UTILIZATION AND CONSERVATION OF TRADITIONAL MEDICINAL PLANTS IN KEIYO SOUTH, ELGEYO-MARAKWET COUNTY, KENYA

BY

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DECLARATION

Declaration by the candidate

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DEDICATION

This work is dedicated to my spouse James, to our children Noah Kipimbir, Gabriel Chesoro, Dominic Kibet Amge, Faith Jepngetich and Mercy Jepchirchir; to all my nephews, nieces and to the Keiyo community whose knowledge is documented in this thesis.

ABSTRACT

Medicinal plants are an important source of healthcare and livelihood for many people in developing countries, particularly in Africa where 80 percent of the population still relies on them for primary health care. Despite this, literature reached indicated that medicinal plants globally are under threat from over utilization and loss of habitats. This is a concern as the demand for plant based medicine for human health is being sought globally due to the belief that they have less harmful effects on human health. This study investigated the utilization and conservation of traditional medicinal plants, threats and the measures to conserve them in Keiyo South Sub-County in Kenya. The study was guided by Garret Hardin's Tragedy of the Commons theory. Primary data was collected using a semi-structured interview schedule, observations and photography. Secondary data was collected from books, journals and theses. A total of 171 respondents comprising 120 household heads, 33 traditional herbalists, 15 herb vendors, and 3 Kenya Forest Service staff were interviewed. Data was coded and analyzed using frequencies and percentages. The results showed that medicinal plants were widely used by the Keiyo people for prevention and treatment of ailments like cold and chest pain in the highlands; malaria in the lowlands; and reproductive health and abdominal problems in all the zones. Medicinal plants obtained from Kerio valley and the escarpment included *Albizia anthelmintica* for de-worming and cleaning the digestive system, *Acacia seyal* (red acacia) and *Maertia subcordita* for abdominal pain, *Zanthoxylum gilletii* (large-leaved knob wood) and *Withania somnifera (*poison gooseberry*)*for throat infections; and *Ficus thonigii (*Black-cloth fig*)* for malaria. Traditional conservation measures adopted included restricted gathering by mature people and herbalists guided by social controls and taboos. Threats identified by the respondents were increased farming (81%), increased human settlements (76%) leading to habitat destruction and lack of knowledge on use of medicinal plants (45%). Measures adopted by the respondents to conserve medicinal plants include planting (63.7%) and protecting medicinal plants growing in farms and protecting existing sacred sites (32.7%). The study concluded that knowledge and use of traditional medicinal plants for primary health care by the Keiyo people is widespread. The study recommends that the community and government should protect traditional sacred sites and establish a research institute in the County. Areas for further study include documentation of other medicinal plants at county level and chemical analysis of the medicinal plants.

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ABBREVIATION AND ACRONYMS

CITES	-	International Trade in Endangered Species
GOK	–	Government/ Republic of Kenya
HIV/AIDs	-	Human Immune Virus/ Acquired Immune Deficiency Syndrome
HELB	–	Higher Education Loans Board
IEBC	-	Independent Electoral and Boundaries Commission
KFS	–	Kenya Forest Service
KEFRI	-	Kenya Forest Research Institute
WHO	–	World Health Organization

OPERATIONAL DEFINITION OF TERMS

Commons – resources available for use by members of the community

Conservation – protection and wise use of available resources in the community

Conservation of medicinal plants – actions taken by the community to protect plants used to treat ailments

Herbal vendors - people in the community who sell medicinal plant parts/ herbs to clients to treat ailments at the local markets and urban areas.

Herbal medicine - medicinal plant parts used for treating human ailments.

Medicinal Plants /herbs- parts of flora such as the roots, bark, leaves and fruits that contain active ingredients used to treat ailments.

Traditional herbalists - Specialized people in the community who diagnose ailments and provide herbal remedies to patients to treat the ailments.

Traditional knowledge – the skills and practices which are indigenous to the Keiyo and other cultures used in treating ailments such as herbal medicine.

Tragedy - a situation where resources available are destroyed due to selfish economic interests manifested through unsustainable use.

Utilization - use of resources in the community

Utilization of medicinal plants - the use of plant material for health care.

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CHAPTER ONE
INTRODUCTION

1.1 Background to the study

Plants provide food, medicine, clothes, shelter (building materials in rural areas), wood fuel, income and raw materials used to make other products (Hawkins, 2008; Wright, 2008). Early man recognized their dependence on nature in health and illness. They were guided by instinct and learned through taste and experience to treat illness using plants, animal parts and minerals that were not part of their diet. In all cultures there exists traditional knowledge on medicinal plants for the health of people and animals. It was through tasting of herbs that man began to acquire some rudimentary medical knowledge. The histories of Chinese traditional medicine narrate a legend of a Chinese ancestor's long process of discovering the properties of medicinal herbs over time through tasting. This culminated in the compilation of the fundamental treatise Shennong's classic of herbal medicine (Youhua Yu, 1996). Dev (1989) noted that:

> *Life, disease and decay are inseparable. From his first awakening, man has sought to fight and control disease and pain, with assistance, inspiration and guidance from nature. During thousands of years of early human existence, many plant materials, by instinct, intuition or trial and error were used to combat various ailments. Almost all ancient cultures and communities evolved their own plant materia-medica or folklore (*Swaminathan and Kochar, 1989, p.267)

The evidence of the use of herbal remedies dates back to 60,000 years ago to a burial site of the Neanderthal man that was uncovered in 1960 in a cave in Iraq. This discovery revealed large quantities of plant pollen of which eight were found to have medicinal value. Other records showing the use of herbal medicine for treatment of illnesses is in the Mesopotamia clay tablet writings and Egyptian manuscripts, written around 1500 BC, and which contain, an inventory of plants in medicine (Owuor, *et al* 2006). Plants have been source of traditional medicine for human beings and livestock. Historically, medicinal plants were used as early as 5000 to 4000 BC in China and 1600BC by Syrians, Babylonians, Hebrews and Egyptians. The Greeks and Romans through the works of scholars like Aristotle and Hippocrates had extensive knowledge of medicinal plants.

Since time immemorial all communities have wisely used and conserved their local medicinal plants using measures that restricted the amount harvested at a time, control on the harvesters and use of taboos to regulate the harvest of plants. This ensured that their health care needs were protected through all generations. African communities have a history of conserving the bio-diversity in medicinal plants which reflect traditional practices surrounding their use, including local knowledge and wisdom. Herbalists have preserved traditional knowledge and practices of herbal medicine used to prevent and treat common ailments as secrets within families (Hamilton, 2004). Most traditional medical knowledge is still transferred orally in many communities and this has contributed to loss of some important uses of some medicinal plants.

According Dev in Swaminathan and Kochar (1989), the arrival of European scientific methods saw many medicinal plants come under chemical analysis leading to isolation of active ingredients such as morphine and opium from well known medicinal plants. The isolation and characterization of the compounds in their pure form of well standardized extracts became part of the pharmacopoeia of several countries. This also led the chemists to develop synthetic drugs by the end of 19th century, which are now utilized for treatment of humans and animals.

Traditional medicine in Africa was the only source of health care before the introduction of western medicine by missionaries and colonialists in the 19th century. During colonization in Africa, local people were encouraged to use western medicines to treat their ailments as part of the colonization mission. African Christian converts were discouraged from using traditional medicines by missionaries who discredited their use. The church also associated traditional medicine with witchcraft and animism and discouraged converts from using traditional medicines in the community. This led to secretive use of traditional medicines and generally in the rural areas especially with the enactment in colonial Kenya of the Witchcraft Act Cap 67 of 1925 (Bussmann *et al,* 2006). The new law restricted the use of traditional medicine by imposing a penalty of imprisonment in Kenya.

After independence, the Kenya medical practitioners, like in other African countries trained by the colonialists, continued to discourage the use of traditional medicine. A study by Mukiama (2005) noted that in Kenya specific steps were taken to ensure that from policy perspective, traditional medicine became marginalized in the colonial period and a non-positive attitude was maintained towards traditional medicine. In 1978, however, the World Health Organization (WHO) encouraged member countries to use traditional systems of medicine for primary health care. The Alma Ata Declaration in 1978 recognized the traditional medicine as one of the ways of achieving total health care (Owuor, *et al* 2006; Addeh-Mensa, 1992).

As a result of the general acceptance of traditional medicine, local communities have increased their use. With increased population and urbanization, traditional medicinal plant parts are now sold in the urban areas to meet the needs of the urban population. This has motivated traditional medical practitioners to move to urban areas to provide these services. The medicinal plant species sold in the urban areas are harvested in the wild and this has led to over harvesting and some species are threatened with extinction (Cunningham, 1993 and Bodeker, 2005). The commoditization of traditional medicinal plants led to destructive harvesting of medicinal plants and unsustainable collection of required parts.

It is also noted that many people in the world rely on herbal medicine for healthcare as many others gain income from the wild harvest, cultivation, or trade in medicinal plants. The growing demand for traditional medicines has also seen the international awareness about the declining medicinal plants globally as a result of over harvesting for commercial purposes, destructive harvesting practices, loss of habitat due to deforestation and agricultural practices (Roberson 2008).

Research indicates that there is high demand for natural medicines globally. The western world is now seeking plant based medicines away from synthetic chemical based medicines with minimum harmful effects on human health (Pamplona-Roger, 2013) This has led to increased commercial exploitation of medicinal plants from the wild to meet

the rising demand and this has contributed to the over-exploitation of useful species and use of destructive harvesting methods leading to decline in medicinal plants (Cunningham, 1993; Hamilton, 2003). Consequently, there is a global concern on loss of plants and the urgent need to conserve traditional medicinal plants that can be used in the development of modern plant based pharmaceuticals.

Cunningham, (1993) reported that there was evidence to show that the supply of plants for traditional medicine is failing to satisfy the demand. The unsustainable harvesting practice by herb gatherers for commercial purposes has led to depletion of many medicinal species. In towns, large quantities of medicines are supplied by commercial harvesters and sold to urban herb traders. Traders in herbal medicine harvest large quantities of various herbs and plants from the wild and preserve them for sale to their clients at the markets and urban centers. As a result the traditional methods of harvesting in small quantities or as required for a patient is not used by the gatherers. Research shows that the challenges to utilization and conservation of medicinal plants and shrubs in Eastern Africa include increased population that has led to higher demand for traditional medicine in rural and urban areas; loss of habitat due to human settlements and clearing of vegetation for agriculture. The decline in the natural habitat has led to over harvesting of the available medicinal plants to meet the increasing local demand and for sale to the urban population (Owuor, *et al* 2006).

In Kenya rural and some urban communities rely on medicinal plants because they belief in their healing ability or cannot afford or access modern medical care. The medicinal plants were traditionally gathered for local use from the natural habitat guided by the cultural practices for sustainable use.

The Kenya Policy Brief of 2008 (GOK, 2008) indicates that in the past, use of traditional medicine in Kenya was in small scale by traditional healers for the local community. The herbalists collected medicinal plants according to tradition and taboos. This ensured that plants were protected from overharvesting. Currently, herb sellers are seen in urban markets giving advice and selling raw plant material and concoctions. These activities

have exaggerated impact on the remaining wild stocks as they provide an economic incentive for destructive harvesting of medicinal plants such as *Aloe* and *Prunus africana (African/bitter almond)*.

Research among the Samburu, Maasai, Nandi, Embu, Kamba and the Sabaot in Kenya shows that medicinal plants have not been documented and this may have led to loss of the orally transferred knowledge on traditional medicinal plants (Bussman, *et al*; 2006; Jeruto, 2008; Okello, 2009; and Kareru, 2007). Traditional herbal medicine in indigenous African communities was administered by the family elders and herbalists to treat ailments in the community. These people grow old and some die without revealing their well guarded and secretive knowledge, leading to loss of immense knowledge on traditional medicinal plants used in the community.

Studies carried out by Kipkorir and Ssennyonga (1984) noted that there is literature on some medicinal plants used by the Marakwet. However, they noted studies need to be done on *Meteria-medica* used by the Keiyo people who like the Marakwet use a wide variety of flora, for treatment. To date few studies have been done on the medicinal plants used by the Keiyo. The Keiyo community is rich on knowledge in herbal medicine since their area of settlement was not occupied by white settlers due to the rugged terrain that was unfavourable for large scale mechanized farming. Despite this, at present there is increased population and loss of indigenous vegetation in the Sub-County. The knowledge on traditional medicinal plant use in the community is still orally transmitted by family elders and herbalists whose knowledge is well guarded due to the secretive nature on matters pertaining to medicinal plant use. This is exacerbated by western education where the youth do not have time or interest to learn the traditional ways of treatment.

This study therefore examined the utilization and conservation of traditional medicinal plants in human health care. It also assessed the threats and measures adopted to conserve medicinal plants in Keiyo South Sub-County, Kenya.

1.2 Statement of the Problem

Before the influence of western culture in Kenya, natural resources were protected using cultural controls and regulations guided by community elders in various community settings. The change in economic activities and oral transmission of knowledge on medicinal plants and increased use has lead to their loss and destruction before documentation of the indigenous plants and their medicinal uses. This study therefore investigated the utilization of traditional medicinal plants by the Keiyo community for human health care in order to establish the present threats and measures adopted to conserve medicinal plants by the Keiyo in Keiyo South Sub-County. This added to the knowledge gap on utilization of medicinal plants for human health and traditional conservation of medicinal plants in Keiyo South. This is necessary because most of the medicinal plants and their uses are not documented in spite of the threats to indigenous plants that are a source of herbal medicine, and potential loss of the oral knowledge held by elders on their use. Traditional communities had traditional ways of wise use of available resources which should guide policy on conservations of resources in the in the Country. These issues are addressed in the study objectives.

1.3 Study Objectives

The general objective of the study was to assess the utilization and conservation of traditional medicinal plants used by the Keiyo community of Kenya. The specific objectives were to:

(i) Determine the traditional use of medicinal plants used by the Keiyo Community in Keiyo South Sub-County, Kenya.

(ii) Establish the traditional measures that were employed to conserve medicinal plants by the Keiyo community in Keiyo South Sub County in Kenya.

(iii) Assess the threats to traditional medicinal plants found in Keiyo South Sub-County in Kenya.

(iv) Suggest policy and strategic options for sustainable utilization and conservation of medicinal plants in the Sub-County

1.4 Research Questions

The research questions that guided the study were;

i). How were medicinal plants traditionally used among the Keiyo people of Kenya?

ii). What traditional measures were employed to harvest and conserve medicinal plants in Keiyo South Sub- County?

iii). What are the threats to medicinal plants in Keiyo South Sub- County?

iv). What are the policy suggestions and options for sustainable utilization of medicinal plants in Keiyo South Sub- County?

1.5 Justification and significance of the study

Keiyo South Sub-County is an important research site because the Keiyo people occupy three topographical zones which have a wide variety of plants that are used by the community to treat various ailments experienced in the locality. The arid and semi arid valley, the steep escarpment, and the cool wet highlands have variety of plants used for medicinal purposes by the local community. Thus the study attempted to fill the knowledge gap on utilization and conservation of traditional medicinal plants that is orally transmitted, establish the threats to these medicinal plants and the measures taken to conserve them.

The WHO's Alma Ata Declaration of 1978 (WHO and UNICEF 1978), called for the promotion and strengthening of primary health care systems in order to achieve the goal of health for all by 2000. This is also relevant to the goals of the 1992 Earth summit held at Rio de Jenairo whose aim was to promote sustainable development in order to meet the present needs while ensuring that we have a healthy and viable world for the future. The traditional knowledge on wise use can be promoted in Elgeyo-Marakwet County to ensure sustainable use of the medicinal plants in the community.

In addition, traditional medicinal plants used to treat ailments in the Sub-County can be subjected to chemical analysis for the production of plant based medicine that can cure diseases like cancer, HIV/AIDs and reproductive health problems. This is because traditional medicinal plants used by traditional herbalists guided in the discovery of

important drugs for human use. For instance, the *Catharanthus roseus* (Madagascar periwinkle) a source of *vincristine* that is useful in treatment of leukemia in children and *vinblastine* used for treatment of hodgins disease (Addae-Mensah, 1992).

The findings of the study are useful in guiding policy makers to adopt and integrate some traditional measures for sustainable utilization of medicinal plants into conventional approaches and to take an active role in promoting indigenous knowledge and conservation of indigenous plants for the benefit of the people and the nation. In addition scholars should carry out research and document indigenous knowledge that is orally transmitted in the society.

1.6 Scope and Limitations of the study

The study was carried out among of household heads, traditional herbalists, and herb vendors on utilization and conservation of medicinal plants in Keiyo South Sub-County, in Elgeyo-Marakwet County. The study was restricted to household heads in the Keiyo community and traditional herbalist who treat sick people at their homes in the study area, and the herb vendors, in the local market centres in the study area. However, the study did not include herb gatherers and the clients seeking treatment.

Most parts of Keiyo South Sub- County cannot be easily accessed by road due to the steep escarpment and the hilly terrain. The highland zones were accessed during the dry season through Kaptagat- Kaptarakwa to Kapkoi then Kaptarakwa-Chepkorio road. The lowland zone was accessed through Iten- Kabarnet route which is tarmarcked. However, the steep escarpment (*Mosop and Korgeet*) was not accessible by road and hence the villages were accessed by walking down the slope using established foot paths from the highlands and up the slope from Kerio Valley.

The Keiyo people, like other African communities, guard their knowledge on traditional medicines (Kokwaro, 1993). Consequently, this may have limited the amount of information given to the researcher. Further, the degree of honesty of household heads,

traditional herbalists and vendors sampled and interviewed may have limited the amount of information given on medicinal plants and their use. This is because issues on herbal medicinal are guarded by those knowledgeable because they consider it a special gift to the family. The researcher therefore assured the respondents of the academic intention of the study and sought their informed consent before the interviews. The next chapter examines literature on utilization and conservation of traditional medicinal plants and threats in various parts of the world, Africa and in Kenya.

CHAPTER TWO
LITERATURE REVIEW

2.1. Introduction

This chapter reviews literature on utilization and conservation of traditional medicinal plants guided by study objectives. Specifically, it examines the utilization of traditional medicinal plants, their value and traditional measures of conservation; threats to medicinal plants and the measures adopted for conservation and sustainable use of medicinal plants.

2.2 Traditional Utilization of Medicinal Plants

The World Health Organizations (WHO) defines traditional medicine as a term used to refer to traditional medical systems such as the Chinese traditional medicine, Tibetan medicine, Indian Ayurveda, Arabic *Unani* and various forms of indigenous medicine. The use of traditional medicine is widespread in developing countries and the use of complementary and alternative medicine is increasing in developed countries. The beneficial effect of medicinal plants in health care is underscored by the WHO is estimated at 80% of the world population that uses them for primary health care. This is because these medicines are obtained from plants that are easily accessible in the locality, culturally acceptable and affordable to the community. Traditional medicine is often referred in developed countries as alternative medicine, complementary medicine, natural medicine, herbal medicine, indigenous medicine or folk medicine (WHO, 2002).

According Larner in Saks, 1992, people in Medieval Europe relied on herbal knowledge handed down from one generation to the next. The use of plants did not require any special skills as long as the patient knew the plant for the medical condition and simply collected and prepared for use. The curative effect of herbs achieves results slowly and gives the body a chance to help in the fight to cure its ills. The 16^{th} and 17^{th} Century life in England and Scotland had the features of simple societies which relied on folk medicine which encompassed, use of plants, herbs and minerals and ritual healing.

During the pre-industrial period there were three types of healing: official and scientific healing; practical and common- sense and ritual healing. The official healing was what was sanctioned by professional associations and taught in universities. Common sense healing involved the use of particular herbs and minerals of established utility. These were used by the patient without the professed healer but one could seek the help of a local healer known to have special knowledge of mixing herbs.

The number of individuals using medicinal plants in Africa and South America is large and is on the increase not only in developing countries but globally. The use of medicinal plants for treatment of various diseases is universal and has been practiced by many people for many years. As Kokwaro (1993) clearly states, plants have been indispensable sources of both preventive and curative preparations for human beings.

Hamilton (2004) noted that the traditional medical systems include traditional systems that have written traditions of documentation of knowledge and pharmacopoeia for doctors and institutions for training. Traditional medical knowledge is orally transmitted and is associated with households, communities and ethnic groups. According to Hoareau (1999), medicinal plants have been used in all cultures as a source of medicine and health care preparations.

The knowledge that plants can cure disease is probably instinctive in man. For thousands of years medicine depended exclusively on flowers, roots, barks and leaves until recently when synthetic drugs came into use and many are “carbon copies” of chemicals identified in plants (Swaminathan & Kochar, 1989). These are traditional medicinal plants which were used to extract modern medicine such as *reserphine* from *rauwolfia* to treat hypertension, insomnia and insanity.

In Asia and Latin America people continue to use traditional medicine due to historical circumstances and cultural beliefs. WHO reports that in Chile 71 percent of the population and 40 percent in Columbia of the population have used traditional medicine (WHO, 2002). Research has shown that, 60-90 percent of Africa’s population relies on

medicinal plants for healthcare needs. Surveys show that in Ghana one traditional doctor cares for 400 people while one western trained medical doctor attends 12,000 people. In Kenya the ratio of traditional doctor to people is 1: 500 while the ratio of trained medical doctor to people is 1: 20,000. This shows that traditional medicines play a key role in health care delivery (Addae-Mensah *et al*, 1992). According to WHO, traditional healers such as herbalists, midwives and spiritual healers constitute the main source of assistance to health problems facing rural population in developing Countries. It is also noted that 80 percent of the population of developing countries rely heavily on traditional medicine to meet their health care needs (Yirga, 2010).

Oladale *et al* (2011) noted that Nigerians in rural areas do not have access to conventional medicine and 75 percent solve their health problems by consulting traditional healers to avoid the expensive medication in available hospitals. Rural communities also have faith in traditional medicine and believe it is the wisdom of their forefathers. Herbalists who collect herbs from the wild are being encouraged to own medicinal gardens especially for plants facing extinction due to over use, bush burning, drought and urban development. In addition there is need for them to work in a clean hygienic environment and good management to prevent contamination of raw materials and other product.

Similarly Yirga (2010) noted that Ethiopian plants have shown effective medicinal value for some human and domestic animal ailments. Thus many people use it due to the trust that communities have in the value of traditional medicine and low cost of using them. It is also noted that the distribution of knowledge and services of medicinal plants are hierarchically placed, where services are obtained from the family, neighbourhood, and village and beyond as the need arises. This is a common order in most indigenous communities where ailments are initially treated within the family and external help is only sought from specialists for ailments that were not familiar.

East Africa is endowed with a rich biodiversity of plant species of various vegetation types. These have been identified by communities as important sources of primary health

care needs. For many years people have developed a store of empirical information concerning therapeutic values of local medicine. According to Kokwaro (1993), this knowledge of medicinal plants faces the challenge that the knowledge is passed orally from one generation to the next and some of the information may be lost or distorted when a medicine man dies.

The use of plants as medicine by local people over the past period is important as it has developed over long period of utilization and management. Knowledge in the use of medicinal plants and their conservation has been achieved through many generations of time tested practices and long term accumulation of knowledge through observations, interactions and innovations (Owuor *et al,* 2006). The utilization of local plants varies from place to place, species to species and even from herbalist to herbalist. Plant parts used include barks of trees, stems of shrubs and roots/bulbs and tubers of plants and leaves and flowers (Kokwaro, 1993). Some medicinal plants which have been found to be effective herbs include *periwinkle* of Madagascar, *Maesa lancetolata* in East Africa and the *Cinchona* bark for treatment of malaria (Addae- Mensah, 1992).

Africa has many medicinal plants based on local knowledge for example *Securidacal longepedunculata* a tropical plant whose dried leaves are used for wounds, sores, coughs, venereal diseases. It is used to treat snake bite in East Africa, skin diseases in Nigeria and headache in Malawi. Many plants used for therapeutic purposes leads to the demand for the herbs.

According to a study by Sindiga (1995), traditional medicine is deeply rooted among the Maasai who have wide knowledge of herbal medicines used to treat people and domestic livestock. Herbal mixtures were prepared and used as digestives or excitants by the Moran preparing for raids. They used *Acacia nilotica* as a digestive and excitant to prevent hunger and thirst. Herbal medicines were obtained almost from all parts of the plant such as the bark and roots which were boiled and drunk. Traditionally it was the duty of every Maasai to learn about the medicinal value of herbs as he/she grows up. The boys learned as they looked after the small stock around the homestead as the girls

learned herbal medicines from their mothers and grandmothers whom they spend a lot of time with.

Among the Marakwet of Kenya, majority of herbalists *(Chepkerichin*) are women. They learned their skills from the older generation and also by trying out new medicines. The aged herbalists' vast knowledge of plants was passed to a favourite daughter or sold to another woman at a fee. The fee that is generally accepted was an un-castrated goat that symbolized the purchaser's growth in wisdom. The success of a herbalist depends on her ability to diagnose and treat her patients. She has to have a wide knowledge of plants and try out new ones as she keeps the herbs to herself. The herbs among the Marakwet people were found on the escarpment than in the forest (Kipkorir and Welbourne, 1973).

For an individual patient in Kenya, herbal medicine has greater advantages than conventional medicines because they are cheaper and readily available; are natural and less toxic as they do not contain the dyes and preservatives in biomedicines. Herbal medicines are considered wholesome as they cure illness and provide the body with nutrients that are required by the body (Sindiga *et al,* 1995) pp. 56

> *Mother Nature in her eco-wisdom provided every part of the world with herbs that constitute appropriate cure for diseases mostly prevalent in the respective ecological set-up if appropriately studied, preserved, propagated and utilized*.

The herbs and plants in general have therefore been used by human beings for food and medicines since time immemorial. According to Kipkorir and Ssennyonga, (1984) the Keiyo and Marakwet have used various herbs for curing ailments since time immemorial. Through trial and error they discovered the herbs that were effective for curing some ailments and not others. The knowledge acquired on medicinal plants was guarded carefully and only passed down from parent to child. It is also noted that at least every village in the Kerio Valley has a resident herbalist who prepared concoctions made either from plant leaves, roots, bark, and stems. This was dispensed free of charge for the village members or at a fee for those from outside the village.

Chebet and Dietz (2000) noted that the Keiyo community was and is still rich in the practices of herbal medicine. The Keiyo relied on the herbs for treatment of diseases and even had knowledge of rudimentary surgery and some specialized forms of treatment. The use of medicinal plants for prevention and cure of common ailments at home before consulting a specialist in the village was greatly valued. It was common in every household to have a basket for storing medicinal herbs, animal oils, plant saps and a pot "*kipsagitit*" dedicated to boiling herbs. The herbs were boiled for daily use by children. Another pot was used by adults when illnesses occurred within the family.

In addition, the Keiyo categorized diseases according to perceived causes such as those caused by natural factors or unnatural/human factors. The natural diseases were treated using traditional medicine either within the family or by a professional herbalist. The practitioners performed their duties as specialists and were rewarded in kind based on the service rendered. Traditionally the first payment was a small gift referred to as "*cheprewo*" (dew). The initial payment was a token to the herbalists who had to gather the herbs very early in the morning by walking through the dew. This was later followed by actual payment for the service once one healed (Chebet and Dietz, 2000).

From the literature reviewed above, it is clear that traditional medicinal plants for human healthcare are widely used globally and in particular Africa. Every community had through trial and error identified plants that cured various diseases and ailments. The herbal medicines were provided by specialists and those knowledgeable in the community who passed the oral knowledge from one generation to another. At present some of these medicinal plants have been documented and most communities in East Africa still pass their well guarded knowledge orally from father to son or mother to daughter. With the discovery of modern medicine, efforts made to provide modern healthcare services to all has not been achieved due to the high cost of providing these services. Hence the persistent use of locally available medicinal plants to treat ailments prevalent among the community.

2.3 Value of medicinal plants

There is a growing demand for herbal medicine due to increasing population and the inadequate provision of western medicine in developing countries. The WHO further acknowledges that 60-70% of world population rely on traditional medicine for their health care needs and in developing countries where 80-90% of the rural people rely on traditional medicine for their primary health care. Consequently the WHO (2002), notes that there is a growing interest in traditional medicine in developed and in developing countries due to low cost and technological inputs and relative low side effects.

According to WHO a third of the global population has no regular access to essential modern medicines. In some parts of developing countries like Asia, Latin America and Africa, half of the population faces shortage of minimum health care. In most developing countries there are limited materials and human resource in health care due to lack of adequate funding. A clear indication of the inequality in health care in developing countries is the ratio of medical doctors per 100,000 persons in various countries in 2004 was as follows; Rwanda 2.9, Uganda 4.7, India 51.3 and China 164.2. This is in contrast to countries such as Australia 249.1 and USA 549.9 (Unnikrishnan, 2009). In many parts of the world where modern health care is not readily available or affordable, people rely on traditional medicines which are derived from locally available natural resources and cultural knowledge.

Before biomedicine in North America was institutionalized most health care occurred at home. Healers and women would traditionally work inside a closed and local setting and grow small gardens of medicinal herbs to treat family members and the local community. In the 19thC biomedicine became established and gradually made herbal medicine appear obsolete by defining it unscientific. By late 20th Century, medicinal plants began to be used in North America due to dissatisfaction with biomedicine and the desire by patients to establish prevention and self care techniques. The public has now turned to herbal remedies as one of the major systems for preventive medicine and as forms of self care (Taylor, 2002).

Schultes (1989) noted that use of plants for medicinal purposes by Amazonian people varies from tribe to tribe. The native populations know the medicinal plants to reduce pain, lessen symptoms and cure pathological conditions. Most tribes had the experts who had wide knowledge of the curative value of plants. The use of alternative medicine has risen in the past few decades and continues to grow in popularity due to growing dissatisfaction in the biomedical system. The use of herbal medicine has grown significantly among health practitioners and the general public at a rate of 20% per year in Europe and North America. The increased interest in herbal medicine has led major drug development companies to search for traditional herbal remedies to be used as natural products and hence seek profit in medicinal plants which can be used in creating and mass marketing new drugs (Hamilton 2004 and Taylor 2002).

Medicinal plants play an important role in the lives of rural people in remote parts of developing countries where there are few health facilities. In Africa 80% of people rely on medicinal plants for their primary health care and is viewed as appropriate for treatment of HIV/AIDS (Owuor *et a*l, 2006). Many people rely on medicinal plants for their cure and as a source of income to the traditional herbalist, collectors and sellers.

There is a high dependency on medicinal plants for health care due to inadequate number of medical doctors for the rural population. As a result the number of traditional healers surpasses that of medical doctors in Africa. For instance in Malawi for one Traditional Medicinal Practitioner there are 138 people compared to one medical doctor for 50,000 people. This imbalance will continue to increase due to rapid population growth (Msuya and Kidegesho, 2009). It has also been observed that where medical services are available traditional medicine has remained as a visible option since it is affordable, accessible and locally available. In addition the local people trust medicinal plants for their efficacy in treating diseases and to provide a cure for the emerging diseases like cancers, diabetes and HIV/Aids (GOK, 2005).

Plants have contributed to western medicine by providing ingredients for drugs. Some drugs have botanical origins while others are made through transformation of chemicals

found within them or have their historical origins in the most active compounds found in plants. Schultes (1989) noted that recently discovered wonder drugs of the past half a century have come originally from the plant kingdom. Drugs which were initially isolated from plants used for treatment in indigenous societies revolutionized modern medical practices. The drugs include curare alkaloids, penicillin and other antibiotics such as *cortisone* and *reserpine*. Similarly a study of empirical medicine of the Aztecs reported by Schultes (1989) shows that their medicinal plants appear to be effective when judged by the native standards. A chemical analysis of 25 plants used by the Aztecs confirmed that 64% produced the effects the Indians claimed and 16% were active and only 20% seemed not to produce the effects attributed to them.

According to Taylor (2002), 30% of all modern drugs utilized in biomedicine were originally derived from plant origins. Although the plant species that provide ingredients for drugs used in western medicine is small but the drugs made from them have great importance on the number of people treated. It is reported that in USA 25% of all prescription drugs contained one or more ingredients from higher plants in 1953-1973 and has not changed much at present (Schultes, 1989). The discovery of drugs from plants used by indigenous people include the bark of cinchona tree used by the Indians to treat fever, and which is now used to make quinine a malaria drug and *rouvolfia* which was used to develop *reserpine* to treat hypertension in young people.

At present, pharmaceutical companies send employees to the Amazon and Africa to search for marketable herbal remedies used by local people without any monetary compensation to the indigenous people. The knowledge of the local people on medicinal plants was used in biomedical system and even patented, mass produced and sold expensively back to the local people for example, the rosy periwinkle of Madagascar used to make drugs such as *vincristine* and *Prunus africana* (African/bitter almond) used to treat prostate cancer.. Increased interest in herbal medicines has caused increased exploitation of medicinal plants for profit and these plants have become a renewed resource for commoditization by pharmaceutical companies (Taylor, 2002).

Besides this medicinal plants provide a significant amount of income for rural people in developing countries through the sale of wild harvested materials. The financially poor are more dependent on medicinal plants for their income and their health care with no alternative to herbal medicine as the more affluent people use pharmaceutical drugs (Hamilton, 2004). In many parts of the world herders, shepherds, the landless and women collect medicinal plant parts in the wild for sale to middlemen and local vendors. The harvesting of medicinal plants enables the poor to make some income especially those who do not have access to farm land, though the pay is low. Many people in the world rely on herbal medicine as others gain income from wild harvest or cultivation, or are involved in trading or processing.

