

**ASSESSMENT OF DIVERSITY AND ROLE OF NON-TIMBER FOREST
PRODUCTS IN THE LIVELIHOODS OF RURAL COMMUNITIES IN
KIBAUNI HILLS FOREST, MACHAKOS COUNTY**

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DECLARATION

This project report is my original work and has not been presented for a degree in any other university

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DECLARATION BY SUPERVISORS

This project report has been submitted with our approval as the university supervisors

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DEDICATION

To my wife Faith and children Keith and Shantell

ACRONYMS

CBO	Community Based Organization
CIFOR	Center for International Forestry Research
DFO	District Forest Officer
DMS	Degrees Minutes Seconds
FAO	Food and Agriculture Organization
Ha	Hectares
HH	Households
KFS	Kenya Forest Service
M.a.s.l	Meters above sea level
NGO	Non-Governmental Organization
NTFP's	Non-Timber Forest Products
PA	Provincial Administration
SPSS	Statistical Package for Social Science
USD	United States Dollar
WHO	World Health Organization

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ABSTRACT

This study was carried out to determine the role of Non-timber Forest Products (NTFPs) towards improved livelihoods in local communities around Kibauni hills forest, Machakos County. Data was collected from three villages adjacent to forest using structured interviews, focused group discussion and participant observation. Quantitative data was collected through random sampling where a total of 99 households were sampled. Secondary data was collected from the Sub-County Forest Offices and existing literature materials and analyzed using appropriate statistical tools. The study result showed that local communities of the study area depend on a portfolio of income sources for living. Crop production, animal husbandry, forest and non-farm activities were the main livelihood strategies. 29% of the respondents were getting NTFP's from the forest of which 83% utilized NTFPs for medicinal purposes. Most of the forest adjacent communities were small scale farmers and local end-uses of NTFPs included fuel wood, spiritual uses, food, construction materials, medicine, water sources, grass for pasture, and traditional rites among others. The study concluded by recommending that policies, strategies and interventions that aim at reducing peoples dependence on natural resource (forest and forest resources) should be put in place to give due attention to community based natural resource management; capacity building of the newly formed Kibauni Hill Community Forest Association to enable them take up the challenges of management of the forest resources and a comprehensive study was needed to examine and quantify the amount of NTFPs collected over time against the existing stock.

CHAPTER ONE

1.1 INTRODUCTION

This chapter discusses the literature reviewed related to research problems. It looks at the utilization of Non Timber Forest products for the general global perspective, utilization by different communities and how the interaction between forest adjacent communities has happened in different parts of the world.

1.2 BACKGROUND

Throughout history, humans have derived many uses and benefits from non-timber forest products (NTFP's) found in their own regions. Initially, wild plants were collected from their natural habitat followed by the cultivation of those that were used most commonly. Global awareness of the crisis concerning the conservation of biodiversity is assured following the United Nations Conference on Environment and Development held in June 1992 in Rio de Janeiro. Of equal concern to many world citizens, is the uncertain status of the indigenous knowledge on Non Timber Forest Products (NTFP) that reflects many generations of experience and problem-solving by thousands of ethnic groups across the globe.

Very little of this knowledge has been recorded, yet it represents an immensely valuable data base that provides humankind with insights on how numerous communities have interacted with their changing environment including its floral and faunal resources. Forestry is a productive sector with significant effects on meeting national socio-economic and environmental functions as well as the improvement of rural livelihoods. Non-Timber forest products (NTFPs) in

particular have been widely advocated by conservation and development organizations as a potential alternative livelihood strategy, particularly among vulnerable forest dependant households

Tropical forests provide ample goods and services; these mainly include timber and Non-Timber Forest Products (NTFPs). NTFPs have been studied by researchers from many different academic fields and each field used a slightly different definition of NTFPs. NTFPs are defined as any product or service other than timber that is produced in a forest (CIFOR, 2004). They include fruits, nuts, vegetables, fish, medicinal plants, resins, essences, and a range of barks and fibers such as bamboo, rattans, and a host of other palms and grasses". NTFPs are hence an indispensable part of the livelihood strategy of communities living in and near forests.

Studies have revealed that Non-timber forest products (NTFPs) constitute an important source of livelihood for millions of people across the world. In India alone it is estimated that over 50 million people are dependent on NTFPs for their subsistence and cash income (Shaanker *et al.*, 2004). Forest-based activities in developing countries, which are mostly in NTFPs area, provide an equivalent of 17 million full-time jobs in the formal sector and another 30 million in the informal sector, as well as 35% of all rural non-farm employment (Duong, 2008).

NTFPs were for long overshadowed by timber products and have received increased policy and research attention only in the last few decades due to their importance in the livelihoods of the forest adjacent communities. This increased policy and research attention was based on three propositions (Arnold and Ruiz-Perez, 2001): The first was that NTFP contribute significantly to the livelihood and welfare for households living in and adjacent to forests. Secondly, exploitation

of NTFP was ecologically less destructive than timber harvesting and other forest uses, and the third point was that NTFP production and development by giving a foundation for sustainable economic development could reduce tropical deforestation. These propositions encouraged researchers to put much effort on the determination of monetary values of NTFPs as well as their contribution to overall livelihoods.

For instance, the studies by Neuman and Hirsch (2000) and Campbell and Luckert (2002) showed that NTFPs contributed to over 50% of the total livelihood income in some areas to less than 20% in others. On the other hand, some studies also made it clear that most rural communities do not depend exclusively on NTFPs for their livelihood, but NTFP exploitation complemented other livelihood activities (Berhanu, 2004; Shackleton and Shackleton, 2004). Some studies, for instance, (Ros Tonen and Wiersum, 2005) argued that the contribution of NTFPs based livelihoods had more potential in agroforestry cultivation system than through natural forest exploitation. However, intensive production and management of NTFPs in anthropogenic vegetation type and semi domestication better contributed to the livelihoods and welfare of people depended on the forest due to their higher productivity. Thus, these propositions were still subject to policy debate. So addressing these policy issues required an improved understanding of how households interact with forest resources and their behavior regarding collection of NTFPs from forested landscape.

Regarding the positive impact of NTFPs to forest conservation. Duong (2008) described it as “harvesting of NTFPs that has a lower impact on the forest ecosystem than timber harvesting and that can provide an array of social and economic benefits, particularly to community operations, this can therefore be an important component of forest ecosystem management”.

