Vascular Plant Diversity and Ethnobotanical Study of Medicinal and Wild Edible Plants in Jibat, Gedo and Chilimo Forests, West Shewa Zone of Oromia Region, Ethiopia

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Vascular Plant Diversity and Ethnobotanical Study of Medicinal and Wild Edible Plants in Jibat, Gedo and Chilimo Forests, West Shewa Zone of Oromia Region, Ethiopia

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GRADUATE PROGRAMMES

This is to certify that the Dissertation prepared by Tena Regassa Duressa, entitled: *Vascular plant diversity and ethnobotanical study of medicinal and wild edible plants in Jibat, Gedo and Chilimo forests, West Shewa Zone of Oromia Region, Ethiopia* and submitted in fulfillment of the requirements for the Degree of Doctor of Philosophy (Biology: Botanical Sciences) complies with the regulations of the University and meets the accepted standards with respect to originality and quality

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ABSTRACT

Vascular Plant Diversity and Ethnobotanical Study of Medicinal and Wild Edible Plants in Jibat, Gedo and Chilimo Forests, West Shewa Zone of Oromia Region, Ethiopia

Tena Regassa, PhD Dissertation

Addis Ababa University, 2016

This study was undertaken in Jibat, Chelia and Dendi districts, Central Ethiopia, in order to investigate the floristic composition and vascular plant diversity of Jibat, Chilimo and Gedo forests and ethnobotanical knowledge of medicinal and wild edible plants used by the Oromo communities in the area. The resulting data are expected to contribute to the conservation of the fast-eroding plant resources and the preservation of the associated ethnobotanical knowledge of the study area. Vegetation data were collected from a total of 457 *relevés* sampled preferentially using a square plot of 400 m^2 (20 m x 20 m) for woody plants and subplots of 2 m x 2 m at the four corners and the centr e of the large *relevé* laid to collect the samples of herbaceous species. Woody species with a diameter at breast height (DBH) > 2 cm were counted and cover abundance values estimated. Agglomerative hierarchical classification in R package version R 2.12.5 software, was used to identify plant communities and synoptic values ≥1 for identification of the dominant species for naming plant communities. Shannon-Wiener diversity index was used to assess species richness and evenness. Ethnobotanical data were collected by interviewing 838 informants (512 males and 269 females). Quantitative approaches were used to determine informant consensus factor (ICF) and fidelity level (FL) values. Ethnomedicinal knowledge held by different informant categories was compared using One-way ANOVA and t-tests in SPSS version 20 and MINITAB Release 14.3.0 statistical package. A total of 415 plant species belonging to 312 genera and 104 families were documented from the study area of which 320, 290 and 241 were from Jibat, Gedo and Chilimo forest stands respectively. A total of 18 plant communities were identified from the vegetation survey. Furthermore, 172 ethnomedicinal plant species belonging to 155 genera and 73 families were documented that are used to treat 86 human ailments reported grouped under 13 major disease categories. Similarly, 97 ethnoveterinary plant species categorized under 94 genera and 56 families reported to treat 44 livestock ailments were documented and a total of 71 wild edible plants belonging to 58 genera and 33 families were reported to be gathered and consumed in the study area. Herbs (ca. 232) were the dominant plant growth forms followed by shrubs (ca.94) and trees (ca. 74) among the vascular plants documented from the area. Asteraceae (68 species in 42 genera) and Fabaceae (26 species in 21 genera) were the most taxonomically diverse families followed by Lamiaceae and Poaceae with 19 genera each and 26 species and 24 species respectively in the study area. A total of 43 endemic plants were documented in this study of which one species, *Kniphofia hildebrandtii* is critically endangered. Leaves (36.6%) followed by roots (19.98%) and seeds (10.34%) were the most consumed ethnomedicinal plant parts in remedy preparation. Most remedies were prepared from fresh plant materials (66.48%), mostly prepared and applied by boiling and drinking the decoction upon cooling (117 citations, 13.88%) followed by drinking the concoction (49 citation, 13.35%). Oral application (220 preparations, 59.94%) was the commonly used route of administration followed by topical or dermal application (95 preparations, 25.88%). Amoebiasis, constipation and diarrhoea were the most commonly reported health problems under the gastrointestinal, pharyngeal and parasitic (GIPP), whereas atopic eczema and dandruff were the most frequently reported under the dermatological and subcutaneous tissues (DST) disease group. The categories with the highest informant consensus factor (ICF) values, GIPP (0.70 for Dendi, 0.67 for Chelia and 0.69 for Jibat districts) followed by respiratory (0.64 for Chelia) and DST (0.64 and 0.63 for Jibat and Dendi respectively.The highest fidelity level (FL) (95%) was recorded for *Hagenia abyssinica* in Jibat District. *Zingiber officinale* and *Jasminium abyssinicum* were reported to have highest FL values in Chelia District (95% each). In Dendi District, *Zingiber officinale, Bothriocline schimperi, Zehneria scabra, Clerodendrum myricoides, Ocimum lamiifolium* and *Acokanthera schimperi* with FL values of 95% each, had the highest FL. In the study area, the highest ICF value was recorded for disease categories dermatological and sensorial problems (0.80) followed by septicaemic problems (0.68) and wound, external injury and animal bite (0.66) in the case of ethnoveterinary medicine. The reports indicate a high incidence of these types of diseases in the study area, possibly due to the poor socio-economic and sanitary conditions of the people. Preference ranking indicated that *Lactuca inermis*, *Coffea arabica* and *Brucea antidysernterica* were the most preferred species to treat diarrhea in Jibat District and *Dodonaea angustifolia*, *Justicia schimperiana* and *Arisaema enneaphyllum* were the most preferred species used against atopic eczema in Chelia and *Carissa spinarum*, *Acanthus sennii* and *Otostegia integrifolia* were the most preferred species to treat rheumatism in Dendi. Knowledge associated with use of medicinal plants is generally kept secret and is transferred orally. Age, literacy level, distance from health centre and experience of informants had statistically significant influence on ethnobatanical knowledge of medicinal and wild edible plants ($P < 0.05$), whereas, marital status and gender did not exert statistically significant difference ($P > 0.05$) regarding their ethnobatanical knowledge. Moraceae and Asteraceae were among the most commonly consumed families with five and four edible taxa respectively. Women and children were the main gatherers of WEPs. The majority of the useful plants were collected from wild source and storage practice was minimal in the study area. The output of the direct matrix ranking revealed that *Prunus africana* was ranked first (the most threatened) followed by *Hagenia abyssinica* and *Olinia rochetiana* which are multipurpose species in Jibat District. Similarly, *Prunus africana* was ranked first (most threatened) followed by *Olea europaea* subsp. *cuspidata* and *Podocarpus falcatus* in Chelia District; and *Juniperus procera* was ranked first (the most threatened) followed by *Prunus africana* and *Hagenia abyssinica* in Dendi District are reported to be the most threatened multipurpose species. Agricultural expansion, over-stocking/grazing and fuel wood collection were found to be the most threatening factors to plant resources in the study area. The study area is endowed with rich flora in general and medicinal and wild edible plants and associated knowledge in particular, yet under great pressure due to anthropogenic and natural factors. Thus, it is recommended that forestry departments of the federal, regional and local governments take strong and urgent conservation actions and strategies to safeguard these valuable resources before they have gone forever. In this, each level would need to mobilize the local people to be actively involved in sustainable forest resource management.

Keywords: Medicinal Plants, Chelia, Dendi, Jibat, Wild edible plants, Informant Consensus, Fidelity Level

DEDICATION

I would like to dedicate this dissertation to my father Ato Regassa Duressa and my mother W/o Alemi Feyissa. It is also dedicated to the wonderful and brilliant local informants of Jibat, Chelia and Dendi districts.

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LIST OF ABBRVIATION

CCL	Cardiovascular, Circulatory and lymphatic
CSA	Central Statistics Agency
CWARDO	Chelia Wereda Agricultural and Rural Development Office
df	degree of freedom
DMR	Direct Matrix Ranking
DST	Dermatological and Subcutaneous Tissues
DWARDO	Dendi Wereda Agricultural and Rural Development Office
EIBAB	External injuries, bleeding and animal bite
ENM	Endocrine, nutritional and metabolic diseases
EVMPs	Ethnoveterinary Medicinal Plants
FAO	Food and Agriculture Organization of the United Nations
FL	Fidelity Level Index
FM	Febrile and 'Michi'
GIPP	Gastrointestinal, Pharyngeal and Parasitic
GRSTD	Genitourinary, Reproductive and Venereal
ICF	Informant Consensus Factor
JWARDO	Jibat Wereda Agricultural and Rural Development Office
MCNDS	Musculoskeletal-Connective tissues, nervous system, dental and sensorial
MP	Medicinal Plant
NMA	National Metrological Agency
SAC	Species Accumulation Curve
TM	Traditional Medicine
WHO	World Health Organization
WEPs	Wild Edible Plants
UTI	Urinary Tract Infection
NPP	Net Primary productivity

CHAPTER ONE

1. INTRODUCTION

1.1. General Background

Vegetation is an important landscape element in any watershed. Forests worldwide are known to be critically important habitats in terms of the biological diversity they contain and in terms of the ecological functions they serve. Humans have depended on forests for a remarkable variety of products, services and benefits. They provide a wide range of environmental services, including biodiversity conservation, water supply, carbon sequestration, flood control and protection against soil erosion and desertification. Forests are sources of wood products. They help regulate local and regional rainfall. Forests are also crucial sources of food, medicine, income, immense recreational, aesthetic and spiritual benefits for millions of people.

Tropical forest ecosystems are the main repositories of biodiversity, source of timber, medicinal and wild edible plants, fuel, fodder and play a critical role in watershed protection (Getachew Tesfaye, 2008). Botanical assessments such as floristic composition and species diversity studies are essential for providing information on species richness of the forests, useful for forest management purpose and help in understanding forest ecology and ecosystem functions. Knowledge of floristic composition and species diversity is also useful in identifying ecologically and economically important plants and their diversities, protecting threatened and economically important plant species (Bilz *et al*., 2011; Han *et al*., 2011; Khan, 2012**;** FAO, 2014). Despite this fact, loss of biodiversity is currently occurring at rates unequalled in geological times and is induced, among other causes, by human land use change. This loss is of major ecological, economical and societal concern. Implementation of efficient conservation measures that limit the extinction of species and preserve the evolutionary processes that sustain biodiversity is thus an imperative challenge (Han *et al*., 2011).

Of all the Earth's biological diversity, the plant kingdom is the most essential to human welfare and is extensively exploited for countless purposes including: food, divination, cosmetics, dyeing, textiles; for building, currency, clothing, rituals, social life, music, fuel, fiber, construction, tools and medicine (Cotton, 1997). In broad terms, the study of the complex and dynamic relationships between plants and people is known as ethnobotany. There are many aspects of ethnobotany, including the ways that people name and classify plants, the values placed on them, their uses and their management (Martin, 1995; Alexiades, 1996; Cotton, 1997). Thus, ethnobotany tries to preserve valuable traditional knowledge for both present and future generations. Recently, the subject has adopted a much more rigorous quantitative methodology and has studied the ways in which people manage their environment (Phillips and Gentry, 1993a, b; Martin, 1995; Cotton, 1997; Höft *et al*., 1999; Hofftman and Gallaher, 2007).

Ethnobotany can be used for many purposes. For instance, ethnobotanical techniques can be used to document the great store of knowledge about plants contained in long established local societies around the world (Martin, 1995; Cotton, 1997). Documenting indigenous knowledge through ethnobiological approach is important for species conservation and sustainable resource use (Stepp, 2005; Uprety *et al*., 2010). The sum-total of this knowledge is one of the great cultural heritages of humankind. In many places, there is urgency about this documentation, given the frequently corrosive influence of the forces of globalization on the cultures of indigenous societies. There are many aspects of people's knowledge of plants, including their material uses and the practical methods by which they can be managed (Balick and Cox, 1996). Also of interest to the ethnobotanist are the beliefs and cultural practices that underpin people's practical activities. It has been found that many long established local societies have religious or philosophical beliefs and related cultural practices, which tend to result in the conservation of the vital natural resources upon which the people depend. Knowledge about such beliefs and practices can make a major contribution to modern conservation (Hamliton, 2010). Furthermore, such studies are often significant in revealing locally important plant species, sometimes leading to the discovery of crude drugs, or contributing to economic development (Uprety *et al*., 2010).

A medicinal plant is one whose one or more of its parts contains substances that can be used for therapeutic purpose or which are precursors for the synthesis of useful drugs (Sofowora, 1982). Medicinal plants are also those plants that are used (parts, extract, etc.) in treating and preventing specific ailments and diseases that affect human beings. Hence, the important role of medicinal plants in healthcare delivery (services) cannot be overemphasized (Nwachukwu *et al*., 2010). Herbal medicine, which is the use of parts of medicinal plants or drugs from medicinal plants in the treatment and cure of sicknesses and diseased conditions, has been with humans since time immemorial. Traditional herbal remedies provide health services even in highly industrialized setups because they are important pillars of culture and human socialization (Cotton, 1997). The change in lifestyles has had a negative impact on maintaining traditional knowledge on herbal remedies; hence there is a danger of this knowledge being lost (Balick and Cox, 1997; WHO, 2008; Nwachukwu *et al*., 2010).

There is a rapid loss of traditional herbalists and a decline in authentic knowledge in traditional treatment, as a result of death of many aged healers (Balick and Cox, 1996). Overgrazing and over exploitation of plant resources have already led to a decline of the plant material available (Bussman and Sharon, 2006; Mirutse Giday *et al*., 2009a; Ermias Lulekal *et al*., 2013, Getnet Chekole *et al*., 2015). With the advent of "modern medicine" and disinterest which many people from the third world countries show towards herbal remedies, there is danger that the knowledge of traditional healers will be lost forever if action is not taken to document the particular prescriptions involved. In view of the rapid loss of natural habitats, traditional community life, cultural diversity and knowledge of medicinal plants, documentation of African traditional plants is an urgent matter (Okello *et al*, 2010; Solomon Araya *et al*., 2015). It is worth mentioning here that an Eastern Africa country, Ethiopia, is not exceptional in this regard.

The current rate of deforestation in Ethiopia is estimated at 140,000 to 160,000 hectare per year (CBD, 2009). Environmental degradation in Ethiopia ranges from very severe in rural areas to severe in urban areas. Soil erosion and degradation remains one of the most critical and far reaching environmental issues affecting the country. As a result of population increases, increased crop cultivation in marginal areas and increased livestock grazing pressure have also contributed to increased deforestation and soil erosion in the central highlands (CBD, 2005; Abiy Debay, 2009; Kindu Mekonnen *et al*., 2010).

Plants have traditionally been used as a source of medicine in Ethiopia too since early times for the control of various ailments afflicting humans and their domestic animals and as widely cited about 80% of human and nearly 90% of livestock depend on this traditional form of medication in one way or the other. Due to its long period of practice and existence, traditional medicine has become an integral part of the culture of Ethiopian people (Pankhurst, 1965, 1976; Keba Mirgisa, 1998). There is a large magnitude of use and interest in medicinal plants in Ethiopia due to acceptability, accessibility and biomedical benefits (Dawit Abebe, 2001; Mirutse Giday *et al*., 2009a). In recent years, researchers and policy-makers have shown a growing interest in the knowledge held by indigenous peoples. This can be evidenced by a growing interest in research works and subsequent documentation such as Dawit Abebe (1986; 1996); Mesfin Tadesse and Sebsebe Demissew (1992); Ensermu Kelbessa *et al*. (1992); Dawit Abebe and Ahadu Ayehu (1993); Abbink (1995); Zemede Asfaw (1997); Zemede Asfaw and Ayele Nigatu (1995); Keba Mirgisa (1998) in the last decades of the last millennium. Zemede Asfaw (200); Zemede Asfaw and Mesfin Tadesse (2001) ; Getachew Addis *et al.* (2001) ; Mirutse Gidey *et al*. (2003); Belachew Wassihun *et al.* (2003); Kebu Belamie *et al.* (2004); Debela Hunde *et al*. (2004) and Mesfin Tadesse *et al.* (2005) in the first half of the last decade. Kebede Deribe *et al*. (2006); Abiyot Berhanu *et al.* (2006); Tesfaye Seifu *et al.* (2006); Tesfaye Hailemariam *et al*. (2009); Mirutse Gidey *et al*. (2009 a, b); Fisseha Mesfin *et al.* (2009); Tesfaye Awas and Sebsebe Demissew (2009); Teferi Filatie *et al.* (2009); Tilahun Tekelehymanot and Mirutse Gidey (2009, 2010); Gidey Yirga (2010); Zemede Asfaw, 2010 in the second halfe of the last decade. More recently Anteneh Belayneh *et al*. (2012); Damtew Bekele *et al*. (2012); Gidey Yirga *et al*. (2012); Girmay Zenebe *et al*. (2012); Abiy Shilema *et al*. (2013); Mathewos Agize *et al*. (2013); Ermias Lulekal *et al*. (2013); Abraha Teklay *et al*. (2013); Banerjee *et al*. (2013); Getachew Addis *et al*. (2013); Gebremedhin Gebrezgabiher *et al*. (2013); Balcha Abera (2014); Berhane Kidane *et al*. (2014); Yibrah Tekle (2014);Tena Regassa *et al*. (2014); d'Avigdor *et al*. (2014); Mohammed Adefa and Seyoum Getaneh (2014); Genene Bekele and Reddy (2015); Gebremedhin Gebrezgabiher *et al*. (2015); Gonfa Kewessa *et al*. (2015); Engedasew Andarge *et al*. (2015) and Getnet Chekole *et al*. (2015) can be cited, among others, as examples.

The studies conducted on the traditional medicinal plants in Ethiopia are limited when compared with the multiethnic cultural diversity and the diverse flora of the country as concluded by Fisseha Mesfin *et al*. (2009). The attempts made so far cannot be said to be complete as compared to works done elsewhere such as in India, Latin America and China. Despite its significant contributions, traditional medicine (TM) in Ethiopia has attracted very little attention in modern medical research and development and less effort has been made to upgrade the role of TM practice (Teferi Filatie *et al.*, 2009; Claire *et al.*, 2013). Today medicinal plants and the associated knowledge in the country are threatened due to deforestation, environmental degradation and acculturation (Mirutse Gidey *et al.*, 2009 a, b; Tilahun Teklehaymanot and Mirutse Giday, 2010; Ermias Lulekal *et al*., 2013; Claire *et al*., 2013).

From times immemorial, people have depended on plants or plant parts to satisfy their hunger and meet their nutritional requirements. Utilization of wild edible plants (WEPs) as food source is an integral part of the culture of indigenous people around the world (Tilahun Teklehaymanot and Mirutse Giday, 2010). WEPs provide staple and supplementary foods, as well as cash income to local communities, thus favouring food security (Tena Regassa *et al*., 2014). However, WEPs are largely ignored in land use planning and implementation, economic development and biodiversity conservation (Uprety *et al*., 2010). Local people, from their own experience, know about the importance and contribution of WEPs to their daily diet, as well as being aware of possible health and environmental hazards (Diress Tsegaye *et al*., 2007; Getachew Addis, 2009; Assegid Assefa and Tesfaye Abebe, 2011).

Many at risk populations in developing countries are deficient in iodine, iron and vitamin A, making them more vulnerable to illness, fatigue, blindness and memory loss and increasing the possibility of incidence of mental retardation among their children (Redzic, 2006). This is true also in the case of Ethiopia mainly due to diets dominated by cereal-based food habit that largely affects children in most parts of the country. Supplementation, food fortification, dietary diversification, nutrition education and food production are strategies that have been developed to reduce these micronutrient deficiencies and have, for the most part, demonstrated positive, though uneven, results (Workneh Ayalew *et al*., 1999; Getachew addis *et al*., 2013). On the other hand, it has been reported that WEPs are the cheapest source of vitamin A, C, minerals and fiber still people fail to consume enough to meet their nutrient requirement due to lack of knowledge in the nutritional value and production of those vegetables in the easiest way (Termote *et al*., 2009; Dandena Gelmesa, 2010; Tilahun Teklehaymanot and Mirutse Giday, 2010).

WEPs have been a focus of research for many ethnobotanists in recent decades. Currently, there is renewed global interest in documenting ethnobotanical information on neglected WEPs (Bharucha and Pretty, 2010). Since traditional knowledge on WEPs is being eroded through acculturation and the loss of plant biodiversity along with indigenous people and their cultural background, promoting research on wild food plants is crucial in order to safeguard this information for future societies (Mirutse Gidey *et al*., 2009 a, b; Zemede Asfaw, 2009).

A considerable array of literature is available worldwide on ethnobotany of WEPs with an emphasis on field surveys and documentation. The major studies conducted in Ethiopia includes: Zemede Asfaw and Mesfine Tadesse, 2001; Kebu Balemie and Fassil Kibebew, 2006; Fentahun Mengistu and Hager, 2008; Zemede Asfaw, 2009; Mirutse Giday *et al*., 2009a; Tilahun Teklehaymanot and Mirutse Giday, 2010; Assegid Assefa and Tesfaye Abebe, 2011; Getachew Addiset *et al*., 2013, Tena Regassa *et al*., 2014 and Yigremachew Seyoum *et al*., 2015. Among similar studies conducted outside Ethiopia but carried out elsewhere are: Pieroni *et al*., 2002; Ertug, 2004; Reyes-Garcia *et al*., 2005; Tardio *et al*., 2006; Arenas and Scarpa, 2007; Rashid *et al*., 2008; Aryal *et al*., 2009; Paul *et al*., 2011. Moreover, research on nutritional value and health benefits of WEPs has been reported from Grivetti and Ogle, 2000; Ohiokpehal, 2003; Heinrich *et al*., 2005; Termote *et al*., 2009, 2010; De Caluwé, 2010; Beluhan and Ranogajec, 2010; Debela Hunde *et al*., 2011; Mahapatra *et al*., 2012; Hegazy *et al.,* 2013 and Getachew Addis *et al*., 2013. Despite the wide utilization of WEPs in Ethiopia, ethnobotanical information regarding local knowledge of these plants is very scanty. Available research information on Ethiopian WEPs represents only about 5% of the country's districts indicating the need for further ethnobotanical research addressing unexplored regions of the country (Ermias Lulekal *et al*., 2011). Hence, the current study was aimed at carrying out ethnobotanical investigation into medicinal and WEPs and documentation of indigenous knowledge associated with these plants in Jibat, Chalia and Dendi districts of West Shewa Zone of Oromia Regional State, Central Ethiopia.

1.2. Statement of the Problem

With broad latitudinal and altitudinal ranges, Ethiopia encompasses an extraordinary number of ecological zones, which in turn hosta wide diversity of species some of which are rare and threatened species and high rates of endemism. In combination with its importance as a centre of genetic and agricultural diversity, the conservation of Ethiopia's biodiversity is an issue of global importance (ENBSAP, 2005). With the second-largest population in Africa, limited capacity to manage natural resources and widespread land degradation, however, Ethiopia also faces many serious challenges to efforts to conserve its biodiversity and forests (Christine *et al*., 2010; Demel Teketay *et al*., 2010).

In Ethiopia, especially in the highlands, strong and prolonged human interference has degraded a range of vegetation types to a badly eroded and denuded landscape with very little differentiation of the vegetation left. The Ethiopian highlands with altitudes above 1,500 m a.s.l. cover about 500,000 km^2 accounting for about 45% of the landmass (ENBSAP, 2005). The highlands of the country are dominated by crop-livestock production system, 88 % of the human and 73% of the cattle populations (ENBSAP, 2005; Abiy Debay, 2010; Demel Teketay *et al*., 2010).

Ethiopia is characterized by high rate of forest degradation. Hundred years ago, about 40% of land was covered by forest in Ethiopia whereas only about 11% of the land is covered by forest currently (FAO, 2010). The major reason behind degradation of forests is human interference (such as expansion of agricultural land, grazing, firewood) and poverty (Alemtsehay Jima, 2010).

Protected areas are and will remain, cornerstones of biodiversity conservation. They are also critical to human welfare and poverty alleviation. As biodiversity becomes rarer and increasingly precious, protected areas, the jewel ecosystems, species, genetic diversity and associated values that societies agree to conserve, are becoming an ever more important focus of interest and concern, delight and conflict.

The botanical diversity and ethnobotanical studies of Chilimo-Jibat-Gedo mountain chain in Oromia Regional State in the Upper Awash and Gibe Watersheds have not been fully investigated previously. This mountain chain is with highly dissected topography and loss of vegetation cover resulting from the conversion of the natural vegetation into agricultural lands due to the increasing human population that leads to soil erosion and habitat destruction. With the degradation of the vegetation (botanical diversity), the ethnobotanical information accumulated over the centuries is rapidly deteriorating. The degradation of the vegetation and the subsequent loss of the biodiversity and the associated indigenous knowledge on the mountain chains can have far reaching social and environmental impacts to the people living in the area and beyond. This study, therefore, intends to investigate floristic composition and vascular plant diversity of the Jibat, Gedo and Chilimo forests and the medicinal and WEPs found in the forests and associated indegenous knowlegde of the Oromo communities living in and around Chilimo-Jibat-Gedo mountain chains. The research has an overarching goal to propose environmentally, economically and socially sound strategies to be considered for sustainable use and management plan for the watershed as well as medicinal and WEPs to resotore the resources and set the stage for sustainable utilization mode.

1.3. Research Questions, Hypotheses and Study Objectives

1.3.1. Research questions

The following were the main research questions identified for in-depth investigation:

1. What type of plant communities exist in Jibat, Gedo and Chilimo forests of West Shewa Zone?
2. Are there medicinal plants in Jibat, Gedo and Chilimo forests? If yes, what is their status and distribution across plant communities?
3. What are the traditional medicinal plants used by people in Jibat, Chelia and Dendi districts? Which of these plants are used to treat human and/or livestock ailments in the area?
4. How do community members use traditional medicinal plant parts to treat human and livestock ailments? How are herbal remedies prepared and administered?

5. How is traditional medicinal knowledge distributed and transferred among different classes of community members and social groups in the area? What major socioeconomic and cultural factors affect this traditional knowledge in the study area?
6. What are the main threats to medicinal plants and associated indigenous knowledge in the area? Are there local conservation practices?
7. Are traditional medicinal plants harvested for uses other than their medicinal role? Which of the medicinal plants used in the area are best-agreed by community members on their efficacy to treat particular human or livestock ailments?
8. Which of the medicinal plants used in Jibat, Chelia and Dendi districts are available in the districts' local markets?
9. What are the wild edible plants used by people in Jibat, Chelia and Dendi districts? Who are the major gatherers and consumers of these resources?
10. Which parts of the wild edible plants are consumed and what are the common food use categories?
11. Where do the local communities gather wild edible plants and what is their conservation status?

1.3.2. Research hypotheses

The study's central hypotheses are:

1. People in the study area have significant traditional knowledge on use and management of medicinal plants to treat human and livestock ailments and wild edible plants;
2. Indigeneous knowledge on use of medicinal and wild edible plants varies based on age, gender and experiences of community members.
3. Indigeneous knowledge associated with use of medicinal and wild edible plants is declining.

1.3.3. Study objectives

General objective

The general objective of the study was to investigate the floristic composition and vascular plant diversity of Jibat, Chilimo and Gedo forests along with traditional medicinal and wild edible plants and the associated local indigenous knowledge of the study area.

Specific objectives

The specific objectives are:

1. To describe the floristic composition and vascular plant diversity of Jibat, Gedo and Chilimo forests and identify the plant communities in these forests;
2. To gather, record and document indigenous knowledge of the people on medicinal and WEPs in the study area;
3. To collect, identify and document traditional medicinal and WEPs used in the study area used for food (food supplements) and treatment of human and livestock health problems;
4. To determine the most popular medicinal and WEPs used in the study area
5. To determine IK dynamics on use of medicinal and wild edible plants by different social groups in the study area and
6. To analyze factors, if any, contributing to depletion or conservation of medicinal and WEPs and/or associated knowledge in the study area.

CHAPTER TWO

2. REVIEW OF RELEVANT LITERATURE

2.1. A glimpse to Vegetation Resources of Ethiopia

Ethiopia is located in the Horn of Africa between 3^o and 15^o North latitude, 33^o and 48^o east longitude. It shares boundaries to the east and southeast with Djibouti and Somalia, to the north with Eritrea, to the south with Kenya and to the west with the Sudan and South Sudan (Fig. 1). The country covers 1.13 million square kilometers, with a wide altitudinal variation ranging from 110 meters (m) below sea level (b.s.l.) in Kobar Sink to 4530 m above sea level (a.s.l.) at Ras Dejen (EFAP, 1994). Temperatures vary from as high as 47°C in the Afar depression to as low as 10°C in the highlands. The average annual rainfall of the lowland areas in the south, southeast, east and northeast is below 500 mm, whereas some areas of the highlands receive over 2000 mm (EFAP, 1994). The entire landscape is divided into two physiographic features: the highlands- areas that are 1500 m a.s.l. altitude and above that share 37 per cent of the country and the lowlands- areas with altitude below 1500 m asl that covers 63 per cent of the country (Friis *et al*., 2010). The Great African Rift Valley runs diagonally across the country from northeast to southwest separating the north western and southeastern highlands. The highlands on each side of the Rift Valley give way to extensive semi-arid and arid lowlands to the east, south, southeast and west of the country (Fig. 1).

Fig. 1. Physical Map of Ethiopia (Source: https://en.wikipedia.org/wiki/Geography_of_Ethiopia)

The physical conditions and variations in altitudes have resulted in a great diversity of climate, soil and vegetation cover of Ethiopia (Zerihun Woldu, 1999; Demel Teketay, 2002). In the country, reliable information on the vegetation resources such as their spatial coverage, distribution, changes over time etc. are lacking or difficult to get because it is scattered and inconsistent (Demel Teketay *et al*., 2010). According to the World Bank-funded Woody Biomass Inventory and Strategic Planning Project (WBISPP), may be the first national inventory that provided reasonably reliable statistics on the forest resources indicated that Ethiopia owns a total of 59.7 million ha covered by woody vegetation among which: 3.56 % is high forest (about 4.07 million ha), 49% woodland (29.24 million ha) and 44.2% shrubland or bushland (26.4 million ha) and plantations cover is/was estimated to be 955,705 ha (WBISPP, 2004; Sisay Nune *et al*., 2010; Wubalem Tadesse, 2012). On the other hand, the recent data on forest resources of Ethiopia reported in FAO (2010) puts Ethiopia among countries with forest cover of 10-30%. According to this report, Ethiopia's forest cover is 12.2 million ha (11%). It further indicated that the forest cover shows a decline from 15.11 million ha in 1990 to 12.2 million ha in 2010, during which 2.65% of the forest cover was deforested.

The vegetation resources of Ethiopia, including forests, woodlands and bushlands, have been studied by several scholars (Hedberg, 1951, 1978; Pichi-Sermolli, 1957; White, 1983). These authors have made a considerable contribution towards understanding the country's vegetation. The oldest overall survey of the vegetation of Ethiopia made by Pichi-Sermolli (1957), recognized 24 vegetation types (for the Horn of Africa, 22 of which occur in Ethiopia), laid the foundation for systematic studies of the vegetation and environmental factors in Ethiopia (Zerihun Woldu, 1999).

In the present Atlas of the potential vegetation of Ethiopia, Friis *et al*. (2011) described twelve major vegetation types. These vegetation types are: desert and semi-desert scrubland; *Acacia-Commiphora* woodland and wooded grassland of the Rift valley; wooded grassland of the western Gambella region; *Combretum–Terminalia* woodland and wooded grassland; dry evergreen Afromontane forest and grassland complex; moist evergreen Afromontane forest;

transitional rainforest; ericaceous belt; Afroalpine vegetation; riverine vegetation; freshwater lakes (including lake shores, marshes, swamps and floodplain vegetation) and salt water lakes (including lake shores, salt marshes and pan vegetation). The current forests cover of Ethiopia, which is 11% of the country's landcover, includes the *Acacia-Commiphora* and *Combretum–Terminalia* woodland (FAO, 2010), in addition to dry evergreen and moist evergreen afromontane and transition rainforest.

Diverse physiographic, altitudinal, climatic and edaphic resources, enables Ethiopia to have various types of vegetation ranging from alpine to desert plant communities (Sahle Gebrekiristos, 1984; Demel Teketay, 2005) which provide economical, socio-cultural and environmental benefits (CBD, 2009). The flora of Ethiopia is about about 6,000 species (Ensermu Kelbessa and Sebsebe Demissew, 2014). Ethiopia is among the African countries known for endemism of wild plant and animal species and about 10% of Ethiopia's flora is considered to be endemic (Ensermu Kelbessa and Sebsebe Demissew, 2014). Endemism is reportedly high on the plateaus, mountains, in the Ogaden region and in the southern woodlands (Vivero *et al*., 2005).

2.1.1. Provisioning services of forest

Empirical evidence from developing countries indicates that forest products play a significant role in rural livelihoods, particularly for the rural poor. Almost a quarter of a billion people live in or around the dry forests of Sub-Saharan Africa (CIFOR, 2008) and most of them depend on the forests for building materials, food, cropland, fuel wood, non-wood products and many other things (Abebe Damte, 2011; Adugnaw Birhanu, 2014). Forests compose the major portion of the flora of Ethiopia and are found in the regions of moist and wet intermediate altitude, moist and wet high altitude and in moist low altitude. About 25 percent of families of close relatives of cultivated crops are distributed in the forest areas of the country (Abebe Damte, 2011). This resource is sharply declining because of over exploitation of the natural forests, woodlands and bushlands, at a rate higher than the natural regeneration (Adugnaw Birhanu, 2014), like other forests, the forests in Ethiopia, provide ecosystem services such as: purification of air and water, climate stabilisation, erosion control, maintaining agents of pollination of crops, natural pest control, providing essential products including food, fibre, fish and timber and the ability to mitigate the effects of natural disasters to millions of Ethiopian people (Adugnaw Birhanu, 2014).

2.1.2. Threats to the forests

Tropical rainforests continue to decline at an alarming rate. Ethiopia is not exceptional with this regard. It is generally believed that a considerable portion of the land area in the highlands of Ethiopia was covered with forests having wider coverage than at present. The presence of a number of isolated large-sized trees, even on farmlands, or patches of forests around churchyards and religious burial grounds in this country indicate the occurrence of vast expanses of earlier forests (Tamrat Bekele, 1993).

The Ethiopian highlands contribute to more than 50% of the land area with Afromontane vegetation of which dry montane forests form the largest part (Yalden, 1983; Tamirat Bekele, 1994). Little of the natural vegetation of the highlands remains today, except for a few forest patches in the south and southwestern parts of the country. The influence of humans and domestic animals has profoundly altered both the vegetation and the landscape. Ecological degradation, including deforestation and erosion, is widespread, particularly in the northern and central highlands of the country (Demel Tekatay, 2005; Lema Etefa, 2011; Adugnaw Birhanu, 2014).

The depletion of the natural vegetation in many parts of the country has also led to the threat and decline in number and distribution of many plant species. According to Ensermu Kelbessa *et al*. (1992), 120 threatened endemic plant species are known from Ethiopia. Thirty five of these species were from the Dry Afromontane forests of the country (Shambel Bantiwalu, 2010; Ermias Lulekal, 2013). The speed with which forest resources have been depleted in Ethiopia has brought significant decline in their biodiversity to the extent that some species are on the verge of local extinction. Though the available information on the forest resources of Ethiopia is very limited, it is estimated that high forests are disappearing at the rate of 140,000-160,000 ha annually (CBD, 2009) while the corresponding rate of plantation, 2000 ha per year, is insignificant and stagnating. Natural forests and woodlands covered 15.1 million ha in 1990. This area declined to 13.7 million ha in 2000. In 2005, the forest cover had further declined and was estimated to cover 13.0 million ha. In other words, Ethiopia lost over 2 million ha of her forests, with an annual average loss of 140,000 ha (FAO, 2010) between 1990 and 2005. Currently, the area is estimated at 12.3 million ha, ca. 11.9 % of the total land area. Of this, the remaining closed natural high forest is 4.12 million ha or 3.37% of Ethiopia's land area. The area of forest is unevenly distributed in the country. Oromia, Southern Nations, Nationalities and Peoples Regional State and Gambella Region account for 95% of the total high forest area (WBISPP, 2004; Million Bekele, 2011).

Several studies focusing on forests or vegetation of specific regions in Ethiopia, viz., in the Central highlands (Zerihun Woldu, 1985, 1988; Sebsebe Demissew, 1988; Zerihun Woldu *et al.*, 1989; Zerihun Woldu and Mesfin Tadesse, 1990; Zerihun Woldu and Backeus, 1991; Mesfin Tadesse, 1993; Tamrat Bekele, 1993, 1994; Demel Teketay, 1996, 2001; Badege Bishaw, 2001; Abate Ayalew *et al*., 2006; Abiyou Tilahun, 2009; Leul Kidane *et al*., 2010; Lema Etefa, 2011; Tesfaye Burju *et al*., 2013; Teshome Soromessa and Ensermu Kelbessa, 2013, 2014; Birhanu Kebede *et al.*, 2014). In the South and Southeast (Lisanework Nigatu and Mesfin Tadesse, 1989; Teshome Soromessa *et al*., 2004; Simon Shibru and Girma Balcha, 2004; Genene Bekele, 2005; Kitessa Hundera *et al*., 2007; Ermias Lulekal *et al*., 2008; Motuma Didita *et al*., 2010) and in the Southwest (Tesfaye Awas *et al*., 2001; Kumilachew Yeshitela and Taye Bekele, 2003; Dereje Denu, 2006; Ensermu Kelbessa and Teshome Soromessa, 2008). Studies carried out in the Western Ethiopia include Tesfaye Awas (2007), Fufa Kenea (2008), Fekadu Gurmessa *et al*. (2012) and Teshome Gemechu *et al*. (2015). These studies have been carried out aimed at describing community types and their relationship with some natural and anthropogenic factors.

Among the many factors driving such deforestation are forest conversion to farmland, exploitation through selective harvest, firewood harvest and charcoal production, seasonally set forest fires, over grazing, shortage of wood products, substantial loss of foreign currency for importing wood, changes in local and regional climates, depletion of biological resources, the absence of a strong forest administration system, further degradation of the remaining vegetation and widespread land degradation (Yitebitu Moges *et al*., 2010, 2012; Takahashi and Todo, 2011; Abyot Dibaba *et al*., 2014). Deforestation has many repercussions that include soil, water and biodiversity degradation (Tola Gemechu and Woldeamlak Bewket, 2007). In sub-Saharan

Africa, deforestation and population have gradually increased together, with the heaviest forest losses coming in areas where wood is needed for fuel or where forest land is needed for growing crops (FAO, 2012). For instance, it is estimated that between 2000 and 2008, 80% of new agricultural land was converted from forests, woodlands or shrub lands. Fuel wood is also largely free access and a major source for household energy in Ethiopia. It is estimated that 90% of the country's total energy for household cooking is derived from biomass fuels, of which 78% come from fire wood (USAID, 2008). In Ethiopia, the cultivated area has increased from 9.44 million ha in 2001 to 15.4 million ha in 2009 alone (6 million ha in 8 years). Reports show that about 1850 ha/year of Boswellia wood land is converted in to agricultural land (Wubalem Tadesse, 2012). The institutional arrangements in the forest sector have been unstable, suffering from frequent restructuring. Such lack of stability in the sector's organizational structure is often cited as one of the major bottlenecks for the lack of coordinated, effective and long term management and development successes in Ethiopian forestry (Demel Teketay *et al*., 2010; Million Bekele, 2011). Even if there are encouraging efforts in this country, yet lots of works are remaining and deforestation problem is being undergoing with even more drastic consequences (Wubalem Tadesse, 2012). However, reversing long-existing trend of deforestation might be possible, though it takes a lot of time, as long as appropriate measures are taken by the concerned governmental sector and the people as a whole (Wubalem Tadesse, 2012; Ermias Lulekal, 2013). It is, therefore, urgent and important to study and document the remaining vegetation resources upon which sound management plans of conservation and sustainable utilization can be based.

2.2. Ethnobotany: Scope, History and Development

2.2.1. The scope of ethnobotany

Ethnobiology is the scientific and humanistic study of the complex set of relationships of the biota to present and past human societies (Martin, 1995; Cotton, 1997). The field can be divided into three major domains of inquiry: economic (how people use plants and animals), cognitive (how people know and conceptualize plants and animals) and ecological (how people interact with plants and animals, especially in an evolutionary and coevolutionary framework). Ethnobiology encompasses two subdisciplines: ethnobotany and ethnozoology. Given the greater importance of plants than animals for most human societies, ethnobotanical studies form the vast majority of research within ethnobiology. Scholarship in all these areas has contributed to methodological advances (Alexiades, 1996; Stepp, 2005; Bridges and Lau, 2006; Gerique, 2006). The term ethnobotany deals with the dynamic relationship, interactions between human populations, cultural values and plants (Alexiades, 1996; Cotton, 1997). The relationship is obligating that it existed long before human civilization. However, the interaction of plants with human society varies due to their uses, relative importance, varying social, cultural and ethnic factors (Panhwar and Abro, 2007).

The definition and scope of ethnobotany remained impressive even by the narrowest definition of the discipline. As Turner (2000, cited in Hamliton *et al.*, 2003) notes in her review of ethnobotany, the discipline still undertakes research on the relationship between people and plants in the areas of linguistics; cognition; education; healing; nutrition; archeology; paleology; resource tenure and management; agriculture and livelihood. “Ethnobotany is the part of ethnoecology which concerns plants (Martin, 1995)”. Whereas ethnoecology encompasses all studies which describe local people’s interaction with the natural environment, including subdisciplines such as ethnobiology, ethnobotany, ethnoentomology and ethnozoology (Martin, 1995; Balick and Cox, 1996; Cotton, 1997). Ethnoecology, as a significant discipline encompassing various fields of the study of indigenous people's perceptions and interactions with their environment, has recently developed various theoretical and practical approaches that not only seek to document information on local classifications and taxonomies, but also to contribute to dynamic processes of community development and conservation programs (Martin, 1995; Alexiades, 1996).

Ethnobotany studies the relationship between humans and plants in all its complexity and is generally based on a detailed observation and study of the use a society makes of plants, including all the beliefs and cultural practices associated with this use (Alexiades, 1996). It is useful for ethnobotanists to live with indigenous people, to share the everyday life of their community and, of course, to respect the underlying cultures. Ethnobotanists have a responsibility both to the scientific community and to the indigenous cultures (Martin, 1995; Balick and Cox, 1996).

Ethnobotany focuses on all useful plants including other natural products derived from plants, such as food, plants used in rituals, coloring agents, fiber plants, poisons, fertilizers, building materials for houses, household items, boat, etc. (Cotton, 1997). Because plants play an important role in almost every realm of human activity, ethnobotany encompasses many fields including botany, biochemistry, pharmacognosy, toxicology, medicine, nutrition, agriculture, ecology, evolution, comparative religion, sociology, anthropology, linguistics, cognitive studies, history and archeology (Martin, 1995; Balick and Cox, 1996; Cotton, 1997).

The multidisciplinary nature of ethnobotany allows for a wide array of approaches and applications and leaves the way open for many scientists to study the plant uses in different ways. But medicinal plants have always been the main research interests of ethnobotany and the study of these resources has also made significant contributions to the theoretical development of the field (Alexiades, 1996; Cunningham, 2001; Gerique, 2006; Kunwar and Bussmann, 2008).

Moreover, ethnobotanical specialties, such as medical ethnobotany, require knowledge and skills in additional areas, such as chemistry, medical anthropology and pharmacology, in order to be sufficiently competent to define and undertake the more specialized ethnobotanical research. However, some skills transcend disciplines. Basic computer competence is needed in virtually all studies to organize and analyze research data (Bridges and Lau, 2006).

2.2.2. Ethnobotany: historical and developmental accounts

The term ethnobotany was first introduced by the American botanist, John Harshberger, in 1896 as "the study of plant use by humans" (Cotton, 1997). Since 1800s the scope of the subject has expanded to include studies of modern cultures, greater interdisciplinary and, more recently, greater attention to its applications to conservation and sustainable development. It is a science that has been rapidly evolving, a state of affairs that will likely continue for some time (Gerique, 2006).

Ethnobotany has been used as a means of extracting knowledge of the uses of plants, especially as medicines, from communities, with the aim of developing new commercial products elsewhere. Over the last decade in particular, Ethnobotany has tended to become more analytical, quantitative, cross-disciplinary and multiinstitutional. Ethnobotanists are now much more engaged with questions of conservation, sustainable development, cultural affirmation and the intellectual property rights of local and indigenous people. A growing inclusion of ecology is leading to new insights into the origin and dynamics of tropical ecosystems (Hamilton *et al*., 2003).

Ethnobotany tries to preserve valuable traditional knowledge for both future generations and other communities. Recently, the subject has adopted a much more scientific and quantitative methodology and has studied the ways in which people manage their environment (Phillips and Gentry, 1993a, 1993b; Martin, 1995; Cotton, 1997; Höft *et al*., 1999). Quantitative methods and species use values enable comparisons of use between vegetation types or ecological zones, between people of different ages, gender or occupation within or between communities (Höft *et al*., 1999; Cunningham, 2001). Additionally, Philips and Gentry (1993a, 1993b) suggest that refined quantitative data collection and analysis improves ethnobotany as a discipline and also enhances its image among other scientists. This serves to strengthen the indicative and predictive value of research data.

2.2.3. Ethnobotanical research: methodological perspectives

It is clear that inter- and multidisciplinary approaches can lead to more fruitful, thorough and systemic approximations in the study of plant-people interactions. Despite or perhaps because of its many challenges, ethnobotany remains a fascinating and promising area of study (Gerique, 2006).

Ethnobotany being the scientific and humanistic study of the complex set of relationships of plants with past and present human societies has developed quantitative and qualitative research approaches. These research approaches are helpful for recovering the local knowledge on use, management and understanding of plants and environments by the people (Stepp, 2005).

As a result of increasing complexity of quantitative ethnobotanical studies in which the relationships among several variables or groups of variables have to be assessed and interpreted, the use of the computer is imminent (Hoft *et al*., 1999; Hoffman and Gallaher, 2007). Various useful computer packages have been developed. Among the most common multivariate analysis techniques are the basic correlation analysis to measure the general relationships among variables, cluster analysis to assess similarities or dissimilarities among variables, principal component analysis to determine variance among variables and regression analysis to establish quantitative relationships among variables and prediction. The latter regression analysis allows for predicting values of response, dependent variables from a group of explanatory, independent variables and is as such appropriate for the explanation and prediction of behavior as a dependent variable from a group of independent background (i.e. predictor variables). In addition, multiple regression models also encompass interaction terms between and among variables (Alexiades, 1996; Slikkerveer, 2005; Bridges and Lau, 2006; Gerique, 2006).

2.3. Traditional Medicine

2.3.1. Definition and scope

The World Health Organization (WHO) defines traditional medicine as health practices, approaches, knowledge and beliefs incorporating plant, animal and mineral-based medicines, spiritual therapies, manual techniques and exercises, applied singularly or in combination to treat, diagnose and prevent illnesses and maintain well-being (WHO, 2003). Traditional medicine has also been defined by the World Health Organization as “the sum total of all knowledge and practices, whether explicable or not, used in the diagnosis, prevention and elimination of physical, mental or social imbalances and relying exclusively on practical experience and observation handed down from generation to generation, whether verbally or in writing" (Rukangira, 2001; Kebede Deribe *et al*., 2006).

WHO estimated that the majority of the populations of most countries are still relying primarily upon indigenous or traditional forms of medicine for meeting everyday healthcare needs (WHO, 2003). Despite its existence and continued use over many countries and its popularity and extensive use during the last decade, traditional medicine has not been officially recognized in most countries. Consequently, education, training and research in this area have not been accorded due attention and support (Dawit Abebe, 1986; Balick and Cox, 1997; Asfaw Debela *et al*., 1999; Hassan, 2007).

2.3.2. Medicinal plants in traditional health-care system

A medicinal plant is one used by people for medicinal purposes–to build or maintain health, stave off disease, or promote recovery from illness or misfortune. No precise definition is possible, given this wide scope and because the use of plants as medicines grades into their use for other purposes, for example, for food, personal hygiene, beauty-care, psychological support and spiritual practices (Balick and Cox, 1997; Fassil Kibebew, 2001; Hamilton, 2008).

Medicinal plants continue to provide health security to rural people in primary healthcare. Healthcare and botany have evolved as inseparable domains of human activity: the medicine man (shaman) is often regarded as the first botanical professional in human history. Whereas western medicine, as taught in most medical schools around the world, has largely switched from natural to manufactured drugs, plant products are still of paramount importance in traditional healthcare systems of developing countries (Hareya Fassil, 2005; Cunningham *et al.,* 2008).

Medicinal plants are the roots of medical practice. Medicinal plant uses range from anti-microbial 'chewing sticks' for dental care and the treatment of internal parasites to symbolic uses. In fact, of the global total of about 300,000 flowering plant species, more than 50,000 are used for medicinal purposes, with an estimated 2500 species of medicinal and aromatic plants traded worldwide, most still collected from wild sources (Lewington, 1993; Schippmann *et al.,* 2006).

2.3.3. Medicinal plants and health-seeking behavior

Reasons for the use of herbal medicine/medicinal plants include the perceived efficacy of traditional systems, the high cost of allopathic medicalcare and cultural beliefs, as well as the lack of available medical doctors. The holistic, philosophical character of many medical systems strongly influences people's health-seeking behaviour, even when Western medicines are available. Good examples include the continued use of Chinese, South Asian (Ayurvedic and Unani), Thai, Tibetan and Vietnamese medical systems as well as diverse healing practices in Africa (also true in Ethiopia) and Latin America. The continued importance of traditional medicine to the estimated 1.24 billion people in China is a well-known example, with herbal preparations accounting for 30–50 percent of total medicinal consumption in China (WHO, 1998, 2003).

Traditional medicine takes a holistic approach where disease or misfortune results from an imbalance between the individual and the social environment, whereas modern biomedicine takes a technical and analytical approach. This is also the reason behind the often-uneasy relationship between traditional and modern medicine. Both rural and urban patients commonly consult traditional healers before, after or simultaneously with consultation with medical doctors, often switching between different medical systems according to the ailment (Hassan, 2007; Cunningham *et al*., 2008).

2.3.4. Risks associated with medicinal plants

Herbal medicines have natural origins, but natural does not mean non-toxic. Like pharmaceutical drugs, herbal medicines need to be harvested, stored, prepared and prescribed with attention to safety, quality and efficacy. In rural areas where healthy stocks of favored species remain, healers are able to harvest quality products locally. Safety, quality and efficacy are more difficult to achieve in urban areas, or where rural healers have to buy favored species from traders. In Nigeria, for example, all herbal medicines tested contained heavy metals (Obi *et al.*, 2006, cited in Cunningham *et al*., 2008).

A similar problem was found with Asian herbal medicines, which contained arsenic, lead and mercury at levels ranging from toxic (49 per cent) to levels higher than public health guidelines (74 per cent) Garvey *et al.*, (2001). High price and scarcity due to rarity or over-harvest pose additional problems, since substitution with similar-looking species with different properties becomes common. In their literature review, Yang *et al.* (2006) had identified 32 pharmaceutical drugs that interacted with herbal medicines, primarily anti-coagulants, sedatives and anti-depressants, oral contraceptives, anti-HIV agents, cardiovascular drugs, immunosuppressant and anticancer drugs. Preventing these adverse reactions is important. Until South Africa's recent policy changes on supplying anti-retrovirals to HIV-positive people, use of herbal medicines such as *Hypoxis* and *Sutherlandia* were being promoted. The study carried out by by Mills *et al.,*

(2005) showed that the use of these African herbal medicines might put patients at risk for drug toxicity, treatment failure or viral resistance.

Adverse reactions are not restricted to herbal medicines; they also occur with pharmaceuticals. Strategies to avoid adverse reactions to herbal medicines can be developed, just as they can for pharmaceuticals. This includes understanding not only which pharmaceuticals interact with which herbal medicines, but also what drives demand for traditional medicines (Cunningham *et al*., 2008).

2.4. An Overview of Ethiopian Traditional Medicine

2.4.1. Ethiopian traditional medicine

Ethiopia is endowed with rich traditional medical lore that has been used for several centuries and continues to be widely used to this day. Ethiopian traditional medicine (TM) comprises of the use of plants, animals and mineral products as well as beliefs in magic and superstition, although medicinal plants is the major one (Pankrust, 1976; Abbink, 1995; Endashaw Bekele, 2007). It also consists of the use of counter-irritation, cautery, bleeding and cupping, surgery, bone-setting, dentistry, thermal bath, steam bath and the use of the holy water (Pankhurst, 1990, 1998; Dawit Abebe and Estifanos Hagos, 1991; Fassil Kibebew, 2001; Kebede Deribe *et al*., 2006).

As in most other developing countries, the majority of the Ethiopian population relies on medicinal plants and other traditional medical practices to alleviate their ailments and improve their health (Dawit Abebe, 1986; Dawit Abebe and Ahadu Ayehu, 1993; Asfaw Debela *et al*., 1999; Teferi Gedif and Hahn, 2003; Debela Hunde *et al*., 2004; Abiyot Berhanu *et al*., 2006; Mirutse Giday *et al*., 2009a; Fisseha Mesfin *et al*., 2009; Ermias Lulekal *et al*., 2013) and more than 95% of traditional medical preparations are of plant origin (Dawit Abebe, 1986). The traditional health practitioners are generally categorized into herbalists, bone setters, traditional birth attendants, spiritual healers, diviners and magicians. Each of these categories is with mixed responsibilities and identities at times. Herbalists are considered to be the biggest group that uses medicinal plants. Practitioners use in one way or the other plants and plant products in their medical practices. Some have described the traditional medical system of Ethiopia as medico-religious system (Dawit Abebe and Ahadu Ayehu, 1993; Dawit Abebe, 1996; Endashaw Bekele, 2007) and others as magico-religious.

There are a number of traditional medicinal practices that reflect the diversity of Ethiopian cultures. Ethiopian traditional medicine is concerned not only with the curing of diseases but also with the protection and promotion of human physical, spiritual, social, mental and material wellbeing (Fekadu Fullas, 2001). The many categories of traditional medicinal practices dealing with these different aspects of health included spiritual healing, prevention, as well as curative and surgical practices. The health and drug policies of the Ethiopian Ministry of Health recognize the important role traditional health systems play in healthcare (Fassil Kibebew, 2001; Kebede Deribe *et al*., 2006).

Most Ethiopian traditional medicinal knowledge is kept in strict secrecy; however, it is dynamic in that the practitioners make every effort to widen their scope by reciprocal exchange of limited information with each other or through reading the traditional pharmacopeias (Dawit Abebe, 1986). This author gives three treatment features of Ethiopian traditional medicines i.e. curative, prophylactic and preventive. Sometimes, the treatment could have a curative as well as a prophylactic effect and it is occasionally claimed that the prophylaxis could even be genetically fixed and can protect the offspring (Fekadu Fullas, 2001; Fassil Kibebew, 2001).

In Ethiopia, the rate at which indigenous knowledge is lost is fast and is not too far from developed countries. The vast knowledge on traditional uses of plants is not fully documented and most of the knowledge is conveyed from generation to generation by word of mouth. This process together with the increasing acculturation, mobility and displacement of communities due to different factors (famine, war etc.), secretive nature of traditional knowledge and skills and the negligence of the contemporary generation to acquire the knowledge on traditional medicine due to expansion of modern education and to some extent modern medicine, puts to question the future of the cultural heritage of the country which was known and practiced for centuries (Getachew Addis *et al*., 2001; Berhanemeskel Weldegerima, 2009).

2.4.2. Role of medicinal plants in Ethiopian traditional medical system

The indigenous peoples of different localities in Ethiopia have developed their own specific knowledge of plant resource uses, management and conservation (Pankrust, 1965; Tesfaye Awas, 2007; Fisseha Mesfin *et al*, 2009). However, there is also some knowledge shared among some communities for instance the use of *Hagenia abyssinica* (locall known as kosso in Amharic; heexoo in Afan Oromo) in expulsion of tapeworms due to its wide use. Plants have been used as a source of traditional medicine in Ethiopia from time immemorial to combat different ailments and human sufferings. Due to its long period of practice and existence, traditional medicine has become an integral part of the culture of Ethiopian people (Pankhurst, 1965; Keba Mirgissa, 1998: Mirutse Giday *et al*., 2009a).

In Ethiopia, up to 80% of human and 90% of livestock population use medicinal plants and plant remedies selected over centuries. Moreover, medicinal plants remain the most important and sometimes the only source of therapeutics (Dawit Abebe, 2001; Tesfaye Awas, 2007). This is mainly due to the cultural acceptability of healers and local pharmacopeias, the relatively low cost of traditional medicine and difficult access to modern health facilities (Dawit Abebe and Estifanos Hagos, 1991; Dawit Abebe and Ahadu Ayehu, 1993; Hareya Fassil, 2005; Mirutse Giday *et al*., 2009a, b; Ermias lulekal *et al*., 2013) and other biomedical benefits (Dawit Abebe, 2001; Gidey Yirga, 2010). Those plants are part of the economic commodity for some members of the society which make their livelihood on their collection, trade and medicinal practices by practitioners or healers. It, thus, has a substantial potential to make contributions to the economic growth and alleviation of poverty in the country (Dawit Abebe, 1986; Fassil Kibebew, 2001; Endachaw Bekele, 2007).

According to personal communication with Professor Ensermu Kelbessa (2015), about 1200 species of plants are documented in the medicinal plants database of Ethiopia held by the National Herbarium (ETH). They are used to treat several human and livestock health disorders. Among these, there are endemics that are becoming rare and rare and at the verge of extinction. Endemic medicinal species restricted to Ethiopia are of primary concern to Ethiopia and to the world as well and thus need serious attention. Equally threatened is the knowledge base on which the traditional medicinal system is based, as the ethnobotanical information is not documented and remains in the memory of elderly practitioners (Tesfaye Awas and Sebsebe Demisew, 2009).

Most folkloric Ethiopian medicinal plants and their method of preparation are often closely guarded secrets, usually passed orally from the father to the eldest son, as the death of the former approaches (Dawit Abebe, 1986; Dawit Abebe and Ahadu Ayehu, 1993; Mirutse Giday *et al*., 2009a). As a result of this tradition, the oral transmission of knowledge from generation to generation gives rise to the possibility of incompleteness, omission, misrepresentation or distortion of the original medicinal plant cure as time goes by mis-identification of herbs, their dubious method of compounding and other variables might lead to ineffective traditional healing (Asfaw Debela *et al*., 1999; Fekadu Fullas, 2001; Endachaw Bekele, 2007; Genene Bekele and Reddy, 2015). Thus, an ethnobotanical research and subsequent documentation and trying to utilize this traditional wealth of healing system in the modern medication system is the next vital task, before these resources have gone forever due to current rate of cultural and habitat loss (Tilahun Teklehaymanot and Mirutse Giday, 2007; Mirutse Giday *et al*., 2009a; Gebremedhin Romha *et al*., 2015).

The potency of a medicinal plant depends on a host of factors, which may sometimes seem subtle. The quantitative chemical constitution of a plant is a function of the part, the age, the growing conditions, the geographical location and the season of collection of the plant. Within the same plant species collected at different times and under different conditions, genetic variations might occur (Eyasu Makonnen *et al*., 2003; Kebede Deribe *et al*., 2006). This in turn leads to different quantities of active ingredients and therefore different potencies of medicinal plants, especially in wild growing varieties. The processing of a plant material is also a significant factor, which contributes to its quality and potency (Tekalign Deressa *et al*., 2010). Some constituents are heat labile and thus a plant may require drying at low temperatures, while for others drying for a prolonged time might enhance moisture-mediated degradation of the active ingredients. Once a plant material is collected or purchased, its efficacy depends on the amount used, the method of preparation adopted and the manner in which the final product is used (WHO, 1998; Tekalign Deressa *et al*., 2010).

For most Ethiopian medicinal plants the dosages are not known, or if known vary among healers and from vendor to vendor, or from user to user. Most herbal medicines, like other goods, are sold not by weighing, but by handfuls, can full, or simply by piling up (Kloos *et al*., 1978). Likewise, the method of preparation is not standardized. This situation is bound to lead to sub-therapeutic treatment in low doses and adverse events in the case of high doses, the principal untoward effects with the latter being chronic toxicity problems, which are not as evident as the manifestations of immediate toxicity. This is in particular true for such chronic remedies as taenicides (Kebede Deribe *et al*., 2006). This discrepancy is indicative of two problems; first, the effective dose is not known by the traditional healers and the consumers and secondly the higher doses and the attendant toxicity might have deleterious effects on the consumer. The method of preparation for most medicinal herbs is not also standardized (Tekalign Deressa *et al*., 2010).

The bulk of the plant matter used for medicinal purposes is collected from natural vegetation stocks that are shrinking with degraded environment and to substantial reduction or dwindling of species of medicinal plants. According to Ensermu Kelbessa *et al*. (1992), habitat and species are being lost rapidly as a result of the combined effects of environmental degradation, agricultural expansion, deforestation and over harvesting of species and this is further enhanced by human and livestock population increase thus hastening the overall rural livelihood impoverishment and loss of the biological diversity and indigenous knowledge which is also of global concern since some of these are endemic to Ethiopia. Today, medicinal plants and the associated knowledge in the country are threatened due to deforestation, environmental degradation and acculturation (Mirutse Gidey *et al.*, 2009a). Therefore, it is worth noting that its proper management will protect environments and conserve biodiversity. A full scale plan to conserve, develop and effectively utilize this resource needs investment commitments by government agencies, the private sector and various global foreign aids for development (Fekadu Fullas, 2001; Fassil Kibebew, 2001; Hareya Fassil, 2005; Endashaw Bekele, 2007).

2.4.3. Traditional medicinal plants in public healthcare system

From time immemorial, plants have played a role in human affairs influencing the evolution of civilizations and cultures, human migration, medicine and healthcare, wars, art, mythology and religion. Humankind has been continuously using plants in one or the other way in the treatment of various ailments (Martin, 1995; Cotton, 1997; Sandhya *et al*., 2006; Endachaw Bekele, 2007). Physical evidence gathered from burial sites of Neanderthal humans discovered in Iraq revealed that the use of medicinal plants in the area goes back to some 6000 years (Sofowora, 1982).

In Ethiopia, plants have been used as a source of traditional medicine from antiquity to solve different health problems and human sufferings (Asfaw Debela *et al.,* 1999; Kebede Deribe *et al*., 2006). For example, in the early 16th century, a European traveller called Francisco Alvarez reported the use of herbs as purgatives in Ethiopia. Another British traveller, James Bruce, who stayed in Ethiopia from 1769 to 1771, also reported the wide use of a plant locally known as waginos (in Amharic or qomonyo in Afan Oromo) that was later named *Brucea antidysenterica* (Simaroubaceae), as a remedy against dysentery. The use of plants in religious ceremonies as well as for magic and medicinal purposes is very common and widely distributed in Ethiopia (Amare Getahun, 1976; Dawit Abebe, 2001; Endachaw Bekele, 2007).

According to Dawit Abebe (2001), there is a large magnitude of use and interest in medicinal plants in Ethiopia due to acceptability, accessibility and biomedical benefits. In this country, the long history of use of medicinal plants is reflected in various medico-religious manuscripts produced on parchments and believed to have originated several centuries ago (Fassil Kibebew, 2001; Hareya Fassil, 2005). Medical textbooks written in Geez or even Arabic in Ethiopia between the mid 17th and 18th century imply that plants have been used as a source of traditional medicine in Ethiopian healthcare system. Even today, it is common for people living in both rural and urban areas to treat some common ailments using plants available around them (example, *Hagenia abyssinica* to expel tapeworm, *Ruta chalepensis* for various health problems) (Abbink, 1995).

Herbal remedies are part of the entire system of traditional medicine. The use of plant extracts or active substances is generally believed to constitute the major part of the therapy in this system. Study made by Dawit Abebe and Ahadu Ayehu (1993) in northern Ethiopia showed that 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. Apart from their use in the traditional system of medicalcare at the local level, medicinal plants are being 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). However, natural products/drugs isolated from only 40 plant species have been incorporated into modern medicine (WHO, 1998) though this figure can be higher currently due to ongoing research and development of drug discovery from herbs. These products include important therapeutic categories such as antiseptics, steroids, quinine and artemisinin. These few examples are adequate to indicate not only how modern drug delivery depends on the continuing availability of plant resources but also to explain why the international pharmaceutical industry has rediscovered the crucial role that medicinal plants could play in the development of safe and effective therapeutic agents (Farnsworth, 1985).

Indigenous healthcare systems rely on herbal remedies for treating illness based on symptoms, visible signs and traditional ideas (Eyasu Mekonnen *et al.*, 2003). The majority of Ethiopians depend on medicinal plants as their only source of healthcare, especially in rural areas where access to villages is lacking due to the absence of vehicular roads. At this very moment, somewhere in the rural hinterland of the Ethiopian rural communities, a local farmer may have just gathered leaves or root parts from a local medicinal plant found near the homestead. In a nearby village, a mother might be in the midst of preparing a traditional plant treatment believed to 'restore strength', relieve stomach cramps, heal a skin condition and 'ward off the evil-eye' or perhaps to help alleviate symptoms of a respiratory tract infection. It is such routine use of local medicinal plants by ordinary members of local communities across the country's diverse and largely rural landscape that accounts for the widely cited 80% estimate of the population who continue to use traditional plant-derived medicines for their primary healthcare needs (Dawit Abebe and Ahadu Ayehu 1993; IBCR, 1999; Fassil Kibebew, 2005).

The indigenous traditional knowledge of medicinal plants of various ethnic communities, where it has been transmitted orally for centuries is fast disappearing from the face of the earth due to the advent of modern technology and transformation of traditional culture (Pankhurst, 1998). The collection of information about natural flora, classification, management and use of plants by the people holds importance among the ethnobotanists (Fassil Kibebew, 2001; Sandhya *et al*., 2006).

Similarly, the study of Ethiopian medicinal plants has not been realized as fully as that of India or other traditional communities elsewhere (Iwu, 1993). 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 view of these, documentation of the traditional uses of medicinal plants is an urgent matter and important to preserve the knowledge (Tesema Tanto *et al*., 2003; Tilahun Teklehaymanot and Mirutse Giday, 2007; Mirutse Giday *et al*., 2010; Ermias Lulekal *et al*., 2013; Solomon Araya *et al*., 2015).

2.4.4. Plants used in ethnoveterinary medicine

Ethnoveterinary medicine was defined by McCorkle (1995), as "the holistic, interdisciplinary study of local knowledge and its associated skills, practices, beliefs, practitioners and social structures pertaining to the healthcare and healthful husbandry of food, work and other income-producing animals, always with an eye to practical development applications within livestock production and livelihood systems and with the ultimate goal of increasing human well-being via increased benefits from stock raising". In most developing countries, particularly in Sub-Saharan Africa, disease remains one of the principal causes of poor livestock performance leading to an ever-increasing gap between supply and demand for livestock and products (Teshale Sori *et al*., 2004; Nkechi *et al*., 2011; Selvaraju *et al*., 2011; Muhammad *et al*., 2012; Rhuan *et al*., 2012; Habib *et al*., 2014). The ever-declining provision of animal health services has resulted in the reappearance of a number of epizootic diseases reducing the economic efficiency of livestock production in Africa (Tafese Mesfin and Mekonnen Lemma, 2001; Pieroni *et al*., 2006; Deeba *et* *al*., 2009; Rhuan *et al*., 2012; Habib *et al*., 2014). In Ethiopia, conventional veterinary services have been playing a paramount role in the control and prophylaxis of livestock diseases in the last three decades. However, they cannot yet deliver complete coverage in preventive and curative healthcare practices because of inadequate labor, logistical problems, an erratic supply of drugs and the high cost of drugs and equipment (Deeba *et al*., 2009; Nkechi *et al*., 2011; Tariq *et al*., 2014; Yadav *et al*., 2014; Habib *et al*., 2014; Immaculate *et al*., 2014). Consequently, the majority of those raising stock in rural areas are far from the site of veterinary stations and those who have access to veterinary services may not be able to afford to pay for them (Teshale Sori *et al*., 2004; Gidey Yirga *et al*., 2012; Abiy Shilema *et al*., 2013; Yared Yigezu *et al*., 2014) and still there are other members of the stock raising community who choose traditional healing regardless of access and affordability (Yibrah Tekle, 2015).

Ethnoveterinary alternatives are an option for small-scale livestock farmers who cannot use allopathic drugs or for those larger conventional farmers whose economic circumstances prevent the use of veterinary services for minor health problems of livestock (Lans *et al.*, 2007; Akash *et al*., 2014; Maria *et al*., 2014; Mangal, 2015). It comprises traditional surgical and manipulative techniques, traditional immunization, magico-religious practices and beliefs, management practices and the use of herbal remedies to prevent and treat a range of disease problems encountered by livestock holders (Tafesse Mesfin and Mekonnen Lemma, 2001; Deeba *et al*., 2009; Al Mamun *et al*., 2015). Ethoveterinary medicine provides traditional medicines, which are locally available and usually cheaper than standard treatments. Livestock holders can prepare and use homemade remedies with minimum expense (Maria *et al*., 2014; Immaculate *et al*., 2014). So far, many livestock holders in rural areas where there are relatively few veterinarians and shortages of other facilities, traditional medicinal plants are the only choice to treat many ailments (McCorkle, 1995; Banerjee *et al*., 2013; Alhaji *et al*., 2015).

Livestock production plays an important role in Ethiopia in the livelihood and economy of the majority of the population. Crop production is almost entirely dependent on traction power provided by animals. Livestock offers in many harsh environments the only way of survival and constitutes a driving force for food security and sustainable development in developing countries like Ethiopia (Berhanemeskel Woldegerima *et al*., 2008). Although, the gain from livestock production is directly related with safeguarding animal health, veterinary medical system has not been developed in Ethiopia (Gidey Yirga *et al*., 2012). Techniques such as those used to treat the more wide spread ailments are common knowledge among livestock holders (ITDG and IIRR, 1996; Gidey Yirga *et al*., 2012). On the contrary, others are known only to a few indigenous professional healers who have learned the practice over the years (Botha *et al*., 2001; Eswaran *et al*., 2013).

According to McCorkle and Mathias (1996), stock raisers both farmers and herders have developed their own ways of keeping their animal health and productivity. They treat and prevent livestock diseases using sometimes age old home made remedies, surgical and manipulative techniques (Teshale Sori *et al*., 2004; Debela Hunde *et al*., 2004; Ermias Lulekal *et al*., 2014). Taken together, these indigenous local animal healthcare beliefs and healthcare practices constitute an ethnoveterinary medicine. Like other kind of local technical knowledge, ethnoveterianry medicinal practice and skills are built up on over time empirical observation, mainly through trial and error and sometimes through deliberate or even desperate experimentation and innovation (McCorkle and Mathias, 1996; Lans *et al*, 2007; Gidey Yirga *et* *al*., 2012; Ermias Lulekal *et al*., 2014; Yared Yigezu *et al*., 2014; Gebremedhin Romha *et al*., 2015).

Therefore, rising of awareness on ethnoveterinary medicine, emphasizing on plants used for treatment of livestock has paramount importance to livestock management (Teshale Sori *et al*., 2004). In addition, proper documentation and understanding of farmers' knowledge, attitude and practices about the occurrence, cause, treatment, prevention and control of various ailments is important in designing and implementing successful livestock production (Tafese Mesfin and Mekonnen Lemma, 2001; Teshale Sori *et al*., 2004; Yared Yigezu *et al*., 2014; Yibrah Tekle, 2015; Mangal, 2015).

