

**Addis Ababa University
School of Graduate Studies**

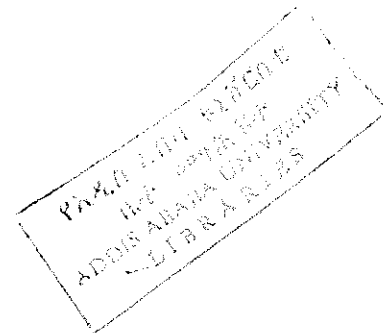
**Use and Management of Traditional Medicinal Plants by
Indigenous People in 'Boosat' Wereda, 'Welinciti' Area: An
Ethnobotanical Approach**

A Thesis Submitted to the School of Graduate Studies of Addis Ababa
University in Partial Fulfillment of the Requirements for the Degree of
Master of Science in Dryland Biodiversity

Debela Hunde

June 2001

Addis Ababa, Ethiopia



**Addis Ababa University
School of Graduate Studies**

**Use and Management of Traditional Medicinal Plants by Indigenous People in
'Boosat' Wereda, 'Welinciti' Area: An Ethnobotanical Approach**

**A Thesis Submitted to the School of Graduate Studies of Addis Ababa University in
Partial Fulfillment of the Requirements for the Degree of Master of Science in
Dryland Biodiversity**

Debela Hunde

**June 2001
Addis Ababa, Ethiopia**

ACKNOWLEDGEMENTS

This work was made possible through combined efforts, positive attitudes and responses of many kindhearted persons and heads of departments, all of whom I thank very much. I shall only mention some among these.

I am very much indebted to my research advisors Dr Zemedet Asfaw and Dr Ensermu Kelbessa whose unreserved and continued assistance and support made the completion of this study possible. Indeed, I thank them for their crucial and concrete suggestions starting with the research proposal, for their constructive criticism and indispensable guidance, for generously offering their time, their personal libraries and knowledge to patiently scrutinizing my draft documents and for facilitating field works and a number of things. Their deep concern and interest in my work will always be remembered.

I am also indebted to 'Boosat' Wereda Administration and Agricultural offices. The indigenous people of 'Boosat' including the Karrayu transhuman pastoralists are highly credited. Ato Abdissa Anbasso, Ato Janbo Boru and Ato Abebe Mijana are thanked for facilitating and assisting me in the field. My thanks also go to Ato Mirutse Giday, Ato Tesfaye Awas, and Ato Teshome Soromssa for sharing me valuable pieces of friendly advice and lending me their personal library materials. Ato Medhane Asmelash, Ato Getachew Tesfaye and Ato Berihun Gebremedhin are thanked for helping me in computer operation during data analysis.

I also like to express my deepest appreciation to Professor Sebesebe Demissew and Dr Ensermu Kelbessa for allowing me to use all Herbarium facilities for identifying and documenting plant specimens. I thank the technical staff of the Herbarium also contributed substantial assistance to my work, to mention few, Ato Solomon Kassaye, Ato Melaku Wendafrash, W/t Shewangziw Lemma and W/t Sosina Ketema.

The Department of Biology, headed by Dr Kifle Dagne and the secretaries W/o Mulualem Tamire and Banchiyehu Mekonen have substantially contributed administrative facilities to my work.

I strongly appreciate and thank RPSUD for its financial support. I am also grateful to Jimma College of Teachers Education and Oromia Education Bureau for sponsoring me to pursue my studies.

Once again I want to express my deepest appreciation to Dr Zemedet Asfaw, Dr Ensermu Kelbessa and Dr Kifle Dagne who initiated me to register for the MSc programme.

I would also like to express my appreciation to my wife, Muluwork Guta and all members of my family and my mother W/o Dinkitu Dima my brothers and sisters for encouraging me morally and materially during my studies.

DEDICATION

This work is dedicated to my father Ato Hunde Feyssa Gesha for inspiring on me the spirit of loving education and paid substantial contribution to other education lovers in his lifetime.

CONTENTS

ACKNOWLEDGEMENTS..... I

DEDICATION..... II

CONTENTS..... III

LIST OF FIGURES..... VI

LIST OF TABLES..... VII

LIST OF APPENDICES..... VIII

ABSTRACT..... IX

1. INTRODUCTION..... 1

 1.1 Background..... 1

 1.2 General objectives..... 4

 1.2.1 General objectives..... 4

 1.2.2 Specific objectives..... 4

2. LITERATURE REVIEW..... 5

 2.1 Development of Ethnobotany and the Need for its Study..... 5

 2.2 Historical Account of Traditional Medicinal Plants..... 7

 2.3 Medicinal Plants and Ethnomedicine in Ethiopia..... 10

 2.3.1 The importance of traditional medicine in Ethiopia's Public healthcare system..... 10

 2.3.2 Importance of traditional medicinal plants in animal husbandry..... 12

 2.4 Future Prospects of Traditional Medicinal Plants in research..... 14

 2.5 Trends in Conservation of Traditional Medicinal Plants..... 16

3. DESCRIPTION OF THE STUDY AREA..... 20

 3.1 Description of Environmental Factors..... 20

3.1.1	Geographical location.....	20
3.1.2	Geology and physiography.....	22
3.1.3	Soil.....	23
3.1.4	Climate.....	24
3.1.5	Vegetation.....	25
3.1.6	Livestock.....	26
3.2	Interaction Between Humans and the Environment.....	27
3.2.1	Population and settlement.....	27
3.2.2	Land use.....	28
3.2.3	Human health problems and medical services.....	28
4.	MATERIALS AND METHODS.....	30
4.1	Sampling Study Sites.....	30
4.2	Sampling Informants.....	30
4.3	Ethnobotanical Information.....	31
4.4	Description of Medicinal Plant Species.....	34
4.5	Vegetation description.....	34
4.6	Data Analysis.....	35
5.	RESULTS.....	36
5.1	Indigenous Knowledge.....	36
5.1.1	Landform classification by indigenous people.....	36
5.1.2	Soil classification by indigenous people.....	38
5.1.3	Vegetation classification by indigenous people.....	38
5.1.4	Vegetation of the study area as examined visually.....	39
5.1.5	Distribution of medicinal plants in vegetation types.....	42

5.2 Ethnobotanical (Ethnomedicinal) Information.....	43
5.2.1 Basic information on medicinally useful plant species.....	43
5.2.2 Habit of medicinal plants and parts used.....	45
5.3 Disease Treatments.....	47
5.3.1 Categories of diseases frequently treated.....	47
5.3.2 Description of widely used medicinal plants.....	49
5.3.3 Medicinal plants used both for livestock and humans.....	65
5.4 Modes of preparation of the Medicine, Dosage and Route of Application.....	65
5.5 Informants Consensus.....	70
5.6 Management and Conservation of Medicinal Plants.....	72
5.7 Indigenous Knowledge of Medicinal Plants by Different Social Groups.....	75
5.7.1 Preference ranking and paired comparison.....	78
6. DISCUSSION.....	82
6.1 Indigenous Knowledge on Medicinal Plants.....	82
6.2 The Medicinal Plants and Parts Used.....	87
6.3 Mode of Preparation of the Medicine, Dosage and Route of Application.....	88
6.4 Habitat and Distribution of Medicinal Plants.....	90
6.5 Management and Conservation Status of the Medicinal Plants.....	92
7. CONCLUSIONS.....	96
8. RECOMMENDATIONS.....	98
9. REFERENCES.....	101

List of Figures

Figure 1 Map of the Study Area.....	21
Figure 2 Climadiagram of 'Boosat' Wereda following Walter (1967).....	25
Figure 3 <i>Balanites aegyptiaca</i> maintained at farm border.....	63
Figure 4 Ritually Protected <i>Acacia tortilis</i> trees.....	64
Figure 5 <i>Withania somnifera</i> being identified in the field.....	64
Figure 6 Dendrogram Showing Distance Between Respondents Single Linkage Euclidean Distance.....	81

List of Tables

Table 1 Vegetation Types and Total Number of Medicinal Plant Species Documented.....	43
Table 2 Families of Medicinal Plants and Number of Species Used for Humans and Livestock.....	44
Table 3 Habit, Total Number of Species and Percentage of Habit Groups of the Total.....	46
Table 4 Parts Used and Habit of Medicinal Plants in Medicine Preparations.....	46
Table 5 Major Human Disease and Number of Species Used by Indigenous People.....	47
Table 6 Major Livestock Disease and Number of Ethnoveterinary Plant Species.....	49
Table 7 Medicinal Plants Primarily Used for Livestock with Some Uses to Humans.....	66
Table 8 Methods of Preparation of Medicines used by the Indigenous People of 'Boosat'.....	68
Table 9 Route of Application of Remedies, Total Number of Remedies and Percentage.....	69
Table 10 List of Medicinal Plants and the Corresponding Number of Informants.....	70
Table 11 Comparing Knowledge of Medicinal Plants Between Two Age Groups.....	76
Table 12 Values for Preference Ranking Based on their Degree of treating Snake Poison for Five Selected Medicinal Plants	80
Table 13 Paired Comparison of Medicinal Plant Species Used to Treat Malaria.....	80

List of Appendices

Appendix 1 Plants Used as Medicine for Humans.....114

Appendix 2 Plants Used as Medicine for Livestock..... 121

Appendix 3 List of Key Informants Who Participated in Ethnomedicinal Study..... 127

Appendix 4 Checklist of Questions or Items Used as a Basis for Discussion
and Interview.....129

Appendix 5 Vegetation Types and Total Number of Medicinal Plant Species..... 130

Appendix 6 Some of The Vegetation Types Found in the Study Area..... 131

Appendix 7 List of Plants in Local Vegetation other than Medicinal Plants..... 132

ABSTRACT

An ethnobotanical study on uses and management of traditional medicinal plants by indigenous people in 'Boosat' Wereda has been conducted in Welinciti area, East Shewa Zone, Oromia Region between July 2000 and March 2001 to make inventory of plants that have ethnomedicinal value and investigate the uses and management practices by local people. Five study sites were systematically established to include areas inhabited by settled farmers and transhuman pastoralists. Eighty informants were randomly selected from age group 15 to 40 years and above from both males and females. Vegetation was examined and the dominant species of vegetation visually recognized were documented. The eight vegetation types identified were: *Acacia albida-Ziziphus spina-christi* woodland, *Acacia senegal-Acacia tortilis* dominated vegetation, the *Pistacia falcata*, *Acacia seyal-Acacia tortilis* and *Cissus quadrangularis*, *Boswellia papyrifera*, *Euphorbia nigrispinoides*, *Acacia senegal* thicket vegetation and *Acacia tortilis-Balanites aegyptiaca* woodland.

Ethnobotanical information of medicinal plants including uses, management and conservation by indigenous people, land, soil and vegetation classification by indigenous people were obtained from informants by semi-structured interview, observations, group discussions, guided fieldwalks. A total of 81 medicinal plant species distributed in 66 genera and 34 families were documented. Of these, 29 species are used to treat 18 livestock diseases while 52 are used to treat 43 human diseases. Habits of medicinal plants include shrubs 41(50,6%), herbs 17(21%), trees 15 (18.5%), climbers 7(8.6%) and hemiparasites 1(1.2%). Roots are the most frequently used plant parts accounting for 49 (31.4%) of the preparation followed by leaves 38 (24.4%). There were 23 different preparation methods reported. However, the most widely used method of preparation is crushing, pounding and mixing with cold water to serve as a drink 43 (24.3%). Eighteen (10.2%) of the preparations are made by concoction of different parts of a plant or different part of the same plant. There is diverse indigenous ethnomedicinal knowledge in the area. Men and women of age above 40 knew 80 (98.8%) of the 81 species while people of age between 15 to 40 years knew 37 (45.7%). Modernization and acculturation have contributed in making the younger generation unwilling to practice, retain traditional knowledge and consider it as less important. Paired comparison and preference ranking showed that people have preferences for some species over the other in treating the same ailment. Environmental degradation, habitat changes fueled by production of charcoal, collection of fuel wood construction material and agricultural intensification are major threats to medicinal plants and knowledge on them. It was found that, there is little practice of bringing medicinal plants under cultivation. Indigenous practices, various cultural and seasonal restrictions of collecting medicinal plants have contributed to the management and conservation of medicinal plants in the area. It is therefore, recommended that the indigenous knowledge and practices be blended with the formal sector to ensure sustainable use, management and conservation of the important medicinal plants in particular and the biota in general. Furthermore, traditional community based *in-situ* conservation should be complemented with *ex-situ* conservation with the participation of indigenous people.

1. INTRODUCTION

1.1 Background

Ethnobotany is a broad term referring to the study of direct interrelations between humans and plants (Martin, 1995; Balick and Cox, 1996). This includes plants used as food, medicines and building materials and for any other economic application (Farnsworth, 1994). It is an interdisciplinary and multidisciplinary science, which focuses on documenting, analysis and use of indigenous knowledge on plants and the interactions between humans and plants as well.

Over centuries, indigenous people have developed their own locality specific knowledge on plant resource use, management and conservation (Cotton, 1996; Balick and Cox, 1996). In these cultures, such information resides within individuals, families or villages (Balick, 1996). The complex knowledge, beliefs and practices generally known as indigenous knowledge (IK) or traditional knowledge develops and changes with time and space. Hence, indigenous (traditional) knowledge includes time-tested practice that developed in the processes of interaction of humans with their environment (Ford, 1978 quoted in Alcorn, 1984; PGRC/E, 1995). Indigenous knowledge systems, for example, can guide the development of new crop varieties and medicines (Balick and Cox, 1996). Ethnobotanical studies are useful in documenting, analyzing, and disseminating of knowledge on the interaction between biodiversity and human society and how it is valued in different societies and how it is influenced by human activities (Martin, 1995). Cotton (1996) and Balick and Cox (1996) explained ethnobotany, as a useful science to define local community plant resource needs, utilization and management. Therefore, the conservation of ethnobotanical

knowledge as part of living cultural knowledge and practices between communities and the environment is essential for biodiversity conservation (Martin, 1995). Furthermore, ethnobotanical methods are so diverse in connection to medicinal uses and management of plants (Farnsworth, 1994; Alcorn, 1984).

According to Farnsworth (1994) ethnomedicine refers to the use of plants by humans as medicines and traditional medicine is the sum total of all nonmainstream medical practices, usually excluding western medicines. Plants used in various forms of traditional medicine have different potential medicinal values (Farnsworth, 1994; Lewis and Elvin-Lewis 1994). However, despite the use of herbal medicines over many centuries, only relatively small numbers of plant species have been studied for possible medical applications (WHO, 1998) and the spread of this knowledge is mostly limited to indigenous societies (Cunningham, 1993; FAO, 1983)

In Ethiopia detailed descriptions for plants used medicinally are generally lacking (Dawit Abebe and Estifanos Hagos, 1991; FAO, 1986). Most of the plants used in traditional medicine are collected from the wild and few have been domesticated (FAO, 1983). In the same work it has been pointed out that there is a real danger of genetic erosion, which in turn calls for the need of collection, investigations, and conservation of these resources and the indigenous knowledge on them.

Much of the knowledge on traditional medicinal plants in most cases is available in rural communities and perpetuated by word of mouth within families and small communities (Wilson and Woldu Gebremariam, 1979; FAO, 1986.). These are fragile traditional skills that

are likely to be lost when communities emigrate to towns or regions with a different flora, or if the local ecology is drastically altered. This is a big challenge for ethnomedicinal research (Cunningham, 1993; Dawit Abebe and Ahadu Ayehu, 1993). Moreover, indigenous people have not only been utilizing medicinal plants but also have developed a system of managing them. This has been achieved through many generations age old and time tested practices and a consequent accumulation of knowledge through a series of observations, practices, interactions and innovations (Abbink, 1995; PGRC/E, 1995; Cunningham, 1996)

In Ethiopia, little emphasis has been given to ethnobotanical (ethnomedicinal) studies over the past decades (Dawit Abebe and Ahadu Ayehu; 1993 PGRC/E, 1995; Mirutse Giday, 1999). Therefore, it can be said that ethnobotanical studies are merely at the start in Ethiopia. Though, there have been some attempts in investigating medicinal plant uses, and there is as yet no in-depth study on the relation between medicinal plants and indigenous knowledge on sustainable management of such plant resources. The Institute of Biodiversity Conservation and Research has pledged to do this in its long- range strategic research plan (IBCR, 2000).

The formal sector has a lot to learn from indigenous people; whose knowledge of medicinal plant uses and management is of paramount importance in plant genetic resource utilization and conservation (PGRC/E, 1995; Alcorn, 1984; WHO, 1998). There is an enormous gap in knowledge and it is from this very fact that the present study on the use and management of traditional medicinal plants by indigenous people in 'Boosat' Wereda, 'Welinciti' Area has been initiated.

This study area was selected because this area, which is located in the arid rift valley climate, has been observed being devegetated and giving away its native vegetation cover over the past years. This was partly because of the intensification of agriculture, high rate of charcoal rely on traditional medicines obtained from plants and that there is no documentation on the plants and the knowledge pertaining to them. production and collection of construction material and firewood. Furthermore, it is known that indigenous people heavily Therefore, this study was aimed at investigating and documenting ethnomedicinal knowledge on uses and management of traditional medicinal plants from indigenous people in 'Boosat' Wereda, Welinciti area.

1.2 Objectives of the Study

1.2.1 General objectives

The general objectives of the study were to:

- Inventorize plants of ethnomedicinal value to humans and livestock
- Document the indigenous knowledge of the local people on the use of medicinal plants
- Investigate the management of medicinally important plants by local people
- Suggest ways of conserving plants of the study area so as to achieve conservation of medicinal plants

1.2.2 Specific objectives

The specific objectives of this study were to:

- Identify plants species used as medicine for treating human and livestock health problems in the study area
- Document plants of medicinal importance and provide the descriptions of parts of plants used for medicinal purposes
- Compile indigenous knowledge on plants of medicinal value
- Give specific recommendations that would contribute to the development of a strategy for conservation and sustainable management of medicinal plants and
- Contribute to the effort being made in building the ethnobotanical database in Ethiopia

2. LITERATURE REVIEW

2.1 Development of Ethnobotany and the Need for its Study

There has been a difficulty to underline single unified definition of ethnobotany (Alcorn, 1984). Recently, ethnobotany is defined as multidiscilne and interdisciplinary science, which deals with inerrlations between humans and plants (Martin, 1995; Cotton, 1996). Results of ethnobotanical research are used as a lead in development, sustainable utilization of plant resources and indigenous knowledge on them in particular and biodiversity in general. There has been an ever-increasing interest of anthropologists, botanists and explorers of the world to document the potential uses or economic potential of plants used by indigenous (traditional) societies (Cotton, 1996). This has its landmarks in 1492 when Christopher Columbus discovered tobacco as being used by local people, during his voyage to Cuba in the same year (Cotton, 1996). British explorer, Richard Spuce around 1858, noted for the first time the psychoactive properties of the South American vine, *Banisteriopsis caapi*, (Cotton, 1996). As the number of expeditions and scholarly communication became wide, there has been an intensified and continuous search by researchers of different fields to disclose traditional use of plant in different parts of the world by indigenous societies (Balick, 1996; Cotton, 1996). This search gradually has laid basic ground for the study of direct interrelations between humans and organisms focusing on documenting, analysis and use of indigenous knowledge of biological objects and processes. This search has been moving to the popularization of ethnobotany as a field of study in biological sciences. Since that time different scholars used different ways of defining ethnobotany. John Harshberger proposed the first formal definition of the term ethnobotany in 1895 (Alcorn, 1984; Balick and Cox, 1996). Evan Richard Shultes in 1941 redefined ethnobotany as the study of the

relations, which exist between humans and their ambient vegetation (Costetter, 1994 cited in Cotton, 1996).

A relatively complete definition of ethnobotany is the study of direct interrelations between humans and plants (Ford, 1978 quoted in Alcorn, 1984). However, when particular ethnobotanical studies are evaluated on the basis of this definition, they are more narrowing their focus because of capitalizing on few biological objects with heavily anthropological and economic focus.

Martin (1995) defined ethnobotany as the study of people's perception, of cultural and scientific field of study for the collection, analysis, interpretation and use of knowledge accumulated by people during prolonged interaction with plants and the environment as a whole. The above definition includes how humans interact with all aspects of the environment and their impact on each other including the influence of human culture, beliefs and practices in the process of interaction. This in turn shows that ethnobotany is an interactive and a dynamic field of study. In response to the misguided perception of ethnobotany being not worthy of a "scientific" status the traditional compilation approach is changing in favour of optimizing methods that allow researchers to quantify, describe and analyse patterns in what they study (Prance, 1991; Phillips and Gentry, 1993). Evaluating the importance of vegetation to one ethnic group, study of medicinal plant species and testing a model of the origin of medicinal plant use have been made possible by this recent scope and the method of ethnobotany (Phillips and Gentry, 1993). Therefore, ethnobotany encompasses other subdisciplines. It combines anthropology and botany (Prance, 1991; Martin, 1995; Cotton, 1998).

Ethnobotanical studies are useful in documenting, analyzing, and dissemination of knowledge on the interaction between biodiversity and human society, and how it is influenced by human activities (Martin, 1995; Cotton, 1996). Studies made by Langeheim and Thimann (1982) revealed that ethnobotany is becoming an essential area of research because of (1) the developing interest in the world's problems, (2) the increased awareness in protection of environment, (3) the demand for food, fibre, energy, medicine, and (4) the increasing need for understanding the interrelations between human population and plants. Hence, ethnobotanical studies are useful to define local community's plant resource needs, sustainable utilization and management. Traditional local communities, world wide, have a great deal of knowledge about native plants on which they intimately depend (Langeheim and Thimann, 1982). Today, much of this wealth of knowledge is being lost with the erosion of traditional cultures (Tewolde B. Gebre Egziabher *et al.*, 1979; Cunningham, 1996). Immense urbanization, road building, industrialization and agricultural intensification have accelerated the transformation of the indigenous knowledge as people migrate to new industrial centres (Cunningham 1993; Cunningham, 1996). This in turn has had great pressure on the decline (degradation) of natural vegetation through land use problems (Ensermu Kelbessa *et al.*, 1992; Sebesebe Demissew, 1998). In this connection, Shanker (1993) has explained that cultural traditions of thousands of communities are under serious threat.

2.2 Historical Account of Traditional Medicinal Plants

From the earliest times, humankind used plants in an attempt to cure diseases and alleviate physical sufferings, which perhaps goes back as Neanderthal man (Hill, 1965). Physical

evidence obtained from the burial sites of the Neanderthal man discovered in 1960 in Iraq revealed that the use of medicinal plants in the area goes back to some 6,000 years (Solace, 1975, quoted in Mirutse Giday, 1999).

In the past, people of all ages have had some knowledge of medicinal plants, derived as the result of trial and error, which was based on speculation and superstition (Hill, 1965). However, the knowledge regarding the source and use of the various products suitable for this purpose was usually restricted to the medicine men of the tribe (Pankhurst, 1965; Pankhurst, 1990).

In China, as early as 5000 to 4000 B.C. many drugs were in use (Hill, 1965). There are Sanskrit writings in existence, which tell the methods of gathering and preparing drugs. The Assyrians, Babylonians and ancient Hebrews were all familiar as early as 1600 B.C. (Hill, 1965). Some of the documents found in Egypt, written as early as 1600 B.C., were reported to contain lists of many medicinal plants used for the treatment of various illnesses (Mirutse Giday, 1999).

Although it needs in-depth historical evidence, the antiquity of the traditional use of medicinal plants in Ethiopia could not be simply overlooked (Pankhurst, 1965 and Pankhurst, 1990; Mirutse Giday, 1999). It has been noted that testimony to this is found in medical text books that have been written in Geez, or even Arabic which were written between the mid of the 17th and beginning of the 18th century (Tewolde B. Gebre Egziabher *et al.*, 1979, Dawit Abebe and Ahadu Ayehu, 1993; Asfaw Debela *et al.*, 1999). The practice of traditional medicine in Ethiopia consists of the use of herbs, spiritual healing, holy water, bone setting

and minor surgical procedures. Pankhurst (1990) explained that, during and after the Italian occupation the general population, with the exception of the few privileged groups, depended almost entirely on traditional medicine.

Apart from the written records about ancient traditional practices, most of this knowledge has only descended through oral folklore (Wilson and Woldu Gebremariam, 1979). Many practitioners of traditional medicine have widely used a large number of plants well known to them (Mesfin Tadesse and Sebsebe Demissew, 1992). The knowledge of the plant, and methods of use of medicinal plants has circulated mainly among practitioners of traditional medicine and /or the beneficiaries of such practices (Kokwaro, 1976; Pankhurst, 1990; Mesfin Tadesse and Sebsebe Demissew, 1992). Indigenous traditional medicinal practices were carried out essentially on the basis of private practice, i. e. private agreement between consenting parties (Pankhurst, 1990; Asfaw Debela *et al.*, 1999). The strict secrecy of information retained by traditional healers is relatively less susceptible to distortion but less accessible to the public (Dawit Abebe, 1986; Abbink, 1993). However, the knowledge is dynamic as the practitioners make every effort to widen their scope by reciprocal exchange of limited information with each other (Tewelde B.Gebere Egziabher *et al.*, 1979; Dawit Abebe, 1986; Abbink, 1993).

Anokbongo (1992) has explained that in 1976, 70-80% of the population in Africa as designated by WHO did not have access to such basic modern health care services as protective immunization, assistance to mothers during pregnancy and childbirth, post-natal and infant care, health and nutrition education, safe water supplies and first aid (emergency care).

2.3 Medicinal Plants and Ethnomedicine in Ethiopia

2.3.1. The importance of traditional medicine in Ethiopia's public healthcare system

Plants have been used as a source of traditional medicine in Ethiopia from time immemorial to combat different ailments and human sufferings (Asfaw Debela *et al.* 1999). Due to its long period of practice and existence traditional medicine has become an integral part of the culture of Ethiopian people (Pankhurst, 1965; Mirgissa Kaba, 1998). It is common for people living in rural and urban centres to treat some common ailments using plants available around them (example, *Hagenia abyssinica* to expel tapeworm, *Ruta chalepensis* for various health problems (Abbink, 1995). Over 80% of the Ethiopian population depends on traditional medicine for their health care practices (Dawit Abebe and Ahadu Ayehu, 1993; Asfaw Debella *et al.*, 1999). This is also true for Africa and the estimate is more realistic in drylands where modern medical facilities are scarce (Chikami, 1998). In connection to this Dawit Abebe (1986) noted, " more than 95% of traditional medicinal preparations are of plant origin". Lack of detailed descriptions of the traditional plants has made it impossible for researchers to decide the identity of these plants universally, with the only reference being the local name of the plant (Kokwaro, 1976; Kayemba-Ogwal, 1989; Mesfin Tadesse and Sebesebe Demissew, 1992). This has also made the spread of knowledge concerning the wealth and variety of African culture to be untouched (Kayemba-Ogwal, 1989)

Most African countries failed to give official recognition and develop their own legacy of traditional medicine, which was partly responsible for the current health crises (Aregebyen, 1996). Modern health care has never been and probably never will provide adequate and equitable health service anywhere in Africa, due to financial limitations related to rapid

population growth, political instability and poor economic performance (Anokbonggo, 1992). The problem of ensuring the equitable distribution of modern healthcare has become more serious, as the gap between supply and demand has continued to widen. Hence, in present-day Africa including Ethiopia, the majority of people lack access to healthcare, and where available, the quality is largely below acceptable level (Abbiw, 1996). This is why Archer (1990) and Nijar (1996) stated that for most indigenous peoples and local communities, reliance on biological resources account for anything up to 95% of their survival requirements. Therefore, careful nurturing and development of biodiversity is for them a matter of life and death. Often the diversity is itself employed in diverse ways and supports an integrated and holistic life style and culture (Nijar, 1996). Herbal remedies are the world's primary therapeutic arsenal to fight diseases for a fairly large proportion of people both rural and urban centres in developing countries (Croom, 1983; Abbiw, 1996).

The continued dependence on herbal medicine alongside modern medicine is largely conditioned by economic and cultural factors (Aketch, 1992; Abbiw, 1996). In addition to this as economic factors among others the modern medical service are inaccessible to the vast majority of populations due to the soaring costs. On the other hand, as cultural factors, even when accessible, the modern medicines are supplemented by the herbal medicines, most of which are always with relatively easy reach. Thus, medicinal plants continue to be in high demand in the health care system as compared to the modern medicine (Aketch, 1992; Cunningham, 1996). This indicates the need for in-depth investigation and documentation of plants of traditional medicinal value to rationally use and conserve the plant resources and indigenous knowledge (Dawit Abebe and Ahadu Ayehu, 1993).