Notably, for the past three decades, there has been a growing awareness on the importance of NTFPs especially for food and medicinal uses. This growing awareness is not only for the role they play in the subsistence economy, but also for their potential and real contribution to the economies of many developing countries (FAO, 1998). Similarly, NTFPs are important forest products especially in dry land areas where they form alternative sources of livelihoods contributing to poverty alleviation through generation of income, providing food and improved nutrition, medicine and foreign exchange earnings (Chikamai and Kagombe, 2002).

For instance, research done in six communities in Tanzania found that farmers were deriving up to 58% of their cash income from the sale of honey, charcoal, fuel wood, wild fruits and vegetables (CIFOR, 1999). On other instances, according to Gardei (2006), majority of farming communities in South West Ethiopia are forest dependant. The forest is the major source of their livelihood and subsistence by providing them with a variety of NTFPs. More than 65 percent of the households who were involved in NTFP's did earn more than one thousand Birr (about USD 100) a year from the production of NTFP's alone, while around half of the people used the forest to generate cash income. For many Ethiopians, the money earned from collecting, selling or processing forest products provided an indispensable contribution to household income and food security. Income from NTFPs enabled rural households to purchase consumable goods and pay for basic expenses.

Kenya hosts about 17 million ha of forested land (about 3.51% of the total Sub-Saharan Africa forest cover), of which about 16,865,000 ha is under natural forest (EarthTrends: Forests, grasslands and drylands, 2003). Outside the gazetted forests, there are other large tracks of forests in trust lands, including national parks and reserves, hill forest reserves and privately

owned lands covering about 0.5 million ha (Kenya's forest resource assessment in the EC-FAO Partnership Programme Report, 2000; The Kenya Forests Act, 2005). Woodlands, bushlands and wooded grasslands, mainly found in the arid and semi-arid lands cover 37.6 million ha, while forest plantations cover about 170,000 ha of land (The Kenya forestry master plan, 1994–2020, 1994).

Kibauni hills forest is located at the heart of Kibauni division, Mwala Sub-county in Machakos County and it's endowed with numerous Non Timber Forest Products that the community utilizes for their sustenance. However, the forest over time has been faced with an increasing threat of human overexploitation and destruction of plant resources at an alarming rate that calls for proper research, documentation and management of its natural resources as well NTFP's.

All in all, there are still a lot of studies needed from various localized areas like Kibauni hills forest to have reliable national data and information on the contributions of NTFPs in Kenya. A better grasp of how and why local people use forest resources around them is deemed critical to the long term realization of both development and; conservation objectives. Therefore, the focus of this study is to provide information on the role of NTFP's for rural livelihoods of communities living around Kibauni hills forest.

1.3 STATEMENT OF THE RESEARCH PROBLEM

Many households in rural and forested areas around the world depend heavily on NTFPs for survival. World Bank (2001) estimates that one out of four of the world's poor depend directly or indirectly on forest resources for their livelihood.

Kibauni division which harbors Kibauni hills Forest forms one of the socially and economically marginalized communities, living on a marginal resource base and in isolated condition. This community has been living in or nearby the forest since ages and exploit plant resources to fulfill their most of the basic needs.

Despite having close relation and sound knowledge with forests and high value-low volume forest products, the community is still poverty ridden. The fewer alternatives available to maintain livelihood and the degrading natural resource base are further pushing the community to the margins of development. This community possesses an immense knowledge on forest products and utilizes the various plants to cope with the environment. The NTFPs are used for food demands, livestock fodder, energy source, medicinal purpose and also for earning cash income.

Despite the commercial, social and ecological value of these resources, very few studies have been done in the study area. The natural resource base of NTFPs has been decreasing over time with increased population and high demand for the products, lack of documentation, reduced resource base and gradual replacement by modern technologies putting the variety of uses of these plants resources under the threat of extinction. This study was carried out to fulfill this gap by analyzing the contribution of NTFP towards improving the livelihoods of the community living around the forest for better, effective and sustainable management of Kibauni hills resources

1.4 RESEARCH QUESTIONS

1. What are the different types of NTFP's collected by communities living around Kibauni hills forest?
2. How are NTFP's utilized by the forest adjacent communities around Kibauni hills forest
3. What are the possible management options for sustainable management of NTFP's of Kibauni hills forest?

1.5 OBJECTIVES

1.5.1 MAIN OBJECTIVE

The main objective of this study was to assess the diversity of Non-Timber Forest Products (NTFP's) and their Role in the Livelihoods of Rural Communities in Kibauni hills forest, Machakos County.

1.5.2 SPECIFIC OBJECTIVES

1. To assess the diversity of NTFPs used by rural households for subsistence and livelihoods in Kibauni hills forest area
2. To identify plant species used for NTFP's and describe the utilization of NTFP's of Kibauni hill forest
3. To document local medicinal knowledge and management practices regarding the utilization of NTFP of Kibauni hill forest

1.3 JUSTIFICATION OF THE STUDY

NTFPs constitute an important source of livelihood for the millions of people from forest fringe communities across the world and also serve as vital livelihood safety nets in terms of hardships to the poor people. The Kenya forestry sector has been under serious reforms since the enactment of the Forest Act 2005 to embrace community participation in the management of the forest resources. Growing interest by different institutions and interest groups has also strongly focused on promoting the NTFPs management as a program for poverty reduction that is to be achieved by providing opportunities for income and employment for poor, women and disadvantaged people. NTFPs are useful in sustenance of rural economics due to their richness in variety such as different sources of food, fiber and, herbal medicines etc. However due to lack of proper management and utilization of NTFPs, rural communities don't gain much benefits from their utilization.

Investigation on contribution of NTFPs and their sustainable utilization will help to push up the economic status and fulfill the basic needs of local people. Hence, this study is very much relevant in the context that it focuses on assessing the contribution of NTFPs on the livelihood of the most deprived, segregated and underserved rural community of people living around Kibauni hills forest.

Besides, the research findings will be helpful to advocate to the development planners, policy makers/donors, resource managers and researchers about their social position and overall reality on the contribution of NTFPs to the livelihoods of these communities. It will help to guide

sustainable management of NTFPs and carry out the programmes that bring the marginalized people into the mainstream of the forestry sector development.

1.6 SCOPE OF THE STUDY

The design of this research was meant to give light on how far NTFPs have been contributing in the livelihood of people living around the forest edges in Kibauni hills, Machakos County. The study will be able to help more reflection on the utilization and management practices of NTFPs by the forest adjacent communities in the study area. The investigation on the utilization and extraction of NTFPs will provide guidelines for removing the bottleneck of NTFPs management, domestication and commercialization. Furthermore, the findings of the study will assist policy makers in policy formulation for bringing a highly marginalized segment of the nation into the mainstream of forest resource development.

Due to time and budget constraint, this study covered only limited areas of the Kibauni-hills.