2.5. An Overview of Wild Edible Plants in Ethiopia

2.5.1. Role of wild edible plants in food and nutrition security

Utilization of wild edible plants (WEPs) as a food source is an integral part of the culture of indigenous people that dwell in the rain forests of Africa and South America (Friedman *et al*., 1993) who gather and consume WEPs as snacks and at times of food scarcity (Getachew Addis, 2009; Tilahun Teklehaymanot and Mirutse Giday, 2010; Assegid Assefa and Tesfaye Abebe, 2011; Ermias Lulekal *et al*., 2011). WEPs provide staple and supplement foods, as well as cash income to local communities, thus favouring food security (Sansanelli and Tassoni, 2014). However, WEPs are largely ignored in land use planning and implementation, economic development and biodiversity conservation (Fentahun Mengistu and Hager, 2008; Uprety *et al*., 2010; Sansanelli and Tassoni, 2014). Local people, from their own experience, know about the importance and contribution of WEPs to their daily diet, as well as being aware of possible health and environmental hazards (Diress Tsegaye *et al*., 2007; Getachew Addis, 2009;

Getachew Addis *et al*., 2013). Many at risk populations in developing countries are deficient in iodine, iron and vitamin A, making them more vulnerable to illness, fatigue, blindness and memory loss and increasing the possibility of mental retardation among their children. This is true also in the case of Ethiopia mainly due to cereal based food habit is practicing and largely affect children in most parts of the country. Supplementation, food fortification, dietary diversification, nutrition education and food production are strategies that have been developed to reduce these micronutrient deficiencies and have, for the most part, demonstrated positive, though uneven, results (Guill-Guerrero *et al*., 1997; Workneh Ayalew *et al*., 1999). On the other hand, it has been reported that WEPs are the cheapest source of vitamin A, C, minerals and fiber; still people fail to consume enough to meet their nutrient requirement due to lack of knowledge in the nutritional value and production of those vegetables in the easiest way (Dandena Gelmesa, 2010).

The existence of diverse farming systems, socio-economics, cultures and agro-ecologies has endowed Ethiopia with a diverse biological wealth of plants, animals and microbial species, especially crop diversity (IBC, 2008). It is also stated in ENBSA (2005) that crops such as tef (*Eragrostis tef*), noug (*Guizotia abyssinica*), Ethiopian mustard (*Brassica carinata*), enset (*Ensete ventricosum*), oromo-dinich (*Plectranthus edulis*), anchote (*Coccinia abyssinica*) and coffee (*Coffea arabica*) have great diversity and believed to have originated in Ethiopia (IBCR, 2001).

Due to this vast genetic diversity there are many wild plants which are used for food, especially during periods of food shortages. The majority of such plants are those used as leafy vegetables, edible fruits, tubers and roots. *Corchorus olitorius* for example has nine species which are found in Ethiopia and collected at a young stage and eaten as cooked vegetable , especially in lowland parts of the country like Afar Region and sold in the supermarket and dried leaves are sent to Djibouti for sell, although, none of them is cultivated. Some of the domesticated plants still also occur with their wild relatives in some parts of the country (Diress Tsegaye *et al*., 2007). Examples are *Thymus spp*. in the Afro-alpine regions of the country; *Ensete ventricosum,* which occurs both in wild and cultivated state in the medium to higher altitudes; *Gossypium spp*. in the lowlands, as wild and cultivated; and *Sesamum spp*. which is found both cultivated and wild at an elevation below 1800 meters above sea level (Mirutse Giday and Tilahun Teklehaymanot, 2013). There are other wild plants currently attracting attention as potential crops, primarily for their use value. *Cordeauxia edulis* which is used in the arid areas as both feed and food source; *Amaranthus spp*. found as common weed in some parts of the country of which young plants are cooked as vegetable and seeds used for porridge and local beer, are among few of them (IBC, 2008).

However, there has been no visible effort made to introduce/domesticate new food materials in our country. Potentially use of important indigenous vegetables by the community has been indicated among which *Corchorus olitorius* in Afar region, *Moringa ollifera* in South Nation Nationality and Peoples Region (SNNPR) and *Coccinia abyssinica* in Wollega areas are good examples (Getachew Addis, 2001).

2.5.2. Status of research and development on WEPs in Ethiopia

WEPs have been a focus of research for many ethnobotanists in recent decades. Currently, there is renewed global interest in documenting ethnobotanical information on neglected wild edible food sources (Bharucha and Pretty, 2010). Since traditional knowledge on WEPs is being eroded through acculturation and the loss of plant biodiversity along with indigenous people and their cultural background, promoting research on wild food plants is crucial in order to safeguard this information for future societies (Zemede Asfaw, 2009; Tena Regassa *et al*., 2014).

A major objective of ethnobotanical investigation into wild food plants is the documentation of indigenous knowledge associated with these plants. Comparative studies on WEPs in different cultures or ethnic groups of a country or among different countries, may contribute to the identification of the most widely used species for further nutritional analysis (Getachew Addis *et al*., 2001; Termote *et al*., 2009; De Caluwé, 2010a, b; Beluhan and Ranogajec, 2010). Nutritional analysis results provide clues to aid the promotion of those species that have the best nutritional values which helps to to ensure dietetic diversity and combat food insecurity (Tardio *et al*., 2006; Ermias Lulekal *et al*., 2011).

CHAPTER THREE

3. MATERIALS AND METHODS

3.1. Description of the Study Area

3.1.1. Location and topography

This study was conducted in Dendi, Chelia and Jibat districts of West Shewa Zone of Oromia Regional State, Central Ethiopia (Fig. 2). Dendi District lies approximately within the coordinates 8° 43' North to 9° 17' North Latitude and 37° 47' East to 38° 20' East Longitude and it covers a total area of 978.90 km^2. The altitudinal range of the district is between 1440 to 3260 m a.s.l. the mean elevation and mean slope of the district is 2,499 m a.s.l. and 12 respectively (Table 1). Chilimo Forest is located in Dendi District in the upper Awash River Basin, where the river springs and is situated 90 km west of Addis Ababa, very near to the district's capital, Ghinchi and close to the main road running from the Addis Ababa to Ambo-Nekemte (Fig. 3). It is situated between ca. 2400 and 2900 m a. s. l. (DWARDO, 2013).

Chelia District lies approximately within the coordinates 9° 02' North to 9° 01' North Latitude and 37° 25' East to 38° 16' East Longitude and it covers a total area of 920.63 km^2. The altitudinal range of the district is between 1300 and 3060 m a.s.l., with mean elevation and mean slope of 2,116 m a.s.l. and 14 respectively. Gedo Forest is located near Gedo Town, the capital of the district, on the Addis Ababa-Nekemte main road at about164 km from Addis. Gedo Forest lies approximately between 2100 and 2800 m a.s.l. (CWARDO, 2013).

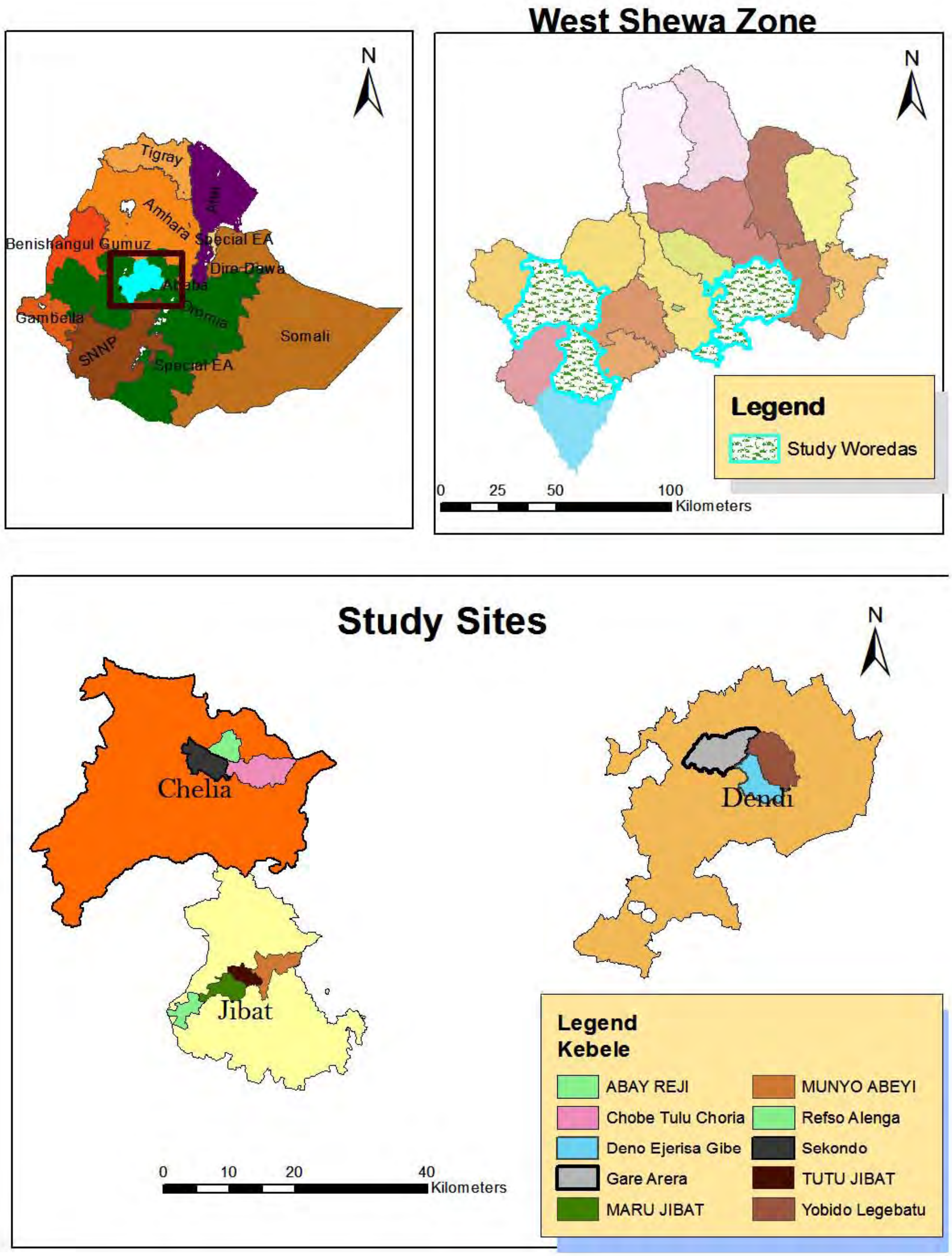


Fig. 2. Map of Ethiopia showing Regions, study districts (weredas) and study sites (including kebeles)

Fig 3. Locations of Jibat, Gedo and Chilimo forests

Jibat District lies approximately within the coordinates 9° 02' North to 9° 01' North Latitude and 37° 25' East to 38° 16' East Longitude and it covers a total area of 550.70 km^2.The capital town of the district, Shenen, is located at 192 kms west of Addis ababa. The altitudinal range of the district is between 1600 and 3200 m a.m.s.l. The mean elevation and mean slope of the district are 2,275 m a.s.l. and 16 respectively (Table 1). The Jibat Forest is located in Western Shewa Zone about 200 km west of Addis Ababa (Fig. 3). The Forest is situated on the western slope of a mountain range with approximately a northsouth alignment. The Forest extends between ca. 2000 m and 2979 m a.s.l. (JWARDO, 2013).

3.1.2. Climate, geology and soil

To describe the climate of the study area, monthly maximum and minimum temperatures and monthly precipitation of twenty three years (1991-2013) was taken from National Metrological Agency (NMA). The metrological data for Dendi and Chelia was recorded from Ginchi (2675 m a.s.l.) and Gedo (2484 m a.s.l.) stations respectively. Metrological station at Shehen has not been functional since seven years, thus the data from nearby station of similar elevation, that is from Enchini (2783 m a.s.l.) was used to describe that of Jibat District.

Chelia District receives a maximum mean annual rainfall ranging between 157.2 and 185.1 mm whereas the lowest mean annual rainfall was 13.5 mm recorded in January. The lowest mean temperature over twenty three years was 9.0ºC recorded in December and the highest was 24.41ºC recorded in February. The district experiences unimodal rainfall and October to February is dry season where as March to September is wet season (Fig. 4).

Jibat District receives relatively higher precipitation as compared to Chelia and Dendi districts. The maximum rainfall received in the district ranges between 375.6 and 368.8 mm received in July and August respectively. The highest average temperature over twenty three years was 25.4 ºC recorded in March and the lowest was 4.0 ºC recorded in December (Fig. 5). Whereas, in Dendi District, a maximum rainfall ranging between 221.2 mm (in July) and 238.4 mm (in August). The maximum and minimum mean temperature recorded in the indicated time period was 27.3 and 4.0 ºC respectively. Similar to Jibat District, the maximum and minimum temperatures were recorded in March and December respectively (Fig. 6).

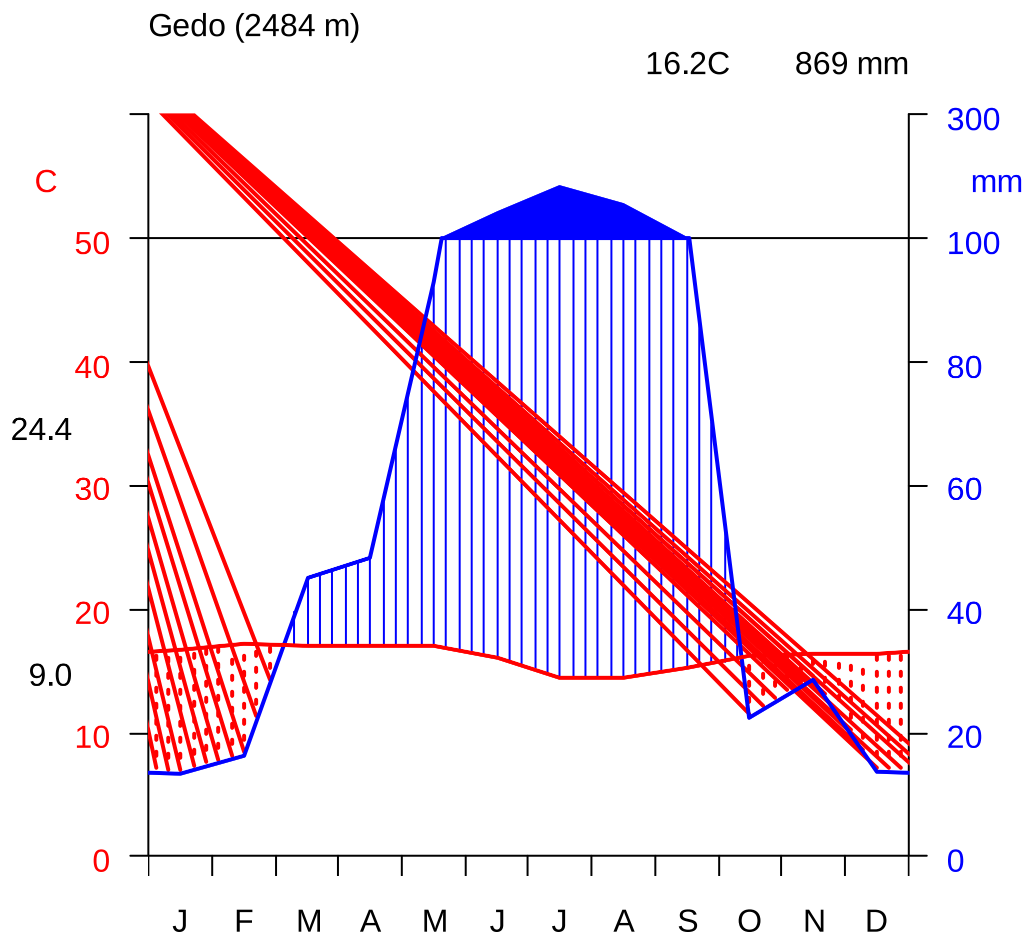


Fig. 4. Climadiagram of Gedo Forest based on Gedo Meteorological Station (Data source: NMA, 1991-2013)

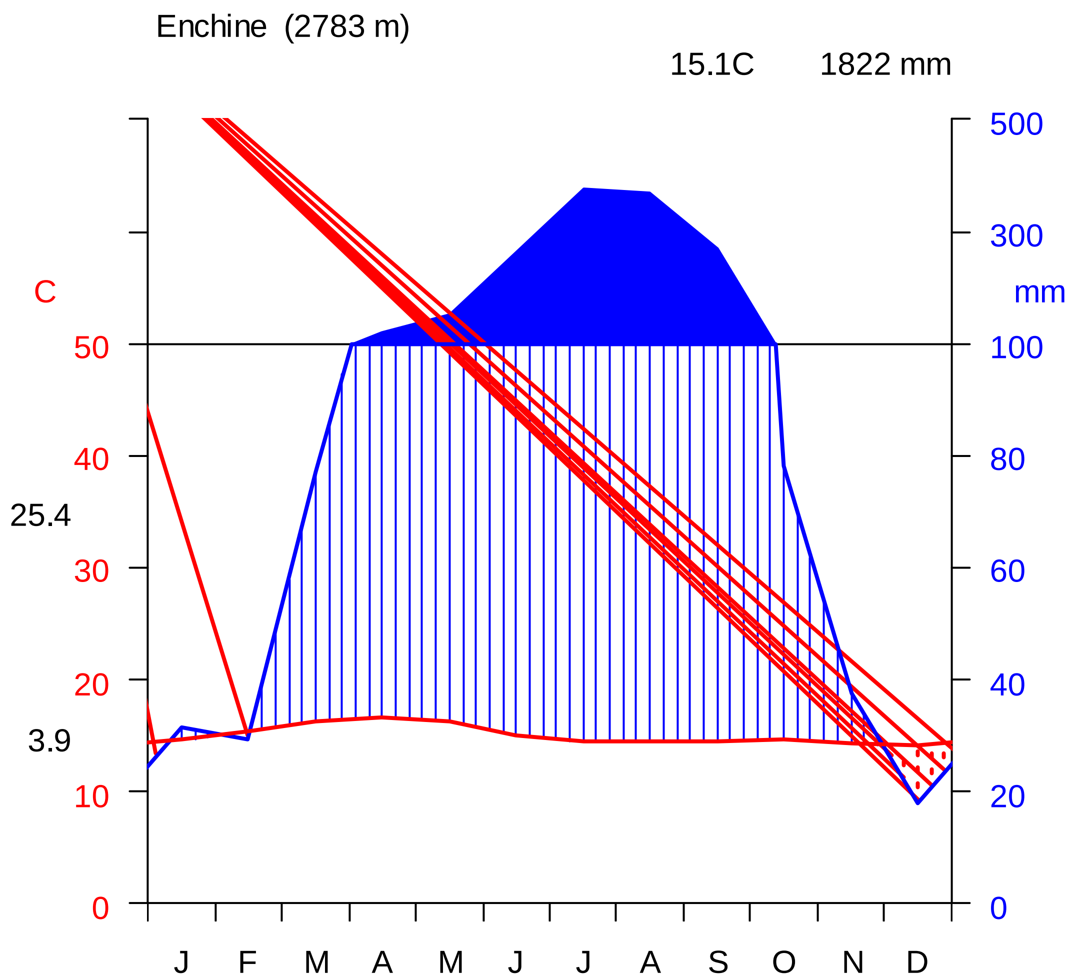


Fig. 5. Climadiagram of Jibat Forest based on Enchine Meteorological Station (Data source: NMA, 1991-2013)

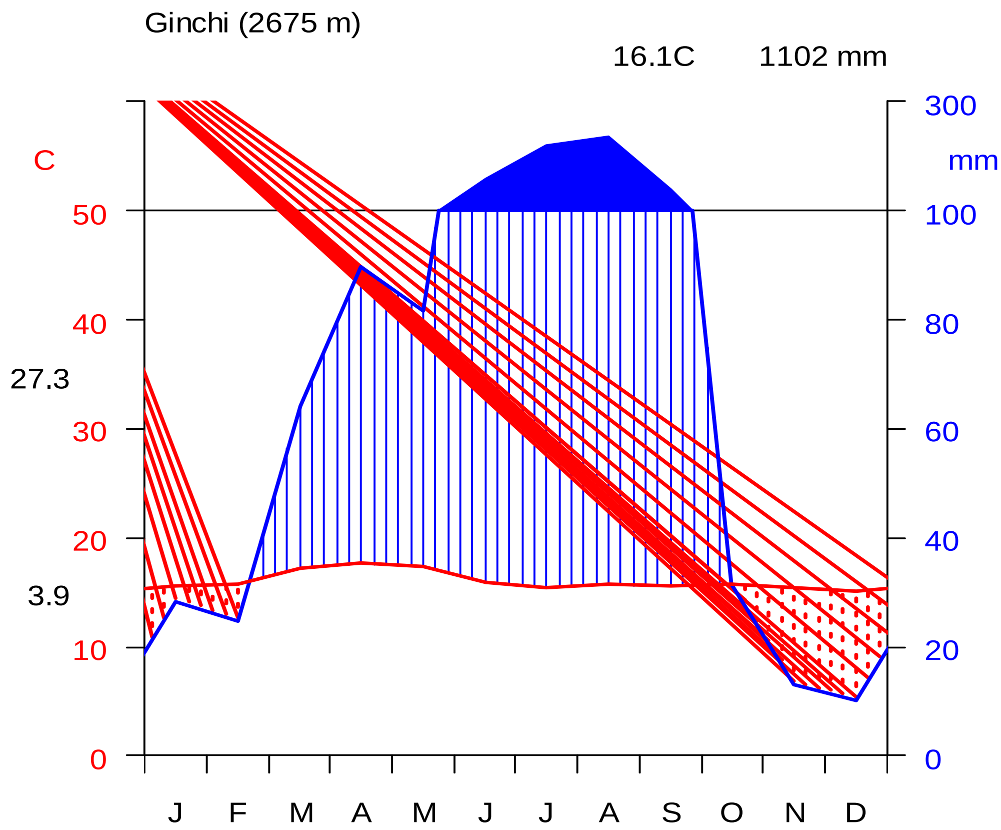


Fig. 6. Climadiagram of Chilimo Forest based on Ginchi Meteorological Station (Data source: NMA, 1991-2013)

Detailed accounts of the Chilimo and Jibat forests site histories and geology are found in Tamrat Bekele (1993). Accordingly, various rock types, including rhyolites, trachytes, tuffs and ignimbrites, compose the Trap Series, but basalts are the most important components and they constitute the main bedrock type of the Central Plateau. The basalts are uniform in composition over the whole range of the high plateaux, both chemically and mineralogically. A detailed survey of the geology of Ethiopia is found in Mohr (1971). The majority of the soils of Central Ethiopia are of volcanic origin (Logan, 1946). Von Breitenbach (1963) characterized the lava plateaux by means of two principal soil types originating from the disintegration of volcanic substrates intermingled with sand and limestone: the black and compact clays ('Black soil') and the reddish-brown and heavy loams ('Red soil'). The former type appears on flat plateau and in the bottom of valleys and the latter on mountain and valley slopes and on better drained plateaux. The red and brown soils and loams are the most common soils in the highlands; they probably make up over 60% of the plateau soils (Logan, 1946) and are also the most common forest soils.

3.1.3. Natural vegetation

The Ethiopian highlands contribute to more than 50% of the land area of Africa with afromontane vegetation (Yalden, 1983; Tamrat Bekele, 1993, 1994), of which dry afromontane forests form the largest part. The dry afromontane forests are either *Juniperus-Podocarpus* forests or predominantly *Juniperus* forests, both with broad-leaved species (Friis, 1992).

The shrubland vegetation in Western Shewa was also studied by Zerihun Woldu and Backeus (1991) who reported that seven different vegetation types, ranging from grassland with scattered shrubs to degenerated forest occur in the area. However, there is no ethnobotanical study of these dry afromontane forests in order to fill the gap of information used in rehabilitation and restoration efforts of the vegetation resource base and associated indigenous knowledge of the area.

High human and livestock population, a decline of forest resources and soil fertility depletion are some of the features of the highlands of central Ethiopia (ICRAF, 1990; German *et al*., 2005). The natural forests in the highlands of Ethiopia in general are heavily exploited to fulfill the cash and wood demand of the growing population. According to Russ (1945, cited in Woldemichael Kelecha, 1979), the forests in Shewa "… are the oldest commercially exploited forests of the country…" because of their proximity to Addis Ababa. He wrote that *Juniperus procera* was the "major" species in the area followed by *Podocarpus falcatus*, *Hagenia abyssinica* and *Prunus africana*. Similarly, the areas previously covered by forests have declined as a result of the expansion of farming with annual crops (Kindu Mekonon *et al*., 2009).

3.1.4. Land use types

Land use pattern indicates the classification of land of an area under different type of socioeconomic uses. Patterns of land use changes from time to time depending up on socioeconomic change. The grazing land, natural forests and fallow lands are declining while the needs for cultivated and residential lands are increasing from time to time.

The majority of the inhabitants overwhelmingly rely on subsistence agriculture, which is dominated by the cultivation of cereal crops and/or animal husbandry. The detail account of land use types, livestock population and medical service of the three study districts is given in Table 1.

Table 1. Land use categories, livestock numbers and mhealth sfacilities by districts

	Jibat	Chelia	Dendi
Land use categories in hectare (%)			
Cultivable Land	11,973 (21.7)	45,850 (49.8)	47,593 (48.62)
Cultivated Land	8,800 (16)	13,543 (21.8)	15,078 (15.4)
Forest and Woodland	30,768 (55.87)	26,738 (29)	23,674 (24.2)
Grazing Land	2456 (4.46)	4,578 (4.97)	3,792 (38.87)
Other Land Use Types	1073 (1.94)	1,354 (1.47)	7,753 (7.9)
Livestock Population (Number)			
Cattle	123,572	124,713	126,467
Goats	21,237	22,220	22,154
Mule	10,683	11,578	11,493
Horses	9,236	8,294	9,542
Donkeys	1,423	1,331	2,567
Sheep	4,876	4,993	5,673
Poultry	54,126	53,026	55,217
Health Facilities (Number)			
Hospitals	-	1	-
Health Centers	3	5	4
Health Posts	23	18	38
Veterinary Clinic	1	2	2

3.1.5. Demographics and livelihoods

Ethnicity and population

The population density for all the three districts ranged between 151.2 and 196.8 people per sq kms.Jibat has the least population density of the three districts. The people in the three districts are Oromo ethinically; are Orothodox and Protestant by religious affiliatin (Table 2).

Table 2. Population, area in km^2, population density, ethnicity, religion and literacy status of Dendi, Chelia and Jibat districts of West Shewa Zone, Oromia Regional State. (Source: CSA, 2007, 2012).

S. no.	District	Population			Area (km^2)	Population density	Mean Elevation	Mean Slope	Ethnic groups (%)			Religion (%)						Literacy Status
		Male	Female	Total					Oromo	Amhara	Others	Orthodox	Muslim	Protestant	Catholic	Traditionalist	Others	
1	Dendi	97,580	95,057	192,637	978.90	196.8	2,499	12	92.8	5.84	1.36	84.98	0.77	5.11	0.30	8.47	0.38	39.56
3	Chelia	91,255	91,007	182,262	920.63	198.0	2,116	14	97.57	1.82	0.61	32.76	5.28	54.38	2.02	5.48	0.08	40.19
3	Jibat	41,399	41,875	83,274	550.70	151.2	2,275	16	95.68	4	0.31	55.92	0.18	36.08	0.43	6.55	0.84	35.19

Health services of the people and the major diseases

According to the annual report of Jibat District health office (JDHO 2012/13, unpublished), the district has three health centre and 23 health posts giving service to a total of 83, 274 people. There is no a hospital in the district (Tables 1, 2). The major human diseases in the area include typhoid followed by dyspepsia, diarrhea, malaria and violence and other intestinal injury (JDHO 2012/13). In Chelia District, there are one hospital, five health centre and 18 health posts supporting a total of 182,262 people (Tables 1, 2). Acute Febrile (AFI) followed by diarrhea, pneumonia, masculo-cutaneous tissue infection and respiratory infection are among the top human diseases reported in the district (CDHO, 2012/13, unpublished). Similarly, based on the annual report of Dendi District health office (DDHO, 2012/13, unpublished), the district has four health centre and 38 health posts rendering service to a total of 192,637 people. There is no a hospital in the district (Tables 1, 2). The top human diseases in the district include heleminthiasis followed by rheumatic pain, arthritis, acute febrile illness and pneumonia (DDHO 2012/13, unpublished). The first top ten diseases reported from the respective district's health offices is presented in Table 3.

Table 3. Top ten diseases prevailing in the year 2012/13 in Jibat, Chelia and Dendi districts (Source: Respective district's health offices)

S.no.	Jibat District	Chelia District	Dendi District
1.	Typhoid	Acute Febrile (AFI)	Heleminthiasis
2.	Dyspepsia	Diarrhea	Rheumatic pain
3.	Diarrhea	Pneumonia	Arthritis
4.	Malaria	Masculo-cutaneous tissue infection	Acute febrile illness
5.	Intestinal injuries	Respiratory infection	Pneumonia
6.	Unspecified URTI	Intestinal parasites	Gastritis
7.	Skin diseases	Urinary tract infection (UTI)	Bronchitis
8.	Pneumonia	Dyspepsia	Tuberculosis
9.	Muscle &Connective tissue	Malaria	Skin related diseases
10.	UTI	Trauma	Urinary tract infection

Health services for livestock and the major diseases

The ethnoveterinary clinics are rare in the study area. There is only one veterinary clinic in Jibat District that is supposed to give service for a total of 225,153 heads of livestock present in the district (JDRADO, 2012/13). There are two veterinary clinics in each of Chelia and Dendi districts (Table 1) that render service to a total of 226,155 and 233,113 heads of livestock present in the Chelia and Dendi districts respectively (CDRADO, 2012/13, DDRADO, 2012/13). The livestock populations of the three districts are given in Table 1. The major livestock diseases reported in the study area were anthrax (abasanga), black leg (abagorba/bushoftu), trypanosomiasis (loli), bloating (bokoksa), glandular swelling (dhitesa), coughing, actinomycosis, pasteurellosis (gororsa), FMDs (foot and mouth diseases), actinobacilliosis, rabies, tonsillitis, mastitis, babesiosis and dermatophilosis (citto) that affect large ruminants including equines and seasonal intestinal diseases (JDRADO, 2012/13; CDRADO, 2012/13; DDRADO, 2012/13).

Livelihoods

Highland mixed–teff livelihood system is the major livelihood system practiced in the study area. In this livelihood system, rainfed production of a wide-range of highland cereals (teff dominated) and pulses using deeply entrenched, traditional crop and livestock husbandry practices under temperate climatic conditions in the highlands, in which long years of extractive forms of production, high population and livestock densities have led to advanced levels of natural resources degradation characterize the system of production. Domestic animals such as cattle, goat, sheep, donkey, paultry and bees are kept on traditional basis. This subsector provides the communities with milk, butter, hides and skins, honey and traction and transportation powers. It also serves as a means of security against crop failure.

The basis of the livelihood system is the production of cereals, pulses and oil crops along with livestock that is kept on natural pasture and crop residues. The most dominant crops in the area are maize *(Zea mays)* and sorghum (*Sorghum bicolor),* teff (*Eragrostis tef)*, wheat (*Tiriticum vulgare*), barley (*Hordeum vulgare*), nigger seed *(Guizotia abyssinica),* beans (*Vicia faba*) and peas (*Pisum sativum*) are also significant crops in the area. Before the depletion of the natural forest cover to its present precarious level, sale of fire wood and wood for construction as well as sale of forest products used to contribute significantly to farmers' livelihoods. Farmers in this system are also engaged, to a certain extent, in petty trade to augment their income.

Rainfall, which has a unimodal pattern in the study area, determines production and livelihood patterns. Increased natural resources degradation and climate change and associated rainfall variability, have induced some degree of small-scale irrigation development and water control. The need to intensify agricultural production to meet the demands of rapidly growing populations in this livelihood system prompted some degree of irrigation development and water control. Most of the traditional and modern small-scale irrigation development activities are concentrated in this livelihood system.

Other diverse forms of livelihoods observed in the study area includes bamboo farming, small-scale irrigation from rivers, springs and drainage for temperate and sub-temperate fruit and cash crop production (vegetables including onion (*Allium cepa*), garlic (*Allium sativum*), potato (*Solanum tuberosum*), cabbage (*Brassica oleracea*), pepper (*Capsicum annum*) and various types of spices., production of small ruminants (sheep, goats), enset and potato production for home consumption and the market, beekeeping, homestead tree planting and eucalyptus woodlots, agroforestry, medicinal and wild edible plants and fodder production for zero grazing.

Another notably important, but 'illegal' and environmentally devastative source of livelihood in the area, is the production and sale of charcoal and firewood. Some households produce charcoal/firewood and sale it at the nearest towns for their daily cash requirements. Similarly, some others make and sale dung-cakes for survival. The business of dung-cake making is usually the work of women and children.

Forest product utilization

Jibat and Gedo forests are under the traditional ‘guard protected system’ managed by the Oromia Forest and Wildlife, Jibat-Gedo District Office. However, the local communities surrounding these forests can ustilize non-timber forest products with close control of the forest department.

Chilimo Forest on the other hand, being under Oromia Forest and Wildlife, Suba-Sebeta District Office, has been experiencing participatory forest management (PFM), the system of management whereby a community forest is managed by the members of the local community and not by some external, remote governing body. This system enables the members of the local community to be the direct beneficiaries of the forests. PFM is also used as a broad term to describe systems in which communities (forest users) and government services (forest services), work together to define rights of forest use, to develop ways of sharing management responsibilities and to agree how to divide forest benefits.The Chilimo Forest area is communally owned, whereas farmland, grazing land and settlement areas (homesteads) are under the "ownership" of individual farmers. According to interview with Ato Abera Tafessu (2014), Board Chairman of Chilimo Forest Union, after working in the Chilimo Forest, the FARM-Africa/SOS Sahel Ethiopia Participatory Forest Management Programme established 12 cooperatives. Out of the twelve, 8 are organized to form the Chilimo Forest Union. After the phasing out of PFMP, the union has continued the PFM work along with the government. The union is now working as per its management plan produced with the support of the government, in order to develop the forest while improving livelihoods. To make the work efficient and effective, each cooperative is divided into 3 blocks and 4 persons per block are assigned in rotation to report back on any incident (e.g. illegal cutting of timber, hunting etc.) to the forest protection committee. This committee in return reports to the general assembly and issues that can be solved by the general assembly will remain with the group, whereas more complicated issues will be taken to court as needed. Though capacity limitation is there, the union and the government are working hand in hand (Abera Tafessu, 2014).

3.2. Research Methods

3.2.1. Reconnaissance survey

Before the start of the actual research work for this study, a reconnaissance survey was carried out in September 2011 in order to gain a general understanding of the characteristics of the study areas and to identify the different forest fragments/sites in the different plant community types. It made bases for selection of specific research sites and data collection techniques. Following the reconnaissance survey, the following appropriate methodologies were developed for in-depth data collection.

3.2.2. Vegetation and ethnobotanical data collection

3.2.2.1. Vegetation data collection

Selection of stands (contiguous areas of vegetation that are reasonably uniform in physiognomy and floristic composition) was preferentially done following standard methods (Smartt, 1978; Barbour *et al*., 1999). In all stands, the presence-absence and the cover/abundance (defined here as the proportion of area in a quadrat covered by every species recorded) data of all vascular plants in *relevés* were visually estimated and recorded following the Braun-Blanquet approach (Braun-Blanquet, 1965; Mueller-Dombois and Ellenberge, 1974). The percentage cover/abundance values were transformed to a scale of ordinal transformed values 1-9 according to modified Braun-Blanquet approach (Van der Maarel, 1979; 2005; Kent and Coker, 1992). A total of 457 (174 from Jibat, 75 from Gedo and 208 from Chilimo forests) *relevés* were sampled using a square plot of 400 m^2 (20 m x 20 m) for woody plants. For the collection of herbaceous species, subplots of 2 m x 2 m at the four corners and the centre of the large *relevé* were laid. Sample plots or *relevés* were selected through preferential means in such a way that the various conditions encountered were represented in the study forests. Additional woody species species within 10 m distance from the plot boundaries were recorded as present for floristic composition.

Altitudes and geographical coordinates were also recorded for each *relevé* using Garmin 72 GPS (Geographical Position System).

3.2.2.2. Specimen collection and identification

The plant specimens collected from the field were labeled, pressed, dried, deep-frozen for 72 hours, identified, voucher numbers given and deposited at the National Herbarium (ETH), Addis Ababa University. Identification of specimens was performed both in the field and later at ETH using taxonomic keys, descriptions and illustrations in the Flora of Ethiopia and Eritrea by comparison with authenticated herbarium specimens and consulting with the experts in particular plant taxa.

3.2.3. Ethnobotanical data collection

3.2.3.1. Site selection and sampling

The study districts (Jibat, Chelia and Dendi) and forests (Jibat, Gedo and Chilimo) were selected following purposive sampling method. Accordingly, three kebeles (the smallest political administrative regions in Ethiopia) (Dano Ejersa Gibe, Yobido Legebatu and Gare Arera from Dendi District), four kebeles (Munyo Abeyi, Tutu Jibat, Maru Jibat and Abay Reji from Jibat District) and three kebeles (Sokondo, Rafso Alanga and Chobi Tulu Choria from Chelia District) for this study. The selection of these study kebeles was influenced by the fact that they had better vegetation cover and they were accessible to the urban centre (Figs. 1 and 2). This study was part of the subthematic research project entitled "*Plant Biodiversity, Ethnobotany and Ecology of the Awash-Gibe Watersheds (Gurage Mountain Chain (SNNPRS)) and Chilimo-Jibat Mountain Chains (Oromia)"* which was in turn part of the main thematic project entitled *"Restoration of Degraded Landscapes in the Awash and Ghibé Watersheds: Mechanisms for Re-establishing Ecosystem Functions, Biodiversity and Livelihoods*" of AAU thematic research.

A total of 838 households (HHs) (544 male headed HHs and 294 female headed HHs; 290 HHs, 327 HHs and 221 HHs from Chelia, Dendi and Jibat districts respectively) were chosen for HHs survey following the method described by Krejcie and Morgan (1970). Only individuals who were 20 years old or older were included among the sample informants. This age group was chosen because these individuals could legally account for their actions and using underage participants would require parental permission, which could make the study unfeasible. A detailed demographic account of the informants is given in Table 4. According to this source, for a finite population, a representative sample size can be calculated using the equation:

$$\text{Sample size} = \frac{x^2 \mathrm{NP}\,(1-\mathrm{P})}{c^2\,(N-1) + x^2 P\,(1-P)}$$

Where: X^2= A constant value of 3.841 (the square of the Z value of 1.96 for 95% confidence level)

N= the population Size

P=the population parameter of 0.5

C=A 95% confidence interval (0.05), a probability that the samples represent the population

To select 838 HHs/ informants, first a total unordered lists of 1179, 2216 and 520 HHs were received from the respective kebele's registrars (pooled together) of the respective districts and systematic random sampling procedure was used to obtain the required sample units. Systematic random sampling is based on selection of units situated at a certain predetermined interval called the sampling interval. It is applicable for small scale surveys (approximately 1000 to 5000 basic sampling units (BSU)). It can be calculated as: Sampling interval=total number of BSU in the population divided by number of sampling units needed. For example, BSU (target population) in Chelia District is 1,179 and the sampling unit needed was 290. Thus, the sampling interval is 1179 divided by 290 which was four. Then, a random number between one and four was chosen, as the first BSU, say three and take every 4th HH as inclusion in the study until the 290 HHs are sampled. Accordingly, the SBU for Chelia, Dendi Jibat districts were four, seven and two respectively to arrive at the required sample size indicated above.

Only one member of the HH was asked to participate in the research. Fifty seven (21 females and 36 males; 20, 22 and 15 from Chelia, Dendi and Jibat respectively) HHs/informants were identified as key informants using purposive sampling methods based on their knowledge of the plants and their uses (Table 4). The key informants were nominated by elderly and knowledgeable people in the community.

Table 4. Demographic statistics of informants: age group, literacy and marital status of informants of the study (M= male, F= Female, T= total)

No.	District	General Informants			Key Informants			Total Informants			Age group		Literacy		Marital status			
		M	F	T	M	F	T	M	F	T	26-44yrs	≥45yrs	liter ate	Illiter ate	Married	Single	Divorced	Widowed
1	Chelia	183	87	270	9	11	20	192	98	290	105	185	116	174	215	8	36	31
2	Dendi	192	113	305	14	8	22	206	121	327	118	209	129	198	254	12	29	32
3	Jibat	137	69	206	9	6	15	146	75	221	80	141	78	143	178	5	17	21
Total		512	269	781	36	21	57	544	294	838	303	535	323	515	647	25	82	84

3.2.3.2. Methods of ethnobotanical data collection

The ethnobotanical study was carried out in six different field trips made to the study sites between 15 October 2011 and 20 November 2013. Qualitative and quantitative data and plant specimens were collected based on methods given by Martin (1995); Cotton (1996); and Alexiades (1996). Accordingly, semi-structured interviewing, direct matrix ranking, focus group discussions (FGDs) and guided field walks with informants were employed. Data were collected in different seasons of multiple years and collection of different plant specimens were carried out during flowering seasons as recommended by (Martin, 1995; Alexiades, 1996; Balick, 1996). Market survey and checking reliability of informants' medicinal and wild and semi-wild edible plant use information were conducted between 25 December 2013 to 12 February 2014.

Interviews and discussion issues (an interview schedule) were prepared in English in advance and translated into Afan Oromo (language of the study community) and administered (Appendix 1). Each informant was directly individually interviewed by the researcher in a face-to-face session (Appendix 11). Interviews varied in duration according to the degree of knowledge of medicinal and WEPs of each interviewee. Interviews took place in areas of each respondents' choice, this being their homes and some times in the field.

The general information recorded on informants included the name, age, gender, level of education, occupation, religion and ethnicity of each informant. Informants were asked about local names of medicinal plants used, ailments treated, habitat of the species, distance to gathering sites, seasonality of species, marketability of species, degree of management (wild/cultivated), abundance, parts used, condition of plant part used (fresh/dried), other ingredients or additives (if any), methods of remedy preparation, remedy preservation (storage), dosage prescriptions, routes of remedy administration, noticeable adverse effects of remedies, use of antidotes for adverse effects, taboos/beliefs related to collection and use of plants, source of knowledge, method of indigenous knowledge transfer, number of years of service in the case of traditional healers, other uses of medicinal plant species, existing threats and traditional conservation practices (if any) following the methods recommended by Cotton (1996); Alexiades (1996) and Balick and Cox (1996). Furthermore, informants were asked to name the WEPs they gather, the main gatherers, the parts consumed, preparation, main consumers and consumption pattern, habitat/collection niches of the species, degree of management (wild/cultivated), other uses of WEPs, existing threats and traditional conservation practices (if any) following the methods used by Alexiades (1996), Cotton (1996) and Balick and Cox (1996).

All semi-structured interviews were followed by independent guided field walk which involved a combination of observation, discussion and interviewing key informants and other local people along the walk focusing on the availability, use and management and the practical identification of medicinal and WEPs in the natural setting. In addition, six FGDs consisting of eight to ten individuals were used to prove the reliability of the data collected through semi-structured interviews as recommended by Alexiades (1996). Furthermore, it was also found to be helpful to conduct voucher specimen collection with the help of the informants and local field assistants.

Data on use diversity of multipurpose medicinal and WEPs were evaluated by direct matrix ranking exercise that involved 45 key informants (15 informants; 11 males and four females; from each district) as described in Cotton (1996). Participants for this exercise were selected based on their long years of experience as traditional herbal medicine practitioners in the districts as described in Haile Yineger *et al*. (2007). The same key informants also participated in preference ranking exercises in the manner recommended by Martin (1995) to identify perceived threatening factors of medicinal and WEPs as well as most preferred medicinal plant species for treating the most commonly reported diseases in the study districts.

Market surveys of medicinal plants of the districts were conducted at three major markets of Dendi, Chelia and Jibat districts namely: Ginchi, Gedo and Shenen respectively. Availability, price and unit of measurement of each marketable medicinal and wild edible plant were documented and analysed so as to identify the extent of use and income generating potential of the respective medicinal and wild edible plants.

3.2.3.3. Ethical Concern and Consent statement

Prior to administration of the questionnaire, conversations with the informants were held with the assistance of local authorities (development and health agents and farmers' association representatives) to elaborate the objectives of the study and build on trust with the common goal to document and preserve the knowledge on medicinal and WEPs. Objectives and methods were explained to all study sites and concerned government offices. Accordingly, permits were sought from Oromia Forest and Wildlife Enterprise, Finfine Zuria Forest and Wildlife Bureau, Suba-Sebata Forest and Wildlife District Office, Jibat-Gedo Forest and Wildlife District Office, West Shewa Zone Administrative Office and Dendi, Chelia and Jibat districts Administrative Offices. No consent letter was sought by each interviewee, instead oral consent of each interviewee to be interviewed and photographed when necessary was sought.

3.2.4. Data analysis and presentation

3.2.4.1. Vegetation data analysis

Initial data tables (Traditional Vegetation Tables) having three column (or databases) formats were converted into the sparse matrices forms (data frames) using a routine, matrify in library (labdsv) provided by Roberts (2010) in R computer programme version R 2.15.2 (R Core Team, 2012). Hierarchical Agglomerative Clustering was done using libraries (cluster and vegan) with Similarity Ratio (SR) in R to come up with plant communities separately for the Jibat, Gedo and Chilimo forests. Reclassification of the Traditional Table was done to obtain new ClusterIDs using libraries (cluster and vegan) and then Synoptic Tables were produced using the new ClusterIDs for the three forests separately. The synoptic tables in the R consol were then pasted onto excel spreadsheet. The plant communities were named as 'type' by dominant characteristic woody species after one or two species with high synoptic values (the mean values of the species cover/abundance of cluster groups in the Traditional Table). The synoptic values ≥1 were considered high values for this study.

Shannon-Wiener diversity index was calculated to measure species diversity of identified plant communities (Kent and Coker, 1992) in Jibat, Gedo and Chilimo forests using:

$$\mathrm{H}' = \sum_{i=1}^{s} \mathrm{pi}\,ln\,\mathrm{pi}$$

Where, H' = Shannon diversity index; s = number of species; pi= proportion of individuals or abundance of the i^{th} species expressed as a proportion of total cover in the sample; and *ln* = the natural logarithm.

Shannon's evenness index (J) was also calculated using: $\mathrm{J} = \frac{\mathrm{H}'}{H'max}$, where, H' = Shannon–Wiener Diversity Index; and H'max = ln S, where s is the number of species in the sample (Kent and Coker, 1992).

3.2.4.2 Ethnobotanical data analysis

Data on informants' backgrounds and medicinal and WEPs used in each of the three districts were entered in an Excel spreadsheet software (Microsoft Corporation, 2007) and prepared for statistical analysis. Traditional knowledge dynamics on use of medicinal and WEPs by males and females, young to middle aged (20–44 years) and elderly (45–90 years); literate (completed at least primary education) and illiterate; knowledgeable (key) and general informants as well as those living near health centre (≤ 6 km from health centre) and far (> 6 km distance from health centre) were compared using two-tailed t-test and one way ANOVA at 95% confidence level between means using MINITAB Release 14.3.0 statistical and SPSS version 20.0 packages. Descriptive statistics were also applied to identify the number and percentage of species, genera and families of medicinal and WEPs used, their growth forms, proportions of parts harvested, modes of preparation and consumption patterns, habitat, main gatherers and consumers in the same manner as described by Agea *et al*., (2011). The number and percentage of species, genera and families of medicinal plants used, their growth forms, proportions of parts harvested, modes of remedy preparation and routes of administration were analysed using descriptive statistics following the methods used by Mirutse Giday *et al*., (2009a). Values or scores given by key informants on use-preference and/or use-diversity of medicinal and WEPs were added and ranked to get the output of preference ranking and direct matrix ranking exercises, respectively, following Martin (1995) and Heinrich *et al*., (1998).

To gain credibility, scientific studies that utilize traditional knowledge must be reliable. In ethnobotanical studies, consensus analysis provides a measure of reliability for any given claim providing reliable evidence. The product of informant consensus factor (ICF), ranges from 0 to 1. High value of ICF indicates the agreement of selection of taxa between informants, whereas a low value indicates disagreement (Heinrich *et al*., 1998). Informant consensus factor (ICF) was computed after the reported traditional remedies and corresponding diseases were grouped into 13 categories. ICF was obtained by computing number of use citations in each disease category (nur) minus the number of times a species used (nt), divided by the number of use citations in each category minus one (Martin, 1995; Alexiades, 1996). ICF was calculated as:

$$\mathrm{ICF} = \frac{\mathrm{nur} - \mathrm{nt}}{\mathrm{nur} - 1}$$

Where: nur= use citations in each disease category, nt= the number of times a species used; ICF= Informant consensus factor

The relative healing potential of each reported medicinal plant used against human and livestock ailments was evaluated using the fidelity level index (FL) in the same manner as described by Heinrich *et al*., (1998) given by: $\mathrm{FL} = \frac{\mathrm{Ip}}{\mathrm{Iu}} x\ 100$, where Ip is the number of informants who independently cited the importance of a species for treating a particular disease and Iu the total number of informants who reported the plant for any given disease.

CHAPTER FOUR

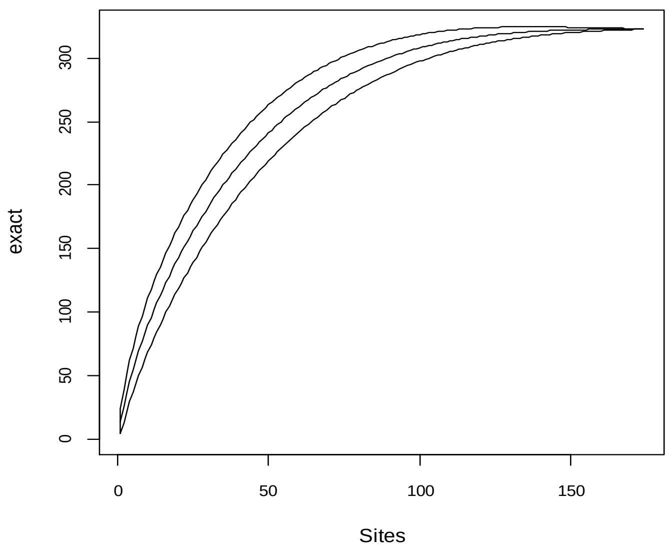
4. RESULTS

4.1. Floristic Compositions and Diversity

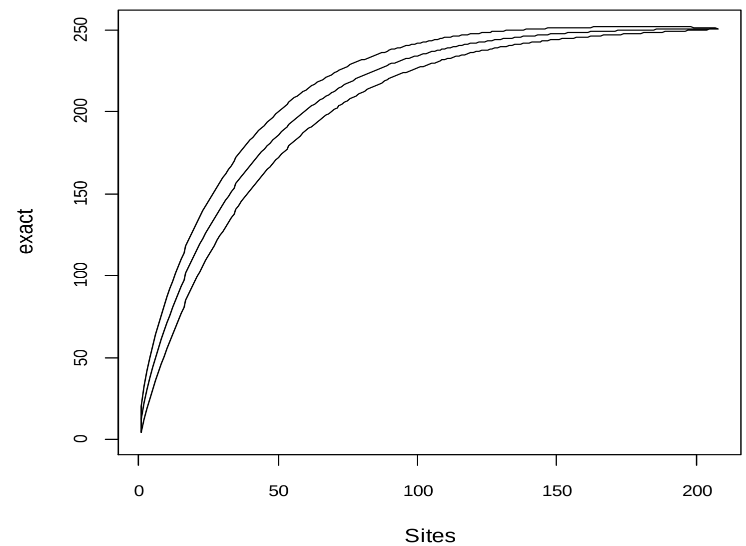
4.1.1. Species accumulation curve

Species Accumulation Curves (SAC) are used to compare diversity properties of community data sets using different accumulator functions. Species accumulation is the accumulation of species when the number of sites increases. The Species Accumulation Curve in adequately sampled study area levels off before the total number of sampling plots is reached. SAC may also be used to estimate the expected number of new species that may be encountered for given additional sampling efforts.

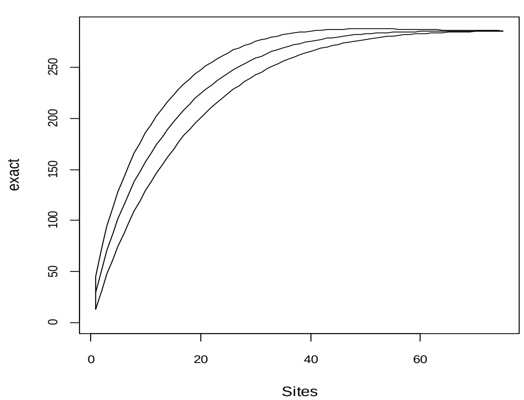
The exact and random method was used in library vegan in R package. Accordingly, SAC of Jibat Forest (Fig. 7A) showed that the curve became leveled off after 150 sample plots. In case of Chilimo Forest the curve became leveled off after 200 sample plots (Fig.7B). Whereas in the case of Gedo Forest, it became leveled off after 60 sample plots (Fig. 7C).



A



B



C

Fig. 7. Species accumulation curve of: A=Jibat Forest; B=Gedo Forest; C=Chilimo Forest

4.1.2. Plant community types

4.1.2.1. Jibat Forest

A total of 320 species were recorded from 174 sample plots/relevés and were used in determining plant community types of Jibat Forest (Appendix 3). Extra 38 species were also documented in a ten meter radius from the boundaries of the sample plots. Seven plant communities were identified (Fig. 8). Plant communities were named as ‘types’ after two species with greater synoptic cover/abundance values. The synoptic phytosociological table was constructed by using species with ≥1 synoptic values (Table 5).

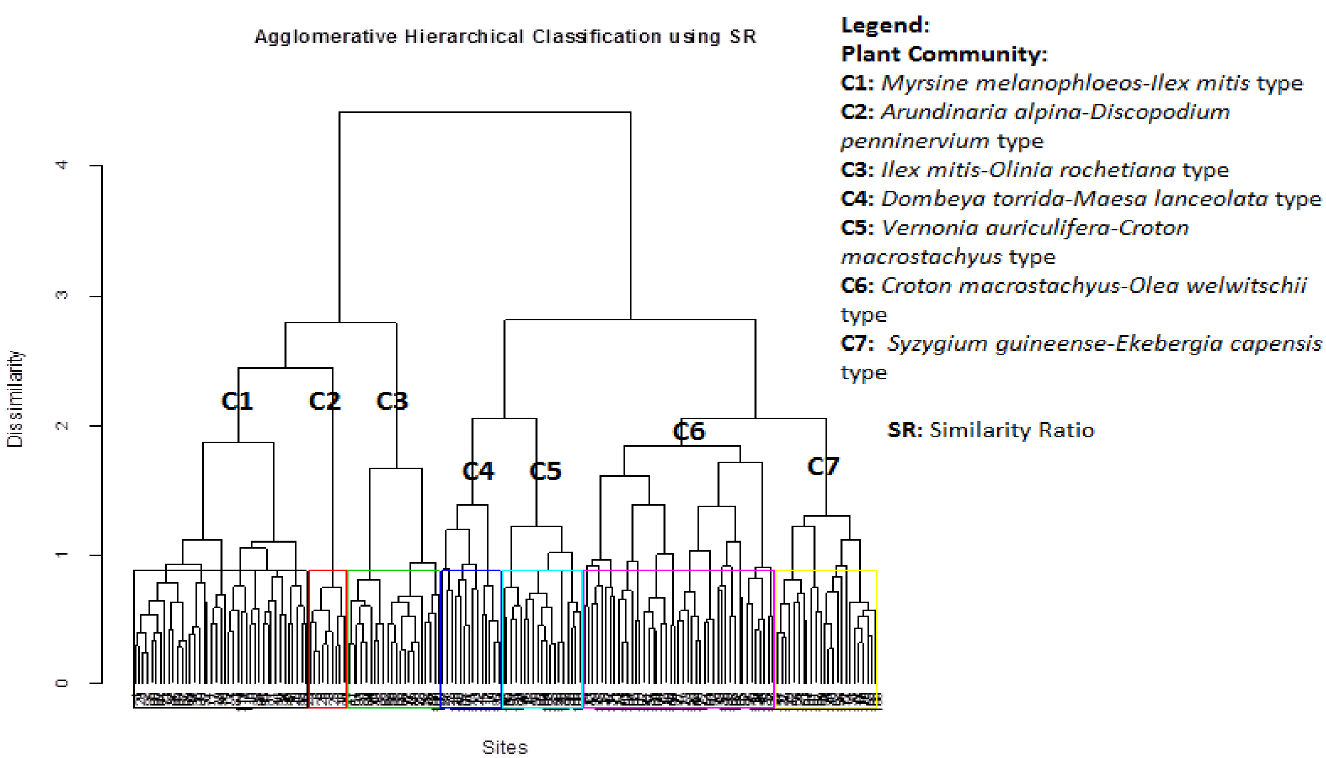


Fig. 8. Dendrogram showing the seven plant communities in Jibat Forest

To complement the clarity (overlap of sites) of Fig. 8, the number of plots, altitudinal range and average altitude of each plant community in Jibat Forest is given in Table 6.

Table 5. The synoptic phytosociological table of Jibat Forest (only species with ≥1 synoptic values were indicated)

Species	**Clusters**						
	C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**
Myrsine melanophloeos	**5.83**	1.56	0.41	0.36	0.13	0.00	0.00
Ilex mitis	**3.44**	0.78	6.05	1.64	0.53	0.17	1.42
Olinia rochetiana	**1.59**	0.00	2.82	0.07	0.27	0.04	0.32
Arundinaria alpina	**1.41**	8.44	0.00	0.00	0.00	0.08	0.00
Nuxia congesta	**1.29**	0.11	0.32	0.14	0.11	0.00	0.00
Rubus steudneri	**1.22**	1.11	0.55	1.71	0.98	1.25	1.00
Galiniera saxifraga	**1.00**	0.33	0.27	1.36	0.20	0.21	0.58
Arundinaria alpina	1.41	**8.44**	0.00	0.00	0.00	0.08	0.00
Discopodium penninervium	0.68	**2.11**	0.82	0.79	0.16	0.21	0.05
Hagenia abyssinica	0.51	**1.67**	0.18	1.14	0.04	0.00	0.11
Myrsine melanophloeos	5.83	**1.56**	0.41	0.36	0.13	0.00	0.00
Vernonia auriculifera	0.83	**1.44**	1.36	1.14	3.04	1.04	0.00
Rubus steudneri	1.22	**1.11**	0.55	1.71	0.98	1.25	1.00
Ilex mitis	3.44	0.78	**6.05**	1.64	0.53	0.17	1.42
Olinia rochetiana	1.59	0.00	**2.82**	0.07	0.27	0.04	0.32
Prunus africana	0.20	0.00	**2.14**	0.00	1.96	1.38	1.05
Vernonia auriculifera	0.83	1.44	**1.36**	1.14	3.04	1.04	0.00
Bersama abyssinica	0.61	0.00	**1.05**	1.79	1.27	1.42	1.42
Dombeya torrida	0.44	0.00	0.00	**3.14**	0.13	0.00	0.00
Maesa lanceolata	0.20	0.00	0.09	**1.93**	0.18	0.21	0.00
Bersama abyssinica	0.61	0.00	1.05	**1.79**	1.27	1.42	1.42
Rubus steudneri	1.22	1.11	0.55	**1.71**	0.98	1.25	1.00
Ilex mitis	3.44	0.78	6.05	**1.64**	0.53	0.17	1.42
Syzygium guineense	0.00	0.00	0.00	**1.43**	1.53	0.13	6.68

Galiniera saxifraga	1.00	0.33	0.27	**1.36**	0.20	0.21	0.58
Apodytes dimidiata	0.15	0.00	0.00	**1.14**	1.42	0.25	1.42
Hagenia abyssinica	0.51	1.67	0.18	**1.14**	0.04	0.00	0.11
Vernonia auriculifera	0.83	1.44	1.36	1.14	**3.04**	1.04	0.00
Croton macrostachyus	0.00	0.00	0.00	0.29	**2.38**	6.33	1.16
Olea welwitschii	0.00	0.00	0.00	0.43	**1.98**	1.63	0.42
Prunus africana	0.20	0.00	2.14	0.00	**1.96**	1.38	1.05
Ficus sur	0.00	0.00	0.18	0.21	**1.58**	0.42	0.84
Syzygium guineense	0.00	0.00	0.00	1.43	**1.53**	0.13	6.68
Albizia schimperiana	0.00	0.00	0.00	0.00	**1.42**	1.38	0.00
Apodytes dimidiata	0.15	0.00	0.00	1.14	**1.42**	0.25	1.42
Bersama abyssinica	0.61	0.00	1.05	1.79	**1.27**	1.42	1.42
Croton macrostachyus	0.00	0.00	0.00	0.29	2.38	**6.33**	1.16
Olea welwitschii	0.00	0.00	0.00	0.43	1.98	**1.63**	0.42
Bersama abyssinica	0.61	0.00	1.05	1.79	1.27	**1.42**	1.42
Albizia schimperiana	0.00	0.00	0.00	0.00	1.42	**1.38**	0.00
Prunus africana	0.20	0.00	2.14	0.00	1.96	**1.38**	1.05
Maytenus obscura	0.27	0.00	0.50	0.00	0.20	**1.25**	0.00
Rubus steudneri	1.22	1.11	0.55	1.71	0.98	**1.25**	1.00
Vernonia auriculifera	0.83	1.44	1.36	1.14	3.04	**1.04**	0.00
Syzygium guineense	0.00	0.00	0.00	1.43	1.53	0.13	**6.68**
Ekebergia capensis	0.00	0.00	0.05	0.00	0.78	0.33	**1.74**
Apodytes dimidiata	0.15	0.00	0.00	1.14	1.42	0.25	**1.42**
Bersama abyssinica	0.61	0.00	1.05	1.79	1.27	1.42	**1.42**
Ilex mitis	3.44	0.78	6.05	1.64	0.53	0.17	**1.42**
Croton macrostachyus	0.00	0.00	0.00	0.29	2.38	6.33	**1.16**
Kalanchoe petitiana	0.41	0.44	0.86	0.64	0.64	0.46	**1.16**
Rosa abyssinica	0.37	0.00	0.27	0.57	0.20	0.08	**1.11**
Prunus africana	0.20	0.00	2.14	0.00	1.96	1.38	**1.05**
Rubus steudneri	1.22	1.11	0.55	1.71	0.98	1.25	**1.00**

Table 6. Number of plots, altitudinal range and average altitude of each plant community in Jibat Forest

Plant community	Plots in each community	Number of plots (N=174)	Attitudinal range (m a.s.l.)	Average altitude (m a.s.l.)
C1	1,2,4,7,10,12,14,15,16,17,19,20,21,22,23,29,30,31,32,34,35,36,37,38,39,60,61,63,65,67,69,71,72,73,79,81,82,83,85,114,116	41	2500-2962	2721.68
C2	3,5,6,8,9,18,24,25,26	9	2736-2979	2901.33
C3	11,13,33,58,59,62,64,66,68,70,75,76,77,78,80,84,86,87,88,92,100,120	22	2441-2835	2647
C4	27,28,40,107,111,113,115,117,118,119,122,123,124,152	14	2176-2928	2539.21
C5	41,42,43,47,49,51,52,53,55,57,74,89,95,99,102,103,104,105,110,131,133,134,135,136,137,139,141,142,143,145,146,148,149,150,151,153,154,158,160,161,167,169,172,173	45	2046-2661	2273.68
C6	44,54,56,101,112,121,127,129,138,140,144,147,156,157,159,162,163,164,165,166,168,170,171,174	24	2073-2520	2208.95
C7	45,46,48,50,90,91,93,94,96,97,98,106,108,109,125,126,128,130,132	19	2183-2562	2408.73

The seven plant community types in Jibat Forest were:

C1. *Myrsine melanophloeos-Ilex mitis* Community Type

This plant community is found at elevation range between 2500 and 2962 m a.s.l. at average elevation of 2721.68 m a.s.l. (Table 6). *Myrsine melanophloeos* and *Ilex mitis* were the dominant species (Fig. 9). Other important tree species in this community include: *Olinia rochetiana, Nuxia congesta, Galiniera saxifraga, Dombeya torrida, Hagenia abyssinica* and *Maytenus addat.* Shrubs such as *Canthium oligocarpum, Bersama abyssinica, Carissa spinarum, Clausena* *anisata, Brucea antidysenterica, Clutia abyssinica, Dalbergia lactea, Dodonaea angustifolia, Dovyalis abyssinica, Embelia schimperi, Helichrysum schimperi, Hypericum revolutum, Maesa lanceolata, Maytenus gracilipes*, *Calpurnia aurea* and *Rubus steudneri* were prevalent. The common herb layeris composed of *Acalypha psilostachya, Achyranthes aspera, Ageratum conyzoides, Alepidea peduncularis, Arisaema enneaphyllum, Asparagus africanus, Bartsia trixago, Carduus leptacanthus, Carex johnstonii, Cynoglossum alpinum, Cyperus longibracteatus* and *Kalanchoe petitiana*.

Fig. 9. *Myrsine melanophloeos-Ilex mitis* Community Type (photo taken at 2726 m a.s.l, note the grey barked pole in front view is *Myrsine melanophloeos* and at the back were *Ilex mitis*)

C2. *Arundinaria alpine* - *Discopodium penninervium* Community Type

This community type could be easily distinguished by its upland bamboo stands **(***Arundinaria alpina*) mixed with *Discopodium penninervium* as dominant species (Fig. 10).

Fig. 10. Highland Bamboo stand (A); more closeup view (B)

This community type was observed at higher altitude in jibat Forest at mean elevation of 2901.33 m a.s.l. (Table 6). The common tree species in this community type are *Hagenia abyssinica, Myrsine melanophloeos, Ilex mitis, Olea europaea* subsp. *cuspidata, Juniperus procera* and *Galiniera saxifraga*. *Hypericum revolutum, Rubus steudneri* and *Vernonia auriculifera* constitute the major shrub species in this community type. The main components of the herb layer are *Salvia nilotica, Stephania abyssinica, Desmodium repandum, Andropogon abyssinicus, Kalanchoe petitiana* and *Cynoglossum alpinum.*

C3. *Ilex mitis - Olinia rochetiana* Community Type

This community type was observed at mean elevation of 2647 m a.s.l. (Table 6). It is dominated by *Ilex mitis* and *Olinia rochetiana* (Fig. 11). Other important tree species occurring in this community type are *Prunus africana, Myrsine melanophloeos, Nuxia congesta* and *Maytenus arbutifolia*. *Vernonia auriculifera, Erica arborea, Brucea antidysenterica, Bersama abyssinica* and *Carissa spinarum* are among the common shrub species in this community type. The herb layer is dominated by *Cynoglossum lanceolatum, Cheilanthes farinosa, Girardinia bullosa, Urtica simensis, Eragrostis botryodes* and *Alepidea peduncularis* among others.

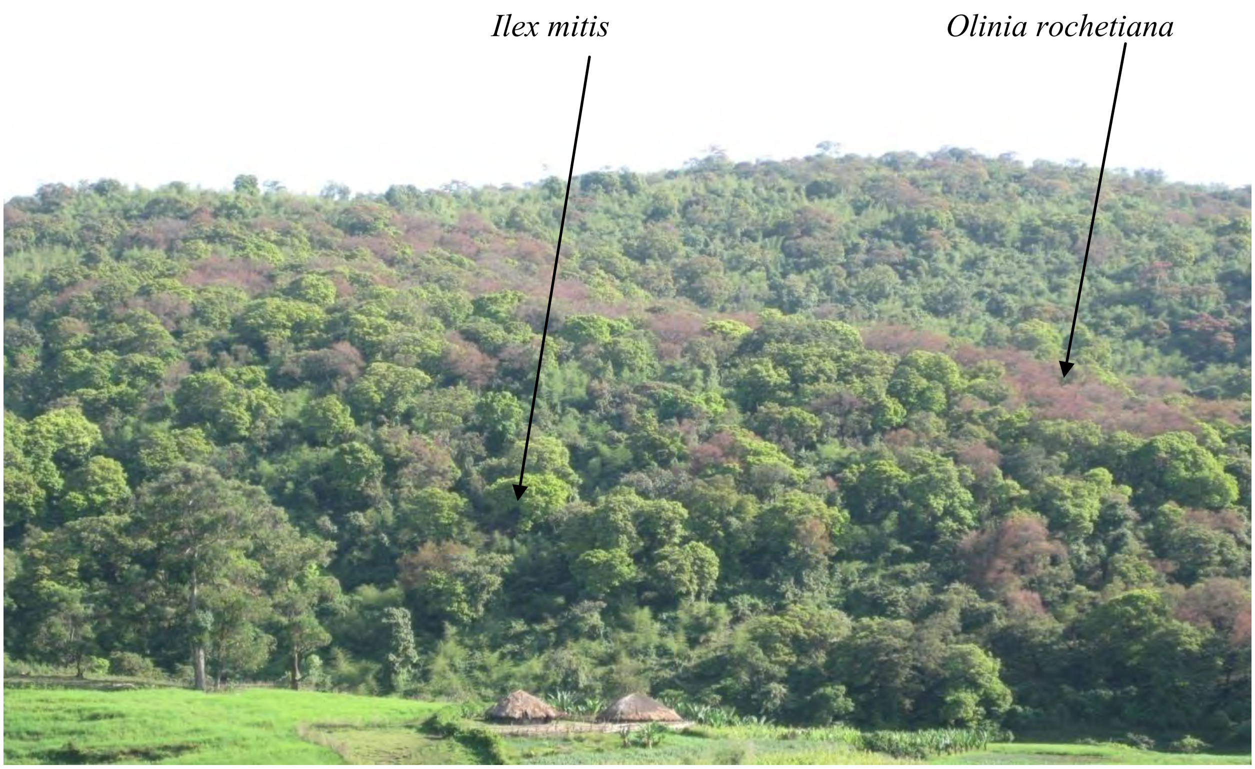


Fig. 11. Plant community dominated by *Ilex mitis* and *Olinia rochetiana* (at 2530 m a.s.l.), note that the redish colored tree in the upper canopy is *Olinia rochetiana* and the light green is *Ilex mitis* behind the huts.

C4. *Dombeya torrida- Maesa lanceolata* Community Type

Occurring in a wide altitudinal range (ca. 2176-2928 m a.s.l.) with mean elevation of 2539.21 m a.s.l. (Table 6), this community type was dominated by *Dombeya torrida* and *Maesa lanceolata*. Other tree species in this community type are *Syzygium guineense, Apodytes dimidiata, Ilex mitis, Galiniera saxifraga* and *Hagenia abyssinica*. The common shrubs include *Rubus steudneri, Carissa spinarum, Asparagus racemosus, Clerodendrum myricoides, Hibiscus micranthus* and *Dalbergia lactea* among others. *Kalanchoe petitiana, Notholaena marantae, Cynoglossum lanceolatum, Girardinia bullosa, Arisaema enneaphyllum, Impatiens aethiopica* and *Trifolium rueppellianum* constituted the herbaceous layer.

C5. *Vernonia auriculifera-Croton macrostachyus* community type

Many of the sample plots (45) were put under this community type. It occurred relatively at lower altitudes ranging between 2046 and 2661 m a.s.l. with average altitude of 2273.68 m a.s.l. (Table 6). *Vernonia auriculifera* and *Croton macrostachyus* were the dominant species with higher synoptic values (Table 5; Fig. 12). *Olea welwitschii, Prunus africana, Ficus sur, Syzygium guineense, Apodytes dimidiata* and *Albizia schimperiana* were tree species with more than one synoptic cover/abundance values in this community type (Table 5). Other important tree species like *Pouteria adolfi-friederici, Polyscias fulva, Ekebergia capensis, Podocarpus falcatus* and *Cordia africana* are also found in this community type. *Bersama abyssinica, Rubus steudneri, Pentas lanceolata, Kalanchoe petitiana, Brucea antidysenterica, Rytigynia neglecta, Landolphia buchananii, Crassocephalum rubens, Carissa spinarum, Periploca linearifolia* were among other common species in this community type.