Trade in traditional medicinal plants is an important livelihood options in developing countries where rural people are economically vulnerable, and this helps in improving their incomes, for instance trade in *Prunus africana* (African/bitter almond). Harvesting of wild resources is an economic activity recognized locally and internationally (Njoroge *et al*, 2010)

It has also been reported that Western medicine has failed in Africa compared to traditional medicine, because patients are not told the cause and nature of their illness. Patients are removed from their families and communities, forced to a hospital setting and subjected to treatment which addresses biological manifestations of the illness and not the spiritual aspects of the illness. As a result majority of the people subjected to this treatment do not heal psychologically and spiritually (Sindiga *et al*, 1995).

Sindiga *et al* (1995) noted that herbal medicine plays a vital role in the health care of rural people in Kenya. Local plants have been used since time immemorial by traditional medicine men with a wealth of experience with herbs. In addition, it has been alluded that diseases which could not be treated with western medicine can be treated with traditional medicine such as allergies and reproductive health. The heavy dependence on medicinal plants renders them vulnerable to over exploitation leading to loss of some species.

Traditional medicines derived from medicinal plants have wide acceptance because they are readily available and affordable to each member in the local community. Rural populations mainly use traditional medicine because it is available and cheap for them. Rural areas do not have access to roads to enable the sick access modern services. Evidence shows that in Kenya health services are mainly located in urban areas yet 80% of the population resides in rural areas. This leads to continued use and dependence on the traditional system of medicine (ibid 1995).

The use of local herbs has also been preferred by local people because modern drugs have side effects of purified synthetic chemical drugs unlike the natural plants. The side effects of synthetic drugs include dizziness, blurred vision and rashes among others (Sindiga *et al*, 1995). As a result most people opt for traditional medicines which are natural and safer. It is further noted that plants provide a storehouse of various drugs and can be searched for medicines to treat all ailments. Despite this, traditional medicine is still unwritten and information on the healing properties of certain medicinal plants is kept secret by traditional healers and only passed on orally from one generation to the next.

There are modern health facilities in Keiyo South Sub-County which are underutilized due to the general preference of traditional medicines by the local people. However, the cost of accessing medical facilities and purchasing the prescribed medicines is too high for most poor rural people residing in these areas. As such they mainly opt for the locally available herbs. As Chebet and Dietz (2000) noted, the health facilities in Kerio valley were least utilized. This is because the Keiyo community was and is still rich in the practice of herbal medicine which is used for treatment of various diseases. The plant parts used vary widely depending on type of plant.

Literature reviewed showed that traditional medicinal plants are an indispensable source of healthcare and they are a readily available, accessible and affordable source of medicine for many rural communities where modern healthcare is not readily available to the people. Communities have relied on them for their healthcare before modern facilities

were made available. Due to limited facilities and few trained modern medical staff, modern medicine has not been accessed by a large percentage of rural communities. It is also further noted that traditional medicinal plants were used to develop modern drugs before the development of the synthetic chemical based drugs. Due the side effects of these chemical based drugs pharmaceutical companies now seek traditional plant remedies to use to develop modern plant based drugs for profit. This calls for conservation of traditional medicinal plants used among the communities to provide medicine that has limited side effect, effective and affordable to the local community.

2.2.1 Medicinal Plants used by indigenous and local communities

Herbalists are traditional healers who dispense plant parts as herbal medicine. The World Health Organization (WHO, 2002) defines a traditional healer as a person who is recognized by the community in which he/she lives as competent to provide healthcare by using vegetables, animal and mineral substances based on social cultural and religious background as well as knowledge attributes and beliefs that are prevalent in the community. The knowledge that plants cure is instinctive and man has obtained medicine exclusively from flowers, barks, leaves until recently when synthetic drugs came into use, or carbon copies of chemicals identified in plants (Addae-Mensah *et al,* 1992).

Pamplona-Roger (2013), notes that active substances are not evenly distributed in the various parts of a plant because of specialization of cells. Some plants however contain the same active substance distributed in all parts of the plant. While other plants have medicinal substances concentrated in one part of the plant, others have different substances in each part of the plant, and other parts have toxic elements. This requires knowledgeable people to provide the correct plant medicine for specific ailment. As such herbalists and other traditional healers were entrusted with this responsibility.

Some of the drug plants which are economically important for the production of some of the drugs currently useful in modern medicine as documented by Dev (1989) include those listed in table 1.

Table 1: Drug plants used in modern medicine

Plant name	**Part used**	**Traditional Place of use**	**Ailment treated**
Madagascar periwinkle Catharanthus roseus	Leaves	Madagascar and Jamaica	Diabetes
Ipecacuanha caphaelis spp	Root rhizome	Brazilian Indians	Induce in the vomiting treatment of dysentery
Cinchona cinchona spp	Bark	Peruvian Indians	Cure for fever and malaria
Opium poppy papaver somniferum L	Juice from Unripe capsules	Western Mediterranean	Headache, arthritis, and to induce sleep

Source: Dev, 1989.

Some medicinal plants of used in America and documented by Pamplona-Roger (2013) are presented in table 2.

Table 2: Medicinal plants used in America

Plant name	Part used	Origin of use	Ailment /diseases
Orange tree	Leaves and Flowers	Arabia	Nervous system
Cornflower	Flower	Ancient times	Remedy for the eyes
Rauwolfia	Root powder	Indian traditional medicine	Snake and spider bites
Hops	Powder from cones	Romans	Calms nerves
Opium poppy	Ripe fruit	Summerians 5000 years	Easing pain and causing drowsiness
Onion	Bulb	Ancient Egypt, Babylonian physicians	Asthma, arthritis
Garlic	Bulb	Asia	Prevents many diseases, diabetes
Eucalyptus	Leaves	Australia	Respiratory problems

Source: Pamplona-Roger, 2013

According to Hamilton (2004), herbal medicine is becoming fashionable in rich countries and is growing at the rate of 10-20% in Europe and North America. These medicines and are botanical products sold as health foods and herbal teas related to health and personal care.

Herbalists mainly use herbs and medicinal plant parts of such plants like the whole root, stem, leaves, bark, flowers and seeds. Herbal preparations are given in powder, to be swallowed or rubbed into cuts made on any part of the body. Some are prepared by soaking the plant part in water, or boiled in water or in soups and consumed by patients. Traditionally the herbalist cures mainly with plants gathered fresh while seasonal plants were dried and stored for use when there was need. At present, plants are traded in as roots, leaves or powders, extracts and herbal teas. The roots, leaves, seeds and bark are mainly used to treat people suffering from colds, flu, ulcers, wounds and gynecological problems (Kokwaro, 1993)

According to Pamplona-Roger (2013), there are different ways of preparing and using medicinal plants. One of the popular methods is preparing herbal tea by using water to extract the chemical substance in the plant. The soft parts of the plant are put in hot water (infusion) or the hard parts are boiled (decoction) or is socked in water at room temperature for a cold extract. The infusion, decoction or cold extract is then used internally or internally. Other methods of preparing medicinal herbs demand specialized knowledge and instruments used in the pharmaceutical industry.

Similarly, Kokwaro (1993) indicated that the plant parts used for medicinal purposes varies from species to species and depends on the structure of the plant. The bark or roots or both are gathered from trees and shrubs which form the main sources of local drugs. The entire herbaceous plant is generally used, although the leaves are widely used as well as the roots. Leaves and the whole stem are commonly used where the treatment requires poultice.

In Kenya, medicinal plants are prepared in several ways before giving to patients. These include boiling, soaking, burning, pounding, chewing or roasting depending on the part of the plant to be used, the kind of injury and the mode of use of the medicine. The most commonly used medicines treat ailments like malaria, fever, wounds and stomach problems among the Maasai and the Samburu (Kokwaro, 1993; Bussmann *et al* 2006).

Kokwaro (1993) provides detailed explanation on the parts used and preparation of medicinal plants as follows:

i). Boiling of plant parts is the most common method where the roots and bark/stem of trees/shrubs are boiled and the resulting decoction is used either internally or externally. In some cases the leaves are pounded and soaked in water and the infusion is used internally or externally.

ii). Some stems and roots are prepared by soaking in cold water over night and used in the morning. These are medicines that are usually bitter and boiling may become difficult to be taken orally by the patient.

iii). Burning of dried useful part mostly leaves or whole plant to form ash is usually taken orally or applied on an external wound or boil.

iv). In some cases plant parts were pounded before boiling or soaking or is used as a dry powder and applied directly on the infected part. Like ash, the extract is used externally on wounds and boils. For skin diseases the extract is mixed with some cream, smeared on the spot and covered with a bandage.

v). Chewing is a method used with leaves, roots and bark as a quick treatment for snake bites, mouth diseases or stomach problems.

Vi). Heating and roasting of succulent leaves is used for sprained joint, back and chest pains.

According to Owuor *et al* (2006) some of the common medicinal trees and shrubs used are based on experience and expertise on traditional herbal medicine includes the ones presented in table 3.

Table 3: Medicinal Plant in East Africa

Botanical Name of plant	**English name**	**Local name**	**Traditional Medicinal use**
Acacia hockii	White thorn acacia	Maasai: *Endewasi*	Leaves used to treat abscess and boils. Bark decoction for stomach ache and syphilis
Kigelia africana		Maasai: *Oldarboi*	Leaves used to treat syphilis, malaria, diabetes
Azadirachta indica	Neem/nim tree	Neem tree/*mwarubaini*	Leaves infusion used to treat malaria, parasitic worms, wounds and boils Bark used to treat boils and scabies
Carissa edulis	Simple spined num num	*Emuriai*: luganda	Leaves used to treat diabetes and headache Roots used to treat syphilis and gonorrhea
Entada abyssinica	Splinter bean	Luganda : *mwololo*	Leaves used to treat hypertension and wounds Root decoction used to treat rheumatic pain
Erythrina abyssinica		Engosorot : Luganda	Leaves used to treat fresh wounds Bark used to treat intestinal worms

Source*: *Owuor et al, 2006

Some of the medicinal plants including trees and shrubs used by the Kipsigis and Marakwet from the Kalenjin communities are listed in table 4.

Table 4: Medicinal Plants used by some Kalenjin speakers in Kenya

Botanical Name of plant	**Local name**	**Traditional Medicinal uses**
Crossandra nilotica	*Cheberenet* (Kipsigis)	Leaves used for snake (cobra) bite
Decliptera laxata	*Turkwot* (Kipsigis)	Roots as cough remedy
Acokanthera schimperi	*Kelyot* (Kipsigis)	Infusion of leaves for syphilis
Peri ploca lineari flora	*Sinendet* (Marakwet)	Stem latex applied on skin sores
Balanites aegytiaca	*Ngoswet* (Kipsigis)	Roots used for abdominal pain Gum used for chest pain
Acasia Senegal	*Chepkomon* (Kipsigis)	Roots used decoction for constipation Bark for diarrhea
Rubu steudneri	*Momonwa* (Marakwet)	Root decoction used for abdominal pain
Toddalia asiatica	*Ketemwet* (Tugen/ Keiyo)	leaves branches for bronchial pain
Rhoissus tridentate	*Torotwet* (Sebei)	Roots for indigestion and abdominal pain

Source: Kokwaro, 1993

Gachati (1992) also lists some common useful trees and shrubs in Kerio valley used as medicine by the Keiyo and Marakwet. Among them *Acacia melifera, Acacia nilotica Acacia seyal, Balanites aegyptiaca Uvaria scheffleri Terminalia brownii, Acocanthera mellifera and Ximea americana.* These are plants that are used for many other uses such as poles for fencing, firewood, charcoal burning and as a source of fodder for animals in the community. Since the medicinal plants are not only used for medicinal purposes, there is need to conserve both the plants themselves and the knowledge associated with their use possessed by indigenous and local people.

The use of traditional medicine for treatment of human ailments is common to all communities globally. Each community had identified plant parts through trial and error, used as medicine to treat ailments which varied from one community to the other. The medicinal plants were gathered by knowledgeable people. The discovery of modern plant based drugs and later synthetic medicine led to negation and marginalization of the use of herbal medicine. However due to the side effects of chemical based drugs, there is an effort to use plant based medicines in the developed world. In other parts of the world, rural communities still use the traditional knowledge on medicinal plants to treat ailments experienced. Hence the need to establish traditional measures used to conserve medicinal plants, and integrate them in conventional methods of conservation.

2.3 Traditional Conservation of Medicinal Plants

Communities that harvest natural resources have interacted widely with their environment and have accumulated important traditional knowledge regarding their use for various purposes over time. The use of herbal medicines is on the increase because of the belief that herbal remedies are safe, cheap and affordable to the local communities and because of its natural origin for the developed countries.

Past studies have shown that almost one third of medicinal plant species could become extinct, in China, India, Kenya, Nepal, Tanzania, Uganda (Hamilton, 2009; Njoroge *et al*, 2010). Medicinal plants are widely used by every community in Africa leading to increased exploitation. The demand for medicinal plants has been increasing because of increased use and the economic value of some plants without clear strategies for sustainable use.

Traditionally sustainable use of medicinal plants was regulated by management practices such as taboos, seasonal and social restrictions on harvesting of medicinal plants which served to limit medicinal plant harvesting. Wooden tools such as pointed wooden sticks used to harvest before metal tools were widely used helped to regulate quantity of bark or roots collected at ago (Cunningham 1993). This in turn minimized the damage on the whole plant or the parts targeted for extraction.

In addition it is reported that other factors that limited pressure on species that would have been over- exploited include:

a) Use of taboos in South Africa and Swaziland which restricted menstruating women from collecting medicines. This was believed would avoid reduction in the healing power of the medicine.
b) Women in South Africa practiced as diviners while men practiced as herbalists, which limited the number of resource users.
c) Control of tools used to remove barks of some plants to wooden sticks and not metal implements.

A study by Mavi and Shava (1997) in Zimbabwe revealed that traditional methods of collecting medicinal plants used by herbalists ensured that plants were harvested in a sustainable manner using the following guidelines:

i). Restricted removal of the bark of a tree for medicinal purposes from the east and west facing parts of the trunk. The north and south facing sides were believed to be ineffective for curative purposes.

ii). Collection of roots for medicinal use was done sparingly so that some roots remained to ensure the plant does not die otherwise it was believed that the patient would also die.

iii). Taboos to regulate over-harvesting were used so that a plant which had already been collected from or that showed signs of having been collected from by another traditional healer was prohibited.

The foregoing among other methods of plant protection ensured that the environment and medicinal plants found therein was conserved. Despite this, some of these cultures have ceased due to migration of people and urbanization which have resulted in the erosion of local people's knowledge of their traditional beliefs and practices. The pressure exerted on medicinal plant resources has however, remained low in remote areas and in countries where commercial trade in traditional medicines has not developed due to the small number and size of urban centres (Dold and Cocks, 2002).

In Tanzania trade in herbal medicine and deforestation are the major factors threatening medicinal plants. The important role that medicinal plants play in people's health together with the increasing threat of extinction facing them requires immediate conservation measures. Therefore, the revival of traditional management practices based on cultural norms and religious beliefs is the basis for sustainable use and conservation of biodiversity. According to Msuya and Kideghesho (2009), the social organization that controlled access to resources within the community, coupled with customary norms and procedures for control, acquisition, maintenance, transfer of resources and traditional utilization were key features used in the traditional natural resources and management practices. Traditional practices are additional management conservation strategies that can complement contemporary conservation and sustainable utilization of natural resources.

Similarly, in Kenya, traditional herbalists' collected herbal medicine guided by taboos and this protected the plants from over harvesting. They had a way of living with the rich biodiversity without destroying it, but using it in a protective way. They knew plant propagation, growth and potential for plants which the present generation knows very little about, leading to destructive harvesting of vulnerable medicinal plants. In addition traditional knowledge about biodiversity is inadequately protected and information is lost as traditional healers die without revealing their knowledge (Owuor *et al*, 2006). Literature reviewed showed traditional conservation measures of medicinal plants have not been well documented among local communities in Kenya. This is due to the secretive nature of herbalists' knowledge. Lack of documentation can also be considered as a threat to medicinal plants as the plants and their uses are lost forever in the community.

Traditional controls on harvesting herbal medicine ensured that medicinal plants were not destroyed. For instance, before colonization of Africa young people were socialized on the plants and their uses in human health, and this enabled all members of the community to be informed on use and care of plants in the community. These members were guided by the elders on the protection of resources that provide food and medicine. The advent

of western culture, introduction of cash economy and government controls led to decline of traditional cultural practices and controls. This has created an environment where people are individualistic and destruction of the available natural resources has been on the increase. This has contributed to loss of indigenous plants used as a source of traditional herbal medicine due to unregulated human activities. Based on the foregoing, it can be argued that traditional measures used traditionally to protect medicinal plants can be useful in establishing appropriate measures in the present day where individual and capitalistic interests are pursued.

2.4. Threats to the utilization of traditional medicinal plants

According to Roberson (2008) medicinal plants globally are at risk from destruction of their habitats, bio-prospecting for new sources and overharvesting of known medicinal species. By 1995, although less than 1% of tropical plant species had been screened for potential drug use, their habitats were being destroyed faster than the scientists can investigate. It is further noted that since medicinal plant species are profitable, private companies are now patenting traditional remedies from the wild and selling them at a profit. The profits made are never shared with indigenous and local communities from where the plant originated, and incidences of being prevented from using the plants they used for centuries have been reported.

As the demand for medicinal plants increase their survival in the natural habitat are under threat. In India, medicinal plants are used by the industry for large scale production of herbal products from plants collected in the wild. The collections generally involve using destructive methods of harvesting since people unsustainably harvest roots, bark, wood, stem or whole herb. The destructive collection poses a definite threat to genetic stocks of the species and to the overall diversity of medicinal plants.

Traditional knowledge of medicinal plants is currently threatened in rural communities in the Caribbean basin due to loss of traditional cultural systems and conversion of local forests to other purposes. The change in land use has affected traditional knowledge and

cultural practices associated with the management of wild and domesticated species. As a result medicinal plants are lost together with their uses for the future generations. Another major threat to medicinal plants and their knowledge in Eastern Brazil is cultural change, and the western world view. The young generations are no longer interested in traditional medicine whose knowledge was and is still passed on orally from one generation to another. The younger generations make conscious effort to avoid learning medicinal species as they associate them with primitive culture (World Bank, 2006).

Similarly, religious change from traditional beliefs to the Christian faith has had major impacts on traditional medical knowledge. During the colonial period conversion to Christianity involved discrediting the role of village healers and religious leaders. Conversion to Christianity required abandoning of traditional practices associated with manifestations of Satan represented in their view by the use of magical powers and medicinal plants (Mukiama, 2005). This discouraged the new converts from consulting them and sought modern medicine in mission health facilities. In addition, their children were sent to school and did not learn the traditional medicine as custom required

In Africa, the major problem facing medicine men and women is keeping the knowledge secret and confidential till they are old, and its transmission requires their trainees to take an oath not to reveal the secrets to anybody. In most cases, women dominate the field of child diseases and child birth and pass the plant drug knowledge to their daughters. Traditionally instructions were given in the field on the location, name of plant and how to harvest and prepare it for treating ailments (Kokwaro, 1993)

According to Cunningham (1993), the high demand for traditional medicine is due to increased population growth rate, rapid urbanization, high unemployment and the value placed on traditional medicines, leading to increased trade in the traditional medicines. Therefore a constructive resource management system needs an understanding of the major factors affecting medicinal plant exploitation. The decline in the natural vegetation due to deforestation has reduced the sources of supply of traditional medicines. In Cote d'Ivoire and Ghana some medicinal plants previously obtained in the regions forest

reserve was cleared for agriculture. In addition commercial harvesting of medicinal plants for export to pharmaceutical companies, logging for timber, use as building material and firewood has led to a decline in the medicinal plants available for use.

The increased human population and declining standards of living result in increased demand for affordable medicine. In addition, the shift in harvesting medicinal plants from traditional specialists to involve commercial gatherers is causing over-exploitation of medicinal plants (Owuor *et al*, 2006). The commercial gatherers either do not know or ignore the traditional guidelines on plant gathering for maximum benefits from the sales to the traders. Medicinal plants are threatened by increasing trade, over-exploitation and natural habitat destruction. The uncontrolled harvesting has led to over-exploitation and some plants currently face the threat of extinction.

According to Bodeker (2005) the shift from subsistence to commercial harvesting offers very low rates of returns to harvesters. In Madagascar the harvesters of *Prunus africana* (African/bitter almond) are paid negligible amount of money compared to the rates paid to middlemen in the trade chain to Spanish and French companies. In Mexico, collectors are reported to receive only 6% of the consumer price for medicinal plants; and this low pay makes gatherers harvest large quantities of medicinal plants to get sufficient income. In addition, the low payment for medicinal plant parts collected further discourages the idea of cultivation of the required plants. In order to secure a fair price for the work of the gatherers and promote sustainable harvesting and local cultivation there is need to shorten the market chains and increase the earnings for the harvesters.

Voek, *et al,* (2004) noted that although the potential economic value of folk medicinal plants to western medicine is high, the primary beneficiaries are the rural communities they serve. Despite this, destructive forest exploitation in countries like Kenya and Brazil and the erosion of ethno-botanical knowledge seem to undermine the anticipated drug development and the health of rural people. In addition there is unsustainable medicinal plant extraction to meet the high demands of national and international markets in tropical countries such as Sierra Leon, Cameroon and India. This eventually leads to the

loss of the plants and their medicinal value as well as the economic benefits to the local communities.

Cunningham (1993) further indicated that medicinal plants are also affected by rapid urbanization particularly in Africa. The urban population consults traditional medical practitioners based in urban areas like Ibadan, Lusaka, Kampala, and Nairobi for their health care needs. This leads to a species specific trade network to provide the needs of the urban population, who cannot afford western medicine and belief in the effectiveness of the traditional medicine. As a consequence, rapid urbanization and increased demand for traditional medicine has led to increased harvesting of medicinal plants from rural areas leading to depletion of the rural resource base of some plant species through over exploitation thus creating problems in healthcare.

In addition, Commercial gathering has changed the medicinal plant gathering and use from the professional herbalists, to involve an informal group of medicinal plant gatherers. The rural traditional medical practitioners gathered plant parts while ensuring that the plants did not die. The commercial gatherers are however motivated by economic gains and hence do not use the traditional conservation practices and harvest without regard to the future survival of the plants. The commercial herb gatherers of medicinal plant material are poor people whose aim is earning a livelihood not resource management leading to unsustainable high levels of exploitation. This is more intense in regions with large urban areas in Africa (ibid, 1993).

It has been documented that natural resources in communal lands are today exploited with little or no control. Herbal medicine traders have easy access to the communal lands due to weakened controls over land and natural resources in South Africa leading to a serious impact on the availability of medicinal plants in communal lands. Medicinal plant collection has shifted from being solely that of traditional specialist to involve commercial harvesters who supply the herbal vendors to meet the large urban demand. In towns, large quantities of medicinal plant materials are bought from commercial harvesters and sold by informal sector sellers, mainly women. Demand for traditional

medicines is highly species specific. The large urban areas dictate prices because of rising unemployment, over supply and cheap labour (Dold and Cocks 2002).

Since hospitals and western trained doctors are few in Africa, the destruction of indigenous forests will also destroy the primary healthcare network involving plants and traditional healers. In addition medicinal plants are significant to both the developing and developed countries since an estimate of 75% of the worlds rural people rely on traditional herbal medicine; and about half of the worlds medicinal compounds are derived from plants such as alkaloids and penicillin (Frankel *et al,* 1995).

Trade in traditional medicine has greatly increased more than at any other time in the past, and is a complex management issue to conservation agencies, healthcare professionals and resource users. The use of medicinal plants is no longer restricted to traditional healers and has resulted in an increase in the number of herb gatherers and traders (Dold and Cocks, 2002). The trade in herbal medicine is further promoted by a cash economy and the emergence of commercial harvesters in areas initially restricted to traditional healers making medicinal plants become a common resource with few incentives for resource management or traditional conservation practices. In the past, traditional healers in African society were only given a gift for the treatment done but not a fee as is the case at present.

People from rural areas have moved to work in urban areas where health care needs are only available in the western medical clinics. Despite this, the cost of modern treatment is too high for most people who prefer to seek the medical services of herbal traders in urban areas. The urban based herb vendors rely on cheap medicinal plant parts gathered from wild harvests in their rural homes. As the demand increases the need for increased supplies promotes commercial harvesting with no traditional regulations to guide. The harvesting for commercial purposes threatens the medicinal plant species if no action is taken to promote sustainable use and conservation.

At present traditional medicinal plant parts are sold in urban areas to treat general or specific ailments. As a result, there is increased harvesting to provide for the ever-increasing population in the rural areas and also the large population of the urban centres. This together with habitat loss and erosion of traditional knowledge is endangering many medicinal plant species and the need for sustainable use and conservation of various plant resources (GOK, 2008). It is also noted that there is an increase in poorly trained practitioners who are not controlled by either the traditional system or modern government administration (Sindiga *et al*, 1995). Kokwaro (1993) also contends that some practitioners pretend to be able to treat all diseases and administer one drug after another for their economic benefit which may eventually lead to deaths.

Literature reviewed shows that the threat to medicinal plants world over is deforestation of indigenous forests and the destructive methods of harvesting popular species of medicinal plants for trade. In Africa the loss of cultural management practices has led to increased gathering by commercial gatherers and vendors to meet the increasing need for medicinal plants for healthcare not met by modern healthcare. As a result medicinal plants are destroyed due to destructive harvesting to meet the increasing demand for medicine in rural and urban centres

2.5. Medicinal Plant Conservation Measures

There is a high medicinal plant use globally with Asia having the greatest volume of medicinal plant use for domestic and export. India harvests 90% of its medicinal plants from uncultivated sources. It is reported that in India, the rapid loss of habitat and over exploitation are a threat to medicinal plant species. China also harvests an estimated 80% of its medicinal plant material from wild sources (WHO, 2002).

The increase in global demand has brought international traders into contact with international regulatory regimes such as the Convention on International Trade in Endangered Species (CITES). This has raised awareness that endangered species cannot be exported and that conservation and cultivation must be adopted to ensure supply for export (Bodeker, 2005). This has raised international awareness of threatened plants that

need protection from traders to avoid the loss of the plants from the areas where they are endangered.

The Chiang Mai Declaration of 1978 stated its recognition that medicinal plants are essential in primary health care and concern over the loss of biodiversity. Due to the realization of this threat, the Chiang Mai Declaration noted the urgent need for international cooperation and coordination to establish programs for conservation of medicinal plants to ensure that they will be available for future generations. The international conference in Chiang Mai, Thailand, in 1988 and Bangalore India, in 1998; have come up with themes which include; the need for coordinated conservation action; inclusion of community and gender perspectives in the development of policies and programmes; the need for information on medicinal plant trade, the establishment of systems of inventorying and monitoring the status of stocks of medicinal plants; the development of sustainable harvesting practices; encouragement for micro-enterprise development by indigenous and rural communities; and the protection of traditional resource and intellectual property. Other declarations that followed called for the conservation, cultivation and sustainable use of medicinal plants. These have raised awareness on the need for global cooperation to conserve medicinal plants for the future (Bodeker, 2005).

In response to the high demand for medicinal plants for export, Asia began large scale progammes of commercial medicinal plant production though other regions have not taken it up except as demonstration projects. At present there is a consensus that cultivation is the answer to the conservation of wild medicinal plants. The cultivation of medicinal plants not only increases the supply but also enhances species identification, improved quality and improved species. The medicinal plants that need to be conserved in Africa are the slow growing species with high demand. The harvesting of these plants has led to increased expansion of gathering to larger areas, leading to increased depletion of the rural resource for the traditional medical practitioners (Cunningham, 1993).

Conservation agencies in the Caribbean work on the scientific identification of medicinal plants and encourages communities to use sustainable methods of bark harvesting and digging roots without killing the plant. At the academic level it is encouraging the development of a curriculum that encourages scholars in the Caribbean universities on conservation and community development (World Bank, 2006)

Moeng (2011) indicated that trade in medicinal plants has a significant and detrimental effect on conservation of medicinal plants. To reduce this, there is need to legalize the trade and to ensure monitoring of products sold and establish community based resource management and initiate projects for cultivation of the most threatened species. There are various conservation methods which include protection of wild species *in-situ*, cultivation in botanical gardens, and collection of *germplasm* and establishment of *germplasm* banks and public campaign. Conservation of the medicinal plant resources can be done through conservation of habitats through in- situ approach. In-situ conservation is the conservation of species in its natural habitat. Many medicinal plants are locally rare or endemic and require protection of their natural habitat. This is achieved through creating of protected areas to ensure complete protection of species. This ensures the protection to the resources and is an effective means to save threatened species from extinction (Fraenkel *et al*, 1995; World Bank, 2006).

Conservation of plant species outside their natural habitats (e*x-situ* conservation) can be achieved through collection and preservation of seeds and establishment of live collections. *Germplasm* conservation has been done for many cultivated species where a repository of seed collections is available at national, regional and international level. In spite of this, many medicinal plants seed collection and conservation are rare. Since medicinal plants are wild and harvested for their roots to prepare remedies, efforts should be made to conserve the medicinal species. There is need to create awareness among the traditional healers and the community to preserve the indigenous medicinal plant species. These may include conservation measures such as area closure where a ban is placed on farming, grazing, and tree felling to minimize environmental degradation (Hamilton, 2004 and Bodeker, 2005).

Studies conducted in Ethiopia, Uganda, Serbia and Northern Peru showed that most medicinal plants species used to treat human ailments were wild. A study by Yirga (2010) in Ethiopia, reported that traditional medicinal plant parts such as leaves, roots and seeds for human health care are harvested mostly from wild stands than from home gardens. The author argues that, medicinal plant conservation in Ethiopia calls for aggressive studies and documentation of indigenous knowledge on medicinal plant use; this is necessary before the rapid ecological and cultural changes distort the physical and related knowledge base. Therefore indigenous knowledge and skills on traditional medicine should be protected. The herbalists should be encouraged to grow medicinal plants in home gardens, together with crops in farmlands and live fences.

Most developing countries in tropical areas are endowed with immense resources of medicinal and aromatic value which have been used to meet the healthcare needs of the people in their local environment. The increasing demand for medicinal plants in developing countries has led to indiscriminate harvesting of plants leading to some plants being endangered (Owuor *et al* 2006 and Roberson, 2008)

According to Chebet and Dietz (2000), the Keiyo were conscious about their environment as a source of life. The semi-arid valley and escarpment required great care to ensure continued provision of forest resources for building, fuel wood and medicinal herbs, as well as protection of community shrines and initiation sites. Some of the commonly used plants found here included *bamboo, cedar, wild olive, croton, sodom apple and kikuyu grass* in the highlands and acacia trees in Kerio valley. Thus there is need to conserve both the plants and the knowledge associated with their use possessed by indigenous people for use in future.

In conclusion, this chapter has discussed the utilization of medicinal plants by communities since immemorial to treat human ailments. Knowledge about them was orally transmitted together with social controls that protected the medicinal plants. The discovery of synthetic modern medicine led to wide use these drugs as traditional

medicines were dismissed. By the late 20th Century the side effect of synthetic drugs had led to a return to plant based drugs in the western world. The high demand for plant based medicines by the rural and urban communities as well as for commercial use has called for the need to conserve medicinal plants and their uses.

2.6 Theoretical Framework

The concept of the Tragedy of the Commons by Hardin, G, (1968) was relevant to this study. The theory of the tragedy of the commons states that when a resource is collectively owned by a group of people, each exploits the resource for his or her own benefit and thus eventually destroying the resource. Hardin (1968) posits that resources that are open to unregulated exploitation are eventually depleted. According to this scenario, a public resource such as pasture that is collectively owned and is unregulated for grazing each person increases the number of his animals. This eventually leads to overgrazing and finally causes the destruction of the commons as each herder adds his stock to maximize on the profits. Accordingly, sustainability requires that common pool resources be maintained so as to continue to yield benefits, not only for the present but also for future generations. Thus lack of management of common pool resources leads to a tragedy for all (Osemeobo, 1991).

According to Wright (2008), where a resource is owned by many people in common or by no one (open access) also known as common pool resource (or commons), the exploitation of such resources presents serious problems and can lead to the eventual ruin of the resource. When there is no regulating authority or one which is ineffective, exploitation of the commons becomes a free for all in which profit is the only common motive.

Among African communities like the Keiyo people of Kenya, there were traditional controls that regulated individuals on the use of natural resources such as herbal plants for the good of all. These regulations protected and conserved the resources for the good of all under the direction of the elders. However during and after establishment of colonial rule, traditional administrative systems were ignored and western systems that were introduced were individualistic and adopted commercial approach in the economy.

This gradually led to the loss of cultural values and hence a tragedy to the indigenous ways of protection of resources including medicinal plants.