This study is focused particularly on NTFPs that are utilized by the communities living around the hills for improved livelihoods and more detailed study is needed to confine itself to the economics of each identified NTFP for commercialization and trade.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter describes the findings of past research studies conducted by various researchers as well as their views and opinions about different aspects of study in the light of the objectives set forth. This would facilitate the present research study to use meaningful information and subject them to sound reasoning and strong interpretation.

2.1.1 Definition of Non-Timber Forest Products

The term ‘forest product’ almost immediately brings to mind wood and wood-based products, but there are equally important non-wood products that are collected from the forests. These include all botanicals and other natural products extracted from the forest other than timber, known as Non-Timber Forest Products (NTFPs). NTFPs are components of the forest system that exist in nature and are generally not cultivated. Non-timber forest products (NTFPs) are plants or plant parts that have a perceived economic or consumption value sufficient to encourage their collection and removal from the forest (Duong 2008).

It can also be referred to as all the resources or products that may be extracted from the forest ecosystem and are utilized within the household or are marketed or have social, cultural or religious significance (FAO, 1990). These include plants and plant materials used for food, fuel, storage and fodder, medicine, cottage and wrapping materials, biochemicals, as well as animals, birds, feather, reptiles and fish. NTFPs which are harvested from within and on the edges of

natural and disturbed forest, may be all or part of a living or dead plant, lichens, fungi, or other forest organisms. It therefore, represents a diversity of potential products sought after by a wide variety of people on a continuum of scales and intensities (FAO, 1990).

It is this importance and significance of NTFPs that the interaction between forest and forest dwelling communities received increasing attention from social scientists and policy makers. This was particularly true in the case of benefits from non-timber forest products (NTFPs) and consequently sustainable management of NTFP for improving the livelihoods of the poor (Shylajan and Mythili, 2007). Many households in rural and forested areas around the world depend heavily on NTFPs for their survival. For instance, the World Bank (2001) estimated that one out of four of the world's poor depended directly or indirectly on forests for their livelihood.

During the last decade, there has been a dramatic increase in interest and research of NTFPs (Shillington, 2002). This is due to the increasing recognition of the fact that NTFPs provide important community needs for improved rural livelihood, contribute to household food security and nutrition, help to generate additional employment and income, offer opportunities for NTFP based enterprises, contribute to foreign exchange earnings, and support biodiversity and other conservation objectives (FAO, 1995). Many local people use varieties of wild plants in traditional ways for their daily requirements as well as primary health care. Studies have shown that some 80 percent of the population of the developing world use NTFPs for health and nutritional needs (WHO, 2000).

These studies and the perception of NTFPs as economically important to the rural livelihoods has assisted in initiating theories that harvesting of these products provides potentially improved

incomes at the same time it decreases the rate of deforestation and environmentally degrading activities. The link between conserving biodiversity (environmental conservation) and supporting human communities is based on the idea of sustainable development.

In terms of NTFPs, sustainable development refers to the economic development of communities (for instance, income generating activities) that simultaneously conserve and protect biodiversity. Neumann and Hirsch (2000) stated that the underlying belief of sustainable development is that a “community and its members will conserve and protect forest resources if it receives the economic benefits from sustainable forest use.” Thus, for NTFPs to be tools of sustainable development they must be harvested in such a way as to not ‘harm’ the forest ecosystems so that there is a continuous supply of resources to adequately support economically the human communities and ecologically the forestry community.

The issue of sustainable harvest, however, has created much debate in NTFP literature. Delineating sustainable harvest entails many variables, including: the type of harvest (*e.g.* root, leaf, fruit, etc.), amount harvested, process of harvesting, attributes of the species harvested, and the type of forest ecosystem from which that product is harvested (Neumann and Hirsch, 2000). Researchers have identified NTFPs as key resources in a strategy to overcome difficulties in time of uncertainty that can be pursued by workers who find themselves without jobs, and by individuals whose employment opportunities are chronically limited by age, gender and disability. The independent nature of the activity is also suitable for people who do not fit comfortably within the demands of contemporary wage labor. The primary requirements to work with NTFPs are knowledge of products, their uses and locations, and the time, energy and mobility to access (Pierce *et al.*, 2002). Panayotou and Glover (1994) and Clay (1992) and Ruiz

Perezi (2005) all stated that NTFPs attracted early attention among practitioners and researchers alike, based on three largely untested assumptions:

- i) NTFPs are widely distributed, contributing more than timber to forest people's livelihoods;
- ii) Their harvesting is ecologically more friendly than alternative forest or non-forest uses , and
- iii) Increasing their commercial value will contribute to an increased appreciation of forests, therefore contributing both to poverty alleviation and to forest conservation.

Moreover, Shillington (2002) also stated that many international development agenda promote NTFPs as tools for sustainable development and gender equity. The promotion of gender equity materializes through NTFPs' ability to improve the economic situation of households by incorporating women as key actors, since they are recognized as the main extractors, processors, and marketers. So NTFPs are viewed as a potential means to better the livelihood strategies of rural populations while simultaneously sustaining the biodiversity of forested areas.

2.2 CATEGORIES AND USES OF NTFPS

Forests contribute to all aspects of rural life: providing food, fodder, fuel, medicines, building materials, and materials for all sorts of household items, as well as many more intangible benefits such as cultural symbols, ritual artifacts and locals (Falconer, 1995). There is, however, great variation in the extent to which forest products are used from area to area and even between households within a community. Because of this variation, it is difficult to abstract generalizations about NTFPs use. Indeed, this variation reflects the extent to which NTFPs are an integral part of rural livelihoods. People only exploit resources from the forests when they cannot

be found on nearby fallow lands, or when they are collecting for trade and better supplies are available in the forest. Classifying these products into like categories is an important first step of understanding the NTFPs industry.

NTFPs can be classified into different categories, based on the purpose of use (for example, as food, fuel, medicine, house hold utensils, farm implements); level of use (self-supporting, commercial); the part of plants harvested (leaf, fruit, stem, roots) and trophy from wild animals (Jeannette, 2000).

2.2.1 Food Products

From various studies, many food products are harvested each year from the forest and are used personally or taken to the family for consumption especially during the dry season to cushion the family during harsh climatic conditions. These food products include wild fruits and berries, herbs, essential oils, honey, nuts, seeds, spices, coffee, tea, insects, edible tubers and roots, and saps. Wild forest plants comprise a great portion of the daily diet for many people, Shillington (2002).