Fig.12. Patch dominated by *Vernonia auriculifera* at 2134 m a.s.l.

C6. ***Croton macrostachyus- Olea welwitschii*** Community Type

This community type is found at lower altitudes (2073-2520 m a.s.l.; mean=2208.95 m a.s.l) in Jibat Forest (Table 6). *Croton macrostachyus* and *Olea welwitschii* are the dominat species (Fig. 13). Other common tree species are *Prunus africana, Albizia schimperiana, Maytenus obscura, Ficus sur, Pouteria adolfi-friederici, Ekebergia capensis* and *Allophylus abyssinicus*. *Bersama abyssinica, Rubus steudneri, Vernonia auriculifera, Brucea antidysenterica, Carissa spinarum* and *Calpurnia aurea* were among the common shrubs. *Pentas lanceolata, Cheilanthes farinosa, Festuca chodatiana, Helichrysum stenopterum, Pteridium aquilinium* and *Stephania abyssinica* are among species in the herbs layer.

Fig.13. *Olea welwitschii* trees at forest edge, photo taken at 2109 m a.s.l.

C7. *Teclea nobilis- Rhus vulgaris* Community Type

This community type occurred below 2600 m a.s.l. at mean altitude of 2408.73 m a.s.l. (Table 6). Next to *Teclea nobilis* and *Rhus vulgaris, Syzygium guineense* and *Ekebergia capensis* were abandunt in this community type. Other common tree species are *Apodytes dimidiata, Ilex mitis, Croton macrostachyus, Phoenix reclinata, Galiniera saxifraga, Ficus sur* and *Olea welwitschii*. *Rosa abyssinica, Rubus steudneri, Brucea antidysenterica* and *Carissa spinarum* are common shrub species. Other prevalent species includes *Urera hypselodendron, Pentas lanceolata, Lobelia giberroa* and *Landolphia buchananii* among other plant species.

4.1.2.2. Gedo Forest

Analysis of 75 sample plots and 290 species (Appendix 4) collected from these plots in R package through agglomerative hierarchical classification using similarity ratio showed five plant communities in Gedo Forest (Fig. 14). Twenty four additional species present within 10 meters radius from the boundary of the sample plots but not present in the sample plots were recorded for complete list of floristic compositio of the Forest. List of medicinal and wild and semi-wild edible plants in and around the Gedo Forest were also included in Appendix 2 to indicate the total plants collected and documented from Chelia District.

The plant communities were determined by analyzing the synoptic phytosociological table (Table 7). This table was constructed by considering species with ≥1 synoptic cover/abundance values. The plant communities where named after two dominant species with greater synoptic values. Furthermore, the number of plots, altitudinal range and mean elevation of each plant community in Gedo Forest is given in Table 8.

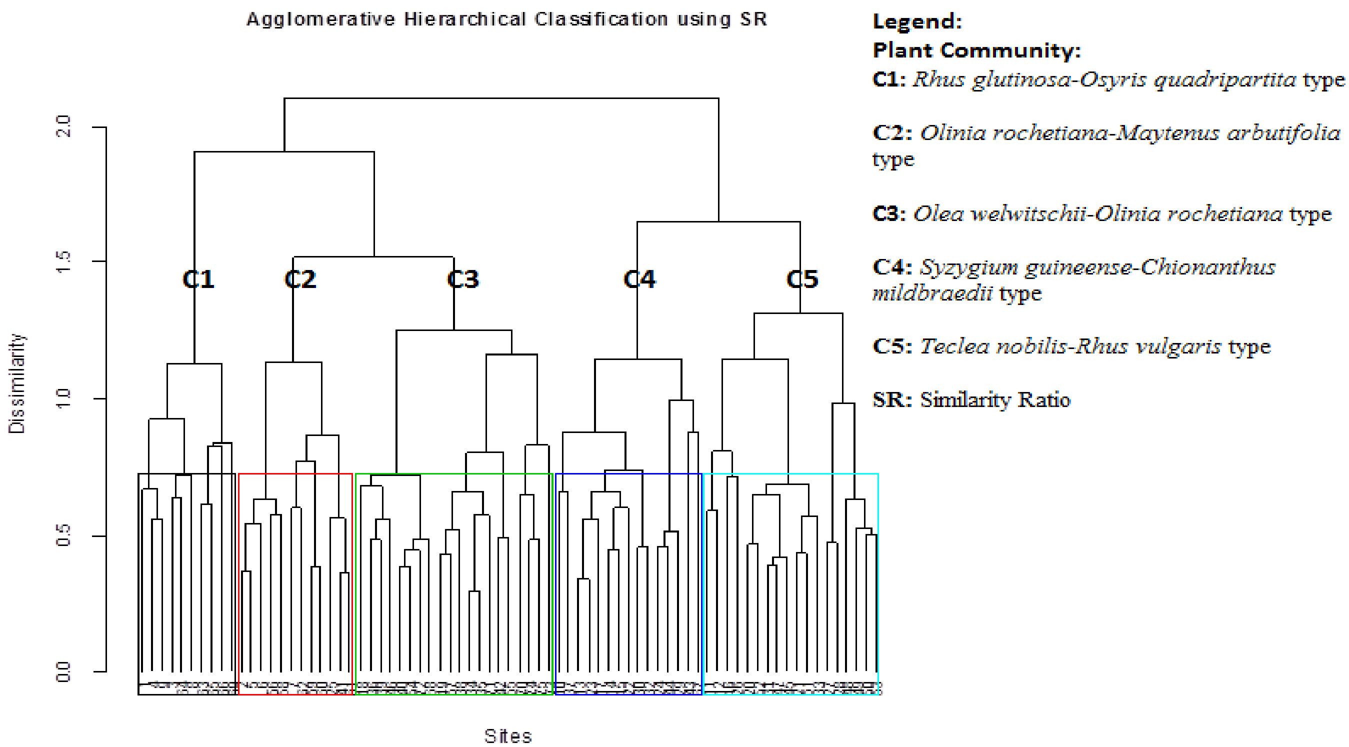


Fig.14. Dendrogram showing plant communities in Gedo Forest

Table 7. Synoptic phytosociological table of Gedo Forest

Species	Community Type (Clusters)				
	C1	C2	C3	C4	C5
Rhus glutinosa subsp. *glutinosa*	**4.10**	1.92	1.33	0.78	0.80
Osyris quadripartita	**3.40**	2.17	0.20	0.61	0.95
Maytenus arbutifolia	**3.20**	4.33	1.33	0.61	1.10
Acacia abyssinica	**2.40**	0.67	0.00	0.83	0.10
Maytenus gracilipes	**2.00**	1.00	1.27	1.39	1.10
Olea europaea subsp. *cuspidata*	**1.80**	1.92	3.47	1.33	1.90
Apodytes dimidiata	**1.50**	0.25	1.73	1.83	2.85
Podocarpus falcatus	**1.50**	1.00	1.13	2.67	0.10
Allophylus abyssinicus	**1.30**	1.25	0.27	0.50	2.10

Myrica salicifolia	**1.30**	0.58	0.40	0.39	0.85
Ilex mitis	**1.20**	0.33	0.00	0.00	0.15
Carissa spinarum	**1.10**	1.17	1.13	1.17	0.75
Olinia rochetiana	0.40	**7.25**	4.33	2.89	3.40
Maytenus arbutifolia	3.20	**4.33**	1.33	0.61	1.10
Osyris quadripartita	3.40	**2.17**	0.20	0.61	0.95
Olea europaea subsp. *cuspidata*	1.80	**1.92**	3.47	1.33	1.90
Rhus glutinosa subsp. *glutinosa*	4.10	**1.92**	1.33	0.78	0.80
Syzygium guineense	0.80	**1.83**	0.47	4.06	0.45
Chionanthus mildbraedii	0.40	**1.42**	3.20	3.17	1.20
Allophylus abyssinicus	1.30	**1.25**	0.27	0.50	2.10
Carissa spinarum	1.10	**1.17**	1.13	1.17	0.75
Nuxia congesta	0.30	**1.08**	0.00	0.11	0.20
Gnidia glauca	0.30	**1.00**	0.00	0.17	0.40
Maytenus gracilipes	2.00	**1.00**	1.27	1.39	1.10
Podocarpus falcatus	1.50	**1.00**	1.13	2.67	0.10
Olea welwitschii	0.00	0.17	**4.87**	0.78	0.05
Olinia rochetiana	0.40	7.25	**4.33**	2.89	3.40
Olea europaea subsp. *cuspidata*	1.80	1.92	**3.47**	1.33	1.90
Chionanthus mildbraedii	0.40	1.42	**3.20**	3.17	1.20
Olea capensis	0.00	0.08	**3.13**	2.72	0.25
Rhus vulgaris	0.80	0.92	**2.93**	1.500	3.30
Phoenix reclinata	0.00	0.42	**1.93**	1.33	0.15
Apodytes dimidiata	1.50	0.25	**1.73**	1.83	2.85
Maytenus arbutifolia	3.20	4.33	**1.33**	0.61	1.10
Rhus glutinosa subsp. *glutinosa*	4.10	1.92	**1.33**	0.78	0.80
Maytenus gracilipes	2.00	1.00	**1.27**	1.39	1.10
Carissa spinarum	1.10	1.17	**1.13**	1.17	0.75
Podocarpus falcatus	1.50	1.00	**1.13**	2.67	0.10
Syzygium guineense	0.80	1.83	0.47	**4.06**	0.45
Chionanthus mildbraedii	0.40	1.42	3.20	**3.17**	1.20
Olinia rochetiana	0.40	7.25	4.33	**2.89**	3.40
Olea capensis	0.00	0.08	3.13	**2.72**	0.25
Podocarpus falcatus	1.50	1.00	1.13	**2.67**	0.10
Prunus africana	0.50	0.25	0.80	**2.28**	2.85
Croton macrostachyus	0.80	0.33	0.27	**1.83**	0.00
Apodytes dimidiata	1.50	0.25	1.73	**1.83**	2.85
Rhus vulgaris	0.80	0.92	2.93	**1.50**	3.30
Ficus sur	0.10	0.00	0.40	**1.39**	0.20
Maytenus gracilipes	2.00	1.00	1.27	**1.39**	1.10
Phoenix reclinata	0.00	0.42	1.93	**1.33**	0.15
Olea europaea subsp. *cuspidata*	1.80	1.92	3.47	**1.33**	1.90

Carissa spinarum	1.10	1.17	1.13	**1.17**	0.75
Teclea nobilis	0.20	0.42	0.60	1.17	**6.65**
Rhus vulgaris	0.80	0.92	2.93	1.50	**3.30**
Prunus africana	0.50	0.25	0.80	2.28	**2.85**
Apodytes dimidiata	1.50	0.25	1.73	1.83	**2.85**
Allophylus abyssinicus	1.30	1.25	0.27	0.50	**2.10**
Olea europaea subsp. *cuspidata*	1.80	1.92	3.47	1.33	**1.90**
Chionanthus mildbraedii	0.40	1.42	3.20	3.17	**1.20**
Maytenus gracilipes	2.00	1.00	1.27	1.39	**1.10**
Bersama abyssinica	0.10	0.42	0.93	0.93	**1.10**
Maytenus arbutifolia	3.20	4.33	1.33	0.61	**1.10**
Hagenia abyssinica	0.70	0.00	0.00	0.00	**1.00**

Table 8. Number of plots and average elevation of each plant community in Gedo Forest (m a.s.l. = meter above sea level, N=total number of sample plots) meter above sea level, N=total number os samples plots

Plant community	Plots in each plant community	Number of plots (N=75)	Altitudinal range (m a.s.l.)	Average altitude (m a.s.l.)
C1	1,3,4,8,9,64,65,66,69	10	2188-2513	2416.10
C2	2,5,6,7,25,41,56,58,59,60,61,62	12	2355-2598	2505.16
C3	10,13,14,15,17,22,23,24,29,30,32,37,43,44,67	15	2358-2599	2461.80
C4	11,12,16,20,21,26,27,28,31,33,45,47,48,49,50,51,52,53	18	2307-2505	2414.33
C5	19,55,39,57,40,68,70,71,42,38,34,72,46,73,18,54,35,36,74,75	20	2468-2683	2549.95

Accordingly, the five plant communities identified in Gedo Forest were as follows:

A. ***Rhus glutinosa* subsp. *glutinosa*- *Osyris quadripartita*** Community Type

This community type was found at altitudes ranging from 2188 m a.s.l. to 2513 m a.s.l. and at mean altitude of 2416.10 m a.s.l (Table 8). *Rhus glutinosa* subsp. *glutinosa* and *Osyris* *quadripartita* were the dominant species of this community type. *Maytenus arbutifolia, Acacia abyssinica, Olea europaea* subsp. *cuspidata, Apodytes dimidiata, Allophylus abyssinicus, Podocarpus falcatus, Ilex mitis, Albizia schimperiana* and *Myrica salicifolia* were tree species in this community with equal to or greater than one synoptic values (Table 8). The common shrubs in this community type include *Maytenus gracilipes, Carissa spinarum, Embelia schimperi, Rosa abyssinica* and *Vernonia auriculifera*. Whereas, *Achyranthes aspera, Acmella caulirhiza, Ageratum conyzoides, Ajuga integrifolia, Andropogon abyssinicus, Arisaema enneaphyllum, Geranium aculeolatum* and *Helichrysum hedbergianu*m constituted the herb layer in this community type. Lianas like *Gouania longispicata, Helinus mystacinus, Clematis simensis* and *Periploca linearifolia* were also common in this community type.

B. ***Olinia rochetiana - Maytenus arbutifolia*** Community Type

Olinia rochetiana and *Maytenus arbutifolia* were the dominant species. This community type was observed in altitudes ranging from 2355 m a.s.l to 2589 m a.s.l. (Table 8). *Osyris quadripartita, Olea europaea* subsp. *cuspidata, Rhus glutinosa* subsp. *glutinosa, Syzygium guineense* subsp. *afromontanum, Chionanthus mildbraedii, Nuxia congesta* and *Podocarpus falcatus* were among other common tree species in this community type. Shrubs like *Gnidia glauca, Maytenus gracilipes, Maesa lanceolata* and *Embelia schimperi* were also common. *Bidens ghedoensis, Convolvulus kilimandschari, Crepis rueppellii, Cynoglossum lanceolatum, Cyperus brevifolius* and *Cynodon dactylon* were among the common herbs.

C. ***Olea welwitschii- Olinia rochetiana*** Community Type

In addition to the dominant species in the type name, *Olea europaea* subsp. *cuspidata, Chionanthus mildbraedii, Olea capensis, Rhus vulgaris, Phoenix reclinata, Apodytes dimidiata* and *Podocarpus falcatus* were tree species with more than one synoptic value (Table 8). *Myrsine africana, Discopodium penninervium* and *Maytenus gracilipes* were also commonly encountered species in this community type.

D. ***Syzygium guineense* subsp. *afromontanum-Chionanthus mildbraedii*** Community Type

The two wild edible tree species i.e., *Syzygium guineense* subsp. *afromontanum* and *Chionanthus mildbraedii* (Fig 15), whose fruits are consumed raw by the local community, were indicator species of this community type. *Olinia rochetiana, Olea capensis, Podocarpus falcatus, Prunus africana, Croton macrostachyus* and *Apodytes dimidiata* were also among the common tree species in this community type.

Fig. 15. Highly branched *Chionanthus mildbraedii* tree covering other species behind in close view, photo taken at 2407 m a.s.l.

E. ***Teclea nobilis - Rhus vulgaris*** Community Type

This community type was found relatively at higher altitudes (ca. 2468-2683 m a.s.l, mean altitude=2468-2683 m a.s.l.) (Table 8). In addition to the community type name species (Fig. 16), *Prunus africana, Apodytes dimidiata, Allophylus abyssinicus, Chionanthus mildbraedii* and *Hagenia abyssinica* were also common tree species. *Justicia ladanoides* dominated the ground layer in most of the plots in this community type.

Fig.16. *Teclea nobilis-Rhus vulgaris* community type at 2678 m a.s.l.

4.1.2.3. Chilimo Forest

The analysis of 241 species (Appendix 5) collected from 208 sample plots analysed in R package showed 6 plant community types (Fig. 17). Agglomerative hierarchical classification using similarity ratio was used to obtain the dendrogram output. The plant communities were determined based on phytosociological synoptic table (Table 9). The synoptic table as constructed by considering species with ≥1 synoptic cover/abundance value. The number of sample plots, elevation range of their distribution and mean elevation of each plant community in Chilimo Forest is presented in Table 10. The plant communities were named as 'type' after two or three species with the highest synoptic cover/abundance values.

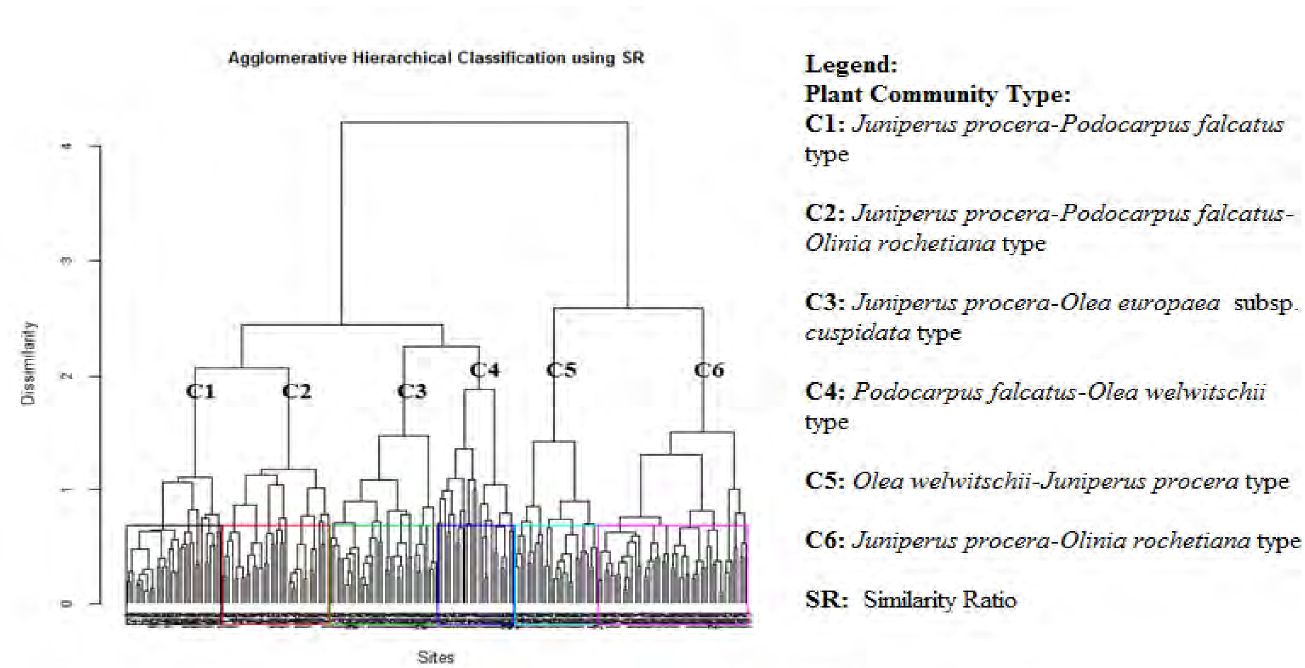


Fig. 17. Dendrogram showing plant communities in Chilimo Forest

Table 9. Synoptic phytosociological table of Chilimo Forest. Only species with ≥1 synoptic values are presented here.

Species	**Community Type (Cluster)**					
	C1	C2	C3	C4	C5	C6
Juniperus procera	**6.28**	7.06	5.81	1.25	4.60	2.69
Podocarpus falcatus	**6.28**	1.58	0.56	7.18	2.82	1.12
Osyris quadripartita	**1.81**	1.17	2.08	0.39	1.36	0.35
Olea europaea subsp. *cuspidata*	**1.72**	0.89	4.83	1.93	3.40	0.96

Rhus glutinosa subsp. *glutinosa*	**1.41**	0.36	1.58	0.86	1.00	0.96
Olinia rochetiana	**1.38**	1.31	0.94	2.18	1.56	2.23
Maytenus gracilipes	**1.19**	0.64	1.31	1.43	1.16	0.50
Juniperus procera	6.28	**7.06**	5.81	1.25	4.60	2.69
Podocarpus falcatus	6.28	**1.58**	0.56	7.18	2.82	1.12
Olinia rochetiana	1.38	**1.31**	0.94	2.18	1.56	2.23
Osyris quadripartita	1.81	**1.17**	2.08	0.39	1.36	0.35
Juniperus procera	6.28	7.06	**5.81**	1.25	4.60	2.69
Olea europaea subsp. *cuspidata*	1.72	0.89	**4.83**	1.93	3.40	0.96
Rhus glutinosa subsp. *glutinosa*	1.41	0.36	**1.58**	0.86	1.00	0.96
Pittosporum viridiflorum	0.00	0.17	**1.39**	0.00	0.42	1.35
Maytenus gracilipes	1.19	0.64	**1.31**	1.43	1.16	0.50
Carissa spinarum	0.63	0.42	**1.00**	0.46	0.76	0.62
Podocarpus falcatus	6.28	1.58	0.56	**7.18**	2.82	1.12
Olea welwitschii	0.22	0.64	0.17	**4.18**	7.22	0.23
Olinia rochetiana	1.38	1.31	0.94	**2.18**	1.56	2.23
Olea europaea subsp. *cuspidata*	1.72	0.89	4.83	**1.93**	3.40	0.96
Maytenus gracilipes	1.19	0.64	1.31	**1.43**	1.16	0.50
Bridelia micrantha	0.81	0.00	0.36	**1.39**	0.44	0.96
Juniperus procera	6.28	7.06	5.81	**1.25**	4.60	2.69
Bersama abyssinica	0.50	0.19	0.33	**1.00**	0.20	0.15
Olea welwitschii	0.22	0.64	0.17	4.18	**7.22**	0.23
Juniperus procera	6.28	7.06	5.81	1.25	**4.60**	2.69
Olea europaea subsp. *cuspidata*	1.72	0.89	4.83	1.93	**3.40**	0.96
Podocarpus falcatus	6.28	1.58	0.56	7.18	**2.82**	1.12
Olinia rochetiana	1.38	1.31	0.94	2.18	**1.56**	2.23
Osyris quadripartita	1.81	1.17	2.08	0.39	**1.36**	0.35
Maytenus gracilipes	1.19	0.64	1.31	1.43	**1.16**	0.50
Rhus glutinosa subsp. *glutinosa*	1.41	0.36	1.58	0.86	**1.00**	0.96
Juniperus procera	6.28	7.06	5.81	1.25	4.60	**2.69**
Olinia rochetiana	1.38	1.31	0.94	2.18	1.56	**2.23**
Pittosporum viridiflorum	0.00	0.17	1.39	0.00	0.42	**1.35**
Podocarpus falcatus	6.28	1.58	0.56	7.18	2.82	**1.12**
Allophylus abyssinicus	0.81	0.53	0.00	0.68	0.30	**1.04**
Hagenia abyssinica	0.00	0.06	0.00	0.11	0.06	**1.04**

The six plant communities identified in Chilimo Forest are presented as follows:

C1. *Juniperus procera-Podocarpus falcatus* Community Type

This community type is characterized by the co-dominance of *Juniperus procera* (Fig. 18) and *Podocarpus falcatus* with the same synoptic value (Table 9). *Osyris quadripartita, Olea europaea* subsp. *cuspidata, Olinia rochetiana* and *Maytenus gracilipes* were among the common species with more than one synoptic value (Table 9). *Cynoglossum lanceolatum*, *Acmella caulirhiza* and *Andropogon abyssinicus* covered the ground layer in most plots. This community type was common at altitudes ranging from 2383 m a.s.l. to 2800 m a.s.l. at mean altitude 2576.65 m a.s.l. (Table 10).

A

B

Fig. 18. *Juniperus procera* dominated stand (Chilimo Forest) (A); close-up (B)

Table 10. Number of plots, altitudinal range and average altitude of each plant community in Chilimo Forest

Plant community	Plots in each plant community	Number of plots (N=208)	Altitudinal range (m a.s.l.)	Average altitude (m a.s.l.)
C1	1,3,5,7,8,11,17,18,19,20,29,34,48,50,54,56,61,66,68,73,82,99,105,106,107,141,146,161,168,171,172,179	32	2383-2800	2576.65
C2	2,9,10,12,13,14,15,16,21,24,25,33,35,37,38,42,44,45,47,49,55,69,70,71,74,109,115,119,122,130,145,147,176,194,195,196	36	2392-2872	2643.19
C3	4,23,30,36,39,40,41,43,51,101,102,103,124,125,126,127,131,136,137,148,149,153,175,178,180,181,182,190,191,192,193,199,200,206,207,208	36	2419-2833	2589.91
C4	6,27,62,64,65,78,79,80,81,83,84,85,88,111,112,117,143,144,150,152,156,157,158,162,165,166,169,205	28	2389-2599	2498.28
C5	22,26,28,53,58,59,60,63,67,72,75,76,77,86,87,89,90,91,92,93,94,95,96,97,98,100,104,108,110,129,132,133,134,135,138,139,142,151,154,155,159,160,163,164,167,183,184,186,187,203	50	2402-2708	2549.26
C6	31,46,52,57,113,114,116,118,120,121,123,128,140,170,173,174,177,185,188,189,197,198,201,202,204	26	2401-2874	2578.53

C2. *Juniperus procera-Podocarpus falcatus-Olinia rochetiana* Community Type

In addition to the dominant community type name species, *Osyris quadripartita* and *Olea europaea* subsp. *cuspidata* are common in this community type. Shrubs such as *Acanthus polystachius, Aspilia africana, Berkheya spekeana, Canthium oligocarpum, Carissa spinarum* and *Rubus steudneri* are also common. The ground layer herbs (*Satureja paradoxa, Phaulopsis imbricata* and *Pennisetum sphacelatum)* are also found in this community type. The community type occurred at range of 2392 and 2872 m a. s. l. (Table 10).

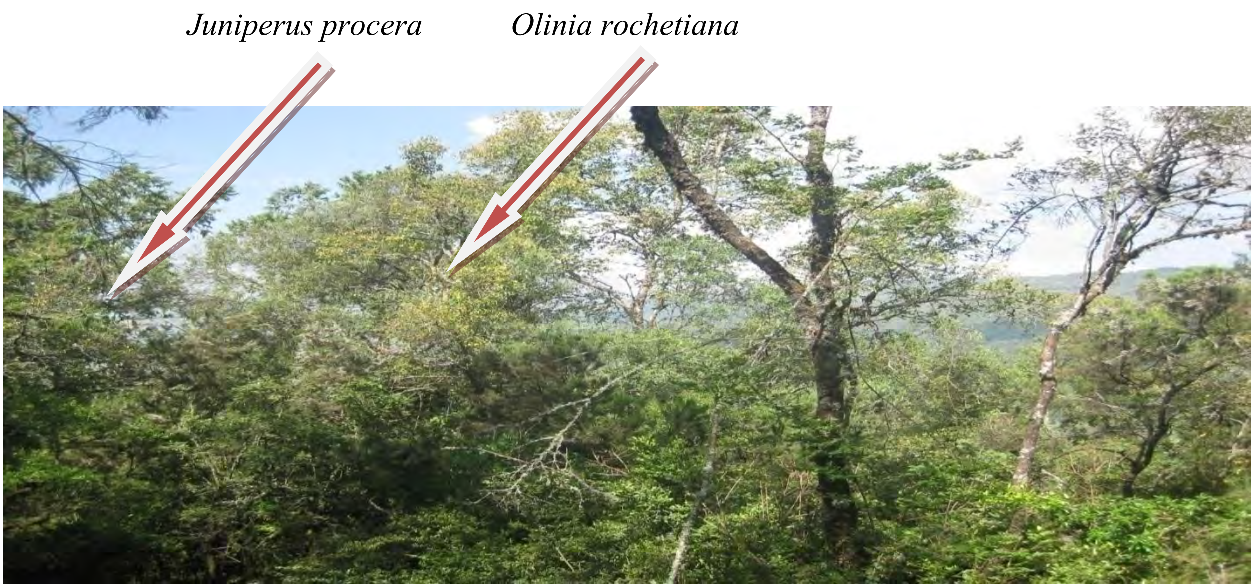


Fig. 19. *Juniperus procera* and *Olinia rochetiana* stand at 2672 m a.s.l. in the upper canopy.

C3. *Juniperus procera-Olea europaea* subsp. ***cuspidata*** Community Type

As indicated in the community type name, *Juniperus procera* and *Olea europaea* subsp. *cuspidata* were the dominant species (Table 9). *Rhus glutinosa* subsp. *glutinosa, Pittosporum viridiflorum, Maytenus gracilipes* and *Carissa spinarum* were other common ones with equal to or more than one synoptic value (Table 9). *Bidens biternata, Eleusine jaegeri, Galinsoga quadriradiata, Geranium arabicum* and *Hypoestes forskaolii* are among the common ground layer herbs. This community type was observed at altitudinal range between 2419 and 2833 m a.s.l. (Table 10). *Rorippa palustris,* a locally rare species was collected from a single temporary pond (Fig. 20)

Fig. 20. Forest patch at secondary growth dominated by *Juniperus procera* and *Olea europaea* subsp. *cuspidata*; note the *Olea europaea* subsp. *cuspidata* trees in the forefront of the photo.

C4. *Podocarpus falcatus -Olea welwitschii* Community Type

Olinia rochetiana, Olea europaea subsp. *cuspidata, Maytenus gracilipes, Bridelia micrantha, Juniperus procera* and *Bersama abyssinica* were among the species with equal or greater than one synoptic value in addition to the community type name species. *Hyparrhenia dregeana, Isoglossa somalensis* and *Eleusine jaegeri* are the common herbs in ground layer.

Fig. 21. A white flowered *Rorippa palustris* (L.) Bess. (Brassicaceae)- Locally rare species

C5. *Olea welwitschii-Juniperus procera* Community Type

Maximum plots (ca.50) were associated with this community type. It was identified at altitude ranging between 2402 and 2708 m a.s.l. and mean altitude 2549.26 m a.s.l. (Table 10). In addition to the characteristic type name species, *Olea europaea* subsp. *cuspidata*, *Podocarpus falcatus*, *Olinia rochetiana*, *Osyris quadripartita* and *Maytenus gracilipes* were dominant species with greater than one synoptic cover/abundance value (Table 9).

C6. *Juniperus procera-Olinia rochetiana* Community Type

Juniperus procera and *Olinia rochetiana* were the indicator species of this community type. *Pittosporum viridiflorum, Podocarpus falcatus, Allophylus abyssinicus* and *Hagenia abyssinica* were tree species with more than one synoptic cover/abundance value (Table 9). *Senecio ragazzii, Pteridium aquilinium, Plantago lanceolata* and *Phaulopsis imbricata* were common herb layer species.

4.1.3. Diversity, richness and equitability of plants from the study area

4.1.3.1. Taxonomic diversity

A total of 415 plant species belonging to 312 genera and 104 families were documented from the study area (Table 11, Appendix 2). Asteraceae (42 genera (13.46%), 68 species (16.38 %)) and Fabaceae (21 genera (6.73%), 26 species (6.26%)) were the families with more number of genera and species followed by Lamiaceae and Poaceae with 19 genera each (6.08%) and 26 species (6.26%) and 24 species (5.78%) respectively (Table 11).

Table 11. Families with more than five genera with their respective number of species in the study area

N0.	Family (N=105)	Number (%) of genera (N=312)	Number (%) of species (N=415)
1	Asteraceae	42 (13.46)	68 (16.38)
2	Fabaceae	21 (6.73)	26 (6.26)
3	Lamiaceae	19 (6.08)	26 (6.26)
4	Poaceae	19 (6.08)	24 (5.78)
5	Rubiaceae	11 (5.52)	12 (2.89)
6	Acanthaceae	9 (2.88)	14 (3.37)
7	Apiaceae	7 (2.24)	7 (1.68)
8	Euphorbiaceae	7 (2.24)	11 (2.65)
9	Cucurbitaceae	6 (1.92)	6 (1.44)
10	Solanaceae	6 (1.92)	10 (2.40)

Herbs (ca.237, 57.1%) were dominant followed by shrubs (ca. 94, 22.65%), trees (ca. 74, 17.83%) and others (Fig. 22). Common names/local names/vernacular was documented for 282 plant species (67.95%) of the total plants identified from the study area (Appendix 2).

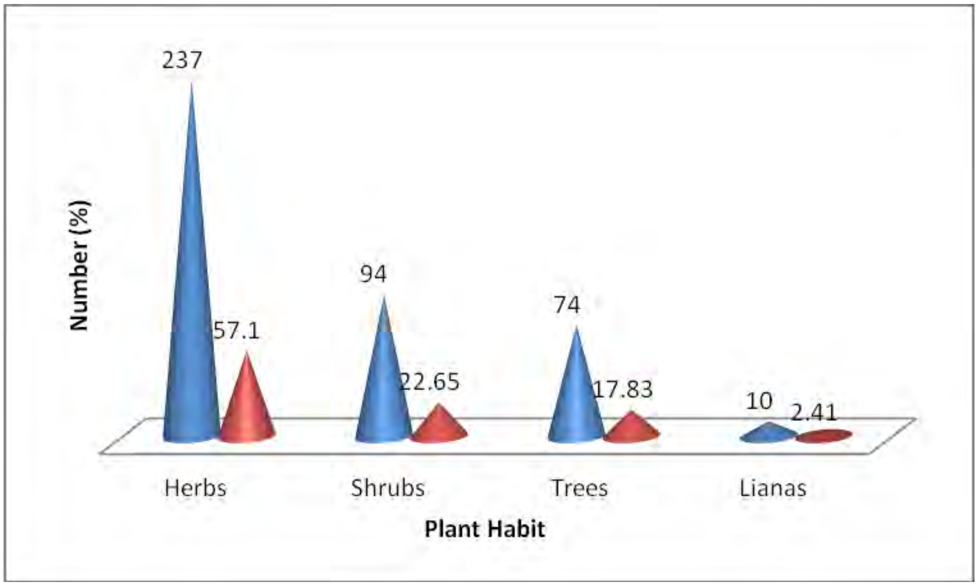


Fig 22. Number and proportion of habits of plants in the study area

4.1.3.2. Species richness, evenness and Shannon-Weiner diversity indices of plant community types

Jibat Fores

The highest species richness and maximum diversity was observed in *Vernonia auriculifera-Croton macrostachyus* type (Table 12). *Arundinaria alpina-Discopodium penninervium* community type was with the least species richness and diversity. The evenness was more or less similar for each community except that the maximum evenness was observed in *Dombeya torrida-Maesa lanceolata* community type and in *Myrsine melanophloeos-Ilex mitis* community type (Table 12).

Table 12. Species richness, evenness and Shannon-Weiner diversity index of plant community types Jibat Forest

Plant communities	Species Richness (S)	Shannon Diversity index (H')	Shannon Evenness (J)
***Myrsine melanophloeos-Ilex mitis* type**	155.00	3.74	0.74
***Arundinaria alpina-Discopodium penninervium* type**	50.00	2.91	0.75
***Ilex mitis-Olinia rochetiana* type**	120.00	3.57	0.75
***Dombeya torrida-Maesa lanceolata* type**	98.00	3.76	0.82
***Vernonia auriculifera-Croton macrostachyus* type**	237.00	4.29	0.78
Croton macrostachyus-Olea welwitschii type	158.00	3.95	0.78
***Teclea nobilis-Rhus vulgaris* type**	128.00	3.77	0.78

The highest value of medicinal species richness (122) was recorded for *Croton macrostachyus-Olea welwitschii* community type. High Shannon's diversity (2.77) was recorded for *Ilex mitis-Olinia rochetiana* community type whereas; highest medicinal species evenness (0.87) was recorded for *Arundinaria alpina-Discopodium penninervium* community type in Jibat Forest (Table 13).

Table 13. Species richness, evenness and Shannon-Weiner diversity index of medicinal plants in the plant communities of Jibat Forest

Plant communities	Species Richness (S)	Shannon Diversity index (H')	Shannon Evenness (J)
***Myrsine melanophloeos-Ilex mitis* type**	14	2.25	0.85
***Arundinaria alpina-Discopodium penninervium* type**	14	2.30	0.87
***Ilex mitis-Olinia rochetiana* type**	33	2.77	0.79
***Dombeya torrid-Maesa lanceolata* type**	39	2.43	0.66
***Vernonia auriculifera-Croton macrostachyus* type**	68	2.06	0.49
Croton macrostachyus-Olea welwitschii type	122	1.43	0.30
***Teclea nobilis-Rhus vulgaris* type**	117	1.32	0.26

Gedo Forest

The maximum and minimum species richness was observed in *Teclea nobilis* - *Rhus vulgaris* and *Rhus glutinosa* subsp. *glutinosa* - *Osyris quadripartita* community types respectively. The diversity and evenness of the communities is more or less similar with slight variation (Table 14).

Table 14. Species richness, evenness and Shannon-Weiner diversity index of plant community types in Gedo Forest

Plant communities	Species Richness (S)	Shannon Diversity index (H')	Shannon Evenness (J)
***Rhus glutinosa* subsp. *glutinosa-Osyris quadripartita* type**	150	4.38	0.87
***Olinia rochetiana-Maytenus arbutifolia* type**	167	4.21	0.82
***Olea welwitschii-Olinia rochetiana* type**	161	4.04	0.80
***Syzygium guineense-Chionanthus mildbraedii* type**	201	4.34	0.82
***Teclea nobilis-Rhus vulgaris* type**	221	4.29	0.79

The highest value of medicinal species richness (109), medicinal species diversity (Shannon's diversity) (4.28) and medicinal species evenness (0.91) were recorded for *Olea welwitschii* - *Olinia rochetiana* type in Gedo Forest (Table 15).

Table 15. Species richness, evenness and Shannon-Weiner diversity index of medicinal plants in the plant communities of Gedo Forest

Plant communities	Species Richness (S)	Shannon Diversity index (H')	Shannon Evenness (J)
***Rhus glutinosa* subsp. *glutinosa-Osyris quadripartita* type**	75	3.71	0.86
***Olinia rochetiana-Maytenus arbutifolia* type**	78	3.37	0.77
***Olea welwitschii-Olinia rochetiana* type**	109	4.28	0.91
***Syzygium guineense -Chionanthus mildbraedii* type**	48	3.20	0.83
***Teclea nobilis-Rhus vulgaris* type**	34	2.92	0.83

Chilimo Forest

The maximum and minimum species diversity was observed in *Olea welwitschii-Juniperus procera* and *Podocarpus falcatus-Olea welwitschii* community types respectively. The maximum diversity and evenness was observed in *Juniperus procera-Olinia rochetiana* community type and the minimum diversity and evenness was seen in *Juniperus procera-Podocarpus falcatus* community type (Table 16).

Table 16. Species richness, evenness and Shannon-Weiner diversity index of plant community types in Chilimo Forest

Plant communities	Species Richness (S)	Shannon Diversity index (H')	Shannon Evenness (J)
Juniperus procera-Podocarpus falcatus type	134	3.38	0.68
Juniperus procera-Podocarpus falcatus- Olinia rochetiana type	137	3.49	0.71
Juniperus procera-Olea europaea subsp. *cuspidata* type	148	3.48	0.70
Podocarpus falcatus-Olea welwitschii type	120	3.46	0.72
Olea welwitschii-Juniperus procera type	170	3.47	0.69
Juniperus procera-Olinia rochetiana type	126	3.94	0.81

The highest value of medicinal species richness (102) was recoded for *Juniperus procera-Podocarpus falcatus* community type. Medicinal species diversity (Shannon's diversity) (3.48) and medicinal species evenness (0.86) were both highest for *Juniperus procera-Podocarpus falcatus-Olinia rochetiana* community type (Table 17).

Table 17. Species richness, evenness and Shannon-Weiner diversity index of medicinal plants in the plant communities of Chilimo Forest

Plant communities	**Species Richness (S)**	**Shannon Diversity index (H')**	**Shannon Evenness (J)**
***Juniperus procera-Podocarpus falcatus* type**	102	2.86	0.62
***Juniperus procera-Podocarpus falcatus- Olinia rochetiana* type**	58	3.48	0.86
***Juniperus procera-Olea europaea* subsp. *cuspidata* type**	92	3.03	0.67
***Podocarpus falcatus-Olea welwitschii* type**	73	3.32	0.77
***Olea welwitschii-Juniperus procera* type**	66	3.08	0.73
***Juniperus procera-Olinia rochetiana* type**	53	3.07	0.77

4.1.4. Species endemicity in the study area

A total of 43 (10.36%) endemic plants to Ethiopia were recorded (Appendix 10). The highest number of endemic plants were documented from Jibat Forest (ca. 40, 9.63%) followed by Gedo and Chilimo Forests (ca. 32, 7.71% each) of total plants documented from the entire study area. Furthermore, IUCN category analysis showed that *Kniphofia hildebrandtii* is critically endangered (CR); five species (11.62%) were endangered (EN); three (6.97%) were vulnerable (UV); 11 species (25.58%) were near threatened (NT); 51.48% (23 species) were under least concern (LC) (appendix 10).

4.2. Medicinal Plants

4.2.1. Ethnomedicinal plants

4.2.1.1. Taxonomic diversity of the ethnomedicinal plants reported

A total of 172 medicinal plant species belonging to 155 genera and 73 botanical families (consisting of 72 angiosperms and 1 gymnosperm) were reported to be used for treating human ailments in the study area (Appendix 2). One hundred sixty one species (belonging to 146 genera and 70 families) were reported from Jibat District whereas, 157 species (belonging to 146 genera and 68 families) and 156 species (belonging to 144 genera and 70 families) were reported from Chelia and Dendi districts respectively (Appendix 2). The family Asteraceae was represented by the highest number of species (15 species, 8.72%) followed by Lamiaceae (14, 8.13%), Fabaceae (11, 6.39%), Solanaceae (7 species, 4.06%), Cucurbitaceae (6 species, 3.48%) and Euphorbiaceae (5 species, 2.9%). The order of importance of these families in medicinal plants reperentation was more or less similar in the three districts except that Lamiaceae was the most represented in Chelia District (13 species, 8.28%) followed by Asteraceae (12 species, 7.64%) (Table 14). Rubiaceae, Myrisinacea, Ranunculaceae, Boraginaceae and Rosaceae were represented by 4 species (2.32%) each. Eight of the reported families i.e., Amaranthaceae, Brassicaceae, Celasteraceae, Moraceae, Myrtaceae, Oleaceae, Rutaceae and Urticaceae were represented by three species each (Table 18, Appendix 2), whereas families Acanthaceae, Alliaceae, Apocynaceae, Asclepiadaceae, Crassulaceae, Loganiaceae, Loranthaceae, Malvaceae, Musaceae, Poaceae, Polygonaceae, Rhamnacaeae, Sapindaceae, Scrophulariaceae and Vitaceae were represented by 2 species each. Each of the remaining 39 families had single species representation. Thus, 46.57% of families were represented by more than one medicinal plant species.

Table 18. Families with three or more human medicinal plant species used for human ailments in Jibat, Chelia and Dendi districts

Family	Jibat District		Chelia District		Dendi District		The three districts combined	
	Number species (N=161)	**% species**	**Number species (N=157)**	**% species**	**Number species (N=156)**	**% species**	**Number species (N=172)**	**% species**
Asteraceae	13	8.07	12	7.64	14	8.97	15	8.72
Lamiaceae	12	7.45	13	8.28	13	8.33	14	8.13
Fabaceae	10	6.21	10	6.36	10	6.41	11	6.39
Solanaceae	7	4.34	7	4.45	6	3.84	7	4.06
Cucurbitaceae	6	3.72	6	3.82	6	3.84	6	3.48
Euphorbiaceae	5	3.10	5	3.18	5	3.20	5	2.90
Myrisinacea	4	2.48	4	2.54	3	1.92	4	2.32
Ranunculaceae	4	2.48	4	2.54	4	2.56	4	2.32
Rubiacae	4	2.48	4	2.54	4	2.56	4	2.32
Amaranthaceae	3	1.86	3	1.91	2	1.28	3	1.74
Boraginaceae	3	1.86	3	1.91	3	1.92	4	2.32
Brassicaceae	3	1.86	3	1.91	2	1.28	3	1.74
Celasteraceae	3	1.86	3	1.91	2	1.28	3	1.74
Moraceae	3	1.86	3	1.91	2	1.28	3	1.74
Myrtaceae	3	1.86	3	1.91	3	1.92	3	1.74
Oleacea	3	1.86	3	1.91	2	1.28	3	1.74
Rosaceae	3	1.86	4	2.54	2	1.28	4	2.32
Rutaceae	3	1.86	3	1.91	3	1.92	3	1.74
Urticaceae	3	1.86	3	1.91	3	1.92	3	1.74

Ficus was the most represented genus in the study area reperentesented by three species. *Allium, Asparagus, Brassica, Carduus, Clematis, Echinops, Eucalyptus, Euphorbia, Guizotia, Maytenus, Myrsine, Ocimum, Plectranthus, Rumex, Solanum* were reperented by two specie each and the rest 139 genera were represented by a single species each (Table 19, Appendix 2).

Table 19. Genera of plants with two or more species used to treat human ailments in Jibat, Chelia and Dendi districts

		Districts		
Genus	# of Species	Jibat	Chelia	Dendi
Ficus	3	x	x	x
Allium	2	x		
Asparagus	2	x	x	x
Brassica	2	x	x	
Carduus	2	x	x	
Clematis	2	x	x	x
Echinops	2		x	x
Eucalyptus	2	x	x	x
Euphorbia	2	x	x	x
Guizotia	2	x	x	x
Maytenus	2	x		
Myrsine	2	x	x	
Ocimum	2	x		X
Plectranthus	2		x	X
Rumex	2	x	x	X
Solanum	2	x	x	

The habits of medicinal plants indicated that herbs (78 species; 45.34%) were more than trees (50; 29.07%) or shrubs (43; 29.07%). Herbs were dominant followed by trees, shrubs and lianas in the districts (Fig. 23). About 9.3% (16 species) of medicinal plants of the study area are found endemic to Ethiopia (Appendix 6).

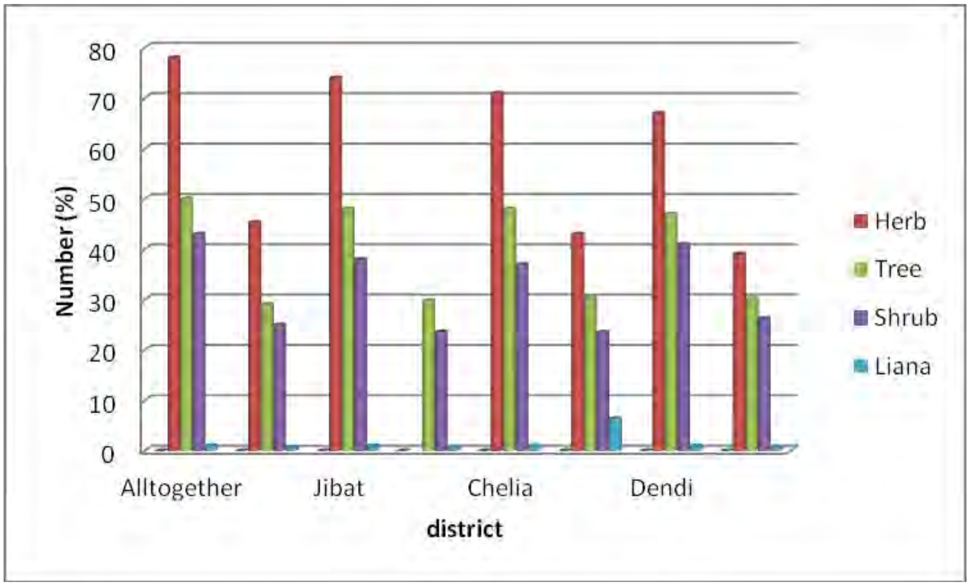


Fig. 23. Habits of medicinal plants used to treat human ailments in Jibat, Chelia and Dendi districts

4.2.1.2 Indigenous knowledge of the communities and different informant groups

Although more number of medicinal plants were reported by females than those reported by male in all the study areas except in Jibat District where males (5.45±1.73) reported more number of medicinal plants than females (5.41±1.41). However, the difference was not significant ($P > 0.05$) when the average number of medicinal plants reported by each group was compared in each study district and the three districts combined together. Similarly, eventhough unmarried (Single/divorced/widowed) ones reported more average number of medicinal plants in Jibat and Chelia districts unlike in case of Dendi District and the three districts combined together where married couples reported more average number of medicinal plants, though there was no siginificant difference ($P > 0.05$). However, there was a significant difference ($P < 0.05$) in the average number of medicinal plants reported by senior members of the community (45–89 years old) and young to middle aged members (26–44 years old); key informants and general informants, illiterate and literate informants (Table 20). More number of medicinal plants was reported by elderly ($\geq$ 45 years old) and key informants than young and general informants. There was significant difference ($P < 0.05$) observed in the average number of medicinal plants listed by informants living around ($\leq$ 6 km) health centre and those living relatively far away (>6 km) from the health centre.The latter reported more average number of medicinal plants than the former (Table 20).

Table 20.Statistical test of significance, t-test, on average number of reported medicinal plants used for human ailments among different Informant groups in the study area. *Significant difference ($p < 0.05$); ** t (0.05) (two tailed), df = 219, 288,325 and 836 (for Jibat, Chelia, Dendi and the three districts combined respectively), N = number of respondents.

District	Parameter	Informant group	N	Average±SD	t-value**	P-value
Jibat	Gender	Male	146	5.45±1.73	0.18	0.858
		Female	75	5.41±1.41		
	Age	Young members	80	3.74±1.69	6.45	0.001*
		Senior members	141	5.27±1.71		
	Literacy level	Illiterate	143	5.48±1.79	-7.91	0.002*
		Literate	78	3.79±1.34		
	Distance from health centre	Near to health centre (≤ 6 km)	96	4.60 ±1.28	6.39	0.011*
		Far from health centre (>6 km)	125	5.77 ±1.42		
	Experience (Informant Category)	Key/Knowledgeable	15	5.72±1.52	-4.54	0.012*
		General	206	7.73±1.67		
	Marital status	Married (Couples living together)	178	5.24±1.15	1.68	0.099
		Unmarried (Single/divorced/widowed)	43	4.79±1.64		
Chelia	Gender	Male	192	5.01±1.48	-0.05	0.959
		Female	98	5.02±1.63		
	Age	Young members	105	4.05±1.46	-6.53	0.023*
		Senior members	185	5.25±1.6		
	Literacy level	Illiterate	174	5.45 ±1.77	8.31	0.003*
		Literate	116	3.92±1.36		
	Distance from health centre	Near to health centre (≤ 6 km)	108	5.40 ± 1.86	-2.51	0.013*
		Far from health centre (>6 km)	182	5.92± 1.40		
	Experience (Informant Category)	Key/Knowledgeable	20	5.72 ±1.64	-5.20	0.014*
		General	270	7.65 ±1.60		
	Marital status	Married (Couples living together)	215	4.91 ± 1.23	-0.34	0.738
		Unmarried (Single/divorced/widowed)	75	4.97±1.55		
Dendi	Gender	Male	206	5.54± 1.68	-0.40	0.687
		Female	121	5.62 ±1.79		
	Age	Young members	118	3.86±1.60	-8.33	0.001*
		Senior members	209	5.43±1.70		
	Literacy level	Illiterate	198	5.59± 1.77	9.27	0.012*
		Literate	129	3.96±1.39		
	Distance from health centre	Near to health centre (≤ 6 km)	123	4.85±1.46	-3.02	0.003*

		Far from health centre (>6 km)	204	5.38 ±1.64		
	Experience (Informant Category)	Key/Knowledgeable	22	7.64± 1.59	5.77	0.021*
		General	305	5.60 ±1.70		
	Marital status	Married (Couples living together)	254	5.59 ±1.96	1.13	0.760
		Unmarried (Single/divorced/widowed)	73	5.31±1.40		
The three districts combined	Gender	Male	544	5.29±1.79	-1.74	0.083
		Female	294	5.52±1.84		
	Age	Young members	303	3.9±1.59	-17.66	0.004*
		Senior members	535	5.9±1.55		
	Literacy level	Illiterate	515	5.93±1.62	-18.12	0.001*
		Literate	323	4.02±1.39		
	Distance from health centre	Near to health centre (≤ 6 km)	208	5.13±1.82	-4.93	0.012*
		Far from health centre (>6 km)	630	5.83±1.61		
	Experience (Informant Category)	Key/Knowledgeable	57	7.39±1.57	9.25	0.022*
		General	781	5.38±1.8		
	Marital status	Married (Couples living together)	647	5.36±1.8	-0.46	0.642
		Unmarried (Single/divorced/widowed)	191	5.43±1.86		

4.2.1.3. Ailments treated and ethnomedicinal plant parts used

A total of 86 disease types were reported in the study area for which traditional healers were visited at least once that were grouped under 13 major disease categories (Appendix 6). The major categories include gastrointestinal, pharengeal and parasitic (GIPP), dermatological and subcutaneous tissues (DST), genitourinary, reproductive and venereal (GRSTD), musculoskeletal-connective tissues, nervous system, dental and sensorial (MCNDS), respiratory, cardiovascular, circulatory and lymphatic (CCL), wound, endocrine, nutritional and metabolic diseases (ENM), external injuries, bleeding and animal bite (EIBAB), spiritual, malaria , febrile and 'michi' (FM) and miscellaneous. Amoebiasis, constipation and diarrhoea were the most commonly reported health problems under the GIPP, whereas atopic eczema and dandruff were most frequently reported under the DST disease group. Other commonly treated ailments include wound, rabies and malaria (Appendix 6).

The pattern of plant parts use in remedy preparation was similar in all the three districts. Although different plant parts were used for remedy preparation, the majority (138 citation, 36.6%) of preparations were from leaves followed by roots (75 citation, 19.98%), seeds (39 citation, 10.34%), barks (35 citation, 9.28) and shoots (18 citation, 4.77%) (Table 21, Fig. 24).

Fig. 24. Herbal remedies prepared from leaves and roots

Table 21. Plant parts used in remedy preparation of medicinal plants used for human ailments in the Jibat, Chelia and Dendi districts

Plant Part Used	**Jibat District**		**Chelia District**		**Dendi District**		**The three districts combined**	
	Citation	**%**	**Citation**	**%**	**Citation**	**%**	**Citation**	**%**
Leaves	127	35.57	126	35.89	130	37.57	138	36.60
Roots	72	20.16	69	19.65	70	20.23	75	19.98
Seeds	39	10.92	39	11.11	34	9.82	39	10.34
Barks	31	8.68	34	9.68	29	8.38	35	9.28
Shoots	16	4.48	15	4.27	14	4.04	18	4.77
Latex	11	3.08	11	3.13	11	3.17	11	2.91
Bulbs	10	2.80	8	2.27	8	2.31	10	2.65
Rhizomes	9	2.52	9	2.56	9	2.60	9	2.38
Stems	8	2.24	6	1.70	8	2.31	8	2.12
Tubers	6	1.68	6	1.70	6	1.73	6	1.59
Inflorescence	6	1.68	6	1.70	5	1.44	6	1.59
Whole plant	6	1.68	6	1.70	6	1.73	6	1.59
Fruits	5	1.40	6	1.70	6	1.73	6	1.59
Sap	4	1.10	4	1.13	4	1.15	4	1.06
Others	7	1.96	6	1.70	6	1.73	6	1.59

Freshly harvested plant parts were the dominant ones (66.48%) used in remedy preparation whereas dried parts were used next (25.06%); the remaining 8.44% of remedies were reported to be prepared both from dried and fresh parts of medicinal plant species. The pattern of condition of plant parts used in remedy preparation was more or less proportional in the the districts (Fig. 25, 33).

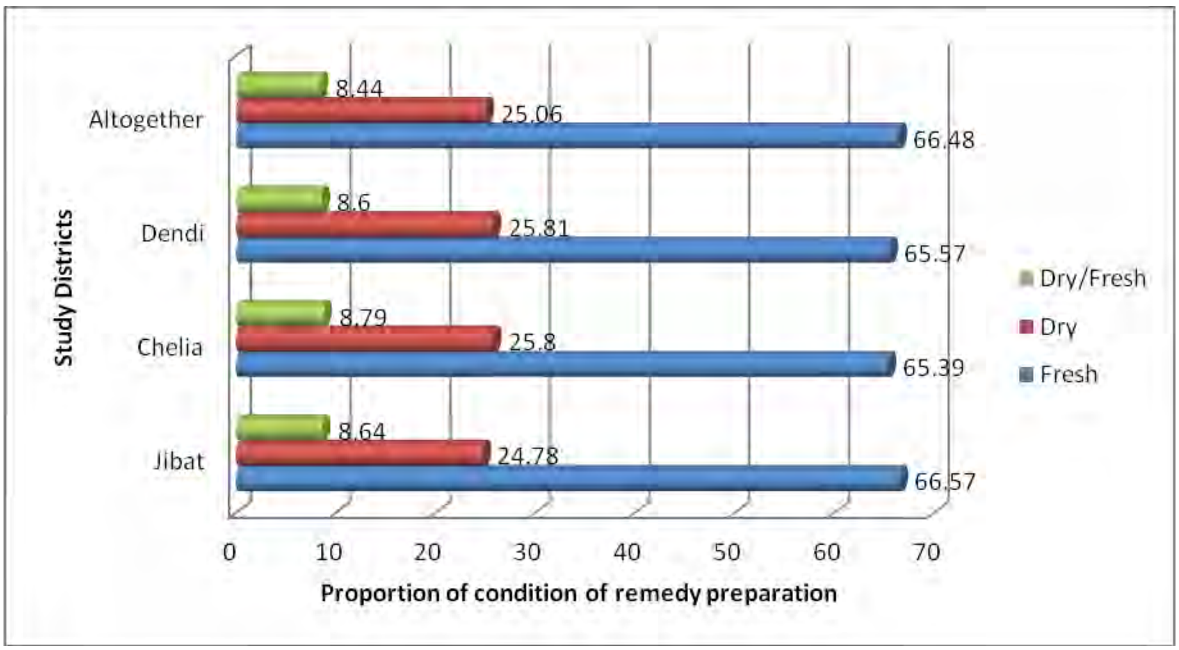


Fig. 25. Condition of remedy preparation of medicinal plants used to treat human ailments in Jibat, Chelia and Dendi districts

4.2.1.4. Modes of remedy preparation and application

Traditional healers in the study area reported that they follow various ways of remedy preparation and this depends, according to their explanations, on the type of ailment. The major modes of remedy preparation were decoction (13.88%); concoction (13.35%) and grinding, pasting the crushed part and tie (9.53%) (Table22).

Table 22. Method of remedy preparation and application of medicinal plants used for human ailments in Jibat, Chelia and Dendi districts

No	Method of remedy preparation and application	Jibat District		Chelia District		Dendi District		Overall	
		Citation	%	Citation	%	Citation	%	Citation	%
1	Boil and drink the decoction upon cooling;	111	31.98	109	31.96	104	30.86	117	13.88
2	Extract the part and pour or paint it;	11	3.17	10	2.93	12	3.56	13	3.54
3	Add chopped plant part(s) to bath water and do bath;	5	1.44	5	1.46	5	1.48	5	1.36
4	Crush and steep plant part in cold water and drink the infusion;	16	4.61	16	4.69	17	5.04	18	4.90
5	Drink as herbal tea;	14	4.03	14	4.10	14	4.15	15	4.08
6	Paint/rub/paste the latex/sap/flesh/juice directly;	18	5.18	19	5.57	19	5.63	19	5.17
7	Eat the plant part (raw/cooked);	5	1.44	4	1.17	5	1.48	5	1.36
8	Hold/chew with teeth;	24	6.91	24	7.03	20	5.93	25	6.81
9	Crush, heat/burn or boil the part and inhale its smoke or steam;	17	4.89	18	5.27	17	5.04	19	5.17
10	Drink the concoction;	48	13.83	46	13.48	48	14.24	49	13.35
11	Pound/squeeze/smash/roast the part and sniff/heat;	20	5.76	19	5.57	18	5.34	20	5.44
12	Grind and paint the powder or crushed part;	24	6.91	26	7.62	26	7.71	27	7.35
13	Grind, paste the crushed part and tie	34	9.79	31	9.09	32	9.49	35	9.53
	Total	347	100.00	341	100.00	337	100.00	367	100.00

4.2.1.5. Routes of remedy administration, dosages and antidotes

Medicinal plant preparations were administered through different routes. Oral application (220 preparations, 59.94%) was the best represented and most commonly used route of administration followed by topical or dermal application (95 preparations, 25.88%) (Table 23).

Most medicinal plants prescribed and given to patients are applied without any standardized doses. However, approximate dosages (although no fixed standards) were reported to be determined based on age, sex and physical appearance of patients visiting local healers. Some medicinal plant preparations were mentioned to be measured in small cups locally called shinii buna (Afan Oromo) referring to traditional cups used for drinking coffee or plastic jugs, while others were measured as handful, spoonful or size of a finger.

Table 23. Route of remedy application of medicinal plants used to treat human ailments in the Jibat, Chelia and Dendi districts

Route of remedy application	**Jibat District**		**Chelia District**		**Dendi District**		**The three districts combined**	
	Citation	**%**	**Citation**	**%**	**Citation**	**%**	**Citation**	**%**
Oral	210	60.51	205	60.11	198	58.75	220	59.94
Dermal	92	26.51	93	27.27	87	25.81	95	25.88
Nasal	24	6.91	22	6.45	23	6.82	26	7.08
Anal	13	3.74	14	4.10	11	3.26	16	4.35
Auricular	5	1.44	4	1.17	6	1.78	7	1.90
Optical	3	0.86	3	0.87	2	0.59	3	0.81
Total	347	100.00	341	100.00	337	100.00	367	100.00

The majority of herbal remedy preparations were without additives (232 citations, 61.7%). Salt (11.17%), honey (6.26%), butter (5.17%), sugar (3.54%), milk (2.45%), soap (0.81%) and other herbs (7.62%), were commonly reported additives in herbal remedy preparations. Milk, the shoot of *Gnidia glauca* and the bark of *Schefflera abysinica* were the commonly reported antidotes with herbal remedy preparations with adeverse side effects such as minor toxicity, vomiting or diarrhea (Table 24).

Table 24. Additives to herbal remedies of medicinal plants used for human ailments in the Jibat, Chelia and Dendi districts

	Jibat District		**Chelia District**		**Dendi District**		**The three districts combined**	
Additive	**Citation**	**%**	**Citation**	**%**	**Citation**	**%**	**Citation**	**%**
Salt	38	10.88	36	10.43	35	14.52	41	11.17
Other herbs	24	6.87	27	7.82	29	12.03	28	7.62
Honey	18	5.15	16	4.63	17	7.05	23	6.26
Butter	14	4.01	15	4.34	14	5.80	19	5.17
Sugar	9	2.57	8	2.31	9	3.73	13	3.54
Milk	4	1.14	6	1.73	5	2.07	9	2.45
Soap	2	5.43	3	0.86	2	0.82	3	0.81
Others	7	2.00	6	1.73	4	1.65	8	2.17
Total	349	100.00	345	100.00	241	100.00	376	100.00

4.2.1.6. Consensus on efficacy and relative healing potential of ethnomedicinal plants

About thriteen disease categories were identified from the total of 86 various human ailments reported in the study area. Amongst these, the categories with the highest informant consensus factor (ICF) values were gastrointestinal, pharyngeal and parasitic (GIPP) (0.70 for Dendi, 0.67 for Chelia and 0.69 for Jibat District) followed by respiratory (0.64 for Chelia) and dermatological and subcutaneous tissues (DST) (0.64 and 0.63 for Jibat and Dendi respectively) and the rest comeup with lower ICF values (Table 28). Highest plant use citation was found for GIPP (21.36% for Dendi, 21.11% for Chelia and 20.17% for Jibat) followed by DST (12.46% for Dendi, 12.60 for Chelia and 12.39% for Jibat) (Table 25).

Highest fidelity level (FL) (95%) was recorded for *Hagenia* abyssinica, followed by *Achyranthes aspera, Brucea antidysernterica, Jasminium abyssinicum, Zehneria scabra, Zingiber officinale, Cyphostemma cyphopetalum, Ehertia cymosa* and *Olinia rochetiana* (94% each) in Jibat District. *Zingiber officinale* and *Jasminium abyssinicum* were reported to have highest FL value in Chelia District (95% each) followed by *Allium sativum* (94 %). In Dendi District, *Zingiber officinale, Bothriocline schimperi, Zehneria scabra, Clerodendrum myricoides, Ocimum lamiifolium, Acokanthera schimperi* with FL 95% each, were with the highest FL followed by *Hagenia abyssinica, Rumex nervosus, Arceuthobium juniperi-procerae, Ilex mitis, Croton macrostachyus* and *Ficus sur* (94 % each) (Appendix 7).

Table 25. Informant consensus factor of medicinal plants used for human ailments in Jibat, Chelia and Dendi districts

Key: **GIPP** =Gastrointestinal, Pharyngeal and Parasitic; **DST** =Dermatological and subcutaneous tissues; **GRSTD** =Genitourinary, Reproductive and venereal; **MCNDS** =Musculoskeletal-Connective tissues, nervous system, dental and sensorial; **CCL** =Cardiovascular, Circulatory and lymphatic; **ENM** =Endocrine, nutritional and metabolic diseases; **EIBAB**= External injuries, bleeding and animal bite; **FM**= Febrile and 'Michi'

S. No.	Disease Category	Jibat District					Chelia District					Dendi District				
		Species	%	Use Citation	%	ICF	Species	%	Use Citation	%	ICF	Species	%	Use Citation	%	ICF
1	GIPP	22	13.17	70	20.17	0.69	24	14.37	72	21.11	0.67	22	20.73	72	21.36	0.70
2	DST	16	9.58	43	12.39	0.64	17	10.17	43	12.60	0.61	16	12.80	42	12.46	0.63
3	GRSTD	21	12.57	48	13.83	0.57	21	12.57	41	11.35	0.50	20	10.97	42	12.46	0.53
4	MCNDS	14	8.38	28	8.06	0.51	15	8.98	30	8.79	0.51	16	7.92	26	7.71	0.40
5	Respiratory	20	11.97	32	9.22	0.38	12	7.18	32	9.38	0.64	13	7.92	32	9.49	0.61
6	CCL	12	7.18	22	6.34	0.47	12	7.18	24	7.03	0.52	15	7.92	24	7.12	0.39
7	Wound	12	7.18	24	6.91	0.52	15	8.98	22	6.45	0.33	15	9.14	25	7.41	0.41
8	ENM	6	3.59	9	2.59	0.37	7	4.19	11	3.22	0.40	7	2.43	11	3.26	0.40
9	EIBAB	18	10.77	31	8.93	0.43	16	9.58	28	8.21	0.44	12	7.31	25	7.41	0.54
10	Spiritual	6	3.59	10	2.88	0.44	6	3.59	10	2.93	0.44	8	3.04	10	2.96	0.22
11	Malaria	6	3.59	8	2.30	0.28	6	3.59	7	2.05	0.16	7	2.43	9	2.67	0.25
12	FM	5	2.99	7	2.01	0.33	9	5.38	12	2.05	0.27	5	3.04	7	2.07	0.33
13	Miscellaneous	9	5.38	15	4.32	0.42	7	4.19	14	4.10	0.53	8	4.26	12	3.56	0.36
		167		347			167		346			164		337		

4.2.2. Ethnoveterinary medicinal plants

4.2.2.1 Taxonomic diversity of ethnoveterinary medicinal plants used in the study area

A total of 169 medicinal uses corresponding to 97 plant species (93 species from Jibat District, 88 from Chelia District and 90 from Dendi District) with veterinary importance belonging to 94 genera and 56 botanical families (55 from Jibat, 50 from Chelia and 53 from Dendi districts) were gathered and documented in this research. About 90.73% of the plants were collected from the wild and only few (9.27%) were cultivated mainly for purposes other than medicinal (Appendix 8).

The majority of the ethnoveterinary medicinal plants documented from the study area were herbs (40.20%) followed by trees (31, 31.98%) and shrubs (23, 23.71%) (Fig. 26).

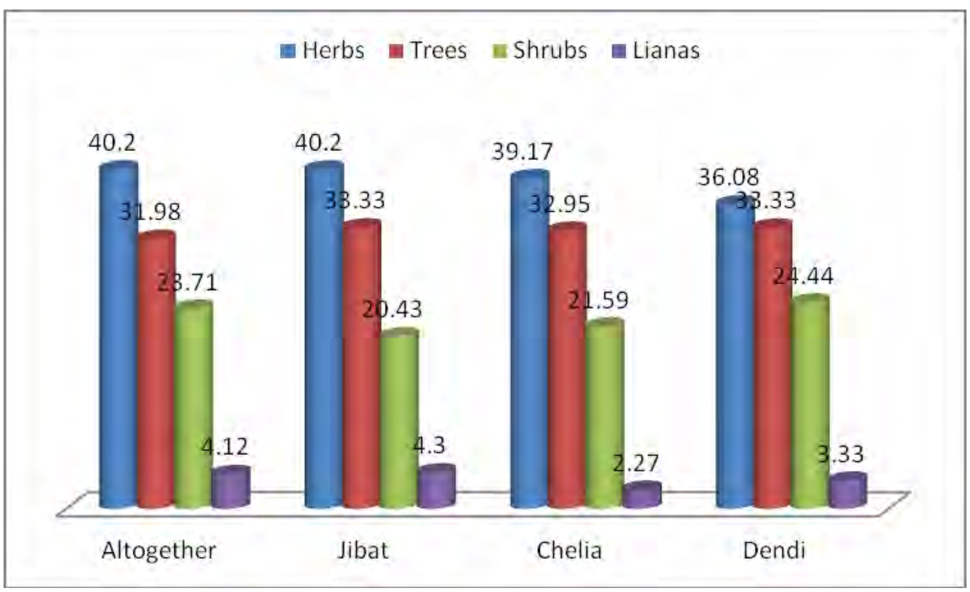


Fig. 26. Growth habit of the ethnoveterinary medicinal plants documented from Jibat, Chelia and Dendi districts

Table 26. The most commonly used plant families with two or more species used in ethnoveterinary medicine in the study area

The three combined			**Jibat District**			**Chelia District**			**Dendi District**		
Family	Species	%	Family	Species	%	Family	Species	%	Family	Species	%
Asteraceae	6	6.18	Asteraceae	6	6.45	Asteraceae	6	6.89	Asteraceae	6	6.74
Lamiaceae	6	6.18	Euphorbiaceae	5	5.37	Lamiaceae	5	5.74	Lamiaceae	6	6.74
Euphorbiaceae	5	5.15	Lamiaceae	5	5.37	Solanaceae	5	5.74	Euphorbiaceae	4	4.49
Solanaceae	5	5.15	Solanaceae	5	5.37	Euphorbiaceae	4	4.59	Fabaceae	4	4.49
Fabaceae	4	4.12	Fabaceae	4	4.30	Fabaceae	4	4.59	Solanaceae	4	4.49
Ranunculaceae	4	4.12	Ranunculaceae	4	4.30	Ranunculaceae	4	4.59	Acanthaceae	3	3.37
Acanthaceae	3	3.09	Acanthaceae	3	3.22	Rubiaceae	4	4.59	Cucurbitaceae	3	3.37
Cucurbitaceae	3	3.09	Cucurbitaceae	3	3.22	Acanthaceae	3	3.44	Myrisinaceae	3	3.37
Myrisinaceae	3	3.09	Myrisinaceae	3	3.22	Cucurbitaceae	3	3.44	Ranunculaceae	3	3.37
Rubiaceae	3	3.09	Rubiaceae	3	3.22	Myrisinaceae	3	3.44	Rubiaceae	3	3.37
Apocynaceae	2	2.06	Araliaceae	2	2.15	Boraginaceae	2	2.29	Apocynaceae	2	2.24
Araliaceae	2	2.06	Boraginaceae	2	2.15	Oleaceae	2	2.29	Boraginaceae	2	2.24
Boraginaceae	2	2.06	Oleaceae	2	2.15	Rhamnaceae	2	2.29	Oleacea	2	2.24
Guttiferae	2	2.06	Rhamnaceae	2	2.15	Rosaceae	2	2.29	Rhamnaceae	2	2.24
Oleaceae	2	2.06	Rosaceae	2	2.15	Sapindaceae	2	2.29	Rosaceae	2	2.24
Rhamnaceae	2	2.06	Sapindaceae	2	2.15	Scrophulariaceae	2	2.29	Sapindaceae	2	2.24
Rosaceae	2	2.06	Scrophulariaceae	2	2.15				Scrophulaceae	2	2.24
Sapindaceae	2	2.06									
Scrophulariaceae	2	2.06									

The Asteraceae and Lamiaceae families were the most commonly used and species-rich families (6 species, 6.18% each) in this study followed by Euphorbiaceae and Solanaceae represented by (5 species, 5.15% each) and Fabaceae and Ranunculaceae (4 species, 4.12% each). Cucurbitaceae, Myrisinaceae and Rubiaceae were reprenented by three species each (3.09%) whereas, nine families Apocynaceae, Araliaceae, Boraginaceae, Guttiferae, Oleacea, Rhamnaceae, Rosaceae, Sapindaceae and Scrophulariaceae were represented by two species each (2.06%) (Table 26).