2.3.2 Importance of traditional medicinal plants in animal husbandry

Traditional animal health care practices, also called ethnoveterinary medicine provide low cost alternatives in situations where modern drugs and veterinary services are not available or too expensive (Mathias, 1996). This is realized in that modern veterinary inputs and services are often not readily available because they are either too difficult to obtain or too expensive for poor, marginal farmers and pastoralists (International Technology Development Group (ITDG) and International Institute of Rural Reconstruction (IIRR), 1996). Under these conditions, traditional animal health care practices (ethnoveterinary medicine) provide readily available low cost alternatives (ITDG and IIRR, 1996). This includes the use of medicinal plants, surgery techniques and management practices to prevent and treat a range of diseases and problems encountered by livestock herders (Mathias, 1996; ITDG and IIRR, 1996). In the same work, it is stated many of these practices have been developed and tested over centuries, so have withstood the test of time. Ethnoveterinary techniques such as those to treat the more widespread ailments are common knowledge among livestock herders (ITDG and IIRR, 1996). Others, however, are known only to a few “indigenous professional” healers, who have over the years learned the practices (ITDG and IIRR, 1996). This shows that ethnoveterinary medicinal knowledge and skills are not always evenly spread within a community or a society.

Stock raisers, both farmers and herders, have developed their own ways of keeping their animals healthy and productive (McCorkle and Mathias, 1996). They treat and prevent livestock diseases using sometimes age old home remedies surgical and manipulative techniques and associated magico religious practices. Taken together, these indigenous local animal healthcare beliefs and practices constitute what is now known as ethnoveterinary

medicine (McCorkle and Mathias, 1996). Like other kinds of local technical knowledge, ethnoveterinary medicinal practices and skills are built up over time from empirical observation, mainly through trial and error and sometimes through deliberate, or even desperate experimentation and innovation (McCorkle and Mathias, 1996). Research findings have shown that, the fields of modern veterinary medicine and ethnoveterinary practices are complementary to one another (Yehenew Mekonnen, 1994; Taffese Mesfin *et al.*, 1995; ITDG and IIRR, 1996).

Study made in highlands of Ethiopian by Taffese Mesfin, *et al.* (1995) for anthelmintic value against helminthes parasites in sheep has showed that chemotherapeutic measures are potentially effective. However, for resource poor and continuously moving pastoralists it needs to be complemented by ethnoveterinary medicine due to the soaring cost, irregular availability of chemotherapeutic measures and uncontrolled grazing system. Therefore, integrating ethnoveterinary information and practices into research and extension services can make livestock development efforts more successful (Mathias, 1996). Ethnoveterinary medicine can be useful whenever and wherever stock raisers have no other animal healthcare options, whether in rural or peri-urban areas. It can also help where conventional veterinary services and commercial drugs are available, by expanding the range of veterinary services available to users.

In spite of its paramount importance as livestock healthcare system, the various traditional veterinary practices remained undocumented both in Africa as a whole (McCorkle and Mathias, 1996) and Ethiopia (Dawit Abebe and Ahadu Ayehu, 1993). Yehenew Mekonnen (1994) has also reported that, the creation of awareness on ethnoveterinary medicine

emphasizing to useful plants and potentially toxic to livestock has paramount importance to livestock management. In the same work it has been explained that there are toxic and potentially toxic plants as there are useful plants for ethnoveterinary medicine. Hence, the arguments given in this particular text show that ethnoveterinary medicine is an area of great academic challenge to research, which is merely starting in Ethiopia (Taffese Mesfin *et al.*, 1995).

2.4 Future Prospects of Traditional Medicinal Plants in Research

Much ethnobotanical information remains undocumented especially in ethnomedicine, because of continual acculturation, accelerated degradation of natural vegetation, agricultural expansion, coupled with high birth rate and economic crises that leave little time to achieve complete documentation (Kokwaro, 1976; Dawit Abebe and Ahadu Ayehu 1993). Although, it has significant contribution to the society, it has received little attention in modern research and development until recent time in Ethiopia (Mirgissa Kaba, 1996; Mirutse Giday, 1999). Abbink (1995) stated, "current relationship between traditional and modern medicine is rather in disharmony". Government medical institutions have little regard for traditional medicine. It is a recent history that the Ethiopian health authorities have shown interest to promote and develop the traditional medicine (Worku Abebe, 1984; Pankhurst, 1990; Asfaw Debella *et al.*, 1999). Ethiopia being one of the member countries of WHO adapted Primary Healthcare (PHC) and established mechanisms for the introduction of traditional medicine into PHC programmers by assessing for safety and efficacy method (Pankhurst, 1990). Based on this the coordinating office for traditional medicine, which is now promoted to Drug Research Department, was established under the Ministry of Health (Dawit Abebe 1998).

Despite all the above drawbacks, by 1973 serious study was launched by members of the Department of Biology of Addis Ababa University (Mesfin Tadesse and Sebesbe Demissew, 1992). This study has focused mainly on the collection; identification and recording of the uses of some of the plants of Ethiopia reported to have medicinal properties. By 1976 more than 700 specimens of plants had been collected and the identity of more than 350 plants established. Some of the good examples of the works aimed at systematic study and documentation of medicinally important plants were Jansen (1981), *Etse Debdabe* (Herbal Message) by Galahun Abate (1989), Mesfin Tadesse and Sebsebe Demissew (1992), (Dawit Abebe and Ahadu Ayehu (1993), Beyene Petros *et al.* (1993), Abbink (1995), Zemedet Asfaw (1999), and Murutse Giday (1999). This shows that there is an increasing interest among scientific institutions, biological research societies in the rational use and sustainable management of medicinal plants, plant parts and or active ingredients (FAO, 1983; Asfaw Debella *et al.*, 1999). The rediscovery of the virtues of medicinal plants is particularly evident in the developed world because medicinal plants are important for pharmacological research and drug development, not only when plant constituents are used directly as therapeutic agents, but also as starting materials for the synthesis of drugs or as models for pharmacologically active compounds (WHO, 1998). This has attracted research-based regulation of exploitation so as to ensure their future availability.

Similarly in Ethiopia, though there has been an attempt in investigating medicinal plant uses, and the relation between medicinal plants and indigenous knowledge about the medicinal plants and sustainable management was not studied in-depth. Recently, there is green light and the Institute of Biodiversity Conservation and Research (IBCR) has included the subject in its long range strategic research plan to inventory, collect, describe and document these

resources (IBCR, 2000) and to search strategies of conservation as part of the conservation measure in action for the entire biota.

2.5 Trends in Conservation of Traditional Medicinal Plants

Availability of Medicinal plants has been affected by a dramatic decrease in the area of native vegetation due to agricultural expansion, deforestation and urban associated developments (Jain and Namite, 1979; Cunningham, 1990; 1996). This has placed greater pressure on the remaining areas due to the effect of over-exploitation such as ring-barking, rooting off, cutting whole plant and selective cutting of preferred species, which results in subsequent die off of forest species and other vegetation (Cunningham, 1996; Cole, 1996) that habitat loss is a serious concern in the tropics as it threatens plants and animals (biological resources) even before their potential economic /medicinal use can be fully investigated. In the same study it has been indicated that tropical forests and savanna woodlands are being deforested at alarming rate.

Intense urbanization, unemployment and the ever-increasing demand on the international market have contributed to the over-harvesting of medicinal plants (FAO, 1983; Cunningham, 1993). FAO (1983) estimated that there are about 4000 to 6000 species of medicinal plants that have entered into international trade (Tuxill, 1999 cited in Mirutse Giday, 1999). Medicinal plants that have entered international trade are found in species list of threatened or endangered in the Convention on International Trade of Endangered Species (CITES)(regulates trade and use of these species) (Cunningham, 1993; Ayensu, 1983 cited in Mirutse Giday, 1999,). The trade of medicinal plants amounted to 500 millions USD in a year (Cunningham, 1993).

The natural tree populations have been and still are subject to indiscriminate destruction in Ethiopia. Shifting cultivation and traditional grazing and browsing have been practiced for centuries. This and the relentless cutting for fuel and building needs by a dense and rapidly growing population, transformation of agriculture from traditional to modern types have led to an almost complete deforestation of the Ethiopian highlands annually over several decades (De Voletter, 1991; Ensermu Kelbessa *et al.*, 1992). In areas of lower altitudes, woodlands, open bush land shrub lands which cover more or less extensive areas that harbour useful medicinal plants have been threatened by overgrazing and browsing, charcoal production, and man made fires and agricultural encroachment to these areas (De Voletter, 1991; Ensermu *et al.*, 1992).

TRAFFIC International (1998) reported that there is no much threat to the Ethiopian medicinal plants as a result of international trade. In the same report it has been shown that the only significantly recorded medicinal plant export from Ethiopia is that of *Catha edulis* which is traded primarily as stimulant (narcotic). There are certain medicinal plants such as *Embelia schimperi* Vatke (*Myrsinaceae*), *Hagenia abyssinica* (Bruce) J.F Gmel. (*Rosaceae*) and *Glinus lotoides* L. (*Molluginaceae*) (Kloos, 1976) have been over exploited for local markets. The loss of habitat as a result of deforestation is the main cause for the reduction in the quality of medicinal plants; a good example is *Hagenia abyssinica* growing in the wild.

Generally, there are some conservation measures that have been undertaken around the world aimed at protecting threatened medicinal plant species from further destruction (Cunningham, 1993). These include on site conservation (example, nature reserves and

parks) and *ex-situ* (example, seed banks, field gene banks and botanical gardens) conservation. Sri Lanka, for instance, has implemented a strong policy of *in-situ* conservation to save its valuable medicinal plants (Cunningham 1996; Lambert 1997 cited in Mirutse Giday, 1999).

In China, about 2100 species of medicinal plants are cultivated each year to counter balance depletion of the wild stock. According to Balick and Cox (1996), in India reserves have been established across the country to protect medicinal plants and ensure the sustainable supply of these resources to beneficiaries. There has been an increased tendency of conserving medicinal plants in homegardens in Cuba (Qualset *et al.*, 1997 cited in Mirutse Giday, 1999).

There are some cases that there is a tradition of cultivating plants from the wild in homegardens for their medicinal use in Ethiopia (Zemedu Asfaw, 1998). This report indicated that from the species purposely maintained in homegardens, about 6% are primarily cultivated for their medicinal value and that in Ethiopia homegardens can play a role in easing the pressure on those plants that are scarce in native vegetation.

The effort being made by the Institute of Biodiversity Conservation and Research is minimum, which involves exploration, collection and identification, and plans to conserve these resources in *ex-situ* in field gene banks and botanical gardens and seed storage in cold storage facilities. There is also recent development to reorganize and strengthen the Department of Traditional Medicine as Drug Research Department under Health and Nutrition Department of the Ethiopian Health and Nutrition Research Institute (Asfaw Debele *et al.*, 1999). This contributes to the conservation effort by bringing some of the well

known medicinal plants into cultivation. In addition to this, the general conservation activities across the country by different stakeholders and institutions will also have positive impact to conserve medicinal plants.

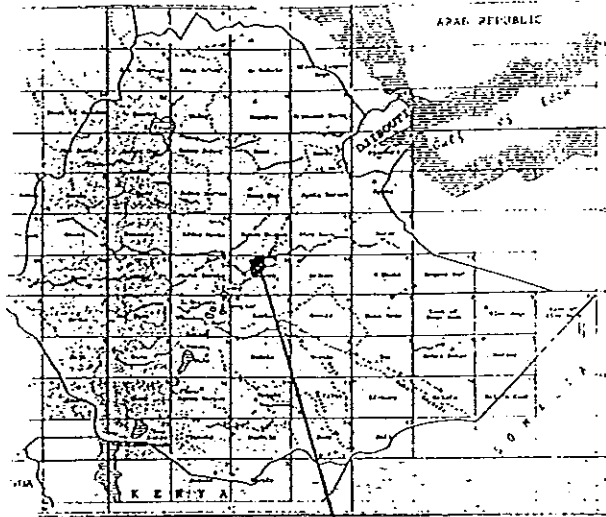
3. DESCRIPTION OF THE STUDY AREA

3.1 Description of the Environment and Environmental Factors

3.1.1 Geographical location

The study was carried out in Oromia Region, northeastern Rift Valley of Ethiopia east Shewa Zone in 'Boosat' Wereda. The study area lies between latitudes 8°25' and 8°50' N and longitudes 39°16' and 39°50'E with a total area of about 151,406.66 hectares (Fig. 1). The eastern and southeastern part of the wereda is lowland with an elevation range of between 1100 and 1400 m.a.s.l (East Shewa Zone Planning and Economic Development (ESZPEDD), 1999). The altitude range of the southern part of the wereda is between 1600 and 1800 m.a.s.l. With mountainous hilly steep escarpments rising to an elevation of about 2447 m in case of mount 'Boosat Gudda' ". Westward to Welinciti the elevation increases gradually to an altitude of 1800 m. The study sites fall in altitudinal range of 1100 m.a.s.l and 1800 m.a.s.l.

Amhara Region in the northeast, Fantalle Wereda in the east, Adama and Lume Weredas in the west and Arsi Zone on the south and southwest border 'Boosat'. Awash River delimits 'Boosat' and Arsi Zone on the south and southwest for about 70 Km distance (ESZPEDD, 1999). The administrative town of 'Boosat' Wereda is Welinciti, which is located about 123 km east of Addis Ababa and about 24 km east of Nazareth (Fig, 1).



'Boosat' (BOSET) WOREDA

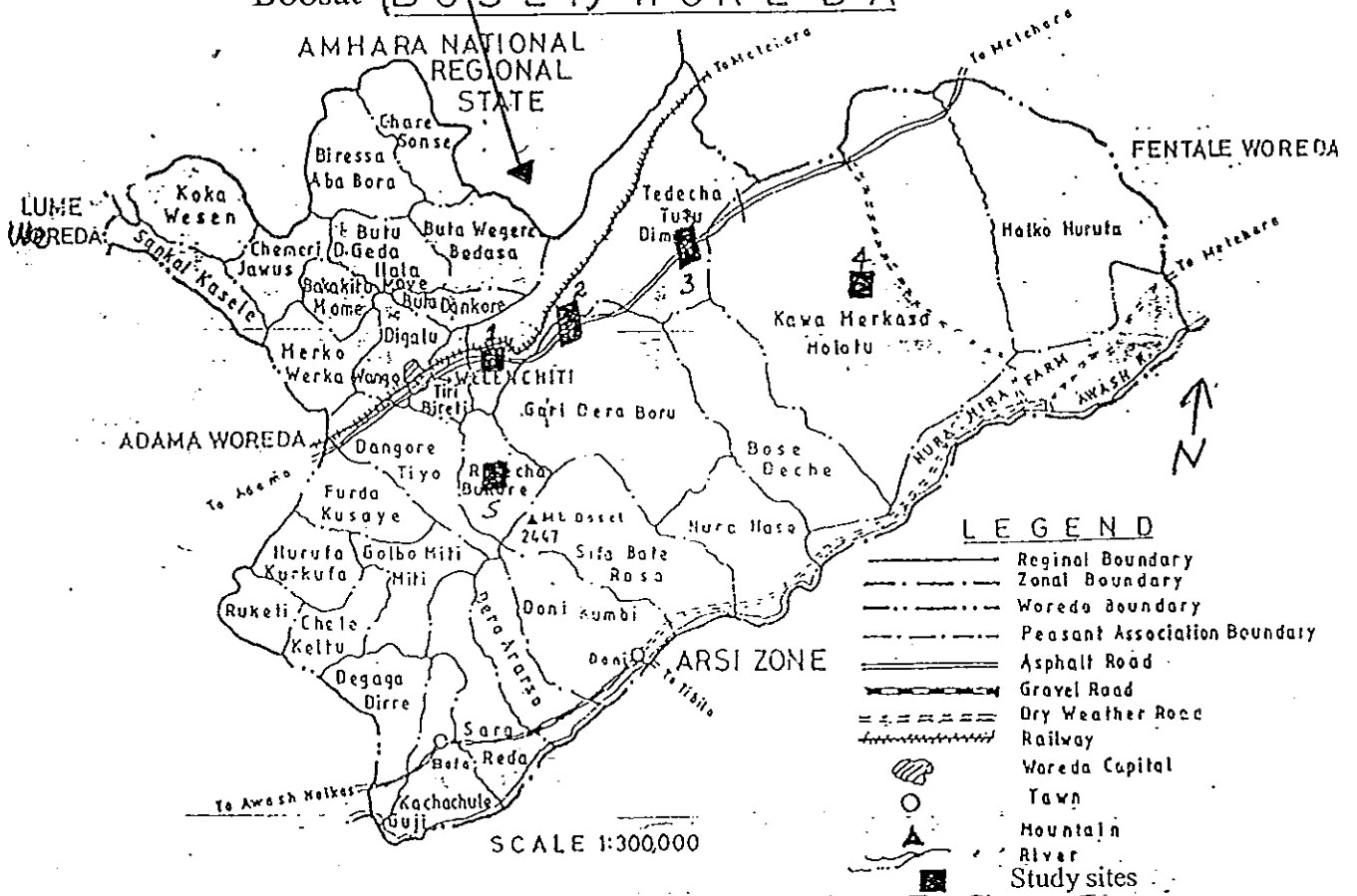


Figure 1. Map of the study Area Modified with Kind Permission of East Shewa Zone Planning and Economic Development Department (ESZPD D) (1999)

3.1.2 Geology and physiography

The landmass of Ethiopia as elsewhere is the result of the combined effect of geological processes from Precambrian to Cenozoic eras. The formation of the Rift Valley is the main feature of the Ethiopian landform (Mesfin Wolde-Mariam, 1972). According to Mohr (1971) and Mesfin Weldemariam (1972), the base of this country consists of intensively folded and faulted Precambrian rock overlain by subhorizontal Mesozoic and Tertiary basalt traps.

The present day physiography of Ethiopia is broadly determined by the uplift of the Arabo-Ethiopian swell and its subsequent bisection by the Rift System (Mohr, 1971). Outpouring of huge quantities of lava, predominantly basaltic which is the result of extensive Quaternary volcanic activities due to tectonic disturbances has taken place (Mohr, 1971). The Rift Valley depression floor of Rift System is affected by several tectonic and volcano- tectonic features such as " enechelon" or rays of faults and grabens partly destructed and preserved calderas, elongated domes and aligned spatter cones (Alula Damte, 1990).

The study area consists of a more or less Pleistocene to subrecent basaltic rocks of vesicular type with very coarse Plagioclase and olivine crystals, which are slightly weathered at the top (Kazmin and Seife Michael Berhe, 1978). Mohr (1971) reported the age of the basalt as 3.5 to 0.9 million years while Kazmin and Seife (1978) reported the lower age limit to be 2.8 to 2.5 million years.

Porphyritic basalt with feldspar phenocrysts is seen east of Welinciti on the roadside (Morton, 1978). In the same study it has been shown that several basaltic scoria cones can be seen about 10 kms east of Welinciti along the track to Bofa south of Welinciti.

Rocks in Sodere area are made up of recent aphyric basalts dating to the beginning of Pleistocene up to recent (Holocene) (Kazmin and Seife Michael Berhe, 1978.). The hot spring of Sodere emerge from the bottom of a hill made of hyalite and obsidian and can also be found within the rhyolite at few places (Morton, 1978). In the same work it has been shown that north- east of Sodere along the Awash River basalt flows can be seen. Several scoria cones found between Sodere and mount 'Boosat Gudda' and 'Boosat Bireecha' is mainly made up of rhyolite lavas with some agglomerates, tuffs pumice and basalt. Hence, the geology and physiography of the area is more or less similar with the geology and physiography of the main Rift System.

3.1.3 Soil

The physical and chemical properties of soils have a significant influence on the occurrence and distribution of plants. Some plants strictly prefer or are confined to certain kinds of soils. Soil classification is based on physico-chemical, morphological and other soil properties (Mesfin Abebe, 1998).

According to FAO-UNESCO (1988) classification weakly developed Xerosols, undifferentiated sand and volcanic materials commonly dominant lowland soils (Coppock, 1989). Alike areas in the northeastern Rift Valley, soils in 'Boosat' mainly include Vertic Andosols, Eutric-Fluvisols, Eutric Regosols, Lithosols and Utric-Cambisols, Luvic Phaeozems and Haplic Phaeozems (MOA, 1998) and Ethiopian Mapping Agency (E MA) (1988).

Pellic and Chromic Vertisol and Utric Fluvisols occur on the lowland plains (UNDP/FAO, 1984). The steeper landforms of 'Boosat' are Cambisols predominated by Lithosols with lithic phases occurring on the steepest slopes. The dominant soil textures of 'Boosat' are clay soil, silty soil, sandy soil and sandy loam (Murphy, 1959; 'Boosat' Wereda Agricultural Development Office (BWADO), 2000). Murphy (1959) has shown that the soils when dry range from pale-brown-gray to grey-brown or brown, dark brown to grey brown. Soils of Nura Heera area are largely sandy loam including the flooded area of west Welinciti and lowland plains northeast of Sodere along the Awash River (BWADO, 2000). The same report has shown that the maximum soil depth is 75 cm and the minimum is 10 cm. Murphy (1959) has reported an effective depth of 25-50 cm and average P^H range of 7.3 to 8.0.

3.1.4 Climate

'Boosat' faces the humid air currents coming from the Atlantic Ocean and receives heavy rainfall during the main rainy season. Analysis of rainfall and temperature data obtained from Nazareth showed that 'Boosat' is located in semi-aride climate of Rift Vally System. Highest mean monthly rainfall has been recorded in months of July to September. The highest rainfall was recorded in August (219.95 mm) and the lowest in December (4.5 mm). Amount of rain gradually increases from March to May and sharply falls from October to December (Fig. 1).

High mean monthly temperature have been recorded from April to June. The highest was 23.3⁰C in June and the lowest mean monthly temperature was 18.9⁰C. The climate of 'Boosat' could have been explained better if data from Metahara has been obtained and extrapolated with data from Nazareth climatic data. The Nazareth data is used because it is about 24 kms far while the station at Metahara is 80 kms far.

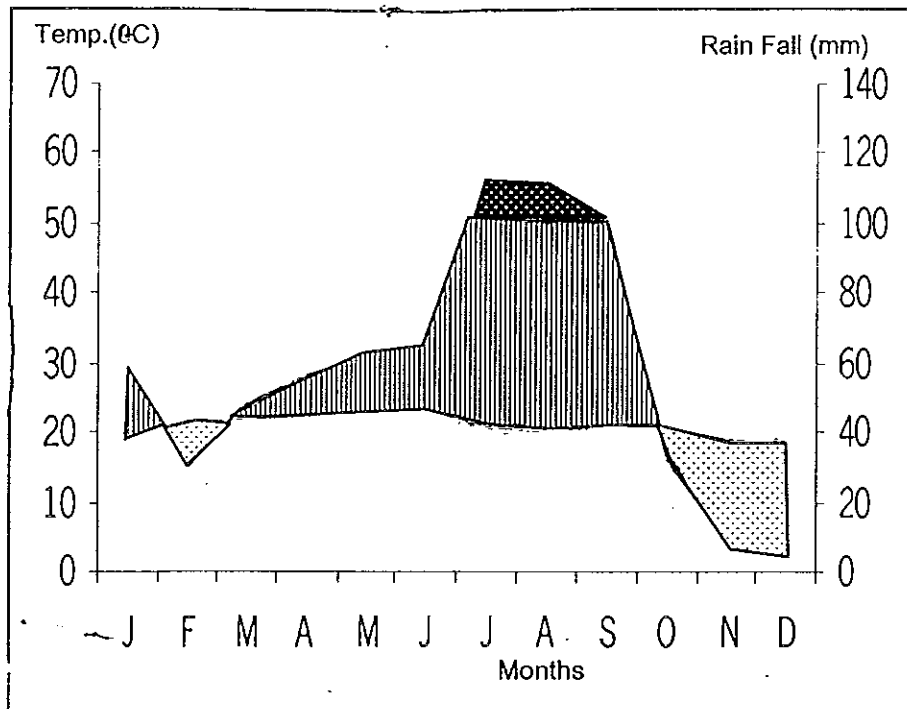


Figure 2 Climdiagram of 'Boosat' Wereda following Walter (1967)
Data obtained from NMSAE (2000)

3.1.5 Vegetation

Vegetation of 'Boosat' lies in the *Acacia-Commiphora* (small leaved deciduous woodland) in the Somalia-Maasi Regional centre of endemism (White, 1983; Tewelde B. Gebre Egziabher, 1991; Ensermu *et al.*, 1992). This is also in agreement with studies made by Zerihun Woldu and Mesifn Taddesse (1990), Sebsebe Demissew (1998) and Zerihun Woldu (1999). This regional vegetation type occupies a large part of mainland Africa between 16°N and 9° S and 34° and 51°E.

Over most of the study area the vegetation has been disturbed by cultivation, commercial production of charcoal, collection of fuel and construction wood, intensive grazing and

browsing pressures (BWADO, 2000). There were no settlements on roadsides to 'Welinciti' except temporary shelter erected for the sale of charcoal prepared from the surrounding vegetation (Isaac Habtemariam, 1984). These days there are settlements and charcoal production is intensified. Furthermore, it can be described as a mixture of cultivated land, open grassland with trees like *Acacia spp.*, *Balanites aegyptiaca*, *Commiphora africana* and *Ziziphus spina-christi*. According to BWADO (2000) report, natural vegetation of the area has been declining at a fast rate. The area is sensitive to overgrazing since the area is dry for most of the months of the year. Deforestation for expansion of agriculture and fuel wood and charcoal production targeted for urban centres like Nazareth and Addis Ababa has affected the natural vegetation.

3.1.6 Livestock

Livestock population of the area is significant. According to BWADO (2000), the wereda possesses 432,374 livestock population consisting of cattle, 111, 624; sheep, 50,686; goat, 138,439; horse, 633; mule, 572; donkey, 35,033; camel, 5,928 and poultry, 89,459. There are problems like shortage of grazing and browsing land adequate veterinary health services and facilities. People try to treat their livestock by ethnoveterinary medicine. The outbreak diseases are anthrax (abbasanga) and black leg (abbagorba), which affect large ruminants including equines. Sheepox (Fiinoohoola) in sheep is caused by bacteria and it disintegrates the skin. CCPP (Contagious Caprine Pleuroneumonia) it affects goat's lung (respiratory tract). It causes fast breathing sometime diarrhoea and it is an acute disease. Newcastle (fengil) affects poultry there is no treatment or vaccine provided for this disease in this area. MCF (Malignant Catteral Fever) it is viral disease, which is rarely observed. No disease outbreak so far reported in the area on camels but many internal parasites (BWADO, 2000).

Non-out break diseases include internal parasites, protozoal diseases and ectoparasites (example, ticks).

Infectious diseases include viral and bacterial among others. Veterinary health service coverage is less than 50%. The underlying reasons reported by BWADO (2000) are shortage of material, manpower, medicine and logistic support.

3.2 Interaction Between Humans and the Environment

3.2.1 Population and settlement

People belonging to the Oromo nationality make the majority of those living in 'Boosat' Wereda. The total population of 'Boosat' is about 126,886 (65633 male and 61253 female) (BWADO, 2000). Of the total population, 92991 are living in rural and 23579 in urban centres. Areas with 1300 m high and above are relatively more densely populated than areas below this range of altitude. There are two major types of settlements: (1) the settled farmers whose life is completely based on cropping and livestock rearing. They constitute the largest proportion of 'Boosat'; (2) the Karrayu transhuman pastoralists settle (stay) in lowland plains of 'Boosat' particularly Borcota and Xaddacha Bal'aa with their camel during the months of June to November. Immediately following harvest of field crops they move back to lowland plains of 'Boosat' and Fantalle- Matahara area.

The settled farmers at lowland plains of 'Boosat' move their cattle to highland places during the dry seasons. This is a difficult time for them, as the livestock need to move long distance for drinking water daily and households remain sedentary. This type of life style is known as

pastoral and agro pastoral life style (semi-nomadic) with herds being mobile and household more sedentary (Caseins and Upton, 1987 cited in Copock, 1989).

3.2.2 Land use

Crop production and livestock rearing (pastoralism) are the main activities of the population of the wereda excluding those in urban centres. BWADO (2000) annual report showed 39309 hectares of land are used for farming purpose by settled farmers. Individual farmers production is for household consumption and local markets. Agricultural production is based on rain fed cultivation and individuals living near Awash River practice minor irrigation.

Major food /agricultural crops grown by farmers are largely field crops. These include *Zea mays* L., *Eragrostis tef* (Zucc.) Trotter, *Phaseolus vulgare* L., and *Sorgham bicolor* (L.) Moench. These are grown in almost all parts of the wereda. *Hordeum vulgare* L. is grown in northwestern and southwestern part of Welinciti at relatively higher places. From vegetables: *Lycopersicum esculentum* Mill. and *Allium cepa* L. are common. *Solanum tuberosum* L. is also recorded from the root crops.

3.2.3 Human health problems and medical services

The first 10 major diseases identified and reported by the 'Boosat' Wereda Health Service Office (BWHSO, 2000) are: malaria, pneumonia, intestinal parasite, diarrhoea, acute respiratory disease, gastritis, tonsillitis, acute febrile illness, anaemia and conjunctivitis in order of their prevalence. These diseases mostly affect children and mothers (BWHSO, 2000). The health facilities are below that is required to cater for the population. BWHSO

(2000) has shown that 58,087 people of the wereda can be assisted by this service, which covers only 56.5% of the population. The service does not cater for 44.5% of the population.