In central and West Africa, for example, approximately 1,500 species of wild plants are collected for consumption. Oiled seeds, leaves and fruit are among the non-timber forest products which contain many of the necessary vitamins and other nutritional elements for survival. Falconer (1992) noted that forest foods continue to contribute significantly to the diet of many rural households while a great variety of goods are gathered from forest and fallow lands, the forests commonly supply tubers, mushrooms and snails.

Many different fruits and seeds are eaten as snacks on the farm or in the bush, especially by children. Foods gathered from fallow and forest areas are added to sauces as flavoring, as medicines or substitutes for staple food during periods of scarcity and especially for their healing properties. Collectively, these foods add diversity and flavor to the diet as well as providing protein, energy, vitamins and minerals (Falconer, 1992).

2.2.2 Medicinal value

This includes medicinal plants, bark, resin and seeds (Andel, 2006). Forests supply medicines for the vast majority of urban and rural people and medicines are consistently ranked as one of the most-valued forest products by diversity of people. Falconer (1992) state that all people use plant medicines and the majority of them (80%) rely on wild plants as their main medicinal source. Even amongst urban households plant medicines are widely used, especially as first aid. Although there are many different healing practices and beliefs, common to most are the use of plants. Knowledge is not confined to specialist healers; common plant treatments are known and used by the majority of people.

Women play a critical role in this regard as it is usually them who administer first aid to their children. Knowledge of common medicines is passed on through families and this knowledge continues to evolve as the environment changes. Many forest plants have been used for their medicinal value for many years. In Sub-Saharan Africa, for example, health care is largely a forest-based service. Barfoot (2006) indicated that there are many reports that caution the extraction of non-timber forest products from the forest, especially of medicinal plants. It has been noted that plants used for medicinal purposes are harvested more than any other product from the natural world. China, for example, is home to approximately 24,000 native species,

with more than 10,000 of these being used medicinally. It is also estimated that 50,000 species of plants are used medicinally throughout the world.

2.2.3 Fuel (Energy supply)

Andel (2006) also noted that fuel includes fuel wood (firewood, charcoal), petroleum substitutes, and lighting resins. All rural households rely on fuel wood to meet all their energy needs. Most fuel wood is collected from farms, bush fallows and the forest. The supply of fuel wood is not a problem in any of the study villages. Although in some cases, where the fuel wood is used commercially such as in markets or preparation of cooked foods for sale, fuel wood collection may be difficult and claim that readily available supplies are scarce (Falconer, 1992).

2.2.4 Animal Fodder

Most of the households collect fodder for their livestock even though they are often free ranging for part of the day (Falconer, 1992). Forests play a significant role in feeding domestic and wild animals through the provision of fodder trees and fodder shrubs. The importance of fodder trees has received recognition by the wider scientific community in recent years, as the number of livestock increased proportionally with the increment of human population in most of tropical countries. Then, it is assumed that fodder plants are important components of animal feed particularly as suppliers of proteins and supplement feed in dry seasons (FAO, 1992).

2.2.5 Honey product

Beekeeping is as old as human history itself (FarmAfrica, 2008). Beekeeping is an ancient tradition in Africa and is practiced by the wider rural community. For example, studies in Ethiopia suggested that Ethiopia has favorable climate for an extended flowering season that supports the involvement of farmers in beekeeping activities (EFAP, 1994).

Ethiopia has been an important honey and beeswax producing country, which dominated by local consumption. Annual honey consumption nearly equals annual production, currently estimated at 43,000 tones. As stated by Ayalew and Gezahegn (1991), Ethiopia is the leading honey producer in Africa and one of the ten largest honey and beeswax producing countries in the world. Moreover, Reinhard and Admasu (1994) indicated that beekeeping has significant role in forest conservation and development. This is because beekeepers conserve the forest or fragmented large trees for hanging beehives and to remain the plant to stay long with flowering so that they could collect honey frequently.

2.2.6 Construction materials

These include forest products like palm leaves or grass for roof thatch, bamboo, wood (sticks and poles) (Andel, 2006). Building materials such as cement and aluminum roofing sheets are available, but the majority of rural households in the study area cannot afford these, relying instead on the forest for their building materials. Falconer (1992) explained that, in most cases, rural houses are mud and wattle, utilizing sapling-size trees as standing poles and raphia (leaf petioles) or bamboo to produce a lattice. While specific species are sought after for particular needs, a great variety of different materials are used, even within one community

2.2.7 Household utensils and agricultural equipment

This encompasses forest products such as fibers, baskets, furniture, bow and arrow, dye, paint, varnish glue (Andel, 2006). NTFP also features commonly in the material culture, providing household, agricultural and marketing equipment. other essential household items include mortars, furniture and sleeping mats, wood for hoe and other tool handles, farm implements, poles for crop storage containers and crop dryers, canes for baskets, crop drying mats, fish traps and other fishing equipment. Most items are made within the household rather than being

purchased and every household uses items made from NTFPs in their daily lives (Falconer, 1992).

2.3 ROLE OF NTFP IN PROMOTING FOREST CONSERVATION

NTFPs have also been trusted to contribute to the conservation of biological diversity via sustainable harvest techniques or agro-forestry arrangements. The interest in NTFPs has grown with increasing awareness of tropical forest deforestation and rising acknowledgment of the need to add value to forest resources, in order to compete with other land uses (Martinez, 2004). The origin of NTFPs conservation role emanates from the assumption that: NTFPs, much more than timber, can contribute in important ways to the livelihoods and welfare of populations living in and adjacent to forests; providing them with food, medicines, other material inputs, and a source of employment and income, particularly in hard times, and the exploitation of NTFPs is less ecologically destructive than timber harvesting and therefore provides a more sound basis for sustainable forest management.

Increased commercial harvest of NTFPs should add to the perceived value of the tropical forest, at both the local and national levels, thereby increasing the incentive to retain the forest resource, rather than conversion of the land for use for agriculture or livestock (Arnold and Perez, 1998). Through the holistic management of NTFPs, an attempt is made to maintain and sustain the resource and its users; contribute to sustainable development; conserve forests and biodiversity, and to promote non-traditional enterprises to improve local economies and diversify the economic base of the rural poor (Falconer,1997). Many who approach NTFPs sector as conservation tool begin with a set of basic assumptions.

It is assumed that natural forest will have greater long-term benefits if left standing; that local people will tend to manage their forest resources more sustainably if they directly benefit from doing so; and that poverty in forest communities is both caused by, degradation of the forest resources (Clarke, 2004). The logical conclusion is that if poverty can be alleviated through harvesting forest products, then there will be greater incentive to conserve those forests (Neumann and Hirsch, 2000).