4.2.2.2 Ethnoveterinary medicinal plants knowledge of the communities and animals treated

Analysis of ethnoveterinary medicinal plant knowledge of the communities in the study area (Jibat, Chelia and Dendi districts combined togethret) revealed that, although more number of ethnoveterinary medicinal plants were reported by female informants (5.78 ± 2.00) (Mean ± SD) than those reported by male informants (5.60 ± 1.93) (Mean ± SD), the difference was not significant ($P > 0.05$) when the average number of medicinal plants reported by each group was compared. However, there was a significant difference ($P < 0.05$) in the number of ethnoveterinary medicinal plants reported by senior members of the community (≥45 years old) and the young to middle aged members (26–44 years old); key informants and general informants, illiterate and literate informants (Table 24). More number of medicinal plants were reported by elderly (≥ 45 years old) (5.93 ± 1.94) and key informants (5.70 ± 3.17) (Mean ± SD) than young people (4.23 ± 1.93) (Mean ± SD) and general informants (4.10 ± 1.48) (Mean ± SD). Similarly, there was significant difference ($P > 0.05$) observed in the number of ethnoveterinary medicinal plants listed by informants living around (≤ 6 km) health centreand those living relatively far away (>6 km) from the health centre.

Furthermore, the analysis showed that though different average numbers of ethnoveterinary medicinal plants were reported by different informant groups in the three studied districts (Jibat, Chelia and Dendi), the statistical test of significance results were similar to the resuts of the three districts combined/pooled together (Table 27).

Table 27. Statistical test of significance, t-test, on average number of reported ethnoveterinary medicinal plants among different informant groups in the study area. **Key**: *Significant difference ($p < 0.05$); ** t (0.05) (two tailed), df = 219, 288, 325 and 836 (for Jibat, Chelia, Dendi districts and Overall respectively), N = number of respondents.

District	Parameter	Informant group	N	Average±SD	t-value**	P-value
Jibat	Gender	Male	146	5.88 ± 1.93	0.51	0.612
		Female	75	6.00 ± 1.59		
	Age	Young members	80	4.09 ± 2.14	-6.51	0.000*
		Senior members	141	6.00 ± 2.02		
	Literacy level	Illiterate	143	6.05 ± 2.02	6.69	0.000*
		Literate	78	4.17 ± 1.99		
		Literate	78	4.17 ± 1.99		
	Distance from health centrs	Near to health centre (≤ 6 km)	96	5.27 ± 1.33	-3.90	0.000*
		Far from health centre (>6 km)	125	6.11 ±1.88		
	Experience (Informant Category)	Key/Knowledgeable	15	7.53± 2.53	5.24	0.000*
		General	206	4.07 ± 1.47		
	Marital status	Married (Couples living together)	178	6.08 ±1.68	-0.04	0.968
		Unmarried (Single/divorced/widowed)	43	6.07± 1.20		
Chelia	Gender	Male	192	5.88 ±1.83	0.42	0.673
		Female	98	5.97± 1.78		
	Age	Young members	105	4.10 ± 1.96	-7.69	0.000*
		Senior members	185	5.93 ±1.94		
	Literacy level	Illiterate	174	6.03 ±2.02	8.17	0.000*
		Literate	116	4.17 ± 1.80		
	Distance from health centrs	Near to health centre (≤ 6 km)	108	5.82 ± 1.63	-1.14	0.255
		Far from health centre (>6 km)	182	6.07± 1.92		
	Experience (Informant Category)	Key/Knowledgeable	20	7.85 ±3.41	4.84	0.000*
		General	270	4.13 ±1.48		
	Marital status	Married (Couples living together)	215	6.05±1.68	0.14	0.892
		Unmarried (Single/divorced/widowed)	75	6.03 ± 1.21		
Dendi	Gender	Male	206	5.84 ± 1.82	-0.09	0.929
		Female	121	5.86± 2.01		
	Age	Young members	118	4.10± 1.92	-8.44	0.000*

		Senior members	209	5.97 ± 1.92		
	Literacy level	Illiterate	198	6.09 ± 1.97	9.06	0.000*
		Literate	129	4.19 ± 1.78		
	Distance from health centre	Near to health centre (≤ 6 km)	123	5.76 ± 1.76	-0.82	0.414
		Far from health centre (>6 km)	204	5.93 ± 1.92		
	Experience (Informant Category)	Key/Knowledgeable	22	7.82 ± 3.50	4.94	0.000*
		General	305	4.11± 1.48		
	Marital status	Married (Couples living together)	254	6.07 ± 1.63	0.19	0.848
		Unmarried (Single/divorced/widowed)	73	6.04 ±1.22		
Overall	Gender	Male	544	5.60± 1.93	-1.26	0.710
		Female	294	5.78± 2.00		
	Age	Young members	303	4.23 ± 1.93	-14.03	0.000*
		Senior members	535	6.19 ± 1.61		
	Literacy level	Illiterate	515	6.16 ± 1.69	-14.81	0.001*
		Literate	323	4.29 ± 1.83		
	Distance from health centrs	Near to health centre (≤ 6 km)	208	5.49 ± 1.75	-4.40	0.000*
		Far from health centre (>6 km)	630	6.10 ± 1.71		
	Experience (Informant Category)	Key/Knowledgeable	57	5.70 ± 3.17	3.79	0.000*
		General	781	4.10 ± 1.48		
	Marital status	Married (Couples living together)	647	6.03 ± 1.96	0.01	0.990
		Unmarried (Single/divorced/widowed)	191	6.03 ± 1.43		

The community in the study area uses ethnoveterinary medicinal plants to treat commony cattle (67 citation, 39.64 %) followed by sheep (31, 18.34%) and goats (22, 13.01%). Animals, cows, poultry, horses, mules, donkeys and oxen had lower proportions in the order listed (Table 28).

Table 28. Proportion of the animals by ethnoveterinary medicinal plants treated in the Jibat, Chelia and Dendi districts

The three combined			**Jibat Disstrict**		**Chelia District**		**Dendi District**	
Animals treated	Citation	%	Citation	%	Citation	%	Citation	%
Cattle	67	39.64	66	40.24	62	38.99	63	38.88
Sheep	31	18.34	28	17.07	28	17.61	28	17.28
Goats	22	13.01	24	14.28	24	15.09	25	15.43
Animals	15	8.87	15	9.14	14	8.80	13	8.02
Cows	11	6.50	10	6.09	10	6.28	10	6.17
Poultry	10	5.91	9	5.48	9	5.66	10	6.17
Horses	5	2.95	5	3.04	5	3.14	5	3.08
Mules	4	2.36	4	2.43	4	2.51	4	2.46
Donkeys	2	1.18	2	1.21	2	1.25	2	1.23
Oxen	2	1.18	1	0.60	1	0.62	2	1.23
Total	169		164		159		162	

4.2.2.3. Ailments treated and ethnoveterinary medicinal plant parts used

A total of 44 livestock ailments (44 from Jibat, 43 from Chelia and 42 from Dendi) were reported as having treatments by ethnoveterinary medicial plants in the study area (Table 27). Bloating and febrifuge were the most important livestock ailment (6 citation, 5.26%) followed by babesiosis (5, 4.38%) in all the three districts (Jibat, Chelia and Dendi) as well as in the entire study area in general. The rest ailments were in decending proportions (Table 29).

Table 29. Frequency of ailments treated by ethnoveterinary medicinal plant in the study area

The three districts combined			**Jibat District**			**Chelia District**			**Dendi District**		
Ailment	Citation	%	Ailment	Citation	%	Ailment	Citation	%	Ailment	Citation	%
Bloat & Febrifuge	6	5.26	Bloat & Febrifuge	6	5.45	Bloat & Febrifuge	6	5.71	Bloat & Febrifuge	6	5.60
Babesiosis	5	4.38	Babesiosis	5	4.54	Babesiosis	5	4.76	Babesiosis	5	4.67
Erythroblasts	5	4.38	Anthrax	4	6.63	Blackleg	4	3.80	Blackleg	4	3.73
Anthrax	4	3.50	Blackleg	4	6.63	Erythroblasts	4	3.80	Erythroblasts	4	3.73
Blackleg	4	3.50	Erythroblasts	4	6.63	Rabies	4	3.80	Rabies	4	3.73
Ecto-parasites	4	3.50	Rabies	4	6.63	Snake bite	4	3.80	Retained faeces	4	3.73
Rabies	4	3.50	Snake bite	4	6.63	Wound	4	3.80	Snake bite	4	3.73
Snake bite	4	3.50	Wound	4	6.63	Anthrax	3	2.85	Wound	4	3.73
Wound	4	3.50	Avian cholera	3	2.72	Avian cholera	3	2.85	Actinomycosis	3	2.80
Actinomycosis	3	2.63	Breast ulcer	3	2.72	Breast ulcer	3	2.85	Anthrax	3	2.80
Avian cholera	3	2.63	Cough	3	2.72	Cough	3	2.85	Avian cholera	3	2.80
Breast ulcer	3	2.63	Diarrhea	3	2.72	Diarrhea	3	2.85	Breast ulcer	3	2.80
Cough	3	2.63	Ecto-parasites	3	2.72	Ecto-parasites	3	2.85	Cough	3	2.80
Diarrhea	3	2.63	Epizootic lymphagities	3	2.72	Epizootic lymphagities	3	2.85	Ecto-parasites	3	2.80
Epizootic lymphagities	3	2.63	Eye problem	3	2.72	Eye problem	3	2.85	Epizootic lymphagities	3	2.80
Eye problem	3	2.63	Mastitis	3	2.72	Mastitis	3	2.85	Mastitis	3	2.80
Mastitis	3	2.63	Pasturolosis	3	2.72	Pasturolosis	3	2.85	Pasturolosis	3	2.80
Pasturolosis	3	2.63	Retained placenta	3	2.72	Retained placenta	3	2.85	Synerosis celebralis	3	2.80
Retained placenta	3	2.63	Synerosis celebralis	3	2.72	Synerosis celebralis	3	2.85	Tongue infection	3	2.80
Synerosis celebralis	3	2.63	Tongue infection	3	2.72	Tongue infection	3	2.85	Anti- inflammatory	2	1.86
Tongue infection	3	2.63	Tonsillitis	3	2.72	Actinomycosis	2	1.90	Chronic wound	2	1.86

Tonsillitis	3	2.63	Actinomycosis	2	1.81	Anti- inflammatory	2	1.90	Coccidiosis	2	1.86
Anti- inflammatory	2	1.75	Anti- inflammatory	2	1.81	Chronic wound	2	1.90	Diarrhea	2	1.86
Chronic wound	2	1.75	Chronic wound	2	1.81	Coccidiosis	2	1.90	Eye problem	2	1.86
Coccidiosis	2	1.75	Coccidiosis	2	1.81	FMD (Foot and Mouth Disease)	2	1.90	FMD (Foot and Mouth Disease)	2	1.86
FMD (Foot and Mouth Disease)	2	1.75	FMD (Foot and Mouth Disease)	2	1.81	Horse disease	2	1.90	Horse disease	2	1.86
Horse disease	2	1.75	Horse disease	2	1.81	Internal parasites	2	1.90	Internal parasites	2	1.86
Internal parasites	2	1.75	Internal parasites	2	1.81	Leeches	2	1.90	Joint dislocation	2	1.86
Joint dislocation	2	1.75	Joint dislocation	2	1.81	Newcastle disease	2	1.90	Leeches	2	1.86
Leeches	2	1.75	Leeches	2	1.81	Retained faeces	2	1.90	Lumpy skin	2	1.86
Lumpy skin	2	1.75	Lumpy skin	2	1.81	Tonsillitis	2	1.90	Mechanical trump	2	1.86
Mechanical trump	2	1.75	Newcastle disease	2	1.81	Ulcertic lymphagities	2	1.90	Newcastle disease	2	1.86
Newcastle disease	2	1.75	Retained faeces	2	1.81	Anti dote for hyena bite	1	0.90	Tonsillitis	2	1.86
Retained faeces	2	1.75	Ulcertic lymphagities	2	1.81	Fever	1	0.90	Tripanosomiasis	2	1.86
Tripanosomiasis	2	1.75	Anti dote for hyena bite	1	0.90	Hyena bite	1	0.90	Ulcertic lymphagities	2	1.86
Ulcertic lymphagities	2	1.75	Fever	1	0.90	Joint dislocation	1	0.90	Anti dote for hyena bite	1	0.93
Anti dote for hyena bite	1	0.87	Hyena bite	1	0.90	Lumpy skin	1	0.90	Fever	1	0.93
Fever	1	0.87	Mechanical trump	1	0.90	Mechanical trump	1	0.90	Hyena bite	1	0.93
Problem of lactation	1	0.87	Problem of lactation	1	0.90	Render pest	1	0.90	Render pest	1	0.93
Render pest	1	0.87	Render pest	1	0.90	Scabies	1	0.90	Scabies	1	0.93
Scabies	1	0.87	Scabies	1	0.90	Sudden sickness	1	0.90	Sudden sickness	1	0.93
Sudden sickness	1	0.87	Sudden sickness	1	0.90	Tape worm	1	0.90	Tape worm	1	0.93
Tape worm	1	0.87	Tape worm	1	0.90	Tripanosomiasis	1	0.90	-	-	-
	-	-	Tripanosomiasis	1	0.90	-	-	-	-	-	-
Sum	114		Sum	110		Sum	105		Sum	107	

Out of the total plant parts used for remedy preparation, leaves were the highest (44, 36.36%), followed by roots (26, 21.28%) and lower values for other parts, in the three districts combined as well as in each respective districts (Table 30).

Table 30. . Frequenency of ethnoveterinary medicinal plants parts used in remedy preparations in the study area.

The three districts combined			**Jibat District**			**Chelia District**			**Dendi District**		
Plant part used	Citation	%	Plant part used	Citation	%	Plant part used	Citation	%	Plant part used	Citation	%
Leaves	44	36.36	Leaves	40	34.48	Leaves	38	34.23	Leaves	41	35.96
Roots	26	21.48	Roots	25	21.55	Roots	24	21.62	Roots	23	20.17
Whole plant	10	8.26	Fruits	11	9.48	Whole plant	10	9.01	Whole plants	10	8.77
Fruits	11	9.09	Whole plant	10	8.62	Fruits	9	8.10	Fruits	10	8.77
Barks	7	5.78	Barks	7	6.03	Barks	7	6.30	Barks	7	6.14
Seeds	5	4.13	Inflorecnce	5	4.31	Inflorecence	5	4.50	Inflorecence	5	4.38
Inflorecence	5	4.13	Seeds	5	4.31	Seeds	5	4.50	Seeds	5	4.38
Stem barks	4	3.30	Stem barks	4	3.44	Stem barks	4	3.60	Stem barks	4	3.50
Latex	2	1.65	Latex	2	1.72	Latex	2	1.80	Latex	2	1.75
Roots barks	2	1.65	Root bark	2	1.72	Root bark	2	1.80	Root barks	2	1.75
Shoots	2	1.65	Shoots	2	1.72	Shoots	2	1.80	Shoots	2	1.75
Rhizomes	1	0.82	Rhizomes	1	0.86	Rh izomes	1	0.90	Rhizomes	1	0.87
Sap	1	0.82	Saps	1	0.86	Spaps	1	0.90	Saps	1	0.87
Tubers	1	0.82	Tubers	1	0.86	Tubers	1	0.90	Tubers	1	0.87

4.2.2.4. Modes of remedy preparation and application of ethnoveterinary medicine

Information about the preparation of each plant has been included in Appendix 8. The results showed that the majority of the remedies (76.29%) were prepared from single plant species and few (23.71%) were prepared from combinations of more than one medicinal plant species. The dominant mode of ethnoveterinary medicinal plants remedy preparation and application was through crushing and steeping plant part(s) in cold water and the resulting infusion was given to the target animal under question to drink (41 citation, 35.96%) followed by boiling and drinking the decoction up on cooling (31, 27.19%) and direct application of the latex/sap/flesh/juice through paint/rub/paste (12, 10.52%). The pattern of mode of remedy preparation and application is similar in the three districts except that the proportions are different (Table 31).

Table 31. Mode of remedy preparation and application of ethnoveterinary medicinal plants in the study area

Mode of remedy preparation and application	**The three districts combined**		**Jibat District**		**Chelia District**		**Dendi District**	
	Citation	**%**	**Citation**	**%**	**Citation**	**%**	**Citation**	**%**
Boil and drink the decoction up on cooling	31	27.19	29	26.36	27	27.71	28	26.16
Crush and steep plant part in cold water and drink the infusion	41	35.96	41	37.27	38	36.19	38	35.51
Paint/rub/paste the latex/sap/flesh/juice directly	12	10.52	11	10.00	10	9.52	9	8.41
Eat the plant part (raw/cooked)	5	4.38	4	3.63	4	3.80	5	4.67
Crush, heat/burn or boil the part and inhale its smoke or steam	4	3.50	4	3.63	4	3.80	6	5.60
Drink the concoction	13	11.4	13	11.81	13	12.38	13	12.14
Grind and paint the powder or crushed part	6	5.26	6	5.45	7	3.80	6	5.60
Grind, paste the crushed part and tie	2	1.75	2	1.81	2	1.90	2	1.86
Total	114		110		105		107	

4.2.2.5 Routes of remedy administration and dosages of ethnoveterinary medicine

It was found that the local people employ about four ways of medicine administration routes with varying frequencies. Of the total, 91 (79.82%) prescriptions were mainly those said to be applied through oral route (Fig. 27). The dosage varied between age and type of livestock treated as judged by healers.

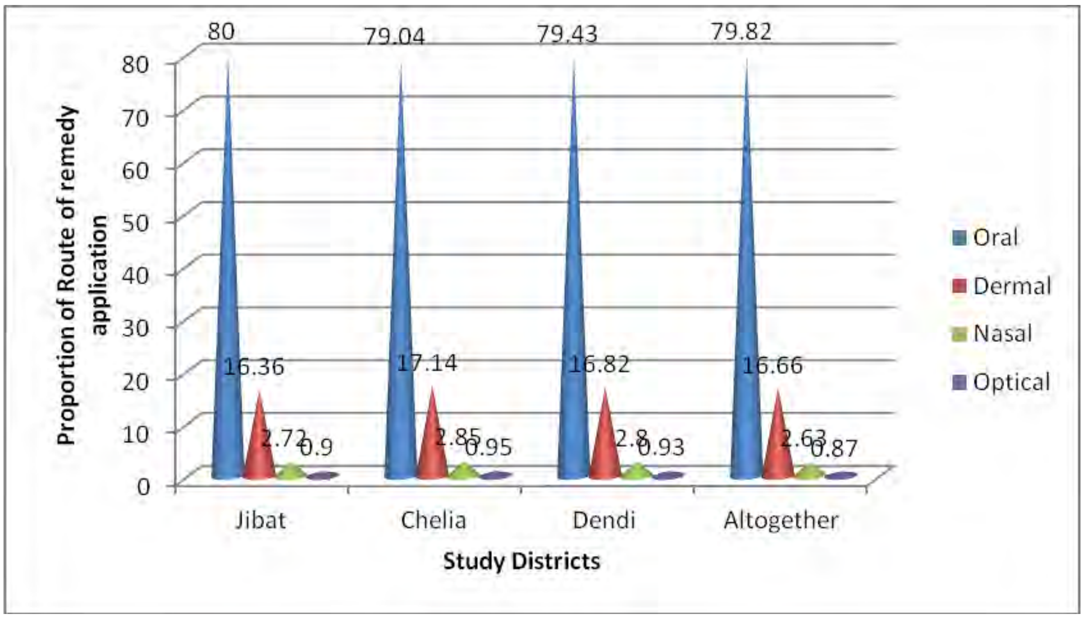


Fig. 27. Route of ethnovetrinary remedies application in Jibat, Chelia and Dendi districts

4.2.2.6 Consensus on Efficacy and Relative Healing Potential of Ethnoveterinary medicinal plants

The 44 livestock ailments reported by the informants in the study area were grouped into seven major categories (Table 31). In the three districts combined together, the highest ICF value was recorded for dermatological & sensorial problems (0.80) followed by septicaemic problems (0.68) and wound, external injury and animal bite (0.66). Wound external injury and animal bite (0.66) came up with the second highest ICF next to dermatological and sensorial problems (0.80) in all the three districts (Table 32).

Table 32. Informant consensus factor (ICF) of ethnoveterinary medicinal plants in Jibat, Chelia and Dendi districts

No.	Ailment category	The three districts combined			Jibat District			Chelia District			Dendi District		
		Species	Use Citation	ICF	Species	Use Citation	ICF	Species	Use Citation	ICF	Species	Use Citation	ICF
1	Dermatological and sensorial problems	8	37	0.80	7	36	0.82	8	42	0.82	8	36	0.80
2	Wound, external injury and animal bite	16	46	0.66	15	45	0.68	14	46	0.71	14	47	0.71
3	Reproductive disorders	17	32	0.48	16	31	0.50	17	26	0.36	17	31	0.46
4	Locomotor problems	13	24	0.47	12	23	0.50	12	19	0.38	13	24	0.47
5	Respiratory tract problems	15	28	0.48	14	26	0.48	14	29	0.53	15	28	0.48
6	Digestive system and parasitic problems	18	34	0.48	17	31	0.46	18	42	0.58	17	34	0.51
7	Septicaemic problems	16	48	0.68	17	47	0.65	16	43	0.64	16	47	0.67

Prunus africana was found to have the highest fidelity level (FL) (97%) in the study area followed by *Acokanthera schimperi*, *Clerodendrum myricoides* and *Sida schimperiana* (96% each) and *Acalypha psilostachya*, *Calpurnia aurea* and *Hypericum quartinianum* (95% each) (Appendix 8).

Prunus africana with the highest FL, was reported to treat Epizootic lymphagitis (biichee faradaa in Afan Oromo) and *Acokanthera schimperi*, *Clerodendrum myricoides* and *Sida schimperiana* were used to treat Tripanosomiasis (gandii in Afan Oromo**)**, Cough (qufaa/soffaa in Afan Oromo) and Chronic wound (madaa in Afan Oromo) respectively.

Tonsillitis (hudhaa in Afan Oromo), Rabies (dhukkuba saree in Afan Oromo) and Erythroblasts (gatacha in Afan Oromo) were said to be treated by *Acalypha psilostachya*, *Calpurnia aurea* and *Hypericum quartinianum* respectively (Appendix 8).

4.2.2.7 Medicinal plants used both in treatment of human and livestock aliments

Out of 97 ethnoveterinary medicinal plants reported in this study, 74/97 species (76.28%) were also used as human medicinal plants and the rest 23/97species (23.71%) were used solely as ethnoveterinary medicinal plants. In otherwords, out of 172 human medicinal plants, 98/172 species (56.97%) were used to treat human ailments alone and the rest 74/172 species (43.02%) were used to treat both human and livestock ailments (Appendix 8).

4.3. Features of the Medicinal Plants of the Study Area

4.3.1 Use diversity of medicinal plants and their importance

The output of the direct matrix ranking (DMR) exercise on twelve multipurpose medicinal plants enabled to identify which of the multipurpose plants is under the greatest pressure in Jibat district and the corresponding factors that threaten the plant. Accordingly, *Prunus africana* was ranked first (most threatened) followed by *Hagenia abyssinica* and *Olinia rochetiana* (Table 30). Results also indicated that those multipurpose medicinal plant species are currently exploited more for firewood and construction than for their medicinal role.

Similar exercise (DMR) in Chelia District gave; *Prunus africana* in the first rank (most threatened) followed by *Olea europaea* subsp. *cuspidata* and *Podocarpus falcatus.* Results also revealed that those multipurpose medicinal plant species are currently exploited more for firewood, charcoal and for making agricultural implements than for their medicinal purpose (Table 33).

Table 33. Average DMR score of fifteen key informants for twelve medicinal plants species of Jibat District with additional uses besides medicinal value (5 = best; 4 = very good; 3 = good; 2 = less used; 1 = least used and 0 = no value).

Use diversity	*Myrsine melanophloeos*	*Arundinaria alpina*	*Ilex mitis*	*Dombeya torrida*	*Croton macrostachyus*	*Olea welwitschii*	*Ekebergia capensis*	*Olinia rochetiana*	*Prunus africana*	*Cordia africana*	*Hagenia abyssinica*	*N uxia congesta*	Total	Rank
Timber	3	0	3	1	2	3	4	4	5	5	5	2	37	6
Agricultural implements	2	1	5	2	1	5	3	4	5	4	5	3	40	4
Firewood	4	3	4	4	4	3	4	5	5	4	4	5	49	1
Charcoal	3	0	5	2	2	5	2	4	4	3	3	5	38	5
Construction	3	5	4	3	3	5	3	4	5	5	5	3	47	2
Medicine	4	3	3	3	5	4	3	5	5	3	5	3	46	3
Total	19	12	24	15	17	25	19	26	29	24	27	21		
Rank	8	11	5	12	10	4	8	3	1	5	2	7		

Table 34. Average DMR score of fifteen key informants for twelve medicinal plants species of Chelia District with additional uses besides medicinal value (5 = best; 4 = very good; 3 = good; 2 = less used; 1 = least used and 0 = no value).

Use diversity	*Osyris quadripartita*	*Rhus glutinosa* subsp. *glutinosa*	*Ilex mitis*	*Chionanthus mildbraedii*	*Syzygium guineense*	*Olea europaea* subsp. *cuspidata*	*Podocarpus falcatus*	*Olinia rochetiana*	*Prunus africana*	*Apodytes dimidiata*	*Cordia africana*	*N uxia congesta*	Total	Rank
Timber	3	2	3	2	3	5	5	4	5	4	5	3	44	5
Agricultural implements	3	4	4	3	3	4	5	4	5	4	5	2	46	3
Fire wood	5	5	4	5	5	4	4	5	4	4	4	5	54	1
Charcoal	4	4	4	4	3	5	3	4	5	3	3	5	47	2
Construction	4	3	4	3	4	4	5	3	4	3	4	3	44	5
Medicine	3	4	4	3	3	5	4	5	5	3	3	3	45	4
Total	22	22	23	20	21	27	26	25	28	21	24	21		
Rank	7	7	6	12	9	2	3	4	1	9	5	9		

Table 35. Average DMR score of fifteen key informants for twelve medicinal plants species of Dendi District with additional uses other than medicinal value (5 = best; 4 = very good; 3 = good; 2 = less used; 1 = least used and 0 = no value).

Use diversity	*Juniperus procera*	*Podocarpus falcatus*	*Olea europaea* subsp. *cuspidata*	*Olea welwitschii*	*Hagenia abyssinica*	*Osyris quadripartita*	*Pittosporum viridiflorum*	*Olinia rochetiana*	*Prunus africana*	*Apodytes dimidiata*	*Acacia abyssinica*	*N uxia congesta*	Total	*Rank*
Timber	5	5	4	3	5	3	3	4	5	3	2	2	44	6
Agricultural implements	5	5	4	4	4	4	4	3	4	3	4	3	47	5
Firewood	5	4	5	4	5	5	5	5	5	4	5	5	57	1
Charcoal	4	4	5	5	4	4	4	3	5	4	5	4	51	2
Construction	5	5	5	4	4	4	3	4	4	4	5	3	50	3
Medicine	5	4	4	4	5	4	4	3	5	4	4	3	49	4
Total	29	27	27	24	27	24	23	22	28	22	25	20		
Rank	1	3	3	7	3	7	9	10	2	10	6	12		

In the same manner as in the two districts indicated above, in Dendi District the result of the direct matrix ranking (DMR) exercise on twelve multipurpose medicinal plants showed that *Juniperus procera* was ranked first (most threatened) followed by *Prunus africana* and *Hagenia abyssinica.* The output also indicated that those multipurpose medicinal plant species are currently exploited more for firewood, charcoal and construction than for their medicinal role (Table 35).

A preference ranking exercise with 15 key informants from Jibat District on medicinal plants that were reported to be used against diarrhoea, the most frequently reported disease in the Gastrointestinal, pharengeal and parasitic disease category, showed that *Lactuca inermis*, *Coffea arabica* and *Brucea antidysernterica* were the most preferred species to treat the reported disease (Table 36).

Table 36. Preference ranking of medicinal plants of Jibat District reported for treating diarrhea (8= highest effective, 1= least effective)

Medicinal plants for Diarrhoea	Informants labeled A to O															Total score	Rank
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O		
Ajuga integrifolia	7	3	5	4	6	4	2	6	4	5	3	3	5	2	4	63	8
Bersama abyssinica	4	5	3	6	4	3	5	4	5	5	5	3	4	6	5	67	7
Brucea antidysernterica	6	8	4	3	7	6	6	4	5	6	7	8	5	4	6	85	3
Calpurnia aurea	3	5	3	7	5	4	5	7	6	4	5	5	4	3	7	72	6
Coffea arabica	8	7	6	6	5	7	8	5	6	7	8	7	6	7	8	101	2
Dodonaea angustifolia	4	7	5	6	4	6	7	3	4	6	5	5	7	6	6	81	4
Lactuca inermis	7	8	7	8	8	7	6	8	8	7	7	6	8	7	8	110	1
Zehneria scabra	5	7	6	4	3	5	4	4	6	5	7	4	4	6	5	75	5

A preference ranking exercise with 15 key informants from Chelia District on medicinal plants that were reported to be used against atopic eczema, the most frequently reported disease in the Dermatological and subcutaneous tissues disease category, showed that *Dodonaea angustifolia*, *Justicia schimperiana* and *Arisaema enneaphyllum* were the most preferred species to treat the reported disease (Table 37).

Table 37. Preference ranking of medicinal plants of Chelia District reported for treating atopic eczema (highest effective=5, least effective=1)

Medicinal plants for atopic eczema	Informants labeled A to O															Total score	Rank
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O		
Arisaema enneaphyllum	4	5	5	3	4	5	4	3	5	5	4	3	4	4	5	59	3
Artemisia abyssinica	3	4	4	3	5	5	3	3	4	2	4	3	3	5	4	55	4
Schefflera abysinica	5	4	3	4	3	3	5	4	4	3	2	4	5	3	3	54	5
Justicia schimperiana	4	5	4	4	5	3	3	5	3	4	4	5	3	4	4	60	2
Dodonaea angustifolia	4	5	4	5	5	4	5	4	4	5	5	4	5	4	5	68	1

Similarly, a preference ranking exercise with 15 key informants from Dendi District on medicinal plants that were reported to be used against rheumatism, the most frequently reported disease in the musculoskeletal-Connective tissues, nervous system, dental and sensorial disease category, showed that *Carissa spinarum*, *Acanthus sennii* and *Otostegia integrifolia* were the most preferred species to treat the reported disease (Table 38).

Table 38. Preference ranking of medicinal plants of Dendi District reported for treating rheumatism (5= highest effective, 1=least effective)

Medicinal plants for rheumatism	Informants labeled A to O															Total score	Rank
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O		
Otostegia integrifolia	5	4	5	4	4	5	4	4	5	5	4	3	4	5	4	61	3
Clematis longicauda	4	3	4	3	5	5	3	4	4	2	4	3	3	4	5	56	4
Clematis simensis	4	5	3	4	3	5	4	4	3	3	4	5	3	3	3	55	5
Carissa spinarum	5	4	4	5	5	4	5	5	4	5	5	4	5	5	4	69	1
Acanthus sennii	5	4	4	4	5	3	3	5	3	4	4	5	4	5	4	62	2

4.3.2. Medicinal plant knowledge mode of transfer

The major way of indigenous knowledge transfer on types of medicinal plants, traditional concepts of illness and methods of diagnosis among traditional healers of the study districts was by word of mouth to a family member, especially of an elder son mostly at verge of death of an elder. The knowledge flow from elders to children and its enrichment thereafter is directly conveyed through observation, imitation and free flow of information among community members through history telling and myths. Songs, riddles and sayings in the study area are indirect ways of conveying knowledge. It was also found that there is maximum secrecy in passing the knowledge within the family circle. None of the participants had written documents on traditional medicine whereas all healers reported that they received the knowledge from their parents or grandparents orally. The way they share their indigenous knowledge to their children was also found to be similar.

4.3.3. Marketability, habitat and abundance of medicinal plants

Though harvesting medicinal plants for commercializing is not a common practice in the study area, there was some transaction on local markets (Shenen, Gedo and Ginchi markets of Jibat, Chelia and Dendi districts respectively). Some were being sold and purchased not entirely for the purposes of their medicinal applications. A good amount has mainly sold for non-medicinal uses but occasionally applied as medicine when the need arises. About 30 species (17.44%) were observed in these markets during market surveys. Some of these reportedly marketable medicinal plants were sold and purchased as spices (*Allium sativum, Allium cepa, Capsicum annuum, Foeniculum vulgare, Lepidium sativum, Lippia adoenesis, Nigella sativa, Rosmarnus officinalis*, *Ruta chalepensis* and *Zingiber officinale*), oil seeds (*Brassica carinata, Brassica nigra, Linum usitatissimum* and *Guizotia abyssinica*), food crops (*Carica papaya, Cucurbita pepo, Enset* *ventiricosum, Plectranthus edulis* and *Vicia faba*), tonic/narcotic (*Rhamnus prinoides, Coffea arabica, Nicotiana tabacum* and *Thymus schimperi*), fumigants (*Echinops kebericho, Nuxia congesta, Olea europaea* subsp. *cuspidata* and *Rhamnus staddo)* and material needs (*Arundinaria alpina* and *Clausena anisata*). In addition to open markets medicinal plants were reported to be sold on Church markets and at homes of healers too.

Although traditional practitioners and local communities of the study area mainly depend on the wild environment for collecting medicinal plants, the effort to conserve and sustainably utilize resources was found frail. Despite harvesting the majority of medicinal plants (145 species, 84.3%) from the wild environment alone no attempt of in situ conservation was observed to save fast eroding medicinal plants of the study area. About 15.69% (27 species) of medicinal plants of the district are available from cultivation (Appendix 6).

4.4. Wild Edible Plants (WEPs) Used and Associated Indigenous Knowledge

4.4.1. Taxonomic diversity of WEPs

A total of 71 WEPs species were reported from the entire study area under this category. These belong to 58 genera and 33 botanical families. The family Moraceae was represented by the highest number of species (5 species, 7.04% each) followed by Asteraceae (4, 5.63%). Acanthaceae, Apocynaceae, Commelinaceae, Cucurbitaceae, Flacourtiaceae, Olacaceae, Poaceae and Rosaceae having three species (4.22% each) took the thrird rank. Amaranthaceae, Fabaceae, Meliaceae, Musaceae, Myrsinaceae, Myrtaceae, Polygonaceae, Rhamnaceae, Rutaceae, Urticaceae and Vitaceae were represented by two species (2.81% each). The rest of the families were represented by single species (1.4% each). These were Anacardiaceae, Aquifilaceae, Arecaceae, Asclepiadaceae, Sapotaceae, Boraginaceae, Campanulaceae, Caparidaceae, Euphorbieaceae, Tiliaceae and Verbenaceae. The taxonomic diversity of WEPs in each district and the entire study area is given in Fig. 28 (Appendix 9).

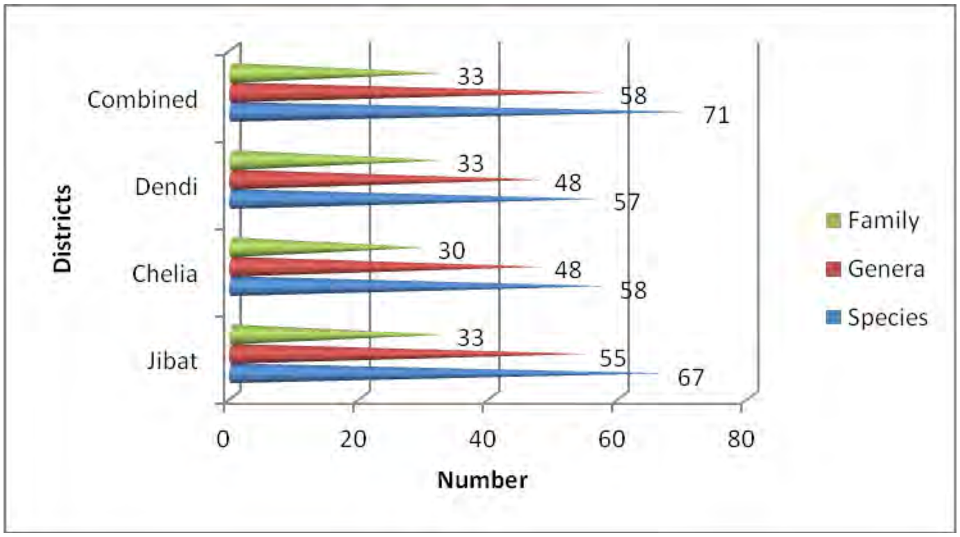


Fig. 28. Taxonomic diversity of WEPs in the study area

4.4.2. Parts consumed and food use categories of WEPs

The major parts of WEPs widely consumed in the study area are indicated in Table 39. Most inhabitants predominantly consume fruit (40.67%) and fresh leaves (16.09%) followed by shoots (11.49%) (Table 39, Fig. 30, 31).

Table 39. Parts of WEPs commonly consumed in the study area

Jibat District		Chelia District		Dendi District		Combined districts	
Plant part	%	Plant part	%	Plant part	%	Plant part	%
Fruit	42.16	Fruit	40	Fruit	43.05	Fruit	43.67
Leaves	16.86	Leaves	17.5	leaves	20.83	Leaves	16.09
Tender Shoots	12.04	Tender shoots	12.5	Young shoots	8.33	Tender shoots	11.49
Roots	6.02	subterranean organs	8.75	Roots	6.94	Roots	5.74
Inflorescences	4.81	Twing/bud	7.50	Inflorescences	4.16	Inflorescences	4.59
Seeds	3.61	Stem	5.00	stem	4.16	Stem	3.44
stems	3.61	Seeds	3.75	tubers	2.77	Seeds	3.44
Bulbs	2.40	Inflorescences	3.75	Gum/ exudates	2.77	Bulbs	2.29
tubers	2.40	Gum/ exudates	1.25	Others	6.94	Gum/ exudates	2.29
Others	6.02					Tubers	2.29
						Others	4.59

The majority of the reported WEPs were consumed as fruits either fresh or dried (50.55%) and leafy vegetables mainly consumed cooked or boiled (16.09%) followed by use for seasonings (11.49%). The latter includes uses as spices and condiments too. The other consumption patterns or food use categories include uses in local alcoholic drink preparation, made into bread/injera (in Ahmaharic)/porridge, tasty sugars consumed from flowers, as herbal tea, use of subterranean organ raw or cooked and consumption of tasty exudates (Fig. 29). Moreover, about 65% of WEPs in the study area were consumed raw (Appendix 9).

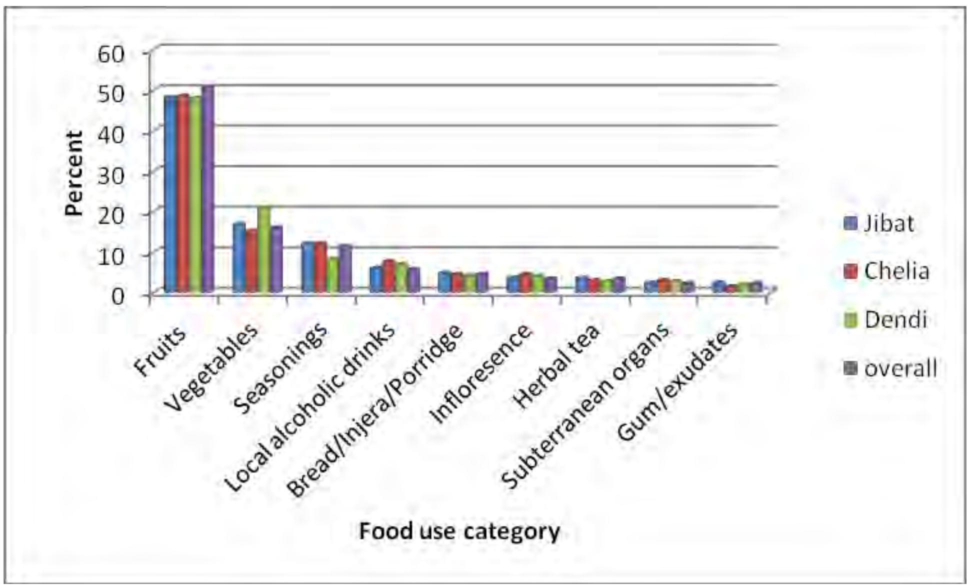


Fig 29. The major food use categories of WEPs of the study area

4.4.3. Ethnobotanical knowledge of the communities on WEPs

The average species number of WEPs reported by women was greater than those reported by men and the difference was significant (P <0.05). Similarly, there was a significant difference (P < 0.05) in the number of WEPs reported by senior members of the community (45–90 years old) compared to those reported by the young to middle aged members (26–44 years old); key informants and general informants, illiterate and literate informants (Table 2). More number of

WEPs was reported by the elderly (≥ 45 years old) and key informants than the young and general informants in the three districts and the study area in general (Table 40).

Table 40. Statistical test of significance, t-test, on average number of reported WEPs among different informant groups in Jibat, Chelia and Dendi districts. *Significant difference ($p < 0.05$); ** t (0.05) (two tailed), df = degree of freedom, n = number of respondents; df = 219, 288, 325 & 836 (for Jibat, Chelia, Dendi districts and the three districts combined respectively)

District	Parameters	Informant groups	n	Mean ± SD	t -value**	p–value
Jibat	Gender	Male	146	5.88 ± 1.93	-3.91	0.000*
		Female	75	7.03 ± 2.14		
	Age	Young members	80	4.09 ± 2.14	6.51	0.000*
		Senior members	141	6.00 ± 2.02		
	Literacy level	Illiterate	143	6.05 ± 2.02	6.69	0.000*
		Literate	78	4.17 ±1.99		
	Experience (Informant category)	Key informant	15	7.67 ± 2.87	-4.79	0.000*
		General informant	206	4.09 ± 1.45		
Chelia	Gender	Male	192	3.27 ± 0.14	-57.71	0.000*
		Female	98	4.35 ± 0.16		
	Age	Young members	105	2.54 ± 0.13	−130.83	0.000*
		Senior members	185	4.87 ± 0.17		
	Literacy level	Illiterate	174	4.69 ± 0.15	35.62	0.000*
		Literate	116	3.97 ± 0.18		
	Experience (Informant category)	Key informant	20	5.97 ± 0.17	74.21	0.000*
		General informant	270	3.14 ± 0.05		
Dendi	Gender	Male	206	5.84 ± 1.82	-3.18	0.002*
		Female	121	6.55 ± 2.04		
	Age	Young members	118	4.17 ± 1.88	-8.93	0.000*
		Senior members	209	6.17 ± 2.05		
	Literacy level	Illiterate	198	6.21 ± 2.01	9.03	0.000*
		Literate	129	4.29 ± 1.79		
The three districts Combined	Gender	Male	544	5.63 ± 1.93	-2.54	0.011*
		Female	294	6.00 ± 2.07		
	Age	Young members	247	4.26± 1.92	-14.07	0.002*
		Senior members	591	6.22 ± 1.63		
	Literacy level	Illiterate	515	6.18 ± 1.68	14.9	0.0012*
		Literate	323	4.29 ± 1.83		
	Experience (Informant category)	Key/Knowledgeable	57	7.27±1.46	8.37	0.034*
		General	781	5.42±1.5		

4.4.4. Main gatherers and consumers of WEPs in the study area

Females (80.6 ± 1.7%) and children (76.1 ± 2.2%) were the major gatherers followed by males (12.8 ± 2.5%) and all household members (13.4 ± 1.1%). The majority (77.2 ± 2.2%) reported that WEPs were consumed by all household members (Table 41). Other respondents who differed from those who said that WEPs were consumed by the entire household indicated that females (23.1 ± 2.2%), elders (15.8 ± 1.9 %) and children (19.3 ± 1.5%) were the main consumers as compared to males (8.6 ± 1.7%) (Table 41).

Table 41. Frequency of citation of the main gatherers and consumers of WEPs in Jibat, Chelia and Dendi districts

Frequency of Citations (%)				
Variables	Jibat District (± SEM)	Chelia District (± SEM)	Dendi District (± SEM)	Overall mean (± SEM)
Main gatherers				
Women	82.3 (1.4)	80.1 (1.6)	79.6 (2.1)	80.6 (1.7)
Men	13.6 (2.2)	13.2 (2.4)	11.8 (3.1)	12.8 (2.5)
Children	77.4 (3.1)	76.1 (2.3)	74.7 (1.2)	76.1 (2.2)
Any household member	14.1 (1.2)	12.9 (1.3)	13.3 (0.7)	13.4 (1.1)
Main consumers				
Women	24.5 (2.5)	23.1 (2.2)	21.7 (2.1)	23.1 (2.2)
Men	8.3 (1.6)	8.2 (2.1)	9.3 (1.5)	8.6 (1.7)
Elders (old aged)	17.3 (2.2)	15.8 (2.3)	14.5 (1.4)	15.8 (1.9)
Children	18.4 (2.0)	19.4 (1.6)	20.3 (1.1)	19.3 (1.5)
Any household member	76.8 (3.2)	77.4 (2.1)	77.5 (1.3)	77.2 (2.2)

4.4.5. Importance of WEPs in the study area

Matrix ranking of the multipurpose WEPs under eight use categories (etic categories) of twelve short listed WEPs gave wild food category in the first rank followed by fuel wood and medicine in the three districts (Table 42, 43 and 44). *Cordia africana* asumed the first rank as a multipurpose species followed by *Vepris dainellii* in Chelia and Dendi districts (Table 42,44) and *Acacia abyssinica* in Jibat District (Table 43).

A. *Rubus steudneri* B. *Dovyalis abyssinica*

Fig.30. Some wild edible fruits of the study area

Table 42. Average DMR score of fifteen key informants for twelve WEPs of Chelia District with additional use values (5 = best; 4 = very good; 3 = good; 2 = less used; 1 = least used and 0 = no value).

No.	Wild edible plants	Broad Use category (Etic category)									
		Wild Food	Medicine	Construction/Building	House hold Furniture	Farm implements	Fuel-wood	Fodder	Honey Bee Forage	Total	Rank
1	*Acacia abyssinica*	2	4	3	2	3	5	1	3	23	6
2	*Acokanthera schimperi*	2	5	2	0	1	3	1	3	17	10
3	*Chionanthus mildbraedii*	4	3	4	2	3	5	1	4	26	3
4	*Cordia africana*	3	4	4	5	4	4	0	5	29	1
5	*Ficus sycomorus*	5	3	3	4	3	3	0	0	21	8
6	*Ficus sur*	5	3	2	3	1	4	0	0	18	9
7	*Olea europaea* L. subsp. *cuspidata*	2	4	5	3	3	4	1	3	25	5
8	*Phoenix reclinata*	4	3	0	0	0	0	0	4	11	12
9	*Syzygium guineense*	4	2	4	1	4	5	0	5	25	4
10	*Vepris dainellii*	4	3	4	3	4	4	2	4	27	2
11	*Urtica simensis*	5	3	0	0	0	0	1	4	13	11
12	*Vernonia amygdalina*	3	4	2	0	0	5	3	5	22	7
Total		43	41	33	23	26	42	10	40		
Rank		1	3	5	7	6	2	8	4		

A. *Carissa spinarum*

B. *Phoenix reclinata*

Fig. 31. Some WEPs of the study area

Table 43. Average DMR score of fifteen key informants for twelve WEPs of Jibat District with additional use values (5 = best; 4 = very good; 3 = good; 2 = less used; 1 = least used and 0 = no value).

No.	Wild edible plants	Broad Use category (Etic category)									
		Wild Food	Medicine	Construction/Building	House hold Furniture	Farm implements	Fuel-wood	Fodder	Honey Bee Forage	Total	Rank
1	*Acacia abyssinica*	2	4	4	2	4	5	2	3	28	2
2	*Arundinaria alpina*	3	5	3	5	0	2	1	0	19	9
3	*Chionanthus mildbraedii*	4	3	4	2	3	5	1	4	26	4
4	*Cordia africana*	4	4	4	5	4	4	0	5	30	1
5	*Ficus sycomorus*	5	4	3	4	3	3	0	0	22	7
6	*Ficus sur*	5	3	2	3	1	4	0	0	18	10
7	*Olea europaea* L. subsp. *cuspidata*	2	4	5	3	3	4	1	3	25	5
8	*Phoenix reclinata*	4	3	0	0	0	0	0	4	11	12
9	*Syzygium guineense*	4	2	4	1	4	5	0	5	25	5
10	*Vepris dainellii*	4	3	4	3	4	4	2	4	27	3
11	*Dovyalis verrucosa*	5	3	0	0	0	0	2	4	14	11
12	*Vernonia amygdalina*	3	4	2	0	0	5	3	5	22	7
Total		45	42	35	28	26	41	12	37		
Rank		1	2	5	6	7	3	8	4		

Table 44. Average DMR score of fifteen key informants for twelve WEPs of Dendi District with additional uses besides food value based on use criteria (5 = best; 4 = very good; 3 = good; 2 = less used; 1 = least used and 0 = no value).

No.	Wild edible plants	Broad use category (Etic category)									
		Wild Food	Medicine	Construction/Building	House hold Furniture	Farm implements	Fuel-wood	Fodder	Honey Bee Forage	Total	Rank
1	*Rhus vulgaris*	0	4	4	3	5	5	0	3	24	6
2	*Acokanthera schimperi*	4	5	2	0	1	3	1	3	19	10
3	*Chionanthus mildbraedii*	5	3	4	2	3	5	1	4	27	3
4	*Cordia africana*	4	4	4	5	4	4	0	5	32	1
5	*Ficus sycomorus*	5	3	3	4	3	3	0	0	21	9
6	*Ficus sur*	5	3	2	3	1	4	0	0	18	11
7	*Olea europaea* L. subsp. *cuspidata*	3	4	5	3	3	4	1	3	26	4
8	*Sideroxylon oxyacanthum*	4	3	3	2	3	3	1	4	23	7
9	*Syzygium guineense*	5	2	4	1	4	5	0	5	26	4
10	*Vepris dainellii*	5	3	4	3	4	4	2	4	28	2
11	*Urtica simensis*	5	3	0	0	0	0	1	4	13	12
12	*Vernonia amygdalina*	4	4	2	0	0	5	3	5	23	7
Total		49	41	37	26	31	45	10	40		
Rank		1	3	5	7	6	2	8	4		

4.4.6. Habitats and conservation prospects of WEPs

Forests were the major reservoirs (22.22%) of WEPs followed by woodland and disturbed bush land (19.88%) and field margins and roadsides (12.28%) and others are shown in Fig. 32.

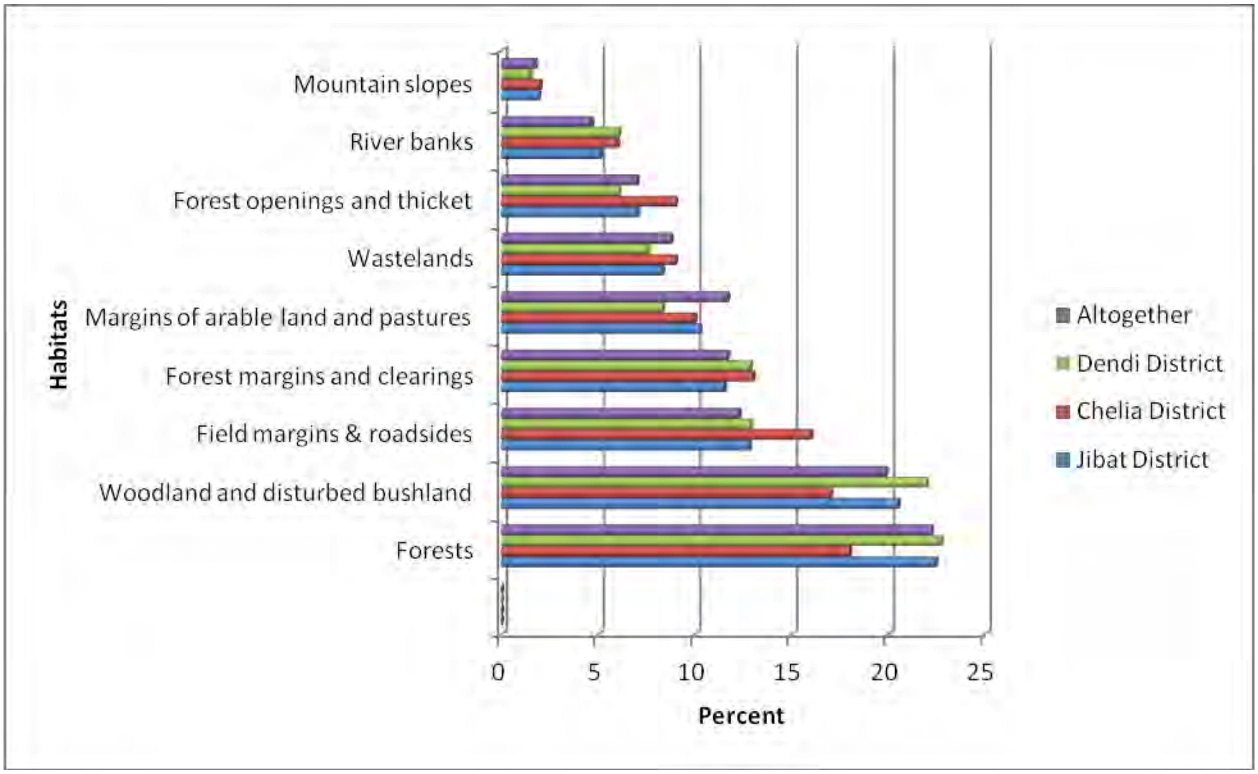


Fig. 32. Habitats occupancy of WEPs in the study area

Ethnoecological knowledge of the communities on threats to WEPs and conservation concerns was assessed based on preference ranking of factors considered as threats to WEPs indicating that agricultural expansion as a major threat followed by overgrazing and fuel wood collection (Tables 45, 46 and 47).

Table 45. Preference ranking of factors considered threats to WEPs in Chelia District

Scores indicate ranks given to factors considered threats to WEPs based on local perceptions. The highest number (6) is given for the most threatening factor and the lowest number (1) for the least threatening factor.

Factors considered as Threats to WEPs	Informants labeled A to O															Total	Rank
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O		
Fuel wood collection	4	5	5	4	3	3	4	5	6	5	3	4	3	4	5	63	3
Drought	2	3	1	1	1	1	2	2	1	1	1	1	2	1	1	21	5
Selective harvesting	3	2	3	4	6	4	3	3	2	3	6	2	4	5	2	52	4
Over-stocking/grazing	4	6	4	4	5	6	5	4	5	3	4	3	5	4	4	66	2
Agricultural expansion	6	5	6	5	4	5	6	6	4	4	5	5	6	3	5	75	1
Fire hazards	1	1	1	3	2	1	1	1	3	1	1	6	1	1	3	21	5

Table 46. Preference ranking of factors considered threats to WEPs in Jibat District

Scores indicate ranks given to factors considered threats to WEPs based on local perceptions. The highest number (6) is given for the most threatening factor and the lowest number (1) for the least threatening factor.

Factors considered as Threats to WEPs	Informants labeled A to O															Total	Rank
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O		
Fuel wood collection	5	4	5	4	4	3	4	5	6	5	3	4	3	4	5	64	3
Drought	3	3	1	1	1	1	2	2	1	1	1	1	2	1	1	22	6
Selective harvesting	3	2	3	4	6	4	3	3	2	3	6	2	4	5	2	52	4
Over-stocking/grazing	4	6	4	4	5	6	5	4	5	3	4	4	5	4	4	67	2
Agricultural expansion	6	5	6	5	4	5	6	6	4	4	5	5	6	4	5	76	1
Fire hazards	1	1	1	3	2	1	1	1	3	1	1	6	1	1		21	5

Table 47. Preference ranking of factors considered as threats to WEPs in Dendi District

Scores indicate ranks given to factors considered threats to WEPs based on local perceptions. The highest number (6) is given for the most threatening factor and the lowest number (1) for the least threatening factor.

Factors considered as Threats to WEPs	Informants labeled A to O															Total	Rank
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O		
Fuel wood collection	4	4	5	4	3	3	4	5	6	5	3	4	3	4	5	62	3
Drought	3	3	1	1	1	1	2	2	1	1	1	1	2	1	1	22	6
Selective harvesting	3	2	3	4	6	4	3	3	2	3	6	2	4	5	2	52	4
Over-stocking/grazing	4	5	4	4	5	6	5	4	5	3	4	3	5	4	4	65	2
Agricultural expansion	5	5	6	5	4	5	6	6	4	4	5	5	6	3	5	74	1
Fire hazards	1	1	1	3	2	1	1	3	1	1	6	1	1	3	1	21	5

4.5. Nutracutical plants of the study area

A total of 49 (69 %) of nutraceutical plants (18 species, 36.73%) shrubs (17 species, 34.69%) herbs, (12 species, 24.48%) trees and (species, 4.08%) liana were identified. People of the study area use nutraceutical WEPs for food and human and livestock medicine. The nutraceutical WEPs are distributed in 43 genera and 28 families (Appendix 9).

Fig. 33. Phographs illustrating ways of medicinal plants remedy preparations and storage

CHAPTER FIVE

5. DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1. Discussion

5.1.1. Sampling sufficiency in vegetation surveys

The species accumulation curve (SAC) of Jibat, Gedo and Chilimo forests vegetation data (cover/abundance data) became leveled off after 150, 60 and 200 sample respectively before the total sample plots (174, 74 and 208 respectively) were reached. This may indicate that, about 150, 60 and 200 sample plots from Jibat, Gedo and Chilimo respectively would have been enough to come up with the data, sampling errors have been minimized. On the other hand, the fact that the curves leveled off before the total sample plots were reached further indicates that the individual study sites were adequately sampled.

5.1.2. Vegetation composition and diversity

Comparison of species richness in tropical and subtropical forests is difficult due to the inherent heterogeneity of the forests (Murphy and Lugo, 1986). However, to give a general picture of the species richness of Jibat Forest, the result of the present study is compared with results from previous studies of other forests in Ethiopia. Accordingly, more number of species (ca.320) was reported in the current study than previous studies of the same forest (Tamrate Bekele, 1994; Tesfaye Burju *et al.*, 2013) with 131 and 183 species respectively. This difference in number of species may be accounted to differences in study time and sampling effort and study objectives at hand. Avialability of complete published floras of Ethiopia and Eritrea also may have contributed particularly to the difference observed with the result of Tamrate Bekele (1994) since the Ethiopian flora was not completely known by then. Although the species number of the present study is significantly different from the pioneering work of Tamrat Bekele (1994), the work provided especially detailed ecological accounts. Jibat Forest is more species rich than other forests in Ethiopia like Hugumbirda-Gratkhassu National Forest Priority Area (ca. 102 species) of South Tigray (Leul Kidane *et al*., 2010), vegetation in Gamo Gofa Zone (ca. 216 species) in Southern Ethiopia Teshome Soromessa *et al*. (2004), Bibita Forest (Gura farada) (ca. 196 species) of Southwest Ethiopia (Dereje Denu, 2006), Denkoro Forest of South Wello (ca. 174 species) (Abate Ayelew, 2003), Gedo Forest (ca.235 species; Birhanu Kebede *et al*., 2014; ca. 290 current study) in West Shewa Zone, woodland vegetation around Dello Menna (ca.171 species) of Southeast Ethiopia (Motuma Didita *et al.,* 2010), Biteyu Forest located along the Western escarpment of the Gurage Mountain Chains (ca. 177 species) (Mekonen Biru, 2003), Sanka Meda Forest of Guna Distric in Arsi Zone (ca.140 species) (Shambal Bantiwalu, 2010), Sese Forest in Southwest Ethiopia (ca. 133 species) (Shiferaw Belachew, 2010).

For Chilimo Forest the present study recorded 241 species while an earlier study by Teshome Soromessa and Ensermu Kelbessa (2014) reported ca. 213 species. Gedo Forest came up with more species than most of the forests compared with (above) except Jibat. The total species number recorded from Chilimo Forest is less than Jibat and Gedo forests and was greater than most of the Ethiopian forests compared with. The probable reason for these differences could be the variations in the local climates (Feyera Senbeta and Demel Teketay, 2003).

Of the plant community types identified in Jibat Forest, the *Vernonia auriculifera*-*Croton macrostachyus* type is most species rich and diverse plant community while *Arundinaria alpina*-*Discopodium penninervium* type is the least. This could be due to the fact that the former community type is found in wider habitat range and contain more sample plots than the latter, which may encourage different microclimatic conditions and the associated occurrence of species adapted to these different microclimates (Table 6). Altitudinal gradients often involve different interacting ecological factors which influence growth, development, diversity and distribution pattern of plants among plant communities in an area (Austin *et al*., 1996). *Teclea nobilis*- *Rhus vulgaris* community type is the most species rich in Gedo Forest because this community type prevails at inaccessible mountain slopes relatively at higher altitudes than the rest and human interference is relatively minimal. Similarly, *Olea welwitschii*-*Juniperus procera* community type was the most species rich among plant communities identified in Chilimo Forest plant communities. This could be due to the fact that community type contains the maximum number of plots (Table 10). The observed relatively medicinal species evenness for *Arundinaria alpina*- *Discopodium penninervium* community type, *Olea welwitschii*-*Olinia rochetiana* type and *Juniperus procera-Podocarpus falcatus-Olinia rochetiana* community type in Jibat, Gedo and Chilimo forests respectively could show that there is no single dominant species, but rather a coexistence of species over all plots in these communities. Local climatic variations and forest disturbances are also mentioned among the factors most responsible for variations in species diversity and evenness in a given forest (Feyera Senbeta and Demel Teketay, 2003).

Furthermore, Asteraceae was the most represented family followed by Fabaceae and Lamiaceae in the study area. The dominance of the highly evolved family Asteraceae is expected in the study area as it is also the most dominant plant family in the flora area as well (Mesfin Tadesse, 2004). The second dominant families, Fabaceae and Lamiaceae, could be attributed to the fact that they were the commonly consumed as medicinal plants and wild edibles in the study area and thus highly recorded from sample plots from natural forest stands or outside. The dominance of herbs followed by shrubs and trees is also an expected coincidence as the survival strategy and thus habitat occupancy of the former is high.

5.1.3. Endemism and conservation concerns

A total of 43 (10.36%) endemic plants to Ethiopia recorded from the entire study sites calls for conservation concerns. As compared with nine endemic species and three endemic subspecies reported in Bibita Forest (Gura Ferda) reported by Dereje Denu (2006), 11 endemic plant species documented from Boda Forest of West Shewa (Fakadu Eresso and Melesse Maryo, 2014), 16 endemic species reported from Jibat Forest (Tesfaye Burju *et al*., 2013), 25 were endemic species from Gedo Forest of West Shewa Zone (Birhanu Kebede *et al*., 2014), 16 endemic plant species from Biteyu Forest of Gurage Zone (Mekonen Biru, 2003), 10 endemic species recorded from Sese Forest (Shiferaw Belachew, 2010), 18 endemic species reported from Chilimo Forest (Teshome Soromessa and Ensermu Kelbessa, 2013) the number of endemic plant species reported in the current study is higher. This could be partly due to the higher prevalence of endemism in the central highlands of Ethiopia and consequence of sampling effort in the current study to capture these endemic plant species.

On the other hand, high rate of endemism implies strong conservation concerns, since due to the fast rate of habitat loss/habitat fragmentation and deforestation, especial emphasis has to be accorded to these endemic plants of the area before they have gone forever unless proper management strategy is in place (Vivero *et al*., 2006). Moreover, some of these endemic species were used as medicinal and WEPs in the study area.

5.1.4. Traditional medicinal plants used for human ailments and associated knowledge

The number of traditional human medicinal plants reported (ca.172 species, belonging to 155 genera and 73 families) and their uses by the local Oromo communities are diverse and include associated local knowledge on these resources and their applications. The Jibat community uses greater number of ethnomedicinal plants (ca.161 species) followed by Chelia (ca.157 species) and Dendi (ca.156 species) communities. This could be partly due to the greater floral diversity of Jibat area as compared to the two, which may emanate from the fact that Jibat area receives greater annual precipitation (as seen in the climadiagrams) as compared to Chelia and Dendi areas on top of geologic and other anthropogenic factors.

Each of the above study community utilizes more medical flora as compared to other communities in Ethiopia, i.e., the Amhara community in Ankober District, northcentral Ethiopia who use 135 species (Ermias Lulekal *et al.*, 2013) and in Bahir Dar Zuria in northwest Ethiopia who use more than 100 species (Hareya Fassil, 2005), Maale and Ari communities in southern Ethiopia who use 128 species (Berhane Kidane *et al.*, 2014), the Kafficho community in South Ethiopia who use 124 medicinal plants (Tesfaye Awas, 2007), the community in and around the (northern) part of the Bale Mountains National Parks who use 101 species (Haile Yineger *et al.,* 2008), the Konta community in southern Ethiopia who make use of about 120 species (Tesfaye Hailemariam *et al*., 2009), the community in Tehuledere District, South Wollo, who use 105 species (Mohammed Adefa and Berhanu Abraha, 2011). This could indicate greater diversity of flora and/or greater dependence of the study community on traditional medicinal plants for their primary healthcare needs. It may also indicate that traditional medicinal plants and the associated knowledge is less eroded in the study area as compared to these communities where less number of medicinal plants was reported.

Some communities in Ethiopia and elsewhere were reported to consume more medicinal plants than the community in current study. These includes: the community in Loma and Gena Bosa districts of Dawro who use 178 medicinal plant species (Mathewos Agize *et al.,* 2013). The

Oromo community residing in Mana Angetu District, southeastern Ethiopia, make use of 230 species (Ermias Lulekal *et al.,* 2008), which is higher than the present study area and which could be due to the more extensive nature of the tropical forest and its intact nature as well as the intimate relation of the local people with the plant resources in general and medicinal plants in particular. The records outside Ethiopia show that 181 medicinal plant species are used in a Quechua community in rural Bolivia (Ina Vandebroek *et al*., 2008), 330 species used in northern Peru (Bussmann *et al*., 2010), 222 medicinal plants used in the Brazilian northeast (Lozano *et al*., 2014), 500 species used by the Kurichia, Kuruma, Kattunaika, Adiya and Paniya tribes of Wayanad District, Kerala (India) (Parasad *et al*., 2013), 231 plant species used in by the local communities of western Uganda (Asiimwe *et al*., 2014), 214 species used the Mahafaly region of south-western Madagascar (Andriamparany *et al.,* 2014), 192 medicinal plant species used in a Brazilian semi-arid region (Zank *et al*., 2015), 240 species used in the Cumbres de Monterrey National Park, Nuevo León, México (Estrada *et al*., 2007), 269 species commercialized in the markets of Mashhad, Iran (Amiri and oharchi, 2013), 219 species used in the Chepang communities from the Mid-Hills of Nepal (Rijal, 2008); 437 species used in in the Regions of Pallars (Pyrenees, Catalonia, Iberiana Peninsula) (Agelet and Valles, 2003) and 200 species used in Gayasan National Park (Korea) (Song *et al*., 2014). This may be indication of the fact that traditional medicinal plants are being eroded in the study community as compared to the above communities where greater number of ethnomedicinal plants consumption is reported or it may depend on variation in ethnoecological and medicinal flora diversity in these communities and the study community. However, since the sizes of the areas and the population are not known, the factors causing them may be much more complex.

However, the number of medicinal plants in Jibat, Chelia and Dendi Diatricts is comparable with reports from other communities in the country and elsewhere. Just to mention few among others: 139 species used in the northwest of the Basque Country (Biscay and Alava), Iberian Peninsula (Menendez-Baceta *et al*., 2013), 141 species used by TaiYai in northernThailand (Khuankaew *et al*., 2014), 158 species used by Luo and Kuria, Kenya (Owuor, 2012), 163 medicinal plant species used in the environs of Tara-gedam and Amba remnant forests of Libo Kemkem District, Northwest Ethiopia (Getnet Chekole *et al*., 2015), 163 medicinal plant species used in the Southern region of the State of Nuevo Leon, Mexico (Estrada-Castillón *et al*., 2012), 152 medicinally important plant species used in Kedarnath Wildlife Sanctuary of Garhwal Himalaya, India (Bhat *et al*., 2013), 164 botanical taxa (genus or species level) in Tyrol, Australia (Pirker *et al*., 2012), 154 plant species used by Bapedi traditional healers in the Limpopo Province, South Africa (Semenya and Potgieter, 2014), 165 species used in the Palestinian Area (Ali-Shtayeh *et al*., 2000) and 143 plant species used in South-Western Nigeria (Soladoye *et al*., 2011). This counld be mean that the study area and the above comparable communities are relatively in equivocal position regarding biological and cultural diversity.

The finding of Asteraceae, Lamiaceae, Fabaceae, Solanaceae, Cucurbitaceae and Euphorbiaceae plant families as the contributors of higher number of species used for medicinal purposes, their importance being according to their list, is shared with similar studies elsewhere in Ethiopia with minor differences in order of importance (Zemede Asfaw, 1999; Mirutse Giday and Gobena Ameni, 2003; Tesema Tanto *et al*., 2003; Mesfin Tadesse *et al*., 2005; Tilahun Teklehaymanot and Mirutse Giday, 2007; Mirutse Giday *et al*., 2009a,b; Mohammed Adefa and Berhanu Abraha, 2011; Girmay Zenebe *et al*., 2012; Mohammed Adefa and Seyoum Getaneh, 2013;

Anteneh Belayneh and Negussie Bussa, 2014); d'Avigdor *et al*., 2014; Balcha Abera, 2014 and Berhane Kidane *et al*., 2014). This could probably be attributed to the overall species richness of these families in the area or abundance of active principles in the representative species of these families. Moreover, Fabaceae, Asteraceae and Lamiaceae are among the largest dicotyledonous families in the Ethiopian flora (Thulin, 1989; Mesfin Tadesse, 2004; Ryding, 2006).