4. MATERIALS AND METHODS

4.1 Sampling Study Sites

During feasibility study in July 2000 it was found that people in the study area lead two types of lifestyles: the settled farmers and transhuman pastoralists. This fact was taken into account when deciding the sampling sites for data collection. Preferential sampling was made to include the areas inhabited by settled farmers and transhuman pastoralists. The five sampling sites were identified and this included (1) Feexo, (2) Xaddacha Bal'aa, (3) Hare Bona, (4) Nura Heera area (Qawa Gaba) peasant association), (5) Rukecho Bokure, all shown in Fig.1.

4.2 Sampling Informants

In this ethnobotanical study 80 individuals (73 men and 7 women) between the ages of 15 and 75 were involved by randomly sampling 16 individuals each from the five sample sites. Number of women is minimum because they are not free to exercise their indigenous knowledge. From the five study sites a total of 31 key informants were selected; 5-6 persons from each study site (Appendix 3). When recording specialized knowledge held by traditional healers or by certain social groups such as children, women or the elderly the choice of key informants is dictated (Martin, 1995). Accordingly, the selection of key informants was made preferential methods to include at least one to two traditional medicinal practitioner(s) in each study site. The interviewed people and key informants were selected with the assistance of local farmers and development agents. Religious leaders (e.g. Hajiis), leaders of transhuman pastoralists and elders also helped in the identification of informants. Information obtained was separately recorded and finally clustered for analysis.

4.3 Ethnobotanical Information

Ethnobotanical data was collected between August 2000 and March 2001 on four field trips made to the sites based on methods given by Hedberg (1993), Martin (1995), Maundu (1995) and Cotton (1996). Accordingly, semi-structured interviews, observation, group discussion guided field walks with key informants were employed. Ethnobotanical / ethnomedicinal information was also gathered from traditional medicine practitioners, selected knowledgeable elders and other individuals from different age groups, sexes, settled farmers and transhuman pastoralists. These people were involved during the whole period of investigation as guides, informants and some of them also helped in collecting the samples of medicinal plants. The interviews and discussions were based on and around a checklist of topics or questions prepared before hand (Appendix 4). Most of the interviews and discussions were held in Afaan Oromo (Oromiffa) directly by the investigator. Interviews were conducted in a place where the informants were most comfortable and during the time they have chosen. Information was gathered by speaking to many of the village residents other than informants on an informal basis to corroborate the ethnomedicinal data and to gather additional information.

Information regarding local names of medicinal plants, part(s) used, methods and conditions of gathering and preparation, disease treated, dosage used, route of application, adverse effect, uses other than medicinal uses, its management by indigenous people, marketability and distribution in local vegetation was collected. Local names of plants were studied by repeated inquiries at different times with same informants so as to check the accuracy of information obtained. This information was recorded on the spot on the field notebook.

Discussions were conducted with 10 to 15 informants and residents in seeking to understand the traditional medicinal system of the people and its management to know how knowledge is maintained in a family or community.

During the course of the study, each informant was visited at least three times in order to verify the accuracy of data obtained. If information recorded during the first visit concerning the use(s) of a particular medicinal plant and other information like local vegetation and landscape classification by indigenous people did not agree with what was told during the second, third and 4th visit, the information was considered inaccurate and had been discarded. Repeated visits also helped to get friendly and open interaction (formal and informal) between researcher and indigenous people of the study area. Furthermore, it has helped to get some additional information that was not mentioned during the previous interviews. Literature review and field notes on herbarium sheets with plant specimens housed at the National Herbarium, Science Faculty, Addis Ababa, substantiated the information obtained from local people.

At the end of the interview, specimens of the plants cited for their medicinal use and other plants found to be major components of the vegetation of the study area were collected, dried, identified and described. Voucher specimens for all the medicinal plants studied were stored at the National Herbarium, Science Faculty, and Addis Ababa (Appendices 1 and 2 for medicinal plants, Appendix 7 for species other than medicinal plants). For the identification specimens taxonomic keys, various Floras, related literature sources and herbarium materials were used. Lastly, the identifications were confirmed by consulting senior taxonomists at the National Herbarium.

Ethnographic interviews are meant to draw out categories of meaning, eliciting what people think, and how one person's perceptions compared with others. Consequently, it is useful to map out shared values in the community and more specifically values that influence behaviour of knowledge transmission from generation to generation (Hardon *et al.*, 1995). Interview was made to compare knowledge of medicinal plant uses and management, i.e. its depth and breadth between the age groups 15 to 40 and above. This was implemented by separately interviewing every member of the two groups as convenient for them.

After identifying the five most effective plants based on their use values as perceived by the whole range of informants, paired comparisons were done as described by Martin (1995) and Cotton (1996). The paired comparisons of the five most effective plants in treating malaria were done using random number table and flipping coins. Ten informants were randomly selected from the key informants and allowed to show their responses independently for pairs of traditional medicinal plants noted for treating malaria.

- ✓ According to Martin (1995), preference ranking is one of the analytical tools that is used for comparing few number of items in a category which is the focus of the research or of an issue being discussed in the community. Accordingly, preference ranking technique was employed to rank some selected medicinal plants based on the degree of their effectiveness in treating snake poison. In this case ten randomly selected key informants ranked medicinal plants according to their degree of effectiveness in treating snake poison. Each rank is given an integer value 1, 2, 3, 4 and 5 and with the most effective one is given the highest value (five), while the least important is assigned a value of one. Finally, these numbers were summed for

all respondents, giving an overall rank for the species. By ordering according to choice, it can be found that the most favoured species are usually the most efficacious, at least in the context of the people who use them.

⇒ 4.4 Description of Medicinal Plant Species

Medicinal plants that are widely used and received about 44% or more of the informants' consensus were described. The description was made to include, the habitats in Ethiopia and elsewhere, the medicinal uses, mode of preparations and applications.

4.5 Vegetation Description

Two approaches were used in describing the vegetation of the study area. On one hand, information was gathered from informants following the emic categorization technique i.e categorization by indigenous people based on their own indigenous knowledge. On the other hand it was described and classified by visual observation following the etic classification technique of ethnobotany as described by Martin (1995). In the latter case morphological characteristics or general appearance of vegetation such as growth and life forms of the dominant or co dominant plants were focused upon. This approach has been extensively used to characterize vegetation (Grabher and Kojima, 1993; Martin, 1995). Whenever possible and time is enough very effective way of detecting spatial and temporal changes of vegetation in detail is by analysis of vegetation formations. For the present study vegetation classification by visual observation was preferred as a fast means of describing vegetation of the study area. This was supported by collection, identification and documentation of dominant and co-dominant species of the vegetation as visually recognized.

4.6 Data Analysis

A descriptive statistical method was employed to summarize and analyse the data on medicinal uses and management of plants and the knowledge associated to them. Paired comparisons of five most effective medicinal plant species used to treat malaria and preference ranking were done for another five most important medicinal plants used in treating snakebite (poison).

By clustering the responses of the ten individuals further analysis was made based on methods given by Martin (1995) and Höft *et al.* (1999) using computer programme known as Statistica (Ollevier, 1993). The linkage distance between responses was obtained and dendrogram is drawn (Fig. 5) to show similarities and differences of the responses of 10 respondents in the paired comparison.

5 RESULTS

5.1 Indigenous Knowledge

5.1.1 Landform classification by indigenous people

The landforms, rivers, gorges, plains and mountain ridges have spiritual, cultural and symbolic importance for people living in 'Boosat'. For instance, 'Tullu Boosat Gudda' in 'Boosat' Wereda has many implications. According to the indigenous people's perception 'Boosat' means it is real or true, trustworthy and respected. On the other hand it is a place where a man of spirit known by the name 'Boosat' has lived for a long time and people worship the place to date.

Landform classification by the people is based on time-tested experience that has been passed from family and community through generations. In the present study it was found that indigenous people of 'Boosat' are endowed with knowledge of landform types and they identified the following nine major landforms:

1 'Tulluu'- refers to sharp or very high-elevated land that is unsuitable for grazing or browsing as well as for farming. It is also called 'Qarree' or 'Gaara Qarree'.

2. Gooba ciisaa or Dirree Tabbaa-refers to landform that is suitable for settlement, cultivation, and livestock grazing or browsing. It is a highland plain mostly covered by grasses with sparsely distributed shrubs such as *Premna resinosa*, *Acalypha fruticosa*, *Acacia tortilis*, *Acacia seyal* and *Ximenia americana* bushes.

3. Dirreetti or Lafa Wal Qixaataa bu`aa bahi hinqabne-indigenous people reported this as suitable for cropping and settlement than landform types 1 and 2. It is levelled plain land that is suitable for both agriculture and if managed for pastureland.

4. Olmaa loonii/horii (Mataa bobbaa)-refers to an extensive area, which is not suitable for

agriculture in most cases. It is left aside by the community for grazing and browsing by livestock. It is open grassland with *Acacia seyal*-- *Balanites aegyptiaca*, *Acacia tortilis*-*Ziziphus spina-christi* woodland and other shrubs and herbs as observed in the study area.

5. Lafa Qonnaa (Oyiru) or Maasaa-refers to landform that serves for cropping. It is cultivated land or land that can be cultivated.

6. Gaara bu`aa bahii dugda dheeratu-refers to highland plain with undulating hills. It is not recommended for settlement, cropping and even for pasture.

7. Horroo (lafa dhakaa gudatuu horiin keessa dheedu garanaa garanaa qilee qabuu)-refers to rocky landform or plain with gorges on different sides. It is not densely forested and it is suitable for livestock grazing and browsing.

8. Qilee-refers to gorges. These are of two types. If the gorge is shallow, it is simply called **qilee**. If it is a deep gorge, they call it **qilee fago**. Livestock entering such gorge could not be reclaimed because people can't get down to the bottom of such gorges to find them out. This landform is mostly covered with shrubs and herbs, for instance, the gorge at the base of Tullu Usadde.

9. Katankata-refers to highly stony rough terrain with scattered secondary bushes. The indigenous people call it unproductive land since it has been proved to be so in any agricultural trial they have made.

These nine landforms are easily recognizable on the basis of the descriptions provided by the local people. This is important in land capability and land use classification and hence it has to be blended with modern systems land use classification.

5.1.2 Soil classification by indigenous people

Indigenous people classify (name) soil based on colour, texture and suitability for cropping. The local people in 'Boosat' identify the following five major soil types:

1. **Gonboree (biyyee diimaa)** – refers to red clay soil.
2. **Kootichaa (biyyee guraacha)** –refers to black soil (vertisol).
3. **Basaqa (cabii jireen)** -some people call it `Qilinxoo` because it carries a plant known as Qilinxoo (*Macaranga capensis*). The equivalent scientific term for this is basaltic soil. The vegetation on such soils is not suitable for cultivation and grazing except for browsing by some livestock species (example goats).
4. **Shakisee**–refers to fine sand soil with silt. It is not suitable for many types of crops, except for few such as *Phaseolus vulgaris*. It is common in erosion prone areas of `Boosat`.
5. **Cirracha (hoofiyye)**-refers to alluvial soils that are the result of deposition by erosion. This is carried from high land area by water erosion. These soil types are also easily distinguished based on the description of the local people and are useful in deciding cultivation of specific crops.

5.1.3 Vegetation classification by indigenous people

According to key informants vegetation of this study area is classified on the basis of density of plants that cover the landform. In the present study the local people identified the following five major vegetation types:

1. **Huura/Bosona nama dhoksu / dukana`a**-This is the name used by settled farmers. This type of vegetation is called **dhibu** by transhuman pastoralists. This refers to densely forested land. The people consider it as home for wild animals including game animals. This type of vegetation has declined nowadays in the study area because of degradation by human

activities, over grazing, browsing, and natural factors (example climate change). Few remnants are found in southeastern parts of Xaddacha Bal'aa, Gari Qimxano and Rukecho

Bokure.

2. **Raasa (lafa qotamu danda`u)** –refers to sparsely wooded land with very little woody shrubs (example *Acalypha fruticosa*, *Grewia spp.*), standing trees in open field include *Acacia spp.*, *Ziziphus spina-christi*, *Ziziphus mucurinata* and grasses.
3. **Xanxalcha**-refers to bare land without vegetation cover except very negligible grass cover during wet season.
4. **Dhiibuu lagaa** –refers to riverine forest. It is relatively covered with both woody and herbaceous vegetation
5. **Gooba**-refers to land with sparsely distributed, *Acacia senegal-Balanites aegyptiaca*, *Acacia tortilis-Ziziphus spina-christi* and abundant *Acalypha fruticosa* shrubs. With careful observation and following people's descriptions these vegetation types can also be recognized.

5.1.4 Vegetation of the study area as examined visually

Through careful visual observation vegetation types were recognized. The types recognized fall into eight groups. These are named based on the dominant tree and shrub species. The naming of the types could change if conventional ecological methods are followed.

1. ***Acacia albida-Ziziphus spina-christi*** woodland vegetation. This vegetation type is characterized by open woodland with standing trees. The major species observed, collected and documented include *Acacia albida*, *Acacia tortilis*, and *Ziziphus spina-christi* and *Commiphora africana*. These are mostly cut for charcoal, fuel wood and construction material. At present this vegetation type is on the processes of being converted into shrubby

or bushy vegetation. This area includes seasonally flooded plains west of Welinciti. *Croton macrostachyus* is also observed at the base of Tullu Usade on grazing lands and farm borders. Eventhough most of this area is dominated by farmland; the southwestern part (area 1500 to 1750 m) is also covered with some trees of *Rhus vulgaris*, *Acokanthera schimperi*, *Olea europaea* ssp. *cuspidata*. The shrubs and herbs include species such as *Grewia bicolor*, *Capparis tomentosa*, *Phyllanthus maderaspatensis*, *Cyphostemma adenocaule*, *Eleusine africana*, *Solanum indicum* on roadsides, *Achyranthes aspera*, *Justicia carulea*, *Ocimum urticifolium*, *Leonotis neptifolia*, *Verbascum sinaiticum* and *Acalypha fruticosa*. The soil of this area is dominated by fine sand and silt.

2. *Euphorbia nigrispnoides* vegetation. It covers the area up to 8 kms east of Welinciti (Sogiddo area). The original vegetation of this area was probably containing abundant *Ficus vasta* as there are still relic trees standing in this vegetation. The shrubby layer includes *Euclea racemosa* *Grewia tenax*, and *Grewia biclor* and other *Grewia* spp., *Aloe* spp, *Premna resinosa*. The disturbed roadside is dominated by *Rumex nervosus*.

3. *Acacia senegal* thicket. This vegetation type covers the area 14 to 28 kms east of Welinciti. This includes wide area of Xaddacha Bal'aa Hare Bonnaa. Some *A. tortilis* and *A. nilotica* trees are observed on roadsides indicating that the area was previously dominated by *A. tortilis* woodland, which is now replaced by *A. senegal* because of over use of the original species for charcoal. Other species include *A. seyal*, *Balanites aegyptiaca*, *Dichrostachys cinerea*, and *Combretum adenogonium*. The major shrub species include *Cissus quadrangularis*; *Grewia villosa*, *Grewia flavescens*, *Premna resinosa*, *Solanum* spp and abundant growth of *Acalypha fruticosa* and scattered individuals of *Indigofera amorphoides*,

Indigofera oblongifolia and *Aerva javanica* were observed. Among the major grasses were *Melinis repens* and *Chrysopogon plumulosus*. This vegetation has been reported by Isaac Habtemariam (1984) in two of the five stands studied.

4. *Boswellia papyrifera* dominated woodland. This is observed on both sides of the main road 10 to 13 kms east of Welinciti. The shrubby layer includes *Euphorbia nigrispnoides*, *Acacia tortilis*, *Acacia senegal* thickets.

5. *Acacia senegal*-- *Acacia tortilis* dominated vegetation is observed at 34 kms east of Welinciti on Metahara road including the area about 2 kms towards south on the road to Nura Heera. The shrubby layer includes *Grewia spp.*, *Cadaba farinosa*, *Acacia oerfota* and *Acalypha fruticosa*.

6. *Pistacia falcate* dominated vegetation related to the caldera. The major species include *Combretum molle*, *Macaranga cappensis*, *Pavetta gardenifolia*, *Ozoroa insignis*, *Terminalia brownii* and *Combretum adenogonium* (Appendix 6). From the shrubs *Grewia spp.*, *Capparis cartilaginea* are common. This vegetation is not rich in under growth species and covers 15 to 25 kms distance of the area largely on south east of the main road along Metahara and Nura Heera area.

7. *Acacia seyal*-*Acacia tortilis* vegetation. This vegetation covers a wide area east of caldera vegetation after 10 kms from the detachment from Metahara road on the road to Nura Heera. Other species include *Ximenia americana*, *Ehretia cymosa*, *Grewia spp.*, *C. quadrangularis* and *Terminalia* species are rarely observed.

8. *Acacia tortilis-Balanites aegyptiaca* woodland. This vegetation is largely observed on alluvial deposits at lowland areas of Nura Heera (Appendix 6). The major species observed are *Berchemia discolor*, *Ehretia cymosa*, *Terminalia brownii*. The shrub and herbaceous species include *Grewia bicolor*, *Cissus quadrangularis*, *Solanum indicum*, *Solanum glabratum-Solanum somalense*, *Solanum renschii*, *Senna occidentalis*, *Leucas inflata*, *Seddera arabica*, *Capparis tomentosa*, *Cadaba farinosa* ssp. *farinosa*, *Tribulus cistoides*, and *Acalypha fruticosa*. The roadsides are rich in under growth like *Achyranthes aspera*, *Xanthium strumarium* and *Solanum indicum*. Ritually protected *A.tortilis* trees (Fig.4) are not included in this classification because they are largely managed by humans near villages.

The west hillsides of this area have the abundant trees of *Boswellia papyrifera* and *Terminalia brownii* among other species indicated above in this vegetation. *Acacia tortilis-Balanites aegyptiaca* vegetation covers wide area of Nura Heera (Qawa Gaba, Qarsa and Karra). The undulating hillside of Karra is mostly dominated by rocks and vegetation, which includes: *A. senegal*, *A. tortilis*, *Ehretia cymosa* and major grasses such as *Chrysopogon* and *Melinis*. This area is mostly used for grazing and browsing.

5.1.5 Distribution of medicinal plants in vegetation types

The result of the study showed that most of the herbal medicines utilized by indigenous people are obtained from native vegetation (Table 1). Most of the medicinal herbs are found in *Acacia tortilis-Balanites aegyptiaca*, *Acacia albida-Ziziphus spina-christi* woodland, grazing lands, and farmlands. Most of the shrubs are identified and collected from woodlands, roadsides and rocky (stony) surfaces and scattered in woody shrubs and

secondary forests. The climbers are mostly found in woodland, shrublands and secondary forests. Some of them could be found on hedges, live fences and farm borders. The tree species are found in open woodland, farm borders, in farmlands, roadsides, hedges, and live fences and in ritually protected areas (the local people call this muka jari). Medicinal plants like *Lens culinaris*, *Nicotiana tabacum*, *Lepidium sativum*, *Ruta chalepensis*, *Withania somnifera*, *Catha edulis*, *Jatropha curcas* are restricted to farmlands, farm borders, live fences and some of them to homegardens. Total numbers of medicinal plant species identified are given in Table 1 and Appendices 1& 2 and collection numbers of the studied species are given in Appendix 5. List of the species studied outside medicinal plants are given in Appendix 7.

Table 1 Vegetation Types and Total Number of Species Documented from Each Vegetation Type

Vegetation Type	Total Number of Species Identified
<i>Acacia tortilis</i> - <i>Balanites aegyptiaca</i> woodland	33
<i>Acacia albida</i> - <i>Ziziphus spina -christi</i> woodland	31
<i>Acacia senegal</i> - <i>Acacia tortilis</i> dominated woodland	16
<i>Acacia seyal</i> - <i>Acacia tortilis</i> and <i>Cissus quadrangularis</i>	21
<i>Acacia senegal</i> thickets	12
<i>Boswellia papyrifera</i> woodland	4
The caldera vegetation (<i>Pistacia falcata</i>)	9
<i>Euphorbia nigrispnoides</i>	9

5.2 Ethnobotanical (Ethnomedicinal) Information

5.2.1 Basic information on medicinally useful plant species

In the present study, 81 species of traditional medicinal plants were identified as used by the indigenous people of 'Boosat' (Appendices 1 and 2). They represent 34 plant families (Table

2), 65 genera, 79 dicotyledons and 2 monocotyledons. Ninety-nine percent (80 species) of the medicinal plants local names in Oromiffa were documented. Very few people knew these plants by other languages like Amharic or Afar. Analysis of the data on medicinal plant showed that most of the remedies are collected from the wild when needed. Medicinal preparations for treating snakebite, cobra and python's attack are preserved and made available for immediate application. Some of the major species used in this method are *Cissus quadrangularis*, *Senna occidentalis*, *Indigofera amorphoides*, *Bidens pilosa* and *Andrachne aspera*.

Informants' consensus during repeated interviews showed that, 49 of the medicinal plants are used for treatment of two or more ailments. There was a big argument as to the medicinal uses of *Parthenium hysterophorus*, one of the invasive weed species in the Rift Valley. Sixty five (80.3%) of the informants did not agree on its medicinal uses rather they capitalized on its poisonous effect on cattle milk, depleting fertility of the soil and invade grasses on grazing lands. The transhuman pastoralists recommend it as a remedy for diarrhoea and tonsillitis. All informants recognized the anti-pest value of the leaf juice. The juice kills bed bugs and cockroaches. In spite of its medicinal use all informants agree to destroy this plant from their locality while striving not to lose most of the medicinal plants, which are indigenous.

Table 2 Families of Medicinal Plants and Number of Species Used for Humans and Livestock

Family	No of Species Used as		Total
	Human Medicine	Livestock Medicine	
Acantaceae	—	1	1
Amaranthaceae	2	1	3
Anacardiaceae	—	1	1
Apocynaceae	1	—	1
Asclepiadiaceae	1	1	2

...Table 2 continued

Asteraceae	4	—	4
Balanitaceae	—	1	1
Boraginaceae	4	—	4
Brassicaceae	1	—	1
Burseraceae	1	—	1
Capparidaceae	2	2	4
Celasteraceae	1	—	1
Combretaceae	—	1	1
Convolvulaceae	1	—	1
Cucurbitaceae	2	1	3
Ebenaceae	—	1	1
Euphorbiaceae	4	2	6
Fabaceae	10	1	11
Lamiaceae	2	3	5
Loranthaceae	1	—	1
Malvaceae	2	1	3
Meliaceae	—	1	1
Olacaceae	—	1	1
Oleaceae	1	—	1
Papaveraceae	1	1	2
Poaceae	1	1	2
Polygonaceae	1	—	1
Rhamnaceae	1	—	1
Rutaceae	1	—	1
Sapindaceae	1	1	2
Scrophuluraceae	1	—	1
Solanaceae	2	4	6
Tiliaceae	2	1	3
Verbenaceae	1	—	1
Vitaceae	—	2	2
Total	52	29	81

5.2.2 Habit of medicinal plants and parts used

Assessment on the habits of the medicinal plants used by the community showed that shrubs accounted for 50.6% (41 species) followed by herbs 21.0% (17 species), trees 18.2% (15 species) climbers 8.6% (7 species) and hemiparasitic 1.2 % (1 species) (Table 3). The majority of these plants are collected from wild habitats in the study area. Informants explained that most of the medicinal plants are collected and used when fresh.

Analysis of the plant parts used revealed that in terms of number roots are the most widely used part accounting for 31.4% (49 species) followed by leaves 24.4 % (38 species) and the third being whole plant parts accounting for 11.5% (18 species) of the preparations (Table 4).

Table 3 Showing Habit, Total number of Species and Percentage of Habit Groups of the Total

Habit	Total No of Species	Percentage of the total
Shrubs	41	50.6
Herbs	17	21.0
Trees	15	18.5
Climbers	7	8.6
Hemi parasites	1	1.2

Table 4 Parts Used and Habit of Medicinal Plants in Medicine Preparations

Parts Used	Habit and Number of Species					Total	% of the total
	Herbs	Shrubs	Trees	Climbers	Hemi parasites		
Fruit	—	1	—	2	—	3	1.9
Seed	5	1	1	—	—	7	4.5
Leaf	9	22	7	—	—	38	24.4
Stem	2	3	4	—	—	9	5.8
Above ground	1	5	1	1	—	8	5.1
Bark	—	5	8	—	—	13	8.3
Milky exudates	—	2	—	—	—	2	1.3
Root	10	31	4	4	—	49	31.4
Whole plant	1	7	4	5	1	18	11.5
Bark and leaf	—	1	3	—	—	4	2.6
Root and leaf	—	2	—	—	—	2	1.3
Twig	—	1	1	—	—	2	1.3
Seed and leaf	—	1	—	—	—	1	0.6
Total	28	82	33	12	1	156	100
%	18.0	52.6	21.2	7.7	0.6	100	

5.3 Disease Treatments

5.3.1 Categories of diseases frequently treated

From 81 medicinal plant species that have been documented fifty-two of them are used against human ailments. They are used to treat 43 different types of diseases. Summary of the data analysis showed that 3 species are used to treat infected wound, 10 species are used for snakebite / poison, 11 species for malaria (lagida), and 4 species for gonorrhoea (Table 5). Twenty-nine species are used to treat 18 livestock diseases. Accordingly, 11 species are used to treat anthrax (abbasanga), 7 species to treat wounds of different origin in different livestock species, 4 species are used to treat lymphatic swelling in cattle, sheep and equines and 2 species each for treatment of bloody urine (biira) in cattle and infected eye in cattle (Table 6).

Although it was difficult to find corresponding English terms for some local medicinal terms in Oromiffa, efforts have been made to find equivalent terms for most of the local terms from literature, experts and physicians in the field.

Table 5 Major Human Disease Types and Number of Species Used by Indigenous People of 'Boosat'

Disease / health problem treated	Total No of Species	%to the total medicinal plants used by humans
Snake poison	10	19.2
Gonorrhoea	4	7.2
Infected wound	3	5.8
Cobra's attack	7	13.5
Malaria	11	21.2
Snake repellent	1	1.9
Ulcerated wound	5	9.6
Cancer (nyaqarsa)	3	5.8

...Table 5 Continued

Tonsillitis	4	7.2
Febrile illness (mich)	4	7.2
Cough (hazaba)	3	5.8
Evil eye	6	11.5
Toothache	4	7.7
Swelling of pancreas (rajiji)	1	1.9
Hepatitis	2	3.9
Urine retention (kidney problem)	3	5.8
Lymphatic swelling (gofle, dhula)	4	7.7
Haemorrhoids	1	1.9
Diarrhoea	3	5.8
Tetanus	4	7.7
Anthrax	1	1.9
Measles (guddiftu)	4	7.7
Pain (waransa)	4	7.7
Expel tape worm	1	1.9
Excessive menstrual bleeding	2	3.9
Spider's poison	2	3.9
Stomach problem	3	5.8
Nasal bleeding (funuuna)	2	3.9
Ameobiasis	2	3.9
Ringworm (robbi)	3	5.8
Headache	1	1.9
Treat delivered women	1	1.9
Sexual impotency in men	3	5.8
Fungal infection	1	1.9
Sudden sickness ('Dingetenya')	1	1.9
Vomiting	1	1.9
Indigestion (kulumu)	1	1.9
Antidotes for poisoned children	1	1.9
Rheumatism (qurtimati)	1	1.9
Intestinal parasite	2	3.9
Fire burn	1	1.9
Pyton's attack	1	1.9
Bronchitis	1	1.9

Table 6 Major Livestock Disease Types and Number of Ethnoveterinary Plant Species Applied to Livestock by Indigenous People of 'Boosat'

Disease/ health problem treated	Total No of plant Species Used	% to the total ethnoveterinary species
Anthrax (abbasanga)	11	37.9
Wounds	7	24.1
Lymphatic swellings	3	10.3
Bloody urine in cattle (biira)	2	6.9
Mentally sick cattle	2	6.9
Urine retention	2	6.9
Running nose (ruusa)	2	6.9
Ectoparasite	2	6.9
Infected eye	2	6.9
Intestinal parasite	2	6.9
Evil eye	1	3.4
Retained placenta	1	3.4
Fertility and normal growth	1	3.4
Fattening (remove parasite)	1	3.4
Remove leeches	1	3.4
Blackleg (abbagorba)	1	3.4
Poison (Kill enemies)	1	3.4
Infected <i>Sorghum bicolor</i> (dangaja)	1	3.4

5.3.2 Description of widely used medicinal plants

Medicinal plants that are widely used, those that have received about 44% or more of the informants' consensuses are described. A brief morpho-anatomical description of each taxon followed by its habitats in Ethiopia and elsewhere is provided. The medicinal use of each plant, mode of preparation and application are given details including Coll. No. are given in Appendices 1 and 2. Accordingly ten medicinal plant species used for treating human health problems and ten used for livestock diseases are described.

Description of major human medicinal plants

1. *Andrachne aspera* Spreng., Euphorbiaceae , Oricha hadha'a (Or.)