The enthusiasm for NTFPs in economic development and conservation grew primarily from reports of their high economic value. Such reports include research by Peters *et al.*, (1989) on fruit and latex extraction in the Amazon, where they reported that the net present value of fruit and latex was more than twice that of timber. They argued that even though an individual timber harvest can have a greater value than that of a NTFP, when measured over a longer period of time the net present value of NTFPs can exceed that of timber (Peters *et al.*, 1989).

The exploitation of NTFPs is viewed as more compatible with biodiversity conservation than timber extraction or agriculture. When standing forest is needed to supply particular plant products such as aerial roots or rattan, commercial extraction can contribute to forest conservation, as harvesters often deliberately protect useful trees from logging. If people make money by selling wild plant products, they will not need to cut down trees to make a living. But, when prices for NTFPs drop and harvesting is no longer economically viable, or if extractors are expelled from customary collection sites, people may shift to more destructive activities such as logging, cash-crop agriculture or cattle ranching (Andel, 2006).

The maintenance of a forest like structure in relation to NTFP production enables the maintenance of some of the conventional forest environmental function like carbon sequestration, nutrient recycling, erosion control, and hydrological regulation (Arnold and Pérez, 2001). Nonetheless, still as compared to alternative land use system, forest and home gardens managed for NTFPs production also retain a large amount of plant and animal biodiversity (Michona and Foresta, 1997).

Although the various studies highlighted the often important role of NTFPs for local communities, they also have led to doubts about the potential of NTFP extraction from natural forests to contribute simultaneously to forest conservation and poverty alleviation (Arnold and Ruiz Perez, 1998; Ros-Tonen, 2000). It was found that it is not at all easy to serve ecological, economic and social objectives simultaneously through the sustainable extraction of NTFPs. Studies regarding ecological impact of NTFPs exploitation indicated that commercial harvesting of NTFPs does have a number of negative impacts, including a gradual reduction in the vigor of harvested plants, decreasing rates of seedling establishment of harvested species, potential disruption of local animal populations and nutrient loss from harvested material (Peters, 1996).

This consequently brought reduction of composition, abundance and genetic diversity of forest species in general and those of a more restricted habitat in particular (Peters, 1996). The counter proposition is that low intensity extraction of NTFPs from natural forest can have a low impact on the local ecology and on biodiversity at the landscape scale and even at the species level (Belicher *et al.*, 2005). Increased production of NTFPs might be achieved through human intervention such intervention may range from enriching forests with valuable NTFPs species to

cultivation of NTFPs species in agroforestry systems. The value of NTFPs In such anthropogenic vegetation types is higher than that of undisturbed natural forests (Ros-Tonen and Wiersum, 2005).

2.4 IMPORTANCE OF NTFP FOR RURAL LIVELIHOOD

Millions of people throughout the world make extensive use of biological products from the wild. These items, commonly termed as Non Timber Forest Products (NTFPs), are harvested for both subsistence and commercial use, either regularly or as a fall-back during times of need. They add to peoples' livelihood security, especially for rural dwellers. NTFPs may also have marked cultural significance and value (Shackleton and Shackleton, 2004). Estimates done by the WHO (2000) revealed that 80% of the people living in developing countries use wild plants to meet some of their health and nutritional needs. NTFPs are conventionally viewed as the products of the poor unlike that of the timber for the rich. However, evidence indicated that in developing countries forest products are also an integral component of the livelihood of a sizeable proportion of urban households (Byron and Arnold, 1999).

NTFPs cover a wide range of products with different characteristics, which are utilized in a variety of context and play important roles in various household livelihood strategies .This involves thousands of plant and tree species, most of which are consumed within the household of the gatherers and are not traded in markets. Studies conducted by (Shackleton and Shackleton, 2004) show that extraction, processing, and trading of NTFPs is often the only employment available for the population in remote rural areas. Adepoju (2007) indicate that NTFPs are a dependable source of income and food supply in the rural areas.

However, it is a diminishing resource as a result of its dependency on land which is known to be under pressure of depletion from agriculture and development of public infrastructures. Several opportunities for improved rural development are linked to NTFPs. In many areas, rural populations are traditionally depended on local forest resources to provide additional income through collection and marketing of NTFPs. Where employment opportunities from traditional industries are declining, workers looking for alternative income sources often turn to collection of these products from nearby forest.

NTFPs also play a role in the household economy of not only the poor, but also the rich (Nguyen, 2006). In Vietnam, more than 320,000 people are involved in NTFP production, Riadh (2007). There is a growing agreement that Non-Timber Tree and Forest Products (NTFPs) play an important role in the livelihoods of the rural poor as a source of food, medicine, construction materials, and income. In other studies, it has been estimated that there are more than 60 million highly forest dependent people in Latin America, West Africa, and Southeast Asia, with an additional 400-500 million people directly dependent on these natural products (Riadh, 2007).

Subsistence use of NTFP represents the greater part of its value to households. However, they are also a source of cash income such income seldom appears to account for a large share of a households total income, but complements other livelihood activities (Shackleton and Shackleton, 2004). Being able to collect and use NTFP to meet daily needs of energy, shelter, food and medicine, allows the scarce cash resources to be used to secure other household needs and to attempt to accumulate the necessary asset base for a more secure livelihood.

This includes the education of children, investment in agricultural tools, or capital for activities that generate income. Such a cost saving would best be reflected by replacement values of the goods that the NTFPs substitute, rather than direct-use value based on farm-gate prices (Shackleton and Shackleton, 2004).

According to Shackleton and Shackleton (2004), NTFPs provide livelihood benefits in assisting households to cope in times of adversity manifested as sudden changes in the economic, social or bio-physical environments in which households exist and function. It provides the poor quick cash or auto consumption goods especially in the event of unpredicted shortfalls, such as failure of agricultural crop or disasters (Angelsen and Wunder, 2003). Shackleton and Shackleton (2004) stated that this sudden change includes events like a death or retrenchment of the head of the household, droughts, floods, frosts or disease leading to crop failure or death of livestock, major economic structural adjustment, or unanticipated and large increases in costs of staple foods and goods. During such times it is common for rural households to turn to NTFPs to tide them over what they perceive is a temporary setback.

Money earned from the sale of forest products has also been shown to complement agricultural income and provide financial cost of health, and house hold expenses (Arnold and Ruiz Perez, 2001). So safety net function of NTFP provides rural poor against falling into poverty by reducing their vulnerability to such risk. Studies by (Ruiz Perez and Arnold, 1995) indicated that NTFP-based activities can be important in filling seasonal and other food or income gaps can provide a buffer in times of hardship or emergency, is an activity of last resort, or can present an opportunity for improving household income and security. The risk-management role of forest products is particularly important in the rural regions of developing countries, given that

agricultural crops face many types of risk, such as price shocks, drought, seasonal flooding, unpredictable soil quality, pests, crop diseases or illnesses.