Results of this study showed significant difference ($P < 0.05$) on average number of medicinal plants reported by different age groups from the three districts. Accordingly, indigenous knowledge on use of medicinal plants is still strong with elderly people (5.27 ± 1.71, 5.25 ± 1.6 and 5.43 ± 1.70) than in the younger generation (3.74 ± 1.69, 4.05 ± 1.46 and 3.86 ± 1.60) for Jibat, Chelia and Dendi districts respectively. Like any other traditional societies in Africa (Fekadu Fullas, 2001), ethnobotanical knowledge of medicinal plants of the study community is transferred from the older people to younger generations at household level. This knowledge is not existent in written form, their losses or distortion at every transfer is inevitable. Likewise, the observed significant differences ($p < 0.05$) for Jibat, Dendi and Chelia districts showed the gradual decline of indigenous knowledge on medicinal plants of the study community. This could be attributed to the impact of modernization (access to school and modern clinics) and the very poor system of sharing indigenous knowledge on medicinal plants to the younger generation. It is obvious that those people who went to school consider traditional use of medicinal plants as harmful and backward and prefer to go to modern clinics.The scenario is similar for other cultural groups in Ethiopia (Mirutse Giday, 2001; Hareya Fassil, 2005; Debela Hunde *et al*., 2006; Mirutse Giday *et al*., 2009a; Tesfaye Awas and Sebsebe Demissew, 2009; Tesfaye Hailemariam *et al*., 2009; Girmay Zenebe *et al*., 2012; Anteneh Belayneh *et al*., 2012; Ermias Lulekal *et al*., 2013; Balcha Abera, 2014 and Berhane Kidane *et al*., 2014) and elsewhere (Beltran *et al*., 2014; Adnan *et al*., 2014; Wayland and Walker, 2014). The result calls for an effort to tackle the problem through continuous professional support and training of local communities with an objective of preserving their traditional health knowledge and practices through systematic documentation.

However, Haile Yineger and Delenasaw Yewhalaw (2007) and Mohammed Adefa and Seyoum Getaneh (2014) reported a statistically insignificant correlation between age and the number of medicinal plants by the local people in Jimma Zone, outh-western Ethiopia and in Chencha District; Gamo Gofa, southern Ethiopia respectively. This could be related to knowledge acquisition by the lower age class in those localities. Girmay Zenebe *et al*. (2012) noted that the reason why elders are more knowledgeable is due to their personal experiences using these plants. The vertical transfer of medicinal plant knowledge among the Bench community is not taking place in a proper manner due to the lack of interest among the younger generation to learn and practice it, which might be attributed to the ever increasing influence of modernization (Mirutse Giday *et al*., 2009a). Beltran *et al*., (2014) explained that older people knew more useful plant species than younger people, probably because ethnobotanical knowledge tends to accumulate through the life cycle. As a result, older people accumulate greater medicinal plant lore due to high degree of opportunity for more cultural contact and experience with plants and associated therapeutic uses than that of younger people (Silva *et al*., 2011). Absence of continuous cultural interaction with plants was also reported as one factor for loss of traditional knowledge down the generation gradient (Winter *et al*., 2008).

Data analysis also showed that there is significant difference ($p=0.002$, $p= 0.014$ and $p= 0.022$) observed between key (mean=7.73 ± 1.67, mean=7.65 ± 1.60 and mean=7.64 ± 1.59) and general (mean=5.72 ± 1.52, mean=5.72 ± 1.64 and mean=5.60 ± 1.70) informants for Jibat, Chelia and Dendi districts respectively. This could be related to the impact of age-old experience and maximum degree of secrecy in using medicinal plants in case of key informants than general informants. Similar findings were reported by Teferi Gedif and Hahn (2003); Mirutse Giday *et al*. (2009a); Tilahun Teklehaymanot (2009); Ermias Lulekal *et al*. (2013).

Similarly, the results showed that there is siginificant difference ($p<0.05$) between literate and iterate and informants close by to and far away from health centre. The mean number of medicinal plants reported by illiterate people and those and far from health centre is higher than those from literate and those living near health centre. Literate people in the study area were found to have less knowledge of medicinal plants as compared to illiterate ones as the former are more likely to be exposed to modernization as also was seen by studies conducted elsewhere (Wester and Yongvanit, 1995; Teferi Gedif and Hahn, 2003; Mirutse Giday *et al*., 2009b; Ermias Lulekal *et al.*, 2013). However, Mirutse Giday *et al*. (2009a) reported that significant differences were not observed ($p > 0.05$) in medicinal plant knowledge between Bench informants residing at kebeles located at less than 1 km distance from nearby road/modern healthcare centre (mean = 0.6 ± 0.0002) and those inhabiting kebeles located at distances between 6 and 8 km from nearby road/modern healthcare centre (mean = 0.7 ± 0.0003). This might indicate that the 6-8 km distance of residential areas from roads/ healthcare centre is not far enough to make residents dwell more on their traditional medical practice and as a result have better knowledge of the same as compared to those residing at a 1 km distance (Mirutse Giday *et al*., 2009a). However, in line with the current study results of other studies conducted elsewhere reported a positive relationship between distance from modern healthcare facilities and local knowledge (Bastien, 1982; Stock, 1983; Wester and Yongvanit, 1995; Wayland, 2001; Vandebroek *et al*., 2004; Bussmann *et al*., 2006 and Feikin *et al*., 2009).

However, the output indicated that there is no statistically significant difference ($p>0.05$) between male and female and married and unmarried informants at all study sites. Unlike level of education, age and proximity to modern health facility of informants described above, that siginificanlty affect medicinal plant knowledge variation of the study community, gender and marital status of the informants as variables do not exert any significant variation on medicinal plants knowledge. This could be attributed to the fact that, either male or female and married or unmarried informants have equal access to traditional medicinal plant knowledge. This is inline with other findings in the country and elsewhere (Bisht *et al.,* 2006; Ayantunde *et al*., 2008; Almeida *et al*., 2010; Girmay Zenebe *et al*., 2012; Ermias Lulekal *et al.*, 2013). In contrast, other studies (Voeks and Leony, 2004; Hareya Fassil, 2005; Mirutse Giday *et al*., 2009a) have reported a positive and significant correlation between gender and the number of species reported among different communities. Voeks (2007) pointed out that gender based differences in medicinal plant knowledge can be derived from experience and degree of cultural contact with curative plants. In general, various studies in different areas in the country and elsewhere demonstrated the existence of knowledge variations and similarities among social groups. This could be attributed to variation in the cultural and socio-economic aspects of each social group (Girmay Zenebe *et al*., 2012).

5.1.4.1. Habitat, growth habits and parts used of medicinal plants used to treat human ailments

Habitat of medicional plants consumed

Out of total medicinal plants, 145 (84.3%) species were collected from the wild environment alone. About 15.69% (27 species) of medicinal plants of the study area are available from cultivation. Medicinal plant source habitats in the study area are consistent with the findings of different researchers (Zemede Asfaw, 1997; Miruste Giday, 2001;Haile Yineger and Delnesaw Yewhalaw, 2007; Mirutse Giday and Tilahun Teklehymanot, 2007; Mirutse Giday *et al*., 2009a; Girmay Zenebe *et al*., 2012; Singh *et al*., 2012; Ermias Lulekal *et al*., 2013; Reta Regassa, 2013; Adnan *et al*., 2014; Molares and Ladio, 2014 and Beltran *et al*., 2014) where most of the medicinal plants utilized in the studied communities were harvested from the wild. Therefore, wild habitats are the major pool of medicinal plant resources for the local communities. The fact that most of the medicinal plants are found in the wild also poses a threat to their existence if habitats are destroyed.

This concern is shared by other authors (Endalew Amenu, 2007; Debela Hunde *et al.,* 2006; Tesfaye Hailemariam *et al*., 2009; Girmay Zenebe, 2012) who have called for a timely intervention for their conservation. There is need for coordinated conservation action, based on both in-situ and ex-situ strategies (Hamilton, 2003) through the recognition and accommodation of local community knowledge, interests and priorities (Quansah, 2004).

Gwoth habits of ethnomedicinal plants used

Herbs were the most represented plant habits for remedy preparations in the study area. This could be due to their availability and high effectiveness in the treatment of ailments in comparison to other growth forms/habits. The finding agrees with the general pattern of dominance of herbaceous species seen in most medicinal plant inventories in Ethiopia (Mirutse Giday *et al*., 2003; Haile Yineger *et al*., 2007; Mirutse Giday *et al*., 2009a; Mirutse Giday *et al*., 2010 and Ermias Lulekal *et al*., 2013) and elsewhere (Tabuti *et al*., 2003; Muthu *et al*., 2006; Singh *et al*., 2012; and Adnan *et al*., 2014). Contrary to this finding, a relatively higher number of other plant habits were previously reported in Ethiopia and elsewhere (Haile Yineger and Delenasaw Yewhalaw, 2007; Tesfaye Hailemariam *et al*., 2009; Fisseha Mesfin *et al*., 2009 and Girmay Zenebe *et al*., 2012).

Ethnomedicinal plants parts used in remedy preparation

Concerning plant parts used medicinally, leaves (36.6%) followed by roots (19.98%) are the most commonly used. Previous works carried out elsewhere in Ethiopia also revealed that leaves followed by roots were the most common parts (Haile Yineger and Delenasaw Yewhalaw, 2007; Haile Yineger *et al*., 2008; Mirutse Giday *et al*., 2009a; Hailemariam Bekalo *et al*., 2009; Mersha Ashagre, 2011; Mohammed Adefa and Berhanu Abraha, 2011; Anteneh Belayneh *et al*., 2012; Girmay Zenebe *et al*., 2012; Reta Regassa, 2013; Mirutse Giday and Tilahun Teklehymanot, 2013; Mohammed Adefa and Seyoum Getaneh, 2013; Abraha Teklay *et al.,* 2013; Mathewos Agize *et al*., 2013; Balcha Abera, 2014 and Berhane Kidane *et al*., 2014) and elsewhere (Adnan *et al*., 2014; Mohamad *et al*., 2014 and Bano *et al*., 2014). Other reports showed roots to be the most widely used plant parts (Debela Hunde *et al*., 2006, Teferi Flatie *et al*., 2009; Ermias Lulekal *et al*., 2008, 2013, Fisseha Mesfin *et al*., 2009; Tilahun Teklehymanot, 2010 and Cheikhyoussef *et al*., 2011). Over exploitation of entire root parts for medicinal plant preparations may pose the threat on long-term survival of corresponding medicinal plants (Ermias Lulekal *et al*., 2013).

The common use of leaves in the preparation of remedies could partly be due to the relative ease of finding this plant part since leaves are available throughout the year, as they are mostly harvested from perennial trees and shrubs. Another factor could be the relatively easy preparation of remedies from this plant part and perhaps the presence of active constituents. Vulnerable flowers, leaves and roots may contain more active chemicals in comparison to fruits, seeds, bark and latex (Bhattarai *et al*., 2006). The preference for root to prepare traditional remedies follows the scientific reasoning that roots generally contain high concentrations of bioactive compounds (Uprety *et al.*, 2010). Leaves, roots, stems and flowers are physically more vulnerable than bark or cone and therefore it is not surprising that they contain more chemical defense in the form of biologically active secondary metabolites. The use of leaves rather than other parts of the plant helps to reduce the threat rate of medicinal plants. Therefore, gathering leaves could be promoted as a more sustainable method since in most cases at least a number of leaves are left over on the parent plant which then allows them to carry on life functions. Studies have shown that removal of up to 50% of tree leaves does not significantly affect plant growth (Okello *et al*., 2010).

However, medicinal plant harvest involving roots, rhizomes, bulbs, bark, stems or whole parts have great consequences both from an ecological point of view and for the survival of the mother plants (Dawit Abebe & Ahadu Ayehu, 1993; Mirutse Giday, 2001; Debela Hunde *et al*., 2006 and Ermias Lulekal *et al*., 2013). Therefore there is need to pay special attention to determine their status and what measures should be taken to ensure their conservation (Mirutse Giday, 2001). Given that leaves constitute the most frequently sought plant parts in this study, the threat to the destruction of medicinal plants due to plant part extraction appears minimal. However, Cunningham (2001) indicated that the harvest of leaves has also a threat to the deterioration of medicinal plants since the removal of leaves limits the transformation of vegetative to reproductive development such as flower production and fruit/seed set, which in its turn limits the natural/wild regeneration of plants.

5.1.4.2. Ailments treated, modes of remedy preparation and application

Ailments treated by traditional healers

The traditional healing system in the study area is well established as the report of 86 human ailments and disease conditions for which traditional healers were most visited by patients indicated a reliance of local people in the study area on traditional medicine and the green pharmacy. The traditional healers of the study area manage a greater number of aliments (ca.86) as compared to reports elsewhere, for instance, Ermias Lulekal *et al.* (2013) who reported ca. 69 ailments, Cheikhyoussef *et al*. (2011) who reported ca.43 ailments, Betti *et al*. (2013) who reported 24 ailments, Anteneh Belayneh *et al*. (2012) who reported ca. 54 ailments, Giday Zenebe *et a*l. (2012) who reported ca. 50 ailments, Tabuti *et al*. (2012) who reported ca.78 ailments, Berhane Kidane *et al.* (2014) who reported ca. 48 ailments, Haile Yineger *et al*., (2008) who reported ca. 56 ailments and Reta Regassa (2013) who reported ca. 53 ailments. This difference in number of ailments could be accounted to the difference in socio-economic, biocultural, service availability and physical conditions in the respective communities.

Of the major disease categories in the study area, the most treated major ailments categories include gastrointestinal, pharengeal and parasitic (GIPP) followed by dermatological and subcutaneous tissues (DST) and genitourinary, reproductive and sexually transmitted diseases

(GRSTD). The fact that the study community uses higher proportions of medicinal plants to treat GIPP ailments could be attributed to the high preponderance of these disorders in the area. Amoebiasis, constipation and diarrhoea were the most commonly reported health problems under the GIPP, whereas atopic eczema and dandruff were most frequently reported under the DST disease group (Appendix 2). This result is in agreement with Ermias Lulekal *et al.* (2013) who reported prevalence of gastrointestinal diseases among Ankober District inhabitants in northcentral Ethiopia. However, in other communities in the country, for instance in Bench community, Mirutse Giday *et al*. (2009a) reported the prevalence of skin-related problems (46%), Balcha Abera (2014) reported prevalence of infectious diseases in Gimbi District of western Ethiopia, Tilahun Teklehaymanot and Mirutse Giday (2007) reported high occurrence of gastrointestinal disorder and parasites (22.8%) in Zegie Peninsula, northwestern Ethiopia, Islam *et al*. (2014) reported prevalence of gastrointestinal disorders in Madhupur Forest area, Bangladesh and Molares and Ladio (2014), reported prevalence of gastro-intestinal use (25%) in Mapuche-Tehuelche community in arid Argentine, Patagonia. Affordability, cultural acceptability, healing potential and availability factors were reported as the key factors which lead the community to knock at the door of traditional healthcare practitioners than the few distantly located modern healthcare centres with unaffordable fees. Similar findings were reported elsewhere by other researchers (Tilahun Teklehaymanot and Mirutse Giday, 2007; Ermias Lulekal *et al*., 2008; Fisseha Mesfin *et al*., 2009; Tesfaye Hailemariam *et al*., 2009; Ermias Lulekal *et al*., 2013).

Commonly, a diagnosistic method practiced by all local healers in the area was visual inspection of patients. Although changes in body temperature, skin and eye colour, appetite and physical appearance help traditional healers to detect which patients face disorders, it was only through visual experience that identification of diseases and prescriptions seem to be made. Other researchers (Alexiades, 1996; Dessalegn Dessissa, 2001; Tilahun Teklehaymanot and Mirutse Giday, 2007; Fisseha Mesfin *et al*., 2009; Ermias Lulekal *et al*., 2013) have also reported similar diagnostic methods in different cultural groups. Misidentification of diseases commonly leads to misprescription which may result in adverse effects to patients. Even though dosages of remedies for various ailments were reported to be determined based on age, occurrence of pregnancy, physical fitness/appearance and gender of the patient, there were no standardized measurements or guidelines set by traditional healers. Overdose of remedies was also reported to bring adverse effects like vomiting, diarrhoea, burning sensations and sometimes fainting of the patient. Lack of precision and standardization has been mentioned as a global drawback of the traditional healthcare system (Dawit Abebe, 2001; Ermias Lulekal *et al*., 2013).

5.1.4.3. Modes of remedy preparation and application

Freshly harvested plant parts were the dominant ones (66.48%) used in remedy preparation in the study area. Other studies conducted elsewhere also indicated the wider use of fresh materials (Ignacimuthu *et al.*, 2006; Bussmann and Sharon, 2006; Haile Yineger *et al*., 2007; Miruste Giday *et al*., 2009a; Ermias Lulekal *et al*., 2013). This could be due to the fact that the widely consumed plant part i.e., leaves are available throughout the year, as leaves are harvest mostly from perennial shrubs and trees. The frequent use of fresh materials might also be an attempt not to lose volatile oils, the concentration of which could deteriorate on drying (Miruste Giday *et al*., 2009a).

Most of the remedies are prepared from a single species; mixtures are seldom used. Out of total preparations, 232 (61.7%) formulations were prepared from single plant species and the rest 28 preparations (7.62%) were from two or more plant species. A number of findings (Mirutse Giday *et al*., 2007; Mirutse Giday *et al*., 2010; Parvez and Yadav, 2010; Tilahun Teklehaymanot and Mirutse Giday, 2013; Ermias Lulekal *et al*., 2013; Maroyi, 2013; Anteneh Belayneh and Negussie Bussa, 2014) reported similar results stating that monotherapy preparation made from single plant species was used more frequently than mixtures for remedy preparations. However, other reports (Haile Yineger and DessalegnYewhalaw, 2007; Haile Yineger *et al*., 2008) indicated use of mixtures of different species to treat ailments than the use of single species.

Most remedies in the study area were prepared in decoction followed by concoction. The common use of medicinal plant decoctions for various ailments might be related to their proven efficacy over many years of trial and indigenous knowledge accumulated on efficacy of such preparations (Ermias Lulekal *et al*., 2013). Decoction was also reported as one of the dominant ways of remedy preparation in ethnomedicinal inventory of other socio-cultural groups in the country (Haile Yineger *et al*., 2007; Fisseha Mesfin *et al*., 2009; Ermias Lulekal *et al*., 2013). Other reports, however, indicated the fairly common use of concoctions in Ethiopia (Dawit Abebe, 1986; Haile Yineger and DessalegnYewhalaw, 2007; Ermias Lulekal *et al*., 2008; Mohammed Adefa and Berhanu Abraha, 2011; Mohammed Adefa and Seyoum Getaneh, 2013; Anteneh Belayneh and Negussie Bussa, 2014). The frequent use of concoctions could be attributed to the belief by many healers of synergic reactions (Lal and Yadav, 1983 and Dawit Abebe and Ahadu Ayehu, 1993).

5.1.4.4. Routes of remedy administration, dosages and antidotes

The fact that most remedies in the study area were applied orally (220 preparations, 59.94%) followed by topical or dermal application (95 preparations, 25.88%) could be due to the high prevalence of gastrointestinal and dermatological ailments in the study area (Appendix 2). Predominance of oral and dermal routes of herbal drug application in the study area could be because of high prevalence of gastrointestinal and skin related problems in the area. Intra-cutaneous application of remedial preparation could also be attributed to the fact that it minimizes the chance of intoxification by drugs than when it is administered orally. In addition, both oral and dermal routes permit rapid physiological reaction of prepared medicines with the pathogens and increase its curative power. In connection to this, reports showed that oral and dermal route of administration of remedies found to enhance the physiological reactions of remedies with the pathogens that in turn increase the healing power of the medication. In this regard, similar findings were reported elsewhere (Debela Hunde *et al*., 2004; Kebu Balemie *et al*., 2004; Tilahun Teklehaymanot and Mirutse Giday, 2007; Mohammed Adefa and Berhanu Abraha, 2011; Anteneh Belayneh *et al*., 2012; Singh *et al*., 2012; Mohammed Adefa and Seyoum Getaneh, 2013; Bano *et al*., 2014).

Salt, other herbs, honey, butter, sugar and milk were some of the additives in herbal remedy preparations among others (Table 21). These could increase the adhesive nature of remedies or could facilitate their palatability by changing their smell and taste more suitable for ingestion or topical application.

As indicated earlier, dosages of remedies were not standardized and overdose of remedies was also reported to bring occasional adverse effects. When this is the case, traditional healers in the study area have reported the use of different antidotes including bark of *Schefflera abysinica*, shoot of *Gnidia glauca*, milk, coffee, honey, yoghurt, sugar and butter for reversing adverse effects and stabilizing any disorder. The same pattern of using antidotes was also reported for other cultural groups elsewhere (Mirutse Giday *et al*., 2009a; Mirutse Giday *et al*., 2010; Mohammed Adefa and Berhanu Abraha, 2011; Ermias Lulekal *et al*., 2013; Mohammed Adefa and Seyoum Getaneh, 2013; Adnan *et al*., 2014; Anteneh Belayneh and Negussie Bussa, 2014).

5.1.4.5. Informant consensus and relative healing potential of the medicinal plants

The medicinal plants that are presumed to be effective in treating a certain disease have higher ICF values. Table 28 shows disease categories with relatively higher ICF values were gastrointestinal, pharyngeal and Parasitic (GIPP) followed by respiratory and dermatological and diseases of subcutaneous tissues (DST). The observed highest informants' agreement supplemented by high plant use citations for these disease categories could also indicate the relatively high incidence of these diseases in the area. High ICF values are also important to identify plants of particular interest in the search for bioactive compounds. Accordingly, medicinal plants of the area (with high ICF values) for treating the aforementioned ailments need to be investigated for their pharmacological properties subsequently.

The reported highest fidelity level values for *Zingiber officinale* (95.65%) against respiratory diseases, *Bothriocline schimperi* against evil eye (95.65%) and *Hagenia abyssinica* (95.83%) against gastrointestinal, pharyngeal and parasitic (GIPP) could be considered as a clue for the high healing potential of these plants against the corresponding diseases. Plants with highest fidelity level values could also be targeted for further phytochemical investigation to prove the bioactive components that are responsible for their high healing potential (Trotter and Logan, 1986; Heinrich *et al*., 1998). Hence, further activity testing experiments need to be carried out on extracts of these species in the future.

5.1.5. Ethnoveterinary medicinal plants of the study area

5.1.5.1. Diversity of ethnoveterinary plants and status of their current use

The communities of the study area depend on livestock as a major support to their livelihoods, employment opportunity, crop production, transport and for generating income to sustain life. Understanding indigenous knowledge, attitudes and practices of such traditional communities about occurrence, treatment, prevention, control and local importance of different livestock ailments and traditionally used medicinal plants against respective ailments is important to design and implement informed veterinary healthcare and husbandry system (Gemechu Wirtu *et al*., 1997; Ermias Luelkal *et at*., 2013). Ethnoveterinary studies have long-term output of developing eco-sustainable projects with a primary goal of using plant-based remedies in traditional and also new agricultural and animal breeding systems (Pioroni *et al*., 2006).This study revealed that communities in the study area have age-old indigenous knowledge on the use of plants in the wild to treat various livestock ailments. They reported a wide diversity of plant species, 97 used in the treatment of 44 different livestock ailments (Appendix 8). This high level of traditional knowledge held by the communities and strong reliance of the community to ancestral medical traditions which are still held as highly valued heritage of the society may be related to the deep-rooted culture of plant use for millennia.

The reason behind strong and continued dependence of the communities on wild plants of ethnoveterinary importance to treat veterinary ailments is due to inadequacy of formal veterinary health facilities on top of other cultural and biomedical reasons. Moreover, some of the rural community lives in marginal areas which are not easily accessible to the rare modern veterinary services which are also known for their high prices totally unaffordable to the less economically endowed people living there.

The reported ethnoveterinary medicinal flora of the study area indicated that the area is rich in its ethnoveterinary plant diversity and indigenous knowledge associated with each traditionally used species. Comparison of the number of ethnoveterinary medicinal plant species used in the study area with other ethnoveterinary research results of cultural communities in Ethiopia (Teshale Sori *et al*., 2004; Haile Yineger *et al*., 2007; Gidey Yirga *et al*., 2012; Gebremedhin Gebrezgabiher *et al*., 2013; Abiy Shilema *et al*., 2013; Mirutse Giday and Tilahun Teklehaymanot, 2013; Ketema Tolossa *et al*., 2013; Banerjee *et al*., 2013; Scantlebury *et al*., 2013; Ermias Luleka *et al*., 2014; Yared Yigezu *et al*., 2014; Tadesse Birhanu *et al*., 2014; Yibrah Tekle, 2014; Tadesse Birhanu and Dereje Abera, 2015; Yibrah Tekle, 2015; Solomon Araya *et al*., 2015) and elsewhere in South Africa (Botha *et al*., 2001), Pakistan (Khan *et al*., 2012; Hassan *et al*., 2014; Mirani *et al*., 2014); Nigeria (Alhajia nd Babalobi, 2014), Kenya (Njoroge and Bussmann, 2006; Gakuubi and Wanzala, 2012); Uganda (Tabuti *et al*., 2003; Nabukenya *et al*., 2014) and India (Selvaraju , 2011; Devendrakumar and Anbazhagan, 2012; Yadav *et al*., 2014; Alagesaboopathi, 2015) confirms the richness of the area in diversity of ethnoveterinary plants. The centuries-old interaction of indigenous people in the area with locally available medicinal plants might have enabled them to develop an indigenous knowledge system best fit to select and use diverse curative medicinal plants to treat frequently occurring livestock diseases. Knowledge on plant use is the result of many years of human interaction and selection on the most desirable and successful plants present in the immediate environment at a given time (Rindos, 1984).

Some ethnoveterinary species of Jibat, Chelia and Dendi districts are also found with use reports in other ethno-linguistic communities in the country. Examples are *Justicia schimperiana* used by Afar people of Ada'ar District (Mirutse Giday and Tilahun Teklehaymanot, 2013); *Brucea antidysernterica*, *Ekebergia capensis*, *Gouania longispicata*, *Croton macrostachyus*, *Vernonia amygdalina*, *Euphorbia schimperiana*, *Clematis longicauda*, *Justicia schimperiana*, *Echinops kebericho*, *Momordica foetida* and *Allium sativum* reported from four districts of Jimma Zone (Yared Yigezu *et al*., 2014)*; Stephania abyssinica* that also occurs in the ethnoveterinary medicinal flora of the Dabat District, northern Ethiopia (Berhanemeskel Woldegerima *et al*., 2008); *Agave sisalana* and *Dodonaea angustifolia* were documented for the Zay people (Mirutse Giday, 2001); *Capsicum annuum*, *Justicia schimperiana*, *Clausena anisata*, *Linum usitatissimum*, *Nicotiana tabacum*, *Agave sisalana*, *Cyphostemma adenocaule* and *Pittosporum viridiflorum*, were recorded for two weredas of southern Tigray, northern Ethiopia (Mirutse Giday and Gobena Ameni, 2003); *Clausena anisata, Croton macrostachyus* and *Ricinus communis* were recorded for the Gilgel Ghibe area, Ankober District (Ermias Lulekal *et al*., 2013) and Borana pastoralists (Teshale Sori *et al*., 2004) ; *Justicia schimperiana*, *Ricinus communis* L., *Zingiber officinale*, *Nicotiana tabacum* L. and *Allium sativum* L. reported from selected weredas of East Wollega Zone (Tadesse Birhanu *et al*., 2014); *Calpurnia aurea* and *Achyranthes aspera* reported for Ankober (Lulekal *et al*., 2013); Tanqua-Abergele and Kolla-Tembien districts (Gebremedhin Gebrezgabiher *et al*., 2013); Ermias); *Acokanthera schimperi*, *Croton macrostachyus* and *Otostegia integrifolia*, documented for Medebay-Zana District

(Gidey Yirga *et al*., 2012); *Olea europaea* L. subsp. *cuspidata*, *Zehneria scabra*, *Prunus africana*, *Brucea antidysernterica*, *Calpurnea aurea* and *Achyranthes aspera* recorded for selected districts of Horo Guduru (Tadesse Birhanu and Dereje Abera, 2015). Similarity of medicinal plant species used in different communities can be attributed to intracultural transmission of the indigeneous plants and the associated knowledge besides popularity of the species in use in areas investigated for their ethnomedicinal knowledge.

The families Asteraceae and Lamiaceae were represented by high number of ethnoveterinary species followed by Euphorbiaceae, Solanaceae, Fabaceae and Ranunculaceae (Table 22). This could be related to their wider distribution and use in Ethiopia/the flora area (Hedberg & Edwards, 1989; Edwards *et al*., 2000; Mesfin Tadesse, 2004; Ryding, 2006). These families were also reported to have the largest share of ethnomedicinal species in other ethnobotanical works in Ethiopia (Haile Yineger *et al*., 2007; Damtew Bekele *et al*., 2012; Mirutse Giday and Tilahun Teklehaymanot, 2013; Gebremedhin Gebrezgabiher *et al*., 2013; Ermias Lulekal *et al*., 2013; Ketema Tolossa *et al*., 2013; Yared Yigezu *et al*., 2014; Yibrah Tekle, 2015; Tadesse Birhanu and Dereje Abera, 2015). A systematic review of European ethnoveterinary research has also revealed similar findings (Mayer *et al*., 2014).

5.1.5.2. Ethnoveterinary plant knowledge of the community

Comparison of medicinal plant knowledge held among community members of varying age groups in the study area indicated a significant difference ($P<0.05$) in plant use by senior/elderly members of the community (5.97 ± 1.92) over younger ones (4.10 ± 1.92). Similarly, illiterate and key informants had more knowledge of ethnoveterinary medicinal plants ($P<0.05$) than literate and general informants. This could be related to a higher degree of cultural contact and experience/specialization of the elderly and key members with curative plants than that of younger and general members in the community and impact of modernization in the cases of younger and literate members of the community as is also evident in other ethnobotanical studies in Ethiopia and other countries (Silva *et al*., 2011, Ermias Lulekal *et al*., 2013; Tena Regassa *et al*., 2014). High degree of secrecy on passing knowledge on medicinal plants within the family circle only to elder sons and lack of interest on traditional remedies by younger groups might also explain the decline of indigenous knowledge going down the generation ladder in the study area. Ethnobotanical inventories in Ethiopia (Kebu Balemie *et al*., 2004; Haile Yineger *et al*., 2008; Tilahun Teklehaymanot, 2009; Mirutse Giday *et al*., 2009; Ermias Lulekal *et al*., 2013; Tena Regassa *et al*., 2014) and elsewhere in other countries (Begossi *et al*., 2002; Uniyal *et al*., 2006; Silva *et al*., 2011) also share a similar concern on the knowledge gap down generations in different cultural groups. Systematic documentation of indigenous knowledge on medicinal plant use through ethnobotanical inventories is crucial to safeguard such fast-disappearing knowledge among successive generations before they have gone forever.

Results of this investigation also showed that both men and women members of the community in the study area are knowledgeable on ethnoveterinary medicinal plant use despite the relative dominance of medicinal plant tradition by men which could be associated with the traditional flow of information along the male line in the country (Tilahun Teklehaymanot, 2009). Absence of significant difference ($P>0.05$, Table 23) between men and women could be related to the equal access to ethnoveterinary medicinal plants resource base.

5.1.5.3. Growth forms, parts of plants used and preparation and application methods

The findings of this study also indicated most-frequent utilization of herbs followed by shrubs and trees in remedy preparation. Dominance of herbs was also reported by earlier ethnobotanical inventories (Mirutse Giday *et al*., 2003; Tabuti *et al*., 2003; Muthu *et al*., 2006; Haile Yinger *et al*., 2007; Mirutse Giday *et al*., 2010; Singh *et al*., 2012 and Adnan *et al*., 2014). In contrast, other investigators (Debela Hunde *et al*., 2006; Haile Yineger and Delenasaw Yewhalaw, 2007; Ermias Lulekal *et al*., 2008; Tesfaye Hailemariam *et al*., 2009; Fisseha Mesfin *et al*., 2009; Girmay Zenebe *et al*., 2012; Mirutse Giday and Tilahun Teklehaymanot, 2013; Ketema Tolossa *et al*., 2013; Ermias Lulekal *et al*., 2014 and Yared Yigezu *et al*., 2014) reported dominance of other species for ethnomedicinal preparation in Ethiopia.

The finding that leaves followed by roots to be the most harvested plant parts used for ethnoveterinary remedy preparation in the study area might be associated with traditional beliefs in different communities that existence of adequate active principles in these parts for treating various ailments. Similar findings were reported elsewhere in the country (Gidey Yirga *et al*., 2012; Abiy Shilema *et al*., 2013; Mirutse Giday and Tilahun Teklehaymanot, 2013; Yared Yigezu *et al*., 2014; Tadesse Birhanu and Dereje Abera, 2014; Yibrah Tekle, 2015; Solomon Araya *et al*., 2015 and Gebremedhin Romha *et al*., 2015) and elsewhere around the globe (Martínez and Luján, 2011; Offiah *et al*., 2011; Gakuubi and Wanzala, 2012; Ritter *et al*., 2012; Eswaran *et al*., 2013; Hassan *et al*., 2014; Tariq *et al*., 2014; Al Mamun *et al*., 2015; Alhaji and Babalobi, 2015; Alagesaboopathi, 2015; Offiah *et al*., 2015 and Mishra *et al*., 2015). However, in ethnoveterinary inventories carried out elsewhere, roots were the most commonly sought plant parts for remedy preparations (Haile Yineger *et al*., 2007; Ketema Tolossa *et al*., 2013; Ermias Lulekal *et al*., 2014; Genene Bekele and Reddy, 2015). Moreover, harvesting of leaves compared to harvesting of roots has a less negative influence on the survival and continuity of useful medicinal plants and hence does not affect sustainable utilization of the plants, provided that proper harvesting techquinique is in place.

Preparations of the majority (76.29%) of remedies involved single medicinal plant (monoherbal preparation), which is in agreement with the findings of studies conducted elsewhere in Ethiopia (Dawit Abebe, 1986; Haile Yineger and Delnesaw and Yewhalaw, 2007; Debela Hunde *et al*., 2004; Mirutse Giday *et al*., 2010; Mirutse Giday and Tilahun Teklehaymanot, 2013; Hassan *et al*., 2014; Gebremedhin Romha *et al*., 2015). However, 23.71% of the traditional therapy were also prepared using formulations from two or more ethnoveterinary medicinal plant species from either similar or different parts of the plants for treating livestock ailments may be attributed to the expected synergetic effect of combinations of parts and their bioactive ingredients to treat ailments. In line with this, the therapeutic efficacy of polyherbal preparations used in other peoples living in northwest Ethiopia (Dawit Abebe and Ahadu Ayehu, 1993) and in southwest Ethiopia (Mirutse Giday *et al*., 2007) for treating various ailments have been reported.

The dominant mode of ethnoveterinary medicinal plant remedy preparation and application was through crushing and steeping plant part(s) in cold water (35.96%) and giving the resulting infusion to the target animal under question to drink. In agreement with this result, use of cold infusion in herbal remedy preparation has also been reported from other cultural groups (Haile Yineger *et al*., 2007; Ermias Lulekal *et al*., 2008; Ketema Tolossa *et al*., 2013 and Ermias Lulekal *et al*., 2014) against various ailments. This could be related to age-old traditional experiences on proven efficacy of such herbal products.

5.1.5.4. Ailments treated and ethnoveterinary remedies: dosage and administration

Out of the total of 44 livestock ailments reported to be managed by ethnoveterinary medicinal plants in the study area the most recurrently reported animal health problem was bloat and febrifuge. The local people use medicinal plants like *Brassica carinata*, *Capsicum annuum*, *Clematis simensis*, *Galiniera saxifraga* and *Vernonia amygdalina* to treat this illness. Babesiosis and erythroblasts were the next common ailments and were treated with *Achyranthes aspera* L., *Cyphostemma dembianense*, *Dracaena afromontana*, *Ficus sur*, *Hypericum quartinianum*, *Impatiens rothii*, *Pittosporum viridiflorum*, *Rytigynia neglecta* and *Vernonia leopoldi*. An enumeration of these plants is given in detail in Appendix 8 (also see Table 25). The use of these plants in the area against the above indicated livestock ailments shows presence of inherent curative property of the plants which, however, need to be tested through further phyochemical and pharmacological studies.

Identification of specific livestock ailment types and selection of crosponding curative plants which were thought to be most appropriate to heal different veterinary diseases in the area was found to be made based on time-tested cultural knowledge on symptoms and corresponding livestock illnesses held in the memories of indigenous people. Among the factors that determined the administration frequency and dose of the herbal remedies included the livestock species, age, body weight, level/state of illness and other conditions such as pregnancy and lactation. Informants only provided the knowledge of observed time of recovery of animals in response to given recipes. The respondents in the study area also indicated that they could identify the diseased livestock by its change in feeding behaviour as has been reported by Banerjee *et al.,* (2013) in southern Ethiopia. Full recovery is confirmed when the animals restart proper feeding and other physical activities. Similar findings were also reported by other ethnoveterinary studies conducted elsewhere (Offiah *et al*. 2011; Hassan *et al*., 2014; Ermias Lulekal., 2014; Tariq *et al*., 2015).

However, no standardized volume or weight measurements were set by traditional healers on the amount of herbal prescriptions for different livestock ailments. Ethnoveterinary studies conducted in Ethiopia (Dawit Abebe, 1986; Mirutse Giday and Tilahun Teklehaymanot, 2013; Ketema Tolossa *et al*., 2013; Ermias Lulekal *et al*., 2014, Banerjee *et al*., 2013; Yibrah Tekle, 2014 and Solomon Araya *et al*., 2015) and elsewehere (Hussain *et al*., 2008; Monteiro *et al*., 2011; Ritter *et al*., 2012; Gakuubi and Wanzala, 2012; Tariq *et al*., 2014 and Alhaji and Babalobi, 2015) have also reported the lack of standardized doses in traditional prescriptions of livestock remedies. This is a common bottle-neck in herbal medicine therapy and should be accorded due attention and further research.

The most common route of administration was oral (79.82%) followed by dermal/topical (16.66%). These recipes are given to the livestock with their feed along with different types of ingredients like salt, milk and so forth, in the area. Similar findings are also reported from other regions of the world (Haile Yineger *et al*., 2007; Offiah *et al*., 2011; Mirutse Giday and Tilahun Teklehaymanot, 2013; Barenjee *et al*., 2014 and Yared Yigezu *et al*., 2014). The use of these vehicles might be due to their enhancing potential of taste (i.e., minimize discomfort) and reduce adverse effects such as vomiting and diarrhoea and enhance the efficacy and healing conditions. The dominance of oral application of remedies could be related to the fact that most of the reported health problems are affecting internal organs and such routes of recipe administration were considered permitting rapid physiological reaction with the pathogens and increasing the curative power of the medicines.These findings were almost consistent with other studies (Teshale Sori *et al*., 1993; Kebu Balemie *et al*., 2004; Gidey Yirga *et al*., 2012; Abiy Shilema *et al*., 2013; Yared Yigezu *et al*., 2014; Ketema Tolossa *et al*., 2013; Yibrah Tekle, 2014 and

Solomon Araya *et al*., 2015) within different regions in Ethiopia and elsewhere in other geographic regions (Tariq *et al*., 2014; Al Mamun *et al*., 2015).

5.1.5.5. Type of livestock treated

The most commonly treated animals in the study area were catagogized under cattle, sheep, goats, animals, cows, poultry, horses, mules, donkeys ad other categories (Table 24). Cattle category had the highest number of known ethnoveterinary remedies (39.64%) followed by sheep (18.34%) and goats (13.01%). The number of known ethnoveterinary remedies for a particular type of livestock may probably correspond with socio-economic value and importance of the animal in the cultural and traditional life of a given community and perhaps this may also explain the order of acquisition of these animals for domestication by the community in their life history (Gakuubi and Wanzala, 2012). The relatively high number of medicinal plants cited for treating cattle ailments may also be related to incidence of more diseases affecting cattle populations in the area. Presence of largest share of ethnoveterinary plants for treating cattle ailments was also reported for other cultural groups in the country (Haile Yineger *et al*., 2008; Gakuubi and Wanzala, 2012; Ermias Lulekal *et al*., 2014).

5.1.5.6. Consensus building amongst key informants on livestock ailments treated

The observed highest informants' consensus (ICF) values on ethnoveterinary medicinal plants used to treat dermatological and sensorial problems (0.80) followed by septicaemic problems (0.68) and wound, external injury and animal bite (0.66) in the study area may indicate popularity of curative plants against these diseases in the respective ailment categories. According to Sharma *et al*. (2012), the ICF are low (near zero) when the plants are randomely chosen or when the informants do not exchange information about their use. High ICF values (close to one) are obtained when the selection criteria are well defined and the use information is shared among informants (Hienrich *et al*., 1998). In short, The ICF defined how homogeneous the information was by the degree of consensus in key informants' responses. Infact, documentation of inherently rich traditional ethnomedicinal/ethnoveterinary knowledge based on ICF values have provided valuable information on new pharmacological dimensions for better healthcare of livestock and humans regarding many ailments (Trotter and Logan, 1986) and also assist conservation and management of rare, gradually vanishing important ethnomedicinal plant species. If validated, the claim for medicinal plants used in traditional medicine for a number of ailments of humans and livestock could provide new applications in supporting healthcare systems that are urgently needed (Ketema Tolossa *et al*., 2013).

The recorded largest ICF value for dermatological and sensorial problems could be due to high prevalence of the main ailments under this category and ease of identifying their clinical signs and perhaps they are well diagnosed by the interviewees. This finding is in consonance with studies conducted in Ethiopia (Ketema Tolossa *et al*., 2013; Ermias Lulekal *et al*., 2014) and elsewhere (Tabuti *et al*., 2003). In contrast to this result, gastrointestinal ailments were reported to have high ICF values in ethnoveterinary studies conducted elsewhere (Ritter *et al*., 2012; Tariq *et al*., 2014 and Gebremedhin Romha *et al*., 2015). Furthermore, the lowest ICF value was obtained for locomotory problems (0.47). Diseases with low ICF values may be either new in the area or poorly diagnosed by the traditional animal healthcare providers (Gakuubi and Wanzala, 2012).

5.1.5.7. Estimation of healing potential of ethnoveterinary plants

Widely used medicinal plant species to treat certain ailments always score the highest fidelity level. *Prunus africana* (97%) was reported to treat Epizootic lymphagitis (biichee farda in Afan Oromo), under dermatological and sensorial problems ailment category and *Acokanthera schimperi*, *Clerodendrum myricoides* and *Sida schimperiana* (96% each) were used to treat trypanosomiasis (gandii in Afan Oromo), cough (qufaa/soffaa in Afan Oromo) and chronic wound (madaa in Afan Oromo) under septicaemic problems, respiratory tract problems and wound, external injury and animal bite categories respectively. Tonsillitis (hudhaa in Afan Oromo), rabies (dhukkuba saree in Afan Oromo) and erythroblasts (gatachaa in Afan Oromo) were said to be treated by *Acalypha psilostachya*, *Calpurnea aurea* and *Hypericum quartinianum* (95% each) respectively (Appendix 8, Table 29).

According to Trotter and Logan (1986), knowledge domain scoring higher informant consensus values are thought to have better potency as compared to plants with less informant consensus values. This could also indicate the relative abundance of these plants in the study area. Thus, high FL values of the above medicinal plants could indicate relatively high healing potential of the species for treating ailments under the respective ailment categories (Ermias Lulekal *et al*., 2014; Tariq *et al*, 2014 and Alhaji and Babalobi, 2015). Thus, these plants should be further subjected to phytochemical and pharmacological investigation to prove their medicinal efficacy.

5.1.5.8. Habitat, avialability and marketablity of ethnoveterinary medicinal plants

Similar to human medicinal plants discussed above, the majority (91.76%) of ethnoveterinary medicinal plants used in the study area were harvested from wild sources. Only few species (8.24%) were under cultivation primarily for other uses than medicinal purposes. Plants were harvested and processed only when needs arose. The use of uncultivated medicinal plants is a common custom in Ethiopia and even sometimes wild source being exclusive source of these plants (Mirutse Giday and Tilahun Teklehaymanot, 2013). This has been accelerating the deterioration of useful plant population in addition to agricultural expansion accompanied by wide cutting of original forest species and environmental degradation. Comparable trends in overharvesting medicinal plants from the wild were also reported in the country (Getachew Addis *et al*., 2001; Kebu Balemie *et al.*, 2004; Haile Yineger *et al*., 2007; Girmay Zenebe *et al*., 2012; Ermias Lulekal *et al*., 2014 and Yibrah Tekle, 2014) and elsewhere (Tabuti *et al*., 2003; Gradé et *al*., 2008 and Khan *et al*., 2012).

Most of the plants were commonly available in the study area and could easily be harvested from the immediate environments. However, *Acalypha psilostachya*, *Polyscias fulva* and *Rhamnus staddo* were reported to be encountered rarely during remedy collection by some respondents and, therefore, required longer time to harvest. This is, in part due to land degradation and accessibility. It is rationalized that marketability of ethnoveterinary medicinal plants is not common as was observed during market surveys made at Shenen, Gedo and Ginchi major local markets. This could indicate either the availability of these resources in the vicinity of households and healers and they may use homemade therapy or buy from traditional veterinary health providers in other means of social structure than using formal local markets. During market surveys at the above local markets only few ethnoveterinary medicinal plants such as *Allium sativum*, *Brassica carinata*, *Capsicum annuum*, *Cucurbita pepo*, *Nicotiana tabacum* and *Zingiber officinale* were observed to be sold, ofcourse as food and spices in the region, though they were mentioned to be occasionally used as remedies when there is a need. Status and availability of marketable medicinal plants were also reported in various sources (Kloos, 1976;

Kloos *et al*., 1978; Desalegn Dessissa, 2001; Mander *et al*., 2006; Mirutse Giday *et al*., 2009a; Ermias Lulekal *et al*., 2014 and Berhane Kidane *et al*., 2014) for other cultural groups in Ethiopia. In contrast to some developing countries, there is no official report, so far, of any medicinal plant export from the country (Mirutse Giday *et al*., 2009a).

5.1.6. Use diversity, ranking and conservation prospectus of the medicinal plants in the study area

Local people in the study area harvest plants with medicinal values for a variety of other uses mostly for timber, agricultural implements, firewood, charcoal and construction. The result evidenced that about 54.16% of the total medicinal plants used by local people in the study area do have multipurpose roles.

The result of a direct matrix ranking exercise by local people of Jibat showed highest values/ranks for a number of multipurpose medicinal plants of the study area including *Prunus africana*, *Hagenia abyssinica* and *Olinia rochetiana*. Results also indicated that those multipurpose medicinal plant species are currently exploited more for firewood and construction than for their medicinal importance (Table 30). Similarly, *Prunus africana*, *Olea europaea* subsp. *cuspidata* and *Podocarpus falcatus* were the top multipurpose medicinal plants and are currently exploited more for firewood, charcoal and for making agricultural implements than for their medicinal purpose (Table 31). *Juniperus procera*, *Prunus africana* and *Hagenia abyssinica* were reported to be important multipurpose medicinal plants of Dendi and are exploited more for firewood; charcoal and construction than for their medicinal role (Table 32).

Overharvesting of these multipurpose medicinal plant species for firewood, construction, charcoaland making agricultural implements were found to be the responsible factors aggravating erosion of the species in the area. The utilization of medicinal plants for uses other than medicinal purpuses may pose additional pressures to these resources. This calls for practical solutions like domestication, in-situ conservation, introduction of other tree species for non-medicinal uses and any other feasible conservation actions to safeguard the fast depleting multipurpose medicinal plant species of the area. Exploitation of multipurpose medicinal plants for uses other than their traditional medicinal purpose was also reported elsewhere (Haile Yineger *et al*., 2007; Girmay Zenebe *et al*., 2012; Ermias Lulekal *et al.*, 2013 and Beltran *et al*., 2014).

The preference ranking exercise helped to identify the most-preferred medicinal plant species of Jibat to treat diarrhoea. Accordingly, *Lactuca inermis*, *Coffea arabica* and *Brucea antidysernterica* scored highest values and were found the most preferred ones to treat the disease. This may be attributed to the presence of bioactive compounds against causative agents of diarrhoea in these species. In the same way, *Dodonaea angustifolia*, *Justicia schimperiana* and *Arisaema enneaphyllum* of Chelia medicinal plants were the most preferred ones against atopic eczema and could indicate the presence of active components in these plants to treat atopic eczema. To treat rheumatism, local people of Dendi use *Carissa spinarum*, *Acanthus sennii* and *Otostegia integrifolia* as their first choice. Unlike local people of Chelia, indigeneous people of Ankober prefer to use *Olea europaea* subsp. *cuspidata* for treating eczema (Ermias Lulekal *et al*., 2013). This could be attributed to intercultural variations concernerning indigeneous medicinal plant knowledge regardless of availability of the plants resources. One can say that, further investigation of these most preferred species for their bioactive principles to treat the respective human ailments may bring promising output.

Concerning the major threats to the medicinal plants of the study area, these resources are under pressure from various anthropogenic and natural origins. Local people's perceptions of factors threatening the medicinal plants were determined through individual interviewees. Accordingly, pressures from agricultural expansion (46%), over-stocking/grazing (27%), fuel-wood collection (18%), selective harvesting (12), drought (6%) and fire hazards (3%) were reported. Similar trends of threat to medicinal plants were also reported in other ethnobotanical studies conducted in the country (Kebu Balemie *et al*., 2004; Fisseha Mesfin *et al*., 2009; Ermias Lulekal *et al*., 2013; Banerjee *et al*., 2013; Mathewos Agize *et al*., 2013; Tena Regassa *et al*., 2014; Berhane Kidane *et al*., 2014; and Getaneh Gebeyahu *et al*., 2014) and elsewhere (Uprety *et al*., 2010 and Khan *et al*., 2012). In general, these studies conducted in the country and elsewhere have shown that wild plant resources including medicinal plants are subjected to a number of anthropogenic and natural factors such as agricultural expansion, collection for fuel and construction, recurrent drought and overgrazing, dominance of exotic/alien plants, absence of cultivation practices. As far as conservation status is concerned, most of the medicinal plants in the study area have no protection since they are harvested from the wild with no evident conservation practices except the few medicinal plants under cultivation. This urges the need for participation of local people and awareness creation through training or education on sustainable utilization and management of plant resources in general and the medicinal plants in particular to ensure sustainable utilization of these resources (Girmay Zenebe *et al*., 2012).

5.1.7. Medicinal plants knowledge acquisition and transfer

Since indigenous knowledge on usage of medicinal plants is transmitted without any systematic process and in the absence of written pharmacopeia, oral transimission is the only way to transimmit the knowledge lore from generation to generation. Younger generations of the communities are not interested in traditional healing system because of factors related to 'modernization' and 'economic reseasons' i.e., due to advent of modern healthcare system and expansion of schools as well as because it has little scope for money, the youngesters engage themselves in other occupations. Thus, it is certain that such knowledge is at the verge of disappearance in the future unless proper action is taken. Comparable results were reported for other cultural groups in the country (Hareya Fassil, 2005; Teferi Flatie *et al*., 2009; Mirutse Giday *et al*., 2009a; Mirutse Giday *et al*., 2010; Ermias Lulekal *et al*., 2013; Mathewos Agize *et al*., 2013; d'Avigdor *et al*., 2014; Berhane Kidane *et al*., 2014 and Yibrah Tekle, 2014) and elsewhere around the globe (Casagrande, 2002; Virapongse, 2006; Singh *et al*., 2012; Khan *et al*., 2012 and Tabuti *et al*., 2012).

According to informants, knowledge of how to treat ailments by respondents is acquired from parents and grandparents or rarely from knowledgeable elders upon substantial payement in return. It was also observed that medicinal plant knowledge is kept quite secrete among traditional healers. This fact suprimposed on lack of any written pharmacopeia on medicinal plants show the threat on the future use of ethnomedicinal potential of the study area. Generally, although the study area was found to be rich in medicinal plant diversity, the attempt to conserve the plants and associated indigenous knowledge was observed to be minimal. It was seen that some informants were aware of the loss of some important medicinal herbs in their vicinity that were easily accessible in earlier times. Community awareness of the threat to the future of traditional herbal medicine has been noted elsewhere in Ethiopia (Teferi Flatie *et al*., 2009 and d'Avigdor *et al*., 2014).

Some efforts, by traditional practitioners, to cultivate medicinal plants at home gardens calls for a sustained governmental and/or non-governmental support to promote overall in-situ and ex-situ conservation strategies for medicinal plants. It is also recommended to establish a traditional healers' association in the study districts and strengthen members by providing professional support and land to establish as much medicinal plant nurseries as possible so as to conserve the fast-depleting medicinal plant resource of the area. Similar trends of medicinal plants knowledge acquisition, mode of transfer and conservation concerns were reported in other ethnobotanical studies conducted elsewhere (Mirutse Giday *et al*., 2009a; Tabuti *et al*., 2012; Ermias Lulekal *et al*., 2013; d'Avigdor *et al*., 2014 and Berhane Kidane *et al*., 2014).

For the rehabilitation of rangelands, promoting in situ and ex situ conservation of the most important and multipurposes species should be given high priority. Rural people not only depend on wild plants as sources of food, medicine, fodder and fuel, but also developed methods of resource management, which may be fundamental to the conservation of some of the world's important habitats (Cotton, 1997). Indigenous knowledge of these local communities includes a system of self-management that governs resource use (Laird and Noejovich, 2002).

To this end, this study will positively contribute to further research and conservation of plant resources, as well as highlighting the indigenous ethnobotanical knowledge of the study communities. Furthermore, to avert the negative outcomes of excessive species use, integrated efforts that involve the local communities in the sustainable use of their resources should be made. Experienced and knowledgeable members of the local community should participate in this process.

5.1.8. Wild edible plants (WEPs) use and associated indigenous knowledge

5.1.8.1. Commonly consumed WEPs in the study area

The wide consumption and availability of wild plants attest their value and are especially visible among indigenous cultures. But in recent times, the old traditions in many tribal communities are at risk and gradually declineing; hence, there is urgent need to study such knowledge systems and find innovative ways of tapping their potential for the welfare of humankind (Rasingam, 2012). In line with this fact, a significant number of WEPs were documented from the study area. There was enough proof that local communities in the study area very often interact with their environment and make use of these WEPs to meet part of their dietary requirements.

Moraceae and Asteraceae were among the most commonly consumed families with five and four edible taxa respectively. This could be related to the fact that most of the *Ficus spp*. are also edible elsewhere (Hegazy *et al*., 2013) and the family Asteraceae is the most diverse plant family in the flora area and thus high probability of encountering edible species. The reason behind the fact that sammaa in Afan Oromo (*Urtica simensis*) was cited by most informants (92.3%) followed by karawayu in Afan Oromo (*Chionanthus mildbraedii*) (81.2%) and agamsa in Afan Oromo (*Carissa spinarum*) (73.7%) could indicate the popularity of these wild edibles in the area. It was found that sammaa (an endemic species to Ethiopia) has high nutritional value compared to many green leafy vegetables commonly cultivated and consumed in Ethiopia. Its protein and mineral content is exceptionally high which makes this vegetable an inexpensive but high quality nutrition source especially for the poor segment of the population where malnutrition is prevalent (Eskedar Getachew *et al*., 2013). Moreover, karawayu and agamsa were among indigenous fruits that play a vital role in the livelihoods of many rural communities in Ethiopia.

The 71 species of WEPS reported to be consumed in this study is lower than some of those reported from other studies within Ethiopia and elsewhere. For example, Getachew Adis *et al*. (2013) reported 137 edible species used by Konso ethnic community in southern Ethiopia. Elsewhere, a total of 122 wild edible plants used in Poba Reserved Forest (Assam), India, belonging to 89 genera under 52 families and 2 varieties were reported by Pegu *et al*. (2013), Uprety *et al*. (2012) reported 81 wild food plants used by indigenous communities and Aryal *et al*. (2009) reported 85 uncultivated food plants used by Chepang people both in Nepal, 188 wild species were reported by Lentini and Venza (2007) from an island in Sicily, 90 species of wild vegetables in Inner Mongolia (China) were reported by Wujisguleng and Khasbagen (2010), Ali-shytayeh *et al*. (2008) recorded 100 wild plant species distributed across 70 genera and 26 families in Palestine (West Bank), Ju *et al*., (2013) documented168 wild edible plant species in 116 genera and 62 families used by Tibetans in Shangri-la region, Yunnan, (China) and Nedelcheva (2013) reported 88 wild edible plants used by local communities in Bulgaria and Redzic (2006) reported 308 wild food plants belonging to 76 botanic families consumed in Bosnia Herzegovina. The possible explanation for these differences could be the differences in local biota diversities and local traditions for instance, rain fed subsistence agriculture is the custom in the study area and erosion of the traditional knowledge on use of WEPs could also be another possible reason.

The results however, compare closely with that of Kebu Balemie and Fassil Kebebew (2006) who documented 66 edible plant species belonging to 54 genera and 34 families in Derashe and Kucha districts in Southern Ethiopia, Agea *et al*. (2011) who recorded 62 WEPs from Matunda and Kiryandongo subcountries of Kibanda country in the Bunyoro-Kitara Kingdom (Uganda) and Ramachandran and Udhayavani (2013) who reported 71 species by Paniyas and Kurumbasof western Nilgris, Tamil Nadu.

5.1.8.2. Main gatherers and consumers of WEPs in the study area

In the study area, WEPs were exclusively collected by women and children. Earlier reports, in Northern Ethiopia Barnett (2001), opined the gathering of WEPS mainly by women and children. Elsewhere in Africa, Agea *et al*. (2011), Vainio-Mattila (2000) and Gullick (1999) in Uganda, Tanzania and Sudan respectively reported the collection of WEPs dominated by women and children in the respective local communities. Hence, roles of women and children as far as gathering of WEPs is concerned should not be underestimated. Zemede Asfaw (2009) stressed the importance of children and women in handling the isse of WEPs with special reference to southern Ethiopia.

The study also indicated that WEPs is largely consumed by all household members than either by men, women or children alone. This practice could indicate the importance of these edible plants in the household diet. This practice may have far reaching implication in food crisis mitigation and dietary diversification and would result in health benefits as the community is practicing cereal based food habit as is true elsewhere in Ethiopia.

5.1.8.3. Relationship between gender, age and knowledge of WEPs

A two-tailed t-test comparison of the knowledge of WEPs between men and women informants showed a significant difference ($P<0.05$). Women informants of the districts were found to report more WEPs on average (6.00 ± 2.07) than men (5.63 ± 1.93). Thus, the result indicated that women are more knowledgeable than men on use of WEPs which could relate to the gender role stereotype in the study community and elsewhere (Agea *et al*., 2011; Tena Regasa *et al*., 2014). Generally, gender based differences in WEP knowledge can be derived from experience and degree of cultural contact with food plants.

Similarly, the significant difference on mean number of WEPs reported by different age groups compared in this study indicated that indigenous knowledge on use of WEPs is still strong with elderly people (6.22 ± 1.63) than in the younger generation (4.26 ± 1.92) in contrast to studies by Tigist Wondimu *et al*. (2006) and Fentahun Mengistu and Hager (2008) where younger generations were more knowledgeable of WEPs in Ethiopia. The fact that adults have a wider knowledge acquisition than children might explain declining parental transmission of WEPs species knowledge by the former to the latter. In other words, the observed strongly significant difference (p = 0.012) showed the gap between generations and the decline of indigenous knowledge on WEPs down the generation ladder. This could be attributed to the impact of modernization (including urbanization and advent of formal education) and the very poor system of sharing indigenous knowledge on WEPs to the younger generation. The result calls for an effort to close the observed generation gap through continuous professional support and training of local communities with an aim of preserving their traditional WEPs knowledge and practices through systematic documentation.

The other significant difference (p = 0.002) observed between key and general informants; and literate and illiterate informants could relate to the impact of age-old experience and maximum degree of knowledge acquisition of WEPs in the former and impact of modernization in the latter case. This result is in contrast with the findings by Fentahun Mengistu and Hager (2008) showing that education is not the important factor responsible for variation of knowledge of WEPs.

5.1.8.4. Main parts consumed and consumption pattern

Fruits, leaves and shoots were the most reported plant parts consumed by the households in the study area. The preference of fruits to other plant parts could be attributed to ease of preparation and consumption pattern. Most fruits were often consumed raw as snacks for instance between meals while collecting fuel wood or herding. Whereas the preference of leaves and shoot could be related to the fact that they are frequently harvested in relatively large quantities, prepared and consumed by the entire members of the households. Elsewhere, in line with the current study Reddy *et al*., 2007; Agea *et al*., 2011; Termote *et al*., 2011 and Nedelcheva (2013) reported the higher preference of fruits and leaves by the indigenous communities in India, Uganda; DR Congo and Bulgaria respectively.

In the present study, WEPs were predominantly consumed as fruits (ripe fruits eaten as snacks) and cooked leafy vegetables in main dishes. Other important consumption pattern in the study area includes as seasonings, in preparation of local alcoholic drinks and as components of bread or porridge. The current consumption of the WEPs in the main meal in the study area reflects the growing importance of these plants in the diet of households of the people (Tena Regasa *et al*., 2014) as is also evident in indigenous communities elsewhere (Agea *et al*., 2011).

5.1.8.5. Cultural importance and Informant consensus on WEPs

The output of a direct matrix ranking exercise showed highest values/ranks for a number of multipurpose WEPs of the study area including *Cordia africana* assumed the first rank as a multipurpose species followed by *Vepris dainellii* in Chelia and Dendi districts and *Acacia abyssinica* in Jibat District .The result indicates that these plants are exploited more for their non-food uses than for reported food values. Overharvesting of multipurpose WEP species for Construction materials, household furniture, farm implements and fuel wood purposes were found the responsible factors aggravating depletion of the species in the area. Thus, the result calls for an urgent complementary conservation action to save the fast eroding multipurpose WEPs plant species of the area. Getachew Addis *et al*. (2013) also reported the same pattern of highest exploitation of WEPs for uses other than their food values in south Ethiopia.

5.1.8.6. Threats and conservation concerns of WEPs and their habitats

The habitats of these valuable WEPs were increasingly threatened by continued destruction of natural vegetation. The fact that most WEPs have multipurpose uses, posed a big threat to their existence due to destruction of their habitats and overharvesting.

Most of the 71 authenticated WEPs occur in two or more habitats. Forest (22.22%) is the major reservoir of WEPs followed by woodland and disturbed bush land (19.88%) and field margins and roadsides (12.28%) among others. This indicates the necessity of conserving woodlands and bush lands and riverbanks in addition to forests in order to ensure sustainable use and conservation of these resources.

The preference ranking exercise helped to identify the most threatening factors of WEPs in the area. Accordingly, agricultural expansion, over-stocking/grazing and fuel wood collection scored highest values and were found to be the most threatening factors. Ethnobotanical investigation done in Ethiopia (Kebu Balemie and Fassil Kebebew, 2006, Debela Hunde *et al*., 2011, Getachew Addis *et al*., 2013 and Tena Regasa *et al*., 2014) and elsewhere Ali-Shtayeh *et al*. (2008) also reported similar pattern of threat factors to WEPs and associated traditional knowledge.

5.1.8.7. Nutracutical plants: dual role

It is a well-known fact that many wild food plants are also used as medicines (Etkin 1996; Bonet and Valle`s 2002; Guarrera 2003) and that the nutritional and medicinal role of many species is intermingled. In general, these plants are known as nutraceuticals (Etkin and Johns, 1998 and Heinrich *et al*., 2005). Etkin and Ross (1982) proposed a food-medicine continuum in which the categories of spices and beverages have an intermediate position. However, data from this study suggest that none of these two use-categories have a clear medicinal role in the area.

5.1.8.8. Scope for future studies

Existing dietary analyses in Ethiopia were found to be very limited and still to be at a basic stage when compared to studies in other countries. In South Africa, Mexico, Niger and India, for example, in-depth nutritional analyses of many WEPs have been reported (Ogle and Grivetti, 1985; Frieberger *et al*., 1998; Lopez-Garcia and Basurto-Pena, 2007; Afolayan and Jimoh, 2009; Rathore, 2009 and Abdillahi *et al*., 2010). A report on nutritional value assessment of *Ziziphus spina-christi* (L) Desf. (Rhamnaceae), *Balanites aegyptiaca* (L.) Del. (Balanitaceae) and *Grewia flavescens* A. Juss (Tiliaceae) in Ethiopia shows that these species are rich in carbohydrate, protein and lipid (Debela Hunde *et al*., 2011). Further research at least on commonly reported Ethiopian WEPs will help to identify more food supplements with rich nutritional values that can help to avert food insecurity. In addition to nutritional analyses, many research reports are also available documenting anti-nutritional and toxicity studies of WEPs from different countries (Guill-Guerrero *et al*., 1997; Vanderjagt *et al*., 2000; Lopez-Garcia and Basurto-Pena, 2007 and Spina *et al*., 2008), which have not been done for WEPs of Ethiopia except for a limited attempt made by Getachew Addis (2009).

5.2. Conclusions

5.2.1. Florestic composition and diversity

The survey showed that a relatively high number of species are found in the three study districts i.e., a total of 415 vascular plant species belonging to 312 genera and 104 families. Asteraceae and Fabaceae were the families with more number of genera followed by Lamiaceae and Poaceae. Herbs were the dominant growth forms followed by shrubs and trees, while lianas were least represented. A total of 43 (10.36%) endemic plants to Ethiopia were documented that are of great conservation concern. These forests are among the last remaining Afromontane forests harboring many endemic species. They are ecologically, socially, economically and culturally very important for the inhabitants residing nearby who are mostly dependent on forest product to make their living. Loss of such forests and the various threatened species would have great implications for the environment, biodiversity and socio-economic setup of the communities. Such species require urgent conservation measures that will enhance healthy regeneration and guarantee sustainable uses of these species. The vegetation types could be grouped into 18 (seven, five and six from Jibat, Gedo and Chilimo respectively) different plant community types. This classification would make the future management of the vegetation feasible since recognition of more or less homogeneous communities facilitates the choice of appropriate management strategies. One of the major threats to the forest vegetations is expansion of farmland surrounding the forests, overgrazing and illegal logging. To reduce this and use the forests sustainably, participatory forest management can be used as an alternative, especially in Jibat and Gedo forests where there is no joint forest management during the time of this study.

5.2.2. Medicinal plants used for human ailments in the study area

Traditional medicine, especially use of medicinal plants, is still popular and has wider acceptance in the study area. The study revealed that the area harbors a diversity of medicinal plants and associated knowledge. Local people depend on medicinal plants to meet their basic healthcare needs. The dependency on these plant resources is associated with easy access, perceived efficacy and cultural values attached to the plants. In the present study, a total of 172 medicinal plant species (161, 157 and 156 from Jibat, Chelia and Dendi districts respectively) belonging to155 genera and 73 botanical families were reported to be used for treating human ailments were documented. Asteraceae was the most represented family followed by Lamiaceae, Fabaceae, Solanaceae, Cucurbitaceae and Euphorbiaceae. The majority of species are found to have herbal growth forms followed by trees, shrubs and lianas. Leaves followed by roots, seeds, barks and shoots are the dominant plant parts used for preparation of most remedies. Remedies were prepared mostly from freshly harvested plant parts. On the other hand, the great numbers of preparations are found to be decoction followed by concoction. The larger proportions of remedies are administered for internal ailments through oral route, while some external ailments are treated commonly using dermal (topical) route. Doses were not standardized for most medicinal plant preparations and prescriptions to patients. Salt, honey, butter, sugar, milk, soap and other herbs were the common additives used in herbal remedy preparations. These additives may have either facilitating or synergetic roles in remedy preparation and administration. Milk, the shoot of *Gnidia glauca* and the bark of *Schefflera abysinica* were the commonly reported antidotes with herbal remedy preparations with adverse side effects such as minor toxicity, vomiting or diarrhea.

The knowledge of medicinal plants is still taught orally, with no written record. The majority of the reported medicinal plant species were wild. Moreover, about 9.3% of medicinal plants of the study area are found to be endemic to Ethiopia. These demand an urgent attention to conserve such vital resources so as to optimize their use in the primary healthcare system. A rich heritage of indigenous medicinal plant use and knowledge was also recognized. Indigenous knowledge on use of medicinal plants is still strong with elderly people ($P < 0.05$) than in the younger generation in the study area. This could be attributed to the impact of modernization and the very poor system of sharing indigenous knowledge on medicinal plants to the younger generation. Similarly, key informants were more knowledgeable ($P < 0.05$) than general informants in the surveyed area. This could be related to the impact of age-old experience and maximum degree of secrecy in using medicinal plants in case of key informants than general informants. Literate people in the study area were found to have less knowledge of medicinal plants as compared to illiterate ones as the former are more likely to be exposed to modernization However, no significant difference ($P>0.05$) was observed between males and females regarding medicinal plant knowledge in the area.

A total of 86 human ailments that were treated by medicinal plants were document in the study area. Amongst these, the categories with the highest informant consensus factor (ICF) values were gastrointestinal, pharyngeal and parasitic followed by respiratory and dermatological and diseases of subcutaneous tissues. Highest fidelity level (FL) (95%) was recorded for *Hagenia* abyssinica, followed by *Achyranthes aspera, Brucea antidysernterica, Jasminum abyssinicum, Zehneria scabra, Zingiber officinale, Cyphostemma cyphopetalum, Ehertia cymosa* and *Olinia rochetiana* (94% each) in Jibat District. *Zingiber officinale* and *Jasminum abyssinicum* were reported to have highest FL value in Chelia District (95% each) followed by *Allium sativum* (94 %). In Dendi District, *Zingiber officinale, Bothriocline schimperi, Zehneria scabra, Clerodendrum myricoides, Ocimum lamiifolium, Acokanthera schimperi* with FL values of 95% each, were with the highest FL followed by *Hagenia abyssinica, Rumex nervosus, Arceuthobium* *juniperi-procerae, Ilex mitis, Croton macrostachyus* and *Ficus sur* (94 % each). Priority should, therefore, be given to these plants to test their efficacy and their toxicity.

5.2.3. Ethnoveterinary medicinal plants

Traditional veterinary medicine, especially the use of medicinal plants in the treatment of livestock diseases, needs to be scientifically explored. The shortage of veterinary drugs and the poor accessibility of modern veterinary healthcare services by rural farmers and pastoralists make the case for the use of medicinal plants stronger. In addition to being cheaper and more accessible, traditionally used medicinal plants can indeed prove to be viable therapeutic options or substitutes, if they are properly investigated and standardized. Traditional veterinary medicine knowledge like all other traditional knowledge systems is handed down orally from generation to generation and it may disappear because of rapid socioeconomic, environmental, technological changes and as a result of loss of cultural heritage under the guise of civilization. So documentation is the primary need in case of systematic studies to be conducted for conservation of this valuable heritage. To this end, in the study districts, 97 medicinal plants were reported 44 livestock diseases. This could be due to inadequacy of formal veterinary health facilities on top of other cultural and biomedical reasons. The families Asteraceae and Lamiaceae were represented by high number of ethnoveterinary species followed by Euphorbiaceae, Solanaceae, Fabaceae and Ranunculaceae. This could be related to their wider distribution and use in Ethiopia/the flora area. Herbs were the most utilized growth forms followed by shrubs and trees in ethnoveterinary remedy preparation. Leaves followed by roots were to be the most harvested plant parts used for ethnoveterinary remedy preparation in the study area. This might be associated with traditional beliefs in different communities that existence of adequate active principles in these parts for treating various ailments. Preparations of the majority (76.29%) of remedies involved single medicinal plant (monoherbal preparation). The dominant mode of ethnoveterinary medicinal plants remedy preparation and application was through crushing and steeping plant part(s) in cold water (35.96%) and giving the resulting infusion to the target animal under question to drink. The local people use medicinal plants like *Brassica carinata*, *Capsicum annuum*, *Clematis simensis*, *Galiniera saxifraga* and *Vernonia amygdalina* to treat bloat, whereas Babesiosis and erythroblasts were the next ailments and treated with *Achyranthes aspera*, *Cyphostemma dembianense*, *Dracaena afromontana*, *Ficus sur*, *Hypericum quartinianum*, *Impatiens rothii*, *Pittosporum viridiflorum*, *Rytigynia neglecta* and *Vernonia leopoldi*. Oral route of administration was dominant route followed by dermal/topical. These recipes are given to the livestock with their feed along with different types of ingredients like salt, injera (traditional Ethiopian flat bread prepared from teff, *Eragrostis tef* and other cereals flour), flour, milk and so forth, in the area.

