have medicinal value.
- **Marga**: refers to an area dominated by grass and other herbaceous plants.

Vegetation classifications of Cheliya, Gimbi and Jeldu Weredas have shown that there is similarity for the name given to densely forested land with Goma Wereda which is called 'Bosanaa' (Endalew Amenu, 2007; Etana Tolasa, 2007 and Zewdie Kassa, 2009). 'Caffee' is a name given to vegetation grown in marshy or water logged areas in Goma Wereda which is similar with the classification of Endalew Amenu (2007) and Zewdie Kassa (2009). The name 'Caffee' associated with the name of the dominant vegetation type mostly grown in water logged area particularly *Cyperus* species; the name is given as a result of the dominance of this kind of species in the area.

5.4 Visual Vegetation Classification

To indicate the distribution of medicinal plants in the study area with respect to the dominant tree species, careful visual observation was made and vegetation of the study area was classified into community types by taking the dominant species for naming the community which gave seven types.

1. ***Ficus sycomorus*** **and** ***Ficus sur*** dominated community type: - This community is predominantly observed at an altitude around 1450 m a.s.l. It is characterized by trees with larger canopy, under side covered with thick bushes and shrubs. It is observed at Didesa Kebele study sites where one could observe remnant forests in farmlands and at margins of agricultural fields. The major species obtained from this community type are: *Ficus sycomorus, Ficus sur, Combretum molle, Combretum collinum, Piliostigma thonningii, Vernonia leopoldii, Stereospermum kunthianum, Indigofera vohemarensis, Gardenia ternifolia, Ficus ovata, Sesbania sesban* and others.

2. ***Albizia gummifera*** **and** ***Croton macrostachyus*** dominated community type:-This community type is normally found at sites in which the vegetation is associated with coffee plantation covering the majority of the study sites. It is predominantly observed at an altitude range of 1560 – 1950 m a.s.l. The major species obtained from this community type are *Albizia gummifera, Croton macrostachyus, Acacia abyssinica, Albizia schimperiana, Coffea arabica, Trichilia dregeana, Brucea antidysenterica, Calpurnia aurea, Erythrina brucei, Buddleja polystachya, Celosia trigyna, Vernonia* species. and others. This community type is found in Cami-cago, Bulado-coce, Koye-seja, Genji-elbu, Keso-heti, Omo-gurude kebeles, and other study sites.

3. ***Sapium ellipticum*** and ***Maesa lanceolata*** dominated community type: - This community is predominantly observed at an altitude from 1680 – 2070 m a.s.l. The major species collected from this community type are *Sapium ellipticum, Maesa lanceolata, Albizia gummifera, Celtis africana, Ehretia cymosa, Millettia ferruginea, Acacia abyssinica, Bidens biternata, Bidens prestinaria, Bidens pilosa, Clausena anisata, Rytigynia neglecta* and others. This community type is found in Beshasha, Keso-heti, Cami-cago and Genji-elbu study sites.

4. ***Cordia africana - Ficus vasta*** dominated community type: - This community is predominantly observed at an altitude ranging from 1528 – 1735 m a.s.l. The major species obtained from this community type are *Cordia africana, Ficus vasta, Albizia grandibracteata, Coffea arabica, Asparagus africanus* and others. This community type is found in Choche and Omo-gurude study sites.

5. ***Vernonia amygdalina - Syzygium guineense*** dominated community type: - This community is predominantly observed at an altitude range from 1720 – 2070 m a.s.l. The major species obtained from this community type are *Vernonia amygdalina. Syzygium guineense, Calpurnia aurea, Dracaena steudneri, Ekebergia capensis, Premna schimperi* and others. This community type is found in Beshasha and Genji-elbu study sites.

6. ***Eucalyptus*** **Plantation**: - This type of community is recorded in almost all study sites. It is one of the good income generating plants for the farmers in the area as a result it is displacing croplands. The major species observed in this type of community are *Eucalyptus* species, *Solanum dasyphyllum*, other herbs and small shrubs.

7. **Riverine Vegetation**: This type of community is observed along the river banks and streams in the study area. The major species observed in this type of community which are recorded along the river courses of river Deguaja and Chiseche which is observed at an altitude around 1600 – 1680 m a.s.l are *Cyperus alopecuroides, Cyperus distans, Acmella caulirhiza, Arundinaria alpina, Drymaria cordata, Ensete ventricosum, Impatiens rothii, Persicaria senegalensis, Snowdenia polystachya* and others.

5.5 Plants in the Homegardens

The local community of the study area obtain many services from homegardens or 'Boro' as it is called in local language. They provide food, spices, medicine and other services. A good number of medicinal plants have been obtained in and around gardens of local people in the study area that are used for different human ailments. The people of the study area cultivate diverse plant species in their homegardens (Appendix 5).

In this study, 59 useful plant species were collected in homegardens. Out of these 46 plant species were used as traditional medicine. The plants are distributed among 31 families and 49 genera. The highest family in terms of species composition is Lamiaceae contributing 8 species (13.55%), family Asteraceae, Rutaceae and Solanaceae each with 4 species (6.77%), Brassicaceae is represented by 3 species and families Acanthaceae, Convolvulaceae, Fabaceae, Musaceae, Myrtaceae and Poaceae are represented by 2 species each and the remaining 22 families are represented by one species each. This indicates there are diverse plants that can be cultivated in the homegardens of the study area. The same study carried out in Gimbi Wereda by Etana Tolasa (2007) come up with 52 species that are collected from homegardens. This number is comparable with the number obtained from Goma Wereda. So, these two groups of people are good practice of cultivating plants in their homegardens.

5.5.1 Habit and use category of homegarden plants

Regarding the habit of plants 25 species (42.37%) are herbs, 19 species (32.20%) are shrubs, 12 (20.33%) are trees and 3 (5.08%) are climbers (Figure 3). The finding of these habits agrees with investigations of Etana Tolasa (2007) and Endalew Amenu (2007) in such a way that the diversity of herbs as the dominant growth form was reported.

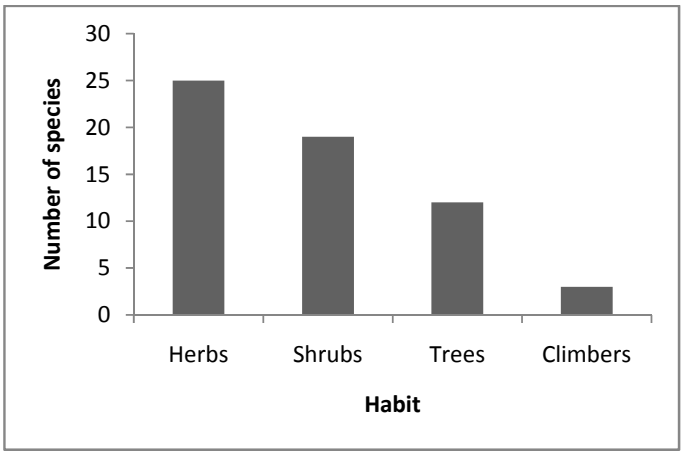

Figure 3 Habits of plants that are collected from homegardens of the study area

The local community gain various uses from the plants in the homegardens. In this study 18 species (30.5%) of the gardens plants have only medicinal value, 14 species (23.72%) are used as both medicine and food and 6 species (10.16%) are purely for food and others do have different uses as Table 3 shows. The majority of the homegarden plants do have more than one use. This result disagrees with the finding of most researches like Etana Tolasa (2007) in which most of the plants obtained from homegardens are food plants. This shift may be as a result of the depletion of medicinal plants in the wild. So, the people of the study area have good habit of cultivating medicinal plants in the homegardens.

Table 3 Service categories of homegarden plants

Service category	**Total no. of species**	**Percent**
Only medicinal	18	30.50
Medicine & food	14	23.72
Food	6	10.16
Medicine & Ornamental	2	3.38
Medicine & spice	2	3.38
Medicine & live fence	2	3.38
Forage, food & cash income	2	3.38
Live fence, food, cash income	2	1.69
Cash income	1	1.69
Spice	1	1.69
Medicine & firewood	1	1.69
Medicinal & cash income	1	1.69
Medicine, cash income, stimulant	1	1.69
Medicine, Forage, Food, Cash income	1	1.69
Medicine, live fence, fire wood	1	1.69
Medicine, fire wood, fence	1	1.69
Medicine, live fence, forage, food, fence	1	1.69
Medicine, fire wood, live fence, forage, fence	1	1.69
Medicine, fire wood, charcoal, live fence, forage, fence, construction	1	1.69
Total	59	100

5.6 Plant Resources of the Study Area

A total of 160 species belonging to 124 genera and 58 families were collected and identified in the study area (Table 4).

Table 4 Distribution of collected species in different family

Family	Number of Species	Percent
Asteraceae	17	10.62
Fabaceae	16	10.00
Lamiaceae	13	8.12
Solanaceae	9	5.62
Euphorbiaceae	7	4.37
Moraceae	5	3.12
Poaceae	5	3.12
Rutaceae	5	3.12
Amaranthaceae	4	2.50
Boraginaceae	4	2.50
Convolvulaceae	4	2.50
Myrtacceae	4	2.50
Polygalaceae	4	2.50
Brassicaceae	3	1.87
Cyperaceae	3	1.87
Meliaceae	3	1.87
Ranunculaceae	3	1.87
Rubiaceae	3	1.87
Acanthaceae	2	1.25
Apiaceae	2	1.25
Combretaceae	2	1.25
Cucurbitaceae	2	1.25
Musaceae,	2	1.25
Rhamnaceae	2	1.25
Rosaceae	2	1.25
Vitaceae	2	1.25
The remaining 32 species	1	20.00

Of these, 101 species were collected from the vegetation in the wild and 59 species are obtained from homegardens. This finding is a good indicator for the presence of considerable diversity of plant species both in the wild as well as in the homegardens of the study area. In terms of family distribution Asteraceae stood first contributing 17 species (10.62%) followed by Fabaceae (16 species) and Lamiaceae (13 species). This agrees with the finding of Endalew Amenu (2007) in which family Asteraceae is the dominant family followed by Fabaceae. This may be due to the weedy nature of the family Asteraceae take advantage of disturbance.

Regarding the habit diversity, herbs were the most common and stood first with 69 species, followed by trees (44 species), shrubs (35 species) and climbers (12 species) (Figure 4). A detailed overview of all plants encountered, their scientific and vernacular names, and uses, are given in Appendices 1, 4 and 5.

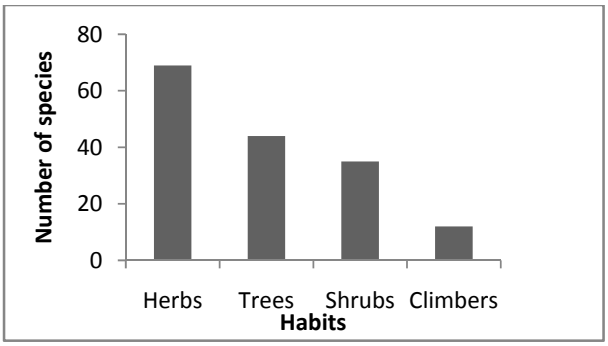

Figure 4 Habits of plants that are collected in the study area.

5.7 Ethnomedicinal Plant Species Used by People of Goma Wereda

From the collected 160 species in the study area a total of 121 medicinal plant species were gathered and documented that are used for the treatment of human and livestock ailments. From these, 92 species (76.03%) were used as human medicine, 12 species (9.91%) as livestock medicine and the remaining 17 species (14.04%) were used for treating both human and livestock ailments (Figure 5). These plants are distributed in 101 genera and 49 families. The family Asteraceae was represented by 15 species, followed by Fabaceae and Lamiaceae represented by 12 species each, Solanaceae 8 species, Euphorbiaceae accounted for 7species, Amaranthaceae, Myrtaceae and Rutaceae were represented by 4 species each; Convolvulaceae, Polygalaceae and Ranunculaceae are represented by 3 species each. Whereas Acanthaceae, Apiaceae, Boraginaceae, Brassicaceae, Cucurbitaceae, Meliaceae, Rhamnaceae, Rosaceae and Vitaceae are represented by 2 species each. The remaining 28 families are represented by 1 species each.

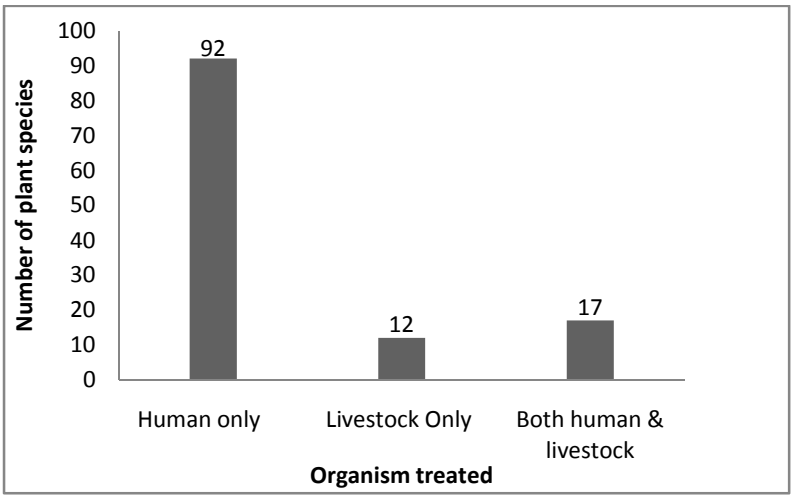

Figure 5 Proportion of medicinal plants used to treat human, livestock and both human and livestock diseases.

Most of the medicinal plant species collected and identified in this study were also medicinally used in other parts of Ethiopia. For example, of the 121 medicinal plants collected from Goma Wereda 47 of them were reported by Etana Tolasa (2007), 36 by Endalew Amenu (2007), 33 by Haile Yineger *et al*. (2008), 33 by Seyoum Getaneh (2009) and 29 by (Fisseha Mesfin, 2007), as medicinally 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 different cultural groups which could validate the medicinal properties of these species. So, people of Ethiopia over wide area have the tendency to use the same medicinal plants as a result of the wider distribution of medicinal plants in the country and to a certain extent their efficacy.

Of the 121 medicinal plants studied, 75 species were gathered from the wild and 46 species were collected from homegardens. This result indicates that the local communities mostly depend more on medicinal plants collected from the wild habitat than those from the homegardens. But, the activity of cultivating medicinal plants in homegardens is also not bad because the number of medicinal plants obtained in homegarden is also promising. This finding agrees with the general pattern seen in many investigations in Ethiopia in which more medicinal plants are collected from the wild than homegardens (Endalew Amenu, 2007; Etana Tolasa, 2007; Haile Yineger and Delenasaw Yewhalaw, 2007).

Habit

The results of growth form analysis of the reported medicinal plant species reveals that herbs constitute the largest category, with 54 species (44.62%), followed by shrubs 30 species

(24.79%), trees 26 species (21.48%) and climbers 11 (9.09%) species. The dominance of herbs is due to easy availability to local people and their abundance in the area and also, as a result of the existence of coffee plantation in such a way that other habits are easily cut during coffee preparation. The analysis of the data also showed that the majority of medicinal plants in the homegardens are herbs. This finding is in line with most medicinal plant inventories in Ethiopia (Endalew Amenu, 2007; Ermias Lulekal, 2005; Debela Hunde, 2001) in which herbs are the dominant growth form of medicinal plant.

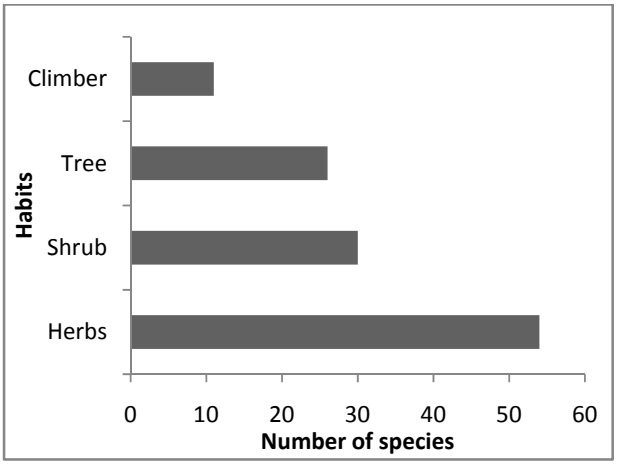

Figure 6 Habits of medicinal plant species in the area.

5.7.1 Distribution of medicinal plants in different plant community types

The distribution of medicinal plants in the visually recognized plant communities is shown in Table 5. From the collected medicinal plants 19.83% of them were obtained from *Albizia gummifera* and *Croton macrostachyus* dominated community type. This is because these species are important as coffee shade and farmers conserve the plants and the area is protected from intervention from human beings as a result large numbers of species are found as shade and fence. The next community types contained 9.91% of the medicinal plants each were the *Vernonia amygdalina* and *Syzygium guineense* and *Sapium ellipticum* and *Maesa lanceolata* dominated community type and the least number of medicinal plants (2.47%) were obtained from *Eucalyptus* plantation as a result of less number of species diversity in this community type which is also frequently harvested by the local people for different purpose.