Habitat, habit and distribution: Usually a woody based perennial herb with sprawling branches in first year and rarely flowering. Stems 60 cm long (Gilbert, 1995). According to Gilbert (1995) the ecology extends into drier areas from about sea level to 2250 m. The species is found in Tigray upland, Gojam, Welo, and also distributed in Cape Verde Islands east to northwest India and South Cameroon, Sudan and Yemen (Gilbert, 1995). In the study area, it often grows in rocky hillsides. According to informants report individual members of this species are becoming rare this days.

Uses as medicine: Malaria, tetanus (hadha), snake poison and pain (waransa)

Mode of preparation and application: For malaria and tetanus dried or fresh root is chewed before breakfast and juice is swallowed. Alternatively for malaria one cup of the juice is drunk with cold water. For snake poison, dried or fresh root is chewed and juices swallowed immediately after snakebite. For pain, pounded leaves are mixed with cold water half glass is served for the adult patient as a drink, one cup for children. Adverse effect: vomiting. Antidotes for the adverse effect are to drink boiled coffee or milk as soon as possible.

2. *Cucumis dipsaceus* Ehrenb. ex Spach, Cucurbitaceae, Holloto (Or.)

Habit, habitat and distribution: Trailing annual herb to 2 m long with pale green stem and simple tendrils. It grows in deciduous *Acacia* woodland, wooded grassland and *Acacia-Commiphora* bush land, also in cultivated places at altitudinal range of 670 to 2000 m. The species is found in Tigray, Shewa, Sidamo and Harerg. It is also distributed in Sudan, Saudi Arabia, adventive in dry neotropics (Jeffery, 1995). In the study area, it is found in disturbed

vegetation, cultivated and waste places, with hedge plants and live fences. The informants reported that it is not common in the forest.

Uses as medicine: Gonorrhoea, tetanus, and kidney infection.

Mode of preparation and application: For gonorrhoea fresh roots of *Leucas abyssinica* and *Lagenaria siceraria* inner wall of the fruit is soaked in water and concocted with honey, one cup of the concoction is served as a drink before breakfast on Tuesdays and Fridays only. For tetanus, crushed seeds are concocted with crushed root of *Withania somnifera* and bandaged to the wound. For kidney infection and pain chewing fresh or dry root and swallow small amount of the juice. Adverse effects: vomiting, diarrhoea. Antidote, boiled coffee, milk and roasted barley flour (basso) could be drunk or eaten. Elsewhere in Ethiopia, the decoction of the whole plant is used as anti-emetic (Jansen 1981).

3. *Eleusine africana* Kenn. O'Byrne, Poaceae, Coqorsa (Or.); Gicha (Am.)

Habit, habitat and distribution: A tufted annual herb. The species grows in disturbed weedy places 500 to 2200 m altitudes. It occurs in Tigray, Gojam, Ilubabor, Kefa; throughout Tropical Africa, but mainly in eastern and southern highlands; rare in West Africa; also in Arabia (Phillips, 1995). In the study area, it is found at farm borders, abandoned land. It is common in the low land plains of the study area.

Uses as medicine: Spider infection or poison.

Mode of Preparation and application: For spider infection or poison, above ground part is chewed by healer and spitted on affected body part. Then *Lens culinaris* seed is chewed and spitted on the same body part early morning before both the healer and the patient urinate and eat breakfast.

4. *Indigofera oblongifolia* Forssk., Fabaceae, Adulaalo (Or.)

Habit, habitat and distribution: A shrub up to 1.5 m tall, silvery pubescent. The species grows in grassland, bush land, sandy ground at altitudes up to 1200 m. In Ethiopia it is found in Afar, Harerge, kefa, Gamo Gofa, and Sidamo. It also occurs in Djibouti, Socotra, Angola, and Arabia and east to Java (Thulin, 1989). In the study area, it grows in grasslands and alluvial plains of 'Boosat' and rarely encountered in bush land.

Uses as medicine: Snake poison and cobra's attack

Mode of preparation and application: Fresh or dried roots are crushed and mixed with cold water, the residue is creamed on affected part. Alternatively, for snakebite / poison a piece of root is chewed and the juice is swallowed immediately. Elsewhere the roots are reported to be toxic and used as purgative and the stems are used as toothbrush and browse plant (Thulin, 1989).

5. *Lagenaria siceraria* (Molina) Standl., Cucurbitaceae, Buqqe hadh'a (Or.)

Habit, habitat and distribution: Vigorous prostrate or climbing annual herb to 4.5 m. The species grows in bush land and grassland, also in cultivated places at altitudes 300-2300 m (Jeffrey, 1995). The species is found in Gonder, Gojam, Tigray, Shewa, Arsi Ilubabor, Kefa, Gamo Gofa, Bale, and Harerge; pan tropical (Jeffrey, 1995). In the study area, it is found in cultivated lands and hedges.

Uses as medicine: Snake poison and malaria

Mode of preparation and application: For snake poison, ripe fruit is bored, rinsed with cold water, one glass is served as a drink immediately after snakebite. For malaria, the above preparation is left overnight; one glass is drunk in the morning before breakfast. Elsewhere in Ethiopia and Eritrea, young fruits are sometimes eaten; mature fruits are widely used as

containers, particularly for milk and are often beautifully decorated. The leaves are boiled and the steam inhaled by patients suffering from malarial fever (Jeffery, 1995).

6. *Lepidium sativum* L., Brassicaceae, Shunfa (Or.); Feexo (Or.)

Habitat, habitat and distribution: An erect glabrous annual herb to 80 cm high. Grown scattered in and with other crops, mostly with *Eragrostis tef* at altitudes between 750 to 2900 m (Fichtl and Admasu Adi, 1994). In the study area, it is found in *Eragrostis tef* field. Informants reported that it is not common as such these days.

Uses as medicine: For febrile illness, malaria and repel malaria vector, tonsillitis, cough, influenza and toothache.

Mode of preparation and application: For malaria, pounded seeds are concocted with *Allium sativum* bulbs and honey, one cup or three spoons are served each day for three days before breakfast. Then one glass of melted butter is recommended after each dose for fast recovery. Crushed seeds when concocted with crushed bulbs of *Allium sativum* in mixture of water kept in open container repel malaria vector. For toothache, gently heated seeds are pounded, mixed with water and rolled onto cotton (*Gossypium spp.*) thread and put on sick tooth. For malaria, delivered lady and sexually disabled person, pound the seeds that is concocted with sugar solution, one cup or more of the concoction are served as a drink before breakfast for 3 days. In most parts of Ethiopia it is cultivated for its seeds considering it as the standard home medicine used to treat a varieties of skin complaints as well as colds, stomach upsets and swollen glands (Jansen, 1981; Fichtl and Admasu Adi, 1994). Seeds are chewed to cure throat diseases, asthma and headache (Kloos, 1976). Seed floor is mixed with honey and taken against amoebic dysentery (Jansen, 1981).

7. *Parthenium hysterophorus* L., Compositae/ Asteraceae , Faramisisa; Aliwaryo (Or.)

Habit, habitat and distribution: A herb about 30 cm high. Roots yellowish-brown, stem pale green with darker green lines. Leaves whitish. Flowers are greenish white (Jonkind, 1987). The species grows in dry, sandy, rocky and overgrazed area (Jonkind, 1987). In the study area, it is a recently introduced weed of roadsides and cultivated land.

Uses as medicine: For treating diarrhoea, tonsillitis and as an antipest.

Mode of preparation and application: For diarrhoea, freshly collected leaves are chewed and small amount of the juice is swallowed. For tonsillitis, chewed leaves are spitted into children's mouth for treatment. As antipest, the juice made from crushed leaves is reported as fatal to lice, bedbugs and cockroaches.

8. *Premna resinosa* Hochst. ex Schauer, Verbanaceae , Urgeesa (Or.)

Habit, habitat and distribution: Shrub, small bushy tree or subscandent, 1-3.6 m high. Found along riverbanks, in open and dry *Acacia* bush land, along forest edges and margins of secondary growth, on stony hillsides and on degraded woodland at altitudes between 1300 and 2400 m. (Verdcourt, 1992; Fichtl and Admasu Adi, 1994). In the study area, it is found in open grassland, *Acacia* bush lands and on stony hillsides.

Uses as medicine: For lymphatic swelling, tonsillitis, wound and evil eye.

Mode of preparation and application: For lymphatic swelling, a tooth collected fresh leaves are chewed and put on swelling (dhulla). The stem is used as chewing stick. For evil eye, crushed shoot is mixed with cold water and sprayed in houses and utensils to remove evil eye and protect evil sprit or evil work. Spiritually, twigs with leaves are put on gates of houses during wedding and carried by bridegrooms. For tonsillitis and wounded throat, fresh

leaves are chewed and juice is spitted into children's' mouth, adults swallow the juice. Fresh leaves are used as preservative of 'injera '

9. *Senna occidentalis* (L.) Link, Fabaceae-Caesalpinia, Shakissa (Or.)

Habit, habitat and distribution: An erect, sometimes woody herb up to 2 m high. The species is usually a weed of cultivation, found on roadsides and waste places, in wooded grassland and near lakes or streams, in altitudinal range of 500 to 1700 m (Thulin, 1989). In Ethiopia the species is found in Afar, Tigray, Welo, Shewa, Harerge, Kefa, Gamo Gofa and Sidamo. The species is also pan tropical, possibly originating in America (Thulin, 1989). In the study area, it grows in bushes and shrubs and degraded *Acacia tortilis* – *Balanites aegyptiaca* woodland. It is also very common in disturbed habitats, roadsides, waste places and grazing land.

Uses as medicine: Diarrhoea, snake poison, repelling snake, cobra's attack, pain (waransa) and dingetegna.

Mode of preparation and application: For diarrhoea, fresh root is chewed and small amount of the juice is swallowed. Alternatively, it is crushed and mixed with cold water and one cup is served as a drink at bedtime. To treat snake poison, dried or fresh root is chewed immediately after the poison. To treat pain fresh or dried root is chewed and spitted into children's' mouth. For adults chewing and swallowing the juice is recommended. Sex is forbidden (lagu) while using the medicine. For dingetegna, dry or fresh root is chewed and the juice is swallowed. To repel snake the dried root is carried in a pocket or on a body part. This is in agreement with the finding of Mirutse Giday (1999). Leaf infusion is used as pain killer elsewhere in Ethiopia (Thulin, 1989).

10. *Vernonia amygdalina* Del., Asteraceae, Eebicha (Or.); Girawa (Am.)

Habit, habitat and distribution: Shrub or small tree 0.5 to 10 m tall much branched spreading branches up to 40 cm in diameter (Fichtl and Admasu Adi, 1994). The species is found in wide range of bush land, woodland and forest habitat between 500 and 2800 m. It is also found around houses. It occurs in almost all Sub-Saharan African countries, also in Yemen (Fichtl and Admasu Adi, 1994). In the study area it is rarely found near houses as live fence.

Uses as medicine: Malaria, evil eye, and diarrhoea

For malaria, crushed leaves are concocted with crushed leaves of *Ruta chalepensis*, one cup is served as a drink for 3-5 days with cold water in the morning. To clean evil eye and evil work from home and livestock fence, crushed young twig with leaves is sprayed on utensils, livestock fence by special ceremony prepared by the whole family. For diarrhoea, crushed leaves mixed with water, one glass of the juice is drunk for 3 days.

Elsewhere in Ethiopia, the leaves and bark are bitter and used in local medicine. They are used against menstruation pain, as purgative and vermifuge, in wound dressing and against urinary inflammations (Abbink, 1993; Beentje, 2000)).

Descriptions of major livestock medicinal plants

1. *Balanites aegyptiaca* (L.), Balanitaceae, Badanno (Or.); Beddanno (Am.)

Habit, habitat and distribution: A spiny evergreen shrub or tree 8 to 10 m high, growing at altitudes between 700-1800 m. In Ethiopia, it is widely distributed in Shewa, Arsi, Harerge, Ilubabor, Sidamo, Gamo Gofa, Welo and Tigray (Sands, 1989). The species is also distributed from Senegal to Somalia and from Egypt south to Zimbabwe and also found in Jordan valley and Western Arabian Peninsula (Sands, 1989; Maundu *et al*, 1999). Commonly

found in open grassland and woodland mainly in red and black cotton clay soil (Maundu *et al.*, 1999). In the study area, the species is common in *Acacia tortilis-Balanites aegyptiaca* and *Acacia albida* dominated woodland from 1200 to 1700 mm.

Uses as medicine: Mentally sick cattle, anthrax, and infected livestock eye.

Mode of preparation and application: For mentally sick cattle, freshly crushed root is mixed with cold water stored over night and 4 to 5 liters are provided to the animal as a drink in the morning. Crushed leaves can also be served as a drink for 2 to 3 days. For anthrax, sick livestock is given crushed leaves as a drink and tied under live tree preventing it from drinking water, it is believed to have spiritual value. For infected livestock eye chewed leaves juice is spitted onto livestock eye for 3 to 5 days.

Uses as food: Ripe fruit is edible by humans and other animals. Elsewhere in Ethiopia and other African countries fruits are edible (Hadidi, 1985; Sands, 1989; Azene Bekele Tesema *et al.*, 1993; Maundu *et al.*, 1999).

2. *Cryptostegia grandiflora* K.Br. Asclepidaceae, Oqonqol (Or.)

Habit, habitat and distribution: It is a prostrate shrub to 4 m long. Purplish corolla. The species grows in rocky shrublands, *Acacia* woodland, along road margins. In the study area, it grows in all types of vegetation including rocky shrublands and roadsides.

Uses as medicine :It kills rodents, snake and other insects.

Mode of preparation and application: Milky exudates from the entire plant is used as a poison for rodents, snake and other insects. If taken in by other animals and humans it is fatal. It protects livestock from snake poison in grazing area, as it is also poisonous to snakes.

3. *Chrysopogon plumulosus* Hochst. Poaceae, Daremu (Or.)

Habit, habitat and distribution: A loosely tufted perennial herb with a short stout rootstock, bushy above the base, 20-80 cm high (Phillips, 1995). The species grows on stony or black clay soils in semi- desert grassland and open *Acacia* bush land, in Shewa, Arsi, Sidamo and Harerge. It also occurs in East Africa, Sudan, Niger, Egypt, Eritrea and Arabia (Phillips, 1995). In the study area, it grows on stony and rocky areas in open *Acacia* bush land and bases of rocky hillsides.

Uses as medicine: Assist fertility and normal growth in cattle and removes intestinal parasites.

Mode of preparation and application: cattle eat whole shoot. It enhances normal body growth and assists fertility. It also removes intestinal parasites by initial stomach runaway.

4. *Datura stramonium* L. Solanaceae, Manji (Or.); Astenagr (Am.)

Habit, habitat and distribution: A strong smelling annual herb, up to 1.2 m tall. Found abundantly on fertile soils in fields and besides roads and paths at altitudes between 1250 and 2400 m (Fichtl and Admasu Adi, 1994). In the study area it is abundant near homes and fertile farmlands and under shades of trees and waste places.

Uses as medicine: used to treat infected livestock wound.

Mode of preparation and application: Crushed leaves are put on infected part. Elsewhere in Ethiopia, this introduced weed is poisonous to livestock. Leaves are used against headache and for wound dressing for animals (Fichtl and Admasu Adi, 1994). Roots are used for otitis media, rectal prolapses and eczema (Mesfin Taddese and Sebsebe Demissew 1992). The root is chewed to treat toothache (Abbink, 1995). Elsewhere in Africa, leaves are used for cough

and chest complaints; leaves or seeds are concocted with palm oil for insect bites and stings and leaves against asthma (Iwu, 1993).

5. *Indigofera amorphoides* Jaub. and Spach. Fabaceae, Henna harre (Or.)

Habit, habitat and distribution: A shrubby herb up to 1 m tall. The species grows in bush land or woodland, roadsides, arable land at altitudes 400 to 2500 m. It is found in Afar, Tigray, Shewa, Arsi, Harerge, Bale and Sidamo; North Somalia and South Arabia (Thulin, 1989). In the study area it grows in bush land, open grassland, in shrubs, mostly abundant on roadsides.

Uses as a medicine: Used to treat anthrax

Mode of preparation and application: For anthrax, freshly crushed whole plant is mixed with cold water; one bottle of the juice is given to the animal. In case it is required for humans one glass is recommended. This species is also effective medicine to treat snake poison in this case fresh or dried root is chewed immediately after snakebite, small amount of the juice is swallowed. The crushed whole plant is also used to wash children's' body to treat measles. The collection and application of the medicine is said to be only when allowed by elders or healer to be effective.

6. *Kedrostis foetidissima* (Jacq.) Cogn. Cucurbitaceae, Saraja'a (Or.)

Habit, habitat and distribution: Climbing or trailing herb to 3 m long, with unpleasant smell when crushed (Jeffrey, 1995). The species grows in woodland, wooded grassland, evergreen bush land at altitudes 350-1900 m. It is found in Tigray, Gonder, Gojam, Shewa, Gamo Gofa, and Harerge and also in tropical Africa, Yemen, India and Burma (Jeffrey,

1995). In the study area it is found in *Acacia tortilis* – *Balanites aegyptiaca*, *Euphorbia nigrispinoides*, *Acacia albida* – *Ziziphus spina-christi* woodland, in live fences and roadsides.

Uses as medicine: Ectoparasite and evil eye.

Mode of preparation and application: For ectoparasite and evil eye, whole plant is crushed and used to wash skin of sick animals. For evil eye, stems and leaves are crushed, mixed with cold water, kept over night and given to the animal in the morning. Though, the species is classified as livestock medicine it is also widely used by humans to treat cough, febrile illness and intestinal infection in children. To treat cough and febrile illness, whole plant is boiled with water and fat of sheep and served as a drink for children of age 7 and below this is also recommended as a treatment for intestinal infection.

7. *Nicotiana tabacum* L. Solanaceae, Tambo (Or.); Tmbaho (Am.)

Habit, habitat and distribution: An erect glandular pubescent annual or biennial growing to 2.5 m high. It is a cultivated plant in homegardens in some parts of the country and sometimes-escaped into waste ground and along streams at altitudes between 1700 and 2400 m (Fichtl and Admasu Adi, 1994). In the study area it is occasionally found in some farmers homegardens on fertile sandy soil and decomposed waste places.

Uses as medicine: For treatment of wound and to expel leeches.

For wound, dried and pounded leaves are added onto the wound. To expel leeches dried and pounded leaves are mixed with one glass of water and given to the affected animal. This species is also used as repellent for malaria vector by dry smoking the leaves into the area. In southern Ethiopia, the juice of chewed leaf is put into the throat of sheep and oxen to kill internal parasites (Fichtl and Admasu Adi, 1994).

8. *Olea europaea* L. ssp. *cuspidata* (Viv.), Oleaceae, Ejersa (Or.); Weyra (Am.)

Habit, habitat and distribution: Evergreen tree growing up to 18 m tall. Commonly found between 1250 and 3100 m in afro-montane forest, particularly in drier highland forests where *Juniper* is common. It is very common in secondary scrub and also in riverine forests. It is found as a relic tree on farmlands and in church compounds where it is protected. It grows where rainfall ranges from 500 to 1500 mm per year (Fichtl and Admasu Adi, 1994). It is wide spread in tropical Africa on mountains of South Africa and east to Somalia and north to Egypt. The species is also found in the Mediterranean area. It is common in Yemen, Saudi Arabia, Oman, Pakistan, North India and South Western China (Fichtl and Admasu Adi, 1994). In the study area it is rarely encountered at borders of farms, relic forests protected tree in live fences by individuals at hillsides.

Uses as medicine: For mentally sick goat and running nose mostly in equines.

Mode of preparation and application: For mentally sick goat, 1 glass of boiled leaves is given as drink and dry smoke is inhaled over it. For running nose, dry smoke from the whole plant is kept in livestock fence at night. This species is also used for cough and febrile illness by dry smoking for humans. Some informants also recommended that external haemorrhoids in humans are cured by burning it with heated stem and adding goat's faeces it applying it to the affected part. Elsewhere in Ethiopia, the roots are used against haemorrhoids and intestinal complaints as a purgative (Fichtl and Admasu Adi, 1994).

9. *Solanum indicum* L. Solanaceae, Hiddi loonii (Or.)

Habit, habitat and distribution; A shrubby herb growing to 80 cm high with spines on stems, leaves and calyx. It is a wide spread herb of disturbed habitat at altitudes from 1400 to

2500 m (Fichtl and Admasu Adi, 1994). In the study area it is widely distributed herb in disturbed grazing lands, roadsides and hedges.

Uses as medicine: Anthrax, ulcer and wound of circumcision origin

For anthrax, roots are concocted with roots of *Rhus vulgaris* and cold water, 1 glass is given to the affected animal for 1 to 3 days. For ulcerated wound, ripe fruit is buried in fire; the inner flesh is cut and put on swollen wound. For wound of circumcision origin in oxen, crushed and pounded leaves are sprayed on the wound. The species is also used to stop nasal bleeding in humans when squeezed leaves are inhaled through nasal opening. Furthermore, when fresh or dried roots are chewed and small amount of the juice is swallowed to treat stomach problem and snake poison. When this preparation is spitted to children's mouth, it is a remedy for stomach problem. Elsewhere in Ethiopia, fruits are poisonous but used in local medicine against intestinal complaints (Fichtl and Admasu Adi, 1994).

10. *Withania somnifera* (L.) Dunal. Solanaceae, Wahalle, Balauru (Or.); Gizawa (Am.)

Habit, Habitat and distribution: It is a small herb up to 0.5 m tall. In the study area it is common in disturbed habitats, open grazing lands. It is commonly planted in homegardens for home consumption and in some cases for marketing (Fig.4).

Uses as medicine: For lymphatic swelling, anthrax and urine retention

Preparation and application: For lymphatic swelling in cattle, freshly crushed root is mixed with cold water, 1 glass is given to sick animal. The same preparation is used in the same way by increasing the dosage to one bottle to treat urine retention in cattle. It's also used in the same way for humans reducing to one cup. It is also a remedy for evil eye; concocting it with the root of *Leucas martinicensis* can increase the efficacy. For anthrax, freshly crushed root is mixed with cold water and one glass is given to the animal preventing the cattle from drinking

pure water not lose the efficacy of the medicine. This species is also used to treat malaria by herbal bath and inhaling the vapour in humans. For children affected by diarrhoea one cup of the juice made of root and leaf is recommended as a drink. Inhaling boiled root or whole plant is recommended for cough (hazaba) in humans. Other studies showed that fresh root is used against chest pain (Mirutse Giday, 1999) and root is also used against headache (Mesfin Taddese and Sebsebe Demissew, 1992). The fruits are used against skin diseases (Mesfin Abebe, 1986). Bark is used against evil eye, headache and stomachache (Dawit Abebe and Estifanose Hagos, 1991).

Other medicinal plant species recorded in this study are described in standard Floras for which the reader is recommended to see the various volumes of Flora of Ethiopia, Flora of Ethiopia and Eritrea, Flora of Tropical East Africa and other related Floras.



Figure 3 *Balanites aegyptiaca* maintained at farm border

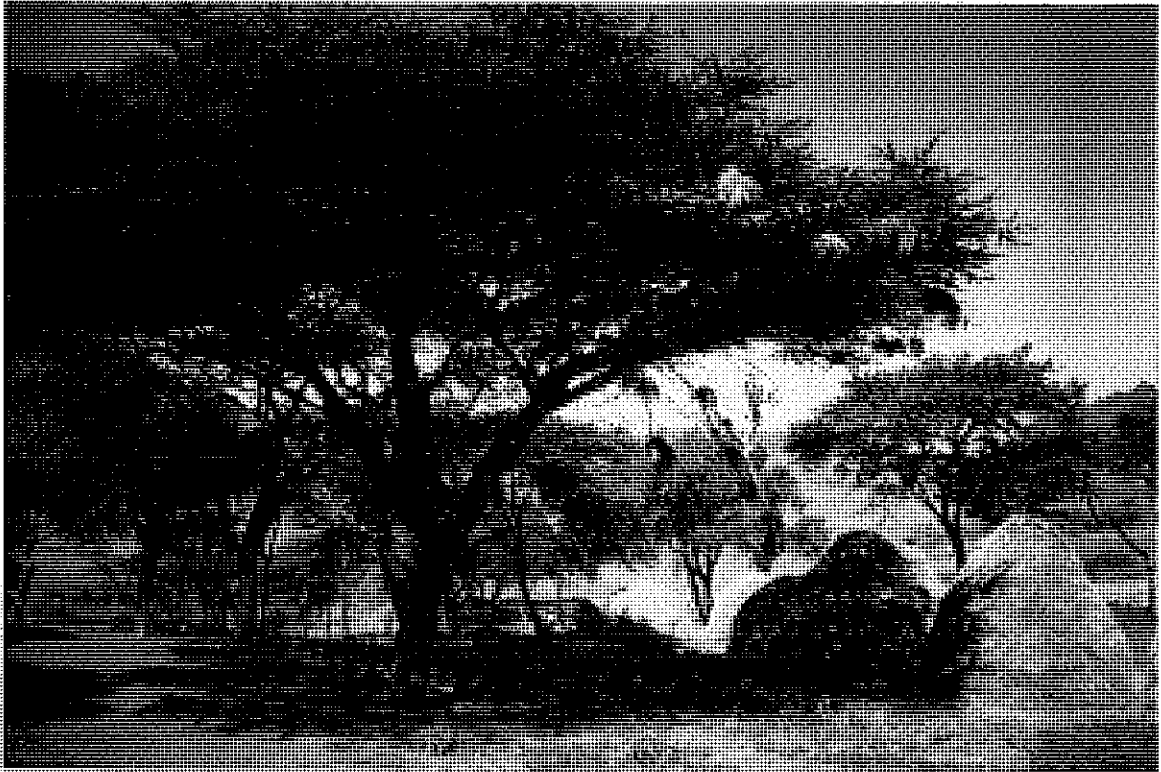


Figure 4 Ritually Protected *Acacia tortilis* trees

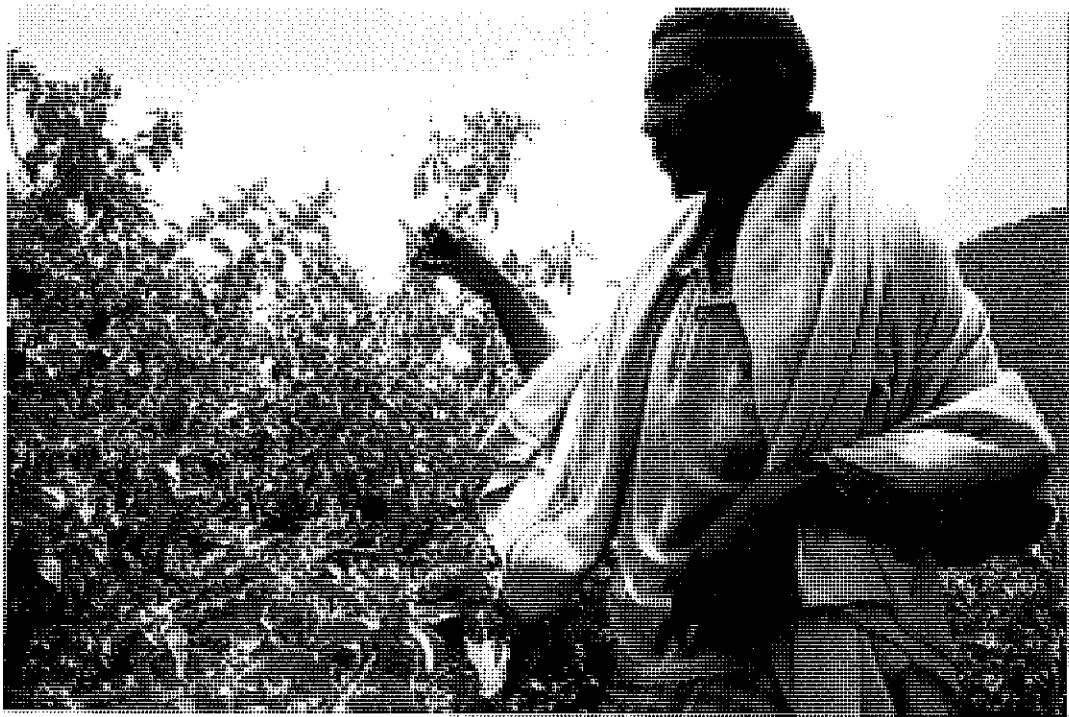


Figure 5 *Withania somnifera* being identified in the field

5.3.3 Medicinal plants used both for livestock and humans

The uses of some medicinal plants are not limited to treat livestock or human ailments. Twenty-nine plants are reported as they are primarily used for livestock. Informants consensus has shown that when need arises 19 species out of 29 livestock medicinal plant species are also used to treat some human ailments. This is a classification based on indigenous people of the study area. The informants in the study area explained that most human medicines are not recommended for the treating livestock health problems. The parts of medicinal plants used for both humans and livestock are also similar. The summary of these plants is given in Table 8.

5.4 Modes of Preparation of the Medicine, Dosage and Route of Application

Assessment of the preparation of the remedies showed that crushing pounding and mixing with cold water is the mode of preparation for the majority of the remedies. This accounted for 43 of the medicinal preparation, followed by chewing and swallowing the juice immediately (19), concoction (18), putting on affected parts (16), boiling and concoction (14), dry smoking (smoke bath) and inhaling the smoke accounted for (12). More detail is given in Table 9.