Therefore, NTFPs can be used directly in consumption or sold to fill cash gaps (World Bank, 2001). Moreover, low capital and skills requirements of NTFPs extraction as well as open or semi-open access to the resource, provides poor households to easily extract the resource (Delacote, 2008). Godoy *et al.*, (1997) had also noted in a study in Honduras, that although NTFP extraction has a low annual value, it can provide insurance in the case of unexpected losses. The coping strategy (observed in Africa) consists of extracting NTFPs only in the case of bad agricultural crops. The use of NTFPs can here be considered as an ex post gap filling use. Forest products are extracted in order to smooth the household's consumption in case of low crop returns (Shackleton and Shackleton, 2004).

Shackleton and Shackleton, 2004 noted that access to forest resources helps rural households diversify their livelihood base and reduce their exposure to risk. Earnings from forest products are often important as a complement to other income. Very large numbers of households generate some of their income from selling forest products, often when farm production is not enough to provide self-sufficiency year round. Income from forest products is often used to purchase seeds, hire labor for cultivation, or generate working capital for trading activities (Warner *et al.*, 2008.) Safety net allows money to be saved and spent on other livelihood strategies such as agriculture which may in turn contribute to the households' sustainability. So safety net function of NTFP had a benefit for those who use the resources frequently in large quantity and occasionally.

Family labor is the key input in the collection and production of NTFPs. Adhikari *et al.*, (2004) found that larger families have a greater demand for natural resources and more labor to fulfill this demand. However, it appears that household composition, gender and age structure are more important than the mere numbers. Adult labor availability places the household in a better position to liquidate communally owned natural stock than labor-poor households. Alternatively, ample adult labor could motivate the household to invest more in agriculture or rural employment that can fetch higher incomes than gathering activities.

In male-dominated rural settings, forest-based low-return cash activities are often taken up by female-headed households who cannot make a significant living from agriculture due to absence of male labor for ploughing. Aging may affect dependence on forest resources negatively since people lose strength to engage in labor demanding jobs. Cavendish (2000) also argued that older people have difficulty carrying out arduous agricultural tasks and may turn to experience-based resource collection activities that demand less physical labor and that are free of entry barriers. Hegde and Enters (2000) indicated that larger households tended to derive more income from NTFPs. This could be because collection of NTFPs, such as honey, tamarind and soap-nut was more efficient through teamwork, and hence, larger households which organized their labor better were able to derive more revenue and also indicated that educated men preferred off-farm employment to collection of NTFPs;

Evidently, education influences the choice of occupation. Moreover, Godoy and Contreras (2001) found that a higher level of formal schooling is associated with less forest cutting. Adhikari *et al.*, (2004) also indicated that a higher level of education provides a wider range of

employment opportunities and reduces forest dependency. Additionally, a higher level of education of family members makes fuel wood collection increasingly unprofitable due to higher opportunity cost of time in collection and gathering.

These findings are similar to Gunatilake (1998) and Shylajan and Mythili (2007) who concluded that education level of the family is negatively related to forest dependency. Regarding proximity to the forest, on an average a household living in the interior forest area derives more income per annum from NTFP compared to households living in the periphery, holding all the other factors constant. Since major source of income of the households located in the interior area is from forest products, the intensity of extraction and pressure on forest will be much higher (Shylajan and Mythili, 2007)

2.5 RESEARCH GAPS

Little has been done regarding the assessment of the Non Timber Forest Products in Kibauni hills forest. The literature review indicates that the only study on this forest conducted in 2012 by the National Museums of Kenya and Green Resources Initiative, a local Non-Governmental Organization documented plant species of Kibauni Hills Forest. There hence exist clear research gaps that need to be filled to ensure sustainable management of resources of this forest. The study generally dwelled Non timber forest products and their role in the livelihoods of the forest adjacent communities. There is need to establish the Total Economic Value (TOC) of the forest as well as economic value of Non Timber Forest Products

2.5 CONCEPTUAL FRAMEWORK

Kibauni hills forest has been providing both timber and non- timber forest products to the people living around it since time immemorial. Like many other forests, the forest is also very important in provision of other forest carrier functions (Floral and faunal habitats), forest service's and forest products (timber materials, fibres and wood fuel, herbal medicine, and genetic resources) and forest nature functions (major moisture reservoirs, water catchment areas, regulate river flow, reduce river sediment load, carbon sequestration or sinks, climatic stability, ground water recharge, erosion and flood control, nutrient conservation and recycling) among others.

Although NTFPs are an important source of subsistence and cash income in the study area, there is growing concern regarding the fact that overharvesting fuelled by an increasing population and climate change is accelerating stock depletion. To ensure that NTFPs fulfill their sustainable development potential, a number of options important to sustainable management of NTFPs have been proposed to be taken into account.

Owing to the fact that forest Management has majorly focused on timber; yet, as concern about rural poverty, deforestation, and sustainable development emerges, so NTFPs' crucial role in rural development and resource conservation. NTFPs constitute a safety net for forest-adjacent people, who, having collected NTFPs for centuries, depend on them for subsistence and cash income. Kibauni hills forest is a case in point, as its indigenous people survive in precisely this way. Given this dependence, establishing better approaches to NTFP management for rural development, improved livelihoods and conservation is a vital issue in this forest as shown in this study.

This research takes its place in this conversation about conserving natural resources and improving local people's livelihoods. Its purpose is threefold: to establish the diversity of NTFP collected and utilized by the local people, a linkage between the resources and livelihood improvement and to investigate plant resources commonly used by the local people for NTFPs, a link between the utilization and exploitation for better decision making, then indigenous knowledge regarding the utilization and management of NTFPs to sustain and improve livelihoods, and on this basis to conceptualize initiatives and decisions for supporting forest resource sustainability and higher incomes for local people in the long term.