The most commonly treated animals in the study area were categogized under cattle, sheep, goats, cows, poultry, horses, mules, donkeys categories. Cattle category had the highest number of known ethnoveterinary remedies (39.64%) followed by sheep (18.34%) and goats (13.01%). The observed highest informants' consensus (ICF) values on ethnoveterinary medicinal plants used to treat dermatological and sensorial problems (0.80) followed by septicaemic problems (0.68) and wound, external injury and animal bite (0.66) in the study area may indicate popularity of curative plants against diseases in the respective ailment categories. Widely used medicinal plant species to treat certain ailments always score the highest fidelity level. *Prunus africana* (97%) was reported to treat epizootic lymphagitis (biichee fardaa in Afan Oromo), under dermatological & sensorial problems ailment category and *Acokanthera schimperi*, *Clerodendrum myricoides* and *Sida schimperiana* (96% each) were used to treat trypanosomiasis (gandii in Afan Oromo), Cough (qufaa/soffaa in Afan Oromo) and chronic wound (madaa in Afan Oromo) under septicaemic problems, respiratory tract problems and wound, external injury and animal bite categories respectively. Tonsillitis (hudhaa in Afan Oromo), rabies (dhukkuba saree in Afan Oromo) and erythroblasts (gatacha in Afan Oromo) were said to be treated by *Acalypha psilostachya*, *Calpurnia aurea* and *Hypericum quartinianum* (95% each) respectively. Similar to human medicinal plants discussed above the majority (91.76%) of ethnoveterinary medicnal plants used in the study area were harvested from wild sources.

5.2.4. WEPs of the study area

In the study area, about 71 WEPs belonging to 48 genera and 30 families were reported as being consumed. The most commonly cited plants were *Urtica simensis, Chionanthus mildbraedii, Carissa spinarum* and *Ficus sur*. More number of species per family was reported for the Moraceae and the Asteraceae.

Traditional knowledge of WEPs is directly proportional to the age of the respondents in that senior members had more knowledge of WEPs ($p<0.05$) than younger people. Regardless of their gender, women knew more number of WEPs ($p<0.05$) than men. The illiterate and key informants were respectively superior ($P<0.05$) to the literate and general informants in having local knowledge of WEPs. Women and children were the main gathers of WEPs followed by men and all household members. There were more WEPs that were consumed by all household members than those consumed only by women, elderly, children and men. Fruits, leaves and shoots were the most predominantly consumed plant parts in the study area and fruits followed by leafy vegetables were most frequently consumed.

Cordia africana and *Vepris dainellii* were reported as multipurpose species followed by *Chionanthus mildbraedii* and *Syzigium guineense*. The main threats to WEPs in the district were reported to be agricultural expansion and overgrazing followed by fuel wood collection and selective harvesting and that overharvesting, superimposed on the other factors, may interfere with the sustainability of these resources. The most gathered WEPs were from wild habitats and this calls for urgent research on the possibility of adapting, growing and intentionally managing some of the commonly consumed WEPs such as *Urtica simensis, Chionanthus mildbraedii, Carissa spinarum* and *Ficus sur*. Furthermore, further research on the toxicity and nutritional composition of the reported WEPs is recommended to ensure safety of consumption.

5.3. Recommendations

There are several gaps in our understanding of the floristic composition and vascular plant diversity of Jibat, Chilimo and Gedo forests; human and ethnoveterinary medicinal plants, WEPS and associated indigeneous knowledge of the Oromo communities in Jibat, Chelia and Dendi districts. Therefore, the following are suggested for subsequent actions:

- Jibat, Gedo and Chilimo forests are among the last remnant forests in Ethiopia. To conserve these forests appropriate management strategy is vital. Implementation of Participatory Forest Management (PFM) is highly recommended especially in the cases of Jibat and Gedo forests where PFM are not at work currently so that local communities take responsibility for the management and conservation of the forest and become beneficiaries of the economic return derived from this activity;
- Inventory of structure, biomass and net primary productivity (NPP) of these forests to provide accurate information on the national biomass stock and carbon pool/flux of the forests and their potential role in the global climate change;
- Excelling the ongoing effort to manage these micro-watersheds and rehabilitate the degraded and degrading landscapes through physical/structural as well as biological activities like

enrichment plantation of the forest patches by indigenous species such as *Hagenia abyssinica, Juniperus procera, Olea europaea, O. capensis, Podocarpus falcatus, Prunus africana* and *Arudinaria alipina* among others. This could be effected through scientific assistance in the propagation and the distribution of seedlings of these plants whose uses are already wide spread in the area and which are threatened at the same time;

- In-situ and ex-situ conservation of medicinal plants should be practiced in the districts by training model medicinal practitioners (farmers) and the elders to ensure the continuity of scarce medicinal plants. Conducting further collection of medicinal plants identified and their ex-situ conservation in cold rooms and field gene banks is also recommended. Furthermore, conservation of these biological resources is very important because their sustainable use can generate higher levels of employment and income. Mounting conceptualization by the people to grow medicinal and WEPs in the home gardens; mixing medicinal and WEPs with crops in the farm lands and live fences will be important. Supporting the activities of plantations of medicinal and WEPs in degraded and degrading areas through forming youth association in the countryside to make them beneficial from the product of the plantations is also another option;
- Pharmacological, toxicological and phytochemical studies need to be carried on medicinal plants (especially on those with high informant consensus and fidelity values) (such as *Hagenia* abyssinica, *Achyranthes aspera, Brucea antidysernterica, Jasminum abyssinicum, Zehneria scabra, Zingiber officinale, Cyphostemma cyphopetalum, Ehertia cymosa, Olinia rochetiana, Allium sativum, Bothriocline schimperi, Clerodendrum myricoides, Ocimum lamiifolium, Acokanthera schimperi, Rumex nervosus, Arceuthobium juniperi-procerae, Ilex mitis, Croton macrostachyus* and *Ficus sur)* in order to ascertain the effectiveness as well as

the possible toxicity of the remedies followed by designing therapeutic strategies based on the most effective and least toxic plants. Further work should be done pertaining to the side effects, drug-herb, herb-herb and herb-food interactions for better treatment, this also helps to enhance full-scale use of these products in primary healthcare systems;

- Pharmacological, toxicological and phytochemical studies need to be carried on ethnoveterinary medicinal plants with high ICF and FL values like *Prunus africana, Acokanthera schimperi*, *Clerodendrum myricoides*, *Sida schimperiana*, *Acalypha psilostachya*, *Calpurnia aurea* and *Hypericum quartinianum.*
- Before cultural transformation destroys the traditional system, greater effort should be devoted to surveys, documentation and conservation of the medicinal and WEPs and the associated indigenous knowledge in the remaining districts of West Shewa Zone and other areas to have a better understanding in the wealth of the information available and urgent measures has to be taken to rehabilitate and conserve the remaining vegetation with special regard to the key medicinal and WEPs and preserve the indigenous knowledge;
- One way of preserving such important traditional knowledge in the new generation is through integrating it to school curricula or at least introducing the idea as an extracurricular school activity. It is important to design undertakings that would help in reclaiming the dying out traditional practices. Local associations, school clubs and societies of interested groups can contribute to that end;
- The most gathered WEPs were from wild habitats and this calls for urgent research on the possibility of adapting, growing and intentionally managing some of the commonly consumed WEPs such as *Urtica simensis, Chionanthus mildbraedii, Carissa spinarum* and

Ficus sur. Furthermore, further research on the toxicity and nutritional composition of the reported WEPs is recommended to ensure safety of consumption;

- This finding can assist in selection and domestication of wild vegetable plants, especially *Urtica simensis*, which are available in most seasons of a year, to be grown in home gardens as alternative vegetable sources. Some of these wild edible plants may have the potential to be a valuable food source (if cultivated) and could be part of a strategy in tackling food insecurity;
- The local community utilizes medicinal and WEPs without gaining organized training, which is a threat to the sustainability of these plants. Thus, provision of training from the districts, zonal offices and NGOs for different management activities and the application of this training to projects that seek to maximize the value of medicinal and WEPs to local community are needed.

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APPENDICES:

Appendix 1. Checklist of questionnaires and semi-structured interview schedules used to document ethnobotanical data regarding use and management of medicinal and wild edible plants in the study area.

1. Socio-demographic Interview:

1.1. Name of the person interviewed:________________________; 1.2. Surname (If any):__________________________; 1.3. Residence: ___________________; 1.4. Gender: female ☐ male ☐; 1.5. Age: __________________; 1.6. Ethnic group: Oromo ☐ Amhara ☐ other ☐ (specify :________________); 1.7. Marital status: Married ☐ Single ☐ Divorced ☐ Widowed; 1.8. Religion: Orthodox☐Muslim☐ Protestant☐ Catholic☐ Traditionalist☐ other☐ (Specify :______________________); 1.9. Literacy status: Literate (able to read and write) ☐ illiterate (unable to read and write) ☐; 1.10. Occupation:_________________________

1.11. Date of Interview: _________________________1.12. Place of interview: _____________________

2. Medicinal plants and associated indigenous knowledge and/health conditions & treatment methods interview:

2.1. Do you use medicinal plants? Which species do you use? About how many plants do you use in all your treatments?

2.2. What types of diseases can be treated with these plants?

2.3. What are the main human health problems in your locality, village or Kebele?

2.4. What are the main livestock health problems or diseases?

2.5. How do you diagnose each disease/ health problem?

2.6. What are symptom(s) of disease(s)?

2.7. How do you control/ prevent disease in your locality?

2.8. How do you treat human and livestock diseases in your locality?

2.9. Which plant do you use to treat that particular health problem/disease?

A/ Local name(s) of the plant(s)? Does the name of the plant have any meaning?

B/ Morphological description of the plant(s)

C/ Habit of the plant: cultivated/ wild? Specify the habitat?

D/ Part (s) of the plant(s) used

E/ How is/are the part(s) gathered? (Including the amount collected at a time)

F/ Season, month, dates and time of collection and preparation of plant medicines

G/ Preferred maturity level

H/Any taboo/ restrictions in plant collections

I/ Detailed methods of remedy preparation & materials used during preparation (Explain the steps to prepare and apply the medicine)

J/ Mode and route of remedy administration

K/ Amount used (dose) of remedy administered

L/ Ingredients or additives (if any)

M/ Does the dose differ among men, women, children and elders?

N/ Any noticeable side effect(s)?

O/Any use of antidotes for adverse effects

P/ Any restrictions in taking remedies (pregnancy, age, etc)?

Q/ Do you store the medicine? If yes, how and for how long?

R/ Number of years of service as traditional healer (If applicable)

S/ What were the symptoms after treatment was finished (day or number of days before recovery; what signs did the healer use to determine that the health condition was cured?

2.10. Is the medicinal plant marketable locally? What is its market value?

2.11. What type of habitat does the medicinal plant prefer?

2.12. How abundant is the plant in the area? Perceived scarcity?

2.13. Seasonality/accessibility of the plant? Types of plants harvested over the rainy season? Types of plants harvested over the dry season?

2.14. How much time does it take to collect the plant? Or how far you go to collect it?

2.15. Trend in the abundance of the plant, whether it is increasing or decreasing?

2.16. Is the plant cultivated in the area? If yes, for what purpose?

2.17. What do you think are the main conservation threats to the plant?

2.18. Any traditional medicinal plants conservation practice?

2.19. For what other purposes do you use the medicinal plants?

2.20. How is the traditional knowledge on traditional medicinal plants transfer? Where did you learn your medical knowledge? At what age did you begin learning the knowledge? Source of knowledge?

2.21. How about the issue of secrecy of this knowledge? How many people have learned your medical knowledge? Are they treating patient now?

2.22. Cultural significance of some plants or preference of one over the other for a given purpose (to treat ailments)

2.23. What is your reason for using medicinal plants Practices?

2.24. Is there a referral system either to other herbalist or modern health facilities? When & how?

2.25. What are the major drawbacks of using medicinal plants in handing human and livestock ailments?

2.26. Is there any ceremony/ rituals in medicinal plants collection and utilization? If yes, why 7 where? Which plants are used in rituals/ceremonies?

3. Wild edible (WEPs) plants and associated indigenous knowledge interview:

3.1. Do you or your family use/know WEPs? WEPs are most commonly used locally?

3.2. Description of the WEPs

i. Local name(s) of the plant(s)? Does the name of the plant have any meaning?

ii. Morphological description of the plant(s)

iii. Habit of the plant: cultivated/ wild? Specify the habitat of WEPs?

iv. Parts of the WEPs commonly consumed

v. How is/are the part(s) gathered? (Including the amount collected at a time)

vi. Season of collection and consumption of WEPs. How often do you collect the WEPs? Availability/abundance?

vii. Preferred maturity level

viii. Any taboo/ restrictions in collections of WEPs?

ix. Is WEPs marketable locally? Which one? What is its market value?

3.3. How is the WEPs processed for consumption?

3.4. What is/are added to WEPs before consumption?

3.5. Who are the main gatherers of WEPs? When? Where? Why?

3.6. Who are the main consumers? When? Where? Why?

3.7. Is there any side effect of consuming WEPs?

3.8. How did you gain the knowledge of WEPs?

3.9. Issue of preference of some WEPs over the others

3.10. Other uses of WEPs in addition to their food value?

3.11. At what conditions and periods are the WEPs used (as ordinary food, as snacks, seasonal foods, emergency and famine foods. Mention!

3.12. Can you mention WEPs that were used in the past and now abandoned? Why they were abandoned?

3.13. What are the major treats to WEPs and associated knowledge in your locality?

3.14. Is there any traditional means of conserving the WEPs? Specify?

3.15. Is there any means of preserving/storing WEPs? How and when? Why?

3.16. Do you use any mentioned wild food plant as medicine?

3.17. Do the used wild food plants have any beneficial effects on your health? If yes, describe these effects in detail.

3.18. Do the used wild food plants have adverse effects? If yes, which ones?

3.19. Do you think they can have any impact on your life and your health?

3.20. Do these plants relieve the symptoms of any disease? If yes, which ones?

Appendix 2. Scientific names, family, local names, habits and districts from which vascular plants were collected (Jibat, Gedo and Dendi); **Bold**=endemic

No.	cientific name	Family	Local name	Ha bit	Jibat	Gedo	Chilimo
1.	*Acacia abyssinica* Hochst. ex Benth. subsp. *abyssinica*	Fabaceae	lafto	T	✓	✓	✓
2.	***Acacia negrii*** Pic.Semi.	Fabaceae	lafto	T	X	X	✓
3.	*Acalypha brachystachya* Hornem.	Euphorbiaceae	alablabee	H	X	✓	✓
4.	*Acalypha psilostachya* Hochst.	Euphorbiaceae	alablabee	H	✓	X	X
5.	*Acanthus polystachius* Delile	Acanthaceae	kosoruu	Sh	✓	✓	X
6.	***Acanthus sennii*** Chiov.	Acanthaceae	kosoruu	Sh	✓	✓	✓
7.	*Achyranthes aspera* L.	Amaranthaceae	darguu	H	✓	✓	✓
8.	*Achyrospermum schimperi* (Hochst. ex Briq.) Perkins	Lamiaceae	baladalacha	H	✓	X	X
9.	*Acmella caulirhiza* Del.	Asteraceae	simoo/ gutichaa	H	✓	✓	✓
10.	*Acokanthera schimperi* (A. DC.) Schweinf.	Apocynaceae	qararuu	Sh	X	X	✓
11.	*Acritochaete volkensii* Pilger	Poaceae	-	H	✓	X	X
12.	*Adiantum poiretii* Wikstr.	Adiantaceae	-	H	✓	✓	X
13.	*Aeschynomene abyssinica* (A. Rich.) Vatke	Fabaceae	-	Sh	✓	✓	✓
14.	*Agarista salicifolia* (Comm. ex Lam.) Hook.f.	Ericaceae	sootira	T	✓	X	✓
15.	*Agave sisalana* Perro ex Eng.	Agavaceae	qaca	Sh	X	X	✓
16.	*Ageratum conyzoides* L.	Asteraceae	arema	H	✓	✓	✓
17.	*Agrocharis incognita* (Norman) Heyw. & Jury	Apiaceae	-	H	✓	X	X
18.	*Agrostis lachnantha* Nees	Poaceae	dagala	H	✓	✓	X
19.	*Ajuga integrifolia* Buch.-Ham. ex D. Don	Lamiaceae	armagusa	H	✓	✓	✓
20.	*Albizia schimperiana* Oliv.	Fabaceae	muka-arba	T	✓	✓	✓
21.	*Alectra sessiliflora* (Vahl) Kuntze	Scrophulaceae	qooricha mada	H	✓	✓	✓
22.	*Alepidea peduncularis* Steud. ex A. Rich.	Apiaceae	-	H	✓	✓	X
23.	*Alisma plantago-aquatica* L.	Alismataceae	-	H	✓	X	X
24.	*Allium cepa* L.	Alliaceae	qulubii dima	H	✓	✓	✓
25.	*Allium sativum* L.	Alliaceae	qulubii adii	H	✓	✓	✓
26.	*Allophylus abyssinicus* (Hochst.) Radlk.	Sapindaceae	sarara	T	✓	✓	✓
27.	*Amaranthus caudatus* L.	Amaranthaceae	eyasu	H	✓	✓	X
28.	*Andropogon abyssinicus* Fresen.	Poaceae	balamee	H	✓	✓	✓
29.	*Andropogon amethystinus* Steud.	Poaceae	balamee	H	✓	X	✓
30.	*Anthemis tigreensis* J. Gay ex A. Rich.	Asteraceae	-	H	✓	X	X
31.	*Anthospermum herbaceum* L. f.	Rubiaceae	-	H	✓	X	X
32.	*Apodytes dimidiata* E. Mey ex Arn.	Icacinaceae	qumbala /calalaqaa	T	✓	✓	✓
33.	*Arceuthobium juniperi-procerae* Chiov.	Viscaceae	-	H	X	X	✓

34.	***Argyrolobium schimperianum*** Hochst ex A. Rich.	Fabaceae	loca	Sh	✓	X	X
35.	*Arisaema enneaphyllum* Hochst. ex Rich.	Araceae	carana	H	✓	✓	X
36.	*Aristida adoenensis* Hochst.	Poaceae	-	H	✓	✓	✓
37.	*Artemisia abyssinica* Sch. Bip. ex A. Rich.	Asteraceae	kodoo	H	✓	✓	✓
38.	*Arundinaria alpina* K.Scum.	Poaceae	shimala	H	✓	X	X
39.	*Asparagus africanus* Lam.	Asparagaceae	saritii	H	✓	✓	✓
40.	*Asparagus racemosus* Willd.	Asparagaceae	saritii	Sh	✓	✓	✓
41.	*Aspilia africana* (Pers.) C.D. Adams	Asteracecae	Ada	Sh	✓	✓	✓
42.	*Aspilia mossambicensis* (Oliv.) Wild	Asteraceae	ada	Sh	✓	✓	X
43.	*Astragalus atropilosulus* (Hochst.) Bunge	Fabaceae	-	H	✓	X	X
44.	*Barleria ventricosa* Hochst. ex Nees	Acanthaceae	waranti	H	✓	✓	✓
45.	*Bartsia trixago* L.	Scrophulaceae	-	H	✓	✓	✓
46.	*Becium grandiflorum* (Lam.) Pic.Serm.	Lamiaceae	urgo	Sh	✓	X	X
47.	*Berkheya spekeana* Oliv.	Asteraceae	qoree	Sh	✓	✓	X
48.	*Bersama abyssinica* Fresen.	Melianthaceae	ararsaa	T	✓	✓	✓
49.	*Berula erecta* (Hudson) Coville	Apiaceae	dammaallasee	H	X	✓	X
50.	*Bidens biternata* (Lour) Merr.& Scher.	Asteraceae	tuuffoo	H	✓	✓	✓
51.	***Bidens ghedoensis*** Mesfin	Asteraceae	kello	H	✓	✓	X
52.	***Bidens pachyloma*** (Oliv. &Hiern.) Cuf.	Asteraceae	kello	H	✓	✓	X
53.	*Bidens pilosa L.*	Asteraceae	maxxannee gowa	H	✓	✓	✓
54.	*Bidens prestinaria* (Sch. Bip.) Cuf.	Asteraceae	-	H	X	✓	✓
55.	***Bothriocline schimperi*** Oliv.& Hiern ex Benth.	Asteraceae	ulee hare	Sh	✓	✓	✓
56.	*Brassica carinata* A. Br.	Brassicaceae	gomanzara	H	✓	✓	✓
57.	*Brassica nigra* (L.) Koch	Brassicaceae	siinaficaa	H	✓	✓	✓
58.	*Bridelia micrantha* (Hochst.) Baill.	Euphorbieaceae	rigaa arba	T	✓	✓	✓
59.	*Brucea antidysenterica* J.F.Mill.	Simaroubaceae	qomonyoo	Sh	✓	✓	✓
60.	*Buddleja polystachya* Fresen.	Loganiaceae	anfarra	T	✓	✓	✓
61.	*Calpurnia aurea* (Ait.) Benth.	Fabaceae	ceeka	Sh	✓	✓	✓
62.	*Canarina abyssinica* Engl.	Campanulaceae	xuxoo	H	✓	✓	✓
63.	*Canthium oligocarpum* Hiern	Rubiaceae	-	Sh	✓	✓	X
64.	*Capsicum annuum* L.	Solanaceae	barbaree	H	✓	✓	✓
65.	*Carduus leptacanthus* Fresen.	Asteraceae	qoree-haree	H	✓	✓	✓
66.	*Carduus pycnocephalus* L.	Asteraceae	arab dubarti	H	X	X	✓
67.	*Carduus schimperi* Sch. Bip.	Asteraceae	arab dubarti	Sh	✓	✓	✓
68.	*Carex johnstonii* Back.	Cyperaceae	ababoku	H	✓	✓	✓
69.	*Carex spicato-paniculata* Bock. ex C.B. Clarke	Cyperaceae	ababoku	H	✓	X	X
70.	*Carica papaya* L.	Caricaceae	papaya	T	✓	✓	✓
71.	*Carissa spinarum* L.	Apocynaceae	agamsa	Sh	✓	✓	✓

72.	*Cassipourea malosana* (Baker) Alston	Rhizophoraceae	gachanfulasa	T	✓	✓	✓
73.	*Casuarina cunninghamiana* Miq.	Casuarinaceae	Shawshawe	T	X	X	✓
74.	*Catha edulis* (Vahl) Forssk. ex Endl.	Celasteraceae	Cati	Sh	✓	✓	✓
75.	*Caylusea abyssinica* (Fresen.) Fisch. & Mey.	Resedaceae	reencii	H	✓	✓	✓
76.	*Celtis africana* Burm. f.	Ulmaceae	caa'ii	T	✓	✓	✓
77.	*Cerastium octandrum* A.Rich.	Caryophyllaceae	maxane	H	✓	✓	X
78.	*Cheilanthes farinosa* (Forssk.) Kaulf.	Sinopteridaceae	karkaro	H	X	✓	X
79.	*Chenopodium schraderianum* Schult.	Chenopodiaceae	qoricha gondaa	H	✓	✓	✓
80.	*Chionanthus mildbraedii* (Gilg & Schellenb.) Stearn	Oleaceae	karra wayyuu	Sh	✓	✓	X
81.	*Cineraria deltoidea* Sond.	Asteraceae	-	H	✓	✓	X
82.	***Cirsium dender*** Friis	Asteraceae	qoree-haree	H	✓	✓	✓
83.	*Cirsium vulgare* (Savi) Ten.	Asteraceae	qoree-haree	H	✓	X	✓
84.	*Cissampelos pareira* L.	Menispermaceae	hida kalalaa	Cl	✓	✓	✓
85.	*Clausena anisata* (Willd.)Benth.	Rutaceae	ulumayii	Sh	✓	✓	✓
86.	***Clematis longicauda*** Steud. ex A. Rich.	Ranunculaceae	hida adi	Cl	✓	✓	✓
87.	*Clematis simensis* Fresen.	Ranunculaceae	hida feetii	Li	✓	✓	✓
88.	*Clerodendrum myricoides* (Hochst.) Vatke	Lamiaceae	ulee haree	Sh	✓	✓	✓
89.	*Clutia abyssinica* Jaub. & Spach.	Euphorbiaceae	ulee lonii	Sh	✓	✓	✓
90.	*Coffea arabica* L.	Rubiaceae	buna	T	✓	✓	✓
91.	*Commelina africana* L.	Commelinaceae	holagabis	H	✓	✓	X
92.	*Commelina benghalensis* L.	Commelinaceae	holagabis	H	✓	✓	✓
93.	*Conium maculatum* L.	Apiaceae	dinbilala laga	H	✓	✓	✓
94.	*Convolvulus kilimandschari* Engl.	Convolvulaceae	-	H	✓	✓	✓
95.	*Conyza aegyptiaca* (L.) Dryand ex Ait.	Asteraceae	-	H	✓	✓	✓
96.	***Conyza nana*** Sch. Bip. ex Oliv. & Hiern	Asteraceae	-	H	X	X	✓
97.	*Cordia africana* Lam.	Boraginaceae	wodessa	T	✓	✓	✓
98.	***Crassocephalum macropappum*** (Sch. Bip.ex A.Rich) S.M	Asteraceae	-	H	✓	✓	✓
99.	*Crassocephalum rubens* (Juss. Ex Jack) S.Moor.	Asteraceae	jirbii qeesii	H	✓	✓	✓
100.	*Crassula alba* Forssk	Crassulaceae	-	H	✓	✓	✓
101.	*Crepis foetida* L.	Asteraceae	-	H	✓	X	X
102.	*Crepis rueppellii* Sch. Bip.	Asteraceae	-	H	✓	✓	✓
103.	*Crotalaria incana* L.	Fabaceae	atara kuruphe	H	✓	✓	✓
104.	***Crotalaria rosenii*** (Pox) Milne-Redh. ex Polhill	Fabaceae	-	Sh	✓	X	✓
105.	*Croton macrostachyus* Del.	Euphorbiaceae	bakanisa	T	✓	✓	✓
106.	*Cucumis ficifolius A.Rich.*	Cucurbitaceae	hiddi hooloo	Li	✓	✓	✓
107.	*Cucurbita pepo* L.	Cucurbitaceae	dabakula	H	✓	✓	✓
108.	*Cupressus lusitanica* Mill.	Cupressaceae	gatirafaranji	T	✓	✓	✓
109.	*Cuscuta kilimanjari* Oliv.	Cuscutaceae	herto	H	✓	✓	X

110.	*Cyanotis barbata* D.Don.	Commelinaceae	qurqufoo	H	✓	✓	✓
111.	*Cyathula cylindrica* Moq.	Amaranthaceae	-	H	✓	✓	X
112.	*Cyathula uncinulata* (Schrad.) Schinz	Amaranthaceae	darguu	H	✓	✓	✓
113.	*Cymbopogon citratus* (DC ex Nees) Stapf	Poaceae	tej sar	H	✓	✓	✓
114.	*Cynodon dactylon* (L.) Pers.	Poaceae	sardoo	H	✓	✓	✓
115.	*Cynoglossum alpinum* (Brand) Riedl	Boraginaceae	maxannee	H	✓	X	✓
116.	*Cynoglossum lanceolatum* Forssk.	Boraginaceae	maxannee	H	✓	✓	✓
117.	*Cyperus brevifolius* (Rottb.) Hasskn.	Cyperaceae	qunii	H	✓	✓	✓
118.	*Cyperus longibracteatus* (Cherm.) KUk.	Cyperaceae	qunii	H	✓	✓	✓
119.	*Cyperus niveus* Retz.	Cyperaceae	qunii	H	✓	✓	✓
120.	*Cyperus sesquiflorus* (I'orr.)Matif. &Kuk. subsp.*cylindricus* (Nees) Koyama	Cyperaceae	qunii	H	✓	X	✓
121.	*Cyperus sesquiflorus* (Torr.) Matif. & KUk.	Cyperaceae	qunii	H	✓	X	✓
122.	*Cyphostemma adenocaule* (Steud. ex A. Rich.) Des. ex Wild & Drum.	Vitaceae	hidda boffa	H	✓	X	✓
123.	*Cyphostemma cyphopetalum* (Fresen.) Des. ex Wild & Drum.	Vitaceae	hidda boffa	H	✓	✓	X
124.	*Cyphostemma dembianense* (Chiov.) Vollesen	Vitaceae	hidda boffa	H	✓	✓	✓
125.	*Dalbergia lactea* Vatke	Fabaceae	-	Sh	✓	✓	✓
126.	*Datura stramonium* L.	Solanaceae	ashangra	H	✓	✓	✓
127.	*Delphinium dasycaulon* Fresen.	Ranunculaceae	-	H	✓	✓	✓
128.	*Desmodium repandum* (Vahl) DC.	Fabaceae	-	H	✓	✓	✓
129.	*Dicrocephala integrifolia* (L.f) 0. Kuntze	Asteraceae	-	H	✓	✓	X
130.	*Digitaria abyssinica* (Hochst. ex A. Rich.) Stapf	Poaceae	-	H	✓	✓	✓
131.	*Discopodium penninervium* Hochst.	Solanaceae	cacuunga	T	✓	✓	✓
132.	*Dispsacus pinnatifidus* Steud. ex A. Rich.	Dispsacaceae	-	H	✓	✓	X
133.	*Dodonaea angustifolia* L. f.	Sapindaceae	xadachaa	Sh	✓	✓	✓
134.	*Dolichos sericeus* E. Mey.	Fabaceae	-	H	✓	✓	✓
135.	*Dombeya torrida* (J. F. Gmel.)P. Bamps	Sterculiaceae	daannisa	T	✓	✓	✓
136.	*Dovyalis abyssinica* (A. Rich.) Warb.	Flacourtiaceae	koshiimii	T	✓	✓	✓
137.	*Dovyalis verrucosa* (Hochat.) Warb.	Flacourtiaceae	akuukuu	Sh	✓	X	X
138.	*Dracaena afromontana* Mildbr.	Dracaenaceae	afarfaatu	T	✓	✓	✓
139.	*Dregea schimperi* (Decne.) Bullock	Asclepiadaceae	hidda goorriissaa	Cl	✓	✓	✓
140.	*Drymaria cordata* (L.) Schu.	Caryophyllaceae	xuxoo	H	✓	✓	X
141.	*Drynaria volkensii* Hieron.	Polypodiaceae	karoo	H	✓	✓	X
142.	***Echinops ellenbeckii*** 0. Hoffm.	Asteraceae	-	Sh	X	✓	✓
143.	***Echinops kebericho*** Mesfln	Asteraceae	qabaricho	Sh	✓	✓	✓
144.	***Echinops longisetus*** A.Rich.	Asteraceae	qabaricho	Sh	✓	✓	X
145.	*Echinops macrochaetus* Fresen.	Asteraceae	qoraattii harree	Sh	X	✓	✓
146.	*Ehretia cymosa* Thonn.	Boraginaceae	ulagaa	Sh	✓	✓	✓
147.	*Ekebergia capensis* Sparrm.	Meliaceae	somboo	T	✓	✓	✓

148.	*Eleusine floccifolia* (Forssk.) Spreng.	Poaceae	gargaraa	H	✓	✓	✓
149.	*Eleusine jaegeri* Pilg.	Poaceae	coqorsa	H	✓	X	✓
150.	*Embelia schimperi* Vatke	Myrisinaceae	hanquu	Sh	✓	✓	✓
151.	***Emilia serpentinus*** Mesfin & Beentje	Asteraceae	-	H	✓	✓	X
152.	*Englerina woodfordioides* (Schweing.) M.Gilbert	Loranthaceae	eerto	H	✓	✓	✓
153.	*Enicostema axillare* (Lam.) Raynal	Gentianaceae	-	H	X	X	✓
154.	*Ensete ventricosum* (Welw.) Cheesman	Musaceae	warke/qoco	H	✓	✓	✓
155.	*Eragrostis botryodes* W.D.Clayton	Poaceae	-	H	✓	✓	X
156.	*Erica arborea* L.	Ericaceae	maxaxe	T	✓	X	✓
157.	*Eriosema scioanum* Avetta	Fabaceae	-	H	✓	X	X
158.	***Erythrina brucei*** Schweinf.	Fabaceae	walenssu	T	✓	✓	✓
159.	*Erythrococca trichogyne* (Muell. Arg.) Prain	Euphorbiaceae	geelloo	T	✓	✓	X
160.	*Eucalyptus camaldulensis* Dhnh.	Myrtaceae	bargamo-diima	T	✓	✓	✓
161.	*Eucalyptus globulus* Labill	Myrtaceae	bargamo-adii	T	✓	✓	✓
162.	*Euclea divinorum* Hiern	Ebenaceae	mi'eechaa	Sh	✓	✓	X
163.	*Euphorbia ampliphylla* Pax	Euphorbiaceae	adamii	T	✓	✓	✓
164.	***Euphorbia dumalis*** S. Carter	Euphorbiaceae	gurii	Sh	✓	X	X
165.	*Euphorbia platyphyllos* L.	Euphorbiaceae	-	H	✓	✓	X
166.	*Euphorbia schimperiana* Scheele	Euphorbiaceae	aloyyee	H	✓	✓	✓
167.	*Exotheca abyssinica* (Hochst. ex A. Rich.)Anderss.	Poaceae	-	H	✓	✓	X
168.	*Felicia dentata* (A. Rich.) Dandy	Asteraceae	-	H	✓	✓	X
169.	*Festuca chodatiana* (St. Yves)Alexeev	Poaceae	garbu dadde	H	✓	✓	X
170.	*Ficus ingens* (Miq.) Miq.	Moraceae	qilinxo	T	✓	✓	X
171.	*Ficus sur* Forssk.	Moraceae	arbu	T	✓	✓	✓
172.	*Ficus sycomorus* L.	Moraceae	odaa	T	✓	✓	✓
173.	*Ficus thonningii* Blume	Moraceae	dambii	T	✓	✓	✓
174.	*Ficus vasta* Forssk.	Moraceae	qilxu	T	✓	✓	✓
175.	*Flacourtia indica* (Burm.f) Merr.	Flacourtiaceae	akuku/hudha	Sh	✓	✓	X
176.	*Foeniculum vulgare* Miller	Apiaceae	insilala	H	✓	✓	✓
177.	*Galiniera saxifraga* (Hochst.) Bridson	Rubiaceae	adaamoo	T	✓	✓	✓
178.	*Galinsoga quadriradiata* Ruiz &Pavon	Asteraceae	arama	H	✓	✓	✓
179.	*Galium spurium* L.	Rubiaceae	buniti	H	✓	✓	✓
180.	*Geranium aculeolatum* Oliv.	Geraniaceae	-	H	✓	✓	✓
181.	*Geranium arabicum* Forssk.	Geraniaceae	-	H	✓	X	X
182.	*Gerbera piloselloides* (L.) Cass.	Asteraceae	-	H	✓	✓	✓
183.	*Girardinia bullosa* (Steudel) Wedd.	Urticaceae	dobii	H	✓	✓	✓
184.	*Gladiolus abyssinicus* (Brongn. ex Lemaire) Gold. & deVos	Iridaceae	qulubi jaldesa	H	✓	X	X
185.	*Gnidia glauca* (Fresen.) Gilg	Thymelaeaceae	didigsa	T	✓	✓	✓

186.	*Gomphocarpus semilunatus* A. Rich.	Asclepiadaceae	-	Sh	X	X	✓
187.	*Gouania longispicata* Engl.	Rhamnaceae	Looca	Li	✓	✓	✓
188.	*Grevillea robusta* A.Cunn. ex R.Br.	Proteaceae	'graviliya'	T	✓	✓	✓
189.	*Grewia ferruginea* Hochst. exA. Rich.	Tiliaceae		Sh	✓	✓	✓
190.	*Guizotia scabra* (Vis.) Chiov.	Asteraceae	hadaa, tuufoo	H	✓	✓	✓
191.	*Guizotia schimperi* Sch. Bip ex. Walp	Asteraceae	tuufoo	H	✓	✓	✓
192.	*Guizotia villosa Sch. Bip. ex Walp.*	Asteraceae	-	H	X	✓	X
193.	*Hagenia abyssinica* (Bruce) J.F. Gmel.	Rosaceae	heexoo	T	✓	✓	✓
194.	*Haplocarpha rueppellii* (Sch. Hip.) Beauv.	Asteraceae	-	H	✓	X	✓
195.	***Helichrysum hedbergianum*** Mesfin & Reilly	Asteraceae	-	H	✓	✓	✓
196.	*Helichrysum nudifolium* (L.) Less	Asteraceae	-	H	✓	X	X
197.	*Helichrysum schimperi* (Sch. Bip. exA. Rich.) Moeser	Asteraceae	-	Sh	✓	✓	✓
198.	*Helichrysum foetidum* (L.)Moench.	Asteraceae	-	H	✓	✓	✓
199.	*Helichrysum stenopterum* DC.	Asteraceae	-	H	✓	X	✓
200.	*Helinus mystacinus* (Ait.) E. Mey. ex Steud.	Rhamnaceae	hudha	Li	✓	✓	✓
201.	*Hibiscus ludwigii* Eckl. & Zeyh.	Malvaceae	hincinii	Sh	✓	X	X
202.	*Hibiscus micranthus* L. f.	Malvaceae	hincinii	H	✓	✓	✓
203.	*Hippocratea africana* (Willd.) Loes.	Celasteraceae	-	Li	✓	X	X
204.	*Hygrophila schulli* (Hamilt.)MR. & S.M Almeida	Acanthaceae	amekela	H	✓	✓	✓
205.	*Hyparrhenia dregeana* (Nees) Stent	Poaceae	-	H	X	✓	X
206.	***Hyparrhenia tuberculata*** W.D. Clayton	Poaceae	-	H	✓	X	✓
207.	*Hypericum quartinianum* A.Rich.	Guttiferae	endhee	Sh	X	✓	X
208.	*Hypericum revolutum* Vahl	Guttiferae	endhee	Sh	✓	X	✓
209.	*Hypoetes forskaolii* (Vahl) R. Br.	Acanthaceae	darguu	H	✓	X	✓
210.	*Hypoetes triflora* (Forssk.) Roem & Schult.	Acanthaceae	darguu	H	✓	✓	✓
211.	*Ilex mitis* (L.) Radlk.	Aquifolaceae	mi'eesa	T	✓	✓	✓
212.	*Impatiens aethiopica* Grey-Wilson	Balsaminaceae	ansosila	H	✓	X	X
213.	*Impatiens hoschtetteri* Warb.	Balsaminaceae	ansosila	H	✓	✓	✓
214.	***Impatiens rothii*** Hook. f.	Balsaminaceae	ansosila	H	✓	✓	✓
215.	*Indigofera arrecta* Hochst. ex A. Rich	Fabaceae	atara kuruphe	Sh	✓	✓	✓
216.	***Inula confertiflora*** A. Rich.	Asteraceae	-	Sh	✓	X	✓
217.	*Ipomoea cairica* (L.) Sweet	Convolvulaceae	hida antuta	H	✓	✓	X
218.	*Ipomoea tenuirostris Choisy*	Convolvulaceae	hida antuta	H	✓	✓	✓
219.	*Isodon schimperi* (Vatke) J.K. Morton	Lamiaceae	-	H	✓	✓	✓
220.	*Isoglossa punctata* (Vahl) Brummitt & Wood	Acanthaceae	darguu	H	✓	X	X
221.	*Isoglossa somalensis* Lindau	Acanthaceae	darguu	H	✓	✓	✓
222.	*Jasminium abyssinicum* Hochst ex Dc.	Oleaceae	hida ilchibee	Li	✓	✓	✓
223.	*Juniperus procera Hochst*. ex Endl.	Cupressaceae	gatira	T	✓	✓	✓

224.	***Justicia diclipteroides*** Lindau subsp. ***aethiopica*** Hedre'n	Acanthaceae	bilike	H	✓	✓	✓
225.	*Justicia ladanoides* Lam.	Acanthaceae	bilike	H	✓	✓	✓
226.	*Justicia schimperiana* (Hochst. ex Nees) T. Anders.	Achanthaceae	dhuumuga	Sh	✓	✓	✓
227.	*Kalanchoe petitiana* A. Rich.	Crassulaceae	bosoqa	H	✓	✓	✓
228.	*Kleinia abyssinica* (A.Rich) A. Berger	Asteraceae	-	H	X	✓	X
229.	***Kniphofia hildebrandtii*** Cufod.	Asphodelaceae	dhabee	H	✓	✓	✓
230.	*Kosteletzkya adoensis* (Hochst. ex A. Rich.) Mast.	Malvaceae	haadha ormaa	Sh	✓	✓	✓
231.	*Lactuca inermis* Forssk.	Asteracecae	-	H	✓	✓	✓
232.	*Lagenaria siceraria* (Molina) Standl.	Cucurbitaceae	bukehadha'a	H	✓	✓	✓
233.	*Laggera crispata* (Vahl) Hepper & Wood	Asteraceae	-	H	✓	✓	✓
234.	*Landolphia buchananii* (Hall.f.) Stapf	Apocynaceae	hida gebo	Li	✓	X	✓
235.	*Lantana trifolia* L.	Verbenaceae	kusaye	Sh	✓	✓	X
236.	*Lathyrus sphaericus* Retz.	Fabaceae	-	H	✓	X	X
237.	*Launaea intybacea* (Jacq) Beauv.	Asteraceae	-	H	✓	✓	✓
238.	*Leonotis ocymifolia* (Burm. f.) Iwarsson	Lamiaceae	matabokkee	Sh	✓	✓	✓
239.	*Lepidium sativum* L.	Brassicaceae	fecoo	H	✓	✓	✓
240.	*Lepidotrichilia volkensii* (Giirke) Leroy	Meliaceae	-	T	✓	X	X
241.	*Leucas deflexa* Hook. f.	Lamiaceae	bokku farda	H	✓	✓	✓
242.	*Linum usitatissimum* L.	Liniaceae	talbaa	H	✓	✓	✓
243.	*Lippia adoenesis* Hochst. ex Walp.	Verbenaceae	kussayee	Sh	✓	✓	✓
244.	*Lobelia giberroa Hemsl*.	Lobeliaceae	malakata	T	✓	X	✓
245.	*Lysimachia ruhmeriana* Vatke	Primulaceae	-	H	X	✓	✓
246.	*Maesa lanceolata* Forssk.	Myrsinaceae	abaayyii	Sh	✓	✓	✓
247.	***Maytenus addat*** (Loes.) Sebsebe	Celasteraceae	kombolcha	T	✓	✓	✓
248.	*Maytenus arbutifolia* (A. Rich.) Wilczek	Celasteraceae	kombolcha	T	✓	✓	✓
249.	*Maytenus gracilipes* (Welw. ex 0liv.) Ecell	Celasteraceae	acaacii/qarxame	Sh	✓	✓	✓
250.	*Maytenus obscura* (A. Rich.) Cuf.	Celasteraceae	kombolcha	Sh	✓	✓	✓
251.	*Mentha aquatica* L.	Lamiaceae	qoricha lagaa	H	✓	✓	X
252.	*Micractis bojeri DC.*	Asteraceae	-	H	X	✓	X
253.	*Microglossa pyrifolia* (Lam.) Kuntze	Asteraceae	-	Sh	✓	✓	✓
254.	*Mikania capensis* DC.	Asteraceae	-	H	✓	X	X
255.	***Mikaniopsis clematoides*** (Sch. Bip. ex A. Rich.) Mine-Redh.	Asteraceae	karkara	H	✓	✓	✓
256.	***Millettia ferruginea*** (Hochst.) Bak.	Fabaceae	sotaloo	T	✓	✓	✓
257.	*Mimulopsis solmsii* Schweinf.	Acanthaceae	-	Sh	✓	✓	X
258.	*Momordica foetida* Schumach	Cucurbitaceae	nyata allaatii	H	✓	✓	✓
259.	*Musa x paradisiaca* L.	Musaceae	warqee	H	✓	✓	✓
260.	*Myrica salicifolia* A. Rich.	Myricaceae	barodoo	T	✓	✓	✓
261.	*Myrsine africana* L.	Myrsinaceae	qacaama	Sh	✓	✓	✓

262.	*Myrsine melanophloeos* (L.) R.Br.	Myrisinaceae	odobada	T	✓	✓	✓
263.	*Nicandra physaloides* (L.) Gaertn.	Solanaceae	heleflefo	H	✓	✓	✓
264.	*Nicotiana tabacum* L.	Solanaceae	tambo	H	✓	✓	✓
265.	*Nigella sativa* L.	Ranunculaceae	abasuda guraacba	H	✓	✓	✓
266.	*Notholaena marantae (*L.) Desv.	Sinopteridaceae	kaarroo	H	✓	✓	X
267.	*Nuxia congesta* R.Br. ex Fresen.	Loganiaceae	qaqawee	T	✓	✓	✓
268.	*Ocimum lamiifolium* L.	Lamiaceae	qoricha michii	Sh	✓	✓	✓
269.	*Ocimum urticifolium* Roth	Lamiaceae	ancaabii	Sh	✓	✓	✓
270.	*Olea europaea* L. subsp. *cuspidata* (Wall. ex G.Don) Cif.	Oleacea	ejersa	T	✓	✓	✓
271.	*Olea capensis* L. supsp. *macrocarpa* (C. H. Wright) Verdc.	Oleacea	gagamaa	T	✓	✓	✓
272.	*Olea welwitschii* (Knob/.) Gilg & Schellenb.	Oleaceae	gajjaa /Baha	T	✓	✓	✓
273.	*Olinia rochetiana* A.Juss.	Oliniaceae	solee/dalachoo	T	✓	✓	✓
274.	*Oplismenus hirtellus* (L.) P. Beauv.	Poaceae	-	H	✓	✓	X
275.	***Oreoschimperella verrucosa*** (A. Rich.) Rauschert	Apiaceae	-	H	✓	X	X
276.	*Orobanche minor* Smit	Orobanchaceae	-	H	✓	✓	✓
277.	*Osyris quadripartita* Decn.	Santalaceae	watoo	T	✓	✓	✓
278.	*Otostegia integrifolia* Benth.	Lamiaceae	tunjutii	Sh	✓	✓	✓
279.	*Otostegia tomentosa* A. Rich.	Lamiaceae	tunjutii	Sh	✓	✓	✓
280.	*Oxyanthus speciosus* DC.	Rubiaceae	birangoo	Sh	✓	X	X
281.	*Panicum monticola* Hook.f.	Poaceae	marga gogoorii	H	✓	✓	✓
282.	*Parochaetus communis* D. Don	Fabaceae	-	H	✓	X	X
283.	*Pavetta abyssinica* Fresen.	Rubiaceae	mixo	Sh	✓	✓	✓
284.	*Pavonia urens* Cav.	Malvaceae	hincinii	Sh	✓	✓	✓
285.	*Pelargonium multibracteatum* Hochst. ex A. Rich.	Geraniaceae	-	H	X	✓	✓
286.	*Pennisetum riparium* Hochst. ex A. Rich.	Poaceae	-	H	X	✓	X
287.	*Pennisetum sphacelatum* (Nees) Th. Dur. & Schinz	Poaceae	migra	H	X	✓	✓
288.	*Pennisetum thunbergii* Kunth	Poaceae	migira saree	H	✓	✓	X
289.	*Pentas lanceolata* (Forssk.) Defl	Rubiaceae	darguu	H	✓	X	X
290.	*Pentas schimperiana* (A. Rich.) Vatke	Rubiaceae	-	Sh	X	X	✓
291.	*Peperomia abyssinica* Miq.	Piperaceae	-	H	✓	✓	✓
292.	*Peperomia tetraphylla* (Forster) Hook. & Am.	Piperaceae	-	H	✓	X	X
293.	*Peponium vogelii* (Hook.f.) Engl.	Cucurbitaceae	bukee sexana	H	✓	✓	✓
294.	*Periploca linearifolia Quart.-Dill. & A. Rich.*	Asclepiadaceae	-	Li	✓	✓	✓
295.	*Persicaria decipiens* (R.Br.) K.L.Wilson	Polygonaceae	-	H	✓	✓	✓
296.	*Persicaria nepalensis* (Meisn.) Miyabe	Polygonaceae	-	H	✓	✓	X
297.	*Phagnalon abyssinicum* Sch. Bip. ex A. Rich.	Asteraceae	-	H	X	✓	✓
298.	*Phaulopsis imbricata* (Forssk.) Sweet	Acanthaceae	darguu	H	✓	✓	✓
299.	*Phoenix reclinata* Jacq.	Arecaceae	meexii	T	✓	✓	✓

300.	*Phragmanthera regularis* (Sprague) M. Gilbert	Loranthaceae	herto	Sh	✓	✓	✓
301.	***Phragmenthera macrosolen*** (A. Rich.) M. Gilbert	Loranthaceae	herto	H	✓	✓	✓
302.	*Phytolacca dodecandra* L'Herit.	Phytolaccaceae	andode	Sh	✓	✓	✓
303.	*Pilea rivularis* Wedd.	Urticaceae	-	H	✓	X	X
304.	*Pinus patula* Schiede ex Schltdl. & Cham.	Pinaceae	'Shuwshuwwee'	T	X	X	✓
305.	*Pittosporum viridiflorum* Sims	Pittosporaceae	solee	T	✓	✓	✓
306.	*Plantago lanceolata* L.	Plantaginaceae	qorxobbo	H	✓	✓	✓
307.	*Platostoma rotundifolium* (Briq.) A.J. Paton	Lamiaceae	-	H	✓	✓	X
308.	*Plectocephalus varians* (A. Rich.) C. Jeffrey ex Cuf.	Asteraceae	-	H	X	✓	✓
309.	*Plectranthus edulis* (Vatke) Agnew	Lamiaceae	dincha Oromo	H	✓	✓	✓
310.	***Plectranthus garckeanus*** (Vatke) J.K. Morton	Lamiaceae	-	H	X	✓	✓
311.	*Plectranthus pseudomarrubioides* R.H. Willemse	Lamiaceae	-	H	X	X	✓
312.	*Plectranthus puntatus* (Lf) L 'Her.	Lamiaceae	-	H	✓	✓	✓
313.	*Podocarpus falcatus* (Thunb.) R.B. ex Mirb	Podocarpaceae	birbirsa	T	✓	✓	✓
314.	*Polyscias fulva* (Hirn.) Harms	Araliaceae	anxaloo	T	✓	X	X
315.	*Polystachya rivae* Schweinf.	Orchidaceae	-	H	✓	✓	✓
316.	*Pouteria adolfi-friederici* (Engl.) Baeh.	Sapotaceae	qararoo	T	✓	X	X
317.	*Premna schimperi* Engl.	Lamiaceae	urgoftu	Sh	X	✓	✓
318.	*Protea gaguedi* J. F. Gmel.	Proteaceae	yubdoo	T	✓	✓	✓
319.	*Prunus africana* (Hook.f.)Kalkm.	Rosaceae	hoomii	T	✓	✓	✓
320.	*Psychotria orophila* Petit	Rubiaceae	xomana	Sh	✓	✓	X
321.	*Pteridium aquilinium* (L.) Kuhn	Polypodiaceae	-	H	✓	✓	✓
322.	*Pterolobium stellatum* (Forssk.) Brenan	Fabaceae	harangama	Sh	✓	✓	✓
323.	***Pycnostachys recurvata*** Ryding	Lamiaceae	-	H	✓	✓	X
324.	*Ranunculus multifidus* Forssk.	Ranunculaceae	-	H	✓	X	X
325.	*Rhamnus prinoides* L'herit.	Rhamnaceae	gesho	Sh	✓	✓	✓
326.	*Rhamnus staddo* A.Rich.	Rhamnaceae	qadiidaa	T	✓	✓	✓
327.	*Rhoicissus tridentata* (L. f.) Wild& Drummond	Vitaceae	-	Sh	X	X	✓
328.	***Rhus glutinosa*** A.Rich.subsp. ***neoglutinosa*** (M.Gilbert) M.Gilbert	Anacardiaceae	xaxessa	Sh	✓	X	✓
329.	*Rhus glutinosa* A. Rich. subsp. *glutinosa*	Anacardiaceae	xaxessa	T	✓	✓	✓
330.	*Rhus vulgaris* Meikle	Anacardiaceae	dabobessaa	T	✓	✓	✓
331.	*Ricinus communis* L.	Euphorbiaceae	qobboo	H	✓	✓	✓
332.	*Ritchiea albersii* Gilg	Caparidaceae	-	Sh	✓	✓	✓
333.	*Rorippa palustris* (L.) Bess.	Brassicaceae	-	H	X	X	✓
334.	*Rosa abyssinica* Lindley	Rosaceae	qaqawe/Inqoxo	Sh	✓	✓	✓
335.	*Rosmarinus officinalis* L.	Lamiaceae	-	H	✓	✓	✓
336.	*Rubia cordifolia* L.	Rubiaceae	maxxannee	H	✓	✓	✓
337.	*Rubus apetalus* Poir.	Rosaceae	gora	Sh	✓	✓	✓

338.	*Rubus steudneri* Schw.	Rosaceae	gora	Sh	✓	✓	✓
339.	*Rumex abyssinicus* Jacq.	Polygonaceae	moqmooqii	H	✓	✓	✓
340.	*Rumex nepalensis* Spreng.	Polygonaceae	tulti	H	✓	✓	✓
341.	*Rumex nervosus* Vahl	Polygonaceae	dhaangagoo	Sh	✓	✓	✓
342.	*Ruta chalepensis* L.	Rutaceae	cilatamoo	Sh	✓	✓	✓
343.	*Rytigynia neglecta* (Hiern) Robyns	Rubiaceae	mixoo	Sh	✓	✓	✓
344.	*Salix mucronata* Willd.	Salicaceae	alaltuu	T	✓	✓	✓
345.	*Salvia nilotica* Jacq.	Lamiaceae	-	H	✓	✓	✓
346.	***Satureja paradoxa*** (Vatke) Engl. ex Seybold	Lamiaceae	xossinyii jaldesa	H	✓	✓	✓
347.	*Satureja punctata* (Benth.) Briq.	Lamiaceae	xossinyii jaldesa	Sh	✓	✓	✓
348.	***Satyrium aethiopicum*** Summerh.	Orchidaceae	-	H	✓	✓	X
349.	*Scadoxus multiflorus* (Martyn) Raf.	Amaryllidaceae	qullubiijallidessaa	H	✓	✓	X
350.	*Schefflera abysinica* (Hochst. ex A. Rich.) Harms	Araliaceae	luqee, gatama	T	✓	✓	✓
351.	*Schefflera myriantha* (Bak.) Drake	Araliaceae	arfatuu	T	✓	✓	X
352.	*Schrebera alata* (Hochst.) Welw.	Oleaceae	qana`ee	T	✓	X	✓
353.	*Scolopia theifolia* Gilg	Flacourtiaceae	kolofa	T	X	✓	✓
354.	*Selaginella kraussiana* (Kunze) A.Bram	Selaginaceae	-	H	✓	✓	X
355.	*Senecio aegyptius* L.	Asteraceae	-	H	✓	X	✓
356.	***Senecio myriocephalus*** Sch.Bip. ex A.Rich.	Asteraceae	-	H	✓	✓	✓
357.	*Senecio ragazzii* Chiov.	Asteraceae	gawe	H	✓	X	✓
358.	*Senecio subsessilis* Oliv. & Hiern	Asteraceae	-	H	✓	X	X
359.	*Senna didymobotrya* (Fresen) Irw. &Barn.	Fabaceae	-	Sh	✓	✓	✓
360.	*Sida schimperiana* Hochst. ex A. Rich.	Malvaceae	borkottee	Sh	✓	✓	✓
361.	*Sida ternata* L.f.	Malvaceae	borkottee	H	✓	✓	✓
362.	*Sideroxylon oxyacanthum* Baill.	Sapotaceae	-	Sh	X	X	✓
363.	*Smilax aspera* L.	Smilacaceae	-	Cl	✓	X	✓
364.	*Solanecio angelatus* (Vahl) C.Jeffrey	Asteraceae	-	H	✓	✓	✓
365.	***Solanecio gigas*** (Vatke) C. Jeffrey	Asteraceae	chachunge	T	✓	✓	✓
366.	*Solanum anguivi* Lam.	Solanaceae	hidi	H	✓	✓	✓
367.	*Solanum campylacanthum* Hochst. ex A. Rich.	Solanaceae	hidi warabesa	Sh	✓	✓	✓
368.	*Solanum dasyphyllum* Schumach.	Solanaceae	hidi loni	Sh	✓	✓	X
369.	*Solanum marginatum* Lf.	Solanaceae	-	Sh	✓	✓	✓
370.	*Solanum nigrum* L.	Solanaceae	hidi sare	Sh	✓	✓	✓
371.	*Solenostemon autrani* (Briq.) J.K. Morton	Lamiaceae	-	H	✓	✓	✓
372.	*Sonchus bipontini* Aschers	Asteracecae	-	H	✓	✓	✓
373.	***Sparmannia macrocarpa*** Ulbr.	Tiliaceae	-	Sh	✓	✓	✓
374.	*Sporobolus africanus* (Poir.) Robyns & Tournay	Poaceae	murii	H	✓	✓	✓
375.	*Stephania abyssinica* (Dillon & A. Rich.) Walp.	Menispermaceae	gura antuta	H	✓	✓	✓

376.	*Stereospermum kunthianum* Cham.	Bignoniaceae	botoroo	T	X	✓	X
377.	*Streblochaete longiarista* (A. Rich.) Pilg.	Poaceae	-	H	✓	X	X
378.	*Swertia abyssinica* Hochst.	Gentianaceae	-	H	✓	X	X
379.	*Syzygium guineense* (Willd.) DC. subsp. *afromontanum*	Myrtaceae	badessa	T	✓	✓	✓
380.	*Syzygium guineense* (Willd.) DC. subsp. *guineense*	Myrtaceae	gossu	T	✓	✓	✓
381.	*Tacazzea conferta* N.f. Br.	Asclepiadaceae	-	Li	✓	X	X
382.	*Tagestes minuta* L.	Asteraceae	-	H	✓	✓	✓
383.	*Teclea nobilis* Del.	Rutaceae	hadhessa	T	✓	✓	✓
384.	*Teucrium scordium* L.	Lamiaceae	fosikoo beeraa	H	X	✓	X
385.	*Thalictrum rhynchocarpum* Dill. & A. Rich.	Ranununculaceae	sireebizuu	H	✓	✓	X
386.	*Thunbergia alata* Boj. ex Sims	Acanthaceae	-	Cl	✓	✓	✓
387.	*Thymus schimperi* Ronniger	Lamiaceae	xosinyii	H	✓	✓	✓
388.	*Tolpis virgata* (Desf) Bertol.	Asteraceae	-	H	✓	✓	✓
389.	*Trachyspermum ammi* (L.) Sprague exTurrill	Apiaceae	azimudii adii	H	✓	✓	✓
390.	*Trema orientalis* (L.) Bl.	Ulmaceae	allele	Sh	✓	X	X
391.	***Trifolium pichisermollii*** Gillett	Fabaceae	sidisa	H	✓	X	✓
392.	*Trifolium rueppellianum* Fresen.	Fabaceae	sidisa	H	✓	✓	✓
393.	***Trifolium schimperi*** A. Rich.	Fabaceae	sidisa	H	✓	✓	X
394.	*Trifolium semipilosum* Fresen.	Fabaceae	sidisa	H	X	X	✓
395.	*Triticum dicoccon* Schrank	Poaceae	Mata jabboo	H	✓	✓	✓
396.	*Triumfetta brachyceras* K. Schum.	Tiliaceae	-	Sh	✓	✓	✓
397.	***Uebelinia erlangeriana*** (Engl.) TCE. Fries	Caryophylaceae	-	H	✓	X	X
398.	***Uebelinia kigesiensis*** R. Good subsp. ***ragazziana*** Ousted	Caryophyllaceae	-	H	✓	✓	✓
399.	*Urera hypselodendron* (A.Rich.)Wedd.	Urticaceae	lanqessaa	Li	✓	✓	✓
400.	***Urtica simensis*** Steudel	Urticaceae	gurgubee	H	✓	✓	✓
401.	***Vepris dainellii*** (Pichi-Serm.) Kokwaro	Rutaceae	hadhesa	T	✓	✓	X
402.	*Verbascum sinaiticum* Benth.	Scrophulariaceae	-	H	✓	✓	✓
403.	*Verbena officinalis* L.	Verbenaceae	-	H	✓	✓	✓
404.	*Vernonia amygdalina* Del.	Asteraceae	eebicha	Sh	✓	✓	✓
405.	*Vernonia auriculifera* Hiern.	Asteraceae	reejii	Sh	✓	✓	✓
406.	***Vernonia leopoldi*** (Sch. Bip. ex Walp.) Vatke	Asteraceae	-	Sh	✓	✓	✓
407.	*Vernonia rueppellii* Sch. Bip. ex Walp.	Asteraceae	-	Sh	✓	✓	✓
408.	*Vicia faba* L.	Fabaceae	baqilaa	H	✓	✓	✓
409.	*Vigna schimperi* Bak.	Fabaceae	-	H	✓	X	✓
410.	*Viola abyssinica* Oliv.	Violaceae	-	H	✓	✓	✓
411.	*Viscum tuberculatum* A. Rich.	Viscaceae	-	Sh	X	X	✓
412.	*Ximenia americana* L.	Olacaceae	akuku	Sh	✓	X	X
413.	*Xanthium spinosum* L.	Asteraceae	-	H	✓	✓	✓

414.	*Zehneria scabra* (Linn. f.) Sond	Cucurbitaceae	-	H	✓	✓	✓
415.	*Zingiber officinale* Roscoe	Zingiberaceae	zinjibila	H	✓	✓	✓

Appendix 3. List of plants in Jibat Forest used in plant community analysis

No.	Abbreviation	Full name	No.	Abbreviation	Full name
1	Aca.aby	*Acacia abyssinica*	38	Con.mac	*Conium maculatum*
2	Aca.pol	*Acanthus polystachius*	39	Cor.afr	*Cordia africana*
3	Aca.psi	*Acalypha psilostachya*	40	Cra.alb	*Crassula alba*
4	Aca.sen	*Acanthus sennii*	41	Cra.mac	*Crassocephalum macropappum*
5	Ach.asp	*Achyranthes aspera*	42	Ber.aby	*Bersama abyssinica*
6	Ach.sch	*Achyrospermum schimperi*	43	Ber.spe	*Berkheya spekeana*
7	Acm.cau	*Acmella caulirhiza*	44	Bid.bit	*Bidens biternata*
8	Acr.vol	*Acritochaete volkensii*	45	Bid.ghe	*Bidens ghedoensis*
9	Adi.poi	*Adiantum poiretii*	46	Bid.pac	*Bidens pachyloma*
10	Aes.aby	*Aeschynomene abyssinica*	47	Bid.pil	*Bidens pilosa*
11	Aga.sal	*Agarista salicifolia*	48	Bot.sch	*Bothriocline schimperi*
12	Age.con	*Ageratum conyzoides*	49	Bri.mic	*Bridelia micrantha*
13	Agr.inc	*Agrocharis incognita*	50	Bru.ant	*Brucea antidysenterica*
14	Agr.lac	*Agrostis lachnantha*	51	Bud.pol	*Buddleja polystachya*
15	Aju.int	*Ajuga integrifolia*	52	Cal.aur	*Calpurnia aurea*
16	Alb.sch	*Albizia schimperiana*	53	Can.aby	*Canarina abyssinica*
17	Ale.ped	*Alepidea peduncularis*	54	Mus.par	*Musa x paradisiaca*
18	Ale.ses	*Alectra sessiliflora*	55	Can.olig	*Canthium oligocarpum*
19	Ali.pla	*Alisma plantago-aquatica*	56	Car.lep	*Carduus leptacanthus*
20	All.aby	*Allophylus abyssinicus*	57	Car.sch	*Carduus schimperi*
21	Ama.cau	*Amaranthus caudatus*	58	Car.spi	*Carissa spinarum*
22	And.aby	*Andropogon abyssinicus*	59	Cas.mal	*Cassipourea malosana*
23	And.ame	*Andropogon amethystinus*	60	Cay.aby	*Caylusea abyssinica*
24	Ant.her	*Anthospermum herbaceum*	61	Cel.afr	*Celtis africana*
25	Ant.tig	*Anthemis tigreensis*	62	Cer.oct	*Cerastium octandrum*

26	Apo.dim	*Apodytes dimidiata*	63	Che.amb	*Chenopodium schraderianum*
27	Arg.sch	*Argyrolobium schimperianum*	64	Che.far	*Cheilanthes farinosa*
28	Ari.ado	*Aristida adoenensis*	65	Chi.mil	*Chionanthus mildbraedii*
29	Ari.enn	*Arisaema enneaphyllum*	66	Cin.del	*Cineraria deltoidea*
30	Art.aby	*Artemisia abyssinica*	67	Cir.den	*Cirsium dender*
31	Aru.alp	*Arundinaria alpina*	68	Cir.vul	*Cirsium vulgare*
32	Asp.afr	*Asparagus africanus*	69	Cis.par	*Cissampelos pareira*
33	Asp.rac	*Asparagus racemosus*	70	Cla.ani	*Clausena anisata*
34	Ast.atr	*Astragalus atropilosulus*	71	Cle.lon	*Clematis longicauda*
35	Bar.tri	*Bartsia trixago*	72	Cle.myr	*Clerodendrum myricoides*
36	Bar.ven	*Barleria ventricosa*	73	Cle.sim	*Clematis simensis*
37	Bec.gra	*Becium grandiflorum*	74	Clu.aby	*Clutia abyssinica*
75	Com.afr	*Commelina africana*	117	Dry.cor	*Drymaria cordata*
76	Com.ben	*Commelina benghalensis*	118	Dry.vol	*Drynaria volkensii*
77	Con.aeg	*Conyza aegyptiaca*	119	Ech.keb	*Echinops kebericho*
78	Con.kil	*Convolvulus kilimandschari*	120	Ech.lon	*Echinops longisetus*
79	Emb.sch	*Embelia schimperi*	121	Eke.cap	*Ekebergia capensis*
80	Emi.ser	*Emilia serpentinus*	122	Ele.flo	*Eleusine floccifolia*
81	Eng.woo	*Englerina woodfordioides*	123	Ele.jae	*Eleusine jaegeri*
82	Era.bot	*Eragrostis botryodes*	124	Eri.arb	*Erica arborea*
83	Cra.rub	*Crassocephalum rubens*	125	Eri.sci	*Eriosema scioanum*
84	Cre.foe	*Crepis foetida*	126	Ery.bru	*Erythrina brucei*
85	Cro.inc	*Crotalaria incana*	127	Ery.tri	*Erythrococca trichogyne*
86	Cro.mac	*Croton macrostachyus*	128	Euc.div	*Euclea divinorum*
87	Cro.ros	*Crotalaria rosenii*	129	Eup.amp	*Euphorbia ampliphylla*
88	Cuc.fic	*Cucumis ficifolius*	130	Eup.dum	*Euphorbia dumalis*
89	Cus.kil	*Cuscuta kilimanjari*	131	Eup.pla	*Euphorbia platyphyllos*
90	Cya.bar	*Cyanotis barbata*	132	Eup.sch	*Euphorbia schimperiana*
91	Cya.cyl	*Cyathula cylindrica*	133	Exo.aby	*Exotheca abyssinica*
92	Cya.unc	*Cyathula uncinulata*	134	Fes.cho	*Festuca chodatiana*
93	Cyn.alp	*Cynoglossum alpinum*	135	Fic.sur	*Ficus sur*
94	Cyn.dac	*Cynodon dactylon*	136	Fic.tho	*Ficus thonningii*

95	Cyn.lan	*Cynoglossum lanceolatum*	137	Fic.vas	*Ficus vasta*
96	Cyp.ade	*Cyphostemma adenocaule*	138	Fla.ind	*Flacourtia indica*
97	Cyp.bre	*Cyperus brevifolius*	139	Gal.qua	*Galinsoga quadriradiata*
98	Cyp.cyp	*Cyphostemma cyphopetalum*	140	Gal.sax	*Galiniera saxifraga*
99	Cyp.dem	*Cyphostemma dembianense*	141	Gal.spu	*Galium spurium*
100	Cyp.lon	*Cyperus longibracteatus*	142	Ger.acu	*Geranium aculeolatum*
101	Cyp.niv	*Cyperus niveus*	143	Ger.ara	*Geranium arabicum*
102	Cyp.ses	*Cyperus sesquiflorus*	144	Ger.pil	*Gerbera piloselloides*
103	Dal.lac	*Dalbergia lactea*	145	Gir.bul	*Girardinia bullosa*
104	Dat.str	*Datura stramonium*	146	Gla.aby	*Gladiolus abyssinicus*
105	Del.das	*Delphinium dasycaulon*	147	Gni.gla	*Gnidia glauca*
106	Des.rep	*Desmodium repandum*	148	Gou.lon	*Gouania longispicata*
107	Dic.int	*Dicrocephala integrifolia*	149	Gre.fer	*Grewia ferruginea*
108	Dig.aby	*Digitaria abyssinica*	150	Gui.sca	*Guizotia scabra*
109	Dis.pen	*Discopodium penninervium*	151	Gui.sch	*Guizotia schimperi*
110	Dis.pin	*Dispsacus pinnatifidus*	152	Hag.aby	*Hagenia abyssinica*
111	Dod.ang	*Dodonaea angustifolia*	153	Hel.foe	*Helichrysum foetidum*
112	Dol.ser	*Dolichos sericeus*	154	Hel.hed	*Helichrysum hedbergianu*m
113	Dom.tor	*Dombeya torrida*	155	Hel.mys	*Helinus mystacinus*
114	Dov.aby	*Dovyalis abyssinica*	156	Hel.nud	*Helichrysum nudifolium*
115	Dra.afr	*Dracaena afromontana*	157	Hel.sch	*Helichrysum schimperi*
116	Dre.sch	*Dregea schimperi*	158	Her.ste	*Helichrysum stenopterum*
159	Hib.lud	*Hibiscus ludwigii*	201	Mic.pyr	*Microglossa pyrifolia*
160	Hib.mic	*Hibiscus micranthus*	202	Mik.cap	*Mikania capensis*
161	Hip.afr	*Hippocratea africana*	203	Mik.cle	*Mikaniopsis clematoides*
162	Hyg.sch	*Hygrophila schulli*	204	Mil.fer	*Millettia ferruginea*
163	Hyp.for	*Hypoetes forskaolii*	205	Mim.sol	*Mimulopsis solmsii*
164	Hyp.rev	*Hypericum revolutum*	206	Mom.foe	*Momordica foetida*
165	Hyp.tri	*Hypoetes triflora*	207	Myr.afr	*Myrsine africana*
166	Hyp.tub	*Hyparrhenia tuberculata*	208	Myr.mel	*Myrsine melanophloeos*
167	Ile.mit	*Ilex mitis*	209	Myr.sal	*Myrica salicifolia*
168	Imp.aet	*Impatiens aethiopica*	210	Nic.phy	*Nicandra physaloides*