Table 5 Distribution of medicinal plants in to dominated plant community types

Community types	Number of medicinal plants	Percent
Homegardens	46	38.01
Albizia gummifera and *Croton macrostachyus*	24	19.83
Sapium ellipticum and *Maesa lanceolata*	12	9.91
Vernonia amygdalina and *Syzygium guineense*	12	9.91
Cordia africana and *Ficus vasta*	11	9.09
Riverine Vegetation	8	6.61
Ficus sycomorus and *Ficus sur*	5	4.13
Eucalyptus plantation	3	2.47
Total	121	100

5.7.2 Medicinal plants used to treat human diseases

The numbers of ethnomedicinally important plant species that are used to treat human ailments recorded in ten kebeles of Goma Wereda are 92. These plants belong to 80 genera and 44 families. Family Asteraceae contributed 13 species, Lamiaceae 11 species, Fabaceae 7 species, Euphorbiaceae 4 species, Amaranthaceae, Myrtaceae, Polygonaceae, Ranunculaceae, Rutaceae and Solanaceae comprises 3 species each, Acanthaceae, Apiaceae, Brassicaceae, Convolvulaceae and Rosaceae represented by 2 species each and the rest 29 families comprises 1 species each. Some of the medicinal plants recorded are also used as remedies in other parts of Ethiopia. Fisseha Mesfin (2007) documented 30 plant species and 25 plant species are mentioned in Endalew Amenu (2007). The dominance of family Asteraceae for the treatment of human diseases was reported in the work of Endalew Amenu (2007), Seyoum Getaneh (2009) and others. This might be due to their weedy nature of the family Asteraceae and take advantages of disturbance.

5.7.2.1 Sources of medicinal plants

From the medicinal plants that are used for human ailments 46 species were collected from the wild vegetation and 46 species from homegardens. These indicated that the local people obtain medicinal plant species from homegardens and wild vegetation in equal proportion. This contrast

to most investigations in Ethiopia that documented more human medicinal plants harvested in the wild rather than homegarden. This shows on the one hand the people do have a habit of cultivating medicinal plants and on the other side it shows agricultural activity are affecting the wild vegetation and this activity shifted the people to depend on homegardens to obtain medicinal plants. In the interview made with some of the traditional practitioners they move to neighbouring Wereda around Cira forest to collect medicinal plants due to the depletion of medicinal plants in the area.

5.7.2.2 Habits, parts used, method of preparation, route of administration, dosage and application of human medicinal plants.

Habits

This study revealed that medicinal plants used to treat human ailments constitute herbs (47 species), shrubs (22 species), trees (17 species) and climbers (6 species) (Figure 7). This finding shows that the most represented life forms of medicinal plants in the study area are herbs followed by shrubs. This could be due to the fact that naturally there are more herbs than woody plants and woody plants are overused because of their diverse use value. The analysis of the data also showed that the majority of medicinal plants in the homegardens are herbs. It might also indicate that the threats that exist on other growth form particularly trees and shrubs. Similar findings were also reported in earlier works in Ethiopia in which herbs are the dominant growth form for human health treatment (Endalew Amenu, 2007).

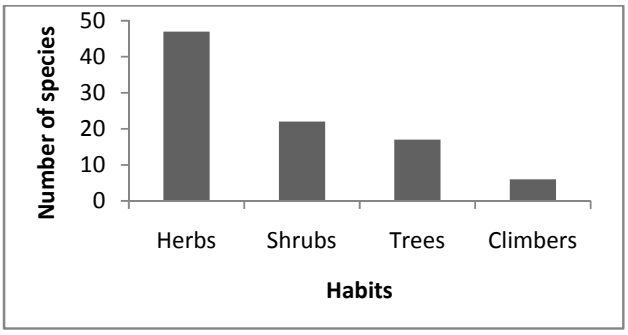

Figure 7 Habits of medicinal plants used for human ailment treatment

Parts used

With regard to the plant parts used for medicinal purposes, different parts of the plants were reported to be used for medicines. The most frequently utilized plant part was leaves (64.58%) of the total record of human medicinal plants preparations followed by roots (14.06%) and seeds (5.72%) (Figure 8). Leaves were the most reported plant parts in the preparation of 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. Remedy preparation that involves roots, rhizomes, bulbs, 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. This finding is in line with the results of other ethnomedicinal studies Endalew Amenu (2007); Etana Tolasa (2007); Haile Yineger and Delenasaw Yewhalaw (2007) who reported that leaves were the most cited plant parts used in remedy preparations.

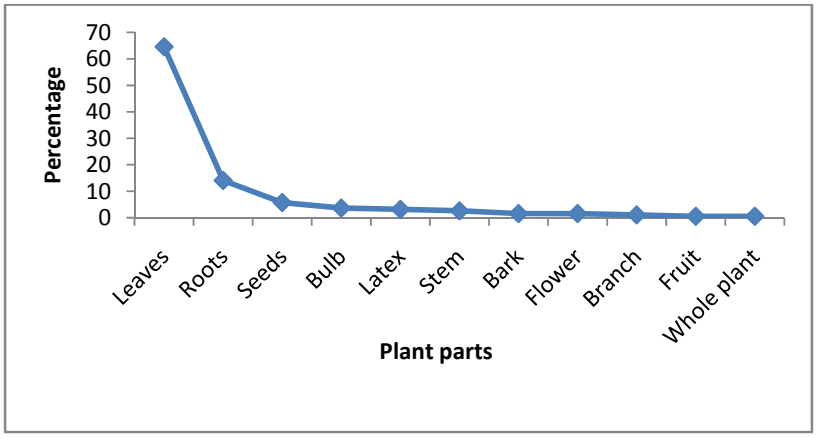

Figure 8 Plant parts used for human ailment treatment.

Method of preparation

Concerning the preparation of medicine for human, the local community employ various methods of preparation of traditional medicines for different types of ailments. The preparations vary based on the type of disease treated and the actual site of the ailment. The principal methods of plant parts remedy preparation forms were reported to be through crushing, which accounts for 26.94%, followed by squeezing (22.79%), burning (7.25%), boiling (6.73%), and squeezing and concoction (6.73%) together, the remaining proportion is accounted for methods like powdering, chewing, harvesting, mixing, cooking, drying, roasting and the combination of each methods (Figure 9).

The informants have various skills associated with remedy preparation. They tend to apply mixing of different plants. The result showed that the majority of remedies were prepared from single plant species and few are prepared from different plant species, which is a combinations of medicinal plants, was used to treat a disease. The result is consistent with the findings of Debela

Hunde (2001) and Etana Tolasa (2007) in which a single plant preparation were reported to be high.

Some of the remedies are taken with different additive substances like honey, sugar, 'teff' flour, butter, salt, milk, boiled coffee, tea, water, 'tella' and edible oil. These additives have important to minimize discomfort, improve the taste and reduce adverse effects such as vomiting and diarrhea, and enhance the efficacy and healing conditions as explained by informants. Mixing and using some medicinal plants with common foods and drinks might be an easy way for effective treatment.

For example, extracting the oil of *Olea europaea* subsp. *cuspidata* , by boiling on fire and mixing with stem of *Croton macrostachyus* and cooking together, honey is added and half of coffee cup is given. This is recommended for a patient as a cure for asthma.

The result in the conditions of plant part used indicated that 90.76% were used in fresh form and 9.23% in dried forms of preparation. Using of fresh materials that are harvested and used soon minimizes chance of preservation for later use. So, this dependency on fresh materials has thrown the species to serious threat than the dried forms, which can be stored for longer period of time. This might also be attributed to the availability of ethnomedicinal plant species in the area. Preservation of remedies was not reported by healers of the study area since the remedies were used mainly in their fresh forms. This finding is consistent with the finding of Endalew Amenu (2007) which reported that the majority of the remedy preparations were in fresh form.

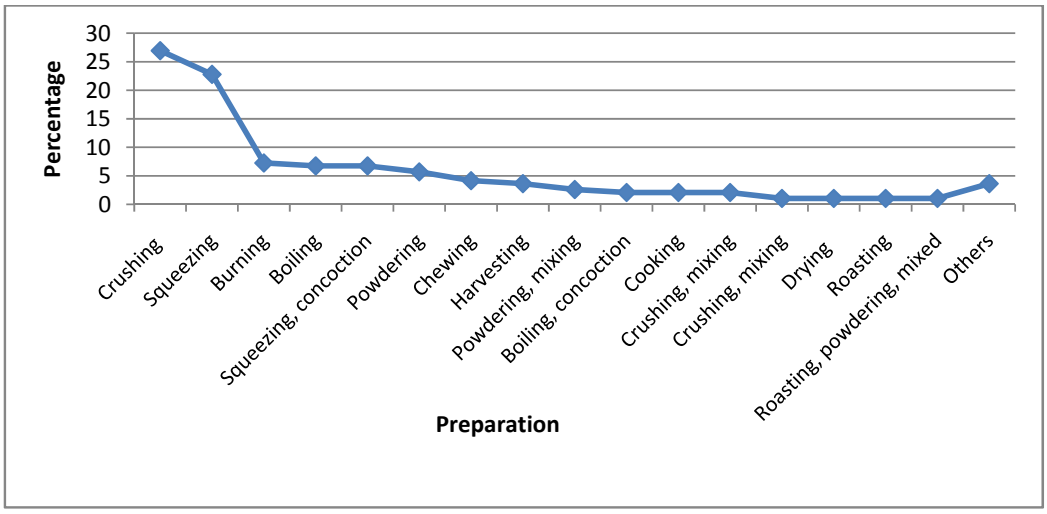

Figure 9 Graph showing ways of preparation of human medicinal plants

Routes of administration

Medicinal plants are applied through different routes of administration. In the study area oral administration is the dominant route with 50.76% of the cases followed by dermal (30.76 %) and nasal (7.17%) and others accounted the remaining percent (Figure 10). Similar results were obtained by Ermias Lulekal (2005), Endalew Amenu (2007), Etana Tolasa (2007), Haile Yineger and Delenasaw Yewhalaw (2007) and others that indicated oral administration dominates over others routes of administration.

For example, leaves of *Ruta chalepensis* are squeezed and added to syringe up to the level of 1 cubic centimetre (cc) then added drop by drop on the left ear of the patient for 40 days. This is used to cure the person from risky disease known as epilepsy. A root of *Phytolacca dodecandra* is squeezed and 1cc is added in to the urethra of a gonorrhea patient person by syringe. This is used to cure the person from the disease within five to seven days. Leaves from the red colour type *Catha edulis* are cooked, allowed to stay for an overnight and 1 glass is drunk for 2 - 3 days in the morning by adding small amount of sugar. This is used to cure the patient from gonorrhea.

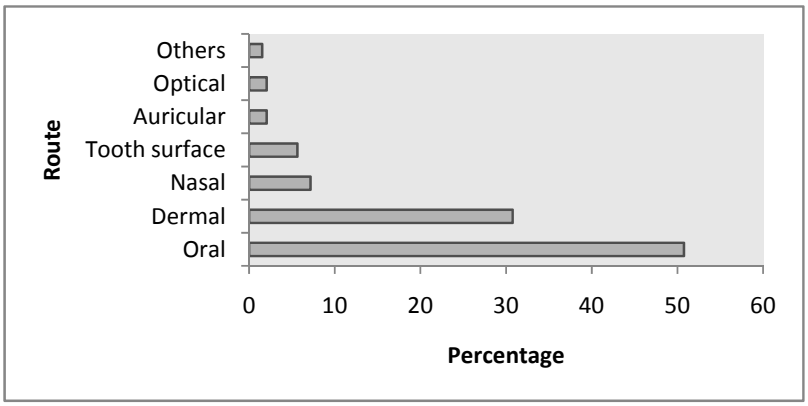

Figure 10 Route of administration of medicinal plants that used for human ailments.

Dosage

The local communities believe the effectiveness of traditional medicine but there is great fear about the amount taken particularly for human medicines which are taken internally. As in various parts of Ethiopia, the knowledge of traditional healers in Goma Wereda, the use of measurement of dosage to treat various diseases was poor. The traditional healers use different measurements for dosage, mostly they use their finger lines and finger nails 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 medicinal plants that are taken topically

they do not have clear cut dosage. Sofowora (1982) and Dawit Abebe (1986) have also discussed lack of precision and standardization as one drawback for the recognition of the traditional healthcare system.

The measurements used to determine the dosages are not standardized and doses given depend on the age, physical appearances and heath conditions; that is, children are given less dose than adults, physically strong individual take more dose than weak individual depending on the type of disease. Though such prescription difference was practiced, still the amount prescribed by healers for both children and adults might not conform to the standard prescriptions as in modern medical literature.

According to the discussion made the healers of Goma Wereda never administer treatments that are taken internally to pregnant women, for children below six months of age and people under coma.

The absence of any adverse effects of traditional medicines after administration were also more frequently mentioned by the traditional healers but some of the preparations were reported to have some adverse effects like diarrhea. The traditional healers indicated that they use antidotes for the adverse effects of some traditional medicines like eating cooked teff flour, bath after taking the medicine. For instance, the use of *Croton macrostachyus* for the treatment of gonorrhea, leaves are powdered, placed on water overnight, filtered and 1 tea glass is taken for two days. During that diarrhea follows, as an antidote the local healers administer the patient to eat cooked teff flour to stop.

Applications

The prepared traditional medicines are applied in a number of methods, drinking account the largest (34.53%), followed by put on (15.97%), eating (10.82%), painting (9.27%), tied and washing accounts 6.7% each and the others dropping, sniffing, smoking, swallowing, brushing account the remaining proportions (Figure 11). Internal ailments were commonly treated by making the patient drink herbal preparations; tooth infection were treated by crushing and put on the remedial plant part on the tooth surface; skin infections such as ringworm were treated by painting herbal preparations on an infected skin.

Some plants do have different applications for different disease types. For example, the leaves of *Drymaria cordata* are covered and rolled seven times with leaves of *Ensete ventricosum* and placed on fire. This preparation will be used for different diseases by diverse application techniques. For instance, putting the leaves on tooth surface is used to cure toothache, to tie on swollen body part is used to cure swelling, sniffing the vapour treat nose smell and headache, to tie on infected body part with cloth is used to treat urine of bat and insect allergy. As a result of these diverse use of the plant the local community call the plant ‘‘Seyidesejel’’/ ‘‘Moti dagalaa’’ which means ‘‘king of plants’’.

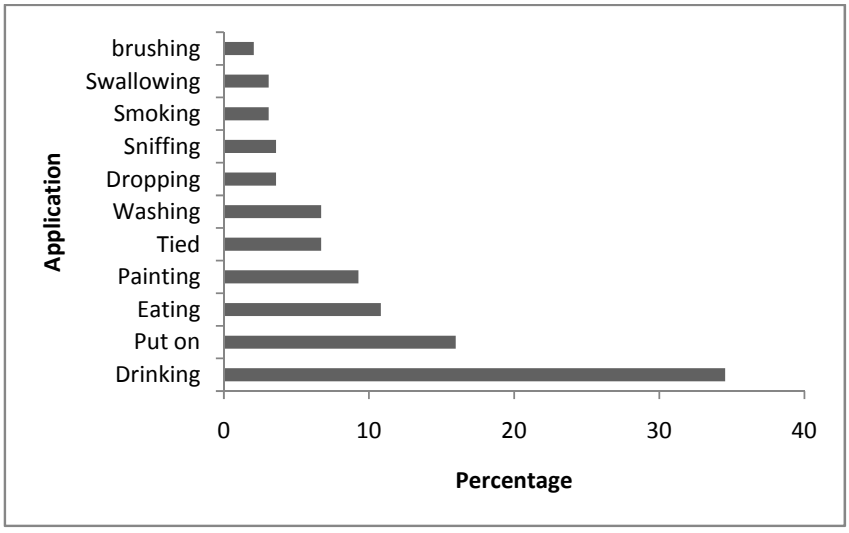

Figure 11 Graph showing ways of application of plant remedies in human ailment treatment

Some informants believed that having *Clerodendrum myricoides* near the house or fence is believed to keep away evil spirits from that area or having a piece of this plant as tooth brush is believed to prevent a person from evil eye. Although these spiritual acts are hard to be explained scientifically, they can give psychological confidence to the users. Some of the informants reported that restrictions are obligatory when patients take certain types of remedies. For instance, a patient who takes remedy against gonnorrea by *Croton macrostachyus* strictly hides from shadow of humans for a day after medication.

5.7.2.3 Major human diseases and plant species used by local people

Though more than 79 different diseases of humans were recorded as human health problem that are treated by 109 plant species (Table 6), one species can treat a single disease or a number of diseases. The practitioners of the area commonly diagnose each health problem by an interview and visual inspection of the patient. These shows large numbers of diseases have got solution by

traditional medicine in Goma compared to different investigations in Ethiopia. For example, Endalew Amenu (2007) reported 47 human diseases treated by 48 plant species, Etana Tolasa (2007) reported 77 plant species used to treat 49 diseases of humans and Seyoum Getaneh (2009) reported 78 plant species that used to treat 50 diseases of humans.

According to the informants the largest number of species was used to treat toothache, which is treated with 16 species. This disease is common in the area because most people engage in chewing chat as a result their teeth are susceptible to the disease; the next is stomachache and wound each of them is treated by 12 species.