As there is little research on use of NTFPs, this study is both fundamental and far-reaching in nature specifically on better utilization of NTFPs to improve the livelihoods of forest-adjacent communities and to achieve the goal of conserving Kibauni hills forest resources

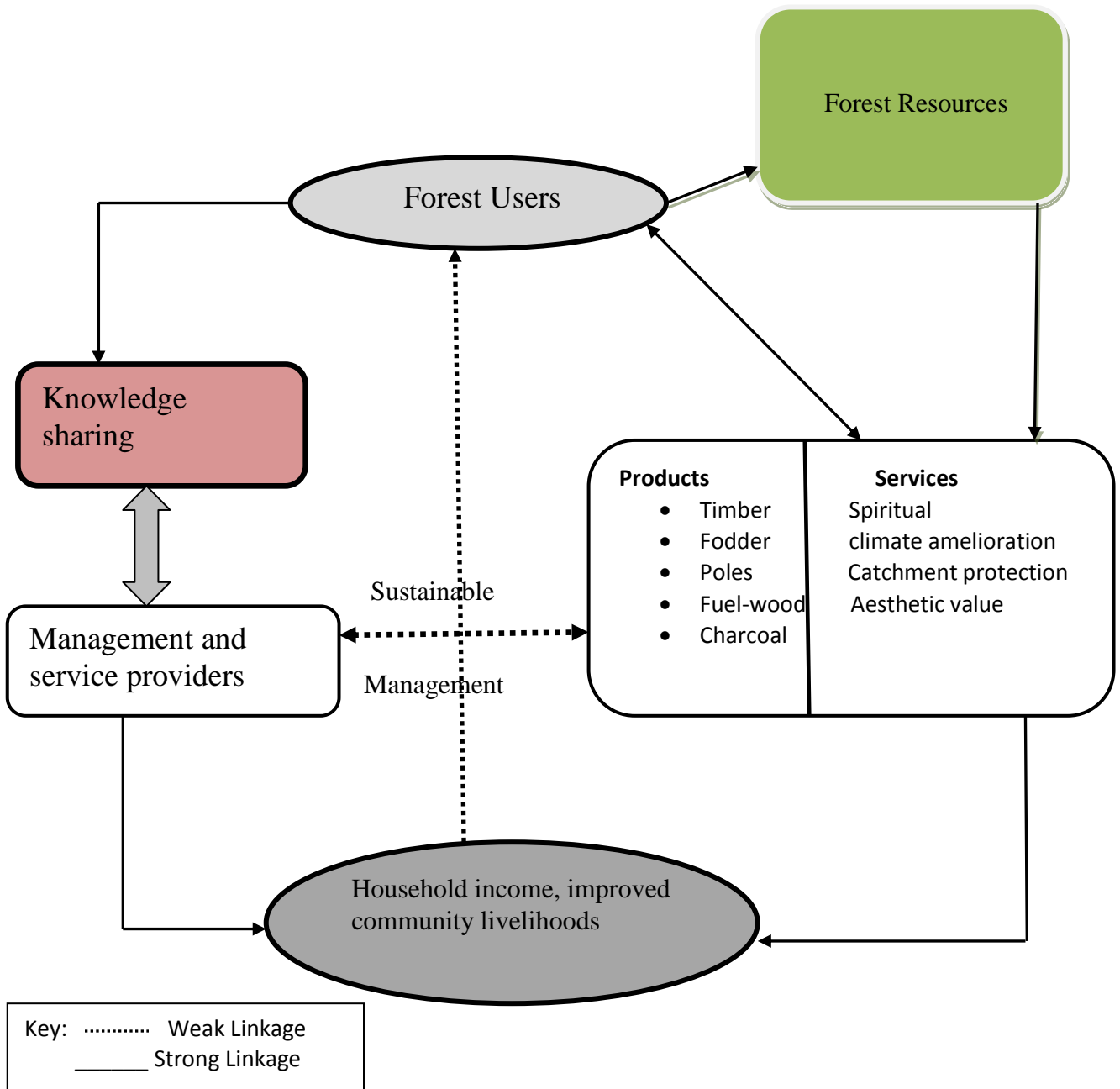


Figure 2.1: Conceptual framework

Source: (Researcher, 2014)

CHAPTER THREE

STUDY AREA

3.1 INTRODUCTION

This chapter covers the location, climate, topography, hydrology, livelihoods and vegetation of the study. It specifically focused on the following: location, climate, drainage, geology and soils, livelihoods, vegetation cover and demographic characteristics of the study area. The focus of this study was Kibauni Hills Forest in Machakos County

3.2 DESCRIPTION OF THE STUDY AREA

3.2.1 Location and size

The study was conducted in Kibauni hill forest, Kibauni division in Machakos County. Kabauni hills forest is a hill (class T - Hypsographic) in (Eastern) Kenya. Its coordinates are 1°33'0" N and 37°37'60" E in DMS (Degrees Minutes Seconds) or -1.55 and 37.6333 (in decimal degrees). Its UTM position is CU42 and its Joint Operation Graphics reference is SA37-06. Kibauni Hill Forest is a dry land forest covering an area of 1617 Ha (KFS)

3.2.2 Topography

Kibauni Hill Forest is a dry land forest with an altitudinal range between 1200m and 1650 m a.s.l. sub-county, Machakos County mainly consist of hills and small plateaus rising between 1,800–2,100 meters above sea level (masl). The mean elevation is however about 1,357 masl. This undulating pene-plain is broken by isolated hill masses like mango hills, Kilimambogo,

uuni hills, Kibauni hills among other small rock outcrops the highest being Kilimambogo or Ol-Donyo Sabuk rising to 2,144m masl as well as the volcanic out-flow of the Yatta Plateau in the east.

3.2.3 Rainfall and drainage

Kibauni division is generally hot and dry. It has two rainy seasons, the long and the short rains seasons. The long rains seasons starts at the end of March and continues up to May, while the short rains season starts at the end of October and lasts till December. The annual average rainfall ranges between 500mm to 1300mm. There are significant regional and seasonal variations within Mwala sub-county and rainfall reliability is quite low. Mwala sub-county receive slightly higher rainfall than the low land areas. Mean monthly temperatures vary between 18⁰C and 25⁰C (Jaetzold *et al.*, 2006; Jones 1988; Corbett 1998). The coldest month is July while October and March are the hottest. Athi River (and their main tributaries,) forms the major drainage system for the County.

3.2.4 Livelihood activities

Communities living in Kibauni area practice various livelihood and income generating activities. These include: crop cultivation (field crops and cash crops), livestock production, NTFPs collection and off-farm & off-forest activities. The respective importance of the various livelihood activities keeps on changing over time due to social and environmental factors. The highland areas which receive higher rainfall are more suitable for rain-fed agriculture than the lowland areas, while the drier parts of the County supports a wide range of agricultural activities. Rain-fed agriculture, integrated crop and livestock production dominate land use and household

livelihoods, especially in the small-scale semi-subsistence sector. Maize is the dominant cereal and most frequently grown crop.