169	Imp.hos	*Impatiens hoschtetteri*	211	Not.mar	*Notholaena marantae*
170	Imp.rot	*Impatiens rothii*	212	Nux.con	*Nuxia congesta*
171	Ing.arr	*Indigofera arrecta*	213	OCi.lam	*Ocimum lamiifolium*
172	Inu.con	*Inula confertiflora*	214	Oci.urt	*Ocimum urticifolium*
173	Ipo.cai	*Ipomoea cairica*	215	Ole.cap	*Olea capensis*
174	Ipo.ten	*Ipomoea tenuirostris*	216	Ole.eur	*Olea europaea*
175	Iso.pun	*Isoglossa punctata*	217	Ole.wel	*Olea welwitschii*
176	Iso.sch	*Isodon schimperi*	218	Oli.roc	*Olinia rochetiana*
177	Iso.som	*Isoglossa somalensis*	219	Opl.hir	*Oplismenus hirtellus*
178	Jas.aby	*Jasminium abyssinicum*	220	Ore.ver	*Oreoschimperella verrucosa*
179	Jun.pro	*Juniperus procera*	221	Oro.min	*Orobanche minor*
180	Jus.dic	*Justicia diclipteroides*	222	Osy.qua	*Osyris quadripartita*
181	Kal.pet	*Kalanchoe petitiana*	223	Oto.int	*Otostegia integrifolia*
182	Kni.hid	*Kniphofia hildebrandtii*	224	Oto.tom	*Otostegia tomentosa*
183	Kos.ado	*Kosteletzkya adoensis*	225	Oxy.spe	*Oxyanthus speciosus*
184	Lac.ine	*Lactuca inermis*	226	Pan.mon	*Panicum monticola*
185	Lag.cri	*Laggera crispata*	227	Par.com	*Parochaetus communis*
186	Lan.buc	*Landolphia buchananii*	228	Pav.aby	*Pavetta abyssinica*
187	Lan.tri	*Lantana trifolia*	229	Pav.ure	*Pavonia urens*
188	Lat.sph	*Lathyrus sphaericus*	230	Pen.lan	*Pentas lanceolata*
189	Lau.int	*Launaea intybacea*	231	Pen.thu	*Pennisetum thunbergii*
190	Leo.ocy	*Leonotis ocymifolia*	232	Pep.aby	*Peperomia abyssinica*
191	Lep.vol	*Lepidotrichilia volkensii*	233	Pep.tet	*Peperomia tetraphylla*
192	Leu.def	*Leucas deflexa*	234	Per.dec	*Persicaria decipiens*
193	Lip.ado	*Lippia adoenesis*	235	Per.lin	*Periploca linearifolia*
194	Lob.gib	*Lobelia giberroa*	236	Per.nep	*Persicaria nepalensis*
195	Mae.lan	*Maesa lanceolata*	237	Pha.imb	*Phaulopsis imbricata*
196	May.add	*Maytenus addat*	238	Pho.rec	*Phoenix reclinata*
197	May.arb	*Maytenus arbutifolia*	239	Phr.mac	*Phragmenthera macrosolen*
198	May.gra	*Maytenus gracilipes*	240	Phr.reg	*Phragmanthera regularis*
199	May.obs	*Maytenus obscura*	241	Phy.dod	*Phytolacca dodecandra*
200	Men.aqu	*Mentha aquatica*	242	Pil.riv	*Pilea rivularis*

243	Pit.vir	*Pittosporum viridiflorum*	285	Sol.mar	*Solanum marginatum*
244	Pla.lan	*Plantago lanceolata*	286	Sol.nig	*Solanum nigrum*
245	Pla.rot	*Platostoma rotundifolium*	287	Son.bip	*Sonchus bipontini*
246	Ple.pun	*Plectranthus puntatus*	288	Spa.mae	*Sparmannia macrocarpa*
247	Pod.fal	*Podocarpus falcatus*	289	Spo.afr	*Sporobolus africanus*
247	Pol.ful	*Polyscias fulva*	290	Ste.aby	*Stephania abyssinica*
249	Pou.ado	*Pouteria adolfi-friederici*	291	Swe.aby	*Swertia abyssinica*
250	Pro.gag	*Protea gaguedi*	292	Syz.gui	*Syzygium guineense*
251	Pru.afr	*Prunus africana*	293	Tac.con	*Tacazzea conferta*
252	Psy.oro	*Psychotria orophila*	294	Tag.min	*Tagestes minuta*
253	Pte.aqu	*Pteridium aquilinium*	295	Tec.nob	*Teclea nobilis*
254	Pte.ste	*Pterolobium stellatum*	296	Tha.rhy	*Thalictrum* rhynchocarpum
255	Pyc.rec	*Pycnostachys recurvata*	297	Thu.ala	*Thunbergia alata*
256	Rhu.glu	*Rhus glutinosa*	298	Thy.sch	*Thymus schimperi*
257	Rhu.vul	*Rhus vulgaris*	299	Tol.vir	*Tolpis virgata*
258	Rit.alb	*Ritchiea albersii*	300	Tra.amm	*Trachyspermum ammi*
259	Ros.aby	*Rosa abyssinica*	301	Tre.ori	*Trema orientalis*
260	Rub.ape	*Rubus apetalus*	302	Tri.bra	*Triumfetta brachyceras*
261	Rub.cor	*Rubia cordifolia*	303	Tri.pic	*Trifolium pichisermollii*
262	Rub.ste	*Rubus steudneri*	304	Tri.rue	*Trifolium rueppellianum*
263	Rum.aby	*Rumex abyssinicus*	305	Tri.sch	*Trifolium schimperi*
264	Rum.ner	*Rumex nepalensis*	306	Ueb.erl	*Uebelinia erlangeriana*
265	Ryt.neg	*Rytigynia neglecta*	307	Ueb.kig	*Uebelinia kigesiensis*
266	Sal.muc	*Salix mucronata*	308	Ure.hyp	*Urera hypselodendron*
267	Sal.nil	*Salvia nilotica*	309	Urt.sim	*Urtica simensis*
268	Sat.aet	*Satyrium aethiopicum*	310	VeP.dai	*Vepris dainellii*
269	Sat.par	*Satureja paradoxa*	311	Ver.amy	*Vernonia amygdalina*
270	Sat.pun	*Satureja punctata*	312	Ver.aur	*Vernonia auriculifera*
271	Sca.mul	*Scadoxus multiflorus*	266	Ver.leo	*Vernonia leopoldi*
272	Sch.aby	*Schefflera abysinica*	313	Ver.off	*Verbena officinalis*
273	Sch.ala	*Schrebera alata*	314	Ver.rue	*Vernonia rueppellii*
274	Sel.kra	*Selaginella kraussiana*	315	Ver.sin	*Verbascum sinaiticum*

275	Sen.aeg	*Senecio aegyptius*	316	Vig.sch	*Vigna schimperi*
276	Sen.myr	*Senecio myriocephalus*	317	Vio.aby	*Viola abyssinica*
277	Sen.rag	*Senecio ragazzii*	318	Xan.spi	*Xanthium spinosum*
278	Sen.sub	*Senecio subsessilis*	319	Xim.ame	*Ximenia americana*
279	Sid.sch	*Sida schimperiana*	320	Zeh.sca	*Zehneria scabra*
280	Sid.ter	*Sida ternata*			
281	Smi.asp	*Smilax aspera*			
282	Sol.ang	*Solanum anguivi*			
283	Sol.aut	*Solenostemon autrani*			
284	Sol.gig	*Solanecio gigas*			

Appendix 4. List of plants in Gedo Forest used in plant community analysis

No.	Abbreviation	Full name	No.	Abbreviation	Full name
1	Aca.aby	*Acacia abyssinica*	38	Can.aby	*Canarina abyssinica*
2	Aca.pol	*Acanthus polystachius*	39	Mus.par	*Musa x paradisiaca*
3	Aca.psi	*Acalypha psilostachya*	40	Can.oli	*Canthium oligocarpum*
4	Aca.sen	*Acanthus sennii*	41	Car.joh	*Carex johnstonii*
5	Ach.asp	*Achyranthes aspera*	42	Car.lep	*Carduus leptacanthus*
6	Acm.cau	*Acmella caulirhiza*	43	Car.sch	*Carduus schimperi*
7	Aco.sch	*Acokanthera schimperi*	44	Car.spi	*Carissa spinarum*
8	Adi.poi	*Adiantum poiretii*	45	Cas.mal	*Cassipourea malosana*
9	Aes.aby	*Aeschynomene abyssinica*	46	Cay.aby	*Caylusea abyssinica*
10	Age.con	*Ageratum conyzoides*	47	Cel.afr	*Celtis africana*
11	Agr.lac	*Agrostis lachnantha*	48	Cer.oct	*Cerastium octandrum*
12	Aju.int	*Ajuga integrifolia*	49	Che.far	*Cheilanthes farinosa*
13	Alb.sch	*Albizia schimperiana*	50	Che.sch	*Chenopodium schraderianum*
14	Ale.ped	*Alepidea peduncularis*	51	Chi.mil	*Chionanthus mildbraedii*
15	Ale.ses	*Alectra sessiliflora*	52	Cin.del	*Cineraria deltoidea*
16	All.aby	*Allophylus abyssinicus*	53	Cir.den	*Cirsium dender*
17	Ama.cau	*Amaranthus caudatus*	54	Cis.par	*Cissampelos pareira*
18	And.aby	*Andropogon abyssinicus*	55	Cla.ani	*Clausena anisata*

19	Apo.dim	*Apodytes dimidiata*	56	CLe.lon	*Clematis longicauda*
20	Ari.ado	*Aristida adoenensis*	57	Cle.myr	*Clerodendrum myricoides*
21	Ari.enn	*Arisaema enneaphyllum*	58	Cle.sim	*Clematis simensis*
22	Art.aby	*Artemisia abyssinica*	59	Clu.lan	*Clutia abyssinica*
23	Asp.afr	*Asparagus africanus*	60	Com.afr	*Commelina africana*
24	Asp.mos	*Aspilia mossambicensis*	61	Com.ben	*Commelina benghalensis*
25	Asp.rac	*Asparagus racemosus*	62	Con.aeg	*Conyza aegyptiaca*
26	Bar.tri	*Bartsia trixago*	63	Con.kil	*Convolvulus kilimandschari*
27	Bar.ven	*Barleria ventricosa*	64	Con.mac	*Conium maculatum*
28	Ber.aby	*Bersama abyssinica*	65	Cor.afr	*Cordia africana*
29	Ber.ere	*Berula erecta*	66	Cra.alb	*Crassula alba*
30	Ber.spe	*Berkheya spekeana*	67	Cra.mac	*Crassocephalum macropappum*
31	Bid.bit	*Bidens biternata*	68	Cra.rub	*Crassocephalum rubens*
32	Bid.ghe	*Bidens ghedoensis*	69	Cre.rue	*Crepis rueppellii*
33	Bid.pac	*Bidens pachyloma*	70	Cro.inc	*Crotalaria incana*
34	Bid.pil	*Bidens pilosa*	71	Cro.mac	*Croton macrostachyus*
35	Bid.pre	*Bidens prestinaria*	72	Cuc.fic	*Cucumis ficifolius*
36	Bot.sch	*Bothriocline schimperi*	73	Cus.kil	*Cuscuta kilimanjari*
37	Bri.mic	*Bridelia micrantha*	74	Cya.bar	*Cyanotis barbata*
75	Bru.ant	*Brucea antidysenterica*	117	Cya.cyl	*Cyathula cylindrica*
76	Bud.pol	*Buddleja polystachya*	118	Cya.unc	*Cyathula uncinulata*
77	Cal.aur	*Calpurnia aurea*	119	Cyn.dac	*Cynodon dactylon*
78	Cyn.lan	*Cynoglossum lanceolatum*	120	Gal.sax	*Galiniera saxifraga*
79	Cyp.bre	*Cyperus brevifolius*	121	Gal.spu	*Galium spurium*
80	Cyp.cyp	*Cyphostemma cyphopetalum*	122	Ger.acu	*Geranium aculeolatum*
81	Cyp.dem	*Cyphostemma dembianense*	123	Ger.pil	*Gerbera piloselloides*
82	Cyp.lon	*Cyperus longibracteatus*	124	Gir.bul	*Girardinia bullosa*
83	Cyp.niv	*Cyperus niveus*	125	Gni.gla	*Gnidia glauca*
84	Dal.lac	*Dalbergia lactea*	126	Gou.lon	*Gouania longispicata*
85	Dat.str	*Datura stramonium*	127	Gre.fer	*Grewia ferruginea*
86	Des.rep	*Desmodium repandum*	128	Gui.sch	*Guizotia schimperi*
87	Dic.int	*Dicrocephala integrifolia*	129	Gui.vil	*Guizotia villosa*

88	Dig.aby	*Digitaria abyssinica*	130	Hag.aby	*Hagenia abyssinica*
89	Del.das	*Delphinium dasycaulon*	131	Hel.foe	*Helichrysum foetidum*
90	Dis.pen	*Discopodium penninervium*	132	Hel.hed	*Helichrysum hedbergianu*m
91	Dis.pin	*Dispsacus pinnatifidus*	133	Hel.mys	*Helinus mystacinus*
92	Dod.ang	*Dodonaea angustifolia*	134	Hel.sch	*Helichrysum schimperi*
93	Dol.ser	*Dolichos sericeus*	135	Hib.mic	*Hibiscus micranthus*
94	Dom.tor	*Dombeya torrida*	136	Hip.afr	*Hippocratea africana*
95	Dov.aby	*Dovyalis abyssinica*	137	Hyg.sch	*Hygrophila schulli*
96	Dra.afr	*Dracaena afromontana*	138	Hyp.dre	*Hyparrhenia dregeana*
97	Dre.sch	*Dregea schimperi*	139	Hyp.qua	*Hypericum quartinianum*
98	Dry.cor	*Drymaria cordata*	140	Hyp.tri	*Hypoetes triflora*
99	Dry.vol	*Drynaria volkensii*	141	Ile.mit	*Ilex mitis*
100	Ech.ell	*Echinops ellenbeckii*	142	Imp.hos	*Impatiens hoschtetteri*
101	Ech.keb	*Echinops kebericho*	143	Imp.rot	*Impatiens rothii*
102	Ech.lon	*Echinops longisetus*	144	Ind.arr	*Indigofera arrecta*
103	Ech.mac	*Echinops macrochaetus*	145	Ipo.cai	*Ipomoea cairica*
104	Eke.cap	*Ekebergia capensis*	146	Ipo.ten	*Ipomoea tenuirostris*
105	Emb.sch	*Embelia schimperi*	147	Iso.sch	*Isodon schimperi*
106	Era.bot	*Eragrostis botryodes*	148	Iso.som	*Isoglossa somalensis*
107	Eri.arb	*Erica arborea*	149	Jas.aby	*Jasminium abyssinicum*
108	Eri.sci	*Eriosema scioanum*	150	Jun.pro	*Juniperus procera*
109	Ery.bru	*Erythrina brucei*	151	Jus.dic	*Justicia diclipteroides*
110	Ery.tri	*Erythrococca trichogyne*	152	Jus.lad	*Justicia ladanoides*
111	Euc.div	*Euclea divinorum*	153	Kal.pet	*Kalanchoe petitiana*
112	Eup.amp	*Euphorbia ampliphylla*	154	Kle.aby	*Kleinia abyssinica*
113	Eup.pla	*Euphorbia platyphyllos*	155	Fel.den	*Felicia dentata*
114	Exo.aby	*Exotheca abyssinica*	156	Fes.cho	*Festuca chodatiana*
115	Fic.ing	*Ficus ingens*	157	Lac.ine	*Lactuca inermis*
116	Fic.sur	*Ficus sur*	158	Lag.cri	*Laggera crispata*
159	Fic.syc	*Ficus sycomorus*	201	Lau.int	*Launaea intybacea*
160	Fic.tho	*Ficus thonningii*	202	Leo.ocy	*Leonotis ocymifolia*
161	Fic.vas	*Ficus vasta*	203	Leu.def	*Leucas deflexa*

162	Fla.ind	*Flacourtia indica*	204	Lip.ado	*Lippia adoenesis*
163	Gal.qua	*Galinsoga quadriradiata*	205	Lys.ruh	*Lysimachia ruhmeriana*
164	Mae.lan	*Maesa lanceolata*	206	Pte.aqu	*Pteridium aquilinium*
165	May.arb	*Maytenus arbutifolia*	207	Pte.ste	*Pterolobium stellatum*
166	May.gra	*Maytenus gracilipes*	208	Pyc.rec	*Pycnostachys recurvata*
167	May.obs	*Maytenus obscura*	209	Rha.pri	*Rhamnus prinoides*
168	Men.aqu	*Mentha aquatica*	210	Rha.sta	*Rhamnus staddo*
169	Mic.boj	*Micractis bojeri*	211	Rhu.glu	*Rhus glutinosa*
170	Mic.pyr	*Microglossa pyrifolia*	212	Rhu.vul	*Rhus vulgaris*
171	Mik.cle	*Mikaniopsis clematoides*	213	Ric.com	*Ricinus communis*
172	Mil.fer	*Millettia ferruginea*	214	Ros.aby	*Rosa abyssinica*
173	Mom.foe	*Momordica foetida*	215	Rub.ape	*Rubus apetalus*
174	Myr.afr	*Myrsine africana*	216	Rub.cor	*Rubia cordifolia*
175	Myr.mel	*Myrsine melanophloeos*	217	Rub.ste	*Rubus steudneri*
176	Myr.sal	*Myrica salicifolia*	218	Rum.aby	*Rumex abyssinicus*
177	Nux.con	*Nuxia congesta*	219	Rum.nep	*Rumex nepalensis*
178	Ole.cap	*Olea capensis*	220	Rum.ner	*Rumex nervosus*
179	Ole.eur	*Olea europaea*	221	Ryt.neg	*Rytigynia neglecta*
180	Ole.wel	*Olea welwitschii*	222	Sal.muc	*Salix mucronata*
181	Oli.roc	*Olinia rochetiana*	223	Sal.nil	*Salvia nilotica*
182	Opl.hir	*Oplismenus hirtellus*	224	Sat.aet	*Satyrium aethiopicum*
183	Oro.min	*Orobanche minor*	225	Sat.par	*Satureja paradoxa*
184	Osy.qua	*Osyris quadripartita*	226	Sat.pun	*Satureja punctata*
185	Oto.int	*Otostegia integrifolia*	227	Sca.mul	*Scadoxus multiflorus*
186	Oto.tom	*Otostegia tomentosa*	228	Sch.aby	*Schefflera abysinica*
187	Pen.sph	*Pennisetum sphacelatum*	229	Sch.ala	*Schrebera alata*
188	Pen.thu	*Pennisetum thunbergii*	230	Sch.myr	*Schefflera myriantha*
189	Pep.aby	*Pennisetum thunbergii*	231	Sco.the	*Scolopia theifolia*
190	Pep.vog	*Peponium vogelii*	232	Sel.kra	*Selaginella kraussiana*
191	Per.dec	*Persicaria decipiens*	233	Sen.did	*Senna didymobotrya*
192	Per.lin	*Periploca linearifolia*	234	Sen.myr	*Senecio myriocephalus*
193	Per.nep	*Persicaria nepalensis*	235	Kos.beg	*Kosteletzkya adoensis*

194	Pha.aby	*Phagnalon abyssinicum*	236	Pho.rec	*Phoenix reclinata*
195	Pha.imb	*Phaulopsis imbricata*	237	Phr.mac	*Phragmenthera macrosolen*
196	Kni.hid	*Jasminium abyssinicum*	238	Phr.reg	*Phragmanthera regularis*
197	Phy.dod	*Phytolacca dodecandra*	239	Sol.mar	*Solanum marginatum*
198	Pit.vir	*Pittosporum viridiflorum*	240	Sol.nig	*Solanum nigrum*
199	Pla.lan	*Plantago lanceolata*	241	Son.bip	*Sonchus bipontini*
200	Pla.rot	*Platostoma rotundifolium*	242	Spa.mac	*Sparmannia macrocarpa*
243	Ple.pun	*Plectranthus puntatus*	285	Spo.afr	*Sporobolus africanus*
244	Ple.var	*Plectocephalus varians*	286	Ste.aby	*Stephania abyssinica*
245	Pod.fal	*Podocarpus falcatus*	287	Syz.gui	*Syzygium guineense*
246	Pol.riv	*Polystachya rivae*	288	Tag.min	*Tagestes minuta*
247	Pre.sch	*Premna schimperi*	289	Xan.spi	*Xanthium spinosum*
247	Pru.afr	*Prunus africana*	290	Zeh.sca	*Zehneria scabra*
249	Psy.oro	*Psychotria orophila*			
250	Tec.nob	*Teclea nobilis*			
251	Teu.sco	*Teucrium scordium*			
252	Tha.rhy	*Thalictrum* rhynchocarpum			
253	Thu.ala	*Thunbergia alata*			
254	Thy.sch	*Thymus schimperi*			
255	Tol.vir	*Tolpis virgata*			
256	Tra.amm	*Trachyspermum ammi*			
257	Tri.bra	*Triumfetta brachyceras*			
258	Tri.rue	*Trifolium rueppellianum*			
259	Tri.sch	*Trifolium schimperi*			
260	Ueb.kig	*Uebelinia kigesiensis*			
261	Ure.hyp	*Urera hypselodendron*			
262	Urt.sim	*Urtica simensis*			
263	Ver.amy	*Vernonia amygdalina*			
264	Ver.aur	*Vernonia auriculifera*			
265	Ver.leo	*Vernonia leopoldi*			
266	Ver.off	*Verbena officinalis*			
267	Ver.rue	*Vernonia rueppellii*			

268	Ver.sin	*Verbascum sinaiticum*			
269	sid.sch	*Sida schimperiana*			
270	Sid.ter	*Sida ternata*			
271	Sol.ang	*Solanum anguivi*			
272	Sol.aut	*Solenostemon autrani*			
273	Sol.cam	*Solanum campylacanthum*			
274	Sol.das	*Solanum dasyphyllum*			
275	Sol.gig	*Solanecio gigas*			

Appendix 5. List of plants in Chilimo Forest used in plant community analysis

No.	Abbreviation	Full name	No.	Abbreviation	Full name
1	Aca.aby	*Acacia abyssinica*	38	Cel.afr	*Celtis africana*
2	Aca.sen	*Acanthus sennii*	39	Che.far	*Cheilanthes farinosa*
3	Ach.asp	*Achyranthes aspera*	40	Che.sch	*Chenopodium schraderianum*
4	Acm.cau	*Acmella caulirhiza*	41	Cir.den	*Cirsium dender*
5	Aco.sch	*Acokanthera schimperi*	42	Cir.vul	*Cirsium vulgare*
6	Adi.poi	*Adiantum poiretii*	43	Cis.par	*Cissampelos pareira*
7	Aes.aby	*Aeschynomene abyssinica*	44	Cla.ani	*Clausena anisata*
8	Aga.sal	*Agarista salicifolia*	45	Cle.lon	*Clematis longicauda*
9	Aga.sis	*Agave sisalana*	46	Cle.myr	*Clerodendrum myricoides*
10	Age.con	*Ageratum conyzoides*	47	Cle.sim	*Clematis simensis*
11	Aju.int	*Ajuga integrifolia*	48	Clu.aby	*Clutia abyssinica*
12	Alb.sch	*Albizia schimperiana*	49	Com.ben	*Commelina benghalensis*
13	Ale.ses	*Alectra sessiliflora*	50	Con.aeg	*Conyza aegyptiaca*
14	All.aby	*Allophylus abyssinicus*	51	Con.kil	*Convolvulus kilimandschari*
15	And.aby	*Andropogon abyssinicus*	52	Con.mac	*Conium maculatum*
16	And.ame	*Andropogon amethystinus*	53	Cor.afr	*Cordia africana*
17	Apo.dim	*Apodytes dimidiata*	54	Cra.alb	*Crassula alba*
18	Ari.ado	*Aristida adoenensis*	55	Cra.mac	*Croton macrostachyus*
19	Asp.afr	*Asparagus africanus*	56	Cra.rub	*Crassocephalum rubens*

20	Asp.rac	*Asparagus racemosus*	57	Cre.rue	*Crepis rueppellii*
21	Bar.ven	*Barleria ventricosa*	58	Cro.inc	*Crotalaria incana*
22	Ber.aby	*Bersama abyssinica*	59	Cro.mac	*Croton macrostachyus*
23	Bid.bit	*Bidens biternata*	60	Cuc.fic	*Cucumis ficifolius*
24	Bid.pil	*Bidens pilosa*	61	Cya.bar	*Cyanotis barbata*
25	Bot.sch	*Bothriocline schimperi*	62	Cya.unc	*Cyathula uncinulata*
26	Bri.mic	*Bridelia micrantha*	63	Cyn.alp	*Cynoglossum alpinum*
27	Bru.ant	*Brucea antidysenterica*	64	Cyn.dac	*Cynodon dactylon*
28	Bud.pol	*Buddleja polystachya*	65	Cyn.lan	*Cynoglossum lanceolatum*
29	Cal.aur	*Calpurnia aurea*	66	Cyp.ade	*Cyphostemma adenocaule*
30	Can.aby	*Canarina abyssinica*	67	Cyp.bre	*Cyperus brevifolius*
31	Mus.par	*Musa x paradisiaca*	68	Cyp.dem	*Cyphostemma dembianense*
32	Car.joh	*Carex johnstonii*	69	Cyp.lon	*Cyperus longibracteatus*
33	Car.lep	*Carduus leptacanthus*	70	Cyp.niv	*Cyperus niveus*
34	Car.sch	*Carduus schimperi*	71	Cyp.ses	*Cyperus sesquiflorus*
35	Car.spi	*Carissa spinarum*	72	Dat.str	*Datura stramonium*
36	Cas.mal	*Cassipourea malosana*	73	Del.das	*Delphinium dasycaulon*
37	Cay.aby	*Caylusea abyssinica*	74	Des.rep	*Desmodium repandum*
75	Dig.aby	*Digitaria abyssinica*	117	Hyg.sch	*Hygrophila schulli*
76	Dis.pen	*Discopodium penninervium*	118	Hyp.for	*Hypoetes forskaolii*
77	Dod.ang	*Dodonaea angustifolia*	119	Hyp.rev	*Hypericum revolutum*
78	Dol.ser	*Dolichos sericeus*	120	Hyp.tri	*Hypoetes triflora*
79	Dom.tor	*Dombeya torrida*	121	Hyp.tub	*Hyparrhenia tuberculata*
80	Dov.aby	*Dovyalis abyssinica*	122	Ile.mit	*Ilex mitis*
81	Dra.afr	*Dracaena afromontana*	123	Imp.hos	*Impatiens hoschtetteri*
82	Ech.keb	*Echinops kebericho*	124	Imp.rot	*Impatiens rothii*
83	Ech.mac	*Echinops macrochaetus*	125	Ind.arr	*Indigofera arrecta*
84	Eke.cap	*Ekebergia capensis*	126	Inu.con	*Inula confertiflora*
85	Ele.flo	*Eleusine floccifolia*	127	Ipo.ten	*Ipomoea tenuirostris*
86	Ele.jae	*Eleusine jaegeri*	128	Iso.sch	*Isodon schimperi*
87	Emb.sch	*Embelia schimperi*	129	Iso.som	*Isoglossa somalensis*
88	Eng.woo	*Englerina woodfordioides*	130	Jas.aby	*Jasminium abyssinicum*

89	Eri.arb	*Erica arborea*	131	Jun.pro	*Juniperus procera*
90	Ery.bru	*Erythrina brucei*	132	Jus.dic	*Justicia diclipteroides*
91	EuP.amp	*Euphorbia ampliphylla*	133	Jus.lad	*Justicia ladanoides*
92	Eup.sch	*Euphorbia schimperiana*	134	Kal.pet	*Kalanchoe petitiana*
93	Fic.sur	*Ficus sur*	135	Kni.hil	*Kniphofia hildebrandtii*
94	Fic.syc	*Ficus sycomorus*	136	Kos.ado	*Kosteletzkya adoensis*
95	Fic.tho	*Ficus thonningii*	137	Lac.ine	*Lactuca inermis*
96	Fic.vas	*Ficus vasta*	138	Lag.cri	*Laggera crispata*
97	Fla.ind	*Flacourtia indica*	139	Lan.buc	*Landolphia buchananii*
98	Gal.qua	*Galinsoga quadriradiata*	140	Lau.int	*Launaea intybacea*
99	Gal.sax	*Galiniera saxifraga*	141	Leo.ocy	*Leonotis ocymifolia*
100	Gal.spu	*Galium spurium*	142	Leu.def	*Leucas deflexa*
101	Ger.acu	*Geranium aculeolatum*	143	Lip.ado	*Lippia adoenesis*
102	Ger.pil	*Gerbera piloselloides*	144	Lob.gib	*Lobelia giberroa*
103	Gir.bul	*Girardinia bullosa*	145	Mae.lan	*Maesa lanceolata*
104	Gni.gla	*Gnidia glauca*	146	May.add	*Maytenus addat*
105	Gou.lon	*Gouania longispicata*	147	May.arb	*Maytenus arbutifolia*
106	Gre.fer	*Grewia ferruginea*	148	May.gra	*Maytenus gracilipes*
107	Gui.sca	*Guizotia scabra*	149	Mic.pyr	*Microglossa pyrifolia*
108	Gui.sch	*Guizotia schimperi*	150	Mik.cle	*Mikaniopsis clematoides*
109	Hag.aby	*Hagenia abyssinica*	151	Mom.foe	*Momordica foetida*
110	Hap.rue	*Haplocarpha rueppellii*	152	Myr.afr	*Myrsine africana*
111	Hel.foe	*Helichrysum foetidum*	153	Myr.mel	*Myrsine melanophloeos*
112	Hel.hed	*Helichrysum hedbergianum*	154	Myr.sal	*Myrica salicifolia*
113	Hel.mys	*Helinus mystacinus*	155	Nic.phy	*Nicandra physaloides*
114	Hel.sch	*Helichrysum schimperi*	156	Not.mar	*Notholaena marantae*
115	Hel.ste	*Helichrysum stenopterum*	157	Oci.lam	*Ocimum lamiifolium*
116	Hib.mic	*Hibiscus micranthus*	158	Oci.urt	*Ocimum urticifolium*
159	Ole.cap	*Olea capensis*	201	Ryt.neg	*Rytigynia neglecta*
160	Ole.eur	*Olea europaea*	202	Sal.muc	*Salix mucronata*
161	Ole.wel	*Olea welwitschii*	203	Sal.nil	*Salvia nilotica*
162	Oli.roc	*Olinia rochetiana*	204	Sat.par	*Satureja paradoxa*

163	Oro.min	*Orobanche minor*	205	sat.pun	*Satureja punctata*
164	Osy.qua	*Osyris quadripartita*	206	Sch.aby	*Schefflera abysinica*
165	Oto.tom	*Otostegia tomentosa*	207	Sch.ala	*Schrebera alata*
166	Pan.mon	*Panicum monticola*	208	Sen.aeg	*Senecio aegyptius*
167	Pav.aby	*Pavetta abyssinica*	209	Sen.did	*Senna didymobotrya*
168	Pav.ure	*Pavonia urens*	210	Sen.myr	*Senecio myriocephalus*
169	Pen.sph	*Pennisetum sphacelatum*	211	Sen.rag	*Senecio ragazzii*
170	Pep.aby	*Peperomia abyssinica*	212	Sid.sch	*Sida schimperiana*
171	Pep.vog	*Peponium vogelii*	213	Sid.ter	*Sida ternata*
172	Per.dec	*Persicaria decipiens*	214	Smi.asp	*Satyrium aethiopicum*
173	Per.lin	*Periploca linearifolia*	215	Sol.ang	*Solanum anguivi*
174	Pha.imb	*Phaulopsis imbricata*	216	Sol.aut	*Solenostemon autrani*
175	Pho.rec	*Phoenix reclinata*	217	Sol.cam	*Scadoxus multiflorus*
176	Phr.mac	*Phragmenthera macrosolen*	218	Sol.gig	*Solanecio gigas*
177	Phr.reg	*Phragmanthera regularis*	219	Sol.mar	*Solanum marginatum*
178	phy.dod	*Phytolacca dodecandra*	220	Sol.nig	*Solanum nigrum*
179	Pit.vir	*Pittosporum viridiflorum*	221	Son.bip	*Sonchus bipontini*
180	Pla.lan	*Plantago lanceolata*	222	Spa.mac	*Sparmannia macrocarpa*
181	Ple.pun	*Plectranthus puntatus*	223	Spo.afr	*Sporobolus africanus*
182	Pod.fal	*Podocarpus falcatus*	224	Ste.aby	*Senecio subsessilis*
183	Pol.riv	*Polystachya rivae*	225	Syz.gui	*Syzygium guineense*
184	Pre.sch	*Premna schimperi*	226	Tag.min	*Tagestes minuta*
185	Pro.gag	*Protea gaguedi*	227	Tec.nob	*Teclea nobilis*
186	Pru.afr	*Prunus africana*	228	Tha.rhy	*Thalictrum* rhynchocarpum
187	Pte.aqu	*Pteridium aquilinium*	229	Thu.ala	*Thunbergia alata*
188	Pte.ste	*Pterolobium stellatum*	230	Thy.sch	*Thymus schimperi*
189	Pyh.dod	*Phytolacca dodecandra*	231	Tol.vir	*Tolpis virgata*
190	Rha.pri	*Rhamnus prinoides*	232	Tra.amm	*Trachyspermum ammi*
191	Rha.sta	*Rhamnus staddo*	233	Tri.bra	*Triumfetta brachyceras*
192	Rhu.glu	*Rhus glutinosa*	234	Tri.rue	*Trifolium rueppellianum*
193	Ric.com	*Ricinus communis*	235	Ueb.kig	*Uebelinia kigesiensis*
194	Rit.alb	*Ritchiea albersii*	236	Ure.hyp	*Urera hypselodendron*

195	Ros.aby	*Rosa abyssinica*	237	Urt.sim	*Urtica simensis*
196	Nux.con	*Nuxia congesta*	238	Rub.ape	*Rubus apetalus*
197	Rum.nep	*Rumex nepalensis*	239	Rub.cor	*Rubia cordifolia*
198	Rum.ner	*Rumex nervosus*	240	Rub.ste	*Rubus steudneri*
199	Rum.aby	*Rumex abyssinicus*	241	Zeh.sca	*Zehneria scabra*
200	Ver.rue	*Vernonia rueppellii*			
243	Ver.sin	*Verbascum sinaiticum*			
244	Ver.amy	*Vernonia amygdalina*			
245	ver.aur	*Vernonia auriculifera*			
246	Ver.leo	*Vernonia leopoldi*			
247	Ver.off	*Verbena officinalis*			
247	Vig.sch	*Vigna schimperi*			
249	Xan.spi	*Xanthium spinosum*			

Appendix 6. **List of medicinal plants used for the treatment of human ailments: scientific name; family; local name; Habit; ailment treated; plant parts used; condition of plant part uses; methods of preparation and application; route of administration; additives; District and voucher number**

Key: Ha=Habit (T=tree, Sh= shrub, H=herb, Li=liana); PPU=Plant part used (Rt=root, Lf=leaf, BK=bark, Sd=seed, ZZ=fruit, RBK=root bark, Fsh =flesh of fruit, Ss=shoot, Bu=bulb, Tu= tuber, In=inflorescence, St=stem, Sp=sap, Wp=whole plant, Lx=latex, Rh=rhizome); CPU= condition of plant part used (dr=dry, Fr=fresh, dr/Fr=dry or fresh); RA=route of remedy administration (Or=oral, Dm=dermal, Na=nasal, Au=auricular, Op=optical); Dis=District (1=Jibat, 2=Chelia, 3=Dendi); MRPA=mode of remedy preparation and application (1= Boil and drink the decoction up on cooling; 2= Extract the part and pour or paint it; 3=Add chopped plant part(s) to bath water and do bath; 4=Crush and steep plant part in cold water and drink the infusion; 5=Drink as herbal tea; 6=Paint/rub/paste the latex/sap/flesh/juice directly; 7=Eat the plant part (raw/cooked); 8=Hold with teeth; 9=Crush, heat/burn or boil the part and inhale its smoke or steam;10=Drink the concoction; 11=Pound/squeeze/smash the part and sniff; 12=Grind and paint the powder or crushed part; 13=Grind, paste the crushed part and tie), VN= voucher number after TR

No.	Scientific name	Family	Local Afan Oromo name	Ha	DM	Ailment treated	PPU	CPU	MRPA	RA	Additive(s)	Dis	VN TRx
1	*Acacia abyssinica* Hochst. ex Benth.	Fabaceae	laftoo	T	W	Tonsillitis	Ss	Fr	8	Or	None	J,C,D	167
						Wound	Ss	Fr	2	Dm	None		
2	*Acanthus sennii* Chiov.	Acanthaceae	kosoru	Sh	W	Sore	Lf	dr	12	Dm	Butter	J,C,D	145
						Rheumatism	Rt	dr	1	Or	None		
						Evil eye	Rt	dr	9	Na	None		
						Tuberculosis	Rt	dr	1	Or	Bread		
						Skin lesion	Lf	dr	12	Dm	Butter		
3	*Achyranthes aspera* L.	Amaranthaceae	darguu	H	W	Gastritis	Rt	Fr	10	Or	None	J,C,D	214
						Impotency	Rt	dr	1	Or			
						Leishmaniasis	Lf/Rt	Fr	13	Dm	None		
4	*Acmella caulirhiza* Del.	Asteraceae	gutichaa	H	W	Amoebiasis	Rt	Fr	10	Or	Salt	J,C,D	332
						Toothache	Rt	Fr	8	Or	None		
5	*Acokanthera schimperi* (A.DC.) Schweinf.	Apocynaceae	qararuu	Sh	W	Gonorrhea	Rt	Fr	4	Or	Salt	D	17
						Tonsillites	Lf	Fr	1	Or	None		
						Sore	Lf	dr	12	Dm	Butter		
6	*Agave sisalana* Perro ex Eng.	Agavaceae	qaca	Sh	W	Wound	Lf	Fr	13	Dm	None	D	110
						Syphilis	Lf	Fr	10	Or	Salt		
7	*Ajuga integrifolia* Buch.-Ham. ex D. Don	Lamiaceae	armagusa	H	W	Diarrhoea	Lf	Fr	1	Or	None	J,C,D	154
						Malaria	Wp	Fr	4	Or	Garlic		
8	*Albizia schimperiana* Oliv.	Fabaceae	emalaa	T	W	Pyelonephritis	Rt	Fr	1	Or	Salt	J,C,D	35
						Syphilis	BK	Fr	4	Or	Salt		
9	*Alectra sessiliflora* (Vahl) Kuntze	Scruphulaceae	qooricha mada	H	W	Minor bleeding	Wp	Fr	13	Dm	None	J,C,D	35
						Wound	Wp	Fr	13	Dm	None		
10	*Allium sativum* L.	Alliaceae	qulubii adii	H	C	Malaria	Bu	dr/Fr	8	Or	Salt	J,C,D	411
						Ringworm	Bu	Fr	12	An	Butter		

						Asthma	Bu	Fr/dr	7	Or	Honey		
						Common cold	Bu	Fr/dr	5	Or	Sugar		
						Dandruff	Bu	Fr	13	Dm	Butter		
						Pneumonia	Bu	Fr/dr	5	Or	Sugar		
						Coughing	Bu	Fr/dr	5	Or	Sugar		
						Bronchitis	Bu	Fr/dr	5	Or	Sugar		
11	*Allium cepa* L.	Alliaceae	qulubii dima	H	C	Jaundice	Bu	Fr	13	Dm	None	J	65
						Asthma	Bu	Fr/dr	5	Or	Ginger		
12	*Allophylus abyssinicus* (Hochst.)Radlk.	Sapindaceae	sarara	T	W	Wound	Lf	dr	12	Dm	None	J,C,D	395
						Syphilis	Lf	dr	1	Or	None		
13	*Amaranthus caudatus* L.	Amaranthaceae	eyasu	H	W	Constipation	Ss	Fr	1	Or	None	J,C	258
						Wound	Rt	Fr	12	Dm	None		
14	*Apodytes dimidiata* E. Mey ex Arn.	Icacinaceae	qumbala /calalaaqa	T	W	Coughing	Lf	Fr	1	Or	None	J,D	24
						Tania paddies	Lf	Fr	13	Dm	None		
15	*Arceuthobium juniperi-procerae* Chiov.	Viscaceae	digalu gatira	H	W	Asthma	Lf	dr	9	Na	None	D	56
						Tuberculosis	Lf	dr	4	Or	Garlic		
16	*Arisaema enneaphyllum* Hochst. ex Rich.	Araceae	carana	H	W	Bloating	Sd, Rt	Fr/dr	1	Or	None	J,C	170
						Atopic eczema	Ss	Fr	13	Dm	None		
17	*Arundinaria alpina* K.Scum.	Poaceae	shimala	H	W	Headache	BK	Fr	11	Na	None	J	401
18	*Artemisia abyssinica* Sch. Bip. ex A. Rich.	Asteraceae	kodoo	H	W	Atopic eczema	Lf	Fr	1	Or	None	J,C,D	359
						Coughing	Lf	Fr	11	Na	None		
						Bronchitis	Lf	Fr	5	Or	None		
19	*Asparagus africanus* Lam.	Asparagaceae	saritii	H	W	Jaundice	Tu	Fr	13	Dm	None	J,C,D	355
						Spider poison	Rt	Fr	13	Dm	None		
						Gastritis	Tu	Fr	10	Or	None		
						Impotency	Tu	dr/Fr	1	Or			

20	*Asparagus racemosus* Willd.	Asparagaceae	saritii	Sh	W	Jaundice	Tu	Fr	1	Dm	None	J,C,D	49
						Fibril illness	Tu	Fr	10	Or	None		
21	*Bersama abyssinica* Fresen.	Melianthaceae	ararsaa	T	W	Amoebiasis	BK	dr	1	Or	None	J,C,D	258
						Constipation	Lf	Fr	10	Or	None		
						Diarrhea	Rt	Fr	10	Or	None		
22	*Bidens ghedoensis* Mesfin	Asteraceae	kello	H	W	Fire burn	Lf	Fr	13	Dm	None	J,C	37
23	*Bothriocline schimperi* Oliv.& Hiern ex Benth.	Asteraceae	ulee hare	Sh	W	Evil eye	Lf	Fr	11	Na	None	J,C,D	321
						Warts	Lf	Fr	13	Dm	None		
24	*Brassica carinata* A. Br.	Brassicaceae	gomanzara	H	C	Bloating	Sd	dr	10	Or	Soap & salt	J,C,D	123
25	*Brassica nigra* (L.) Koch	Brassicaceae	siinaficaa	H	C	Bloating	Sd	dr	1	Or	Salt	J,C	73
						Common cold	Sd	dr	1	Or	'Tella'		
						Asthma	Sd	dr	4	Or	Garlic		
26	*Brucea antidysernterica* J.F.Mill.	Simaroubaceae	qomonyoo	Sh	W	Toothache	Sd	Fr	8	Or	None	J,C,D	25
						Gonorrhea	Sd	dr	1	Or	Salt		
						Diarrhea	BK	Fr	10	Or	None		
27	*Buddleja polystachya* Fresen.	Loganiaceae	anfara	T	W	Ascariasis	Lf	Fr	10	Or	Salt	J,C,D	61
						Evil eye	BK	dr	9	Na	None		
						Amoebiasis	Lf ,Rt	dr	1	Or	None		
						Hepatitis	Bk	dr	9	Na	None		
28	*Calpurnia aurea* (Ait.)Benth.	Fabaceae	ceekaa	Sh	W	Rabies	Rt	Fr	1	Or	None	J,C,D	69
						Tuberculosis	Rt	Fr	1	Or	None		
						Diarrhea	Sd	dr	10	Or	Honey		
29	*Canarina abyssinica* Engl.	Campanulaceae	xuxoo	H	W	Leprosy	Wp	dr	13	Dm	Garlic	J,C,D	164
30	*Capsicum annuum* L.	Solanaceae	barbaree	H		Malaria	ZZ	dr	1	Or	Honey	J,C,D	49
31	*Carduus leptacanthus* Fresen.	Asteraceae	qoree-haree	H	W	Wound	Lf,Rt	dr	13	Dm	None	J,C,D	357

						Gonorrhea	Rt	dr	10	Or	None		
32	*Carduus schimperi* Sch. Bip.	Asteraceae	balanwarantii	Sh	W	Hepatitis	Rt	Fr	1	Or	None	J,C,D	97
						Jaundice	Rt	Fr/dr	1	Or	None		
33	*Carica papaya* L.	Caricaceae	'papaya'	T	C	Gastritis	Sd	dr	12	Or	None	J,C,D	361
						Constipation	Lf	Fr	4	Or	Honey		
34	*Carissa spinarum* L.	Apocynaceae	agamsa	Sh	W	Evil eye	RBK	dr	9	Na	None	J,C,D	82
						Rheumatism	Sd	dr/Fr	1	Or	None		
						Headache	Lf	Fr	11	Na	None		
						Ascariasis	Sd	dr	10	Or	None		
						Impotency	Rt	dr	1	Or	None		
						Rabies	Rt	Fr	10	Or	None		
35	*Catha edulis* (Vahl) Forssk. ex Endl.	Celasteraceae	cati	Sh	C	Impotency	Rt	Fr	10	Or		J,C,D	350
						Common cold	Lf	dr	5	Or	Sugar		
						Ascariasis	BK	Fr	1	Or	Garlic		
36	*Cassipourea malosana* (Baker) Alston	Rhizophoraceae	gachanfulasa	T	W	Gonorrhea	BK	Fr	1	Or	None	J,C,D	85
						Gingivitis	BK	Fr	8	Or	None		
37	*Caylusea abyssinica* (Fresen.) Fisch. & Mey.	Resedaceae	reencii	H	W	Ringworm	Wp	Fr	6	An	None	J,C,D	19
38	*Celtis africana* Burm. f.	Ulmaceae	caa'ii	T	W	Asthma	BK	dr	1	Or	Garlic	J,C,D	291
						Evil spirit	Bk	dr	9	Na	None		
39	*Chenopodium schraderianum* Schult	Chenopodiaceae	qoricha gondaa	H	W	Evil eye	Lf	Fr	9	Na	None	J,C,D	247
40	*Chionanthus mildbraedii* (Gilg & Schellenb.) Stearn	Oleaceae	karra wayyuu	Sh	W	Toothache	Lf	Fr	9	Or	None	J,C	173
						Syphilis	BK	Fr	1	Or	None		
41	*Cirsium vulgare* (Savi) Ten.	Asteraceae	qoree-haree	H	W	Weight loss	Rt	Fr	10	Or	None	J,D	393
						Malaria	Rt	dr	1	Or	Salt		
42	*Clausena anisata* (Willd.)Benth.	Rutaceae	ulumayii	Sh	W	Impotency	Rt	Fr	1	Or	A.africanus	J,C,D	361

43	*Clematis simensis* Fresen	Ranunculaceae	hida feetii	Cl	W	Rheumatism	Sd	dr	1	Or	None	J,C,D	9
						Toothache	Lf	Fr	9	Lo	Salt		
						Ascariasis	Rt	dr	10	Or	None		
44	*Clematis longicauda* Steud. ex A. Rich.	Ranunculaceae	hida adii	Cl	W	Rheumatism	Rt	dr	1	Dm	Butter	J,C,D	193
						Sore	Lf	Fr	13	Dm	None		
						Tetanus	Lf	Fr	13	Dm	None		
45	*Clerodendrum myricoides* (Hochst.) Vatke	Lamiaceae	ulee haree	Sh	W	Malaria	Rt	Fr	1	Or	Garlic	J,C,D	44
						Infertility	Rt	Fr	10	Or	None		
46	*Clutia abyssinica* Jaub. & Spach.	Euphorbiaceae	ulee lonii	Sh	W	Tinea corporis	Lx	Fr	6	Au	None	J,C,D	68
						Hepatitis	Lx	Fr	6	Op	None		
						Mumps	Lx	Fr	6	Au	None		
47	*Coffea arabica* L.	Rubiacae	buna	T	C	Diarrhea	Sd	dr	1	Or	Honey	J,C,D	87
48	*Conyza nana* Sch. Bip. ex Oliv. & Hiern	Asteraceae		H	W	Hemorrhoids	Ss	Fr	2	An	None	D	
						Leishmaniasis	Ss	Fr	2	Dm	None		
49	*Cordia africana* Lam.	Boraginaceae	wodessa	T	W	Toothache	Lf	Fr	8	Lo	Salt	J,C,D	75
						Snake poison	BK	Fr	1	Or	None		
50	*Crassula alba* Forssk	Crassulaceae		H	W	Skin lesion	Lf	Fr	4	Dm	None	J,C,D	43
						Swelling	Rt	dr/Fr	10	Or	None		
51	*Crotalaria rosenii* (Pox) Milne-Redh. ex Polhill	Fabaceae	atarakuruphe	Sh	W	Amoebiasis	St	Fr	1	Or	None	J,D	108
52	*Croton macrostachyus* Del.	Euphorbiaceae	bakanisa	T	W	Tinea corporis	Sp	Fr	6	Dm	None	J,C,D	251
						Epistaxis	Lf	fr	11	Na	None		
						Headache	Lf	Fr	11	Na	None		
						Wound	Lf	Fr	13	Dm	None		
						Rabies	Rt	Fr	1	Or	None		
						Hemorroids	Sp	Fr	6	An	None		
53	*Cucumis ficifolius* A.Rich.	Cucurbitaceae	hiddi hooloo	Cl	W	Ascariasis	Rt	Fr	1	Or	None	J,C,D	362

54	*Cyathula uncinulata* (Schrad.) Schinz	Amaranthaceae	maxanne	H	W	Infertility	Rt	Fr	10	Or		J,C,D	202
						Minor bleeding	Lf	Fr	13	Dm	None		
55	*Cucurbita pepo* L.	Cucurbitaceae	dabaqula	H	C	Taeniasis	Sd	dr	1	Or	None	J,C,D	60
						Ascariasis	Sd	dr	1	Or	None		
56	*Cymbopogon citratus* (DC ex Nees) Stapf	Fabaceae	'tej sar'	H	C	Influenza	Lf	Fr	9	Na	None	C,D	42
57	*Cynoglossum lanceolatum* Forssk.	Boraginaceae	maxannee	H	W	Fibril illness	Rt , Lf	Fr	4	Na	None	J,C,D	50
						Gingivitis	Lf	Fr	8	Or	Salt		
58	*Cyphostemma cyphopetalum* (Fresen.) Des. ex Wild & Drum.	Vitaceae	hidda boffa	H	W	Snake poison	Ss	Fr	1	Or	Salt	J,C	27
						Spider poison	Ss	Fr	1	Or	Salt		
59	*Datura stramonium* L.	Solanaceae	asangra	H	W	Dandruff	Lf	Fr	13	Dm	Butter	J,C,D	43
60	*Delphinium dasycaulon* Fresen.	Ranunculaceae	qoricha boffa	H	W	Epilepsy	Rt	Fr	10	Or	None	J,C,D	74
						Snake poison	Rt	Fr	10	Or	None		
						Coughing	Sp	fr	1	Or	None		
61	*Discopodium penninervium* Hochst.	Solanaceae	cacuunga	T	W	Tania paddies	Lf	Fr	2	Dm	Butter	J,C,D	135
						Goiter	Lf	Fr	10	Dm	Butter		
						Breast ulcerate	Lf	Fr	13	Dm	Butter		
62	*Dodonaea angustifolia* L. f.	Sapindaceae	xadachaa	Sh	W	Diarrhoea	Rt	dr/Fr	1	Or	None	J,C,D	239
						Atopic eczema	Lf	Fr	3	Dm	None		
						Back pain	Lf	Fr	1	Or	None		
63	*Dombeya torrida* (J. F. Gmel.) P. Bamps	Sterculariaceae	danisa	T	W	Snake poison	Rt	Fr	10	Or	Salt	J,C,D	4
64	*Dovyalis abyssinica* (A. Rich.) Warb.	Flacourtiaceae	koshimii	Sh	W	Menstrual disorder	Rt	dr/Fr	1	Or	None	J,C,D	25
						Leprosy	Rt	Fr	13	Dm	None		
65	*Dracaena afromontana* Mildbr.	Dracenaceae	afarfatuu	T	W	Hepatitis	Rt	Fr	12	Dm	None	J,C,D	228

						Chanchroid	Lf	Fr	13	Dm	None		
66	*Dregea schimperi* (Decne.) Bullock	Asclepidaceae	hidda goorriissaa	Cl	W	Tania paddies	Lx	Fr	6	Dm	None	J,C,D	44
						Skin lesion	Lx	Fr	6	Dm	None		
67	*Echinops ellenbeckii* 0.Hoffm.	Asteraceae		Sh	W	Wound	Lf	dr	12	Dm	None	C,D	31
						Rabies	Rt	Fr/dr	1	Or			
68	*Echinops kebericho* Mesfin	Asteraceae	qabarichoo	Sh	W	Rabies	Rt	Fr/dr	1	Or	R. communis (Rt)	J,C,D	347
						Gonorrhea	Rt	Fr/dr	10	Or	None		
						Evil spirit	Rt	dr	9	Na	None		
						Evil eye	Rt	dr	9	Na	None		
69	*Ehertia cymosa* Thonn.	Boraginaceae	ulagaa	T	W	Retained placenta	Rt	Fr	1	Or	Salt	J,C,D	224
						Erythroblasts	Rt	Fr	1	Or	Salt		
70	*Ekebergia capensis* Sparrm.	Meliaceae	somboo	T	W	Menstrual disorder	BK	Fr	1	Or	Honey	J,C,D	244
						Chanchroid	BK	Fr	13	Or	Honey		
71	*Embelia schimperi* Vatke	Myrisinacea	hanquu	Sh	W	Taeniasis	Sd	dr	1	Or	None	J,C,D	50
						Herpes zoster	ZZ	dr	13	Dm	Butter		
72	*Englerina woodfordioides* (Schweing.) M.Gilbert	Loranthaceae	digaluu	H	W	Herpes zoster	Lf	Fr	13	Dm	Butter	J,C,D	258
						Dysuria	Lf	Fr	10	Or	None		
73	*Enset ventiricosum*(Welw.) E.E. Chees.	Musaceae	warqee/qoco	T	C	Gastritis	Rt	dr	1	Or	Salt	J,C,D	369
						Wound	Ss	Fr	2	Dm	None		
74	*Erica arborea* L.	Ericaceae	maxaxee	T	W	Giardiasis	Ss	Fr	1	Or	None	J,D	324
75	*Erythrina brucei* Schw.	Fabaceae	walleensu	T	W	Gastritis	Rt, BK	Fr	10	Or	*A. shimperiana* (Rt)	J,C,D	263
						Swelling	Rt	Fr	10	Or	Salt		
76	*Eucalyptus camaldulensis* Dhnh.	Myrtaceae	bargamodiima	T	C	Fibril illness	Lf	Fr	9	Na	None	J,C,D	249

77	*Eucalyptus globulus* Labill.	Myrtaceae	bargamoadi	T	C	Common cold	Lf	Fr	9	Na	None	J,C,D	351
						Asthma	Lf	Fr	9	Na	None		
78	*Euphorbia ampliphylla* Pax	Euphorbiaceae	adamii	T	W	Wound	Lx	Fr	6	Dm	None	J,C,D	162
						Scabies	Lx	Fr	6	Dm	None		
						Hemorrhage	Lx	Fr	6	Dm	None		
79	*Euphorbia schimperiana* Sch.	Euphorbiaceae	allooyee	H	W	Hemorrhoids	Lx	Fr	6	An	None	J,C,D	240
						Hemorrhoids	Lf	Fr	6	An	None		
80	*Ficus sur* Forssk.	Moraceae	harbuu	T	W	Impotency	Rt	Fr	1	Or	None	J,C,D	246
						Pyelonephritis	BK	Fr	10	Or	None		
81	*Ficus sycomorus* L.	Moraceae	odaa	T	W	Hemorrhoids	Ss	Fr	6	An	None	J,C,D	47
						Gonorrhea	Rt	Fr	1	Or	None		
82	*Ficus vasta* Forssk.	Moraceae	qilxu	T	W	Hepatitis	Lx	Fr	6	Na	None	J,C,D	82
						Pyelonephritis	BK	Fr	1	Or	None		
83	*Foeniculum vulgare* Miller	Apiaceae	insilala	H	C	Epilepsy	Lf	Fr	4	Na	None	J,C,D	262
						Ascariasis	Sd	dr	1	Or	Salt		
84	*Galineria saxifraga* (Hochst.) Bridson	Rubiaceae	mixo	T	W	Retained placenta	Rt	Fr	1	Or	None	J,C,D	399
85	*Girardinia bullosa* (Steudel) Wedd.	Urticaceae	dobii	H	W	Pyelonephritis	Rt	Fr	10	Or	None	J,C,D	147
						Gastritis	Lf	Fr	1	Or	None		
86	*Gnidia glauca* (Fresen.) Gilg	Thymelaeceae	didigsa	T	W	Antidote	Lf , Ss	Fr	1	Or	None	J,C,D	342
87	*Grewia ferruginea* Hochst. ex A. Rich.	Tiliaceae	dhoqonu	Sh	W	Rabies	Lf	Fr	1	Or	None	J	220
						Gingivitis	Lf	Fr	8	Or	None		
88	*Guizotia abyssinica* (L. f) Cass.	Asteraceae	nugii	H	C	Swelling	Sd	dr	10	Or	Salt	J,C,D	44
						Constipation	Sd	dr	1	Or	Salt		
89	*Guizotia scabra* (Vis.) Chiov.	Asteraceae	hadaa, tuufoo	H	W	Wound	Lf ,Ss	Fr	13	Dm	None	J,C,D	119
90	*Hagenia abyssinica* (Bruce) I.F. Gmel.	Rosaceae	heexoo	T	W	Taeniasis	Rt,In	dr	1	Or	*E. schimperi*	J,C,D	413

											(Sd)		
						Giardiasis	BK	Fr	10	Or	None		
91	*Helinus mystacinus* (Ait.) E. Mey. ex Steud.	Rhamnaceae	hudha	Cl	W	Minor bleeding	Lf	Fr	13	Dm	None	J,C,D	335
						Throat infection	Lf	Fr	8	Or	None		
92	*Hypericum revolutum* Vahl	Hypericaceae	endhee	Sh	W	Dandruff	St	Fr	2	Dm	None	J,D	249
						Erythroblasts	Lf	Fr	1	Or	None		
93	*Ilex mitis* (L.) Radlk.	Aquifoliaceae	mi'eesa	T	W	Tonsillitis	Lf	Fr	8	Or	None	J,C,D	339
						Dysuria	Lf	Fr	10	Or	None		
94	*Indigofera arrecta* Hochst. ex A. Rich	Fabaceae	qoricha dingetenya	H	W	Sudden sickness	Rt	Fr	4	Or	None	J,C,D	209
						Epilepsy	Lf	Fr	11	Na	None		
95	*Ipomoea cairica* (L.) Sweet	Convolvulaceae	hida antuta	H	W	Diarrhea	Rt	Fr	8	Or	None	J,C	90
						Epilepsy	Rt	Fr	8	Or	None		
96	*Jasminium abyssinicum* Hochst ex Dc.	Oleaceae	hida ilchibee	Cl	W	Toothache	Lf	Fr	8	Or	None	J,C,D	391
						Hypertension	Rt	dr	1	Or	Honey		
97	*Juniperus procera* Endl.	Cupressaceae	gatira	T	W	Tonsillitis	St	Fr	8	Or	None	J,C,D	40
						Malaria	BK	dr	1	Or	None		
						Pneumonia	Lf	Fr	4	Or	None		
98	*Justicia schimperiana* (Hochst. ex Nees) T. Anders.	Acanthaceae	dhumuuga	Sh	C	Atopic eczema	Lf	Fr	1	Or	None	J,C,D	184
						Rabies	Rt	Fr	1	Or	Milk		
99	*Kalanchoe petitiana* A. Rich.	Crassulaceae	andawulaa	H	W	Hemorrhoids	Lf	Fr	13	An	None	J,C,D	166
100	*Lactuca inermis* Forssk.	Asteracecae	-	H	W	Diarrhea	Rt	Fr	10	Or	None	J,D	121
						Wound	Rt	Fr	13	Dm	None		
101	*Lagenaria siceraria* (Molina) Standi.	Cucurbitaceae	buqehadha'a	H	W	Taeniasis	Sd	dr	1	Or	None	J,C,D	157
						Amoebiasis	Sd	dr	10	Or	None		
102	*Lepidium sativum* L.	Brassicaceae	fecoo	H	C	Skin rash	Sd	dr	12	Dm	None	J,C,D	398

						Gastritis	Sd	dr	4	Or	None		
						Goiter	Sd	dr	1	Or	None		
						Indigestion	Sd	dr	1	Or	Salt		
103	*Leucas deflexa* Hook. f	Lamiaceae	bokku farda	H	W	Toothache	Lf	Fr	8	Or	Salt	J,C,D	293
104	*Linum usitatissimum* L.	Liniaceae	talbaa	H	C	Constipation	Sd	dr	1	Or	None	J,C,D	242
						Retained placenta	Sd	dr	1	Or	None		
						Bone fracture	Sd	dr	10	Or	Salt		
105	*Lippia adoenesis* Hochst. ex Walp.	Verbenaceae	kussayee	Sh	W	Infuelenza	Lf	dr	5	Or	Honey	J,C,D	243
						"Mich"	Lf	Fr	3	Na	None		
106	*Maesa lanceolata* Forssk.	Myrsinaceae	abaayyii	Sh	W	Taeniasis	ZZ	dr	1	Or	Salt	J,C,D	167
						Elephantiasis	ZZ	dr	1	Or	Salt		
107	*Maytenus addat* (Loes.) Sebsebe	Celasteraceae	kombolcha	T	W	Tuberculosis	Lf	Fr	10	Or	None	J,C	232
						Urine retention	Bk	dr	1	Or	Milk		
108	*Maytenus arbutifolia* (A. Rich.) Wilczek	Celasteraceae	Kombolcha	T	W	Sore	Lf	dr	12	Dm	Butter	J,C,D	171
						Pneumonia	Lf	Fr/dr	10	Or	None		
109	*Mentha aquatica* L.	Lamiaceae	qoricha lagaa	H	W	Sudden sickness	Lf	Fr	11	Na	None	J,C	218
110	*Millettia ferruginea* (Hochst.) Bak.	Fabaceae	sotaloo	T	W	Gonorrhea	BK	dr/Fr	4	Or	None	J,C,D	358
						Skin rash	Lf	Fr	4	Dm	None		
111	*Momordica foetida* Schumach	Cucurbitaceae	nyata allattii	Cl	W	Mumps	Lf	Fr	2	Au	None	J,C,D	247
						Urine retention	Lf	dr	1	Or	Honey		
112	*Musa x paradisiaca* L .	Musaceae	warkee	H	C	wound	Sp	Fr	6	Or	Salt	J,C,D	215
113	*Myrica salicifolia* A. Rich.	Myricaceae	barodoo	T	W	Gastritis	Lf	Fr	4	Or	None	J,C,D	354
						Epistaxis	Lf	Fr	2	Na	None		
114	*Myrsine africana* L.	Myrsinaceae	qacaama	Sh	W	Tuberculosis	Lf	Fr	10	Or	None	J,C,D	349
115	*Myrsine melanophloeos* (L.)R.Br.	Myrisinaceae	odobada	T	W	Epistaxis	Lf	Fr	2	Or	None	J,C	38

						Infertility	Lf	Fr	1	Or	None		
						Paralysis	BK	Fr	1	Or	None		
116	*Nicandra physaloides* (L.) Gaertn.	Solanaceae	asangiraa	H	W	Toothache	Sd	dr	11	Dm	None	J,C,D	91
117	*Nicotiana tabacum* L.	Solanaceae	tamboo	H	C	Hepatitis	Lf, In	dr	9	Na	None	J,C,D	182
118	*Nigella sativa* L.	Ranunculaceae	abasuda	H	C	Tonsillitis	Sd	dr	5	Or	None	J,C,D	273
						Amoebiasis	Sd	dr	1	Or	salt		
						Headache	Sd	dr	11	Na	None		
119	*Nuxia congesta* R.Br. ex Fressen.	Loganiaceae	qaqawee	T	W	Toothache	BK	Fr	8	Or	None	J,C,D	167
120	*Ocimum lamiifolium* L.	Lamiaceae	qoricha michii	Sh	W	"Mich"	Lf	Fr	10	Na	None	J,C,D	210
						Fibril illness	Lf	Fr	3	Na	None		
121	*Ocimum urticifolium* Roth	Lamiaceae	anchabii	Sh	W	"Mich"	Lf	Fr	11	Na	*C.macrost achyius*	J,C,D	308
						Migraine	Lf	Fr	11	Na			
122	*Olea europaea* L. subsp. *cuspidata* (Wall. ex G.Don) c.f.	Oleacea	ejersa	T	W	Tonsillitis	Lf	Fr	1	Or	None	J,C,D	364
						Skin infection	St	Fr	12	Dm	None		
						Coughing	BK	dr	1	Or	None		
123	*Olinia rochetiana* A.Juss.	Oliniaceae	solee	T	W	Scabies	Lf	Fr	6	Dm	*P.africana* (Lf)	J,C,D	267
						Toothache	St	Fr	8	Or	none		
124	*Osyris quadripartita* Decn.	Santalaceae	wato	T	W	Pyelonephritis	BK	Fr	1	Or	None	J,C,D	168
125	*Otostegia integrifolia* Benth.	Lamiaceae	tunjuti	Sh	W	Rheumatism	Lf	dr/Fr	10	Or	Sugar	J,C,D	295
						Back pain	Lf	dr/Fr	1	Or	None		
126	*Pavonia urens* Cav.	Malvaceae	hincinii	Sh	W	Paralysis	Lf	Fr	10	Or	None	J,C,D	108
127	*Peponium vogelii* (Hook. f.) Engl.	Cucurbitaceae	buqesexana	Cl	W	Evil sprit	Lf	Fr	11	Na		J,C,D	307
						Herpes zoster	Fsh	Fr	12	Dm	None		
128	*Phragmenthera macrosolen* (A. Rich.) M.	Loranthaceae	digalu	H	W	Elephantiasis	Lf	Fr	10	Or	None	J,C,D	107

	Gilbert												
129	*Phytolacca dodecandra* L'Herit.	Phytolaccaceae	andode	Sh	W	Rabies	Rt	Fr /dr	1	Or	None	J,C,D	403
						Dandruff	ZZ	Fr	3	Dm	None		
						Pyelonephritis	Lf	Fr	4	Or	Honey		
						Hepatitis	Sd	dr	9	Na	None		
130	*Periploca linearifolia* Quart.-Dill. & A. Rich.	Asclepiadaceae	-	Li	W	Lx	Fr	13	Dm	Non e		J,C,D	201
131	*Phoenix reclinata* Jacq.	Arecaceae	meexii	T	W	Giardiasis	Sd	dr	1	Or	None	J,C,D	166
						Tetanus	Sd	Fr	1	Or	None		
132	*Pittosporum viridiflorum* Sims	Pittosporaceae	solee adi	T	W	Tonsillitis	St	Fr	8	Or	None	J,C,D	243
133	*Plantago lanceolata* L.	Plantaginaceae	qorxobii	H	W	Wound	Lf	Fr	2	Dm	None	J,C,D	194
						Minor bleeding	Lf	Fr	2	Dm	None		
134	*Plectranthus edulis* (Vatke) Agnew	Lamiaceae	dinicha Oromo	H	C	Swelling	Rh	Fr	11	Dm	None	J,C,D	117
135	*Plectranthus garckeanus* (Vatke) J.K. Morton	Lamiaceae	dinichaboye	H	W	Scabies	Lf	Fr	6	Dm	None	C,D	229
						Hypertension	Lf	Fr	1	Or	None		
136	*Premna schimperi* Engl.	Lamiaceae	urgoftu	Sh	W	Coughing	Lf	Fr	5	Or	Honey	C,D	103
137	*Prunus africana* (Hook.f.)Kalkm.	Rosaceae	hoomii	T	W	Wound	BK	dr	12	Dm	None	C,D	268
						Urine retention	Bk	dr	1	Or	Milk		
138	*Pterolobium stellatum* (Forssk.) Brenan	Fabaceae	harangama	Cl	W	Snake poison	St	Fr	1	Or	None	J,C,D	220
						Failure of lactation	Lf	Fr	10	Or	Salt		
139	*Rhamnus prinoides* L'herit.	Rhamnacaeae	geshoo	Sh	C	Tinea corporis	Fsh	Fr	13	Dm	None	J,C,D	110
						Skin infection	Fsh	Fr	13	Dm	None		
140	*Rhoicissus tridentata* (L. f.) Wild& Drummond	Vitaceae	hidarefa	Sh	W	Goiter	Rt	Fr	1	Or	None	D	303
141	*Rhus vulgaris* Meikle	Anacardiaceae	dabobessaa	T	W	Head ache	Lf	Fr	11	Na	None	J,C,D	117
						Leprosy	Lf	Fr	12	Dm	None		

142	*Ricinus communis* L.	Euphorbiaceae	qobboo	H	C	Rabies	Rt	Fr	1	Or	*P. dodecandra*	J,C,D	108
143	*Rosa abyssinica* Lindley	Rosaceae	gora	Sh	W	Impotency	Rt	dr	1	Or	None	J,C,D	229
						Menstrual disorder	ZZ	Fr	1	Or	None		
						Throat infection	In	Fr	1	Or	None		
144	*Rosmarinus officinalis* L.	Lamiaceae	balaxibisii	H	C	Fire burn	Lf	Fr	12	Dm	None	J,D	334
145	*Rubia cordifolia* L.	Rubiaceae	maxxannee	H	W	Asthma	Ss	Fr	4	Na	None	J,C,D	119
						Skin rash	Lf	Fr	3	Dm	None		
146	*Rubus steudneri* Schw.	Rosaceae	gora	Sh	W	Asthma	Lf	Fr	1	Or	None	J,C,D	338
						Pharyngitis	Lf	dr	1	Or	None		
147	*Rumex abyssinicus* Jacq.	Polygonaceae	mooqmoqii	H	W	Diabetis mellitus	Rh	dr/Fr	2	Or	Sugar	J,C,D	239
						Spider poison	Lf	Fr	12	Dm	None		
148	*Rumex nervosus* Vahl	Polygonaceae	dhaangagoo	Sh	W	Gastritis	BK	Fr	8	Or	None	J,C,D	413
						Nasal sinus	Lf	Fr	11	Na	None		
149	*Ruta chalepensis* L.	Rutaceae	cilatamoo	Sh	W	Common cold	St	Fr	5	Or	Garlic	J,C,D	194
						Leishmaniasis	Lf	Fr	13	Dm	None		
150	*Rytigynia neglecta* (Hiern) Robyns	Rubiaceae	mixoo	Sh	W	Dandruff	Sd	dr	12	Dm	None	J,C,D	103
						Pharyngitis	Lf	dr	1	Or	None		
151	*Salix mucronatha* Willd.	Salicaceae	barodoo	T	W	Rabies	BK	Fr	12	Or	None	J,C,D	211
						Hemorrhage	Ss	Fr	6	Dm	None		
152	*Salvia nilotica* Jacq.	Lamiaceae	-	H	W	Pyelonephritis	In	Fr	1	Na	None	J,C,D	311
						Migraine	Lf	Fr	11	Or	None		
153	*Satureja paradoxa* (Vatke) Engl. ex Seybold	Lamiaceae	shittoo qamale	H	W	Sore	Wp	dr	12	Dm	None	J,C,D	283
						Diabetis mellitus	Lf	dr	5	Or	Sugar		
154	*Schefflera abysinica* (Hochst. ex A. Rich.) Harms	Araliaceae	luqee, gatama	T	W	Atopic eczema	Lf	Fr	12	Dm	None	J,C,D	319