Concerning the route of application, most of the remedies are taken through the mouth (oral), which accounted for 80 (92 %) of the medicinal preparations, followed by dermal application in the case of 36 (48.7) of the medicinal preparations details are given in Table 10. Chewing and spitting accounted for 8, of the preparations followed by smoke bath and spraying at near by areas each accounted for 5 of the preparations while inhaling or taking in few drops accounts for 4 of the medicine preparations

Table 7 Medicinal Plants Primarily Used for Treating Livestock with Some Medicinal Uses for Humans

Medicinal Plant Species	Disease / health problem treated	Part Used
<i>Achyranthes aspera</i>	Malaria and excessive menstrual bleeding	Root
<i>Acalypha fruticosa</i>	Snake poison	Leaf
<i>Argemone mexicana</i>	Cancer, malaria, stomach-ache and pain	Root
<i>Capparis tomentosa</i>	Evil eye	Root
<i>Cissus quadrangularis</i>	Snake poison and cancer	Root
<i>Datura stramonium</i>	Tooth infection	Seed
<i>Dodonaea angustifolia</i>	Malaria	Root
<i>Grewia bicolor</i>	Gastritis	Fruit
<i>Indigofera amorphoides</i>	Cobra's attack, snake poison, evil eye and measles	Root and leaf are additional for treatment of cobra's attack
<i>Jatropha curcas</i>	Abortion	Shoot (Ag)
<i>Justicia caerulea</i>	Breast ulcer and general pain	Root
<i>Kedrostis foetidissima</i>	Cough, febrile illness, intestinal problem and measles	Whole
<i>Ocimum urticifolium</i>	Cancer	Leaf
<i>Olea europaea ssp.cuspidata</i>	Cough and febrile illness	Whole plant
<i>Rhus vulgaris</i>	Malaria, kidney problem	Leaf
<i>Solanum indicum</i>	Ulcer, menstrual bleeding, snake poison and nasal bleeding	Leaf and root
<i>Terminalia browni</i>	Hepatitis and tapeworm	Bark
<i>Withania somnifera</i>	Fiberile illness, cough, evil eye	Whole plant
<i>Ximenia americana</i>	Hepatitis, wound and swelling of pancreas	Bark, leaf and stem as specified

The results of the study showed that 74 of the preparations of the remedies are applied externally while 87 of the remedies are applied internally (Table 10). The modes of application of some remedies (e.g. *Senna occidentalis* and *Cissus quadrangularis*) are used

for repelling snakes. *Cissus quadriangularis* is also used to catch snakes alive. Fresh or dried roots of these species are kept in a pocket or on arms by the local people while walking in a local environment, mostly in forest and rocky hilly sides to prevent snake and python's attack and to cure the injuries if bitten.

Some informants reported that there are directions and restrictions imposed to the collection and application of some remedies which otherwise reduce the efficacy of the remedy or cause danger on the patient and the collector. An example given by one informant was *Indigofera amorphoides* which when applied for cobra's attack; it should be massaged downwards to the direction of the foot. The collection of this species for treatment of measles is possible only when permitted by an elder specialist in the community for its effectiveness. Key informants reported that the community respects this belief. Restrictions of days of application of the remedies are common practices for some of the remedies. The application of medicinal preparation of *Kedrostis foetidissima* is possible on Mondays and Thursdays only by restricting sexual activity both the patient and healer. There is a belief that other persons are not allowed to come in contact to the patient until the completion of the medication.

Some of the medicinal preparations are reported to have adverse effects on the patients (user). From the findings *Agremone mexicana*, *Solanum somalense*, *Ziziphus spina-christi*, *Terminalia brownii*, *Ajuga integrifolia* and some others are found to have adverse side effect like vomiting and diarrhoea. The informants and traditional medicinal practitioners recommended antidotes for some of these adverse side effects, such as drinking boiled coffee, milk or barley soup immediately. Some of the preparations are made from the beginning with additives to reduce or cancel the adverse effect (s). For instance, *Amaranthus*

dubius when used for the treatment of diarrhoea is baked with *Eragrostis tef* to reduce the adverse effect.

Table 8 Methods of Preparation of Medicines Used by the Indigenous People of 'Boosat'

Methods of preparation	Total	%
Crushed, pounded and mixed with cold water	43	24.3
Crushed and squeezed	1	0.6
Squashed and pounded	1	0.6
Put on affected part	16	9.0
Chew and swallow the juice	19	10.7
Chew and rinse the mouth with the juice	1	0.6
Tie cattle under live tree preventing it from drinking water	1	0.6
Crushed and mixed with cold water and sprayed	6	3.4
Rubbed, creamed as an ointment on affected parts	7	4.0
Role old cloth on stem and into cattle's mouth	1	0.6
Dry smoke (smoke bath) inhaling	15	8.5
Spread pieces of whole plant on stored crop	1	0.6
Concoction	18	10.2
Crushed and bandaged on wound	2	1.1
Herbal	9	5.1
Chewed and spitted in/on affected parts	8	4.5
Crushed, boiled and filtered for drink	4	2.3
Boiled and concocted	14	7.9
Tooth brush	3	1.7
Pounded, mixed with cold water and baked	2	1.3
Crushed, pounded and tied on neck (kudhamu)	3	1.7
Burry in/ around livestock's fence and home	1	0.6
Milky exudates is mixed with distilled water for injection	1	0.6
Total	177	

Dosage applied: most of the remedies are applied only ones and others are applied until the patient is cured. In most cases the measurements are rough, lack precision and dosage given to the patient has no strict specification. Most of the remedies are measured in cup glasses or

they simply recommend or prescribe small amount or large quantities, a drop, inhale even sometimes with no specific number of dates to be applied. They prescribe the quantity by simply looking at the physical appearance of the person. Informants reported that the community cares for different ages in prescribing the doses. The parents preferably mothers, give medicine for children especially for age below seven years. Pregnant women are also not given those medicines with observable adverse effects such as vomiting and diarrhoea. Preparations for malaria, internal haemorrhoid and gonorrhoea are not applied for pregnant women and physically weak persons by other health problems.

Table 9 Route of Application of the Remedies, Total Number of Remedies and Percentage

External	Total No of Remedies	% Of the total	Internal	Total No of Remedies	% of the total
Dermal	36	48.7	Oral	80	92.0
Chewing and spitting	8	10.8	Anal	1	1.2
Steam bath	2	2.7	Nasal	4	4.6
Smoke bath	5	6.8	Injection	1	1.2
Herbal bath	4	5.4	Goggling	1	1.2
Dry smoke	6	8.1	Total	87	100
Tooth brush	3	4.1			
Spray at nearby areas	5	6.8			
Tie on neck	1	1.4			
Holdng on hands or/in pocket	2	2.7			
Keep on roof of houses	1	1.4			
Put on stored crop	1	1.4			
Total	74	100			

5.5 Informants Consensus

The result of the study showed that some medicinal plants are more popular than others. Accordingly, *Andrachne aspera* and *Cryptostigia grandiflora* took the lead as each was cited by 80 informants (100%) for their medicinal value. *Withania somnifera*, *Solanum indicum* and *Indigofera amorphoides* are cited by 75 informants (93.8%). *Chrysopogon plumulosus* ranked third by 86.3%, *Lepidium sativum* stood 4th with 75% informants consensus while *Premna resinosa* and *Nicotiana tabacum* and *Balanites aegyptiaca* were cited by 58 (72.5%) informants each and ranked 5th. All of the other medicinal plants mentioned by two or more informants are given in Table 10 and the widely used are described in section 5.3.2. Similarly, key informants and interviewees reported that some plants are more familiar to them than others, for being used against a particular ailment or health problem. The case of *C. grandiflora* and *Parthenium hysterophorus* is left for further investigation, as they are incomers.

Table 10. List of Medicinal Plants and the Corresponding Number of Informants who cited the Medicinal Value of Each Species

Scientific Name	Number of Informants	% of total informants
<i>Acacia albida</i>	2	2.5
<i>Acacia nilotica</i>	18	22.5
<i>Acacia oerfota</i>	3	3.8
<i>Acacia tortilis</i>	18	22.5
<i>Acaclypha fruticosa</i>	16	20.0
<i>Achyranthes aspera</i>	18	22.5
<i>Andrachne aspera</i>	80	100.0
<i>Aerva javanica</i>	4	5.0
<i>Ajuga integrifolia</i>	15	18.8
<i>Amaranthus dubius</i>	14	17.5

.... Table 10 Continued

<i>Argemone mexicana</i>	18	22.5
<i>Azadrachta indica</i>	30	37.0
<i>Balanites aegyptiaca</i>	58	72.5
<i>Berchemia discolor</i>	5	6.3
<i>Bidens pilosa</i>	6	7.5
<i>Carissa edulis</i>	4	5.00
<i>Catha edulis</i>	4	5.0
<i>Cadaba farinosa</i>	3	3.7
<i>Calotropis procera</i>	18	22.5
<i>Capparis cartilaginea</i>	2	2.5
<i>Capparis tomentosa</i>	12	15.0
<i>Cissus quadrangularis</i>	22	27.2
<i>Cleome ramosissima</i>	15	18.8
<i>Commiphora africana</i>	10	12.5
<i>Croton macrostachyus</i>	2	2.5
<i>Cryptostegia grandiflora</i>	80	100.0
<i>Chrysopogon plumulosus</i>	69	86.3
<i>Cucumis dipsaceus</i>	48	60.0
<i>Cynoglossum caeruleum</i>	32	40.0
<i>Cyphostemma adenocaula</i>	15	18.8
<i>Datura stramonium</i>	52	65.0
<i>Dichrostachys cinerea</i>	4	5.0
<i>Dodonaea angustifolia</i>	7	8.8
<i>Ehretia cymosa</i>	16	20.0
<i>Eleusine africana</i>	37	46.3
<i>Erianthem dregei</i>	15	18.8
<i>Euclea racemosa</i>	25	31.3
<i>Euphorbia nigrispinoides</i>	13	16.3
<i>Grewia bicolor</i>	2	2.5
<i>Grewia ferruginea</i>	2	2.5
<i>Grewia tenax</i>	2	2.5
<i>Heliotropium albohispidum</i>	10	12.5
<i>Heliotropium cinreascens</i>	3	3.7
<i>Hibiscus micranthus</i>	3	3.7

.... Table 10 continued

<i>Indigofera amorphoides</i>	75	93.8
<i>Indigofera oblongifolia</i>	35	43.8
<i>Indigofera vahemarnsis</i>	15	18.8
<i>Jasminium abyssinicum</i>	15	18.8
<i>Jatropha curcas</i>	16	20.0
<i>Justicia caerulea</i>	3	3.7
<i>Kedrostis foetidissima</i>	48	60.0
<i>Lagenaria siceraria</i>	48	60.0
<i>Lens culinaris</i>	12	15.0
<i>Lepidium sativum</i>	60	75.0
<i>Leucas abyssinica</i>	14	17.5
<i>Leucas inflata</i>	2	2.5
<i>Leucas martinicensis</i>	27	33.8
<i>Nicotiana tabacum</i>	58	72.5
<i>Ocimum urticifolium</i>	4	5.0
<i>Olea europaea ssp cuspidata</i>	55	68.8
<i>Parthenium hysterophorus</i>	35	43.8
<i>Phyllanthus maderaspatensis</i>	10	12.5
<i>Premna resinosa</i>	58	72.5
<i>Rhus vulgaris</i>	2	2.5
<i>Rumex nervosus</i>	4	5.0
<i>Ruta chalepensis</i>	3	3.7
<i>Sedera arabica</i>	2	2.5
<i>Senna italica</i>	30	37.0
<i>Senna occidentalis</i>	37	46.8
<i>Sida ovata</i>	16	20.0
<i>Solanum indicum</i>	75	93.8
<i>Solanum renschi</i>	16	20.0
<i>Solanum somalense</i>	16	20.0
<i>Tamarindus indica</i>	16	20.0
<i>Terminalia browni</i>	4	5.0
<i>Verbascum sinaiticum</i>	6	7.5
<i>Vernonia amygdalina</i>	41	50.3
<i>Withania somnifera</i>	75	93.8
<i>Xanthium strumarium</i>	10	12.5
<i>Ximenia americana</i>	22	27.5
<i>Ziziphus spina -christi</i>	2	2.5

5.6 Management and Conservation of Medicinal Plants

Indigenous people in 'Boosat' do have their own way of managing medicinal plants. The study showed the existence of indigenous practices of medicinal plant management for multiple uses. Analysis of data recorded in the present study revealed that the gathering and processing of many medicinal plants are traditionally restricted to traditional medicinal practitioners,

their trainees under special circumstances who are trustworthy. At family level it is restricted to the elders (men and women), followed by elder son or daughter or their trustworthy person.

People of 'Boosat' have been managing local vegetation not only to meet their needs of medicine but also to meet their needs of multiple products, such as fodder, fruits, construction and fuel wood, cultural, religious and spiritual issues at family and community level. Some of the medicinal plants were observed in agricultural fields. These include *Balanites aegyptiaca*, *Ziziphus spina-chriti*, *Croton macrostachyus*, *Commiphora africana*, *Acacia albida*, *A. tortilis* and rarely *Grewia bicolor*.

The above-mentioned medicinal plants are managed and conserved because of their spiritual, ritual and material values among which medicinal, food, fuel and construction wood, and their use as shade plants are primary to the indigenous people of 'Boosat'. The study showed that for the transhuman pastoralists both culturally and spiritually it was not allowed to cut a piece of *A. tortilis*, unless it was for spiritual and medicinal use. This is also true for majority of the transhuman pastoralists nowadays. As their livelihood is largely dependent on livestock rearing, the production of charcoal by transhuman pastoralists is not strongly accepted in their culture and belief compared to settled farmers.

The indigenous people of 'Boosat' have strong and genuine belief on the healing power of the plants and therefore, know their habitat, distribution and do not want to lose them. A medicinal plant like *Withania somnifera*, which has multiple medicinal uses, is found in nearly all-family gardens and farm borders. People have the perception that they need not be devoid of such species from their vicinity.

The collection and application of some medicine require strict cleanness of spiritual body, special prey to attain full spiritual power of healing (efficacy) for the medicine and not to be affected by devil when collecting the medicinal plant. The informants further revealed that, the healer or collector should not sleep with his/her partner (wife or husband) and sexual activity is not allowed for 24 hours before collection. In some cases this can be for one week time (the local people call it ('qoricha xaharan/ qulqulinan funaanu').

Healers and informants believe that certain medicinal plants should be collected at certain times of the day, week, month or year in order to obtain full therapeutic effect. Some medicines are collected on the last day of the year and preserved for use another one year and most of the previous collections are disposed by burying them. Most of the stored medicines are from medicinal plants whose efficacy will not decrease when dried. *Cissus quadrangularis*, *Senna occidentalis*, *Andrachne aspera* and *Phyllanthus maderaspatensis* are recorded for such utility.

There is strong common understanding among indigenous people in that special care should be given for the preservation of herbal medicines. Keeping under roofs of houses or special container to hide from spiritually unclean people. For instance after sexual activity it is not allowed to come near the preserved medicine, locally known as 'gaddidu lagu'. Otherwise it is believed that the medicine will not be efficacious. On the other hand, medicinal remedies which need not be used fresh are collected from the wild or if found from gardens and applied as prescribed by the healer or knowledgeable person. The transhuman pastoralists

carry emergency medicine along with them while moving with camel and cattle, except for those medicines, which are commonly known by all members of the pastoralists.

5.7 Indigenous Knowledge of Medicinal Plants by Different Social Groups

At family level and in the community men and women have specific duties. This division of labour emanates from labour required at home, taking care of livestock, farming and the social organization. Females mostly stay with cattle and they are responsible for milking cow, taking care of calves and children and remove cow dung. Males represent the family at official meetings and shoulder duties such as milking and taking care of camels. Children's share in shepherding livestock is high. This very fact of the division of labour and social organization resulted in differences of indigenous knowledge between both sexes and different social groups.

The result of the study made to ascertain the extent of medicinal plants knowledge among people in 'Boosat' showed that local people possess rich knowledge of medicinal plants species, their uses and management. Analysis of the data by comparing knowledge of medicinal plants between two age groups 15 to 40 and above 40 showed generally that indigenous people of the age group above 40 mentioned more medicinal plants than the age group 15 to 40. Fourty six of the interviewees (57.5 %) from this age group above 40 cited at least one medicinal plant each (1.74 on average). Two individuals (2.5%) from this group cited no medicinal plant. The total number of species mentioned by this group was 80 (98.8%). Every member of this group knew the life form of the medicinal plant species the habitat (location) where it was collected, its preparation for specific remedy and route of

application for the medicinal plants he / she cited. Some of them knew the adverse effects, antidotes and restrictions pertaining to its collection, preservation and rituals.

Thirty two of the interviewees (40 %) from the age group 15 to 40 cited at least one medicinal plant each (1.16% on average). Some of them were not able to explain about the location outside their familiar locality, the plant part used, methods of preparation, preservation and modes of application. Many of them cannot explain clearly the adverse effects, antidotes, rituals and restrictions pertaining to the collection, preservation and rituals (Table 11).

Table 11 Comparing Knowledge of Medicinal Plants Between Two Age Groups

Age group	Number of people who cited at least one medicinal plant	Total number of medicinal plants reported by each group	Percentage of the total
15 to 40 years	32	37	45.7
Above 40 years	46	80	98.8

The result revealed that men and women above the age 40 could identify medicinal plants for a disease (s) and describe the uses with related information. Some older females and those between ages 45 to 55 have been found as specialists in the community, treating many diseases in their locality than men. Two of them revealed that they acquired the knowledge from their husbands when their husbands approached death. Another female explained that she acquired the knowledge from her traditional healer after she has got repeated treatment by female traditional healer.

Almost all women interviewed and who have worked as key informants revealed that they are more responsible for family healthcare, in which case they collect medicinal plants from nearby fields and homegardens, farmlands and live fences. This was illustrated in those medicinal plants for febrile illness, malaria, bad spirit, diseases related to calves and cows could be collected and applied by women. In contrast old men are more knowledgeable about medicinal plant species collected in distant fields, forests, hilly rocky sides and far farmland.

A major problem observed during the study is that knowledgeable persons keep their knowledge secret. The knowledge passes from individual to individual, from healer to healer on exchange bases to keep their knowledge up-to-date with the increasing needs to find new remedies. Traditionally, knowledge passes only to their first-born son or trustworthy persons or elder daughter when the father or mother is getting old or just about to die. The son or other persons inheriting the knowledge will normally take an oath with warning not to reveal its secrecy to any body else out of the traditions learned in the family or community. Instructions are generally given in the field orally, with detailed explanations, including the life forms of the plant. He or she is told the vernacular name(s), how to collect, how to prepare the remedies from the plant(s) for specific disease. An example given at one of the study sites (Rukecho Bokure) showed that an old woman was knowledgeable in treating many diseases; the community has relied on her services in her lifetime. When she was about to die, she gave a blessing and will (ebba) to her two children. The informants and residents reported that none of these children have continued to practice the medicinal knowledge inherited from their mother. The informants explained that one of here sons has attended grade ten of modern education, but he failed to retain and practice medicinal knowledge inherited by oath from his mother.

The indigenous people classified traditional medicinal plants into human and livestock medicine. Medicinal plants used for particular diseases and species of livestock are given group names. Medicinal plants used to treat anthrax and blackleg are classified as medicine for cattle ('qoricha sa'a/ loonii'). Medicinal plants which are used to treat lymphatic swelling and bloody urine are named as 'qoricha gofle' and qoricha biira respectively (Appendix, 2).

Medicinal plants used to treat human diseases are classified and named on the basis of the diseases they are used to treat. Accordingly, medicinal plants that are primarily used to treat malaria are classified as '-qoricha lagida' and named as 'qoricha ho'aa'. Plants that are used to treat fiberile illness and measles are named 'qoricha michi' and 'qoricha badhaftu' respectively. Medicinal plants used to treat sexually transmitted diseases are named as 'dawa /qoricha dhira'. These classifications and nomenclature have implications about the diseases and the plants used by indigenous people.

5.7.1 Preference ranking and paired comparison

The preference ranking for five medicinal plants species used to treat snake poison / bite showed that *C. quadrangularis* is the most preferred followed by *Senna occidentalis*, *Indigofera amorphoides*, *Senna italica* and *Bidens pilosa* in that order respectively (Table 12).

The cluster analysis of paired comparison (Table 13) showed the existence of similarities and differences in the way the informants responded (Fig. 6). The highest similarity is shown between R₆ and R₉. R₈ responded in a parallel way to all others. This could be ascribed to the

fact that R₈ is found in age group of 15 to 40 and the knowledge of medicinal plant species is less compared to other respondents. R₃ and R₄ responded in a parallel way to each other and to other respondents too as R₃ is a youngman from transhuman pastoralists and R₄ is youngman from settled farmers. This result showed that the age group and the life style among others influenced the way informants responded.

Table 12 Values for Preference Ranking based on their Degree of Treating Snake Poison for five Selected Medicinal Plants in the Study Area as Perceived by Informants

List of medicinal Plants	Key Informants Coded (A - J)										Rank	
	A	B	C	D	E	F	G	H	I	J		Total
<i>Bidens pilosa</i>	3	4	4	1	4	4	1	3	2	2	28	5 th
<i>Cissus quadrangularis</i>	5	4	5	2	5	5	5	5	5	5	46	1 st
<i>Indigofera amorphoides</i>	4	2	1	4	3	4	3	4	4	4	33	3 rd
<i>Senna occidentalis</i>	4	4	4	4	4	3	2	3	4	4	36	2 nd
<i>Senna italica</i>	3	2	3	3	1	4	4	3	4	3	30	4 th

Table 13 Paired Comparison of Medicinal plant species Used to Treat Malaria; 5 =best, 4=very good, 3=good, 2=fair, 1= least

Species of medicinal Plants(S)	Respondents(R)										Total	Rank
	R ₁	R ₂	R ₃	R ₄	R ₅	R ₆	R ₇	R ₈	R ₉	R ₁₀		
<i>Anrache aspera</i> (S ₁)	5	3	4	5	1	2	4	5	2	3	34	2 nd
<i>Lepidium sativum</i> (S ₂)	4	2	1	3	5	4	4	5	3	4	35	1 st
<i>Phyllanthus maderaspatensis</i> (S ₃)	2	3	4	1	3	1	4	5	1	2	26	5 th
<i>Vernonia amygdalina</i> (S ₄)	4	3	5	2	3	2	4	1	3	2	29	4 th
<i>Ximenia americana</i> (S ₅)	5	2	4	3	2	3	4	5	2	1	31	3 rd

S= stands for the species in the paired comparison and subscripts 1,2,3,4 and 5 indicate the specific species.

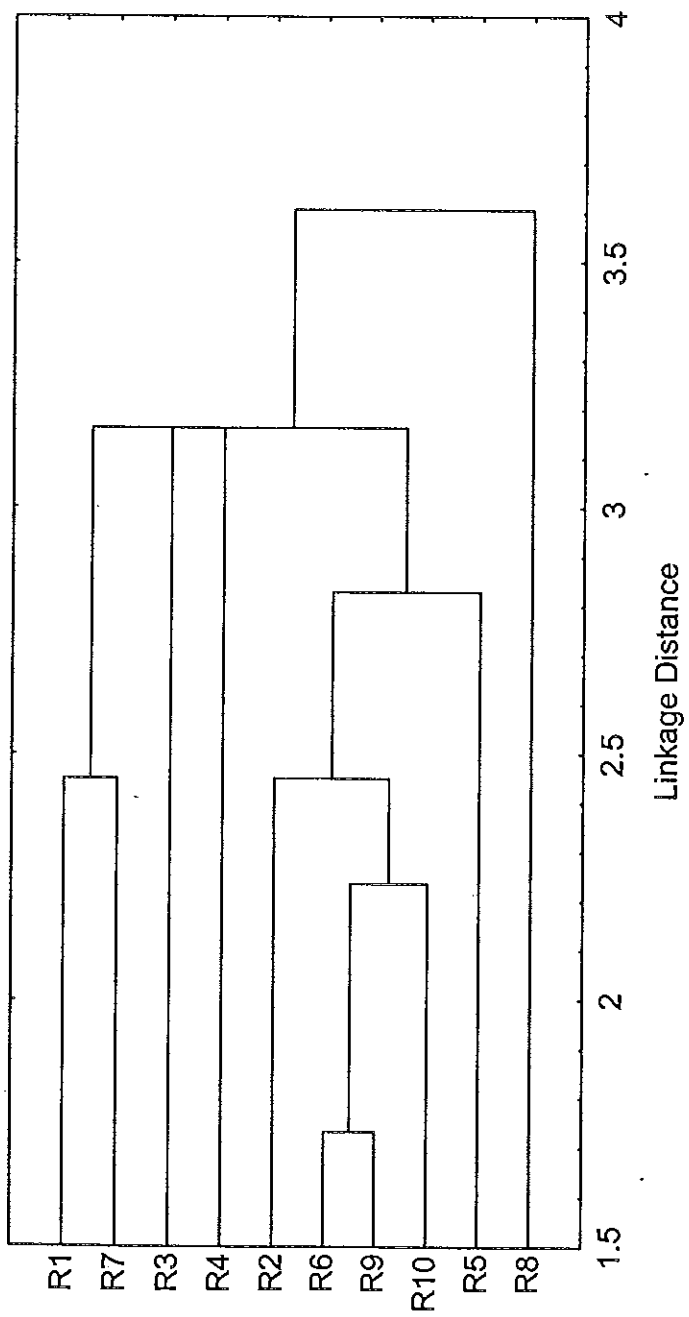


Figure 6 Dendrogram showing distance between respondents (single linkage, Euclidean distance).

6. DISCUSSION

6.1 Indigenous Knowledge on Medicinal Plants

A significant number of medicinal plant species have been documented in the present study. The knowledge base on medicinal plants is also significant. Though there is continued degradation in the area, the study in 'Boosat' has yielded many potent plants for treating human and livestock health problems. There is also difference between knowledge held by pastoralists and settled farmers. In a study made by Bayafers Tamene (2000) on people of Chaffa (Welo), 83 species of medicinal plants were reported. Abbink (1993) studied medicinal knowledge of the Me'en people in southwestern Ethiopia, in an area with better vegetation cover, reported 52 species of medicinal plants. The diversity of medicinal plants recorded in this study indicates that although the area is losing its natural vegetation, there are still many medicinal plants available to the users. There is also broad indigenous knowledge on the remaining vegetation and the medicinal plants, which also varies with gender, age, and lifestyle of the community.

Most of the women interviewed during the study explained that they are more responsible for family healthcare, especially that of children. Women usually collect the medicinal plants from nearby fields, homegardens, farmlands and live fences. Elderly men are more knowledgeable about a wide variety of medicinal plant species found in distant areas such as forests, rocky hillsides and faraway farmlands. However, many young people today are not versed about the variety and values of indigenous medicinal plants. This is more pronounced in the case of settled farmers. Key informants and elders of transhuman pastoralists explained that when their children are grown up the first thing that they are informally taught are the traditions, beliefs and norms of the family to be followed by that of the community. These

include how to move with herds of livestock, protect themselves from enemies and accidental illness and how to use traditional remedies and means of combating the problems as well. Medicinal plant knowledge, use and transfer of knowledge to the young generations can be affected by religious beliefs, modernization, acculturation and environmental change (Cunningham, 1993; Caniago and Siebert, 1998).

Though the young men and young women of transhuman pastoralists are far better in knowing medicinal plants and their applications than their counterpart settled young men and young women, increased modernization has influenced the transfer of knowledge and its sustainability. Those who go to school are showing unwillingness to learn from their parents, which is an evidence for the gradually disappearing traditional knowledge. This trend is also observed in other parts of Ethiopia. Ethnomedicinal knowledge diminishes with the death of elderly knowledgeable members of society since less and less young people are willing to acquire the knowledge. In this connection, Caniago and Siebert (1998) found that erosion of knowledge on medicinal plants is more significant in species collected from primary forests for use in treating rare and unusual ailments.

It is culturally believed that the treatment of spider's poison is strictly passed from generation to generation within the same family. There is a strong belief that the knowledgeable person could not give the medicine to others unless blessed by members of the family. Otherwise, it is believed that the medicine will be inefficient in treating the associated health problems.

The plants used and the methods of preparation are often closely guarded secretly, that is unusually passed from father to the eldest son or trustworthy person, and in the absence of

these, the elder daughter or the wife takes the oath. With each succeeding generation, the chance of distortion or misrepresentation of the original plants or cures may increase and many mistakes occur. Knowledge acquired without the permission of elders or healers and put into practice is believed to be ineffective. The consequence of acquiring indigenous knowledge out of the norms and traditions (illegally) is believed to result in a complex disaster, known as 'Orisa Rabbi' meaning God's rebuke, which in some cases is said to result in being handicapped by 'jinni'. This is an unexpected natural disaster believed to happen to the user and the healer.