This theory is applicable to the harvesting of medicinal plants for local and global use which may eventually lead to the depletion of the plants due to over harvesting and destructive methods of harvesting. Medicinal plants were traditionally gathered by herbalists for use by the local community with a smaller population. At present the increasing population, high demand for herbal medicine and commercial harvest for profit without clear regulations may eventually lead to depletion of the resource.

Land in Keiyo escarpment and Kerio valley is communally owned by clans who obtain resources guided by cultural regulation of the elders. In addition, the local people allowed members of the community to gather medicinal plants without restriction. At present, high demand for herbal medicine to supply the increasing rural and urban population has led to the use of untrained herb gatherers who harvest large quantities of medicinal plant parts to be sold to herb vendors and to distant herbalists.

The emergence of commercial medicinal plant gatherers in response to urban demand for medicinal plants and rural unemployment has resulted in indigenous medicinal plants being regarded as an open access or common property resource instead of a resource only used by specialists. The gatherers harvest plants in farms with the traditional idea that no one is denied to gather medicine in community land.

Controls by community leaders are on the decline due to cultural change, increasing cash economy and rising unemployment. This has led to the removal of too much bark and uprooting of herbs and shrubs for larger collection at once instead of harvesting roots of the plants in small amounts to allow the plants to grow. To the commercial gatherers traditional taboos previously used are no longer important to them and the buyers (Cunnigham, 1993). Thus the commons in communal lands are usually threatened when communal systems are integrated into the capitalist system. Based on the above analysis and literature reviews, the conceptual framework adopted is indicated in the next section.

2.7 Conceptual Framework

Every locality has various plants in the natural setting used to meet the needs of the community. These have been used sustainably by the past generations to provide food, shelter, wood fuel and medicine by traditional societies. With the advent of colonial rule came western systems, laws and regulations. This led to a decline in traditional governance systems by the elders and the destruction of African economy and social controls governing use of resource among the Keiyo community.

The western systems introduced a cash economy that led to individualism and commercialization of commodities in African communities. This has played a role in promoting the tragedy of the commons as people seek individual interests at the expense of protecting community resources. Human economic activities in present day has witnessed the potential loss of medicinal plants in the wild due to deforestation of indigenous vegetation for planting food and cash crops and increased commercial gathering of medicinal plants to meet the rising demand in the larger community. This calls for measures to conserve indigenous plants for their medicinal use and to ensure availability in the future for human health care and regulations to guide in gathering these plants.

Figure 1 illustrates the independent and dependent variables used in this study and their inter-relatedness.

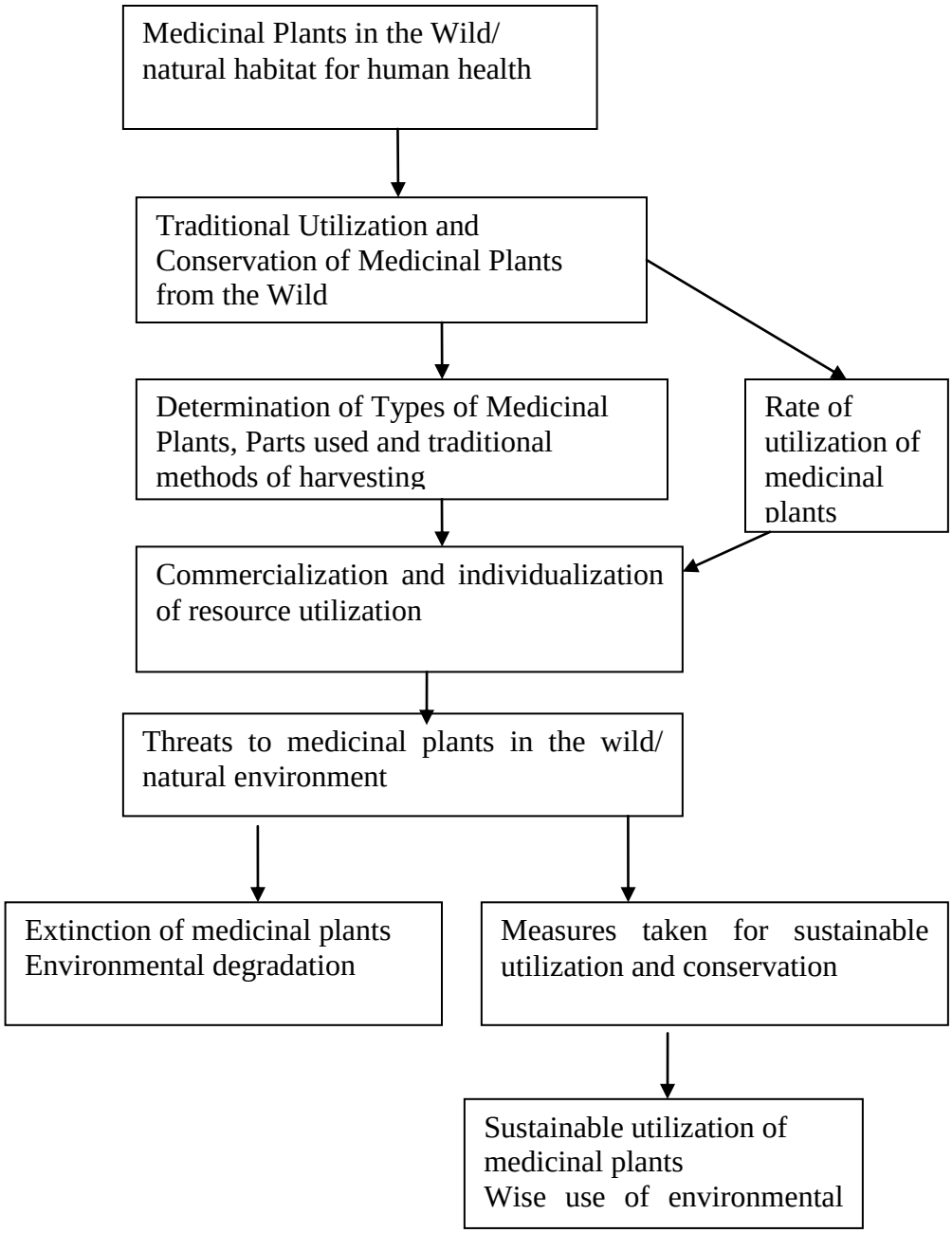

Figure 1: Conceptual Framework

Source: Author, 2015

Independent variables: Medicinal plants in the wild/natural habitat

Dependent variables: Exploitation of medicinal plants- unsustainable utilization

Intervening variables: Human activities like deforestation and natural events

The next chapter discusses the study area and the methodology of the study.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1. Introduction

This chapter presents the methodology used in the study. The chapter covers the study area, research design, the target population and sample, methods of sampling and sample size, data collection procedures, and data analysis methods and presentation techniques.

3.2. Study area

The study was conducted in Keiyo South Sub-County, one of the two sub- counties occupied by the Keiyo community in Elgeyo-Marakwet County which is one of the forty seven Counties in Kenya. The County is inhabited by two main communities namely the Keiyo who occupy the southern and central parts and the Marakwet who occupy the Northern part (Gachati, 1992)

The two sub-counties namely Keiyo South and Keiyo North were created from the defunct Keiyo District. Former Keiyo District and Marakwet District form Elgeyo-Marakwet County as shown in figure 2.

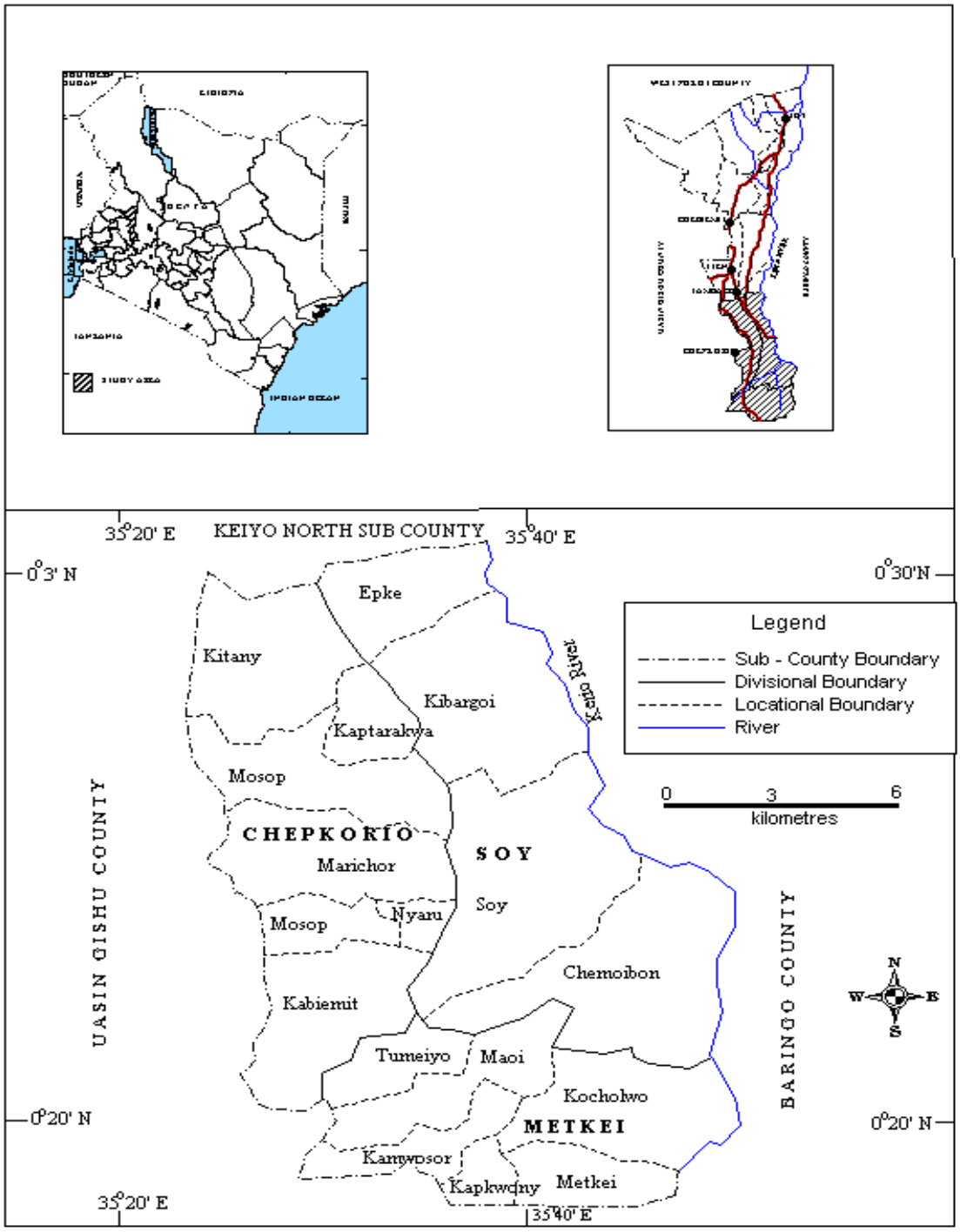

Figure 2: Map showing Kenya, Elgeyo-Marakwet County and Keiyo South Sub-County

Source; GIS Lab Moi University, 2015

Keiyo South Sub-County was Keiyo South constituency which is a parliamentary constituency divided into six County Assembly Wards namely Kaptarakwa, Chepkorio, Kabiemit, Metkei, Soy South and Soy North.

3.2.1 Location and size

Keiyo South Sub- County lies between latitude 0˚ 20”to 0˚ 30” North and 35˚ 20” and 35˚ 45” East. Figure 3 It borders Keiyo North Sub-County to the North, Baringo County to the east and south, and Uasin-Gishu County to the west. The Sub-County has a total area of 899.7sq.km, with a total population of 109,160 (GOK, 2012).

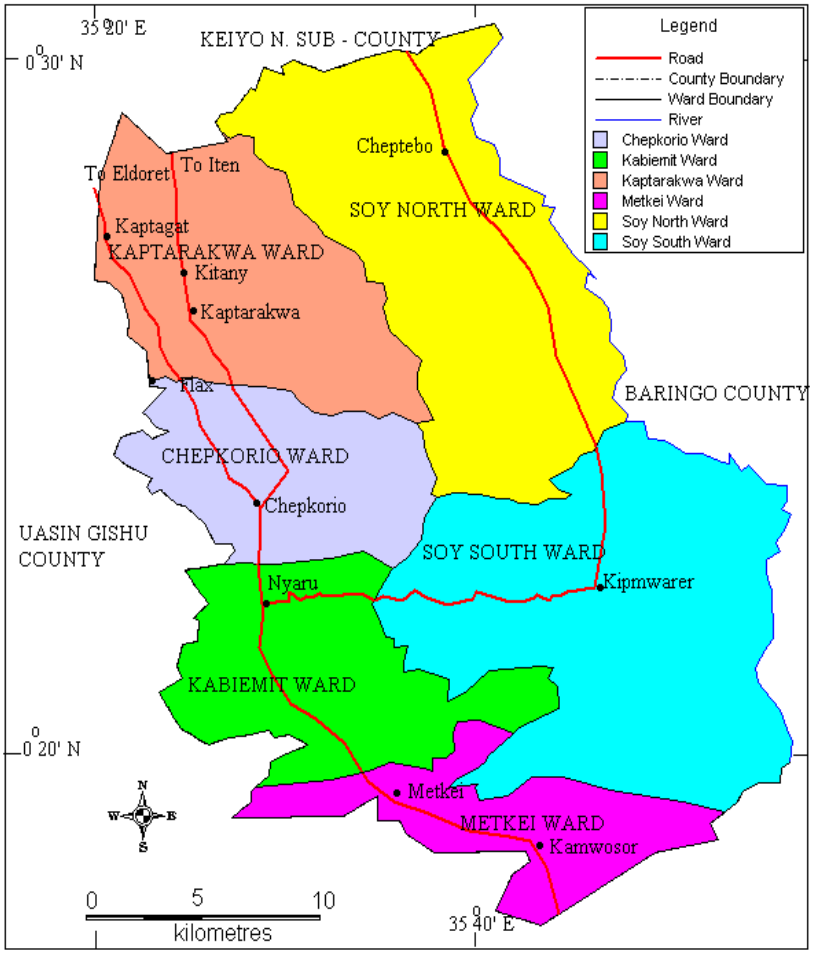

Figure 3: Map showing the Keiyo South Sub-County Wards

Source: GIS Lab Moi University, 2015

Four County Assembly Wards namely Kaptarakwa, Chepkorio, Kabiemit and Metkei are on the highlands and Soy South and Soy North which cover the valley and the escarpment.

3.2.2 Topographic features

Keiyo South Sub-County is bordered by the large scale farms of Uasin Gishu County on the west and Kerio River to the East. Like the rest of Elgeyo Marakwet County, the Sub-County has three main topographical zones which run parallel to each other in a north-south direction. These zones are the Kerio valley, the Elgeyo escarpment and the highland plateau (GOK, 2002, Chebet and Dietz, 2000). Kerio valley floor has an altitude ranging from 800m-1250m above sea level. The valley floor is relatively flat and lies at 1100m above sea level sloping up gradually westwards towards the escarpment at 1200m above sea level. It is bound by the Elgeyo escarpment to the west and Kerio River to the east (Chebet and Dietz, 2000) as shown on figure 4.

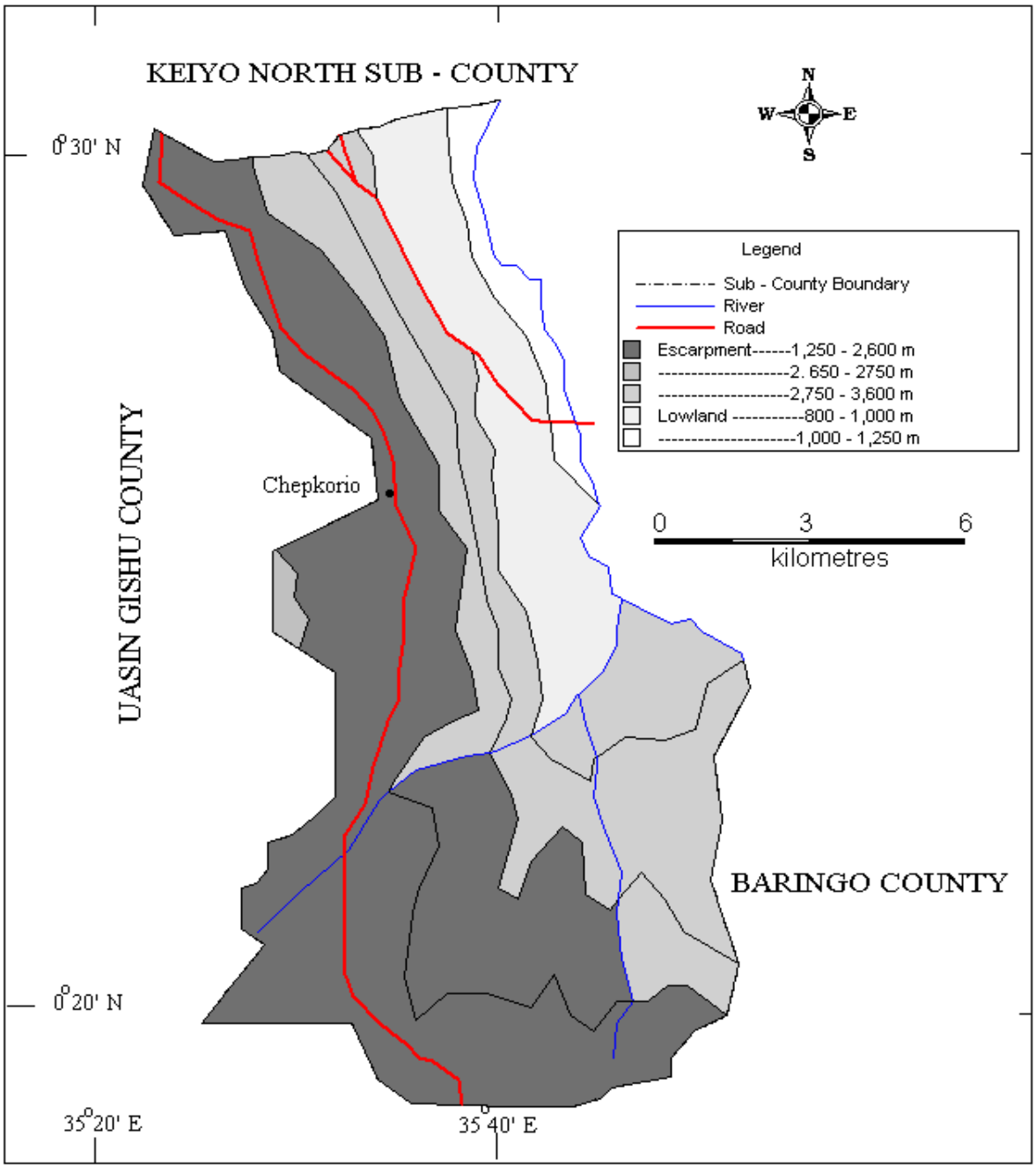

Figure 4: Map showing Relief of Keiyo South Sub-County

***Source: GIS Lab Moi University, 2015*.**

The escarpment's altitude ranges in from 1250m to 2600m above sea level and divides the sub county into two namely the lowlands and the highlands. It falls in a series of steep scarps and flat plateaus in a North-South direction. The thickly forested upper part of the

escarpment referred to as *Tumoo* is humid with cool temperature and the lower part are drier and warmer.

The highland plateau on top of the escarpment is locally referred to as *Tengunin or Wareng*. The humid highlands rise to 2700m above sea level on Metkei ridges in the South (Republic of Kenya, 2005). The topographical zones run parallel to each other in a North-south direction, which are the highlands, the Elgeyo escarpment and the Kerio valley (Chebet & Dietz, 2000).The three topographic regions occupied by the Keiyo community provide them with a variety food and medicine. The residents of one zone obtain some needs from other two zones.

3.2.5 Climatic conditions

The climate of the Sub County varies with altitude which ranges from 1000 meters above sea level at the valley, and 2700 meters at the top of the escarpment. The highlands have Sub-tropical climate with moderate temperature, low evaporation rates and high rainfall. The average rainfall during the wet season in the highlands is 1500 mm. The rainfall is bi-modal with long rains in March to June and the short rains from June to November. The highlands are cold with temperatures ranging from 14˚- 24˚Celsius and a mean of 19˚C (GOK, 2002). At the top of the escarpment the minimum temperatures are 6˚-8˚ Celsius with occasional frost conditions during the wet season (Chebet and Dietz, 2000).

Kerio valley receives low rainfall of which is unreliable and unevenly distributed. Occasionally droughts occur and rainfall is as low ranging between 250mm and 850mm. The evaporation rate is quite high in the dry season and low during the wet season. The temperatures in Kerio valley are high and make it unsuitable for agricultural production except under irrigation during the dry seasons (Chebet and Dietz, 2000).

Therefore, the vegetation in the highlands and upper escarpment generally grow faster due to the fertile soils and wet conditions. However the lower escarpment and the valley

grow slowly due to the semi arid conditions and unreliable rainfall. These conditions provide different indigenous plants used in the community for medicinal purposes (GOK, 2002).

Natural problems in the Sub-County include flooding of the lowlands during the rainy season and drought during the dry season leading to loss of vegetative cover and massive soil erosion. Gulley erosion on the alluvial soils in some parts of the valley causes washes away plants on its way including medicinal plants. Similarly severe droughts in the semi arid valley cause some plants to dry up reducing availability of the plants in the area. This is worsened by over-grazing and browsing by animals. This also affects the availability of medicinal plants.

Man induced problems include fires, loss of vegetation due to deforestation and poor conservation methods. This leads to loss of biodiversity, environmental degradation in form of soil erosion and poor farming methods along the escarpment (GOK, 2002). Occasional accidental fires during land preparation in the escarpment and honey gathering in the forests lead to extensive destruction of vegetation especially young plants in the areas affected. In addition, prolonged cultivation of food crops on the steep slopes has further promoted land degradation and a threat to medicinal plants in the area.

3.2.6 Vegetation

The vegetation cover in Keiyo varies a great deal due to the difference in altitude and varying climatic conditions. The vegetation along river Kerio is the riverine forest, the shrub woodland on the valley floor, woodland forest on the escarpment, the savanna woodland and the woodland forest in the highlands as shown in figure 5.

The highlands are wet with forest cover and ridges that serve as a water catchment area and water divide for rivers and streams that flow to the Kerio valley to the East and drains to Lake Turkana; and to the west is the Lake basin which drains to Lake Victoria. The highlands which lie between the escarpment to the east and Uasin-Gishu plateau on

the west was originally covered with green forests and meadows but are now interrupted with cultivated land. Some parts of the highlands and the escarpment have indigenous forest and trees such as bamboo and cedar (Chebet and Dietz 2000; GOK, 2008)

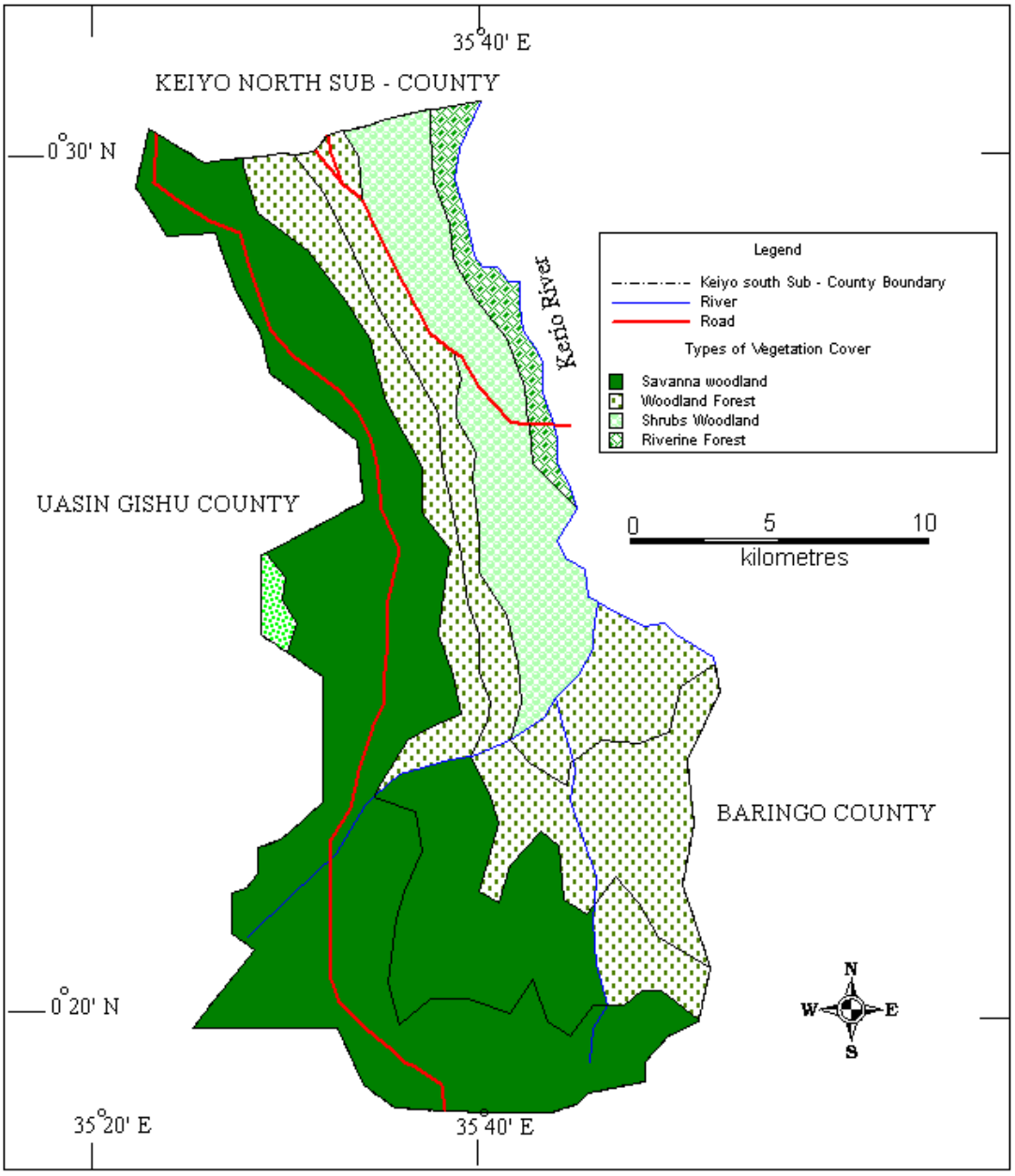

Figure 5: Map showing the vegetation zones in Keiyo South Sub-County

Source: GIS Lab Moi University, 2015.

The upper ridges of the escarpment are covered with forests mainly indigenous trees on top of Metkei forest known as Ti'ngwo. The trees are mainly bamboo, cedar and climbers like *Periploca linearifolia* and other flora as the ecosystem is fairly intact. The middle zone that lies between the highlands and the valley is a transition zone between the low valley and the cool highlands and has a variety of plants due to its warm and wet conditions. The cooler part of this zone has some indigenous plants found in the highlands and the warmer parts have some plants also found in the lowlands. The lower part of the escarpment is sparsely covered with scattered trees, shrubs and bushes as vegetation is generally low and some parts are badly eroded and gapping gullies are common. Some of the trees and shrubs found on the lower escarpment area Acacia hockii (white thorn acacia), *Flacourtia indica, Dodonea viscosa (*hopbush*)and Erythrina abyssnica, and Euphorbia candelabrum (Candelabra tree)* (Kiplagat, 1998; Chebet and Diet, 2000).

The Kerio valley floor is covered with acacia species, shrubs, herbs and forbs. Some of the trees and shrub species include *Terminalia brownii, balanites eagyptiaca, Euphorbia candelabrum (*Candelabra tree*), Teclea nobilis* (Small fruited teclea) *and Ximenia americana (*tallow wood*)* (ibid). The semi-arid land is covered with sparse acacia and indigenous trees, shrubs and bushes which provide the residents of the valley with wood for fuel, fencing and building, fodder, medicine, working tools and items of culture and entertainment. The main tree species are A*cacia tortilis and Balanites aegyptiaca (*desert date*)* together with deciduous shrubs such as C*roton dichogamus* and Acacia mellifera (black thorn) among others. They provide shade and act as windbreaks which help prevent soil erosion on the alluvial soil that is easily eroded. The animals found in this area include elephants, antelopes and various reptiles. The wild animals such as the elephants have been restricted to Rimoi game reserve (Gachati, 1992).

Traditionally the vegetation in each zone was used for specified purpose such as the valley for grazing, escarpment mainly for settlement and well regulated subsistence farming. The farming was mainly shifting cultivation which allowed regeneration of plants. At present there is increased cultivation and livestock keeping leading clearing of

indigenous vegetation and introduction of exotic trees and cash crops especially in the highlands. The local community however still obtains the medicinal plants parts from all the zones as the need arises.

3.3.4 Economic activities

The economic activities in the area are greatly influenced by the topography and the climate. The highland is of high potential and is the best land for agriculture and livestock production in the Sub-County (Republic of Kenya, 2002). The Keiyo people who reside in the highlands practice mixed farming by growing crops such as maize, beans, potatoes, vegetables, tea and pyrethrum and keep dairy cattle (Chebet and Dietz, 2000). The increased farming of food crops and livestock keeping has greatly reduced indigenous vegetation cover in the highlands.

The Kerio valley is suitable for livestock farming. The main occupation of the residents is keeping of goats, sheep and zebu cattle as well as subsistence farming. Drought resistant crops such as finger millet, sorghum, groundnuts, cow peas and cassava are grown (Gachati, 1992). The traditional subsistence farming protected medicinal plants in the cultivated areas. Honey is used as food, drink and for medicinal purposes (Chebet and Dietz 2000). At present fruits such as mangoes and water melons are grown under irrigation near Kerio River.

Land in Kerio valley was traditionally used for grazing livestock and subsistence farming. At present some parts are used for growing cash crops, settlement and grazing animals. This has put pressure on the semi arid land leading to overgrazing and increased farming for a prolonged period. Larger farms are cleared and cultivated, removing indigenous plants in the farms to increase production and pasture for the animals.

3.3.5 Culture and land use patterns

The Keiyo people are a sub-tribe of the Kalenjin who remained behind in the Kerio valley when the other Kalenjin groups moved to their current settlement areas. Literature refers to the Keiyo as a group of people who occupy the land from Kerio valley up to the highlands. They border the Marakwet to the north, Tugen to the East and Nandi to the West.

Historically the Keiyo have had interest in all the three zones: Kerio Valley (*Soin*), the Keiyo escarpment (*korgeet*) and the upper highlands (*Tengunin*). Each clan had a strip running from the Kerio River (*Endo*) on the valley floor up to the highlands. In the past they settled on the warm lower escarpment (*Korgeet*) that was free from tsetse flies and mosquitoes and more secure from neighbouring communities. The valley floor was considered unfavourable for settlements due to harsh climatic conditions and attacks from the Tugen community. In addition the highlands were considered too cold and unsuitable for their habitation and fear of attacks from the Maasai and the Nandi in the highlands (Ng'ang'a, 2006).

Traditionally the nucleus of the Keiyo people was the household, headed by the man with a wife and children. Then there were the extended family (*oret*) with a common ancestry and the clan which comprised of several sub-clans of related families. The community traditionally secured land for communal grazing and cultivation. They settled in villages which were considered secure and accessible to resources such as water. Land, water and forests resources were communally owned and hence administered by elders on behalf of the clan for the good of everyone. The community members followed rules of custom, morals and law to satisfy the needs of all their members (Chebet and Dietz, 2000). This ensured that the natural resource in the community were used and protected in the community.

Land was communally owned by the male members of the family in the clan. Land in the escarpment (*Mosop* and *Korgeet)* was inhabited and was demarcated by elders using stones that acted as beacons. The lower part of the valley was used for grazing animals,

hunting and gathering because it was infested with mosquitoes and tsetse flies and not suitable for human settlement (Chebet and Dietz 2000; Ng'ang'a, 2006). The elders also had important judicial and reconciliatory functions guided by unwritten rules and regulations that were observed by all people. Any breach of these rules was punished appropriately by the elders.

Traditionally, the Keiyo community relied on herbs for treatment of natural diseases. The natural diseases which were perceived to be caused by natural factors were treated using herbs provided by the family or by traditional herbalist/ healer (medicine-man or woman) known as *chepkerichot*. Those which were perceived to be caused by unnatural factors or human behaviours were referred to specialists such as priests known as *Tisiik* and/or spiritual healers called *Chepsogeiyot.* The family provided herbal medicine for its members for general ailments and only consulted a specialist when the need arose. Literature indicates that the Keiyo had a rudimentary knowledge of surgery and other specialized forms of treatment (Chebet and Dietz, 2000). Due to the wide variety of plants in the region, the locals obtained their medicinal herbs from their territory.

Traditionally the patients or the relatives paid a token in kind to the specialist and that was viewed as an initial gift (*Cheprewo*) and in some cases treatment was given for free. When the patient was healed then the main gift would be given to the specialist. Traditional herbalists gathered herbs for dispensing to a patient, but they also had a basket of herbs stored in the home that were used regularly or what was gathered from other zones. At present traditional medicinal plants have been commercialized and are sold to generate income without traditional guidelines.