In addition to these, the practitioners were also visited more for diseases like evil eye, fibril illness, insect allergy, spider poison, urine of bat and others. The local community prefer traditional healers for such diseases rather than modern medication.

Table 6 Human diseases and number of plant species used

Disease treated	Total Species	Percent
Toothache	16	6.25
Stomachache	12	4.68
Wound	12	4.68
Headache	9	3.51
Malaria	9	3.51
Fibril illness	8	3.12
Evil Eye	7	2.73
Gonorrhea	7	2.73
Tonsillitis	7	2.73
Blood clot	6	2.34
Diarrhea	6	2.34
Insect allergy	6	2.34
Rheumatism	6	2.34
Spider poison	6	2.34
Stomach Problem	6	2.34
Eye problem	5	1.95
‘Naqarsaa’	5	1.95
Urine of bat	5	1.95
Ascaries	4	1.56
Gastritis	4	1.56
Poisoning	4	1.56
Liver problem	4	1.56
Tape Worm	4	1.56
Rabies	4	1.95
Nose smell	4	1.95
Amoeba	3	1.17

Asthma	3	1.17
Blood pressure	3	1.17
Cough	3	1.17
Ear problem	3	1.17
Glandular swelling	3	1.17
Kidney problem	3	1.17
Nasal bleeding	3	1.17
Snake bite	3	1.17
Stop pregnancy	3	1.17
Swelling	3	1.17
Vomiting	3	1.17
Warts	3	1.17
Skin rash	3	1.17
Common cold	2	0.78
Constipation	2	0.78
Dandruff	2	0.78
Epilepsy	2	0.78
Hemorrhoids	2	0.78
Intestinal parasite	2	0.78
Scabies	2	0.78
Stabbing pain	2	0.78
Tinea versicolor	2	0.78
‘Dhukuba lafaa’	2	0.78
Foot smell	2	0.78
Swelling of leg	1	0.39
‘Allaatii’	1	0.39
Anaemia	1	0.39
‘Hypertension’	1	0.39
Diabetes	1	0.39
Ecto-parasite	1	0.39
Evil spirit	1	0.39
Excessive menstrual bleeding	1	0.39
Fire Burn	1	0.39
Heart failer	1	0.39
Heart problem	1	0.39
Influenza	1	0.39
Insect bite	1	0.39
Madness	1	0.39
Male sexual impotency	1	0.39
Mouth smell	1	0.39
Mouth sore	1	0.39
Pancreatic problem	1	0.39
Ringworm	1	0.39
‘Harqansu’	1	0.39
Snake breath	1	0.39
Snef of faeces	1	0.39

STDs	1	0.39
Swelling of leg	1	0.39
Tetanus	1	0.39
Weight loss of children	1	0.39
'Xooroo'	1	0.39

5.7.3 Medicinal plants used to treat livestock health problems

Medicinal plants that are collected and identified in the study area that are used for livestock health problems are 12 species. They are grouped in 10 genera and 10 families. Family Solanaceae and Vitaceae comprise 2 species each and Asteraceae, Bignoniaceae, Dracaenaceae, Euphorbiaceae, Fabaceae, Myrtaceae, Poaceae and Rhamnaceae comprise 1 species each. 10 species are obtained from the wild and 2 species from homegardens. More species for livestock treatment have obtained from the wild. This shows that the practice of local community is less for cultivating livestock remedies in homegardens.

As most informants agree even though the areas do have high number of livestock population the local people do have low knowledge of ethnoveterinary important medicinal plants compared to human treatment. Mostly they use clinics for the treatment of their livestock.

5.7.3.1 Habits, parts used, method of preparations, route of administration and application of livestock medicinal plants

Habits

The habits of medicinal plants that are used for ethnoveterinary health problem are trees comprises 5 species, herbs 3 species, climbers 3 species and shrubs1species (Figure 12). In this study trees like *Dracaena steudneri, Albizia schimperiana, Euphorbia abyssinica, Stereospermum kunthianum* and *Syzygium guineense*; shrub like *Solanum dasyphyllum* and herb species like *Pennisetum thunbergii, Solanum anguivi,* and *Tagetes minuta* as well as from climbers *Helinus mystacinus, Cyphostemma cyphopetalum* and *Cyphostemma adenocaule* were used for the treatment of only livestock ailments in the study area. This finding agrees with the work of Endalew Amenu (2007) in which trees are the dominant habits for the treatment of livestock ailments. This indicates unlike that of human medicine the local community use more tree species for livestock health treatment.

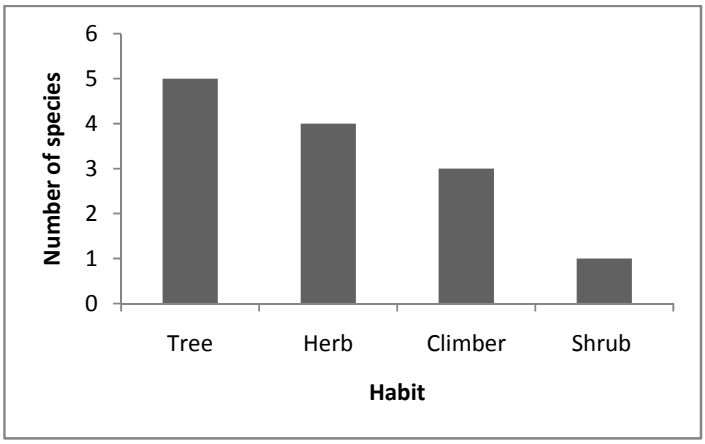

Figure 12 Distribution of habits of medicinal plants used for livestock health treatment.

Plant parts

The plant parts used for livestock health treatment in the area are leaves 57.14%, bark 14.28%, seed and root together accounts 14.28%, whole plant 7.14%, only root 7.14% (Figure 13). Like that of human medicine leaves again the most harvested plant part of remedy preparation for livestock ailments. This disagree with the report of Endalew Amenu (2007) in which roots are the major plant part used for livestock remedy preparation followed by leaf.

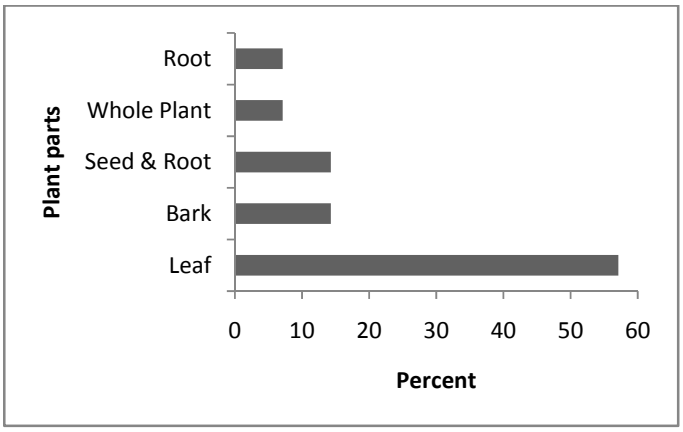

Figure 13 Percentage of medicinal plant parts used for livestock health treatment

Method of preparations and route of administration

The local people use different forms of remedy preparations and applications to treat livestock diseases. The technique of preparations used involved squeezing, crushing, squeezing followed by concoction and crushing followed by concoction and harvesting. For instance, the leaves of *Dracaena steudneri* is crushed with root of *Ricinus communis* and leaves of *Senna didymobotrya* then mixed with 1 litre of boiled water and given to cattle. This concoction result is used to treat the common disease in the area known as black leg (locally known as 'sinch'). Fumigating the

leaves of *Euphorbia abyssinica* to cattle is used to relief the animal from a disease known as rinderpest.

Based on the nature of the ailment the remedies were applied through different routes. Oral application of remedies was found the highest (56.25%), followed by nasal (25%) and dermal application (18.75%) (Figure 14). This finding agrees with the work of Teshale Sori *et al*. (2004) and Endalew Amenu (2007) which reported that oral administration is the most common route of administration.

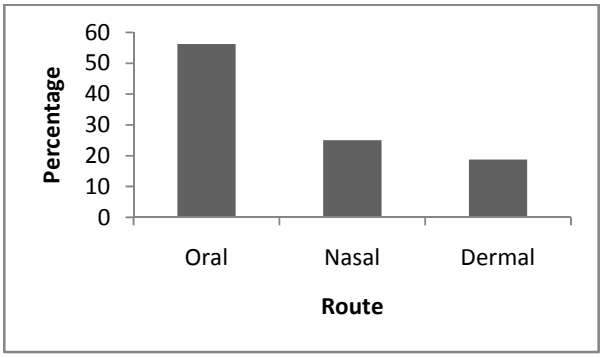

Figure 14 Percentage of route of medicinal plants administration for livestock ailments

Application

Application of ethnoveternary medicinal plants involves drinking (56.25%), smoking (18.75%), put on (12.5%), dropping (6.25%) and tied (6.25%) (Figure 15). For example, if leaves of *Stereospermum kunthianum* squeezed with leaves of *Asparagus africanus* and the squeezed sap is given orally to cattle it can cure the animal from the poisonous snake bite. Crushing and adding the seeds of *Solanum anguivi* to the dermal of cattle will kill parasitic ticks that are found in the body of the animal

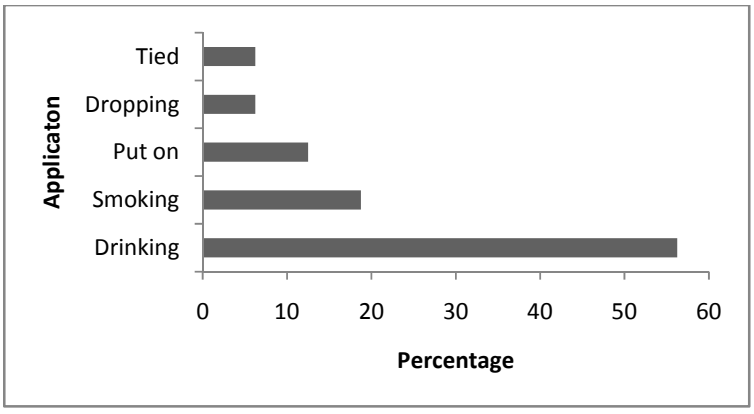

Figure 15 Application of livestock medicinal plants

5.7.3.2 Major livestock diseases and number of plant species used by local people

In comparison to human diseases livestock diseases are treated with a few number of plant species in the study area. A total of 25 livestock ailments were identified that are treated by traditional medicinal plants in the area. Common diseases affecting livestock health's in the study area are wound which is treated by 6 species. black leg by 5 species, blotting and stomachache by 3 species each, common cold, cough, eye problem, rabies and weight loss are treated by 2 species each and the remaining disease are treated by 1 species each (Table 7). This finding related with the work of Endalew Amenu (2007) that reported 27 livestock problems.

Table 7 Common diseases of livestock and number of species used.

Disease treated	Total species	Percent
Wound	6	33.33
Black leg	5	27.77
Blotting	3	16.66
Stomachache	3	16.66
Common cold	2	11.11
Cough	2	11.11
Eye problem	2	11.11
Rabies	2	11.11
Weight loss	2	11.11
Ecto-parasite	2	11.11
Mastitis	1	5.55
Rinderpest	1	5.55
'Dhora jabbii'	1	5.55
Evil eye	1	5.55
eye cataract	1	5.55
'Goloba'	1	5.55
Infection	1	5.55
Internal parasite	1	5.55
Leeches	1	5.55
Malaria of mule	1	5.55
Pancreatic problem	1	5.55
Poisoning	1	5.55
Shivering of livestock	1	5.55
Snake bite	1	5.55
Ticks	1	5.55

The local people use different species for the treatment of wound that require simple techniques of preparation. For example, the bark of *Albizia schimperiana* is crushed with bark of *Erythrina brucei* and added on the area. Or painting the latex of *Croton macrostachyus* on the area is used

to cure wound. They use also crushed root of *Ipomoea cairica* or leaves of *Datura stramonium* for the disease.

5.7.4 Medicinal plant species used to treat both livestock and human ailments

Medicinal plants recorded for the treatment of human and livestock in the study area are 17 species. These are distributed in 16 genera and 10 families. Family Fabaceae comprises 4 species, Solanaceae 3 species, Amaranthaceae 2 species, Euphorbiaceae 2 species; the others Boraginaceae, Convolvulaceae, Cucurbitaceae, Lamiaceae, Meliaceae and Rutaceae comprise 1 species each. The sources of these species are 13 species are from the wild vegetation and 4 species are from homegarden. This result agrees with the work of Endalew Amenu (2007), in which the wild sources of plants for the treatment of livestock and human ailments are took the lead.

5.7.4.1 Habits, parts used, method of preparation, route of administration and application

The habits of medicinal plants that are harvested for the treatment of human and livestock ailments are shrubs 7 species, herbs 5 species, trees 4 species and climbers 2 species (Figure 16). This agrees with the work of Endalew Amenu (2007) in which shrubs take the lead.

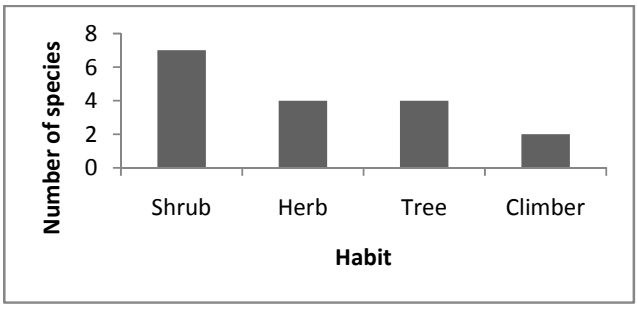

Figure 16 Habits of medicinal plants that used for both human and livestock treatment.

The parts of a plant used for remedy preparation of human and livestock ailments are leaves stood first (57.47%), followed by root (12.64%), stem accounted for 10.34%, seeds 10.34% of preparation, latex 4.59%, bark 3.44% and branch take 1.14% of the preparations.

The local community use different forms of remedy preparations and applications to treat livestock diseases. The common forms of preparations are squeezing (32.58%), crushing (13.48%), powdering (8.98%), harvesting (7.86%), chewing (6.74%), crushing and concoction (5.61%) and others (Table 8).

Table 8 Ways of preparations of human and livestock medicinal plants

Preparation	Number	Percent
Squeezing	29	32.58
Crushing	12	13.48
powdering	8	8.98
Harvesting	7	7.86
Chewing	6	6.74
Crushing and concoction	5	5.61
Burning	3	3.37
Crushing and mixing	3	3.37
Boiling	2	2.24
Cooking	2	2.24
Squeezing and concoction	2	2.24
Boiling and mixing	1	1.12
Filtering	1	1.12
Homogenising in water	1	1.12
Mixing and boiling	1	1.12
Powdering and homogenising in water	1	1.12
Mixing and boiling	1	1.12
Powdering and mixing	1	1.12
Powdering and concoction	1	1.12
Squeezing and mixing	1	1.12

In all of the cases, oral application is the dominant route that accounted for 55.17%, followed by dermal that accounted 26.43%, nasal and tooth surface take 6.89% each, optical 2.29%, auricular and neck each route take 1.14% for administration of plant remedies.

The medicinal plants have different application techniques the major ones are drinking take 37.93%, painting 12.64%, eating 9.19%, put on 9.19%, swallowing 6.89%, and others like

washing, dropping, Sniffing, tied, brushing, smoking take the remaining percent. This result agrees with the work of Endalew Amenu (2007), in terms of the habits, plant parts used, route of administration and method of application.

5.8 Informant Consensus

The results of this study showed that some medicinal plants are popular than others, in this study the highest informant consensus goes to *Ocimum lamiifolium* which is cited by 89 informants (Table 9). The popularity of this medicinal plant is due to the preference of the species for treating fibrile illness in the community rather than going to modern medication for the disease and its easy access in the homegardens of many people. *Croton macrostachyus* is cited by 60 informants, 58 informants cited *Allium sativum* species and *Vernonia* species by 58 informants for the treatment of wound, *Ruta chalepensis* by 55 and *Vernonia amygdalina* cited by 39 informants for treating different health problems. Popularity of these medicinal plants is due to the access of occurrence of the disease is high as a result everybody should have got a chance to see the treatment and as a result the secrecy become low.