In spite of their rich medicinal knowledge, most women in the study area are not free to exercise it. Women who were involved in this study were only seven and this was possible on special permission from their husbands. In the case of transhuman pastoralists it was impossible to document women's medicinal knowledge since such permission was denied. From the settled farmers, four women were specialist healers for different diseases, one for hepatitis, two for a variety of diseases and one for treating spider poison.

Another reason for the disappearance of knowledge of medicinal plants is also connected with the fact that most specialized healers in the area do not properly pass it down to the next generation. The reasons given were threefold: (1) healers show strong tendency of keeping their knowledge secret, (2) when they are willing to pass the knowledge to somebody else, the knowledge is possessed verbally and it includes vernacular names of the plant, mode of preparation, disease(s) treated and habitat of the plant which are very difficult for the learner to properly memorize all these facts, (3) aged healers passing the knowledge are not considered proper in most cases due to doubtful authenticity of the descriptions they provide

to learners. This has been evidenced by three-interviewed young men whose parents were professional healers. They reported that although they have taken the oath (ebba or tufa), they remember only the name of the disease their parents used to treat, but not the plants, where to find them and the methods of preparation. Cultural restrictions also contribute to loss of the knowledge. This is illustrated by the observation that an individual who has learned a variety of treatments from a well experienced healer, whom he had been serving, refused to practice his knowledge after the death of the healer because he did not receive the blessing and permission from the healer.

More medicinal plants were used in the past than those reported now as assessed from community consensus and informal communication with residents. This happened partly as a result of deforestation and cultural shifts that took place in the area over several years. This has resulted in the scarcity of individual members of some medicinal plants and the associated knowledge. The lower alluvial plains of Nura Heera that is now changed to the Nura Heera state farm were reported to have been covered with many species that are now observed as individual trees in scattered woodland and thickets in the grazing and browsing land. These tree species have been destroyed mainly due to the expansion of agriculture, the widely practiced production of charcoal, cutting for construction and firewood. The charcoal and the firewood are transported for sale in urban centres like Nazareth and Addis Ababa.

The fact that 32 medicinal plant species are known by both the settled farmers and transhuman pastoralists hint that the major sources of knowledge on the medicinal plants of 'Boosat ' are both the settled farmers and transhuman pastoralists, though there are differences

in the way the medicines are used. This might have happened as a result of the long-standing interaction in their day-to-day activities.

The majority of rural households use plants found in the environment for their primary health needs. It was found that the knowledge base of people in the study area is wider in treatment of common ailments, home remedies and applying preventive methods. For instance, treatment of febrile illness, malaria and preventive measures for anthrax are known at least by one family member in 'Boosat '. However, there are more specialized treatments where the knowledge is more restricted to a specialist practitioner or sometimes to two or more members of the family. For instance, ability to treat hepatitis is restricted to two individuals in the entire study area, one of whom is a female. The treatment of spider's poison was found being restricted to one family, a father and his son, giving services for the entire community. Respondents aged above 40 years were familiar with a wider variety of plant species and their medicinal uses and a greater number of species that are not currently found in the immediate vicinity of the village. This indicates that as one grows older one accumulates more knowledge, which appears to be significant when the knowledge difference between age groups 15-40 and those above 40 were considered. Most medicines are taken/given by a member of a family upon the permission or supervision of the head of the family or a healer, because they offer blessings.

According to informants, for health problems that affect humans and livestock, the efficacy and adverse effects of the medicines are tested on domestic animals before they are applied for treating human health problems. For example, anthrax, bronchitis and tuberculosis are

known to pass from livestock to humans, but the dosage and parts of plants used sometimes vary as prescribed by healers.

When there are different species prescribed for the same health problem, people show preference of one over the other. Of the several species used against snakebite people showed preference of one over the other. Furthermore, have shown their comparative choices of some medicinal plants more than others to treat specific diseases as was shown through paired comparison of plants used for treating malaria patients. When presented to the in a pair wise manner, the informants chose *Lepidium sativum* as the best medicine for malaria followed by *Andrachne aspera*, *Ximenia americana*, *Vernonia amygdalina* and *Phyllanthus maderaspatensis* in the order given.

From both paired comparison and preference ranking it could be understood that the most favoured species are usually the most efficacious, at least in the context of the people who use them. Furthermore, this shows the credibility and transitivity/continuity of the ethnomedicinal information obtained from indigenous people.

6.2 The Medicinal Plants and Parts Used

The finding that the most widely used plant remedies by people of 'Boosat' are obtained from shrubs (50.6%) followed by herbs (21.0%) might indicate that people rely more on shrubs and herbs because they are relatively common in the area as compared to medicinal tree species. This indicates that shrubs and herbs are replacing the forest resources of the area.

The fact that roots provide most remedies may hint at the possibility that use as medicine may contribute to the destruction of the natural vegetation and the medicinal plants therein. The popularity of roots, bark, rhizomes, stem and whole plants may have negative consequences on biodiversity and sustainability of the medicinal plant species in the area. *Ximenia americana*, *Croton macrostachyus* and *Andrachne aspera* which are harvested in the area for their roots and bark have already become scarce, perhaps indicating the possibility that medicinal use may have contributed to their reduction.

Collecting leaves alone could not pose a lasting danger to the continuity of an individual plant compared with the collection of underground parts, stem or whole plant. It has been noted that the increased awareness of the local people has helped them to find ways of regaining or conserving the most preferred species in homegardens, farm borders, live fences and ritually respected areas.

6.3 Mode of Preparation of the Medicine, Dosage and Route of Application

The study showed that 43 (24.3%) of the medicinal preparations are made from single plant preparations, and the use of mixtures of plant species in treating a particular ailment is also significant and accounted for 18 (10.2%) of the total (see Table 8). Potentiating effect of a concoction rather than using one plant to cure a particular disease is evident when they prescribe two or more medicinal plants. For instance, the curing potential of *Grewia ferruginea* in the treatment of malaria and intestinal parasites is increased by concocting it with roots of *Hagenia abyssinica* and *Euclea divinorum* in the preparation. Furthermore, *Rumex nervosus* when used in the treatment of measles is potentiated by concocting it with leaves of *Carissa edulis*, *A. tortilis* and *Capparis tomentosa*. Synergic interaction or

potentiating effect of one plant on the other in prescription of multiple sources is well recognized in Ethiopian tradition medicinal practice (Dawit Abebe and Ahadu Ayehu, 1993). A single species is also used in a variety of ways by concoction or mixing it with other species to cure different diseases. One of the many species used in this way is *Achyranthes aspera*. The root of this species could be concocted with *W. somnifera* root to treat urine retention problem in humans and concocted with roots of *Balanites aegyptiaca* and *W. somnifera* in cold water to treat anthrax in cattle.

Some of the preparations have material, spiritual and ritual values. Informants have evidenced that the young twigs and fresh leaves of *Premna resinosa* and *Vernonia amygdalina* are crushed and sprayed near or around fences of cattle, in houses and on utensils to remove evil work and bad spirit locally referred to as falfala, amajaji and buda. Crushed leaves of *Acalypha fruticosa* are mixed with cold water and sprayed in livestock fence to protect cattle from anthrax and on meat that is infected by anthrax probably to disinfect it. Dry or fresh roots of *Leucas abyssinica* and *Achyranthes aspera* are buried inside or on the gate of cattle fence as preventive measure of anthrax and blackleg from cattle and sheep.

Lack of precision in specifying the doses has been noted. Informants reported that unless there is proper handling and care, some of the medicinal preparations could be poisonous to humans and livestock. Some of the species noted for their poisonous effects are *Cissus quadrangularis*, *Datura stramonium* and *Parthenium hysterophorus*. Special care is required to keep away the milky exudates of *Cryptostegia grandiflora* from domestic animals and humans. Precautions are required in the case of *Jatropha curcas*, *Xanthium strumarium* and *Croton macrostachyus*. The milky exudates from *Euphorbia nigrispinoides* is considered to

be fatal if taken in larger quantities than prescribed by the healer. Informants showed their perception that the medicine is effective for those who can use it as prescribed by the healer. Most of the remedies for livestock are in larger quantities when compared to those given to humans.

The study showed that the leading route of application is internal, out of which oral administration accounted for 80 (92%) while the dermal application accounted for 36 (48.7%) of the external routes of application. Dawit Abebe and Ahadu Ayehu (1993) found out that the leading route of application of all the reported remedies used in northern Ethiopia is oral, which accounted for 42 %.

6.4 Habitat and Distribution of Medicinal Plants

Medicinal plants utilized by indigenous people of 'Boosat' are collected from the wild, only a few being found under cultivation. They are distributed in woodlands, shrublands, rocky hillsides, degraded woodlands, grazing and browsing lands, roadsides, in farmlands, farmboarders, and in ritually and spiritually protected areas as 'muka irrecha'.

The habitats of these medicinal plants are increasingly becoming threatened due to continued destruction of indigenous vegetation and drought for several years. The fact that most of the remedies are found in the wild poses a big threat to their existence as long as destruction of their habitats continues. Destruction of habitats has resulted in the rarity of some medicinal plants. For instance, informants reported that medicinal plants such as *Phyllanthus maderaspatensis*, *Carissa edulis*, *Olea europaea ssp. cuspidata*, *Croton macrostachyus* and *Senna italica* are rarely encountered in the area. Furthermore, they explained that the future

fate of tree species like *A. tortilis*, *A. albida*, *B. aegyptiaca* and *Ziziphus spina-christi* might be restricted to near settlements, in or at borders of individual farmlands, in relic forests and at spiritually and ritually protected areas. The destruction of tree species will inevitably increase the pressure on shrubs and herbs. The availability of medicinal plants is also influenced by seasonal variation. Some of the annual herbs become scarce during the dry season, and their spatial distribution is restricted to a few places making their collection and use difficult.

According to informants, 25 to 40 years ago, the society was dependent on indigenous medicinal plants to medicate themselves and their livestock. Finding medicinal plants in the nearby vegetation was easier. Recently, because of environmental degradation caused by several factors some of which are deforestation as a result of agricultural expansion, firewood collection, alien species encroachment, charcoal making and cutting trees for construction and other development related activities, some medicinal plants and multipurpose forest products could not be easily accessible. These days, for severe human and livestock diseases people are forced to go to government or private clinics for the purchase of modern medicines, which is unaffordable by the majority of the people.

However, the informants expressed hope that if they get alternative livelihoods the area could be rehabilitated. They need not only preserve and conserve the plant diversity of the area, but also to preserve a wide range of places of indigenous ethnobotanical information and cultural components. The ritually protected areas for the celebration of 'Gada' referred to as the 'Butta

Qala' area at Nura Heera and 'Muka Jaari' or 'Muka Irrecha' is the living examples for these practices and needs.

6.5 Management and Conservation Status of the Medicinal Plants

Medicinal uses of plant material are an integral part of the healing practices of many of the indigenous people of 'Boosat'. They have been using a wide variety of plants from nature. People of 'Boosat' have strong and genuine belief on the healing power of the plants and hence, they know the habitats, distributions, methods of gathering, utilization and preservation of the medicinal plants. They are also endowed with knowledge of local management and conservation of these plants. The intermixing of multipurpose indigenous trees by farmers on their farmland is evidence to the practice. This type of management practice benefits the indigenous people and also encourages them to conserve the plants for medicine and other uses. In arid and semi arid countries where people live in scattered communities having medicines within the area or close by is an indispensable necessity (Morgan, 1981). That is why almost many plants have medicinal or economic value for transhuman pastoralists or semi-nomadic or semi-arid dwellers (Morgan, 1981).

There is a strong belief that *Balanites aegyptiaca* and *Acacia tortilis* have high spiritual value in addition to their medicinal and other material values such as fodder and shade. The former is believed to enhance surplus (baraka) for crop production and to improve livestock health and as a shade for livestock and humans. Hence, people are concerned about its continued existence including by maintaining in their agricultural fields and near their homes.

Under the shade of *Acacia tortilis* people worship 'Rabbi / Waaqayo' and make ceremonies known as 'Jaari' for the well being of their family and their, village, good cropping and healthy livestock. For transhuman pastoralists, *A. tortilis* is a special spiritual and ritual tree. The bride and the bridegroom, on their wedding day, sit under this tree to be blessed by the elders in the name of 'Rabbi / Waaqayo'. In addition to this, a special tree from the genera *Grewia* or *Olea*, known as 'Bokku', is planted under the shade of *A. tortilis* for the celebration of 'Gada' festival. In a place where it is difficult to find *B. aegyptiaca*, sick cattle are tied under the shade of *A. tortilis* after placing a piece of *B. aegyptiaca* twig or leaves on *A. tortilis* tree. Some families put flag on individual tree where a group of trees are grown and protect for ritual and spiritual purposes. Any member of the family or community who cut a piece of these trees is believed to be punished by 'Rabbi/Waaqayo' (Orisa Rabbi).

The fruit of *Ziziphus spina-christi* is edible by humans, birds and other animals and it is also a medicinal plant. *Jatropha curcas* is medicinal plant widely used but not common in natural vegetation except on live fences. Informants reported that they conserve the plant for its medicinal value by growing it as live fence. Hence, the usefulness of these plants initiated the local people to conserve the medicinal plants. This indicates that the conservation of biodiversity exists in their socio-economic value. Martin (1994) directly connects this with biodiversity conservation, cultural survival and the search for new products, which are all inextricably linked.

Restriction on the time of collection, the need for special seasons, days, weeks and months contribute to the conservation of medicinal plants. The restrictions posed on the collection of medicinal plants such as the need for special prey before collecting them from the wild,

which is done only by a few inhabitants, is part and parcel of the management and conservation practice. In this case few individuals collect the medicinal plants on specific season, day and hours of the day. Some remedies are collected at the beginning of the year (for example, first day of September) by healers or elders only. In such cases the medicinal plant species would have enough time to regenerate and complete its life cycle. This is true mostly for annuals, those whose leaves, fruits, seeds and twigs are used, provided that other destructive pressures are kept at low level.

The secrecy behind collecting the medicinal plants from the wild, preparation methods and application are twofold. Firstly, it is a means of ensuring that the people do not lose the medicinal resources, secondly to keep the knowledge only by the healer or his/ her trainees. A person can collect medicinal plants known by other knowledgeable person or traditional healer if and only if he/she took an oath and put 'irrefacha '. Irrefacha is putting some precious material or money under the plant to be collected for medicine even after healer or the elders give permission. This can be seen as one form of exercising an intellectual property rights at the level of indigenous people. For example, there is a strong belief that the collection of *Cissus quadrangularis* requires 'irrefacha'. In the absence of 'irrefacha' it is believed that a snake or 'jinni' will affect the healer and the user being the cause for handicapedness. This also restricts the collection of medicinal plants to fewer people and hence less destructive.

The conservation measures in use by indigenous people of 'Boosat ' are limited when compared to counter conservation activities. The net effect is losing its natural vegetation at a fast rate. Agricultural intensification, production of charcoal, collection of firewood and

wood for construction fuelled up by increase in population, drought heavy grazing and browsing pressures accelerated the rate of devegetation.

7. CONCLUSIONS

There are many traditional medicinal plants with human and veterinary importance used by the community in 'Boosat'. The wide uses of these plants indicate that there is good consensus on the effectiveness of their medicinal properties. The traditional medicinal plants are central to the rural cultures and material needs. People are knowledgeable about the plants, their distribution, use, management and conservation. Indigenous practices somehow contributed to the sustained use, management and conservation of medicinal and multiple-use indigenous trees. This is further buffered by cultural and spiritual practices.

The area possesses diverse natural vegetation. The environment, however, is in the process of degrading. Therefore, these important medicinal plants are under threat and peoples' indigenous knowledge is also eroding. The major threats to medicinal plants and the associated knowledge are habitat changes because of environmental degradation, increased needs for land use and change in the peoples' lifestyles. This has greatly affected the availability of medicinal plants and has threatened the knowledge base as well.

Indigenous people of 'Boosat' have diverse knowledge of utilizing the medicinal plants. The knowledge is wider among elderly women and men while the young are comparatively less knowledgeable. The knowledge of medicinal plants is decreasing in its depth and breadth, less and less medicinal plants are being utilized by the current generation. However, young men of the transhuman pastoralists are relatively more knowledgeable than the young men of the settled farmers. Modernization, acculturation and increased commercial activities in the area have played a part in making the younger generation unwilling to practice and retain

traditional knowledge. In effect, the younger generation has started to consider traditional knowledge and practices less important.

People who are well versed about the plants and their uses must be assisted to implement appropriate conservation strategies. They need support from governmental and non-governmental organizations. They also need support from scientists to enhance and develop their traditional therapeutic systems as well.

The results of this study would have significant contribution in efforts directed towards conservation and preservation of the remaining resources of which there is still a considerable proportion left, provided that the necessary mechanisms are put in place before it is too late.

8. RECOMMENDATIONS

On the basis of the results of this study and the facts underlined in the conclusion the following recommendations are given:

- *Conservation measures should be targeted to priority species, which are currently the widely used medicinal plants in the area:* The targeted conservation measures can be achieved by encouraging people to grow medicinal plants in their homegardens, live fences and farmlands. In addition to this, local peoples' management and conservation of indigenous resources, which is set within complex spiritual, cultural and religious framework, should be maintained. This will ensure the continuation of the indigenous practices and the natural vegetation, which carry these medicinal plants.
- *Instituting measures for conservation of vegetation by employing sustainable utilization of indigenous knowledge:* The existing heavy pressure on the natural vegetation due to agricultural expansion, cutting of trees for construction, charcoal production and firewood, further aggravated by grazing and browsing pressures calls for urgent measures to be taken to rehabilitate and conserve the remaining vegetation. Governmental organizations, non-government organizations and scientists should direct their efforts towards the proper management and conservation activities with the active participation of local people by seeking alternative resource utilization in order to ensure the continued productivity and stability of the area. The indigenous knowledge and traditional systems play vital roles in the sustainable utilization and management of medicinal plant resources and the biodiversity in general in the study area. Hence, considerable attention should be given for recovery, sustainable utilization and management of medicinal plant resources

as an integral part of the natural vegetation of 'Boost'. Furthermore, traditional community based *in-situ* conservation should be complemented with *ex-situ* conservation.

- *Cultivate positive attitudes towards traditional medicinal plants:* Traditional medicinal plants are central to the indigenous cultures and material needs. Therefore, both formal and non-formal education systems should cultivate positive attitudes among the young by integrating into the curricula about the traditional use of plants in general and medicinal plants in particular. This could help to develop positive attitudes towards natural resources, indigenous knowledge and practices in medicinal plants. Thus, traditional medicinal plant resource use and management should be strengthened by developing peoples' values and positive attitudes towards indigenous knowledge and biodiversity. This also needs to give attention to indigenous peoples' intellectual property rights.
- *Pharmacological testing of popular medicinal plants:* The priority to test and develop the pharmacological and therapeutic / biological activity should be given to those medicinal plants that are most popular and efficacious in the context of the people who use them. In this regard pharmacological investigation could be recommended for antimalarial medicinal plants such as *Lepidium sativum*, *Andrachne aspera*, *Ximenia americana*, as medicine for snake bite *Cissus quadrangularis*, *Senna occidentalis* and *Indigifera amorphoides* and for spider poison *Eleusine africana* and *Lens culinaris*. Furthermore, the 20 medicinal plants widely used by humans and livestock, which also include the above, mentioned medicinal plants should be given considerable attention for the pharmacological investigation process.

- *Participatory development of environmental projects:* Development activities should originate at grassroots level and not from top down. It should integrate the needs and interests of the local people and their knowledge. Indigenous people should be consulted and directly involved in the planning and implementing of development and environmental projects. This would ensure the integration of positive cultural attitudes in the eventual execution of projects and build a sense of belonging on the part of the local community.

9. REFERENCES

- Abbink, J. (1993). Me'en ritual, medicinal and other plants: A contribution to southwest Ethiopia Ethnobotany. *Journal of Ethiopian Studies*, 26 (2): 1-21.
- Abbink, J. (1995). Medicinal and ritual plants of Ethiopia southwest: An account of recent research. *Indigenous Knowledge and Development Monitor*, 3(2): 6-8.
- Abbiw, D. K. (1996). Misuses and abuses of self-medication with medicinal plants: The case of *Erythropheum* in Ghana. In: *The Biodiversity of African plants: proceedings of the 14th AETFAT Congress 27 August 1994.*(vander Mesen.L.J.G., van der Burgt.X.M. and van Mednbach de Rooy. J,M. , ed.) Pp. 714-718. Wageningen, The Netherlands.
- Aketch, C. A. (1992). A preliminary survey of conservation status of some plant species in Kenya. In: Edwards, S and Zemedede Asfaw. (eds.). *The Status of Some Plants Resources in Parts of Tropical Africa. Botany 2000: East and Central Africa. NAPRECA Monograph series No 2*, pp, 58-65. Addis Ababa University, Addis Ababa, Ethiopia.
- Alcorn, B. J. (1984). *Huastec Mayan Ethnobotany*. University of Texas Press, Austin, USA. Pp 982.
- Alula Damte (1990). *Neotectonic of Nazret-Dera Area: A Thesis Presented to the School of Graduate Studies for the Degree of Master of Science in Geology*. Addis Ababa University, Faculty of Science, Geology Department, Ethiopia. Pp. 97.
- Anokbonggo, W.W. (1992). The Role of African Traditional Medicine in Healthcare Delivery Alongside Modern Medicine. In: Edwards, S. and Zemedede Asfaw (eds.). *Plants used in African traditional medicine as practiced in Ethiopia and Uganda*. Botany 2000, East and Central Africa, *NAPRECA Monograph Series No. 5*, pp. 24-35. Addis Ababa University, Addis Ababa, Ethiopia.

- Archer, F. M. (1990). Planning with people. *Ethnobotany and African uses of plants in Namaqualand (South Africa)*. In: *Proceeding of the 12th Plenary meeting of AETFAT*. (Peters.C.R.,and Jejoly.J., ed.), pp, 959-972. Mitt, Institute, Allg. Bot. Hamburg.
- Aregbeyen, J. B. O. (1996). Traditional herbal medicine for sustainable primary healthcare. *Indigenous Knowledge and Development Monitor* 4 (2): 14-15.
- Asfaw Debella, Dawit Abebe and Kelbessa Urga (1999). *An overview of traditional medicine in Ethiopia: Perspectives and Developmental Efforts*. In: *Ethiopian Pharmaceutical Association. Silver Jubilee Anniversary, Special Issue* . (Tamirat Ejigu, ed.), pp. 45-52. Ethiopian Pharmaceutical Association, Addis Ababa, Ethiopia.
- Azene Bekele- Tesema, Birnie, and Tegrias, B. (1993). *Useful Trees and Shrubs for Ethiopia*. Regional Soil Conservation Unit (RSCU), Swedish International Development Authority-Technical Handbook No 5. Nairobi, Kenya.Pp. 474.
- Balick, M. J and Cox, P.A. R. (1996). *Plants, People and Culture: The Science of Ethnobotany*. Scientific American Library, New York, USA. Pp. 219.
- Bayafers Tamene (2000). *A Floristic Analysis and Ethnobotanical Study of the Semi- Wetland of Cheffa Area, South Welo, Ethiopia*. Masters Thesis. A Paper Submitted to School of Graduate Studies. Addis Ababa University, Science Faculty, Department of Biology, Ethiopia. Pp. 139.
- Beentje, H. J. and Smith, S. A. L. (eds.) (2000). *Compositae/Asteraceae* (part 1). *Flora of Tropical East Africa*, pp. 1-313 Royal Botanic Gardens, Kew.
- Beyene Petros, Solomon Sorsa, Fekede Balcha and Mesfin Bogale (1993). An invitro screening of some Ethiopian traditional plants against *Plasmodium falciparum*. In: *Fifth NAPRECA, Symposium on Natural Products, Sept. 19-23, 1993*, pp. 117-119. Antanarivo, Madagascar.

- BWADO (Boosat Wereda Agricultural Development Office) (2000). *1998/1999 Annual Activity Report*. pp. 1-30. Welincitii, Ethiopia (unpublished).
- BWHSO (2000) (Boosat Wereda Health Service Office). *1999/2000 Annual Report*, pp. 20-25. Welinciti, East Shewa, Ethiopia.
- Caniago, I. and Siebert, S. F. (1998). Medicinal plant ecology, knowledge and conservation in Kalimantan, Indonesia: *Economic Botany* 52 (3): 229-250.
- Chikamai, B. (1998). Non-Wood forest products of Africa's drylands: Their contribution to local community livelihood systems. In: *Dryland Biodiversity: Focus on forest biotechnology research. Impact on African communities*, Odera, J. (ed.), pp. 9-14. National Museums of Kenya, Nairobi.
- Cole, N. H. A. (1996). Diversity of Medicinal plants in West Africa Habitats. In: *The Biodiversity of African Plants Proceeding 14th AETFAT Congress 22-27 August 1994*, (vander Mesen.L.J.G.,van der Burgt.X.M. and van Mednbach de Rooy. J,M. ,ed.) , pp. 704-768. Wageningen, The Netherlands.
- Coppock, L. (1989). The arid and semi-arid lowlands of Ethiopia: *Environments, Pastoral Economics and Issues in Natural Resources Sustainability*. In: *Proceedings of The First Natural Resources Conference*, pp. 116-122, IAR, Addis Ababa, Ethiopia.
- Cotton, C. M. (1996). *Ethnobotany: Principles and Applications*. John Wiley and Sons Ltd., West Sussex, England. Pp. 347.
- Croom, E. M. JR. (1983). Documenting and Evaluating Herbal Remedies: *Economic Botany*, 37 (1): 13-27.
- Cunningham, A. B. (1990). People and Medicine. *The explanation and conservation of Traditional Zulu Medicinal Plants*. In: *Proceeding of the 12th Plenary Meeting of*

AETFAT Symposium VIII. (Peters.C.R.,and Jejoly.J., ed.), pp., 979-990, Mitt. Institute, Allg. Bot. Hamburg.

Cunningham, A. B. (1993). African medicinal plants: Setting priorities at the interface health care between conservation and primary healthcare (Sample, A. ed.). *People and Plants working paper*, pp 1-50. Paris, UNESCO.

Cunningham, A. B. (1996). People, park and plants use recommendations for multiple use zones and development alternatives around Bwindi: Impenetrable National Park, Uganda. (Sample, A.ed.). *People andp plants working paper 4*,Walter, M & Höft, R. (eds), pp 18-23. UNESCO, Paris.

Dawit Abebe (1986). Traditional medicine in Ethiopia. The attempts being made to promote it for effective and better utilization. *SINET, Ethiop., J., Sci.*, 9 (supp): 61-69, Faculty of Science. Addis Ababa, Ethiopia.

Dawit Abebe (1998). *The Role of Medicinal plants in Healthcare coverage of Ethiopia* National workshop on “ Biodiversity Conservation and Sustainable use of Medicinal Plants in Ethiopia: *Programme and Abstracts*, April, 28-May 1, 1998. Addis Ababa, Ethiopia.

Dawit Abebe and Ahadu Ayehu (1993). *Medicinal Plants and Engmatic Health Practices of Northern Ethiopia*. Berhanina Selam Printing Enterprise, Addis Ababa, Ethiopia. Pp .341.

Dawit Abebe and Estifanos Hagos (1991). Plants as a Primary Source of Drugs in the Traditional Healthcare Practices of Ethiopia. In: *Plant Genetic Resources of Ethiopia*. (Engles, J. M. M, Hawkes, J. G and Melaku Worede, eds.), pp. 101-130, Cambridge University Press, Cambridge.

- Daniel Gamachu (1977). *Aspects of Climate and Water in Ethiopia*. Addis Ababa University Press. Pp.71
- De Voletter, J. (1991). *Forest Genetic Resources of Ethiopia*. In: *Plants of Important Gene Pool in Ethiopia*. Engles, J.M.M., Hawkes, J.G., Melaku Worede, (eds.), Pp. 82-87. PGRC/E, Cambridge
- Ethiopian Mapping Agency (EMA) (1988). *National Atlas of Ethiopia*, P. 30, Addis Ababa, Ethiopia.
- Ensermu Kelbessa, Sebesebe Demissew, Zerihun Woldu and Edwards, S. (1992). Some threatened endemic plants of Ethiopia. In: Zemedede Asfaw and Edwards, S. (eds.). *The Status of Some Plant Resources in Parts of tropical Africa*, Botany 2000. *NAPERECA, Monograph No 2*: 35-55. Addis Ababa, Ethiopia.
- East Shewa Zone Planning and Economic Development Department (ESZPEDD) (1999) (East Shewa Zone Planning and Economic Development Department) (1999). *Zonal Atlas of East Shewa*, Berhanina Selam Printing Enterprise, Adama, Oromia, Ethiopia. Pp. 60.
- FAO (1983). Selected medicinal plants. *FAO Plant Production and Protection Paper 53-1*, pp. 1-94. UN, Rome.
- FAO (1986). *Some medicinal forest plants of Africa and Latin America*. FAO, UN, Rome. Pp. 253.
- FAO-UNESCO. (1988). *Soil map of the world*. Revised legend, Rome. Pp.81
- Farnsworth, N. R. (1994). Ethnopharmacology and Drug Development. In: *Ethnobiology and the Search for New Drugs*. Wiley Chichester (Ciba Foundation Symposium 185), pp. 42-59. Chicago, USA.
- Fichtl, R. and Admasu Adi (1994). *Honeybee Flora of Ethiopia*. Margraf Verlag, Wickersheim, Germany. Pp. 510.