During and after colonization the government administration reduced the authority of the elders in the community. The introduction of private land ownership and a cash economy promoted individualistic approach to economic development. This has led to decline of indigenous vegetation in the areas with high agricultural potential. At present the demand for land is increasing and the people now seek the clan lands for settlement and farming.

3.3.6 Population of Keiyo South Sub-County

The population of Keiyo South is greatly influenced by the climatic conditions and productivity of the land. The Sub-County has a population growth rate of 2.8 percent and the population of the community varies according to the topography. The highlands are densely populated and settlements at the Kerio Valley floor are concentrated near the road and the gentle areas on the escarpment. The total population of the sub county was 109, 160 (GOK, 2005, GOK, 2012). The population according to IEBC records is as shown in table 5.

Table 5: Population of Keiyo South Sub-County per Ward

	County Assembly Ward	**Population(2009 national census)**
1	Kaptarakwa	19,069
2	Chepkorio	23,349
3	Soy south	20,370
4	Soy north	14,457
5	Kabiemit	18,970
6	Metkei	12,945

Source: Independent Electoral and Boundaries Commission (IEBC), 2012

Due to rapid population growth there is increased unemployment and high demand for agricultural land and high poverty level. The poor in the Sub-County, who live in absolute poverty, include squatters, the aged, orphaned, handicapped, female household heads, small holder agricultural and livestock farmers. The available modern health facilities are spread and are inaccessible to many local residents. As a result of rapid population growth in the Sub-County, there is encroachment into forest land, over-utilization of forest products, which has led to ecological imbalances. However, those who live in the highlands and the escarpment generally have higher incomes than those in the valley because of higher agricultural productivity in the region (GOK, 2005). The population of Keiyo South is steadily increasing and hence increasing land use in the region. Land that was not cultivated in the past is now being cultivated for food crops as we as cash crops to meet the increasing demand for food and cash to meet other needs.

3.3 Research design

The study was designed as a survey research. Mugenda and Mugenda (2003) defined it as "a survey is an attempt to collect data from members of the population in order to determine the current status of that population with respect to one or more variables" .Survey research could be descriptive, exploratory or involving advanced statistical analysis. In survey research scientists usually ask a random sample of individuals to respond to a set of questions about their backgrounds, past experiences and attitudes (Frankfort-Nachmias and Nachmias, 1996). Therefore the Survey research was appropriate for this study since it enabled the researcher to obtain information from the respondents in the field. Therefore a survey of household heads, traditional herbalists and herb vendors was carried out in the study area to establish the traditional utilization of medicinal plants.

3.4. Target population and sample description

The target population for the study comprised of 22,400 household heads, and an estimate of 110 herbalists and herb vendors in Keiyo South Sub-County. Household heads were the target population for this study because traditionally, in the Keiyo community, when a member of the family was sick one was first treated within the family. If the treatment provided was not effective the person was taken to a traditional herbalist (medicine man/woman) in the village recommended by the household head.

At present there is a new group of herb providers who sell medicinal plant parts in urban centers. This is a new phenomenon where some herbalists have adjusted to the increasing demand for herbal medicine by their clients for use by availing them in their stalls and specific sites during market days. The herb vendors' stock large quantities of medicinal plant parts obtained from different zones of the sub-county for treating their patients and selling to individual buyers for use in other areas.

Therefore, household heads, traditional herbalists and the herb vendors in Keiyo South Sub-county were sampled for interview on traditional utilization and conservation of medicinal plants. In addition Kenya Forest Service staff in the Sub-County were targeted as key informants as government representatives in forest conservation.

3.5 Sampling Procedures and Sample Size

The researcher first selected the study area and then sampled the respondents to be interviewed as discussed in the subsequent sections.

3.5.1 Sampling of the study area

The two Sub-Counties occupied by the Keiyo are Keiyo North and Keiyo South in the former Keiyo District. Keiyo South Sub-County was purposively selected for this study because it covers the high altitude highlands of Metkei (2700m ASL), the steep escarpment and gentle plateaus on the escarpment and the semi-arid valley all occupied by the Keiyo people. This enabled the researcher to obtain data from residents in each topographical zone occupied by the Keiyo who utilize traditional medicinal plants obtained from Kerio valley, the escarpment and the high altitude highlands. Therefore Keiyo South was selected because of the indigenous Keiyo inhabitants of the area unlike Keiyo North which has a more cosmopolitan population due to the presence of large urban centres, inhabited by both the Keiyo and migrant communities.

In addition, Keiyo South was selected because it has not had a long period of western influence compared to Keiyo North which had the colonial administrative offices in Tambach as well as the only modern hospital. It was not until independence that health centres and dispensaries were built in other parts of Keiyo (Chebet and Dietz 2000). Therefore, Keiyo South was purposely selected as it provided rich information on Keiyo traditional utilization of medicinal plants for human health care from all the zones. Hence, the residents occupying the three zones of Keiyo South provided an ideal target population for the study.

3.5.2 Sampling of Household heads

The sampling unit of the study was the household head. The household heads were sampled because in a traditional Keiyo family the household head played an important role in the initial treatment of a sick member of the family. If the treatment provided by

the family was not effective, then the household head decided on the village herbalist (*Chepkerichot)* to be consulted (Chebet and Dietz 2000).

The sample size

According to Frankfort-Nachmias (1996), the fundamental requirement of any sample is that it should be as representative as possible to the population from which it is drawn. Mugenda and Mugenda (2003) indicate that in determining the sample size the rule of the thumb should be to obtain as big a sample as possible. To obtain the sample size, *n* the sample size calculator by Creative Research Systems (2012) was used to calculate the sample size for interview using the formula;

$$ss = \frac{Z^2 * (p) * (1-p)}{c^2}$$

Where:

Z = Z value (e.g. 1.96 for 95% confidence level)

p = percentage picking a choice, expressed as decimal

c = confidence interval, expressed as decimal

The sample size calculator calculates the number of sampling units needed for a measurement based on the requirements as follows:

Calculating sample size using a sample size calculator

Confidence level	95%
Confidence interval	9
Population	22,400
Sample size	118

According to the 2009 population census statistics, Keiyo South had a total population of 109, 160 and 22,400 households (GOK, 2012). The confidence level used was 95%, and a confidence interval of 9. These were used to calculate a sample size of 118

respondents. Therefore the researcher then added two and hence used a sample size of one hundred and twenty (120) household heads and interviewed for the study. For more in depth data on the study, traditional herbalists and herb vendors were purposely selected from the study area.

In order to obtain a random sample of 120 household heads systematic random sampling was used to select the household heads interviewed. Systematic random sampling involves selecting every K^{th} sampling unit of the population after the first sampling unit is randomly selected from the total sampling units (Mugenda and Mugenda, 2003).

The researcher then sampled one hundred and twenty (120) household heads out of twenty two thousand four hundred (22,400) household heads in the study area, by taking every 187^{th} household head, calculated as follows; K=N/n = 22400/120=186.6667. In this study the researcher used a list of ten household heads clusters from the Chief's office in every Ward. The first cluster of ten was used to randomly pick the initial household number eighth (8^{th}) then the next household was $195^{th.}$ The researcher then proceeded to select every 187^{th} household in each Ward until the required number was obtained. Systematic random sampling method was convenient to the researcher but the greatest challenge was the houses were not arranged in a specific order. To overcome the challenge the researcher used a list of households available in the chief's office and research assistants were able to identify households that the household head would be interviewed. Where the male household head (father/husband) was absent the female (mother/wife) was interviewed.

In addition, traditional herbalists in the Sub-County play a key role on matters of utilization and conservation of medicinal plants. The traditional herbalists are recognized in the community as specialist healers who treat sick people using medicinal plants.

3.5.3 Traditional herbalists

According to the *Final Draft* National policy on Traditional medicine (2005) of Kenya, the ratio of Traditional Medical Practitioners to the patient was 1: 987. According to the 2009 National census, the population of Keiyo South Sub-County was 109,160. Based on the national ratio of traditional medical practitioners to patient, the number of traditional medical practitioners in the Sub County was calculated as follows 109,160/987 = 110. From this figure, it was inferred that the traditional medical practitioners based on the national ratio is one hundred and ten (110) in the study area. Thus purposive and snowball sampling techniques was used to select traditional herbalists who provided key information on the objectives of the study. According to Mugenda and Mugenda (2003) purposive sampling allows the researcher to use cases that have the required information for the study.

According to Bailey (2007) when selecting individuals to be interviewed a good starting point is 20, then continue to interview till five new cases do not add any new information to the study. In this study, thirty three (33) out of one hundred and ten (110) traditional herbalists interviewed in this study met this requirement as the responses to the interview schedule questions became similar as the point data saturation was reached.

Therefore the first traditional herbalist was identified through purposive sampling technique, and then snowballing was used to identify others to be interviewed in the study area. Mugenda and Mugenda (2003) noted that in snowball sampling the initial subjects are identified using purposive sampling technique. Then the identified subjects name others that they know have the same characteristics until the researcher gets the required number. The traditional herbalists identified were interviewed. In order to obtain information across the study area, each Sub-County ward was allocated a number of herbalists as per the population of the Ward as follows; Kaptarakwa, five (5), Chepkorio, four (4), Kabiemit, four (4), Metkei, four (4), Soy South, eight (8) and Soy North, eight (8); a total of thirty three herbalist were interviewed.

3.5.4 Sampling of herb vendors

The practice of selling herbs in the Keiyo community is a new phenomenon. The herb vendors based in local markets were sampled for interview as they provided unique information regarding the use of medicinal plant parts they sold in trading centres. The herb vendors based in local market centers were selected for interview through snowballing. The herb vendors were easily identified at their stalls and specific sites in the centre/markets. The researcher randomly approached a vendor at the work point and requested for time with them to be interviewed on traditional utilization of medicinal plants for human health. After the interview the vendor was requested to recommend another herb vendor to be interviewed on the topic.

The researcher then interviewed one or two vendors per centre on a market day. A total of fifteen vendors were interviewed at various centres such as Kitany and Kaptarakwa, Flax and Chepkorio, and Kamwosor in the highlands; then Kimwarer and Muskut centres, Chekobei/Cheptebo centres in Kerio valley. A data saturation point was reached after the fifteen vendors were interviewed. In addition, three (3) Kenya Forest Service Staff purposely sampled for interview on conservation of medicinal plants in the Sub-County. They were interviewed at their work station at Kaptagat and Kipkwen Kenya Forest Offices.

Therefore, systematic random sampling was used to sample the household heads and purposive sampling and snowballing was used to select herbalists and herb vendors for an in depth interview on the study. A total number of 171 respondents who were interviewed were distributed as follows; 120 household heads, 33 traditional herbalists, 15 herb vendors and three KWS staff.

3.6 Data collection

In order to carry out the study in Keiyo South Sub-County of Elgeyo-Marakwet County, the researcher applied for a research permit from the National Council for research through the School of Environmental Studies to grant the researcher permission to carry

out the study. This was obtained and was used in the field as it provided an introduction of the researcher to the County Commissioner and other government officials on the intended study in the area (Appendix 2).

In order to reach the traditional herbalist and household heads to be interviewed, the researcher sought the assistance of the chief/ assistant chief or village elders to access the homes. However, this was not possible as it entailed a long process hence the researcher revised to use relatives, friends and colleagues and research assistance from every locality. The researcher discussed with each research assistant the details of the interview schedule and the objectives of the study before proceeding to the various areas.

Mugenda and Mugenda, (2003) noted that there are three methods usually used to collect qualitative data, namely direct observation, participant observation and the interview method. Personal Interviews were used in this study as they allowed a face to face interaction between the researcher and the respondents. In addition observations were made in the homes and stalls of herb vendors, and photographs taken to enrich the data with the consent and guidance of the respondents.

The researcher used a semi structured interview schedule for oral interview with respondents. The interviews were done in the local Keiyo language and responses written in English, and names of plants in the local language. The botanical names of the plants were later obtained from secondary sources. The data obtained was recorded during the interviews on the spaces provided in the interview schedule. The researcher made observations and took photographs of the stall/tables of herb vendors. In addition, photographs of medicinal plants in the forest/bushes and around the homes of the respondents were taken.

Household heads and the traditional herbalists were interviewed at their homes while herb vendors were interviewed at their stalls and specific sites during market days. One of the Kenya Forest Service Staff was interviewed in the office after booking an appointment. While the other two were interviewed at their work station at Kipkwen tree

nursery as the forester was away on official duty. Using these methods the researcher gathered the primary data on utilization, threats and measures to conserve traditional medicinal plants in Keiyo South Sub-County.

In addition, secondary data was obtained from books, journals and unpublished theses. Literature on past related studies was widely referred to in this study. The botanical names of medicinal plants given in the local language in the field were obtained from books and studies on trees, shrubs and lianas in Kenya, journals and unpublished theses such as Bentje (1994). Kigen et al (2014) Cheruiyot (2012) and Kiplagat (1989) among others.

3.7 Delimitations and challenges encountered

In order to gain entry into the community the researcher had to first identify a member of the community to assist in the field study by through friends, colleagues and relatives from each locality. The researcher introduced herself to respondents interviewed using her maiden name, family names, clan and home village which was well identified in at least four County Assembly Wards. Access to the other two Wards was mainly based on the trust of the people introducing the researcher and research assistants. The use of the local language by the researcher was an added advantage as the respondents did not strain in sharing their knowledge. The escorts were mainly colleagues from Moi University who assured them that the research was basically for academic purpose.

The research assistants escorted the researcher to various areas in each Ward. Since the research assistants were from the locality they were able to introduce the researcher to the interviewees and explained the objective of the study. This approach was consistent to what Bailey (2007) recommended that *"to facilitate gaining entrée explain who you are, and why you are conducting research".*

All interviews done by the researcher required a detailed introduction of the researcher and purpose of the study by a colleague or relative or research assistant from the local area to the herbalists and household heads. In some cases herbalists requested for

contacts of relatives of the researcher known to them to confirm the identity of the researcher. This took time because the local culture expects visitors to stay overnight in their homes so as to be accepted and be given important information in an interview. The researcher followed this procedure. However, respondents who were called on phone prior to the visit were quite cooperative and ready for the interview.

Some herbalists and vendors who were very secretive only accepted to be interviewed on condition that the medicinal plants used and their uses were not revealed. They claimed the knowledge they held about them was a preserve of the family. The herbalists only revealed the medicinal plant names but not the combinations used to treat specific ailments. Most herbalists also did not accept to take the researcher to the field for plant identification. In fact, one vendor asked the researcher whether Keiyo initiation ceremonies were revealed locally stated "*kigas kemwoitoi tumdap Keiyo?*" This was a clear message that she would not reveal her knowledge on traditional medicinal plants used to treat chronic ailments but could be interviewed on other issues. After a brief discussion and gaining her confidence the researcher asked her if she could name some of the medicinal plants that most people knew and use. This made her relax and name some traditional medicinal plants used by the community. Other herbalists who were enlightened and related to the researcher accepted to take the researcher to the field and identify the medicinal plants used to treat ailments among the Keiyo people.

3.8 Data processing, analysis and presentation

Data collected was summarized to show the demographic and social characteristics of the respondents, medicinal plants used, ailments treated and traditional harvesting practices employed. In addition, the threats and conservation measures recorded using the interview schedule were summarized. Quantitative data was first coded and entered into a computer using SPSS 16 and analyzed using descriptive statistics. Results are presented using tables. Quantitative data analyzed organized the descriptions into various categories and qualitative data was discussed in detail according to the information obtained from the respondents. Results are presented as shown in table 6.

Table 6: Matrix of the study questions, data collected and analysis techniques

Questions	**Data required / collected**	**Data collection methods**	**Data analysis**	**Expected results**
Demographic and socio-economic data	Gender, age, livelihood, ward, income, source of treatment	Interview and observation	Descriptive frequencies and percentages	Number of males and females occupation, Ward, income from herbal medicine
What are the traditional medicinal plants, parts used, ailments and zone where gathered in Keiyo? -value of traditional medicinal plants in community?	Names of the plants, zones plant part used ailment(disease) treated Importance of medicinal plants	Interviews observation discussions, oral history and photography	Plants and parts used, zone and ailment Treatment prevention of ailments	local names of Plants, parts used e.g. roots Diseases treated like colds, reproductive ailments and malaria among others
What are the traditional conservation measures used to conserve medicinal plants	Measures used to protect and conserve medicinal plants	Interview method and oral history Observation photography	-Descriptive traditional methods -Discourse analysis	Taboos and social restrictions
What are the threats to medicinal plants in Keiyo?	Human/ natural activities that degrade plants and their habitat	Observations interviews and photography	Descriptions of specified threats	Loss of habitats to farming, overharvesting and destructive unsustainable methods of harvesting

Source: Author, 2015

Table 6: Matrix of the study questions, data collected and analysis techniques (Continued)

What are the Environmental effects /consequences of medicinal plant utilization?	Evidence of damage of to vegetation cover or loss of medicinal plants	Observation method interview and photography	Descriptive of observed effects	drying debarked trees, several cuts on stem of plants, - scarcity of plants
What measures are employed to conserve medicinal plant?	modern methods of sustainable use and Conservation	Interview method Key informant observation	Descriptive modern methods	protected areas in the forests and home gardens

Source: Author, 2015

Qualitative data was summarized and presented under various themes like ailments treated, healthcare providers and social controls on harvesting medicinal plants. Findings on medicinal plants found in each zone were listed and presented in tables indicating the local, English and botanical name, part used and the ailment it treats or prevents. The traditional social controls on gathering and conservation were recorded and the content obtained was summarized under social controls and taboos.

A list of threats provided in the interview schedule guided respondents on what was viewed as the biggest to the least threat. Results were analyzed and the findings presented in tables in form of frequencies and percentages. In addition, the effects of utilization on medicinal plants were noted and the measures adopted to conserve them were identified and recorded. Results and the discussion are presented in detail in the next chapter.

CHAPTER FOUR
RESULTS AND INTERPRETATION

4.1 Introduction

This chapter focuses on the findings of the study guided by the objectives. The chapter starts with socio-demographic details of the respondents interviewed which include: age, gender and their residence (administrative Ward) in the study area. In addition, the socio-economic activities of the respondents and the role of herbal medicine in respondents' livelihoods are discussed. The chapter also discusses the utilization of traditional medicine, terms of treating common ailments, source medicinal plants used and their value, traditional conservation measures; threats to traditional medicinal plants and measures taken currently to conserve medicinal plants and recommendations made for wise use and conservation.

4.2 Socio-Demographic and Socio-Economic characteristics of the respondents

Data on respondents' age, administrative ward they reside in, occupation and the income earned from herbal medicine was obtained using interviews, discussions and observations.

4.2.1 Gender of Respondents

The respondents' gender was noted on the interview schedule for every respondent. The data recorded and analyzed is shown on table 7

Table 7: Gender of Respondents

Gender	Frequency	Percentage
Male	79	46.2
Female	92	53.8
Total	**171**	**100.0**

Source: Author, 2015

Table 7 indicates that the number of respondents interviewed were 171, out of which 79 were males, while 92 were female. The males interviewed represented 46.2 percent while the female were 53.8 percent. These included the household heads, herbalists, herb vendors and a forester. The results depict the important role played by the women in providing herbal medicine. This finding agrees with that of Kipkorir and Welbourn (1973) and Kipkorir and Ssennyonga (1984), who noted that among the Marakwet, most of the herbalists are women.

4.2.2 Age of Respondents

The respondents were also asked to give their estimate age or the actual for those who were young and able to specify. This was then recorded and analyzed as shown on the table 8

Table 8: Age of respondents

Age range	Frequency	Percentage
below 35	15	8.8
36-55	60	35.1
56-75	86	50.3
75 and above	10	5.8
Total	**171**	**100.0**

Source: Author, 2015

The respondents were asked to give their age and since most respondents did not give the actual age, the age range was used and tabulated as shown on table 8. The respondents aged below 35 years were 8.8 percent and those aged between 36-55 years were 35.1 percent comprised mainly of household heads, while those aged bracket of 56-75 years 50.3 percent were the practicing herbalists' and vendors. Those who were above 75 years were 10 (5.8 percent) and constituted mainly the elderly household heads knowledgeable in medicinal plants and herbalists based in their homes. From the age categorization it was clear that majority of the herbalists were elderly people within the age of 56-75years.

This is consistent with literature which indicates that old men and women practiced herbal medicine and passed the skill to their first born or favorite children (Kokwaro, 1993).

4.2.3 Residence of Respondents

Respondents interviewed resided in various Wards as shown in table 9

Table 9: Residential Ward of respondents

Ward	Frequency	Percentage
Metkei	24	14.0
Kabiemit	23	13.5
Chepkorio	28	16.4
Kaptarakwa	33	19.3
Soy South	31	18.1
Soy North	32	18.7
Total	**171**	**100.0**

Source: Author, 2015

Results showed the residence of respondents in each of the six wards was as follows: Metkei were 24(14%), Kabiemit were 23(17.5%), Chepkorio were 28(16.4%), Kaptarakwa were 33(19.3%), Soy South were 31(18.1%) and Soy North were 32(18.7%). From these results it can be inferred that the respondents were proportionally distributed across the six Wards.

The identified respondents from each administrative ward who were willing to be interviewed were interviewed. Though some were hesitant initially, eventually they accepted. It was in the administrative wards where the researcher and research assistant was well identified through referral and acquaintances that the respondents accepted to give the information during the interview.

The herbalist and vendors who were the most secretive accepted to be interviewed on condition that the medicinal plants and their uses were not revealed as the knowledge was a preserves of the family alone.

4.2.3: Source of Livelihood of Respondents

The livelihood activities in which respondents are engaged in are shown in table 10.

Table 10: Respondents occupation and livelihood activities

Source of livelihood/ occupation	Frequency	Percentage
Household head (farmers, employed)	120	70.2
Traditional herbalist	33	19.3
Herb vendor	15	8.8
KFS Staff	3	1.3
Total	171	100.0

Source: Author, 2015

Respondents interviewed identified the following activities as their livelihood activities; peasant farming including herding (animals) and mixed farming (70.2%) and traditional herbalists (19.3%). Household heads interviewed showed a general knowledge of use of medicinal plants in the community. The herbalists and the vendors were however more professional and earned livelihood from practicing traditional medicine.

Household heads and herbalists were interviewed in their homes while vendors were interviewed at trading centers during market days such as at Kitany on a Tuesday, Kaptarakwa on a Wednesday, Flax on Thursday, Chepkorio on Monday and Kamwosor on Thursday. Other centres visited Chekobei/Cheptebo, Muskut and Kimwarer in Kerio valley.

4.2.4: Income Earned By Respondents from Herbal Medicine

Results on income received by respondents from herbal medicine are tabulated in table 11.

Table 11: Income from medicinal plants

Percentage Income from Herbal Medicine	Frequency	Percentage
0-25%	102	59.6
26-50%	37	21.6
51-75%	15	8.8
76-95%	15	8.8
over 96%	2	1.2
Total	**171**	**100.0**

Source: Author, 2015

From the results 102 respondents (59.6 percent) indicated that they earned less than 25 percent from herbal medicine. The household heads reported that they did not receive direct cash from providing herbs, but rather saved by not spending money to seek treatment in a modern health facility or to pay a herbalist. In their view although the income was not direct the savings made by using medicinal plants/ herbs to treat cough, colds and mild complaints which would have cost them money if they sought treatment in modern health facilities was good enough. The herbalists in the rural areas also reported that most people in the neighborhood were relatives and neighbours and payment was not immediate. They only gave small tokens whenever they had, and could eventually give a goat or sheep in payment for treatment and the care provided to them. Therefore more than 50 percent of the respondents did not depend on the provision of herbal medicine as a source of livelihood but to help treat the sick in the community.

Similarly, 21.6 percent of the respondents interviewed indicated that they earned between 26-50 percent from herbal medicine. These were mostly herbalists based in their homes whose income from herbal medicine varied widely, based on the number and economic ability of the clients. This also varied widely due to accessibility of the herbalist residing in the rural areas. Those in inaccessible areas earned less than 25 percent while well-

known herbalists who live in accessible areas near roads earned between 51-75 percent of their income from providing herbal medicine. These herbalists could be identified in every location for specific ailments like cancer, reproductive health problems and chronic ailments which modern medicine did not cure completely.

Respondents who earned between 51 and 75 percent of their income from the practice of herbal medicine were 8.8 percent. Another 8.8 percent earned over 75 percent of their income from herbal medicine. These were popular herb vendors and a few herbalists in rural areas. Some herb vendors have dedicated their time to treating people in market centres and selling herbs. Some of them treat and sell herbs in far places such as Uasin Gishu and Trans Nzoia Counties, while some received and treated clients/patients from other communities in their homes from distant locations and Counties like Nairobi and Nyanza.

Some herb vendors dispensed herbal medicine moving from one market centre to another. For instance one male vendor has a stall in Chepkorio and Flax centres in Keiyo South Sub-County; and in Kipkorkot and Marura centres in Uasin Gishu County. He advertised that he treats typhoid, cancer and reproductive health problems among others, and works from a stall daily in different stations from Monday to Friday. In addition the herbalist treats clients from his home in Chepkorio every Saturday. He reported that he treats patients who seek him for treatment and administers herbs that cause vomiting (emetic) and those which provoke diarrhea (purgative) to patients. In an effort to complete the interview with him, the researcher made three trips; one to Flax and twice to Kipkorkot / Islamic centre because the interviews were frequently paused for him to attend to many clients. The clients were many that he did not have adequate time for the interviews. The researcher therefore interviewed him briefly on the three occasions.

During the interview he mentioned that the fee for children was on an average Ksh. 50 to Ksh100 and that for adults was between Ksh.100 and Ksh200 per pre-packed herbs. The cost varied with the kind of ailment one had and was varied by adding two to three plant

parts from those displayed on the stall. The popular vendors were on full time duty as they moved from one market centre to another daily from Monday to Friday.

The vendors in the highlands indicated that they relied on herbs gathered from Kerio valley. They involved some people in the lowlands mainly relatives and those available to gather specific plant parts and send to them in the highlands. The herbs were packed in 50 kg bags and transported to the highlands using regular public transport vehicles from Kimwarer- Nyaru- Chepkorio or Kimwarer- Nyaru- Kamwosor markets. In some cases some of the gatherers simply walked up the escarpment to deliver the herbs to their regular buyers as they carried out their private activities in the market.

At Kaptarakwa centre a herb vendor who lives in the gentle plateaus on the escarpment, reported that he personally gathers his herbs. The vendor informed the researcher that he also buys some herbs from people who live in Kerio valley. In addition he coordinates with a female herbalists based in the highlands. He indicated that their herbal medicine is a combination from the highlands, lowlands and the escarpment, as need arises. From the foregoing the researcher found that herbalists have connections in all parts of the Sub-County and beyond. The herbs stocked were gathered from all zones of the Sub-County. Some herb vendors also stock several bags of herbs and alleged that some gatherers do not gather them as per the traditional controls and guidelines on gathering.

Fee payment

Traditionally treatment within the family was free. However, for treatment outside the family, one was required to give a token of appreciation for treatment such in the form of millet, or gourd of milk. This has in the recent past been translated into money which gradually progressed from Kshs 20, to Kshs 50, in the rural setting. As one household head remarked, "*when you go to a herbalists, you do not go empty handed*". According to most respondents this is presented as a sign of appreciation for the medicine provided. However, if a patient does not have anything to offer, he/she is not denied the treatment and medicine in the rural areas because it is expected that they will take a token of appreciation during subsequent visits.

In most cases, long term care and treatment of children or expectant mothers is normally on mutual understanding. It was reported that a well-known mature female herbalist who was knowledgeable in mother and baby care was approached clinical services and treatment to the expectant mother and after sometime a visit is made to her home with a gift.

Traditionally, local brew was made for the herbalist to enjoy with is/her friends but at present meals are prepared and gifts given. This is viewed as a period of bonding with the rest of the family and a long term relationship is established. The sampled herbalists confirmed that at present, they refer some cases to hospital for further management. Herbalists in Kerio Valley also noted that in some cases, staff in dispensaries sometimes advice some patients to see them, especially for babies who need herbalists' general care.

Most herbalists sampled acknowledged that they give herbal medicine, bless it and God heals the patient. Whenever a herbalist gives medicine he/ she spits on it as a sign of blessing. For someone new to the community this may be taken negatively, but for a local person this is an assurance that the herbalist has blessed the medicine to treat their ailment. These findings agree with the study by Sindiga (1995) who pointed out that in Gusii traditional medicine, herbalists and their patients relied on faith and the power of herbal remedies to work together to control diseases and illness. The belief by the Keiyo in the role of the supernatural is common and strong among Keiyo herbalist and they traditionally received tokens of appreciation for providing medicine not for healing the patient. The household heads and herbalists therefore played a key role in providing medicinal plant parts/herbs for treatment of ailments in the family and the community.

4.3 Utilization of Traditional Medicinal Plants

In order to establish the utilization of medicinal plants in study area, the researcher sought to identify the common ailments in the area, where those unwell seek treatment, who treats them, and the zones where medicinal plants are obtained. These were summarized into; prevalent ailments, source of the medicinal plants, part used and ailment it treats presented in tables.

4.3.1 Prevalent Ailments treated in the Keiyo community

The respondents were requested to indicate the prevalence of ailments presented by ranking them as very common, common or least common, as shown in table 12. The respondents' rankings are given for each ailment:

Table 12: Prevalent ailments in the study area

Ailment/ disease	Very common	Common	Least common	percentage
Cold/ flu	54.4%	41.5%	4.1%	100
Chest pain	41.5%	36.3%	22.2%	100
Malaria	32.7%	18.7%	48.5%	100
Abdominal ache	24.6%	59.1%	16.4%	100
Abdominal worms	25.1%	48.5%	26.3%	100
Reproductive health	18.1%	38.0%	43.9%	100
Cancer	4.7 %	36.3%	59.1%	100
H.I.V/AIDS	3.5%	36.3%	60.2%	100
Others (arthritis,				

Source: Author, 2015

Based on responses of those interviewed, the following ailments were considered very common and were treated using herbal medicine in Keiyo South Sub-County include colds and flu (54.4%), Chest pain (41.5%) and Malaria (32.5%).

Respondents also identified the following as common ailments abdominal ache (59.1%), abdominal worms (48.5%), and cold/flu (41.5%) on Table 4.6. Other common health problems are reproductive health (38.0%), Chest pain (38.3%) and HIV/AIDS (36.3%). The ailments viewed as common are those which are generally prevalent and it is not easy to distinguish the exact cause of the ailment such abdominal pain and worms.

Finally the ailments /diseases identified by respondents' as the least common were HIV/AIDs (60.2%), Cancer (59.1%) and Malaria (48.5%) on Table 4.6. Other ailments include reproductive health problems (43.9%)., abdominal worms(26.3%), and chest pain(22.2%). Other diseases that were viewed by the respondents as prevalent in all zones include typhoid, arthritis, allergies and lower abdominal pain referred locally to as "*katet*". From the oral interviews, it was clear that the residents of the highlands mainly

experienced ailments such as colds/flu, coughs and chest pains medically referred to as pneumonia and upper respiratory tract infections. The high altitude of Keiyo South is generally cold and wet and people become susceptible to such infection.

During the field interviews it was clear that Malaria was most common in the lowlands and the escarpment due to the hot and dry climatic conditions while the residents of the valley indicated that this was a very common ailment especially during the wet season. While residents of the highlands only suffered from malaria mainly after travelling to malaria prone areas like Kerio Valley. Typhoid was perceived to be resistant to modern medical treatment and herbal medicine was considered most effective as it cleared the infection from the patient's body. Similarly arthritis was mainly associated with the elderly people while allergies affected both the young and the elderly.

HIV/AIDs and cancers were viewed as least common ailments. This is because HIV/AIDs and cancer are ailments that cannot be easily identified until it has reached an advanced level. In addition, HIV/AIDs is a new disease that is tested and managed in modern health facilities and therefore the local herbalists and members of the community may not easily know who is infected or not. Cancer was also rated as least common because it is a rare disease, which may not be easily detected at an early stage. However, it was noted that people who seek treatment for cancer from local herbalist do not come from the sub-county. One literate herbalist alleged that most people who seek treatment for cancer do not reside in the county and may not have used herbal medicine when they were young. According to his assessment most people who seek treatment for cancer come from distant areas. It was even reported that one herbalist treated patients seeking treatment from outside the County and even outside the country. They gave an example of a Dutch national who was treated of skin cancer. Other least common ailments included malaria in the highlands and reproductive health problems in the sub- County. This is mainly due to the regular use of preventive herbal medicine that targets reproductive system in children.

In conclusion, it is noted that the ailments viewed as most common and those viewed as common by the respondents are the ailments that affect all people in the Sub County and include colds/flu followed by chest pains and finally abdominal aches and worms; while the least common ailments are HIV/AIDs and cancer.