Table 9 List of Medicinal plants and the corresponding informants (Percentage ≥ 10)

Scientific Name	No. of informants	% of informants
Ocimum lamiifolium	89	89
Croton macrostachyus	70	70
Allium sativum	58	58
Vernonia species	58	58
Ruta chalepensis	40	40
Vernonia amygdalina	39	39
Trichilia dregeana	35	35
Artemisia abyssinica	34	34
Citrus limon	34	34
Rumex nepalensis	34	34
Artemisia afra	33	33
Foeniculum vulgare.	33	33
Lepidium sativum	33	33
Withania somnifera	33	33
Eucalyptus globulus	32	32
Brucea antidysenterica	30	30
Drymaria cordata	30	30
Clerodendrum myricoides	29	29
Solanecio angulatus	29	29
Coffea arabica	28	28

Verbena officinalis	28	28
Ajuga integrifolia	26	26
Calpurnia aurea	26	26
Phytolacca dodecandra	25	25
Carica papaya	23	23
Clematis hirsuta	23	23
Nicotiana tobaccum	23	23
Thymus schimperi	23	23
Datura stramonium	22	22
Olea europaea subsp. *cuspidata*	22	22
Celosia trigyna	21	21
Rumex abyssinicus	21	21
Kalanchoe petitiana	21	21
Justicia diclipteroides	20	20
Ricinus communis	20	20
Acmella caulirhiza	19	19
Lawsonia inermis	19	19
Plantago lanceolata	19	19
Pycnostachys abyssinica	19	19
Asparagus africanus	18	18
Justicia schimperiana	18	18
Cordia africana	17	17
Ocimum basilicum	16	16
Senna petersiana	16	16
Achyranthes aspera	15	15
Albizia gummifera	15	15
Maesa lanceolata	15	15
Aloe kefaensis	14	14
Ananas comosus	11	11
Buddleja polystachya	11	11
Caylusea abyssinica	11	11
Catha edulis	10	10
Erythrina brucei	10	10
Laggera crispata	10	10
Ocimum gratissimum	10	10
Sonchus asper	10	10

Informant consensus factor (ICF)

The diseases of the study area have grouped in to different categories based on the site of occurrence of the disease, condition of the disease as well as treatment resemblance of the disease

to the local people. The informant consensus factors have been calculated for each category (Table 10). In this study, the informant consensus of medicinal plant usage resulted in ICF ranging from 0.675 to 0.907 per illness category. 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.

Table 10 Informant consensus factor by categories of diseases in the study area

Category	**Species**	**Use citation**	**ICF**
Rheumatism and stabbing pain	8	77	0.907
Evil eye and evil spirit	8	77	0.907
Asthma, Common cold, Cough, Influenza	9	83	0.902
Blood clot, Excessive menstrual bleeding, Nasal bleeding	10	92	0.901
Fibrile illness and Headache	17	160	0.899
Amoeba and Diarrhea	9	71	0.885
Epilepsy and Madness	3	18	0.882
Rabies, Snake bite	6	41	0.875
Gastritis, Stomachache, Constipation, Vomiting	22	156	0.864
Kidney Problem, Liver problem, Pancreatic Problem	8	46	0.844
STDs	8	44	0.837
Fire burn, Wound, Mouth sore, Tonsillitis, Toothache	38	219	0.830
Swelling	8	42	0.829
Ringworm, Scabies, Skin rash, Tinea versicolor	9	47	0.826
Ascaries and Tape Worm	8	36	0.800
Insect allergy, Spider poison, Urine of bat	17	69	0.764
Eye problem, Ear problem, Nose smell, Mouth smell	13	38	0.675

As the table shows the following two categories: rheumatism and stabbing pain; evil eye and evil spirit categories each have scored the highest informant consensus factor of 0.907 followed by Asthma, common cold, cough, influenza category and blood clot, excessive menstrual bleeding, nasal bleeding category each have scored an informant consensus factor of 0.902. A high ICF value (close to 1) indicates that the informants use relatively few taxa to manage specific disease conditions as well as consistency in the use of plant species, while a low value indicates that the informants disagree on the taxa to be used in the treatment within a category of illness. The lower informant consensus factor (0.675) in this study scored for the category of diseases like eye, ear,

nose and mouth problems. This category may be indicative for lack of consistency in the use of plant species in the study area.

5.9 Preference Ranking

When there are different species prescribed for the same health problem, people show preference of one over the other. Preference ranking of 7 medicinal plants that were reported for treating tonsillitis was conducted after selecting 10 key informants. The informants were asked to compare the given medicinal plants based on their efficacy, and to give the highest number (7) for the medicinal plant which they thought most effective in treating tonsillitis and the lowest number (1) for the least effective plant in treating tonsillitis (Table 11).

Table 11 Preference ranking of medicinal plants used for treating tonsillitis

Informants Labelled 1-10	**Medicinal Plants**						
	Acmella caulirhiza	*Albizia gummifera*	*Dioscorea praehensilis*	*Erythrina brucei*	*Ricinus communis*	*Rhamnus prinoides*	*Solanum incanum*
I_1	7	2	3	5	6	4	1
I_2	5	1	4	1	3	2	6
I_3	6	2	1	4	3	7	5
I_4	7	4	2	5	1	3	6
I_5	6	1	7	5	3	2	4
I_6	7	1	4	6	3	2	5
I_7	6	2	3	5	4	1	7
I_8	7	3	2	5	1	4	6
I_9	7	4	3	6	2	1	5
I_{10}	6	4	3	5	1	2	7
Total	64	24	32	47	27	28	52
Rank	1st	7th	4th	3rd	6th	5th	2nd

As indicated in the table preference ranking for seven medicinal plants used to treat tonsillitis shown that *Acmella caulirhiza* ranked first and hence is the most effective medicinal plant to cure tonsillitis. Ethnobotanical investigations done elsewhere in Ethiopia also reported that *Acmella caulirhiza* was used for treatment of tonsillitis (Endalew Amenu, 2007). The second, third, fourth and fifth most preferable medicinal plants against this disease are *Solanum incanum*, *Erythrina*

brucei, Dioscorea praehensilis and *Rhamnus prinoides* respectively, while the least preferable species compared to other five species are *Ricinus communis* and *Albizia gummifera* according to informants.

5.10 Paired Comparison

For medicinal plants that were identified by the informants to be used in treating insect allergy ('Hadha'), disease that develop when the larva of an insect touches human body, which was the most common disease for which patients visited the traditional medicinal practitioners rather than modern clinics. A pair wise comparison was made among five of them (Table 12).

Seven key informants did the pair comparison of five medicinal plants and the value is summarized. It was found that *Indigofera spicata* species stood first for the treatment of insect allergy and *Drymaria cordata, Ipomoea tenuirostris* and *Withania somnifera* will be 2nd, 3rd, and 4th respectively. *Kalanchoe petitiana* was the least preferred species to treat the disease in the area. This rank is because of the efficacy of the plant at least in the context of local people.

Table 12 Paired comparison of medicinal plant species used to treat insect allergy

Medicinal plants	**Informants labelled 1 to 7**								
	I_1	I_2	I_3	I_4	I_5	I_6	I_7	Total	Rank
Drymaria cordata	3	2	3	3	4	2	2	19	2nd
Indigofera spicata	4	3	2	3	2	2	4	20	1st
Ipomoea tenuirostris	2	3	3	2	3	1	2	16	3rd
Kalanchoe petitiana	1	0	1	0	1	3	3	9	4th
Withania somnifera	0	2	1	2	0	2	0	7	5th

5.11 Direct Matrix Ranking

In the study area the majority of the community relies on wild plants for various purposes such as charcoal, construction, fencing, firewood, forage, furniture making, medicinal, etc. To assess the relative importance and to check the major impact on such plants direct matrix ranking was preformed (Table 13). In the area a number of medicinal plants were found to be multipurpose species being utilized for a variety of uses. It was found that 70 species (43.04%) of medicinal plants have values other than their medicinal role.

Six commonly reported multipurpose species and seven use-categories were involved in direct matrix ranking with four informants. Respondents evaluate their relative importance to the local people and the extent of the existing threats related to their use values. The values for use reports across the selected species were summed up and ranked.

As table 13 shows, the results of the direct matrix ranking revealed that *Cordia africana* ranked first and hence it is the most preferred plant by local people for various uses and is the most threatened species as the informants reported, which is evidently shown by its scarce distribution in the area except in some protected coffee forests. This scarcity of *Cordia africana* is due to over harvesting for not only medicinal but also for other uses particularly for timber production. *Maesa lanceolata* ranked second, *Trichilia dregeana* ranked as third, *Syzygium guineense* obtained fourth place, *Premna schimperi* placed on fifth place and *Croton macrostachyus* got the last sixth place. So, the top ranked species are highly threatened that is 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.

Table 13 Direct matrix ranking of six plant species by four informants based on seven use criteria (5 = best; 4 = Very good; 3 = good; 2 = less used; 1 = least used and 0 = no value)

Use-categories	**Medicinal Plants**																							
	Croton macrostachyus				*Cordia africana*				*Maesa lanceolata*				*Premna schimperi*				*Trichilia dregeana*				*Syzygium guineense*			
	Informants (I_{1-4})				I				I				I				I				I			
	1	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Charcoal	2	3	2	1	4	4	5	3	3	5	2	2	2	2	3	1	4	3	4	3	4	4	3	5
Fire wood	3	4	5	3	4	3	3	4	5	4	3	2	2	1	3	2	5	5	5	5	4	4	5	3
Construction	3	4	2	3	5	5	5	5	3	3	2	4	3	4	3	3	4	3	4	5	2	1	1	2
Fencing	2	2	3	1	5	5	5	5	5	5	5	5	5	5	5	5	2	3	2	3	4	5	4	3
Medicinal	5	5	5	5	3	4	3	2	4	4	5	4	4	5	3	4	5	5	5	5	3	4	2	3
Furniture	1	1	1	1	5	5	5	5	1	1	2	1	1	1	1	1	2	1	2	2	2	1	2	3
Fodder	2	1	1	1	3	3	4	2	4	3	5	4	2	3	2	3	2	2	3	1	5	5	5	4
Ind. total	18	20	19	15	29	29	30	26	25	25	24	22	19	21	20	19	24	22	25	24	24	24	22	23
Grand total	72				114				96				79				95				93			
Rank	6^{th}				1^{st}				2^{nd}				5^{th}				3^{rd}				4^{th}			

5.12 Jaccard Coefficient of Similarity

The results of the comparison by using Jaccard coefficient of similarity indicated that the highest degree of similarity was observed with the study conducted in Gimbi Wereda (29.5%) followed by Southwest Oromo (21.2%) followed by Cheliya Wereda (20.6%), then Wonago Wereda (19.3%) and finally with Debre Libanos Wereda (18.5%) (Table 14).

Table 14 The Jaccard coefficient of similarity of Goma Wereda with five other areas with respect to medicinal plant composition.

Author and sample area	**a**	**b**	**c**	**%JCS**
Goma Wereda	121	-	-	
Etana Tolasa (2007)/ Gimbi Wereda	85	38	47	29.5
Endalew Amenu (2007)/ Chelya Wereda	89	53	36	20.6
Haile Yineger *et al.,* (2008)/ Southwest Oromo	67	34	33	21.2
Siyoum Getaneh (2009)/ Derbre Libanos Wereda	90	57	33	18.5
Fisseha Mesfin (2007)/ Wonago Wereda	58	29	29	19.3

The highest degree of similarity is observed with Gimbi, Southwest Oromo and Cheliya Wereda. This may probably due to socio-cultural factors that could contribute to the medicinal plant knowledge base of people. There is also nearness to each other of the study area that might contribute to higher degree of cultural influx. The lowest degree of similarity is observed in Debre Libanose Wereda this might be due to vegetation difference of the two study areas and cultural difference of the two groups of people.

6. THREATS AND CONSERVATION PRACTICES TO MEDICINAL PLANTS

People need plants for their daily life activity. In Goma Wereda from the interview of informants, various factors were recorded as the main threats for medicinal plants in the area. There is loss of plants as a result of agricultural encroachment, firewood, charcoal, timber, construction material are contributing factors for the loss of plant species in general and medicinal plants in particular. During field observation there is high rate of reduction of species is observed particularly for those plants which are not suitable for coffee shade. That is, most naturally grown plant species have been removed if it is less significant for coffee shade. In addition, problems related to the high mortality of a popular coffee shade tree (*Albizia gummifera)* death have also been observed in some places. *A. gummifera* is a famous shade tree in Goma, but the problem of its death is an issue which needs some attention. This requires identifying the causes of its death and trying to solve it in collaboration with extension and research system and farmers in the Wereda.

According to the traditional healers, nowadays searching of medicinal plants require long time and moving long distance even going to neighbouring Wereda to collect the plants. Even some healers have started to grow some medicinal plants in the coffee plant as a fence and in their homegarden as a result of scarcity of plants in the wild.

According to informants' response the most mentioned threats to medicinal plants of the study area are agricultural expansion (90%), fire wood (55%), charcoal production (45%), timber production (15%) and construction (15%) (Figure 17). Similar results were obtained in different investigation in Ethiopia Endalew Amenu (2007) showed that need for agricultural land and population pressure severely threatened plant species in general and medicinal plants in particular.

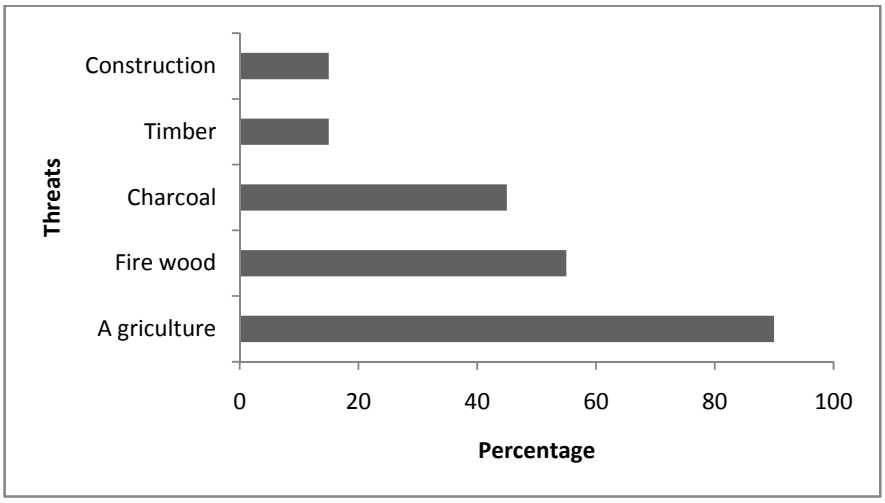

Figure 17 Percentages of reported threats to medicinal plants

According to Sofowara (1982) the loss of medicinal plants associates with the missing advantages gained from medicinal plants and indigenous knowledge associated with plants. Some of the traditional healers might have given much attention to the indigenous knowledge transfer while others have little concern regarding the value of indigenous knowledge. In general, the knowledge on medicinal plants become lesser and lesser due to its secrecy, unwillingness of young generation to gain the knowledge, oral based knowledge transfer, unavailability of the species, influence of modern education and awareness factors which all results in gradual loss of indigenous knowledge on medicinal plants in the area.

A remarkable traditional medicinal plant knowledge and practice was documented from the study area. Older traditional healers had greater knowledge and use of ethnomedicinal plant species than younger traditional healers. The average age of the traditional healers was 57.12 years. The fact that 70.83% of the healers were aged above 50 years implies that the legacy of the use of traditional medicines to manage diseases is in danger of being permanently lost if quick efforts are not exerted to document this invaluable knowledge. As a result, the community suffered an important erosion of ethnomedicinal plant knowledge. It is a fact that as traditional healers who value traditional knowledge are becoming very old, the indigenous medicinal plants use knowledge was declining among the younger generation, which could be attributed to the low interest of the younger generation to inherit and use ethnomedicinal knowledge.

Ethnomedicinal knowledge diminishes with the death of elderly knowledgeable person. A key informant from one of the study site Keso-heti with an age of 70 said ‘‘I will tell my knowledge

of medicinal plants to my child at the time when I die.'' This saying indicates that there is poor ways of transferring knowledge on medicinal plants. Depending on the age of the healers passing the knowledge of numerous species of ethnomedicinal plants use, management and ways of preparation are threatened. Old aged healers provide the knowledge with doubtful accuracy to the learners. Results also revealed that many of the traditional healers reported to transfer their knowledge and use of ethnomedicinal plants orally to their favourite family member. Such transfer of indigenous knowledge is liable to erosion as it could vanish when knowledgeable elders die before the knowledge is transferred. So, apart from its effect on plants human thinking by itself is great threat to medicinal plants.

The practitioners know the importance of conserving medicinal plants; homegardens are good places for conservation of medicinal plants and for better transfer of the indigenous knowledge to the younger generation. Some traditional practitioners have started to conserve medicinal plants by cultivating at homegardens. About 38%, of the medicinal plants collected were reported as found cultivated at homegardens (Appendix 5). The local community manage vegetation of the area for their medicinal attributes. Some healers of Goma Wereda grow medicinal plants with coffee plantation and in homegardens as well as a fence in coffee plantation and resident place. This paves a way for knowledge on medicinal plants to pass from generation to generation.

Moreover, significant number of plant species (11) reported as endemic to Ethiopia thereby recorded in the IUCN Red List was also recorded in the study area. These species are *Aloe kefaensis, Cirsium englerianum, Cynoglossum densefoliatum, Erythrina brucei, Impatiens rothii, Kalanchoe petitiana, Leucas stachydiformis, Millettia ferruginea*, *Pycnostachys abyssinica*, *Thymus schimperi* and *Vernonia leopoldi.* Therefore, there are a considerable number of endemic plant species recorded in the study area and that more and more endemic species might be recorded if detailed botanical studies are undertaken throughout the area.

7. CONCLUSION

Goma Wereda is relatively rich in medicinal plant diversity. One hundred twenty one medicinal plants were recorded of which 92 species were noted to treat human ailments while, 12 species are documented to treat livestock ailments and 17 species are used to treat both livestock and human ailments. The medicinal plant species collected and identified were 75 species from the wild vegetation and 46 species are from homegardens. There are locally preferable treatments by traditional healers for some diseases in the area like evil eye, fibrile illness, evil spirit, insect allergy, spider poison and urine of bat rather than modern clinics.