- Gelahun Abate (1989). *Etse Debdabe (Herbal Message). Ethiopian Traditional medicine*. Addis Ababa University, Department of Biology. Artistic printing press, Addis Ababa, Ethiopia. Pp.224.
- Gilbert, M. G. (1995). *Euphorbiaceae*. In: *Flora of Ethiopia and Eritrea* volume 2 part 2. Edwards, S, Mesfin Tadesse and Hedberg, I. (eds.), pp. 265-380. Addis Ababa, Ethiopia, Uppsala, Sweden.
- Grabher, G. and Kojima, S. (1993). *Vegetation Diversity and Classification Systems*. In: *Vegetation Dynamics and Global Change*. Solomon, A. and Shugart, H. (eds.), pp. 218-231. Chapman and Hall, Inc. London.
- Hadidi, M. N. (1985). Food plants of prehistoric and Predynastic Egypt. In: Wickens, G., Goodin, J. and Field, D. (eds.). *Plants for Aridlands Proceeding of the Kew International Conference on Economic Plants for Aridlands in the Jodrell Laboratory, Royal Botanic Gardens. Kew, England; 23-27 July 1984*, pp. 87-92. George Allen and Unwin Publishers Ltd, London, UK.
- Hardon, A., Boonmongkon, P., Streefland, P., Limtan, M. Hanguivatana, T, Greet, S.V, Vanstaa and A. L. Varkevisser, C. (1995). *Manual of Applied Health Research: Anthropology of Health and Healthcare*. Second revised print. University of Amsterdam Medical Anthropology Unit, Netherlands. Pp. 331.
- Hedberg, I. (1993). Botanical methods in ethnopharmacology and the need for conservation of medicinal plants. *Journal of Ethnopharmacology*. No. 38 : 121-128.
- Hill, A. F. (1965). Fatty oils and waxes. *A Text Book of useful plants and plant products. Economic Botany*, 2nd ed. McGraw. Hill Book Company Newdelli, India. Pp. 65.

- Höft, M., Barik, S. K, and Lykke, A. M. (1999). Quantitative ethnobotany. Applications of multivariate and statistical analysis in ethnobotany. *People and plants working paper. (Höft,R.ed.).* 6: 1-46. UNESCO, Paris.
- IBCR. (2000). *National Biodiversity Conservation and Research Program* (unpublished official document). Pp. 53—56. Institute of Biodiversity Conservation and Research (IBCR), Addis Ababa, Ethiopia
- Isaac Habtemariam (1984). *Vegetation Succession in the Volcanic Region Between Kulumsa and Metahara*. A Thesis Submitted to the School of Graduate Studies, Addis Ababa University. .Pp.86
- ITDG and IIRR (1996). Ethnoveterinary medicine in Kenya: *A field Manual of Traditional Animal Healthcare Practices*: Intermediate Technology Development Group and International Institute of Rural Reconstruction.. Nairobi, Kenya. Pp. 226.
- IWU. (1993). *Handbook of African Medicinal Plants*. CRC. Inc. Boca, Raton. Ann Arbor. London. Tokyo. . Pp. 43.
- Jain, S. K. and Namita, D. (1979). Some Ethnobotanical notes from northeastern India. *Economic Botany*, 33 (1): 52-56.
- Jansen, P. C. M. (1981). *Spices Condiments and Medicinal Plants in Ethiopia: Their Taxonomy and Agricultural Significance..* Wageningen, The Netherlands. Pp. 315.
- Jeffrey, C. (1995). *Cucurbitaceae*. In: *Flora of Ethiopia and Eritrea* Vol 2 part 2. Edwards, S, Mesfin Tadesse and Hedberg, I. (eds.), pp. 17-59. Addis Ababa, Ethiopia, Uppsal, Sweden.
- Jongkind, C. (1987). *Herbarium Description of Parthenium hysterophorus*. Herbarium Vadense, Wageningen, 1975-1977.

- Kayemba- Ogwal, E.N. (1989). The Value of Taxonomic Investigations Into Medicinal Plants in Africa. *NAPRECA. Symposium on Natural Products, Symposium Handbook, May 15-19, 1989*, pp, 66-69. Arusha, Tanzania.
- Kazmin, V. and Seife Michael Berhe (1978). Stratigraphy and Correlation of Tertiary Volcanic Rocks in Ethiopia: *A Report on the Nazareth Sheet Geological Map*: Ministry of Mines and Power Resources, Addis Ababa, Ethiopia.
- Kloos, H.(1976), *Medicinal Plants and PLant Products in Market of Central Ethiopia. Semifinal Draft of Ph.D. Thesis*. University of California, USA. Pp. 20
- Kokwaro, J, O. (1976). *Medicinal plants of East Africa*. General Printers Ltd. Nairobi, Kenya. Pp. 384.
- Langenheim, J. H. and Thimann, K.U. (1982). *Plant Biology and its Relation to Human Affairs*. University of California, Santa Cruz, Newyork . Pp. 10-45.
- Lewis, W. H and Elvin-Lewis, M. P (1994). Basic quantitative and experimental research phase of future ethnobotany with reference to the medicinal plants of South America. In: *Ethnobotany and the search for new drugs, Chichester (Ciba Foundation Symposium, 185)*, pp. 60-76. Washington University, USA.
- Martin, G. J. (1994). Conservation and ethnobotanical exploration. In: *Ethnobotany and the search for new drug, John, Wileye, Chichester (Ciba, Foundation Sympisium 185)*, pp. 228-245. Place de Fonteny, Paris, France.
- Martin, M. J. (1995). A Methods Manual. Chapaman and Hill, London. Pp. 251.
- Mathias, E. (1996). How can ethnoveterinary medicine be used in field project? *Indigenous Knowledge and Developmetn Monitor*, 4 (2): 6-7.
- Maundu, P. M. (1995). Methods for collecting and sharing. indigenous knowledge: A case study. *Indigenous Knowledge and Development Monitor*. 3 (2): 3-5.

- Maundu, P. M., Ngugi, Kabuye, C. H. S. (1999). *Traditional Food Plants of Kenya*. Kenya Resource Centre for Indigenous Knowledge (KENRIK), National Museums, Kenya. Pp. 270.
- Mc Corkle, C. M. and Mathias, E. (1996). *Animal Health Biotechnology: Building on Farmers Knowledge*. Bunders, J, Haverkort, B and Heiemstra, W., (eds.), pp. 22-51. Macmillan Education LTD., London.
- Mesfin Abebe (1998). *Nature and Management of Ethiopian Soils*. Alemeya University of Agriculture, Ethiopia. Pp. 270.
- Mesfin Tadesse and Sebsebe Demissew (1992). Medicinal Ethiopian Plants: Inventory, Identification and Classification. In: Edwards, S. and Zemedede Asfaw, (eds.). Plants used on African traditional medicine as practiced in Ethiopia and Uganda. East and Central Africa. *Botany 2000. NAPRECA, Monograph Series No. 5*: 1-19. Addis Ababa University, Ethiopia.
- Mesfin Wolde-Mariam (1972). *An Introductory Geography of Ethiopia*, H.S.I. University, Addis Ababa, Ethiopia. Pp.214.
- Mirgissa Kaba (1996). Utilization of plant medicine for the treatment of health problems. The Case of the Oromo of Chora District Ilubabor Zone, Western Ethiopia. *The Ethiopian Journal of Health Development*, 10 (3): 161-166.
- Mirutse Giday (1999). *Medicinal plants by the Zay people in Ethiopia: Masters Thesis, a paper submitted to University of Uppsala*, for the Partial Fulfillment of the Degree of Master Science in Biodiversity, Swedish Biodiversity Centre, Uppsala, Sweden. Pp. 90.
- MOA (1998). *Agro-Ecological Zonation Map of Ethiopia*. MOA, Natural Resources Management and Regulatory Department, Addis Ababa, Ethiopia.

- Mohr, P. A. (1971). *The Geology of Ethiopia. 2nd ed.* University College of Addis Ababa Press, Addis Ababa, Ethiopia. Pp. 130.
- Morgan, W.T.W. (1981). Ethnobotany of the Turkana: Use of plants by a pastoral people and their livestock in Kenya. *Economic Botany*. 35 (1): 96-130.
- Morton, B. (1978). *A Field Guide to Ethiopian Minerals, Rocks and Fossils*, Aristic Printers, Addis Ababa University, Addis Ababa. Ethiopia. Pp. 170.
- Murphy, H. F. (1959). A report on the fertility status of some soils of Ethiopia: *Experimental Station Bulletin No. 1*, pp. 164-171. Imperial Ethiopian College of Agriculture and Mechanical Arts. Artistic printing press, Addis Ababa, Ethiopia.
- Nijar, G. S. (1996). *Trips and biodiversity: The threats and responses: A third World View*, pp. 1-36. Third World Network, Penang, Malesiya.
- NMSAE. (2000). 1965-1998 Metreological Data on Rainfal and Temperature of Nazareth Mission- the nearest station to Boosat. National Metrological Service Agency of Ethiopia , Addis Ababa, Ethiopia.
- Ollevier, K.U.L. (1993). *Statistica for Windows*. Statistica Software. Inc. USA.
- Pankhurst, R. (1965). A historical examination of tradiational medicine and surgery. *Ethiopian Medicinal Journal*, 3 (4):160.
- Pankhurst R. (1990). *An Introduction to Medicinal History of Ethiopia*, pp. 250-251. The Red Sea Press, Inc. New Jersey.
- PGRC / E (1995). Proceeding of the Workshop on Planning and Priority Setting. *Eco-geogrphic Survey and Ethnobotanical Research in Relation to Genetic Resources in Ethiopia, Feb. 15-16, 1995*. (Hirut Kebede, Dawit Taddesse and Fassil Kebebew, (eds.). Institute of Biodiversity Conservation and Research, Berhanena Selam printing press, Addis Ababa Ethiopia.

- Phillips, O and Gentry, A. H. (1993). The Useful Plants of TAMBOPATA, PERU: Statistical Hypothesis Test With A New Quantitative Technique. *Economic Botany*, 47 (1): 15-32.
- Phillips, S. (1995). *Poaceae*. In: *Flora of Ethiopia and Eritrea*, Vol 7, Hedberg, I. and Edwards, S. (eds.), pp 303-304. Addis Ababa, Ethiopia, Uppsala, Sweden.
- Prance, Ghilleen, J. (1991). What is ethnobotany today? *Journal of Ethnopharmacology*, 32 : 209-216.
- Sands, M. (1989). *Balanitaceae*. In: *Flora of Ethiopia* Vol 3, Hedberg, I and Edwards, S., (eds.) pp. 433-436. Addis Ababa, Ethiopia, Uppsala, Ethiopia.
- Shanker, D. (1993). Medicinal plants and Biodiversity. *Journal of Ethnopharmacology*. 33: 100-119. Elsevier Scientific publishers, Ireland Ltd. Ireland.
- Sebsebe Demissew (1998). A study of the vegetation and floristic composition of Southern Wällo, Ethiopia. In: *Journal of Ethiopian Studies (JES)*, 31 (1): 159-192.
- Taffese Mesfin, Sisay Lemma, Gebru Bongor, Gebrenegus Tesfamariam and Zeleke Assaye (1995). *Evaluation of Some Traditional Herbs In The Highlands of Ethiopia For Their Anthelmintic Value In sheep: Phase I Research Report 1995*, pp. 1-18. Addis Ababa, Ethiopia.
- Tewelde Berhan Gebre Egziabher, Mesfin Tadesse, Gelahun Abate, Birhanu Abegaz and Tesfaye Biftu (1979). The Potentials of Traditonal Healers and Indigenous Drugs In Healthcare In Africa. In: *13th Annual Meeting of the Association of Medical Schools In Africa. April 23-27, 1979*, pp. 1-8. Faculty of Science, Addis Ababa University Ethiopia.

- Thulin, M. (1989). *Fabaccae*. In: *Flora of Ethiopia* Vol. 3, Hedberg, I and Edwards, S. (eds.), pp. 49-251. The National Herbarium, Addis Ababa University Addis Ababa and Asmara, Ethiopia, Uppsala, Sweden.
- TRAFFIC International (1998). *Searching for A Cure: Conservation of Medicinal Wildlife Resources in East and Southern Africa*, pp. 1-111. Cambridge, U.K.
- UNDP/FAO (1984). *Assistance to Land Planning of Ethiopia. Geomorphology and Soils*. Addis Ababa, Ethiopia. Pp. 246.
- Verdcourt, B. (1992). *Verbenaceae. Flora of Tropical East Africa*. Polhill, R.M., (ed.), Royal Botanic Gardens, Kew. Pp. 155
- Walter, H., Lieth, H. (1967). Klimadiagram, Weltatlas VEB. Gustaw-Fischer, Jena.
- White, F. (1983). *The Vegetation of Africa: A Descriptive Memoir to Accompany the UNESCO/AETFAT/UNSO Vegetation of Africa*, pp. 44-117. UNESCO, Paris.
- WHO. (1998). Regulatory situation of herbal medicines: A *Worldwide Review*: pp. 1-9. *WHO/TRM/98.1*, Geneva.
- Wilson, R.T. and Woldu Gebremariam (1979). Medicine and magic in central Tigre: A contribution to the ethnobotany of the Ethiopian plateau. *Ecnomic Botany*, 33 (1): 29-34
- Worku Abebe (1984). Traditional Pharmaceutical Practice in Gonder Region. North Western Ethiopia. *Journal of Ethnopharmacology*, 11: 33-47.
- Yehenew Mekonnen (1994). A survey of plants potentially toxic to livestock in the Ethiopian Flora. In: *SINET Ethiop. J. Sci.* 17 (1): 20-35.
- Zemedede Asfaw (1998). The Role of Homegardens in Production and Conservation of Medicinal Plants. *National Workshop on "Biodiversity Conservation and Sustainable*

Use of Medicinal Plants in Ethiopia, P.I. Programme and Abstracts April, 28-May 1, 1998. Addis Ababa, Ethiopia.

Zemedu Asfaw (1999). *Ethnobotany of Nations, Nationalities and Peoples in Gambella, Benshangul Gumuz and Southern Regions of Ethiopia*, (a research report submitted to the Research and Publication Office, Addis Ababa University), Addis Ababa, Ethiopia. Pp. 172.

Zerihun Woldu (1999). Forests in the Vegetation Types of Ethiopia and their Status in the Geographical Context. In: *Forest Genetic Resources Conservation: Principles, Strategies and Actions: Proceeding of The National Forest Genetic Resource Conservation Strategy Development Workshop*. Edwards, S., Abebe Demissew, Taye Bekele and Hasse, G., (eds.), pp. 1-36. IBCR/GTZTCO, Berhanena Selam Printing Enterprise, Addis Ababa. Ethiopia.

Zerihun Woldu and Mesfin Tadesse (1990). The status of the vegetation in the Lake Region Rift Valley of Ethiopia and possibilities of its recovery. *SINET. Ethiop. J. Sci.*, 13 (2): 97-120.

Appendix 1 Plants Used as Medicine for Humans, their Local names, Habit, Type of Disease, Mode of Application, Collection Number (Coll. No.), Ha, Habit; H, herb; C, Climber; S, Shrub; T, tree; PP, plant part used; L, leaf; F, fruit; S, seed; AG, aboveground; Ro, root; St, stem; S, L, seed and leaf; Tg, twig; FL, flower; B, bark; Wp, whole plant; MA, mode of application; Ro, L, root and leaf; Ro, AG, root and aboveground; B, L Bark and leaf; St, L, stem and leaf, Am., Amharic; Or., Ormiffa; DH, Debela Hunde

Scientific name	Family	Local name	Ha	PP	Disease treatment	Mode of Application	Coll.No
<i>Acacia albida</i> Del. (<i>Faidherbia albida</i> Del.) A. Chev.	FABACEAE	Garbi (Or.)	T	B	Malaria (lagida)	Crushed pieces of bark of <i>A. albida</i> and <i>Zingibar officinarum</i> rhizome and NaCl solution are concocted and mixed in cold water. 1 cup of the mixture is served as a drink for 3 days.	DH. 57
<i>Acacia nilotica</i> (L.) Willd ex Del.	FABACEAE	Kassale, Burquqe (Or.)	T	B, L	Tonsillitis in children (harsase)	A piece of fresh bark and leaves are chewed and small amount of the juice is spitted into children's mouth for repeated days. For grown up children 1 cup of the juice is recommended as a drink. The remedy could be concocted with piece of bark of <i>Commiphora africana</i>	DH. 24
<i>Acacia tortilis</i> (Forssk.) Hayne	FABACEAE	Xaddacha (Or.)	T	B, L	Swelling (Dhulla)	Pieces of fresh leaves and bark are chewed and some amount of the juice is spitted onto the swelling. It forces the swelling to burst.	DH. 89
<i>Andrachne aspera</i> Spreng.	EUPHORBIACEAE	Qoricha Ilmaan Gobana (Or.)	H	Ro	Malaria Tetanus and Snake poison	A piece of fresh or dried root is chewed before breakfast and small amount of juice is swallowed. Alternatively 1 cup of the juice could be drunk.	DH.26
				L	Malaria, Tetanus and snake poison	Dried leaves are pounded and mixed with cold water, ½ glass of the mixture is served as a drink for children and 1 cup for adult patient	
<i>Acacia oerfota</i> (Forssk.) Schweinf.	FABACEAE	Ajo (Or.)	S	St	Toothache	A piece of fresh stem is chewed and small amount of juice is swallowed. Alternatively it could be used as toothbrush.	DH. 109
				St	Pain (waransa)	A piece of stem is used as tooth brush	
<i>Amaranthus dubius</i> Mart. ex Thell.	AMARANTHACEAE	Jalachisa; Harandiimessa (Or.)	H	S	Diarhoea	Dried seeds are pounded and mixed with flour made from <i>Eragrostis tef</i> seeds and a piece of bread is made from the mixture and served to the patient any time of the day.	DH. 83
<i>Aerva javanica</i> (Burm. f.) Schultes	AMARANTHACEAE	Akiya (Or.)	S	Ro	Snake poison and cobra's attack (Buutii)	A piece of crushed and pounded root is tied on affected part.	DH. 9
				Ro	Nasal bleeding (funuunna)	Crushed root is soaked in water and the decoction is creamed in nasal opening, alternatively the dry smoke is inhaled	

<i>Ajuga integrifolia</i> Ham.	LAMIACEAE	Harmagusa (Or.)	H	L	Malaria and Pain	Few green crushed leaves are mixed with cold water, 1 cup of the mixture is served as a drink	DH. 66
				L	Rheumatism (Qurxumati)	Crushed leaves are mixed with cold water, 1 cup is served as a drink for 3 to 7 days	
				L	Bronchitis	The same preparation as for rheumatism. Adverse effect is vomiting.	
<i>Berchemia discolor</i> (Klotzsch.) Hemsl.	RHAMNACEAE	Jajaba (Or.)	T	B	Sexual impotence in men (Zakaara laafe)	A piece of inner fresh bark is crushed pounded and boiled with milk of camel, goat or honey or simply heated in water, 1 cup of the filtrate is served as a drink before breakfast. The remede is applied only if there is a sign of response	DH.71
<i>Bidens pilosa</i> L.	ASTERACEAE	Maxxanne (Or.)	H	L.	Diahroea	Few leaves are crushed and squeezed, 1 glass of the juice is drunk for 3 days with cold water	DH. 12
					Nasal bleeding (funuuna)	Freshly squeezed leaves are inhaled through nasal opening	
				Ro	Snake poison	Fresh or dried root is chewed and small amount of the juice is swallowed immediately after snake poison.	
<i>Cadaba farinosa</i> Forssk.	CAPARIDACEAE	Qualqalcha (Or.), Gumera (Am.)	S	Ro	Evil eye in children	A piece of root is crushed and pounded; the powder is tied on children's neck by new and clean cloth .Dry smoke of root is inhaled.	DH. 69
				Ro	Ulcerated wound (Bleast Ulcer	A piece of freshly collected root is boiled with butter or fat of sheep tail; 1 cup of the filtrate is served as a drink before breakfast for 3 days. Adverse effect, vomiting.	
<i>Calotropis procera</i> (Ait.) Ait. f.	ASCLEPIADACE AE	Falfala adal (Or.)	S	Me	Hemorrhoids (external)	Milky exudate is topically applied for external hemorrhoids	DH. 97
				Ro	Hemorrhoids (internal)	A piece of root is crushed and boiled with water 1 cup of the filtrate is served as a drink before breakfast. The treatment is given any other three days for 3 days. Adverse effect, vomiting. Antidites: boiled coffee and milk.	
<i>Carissa edulis</i> (Forssk.) Vahl	APOCYNACEAE	Hagamsa (Or.)	S	Ro	Evil eye	Fresh root is pounded, mixed with cold water and 1 cup is drunk for 1 or 5 days. Alternatively it can be taken with un boiled milk	DH 58
<i>Catiba edulis</i> (Vahl.) Forssk. ex Endl.	CELASTRACEAE	Caati (Or.)	S	St	Amoebiasis	Freshly collected young stem with leaves of <i>Withania somnifera</i> are boiled together and ½ glass of the filtrate is served as a drink. Alcoholic drink is restricted, lemon and sugary food is allowed after 3 hours	DH. 126
				L	Gonorrhoea	Few fresh leaves are crushed, pounded and mixed with cold water; ½ glass of the filtrate is served as a drink before breakfast.	
<i>Cleome ramosissima</i> Weib. ex Par.	CAPPARIDACEAE E	Qoricha gofle (Or.)	S	Wp	(Lymphatic Swelling)	The patient inhales the drysmoke of whole plant until he/she sweat at bedtime for 3 days.	DH.33

<i>Commiphora africana</i> (A. Rich.) Engle.	BURSERACEAE	Hamma (Or.)	T	B.J	(Gofle) Cobra's attack and infected wound	Pieces of fresh leaves and bark are crushed and mixed with cold water the mixture is tied to the affected body.	DH. 30			
<i>Croton macrostachyus</i> Del.	EUPHORBIACEAE E	Bakkanisa (Or.)	T	Wp	Wound (fungal infection)	A piece of bark is dried and pounded on a wound washed by dilute NaCl solution	DH. 42			
				L	Ringworm (Robbi) and infected wound of any sort.	Young leaves and bud are squashed and topically added to the wound, external fungal infections and ringworm				
				Ro	Gonorrhoeae	A piece of fresh or dried root bark is boiled in water and filtrate is concocted with rinsed milk (baadu), 1/2 glass is served as a drink for 3 days.				
				Ro	Sexual impotency in men	The same preparation made for Gonorrhoeae assist male sex organ, even the inactive one to erect. Adverse effect, it dehydrates the whole body. When it becomes serious stop the medication.				
<i>Cucumis dipsaceus</i> Ehrenb. ex Spach.	CUCURBITACEAE E	Holloto (Or.)	C	Ro	Gonorrhoeae	Crushed fresh roots of <i>L. abyssinica</i> concocted with crushed roots of <i>C. dipsaceus</i> and little honey, 1 cup of the concoction is served as a drink before breakfast 3 times in a week (Tuesday, Thursday and Friday)	DH. 54			
				S	Tetanus (Hadha'a)	Crushed seeds are concocted with crushed root of <i>W. somnifera</i> and put on the wound				
				Ro	Kidney infection and pain	A piece of fresh or dried root is chewed and small amount of the juice is swallowed				
<i>Cynolossium caeruleum</i> Hochst, DC.	BORAGINACEAE	Qoricha Michi (Or.)	S	L	Fibrile illness (Michi)	Handful of fresh leaves are smashed by hand, small amount of cold water is added to the squash, the mixture is inhaled and few drops are drunk (unachuu). Alternatively, vapour smoke of boiled leaves is served and the residue is also creamed to the patient's body after cooling	DH. 23			
<i>Dichrostachys cinerea</i> L. Wight. ex A. Rich	FABACEAE	Jirme (Or.)	S	L	Tetanus	Crushed leaves are concocted with crushed shoot part of <i>Sida ovata</i> ; water mixture of the concoction is creamed on to the wound everyday for 5 to 7 days.	DH. 22			
<i>Eleusine africana</i> Kenn. O' byrne	POACEAE	Coqorsa (Or.)	H	Ag	Spider poison	Above ground part is chewed and spitted on affected part of the body and covered with <i>Lens culinaris</i> seeds that are chewed and applied to the affected part. Both the healer and who applies the medicine and the patient are advised not to urinate and have breakfast before applying the medicine, which is very early in the morning.	DH. 43			

<i>Ehretia cymosa</i> Thonn.	BORAGINACEAE	Ulagaa (Or.)	T	L	Fibrile illness	Juice is made by squeezing leaves, the juice is topically applied on the whole body at bedtime. Over it 1 cup of the juice is drunk and the residue is used to wash the body in the morning	DH. 19
<i>Erianthemum dregei</i> (Ekl. And Zeey.) Tiegheem.	LORANTHACEA E	Dheertu xaddaaha (Or.)	Hp	Wp	Measles (Guddiftu)	Whole plant is boiled in water, the vapour is smoked and residue is used for washing children for 3 days. The waste is disposed out of reach of other people.	DH. 99
<i>Euphorbia nigrispinoides</i> M. Gilbert.	EUPHORBIACEA E	Hadeamii gababaa (Or.)	S	Ag	Goiter and Lymphotic swelling	Milky exudate of stem is mixed with distilled water; the mixture is injected into swollen part only once. Adverse effect. Vomiting and diarrhoea. Antidote, drinking milk after quitting the medication	DH. 75
<i>Grewia ferruginea</i> Hochst. ex A. Rich.	TILIACEAE	Danisa (Or.)	S	B	Malaria and Intestinal parasite	A piece of bark is crushed and concocted with roots of <i>Hagenia abyssinica</i> and <i>Euclea divinorum</i> mixed with water and kept overnight, 1 glass of the mixture is served as a drink before breakfast	DH. 86
<i>Grewia tenax</i> (Forssk.) Fiori	TILIACEAE	Eka (Or.)	S	L	Infected wound	Dried leaves are pounded and the powder is added to the wound every 2 days for 7 days.	DH. 84
<i>Heliotropium alobispidium</i> Bak.	BORAGINACEAE	Qoricha buutii (Or.)	S	Ro	Cobra's attack	Fresh root is crushed, pounded and mixed with cold water, 1 bottle of the mixture is served as a drink for 3 to 4 days	DH. 38
<i>Heliotropium cinerascens</i> Steud ex DC.	BORAGINACEAE	Qoricha michi (Or.)	S	Ro, Ag	Fiberile illness	Whole fresh plant is crushed and used to wash patient's face any time when sick	DH. 37
<i>Hibiscus micranthus</i> L.	MALVACEAE	Dobbi; Eurgubbee (Or.)	C	Ro	Sexual potency impotence in men	A piece of root is chewed and the juice is swallowed to increase sexual potency of inactive or weak male sex organ. Restriction, the healer is advised to avoid sexual activity for 24 to 48 hrs. No contact with other person except the one who serve food	DH. 94
<i>Indigofera oblongifolia</i> Forssk.	FABACEAE	Adulaala (Or.)	S	Ro	Snake poison and Cobra's attack	Fresh or dried roots are crushed and mixed with cold water; the residue is creamed on affected part. For snake poison, root is chewed and small amount of the juice is swallowed immediately after bite.	DH. 36
<i>Indigofera vahemarnsis</i> Baill	FABACEAE	Dhungo (Or.)	S	Ro	Intestinal parasite	Pieces of fresh roots are crushed, pounded then mixed with 1 cup of water, 1 cup of the mixture is served for the patient as a drink only once	DH. 85
<i>Lagenaria siceraria</i> (Molina). Standl.	CUCURBITACEA E	Buqqee hadha 'a	C	F	Snake poison	Ripe fruit is bored, rinsed with cold water, 1 glass is served as a drink immediately after snakebite	DH. 55
<i>Lens culinaris</i> Mill.	FABACEAE	Misira (Or.)	H	S	Malaria	The same preparation as for snakebite is left overnight, 1 glass is drunk in the morning before breakfast (decoction)	
<i>Leucas martinicensis</i>	LAMIACEAE	Haxxifachisa	H	L	Spide's poison	Seeds are chewed and spitted to infected part of the body. The patient and the healer are advised to apply the remedy early in the morning before urinating and breakfast.	DH. 100
					Gonorrhoea	Few crushed leaves are concocted with crushed shoot of W.	DH. 45

<i>Senna italica</i> Mill.	FABACEAE	Adulala (Or.)	S	Ro	Snake poison	Fresh roots are crushed pounded and mixed with cold water, 1 glass is served as a drink. Alter- natively a piece of root is chewed and juice is swallowed immediately after bite.	DH. 127
<i>Senna occidentalis</i> (L.) Link	FABACEAE	Shakissa; Shawushawe (Or.)	S	Ro	Diahrroae and snake poison	Fresh roots are chewed and small amount of the juice swallowed. Alternatively crushed root is mixed with cold water, 1 cup of the filtrate is served as a drink only once.	DH.4
				Ro	Repel snake and cobra	Holding the fresh or dried root in hands or tie some where on clothes.	
<i>Sida ovata</i> Forsk.	MALVACEAE	Cidhaan Korbee (Or.)		Ro	Pain (waransa) and Dingetenga	A piece of fresh or dry root is chewed and the juice is spitted into children's mouth. For adult swallowing the juice is a remedy. Patients are advised to be free from sexual activity.	
			H	Wp	Tetanus (Kan waa waranef)	Boiled whole plant with water cool and 2 glasses are served as a drink to the patient, finally mix the residue with edible oil and creamed on to the wound	DH.21
<i>Solanum renschii</i> Vatke	SOLANACEAE	Hiddi warabessa (Or.)	S	Ro	Dingetenga and in digestion (Kulamu)	A piece of fresh or dry root is chewed and small amount of the juice is swallowed	DH.79
				Ro	Against poison in children	Fresh roots are pounded mixed with water and creamed to the whole body	
<i>Solanum samalense</i> Franchet.	SOLANACEAE	Hiddobido (Or.)	H	Ro	Lymphatic swelling (gofle)	A piece of pounded fresh root is mixed with water and tied on swelling.	DH.15
				Ro	Python's attack	Freshly collected and pounded roots are mixed with cold water, 1 glass is served as a drink for 2 days. Adverse effect, Vomiting. Antidotes, boiled <i>Allium sativum</i> with goats milk is drunk	
<i>Verbascum sinaiticum</i> Benth.	SCROPHULARIA CEA	Gurra harre (Or.)			Stomach problem and pain (Waransa)	Decoction of fresh leaves are drunk with coffee, tea or milk. Alternatively it can be concocted with <i>Vernonia amygdalina</i> leaves juice to drink 1 cup	
			S	Ro	Gonorrhoea	A piece of root is chewed and small amount of the juice is swallowed	DH.87
<i>Vernonia amygdalina</i> Del.	ASTERACEAE	Ebicha (Or.) Girawa (Am.)	T	L	Malaria	Crushed leaves are concocted with crushed leaves of <i>Ruta chalepensis</i> , 1 cup of the mixture is served as a drink for 3 to 5 days before breakfast	DH. 124
				Ag	Clean evil spirit and devil work from home (haxaruu)	Crushed young twig with leaves and sprayed on utensils, livestock fence with special ceremony	
<i>Tamarindus indica</i> L.	FABACEAE	Rooga (Or. And Am.)	T	S	Malaria and Amoebiasis	Some seeds are soaked overnight in cold water, 1 glass of the infusion is served as a drink before breakfast. Adverse effect.	DH. 5

<i>Xanthium strumarium</i> L.	ASTERACEAE	Banda (Or. And Am.)	H	L	Ringworm (Robbi)	diathroea Fresh leaves are crushed and topically applied by squeezing it through clean locally made cloth. Direct application cause irritation and wound the normal body	DH.6
<i>Ziziphus spinachristi</i> (L.) Desf.	RHAMNACEAE	Qurqura (Or.)	T	B	Hepatitis (Sinbira)	A piece of crushed bark is concocted with crushed leaves of <i>Ximenia americana</i> , <i>Ocimum urticifolium</i> and bark of <i>Terminalia brownii</i> , the boiled mixture is filtered, 3 glasses are served every 2 days	DH. 94

Appendix 2 Plants Used as Medicine for Livestock, Their Local Names, Habit, Part Used, Type of Disease, Mode of Application and Collection Number (Coll. NO.). Ha, Habit; H, herb; C, Climber; S, Shrub; T, tree; PP, plant part used; L, leaf; F, fruit; S, seed; Me, milky exudate; AG, above ground; S, L, seed and leaf; Ro, root; St, Stem; Tg, twig; Fl, flower; B, bark; Wp, whole plant; MA, mode of application; Ro, L, root and leaf; Ro, AG, root and above ground; B, L, Bark and leaf; St, L, stem and Leaf; St, L, stem and leaf Am. Amharic; Or, Oromiffa; DH, Debela Hunde.