4.3.2 Where people seek Treatment in Keiyo

Respondents' views on where they seek treatment when they or their family members were sick are shown in table 13

Table 13: where people seek treatment in the study area

Source of treatment	First	Second	Third	Total
Health facility	24.6%	52.6%	22.8%	100
Self finds herbs	77.8%	21.6%	0.6 %	100
Family provides herbs	77.2%	18.7%	4.1%	100
Visit herbalist	15.2%	26.3%	58.5%	100

Source: Author, 2015

Respondents interviewed were asked to indicate where they sought treatment in order of priority. Based on their responses it was found that 77.8% of the respondents used herbal medicine obtained by self as the first option while 77.2% of the respondents used herbs provided by the family members. The second option preferred by respondents was to visit a modern health facility as reported by 52.6 % of the respondents while the third option was to seek treatment from a herbalist as reported by 58.5% of those interviewed. This clearly reflects the pattern which most members of the community follow. They first use the locally available herbs as a priority before seeking modern medication if the problem persisted. Surprisingly, if modern medicine does not cure the problem, the people again sought the help of a known herbalist. As one herbalist commented, people seek traditional herbal treatment from them when modern medicine has failed to heal them. She remarked this in the local dialect as, "*bwoni biik kerichek chebo gaa ne kakowir beek".* Based on these responses it was noted that the respondents heavily relied on the use of traditional medicinal plants to treat chronic ailments. This is based on the wide knowledge that local people have on use of medicinal plants available in the locality.

This was particularly noted in Kerio valley and Keiyo escarpment where residents were very knowledgeable about medicinal plants used for treating various ailments.

Respondents also indicated that the choice of where to seek medication is influenced by the seriousness of the problem. Thus for one to visit a herbalists, the available herbal medicines and knowledge of family members should have failed to treat, hence the small percentage of people who visit a herbalist as a first priority. As a second option, the respondents who sought treatment from herbalists do so after the family has exhausted its options, and thus take the sick person to a herbalist for professional treatment. This view was supported by 58.7% of the respondents who reported that they opted to seek treatment from a herbalist as a third option.

When the herbs provided by self or the family; and the health facility do not bring any positive change in the patient's health, the traditional herbalists was consulted as a last resort particularly in ailments related reproductive health and cancers which members of the local community belief is not treated effectively by modern medicine. It was also noted that herbalists specialize in treating children only or adults only or both children and adults.

Providers of herbal medicine

Results on respondents views on whom they treat with herbal medicines are shown in table 14.

Table 14: People to whom treatment is provided by respondents

People Treated by Respondents	**Frequency**	**Percentage**
Adults	45	26.3
Children	22	12.9
Both	60	35.1
None	44	25.7
Total	**171**	**100.0**

Source: Author, 2015

Results in table 14 shows that 45(26.3%) respondents treated adults only while 22 (12.9%) respondents treated only children. Those who stated that they treat both adults and children were 60 (35.1%), while 44 (25.7%) of the respondents indicated they neither treated children or adults but they have knowledge on the medicinal plants used but do not practice. This response is associated to some household heads and the forest officers interviewed. It was also noted that those who provided herbal medicine to treat adults only were mainly household heads who had general knowledge of herbal medicine used in the community. The household heads provided herbs for minor ailments such as coughs, colds, stomach upsets and general first aid for cuts and sprains. However, those who treated children were mainly knowledgeable female herbalists' who specialized in child care. Those who indicated that they treated both children and adults were herbalists and vendors, who had wide knowledge and experience on use of herbal medicines.

At present there are household heads who do not provide herbal medicine nor treat any ailments. These people do not know the use of the medicinal plants due to the lack of exposure to herbs. Most of them spend most of their childhood in learning institutions and/or were brought up in Christian family backgrounds where use of traditional medicine was discouraged. These people are mainly employed and have more access to modern health facilities. This is a concern on the potential loss of knowledge of medicinal plants and their uses and a threat in the conservation of medicinal plants by the young generation of the Keiyo people. This is because traditionally every household head was knowledgeable on herbal medicine used in the community.

It was also noted that ailments treated by herbalists are mainly chronic health problems or ailments such as infertility, cancer, infant medical care and arthritis. These are ailment which respondents' believe are not treated effectively in modern medical facilities. Despite this, some most household heads provided herbal medicines for mild ailments such as coughs, colds and mild abdominal pains and herbs for de-worming.

Some herb vendors alleged that most of the present cases of infertility are related to use of modern hormone based family planning methods such as injections and implant. They

claimed that most women seek their help when they are unable to conceive due to prolonged use of family planning methods. Herb vendors also indicated that infertility is on the rise especially in many areas due to use of modern hormone based family planning methods to delay childbearing. However, when they stop this modern treatment and would like to have a child, this becomes difficult. The women resort to seeing herbalists and herb vendors to provide herbal medicine to help them conceive. Other common ailments were related to reproductive health. According to herbalists interviewed, some women have challenges in conceiving because they never used herbal medicine as was recommended in the past. According to the herbalists, treatment only becomes effective when the couple take the herbal medicine at the same time.

Other outstanding problem related to reproductive health according to the herbalists was male erectile dysfunction. This was common among men yet they rarely sought treatment. Instead their female partners or spouses took the initiative to seek treatment. According to one herb vendor, the treatment they provide is effective and their clients reported that they were healed. Other ailments that were reported to occur include epilepsy (*cheptoleit*) and cancer (*koroitab ketik)* either of the bones, blood or flesh. These ailments are attended to by specialist herbalists. Therefore patients with symptoms of such ailments are referred to known expert herbalists in the community.

According to some herbalists and vendors another ailment that is common at present is typhoid which though treated using modern medicine does not clear completely. This was referred to as a foreign disease which originally came from the Sabaot community, then it spread to Nandi land and later to Keiyo. A male herb vendor said it used to be called the disease of the Nandi locally expressed as "*koroitab Nandi".* However, it was noted that, the disease has spread to many parts because it is transmitted through food and water. According to the herbalists the community believed that the disease was airborne.

The use of medicinal plants for treatment and prevention of ailments was done at the family level, where a mature person who was knowledgeable would gather medicinal plant parts for use in the family. In other situations, the mother of the baby or

grandmother would also gather the required plant parts for her children or grandchildren. Referral to specialist herbalist was initiated only when the disease persisted. Some herbs are known by household heads while others are known by specialists only. In some cases it was the combination of herbs known to the herbalists that made the difference in treating an ailment.

4.3.3 Herbal medicine used among the Keiyo community

Herbalist/ vendors and household heads agree that use of herbal medicine in the community traditionally was mandatory. However, this has changed in the present time. Traditionally, use of herbal medicine began before conception and during pregnancy, then from infancy up to early childhood. This was emphasized by stating that in the past, herbs were taken to prevent diseases and make children healthy.

According to herbalists and the elderly respondents in the community, there were herbs for use at every stage in life such as during pregnancy, for new borne babies and for children from one year up to five years. After this regular use of herbal medicine became irregular and was only administered when the child was unwell. Herbal medicine related to reproductive health such as abdominal crumbs in girls during their monthly period was not given after ten years.

But when a young lady was ready for marriage she could be given herbal medicine by her grandmother that was intended to prepare her for conception and pregnancy. These herbs were mainly to clean her reproductive system and ensure that she had no infections. Once these herbal medicines were used as recommended in childhood, it was expected that conception would easily take place after marriage. During the period of pregnancy there were senior mothers assigned to monitor the pregnancy and provide appropriate herbal medicine and general guidance at each stage. After delivery, the baby was examined thoroughly by the birth attendant and the mother in law. Based on their observation the medicinal plants parts necessary were collected and prepared for the new born.

In addition, there were the general herbs which were a must for all babies. These herbal concoctions were to ease symptoms of abdominal pain, delay in passing stool and skin rashes among others. Other common observations included monitoring the overall physical development of the infant and the herbal medicine was provided and given appropriately by the knowledgeable women in the family or would seek the help of the village herbalist. As children grew, it was the duty of the mother and the mother in law to ensure that herbs were provided, prepared and given to the children regularly. De-worming was done seasonally and this also helped clean up the digestive system. The medicinal plant parts used were roots and tubers as well as barks and leaves that were gathered wisely to ensure that they would be available for all generations.

Herbalists among the Keiyo community

Herbalists who practice in Keiyo were found to be aged between 50-75 years. Most of them reported that they learned the practice from their parents, grandparents or other relatives. They indicated that by living with their grandparents and elders they used to regularly escort them to gather medicinal plants in the forest. With time they were send to collect some specified medicinal plant parts on their own. After a long time of practice (training) their parents finally blessed them to practice as herbalists using the same medicinal plants. One male herbalist stated as children grow one watches their ability to learn to identify a medicinal plant and collect it appropriately. With time the one who is keen is introduced on how and when to use the medicine to treat patients.

A female herbalist asserted that “herbalism can also look for you” as it happened to her. She indicated that one herbalist who used to provide herbs for her children noted her diligence in the use of herbal medicine and offered to bless her to use her medicinal plants to treat other people’s children. As culture required, she gave a gift to the aging herbalist then she was shown the medicinal plants, blessed and was allowed to practice using the same medicinal plants. The same herbalist also reported that her aunt, who was aging, sent for her from her marital home and gave her information on how to administer some medicinal plants. This herbalist stated that at the moment she practices herbalism using knowledge she obtained from a non-relative herbalist whom she paid a fee and

knowledge from her aunt who passed the knowledge to her. In addition, this herbalist indicated that she also gained more knowledge from an elderly neighbor, a traditional gynecologist, who approached her to assist in physical examination of her patients. The physical examination requires strong sense of touch which the elderly herbalist felt she could not effectively examine and hence the need for a younger person. Through practice the younger herbalist has continued to carry on with the new skills in the village.

The practice of herbal medicine and knowledge of use of medicinal plants among the Keiyo community can be learned after one is treated and healed by a specialist. This was reported by one herbalist who asserted that her son became epileptic and she sought treatment from a herbalist who administered herbs to him and her son was cured. She eventually requested to be shown the medicinal plants used and how to use the herbal medicine to cure epilepsy. She then paid the required fee to the specialist. A similar case was noted where a 43 year old lady was treated of cancer on her hand by a elderly herbalist. When she was fully cured, she gave a gift to thank the herbalist and requested to be shown the medicinal plants used to treat her. She alleged that she paid a fee, the value of a cow to be shown the medicinal plants and blessed to use the same to treat other cancer patients. Thus the elderly herbalist blessed her to use his medicinal plants to treat cancer patients. From field interviews this was an exceptional herbalist because traditionally Keiyo female herbalists were not allowed to practice until past child bearing age, estimated at 50 years of age.

The young herbalist began treating patients at her home, but due to too many patients seeking treatment she decided to open a clinic outside her home where she could examine and administer herbal medicine to the patients away from her matrimonial home. This was in line with what one elderly herbalist reported to the researcher that “it is not good to have sick people come to your home for treatment, you never know what they come with.” That is why traditional Keiyo herbalists do not openly disclose the diseases they treat. For instance, a herbalist who treats cancer asked the researcher to record that she treats children’s general ailments. It was observed that most traditional Keiyo herbalists were discreet. Unless one was directed or escorted by a local member of the village to

the home of a herbalists it was very difficult to just walk into a home to see a herbalist or seek treatment without being introduced to the herbalists by a member of the community. Like the Maasai healers, the Keiyo did not have a formal training for their vocation. They acquired their skills through informal training, such as escorting the elders in the family/ herbalists to collect herbs, assisting to sort and dispense them (Sindiga, 1995).

The Keiyo however had an opportunity to pay for the knowledge after being treated and/or cured of a sickness. This allowed other people who may not have had skills in the family to acquire through purchase and blessing from the herbalists attending to the family or self.

The Herb Vendors in Keiyo

The new phenomenon of selling medicinal plant parts is foreign in the Keiyo community. The practice according to the elderly people is contrary to traditional controls on handling herbal medicine. According to elderly people in the community, handling herbal medicine was guided by the restrictions on who may handle and where to handle medicine. The elderly respondents in the community stated that traditionally, there were taboos governing the use of herbal medicine. For instance, if a visitor arrived in a home when herbs were being boiled, the pot was removed from fire place and put aside. Similarly, after herbs had been gathered they were dried away from areas where other human activity took place. It was believed that if a human shadow was cast on the herbs, they would lose the healing power.

In spite of the existence of the foregoing beliefs and taboos, herb vendors at the market place seemed to ignore this practice. One vendor reported that because of her Christian faith she believed that the herbs she sells at the market were protected. The traditional beliefs of medicine losing power according to her were no longer effective because of her faith in God. She was confident that the healing power remains in her in spite of this exposure. A male vendor, who seemed quite popular, shared this opinion when he indicated that the great demand to avail traditional medicine by those in need supersedes the old traditions and taboos. It can, however be argued that herb vendors ignore this

belief because of the lucrative business associated with medicinal herbs. Some of the medicinal plants used to treat ailments in the study area are discussed in the next section.

4.3.4 Sources of Medicinal Plants used among the Keiyo community

Respondents' views on the zones where medicinal plants were gathered from are shown in table 15.

Table 15: Source of medicinal plants

Zones of harvesting	Frequency	Percentage (%)
Highlands	8	4.7
Keiyo escarpment	10	5.8
Lowlands(Kerio valley)	48	28.1
Others areas outside the Sub-County	2	1.2
Keiyo escarpment and lowlands	36	21
Highlands and lowlands	12	7
Highlands, lowlands and Keiyo escarpment	30	14.6
Highlands and Keiyo escarpment	25	14.6
Total	**171**	**100.0**

Source: Author, 2015

The results in the table show that 28.1% of the respondents harvested herbal medicine from the lowlands (Kerio Valley) and 21% from Keiyo escarpment and lowlands. In addition, 14.6% indicated that they gathered from the all the zones highlands, lowlands and the escarpment and another 14.6% gathered from the highlands and the Keiyo escarpment only. Others indicated that they gathered as follows; highlands and lowlands 7%, Keiyo escarpment, 5.8%, Highlands, 4.7% and 1.2% obtained medicinal plants from other places such as Marakwet Sub-Counties, Uasin Gishu and Baringo Counties. Other medicinal plant parts that was not locally available such as *Zanthoxylum chavalieri* was sourced from Nandi and *Warbugia ugandensis (*Uganda green-heart*)* from Baringo

County. From the results it can be inferred that medicinal plants utilized were derived from all the three zones namely the Kerio valley, escarpment and the highlands.

Based on the foregoing responses it was clear that most of the medicinal plants used in the sub-county were mainly found in Kerio valley and the Keiyo escarpment. The Keiyo communities reside in all the three ecological zones in the Sub County. Originally their residence was on the escarpment. Later at independence some started occupying the cold highlands but maintained contacts with their relatives who remained in the escarpment. Therefore they learned the medicinal plants found in each zone. However, the local community believed that herbal medicine derived from medicinal plants found in Kerio valley (lowlands) and the escarpment was stronger and hence more effective in treating diseases.

4.3.5 Medicinal Plants Used in Keiyo South

Respondents were asked to name some of the medicinal plants used in Keiyo South. Their responses are shown in tables 16 (medicinal plants found in Kerio Valley), 17 (medicinal plants found in the escarpment) and 18 (medicinal plants found in the highlands).

Table 16: Medicinal Plants found in Kerio Valley (lowlands)

Local name	Botanical name	English name	Part used	Ailment to treat
Mugutan	*Albizia anthelmintica*	Worm-curve albizia	Root	De-worms and cleans the digestive system
Kelelwet	*Croton dichogamus*		Root	Cough/ flu Allergy
Lengnet	*Acacia seyal*	Red acacia	Bark	Skin disease Reproductive health
Muyengwet	*Ximenia americana*	Tallow wood	Root	Abdominal pain in pregnant women
Kokchat	*Zanthoxylum chalybeum*	Knob wood	Bark	Tonsillitis / cough
Arwet	*Tamarindus indica*	Tamarind tree	Bark Fruits	Headache Stomach ache
Titiweet	*Euphorba tirucalli*	Pencil tree	Stem	Allergy, throat infection, malaria
Tilatiliet	*Acacia hockii*	White thorn acacia	Bark	Allergy, stomach ache
Tibilikwet	*Dodonea viscosa*	Hopbush	Root	Allergy
Simotwet	*Ficus thonigii*	Black-cloth fig	Root	Malaria
Noiweet/ naiwet	*Ziziphus mucronata*	Buffalo thorn	Bark	Cough
Emtit	*Olea africana*	Wild olive	Leaves	Eye problem
Pilil	*Acacia mellifera*	Black thorn	Bark, root	Throat infections
Soket(planted in Keiyo)	*Warbugia ugandensis*	Uganda green heart	Stem Bark Leaves	Headache Chest pain Skin rashes / allergies
Mutungwet	*Heeria reticulatea Ozoroa insignis*	Raisin bush / tar berry	Bark	Throat infections and abdominal pain, Cancer
Mumiab chepkuk	*Withania somnifera*	Poison gooseberry	Root	Throat infection
Ngoswet	*Balanites aegyptiaca*	Desert date	Gum Root	Chest pain Abdominal pain
Chepyetabei	*Maerua subcordata*	The wolf	Root	Reproductive health, and abdominal pain

Source: Author, 2015

"Table 16: Medicinal Plants found in Kerio Valley (Continued)"

Local name	Botanical name	English name	Part used	Ailment to treat
Chepsowoit	*Cucumis prophetarum*	Cucumber prophet	Root	Lower abdominal pain
Kokorweet	*Erythrina abyssinica*	Uganda coral	Bark	Throat infection abdominal pain in babies
Mugulatiet	*Sansevieria suffruticosa*	Mother-in-law's tongue	Root	Lower abdominal pain
Senetwet	*Cassia didymobotrya*	African senna	Root	Softens hard stool /Laxative
Tomotop lakwa (mwokchot)	*Ocimum suave*	Clove basil	Root	Cough / flu Stops diarrhea
Moinet	*Lannea schweinfurthii var, stuhlmannii*	Dales marula	Root	Relieves Stomach ache
Chebiywet	*Acacia nilotica*	Egyptian mimosa	Bark	Treats liver and abdominal pain
Ngororet	*Acacia senegal*	Gum acacia/ Senegal gum	Bark	Relieves abdominal pain
Kuresiet (toxic)	*Euphorbia candelabrum*	Candelabra tree	Root	physical development in babies
Kuriot	*Teclea nobilis*	Small fruited teclea	Leaves	Stops vomiting
Tengeretwet	*Aloe turkanensis* *Aloe kedongensis*	Dyke aloe	Root Leaves	Ulcers, typhoid Malaria, skin rashes
Kipumetiet	*Bersama abyssinica*	Winged bersaua	Bark	Epilepsy
Lelechwet	*Tarchonanthus camphorates*	Camphor bush	Leaves	Allergy
Lamaiwet	*Sizygium guineensis*	Waterberry	Bark	Stops diarrhea
Uswet /cheptuiya	*Euclea divinorum*	Magic guarri	Root	Cold and cough
Cherorowo	*Cissus rotundifolia*	Round leaved vine	Root	Baby general health
Chepkerer long/ Chepchirmitit	*Trimeria grandifolia*	Mulberry leaf	Root	Allergy, epilepsy
Aryat	*Tamarindus indica*	Tamarind	Root	Stomach ache Stops diarrhea

Source: Author, 2015

Some medicinal plants are found in the valley known as "*Soin or Endo"* near Kerio River, while some are in the higher areas on the lower escarpment commonly known as *Korgeet*. The medicinal plants found in the escarpment are also found in the valley due to the similarity in weather conditions. Similarly other medicinal plants found S*enna didymobotrya* is found all zones. Knowledgeable members of the community especially herbalists can identify and gather the medicinal plants from the escarpment or the highlands. Some of those medicinal plants found in Kerio valley are as shown in figures/ plates in subsequent sections.

Figure 6: ***Sansevieria suffruticosa*** **(Mother-in-law's tongue) in Kerio Valley**

Source: Author, 2015

Figure 7: *Aloe turkanensis* (Dyke aloe) in Kerio valley

Source: Author, 2015

Figure 8: *Withania somnifera* (poison gooseberry) in Kerio valley

Source: Author, 2015

Figure 9: *Zanthoxylum chalybeum (*Knob wood*)* in Kerio valley

Source: Author, 2015

Table 17: Medicinal plants found in the Keiyo escarpment

Local name	Botanical name	English name	Part used	Ailment to treat
Kuresiet (toxic)	*Euphorbia candelabrum*	Candelabra tree	Root	Babies physical development
Tamanges	*Uvaria scheffleri*		Root	Stomach ache
Koloswet	*Terminalia brownie*	Darot	Bark	Yellow urine, jaundice allergy
Kokorweet	*Erythrina abyssinica*	Red-hot poker tree	Bark	Throat infection Babies abdominal pain
Tibilikwet	*Dodonea viscosa*	Hopbush	Leaves Root	Noise bleeding, epilepsy, Allergy, abdominal pain
Toboswet	*Croton macrostachyus*	Broad leaved croton	Bark Root	Cancer, infertility Allergy and cough
Mutungwet	*Heeria reticulatea Ozoroa insignis*	Raisin bush	Bark	Cancer / throat infections and abdominal pain

Source: Author, 2015

Table 17: Medicinal plants found in the Keiyo escarpment (Continued)

Mesembet	*Entada abyssinica*	Splinter bean	Bark	Abdominal pain
Mumiab chepkuk	*Withania somnifera*	Poison gooseberry	Root	Throat infection General ailments in babies
Kipyagit (kipabustany)	*Maesa lancecolata*	False assegai	Root and fruits	Body rashes, measles
Tabararietab koita	*Cissampelos Pareira*	Abuta	Roots	Throat infection

Source: Author, 2015

Some medicinal plants found in the escarpment are as shown in figure/ plates 10 and 11

Figure 10: *Terminalia brownii* in Keiyo escarpment

Source: Author, 2015

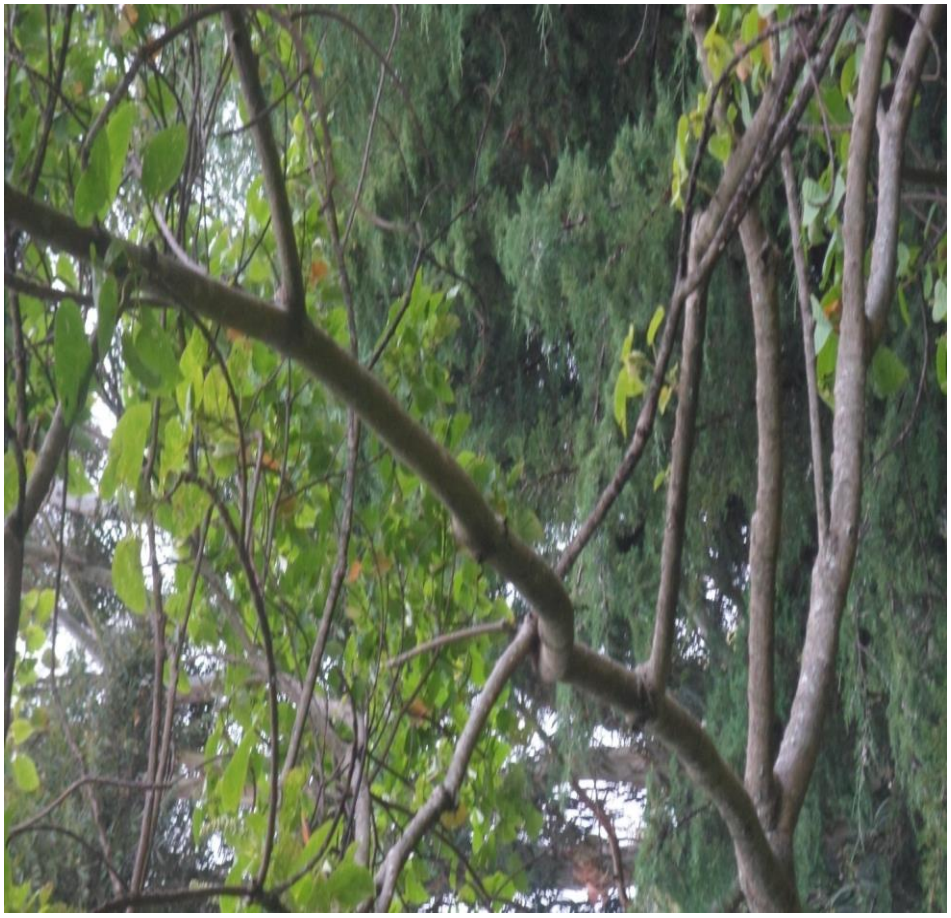

Figure 11: *Croton macrostychis* in the Keiyo escarpment

Source: Author, 2015

Table 18: Medicinal Plants found in the highlands

Local name	Botanical name	English name	Part used	Ailment to treat
Kosisitiet	*Rhamnus prunoides*	Dogwood	Root	Treats abdominal pain Infertility, Cough / cold
Senetwet	*Senna didymobotrya*	Peanut butter cassia	Leaves Root	Laxative for babies, cleans digestive system
Torotwet	*Rhoicissus tridentata*	Bitter grape	Root/tuber	Care of expectant woman
Mosombori et	*Faurea saligna*	Willow beachwood	Root	Relieves abdominal pain
Mwarubaini (neem) exotic	*Azadirachta indica*	Neem/nim tree	Bark	chest pain, malaria
Kabunbunit	*Myrica salicifolia*	Willow leaved shepherd tree	Bark	Cough and chest pain
Cheptender et	*Momordica foetida*	Concombre sauvage	Root leaves Young stem	allergy ,cough, Chest pain pneumonia
Kipyagit/Kipabus tany	*Maesa lancecolata*	False assegai	Roots Fruits	Skin rashes, abdominal pain, Chest pain
Tendwet	*Prunus africana*	African/bitter almond	Bark	Prostate cancer and old men's ailments
Mboniot	*Physalis peruviana*	Cape gooseberry	Root	Babies stomach ache, Throat infection, tonsillitis
Butbutik	*Acmella calirhiza*		Flowers and leaves	Mouth ulcers Oral thrush in babies
Momonik	*Rubus pinnatus*	Blackberry	Roots	Abdominal pain esp. babies
Ketemweet	*Toddalia asiatica*	Climbing orange	Root	Cold / flu, chest pain, back ache and infertility
Sinendet	*Periploca linearifolia*		Roots	Abdominal pain and infertility
Emtit	*Olea africana*	African/wild olive	Bark	Cancer and stomach ache
Kipkotiwet	*Bidens pilosa*	Black jack	Leaves juice/ roots	Fresh wound Throat infection Bleeding gums
Sebesebet	*Macaranga kilimandscharica*	Macaranga	Roots	Chest pain
Simotwet	*Ficus thonningii*	Burke's fig	Root	Malaria, diarrhoea with blood

Source: Author, 2015

"Table 18: Medicinal Plants found in the highlands (continued)"

Local name	Botanical name	English name	Part used	Ailment to treat
Legetetwet	*Carissa edulis*	*Simple spined num num*	Root	Treat allergies
Kipkutwet/ Kipkutwo	*Echinops hispidus*		Root, Leaves	Cough and throat infections, stomach ache
Butbutiet	*Acmela calirhiza*		Flowers and leaves	Mouth infections
Mindilinwet	*Dovyalis abyssinica*		Root	Lower abdominal pain
Seketet	*Myrsine africana*	*Cape myrtle*	Ripe fruits	de-wormer, Cleans the digestive system
Senetwet	*Senna didymobotrya*	*Peanut butter cassia*	Root	Laxative
Teldet	*Ekerbergia capensis*	*Cape ash / dogpulm*	Bark	Abdominal pain
Mobonet	*Tabernaemontana stapfiana*	*Soccer ball fruit*	Bark	Chest pain, pneumonia Throat infection and cough
Tebengwet	*Vernonia auriculifera*	*Eared vernonia*	Root	Heart burn, diarrhoea Abdominal crumbs
Kuresiet	*Euphorbia sp.*	*Rubber hedge plant*	Clean root	Baby's development
Soket (exotic to Keiyo)	*Warbugia ugandensis*	*Uganda green heart*	Leaves Stem Bark	Skin infection Headache Chest pain
Ikomiet (exotic to Keiyo)	*Zanthoxylum gilletii*	*Large leaved knob wood*	Stem Bark	Chest pain / throat infection
Sukumerik	*Dryopteris inaequalis*	*Wood fern*	Roots	De-wormer
chuchuniet	*Leonotis nepetifolia*	*Lion's ear / minaret flower*	Leaves	Cancer
Chorwet	*Pavetta gardenifolia*	*Poison bride's bush*	Bark	Skin rashes
Silibjet	*Dombeya goetzenii*	*River dombeya*	Bark	Diarrhea of blood
Torokwet	*Juniperus procera*	*African juniper*	Leaves Bark	Burns Abdominal ache
Bopab tega	*Engleromyces goetzei*	*Narrowpod elephant root*	Fungus	dewormer, diarrhea, abdominal pain
Chepkingungit	*Momordica friesiorum*		Root / tuber	Induces vomiting Malaria

Source: Author, 2015

Some of the medicinal plants found in the highlands are shown in the figure/ plates that follow.

Figure 12: ***Vernonia auriculifera*** **(eared vernonia)**

Source: Author, 2015

Figure 13: ***Faurea saligna*** **(Willow beachwood) in Kaptarakwa**

Source: Author, 2015

Figure 14: ***Mormodica foetida*** **in Kaptarakwa**

Source: Author, 2015

Figure 15: ***Echinops hispidus*** **in Kapchebelel**

Source: Author, 2015

Figure 16: ***Rhamus prunoides*** **in Kaptagat**

Source: Author, 2015

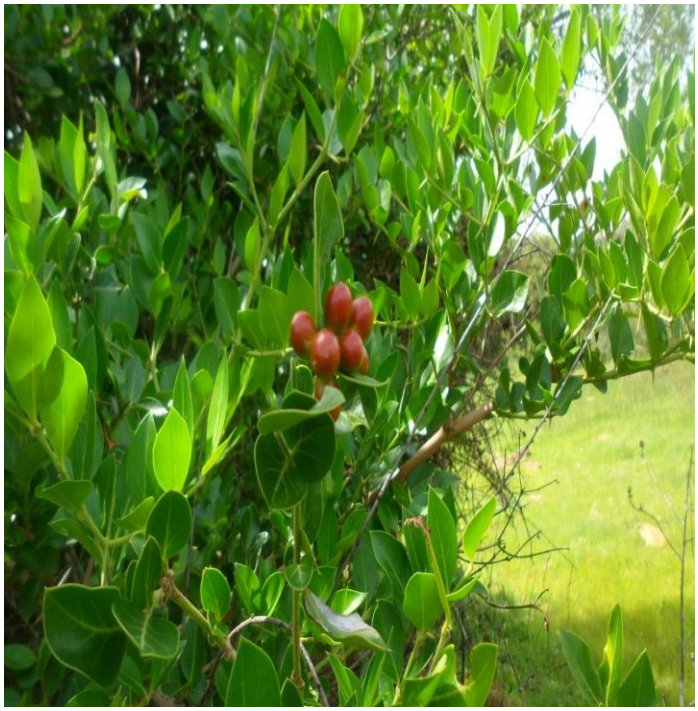

Figure 17: ***Carissa edulis*** **(Simple spined num num) in Kaptagat**

Source: Author, 2015

The medicinal plants found in the highlands are found in the upper plateau of the escarpment called 'Mosop' and 'Tumo' up to the edge of the originally forested region tilting westwards to Uasin Gishu County. These are medicinal plants used mainly by people who live in the highlands, though they still rely heavily on plants from the Kerio valley floor and the lower part of the escarpment.

Herbalists alleged that herbal medicine from medicinal plants in the highlands was considered weaker as compared to those from Kerio valley (lowlands). They believed that plants found in the arid and semi arid areas take long to grow and hence have stored a higher concentration of active substances for healing. The plants in the wet highlands were alleged to have less concentration of active substances due to high water content and more rapid growth rate. This is why herbalists, herbal vendors and household heads contended that they source medicinal plants from Kerio valley. The medicinal plants found in the highlands were said to be used for general treatment while those from the lower escarpment and the floor of Kerio valley were used for treating chronic and serious ailments.

4.3.6 The Value of Medicinal Plants among the Keiyo community

Respondents' opinions on the value of medicinal plants in the Keiyo community are shown on table 19.

Table 19: Value of medicinal plants

Value	Yes (%)	No (%)	Total percentage
Treat minor ailments	97.1	2.9	100%
Generate income	47.4	52.6	100%
Treat chronic ailments	94.7	5.3	100%
Source of power for herbalists	6.4	93.6	100%
Other – prevented ailments, immunized babies, makes children healthy, first aid	56.7	43.3	100%

Source: Author, 2015

According to 97.1% of the respondents traditional medicinal plants were used for treating minor ailments and only 2.9% indicated it was not. Similarly 94.7% of the respondents

indicated that traditional medicinal plants are important in treating chronic ailments such as cancer, reproductive health problems, typhoid and malaria. They asserted that there were specialists knowledgeable in treating some ailments in the community. In addition, the respondents indicated that medicinal plants were for treating sick people as well as preventing ailments. They all agreed that medicinal plants were used to treat minor ailments such as colds, flu and cough, stomach upsets and headache. They also provide medicine for first aid when one had a cut or a sprain.

More than half of the respondents (52.6%) noted that traditionally medicinal plant use was not to generate income for the herbalist but to treat sick people. However, in the present time medicinal plants have been used by some people in the community as a source of income and livelihood according to 47% of the respondents. The herb vendors have dedicated their time to dispensing herbs in the markets every day of the week. This is evidenced in figure/ plates 18 and 19 showing herb vendors attending and dispensing herbal medicine at market centres.