						Antidote	BK	Fr	1	Or	None		
155	*Senna didymobotrya* (Fresen) Irw. &Barn.	Fabaceae	kishikishii	Sh	W	Snake poison	Lf	Fr	1	Or	None	J,C,D	234
						Nasal sinus	Lf	Fr	11	Na	None		
156	*Sida schimperiana* Hochst. ex A. Rich.	Malvaceae	borkottee	Sh	W	Breast ulcerate	Lf	dr	1	Or	None	J,C,D	200
						Urine retention	Lf	dr	1	Or	None		
157	*Solanecio gigas* (Vatke) C. Jeffrey	Asteraceae	chachunge	T	W	Evil sprit	Rt	Fr	11	Na	None	J,C,D	208
						Failure of lactation	Lf	Fr	10	Or	Salt		
158	*Solanum anguivi* Lam.	Solanaceae	hidi	H	W	Rabies	Rt	Fr	1	Or	None	J,C	332
						Gingivitis	Sd	dr	9	Or	None		
159	*Solanum nigrum* L.	Solanaceae	hidi sare	Sh	W	Conjunctivitis	Fsh	Fr	8	Or	Salt	J,C,D	407
						Warts	Fsh	Fr	12	Dm	None		
160	*Stephania abyssinica* (Dillon & A. Rich.) Walp.	Menispermaceae	gura antuta	H	W	Warts	Rt	Fr	13	Dm	None	J,C,D	315
						Gastritis	Lf	Fr	1	Or	None		
						Syphilis	Rt	dr	10	Or	Honey		
161	*Stereospermum kunthianum* Cham.	Bignoniaceae	botoroo	T	W	Tooth ache	BK	Fr	8	Or	None	C	54
						Indigestion	BK	Fr	1	Or	None		
162	*Syzygium guineense* (Willd.) DC. Subsp *afromontanum*	Myrtaceae	badessa	T	W	Impotency	BK	Fr	1	Or	'Dorowat'	J,C,D	92
						Ascariasis	Rt	dr	1	Or	None		
						Malaria	Lf	Fr	4	Or	Ginger		
163	*Teclea nobilis* Del.	Rutaceae	hadhessa	T	W	Hemorrhoids	Lf	Fr	12	An	None	J,C,D	47
						Diabetis mellitus	Lf	dr/Fr	5	Or	Sugar		
164	*Thymus schimperi* Ronniger	Lamiaceae	xosingii	H	W	Hypertension	Lf	dr	5	Or	Sugar	J,C,D	61
						Perichondritis	Lf	Fr	12	Dm	None		
165	*Triticum dicoccon*	Poaceae	mata jabboo	H	C	Bone fracture	Sd	dr	7	Or	Salt	J,C,D	157

	Schrank												
						Back pain	Sd	dr	7	Or	Salt		
166	*Urera hypselodendron* (A.Rich.)Wedd.	Urticaceae	dhoqonu	Cl	W	Fire burn	BK	Fr	13	Dm	None	J,C,D	294
						Urine retention	Lf	Fr	1	Or	None		
167	*Urtica simensis* Steudel	Urticaceae	gurgubee	H	W	Gastritis	Ss	Fr	7	Or		J,C,D	127
						Epistaxis	Ss	Fr	11	Na	None		
						Abdominal pain	Rh	Fr	7	Or			
168	*Verbascum sinaiticum* Benth.	Scrophulariaceae	-	H	W	Tuberculosis	Ss	dr	1	Or	Honey	J,C,D	368
						Hemorrhoids	Lf	Fr	12	An	None		
						Conjunctivitis	In	dr	9	Op	None		
						Perichondritis	Lf	Fr	12	Dm	None		
169	*Vernonia amygdalina* Del.	Asteraceae	eebicha	Sh	W	Giardiasis	Lf	Fr	2	Or	Salt	J,C,D	287
						Retained placenta	Lf	Fr	1	Or	Honey		
						Erythroblasts	Lf	Fr	10	Or	Salt		
170	*Vicia faba* L.	Fabaceae	baqilaa	H	C	Snake poison	In	Fr	8	Or	None	J,C	303
171	*Zehneria scabra* (Linn.f.) Sond.	Cucurbitaceae	hida adii	Cl	W	Diarrhea	Lf	Fr	1	Or	None	J,C,D	
						Weight loss	Lf	Fr/dr	1	Or	None		
						Perichondritis	Lf	Fr	12	Dm	None		
172	*Zingiber officinale* Roscoe	Zingiberaceae	zinjibila	H	C	Gastritis	Rh	dr/Fr	8	Or	Salt	J,C,D	397
						Coughing	Rh	dr/Fr	1	Or	Garlic		
						Common cold	Rh	dr/Fr	1	Or	Garlic		
						Malaria	Rh	dr/Fr	10	Or	Garlic		
						Diabetis mellitus	Rh	dr/Fr	5	Or	Sugar		
						Abdominal pain	Rh	dr/Fr	8	Or	Garlic		

Appendix 7. Fidelity level of medicinal plants used to treat human ailments in the study area

NO	Medicinal plant	Jibat District			Chelia District			Dendi District		
		Ip	Iu	FL (%)	Ip	Iu	FL (%)	Ip	Iu	FL (%)
1	*Acacia abyssinica* Hochst. ex Benth.	14	15	93.33	12	14	85.71	11	12	91.66
2	*Acanthus sennii* Chiov.	13	14	92.85	12	13	92.30	15	19	78.94
3	*Achyranthes aspera* L.	18	19	94.73	12	15	80.00	13	17	76.47
4	*Acmella caulirhiza* Del.	15	16	93.75	13	14	92.85	12	14	85.71
5	*Acokanthera schimperi* (A.DC.) Schweinf.	0	0	0.00	0	0	0.00	19	20	95.00
6	*Agave sisalana* Perro ex Eng.	0	0	0.00	0	0	0.00	12	16	75.00
7	*Ajuga integrifolia* Buch.-Ham. ex D. Don	13	16	81.25	13	14	92.85	11	13	84.61
8	*Albizia schimperiana* Oliv.	10	13	76.92	7	9	77.77	8	11	72.72
9	*Alectra sessiliflora* (Vahl) Kuntze	14	16	87.5	15	17	88.23	11	15	73.33
10	*Allium cepa* L.	6	8	75.00	0	0	0.00	0	0	0.00
11	*Allium sativum* L.	19	21	90.47	18	19	94.73	23	25	92.00
12	*Allophylus abyssinicus* (Hochst.)Radlk.	11	13	84.61	8	9	88.88	9	11	81.81
13	*Amaranthus caudatus* L.	5	7	71.42	7	9	77.77	0	0	0.00
14	*Apodytes dimidiata* E. Mey ex Arn.	6	8	75.00	0	0	0.00	12	15	80.00
15	*Arceuthobium juniperi-procerae* Chiov.	0	0	0.00	0	0	0.00	18	19	94.73
16	*Arisaema enneaphyllum* Hochst. ex Rich.	4	7	57.14	6	9	66.66	0	0	0.00
17	*Artemisia abyssinica* Sch. Bip. ex A. Rich.	6	10	60.00	5	9	55.55	6	8	75.00
18	*Arundinaria alpina* K.Scum.	5	8	62.50	0	0	0.00	0	0	0.00
19	*Asparagus africanus* Lam.	16	18	88.88	14	16	87.5	15	19	78.94
20	*Asparagus racemosus* Willd.	13	17	76.64	13	17	76.47	15	17	88.23
21	*Bersama abyssinica* Fresen.	9	11	81.81	6	9	66.66	4	9	44.44
22	*Bidens ghedoensis* Mesfin	7	11	63.63	5	7	71.42	0	0	0.00
23	*Bothriocline schimperi* Oliv.& Hiern ex Benth.	16	19	84.42	17	20	85.00	22	23	95.65

24	*Brassica carinata* A. Br.	9	13	69.23	10	14	71.42	9	13	69.23
25	*Brassica nigra* (L.) Koch	14	15	93.33	8	9	88.88	0	0	0.00
26	*Brucea antidysernterica* J.F.Mill.	18	19	94.73	16	18	88.88	14	16	87.50
27	*Buddleja polystachya* Fresen.	10	11	90.90	7	9	77.77	6	9	66.66
28	*Calpurnia aurea* (Ait.)Benth.	15	18	83.33	15	16	93.75	16	19	84.21
29	*Canarina abyssinica* Engl.	5	7	71.42	6	8	75.00	5	9	55.55
30	*Capsicum annuum* L.	5	8	62.50	6	9	66.66	4	7	57.14
31	*Carduus leptacanthus* Fresen.	15	18	83.33	14	19	73.68	17	21	80.95
32	*Carduus schimperi* Sch. Bip.	13	15	86.66	14	18	77.77	14	19	73.68
33	*Carica papaya* L.	6	8	75.00	9	12	75.00	8	13	61.53
34	*Carissa spinarum* L.	21	23	91.30	19	21	90.47	18	20	90.00
35	*Cassipourea malosana* (Baker) Alston	7	11	63.63	6	9	66.66	11	17	64.70
36	*Catha edulis* (Vahl) Forssk. ex Endl.	5	9	55.55	4	7	57.14	6	11	54.54
37	*Caylusea abyssinica* (Fresen.) Fisch. & Mey.	8	13	61.53	6	11	54.54	7	15	46.66
38	*Celtis africana* Burm. f.	11	16	68.75	10	15	66.66	9	13	69.13
39	*Chenopodium schraderianum* Schult	8	13	61.53	7	11	63.63	6	10	60.00
40	*Chionanthus mildbraedii* (Gilg & Schellenb.) Stearn	10	14	71.42	6	9	66.66	0	0	0.00
41	*Cirsium vulgare* (Savi) Ten.	12	15	80.00	0	0	0.00	11	12	91.66
42	*Clausena anisata* (Willd.)Benth.	9	11	81.81	12	15	80.00	10	14	71.42
43	*Clematis longicauda* Steud. ex A. Rich.	12	14	85.71	13	18	72.22	10	16	62.5
44	*Clematis simensis* Fresen	16	19	84.21	10	14	71.42	9	12	75.00
45	*Clerodendrum myricoides* (Hochst.) Vatke	18	20	90.00	21	24	87.50	21	22	95.45
46	*Clutia abyssinica* Jaub. & Spach.	11	13	84.61	9	14	64.28	6	8	75.00
47	*Coffea arabica* L.	14	17	82.35	7	11	63.63	12	15	80.00
48	*Conyza nana* Sch. Bip. ex Oliv. & Hiern	0	0	0.00	0	0	0.00	11	15	73.33
49	Cordia africana Lam.	8	9	88.88	10	14	71.42	6	9	66.66
50	*Crassula alba* Forssk	14	17	82.35	13	15	86.66	11	16	68.75
51	*Crotalaria rosenii* (Pox) Milne-Redh. ex Polhill	8	14	57.14	0	0	0.00	7	12	58.33

52	*Croton macrostachyus* Del.	16	18	88.88	14	15	93.33	16	17	94.11
53	*Cucumis ficifolius* A.Rich.	12	15	80.00	9	11	81.81	10	14	71.42
54	*Cucurbita pepo* L.	9	11	81.81	8	10	80.00	7	9	77.77
55	*Cyathula uncinulata* (Schrad.) Schinz	14	19	73.68	13	15	86.66	13	16	81.25
56	*Cymbopogon citratus* (DC ex Nees) Stapf	0	0	0.00	7	9	77.77	6	8	75.00
57	*Cynoglossum lanceolatum* Forssk.	13	16	81.25	12	14	85.71	10	15	66.66
58	*Cyphostemma cyphopetalum* (Fresen.) Des. ex Wild &Drum.	17	18	94.44	14	16	87.50	0	0	0.00
59	*Datura stramonium* L.	13	14	92.85	11	13	84.61	8	9	88.88
60	*Delphinium dasycaulon* Fresen.	15	16	93.75	13	15	86.66	17	19	89.47
61	*Discopodium penninervium* Hochst.	13	15	86.66	12	14	85.71	16	18	88.88
62	*Dodonaea angustifolia* L. f.	14	16	87.50	13	15	86.66	9	11	81.81
63	*Dombeya torrida* (J. F. Gmel.) P. Bamps	7	8	87.50	10	13	76.92	11	16	68.75
64	*Dovyalis abyssinica* (A. Rich.) Warb.	8	11	72.72	6	9	66.66	7	13	53.84
65	*Dracaena afromontana* Mildbr.	5	7	71.42	8	10	80.00	9	11	81.81
66	*Dregea schimperi* (Decne.) Bullock	15	17	88.23	18	21	85.71	15	19	78.94
67	*Echinops ellenbeckii* 0.Hoffm.	0	0	0.00	14	17	82.35	15	18	83.33
68	*Echinops kebericho* Mesfin	21	24	87.50	20	22	90.90	22	26	84.26
69	*Ehertia cymosa* Thonn.	17	18	94.44	14	16	87.50	15	19	78.94
70	*Ekebergia capensis* Sparrm.	6	8	75.00	7	11	63.63	4	7	57.14
71	*Embelia schimperi* Vatke	16	18	88.88	15	17	88.23	14	16	87.50
72	*Englerina woodfordioides* (Schweing.) M.Gilbert	13	14	92.85	15	16	93.75	12	14	85.71
73	*Enset vertiricosum*(Welw.) E.E. Chees.	9	12	75.00	10	14	71.42	8	13	61.53
74	*Erica arborea* L.	7	9	77.77	0	0	0.00	6	8	75.00
75	*Erythrina brucei* Schw.	11	13	84.61	10	14	71.42	12	15	80.00
76	*Eucalyptus camaldulensis* Dhnh.	8	11	72.72	10	13	76.92	9	13	69.23
77	*Eucalyptus globulus* Labill.	12	15	80.00	13	14	92.84	15	18	83.33
78	*Euphorbia ampliphylla* Pax	16	19	84.21	17	19	89.47	14	17	82.35
79	*Euphorbia schimperiana* Sch.	15	16	93.75	16	18	88.88	15	19	78.94

80	*Ficus sur* Forssk.	16	19	84.21	15	21	71.42	16	17	94.11
81	*Ficus sycomorus* L.	17	20	85.00	16	20	80.00	14	18	77.77
82	*Ficus vasta* Forssk.	14	19	73.68	15	19	78.94	13	17	76.47
83	*Foeniculum vulgare* Miller	13	17	76.47	18	22	81.81	11	15	73.33
84	*Galineria saxifraga* (Hochst.) Bridson	9	10	90.00	5	8	62.50	6	9	66.66
85	*Girardinia bullosa* (Steudel) Wedd.	12	14	85.71	8	11	72.72	12	15	80.00
86	*Gnidia glauca* (Fresen.) Gilg	8	11	72.72	6	8	75.00	7	9	77.77
87	*Grewia ferruginea* Hochst. ex A. Rich.	9	13	69.23	0	0	0.00	0	0	0.00
88	*Guizotia abyssinica* (L. f) Cass.	9	11	81.81	7	9	77.77	8	10	80.00
89	*Guizotia scabra* (Vis.) Chiov.	4	6	66.66	7	10	70.00	8	11	72.72
90	*Hagenia abyssinica* (Bruce) I.F. Gmel.	20	21	95.23	19	22	86.36	18	19	94.73
91	*Helinus mystacinus* (Ait.) E. Mey. ex Steud.	18	20	90.00	19	21	90.47	18	22	81.81
92	*Hypericum revolutum* Vahl	12	14	85.71	0	0	0.00	15	19	78.94
93	*Ilex mitis* (L.) Radlk.	16	18	88.88	14	16	87.50	17	18	94.44
94	*Indigofera arrecta* Hochst. ex A. Rich	11	13	84.61	8	10	80.00	12	14	85.71
95	*Ipomoea cairica* (L.) Sweet	8	10	80.00	7	9	77.77	0	0	0.00
96	*Jasminium abyssinicum* Hochst ex Dc.	18	19	94.73	20	21	95.23	22	24	91.66
97	*Juniperus procera* Endl.	17	20	85.00	18	21	85.71	15	17	88.23
98	*Justicia schimperiana* (Hochst. ex Nees) T. Anders.	16	19	78.19	14	18	77.77	13	15	86.66
99	*Kalanchoe petitiana* A. Rich.	17	19	89.47	18	20	90.00	14	17	82.35
100	*Lactuca inermis* Forssk.	12	13	92.30	0	0	0.00	11	14	78.14
101	*Lagenaria siceraria* (Molina) Standi.	6	7	85.71	7	11	63.63	5	7	71.42
102	*Lepidium sativum* L.	12	14	85.71	13	14	92.85	15	17	88.23
103	*Leucas deflexa* Hook. f	7	9	77.77	11	13	84.61	11	15	73.33
104	*Linum usitatissimum* L.	12	15	80.00	11	14	78.14	14	18	77.77
105	*Lippia adoenesis* Hochst. ex Walp.	18	21	85.71	19	22	86.36	19	21	90.47
106	*Maesa lanceolata* Forssk.	18	22	81.81	20	23	86.95	21	23	91.30
107	*Maytenus addat* (Loes.) Sebsebe	12	15	80.00	13	16	81.25	0	0	0.00

108	*Maytenus arbutifolia* (A. Rich.) Wilczek	9	11	81.81	12	15	80.00	11	14	78.57
109	*Mentha aquatica* L.	13	15	86.66	13	17	76.47	0	0	0.00
110	*Millettia ferruginea* (Hochst.) Bak.	16	19	78.19	11	14	78.57	9	12	75.00
111	*Momordica foetida* Schumach	7	9	77.77	5	7	71.42	6	11	54.54
112	*Musa x paradisiaca* L .	8	13	61.53	6	11	54.54	7	15	46.66
113	*Myrica salicifolia* A. Rich.	11	15	73.33	12	15	80.00	10	13	76.92
114	*Myrsine africana* L.	8	13	61.53	7	11	63.63	7	10	70.00
115	*Myrsine melanophloeos* (L.)R.Br.	10	14	71.42	7	9	77.77	0	0	0.00
116	*Nicandra physaloides* (L.) Gaertn.	12	15	80.00	13	16	81.25	11	12	91.66
117	*Nicotiana tabacum* L.	9	12	75.00	12	15	80.00	10	14	71.42
118	*Nigella sativa* L.	12	14	85.71	13	18	72.22	11	16	68.75
119	*Nuxia congesta* R.Br. ex Fressen.	16	19	84.21	11	14	78.14	10	12	83.33
120	*Ocimum lamiifolium* L.	18	21	85.71	21	24	87.50	21	22	95.45
121	*Ocimum urticifolium* Roth	11	13	84.61	9	14	64.28	7	9	77.77
122	*Olea europaea* L. subsp. *cuspidata* (Wall. ex G.Don) c.f.	13	16	81.25	12	14	85.71	10	15	66.66
123	*Olinia rochetiana* A.Juss.	17	18	94.44	14	16	87.50	12	14	85.71
124	*Osyris quadripartita* Decn.	13	15	86.66	11	13	84.61	8	9	88.88
125	*Otostegia integrifolia* Benth.	15	16	93.75	13	15	86.66	17	19	89.47
126	*Pavonia urens* Cav.	13	15	86.66	12	14	85.71	16	18	88.88
127	*Peponium vogelii* (Hook. f.) Engl.	14	16	87.5	13	15	86.66	9	11	81.81
128	*Periploca linearifolia* Quart.-Dill. & A. Rich.	7	9	77.77	10	13	76.92	11	16	68.75
129	*Phoenix reclinata* Jacq.	8	11	72.72	6	9	66.66	7	13	53.84
130	*Phragmenthera macrosolen* (A. Rich.) M. Gilbert	5	7	71.42	8	11	72.72	9	11	81.81
131	*Phytolacca dodecandra* L'Herit.	15	17	88.23	18	21	85.71	16	19	84.21
132	*Pittosporum viridiflorum* Sims	18	21	85.71	14	17	82.35	15	18	83.33
133	*Plantago lanceolata* L.	21	24	87.5	19	22	86.36	20	23	86.95
134	*Plectranthus edulis* (Vatke) Agnew	14	15	93.33	12	14	85.71	11	12	91.66
135	*Plectranthus garckeanus* (Vatke) J.K. Morton	0	0	0.00	12	13	92.30	15	19	78.94

136	*Premna schimperi* Engl.	0	0	0.00	12	15	80.00	13	17	76.47
137	*Prunus africana* (Hook.f.)Kalkm.	0	0	0.00	13	14	92.85	12	14	85.71
138	*Pterolobium stellatum* (Forssk.) Brenan	14	16	87.5	13	15	86.66	11	13	84.61
139	*Rhamnus prinoides* L'herit.	7	8	87.5	9	11	81.81	12	16	75.00
140	*Rhoicissus tridentata* (L. f.) Wild& Drummond	0	0	0.00	0	0	0.00	11	13	84.61
141	*Rhus vulgaris* Meikle	10	13	76.92	7	9	77.77	8	11	72.72
142	*Ricinus communis* L.	14	16	87.5	15	17	88.23	11	15	73.33
143	*Rosa abyssinica* Lindley	6	8	75.00	9	11	81.81	11	13	84.61
144	*Rosmarinus officinalis* L.	19	21	90.47	0	0	0.00	23	25	92.00
145	*Rubia cordifolia* L.	11	13	84.61	8	9	88.88	9	11	81.81
146	*Rubus steudneri* Schw.	5	7	71.42	7	9	77.77	0	0	0.00
147	*Rumex abyssinicus* Jacq.	6	8	75.00	9	12	75.00	12	15	80.00
148	*Rumex nervosus* Vahl	5	7	71.42	8	10	80.00	18	19	94.73
149	*Ruta chalepensis* L.	4	7	57.14	6	9	66.66	8	11	72.72
150	*Rytigynia neglecta* (Hiern) Robyns	6	7	85.71	7	11	63.63	5	7	71.42
151	*Salix mucronatha* Willd.	12	13	92.3	13	14	92.85	15	17	88.23
152	*Salvia nilotica* Jacq.	7	9	77.77	11	14	78.54	11	15	73.33
153	*Satureja paradoxa* (Vatke) Engl. ex Seybold	12	15	80.00	11	13	84.61	14	18	77.77
154	*Schefflera abysinica* (Hochst. ex A. Rich.) Harms	18	20	90.00	19	22	86.36	18	21	85.71
155	*Senna didymobotrya* (Fresen) Irw. &Barn.	18	22	85.71	20	23	86.95	21	23	92.3
156	*Sida schimperiana* Hochst. ex A. Rich.	12	15	80.00	13	16	81.25	15	17	88.237
157	*Solanecio gigas* (Vatke) C. Jeffrey	7	10	70.00	6	9	66.66	11	17	64.70
158	*Solanum anguivi* Lam.	6	9	66.66	5	7	71.42	0	0	0.00
159	*Solanum nigrum* L.	8	13	61.53	6	11	54.54	9	15	60.00
160	*Stephania abyssinica* (Dillon & A. Rich.) Walp.	11	16	68.75	11	15	73.33	9	13	69.23
161	*Stereospermum kunthianum* Cham.	0	0	0.00	7	11	63.63	0	0	0.00
162	*Syzygium guineense* (Willd.) DC. Subsp *afromontanum*	10	14	71.42	6	9	66.66	8	14	57.14
163	*Teclea nobilis* Del.	12	15	80.00	14	16	93.33	11	12	91.66

164	*Thymus schimperi* Ronniger	9	11	81.81	13	15	86.66	10	14	71.42
165	*Triticum dicoccon* Schrank	12	14	85.71	13	18	72.22	12	16	75.00
166	*Urera hypselodendron* (A.Rich.)Wedd.	16	19	84.21	11	14	78.57	10	12	83.33
167	*Urtica simensis* Steudel	18	21	85.71	22	24	91.66	20	22	90.9
168	*Verbascum sinaiticum* Benth.	12	15	80.00	13	16	81.25	11	12	91.66
169	*Vernonia amygdalina* Del.	10	12	83.33	13	15	86.66	10	14	71.42
170	*Vicia faba* L.	11	14	78.57	13	18	72.22	0	0	0.00
171	*Zehneria scabra* (Linn.f.) Sond.	18	19	94.73	12	13	92.30	21	22	95.45
172	*Zingiber officinale* Roscoe	18	19	94.73	23	24	95.83	22	23	95.65

Appendix 8. List of medicinal plants used to treat livestock ailments: scientific name; family; local name; habit; ailment treated; plant parts used; condition of plant part uses; methods of preparation and application; route of administration ; additives; animals treated; degree of management; fidelity level; District and voucher number

Key: Ha=Habit (T=tree, Sh= shrub, H=herb, Li=liana); PPU=Plant part used (Rt=root, Lf=leaf, BK=bark, Sd=seed, ZZ=fruit, RBK=root bark, Fsh =flesh of fruit, Ss=shoot, Bu=bulb, Tu= tuber, In=inflorescence, St=stem, Sp=sap, Wp=whole plant, Lx=latex, Rh=rhizome); CPU= condition of plant part used (dr=dry, Fr=fresh, dr/Fr=dry or fresh); MRPA= Mode of herbal remedy preparation: 1= Boil and drink the decoction up on cooling, 2=Crush and steep plant part in cold water and drink the infusion, 3=Paint/rub/paste the latex/sap/flesh/juice directly, 4=Eat the plant part (raw/cooked), 5=Crush, heat/burn or boil the part and inhale its smoke or steam, 6=Drink the concoction, 7=Grind and paint the powder or crushed part, 8=Grind, paste the crushed part and tie; RA=route of remedy administration (Or=oral, Na=nasal, Dm=dermal, Op=optical); Dis=District (J=Jibat, C=Chelia, D=Dendi); AT=Animals treated: 1= Cattle, 2=Sheep, 3=Goats, 4=Animals, 5= Cows, 6=poultry, 7= Horses, 8=Mules, 9=Donkeys, 10=Oxen; DM=Degree of management: W=wild, C=cultivated; V.No.= voucher number.

No.	Scientific name	Family	Local Afaan Oromo name	Ha	Ailment treated (Local name)	PPU	CPU	MRPA	RA	MW	AT	DM	FL (%)	Dis	V. No.
1	*Acalypha psilostachya* Hochst.	Euphorbiaceae	alablabee	H	Tonsillitis (Hudhaa)	Lf	Fr	2	Or		1	W	95	J	7
2	*Acanthus sennii* Chiov.*	Acanthaceae	kosoru	Sh	Chronic wound (Madaa)	Lf	dr	5	D m	23	1,2, 3	W	93	J,C, D	145
3	*Achyranthes aspera* L.*	Amaranthaceae	darguu	H	Babesiosis (Dhiga Fincessa)	Rt	Fr	2	Or	30	1	W	89	J,C, D	214
4	*Acokanthera schimperi* (A. DC.) Schweinf.*	Apocynaceae	qararuu	Sh	Tripanosomiasis (Gandii)	Rt	Fr	1	Or		1	W	96	D	17
5	*Agave sisalana* Perro ex Eng.*	Agavaceae	qaca	Sh	Mechanical trump (Madaa gatiitti)	Lf	Fr	3	D m		10	W	64	D	110
6	*Ajuga integrifolia* Buch.-Ham. ex D. Don*	Lamiaceae	armagusa	H	Synerosis celebralis (Maranmarto)	Wp	Fr	2	Or	8	1,2	W	73	J,C, D	154
7	*Albizia schimperiana* Oliv.*	Fabaceae	muka-arba	T	Retained placenta (Dil'uu bahu didu)	Rt	Fr	2	Or		2,3, 5	W	88	J,C, D	35
8	*Allium sativum* L.*	Alliaceae	qulubii adii	H	Anthrax (Abba sangaa)	Tu	Fr/ dr	4	Or		1	C	86	J,C, D	411
9	*Allophylus abyssinicus* (Hochst.) Radlk.*	Sapindaceae	sarara	T	Retained placenta (Dil'uu bahu didu)	Lf, SB K	Fr	2	Or		2,3, 5	W	79	J,C, D	395
10	*Apodytes dimidiata* E. Mey ex Arn.*	Icacinaceae	calalaaqa	T	Actinomycosis (Kurufsisaa)	Lf	Fr	1	Or		6	W	90	J,C, D	24
11	*Arisaema enneaphyllum*	Araceae	carana	H	Retained faeces (Dhoqqee goge)	Rt	Fr	1	Or		1	W	81	J,C	56

	Hochst. ex Rich.*														
12	*Asparagus africanus* Lam.*	Asparagaceae	saritii	H	Rabies (Dhukkuba saree)	Rt	Fr	2	Or		1	W	94	J,C, D	355
13	*Bartsia trixago* L.	Scrophulaceae	-	H	Lumpy skin (Dhukkuba gogaa)	Wp	Fr	6	Or		1	W	69	J,C, D	106
14	*Bersama abyssinica* Fresen.*	Melianthaceae	ararsaa	T	Mastitis (Dhibe Mucha)	Lf	Fr	2	Or	8	5	W	92	J,C, D	258
					Hyena bite (Cininna warabessa)	BK	Fr	1	Or		1				
15	*Bothriocline schimperi* Oliv.& Hiern ex Benth.*	Asteraceae	ulee hare	Sh	Horse disease (Dhibee fardaa)	Rt, Lf	Fr	2	Or		7,8	W	88	J,C, D	321
16	*Brassica carinata* A. Br.*	Brassicaceae	gomanzara	H	Bloat & Febrifuge (Bokoksaa horii)	Sd	dr	6	Or	8	1	C	82	J,C, D	123
17	*Brucea antidysernterica* J.F.Mill.*	Simaroubaceae	qomonyoo	Sh	Ulcertic lymphagities (Biichee harree)	ZZ	Fr	5	D m		9	W	77	J,C, D	25
18	*Calpurnia aurea* (Ait.)Benth.*	Fabaceae	ceekaa	Sh	Rabies (Dhukkuba saree)	Rt	Fr	1	Or	53	1	W	95	J,C, D	69
					Ectoprasits (maxanttuu ala)	Lf	Fr	2	D m		1				
19	*Capsicum annuum* L.*	Solanaceae	barbaree	H	Bloat & Febrifuge (Bokoksaa horii)	ZZ	dr	6	Or		1	C	65	J,C, D	49
20	*Celtis africana* Burm. f.*	Ulmaceae	caa'ii	T	FMD (Foot and Mouth Disease) (Madarra hoolaa)	Fr	Fr	5	D m		2	W	74	J,C, D	291
21	*Clausena anisata* (Willd.)Benth.*	Rutaceae	ulumayii	Sh	Eye problem (Dhukkuba ijaa)	Lf	Fr	1	Op		1	W	68	J,C, D	361
22	*Clematis longicauda* Steud. ex A. Rich.*	Ranunculaceae	hida adi	Cl	Fever (Dhagna guba)	In	Fr	4	Or		1	W	72	J,C, D	193
23	*Clematis simensis*	Ranunculaceae	hida feetii	Li	Wound	Lf	Fr	3	D	2	1	W	93	J,C,	9

	Fresen.*				(Madaa)				m					D	
					Bloat & Febrifuge (Bokoksaa horii)	Sp	Fr	6	Or		1				
24	*Clerodendrum myricoides* (Hochst.) Vatke*	Lamiaceae	ulee haree	Sh	Cough (Qufaa/ Soffaa)	Rt	Fr	1	Or		1	W	96	J,C, D	44
					Snakebite (Iddaa bofaa)	BK	Fr	2	Or		4				
25	*Conium maculatum* L.	Apiaceae	dinbilalalag a	H	Snake bite (Iddaa bofaa)	Rt	Fr	5	Na		1	W	92	J,C, D	185
26	*Crepis rueppellii* Sch. Bip.	Asteraceae		H	Diarrhea (Albaasa)	Rt	Fr	1	Or		4	W	94	J,C, D	197
27	*Croton macrostachyus* Del.*	Euphorbiaceae	bakanisa	T	Wound (Madaa)	Lf	Fr	3	D m		1,2, 3	W	93	J,C, D	201
28	*Cucurbita pepo* L.*	Cucurbitaceae	dabaqula	H	Internal parasites (Maxanttuu kessaa)	Sd	dr	2	Or		1,2, 3	C	84	J,C, D	109
29	*Cynoglossum lanceolatum* Forssk.	Boraginaceae	maxannee	H	Breast ulcer (Dhiitoo harmaa)	Wp	Fr	6	Or		2,3, 5	W	59	J,C, D	231
30	*Cyphostemma dembianense* (Chiov.) Vollesen	Vitaceae	hidda boffa	H	Blackleg (Bushooftuu)	Rt	Fr /dr	1	Or	3	1	W	90	J,C, D	216
					Babesiosis (Dhiga Fincessa)	Rt	Fr	2	Or		1				
31	*Delphinium dasycaulon* Fresen. *	Ranunculaceae	-	H	Snake bite (Iddaa bofaa)	Rt	Fr	2	Or		1,2, 3	W	70	J,C, D	276
32	*Discopodium penninervium* Hochst.*	Solanaceae	cacuunga	T	Tongue infection (Arraba hiddaa)	Lf	Fr	2	Or		1	W	89	J,C, D	135
33	*Dodonaea*	Sapindaceae	xadachaa	Sh	Anthrax	Lf ,	Fr	6	Or	13	1	W	87	J,C,	239

	angustifolia L. f.*				(Abba sangaa)	BK								D	
34	*Dombeya torrida* (J. F. Gmel.)P. Bamps*	Sterculiaceae	daannisa	T	Anti-inflammatory (Riifensa kaasaa)	Lf	Fr	2	Or		1,2,3	W	77	J,C,D	4
35	*Dracaena afromontana* Mildbr.*	Dracenaceae	afarfatuu	T	Erythroblasts (Gatacha)	Lf	Fr	2	Or		1,2,3	W	88	J,C,D	228
36	*Echinops kebericho* Mesfin*	Asteraceae	qabaricho	Sh	Avian cholera (Fingillee)	Rt	dr	9	Or		6	W	75	J,C,D	347
37	*Ehretia cymosa* Thonn.*	Boraginaceae	ulagaa	Sh	Actinomycosis (Kurufsisaa)	Rt	dr	4	Or	27	6	W	69	J,C,D	224
38	*Ekebergia capensis* Sparrm.*	Meliaceae	somboo	T	Mastitis (Dhibe Mucha)	ZZ	Fr	6	Or		1,2,3	W	54	J,C,D	244
39	*Erythrina brucei* Schweinf.*	Fabaceae	walenssu	T	Anthrax (Abba sangaa)	SBK	Fr	6	Or		1	W	78	J,C,D	289
40	*Euphorbia ampliphylla* Pax*	Euphorbiaceae	adamii	T	Tongue infection (Arraba hiddaa)	Lx	Fr	2	Or		1	W	86	J,C,D	162
41	*Euphorbia schimperiana* Scheele*	Euphorbiaceae	aloyyee	H	Avian cholera (Fingillee)	Lf	dr	4	Or	8	6	W	59	J,C,D	240
42	*Ficus sur* Forssk.*	Moraceae	harbu	T	Babesiosis (Dhiga Fincessa)	Lx	Fr	3	Or		1	W	82	J,C,D	246
43	*Galiniera saxifraga* (Hochst.) Bridson*	Rubiaceae	adaamoo	T	Blackleg (Bushooftuu)	ZZ	Fr	5	Na		1	W	94	J,C,D	399
					Bloat & Febrifuge (Bokoksaa horii)	RBK	Fr	2	Or		1,2,3				
44	*Gnidia glauca* (Fresen.) Gilg*	Thymelaeaceae	qaqaroo / didigsa	T	Pasturolosis (Gororsaa)	SBK	Fr	8	Dm		1	W	76	J,C,D	342
45	Gouania longispicata Engl.	Rhamnaceae	looca	Li	Render pest (Mariyyee)	In	Fr	2	Or		1	W			
46	*Hagenia abyssinica* (Bruce) I.F. Gmel.*	Rosaceae	heexoo	T	Tape worm (Ramoo gara)	Rt,In	dr	1	Or		4	W	92	J,C,D	413
47	*Helichrysum*	Asteraceae		Sh	Breast ulcer	Lf	Fr	6	Or		1,2,	W	93	J,C,	272

	schimperi (Sch. Bip. exA. Rich.) Moeser*				(Dhiitoo harmaa)						3			D	
					Coccidiosis (Mugsiisaa lukkuu)	Lf	dr	7	Or		6				
					Cough (Qufaa/ Soffaa)	Rt	Fr	2	Or		1				
48	*Hygrophila schulli* (Hamilt.)MR. & S.M Almeida	Acanthaceae		H	Epizootic lymphagitis (Biichee faradaa)	Lf	dr	5	Na	2	7,8	W	54	J,C, D	281
49	*Hypericum quartinianum* A.Rich.	Guttiferae	endhee	Sh	Erythroblasts (Gatacha)	Lf	Fr	1	Or		2,3, 5	W	95	C	286
50	*Hypericum revolutum* Vahl*	Guttiferae	endhee	Sh	Erythroblasts (Gatacha)	Lf	Fr	1	Or	64	2,3, 5	W	94	J,D	249
					Ecto-parasites (Maxanttuu ala)	Lf	Fr	5	D m		1				
51	*Impatiens rothii* Hook. f.	Balsaminaceae	ansosila	H	Erythroblasts (Gatacha)	Wp	Fr	2	Or		1,2, 3	W	56	J,C, D	283
52	*Isodon schimperi* (Vatke) J.K. Morton	Lamiaceae		H	Eye problem (Dhukkuba ijaa)	Wp	Fr	3	D m		4	W	66	J,C, D	302
53	*Jasminium abyssinicum* Hochst ex Dc.*	Oleaceae	hida ilchibee	Cl	Wound (Madaa)	Rt	Fr	9	D m		4	W	91	J,C, D	391
54	*Justicia schimperiana* (Hochst. ex Nees) T. Anders.*	Achanthaceae	dhuumuga	Sh	Rabies (Dhukkuba saree)	Rt	Fr	1	Or	18	1,2, 3	C	90	J,C, D	184
55	*Kalanchoe petitiana* A. Rich.*	Crassulaceae	andawulaa	H	Newcastle disease (Koffisa lukkuu)	Lf	Fr	1	Or		6	W	89	J,C, D	163
56	*Kniphofia*	Asphodelaceae		H	Joint dislocation	Rt	Fr	1	Or		4	W	71	J,C,	323

	hildebrandtii Cufod.				(Cabbuu)									D	
57	*Landolphia buchananii* (Hall.f.) Stapf	Apocynaceae	hida gebo	Li	Joint dislocation (Cabbuu)	Zz	Fr	1	Or		4	W	65	J,D	336
58	*Linum usitatissimum* L.*	Liniaceae	talbaa	H	Leeches (Dhulaandhula)	Sd	dr	2	Or		1	C	69	J,C, D	242
59	*Lobelia giberroa* Hemsl.	Lobeliaceae	malakata	T	Lumpy skin (Dhukkuba gogaa)	Lf , In	Fr	2	Or		1	W	72	J,D	344
60	*Maesa lanceolata* Forssk.*	Myrsinaceae	abaayyii	Sh	Intestinal parasites (Maxanttuu kessa)	Sd	Fr /dr	1	Or		1,2, 3	W	94	J,C, D	167
					Mastitis (Dhibe Mucha)	Lf	Fr	1	Or		1,2, 3				
61	*Maytenus addat* (Loes.) Sebsebe *	Celasteraceae	kombolch a	T	Mechanical trump (Madaa gatiitti)	Lf	Fr	3	D m	27	10	W	73	J,C, D	232
62	*Millettia ferruginea* (Hochst.) Bak.*	Fabaceae	sotaloo	T	Newcastle disease (Koffisa lukkuu)	Lf	dr	1	Or		6	W	82	J,C, D	358
63	*Momordica foetida* Schumach*	Cucurbitaceae	xirroo	H	Pasturolosis (Gororsaa)	ZZ, Lf	Fr	2	Or		1	W	64	J,C, D	247
64	*Myrsine africana* L.*	Myrsinaceae	qacaama	Sh	Rabies (Dhukkuba saree)	Rt	Fr	1	Or		1,2, 3	W	89	J,C, D	349
65	*Myrsine melanophloeos* (L.)R.Br.*	Myrisinaceae	odobada	T	Blackleg (Bushooftuu)	Lf	Fr	2	Or		1	W	87	J,C, D	38
66	*Nicandra physaloides* (L.) Gaertn.*	Solanaceae	heleflefo	H	Retained faeces (Dhoqqee goge)	Wp	Fr	2	Or		1	W	77	J,C, D	91
67	*Nicotiana tabacum* L.*	Solanaceae	timboo	H	Pasturolosis (Gororsaa)	In ,ZZ	dr	1	Or		1	C	79	J,C, D	182
68	*Olea europaea* L. subsp. *cuspidata* (Wall. ex G.Don) c.f.*	Oleacea	ejersa	T	Retained placenta (Dil'uu bahu didu)	Lf	Fr	2	Or		2,3, 5	W	86	J,C, D	364

69	*Olinia rochetiana* A.Juss.*	Oliniaceae	solee	T	Leeches (Dhulaandhula)	ZZ	Fr/ dr	1	Or		1	W	83	J,C, D	267
70	Orobanche minor Smit	Orobanchaceae		H	Scabies (Cittoo)	Wp	Fr	3	D m	8	1		64	J,C, D	383
					Snake bite (Iddaa bofaa)	Wp	Fr	1	Or		1				
71	*Osyris quadripartita* Decn.*	Santalaceae	watoo	T	Sudden sickness (Dingetegnaa)	Lf	Fr	2	Or		1,2, 3	W	84	J,C, D	168
					Synerosis celebralis (Maramartoo)	BK	Fr/ dr	1	Or		1,2, 3				
72	*Otostegia integrifolia* Benth.*	Lamiaceae	tunjutii	Sh	Tonsillitis (Hudhaa)	Ss	Fr	2	Or		1	W	90	J,C, D	295
					Tripanosomiasis (Gandii)	Rt	Fr	1	Or		1				
73	*Phoenix reclinata* Jacq.*	Arecaceae	meexii	T	Diarrhea (Albassaa)	Sd	Fr	1	Or		4	W	80	J,C, D	166
74	*Pittosporum viridiflorum* Sims*	Pittosporaceae	solee	T	Ulcertic lymphagities (Biichee harree)	Lf	Fr	3	D m		9	W	91	J,C, D	243
					Babesiosis (Dhiga Fincessa)	BK	Fr/ dr	6	Or		1				
75	*Plantago lanceolata* L.*	Plantaginaceae	qorxobbo	H	Wound (Madaa)	Wp	Fr	8	D m	27	4	W	89	J,C, D	194
76	*Polyscias fulva* (Hirn.) Harms	Araliaceae	anxaloo	T	Anthrax (Abba sangaa)	Lf	Fr	2	Or		1	W	94	J	400
77	*Premna schimperi* Engl.	Lamiaceae		Sh	Actinomycosis (Kurufsisaa)	Lf	dr	4	Or		6	W	82	C,D	385
78	*Prunus africana* (Hook.f.)Kalkm.*	Rosaceae	hoomii	T	Epizootic lymphagitis (Biichee faradaa)	BK	dr	7	D m	74	7	W	97	J,C, D	268
79	*Rhamnus staddo*	Rhamnaceae	qadiidaa	T	Tonsillitis	Ss	Fr	2	Or		1	W	74	J,C,	407

	A.Rich.				(Hudha)									D	
80	*Rhus vulgaris* Meikle*	Anacardiaceae	dabobessaa	T	Anti-inflammatory (Riifensa kaasaa)	Lf	Fr	2	Or		4	W	62	J,C, D	238
81	*Ricinus communis* L.*	Euphorbiaceae	qobboo	H	Tongue infection (Arraba hiddaa)	Rt	Fr	2	Or		1	C/ W	54	J,C, D	108
82	*Rubia cordifolia* L.*	Rubiaceae	maxxannee	H	Avian cholera (Fingillee)	Lf	dr	1	Or		6	W	75	J,C, D	119
83	*Rytigynia neglecta* (Hiern) Robyns*	Rubiaceae	mixoo	Sh	Babesiosis (Dhiga Fincessa)	ZZ	Fr	1	Or		1	W	92	J,C, D	103
84	*Salix mucronatha* Willd.*	Salicaceae	alaltuu	T	Blackleg (Bushooftuu)	Lf	Fr	1	Or		1	W	57	J,C, D	211
85	*Salvia nilotica* Jacq.*	Lamiaceae		H	Blotting (Bokoksaa horii)	Lf	Fr	2	Or	8	1,2, 3	W	69	J,C, D	311
86	*Schefflera abysinica* (Hochst. ex A. Rich.) Harms*	Araliaceae	luqee, gatama	T	Breast ulcer (Dhiitoo harmaa)	Lf	Fr	2	Or		2,3, 5	W	93	J,C, D	300
					Cough (Qufaa/ Soffaa)	RB K	dr	6	Or		1				
					Anti dote for hyena bite(Cininaa Warabesa)	SB K	Fr	2	Or		4				
87	*Sida schimperiana* Hochst. ex A. Rich.*	Malvaceae	borkottee	Sh	Chronic wound (Madaa)	Lf	dr	7	D m		4	W	96	J,C, D	200
88	*Solanum anguivi* Lam.*	Solanaceae	hidi	H	Eye problem (Dhukkuba ijaa)	ZZ	Fr	3	D m		4	W	84	J,C	332
89	*Stephania abyssinica* (Dillon & A. Rich.) Walp.*	Menispermaceae	gura antuta	H	Synerosis celebralis (Maramartoo)	Wp	Fr	2	Or	8	1,2, 3	W	88	J,C, D	315
90	*Tacazzea conferta* N.f. Br.	Asclepiadaceae	-	Li	Problem of lactation (Hanqina	Rt	Fr	1	Or		1	W	92	J	399

					Anani)										
91	*Thalictrum rhynchocarpum* Dill. & A. Rich	Rananunculaceae	sireebizuu	H	Diarrhea (Albassaa)	Rt	Fr	2	Or		4	W	87	J,C	404
92	*Urera hypselodendron* (A.Rich.)Wedd.*	Urticaceae	dhoqonu	Cl	Coccidiosis (Mugsiisaa lukkuu)	Lf	Fr	6	Or		6	W	76	J,C, D	294
93	*Verbascum sinaiticum* Benth.*	Scrophulariaceae	-	H	Ecto-parasites (Maxanttuu ala)	Lf	Fr	3	D m	18	4	W	83	J,C, D	368
					Epizootic lymphagitis (Biichee faradaa)	Rt	Fr	2	Or		7,8				
94	*Vernonia amygdalina* Del.*	Asteraceae	eebicha	Sh	Bloating & febrifuge (Bokoksaa horii)	BK	Fr/ dr	6	Or		1	W	87	J,C, D	287
95	*Vernonia leopoldi* (Sch. Bip. ex Walp.) Vatke	Asteraceae		Sh	Erythroblasts (Gatacha)	Lf	Fr	2	Or		2,3, 5	W	58	J,C, D	406
96	*Zehneria scabra* (Linn. f.) Sond*	Cucurbitaceae	sokoke	H	FMD (Foot and Mouth Disease) (Madarra hoolaa)	Lf	Fr	1	Or	3	2	W	76	J,C, D	397
97	*Zingiber officinale* Roscoe*	Zingiberaceae	zinjibila	H	Horse disease (Dhibe Farda)	Rh	Fr/ dr	2	Or	77	7,8	C	77	J,C, D	266

*=ethnoveterinary medicinal plants used also as human medicinal plants.

Appendix 9. Habit, habitat, parts used, collection, preparation, mode of consumption and other local uses of WEPs of Jibat, Chelia and Dendi districts.

Key: Hb=Habit (T= tree, H=herb, Sh=shrub, Li=liana); Ha=Habitat (1= mountain slopes, 2= field margins & roadsides, 3= Forest margins and clearings, 4= forest openings and thicket, 5= forests, 6= margins of arable land and pastures, 7= woodland and disturbed bushland, 8= river banks, 9= wastelands); OLU=Other Local Uses (Fu =fuel/energy, Co=construction, Tm=traditional medicine, Tk=technology, Cr=ceremonial, Fo= fodder, Fm=fumigant, Sd=shade, Bf= honey bee forage, Lv=live fence); FPC=Frequency of Plant Citation; VN=voucher number, after TR; Bold=endemic species to the flora area.

No.	Plant name (scientific)	Family	Local name	Hb	Ha	Parts used	Collection, preparation and mode of consumption	LMk	FPC	OLU	Dis	VN TRx
1.	*Acacia abyssinica* Hochst. ex Benth.	Fabaceae	laftoo	T	5,7	Gum/exudates	Edible raw gums chewed by children for being tasty	Ca	13.5	Tk , Co,Tm Fu,Sd	1,2.3	167
2.	***Acacia negrii*** Pic.Semi.	Fabaceae	garbi	T	2,3,4,5 ,6,7	Gum/ exudates	Edible gums chewed by children for being tasty	Ca	21.2	Tk , Co,Tm Fu,Sd	3	63
3.	*Acanthus polystachius* Delile	Acanthaceae	kosoruu	Sh	2,9	Inflorescences	The nectars from flowers sucked by children	Ca	23.9	Fu , Tm	1,2	259
4.	***Acanthus sennii*** Chiov.	Acanthaceae	kosoruu	H	2,9,6	Inflorescences	The nectars from flowers sucked by children	Ca	9.4	Fu , Tm	1,2,3	145
5.	*Acokanthera schimperi* (A. DC.) Schweinf.	Apocynaceae	qararuu	Sh	5,3	Fruits	Ripe fruits eaten raw	Fd , Ca	18.7	Fu, Co, Tm , Bf	3	17
6.	*Amaranthus caudatus* L.	Amaranthaceae	eyasu	H	6,9	Seeds , young shoots	Seeds used as famine food (historical) and also used in making local beer (TELLA), young shoot is cooked used as vegetables	NM	5.6	Tm, Bf	1,2	258
7.	*Artemisia abyssinica* Sch. Bip. ex A. Rich.	Asteraceae	kodoo	H	2,6.9	Leaves	Leaves commonly boiled with milk to	Tm , Cr	19.3		1.2.3	357

							improve milk quality				
8.	*Arundinaria alpina* K.Scum.	Poaceae	shimala	H	5,2	young Shoots	Young shoots cooked and eaten as vegetables	Fr, Co	21.1	Fu ,Co, Cr, Tm, Tk,Fo	1	401
9.	*Bidens pachyloma* (Oliv. &Hiern.) Cuf.	Asteraceae	kello	H	2,9	Tender Shoots	Young shoots & leaves chopped, cooked & eaten as vegetables (Famine food)	NM	5.9	Tm , Fo	1,2	391
10.	*Bridelia micrantha* (Hochst.) Baill.	Euphorbieaceae	rigaa arba	T	3,5	Fruits	Ripe fruits eaten raw	NM	66.1		1,2,3	293
11.	*Canarina abyssinica* Engl.	Campanulaceae	xuxoo	H	5,7	Fruits	Ripe fruits eaten raw	NM	38.4	Tm , Bf	1,2,3	164
12.	*Carissa spinarum* L.	Apocynaceae	agamsa	Sh	4,7	Fruits	Ripe fleshy fruit eaten raw	Fd ,Tm	73.7	Tm , Co	1,2,3	82
13.	*Chionanthus mildbraedii* (Gilg & Schellenb.) Stearn	Oleaceae	Karra wayyuu	Sh	5	Fruits	Ripe fruit eaten raw	Fd , Ca	81.2	Fu, Co, Tm , Bf	1,2	173
14	*Commelina africana* L.	Commelinaceae	holagabis	H	6,9	Bulbs	Underground bulb eaten raw by children		21.5		1,2	18
15.	*Commelina benghalensis* L.	Commelinaceae	holagabis	H	2,6,9	Roots, tubers	Roots and tubers cooked as root vegetables during food shortage	1,2,3	8.1		1,2,3	246
16	*Cordia africana* Lam.	Boraginaceae	wodessa	T	5,7	Fruits	Ripe fleshy fruit eaten raw	Fd , Fr	24.2	Co, Tk, Fu, Bf	1,2,3	75
17.	*Cucumis ficifolius* A.Rich.	Cucurbitaceae	hiddi hooloo	Li	2,6	Roots	Root extracts used in local honey-wine TEJ/DADHI to make beverage more intoxicating	Tm	12.1		1,2,3	55
18.	*Cyanotis barbata* D.Don.	Commelinaceae	-	H	2,6	Bulbs	Underground bulbs eaten raw by children	NM	16.7		1,2,3	48
19.	*Cyathula unicinulata* (Schrad.) Schinz	Amaranthaceae	maxannee	H	2,6,9	Leaves	Shoots & leaves chopped , cooked & eaten as vegetable (famine food)	NM	29.6	Tm	1.2.3	202
20.	*Cyphostemma adenocaule* (Steud. ex	Vitaceae	hidda boffa	H	2,6,7,9	Leaves & tubers	Leaves & tubers eaten cooked during	Tm	43.2		1,3	88

	A. Rich.) Des. ex Wild & Drum.						famine					
21.	*Dovyalis abyssinica* (A. Rich.) Warb.	Flacourtiaceae	koshimii	T	1,2,3,7	Fruits	Ripe fleshy fruits eaten raw	Ca	58.1	Co , Tm	1,2,3	25
22.	*Dovyalis verrucosa* (Hochat.) Warb.	Flacourtiaceae	akuukuu	Sh	5	Fruits	Ripe fleshy fruits eaten raw	NM	43.9	Co , Tm	1	94
23.	*Ekebergia capensis* Sparrm.	Meliaceae	somboo	T	5	Fruits	Fleshy fruits eaten by children rarely	Fr, Ca	13.1	Fu, Co, Tm	1,2,3	244
24.	*Embelia schimperi* Vatke	Myrisinaceae	hanquu	Sh	2,6,7	Fruits	Fleshy ripe fruits eaten raw	Fd, Tm	65.3	Tm , Fu	1,2,3	50
25.	*Ensete ventricosum* (Welw.) Cheesman	Musaceae	qocoo	H	5	Fruits , stems	Fleshy fruits eaten raw, stem sucker processed, cooked and eaten	Fd, Fp	66.2	Tm	1,2,3	41
26.	*Festuca abyssinica* Hochst. ex A. Rich.	Poaceae	garbu dadde	H	2,9	Seed s	Fruits eaten as snack	NM	21.7	Fu, Co, Tk, Tm	1,2	72
27.	*Ficus ingens* (Miq.) Miq.	Moraceae	qilinxo	T	1,5,7	Fruits	Fruits eaten raw	Fr , Ca	63.6	Fu, Co, Tk, Tm	1,2	52
28.	*Ficus sur* Forssk.	Moraceae	arbu	T	5,7,8	Fruits	Ripe fruits eaten raw	Fd , Fr, Ca	71.1	Fu, Co, Tk, Tm	1,2,3	246
29.	*Ficus sycomorus* L.	Moraceae	odaa	T	5,7,8	Fruits	Ripe fruits eaten raw	Fd , Fr, Ca	67.2	Fu, Co, Tk, Tm	1,2,3	49
30.	*Ficus thinningii* Blume	Moraceae	damb i	T	5,7,8	Fruits	Ripe fruits eaten raw	Ca, Co	29.3	Fu, Co, Tk, Tm	1,2,3	26
31.	*Ficus vasta* Forssk.	Moraceae	qilxu	T	5,7,8	Fruits	Ripe fruits eaten raw	Fd , Fr, Ca	68.7	Fu, Co, Tk, Tm	1,2,3	82
32.	*Flacourtia indica* (Burm.f.) Merr.	Flacourtiaceae	hudhaa	Sh	5,3	Fruits	Ripe fruits eaten raw	Fd	41.1	Tk, Co,Fu, Tm	1,2	79
33.	*Girardinia bullosa* (Steudel) Wedd.	Urticaceae	dobii	H	2,3,9	Young shoots	Cooked & eaten as leafy vegetables	Tm	23.1		1,2,3	147
34.	*Grewia ferruginea* Hochst. ex A. Rich.	Tiliaceae	dhoqonu	Sh	5,7	Fruits	The ripe fruits eaten raw	Fd , Fr	22.7	Fu ,Co, Tm	1,2,3	220
35.	*Guizotia scabra* (Vis.) Chiov.	Asteraceae	hadaa, tuufoo	H	2,6,9	Young leaves, tender	Leave & tender shoots cooked & eaten as vegetable (	NM	7.5	Tm	1,2,3	111

						shoots	in earlier times)					
36.	*Ilex mitis* (L.) Radlk.	Aquifilaceae	mi'eesa	T	5,7	Twigs	The twig used as toothbrush/chewed to relieve thrust	Ts , Co, Fi, Ca	16.5	Fu ,Co, Tm	1,2,3	339
37.	*Justicia schimperiana* (Hochst. ex Nees) T. Anders.	Achanthaceae	dhuumuga	Sh	2	Infloresce nces	The nectars from flowers sucked by children	NM	26.7	Lv , Fu, Bf	1,2,3	184
38.	*Landolphia buchananii* (Hall.f.) Stapf	Apocynaceae	hida gebo	Li	5	Fruits	The ripe fruits eaten raw	Co	27.4		1,3	336
39.	*Lepidotrichilia volkensii* (Giirke) Leroy	Meliaceae		T	5	Fruits	The ripe fruits eaten raw	Fm , Tm	4.7	Fu, Tm, Fm	1	231
40.	*Lipia adoenesis* Hochst. ex Walp.	Verbenaceae	kussayee	Sh	2,6	Leaves	The leaves used as condiments in spice preparation	NM	58.9	Tm	1,2,3	108
41.	*Momordica foetida* Schumach	Cucurbitaceae	nyata allatii	H	3,7	Fruits	The pulpy covering of the seeds eaten by herders		61.2	Tm	1,2,3	257
42.	*Musa x paradisiaca* L .	Musaceae	warke	H	4,5,8	Fruits	Ripe fruits eaten raw	Ts	71.6	Tm	1,2,3	243
43.	*Myrsine africana* L.	Myrsinaceae	qacaama	Sh	5	Fruits	The ripe fruits eaten raw	Fm, Tm, Ca	43.1	Fu, Tm, Fm	1,2,3	349
44.	*Ocimum urticifolium* Roth	Lamiaceae	anchabii	Sh	3,7	Leaves	The leaves are used as condiments & spice	Fm, Tm, Ca	75.3	Fu, Tm, Fm	1,2,3	308
45.	*Ocimum lamiifolium* L.	Lamiaceae	anchabii	Sh	3,7	Leaves	The leaves used as condiments & spice	Fm, Tm, Fr, Fi, Co, Ca	67.5	Sd ,Fu, Co, Tm, Cr	1,2,3	210
46.	*Olea europaea* L. subsp. *cuspidata* (Wall. ex G.Don) c.f.	Oleacea	ejersa	T	5,7	Fruit, Leaves	The leaves used as condiments in local drinks; ripe fruits eaten raw and used to extract oil.	Tm	61.3		1,2,3	364

47.	*Peponium vogelii* (Hook.f.) Engl.	Cucurbitaceae	bukee sexana	H	3,7	Fruits	Cooked fruit was used to be eaten in time famine	Ut, Fd	14.2	Sd , Cr, Tm, Tk	1,2,3	307
48.	*Phoenix reclinata* Jacq.	Arecaceae	meexii	T	5,7,8	Fruits , shoots, buds	The fleshy ripe fruits eaten raw; young shoots and buds eaten as vegetables (cooked)	Fd	63.4	Tm	1,2,3	166
49.	*Rhamnus prinoides* L'herit.	Rhamnaceae	gesho	Sh	3,5,7	Leaves , brach, stem	To flavor traditional alcoholic drinks (tela,tej & areke)	Fm, Ca	62.5	Tm , Fm	1,2,3	110
50.	*Rhamnus staddo* A.Rich.	Rhamnaceae	qadida	Sh	5,7	Leaves	Leaves dried and used to flavor areke & tej (local drink)		42.6		1,2,3	407
51.	*Rhoicissus tridentata* (L. f.) Wild& Drummond	Vitaceae	-	Sh	5,7	Fruits	Ripe fruits eaten raw		9.5		3	261
52.	*Rhus vulgaris* Meikle	Anacardiaceae	dabobessaa	T	5	Fruits	Ripe fruits eaten raw		19.2		1,2,3	380
53.	*Ritchiea albersii* Gilg	Caparidaceae	-	Sh	5	Fruits	Ripe fruits eaten raw	Fd	25.4	Fo , Bf, Tm	1,2,3	83
54.	*Rosa abyssinica* Lindley	Rosaceae	qaqawwee	Sh	1,3,4,7	Fruits	Ripe fruits eaten raw	Fd	69.2	Tm	1,2,3	70
55.	*Rubus apetalus* Poir.	Rosaceae	gora	Sh	3,4,7	Fruits	Ripe fruits eaten raw	Fd	68.9	Tm, Bf	1,2,3	20
56.	*Rubus steudneri* Schw.	Rosaceae	gora	Sh	3,4,7	Fruits	Ripe fruits eaten fresh & raw	NM	64.3	Tm	1,2,3	338
57.	*Rumex abyssinicus* Jacq.	Polygonaceae	mooqmoqii	H	2,4,9	Roots , tender shoots	The tender shoots eaten fresh &raw by children (famine food), roots are used to refine butter & to prepare local tea	Ca	58.7	Bf , Fu, Tm	1,2,3	239
58.	*Rumex nervosus* Vahl	Polygonaceae	dhaangagoo	Sh	2,4,9	Inner part of Stem, leaves , tender shoots, roots	Young tender shoots, leaves & inner part of stem eaten fresh & raw mostly by children, root used as condiments in butter	Nm	23.5	Tm	1,2,3	413

59.	*Salvia nilotica* Jacq.	Lamiaceae		H	3,4,6	Seeds	The nutlets collected from the wild and used in a similar way as linseed.	Fm	9.5	Bf, Tm	1	311
60.	*Satureja punctata* (Benth.) Briq.	Lamiaceae	Xossinyii Jaldessaa	Sh	3,4,6	Leaves & Inflorescence	Used to improve quality of milk	Ca, Co, Fi	56.5	Co , Tm	1,2,3	401
61.	*Sideroxylon oxyacanthum* Baill.	Sapotaceae	bittee	T	5	Fruits	Ripe fleshy fruits eaten raw by children as snack		45.8		3	54
62.	*Sporobolus africanus* (Poir.) Robyns & Tournay	Poaceae	murii	H	3,4,6	Grains	The grain was powdered and baked to bread or injera like TEF during famine	Fd , Ca	14.5	Sd , Bf, Fu, Co, Fm, Tm	1,2,3	89
63.	*Syzygium guineense* (Willd.) DC. Supsp *afromontanum*	Myrtaceae	badessaa	T	5,7,8	Fruits	Ripe fruits eaten fresh & raw	Fd , Ca	70.3	Sd , Bf, Fu, Co, Fm, Tm	1,2,3	228
64.	*Syzygium guineense* (Willd.) DC. Supsp *guineense*	Myrtaceae	gossu	T	5,7,8	Fruits	Ripe fruits eaten fresh & raw		59.6		1,2,3	305
65.	*Tacazzea conferta* N.f. Br.	Asclepiadaceae	-	Li	5,7	Roots	Its root extract used to enhance lactation in suckling mothers	Fd , Ca	12.4	Fu, Co, Tm	1,2,3	399
66.	*Teclea nobilis* Del.	Rutaceae	hadhessa	T	5,7	Fruits	Ripe fruit eaten raw	Tm	59.2		1,2,3	47
67.	*Thymus schimperi* Ronniger	Lamiaceae	Xosinyii	H	3,4,6	Leaves	Dried leaves used as tea	NM	61.3	Tm	1,2,3	61
68.	*Urtica simensis* Steudel	Urticaceae	gurgubee	H	2,3,6,9	leaves & young shoots	The leaves & young shoots are cooked & eaten as vegetables	Fd , Ca	92.3	Fu, Co, Tm , Bf	1,2,3	127
69.	*Vepris dainellii* (Pichi-Serm.) Kokwaro	Rutaceae	hadhesa	T	5,7	Fruit	Ripe fruit eaten raw	Ca	65.6	Fu, Fo, Co, Lv, Bf	1.2	414
70.	*Vernonia amygdalina* Del.	Asteraceae	eebicha	Sh	3,5,7	Leaves	Leaves & twigs used as condiments in preparation of local alcoholic drinks		36.1	Tm	1,2.3	287
71.	*Xamenia americana* L.	Olacaceae	akuku	Sh	5,7	Fruits	Ripe fruit eaten raw		56.4		1	399

Appendix 10. Endemic plants of the study area showing their floristic regions, their distribution in the study area and their conservation status based on Vivero *et al*., 2005. **Key**: **CR**=Critically Endangered; **EN**= Endangered; **VU**=Vulnerable; **NT**=Near Threatened; **LC**= Least Concern; **CR**=Critically Endangered; **EN**=Endangered; Note: see **appendix 2** for their habits.

No	Scientific Name	Family	Floristic region	Jibat	Gedo	Chilimo	IUCN Status
1.	*Acacia negrii* Pic.Semi.	Fabaceae	GD WU GJ SU HA	X	X	✓	VU
2.	*Acanthus sennii* Chiov.	Acanthaceae	GD GJ WU SU AR WG KF GG SD BA HA	✓	✓	✓	NT
3.	*Argyrolobium schimperianum* Hochst ex A. Rich.	Fabaceae	TU GD GJ SU	✓	X	X	EN
4.	*Bidens ghedoensis* Mesfin	Asteraceae	SU WG IL KF GG SD	✓	✓	X	LC
5.	*Bidens pachyloma* (Oliv.&Hiern) Cuf	Asteraceae	GD GJ WU SU AR GG	✓	✓	X	LC
6.	*Bothriocline schimperi* Oliv. & Hiern ex Benth.	Asteraceae	GD GJ SU AR WG 1LKF GG SD BA	✓	✓	✓	LC
7.	*Cirsium dender* Friis	Asteraceae	SU IL KF GG	✓	✓	✓	VU
8.	*Clematis longicauda* Steud. ex A. Rich.	Ranunculaceae	GD GD/GJ GJ SU WG KF IL SD	✓	✓	✓	LC
9.	*Conyza nana* Sch. Bip. ex Oliv. & Hiern	Asteraceae	GD SU BA	X	X	✓	EN
10.	*Crassocephalum macropappum* (Sch. Bip.ex A.Rich) S. Moore	Asteraceae	GO GJ WU SU WG IL KF GG SO BA HA	✓	✓	✓	LC
11.	*Crotalaria rosenii* (Pox) Milne-Redh. ex Polhill	Fabaceae	SU AR BA KF SD	✓	X	✓	NT
12.	*Echinops ellenbeckii* D.Hoffm.	Asteraceae	SU AR HA	X	✓	✓	EN
13.	*Echinops kebericho* Mesfin	Asteraceae	TU GJ SU	✓	✓	✓	VU
14.	*Echinops longisetus* A.Rich.	Asteraceae	GD GJ WU SU AR WG KF GG SD BA HA	✓	✓	X	LC
15.	*Emilia serpentinus* Mesfin & Beentje	Asteraceae	SU KF I L GG SD HA	✓	✓	X	LC
16.	*Erythrina brucei* Schweinf.	Fabaceae	WU WG GJ SU BA HA IL KF GD GG SD	✓	✓	✓	LC
17.	*Euphorbia dumalis* S. Carter	Euphorbiaceae	SU AR KF SD SA	✓	X	X	LC
18.	*Helichrysum hedbergianum* Mesfin & Reilly	Asteraceae	GJ SU	✓	✓	✓	EN
19.	*Hyparrhenia tuberculata* W.D. Clayton	Poaceae	GJ SU	✓	X	✓	EN
20.	*Impatiens rothii* Hook. f.	Balsaminaceae	TU/GD SU AR WG KF SD BA HA	✓	✓	✓	LC
21.	*Inula confertiflora* A. Rich.	Asteraceae	WU SU AR BA HA	✓	X	✓	NT

22.	*Justicia diclipteroides* Lindau subsp. *aethiopica* Hedr`en,	Acanthaceae	SU IL WG AR KF GG SD	✓	✓	✓	NT
23.	*Kniphofia hildebrandtii* Cufod.	Asphodelaceae	SU	✓	✓	✓	CR
24.	*Maytenus addat* (Loes.) Sebsebe	Celasteraceae	SU AR SD GG	✓	✓	✓	NT
25.	*Mikaniopsis clematoides* (Sch. Bip. ex A. Rich.) Mine-Redh.	Asteraceae	TV/GD WU SU AR KF BA HA	✓	✓	✓	LC
26.	*Millettia ferruginea* (Hochst.) Bak.	Fabaceae	TU GD GJ SU WG HA IL	✓	✓	✓	LC
27.	*Oreoschimperella verrucosa* (A. Rich.) Rauschert	Apiaceae	SU AR KF SD BA HA	✓	X	X	-
28.	*Phragmenthera macrosolen* (A. Rich.) M. Gilbert	Loranthaceae	TU GD GJ SU WG IL KF SD	✓	✓	✓	LC
29.	*Plectranthus garckeanus* (Vatke) J.K. Morton	Lamiaceae	GD GJ SU AR KF SD BA WG	X	✓	✓	-
30.	*Pycnostachys recurvata* Ryding	Lamiaceae	SU WG IL KF SD BA	✓	✓	X	
31.	*Rhus glutinosa* A.Rich.subsp. *neoglutinosa* (M.Gilbert) M.Gilbert	Anacardiaceae	WU SU AR BA HA	✓	X	✓	LC
32.	*Satureja paradoxa* (Vatke) Engl. ex Seybold	Lamiaceae	GD GJ SU AR WG IL KF GG SD BA HA	✓	✓	✓	NT
33.	*Satyrium aethiopicum* Summerh.	Orchidaceae	TU SU WG KF SD	✓	✓	X	
34.	*Senecio myriocephalus* Sch.Bip. ex A.Rich.	Asteraceae	TU/GD GD WU SU AR KF SD SA HA	✓	✓	✓	LC
35.	*Solanecio gigas* (Vatke) C. Jeffrey	Asteraceae	GD GJ WUSU ARSD IL KF BA HA;	✓	✓	✓	LC
36.	*Sparmannia macrocarpa* Ulbr.	Tiliaceae	GD GJ WUSU AR WG KF GD HA	✓	✓	✓	NT
37.	*Trifolium pichisermollii* Gillett	Fabaceae	GJ SU	✓	X	✓	-
38.	*Trifolium schimperi* A. Rich.	Fabaceae	TU GO GJ WG WU SU AR KF	✓	✓	X	-
39.	*Uebelinia erlangeriana* (Engl.) TCE. Fries	Caryophylaceae	SU AR KF SD	✓	X	X	VU
40.	*Uebelinia kigesiensis* R. Good subsp. *ragazziana* Ousted	Caryophyllaceae	GJ SU AR WG KF BA	✓	✓	✓	NT
41.	*Urtica simensis* Steudel	Urticaceae	TU GD GJ SU AR BA SD	✓	✓	✓	LC
42.	*Vepris dainellii* (Pichi-Serm.) Kokwaro	Rutaceae	GJ SU WG IL KF SD BA	✓	✓	X	LC
43.	*Vernonia leopoldi* (Sch. Bip. ex Walp.) Vatke	Asteraceae	TU GD GJ WU SU WG KF HA GG	✓	✓	✓	LC

Appendix 11. Photographs illustrating some aspects of ethnobotanical field data collection

A. Focal group discussion with small groups

B. Individual interviews at field and market

C.Traditional medicinal plant practioners (Healers) disclosing medicinal plants they use