In the study area, 102 ailments were reported (77 for human and 25 for livestock) which are being treated by traditional medicinal plants of the area. Herbs were found the dominant habits used for preparation of traditional remedies followed by shrubs and trees. Leaves were also found to be the most frequently used plant parts followed by roots for preparation of human and livestock remedies. Traditional medicine preparation mostly involves single plant; the mode of administration is mainly internal in which oral administration is the common route.

The main threat for medicinal plants in the area arises from agricultural expansion, firewood, charcoal production, timber production and construction. Threat comes to medicinal plants due to the utilization of these plants for medicinal purpose is negligible. Whereas threats that erode indigenous knowledge emanate from secrecy, oral based knowledge transfer, 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 rising should be made among the healers so as to avoid erosion of the indigenous knowledge and to ensure its sustainable use. Further biological studies should also be conducted on the reported medicinal plant species of the study area so as to utilize them in drug development.

8. RECOMMENDATIONS

Based on the research results, the following recommendations are forwarded:

- Local community of the study area should be involved in conservation and management of plant resources and their indigenous knowledge in their locality.
- Identifying effective medicinal plants and encouraging the local people to grow medicinal plants in homegardens, mixing with crops, coffee farms and as live fences of their resident and surrounding coffee plantation is crucial.
- Local people harvest plants for business or for household use with little awareness of its threat, awareness should be raised either, by development agents or agricultural workers through which sustainable harvesting be practiced.
- Since some of the traditional healers might have given much attention to the indigenous knowledge transfer while others have little concern regarding the value of indigenous knowledge, some governmental and nongovernmental organization should participate in awareness raising for healers to minimize the loss of indigenous knowledge.
- The knowledge of traditional medicine practitioners must be encouraged and protected. This could be the way through which such people could exercise their skill broadly.
- There is a need of coordination of traditional healers of the area together by certification or by organizing them at Wereda level that popularize their indigenous knowledge on medicinal plants. Establishing Traditional Healers Association, by providing land for cultivating medicinal plants, funds and assisting their activities with professional guidance helps to conserve the fast eroding medicinal plants of the area.
- There should be a need of development of community- based forest priority area (park) establishment in the Wereda for the conservation of forest in general and medicinal plants in particular rather than converting all areas in to coffee plantation sites.
- The overall analysis reveals that major uses of medicinal plants for treatment of different diseases ranges from simple diseases to fatal diseases. These traditional remedies indeed, need to be confirmed through scientific investigations to identify those that may provide alternatives for modern drugs.

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11. APPENDICES

Appendix 1: List of medicinal plants used for both human and/or livestock diseases, scientific name; family ; local name; habit; parts used; disease treated; mode of preparation with dosage used and route of administration. For voucher numbers see Appendix 4 and 5.

Key: Habit (Ha.): Herb (H); Shrub (S); Tree (T); Climber (Cl). Parts used (Pu) (Bark, B; Latex, La; Root, R; Leaf, L; Fruit, Fu.; Flower, F.; Seed, Se.; Stem, S.; Bulb, Bu.; Above ground, Ag; Whole plant, Wp.). Use (Hu-Human, Ls-Livestock).

Scientific Name	Family	Local Name	Ha	Use	Pu	Disease Treated	Mode of Preparation	Route
Acacia abyssinica Hochst. ex Benth.	Fabaceae	Lafto	T	Hu	L	Skin rash	Powdered and put on the area	Dermal
Achyranthes aspera L.	Amaranthaceae	Cagogit/ xalanji/ gerbi	H	Ls	L	Eye problem	Chewed and added on the eye	Optical
				Hu	Br	Excessive menstrual bleeding	Tied on the foot	Dermal
				Hu	R	Nasal bleeding	Crushed and sniffed with leaves of *Solanum incanum*	Nasal
Acmella caulirhiza Del.	Asteraceae	Yamidir barbare	H	Hu	F	Toothache	Chewed and put on	Tooth surface
				Hu	F	Tonsillitis	3 flowers are chewed together	Oral
Ageratum conyzoides L.	Asteraceae	Tuffoo cabii/ Qoricha shankila	H	Hu	L	Blood clot	Crushed and put on	Dermal
Ajuga integrifolia Buch,Ham	Lamiaceae	Harma bussee/ Anaamiro	H	Ls	L	Black leg	Crushed with powdered *Echinops kebericho* and 1 L is given to cattle	Oral
				Hu	L	Rheumatism	Squeezed and 1 glass cup is taken per day for 3 consecutive days by adding salt	Oral
Albizia gummifera (J.F. Gmel.) C.A.Sm.	Fabaceae	Anbabesaa	T	Hu	Ba	Stomachache	Chewed	Oral
				Hu	Ba	Diarrhea	Powdered and 1 coffee cup is taken	Oral
				Hu	Ba	Tonsillitis	Chewed	Oral

Albizia schimperiana Oliv.	Fabaceae	Ca'o	T	Ls	Ba	Wound	Crushed with bark of *Erythrina brucei* and added on the area	Dermal
Allium sativum L.	Alliaceae	Qullubi adii	H	Hu	Bu	Malaria	Crushed and eaten	Oral
				Hu	Bu	Heart failer	Crushed and eaten for 2-3 days in the morning	Oral
				Hu	Bu	Hemorrhoides	Mixed with honey, butter, *Nigella sativa* and *Trachyspermum ammi* filtered and stayed for 1 day then one soup spoon is taken each day in the morning	Oral
				Hu	Bu	Stomachache	Eaten by mixing with *Ruta chalepensis* and adding salt	Oral
				Hu	Bu	Asthma	Mixed with honey, *Nigella sativa* and *Trachyspermum ammi* and one soup spoon is taken each day in the morning.	Oral
Aloe kefaensis Gilbert & Sebsebe	Aloaceae	Argisaa/ Arkiso	H	Hu	La	Fire burn	The latex is painted on the wound	Dermal
Ananas comosus (L.) Merr.	Bromeliaceae	Anaanaasii	H	Hu	Fr	Vomiting	Eating the fruit	Oral
Artemisia abyssinica Sch. Bip. ex A.Rich.	Asteraceae	Sukundee	H	Hu	L	Kidney problem	Squeezed with *Thymus schimperi* and drunk half of coffee cup	Oral
				Hu	L	Gastritis	Squeezed and drunk 1 glass cup	Oral
				Hu	L	Child Stomachache	Squeezed and ¼ of coffee cup is given to children	Oral
Artemisia afra Jacq. ex Willd.	Asteraceae	Godo guraachaa	H	Hu	L	Diarrhea	Crushed, squeezed and 1 coffee cup is given	Oral
				Hu	L	Evil eye	Crushed, squeezed with *Withania Somnifera* and 1/4 coffee cup is given	Oral
				Hu	L	Fibril illness	Mixed with *Foeniculum vulgare, Kalanchoe petitiana, Withania somnifera* squeezed together, filtered and 1 glass cup is given.	Oral

				Hu	L	Stomachache for children	Mixed with *Ruta challepensis* squeezed and given to children.	Oral
Asparagus africanus Lam.	Asparagaceae	Sarriiti/ qastanicha	H	Hu	L	Snake bite	Squeezed with leaves of *Stereospermum kunthianum* and *Citrus limon* and 1 coffee cup is given	Oral
				Hu	L	Poisoning	Squeezed and given	Oral
				Hu	R	Diabetes	Powdered and taken with honey	Oral
Bidens pilosa L.	Asteraceae	Maxanee	H	Hu	L	Ear problem	Squeezed and added	Auricular
				Hu	R	Gonorrhea	Squeezed and drinking 1 glass cup	Oral
				Hu	L	Spider poison	Burned on fire and put on the area	Dermal
Bidens prestinaria (Sch.Bip) cufod.	Asteraceae	Kello	H	Hu	L & F	Ear problem	Squeezed and added	Auricular
Brassica carinata A.Br.	Brassicaceae	Ija raafu	H	Hu	Se	Stomach problem	Crushed and eaten with *Allium sativum* by adding salt	Oral
Brucea antidysenterica J.F.Mill.	Simaroubaceae	Qomonyo	S	Hu	L	Rheumatism	Crushed and washed by adding leaves of *Justicia shimperiana, Acacia abyssinica* and *Momordica foetida*	Dermal
				Hu	L	Rabies	Squeezed and baked with teff flour and given for 3 days	Oral
				Hu	L	Swelling of leg	Boiled and washed for 3 days	Oral
Calpurnia aurea (Ait.) Benth.	Fabaceae	Cekaa	S	Hu	L	Stomachache	Squeezed and drunk one spoon	Oral
				Ls & Hu	L	Ecto-parasite	Crushed and washed	Dermal
				Hu	S	Amoeba	Squeezed, drunk 1/2 glass cup	Oral
				Hu	S	Toothache	Harvested and brushed	Tooth surface
				Hu	L	Diarrhea	Squeezed and drunk 1/2 glass cup	Oral
Carica papaya L.	Caricaceae	Papaye	T	Hu	L	Gastritis	Crushed, squeezed and drunk 1 glass cup in the morning	Oral
				Hu	L	Malaria	Yellow leaves are squeezed and drunk	Oral
				Hu	R	Malaria	Crushed, boiled by adding sugar and	Oral

							taken	
				Hu	Se	Ascaries	The seeds are dried and eaten	Oral
				Hu	R	Wound	Crushed and painted	Dermal
				Hu	Se	Amoeba	Dried, powdered and taken with tea	Oral
Catha edulis (Vahl) Forssk. ex Endl.	Celastraceae	Caati	S	Hu	L	Gonorrhea	Red colour *Catha edulis* cooked, stayed for one night and 1 glass cup is taken for 2 - 3 days in the morning by adding small amount of sugar.	Oral
Caylusea abyssinica (Fresen.) Fisch. & Mey.	Resedaceae	Aranci	H	Hu	L	Tinea versicolor	Crushed and painted	Dermal
				Hu	R	Intestinal parasite	Eaten with roasted barley	Oral
				Hu	R	Diarrhea	Crushed and eaten by salt	Oral
Celosia trigyna L.	Amaranthaceae	Dagiso	H	Hu	R	Tapeworm	Squeezed and drunk 1 glass cup or eaten with roasted barley.	Oral
				Hu	L	Gonorrhea	squeezed and drunk 1/4 coffee cup	Oral
Centella asiatica (L.) Urban	Apiaceae	Tussee	H	Hu	L	Toothache	Crushed & put on	Tooth surface
Cirsium englerianum O.Hoffm.	Asteraceae	Umbahoo	H	Hu	R	Liver problem	Squeezed and 1 tea cup is given	Oral
Citrus limon (L.) Burm.f.	Rutaceae	Lomi	S	Hu &Ls	Fr	Poisoning	Squeezed and given	Oral
				Ls	Fr	Eye cataract	Squeezed and added on eye	Optical
				Hu	Fr	Common cold	Boiled with sugar and taken	Oral
Citrus medica L.	Rutaceae	Tiringo	T	Hu	L	Stabbing pain	Cooked and drunk the sap	Oral
Clausena anisata (Willd.) Benth.	Rutaceae	Ulmaayii	S	Hu	L	Fibril illness	Boiled and washed	Dermal
Clematis hirsuta Perr. & Guill.	Ranunculaceae	Fiitii	Cl	Hu	L	Urine of Bat	Placed on fire and put on the area	Dermal
				Hu	L	Toothache	Crushed and put on	Tooth

								surface
				Hu	L	Swelling of leg	Placed on fire with leaves of *Plumbago zeylanica* and *Drymaria cordata* and washed	Dermal
				Hu	L	'Xooroo'	Crushed and painted	Dermal
Clerodendrum myricoides (Hochst.) Vatke	Lamiaceae	Maraasisa/ Misirich	S	Hu	L	Evil Eye	Squeezed and 1 coffee cup is given	Oral
				Hu	S	Toothache	Brushed	Tooth surface
				Hu	S	Evil Spirit	To brush the teeth	Tooth surface
Coffea arabica L.	Rubiaceae	Buna	S	Hu	Se	Wound	Roasted, powdered and put on	Dermal
				Hu	Se	Spider poison	Roasted, powdered, mixed with butter and painted	Dermal
				Hu	Se	Diarrhea	Roasted, powdered, mixed with honey and eaten in the morning	Oral
Colocasia esculenta (L.) Schott	Araceae	Godare	H	Hu	R	Ascaries	Cooked and eaten	Oral
				Hu	L	Constipation	Boiled and eaten	Oral
				Hu	L	Gastritis	Boiled, cooled, stay for one night and the sap is taken in the morning	Oral
Cordia africana Lam.	Boraginaceae	Wadeesaa	T	Hu	L	Skin rash	Dried, powdered, mixed with butter, painted by washing the area every day for 7 days and tied with cloth	Dermal
				Hu	S	Skin rash	Dried and added on the area with coffee, butter and faeces of rabbit for 3 days	Dermal
				Hu	S	Smell of foot	Stem soaked and added on leg	Dermal
				Hu	L	Wound of leg	Placed on fire and put on the area	Dermal
				Hu	L	Scabies	Powdered , mixed with butter and painted	Dermal
Crotalaria species	Fabaceae	Yeayit shimbraa	S	Hu	L	Glandular swelling	Rubbing the area with crushed leaves	Dermal
Croton macrostachyus Del.	Euphorbiaceae	Makanisaa	T	Ls	L	Blotting	Crushed and sniffed	Nasal
				Hu	L	Blood clot	Squeezed on the area	Dermal

				Ls	L	Stomachache	Crushed, squeezed and drunk	Oral
				Hu	La	Ringworm	Painted on the area	Dermal
				Hu	S	Liver problem	The middle part of the stem cooked with teff flour and 5 - 7 spoons is taken.	Oral
				Hu	L	Malaria	Crushed and Smoked	Nasal
				Ls	La	Wound	Harvested and painted on the area	Dermal
				Hu	L	Gonorrhea	Powdered, placed on water overnight and filtered and drunk 1 tea glass for two days, hiding from shadow for one day; cooked teff flour is eaten to stop diarrhea.	Oral
				Hu	S	Ascaries	Cooked with teff flour and eaten from 3-5spoon.	Oral
				Hu	La	Constipation	Harvesting the soft part of stem and drinking with 'Borde or Merek'	Oral
				Hu	L	Tetanus	The upper part of the plant leaf is crushed and added to the area	Dermal
Cucurbita pepo L.	Cucurbitaceae	Buqee/dubaa	H	Hu	Se	Tape worm	Roasted and eaten	Oral
Cuscuta australis R. Br.	Cuscutaceae	Sabata waaqayoo	H	Hu	L	Stomach problem of child	Boiled and 1/4 coffee cup is given	Oral
Cyanotis species	Commelinaceae	Araman dawaa	H	Hu	R	'Naqarsa'	Crushed and 1 coffee cup is taken by adding sugar	Oral
Cyathula cylindrica Mog.	Amaranthaceae	Maxanee	H	Hu	L	Nasal bleeding	crushed and sniffed	Nasal
				Hu	L	Wound	Crushed and added	Dermal
Cyathula uncinulata (Schrad.) Schinz	Amaranthaceae	Maxane hoollaa	S	Hu	L	Blood clot	Squeezed and painted	Dermal
				Hu	L	Ear problem	Squeezed and added	Auricular
				Hu	L	Spider poison	Crushed and tied on the area	Dermal
Cyperus species	Cyperaceae	Qunnii	H	Hu	R	Cough	Crushed, boiled with sugar and taken	Oral
Cyphostemma adenocaule (Steud. ex	Vitaceae	Aserkush tebetebkush	Cl	Ls	Ag	Infection on neck	Tied on the area	Dermal

A.Rich.) Desc. ex wild & Drummond								
*Cyphostemma cyphopetalum (*Fresen.) Discoings ex Wild & Drummond	Vitaceae	Hida reenfaa	Cl	Ls	R	Weight loss	Squeezed and given 1 glass cup by adding salt	Oral
Datura metel L.	Solanaceae	Qoricha bofaa	H	Hu	L	Snake breath	Crushed and painted	Dermal
				Hu	L	Snake bite	Squeezed and drinking 1/2 coffee cup	Oral
Datura stramonium L.	Solanaceae	Asangiraa	H	Hu	L	Nasal bleeding	Squeezed and dropped	Nasal
				Hu	L	'Dhukuba lafaa'	Boiled and taken up to half of the smallest finger nail	Oral
				Ls	L	Wound	Crushed and put on	Dermal
				Hu	L	Dandruff	squeezed and painted on bare head	Dermal
				Hu	Se	Gonorrhea	Crushed, mixed with butter, taken	Oral
Dioscorea praehensilis Benth.	Dioscoreaceae	Wacino	Cl	Hu	L	Tonsillitis	Chewing the leaves in the morning	Oral
				Hu	Bu	'Hypertension'	Boiled and eaten	Oral
Dracaena steudneri Engl.	Dracaenaceae	Gido/Algee	T	Ls	L	Black leg	Crushed with root of *Ricinus communis*, leaves of *Senna didymobotrya* and mixed with 1 lt boiled water and given.	Oral
Drymaria cordata (L.) Schultes	Caryophyllaceae	Sayidasajal/ Moti dagalaa	H	Hu	L	Toothache	Covered with leaves of *Ensete ventricosum* and placed on fire and put on tooth	Tooth surface
				Hu	L	Swelling	Covered with leaves and placed on fire and tied on the area	Dermal
				Hu	L	Nose smell	Covered with leaves, placed on fire and sniffed	Nasal
				Hu	L	Headache	Covered with leaves, placed on fire and sniffed	Nasal
				Hu	L	Urine of bat	Covered with leaves, placed on fire and put on	Dermal