Figure 18: Female herb vendor examining a baby at Flax market

Source: Author, 2015

In addition figure/ plate 19 shows a herb vendor at work attending to clients who seek treatment at his stall and packing the medicinal plant parts for treatment, while figure / plate 20 shows a list of ailments treated by the herbalist such as typhoid, ulcers, arthritis, asthma, bronchitis, kidney problems, diabetes, epilepsy, 'blood washing" and throat pains. This group of herb vendors' livelihood depends on treating sick people and selling herbs needed by clients in addition to doing peasant farming.

Figure 19: Herb vendor prepares herbs packed in polythene bags for clients at Flax

Source: Author, 2015

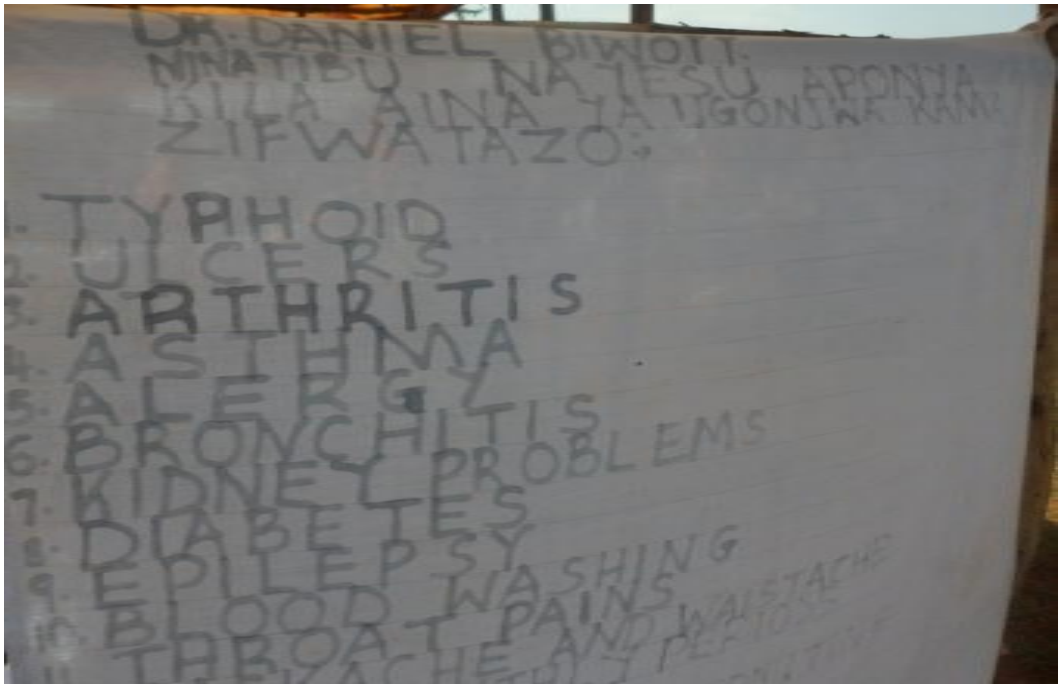

Figure 20: List of diseases treated by a vendor using medicinal plant parts

Source: Author, 2015

Majority, of the respondents (93%) indicated that traditional medicine was not considered a source of power for herbalists. Herbalists were and are viewed as gifted people whose work was to help treat people in the community. Unlike the seers and witchdoctors, herbalists interacted freely with members of the community and were not feared. Hence they interact freely with the members of the community without any restrictions.

In addition, 56% of the respondents alluded that medicinal plants were used to strengthen the immunity of new born babies and prevent ailments in children and adults. Therefore children were given herbal concoctions from birth on regular basis and were varied as the child grew. Some medicinal plants were believed to be very valuable in ensuring the development of the foetus in the mother's womb. The care given to the mother by the herbalist ensured she gave birth to a healthy baby. In addition, herbs were given to children up to 10 years to keep their bodies strong and resistant to diseases.

Similarly, herbs related to reproductive health were given to children to ensure development of reproductive organs. These herbs were used to promote good

reproductive health of young people. However if problems such as delays in conceiving were noted later in life one could consult a general herbalist who would treat this or in other cases they were referred to a specialist in reproductive health. According to the herbalists and vendors sampled medicinal plants were provided by God to every locality for the community's good health. Therefore, plants in each locality enabled man to meet his basic needs such as shelter, warmth, food and medicine.

Among the Keiyo were experts or specialists who treated chronic ailments such as cancers, epilepsy, and yellow fever among others. Knowledge of medicinal plant use is viewed as a great gift to the family. Thus knowledge on medicinal plants and their use is greatly guarded from non family members and this has to a great extend led to loss of this knowledge as the elderly people guard it until death. As a result, the younger generation may not know the value of some plants as medicinal plants. The researcher affirmed this when some respondents kept saying that their grandparents used to treat people but none of them learned their medicines. One herbalist claimed that her mother in law died without passing her knowledge to anyone in the family.

A traditional herbalist introduced to the researcher by a relative accepted to be interviewed because he was related to the researcher. The male herbalist accepted to be interviewed when he confirmed that he and the researcher were related by saying ("*ii tilyet*"). This was a clear message that he would not discuss with anyone such a well-guarded topic. This herbalist became free to share some his knowledge, showed the plants and gave the researcher some books he had on indigenous plants.

In addition medicinal plants were valued because they were used to manage emergency ailments. In case of an emergency, people would shout for help, stating the nature of sickness and on hearing the appeal for medicine, people would run to the home or place carrying herbs known to them that could cure the illness. This is still practiced by residents of Kerio valley and the Keiyo escarpment where modern medical facilities are not easily accessible. Herbal medicine therefore helped to revive and cure sick people who would have died or gotten worse.

In spite of the significance of medicinal plants to the Keiyo community in treating ailments, they were currently under threat from human activities and commercialization of medicinal plant parts. Since the herbal medicines are obtained from medicinal plants, the plants played a key role in the health of the community. Great care was given to ensure that they were gathered wisely.

4.4 Traditional measures of harvesting and conserving medicinal plants

Traditional ways of gathering medicinal plants were guided by the need to protect the plant from drying up or being destroyed. There were various measures adopted and used to ensure that medicinal plants did not die due to harvesting of medicine. These harvesting methods included uprooting herbs or removing a few roots, or bark or some leaves from a shrub or tree required for use in the family or by a patient. These methods are discussed in the subsequent sections.

a) Harvesting roots

The study noted that the local community relied a great deal on medicinal plant roots for treatment of ailments. The roots were removed using a stick or simple tools. This would be chewed on the spot to relieve some discomfort or carried home for boiling with other herbs provided by the household head or herbalist.

i) Uprooting of herbs

According to the respondents plants that were small and had few roots or one tuber could be uprooted. Once the roots or the tuber was removed the plant was then replanted, with the hope that it would grow. In addition the harvester spat on the plant as a sign of blessing and uttered words whose intention was not to destroy or kill the plant but to use it to treat a disease. This was demonstrated by a herbalist in Kerio valley as shown in figure/ plates 21 and 22

Figure 21: Herbalist demonstrates harvesting by uprooting a medicinal plant in Kerio Valley

Source: Author, 2015

Figure 22: Herbalists replanting the uprooted medicinal plant after removing the tuber

Source: Author, 2015

Small shrubs and herbs could be uprooted if they were plenty in an area or otherwise one would only remove few roots.

ii) Removing of some roots

According to the respondents, harvesting roots of medicinal plants was mainly from trees and shrubs that have several strong roots. In order to gather the roots of trees or shrubs, it was a practice to remove one or two roots and at most four. The local people literally said they scratch out a few roots by stating that '*kingwari tikitik eang akoi angwen eng ketit agenge*". That is to remove only two to four roots from a plant only. This meant that they only gathered what was required without destroying the plant.

The person harvesting identified one or two roots of a medicinal plant and removed the whole root at a time. If one needed more roots then he/she identified another and removed it. Traditionally, the maximum allowed to be removed from one plant were two to four roots. Due to these restrictions herbalists taught the young people never to remove the tap root- which they referred to as the 'heart*'* of the plant locally referred to as '*muguleldab ketit'*.

The common words used were '*kingwori sakitia ma kibolu'* literally translated as "you only scratch a medicinal plant not digging out". Therefore the use of the term scratching means avoiding digging with a hoe or "*jembe*" which may remove many roots at once. This traditional method ensured that the plant was not affected as only few roots were removed which ensured the continued survival of the medicinal plant. This was demonstrated by a herbalist in his garden of herbs as shown in figures/ plates 23 and 24.

Figure 23: Herbalist explains to the researcher how to harvest roots of a medicinal plant

Source: Author, 2015

Figure 24: Herbalist demonstrates removal of an identified root of medicinal plant

Source: Author, 2015

If a herbalist or a person sent to harvest plants, found that a medicinal plant has been harvested from recently, then he/she considered one of the two options;

(i) To remove two roots from the opposite side of the section where the roots/bark were recently gathered from. This was done only if the medicinal plant was not easily available in the vicinity, or

(ii) To leave the medicinal plant already harvested from and look for another plant. This is because, it was believed that if one harvested from what had been freshly harvested from; the earlier patient's disease would spread to that person. In addition, it was believed that if one harvested herbs from the same plant and it died then the patient would never get well. It was also believed that if one gathered herbs from a plant to the extent of making it dry up, then one would ask if the harvester had also taken and owned the disease or cleared it from the society.

This was the same case with people who made the mistake of uprooting a shrub or a tree to get herbs. It was believed that if one gathered and uprooted a medicinal plant and does not replant and bless it, they were viewed as "*bad people who think they had cleared the disease*" which the plant treats. This is similar to the beliefs cited by Mavi and Shava (1997) who assert that in Zimbabwe collection of roots for medicinal use was done sparingly so that some roots remained and the plant does not die or else it was believed the patient would also die.

b). Removal of the bark

Traditionally the bark of medicinal trees and shrubs were harvested for use in preparing herbal medicine. When one required the bark of a certain tree, it was recommended that one removes a bark that is the size of the palm of one's hand. The average estimated measurement was a maximum of nine (9") inches by four (4") inches from one side a tree. This size ensured that the plant did not dry up or get stunted due to removal of a large piece of the bark. This was demonstrated by one elderly household head as shown in figure/ plate 25.

Figure 25: Respondent demonstrates size of bark to be removed from medicinal tree

Source: Author, 2015

After removing the bark it was also mandatory that one covered the exposed stem by rubbing the debarked portion of the tree with soil. It was believed that failure to do this would make the tree drop its sap and appear like the tree was crying, which would be a curse on the gatherer. The local residents expressed this as "*makararan korir ketit*" which literally means 'it is bad for the tree to cry after you.'

Rubbing or covering the debarked portion with soil was believed to help the plant to recover faster from the injury as the soil would help the cut edges to heal and get back together. The soil also was said to protect the gatherer from curses from other people who would see the plant believed to be "crying". One herbalist reported that if one saw an uncovered debarked part of a medicinal plant and made a sound "*puuoi" "puuoi"*, in shock it was a bad omen or curse on the person who left the plant uncovered. He stated in the local dialect as "*ngot koker chi ketit kalelit ak lole puoi"* meaning if someone saw a

white debarked tree and made the sound '*puoi*" then it is not good for the harvester. One herbalist demonstrated how the bark of a medicinal plant was removed and covered with soil as shown in the figure/ plates 26 and 27.

Figure 26: Medicinal Tree with acceptable portion of bark removed

Source: Author, 2015

Figure 27: Debarked portion of medicinal plant covered with soil

Source: Author, 2015

As stated earlier, in case a herbalist/gatherer found that another person had harvested from a particular plant the option was for one to remove the bark from the opposite side of the same tree previously gathered from. It was required that this would not be directly opposite but be either on the lower part or upper part of the previous portion. This ensured that the plant was not ring barked and did not dry up. In situations where the plant had been harvested from severally the harvester was to look for another plant elsewhere. This was to ensure that the plant grows strong for future harvesting.

c) Taboos and social controls on harvesting of medicinal plants.

Besides controls on harvesting, African communities had taboos that guided the social behavior of the people in the society with regard to harvesting of traditional medicinal plants.

In this study elderly household heads and herbalists interviewed reported that some of the taboos, controls and prohibitions on who may harvest or handle medicinal plants were locally referred as "*etan ak che kikirei"* that is to say restrictions and taboos. The society created taboos for purposes of protecting and conserving medicinal plants. These were

myths which may not literally have an affect but regulated the handlers of herbs. Among the Keiyo these included:

i) A woman in her reproductive age was not allowed to practice herbal medicine in the community especially when she still had her menstrual periods. This was stated philosophically as "*when she is still going to the river"* or stated in the local language *"koto kowendi kwony oino".* The expression implied that a woman who was still having her monthly periods was not allowed to practice. Therefore only mature women who were past menopause were allowed to practice herbal medicine in the community. This in a way restricted the number of people who harvested medicinal plants to mature people who were considered responsible.

ii) Young people in their youthful state were not allowed to harvest medicinal plants on their own. They could only accompany the elders or a herbalist to the forest and assist them in collecting the parts needed. Their duty was to dig out the roots or remove the bark under the guidance of the elder or herbalist. This process helped the young person to only identify the plant and the part used. A young person who was keen would gradually learn and could eventually be sent alone to harvest herbs for the elder, but after a period of apprenticeship.

iii) Child bearing mothers were allowed to harvest medicinal plants parts for treating their own children only. These were mainly herbs shown to her by her mother or grandmother. Even if the young mother knew some medicinal plants to treat some ailments she was not allowed to practice in her own capacity. She could only gather and give herbal medicine to someone else on behalf of an elderly person usually a grandmother or grandfather, locally referred to as *'koko' or a 'kuko'* respectively. As such if a young mother noted an illness/ailment he/she would inform the parents of the child or the sick person that she will go and inform the consultant '*koko*' or '*kuko'* to give medicine for the sick person. Then she could gather and give the medicine on behalf of the consultant. She would then tell the sick person or parent of a child that "*grandmother says you use this medicine and it will help you*." This ensured that the young person was restricted and does not start practicing before the acceptable age.

iv). Breastfeeding mothers or those pregnant were not allowed to go near medicinal herbs being dried because it was believed that if their shadow was cast on the medicine it would reduce the power of the medicinal plant parts. As a result any herbs gathered were kept away from areas where such women work in the homes so as to avoid the herbs losing their medicinal power, locally referred to as "*kemiir*". If a pregnant woman was at home, and the herbs must be collected from the drying point, she would ask a child/youth to collect and keep the herbs in the store for the herbalist or elderly person to avoid her shadow being cast on the medicine.

v). Another social control that regulated harvesting of medicinal plants was that if anyone had had sexual intercourse he/she was not allowed to harvest or administer herbal medicine to a patient. This was believed could destroy the healing power of the traditional medicine. It was believed that giving herbal medicine after having had intercourse would negatively affect the sick person and could even make the patient get worse. Therefore, a herbalist who engaged in sexual intercourse would simply tell the patient to come the following day. This would sound like the herbalist would collect the herbs/medicine during the day to be given the following day.

vi). Among the Keiyo it was a taboo to collect medicinal plants from sites where people were left to die. Every clan or family had sites where terminally sick people were taken to die. In the past herbalists and elders did not collect medicinal plant parts from such areas. In addition, it was also a taboo to gather medicine from areas where epidemics had been experienced. Such sites included areas where families and/or clans have been wiped out by diseases. Such areas were believed to be unclean and medicinal plants in these areas were not gathered to treat patients.

vii). Traditionally, women were the herbalists in the villages and took care of expectant mothers, nursed babies and administered medicines to prevent and/or to treat diseases. Despite this, there were men who treated chronic illnesses like cancer, throat infections, mental ailments and diseases that were to be viewed as beyond the scope of women and

only men who practiced herbal medicine mainly handled such complicated cases. According to one herbalist, men were mainly known to be diviners (*ngorik)*. This was an element of specialization though they could also collect medicines for their parents or wives on request of specified plant parts. The men were equally knowledgeable on traditional medicinal plants and would guide their spouses on what to give to a sick child in the home. These practices tended to limit the number of those who gathered herbs and hence acted as a deterrent to overharvesting of medicinal plants.

According to the respondents interviewed, harvesting medicinal plants for use was done strictly as per the guidelines of the elders in the community. As a result there was limited or no effect of gathering on medicinal plants. In addition, the medicinal plants were in plenty given the smaller human population and limited farming activities. Therefore in the past, gathering medicinal plants hardly had any harm on the plants. Respondents agreed that the measures used ensured availability of medicinal plants as gathering was restricted to elders, herbalists and their trainees. Furthermore, medicinal plants were used to treat people and not as a source of income like in the present day. In addition indigenous plants were protected in farms as stumps were never dug up and shifting cultivation allowed the plants to grow. s a result medicinal plants were readily available for use in the locality.

d) Sacred Sites for Conservation of Medicinal Plants.

Respondents reported that in the past every clan, in Keiyo South Sub County occupied land from the Kerio valley up to the escarpment. Each clan had a sacred site which was an area set aside for prayer and consulting their God called *Asis.* Some mature men who were set apart after undergoing several traditional ceremonies and considered clean (‘*libwoben*’) in the community would go to these sites, usually a hill, for a period of time to carry out their sacred activities, pray and consult their ancestors and Asis. These people actually served as priests (*tisik*) in the community. They performed special roles in cleansing, blessing and, in extreme situations to ‘curse’ if individuals never owned up for crimes committed. One herbalist reported that every family had their hill *‘kitinyei kapchi tugul tulwengwai’.* For example, the hill for Singore zone was called *Semo* in figure/ plate

28. Another hill for the Kapkee clan, also referred to as *Chepchonge* is shown in figure/ plate 29.

Figure 28: Sacred site (*Semo*) with medicinal plants at the gentle plateau of the escarpment surrounded by crop

Source; Researcher, 2015

Sacred sites had very strict regulations regarding who may ascent this region and no one was allowed to cut a tree, graze animals or collect firewood. Traditional sacred sites in the sub-county included others Kabarak, Semo and Chepchonge in Kaptarakwa and Soy North; and Simit in Soy South, Kabiemit and Metkei wards among others.

Figure 29: Sacred site (C*hepchonge*) below the cliff protects medicinal plants in Kaptarakwa
Source: Author, 2015

The foregoing sacred areas have presently been encroached especially the Kiplaka (Kabarak site) in Kaptarakwa ward, by young people who cut trees and others who cultivate claiming it belongs to the family. This sacred site is threatened and may not last long if it is not protected. However 'Semo' the sacred area in Singore zone in Kaptarakwa is fairly intact, though people have started felling some trees for posts and for burning charcoal. The sacred area on the escarpment is estimated by one herbalist at two acres, while that of 'Simit' in Soy South is about one acre, as a result of increasing rate of encroachment. At present, people are gradually expanding their farms by cutting down trees around the traditional sacred sites. In the past the old men played a key role in ensuring the protection of the community's sacred areas and the indigenous trees/ vegetation were never destroyed. However, with the coming of the colonial government and the influence of Christianity these areas are currently neglected and greatly encroached.

In addition there were initiation sites which were protected to provide a hideout for male initiates during their seclusion period. These areas were important for conservation of

indigenous plants where medicinal plants would be found. In the past these areas were well protected but at present the vegetation in these sites has been cleared. At present the community relies mainly on bushes near streams. This confirms the important role that traditional controls protected medicinal plants in the natural environment and encouraged sustainable use. However, at present the traditional controls are not used effectively and this may be a threat to the medicinal plants found in the study area.

4. 5. Threats to Traditional Medicinal Plants

Threats to medicinal plants were first identified by asking respondents whether medicinal plants were readily available and if they had observed any change in their availability.

i) Availability of medicinal plants

Data analyzed showed that respondents felt that Medicinal plants still existed in the Sub-County as shown on the table 20

Table 20: Existence of medicinal plants

Availability	Frequency	Percentage
Yes	104	60.8
No	67	39.2
Total	**171**	**100**

Source: Field data 2015

Sixty percent (60%) of the respondents agreed that medicinal plants were still available while 39.2% noted that medicinal plants were no longer readily available. This was observed in the field as some areas were still covered with indigenous vegetation protected by the government and the elderly members of the community, while some widely used medicinal plants were either over-gathered or were not easily to found in some areas.

According to the respondents, the herbalists/ vendors mainly rely on medicinal plant from the Kerio escarpment and Kerio valley. Hence it was reported medicinal plants in the study area were still available and were obtained in areas not inhabited on the steep slopes and along the streams. In addition medicinal plants were found in the lower part of the escarpment which is hot and dry. Due to the steep terrain and unfavourable climate,

people have not settled or cultivated in these areas and therefore medicinal plants were still existed in these areas.

Majority of the respondents indicated that medicinal plants available in the highlands were mainly found along river banks in government protected exotic forests and on private farms owned by those who heeded the agricultural officer's advice to protect river banks from erosion by leaving natural vegetation to grow. Some medicinal plants were found in privately owned farms, and in areas where indigenous vegetation has not been cleared on the steep slopes of the upper escarpment locally known as "mosop" and "*tumoo*".

In government protected exotic forests, medicinal plants were found along water catchment areas where indigenous vegetation was left to grow naturally. The water catchment areas provided protection for medicinal plants which could be gathered by herbalists. In addition, there are indigenous forests such as Kapkobol (at the Border between Keiyo North and Keiyo South Sub County), Tingwo and Sururu forest that provide a rich source of indigenous plants used by the community for medicinal purposes. As such people who live near government forests like Kitany, Kaptarakwa and Chepkorio obtained most of their herbs from Kapkobol (indigenous forest) and Kaptagat forests. In Kabiemit and Metkei they obtained herbs from Tingwo indigenous forest in the highlands shown in figure/ plate 30 and water catchment areas along the river banks in Kaptagat (exotic trees) forest in figure/ plate 31.

Figure 30: Tingwo forest where medicinal plants are harvested in Kabiemit and Metkei
Source: Author, 2015

Figure 31: Indigenous plants along streams provide medicinal plants in Kaptagat forest
Source: Author, 2015

Those who reside on the gentle slopes of the escarpment state that they gathered the medicinal plants from the upper slopes which were forested in the past and along the streams and the steep slopes that have not been cultivated as shown in figure/ plate 32

Figure 32: Indigenous forests on the steep slopes source of medicinal plants in Kabiemit

Source: Author, 2015

The gentle areas of the highlands are heavily settled and indigenous vegetation replaced by exotic vegetation such as cypress as shown in figure/ plate 33

Figure 33: Settlements on gentle areas in the highlands in Kabiemit

Source: Author, 2015

In addition, it is noted that the climate of the highland is generally conducive for growth of all kinds of vegetation and unless the plants are completely uprooted there is a likelihood that they grow faster due to the fertile soils and generally wet conditions. Generally the local people, who know the medicinal plants, protect them in their farms near the streams and in steep sections where human activities are impossible.

In the Keiyo escarpment medicinal plants were available in areas not cultivated due to the steep terrain of the higher slopes of the Keiyo escarpment and on the generally dry lower slopes where cultivation of crops is not possible. However, in gentle slopes on the upper cool and wet areas farming is intensively carried out leading to a decline in medicinal plants in the area. Finally in the floor of Kerio valley availability of medicinal plants has declined and is only found on uncultivated areas and steep inaccessible areas. This suggests that such areas were only accessible to local inhabitants who reside in the villages such as Sego and Muskut where traditional conservation measures were still being practiced.

a) Changes in availability

Responses on observed changes in availability of medicinal plants in the study area are as shown in table 21.

Table 21: Changes in availability

Changes noticed	Frequency	Percentage
Yes	164	95.9
No	7	4.1
Total	**171**	**100**

Source: Author, 2015

From the results, majority of the respondents interviewed (95.9%) agreed that they have observed changes in the availability of medicinal plant especially over a period of ten years , changes observed include:

First the number of medicinal plants in the area has declined, as more land is cultivated for food crops and human settlements increase. The sizes of some the medicinal plants have generally become smaller and not fully mature. As a result, the quality of the medicine in these ploughed land also decline due to immaturity of the plants normally harvested for herbal medicine. Secondly, medicinal plants were only found in places far from human settlements and where they used to be found. For instance in the government forests, one had to travel deeper into the forests to get those plants which had not been over harvested while in the escarpment, some medicinal plants were found in very steep areas which were very dangerous to access.

In addition, one herbalist reported that they obtained some herbs from Rimoi Game Reserve because they were no longer available in other areas. This made them very costly to purchase from the harvesters who are usually exposed to attack by protected game or face arrest by rangers for trespass and or involvement in illegal activities.

b) Causes of the changes in availability of medicinal plants

According to results from interviews and observation by the researcher, the main causes of change in availability of medicinal plants in the study area were diverse and include introduction of the *shamba* system and unsustainable harvesting of medicinal plants.

The s*hamb*a system or the Plantation Establishment Livelihood Improvement System (PELIS) in government exotic forests like Kaptagat forest. When members of the community are allocated portions of the forest to cultivate before planting of plantation trees, they clear all the vegetation down to the stream banks leaving a very narrow strip of trees next to the stream. They then till and plant food crops like maize, beans and potatoes. The farmers maximize the land by tilling beyond the point where commercial exotic trees were initially planted hence destroying some of the indigenous plants along the banks of streams as shown in the figures/ plates 34, 35 and 36.

Figure 34: Exotic trees felled leaving land without indigenous plants at Kapchebelel

Source: Author, 2015

Figure 35: Farmers cultivate forest land in Kaptagat forest clearing all indigenous plants

Source: Author, 2015

Figure 36: A narrow strip of indigenous plants along the stream protects some medicinal plants

Source: Author, 2015

Medicinal plants were being uprooted and over de-barked by "young greedy and ignorant people" who had no knowledge or regard to traditional controls on gathering. The gatherers harvest as much medicinal plants as possible at once to sell to vendors and herbalists. Since their interest is to obtain money, they care little about the future and uproot the whole plant or remove large portions of the bark of one tree. During the study period, it was observed that at times they removed the bark from a plant which had already been harvested from making the plant to dry up and/or have stunted growth. This was reported and observed in Kerio valley as shown in figure/ plate 37.

Figure 37: A dried up medicinal plant (*Acacia seyal* (red acacia*)* due to overharvesting in Kerio valley

Source: Author, 2015

In addition cultivation of food crops on the escarpment has led to the clearing of areas that had never been farmed in the past. The areas where indigenous vegetation used to be found have now been cleared.

Other causes of change in the availability of medicinal plants were associated with weather changes particularly in the lowlands. It was reported that due to prolonged drought in the lowlands the plant seedlings dry up in the wild, while during wet seasons increased sheet and gulley soil erosion in the Kerio valley washes away medicinal plants as water from the highlands flows through the water ways as shown in figures/ plates 38 and 39. Consequently, plant seedlings and seeds are washed away during the flash floods.

Figure 38: Gully erosion in Kerio valley washes away medicinal plants

Source: Author, 2015

Figure 39: Sheet erosion in Kerio valley gradually washes away medicinal plants

Source: Author, 2015

Likewise, medicinal plants which grow near sources of water are washed away during floods flowing along the gullies. This has led to some plants being endangered as documented in subsequent sections.

i) Endangered plants in the study area

Respondents stated that the medicinal plants that are endangered in the Keiyo community were mainly in Kerio valley because all the Keiyo people residing in the Sub County and those living in other counties such as Uasin Gishu and Trans Nzoia rely on medicinal plants from the region. In addition, herb vendors send for medicinal plant parts for use in the highlands and for sale at trading centres mainly at Kamwosor, Flax, Chepkorio and Kaptarakwa market centres. The vendors reported that over 75% of the herbs they use and sell are obtained from Kerio valley and the escarpment.

Vendors and herbalists identified people who live in the valley and the plateaus on the escarpment and engage them to gather plant parts for them. Vendors in Chepkorio and Flax markets received the medicinal plant parts from Kimwarer area that was delivered to them by Passenger Service Vehicles and private vehicles. Herb vendors in Kaptarakwa, Kitany and Kapkoi markets received medicinal plant parts harvested from the escarpment by people from the valley at a fee. Similarly, herbalists have regular contacts with people who harvest and deliver medicinal plant parts to them to their homes.

Some of the medicinal plants endangered in the valley include *Heeria reticulatea (*raisin bush*), Zanthoxylum chelybeum* and *Maerua subcordata* (the wolf) and in the escarpment is Terminalia brownie (Darot) and *Albizia antihelmintic*. *Zanthoxylum chalybeum (*Knob wood*)* is widely used for its roots, bark and the fruits. These plants are endangered due to extensive use and high demand. In addition, since the plants are found in the semi arid Kerio valley and lower escarpments they grow slowly over a long period of time; and hence those widely gathered are endangered.

In the highlands it is mainly *Tabernaemontana stadfiana* and *Prunus africana (*African/bitter almond*), Carisa edulis*, *Dryopteris inaequalis* (Wood fern) and *Engleromyces goetzei* (Narrowpod elephant root*)* that were highly exploited for use as medicinal plants.

It was noted that most medicinal plants used are mainly for the abdominal problems to cure any pain and discomfort. This has endangered plants mainly used to treat abdominal pain, reproductive health, coughs and colds. In addition, it was observed that there is a common phenomenon where the local people regularly use purgatives and emetics to clean the digestive system leading to frequent use of medicinal plants. Similarly plants most endangered are those found in the valley floor where there is increased extensive farming of areas with slow growing plants of semi-arid conditions.

v) Threats to medicinal plants in Keiyo south

The interviewees were requested to rank the listed potential threats to medicinal plants in their locality in order of what they considered as the biggest threat to the least threat. These were then analyzed and presented in table 22.

Table 22: Threats to medicinal plants

SR. No.	Threats	Biggest threat %	Moderate threat %	Least threat %
1	Increased Farming	81.3	18.1	0.6
2	Increase human settlements	76.6	19.9	3.5
3	Lack of knowledge on use of medicinal plants	45.0	38.0	17.0
4	Overharvesting of medicinal plants	40.9	39.2	19.9
5	Lack of control of harvesters	37.4	49.1	13.5
5	Lack of traditional control	37.4	46.8	15.8
7	Trade in medicinal plants	28.7	57.3	14.0
8	Commercial gathering	21.6	54.4	24.0
9	Charcoal burning	16.4	35.1	48.5
10	Overgrazing by animals	15.8	31.0	53.2

Source: Author, 2015

a) **Biggest threats**

Results showed the threats identified the biggest threats as increased farming activities (81.3%) and increased human settlements (76.6%), followed by lack of knowledge on use of medicinal plants (45.0%) and overharvesting of medicinal plants (40.9%). From table 22 it is clear the high percentage of responses given about biggest threat was a clear demonstration of what was viewed as a major threat by the local community.

Increased farming activities was the biggest threat to medicinal plants in the highlands because available land was arable and thus cultivation of food crops involved the clearing of all indigenous trees/ shrubs and herbs. Dairy farmers also clear trees and shrubs from the pasture land to increase land for planting. Further destruction has been by a new trend of using herbicide to kill herbs and grass in the farms instead of manually tilling land. Use of herbicides dries up all herbs and grass paving way for planting of food crops as shown in figure/ plate 40.

Figure 40: Farmland sprayed with herbicides in Kapkitony destroys herbs

Source: Author, 2015

Similarly increased farming in Kerio valley near Kerio River (Endo) has also destroyed some medicinal plants due to the use of tractors to till land for food crops. This has endangered medicinal plants endemic to the area as shown in figure/ plates 41 and 42.

Figure 41: Farms cleared of all indigenous vegetation along Kerio River

Source: Author, 2015

Figure 42: Food crops (water melons) planted in cleared farms near Kerio River

Source: Author, 2015

Another major threat is the increased human settlements due to population growth. The current trend is that family members (sons) settle in family and ancestral lands that were not occupied in the past. This has lead to sub division of land into small units. The high poverty level also confines people to settle even in steep and unfavourable areas in the upper slopes of the hanging valley and upper plateaus. Due to clearing of vegetation for human settlements and faming, when heavy rains fall landslides and mudslides occur, uprooting more plants on its way down the slopes and causing a lot of havoc, down slope. Farming on the escarpment is as shown in figure/ plate 43.

Figure 43: Extensive cultivation of food crops on the plateau (middle zone) clears medicinal plants

Source: Author, 2015

Overharvesting of herbs mainly occurs to meet the high demand for sale in the local and outside markets as shown in the pictures in figure/ plate 44

Figure 44: Large quantities of medicinal plant parts at a vendor's stall at Kamwosor market

Source: Research, 2015

The foregoing has led to frequent harvesting of plants which destroys the plants in the government protected exotic forests and indigenous forests in communal lands in Kerio valley. Herb vendors, herbalists and gatherers access the indigenous and exotic forest to gather medicinal plants without much control, and this has endangered the plants driving some to extinction.

b) Moderate threats to medicinal plants

Responses given by respondents on the moderate threats are shown in table 22. Based on the responses of the interviewees in table 22, the threats identified as moderate include: trade in medical plants (57.3%), commercial gathering of medicinal plants (54.4%), and lack of control of harvesters (49.1%). This basically shows that the challenges arising with the phenomena of selling traditional medicinal plant parts to many clients in the market centres in recent years is equally a threat to medicinal plants.