Scientific name	Family	Local name	H	PP	Disease treatment	Mode of Application	Coll. No
<i>Achyranthes aspera</i> L.	AMARANTHACEAE	Dargu rba (Or.)	S	B	Urine retention (Kidney problem)	Pieces of crushed root are mixed with crushed root of <i>Withania Somnifera</i> in cold water and given to cattle in large amount.	DH. 11
				Ro	Malaria (Iagida)	Fresh root is crushed and mixed with cold water, 1 glass is given as a drink before breakfast. Adverse effect: vomiting. Antidote, sugar solution and boiled coffee.	
				L.	Anthrax (abbasanga)	Few fresh leaves are crushed and concocted with crushed roots of <i>Balanites aegyptiaca</i> and <i>Withania somnifera</i> in cold water, 1-2 glasses are given as a drink for 3 days	
				Ro	Excessive menstrual bleeding	Crushed and pounded fresh roots are mixed with cold water, 1 cup is given as a drink for 3 days	
<i>Acalypha fruticosa</i> L.	EUPHORBIACEAE	Ciri (Or.)	S	L	Anthrax	Crushed leaves are sprayed in livestock's fence, on infected meat to disinfect or boil with leaves. It is also additive to milk and butter.	DH. 20
				L	Lymphatic swelling (Gofle)	Crushed fresh leaves are pounded, mixed with cold water, 1 glass is given as a drink for livestock	
				L	Snake poison	Crushed fresh leaves are mixed with cold water, 1 glass is given as a drink for 7 days and tied on wound.	
<i>Argemone mexicana</i> L.	PAPAVERACEAE	Nacila baashii (Or.)	H	Ro	Anthrax	Crushed leaves are mixed with roots of <i>Solanum indicum</i> in cold water, 1 glass is given as a drink for cattle.	DH. 40
				Ro	Cancer and malaria	Crushed roots are mixed with cold water; ½ cup of the filtrate is given for adult, ¼ for children. Adverse effect: vomiting, diarrhoea. Antidote. Sugar solution and milk.	
<i>Azadirachta indica</i> A. Juss.	MELIACEAE	Kinii (Or.); Neem	T	L	Anthrax	Freshly crushed leaves are mixed with cold water and given as a drink in large amount for cattle.	DH. 62

		(Eng.)		St	Stomachache and pain (waransa)		
<i>Balanites aegyptiaca</i> (L.) Del.	BALANTACEAE	Badda nno (Or.) Beddo nno (Am.)	T	Ro	Mentally sick cattle (jinni)	A piece of stem is used as chewing stick small amount of juice is swallowed. Alternatively crushed fresh leaves are mixed with cold water, 1 cup is given as a drink. Freshly crushed root is mixed with cold water, kept over night, 4-5 liters are given as a drink in the morning.	DH. 32
				L	Black-leg (Abbagora)	Freshly crushed leaves are mixed with cold water, 4-5 liters given as a drink for 2-3 days preventing it from drinking water. The animal is tied under shade of live tree.	
				Ro	Snake poison and cobra's attack	Crushed roots are mixed with cold water, 1 glass of the mixture is given as a drink.	
				St	Lymphatic swelling	Swollen part is burned with hot (glowing stem)	
					Gastritis	Stem is used as toothbrush and a glass of boiled leaf is given as a drink after cooling.	
				L	Infected eye in cattle	Fresh leaves are chewed and the juice is spitted into the infected eye for many days.	
<i>Capparis cartilaginea</i> Decne.	CAPPARIDACEAE	Dalans isa (Or.)	S	L	Fatten cattle by expelling intestinal parasites	Fresh leaves are crushed, 2 glass of the juice is given as a drink for 3 days.	DH. 76
<i>Capparis tomentosa</i> Lam.	CAPPARIDACEAE	Harang ama (Or.)	S	S	Infected cattle's eye	A single seed is cut into two halves and rubbed together; the foam formed is creamed into the infected eye.	DH. 47
				Ro	Evil eye	Crushed and pounded roots are dry smoked at bedtime for humans.	
<i>Cissus quadrangularis</i> L.	VITACEAE	Cophi (Or.)	C	Ro	Ulcer (Swollen) in cattle	Fresh or dried root is crushed and tied on to the swelling to facilitate the bursting of the swelling	DH. 25
				Ro	Hyena bitten wound in cattle	Fresh root is crushed and tied onto the wound	
				Ro	Snake poison	Crushed root is mixed with water, 1 glass is served as a drink	
				Ro, St	Ulcerated Wound (Nyagarsa)	Root and fresh stem are crushed; the juice is added on to externally swollen wound by gently making scare on it.	
<i>Cryptostegia grandiflora</i> K. Br.	ASCLEPIADACEAE	Hoqon qol (Or.)	S	Me	Kill Rodent, Snake and other insects	When milky exudate of stem and leaves is taken orally by chance or deliberately it kills rodent, snake and other insects	DH. 16

<i>Chrysopogon plumulosus</i> Hochst	POACEAE	Daremu (Or.)	H	Ag	Assist fertility and normal growth	Shoot is eaten to enhance growth and fertility. Remove intestinal parasite by initial stomach runaway.	DH. 39
<i>Cyphostemma adenocaula</i> Steud. ex A. Rich.	VITACEAE	Hiddalaafaa (Or.)	C	WP	Protect pest	The whole fresh plant is cut and put in crop store (gumbii).	DH. 8
<i>Datura stramonium</i> L.	SOLANACEAE	Banji (Or.)	H	S	Skin wound in cattle	Crushed leaves are used to wash wound.	DH. 7
<i>Dodonaea angustifolia</i> L.f	SAPINDACEAE	Itacha (Or.)	S	L.	Tooth infection in humans	Ripe seeds are boiled and vapour is inhaled into mouth	
<i>Euclea divinorum</i> Heim	EBENACEAE	Mieesa (Or.)	S	Ro	Wound in donkey	Dried leaves are pounded and sprayed on to external wound	DH. 63
<i>Grewia bicolor</i> A. Juss	TILIACEAE	Haroor essa (Or.)	S	St	Malaria	Crushed and pounded root are concocted with bark of <i>Hagenia abyssinica</i> and <i>Euclea divinorum</i> , served for eating before breakfast. Food is eaten after 4 hours of medication.	
<i>Indigofera amorphoides</i> and Spach.	FABACEAE	Henna Harre (Or.)	S	F	Ringworm (Robbi)	Roots are crushed, pounded and mixed with cold water, applied topically, the patient is advised to seat in sun's heat.	DH. 81
				Wp	Infected <i>Sorgham bicolor</i>	Old cloth is rolled on straight stem and inserted into the mouth of the cattle and pull out the infected <i>S. bicolor</i> .	DH. 72
				Ro, L	Gastritis	Unripe fruit is crushed, mixed with cold water. 1 glass of the flitrate is given as a drink for 3 days.	
				Ro	Anthrax	Freshly crushed whole plant is mixed with cold water. 1 bottle of juice is served as a drink.	DH. 10
				Ro	Cobra's attack	Crushed fresh roots and leaves are massaged on the swollen part downwards to feet direction	
				Ro	Snake poison	Dried or fresh root is chewed immediately after bite, swallow small amount of the juice	
				Ro	Evil eye in human	Dry or fresh root is crushed, pounded and concocted with 1 glass of rinsed milk; 1 cup is served as a drink before breakfast.	
				Wp	Measles (Guddiftu)	Whole plant is crushed and used to wash the child for 3 days early in the morning	
<i>Jatropha curcas</i> L.	EUPHORBIACEAE	Abatabulk (Or.)	S	Ag	Intestinal parasite in Cattle	Shoot is crushed, pounded, mixed, with cold water. 1 glass is served as a drink.	DH. 1
<i>Justicia caerulea</i> Forssk.	ACANTHACEAE	Dargu (Or.)	S	Ag	Abortion (Human)	The same preparation is used for abortion (Poisonous to human)	
				Ro	Anthrax	Crushed, pounded root is concocted with roots of <i>B. aegyptiaca</i> , <i>W. Sminifera</i> leaves in cold water, 1 glass is given as a drink for 3 days. The residue is creamed to the whole body.	DH. 46
				Ro	Breast ulcer and	Crushed, pounded dried roots are concocted with roots of <i>Withania</i>	

<i>Kedrostis foetidissima</i> (Jacq.) Cogn.	CUCURBITACEAE	Saraja'- a (Or.)	C	Wp	generalpain (Waransa)	<i>Sonnifera</i> , <i>Croton macrostachyus</i> and <i>Senna occidentalis</i> are given as a drink on non-fasting days. For breast ulcer the concoction is mixed with butter to cream on wound. Whole plant is crushed and used to wash animal body for 3 days and given as a drink for 3 days The whole plant is boiled with water and sheep fat and given as a drink especially for children of age below 7 years.	DH. 27
<i>Leucas abyssinica</i> (Benth) Birq	LAMIACEAE	Ashale (Or.)	S	L	Measles	Whole plant is boiled and used as herbal bath for children	DH. 51
<i>Leucas inflata</i> Benth	LAMIACEAE	Afa frashii (siree) (Or.)	S	Ro	Infected livestock eye Anthrax	Dry fresh roots are mixed with roots of <i>A. aspera</i> and buried in livestock fence as preventive measure of the transmission of anthrax.	DH. 68
<i>Nicotiana tabacum</i> L.	SOLANACEAE	Timbo (Or.)	H	L	Wound in Cattle	Dried, pounded leaves are added on to wound every two days. The same preparation serves humans	DH. 60
<i>Ocimum urticifolium</i> Roth	LAMIACEAE	Qorich a Michi (Or.)	S	L	Expel leeches Anthrax	Dried, crushed and pounded leaves are mixed with cold water, 1 glass is served as a drink for cattle. Crushed roots and leaves are mixed with cold water, 1 bottle is served as a drink and the residue is creamed on the whole body.	DH. 44
<i>Olea europaea</i> L. ssp. <i>cuspidata</i> (Viv.) P.S.Green.	OLEACEAE	Ejersa (Or.) weyira (Am.)	T	Wp	Cancer (Nyaqarsa) Mentally sick goat and Running nose	Green leaves are squeezed and inhaled. The residue is creamed on affected part in humans Whole plant is dry smoked into the fence; the goat and cattle inhale the dry smoke in cattle.	DH. 56
<i>Rhus vulgaris</i> Meikle	ANACARDIACEAE	Daboo bessa (Or.) Mistay ibelash (Am.)	T	Wp St L	Cough and mich in humans External Haemorrhoids Malaria	The above preparation is served. Burn it by hot stem and add goat's faces on affected part The bud is mixed with bud of <i>Leucas martinicensis</i> pounded and mixed with cold water; 1 cup is served to the patient as a drink before breakfast. It is also served without concoction. Talking is not allowed while processing the medicine. Sexual activity is forbidden as well.	DH. 93
				Ro.	(Anthrax) Abbasaga	Fresh leaves are ground and mixed with cold water kept on outer root of house	

<i>Solanum indicum</i> L.	SOLANACEAE	Hiddii loonii (Or.)	S	Ag L	Kidney infection Cobra's attack	and given for cattle as a drink in the morning Crushed leaves are mixed with cold water; 1 cup is served as a drink 3 days. A piece of bark is crushed and mixed with water and creamed on part of body affected by cobra.	DH. 2
				Ro	(Anthrax) Abbasanga	Crushed roots are concocted with <i>Acolathra schimper</i> and cold water, 1 glass is given as a drink for 1-3 days	
				L	Ulcerated swelling	Squeezed fresh leaves are inhaled	
				Ro	Stomach problem	Chewing the fresh or dried root and small amount of the juice is swallowed by adults and spitted to children's mouth	
				L	Menstrual bleeding	Dry smoke into vaginal opening to stop excessive menstrual bleeding in women	
				L	Wound of circumcision origin in ox	Crushed and pounded fresh leaves are sprayed on wound	
				Ro	Snake poison	Fresh or dry root is chewed and juice is swallowed	
<i>Terminalia brownii</i> Fresen.	COMBRETACEAE	Bireeha (Or.)	T	B	Expel placenta in cattle	Crushed bark is concocted with crushed seeds of <i>Lepidium sativum</i> and mixed in 1 1/2 glass of cold water and given for drink	DH. 78
				B	Bloody urine (baira)	The same preparation as above is given as a drink	
				B	Expel tapeworm	When <i>Hagenia abyssinica</i> is not effective a piece of bark is pounded, boiled, and 1 cup mixed to it, 1 glass of mixture is given as a drink before breakfast.	
				B	Hepatitis	The bark is boiled and concocted with NaCl solution and the patient is given as a drink, 1 glass for a day for 3-5 days, before breakfast. Adverse effect, vomiting and diarrhoea. Antidote, coffee or milk.	
<i>Withania somnifera</i> (L.) Dunal	SOLANACEAE	Wahalle; Bala (Or.)	S	Ro, L	Michi (humans) and (Lymphatic swelling in cattle)	Fresh roots and leaves are boiled and the vapour is smoked. Leaves and roots are crushed, mixed with cold water, a liter of juice or more is given as a drink and dry smoked for 1-2 days.	DH. 3
				Wp	Cough (hazabaa) in human	Inhaling smoke of boiled whole plant at bedtime.	
				Ro	Evil eye	Pounded root is mixed with cold water, 1 cup is served as a drink, If it is jinni roots of <i>Leucas martinicensis</i> is mixed	
				Ro	Anthrax	Crushed fresh roots are mixed with cold water & 1 bottle is given for livestock as a drink preventing it from drinking water	
				Ro	Urine retention in humans	Crushed fresh roots are mixed with cold water, 1 cup is given as a drink after dinner	
<i>Ximelia americana</i> L.	OLACACEAE	Hudha (Or.)	S	B	Hepatitis (Sinbira) and Malaria	Crushed, boiled and filtered piece of bark is soaked for patient as a drink, 1 glass for 2-3 days.	DH. 29
				B	Infected wound	Dried piece of bark is crushed powdered and tied on wound by clean cloth for	

Appendix 3 List of Key Informants Who Participated in Ethnomedicinal Study

Name	Sex	Age	Occupation	Locality	Remark
Hajji Badhasoo Dadhii	Male	55	Farming	Nura Heera	Known healer for a wide variety of disease
Hajji Ganna Turee	"	50	"	"	Same as above
Hussen Irresso	"	50	"	"	Same as above
Obsee Shalo	"	55	"	"	Same as above
Abdurroo Kenno	"	28	"	"	"
Gadaa Golijee	"	75	"	"	"
Gannoo Dadhii Yamba	Female	25	"	"	"
Faxuma Alyi	"	45	"	"	"
Ayantu Hawas	"	40	"	Hare bona	Known healer for a wide variety of diseases
Halkoo Qumbii	"	55	"	"	Same as above
Holku Jilo	"	50	"	"	Same as above
Baqqala Basha	Male	45	Farming	Rukecho	Specialist in healing spider's poison
Tufa Dachasa	"	47	"	"	Known healer for many diseases
Gadaa Tufa	"	60	"	"	Same as above
Isheetu Jimaa	"	45	"	"	"
Gamba Gurmu	"	49	"	"	"
Kenne Tullu Bune	"	46	"	"	"
Baqqala Birru	"	70	"	"	"
Badhaasoo Lamma	"	46	"	Rukecho	"
Dachasa Badhadha	"	49	"	Bokure	"
Ayntu Tulamaa	Female	35	"	Rukecho	"
Baqqalu Olii	"	60	"	Bokore	Specialist in healing hepatitis
Gutama Jiru	Male	65	Farming	Xaddacha Feexo	"
Jima Tufa	"	50	Farming	Xaddacha (Dhigrii)	"
Bulga Boru Wadyi	"	30	Transhuman Pastoralist	Xaddacha (Dhigrii) Bal'aa	"

Shinko Roobaa Burqaa	"	30	"	(Qobbo) Xaddaaha Bal'aa	
Jiloo Arrollee Ususu	"	46	"	(Qobbo) Xaddacha Bal'aa (yimiru)	
Wadyi Boru Wadyi	"	28	"	Xaddacha Bal'aa (Qobbo)	
Badhadha Dayyasa Gurmuu	"	42	"	Xaddacha Bal'aa	Known healer for variety of diseases
Jambooo Waaqa	"	41	"	Nura Heera	
Tirunesh Lemma	Femal e	75	Village trade	Bofa	Known healer of Amoebiasis ane evil eye

Appendix 4 Checklist of Questions or Items Used as a Basis for Discussion and Interview

Information on respondents: name, age, occupation, educational status, religion and others as necessary

Local name of the medicinal plant

Habitat of the plant- where it grows in the study area, including vegetation type.

Habit of the plant: tree, shrub, herb, parasite, hemi parasite, liana, aqueous plant.

Size of the plant

Use of plant:

The type of ailment treated by medicine from the plant

What is the cause of the ailment if it is known?

What is (are) the symptom(s) (if any)

Part/ parts of the medicinal plant collected for medicinal use:

Preparation of remedy: detailed account.

Fresh, dried, crushed, pounded (powdered)

Used alone, mixed with water or other materials

Concoction and decoction if any

Amount used (dose)

Any noticeable side effect (Adverse effect) caused by the medicine if any.

Does the dose differ among males females, children, elders is/are) there antidotes for adverse effects?

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

How is the medicinal plant (s) preserved (if any)?

Are there members of the community who frequently use the medicinal plant (if any)?

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

Are there regimens in the use of medicinal plants?

Is (are) the medicinal plant (s) marketeable?

How is the knowledge passed from elders to younger generations in family or at community level in the study area?

How does modernization interfere with traditional medicinal system?

Are there threats to the medicinal plants?, list out the main threats.

Are there traditional conservation methods used to conserve medicinal plants in the area?

Include the management practices by indigenous people

Is the plant under cultivation in the study area?

Are there taboos in the utilization of some medicinal plants in the locality, sex, age, and so on?

Information on edibility and other uses if any of the plant besides its medicinal uses/value.

What are the reciprocal impacts of plant- human interactions?

Appendix 5 Vegetation Types and Total Number of Medicinal Plant Species
Documented from Each Vegetation Type and Collection Number
of the Species

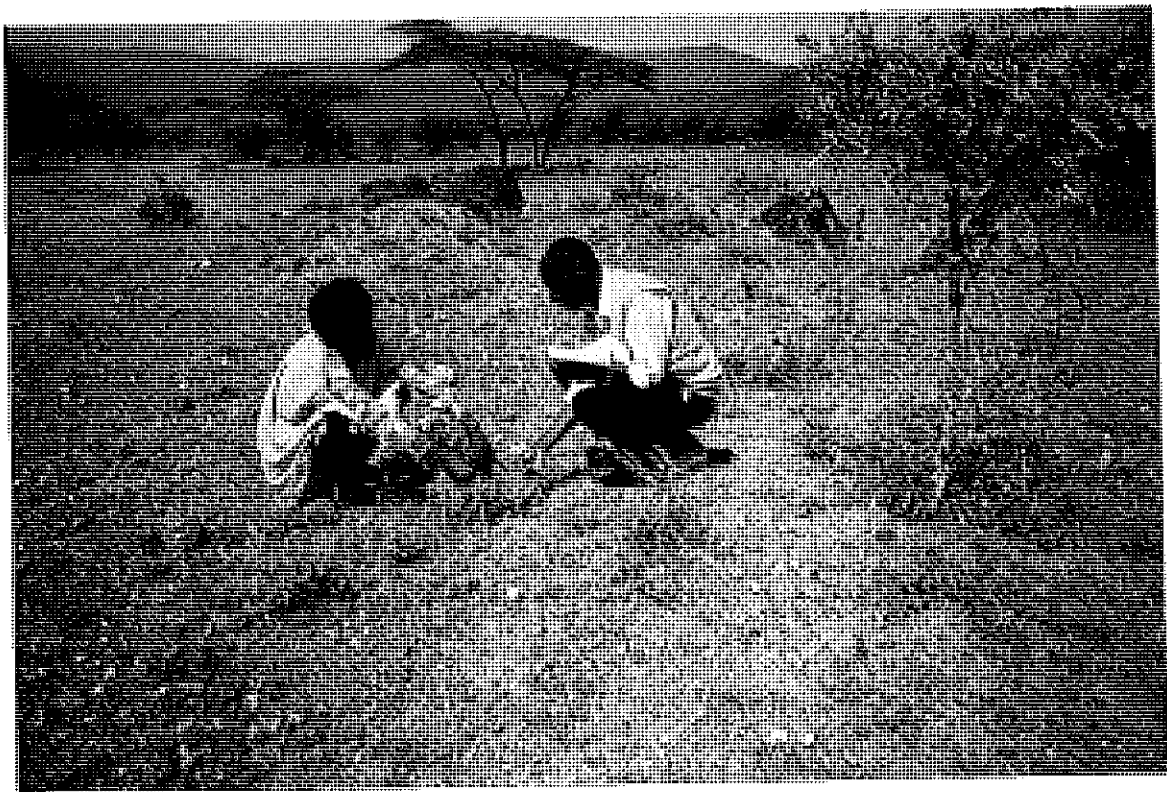
Vegetation Type	Total Number of Species Identified	Collection Number of the Species
<i>Acacia tortilis</i> - <i>Balanites aegyptiaca</i> woodland	33	2,29,24,19,30,4,69,73,6,21, 79,15,12, 33,37,94,28,5,11,20,40,47,16,8,81,72, 46,27,51,68,93,3 &5
<i>Acacia albid</i> -- <i>Ziziphus spina -christi</i> woodland	31	25,46,57,94,42,93,87,20,40,16,43,46,44,56,47 32,72,3,66,12,10,58,126,54,43,99,85,36,45,55,2
<i>Acacia Senegal</i> - <i>Acacia tortilis</i> dominated woodland	16	3,10,51,27,97,54,23,28,20,32,47,25,16,63,81,22
<i>Acacia seyal</i> - <i>Acacia tortilis</i> and <i>Cissus quadriangularis</i>	21	11,16,8,3,9,97,69,22,19,99,84,28,61,20,32,32,47,25 27,51,68,86.
<i>Acacia senegal</i> thickets	12	89,109,97,84,94,97,20,11,25,16,63,81.
<i>Boswellia paprifera</i> woodland	4	97,20,25,93.
<i>Pistacia falcata</i> vegetation	9	78,86,84,78,97,20,25,72,47.
<i>Euphorbia nigrispnoides</i>	9	57,109,75,89,94,97,20,25,16.

Note: Every collection number is preceded by code DH. in field note on the herbarium sheet. Detailed information of each species is given in Appndices 1 and 2.

Appendix 6 Some of The Vegetation Types Found in the Study Area



A. *Pistacia falcate* dominated Vegetation



B Degraded *Acacia tortilis* – *Balanites aegyptiaca* vegetation

Appendix 7 List of plants in local vegetation other than medicinal plants

Plant species	Family	Local name	Collection NO.
<i>Acacia mellifera</i> Benth	Fabaceae	Saphaz (Or.)	DH. 45
<i>Acacia senegal</i> (L.) Willd	Fabaceae	Doddoti (Or.)	DH.114
<i>Acokanthera schimperi</i> (DC.)	Apocynaceae	Qarao (Or.)	DH. 50
<i>Boswellia papyrifera</i> (Del.) Hochst.	Bruseraceae	Muka ixanaa (Or.)	DH.80
<i>Combretum adenogonium</i> Steud.exA.Rich.	Combretaceae	Rukenssa (Or.)	DH.101
<i>Comretum molle</i> G.Don.	Comretaceae	Ulushanka (Or.)	DH.110
<i>Grewia flavescens</i> A.Juss.	Tiliaceae	Amurgi (Or.)	DH.105
<i>Grewia tembensis</i> Fresen	Tiliaceae	Damborash (Or.)	DH.123
<i>Grewia villosa</i> Willd.	Tiliaceae	Ogumdi (Or.)	DH.104
<i>Indigofera articulata</i> Gouan	Fabaceae	Hinna (Or.)	DH.117
<i>Leonotis neptifolia</i> (L.)	Lamiaceae	Haxxifachisa (Or.)	DH.45
<i>Macaranga capensis</i> (Bill.)	Euphybiaceae	Qilinxo (Or.)	DH.112
<i>Melinis repens</i> A.Juss.	Poaceae	Daggala (Or.)	DH.103
<i>Ocimum spicatum</i> Delfers.	Lamiaceae	Qoricha michi (Or.)	DH.121
<i>Ozoroa insiginis</i> Del.cf. ssp. <i>reticulata</i> (Bak.)	Anacardiaceae	Dhama'e (Or.)	DH.116
<i>Pavetta gardenifolia</i> A.Rich.	Rubiaceae	Bunitii (Or.)	DH.113
<i>Pistacia falcata</i> Becc.ex Martelli	Anacardiaceae	Hawas (Or.)	DH.113
<i>Rhus vulgaris</i> Meik.	Anacardiaceae	Daboobessa (Or.)	DH. 93
<i>Solanum glabratum</i> Franchet	Solanaceae	Hiddi qoree (Or.)	DH.35
<i>Tribulus cistodes</i> L.	Zygophyllaceae	Qumudo (Or.)	DH.34
<i>Zisiphus mauritiana</i> Lam.	Rhamnaceae	Qurqura hadha (Or.)	DH.49