				Hu	L	Insect allergy	Covered with leaves, placed on fire and tied on	Dermal
Ehretia cymosa Thonn	Boraginaceae	Ulaagaa	T	Hu	L	Toothache	Crushed and put with leaves of *Psidium guajava* and *Calpurnia aurea*	Tooth surface
				Ls	L	Shivering of livestock	Crushed, squeezed with the leaves of *Caylusea abyssinica, Justicia shimperiana* and 1 litre is given in the morning and evening to cattle.	Oral
				Hu	L	Rheumatism	Washing with leaves of *Acacia abyssinica, Ocimum lamiifolium* and *Justica shimperiana* for 3 days	Dermal
Ensete ventricosum (Welw.) Cheesman	Musaceae	Qocho	S	Hu	R	Diarrhea	Roasted and eaten with salt	Oral
Erythrina brucei Schweinf.	Fabaceae	Walleensu	T	Ls	L	Eye problem	Squeezed and added	Optical
				Hu	L	Stomachache	Chewed	Oral
				Ls	L	Cough	Crushed, mixed with food and given to hen	Oral
				Hu	L	Insect bite	Squeezed and painted	Dermal
				Hu	Ba	Tonsillitis	Chewed in the morning	Oral
				Hu	L	Toothache	crushed and put on	Tooth surface
				Ls	Ba	Wound	powdered and added	Dermal
				Hu	L	Eye problem	Chewed	Oral
Eucalyptus globulus Labill.	Myrtaceae	Baarzaafii adii	T	Hu	L	Cough	Boiled with sugar 1 tea cup of syrup is given	Oral
				Hu	L	Influenza	Smoked	Nasal
				Hu	L	Malaria	Smoked	Nasal
Eucalyptus species	Myrtaceae	Baarzaafi	T	Hu	L	Foot smell	Added on shoes	Dermal
Euphorbia abyssinica Gmel.	Euphorbiaceae	Adaami	T	Ls	L	Mule malaria	Fumigating the mule with leaf	Nasal
				Ls	L	Rinderpest	Fumigating the animal	Nasal
				Ls	L	‘ Golobaa’	Fumigated with the leaf of *Croton macrostachyus & Ricinus communis*	Nasal

Euphorbia tirucalli L.	Euphorbiaceae	Cadaa	S	Hu	La	Warts	the latex are painted on the area	Dermal
Falkia canescens C.H.Wright	Convolvulaceae	Gura hantutaa	H	Hu	L	Spider poison	Crushed and put on the area	Dermal
				Hu	L	Insect allergy	Crushed and tied on the area	Dermal
				Hu	L	Male sexual impotency	Crushed, mixed with butter and eaten for 5 days	Oral
Foeniculum vulgare Mill.	Apiaceae	Wallaago	H	Hu	L	Kidney Problem	Squeezed with leaves of *Thymus schimperi* and drunk 1 coffee cup for 3 days	Oral
				Hu	L	Blood pressure	Squeezed and drunk1 glass cup	Oral
				Hu	L	Stomachache	Squeezed with leaves of *Ocimum lamiifolium* and *Withania somnifera* and taken	Oral
				Hu	L	Snef of faeces	Squeezed with leaves of *Ruta nepalensis* and taken	Oral
Guizotia scabra (Vis.) Chiov.	Asteraceae	Tuffoo	H	Hu	L	Wound	Squeezed on the area	Dermal
Hagenia abyssinica (Brace) J.F.Gmel.	Rosaceae	Koso	T	Hu	Se	Tape worm	Crushed and drunk with local drink 'tella'	Oral
Helinus mystacinus (Ait.) E. Mey. ex Steud.	Rhamnaceae	Omaachisaa/ Hida gundoo	Cl	Ls	L	'Dhora jabbii'	Squeezed & 1 glass cup is given to cattle	Oral
Indigofera arrecta A.Rich.	Fabaceae	Gerewda	H	Hu	L	Evil eye	Crushed and smoked	Nasal
Indigofera spicata Forrsk.	Fabaceae	Qoricha hadha	Cl	Hu	L	Insect allergy	Crushed and tied on the area	Dermal
Indigofera vohemarensis Baill.	Fabaceae	Heenaa	S	Hu	L	Toothache	Covered by leaves and placed on fire and put on	Tooth surface
Ipomoea cairica (L.) Sweet	Convolvulaceae	Kalaalaa	Cl	Hu	L	Fibril illness	Washed by crushing with *Ocimum gratissimum*	Dermal
				Hu	L	Warts	Crushed and painted	Dermal
				Ls	R	Wound	Crushed and painted	Dermal
Ipomoea tenuirostris	Convolvulaceae	Nisbaa	Cl	Hu	L	Insect allergy	Placed on fire and tied on the area by	Dermal

Choisy							cloth	
Jatropha curcas L.	Euphorbiaceae	Beeroo faranji	T	Hu	Se	Liver problem	3 Seeds for children and 6 seeds for adult crushed, powdered and mixed with cheese and given	Oral
				Hu	Se	STDs	5-10 internal parts of seeds are powdered and 1 glass cup is taken with tea	Oral
Justicia diclipteroides Lindau	Acanthaceae	Togo	S	Hu	L	Anaemia	Boiled with sugar, drunk 1 glass cup	Oral
				Hu	L	Eye infection	Crushed and washed	Optical
Justicia schimperiana (Hochst. ex Nees) T.Anders.	Acanthaceae	Dhumugaa/ Halaltu	S	Hu	L	Rabies	Crushed , squeezed, mixed with milk given 1/2 coffee cup	Oral
				Hu	L	Rheumatism	Mixed with *Brucea antidysenterica, Croton macrostachyus, Clausena anisata, Pycnostachys abyssinica* boiled and washed for 3 days.	Dermal
Kalanchoe petitiana A.Rich.	Crassulaceae	Bosoqe	H	Hu	L	Wound	Placed on fire put on the area	Dermal
				Hu	L	Hemorrhoids	Squeezed and drunk 1 glass cup	Oral
				Hu	L	Ascaries	Squeezed and 1/2 coffee cup is given	Oral
				Hu	L	Insect allergy	Crushed and tied on the area	Dermal
				Hu	L	Swelling	Crushed, boiled and placed on the area	Dermal
Laggera crispata (Vahl) Hepper & Wood	Asteraceae	Tambo	H	Hu	La	Stabbing pain	crushed and sniffed	Nasal
Lawsonia inermis L.	Lythraceae	Hinaaye	T	Hu	L	Headache	Crushed and put on head with butter	Dermal
				Hu	L	Rheumatism	Boiled and 1 glass cup will be taken with sugar	Oral
Lepidium sativum L.	Brassicaceae	Fexo/Shinfaa	H	Hu	Se	Malaria	Smoked with *Echinops Kebericho* and leaves of *Croton macrostachyus*	Nasal
Leucas martinicensis (Jacq.) R.Br.	Lamiaceae	Segere/ Raas kimir	H	Hu	L	Blood pressure	Crushed, squeezed and drunk 1/2 coffee cup	Oral
Leucas stachydiformis (Hochst. ex Benth.) Briq.,	Lamiaceae	Qumudu	H	Hu	Wp	Malaria	Boiled with *Ocimum lamiifolium* and the vapour is inhaled.	Nasal

Lycopersicon esculentum Mill.	Solanaceae	Timaatimii	H	Hu	L	Spider poison	Chewed and put on	Dermal
Maesa lanceolata Forssk.	Myrsinaceae	Abayi	T	Hu	L	Rabies	Crushed, squeezed and taken	Oral
				Hu	L	Urine of bat	Crushed, covered with leaves, placed on fire and put on the area	Dermal
Melia azedarach L.	Meliaceae	Mim	T	Hu	L	Malaria	Squeezed and 1/4 coffee cup is taken	Oral
				Hu	L	Abortion	Squeezed and drunk	Oral
Mentha spicata L.	Lamiaceae	Naanaaye	H	Hu	L	Headache	Crushed and sniffed	Nasal
				Hu	L	Vomiting	Squeezed and taken by mixing with coffee	Oral
				Hu	R	'Harqansu'	Squeezed with leaves of *Thymus schimperi* and drunk 1/4 coffee cup	Oral
Momordica foetida Schumach.	Cucurbitaceae	Minaan loa	Cl	Ls	R	Evil eye	Crushed and Washed	Dermal
				Hu	L	Evil eye	Squeezed and 1/2 coffee cup is given	Oral
				Hu	L	Wound	Crushed, washed and the area is covered with the leaves overnight and again washed with hot water in the morning.	Dermal
				Hu	L	Stomachache	Squeezed with leaves of *Ruta chalepensis* and drunk 1 coffee cup	Oral
				Ls	L	Blotting	Squeezed and 1/2 litre is given to cattle	Oral
				Hu	R	Toothache	Boiled with salt and mouth is rinsed	Tooth surface
Nicotiana tobaccum L.	Solanaceae	Timbaho	H	Hu	L	'Naqarsa'	Placed on fire and put on the area	Dermal
				Ls	L	Cough	Squeezed and 1/2 litre is given to cattle	Oral
				Hu	L	Toothache	Placed on fire and put on the tooth	Tooth surface
				Ls	L	Leeches	Squeezed and 1 coffee cup is given to cattle	Oral
Ocimum basilicum L. var. *basilicum*	Lamiaceae	Keffoo	S	Hu	L	Headache	crushed and sniffed	Nasal
Ocimum gratissimum L.	Lamiaceae	Kefo saree	S	Hu	L	Fibril illness	Crushed and washed by adding leaves of *Ocimum lamiifolium* and *Croton*	Dermal

							macrostachyus	
Ocimum lamiifolium Hochst. ex Benth.	Lamiaceae	Daamaakase	S	Hu	L	Fibril illness	Squeezed and washed	Dermal
				Hu	L	Headache	Squeezed and taken	Nasal
				Hu	L	Mouth smell	Squeezed and1 glass cup is given	Oral
				Hu	L	Common Cold	Squeezed and1 glass cup given	Oral
				Hu	L	Eye infection	Squeezed and painted with leaves of *Justicia diclipteroides*	Optical
Olea europaea L. subsp. *cuspidata* (Wall. ex G.Don) Cif.	Oleaceae	Ejarsaa	T	Hu	La	'Naqarsaa'	The oil is extracted and painted on the area	Dermal
				Hu	La	Headache	The oil of Olea mixed with powdered *Echinops kebericho* and placed on head	Oral
				Hu	La	Asthma	The oil of Olea, stem of *Croton macrostachyus* cooked together, mixed with honey and 1/2 coffee cup is taken	Oral
Oxalis corniculata L.	Oxalidaceae	Sidisa	H	Hu	L	Urine of bat	Placed on fire and put on the area	Dermal
Pennisetum thunbergii Kunth	Poaceae	Marga abaaboo	H	Ls	Wp	Weight loss	Squeezed with leaves of *Thymus schimperi* and salt is added and 1 litre is given to cattle	Oral
Phytolacca dodecandra L. Herit	Phytolacaceae	Andode	Cl	Hu	R	Poisoning	Crushed and taken with boiled coffee and butter	Oral
				Hu	R	Abortion	Crushed and taken	Oral
				Hu	L & S	Rabies	Crushed, dried, powdered, mixed with milk ('Aguat') 2 spoon is given	Oral
				Hu	L	Scabies	Pounded, mixed with leaves of *Vernonia amygdalina* and washed	Dermal
				Hu	R	Gonorrhea	Squeezed and 1cc is injected in to the urethra by syringe	Penus
Plantago lanceolata L.	Plantaginaceae	Qorxib	H	Hu	L	Blood clot	Crushed and added on the area	Dermal
				Hu	L	Wound	Crushed and put on	Dermal
Plectranthus punctatus	Lamiaceae	Dabase	H	Hu	L	Headache	Crushed and sniffed	Nasal

(L.f.) L'her.								
Plumbago zeylanica L.	Plumbaginaceae	Ameeraa	H	Hu	S	Glandular swelling of children	Stems cut in to 3 pieces and tied on neck with Seed of coffee	Neck
				Hu	R	'Naqarsa'	Powdered with dried leaves of *Cordia africana* and mixed with butter and put on the area	Dermal
Premna schimperi Engl.	Lamiaceae	Qooraasumaa	T	Hu	L	Toothache	Crushed and put on	Tooth surface
				Hu	L	Fibril illness	Crushed and washed	Oral
				Hu	L	Pancreatic problem	Crushed, squeezed and taken	Oral
Psidium guajava L.	Myrtaceae	Zayitunaa	T	Hu	Bu	Toothache	Crushed and put on	Tooth surface
Pycnostachys abyssinica Fresen.	Lamiaceae	Xurooftu/ Yerio	S	Hu	L	Fibril illness	Boiled and washed with leaves of *Croton macrostachyus* and *Ocimum lamiifolium*	Oral
				Hu	L	Eye problem	Crushed and put on the leaves on the eye	Optical
				Hu	L	Stomach problem of child	Boiled on fire and the sap is given to children.	Oral
Ranunculus multifidus Forssk.	Ranunculaceae	Misinga	H	Hu	L	Urine of bat	Crushed and put on	Dermal
				Hu	L	Nose smell	Squeezed and taken	Oral
Rhamnus prinoides L 'Herit.	Rhamnaceae	Gesho	S	Hu	Br	Tonsillitis	7 small branches are crushed and chewed	Oral
				Hu	Br	'Allaatii'	7 branches are cut, mixed with leaves of *Clerodendrum myricoides* and a child is washed for 3 days or for 7 days	Dermal
Ricinus communis L.	Euphorbiaceae	Qobo	S	Ls	R	Stomachache	Dried, powdered and mixed with leaves of *Momordica foetida* 1/2 litre is given	Oral
				Hu	Se	Wound	The oil is painted	Dermal
				Ls	R	Black leg	Crushed, powdered, mixed with soap and	Oral

							1/2 litre is given	
				Ls	L	Blotting	Crushed with leaves of *Croton macrostachyus* and sniffed.	Nasal
				Hu	S	Tonsillitis	Tied on neck	Neck
Rosa x rechardii Rehd.	Rosaceae	Urji	S	Hu	F	Eye problem	Squeezed and dropped	Optical
Rumex abyssinicus Jacq.	Polygalaceae	Momoqo	H	Hu	R	Liver problem	Powdered and drunk 1 tea cup with coffee or tea	Oral
				Hu	R	Asthma	Powdered, boiled for 3 days on fire, taken by mixing with tea	Oral
				Hu	R	Blood pressure	Powdered and drunk with tea	Oral
Rumex nepalensis Spreng.	Polygonaceae	Baaruda	H	Hu	L	Blood clot	Squeezed	Dermal
				Hu	R	Stomachache	Squeezed and drunk 1 soup spoon	Oral
				Hu	R	Abortion	Placed in vagina	Vaginal
				Hu	R	Toothache	Crushed, put on	Tooth surface
Rumex nervosus Vahl	Polygonaceae	Harqasis	S	Hu	l	Stomachache	Squeezed with leaves of *Artemisia abyssinica* and 1 glass cup is taken	Oral
				Hu	S	Toothache	Brush up	Tooth surface
				Hu	L	Evil eye	Squeezed with leaves of *Ruta chalepensis* and drunk1/2 coffee cup	Oral
Ruta chalepensis L.	Rutaceae	Teenaadaama	H	Hu	L	Stomachache	Chewed and eaten or Squeezed and 1/2 glass cup is taken	Oral
				Hu	L	Epilepsy	Squeezed, added to syringe up to 1 cc and added drop by drop on the left ear for 40 days.	Auricular
Santolina chamaecyparissus L.	Asteraceae	Odoo gifti faatumaa	S	Hu	L	Stomach problem of child	Squeezed, mixed with *Ruta chalepensis* and *Foeniculum vulgare* and given to children	Oral
Sapium	Euphorbiaceae	Bosoqa	T	Hu	L	Weight loss	Cooked and 1 glass cup of the sap is	Oral