Trade in medicinal plants is a new phenomenon among the Keiyo community. At present, herb vendors have moved to market centres to diagnose diseases and dispense medicinal plant parts. This has led to high demand for some plants found in Kerio valley and from the highlands. This has led to over gathering of medicinal plants in Kerio valley due to high demand for specific plants leading to failure to use traditional gathering techniques.

The foregoing practice has encouraged gathering of medicinal plant parts by people who are not guided by cultural practices of the community. In addition, the respondents interviewed indicated that other moderate threats to medicinal plants are lack of traditional controls on gathering of required medicinal plant parts. This shows the impact of trade where young people gather for vendors at a fee regardless of the impact on the medicinal plants has led to over-harvesting by over de-barking of some medicinal plants and many cuts on the few available *Tabaernamontana stapfiana (secretball fruit)* trees in the highlands as shown in figure/ plate 45.

Figure 45: Over harvested bark of a medicinal plant (*Tabaernamontana stadfiada*)

Source: Author, 2015

The collectors who sell the herbs to the vendors in markets in the highlands transport them to vendors and other users through the Kimwarer -Nyaru road and to Iten town in the County and to Eldoret town in Uasin Gishu County. The medicinal plants that are ring barked dry up and this a clear evidence of destructive harvesting of medicinal plants as shown in figure/ plate 46.

Figure 46: A medicinal plant ring barked at the base in Kerio valley

Source: Research, 2015

Lack of control of gatherers has also become a threat to medicinal plants. Gatherers at present harvest plant parts without caring about the future of the medicinal plants. It was reported that some gatherers literally uproot trees and shrubs to obtain maximum root parts for sale. This habit is associated with poor and irresponsible people who are after

quick money. As a result some plants have been uprooted and/ felled to remove the bark to supply the vendors at a specified fee for the parts collected.

The cash economy has made people look for money by all means. They gather and sell herbs to the vendors, harvest as much as possible from one plant to make quick money in the shortest time possible. According to the vendors interviewed, the cost of buying a small bundle of medicinal plants is Ksh 20. A 50 kg bag costs a total of Ksh 500 at Flax and Chepkorio trading centres, inclusive of transport and a fee to land owners in Kerio valley. Vendors also claimed that they obtain some herbs from Marakwet and Baringo Counties which they pay the supplier up to Ksh 2,000 to gather and deliver a specific quantity of the herbs. This was reported increased the cost of treating patients and dispensing herbs.

Herbalists and elderly household heads also reported that the present young generations are ignorant of plants that have medicinal value as well as knowing uses of most indigenous plants in their environments. The older generations on the other hand can identify the plants and their uses. They protect the plants in their farms and conserve medicinal plants in areas where they are found. The ignorance of the younger generation has contributed to cutting down and uprooting up of medicinal plants from their farms. Young people especially in the highlands reported using even use medicinal plants for firewood which was not the case in the past. Knowledge of use of medicinal plants has however declined in the recent due to the availability of modern medical facilities that young people believe in. This problem has been compounded by failure of the older generation to educate the younger generation on traditional medicine.

b) Least threats to medicinal plants

Threats that were indicated as the least are shown in table 4.16, from the results given, the respondents also indicated that overgrazing (53.2%) and charcoal burning (48.5%) were among the least threats to medicinal plants in the study area. However, what is now considered as least threat has a potential to be a major threat if not checked. Overgrazing by animals was more pronounced in Kerio valley and the lower escarpment where the

arid and semi arid conditions contributed to the slow growth of medicinal plants. When there is prolonged drought animals graze and browse on palatable plants found in the valley including medicinal plants. as a consequence, plants may take a long time to recover and grow but eventually are able to regenerate as shown in figure/ plate 47.

Figure 47: Browsed medicinal plant (*Sansevera suffruticora)* in Kerio valley

Source: Author, 2015

Charcoal burning is done using large specific trees while most medicinal plants are shrubs and herbaceous plants. This protects the small medicinal plants from being cleared for charcoal. Some trees and shrubs used for charcoal burning to obtain income include B*alanite aegyptica*, *Acacia hockii (w*hite thorn acacia*), Acacia nilotica, Acacia seyal (*red acacia*)* in the valley and *Tabarnaemontana stadfiada, Olea europea and Prunus africana (*African/bitter almond*)* in the highlands which are also used for medicinal purpose.

The elderly people interviewed noted that in the past there was small scale farming in Kerio valley and minimum human settlements. This has however, years increased in recent because of population growth and human settlements in areas that were not suitable on the floor of Kerio valley. Presently people cultivate crops like Water melons using irrigation in areas near Kerio River and other sources of water. Medicinal plants are

therefore likely to be lost as well as in their habitats, and people are likely to lose knowledge of use of these medicinal plants.

The potential loss of knowledge on indigenous medicinal plants and their use was clear to the elderly herbalists. One of the herbalists interviewed who was an elderly woman aged over eighty years was excited about the study. According to her the study was a great opportunity for her to give her knowledge to be recorded on paper because her son had been postponing the need to record her knowledge on medicinal plants for a long period. She claimed that she has always wanted this knowledge recorded, but had never managed to make her son sit down and write.

The study therefore concluded that the biggest threat to medicinal plants is loss of habitat through increased farming and human settlements. In addition lack of knowledge on the medicinal value of the plants increased the threats to medicinal plants not overharvesting as popularly believed. However, moderate threats identified were trade in medicinal plants parts, and lack of traditional controls and commercial gathering which needs to be controlled to avoid loss of valuable medicinal plants. The study further identified the measures used to conserve traditional medicinal plants as discussed in subsequent sections.

4.6 Measures used to Conserve Medicinal Plants

Conservation of medicinal plants is necessary in the community to ensure that they are available for future generations' health care. Those interviewed were asked to indicate the main players in conservation and state the measure adopted by each group of players to conserve medicinal plants in the study area.

a) Main players in the conservation of medicinal plants

Respondents were asked to identify the players who were most active, active and those who were inactive in the conservation of medicinal plants in the study area. Their responses are presented on table 23.

Table 23: Players involved in conserving medicinal plants

No.	Players	Most Active %	Active %	Not active %
1	Traditional herbalists	74.3	23.4	2.3%
2	Family elders	56.1	39.8	4.1%
3	Government offices	23.4	25.7	50.9%
4	Herb gatherers	16.4	11.7	71.9%
5	Village elders	15.2	15.2	69.6%
6	Herb vendors	6.4	12.9	80.7%

Source: Author, 2015

From the results in table 23 most active players in conservation of medicinal plants in the conservation of medicinal plants in the study area were traditional herbalists by (74.3%) active. This was because the herbalists knew the medicinal plants, their medicinal value and their availability. They also valued most medicinal plants and hence engaged in wise gathering using traditional methods that ensured sustainable utilization of the medicinal plants.

Family elders were viewed by the respondents as second (56.1%) to the herbalists in conservation of medicinal plants. This is because they resided in areas where the medicinal plants grow, and the plants provide medicine to treat family members. They therefore, made an effort to conserve them as they gathered them for use. This is clearly demonstrated by a herbalist gathering herbs protected in her maize farm in figure/ plate 48.

Figure 48: A herbalist harvests roots of a medicinal plant protected in her garden in Soy North

Source: Author, 2015

Traditionally, conservation included harvesting small quantities of plant parts and also dispensing them in small quantities. The herbalists interviewed in their homes gathered and stored well small quantities of herbs in baskets and dispensed a small amount at a time. This regulated the amount gathered and stored thus promoting conservation of medicinal plants as shown in figures/ plates 49 and 50.

Figure 49: A herbalist shows a basket of dried herbs stored at home in Soy South

Source: Author, 2015

Figure 50: A herbalist shows a dose of herbs given to a patient in Soy North

Source: Field photo, 2015

Similarly most elderly household heads also adopted the traditional methods of gathering of medicinal herbs as the herbalists. They stored only those herbs that were not easily

available and those which serve as a first aid for ailments' like coughs and stomach upsets. Other herbs were collected only when the need arose and this promoted wise use and conservation of medicinal plants.

Results in table 23 indicate that 23.4% of the respondents stated that government officials were most active in conservation. The Kenya Forest Service staff guard government forest made of exotic trees and indigenous forests from unauthorized persons in the highlands. Since indigenous plants grow along the streams and in water catchment areas in the government forests, medicinal plants are also protected. The restriction of people into the forest indirectly provides protection to indigenous medicinal plants mainly in the highlands. In addition, the Forest officers protect the forests from fire and also restrict grazing of animals in the forest. They plant tree seedlings or allow natural regeneration in areas where plants were cut down or were destroyed by fires as shown in figure/ plate 51.

Figure 51: A Burnt section of Kaptagat forest which destroyed all plants

Source: Author, 2015

Figure/ plate 52 shows the KFS tree nursery in Kaptagat where tree seedlings are prepared for planting in the forest. Once planted, the trees are protected by forest guards as explained by the forester in figure/ plate 53.

Figure 52: KFS Kaptagat tree nursery with exotic and indigenous tree seedlings

Source: Author, 2015

Figure 53: A KFS Forester explain the role of tree nurseries in conserving indigenous plants

Source: Author, 2015

Active players in conserving medicinal plants

Respondents indicated that those who were active in conserving medicinal plants were family elders (39.8%), government officials (25.7%) and traditional herbalists (23.4%). The indigenous vegetation in the escarpment and lowlands are directly under the control of the local residents under communal land ownership. Family elders and herbalists take care of family land with its vegetation for use as medicinal plants. Local communities in rural areas did not see any direct role of the government in conservation of medicinal plants especially on the escarpment. It is only in the highlands where the forest guards provide security for government protected indigenous forests and the exotic forests. Thus conservation of medicinal plants is purely under the control of the residence who do not have full control over the conservation of medicinal plants in the locality.

Least active players in conserving medicinal plants

According to respondents, the least active participants in conservation of medicinal plants were herb vendors (80.7 %), medicinal plant gatherers (71.9%) and village elders (69.6%). The herb vendors were considered least active players in conservation because according to the respondents, the vendors were mainly in trading centers, selling herbs. They relied on what is supplied to them by their suppliers who deliver the required medicinal plant parts in the markets and thus have no or minimum role in gathering and conserving the medicinal plants.

According to the respondents herb vendors and herb gatherers play the minimum role in conservation of medicinal plants in Keiyo South Sub County. Therefore there is need to encourage all members of the community to take an active role in conserving indigenous vegetation in the county and conserve medicinal plants for human health either directly or indirectly. After identification of the status of various actors in conservation of medicinal plants respondents were asked to indicate the conservation measures of medicinal plants.

b) Measures adopted to conserve medicinal plants in the community

In order to identify the measures adopted by the community interviewees were asked to rank the measures listed in the interview schedule from the most common, common to the least common measures. Their responses are shown in table 24.

Table 24: Measures adopted by the community to conserve medicinal plants

SR No	Measures	Most common %	Common %	Not common %
1	Protecting existing sacred sites	22.3	32.7	45
2	Community monitoring of plants exploited	19.9	32.7	47.4
3	Planting medicinal plants in home gardens	14	63.7	21.6
4	Establishing sacred places for plants	6.4	12.3	81.3
5	Education on harvest methods	5.8	32.2	62.0
6	Government efforts to conserve	5.3	30.4	64.3

Source: Author, 2015

From the responses the most common measures adopted include protecting existing sacred places by 22.3% of the respondents and monitoring of plants gathered by local residents and outsiders by 19.9%. Similarly 63.7%, of the respondents identified planting of medicinal plants as a common measure. Monitoring the individuals who access the community to gather medicinal plants and protecting existing sacred sites was indicated as a conservation measure by 32.7% of the respondents. These were measures adopted mainly by the community in the lowlands and the escarpment where cultural practices were still respected. The residents respect their elders and any inquiries made are responded to appropriately and hence monitoring of people was possible. The sacred sites are located on the escarpment and efforts to protect them have yielded positive results. However, in the highlands the community land has changed to private land ownership and this has led to rapid loss of cultural practices in conservation.

Respondents (83.3%) also noted that the least common measures adopted to conserve medicinal plants was the establishment of sacred sites. Government effort to conserve medicinal plants was identified by 64.3% and education on harvesting methods by 62.0% of the respondents was cited as the least common measure.

According to the respondents, there were no specific measures that the government has taken to conserve medicinal plants. However, the herb vendors reported that they have an organization which aims at seeking government support to provide land to plant indigenous plants that are of medicinal value. A rare case was noted where a herbalist has been permitted to plant medicinal plants on a small portion of government forest land in the highlands. It was in the garden that the herbalist gathers the herbs and treats the patients. Establishing new sacred sites is not common due to the high demand for land by the local residents for other purposes such as farming and this has led has led to encroachment on existing sacred sites which were established in the past for instance the sacred sites in Soy North and Soy South.

Specific Measures used to conserve medicinal plants in Kerio Valley region

In Kerio valley, particularly in Soy South and Soy North, the local community takes responsibility to protect their farms and those of the neighbours from destructive strangers. Nobody was allowed to gather medicinal plants in private land without requesting the owner. This made the gatherers collect responsibly, using traditional controls. This has helped to control gatherers, who vendors claimed pay a fee to the owner of the farm where the herbs were gathered.

In addition, a stranger was not allowed to access private land or community land without clear explanation on the purpose. As such strangers in the area had to identify themselves and the place where they are going to. Through such interrogation strangers do not easily access communal land to gather medical plants. This was observed by the researcher at Chekobei and Sego in Kerio valley. Therefore, if one has to gather any medical plants he/ she must be assisted or accompanied by a local member of the community to make appropriate request.

In addition, the local government officials such as the chief helps to apprehend anyone who fails to comply with community regulation. For instance, if someone cut a tree in another person's land, it was reported to the chief for action if the person was not remorseful. As a result the person is fined for the damage on the vegetation of the community. This has helped to make people responsible and control cutting of indigenous trees for charcoal or posts on private and community land.

In the valley and escarpment the people rely on natural indigenous vegetation for their medicinal plants. They trust what nature has provided for them and made every effort not to exhaust them as the inhabitants' generally protected medicinal plants in the land they tilled manually. Medicinal plants on the slopes were likely to be available even in areas that food crops were planted.

Herbalists, vendors and some household heads interviewed further reported that they had made an effort to plant or protect some medicinal plants growing naturally in their farms that were frequently used such as *Zanthoxylum gilletii (*large-leaved Knob wood*), Momordica foetida (*Concombre sauvage*) and Ximea americana (*Blue sourplum*)* among others. They reported that when performing their daily chores such as cultivating their farms, grazing livestock in community land and find seedlings of medicinal plants they uproot and replant in their gardens and farms. This was also the case in the highlands where medicinal plant seedlings are collected from government protected forests and planted in cultivated private land. Figures/ plates 54 and 55 show medicinal plants planted in a garden by a household head.

Figure 54: Medicinal plants (*Zanthoxylum gilletri*) planted in gardens in Kaptarakwa

Source: Author, 2015

Figure 55: Medicinal plants (*Warbugia Ugandenensis)* planted in a farm in Kaptarakwa

Source: Author, 2015

Some household heads reported that since they do not know specific medicinal plants they have not planted any in their farms. They reported that they only protected indigenous plants in some areas of their farms. In addition, medicinal plants that grow naturally in the farm are protected when the farm is tilled by those who know their uses otherwise those ignorant clear them from their farms. Some of the medicinal plants protected in farms include *Dombeya goetzenii (*River dombeya*), Tabaernamontana stapfiana (*secretball fruit*) and* Ximea *americana (*Blue sourplum*)* shown in figure/ plates 56, 57 and 58.

Figure 56: Medicinal plants *Dombeya goetzenii (River dombeya)* protected in a garden

Source: Author, 2015

Figure 57: A medicinal plant (*Tabaernamontana stapfiana*) protected in a farm in Kaptarakwa

Source: Author, 2015

Figure 58: A medicinal Plant (*Ximea americana*) protected in cultivated land in Kerio valley

Source: Author, 2015

In Kerio valley, seedlings of medicinal plants found growing were usually protected from animals by covering them with thorns by knowledgeable household heads so that the plants are not browsed or stepped on by livestock. This ensured that they are not only protected but also conserved. Some respondents interviewed also reported that they had reserved areas near the streams in their farms to protect and conserve indigenous vegetation and this allowed medicinal plants to grow. This was supported by agricultural officers who encouraged farmer not to till land next to the streams and rivers.

b) Conservation measures taken by Kenya Forest Services

The staff at Kenya Forest Service stations in the study area reported occasionally planting indigenous plants in water catchment areas like in Kaptagat forest. It was observed that there are tree nurseries where they prepared indigenous as well as exotic plant seedlings. The exotic seedlings in Kaptagat forest station are planted in the plantations but the indigenous seedling are reserved for planting in open water catchment areas in the forest to protect sources of water. Indigenous plant seedlings at Kaptagat and Kipkwen tree nurseries include; *Olea africana* (Wild olive), *Podo G*., *Prunus africana* (African/bitter almond), *Juniperus alphina* (Cedar), *Dombeya goetzenii* (River dombeya). Figure/ plate 59 show seedlings in a tree nursery.

Figure 59: Kenya Forest Service tree nursery with indigenous and exotic seedlings in Kaptagat forest

Source: Author, 2015

In Kipkwen tree nursery, Kenya Forest Service staff indicated that indigenous trees are mainly planted in water catchment areas during public functions and occasionally along the 'hanging valley' to prevent soil erosion in landslide prone areas. The members of the community are also encouraged to buy some of the seedlings to plant in their farms in order to minimize pressure on natural forests. It was also reported that in the past the tree nurseries which were at Chiefs' offices provided the local community with free seedling as a way of encouraging individuals to plant various types of trees in their farms. However those tree nurseries were closed due to shortage of staff.

According to the Forester in charge, Kenya Forest Service does not target specifically medicinal plants but the protection of indigenous vegetation within the forests and hence the traditional medicinal plants within the forests are protected in the process. In addition, indigenous forests within the Sub County that are protected by Forest Guards such as Kapkobol and Tingwo forests help to safeguard the indigenous vegetation. Through these efforts the government helps to protect indigenous plants which are used by the local community for medicinal purposes. Similarly, Chiefs and other local leaders educate the community to protect natural/ vegetation and use wisely the natural heritage for future generation. The chiefs confirmed that during their regular community meetings (*baraza*) they use the opportunity to educate those in attendance to protect the available natural resources and water catchment areas in the region. These efforts indirectly contribute to the conservation of indigenous forests and medicinal plants.

c) Adequacy of Conservation Measures

Responses from interviewed herbalists, herb vendors, and household heads on the adequacy of the measures indicated that the measures taken are done by individuals. It was also evident that household heads and herbalists plant some medicinal plants that they use. They also protected plants they knew in their own farms. For instance some respondents indicated that when one finds a young seedling of a medicinal plant in the bush they remove and replanted it in their private farms. This helped to protect and conserve plants that would otherwise not survive in the bush.

However, these measures were considered inadequate because they were generally individual efforts with no government effort targeting indigenous medicinal plants. In most cases it was observed that the natural vegetation is being cleared and ploughed for farming by individual land owners while herb gatherers continue harvesting herbs for sale to herb vendors locally and beyond the County. This will definitely lead to loss of indigenous plants used for medicinal purposes for the future generations if conservation measures are not enhanced by individuals and the government.

4.7. Suggestions given for wise use and conservation of medicinal plants

Respondents interviewed made various recommendations for wise use and conservation of medicinal plants in the Sub County. First it was recommended that individuals who know the plants used for herbal medicine should take the initiative to plant them in their private farms. All the elders in the family and the community should be encouraged to impart knowledge on medicinal plants to the young generation. This will make them conscious of the need to protect them on their farms. This will also encourage the establishment of regulations of access and controls to be introduced and implemented on use of the medicinal plants. This will be used in future to earn income from those who will harvest for medicinal use.

Secondly, the County and the National government should relocate people who live and farm on the steep escarpment and highly eroded Kerio valley to allow growth of indigenous vegetation and hence medicinal plants in the region. This will also provide a natural tourist site to earn income not only for the County but also the National Government. Once the escarpment is protected the natural vegetation will recover, while areas already tilled can be reforested with the indigenous trees or left fallow.

Thirdly, it was suggested that the National Government and County Government should establish a botanical research center in the area that can carry out research on indigenous medicinal plants in the County. This will promote the development of plant based medicines like in china and India for local use and for the future generations.

Fourthly, while gathering, the collectors should gather small portions of the bark and roots to ensure that the plant continues to grow without withering or drying up. This can be realized by use of traditional ways of gathering which include removing the bark that is the size of the palm of the hand from one tree. In addition the roots gathered should be as traditionally recommended where two to four roots are removed without killing the plant.

Fifthly, indigenous plants should be protected in the farms and along river banks. Each land owner should be encouraged to set aside a small portion of land for indigenous vegetation to develop. This will allow the growth of medicinal plants in individual farms which can be used as a source of medicine in the community. Herbs should only be gathered with permission of the owner of the farm.

Sixth, quack vendors who now practice as traditional herbalists should be vetted and stopped from gathering and selling medicinal plant parts. Most of them are alleged to have been herb gatherers and when they realized that it pays to sell these herbs in the market they also started practicing as herb vendors. They then collect the herbs known to be medicinal and sell them in the market to people who need them for general use or to treat specific ailments. This is a new phenomenon among the Keiyo who belief that practicing herbal medicine is a family gift which can only be practiced by those blessed and gifted to treat people but not for business.

Thus for wise use of herbs and medicinal plants genuine herbalists known to the community need to be identified and verified by the community and supported to treat patients referred to them. This is similar to a report by Maore Ithula in the Daily Nation of Monday 10th November 2014 where Prof. Mwangi confirmed that there are fake herbalists who have taken over Kenyan towns as patients pay dearly for their services. Thus genuine herbalists together with the government should make laws to protect the citizens from quacks.

CHAPTER FIVE
DISCUSSION

5.1 Introduction

This chapter presents a summary and discussion of the study findings as per the research objectives.

5.2 Utilization of traditional medicinal plants

The study showed that the people of Keiyo South Sub-County widely use traditional herbal medicine obtained from local medicinal plants. The providers of herbal medicine were the household heads (men/women) and the local herbalists. At present there are herb vendors who treat clients and/or sell medicinal plant parts in the local trading centres. This is a new phenomenon in Kenya and Africa due to urbanization and migration to farms away from ancestral lands. The high cost of modern medicine and some chronic diseases have all encouraged the local community and non locals to seek herbal medicine that is locally available. The medicinal plants parts purchased are used to treat and prevent ailments.

Most herbalists and household heads reported they learned the art of herbal practice from their parents, grandparents or other relatives. However, others paid a fee to learn the treatments and be shown the plants used to treat specific diseases. At present, unlike in the elderly household heads, some household heads interviewed were ignorant of traditional medicinal plants especially those who grew up in Christian homes and were on salaried employment. This showed the impact of missionaries who encouraged Christian converts to go to school and use modern medicine provided by modern health facilities. This is a confirmation that western culture has had an impact on the traditional socialization on use of medicinal plants to treat ailments. This was enhanced by marginalization of traditional medicine by colonial government (Mukiama, 2005) and promoted by the missionaries in mission and government schools. However, in Keiyo the effect is still limited as the impact of western culture and Christianity has not completely influenced the local community due to its location and limited colonial control.

Gathering and use of traditional medicinal plants has been a preserve of the herbalist and household heads who have knowledge on the plant type, and how to combine various plant parts to produce the right effect on the patient. This is probably why it was traditionally advisable that one should not gather medicinal plants that he or she has not been blessed to avoid causing harmful effects on the patient. Patients are therefore encouraged to seek treatment from known traditional herbalists in the community. The ailments treated by herbalists are discussed.

a) Ailments treated in the study area

The study revealed that the common ailments are cold/flu, cough and throat infections chest problems mainly in the highlands and malaria which was said to be more prevalent in the lowlands. Abdominal pains were identified in all the zones. This was in agreement with what is indicated in the Keiyo strategic plan 2005-2010 (2005) which notes that the most prevalent diseases in the district are upper respiratory tract infections, malaria and diarrheal diseases and urinary tract infections. These ailments were treated mainly using herbal medicine provided by the family, traditional herbalists or bought from herb vendors at the local market centres. Herbalists and vendors attended to patients and clients from within the Sub-County, County and those from outside the County.

b) Livelihood of herb providers

The study showed that herbalists in the rural areas do not rely on the practice of herbal medicine as their main source of income. They carry out farming activities on regular basis and only treat clients who visit their homes. They are given a gift which can be in kind or cash money which is not fixed and they end up earning very little. Household heads provide treatment to their family members without earning direct income and regular use of herbal medicine by children prevents ailments even later in life. However, they save money which would have been spent to seek treatment from traditional herbalists or in modern health facilities.

The herbalists who were non family members were traditionally given a token of appreciation in form of millet or milk and later when the patient was healed, the patient would take another gift to the herbalist. At present, giving a token is still practiced but is being transformed to cash payment. This has led to a new group of herbalists who treat and sell herbs in the markets for cash and is generally a short term relationship where the client is not obliged to take a gift later. This trade in herbs has therefore become a new source of livelihood for the herb vendors unlike in the past when traditional herbalists earned their livelihood like all other members of the community by farming.

The herbalists residing in accessible areas and those who are well known for treating ailments such as cancer and reproductive health problems earn high income like the herb vendors who moved from one market to another on market days. This group of traditional herbalists earned more income from clients who seek treatment from distant places and pay cash money. The modern mode of payment to herb vendors is contrary to the traditional ways as reported by Chebet and Dietz (2000) that the first payment was a gift and later an actual payment was given for the services. Well known herbalists who treat more chronic diseases such as cancer and infertility earned more money. The practice of herbal medicine has become a regular source of income for those who herb vendors and herbalists in accessible areas.

c) Treatment of patients

Oral interview findings indicated that use of medicinal plants to treat ailments was still widespread. Interviewees reported that, traditionally, use of herbal medicine is a must for good health of the individual and treating various ailments in children and adults. Herbs were administered to children to ensure good health and particular attention was given to mothers and babies. For instance, an expectant mother was under the care of an experienced elderly woman who monitored her progress to ensure the good health of the mother and the unborn child. After delivery, the baby was given a daily dose of herbal concoction which was taken with daily food and referred to as "food for the baby". Medicinal plants were used widely for babies/children. Parents, grandparents and the

local herbalist administered the herbs appropriately. This promoted good health and prevented ailments in the members of the community.

The medicinal plants used for babies mainly comprised of laxative, those which relieved abdominal pain and general development of the baby. The community generally believed that herbal medicine helps the baby to grow up healthy and ensured good physical development. In case of an ailment a herbalists could be consulted for further management. Presently most families especially in the remote rural areas relied on herbal medicine that is gathered locally. As a child grows up it was recommended that herbal medicine should be administered occasionally. However, when one was ill the appropriate herbal medicine was provided especially in the lowlands and escarpment, where the use of traditional medicine is widespread. This is also in agreement with Chebet and Dietz (2000) and Kipkorir and Ssennyonga (1984) account that in every African community, every person was taught about diseases and illnesses in the community and the appropriate medication. When one in the family got sick medicine was provided at the family level and if one was not healed then a herbalist was sought to assist.

The residents of the highlands reported that they sought medication in modern health facilities when sick rather than from herbalists. The young generation particularly sought modern medication in the health facilities. Interestingly some herbalists also advised their clients to go for medical laboratory tests in the modern health facilities for ailments such as typhoid and malaria before they dispensed some herbs. In one rare case, a literate male herbalist sought for ultrasound scan report of the lower abdomen. The herbalists used the medical laboratory results to provide the appropriate medicine to manage the condition identified. However, the herbalists noted that most of the sick people turn to them when the hospital has failed to treat their ailments. They complained that in most cases patients sought their treatment when they felt the modern health facility has failed to treat and the ailment has spread in the body. In some cases due to lack of medicine in rural health facilities, medical staff refer mothers with infants to seek treatment with known herbalists in the locality.

This finding is in agreement with Mukiama's (2005) report that, that traditional medicine continues to play an important economic and social role in healthcare particularly in rural areas and even expanding to urban areas. The use of traditional plant based medicine in the rural areas is very important as it not only prevents and treats but also provides treatment where modern health facilities have not succeeded. The wide use of traditional medicinal plants show the value the local community attached to them.

c) Value of medicinal plants

Medicinal plants have been used from time immemorial to prevent and treat ailments, in all communities in the world. It was only in the 19th Century that scientists and pharmacists were able to isolate active substance in plants such as morphine from Opium Poppy, aspirin from the bark of the willow, and quinine from cinchona. These discoveries led to chemists synthesizing chemical based drugs that were cheaper and quick in bringing positive results to sick people. As a result plant based medicines were substituted, ignored and even dismissed at some period in the 19th and 20th century (Dev, 1989). This extended to Africa during colonization where traditional medicine was suppressed as modern chemical based plants were introduced (Mukiama, 2005).

The study showed that medicinal plants were still greatly valued for their role in preventing and treating human diseases. The interviewees were not in doubt that medicinal plants treated people who were sick and prevented any ailments from occurring. For this reason, it was mandatory in the community for babies and young children to be given a daily dose of medicine for various purposes and to prevent any ailment. To date an herbalist simply observes and examines a child and can tell whether the child used herbal medicine or not. As Chebet and Dietz (2000) noted, in the past there was a pot set aside in every home for boiling children's herbs for daily dosage for children and another one for occasional use for boiling medicine for a sick adult in the family. The study observed that this practice was still common with the residents of the escarpment and the Kerio valley.

In the past, a token of appreciation was only given to the herbalist, but in the present day, cash money is used and this has transformed provision of herbal medicine to a source of livelihood. Popular herbalists and herb vendors earn a living mainly from the practice as they supplement with the farming. Presently, the practice of herbal medicine has attracted quacks especially among the vendors who use them as a means of earning a living through the sale of herbs and treating clients in market centers. The trade in medicinal plant parts has led to destructive ways of gathering herbs. There is need to assess how the Keiyo community can conserve their indigenous medicinal plants and knowledge without communicating this.

Existing literature is in line with the findings of this study especially on the value attached to medicinal plants. It shows that the western world is now turning back to plant based medicines to treat ailments (Swaminathan and Kochar (1989) and Pamplona-Rogers 2013). This is happening when there is increased loss of indigenous vegetation with valuable medicinal plants globally (Cunningham 1993, Hamilton, 2003). In Kenya, the situation is worse as traditional medicinal plants and their uses have not been documented in every community and are lost as the elders and herbalists grow old and die without releasing their well guarded knowledge (Bussman *et al*, 2006, Jeruto, 2008, Okello, 2009).

5.2.1 Traditional medicinal plants used in Keiyo South

The people in the Sub County largely used locally available medicinal plants to treat the ailments. They were obtained from the Kerio valley (lowlands), the Keiyo escarpment and the highlands. The local people especially those in the highlands combine the medicinal plants from each of the three zones to obtain the best effect on the patient. Medicinal plants for chronic ailments such as arthritis and reproductive health problems were mainly obtained from Kerio valley and the escarpment. The highlands are also endowed with medicinal plants used to treat various ailments.

The medicinal plants mainly used to treat or prevent ailments in babies include *Euphorbia candelabrum* (Candelabra tree), *Erythrina abyssinica, Maesa lancecolata* (False assegai), and *Acmella calirhiza* , *Uvaria scheffleri* and *Cissus rotundifolia* (Round leaved vine) among many others.

Medicinal plants widely used to treat cold/flu, cough and chest pain include; *Croton dichogamus , Zanthoxylum gilletii (*large-leaved knob wood*), Ziziphus mucronata (*buffalo thorn*) , Warbuga ugandensis (*Uganda green heart*), Heeria reticulatea ozoreainsi (*raisin bush*), Withania somnifera (*poison gooseberry*), Balanites aegyptica , Euclea divinorum (*Magic guarri*), Erythrina abyssinica* and *Cissampelos pereira,* found in the lowlands. Those found in the highlands were *Rhamnus prunoides (*Dogwood*), Momordica foetida (*Concombre sauvage*), Tabernaemontana stadfiana and Toddalia asiatica (*Climbing orange*).*

The medicinal plants used for general abdominal pains and particularly the lower abdomen mainly related to reproductive system and fertility include; Acacia *seyal, Ximea americana* (blue sourplum), *Maerua subcordata* (the wolf), *Cucumis prophetarum (*cucumber prophet*), Sansevieria suffruticosa* (Mother-in-law's tongue), *Acacia nilotica, and Acacia senegal (*Senegal gum*),* found in the lowlands. *Entada abyssinica (*splinter bean*)* is found on the escarpment and *Rhamnus prunoides* (Dogwood) found in the highlands are widely used in the community.

The medicinal plant parts used to treat Malaria include; *Ficus thonigii (*Black-cloth fig*)* and *Aloe turkanensis (*Dyke aloe*).* The medicinal plants used to de-worm include; Albizia anthelmintica, in the lowlands and *Senna didymobotrya* (Peanut butter cassia), found in all zones and *Myrcine Africana, Dryopteris inaequalis* (Wood fern), *and Engleromyces goetzei* (Narrowpod elephant root) found in the highlands. The plant used to clean the digestive system by inducing vomiting is *Momordica friesiorum* is found in the highlands.