ellipticum(Krauss) Pax						of children	given to children	
Senna didymobotrya (Fresen.) Irwin & Barneby.	Fabaceae	Sanaa maki arabaa	S	Hu	se	Headache	Mixed with seed of *Senna petersiana* boiled with coffee and taken	Oral
				Ls	L	Black leg	Crushed with root of *Ricinus communis* and given to cattle	Oral
Senna petersiana (Bolle) Lock	Fabaceae	Sanaa maki	S	Hu	L	Fibril illness	crushed and Painted on the area	Dermal
				Ls	L	Rabies	Squeezed and given with food to cattle	Oral
				Ls	L	Black leg	Squeezed and mixed with soap and given 1/2 litre to cattle	Oral
				Hu	L	Snake bite	Squeezed and 1/2 coffee cup is given for 2-3 days	Oral
Sesbania sesban (L.) Merr.	Fabaceae	Ambaltaa	T	Hu	L	Wound	Crushed and added on the area	Dermal
Solanecio angulatus (Vahl) C.Jeffrey	Asteraceae	Aqarqaraa	H	Hu	L	Headache	Crushed and tied on head with butter	Dermal
				Hu	L	Madness	Crushed, tied on head with butter in 3 times for 3 days	Dermal
Solanum anguivi L.	Solanaceae	Hidi	H	Ls	Se	Ticks	Crushed and added	Dermal
Solanum dasyphyllum Schumach.	Solanaceae	Hidi waraabesaa	S	Ls	Se & R	Common Cold	squeezed and given with nose to cattle	Nasal
				Ls	Se & R	Rabies	Squeezed and 1/2 coffee cup is given to the animal	Oral
Solanum incanum L.	Solanaceae	Hidi/enbuay	S	Ls	Se	Pancreatic problem	Placed on water for one day, filtered and 1 glass cup is given for 3 days	Oral
				Ls	Se	Common cold	Filtered with cloth and given	Oral
				Hu	R	Stomachache	Chewed	Oral
				Hu	Se	'Lemerate tinfash'	The seeds are squeezed, mixed with goats milk and 1/2 size of small nail is given	Oral
				Hu	Se	Tonsillitis	The seed are squeezed and the sap is taken	Oral
Sonchus asper (L.) Hill	Asteraceae	Attuchi	H	Hu	L	Tinea versicolor	Crushed and painted	Dermal
Stereospermum	Bignoniaceae	Botoro	T	Ls	L	Snake bite	Squeezed with leaves of *Asparagus*	Oral

kunthianum Cham.							*africanus* and given to cattle	
Syzygium guineense (Wild.) DC.	Myrtaceae	Baddeessaa	T	Ls	Ba	Stomachache	Crushed, squeezed and 1 glass cup is given	Oral
Tagetes minuta L.	Asteraceae	Chiibo	H	Ls	L	Black leg	Squeezed and 2 glass cup is given	Oral
Thalictrum rhynchocarpum Dill. & A. Rich.	Ranunculaceae	Inchiilaal badaa	H	Hu	L	Swelling	Crushed and washed	Dermal
				Hu	L	Epilepsy	Crushed and smoked	Nasal
Thymus schimperi Ronninger	Lamiaceae	Xasse	H	Hu	L	Kidney problem	Squeezed and taken with tea	Oral
				Hu	R	Vomiting	Crushed and taken with sugar	Oral
				Hu	L	Stomachache	Boiled With leaves of *Foeniculum vulgare* and 1 tea cup is taken	Oral
Tragia mixata M.Gilbert	Euphorbiaceae	Gugubdu	Cl	Hu	R	Rheumantism	Powdered, mixed with milk and 1 coffee cup is taken	Oral
				Hu	L	Spider poison	Placed on sun light and painted	Dermal
Trichilia dregeana Sond.	Meliaceae	Anunu	T	Hu	S	Toothache	Soaked, cooked & put on	Tooth surface
				Hu	R	'Naqarsa'	Powdered & 1 tea spoon is taken early in the morning and then much food is eaten.	Oral
				Hu	Ba	Nose smell	Powdered and sniffed	
				Hu	R	Glandular swelling	Powdered and 1/2 cup of tea is taken	Oral
				Hu	S	Warts	Powdered, mixed with honey and oil, and tied	Dermal
				Hu	S	Wound	Powdered and tied with oil in the area.	
				Hu	S	Intestinal parasite	Dried, powdered & eaten with raw meat from 3-5 times	Oral
				Ls	R	Mastitis	Dried, powdered, baked with teff flour and given to cattle	Oral
Verbena officinalis L.	Verbenaceae	Attuchi	H	Hu	R	Stomachache	Chewed and swallowed	Oral
				Hu	R	Evil eye	Squeezed and taken	Oral
				Hu	R	Amoeba	Squeezed and taken	Oral

Vernonia amygdalina Del.	Asteraceae	Ebicha	S	Hu	L	Mouth sore	Squeezed and mouth is rinsed	Oral
				Hu	L	Heart problem	Squeezed and drunk 1 coffee cup	Oral
				Hu	L	Poisoning	Squeezed and drunk 1 coffee cup	Oral
				Hu	L	Gastritis	Chewed and the sap is swallowed	Oral
				Hu	L	Malaria	Squeezed and drunk 1 glass cup	Oral
				Hu	La	Dandruff	The stem is harvested and the latex is painted on head	Dermal
				Hu	L	Cough	Squeezed and drunk 1/2 coffee cup	Oral
				Ls	L	Wound	Squeezed and painted	Dermal
Vernonia species	Asteraceae	Reji	S	Hu	L	Wound	The leaf is squeezed in the area	Dermal
				Hu	L	Blood clot	Squeezed in the area	Dermal
Withania somnifera (L.) Dunal in DC.	Solanaceae	Gizaawaa	S	Hu	L	Evil eye	Squeezed with leaves of *Ruta chalepensis* and drunk 1 soup spoon	Oral
				Hu	L	Insect allergy	Crushed and tied by cloth in the area	Dermal

Appendix 2 List of human diseases which are treated by medicinal plants in the study area

No.	Local Name	English Name
1	Afura bofaa	Snake breath
2	Allaatii	xxxxxx
3	Ameebaa	Amoeba
4	Asmi	Asthma
5	Busaa	Malaria
6	Ciinina terbi	Insect bite
7	Ciitoo	Scabies
8	Coobxo	Gonorrhea
9	Hypertension	xxxx
10	Dhadhabina laphe	Heart failer
11	Dhadhabina qunamti saalaa	Male sexual impotency
12	Dhibaa dhiga	Blood pressure
13	Dhiga adafii dhaabu diide	Excessive menstrual bleeding
14	Dhiga dhaabu	Blood clot
15	Dhita miilaa	Swelling of leg
16	Dhitoo	Swelling
17	Dhukuba garaa	Stomach problem
18	dhukuba gatuu	Epilepsy
19	Dhukuba guraa	Ear problem
20	Dhukuba ijaa	Eye problem
21	Dhukuba ilkaani	Toothache
22	dhukuba kallee	Kidney problem
23	Dhukuba lafaa	xxxxxx
24	Dhukuba laphe	Heart problem
25	Dhukuba saree	Rabies
26	Dhukuboota qunamti saalaan dadarbanu	STDs
27	Fooroforii	Dandruff
28	Funuuna	Nasal bleeding
29	Garaacha	Gastritis

30	Garaa ciininaa	Stomachache
31	Googinsa garaa	Constipation
32	Gubaa ebidaa	Fire Burn
33	Hadha	Insect allergy
34	Harqansu	xxxx
35	Hida boofaa	Snake bite
36	Hirina dhigaa	Anaemia
37	Huba qoonqo	Tonsillitis
38	Ija namaa	Evil eye
39	injiraan	Ecto-parasite
40	Kaasaa	Diarrhea
41	Kintaarotii	Hemorrhoids
42	Koosoo	Tapeworm
43	Kormomu	Warts
44	Maagaa	Ascaries
45	Madaa afaani	Mouth sore
46	Maddaa	Wound
47	Maraasisa	Madness
48	Mataa bo'u	Headache
49	Michi	Fibril illness
50	Naqarsaa	xxxxx
51	Nyaataa	Rheumatism
52	Oldeebisaa	Vomiting
53	Qoricha dhuge	Poisoning
54	Quffaa	Cough
55	Raamoo garaa	Intestinal Parasite
56	Rojjii	Ringworm
57	Sabata waaqayoo	Liver problems
58	Seexaana	Evil spirit
59	Shereriti	Spider poison
60	Sibiji/ shife	Skin rash
61	Simbiroo alkani	Urine of bat

62	Soonoo	Tinea versicolor
63	Sukuar beshitaa	Diabetes
64	Tetaanosii	Tetanus
65	Ulfa baasu	Abortion
66	Uqachu	Weight loss of children
67	Utaaloo	Common Cold
68	Utaaloo	Influenza
79	Waraansa	Stabbing pain
70	Xanacha	Glandular swelling
71	Xiira'a afaanii	Mouth smell
72	Xiiraa miilaa	Foot smell
73	Xiiraa sagaraa	Snef of faeces
75	Xiiraa’a miilaa	Smell of foot
76	xiiraa'a funyaanii	Nose smell
76	Xooroo	xxxx
77	Yetafiya Beshita	Pancreatic problem

Appendix 3 List of livestock diseases which are treated by medicinal plants in the study area

No.	Local name	English name
1	Bookaksaa	Blotting
2	Busaa gaange	Malaria of mule
3	Desta	Rinderpest
4	Dhora jabbii	xxxxx
5	Dhukuba ijaa	Eye problem
6	Dhukuba muchaa	Breast problem
7	Dhukuba saree	Rabies
8	Furrii	Cough
9	Garaa cininaa	Stomachache
10	Golobaa	xxxx
11	Hida bofaa	Snake bite
12	Huqisa	Weight loss
13	Ija namaa	Evil eye
14	Injiraan	Ecto-parasite
15	Lemiyanketekit	Shivering of livestock
16	Madaa	Wound
17	Mooraa ijaa	Eye cataract
18	Qoricha dhugee	Poisoning
19	Raamoo garaa	Internal parasite
20	Silmi	Ticks
21	Sinchi	Black leg
22	Ulaandhula	Leeches
23	Utaaloo	Common cold
24	Yeanget mefafak	Infection
25	Yetafiya beshita	Pancreatic problem

Appendix 4 List of Plants encountered in the study area from wild Vegetation

Scientific Name	**Family**	**Local Name**	**Ha**	**V. no.**
Acacia abyssinica Hochst. ex Benth.	Fabaceae	Lafto	T	BE 097
Achyranthes aspera L.	Amaranthaceae	Cagogit/xalanji/gerbi	H	BE 047
Acmella caulirhiza Del.	Asteraceae	Yamidir barbare	H	BE 045
Ageratum conyzoides L.	Asteraceae	Tuffoo cabii	H	BE 136
Albizia grandibracteata Taub.	Fabaceae	Anbabesa arbaa	T	BE 094
Albizia gummifera (J.F. Gmel.) C.A.Sm.	Fabaceae	Anbabeesaa	T	BE 080
Albizia schimperiana Oliv.	Fabaceae	Ca'o	T	BE 093
Arundinaria alpina K. Schum.	Poaceae	Lemen	H	BE 151
Asparagus africanus Lam.	Asparagaceae	Sarriiti/qastanicha	H	BE 095
Bidens biternata (Lour.) Merr. & Sherff	Asteraceae	Maxane	H	BE 081
Bidens pilosa L.	Asteraceae	Maxanee	H	BE 025
Bidens prestinaria (Sch.Bip) cufod.	Asteraceae	Kello	H	BE 075
Brucea antidysenterica J.F.Mill.	Simaroubaceae	Qomonyoo	S	BE 024
Buddleja polystachya Fresen.	Loganiaceae	Cocco	T	BE 044
Calpurnia aurea (Ait.) Benth.	Fabaceae	Cekaa	S	BE 003
Caylusea abyssinica (Fresen.) Fisch. & Mey.	Resedaceae	Aranci	H	BE 058
Celosia trigyna L.	Amaranthaceae	Dagiso	H	BE 015
Celtis africana Burm.f.	Ulmaceae	Cayi	T	BE 129
Centella asiatica (L.) Urban	Apiaceae	Tussee	H	BE 004
Cirsium englerianum O.Hoffm.	Asteraceae	Umbahoo	H	BE 091
Clausena anisata (Willd.) Benth.	Rutaceae	Ulmaayii	S	BE 053
Clematis hirsuta Perr. & Guill.	Ranunculaceae	Fiitii	Cl	BE 069
Coffea arabica L.	Rubiaceae	Buna	S	BE 042
Combretum collinum Fresen.	Combretaceae	Dabaqaa	T	BE 141
Combretum molle R.Br. ex G.Don	Combritaceae	Abalo	T	BE 145
Cordia africana Lam.	Boraginaceae	Wadeesaa	T	BE 037
Croton macrostachyus Del.	Euphorbiaceae	Makanisaa	T	BE 010
Cuscuta australis R. Br.	Cuscutaceae	Sabata waaqayoo	H	BE 138
***Cyanotis* species**	Commelinaceae	Araman dawaa	H	BE 133
Cyathula cylindrica Mog.	Amaranthaceae	Maxanee	H	BE 050

Cyathula uncinulata (Schrad.) Schinz	Amaranthaceae	Maxane hoollaa	S	BE 027
Cynoglossum amplliphollium Hochst. ex A.DC. in DC	Boraginaceae	xxx	H	BE 158
Cynoglossum densefoliatum Chiov.	Boraginaceae	xxx	H	BE 159
Cyperus alopecuroides Rottb.	Cyperaceae	Cafe	H	BE 154
Cyperus distans L.f.	Cyperaceae	Caffee	H	BE 155
Cyphostemma adenocaule (Steud. ex A.Rich.) Desc. ex Wild & Drummond	Vitaceae	Aserkush tebetebkush	Cl	BE 146
Cyphostemma cyphopetalum (Fresen.) Discoings ex Wild & Drummond	Vitaceae	Hida reenfaa	Cl	BE 121
Datura stramonium L.	Solanaceae	Asangiraa	H	BE 026
Dracaena steudneri Engl.	Dracaenaceae	Gido/Algee	T	BE 033
Drymaria cordata (L.) Schultes	Caryophyllaceae	Sayidasajal	H	BE 012
Ehretia cymosa Thonn.	Boraginaceae	Ulaagaa	T	BE 059
Ekebergia capensis Sparrm.	Meliaceae	Sombo	T	BE 122
Erythrina brucei Schweinf.	Fabaceae	Walleensu	T	BE 031
***Eucalyptus* species**	Myrtaceae	Baarzaafi	T	BE 137
Euphorbia abyssinica Gmel.	Euphorbiaceae	Adaami	T	BE 112
Falkia canescens C.H.Wright	Convolvulaceae	Gura hantutaa	H	BE 030
Ficus ovata Vahl	Moraceae	Qilinxo	T	BE 142
Ficus sur Forssk.	Moraceae	Arbu	T	BE 124
Ficus sycomorus L.	Moraceae	Odaa	T	BE 123
Ficus vasta Forssk.	Moraceae	Qilxu	T	BE 125
Gardenia ternifolia Schumach. & Thonn.	Rubiaceae	Gambela	T	BE 126
***Guizotia scabra* (Vis.)** Chiov.	Asteraceae	Tuffoo	H	BE 062
Hagenia abyssinica (Brace) J.F.Gmel.	Rosaceae	Koso	T	BE 130
Helinus mystacinus (Ait.) E. Mey. ex Steud.	Rhamnaceae	Omaachisaa/ Hida gundo	Cl	BE 089
Impatiens rothii Hook. f.	Balsaminaceae	xxx	H	BE 157
Indigofera arrecta A.Rich.	Fabaceae	Gerewda	H	BE 079
Indigofera spicata Forrsk.	Fabaceae	Qoricha hadha	Cl	BE 127
Indigofera vohemarensis Baill.	Fabaceae	Heenaa	S	BE 086

Ipomoea cairica (L.) Sweet	Convolvulaceae	Kalaalaa	Cl	BE 029
Kalanchoe petitiana A.Rich	Crassulaceae	Bosoqe	H	BE 014
Laggera crispata (Vahl) Hepper & Wood	Asteraceae	Tambo	H	BE 096
Leucas martinicensis (Jacq.) R.Br.	Lamiaceae	Segere/ Raas kimir	H	BE 077
Maesa lanceolata Forssk.	Myrsinaceae	Abayi	T	BE 046
Mentha aquatica L.	Lamiaceae	xxx	H	BE 156
Mentha spicata L.	Lamiaceae	Naanaaye	H	BE 066
Millettia ferruginea (Hochst.) Bak.	Fabaceae	Asgiraa	T	BE 143
Momordica foetida Schumach.	Cucurbitaceae	Minaan loa	Cl	BE 011
Nicotiana tobaccum L.	Solanaceae	Timbaho	H	BE 013
Oxalis corniculata L.	Oxalidaceae	Sidisa	H	BE 116
Pennisetum thunbergii Kunth	Poaceae	Marga abaaboo	H	BE 063
Persicaria senegalensis (Meisn.) Sojak	Polygonaceae	Asaangira	H	BE 147
Phytolacca dodecandra L. Herit	Phytolacaceae	Andode	Cl	BE 009
Piliostigma thonningii (Schumach.) Milne-Redh.	Fabaceae	Lilu	T	BE 144
Plantago lanceolata L.	Plantaginaceae	Qorxobi	H	BE 064
Plumbago zeylanica L.	Plumbaginaceae	Ameeraa	H	BE 088
Premna schimperi Engl.	Lamiaceae	Qooraasumaa	T	BE 021
Pycnostachys abyssinica Fresen.	Lamiaceae	Xurooftu/Yerio	S	BE 068
Ranunculus multifidus Forssk.	Ranunculaceae	Misinga	H	BE 148
Ricinus communis L.	Euphorbiaceae	Qobo	S	BE 052
Rumex nepalensis Spreng.	Polygonaceae	Baaruda	H	BE 005
Rytigynia neglecta (Hiern) Robyns	Rubiaceae	Mixoo	S	BE 117
Sapium ellipticum (Krauss) Pax	Euphorbiaceae	Bosoqa	T	BE 105
Senna didymobotrya (Fresen.) Irwin & Barneby	Fabaceae	Sanaa maki arabaa	S	BE 038
Senna petersiana (Bolle) Lock	Fabaceae	Sanaa maki	S	BE 016
Sesbania sesban (L.) Merr.	Fabaceae	Ambaltaa	T	BE 085
Snowdenia polystachya (Fresen.) Pilg.	Poaceae	Mujjaa	H	BE 118
Solanum anguivi L.	Solanaceae	Hidi	H	BE 070
Solanum dasyphyllum Schumach.	Solanaceae	Hidi waraabesaa	S	BE 019

Solanum incanum L.	Solanaceae	Hidi/enbuay	S	BE 035
Sonchus asper (L.) Hill	Asteraceae	Attuchi	H	BE 139
Stereospermum kunthianum Cham.	Bignoniaceae	Botoro	T	BE 119
Syzygium guineense (Wild.) DC.	Myrtaceae	Baddeessaa	T	BE 120
Tagetes minuta L.	Asteraceae	Chiibo	H	BE 090
Thalictrum rhynchocarpum Dill. & A. Rich.	Ranunculaceae	Inchiilaal badaa	H	BE 054
Thelypteris confluens (Thunb.) Morton	Thelypteridaceae	Hexo	S	BE 160
Tragia mixata M.Gilbert	Euphorbiaceae	Gugubdu	Cl	BE 055
Trichilia dregeana Sond.	Meliaceae	Anunu	T	BE 002
Verbena officinalis L.	Verbenaceae	Attuchi	H	BE 020
Vernonia amygdalina Del.	Asteraceae	Ebicha	S	BE 032
Vernonia ieopoldii (Sch. Bip. ex Walp.) Vatke	Asteraceae	xxx	T	BE 132
***Vernonia* species**	Asteraceae	Reji	S	BE 001

Key: In **bold** are medicinal plants

Appendix 5 List of plants collected from home gardens in the study area

Key : M- Medicinal, FW-Fire wood, LF- live fence, C-Charcoal, Fu- Furniture, Co-Construction, Ed-edible, Fe-Fencing, Fo-Forage, Or-ornamental, Sp-spice, CI- cash income, St-stimulant, Ha-Habit, V. No.- Voucher number.

Scientific Name	**Family**	**Local name**	**Ha**	**Other use**	**V. no.**
Ajuga integrifolia Buch,Ham	Lamiaceae	Harma bussee/ Anaamiro	H	M	BE 114
Allium sativum L.	Alliaceae	Qullubi adii	H	M, Ed	BE 049
Aloe kefaensis Gilbert & Sebsebe	Aloaceae	Argisaa/Arkiso	H	M, Or	BE 018
Ananas comosus (L.) Merr**.**	Bromeliaceae	Anaanaasii	H	M, Ed	BE 103
Artemisia abyssinica Sch. Bip. ex A.Rich	Asteraceae	Sukundee	H	M	BE 078
Artemisia afra Jacq. ex willd	Asteraceae	Godo guraachaa	H	M	BE 057
Beta vulgaris L.	Chenopodiaceae	Qosta	S	Ed	BE 100
Brassica carinata A.Br.	Brassicaceae	Ija raafu	H	M, Ed	BE 072
Brassica oleracea L.	Brassicaceae	Raafu	H	Ed	BE 110
Canavalia ensiformis (L.) DC.	Fabaceae	Foolfolli	Cl	Ed	BE 092
Capsicum annum L.	Solanaceae	Qaaraa	H	Ed	BE 104
Carica papaya L.	Caricaceae	Papaye	T	M, Ed	BE 061
Catha edulis (Vahl) Forssk. ex Endl.	Celastraceae	Caati	S	M, CI, St	BE 115
Citrus limon (L.) Burn.f.	Rutaceae	Lomi	S	M, Ed	BE 041
Citrus medica L.	Rutaceae	Tiringo	T	M, Ed	BE 084
Citrus sinensis (L.) Osb.	Rutaceae	Birtukani	T	Ed	BE 109
Clerodendrum myricoides (Hochst.) Vatke	Lamiaceae	Maraasisa/ Misirich	S	M	BE 043
Colocasia esculenta (L.) schott	Araceae	Godare	H	M, Ed	BE 067
Crotalaria **species**	Fabaceae	Yeayit shimbraa	S	M, Ed	BE 082
Cucurbita pepo L.	Cucurbitaceae	Buqee/dubaa	H	M, Ed	BE 040
Cymbopogon citratus (DC.) Stapf.	Poaceae	Taj sar	H	Sp	BE 128
Cyperus **species**	Cyperaceae	Qunnii	H	M	BE 071

Datura metel L.	Solanaceae	Qoricha bofaa	H	M	BE 017
Dioscorea praehensilis Benth.	Dioscoreaceae	Wacino	Cl	M, Ed	BE 034
Ensete ventricosum (Welw.) Cheesman	Musaceae	Qocho	S	M, Ed	BE 101
Eucalyptus globulus Labill.	Myrtaceae	Baarzaafii adii	T	M, FW,C, LF,Fe, Co	BE 051
Euphorbia tirucalli L.	Euphorbiaceae	Cadaa	S	M, LF	BE 039
Foeniculum vulgare Mill.	Apiaceae	Wallaago	H	M	BE 022
Gossypium hirsutum L.	Malvaceae	Jirbi	S	CI	BE 098
Ipomoea batatus (L.) Lam.	Convolvulaceae	Sikuar dinch	S	Ed	BE 099
Ipomoea tenuirostris Choisy	Convolvulaceae	Nisbaa	Cl	M	BE 149
Jatropha curcas L.	Euphorbiaceae	Beeroo faranji	T	M,FW,LF, Fo, Fe	BE 140
Justicia diclipteroides Lindau	Acanthaceae	Togo	S	M	BE 007
Justicia schimperiana (Hochst. ex Nees) T.Anders.	Acanthaceae	Dhumugaa/ Halaltu	S	M, LF	BE 023
Lawsonia inermis L.	Lythraceae	Hinaaye	T	M, FW, LF	BE 087
Lepidium sativum L.	Brassicaceae	Fexo/Shinfaa	H	M, Ed	BE 106
Leucas stachydiformis (Hochst. ex Benth.) Briq.	Lamiaceae	Qumudu	H	M	BE 152
Lycopersicon esculentum Mill.	Solanaceae	Timaatimii	H	M, Ed	BE 083
Mangifera indica L.	Anacardiaceae	Mango	T	LF,Ed, CI	BE 111
Melia azedarach L.	Meliaceae	Mim	T	M,FW, Fe	BE 065
Morus alba L.	Moraceae	Enjori	T	FW, LF, Fo, Ed, Fe	BE 131
Musa x paradisiaca L.	Musaceae	Muzi	H	Fo, Ed, CI	BE 108
Ocimum basilicum L. var**.** ***basilicum***	Lamiaceae	Keffoo	S	M, Sp	BE 073
Ocimum gratissimum L.	Lamiaceae	Kefo saree	S	M, Sp	BE 135
Ocimum lamiifolium Hochst. ex	Lamiaceae	Daamaakase	S	M	BE 006

Benth.					
Olea europaea L. subsp. ***cuspidata*** (Wall. ex G.Don) Cif.	Oleaceae	Ejarsaa	T	M, FW	BE 113
Persea americana Mill.	Lauraceae	Avocado	T	LF, Ed, CI	BE 102
Plectranthus punctatus (L.f.) L'her.	Lamiaceae	Dabase	H	M	BE 150
Psidium guajava L.	Myrtaceae	Zayitunaa	T	M, Fo, Ed, CI	BE 048
Rhamnus prinoides L 'Herit.	Rhamnaceae	Gesho	S	M, CI	BE 056
Rosa x rechardii Rehd.	Rosaceae	Urji	S	M, Or	BE 036
Rumex abyssinicus Jacq.	Polygalaceae	Momoqo	H	M, Ed	BE 028
Rumex nervosus Vahl	Polygonaceae	Harqasis	S	M	BE 074
Ruta chalepensis L.	Rutaceae	Teenaadaama	H	M	BE 060
Saccharum officinarum L.	Poaceae	Shenkoraa	H	Fo, Ed, CI	BE 107
Santolina chamaecyparissus L.	Asteraceae	Odoo gifti faatumaa	S	M	BE 134
Solanecio angulatus (Vahl) C.Jeffrey	Asteraceae	Aqarqaraa	H	M	BE 153
Thymus schimperi Ronninger	Lamiaceae	Xasse	H	M	BE 076
Withania somnifera (L.) Dunal in DC	Solanaceae	Gizaawaa	S	M	BE 008

Key: In bold are medicinal plants

Appendix 6: Format for collecting ethnobotanical information. Serial No. _____

Date _____

1. Information on respondents:

Name _____ Age _____ Sex M or F

Religion _____ Marital status _____ Ethnicity _____

Educational status _____ Occupation _____ Locality _____

For how long you have lived in the area _____

2. What are the most common diseases of humans in your area?

3. What are the most common diseases of animals in your area?

4. List plant species used to treat a given disease in your area.

4.1 Plants used to treat human diseases

Name Plant	Disease	Pu	Ha	Habitat	Appl.	Prep.	Dosage	Side effects & antidotes	Other uses	Coll. no.

4.2 Plants used to treat animal diseases

Name Plant	Disease	Pu	Ha	Habitat	Appl.	Prep.	Dosage	Side effects & antidotes	Other uses	Coll. no.

5. List traditional way of classifying soil, landscapes and vegetation in your area?

6. How do you preserve/ conserve traditional medicines?

7. Are there restrictions /taboos in collecting medicinal plants? Are there taboos in the utilization of some medicinal plants in the locality?

8. Are medicinal plants marketable?

9. Is the medicinal plant easily accessible? If not, why?

10. Are there threats to those medicinal plants?

11. Is there any effort made to conserve medicinal plants in the area?

12. How is the knowledge of traditional medicine passed to a family member/younger generation?

13. How dose modernizations interfere with traditional medicine application and use?

14. Are there conditions that forbid taking the medicine such as pregnancy and others?

15. Are there members of the community who frequently use the medicinal plant?

16. Is the plant currently cultivated in the study area?

Appendix 7 List of informants participated in ethnobotanical study

	Name	S	Age	Kebele	Occupation
1	Aba Ali Aba Gero	M	75	Beshasha	Farming
2	Aba Bulgu Aba Gero	M	78	Beshasha	Farming
3	Aba Dega Balto	M	60	Cami-cego	Farming
4	Aba Diga Aba Gisa*	M	71	Keso-heti	Farming
5	Aba Dilbi Aba Sinbo	M	75	Omo-gurude	Farming
6	Aba Fira Aba Milki	M	55	Beshasha	Farming
7	Aba Fita Aba Megal	M	72	Genji-elbu	Farming
8	Aba Gero Aba Dilbi*	M	73	Omo-gurude	Farming
9	Aba Gero Aba Waji*	M	70	Koye-seja	Farming
10	Aba Gisa Aba Gero*	M	68	Beshasha	Farming
11	Aba Jihad Aba Simel*	M	56	Genji-elbu	Farming
12	Aba Keno Aba Gisa	M	60	Genji-elbu	Farming
13	Aba Maca Aba Godu	M	72	Bulado-coche	Farming
14	Aba Meca Haji	M	75	Dalecho	Farming
15	Aba Nebso Aba Gisa	M	64	Cami-cego	Farming
16	Aba Temam Aba Fogi	M	70	Beshasha	Farming
17	Aba Temam She Dawd	M	50	Omo-gurude	Farming
18	Aba Zinab Aba Gisa	M	50	Dalecho	Farming
19	Aba Zinab Aba Dilbi	M	75	Cami-cego	Farming
20	Aba Zinab Aba Dula	M	45	Bulado-coche	Farming
21	Aba Zinab Xaha	M	62	Cami-cego	Farming
22	Abaru Wereta*	M	80	Didesa	Healer
23	Abdela Aba Maca	M	45	Cami-cego	Farming
24	Abebaw Getahun*	M	62	Beshasha	Merchant
25	Abreham Woldu	M	62	Didesa	Farming

26	Adisu Abdela	M	35	Genji-elbu	Merchant
27	Ahmed Meca	M	40	Coche	Farming
28	Alima Mohamed	F	48	Coche	House wife
29	AlimaTemam	F	35	Omo-gurude	Farming
30	Anberu Aba Fita	F	45	Coche	House wife
31	Asefa Abay	M	40	Didesa	Farming
32	Asha Sherif	M	45	Koye-seja	Farming
33	Ayalew Sisay*	M	70	Coche	Farming
34	Bekele Busho	M	48	Dalecho	Farming
35	Bekele Mekuria	M	64	Keso-heti	Farming
36	Bultu Aba Negash	F	55	Cami-cego	House wife
37	Dafis Aba Gisa	M	42	Coche	Farming
38	Demekech Nigusse	F	33	Dalecho	House wife
39	Engida Asefa *	M	40	Cami-cego	Farming
40	Fami Jihad	M	25	Genji-elbu	Student
41	Fatuma Aba Gumbul	F	35	Dalecho	Farming
42	Fatuma Abdo	F	35	Didesa	Farming
43	Fedila Mohammed	F	30	Dalecho	Farming
44	Gomiti Aba Zinab	F	40	Dalecho	House wife
45	Hada Kuma Aba Rago	F	50	Beshasha	House wife
46	Hada Sufiyan Aba Meca*	F	68	Keso-heti	House wife
47	Hadha Gidii Abdo	F	45	Koye-seja	Farming
48	Hadha Qoro Aba Jobir	F	55	Bulado-coche	Farming
49	Halefom Arguy	M	65	Didesa	Farming
50	Hassen Aba Fita	M	28	Didesa	Farming
51	Hussein Aba Kelbi	M	32	Genji-elbu	Merchant
52	Jaallee Kumsa	F	75	Omo-gurude	House wife
53	Jibril Aba Dura*	M	38	Genji-elbu	Farming

54	Kadir Haji*	M	30	Genji-elbu	Farming
55	Kaliti Aba Dega	F	35	Bulado-coche	Farming
56	Kaliti Aba Jihad	F	50	Bulado-coche	Farming
57	Kalusa Aba Dega	M	70	Koye-seja	House wife
58	Kedija Ahmed*	F	60	Bulado-coche	House wife
59	Kedija SheJemal	F	45	Cami-cego	Farming
60	Kedir Jibril	M	45	Omo-gurude	Farming
61	Kelifa Aba Biya	M	22	Dalecho	Farming
62	Lemlem Ali	F	20	Keso-heti	Student
63	Lubaba Aba Dima	F	65	Cami-cego	House wife
64	Mekiya Aba Meca	F	50	Omo-gurude	House wife
65	Melaku Getahun*	M	50	Didesa	Healer
66	Melka Burayo*	M	75	Dalecho	Farming
67	Mohammed Hussein*	M	50	Bulado-coche	Farming
68	Mohammed Jemal	M	55	Didesa	Farming
69	Mohammedamin Aba Nebso	M	44	Koye-seja	Trader
70	Muhaba Aba Milki	M	30	Omo-gurude	Farming
71	Mulgeta Aba Meca	M	36	Keso-heti	Farming
72	Nasir Aba Meca	M	40	Keso-heti	Farming
73	Nasir Mohammed	M	30	Koye-seja	Farming
74	Nebso Aba Gero	M	52	Coche	Farming
75	Nebso Aba Rago	M	45	Cami-cego	Farming
76	Negash Aba Gero Aba Waji*	M	42	Koye-seja	Farming
77	Negash Aba Gero*	M	60	Cami-cego	Farming
78	Negati Aba Nura	F	52	Genji-elbu	Farming
79	Nezif Aba Simel	M	36	Beshasha	Farming
80	Rabiya Aba Zinab	F	40	Koye-seja	Farming
81	Sabir Shafi	M	21	Beshasha	Farming

82	Seifu Temam	M	25	Omo-gurude	Farming
83	She Edris Suleman *	M	45	Beshasha	Vendor
84	Shekedir Aba Bekir*	M	76	Keso-heti	Healer
85	Shekemal Haji Mohamed Sayid*	M	75	Bulado-coche	Farming
86	Shemsiya Aba Oli	M	70	Koye-seja	House wife
87	Sherefe Aba Wari	F	70	Keso-heti	House wife
88	Shishig Bargu	F	40	Didesa	Farming
89	Sisay Aba Gochu	M	45	Coche	Farming
90	Staz Tijani Suleman*	M	61	Omo-gurude	Farming
91	Suleman Bushira	M	47	Bulado-coche	Farming
92	Teha Aba Jebel	M	35	Keso-heti	Merchant
93	Temam Aba Dura	M	42	Coche	Farming
94	Tigabu Zinabu	M	38	Didesa	Farming
95	Tijani Aba Fogi	M	34	Keso-heti	Farming
96	Tsega Mitiku*	F	26	Coche	Student
97	Xayibo Aba Meca *	M	25	Dalecho	Farming
98	Yeshi Girma	F	27	Bulado-coche	Student
99	Yesuf Aba Fita	M	45	Didesa	Herder
100	Zinabu Aba Simel	M	45	Beshasha	Farming

Key: With * are key informants