The medicinal plants used to treat cancer include; *Toddalia asiatica (*Climbing orange*),* *Trimeria grandifolia* (Mulberry leaf), *Olea europaea* (African olive) and *Ficus thonigii* (Black-cloth fig).

Generally, most household heads who were herders and farmers in the rural areas knew some medicinal plant names, though some of them were not clear on the use. They freely gave the information on the medicinal plants and the uses that they knew. On the other hand the vendors were not willing and refused to reveal the names of medicinal plants, they used to treat in the markets. This was basically the fear of the intentions of the researcher of probably using their knowledge. However, the elderly household heads in the community interviewed were very resourceful and shared their knowledge. They shared the knowledge on the medical plants used but did not reveal the combination to bring about the healing. They even advised the researcher not to disclose all the information they gave. This is similar to the experience that Kokwaro (1993) had on the research on medicinal plants and a request to be shown the plant is viewed with a lot of suspicion and caution. When one was kind enough to show the plant it was on condition that you do not show anyone else.

The medicinal plants identified in the study area are similar to those used in other regions, though they vary in the parts that each community used and the ailment to treat. As Pamplona-Rogers (2013) indicated, not every plant of the same species always produces the same amount and concentration of active substances; but they vary from one plant to another depending on environmental and biological factors. These include the age of the plant which also varies from one species to another. In addition, the climate and soil type influences the quantity and quality of active components in the plant. Thus it is experienced members of the community and herbalists are the people who can identify and dispense the right herbal medicine for the people and patients in need of treatment.

Some of the local plants found in many parts of Kenya are traditional medicines that have proved effective in treating malaria include the climbing orange (*Toddalia asiatica*

(Climbing orange) and Aloe vera herb. Although these plants have been used in traditional medicine no chemical analysis of the plant has been done. These medicinal plants have maintained the health of the people in the study area and were well conserved using traditional ways of gathering and conservation.

3 Traditional ways of conserving medicinal plants

In the past, the Keiyo community used the medicinal plants in a way that preserved them for the present and the future generations even when they were available in plenty. Conservation of medicinal plants in the community was guided by social controls and taboos that regulated who may gather and how to gather herbs for use. These controls included age and experience of the person gathering as well as the family background. The Keiyo believed that only mature people could practice herbal medicine. These people were recognized as herbalists by the residents through previous treatments that they provided and treated. People with similar ailments were recommended to by relatives of sick people with similar symptoms. However, the young people in their reproductive age were allowed to gather herbs only for members of the nuclear family. They were not allowed to practice or gather medicinal plant parts for non-family members on their own without the direction of an elder or herbalist.

Those who had the knowledge and gift to gather herbs among the Keiyo, were trained on how gather and preserve the herbs. They were taught to gather few roots (two to four) from one plant and the bark of a tree only a small portion (the size of the palm) for use, and how to protect the herbs from losing its power. In addition they were expected to cover the debarked portion and the roots of the plant with soil, and bless them to grow for future use. The Keiyo believed that failure to do so would be a curse from the tree if it "cries" (that is when it dropped its sap) and dies due to poor gathering technique. Similarly a plant which had been gathered from on both sides was left and the gatherer was expected to seek another plant. These controls ensured that the gatherers protected the medicinal plant from drying up and denying other users its use in future.

In addition there were sacred sites which were reserved for use and accessed only by elderly men who were set apart as "clean" in the clan. These sacred sites such as the sacred hills and initiation sites were restricted and no tree was to be cut and these sites retained most indigenous plants used as medicine. The old sacred sites, though they are now small and encroached by the community, still exist and have old mature indigenous trees. These sites are now endangered with the ongoing land demarcation in the Kerio valley and the Keiyo escarpment as the young generation is claiming the sites in their clan land to be allocated to them. Like the small forest patches known as the Kayas by the Mijikenda the sacred sites in Keiyo need to be conserved by the community and the Government. The Kaya sacred sites are islands of biodiversity in an area where agriculture activities are done in every available arable land (Wilson, 1993).

Generally, all the members of the community were taught medicinal plants used for general ailments such as cuts, colds, cough and abdominal pains. The knowledge on use of plants guided the people in their day to day activities to protect medicinal plants. For instance in Kerio Valley, young browsed medicinal plants were covered with a thorny branch to protect it from browsing animals as it grows. During land cultivation, the farmers avoided uprooting any plants especially known medicinal plants. Instead they only cut the branches and left the tree stump which would re-grow after some time. Therefore medicinal plants used in the community were well conserved. The traditional methods of gathering had guidelines that were intended to protect the plants and the user. As Pamplona-Rogers (2013) states, when gathering plants for medicinal purposes special measure must be taken. The medicinal plants should be gathered without destroying by uprooting.

Therefore, the control on who gathers, how much to gather and care of the plants ensured that the medicinal plants were gathered and used sustainably. The local people value and widely use medicinal plants to treat ailments though the young generations prefer modern medicine. In the rural health facilities some clients are advised to seek the advice of well known herbalists. This practice has led to harmful practices that threaten the availability of medicinal plants that have been used in the community since time immemorial.

The traditional guidelines for conservation protected the medicinal plant resources in the community. Though the resources were communally owned, the controls were adhered to under the direction of the elders in the community. Thus the tragedy of the commons in the traditional setting was not experienced as members of respected the elders direction and guidelines. The western culture and commercial use of resources has created a tragedy on medicinal plant in the community and hence the threats affecting the medicinal plants in Keiyo South.

5.4 Threats to medicinal plants

Contrary to the popular belief the study found that the major threats to medicinal plants was not overharvesting but increased farming activities and human settlements in Keiyo South. Rapid Population growth of the local people has led to clearing of indigenous vegetation to cultivate food crops and improve the pasture for animals. Presently people clear all vegetation and remove the stumps of trees and shrubs to ensure maximum utilization of the land. In the regions near Kerio River (Endo), tractors were used to plow large tracks of land for food crops. As a result, the medicinal plants endemic to such areas were cleared and uprooted from the site and are thus destroyed. With increased population, the clan land becomes too small especially for families that were not able to purchase land in other areas like Uasin Gishu. As a result people in the upper escarpment have settled and farmed in steep slopes that were not ideal for settlement. The sleep slopes that provided a habitat for indigenous medicinal plants are now endangered.

In Keiyo threats to medicinal plants are the high rate of deforestation on ancestral communal lands. Due to high cost of purchasing land in the highlands and Uasin- Gishu plateau, people have gone back to their ancestral lands on the escarpment to settle and cultivate food crops (Republic of Kenya, 2008-2012). This is more pronounced in Keiyo Sub-County where people used to farm in highland plateau in the government forests, particularly in the Kaptagat forest through the *shamba* system. When land was not people started farming the steep areas of the escarpment to plant food crops such as maize and beans. In addition, the Kerio valley was opened up for increased settlement with the

construction of the Iten- Kabarnet tarmac road while cattle rustling in the northern valley forced many people to settle on the escarpment (Jungerius, 1996). This led to clearing of vegetation in areas traditionally not for cultivation and settlement.

In the highlands most indigenous plants were cleared and replaced with exotic vegetation on privately owned land. The local residents clear their farms of indigenous vegetation to plant food crops and graze their animals. They then plant exotic trees that grow fast for timber at the edges of the farms. This has led to rapid decline in the availability of traditional medicinal plants that used to grow naturally in the undisturbed areas of the land.

Other threats to medicinal plants are commercialization and trade in medicinal plant parts. This has led to increased demand and over- gathering of the medicinal plant parts frequently used in the community. Due to the steep and hilly terrain, younger people are sent by vendors to gather specified plant parts in large quantities for payment. Since the gatherers are only interested in making money paid by the vendors, they do not observe the traditional controls on gathering that helped to conserve the medicinal plants. Instead, they are alleged to be responsible for de-barking large portion of the plant and in some cases uprooted the medicinal plant to obtain the required quantity in the shortest time possible and get paid. Some of them are poor and idle members of the community who look for a little money to buy alcohol. This is similar to what Cunningham (1993), noted that gatherers are mainly the poor in society who are engaged to gather in order to earn a living.

In addition some members of the community are generally ignorant on the use of some indigenous plants. As a result they cut and uproot the indigenous plants in their farms to create more space for food crops. They also cut indigenous trees to burn the best charcoal and for good firewood. This situation is made worse by ignorance of the young generation on the uses of indigenous plants who cut them down and clear from the farms.

Although the loss of habitat for medicinal plants is experienced globally, the harm is greater in the study area because the plants and medicinal uses have not been documented. Furthermore the trade and destructive gathering to generate income will eventually lead to loss of the medicinal plants that past generations have used to cure ailments. Therefore the tragedy of the commons will eventually occur as vendors' sale the herb and gatherers destroy the medicinal plant for profit with no controls on conservation. This requires urgent measure by the community leaders and the government to conserve the natural environment and document the oral knowledge of the elders before they are lost completely. Despite these threats, there were specific efforts made by the members of the community to conserve medicinal plants.

Therefore, the threats to medicinal plants in Keiyo South are mainly as result of introduction of western civilization introduced by the colonial government. The colonial administration introduced private land ownership, cultivation of cash crops and cash economy began the tragedy of the commons scenario. The control of elders was lost as the people sought to increase production of cash and food crops in the available land. This led to unregulated use of natural resources in the community which has now reached a point where medicinal plants are threatened in the natural environment. Action needs to be taken to protect and conserve indigenous plants in natural habitat and the knowledge on their medicinal uses. This is necessary to avoid the loss of the plants as people seek individual economic achievements.

5.4.1. Measures adopted in the community to conserve medicinal plants

The herbalists, vendors and the household heads were quite aware of the threats and danger of losing traditional medicinal plants. They confirmed, that though the medicinal plants were still available in the community, they have noticed their decline in the areas they used to gather from. According to them, the loss of the God given natural resources would be a disaster for human health in the present day when modern medicine is inaccessible, and unaffordable. They expressed the need to conserve the medicinal plants before they are lost completely with time.

They noted that the people who are knowledgeable in the use of certain medicinal plants collected seedlings from the bush/forest and planted them in their private farms and home gardens. In most homes there were medicinal plants planted within the farm for easy access when the need arises. The most common medicinal plants planted in the highlands are those for cough, colds and stomach upsets. This is in line with the effort by Kenya Forest Research Institute (KEFRI) to provide guidelines for growing aloes traditionally used for human and animal healthcare (Oduor and Mukonyi, 2008).

In addition, those whose farms extent to the streams and water banks preserved a portion near the streams for indigenous vegetation to grow. It was reported that when land was left uncultivated various plants grew naturally in the undisturbed portions of the farm. Plants such as *Prunus africana (*African/bitter almond*), podo, juniperous procera and olea europaea* (African olive) grew without being planted. Currently, elders/household heads and herbalists in the community deliberately plant and protect indigenous plants that are of medicinal value in their farms.

Another approach adopted to conserve medicinal plants in the lowlands is monitoring of individuals trespassing into private and communal land to ensure that they do not harm any plants in the communal farms particularly medicinal plants. Though maximum control is not achieved, the locals and outsiders are conscious that they are being observed and any harm can be traced to them.

The government has indirectly helped to conserve traditional medicinal plants through its policies of protecting forests in the highlands. For instance, Kaptagat forests indigenous vegetation is protected along the water catchment areas. The indigenous vegetation in these areas provided medicinal plants gathered and used by the herbalists and vendors in the local community. In addition, there is the government protected indigenous vegetation in Kapkobol, Tingwo and Sururu forest by the Kenya Forest Services. Consequently, the forests have in turn protected the medicinal plants and have become a major source of medicinal plants to the herbalists.

In the upper slopes of the escarpment, indigenous plants were mainly found on the steep slopes which cannot be used for cultivation of crops or for settlements. These steep areas have also become conservation zones for the medicinal plants in the warmer zones of the escarpment. The gentle plateaus on the escarpment have been farmed for food crops and for human settlements on the communal clan land.

The area which has not been greatly destroyed is the steep dry areas of lower escarpment (*korgeet*) which is not fit for farming or human settlements. The area is difficult to access due to the steep terrain. It is only the local residents who walk down slope or up the cliff. This zone has only indigenous vegetation that is a main source of medicinal plants. The community can conserve these areas and therefore ensure availability of the medicinal plants.

In conclusion, the herbalists and elderly household heads use traditional ways to conserve and use medicinal plants in the locality. They gather and dispense in small quantities and protect the medicinal plants in their farms. Some respondents attempt to conserve medicinal plants in their farms. However, herbs gatherers send by vendors are responsible for destructive gathering and overharvesting of medicinal plants to supply the market demand.

5.5 Suggestions for wise use and conservation of medicinal plants

The study showed that the local people in the study area acknowledge the importance of traditional medicinal plants. The medicinal plants provide them with medicine used to prevent and treat common ailments and cure chronic diseases which modern medicine has not managed to treat, such as cancer and some reproductive health problems. Furthermore, the herb vendors and herbalists earn their livelihood by treating and selling herbs to clients.

Interviewees recommended the regulation of quantity of medicinal plants gathered at ago by the users. One way of doing this was that vendors who finance gathering of large quantities of medicinal plants for sale should not send irresponsible people to gather for

them. Irresponsible herb gatherers use culturally unacceptable ways such as uprooting and over de-barking a plant to obtain the required amount in the shortest time possible. Once the rate of gathering is regulated use of traditional methods of gathering small quantities should be implemented by the elders in the community supported by government agents.

Similarly, young people should to be taught the present and future value of medicinal plants in treating ailments. According to Pamplona- Rogers (2013) the value of natural remedies has been rediscovered and medicine is using more and more healing plants again. Though the effects of herbs may seem slower, the results are more effective in the long term especially in healing chronic diseases. In addition, it is also noted that at present more than 25% of the medicines sold in the pharmacies all over the world are directly derived from plants or were based on therapeutic agents derived from higher plants (Swaminathan and Kochar, 1989, and Pamplona-Roger, 2013). With this knowledge the young people can protect indigenous medicinal plants with the potential for use in developing plants based drugs as the world goes back to nature. This can be done by the elders and herbalists at the family level, community and also in institutions of learning. This can be promoted by including the local indigenous plants used in the community in the school curriculum.

In addition literate herbalists and vendors recommended that protected areas should be established in every zone to help protect locally available, endangered and frequently used medicinal plants. This should be protected by the County government to ensure medicinal plants will be available in future. This goes hand in hand with each individual family or clan setting aside a fraction of their land for indigenous vegetation, planting and protecting any medicinal plants within their land. This will ensure that the percentage of tree cover is increased as well as protection of medicinal plants. Further strict measures should be put in place to ensure that all catchment areas are protected and that farmers should till their land as per the guidelines of the ministry of agriculture. The vegetation should be restricted to indigenous plants along the river banks. Once the stream banks

are protected all kinds of vegetation will naturally grow and hence be a great resource to the present and future generations.

This study recommends a research institute in the County to carry out extensive identification of indigenous and locally used medicinal plants. This would assure the local herbalists and elders of the security of their knowledge on plants if it is done within the County. The indigenous plants once identified can be taught in schools beginning from the primary level.

Therefore the recommendation to promote wise use of medicinal plants include; young people should be taught traditional uses of plants as well as the present and future value of medicinal plants at the home and in school. There is need to establish protected areas, support planting and protection of indigenous plants and in particular medicinal plants. Finally regulation of the quantity of medicinal plants gathered by herb gatherers and vendors by the community leaders with the support from the government officials.

CHAPTER SIX
CONCLUSION AND RECOMMENDATIONS

6.1 Conclusions

The study sought to assess the utilization and conservation of traditional medicinal plants, threats to these plants and measures adopted by the community to promote conservation. Findings showed that residents of Keiyo South Sub-County widely use traditional medicinal plants to prevent and treat various ailments using herbs provided by the family, herbalists and herb vendors. Modern medicine in health facilities is widely used by the youth and some residents who were converted to Christianity. Some herbalists use modern medical reports obtained by their patients from hospitals when treating their clients. The medicinal plant parts which are used are mainly obtained from Kerio valley and Keiyo escarpments are believed to be more effective for all ailments.

Traditional medicinal plants are still available in Keiyo because herbalists and elders used traditional controls that regulated gathering and protection of these medicinal plants. These ensured that medicinal plants did not dry up due to over harvesting. In addition indigenous plants in cultivated farms were never uprooted giving room for regeneration of the tree. This system helped to protect medicinal plants in cultivated farms for future use among the community.

Despite the efforts to promote use of traditional methods of gathering, increased farming and human settlements are major threats to medicinal plants. This is due to modern farming techniques' where all plants are uprooted and the use of pesticides and herbicides to increase crop production and pasture. Increased human population coupled with increased gathering of medicinal plant parts due to increased number of users and collection for sale have led to rapid decline in availability of medicinal plants for use in treating patients.

Results also noted that knowledge of plants and their medicinal value is mainly with the elderly in remote rural areas of Keiyo Sub-County and among the herbalists who protect this knowledge as instructed by their fore fathers who taught them the knowledge. There

is however, an increasing rate of loss of the knowledge of plants and their medicinal use as evidenced by young household who were not aware of names of medicinal plants and their use. Most of these young household heads and the youth rely on modern health facilities for treatment. It is no wonder that the youth are alleged to be destroying medicinal plants in farms and also harvest them without traditional regulatory practices.

In spite of the foregoing, it was noted that, all is not lost since some household heads and herbalists plant some medicinal plants in their gardens and farms. They also protect young seedlings of indigenous plants known to them to have medicinal value. Other respondents with larger farms have reserved portions of their farms near water sources for indigenous vegetation. This helps conserve medicinal plants in the Sub-County that may be useful to the present and future generations.

Respondents were also aware of the decline in the availability of the medicinal plants and the destructive activities of gatherers. They gave suggestions on the establishment of protected areas in every zone by families or clans to protect medicinal plants in these zones. In addition, they suggested the need for regulations to guide the harvesting of medicinal plants in the community, and educate the young people on the medicinal plant use at home and at school to promote conservation.

Results also showed that, the effort by the government to protect indigenous vegetation in water catchment areas, exotic forests and indigenous forests has greatly helped protect some medicinal plants in the highlands. Though the government through the Kenya Forest Service does not target protection of medicinal plants, it has provided an environment that protects medicinal plants. Similarly, Chiefs and assistant chiefs use public meetings (*baraza*) to educate people on the need to protect indigenous vegetation and help resolve cases on destructive activities on plants in Kerio valley.

It was also noted that since it is now locally and globally acknowledge that traditional medicine especially plant based medicine plays a key role in providing primary health care, it is important for each community to conserve locally available medicinal plants.

This is an important resource for research and development on plant based medicines that are affordable and have limited harmful side effects.

From the study findings it was clear that medicinal plants are a major source of herbal medicine for treatment of ailments in the local community. However the loss of habitats, destructive harvesting of plant parts for sale by irresponsible gatherers may eventually lead to loss of the medicinal plants. This is a scenario similar to that of Hardin's theory of the Tragedy of the Commons, where people seek to maximize profits and production in farming and income by clearing all indigenous vegetation to the detriment of medicinal plants. The lack of cultural controls in the present day has further contributed to destructive activities of gatherers of medicinal plants since they are not regulated by any modern guidelines. Therefore respondents suggested that the local community needs to take action together with the government to provide guidelines that protect indigenous vegetation for medicinal purposes in the study area.

6.2 Recommendation

6.2.1 Recommendations for management, utilization and conservation

The study recommends the following measures for the management utilization and conservation of traditional medicinal plants in Keiyo South Sub-County:

1. The young people (youth) and children should be sensitized on the value of the indigenous plants in homes by family members who are knowledgeable and by teachers at school. Traditionally all young people were taught the medicinal uses of some plants. The Central Government should therefore enhance a school curriculum that will promote the value of local cultural resources and in particular the uses of known medicinal plants in each County. In addition a training institute should be established to train professional herbalist on best practices in herbal medicine. This will help the young generation appreciate the value of herbal medicine and the need to conserve indigenous plants for medicinal purposes. Those who are interested in herbal medicine can be supported to attain skills in current practices in herbal medicine. This is necessary because the world is

turning back to plant based medicines to treat ailments using plant based medicine which have fewer side effects and are readily available in the locality.

2. Medicinal plants that are widely used and endangered in the study area should be protected and planted by household heads and herbalists. In addition, every member of the community should protect local indigenous plants growing naturally in their farms and also plant others not found in their farms. Indigenous plants can be planted and protected along river banks in private farms, along the edges; or individuals to set aside a fraction of their land to plant or allow indigenous plants to grow. This should be spearheaded by mature household heads and herbalists who understand the medicinal value of indigenous plants. The County governments through the ministry in charge of agriculture should implement the 10% forest cover policy in every farm and plant diverse plants preferably indigenous plants.

3. In order to promote sustainable use of medicinal plants, the community at the village level should identify genuine local herbalists who practice traditional herbal medicine without destroying local plant resources. Mature traditional herbalists with the support of the County government can be mandated to guide and regulate harvesting of plants to curb the destructive actions of some gatherers and vendors. In addition, traditional controls and taboos guiding the practice of herbal medicine should be applied so that those barred from gathering medicine are restricted with the help of legal measures. Every member of the community should gather medicinal plants using acceptable ways that ensure sustainable utilization in order to promote conservation.

4. The "*Nyumba Kumi"* community policing policy introduced by the National Government is an appropriate tool for monitoring activities of members of the community who engage in unacceptable and destructive activities with regard to harvesting of medicinal plants and other plant resources. This will ensure that the work of every member of the community is known and is not harmful to resources and people in the community.

5. The County and National government should establish protected areas based on the encroached traditional sacred sites in every clan where medicinal plants may be obtained. During land demarcation advice of elders should be sought to guide on land to be conserved as per the traditions for the benefit of future generations. Sites identified should be protected by the community with the support of the County government. These traditional sacred sites should provide a conservation area where research can be carried out locally and internationally. Further conservation of indigenous vegetation can be done on the steep slopes on the escarpment which are still rich in plant varieties that the elderly residents feel should not be exhausted for use in the near future.

6. There is urgent need to document the medicinal plants, their uses and conservation to ensure that those which are threatened are protected in the community and the County. As indicated in the preceding chapters, the least threats have the potential to increase and become major threats if unchecked. Therefore, every community which had ignored or abandoned knowledge on medicinal use of plants needs to revisit their traditional knowledge and identify their God given resources. This should encourage every individual to plant and protect indigenous vegetation, conserve areas rich in indigenous plants as a source of medicines and control the destructive methods of gathering. Once this is achieved commercial gatherers can be regulated in gathering herbs from government protected areas or private land. This will ensure that medicinal plants are used and conserved as each community educates their young people on the available valuable plants and the need to protect them for the present and future benefits.

6.2.2 Recommendations for further research

Further research should be carried out to identify and document other medicinal plants and their uses in the study area and the County at large. This is because the information obtained is not exhaustive as some herbalists were reluctant to provide their knowledge.

Secondly, a study on the chemical analysis of traditionally used medicinal plants should be carried out to establish the active substances in these plants that make them effective in treating various ailments. Findings of the studies can be utilized to develop plant based

medicines for use. Lastly a study should be conducted to determine how active substances in medicinal plants can be patented to enable the Keiyo community to benefit.

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APPENDIX 1: INTERVIEW SCHEDULE FOR RESPONDENTS'

UTILIZATION AND CONSERVATION OF TRADITIONAL MEDICINAL PLANTS IN, KEIYO SOUTH SUB-COUNTY, ELGEYO- MARAKWET COUNTY, KENYA.

I am Monica Kurui, a postgraduate student at the University of Eldoret. I am conducting a research on utilization and conservation of traditional medicinal plants in Keiyo South Sub County, Keiyo Marakwet County, Kenya. I kindly request you to allow me to interview you on this topic. Your responses will be very important for my research. All your responses will be treated with confidentiality and will only be used for research purpose. Your participation will be highly appreciated.

Thank you very much.

Monica C. Kurui

SECTION A: BIO-DATA OF RESPONDENTS

Kindly respond to the questions below:

1. Gender: i). Male ---------- ii).Female ----------

2. Age in Years-

i) Below 35 years ------ ii) 36-55 ------- iii) 56- 75 ------- iv) above 75 ---------

3. Which Division/ward in Keiyo do you come from?

Metkei	Kabiemit	Chepkorio	Kaptarakwa	Soy South	Soy North

4. i) What do you do mainly for a living?

Farmer (crops)	Herder (animals)	Mixed farming	Traditional herbalist	Herb vendor	Herb collector	Employed	other

5. Give an estimate of the percentage contribution of herbal medicine to your income/living?

Less than 25%	26-50%	51-75%	76-95%	Over 95%

SECTION B: UTILIZATION OF TRADITIONAL MEDICINAL PLANTS

6. What are the common ailments in this region? Rank them from the very common(1), common (2), least common (3) using the table below.

Disease/ rank	**Very common -1**	**Common -2**	**Least common**
Chest pain((URTI)			
Malaria			
Cold/ flu			
Reproductive health problems(infertility)			
Abdominal ache			
Cancer			
Hiv/Aids			
Abdominal worms			

7. When someone is sick in the family or village, where do they seek treatment? Indicate the order of priority from 1, 2 and 3.

Treatment /priority	**First**	**Second**	**Third**
Visit health facility			
Find herbs to use			
Family provides herbs			
Visit herbalist			
Other(specify)			

8. What ailments do you treat? Adult or children ailments ……

9. Which zones are most medicinal plants gathered from?

Highlands -------- b) Keiyo escarpment ----------

Low lands(Kerio valley) --------- d) Others (places if any) ----------

Which are some of the traditional medicinal plants used to treat people among the Keiyo community?

a) Traditional medicinal plants used to treat people

Local name of plants	Botanical name	English name	Where the plant is found/zone	Part(s) used	Disease which it treat/prevents

b) Traditional medicinal plants found in Kerio valley

Local name of plant	Botanical name	Where the plant grows	Part used mainly	Ailment used to treat

c) Traditional medicinal plants found in Kerio escarpment

Local name of plant	Botanical name	Where the plant grows	Part used mainly	Ailment used to treat

d) Traditional medicinal plants found in the highlands

Local name of plant	Botanical name	Where the plant grows	Part used mainly	Ailment used to treat

11. (a) How were medicinal plants gathered traditionally? List

	Method	**Plant type**	**Other**
1	Uproot the plant		
2	Remove some roots		
3	Remove part of the bark		
4	Remove some leaves		
5	Remove tubers		

12) State the conservation measures used to protect the plants?

Protection measures	**How measure was used**
Size of part removed	
Frequency of gathering from one plant	
Taboos guiding gathering	

13. What are some of the effects of harvesting traditional medicine on the plants?

Part harvested	**Effect on plant**
Roots	
Leaves	
Bark	
Fruits	

14. What measures were used traditionally to gather herbs that ensured that the medicinal plants were available for future generations (sustainable)?

Restricted gathering to herbalists/trainees/elders	

Shifting cultivation to allow regeneration	
Medicinal plants used for local community only	
Medicinal plant used to treat not earn income	
Others(specify)	

15. What are some of the traditional measures used to conserve medicinal plants? Rank the most effective measure as follows; 1-most effective, 2 - moderately effective, 3 - not effective

Conservation measure	**1- Most effective**	**2 - Moderately effective**	**3 - Not effective**
Gather for use only			
Gathering early morning to regenerate			
Herbalists only or trainees			
Elders or guided gathering			
Restricted sacred areas			
Harvest small portion of plant			
Controlled seasons of gathering			
Guided by taboos on harvest			

16. What is the value of traditional medicinal plants among the Keiyo?

Treat minor ailments	
Generate income	
Treat chronic ailments- cancers and reproductive problems	
Source of power for herbalists	
Other	

SECTION C: THREATS TO TRADITIONAL MEDICINAL PLANTS

17. a) Are medicinal plants easily available in your environment (village)?

Yes --------- No ----------

b) Explain your answer? ----------

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18. a) Have you noticed any changes over time in the availability of medicinal plants in your environment? Yes ------- No ----------

b) If yes, what are the changes? What has caused these changes?

Changes	**Cause of change**

19. In your opinion, what are the major threats to traditional medicinal plants among the Keiyo community? Please indicate from the greatest to the least threat as follows: 1. biggest threat, 2. moderate and 3. the least threat

Threats	**1 –Biggest threat**	**2- Moderate**	**3 Least threat**
Overharvesting of plants			
Increased farming activities			
Overgrazing by animals			
Lack of knowledge on use			
Charcoal burning of plants			
Commercial harvesting			
Lack of traditional controls			
Trade in medicinal plants			
Increased human settlements			
Lack of control over harvesters			
Other			

20. List some traditional medicinal plants that are threatened/endangered in this area? Indicate from most endangered (1), endangered (2) and not endangered (3)

Medicinal Plants	**Most endangered (1)**	**Endangered (2)**	**Not endangered (3)**

SECTION D: MEASURES TAKEN TO CONSERVE TRADITIONAL MEDICINAL PLANTS

21. In your view, who are the main players (people) in conservation of medicinal plants? Rank the most active player as follows; 1- most active, 2-active, 3- not active

	1- most active	**2-active**	**3- not active**
Government officials – chief, D.O,			
Traditional herbalists			
Medicinal plant gatherers			
Herb vendor			
Family elders			
Village elders			
Others (Specify)			

22. a) What Measures have been adopted by the community to conserve traditional medicinal plants? Rank the common measure as follows; most common- 1, common-2, not common-3

Measures	**Most common- 1**	**Common -2**	**Not common -3**
Planting medicinal plants in home gardens			
Community monitoring of plants gathered			
Establishing sacred places for the plants			
Education on harvest methods			
Government efforts e.g. collection of seeds to conserve			
Protecting existing sacred places			

b) What measures have you/ herbalists taken to alleviate the threats to medicinal plants?

i)----------

ii) ----------

23. What Measures have been adopted by other herbalists to mitigate the threats to medicinal plants?

i)----------

ii) ----------

iii) ----------

iv). ----------

24. What Measures have been adopted by the government to alleviate the threats to medicinal plants?

i)----------

ii) ----------

iii) ----------

iv) ……..

25. a) Are the measures used to conserve medicinal plants adequate?

Yes ---------- No ----------

Please explain why. ----------

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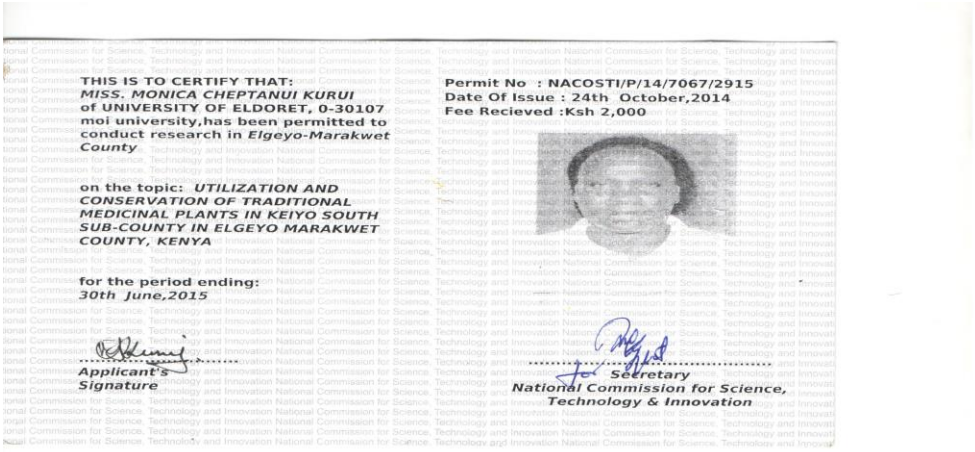
26. What other measures do you recommend to promote wise use and conservation of medicinal plants?

i). ----------

ii) ----------

iii). ----------

APPENDIX 2: RESEARCH PERMIT



THIS IS TO CERTIFY THAT:
MISS. MONICA CHEPTANUI KURUI
of UNIVERSITY OF ELDORET, 0-30107 moi university,has been permitted to conduct research in *Elgeyo-Marakwet County*

on the topic: *UTILIZATION AND CONSERVATION OF TRADITIONAL MEDICINAL PLANTS IN KEIYO SOUTH SUB-COUNTY IN ELGEYO MARAKWET COUNTY, KENYA*

for the period ending:
30th June,2015

Permit No : NACOSTI/P/14/7067/2915
Date Of Issue : 24th October,2014
Fee Recieved :Ksh 2,000

Applicant's Signature

for Secretary
National Commission for Science, Technology & Innovation

CONDITIONS

1. You must report to the County Commissioner and the County Education Officer of the area before embarking on your research. Failure to do that may lead to the cancellation of your permit
2. Government Officers will not be interviewed without prior appointment.
3. No questionnaire will be used unless it has been approved.
4. Excavation, filming and collection of biological specimens are subject to further permission from the relevant Government Ministries.
5. You are required to submit at least two(2) hard copies and one(1) soft copy of your final report.
6. The Government of Kenya reserves the right to modify the conditions of this permit including its cancellation without notice

REPUBLIC OF KENYA

National Commission for Science, Technology and Innovation

RESEARCH CLEARANCE PERMIT

Serial No. A 2709

CONDITIONS: see back page