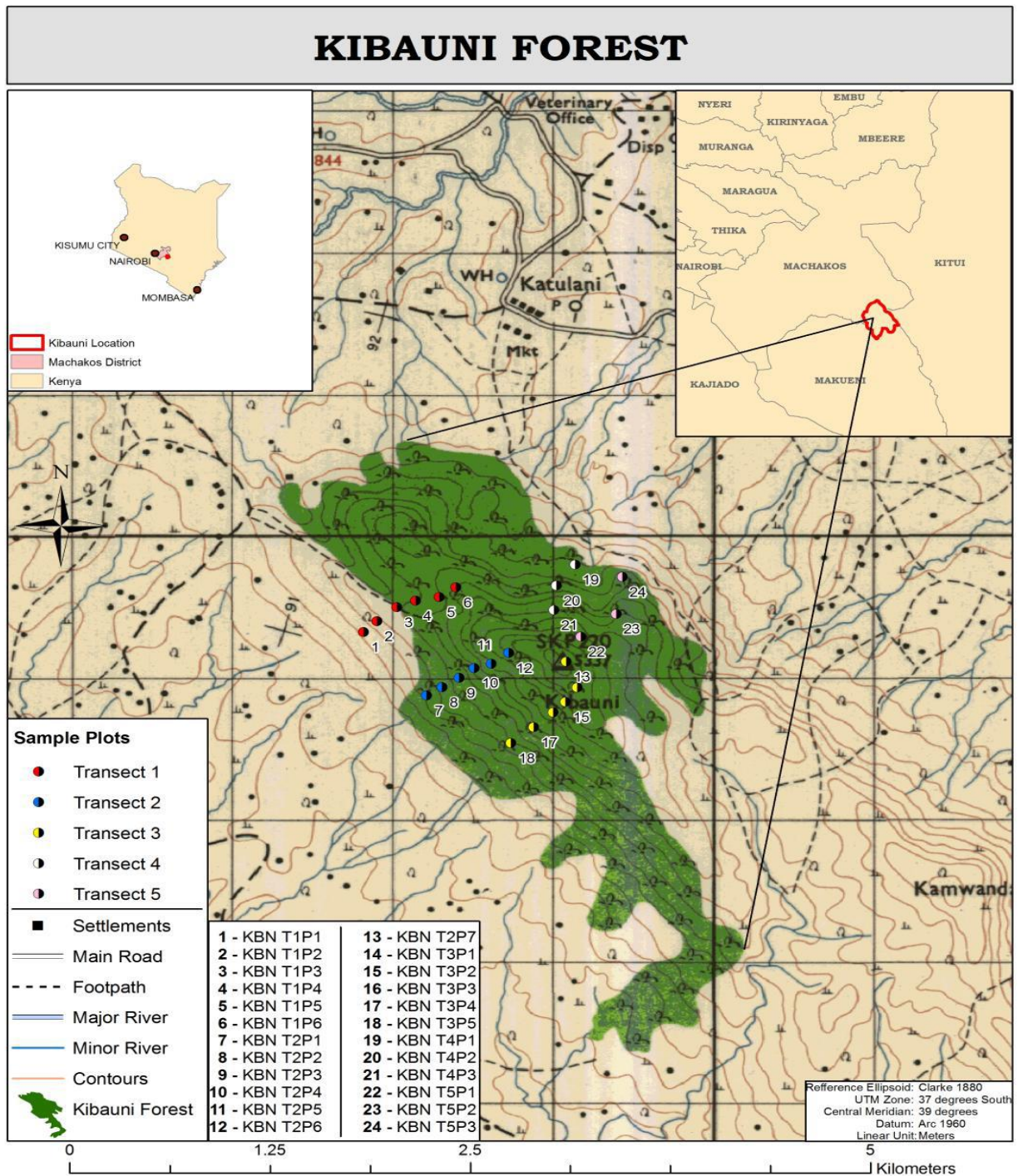


Figure 3.1: Kibauni hills forest map:

Source: (The Kenya Forest Department 2012)

3.2.5 Legal and Administrative status

Kibauni hill forest is a local Authority forest under the jurisdiction on Masaku County Council and managed by the Kenya Forest Service. Kibauni Division has the following locations: Kibauni, Ikalaasa and Ngomano

3.2.6 Geology, Soils and hydrology

Even though a detailed soil study of the sub-county has not been conducted, a broad part of the Sub-county is categorized to contain five major soil types namely: alfisols, acrisols, ferrasols, vertisols and andasols. Kibauni Hill forest is well drained and forms the upper semi-catchment of several rivers and springs.

3.2.7 Vegetation cover

The Major part of the County is dry land, with considerable amounts of woodlands and grasslands. Kibauni Hill forest is also is a host of various flora and fauna diversity as well as endemism. Five species have been found to be Kenyan endemics and two of them are rated as rare or vulnerable (Annex 2). A total of 79 species belonging to 36 families and 57 genera were recorded in a recent study by the national Museums of Kenya researchers in collaboration with a local Non-Governmental Organization-Green Resources Initiative.

Six families alone contributed to 50% of the species while 23 families contributed 1.25% each and 11 % in total. Majority of the species were from the Leguminosae, Euphorbiaceae, Labiatae, Burseraceae and Anacardiaceae families with Leguminosae being the most dominant. The most dominant species were: *Euphorbia bussei* Pax var. *kibwezensis*, *Acacia seyal*, *Acacia mellifera*, *Croton dichogamus*, *Croton megalocarpus*, *Dombeya kirkii*, *Commiphora habessinica* and *Euphorbia candelabrum*. Even though there has been continuous degradation of the forest

resources for expansion of farmlands, still the area is endowed with forest resources with high biodiversity and watershed protection services. Moreover, the forest is a habitat for numerous wild animals, reptiles and different types of birds.

CHAPTER FOUR

METHODOLOGY

4.1 INTRODUCTION

This chapter describes the approach and methods used in the research project in terms of the following attributes: study design, sampling and sample size, sources of data and data analysis.

4.2 RECONNAISSANCE AND PRE-TESTING OF THE SURVEY TOOL

An initial discussion was held with local administration and Provincial Administration leaders to explain the purpose of the study and to get permission to conduct the study in the area. Similarly, discussions were held with the Kenya Forest Service through the Sub-County Forest Office. Kibauni Community Forest Association also provided vital information on the main types of NTFPs and their availability in the area. Field visit was arranged to verify the discussion made at the office. During the field visit discussion was carried out with local people, village leaders and community based organizations. Farmers and key informants were selected based on their knowledge of the study area. After introduction meeting and selection of key informants an initial meeting was arranged and discussion was held with selected local farmers

Six locally trained enumerators were trained by the researcher on the objectives of the survey and the approach to be employed. The questionnaires was pre-tested outside the three selected study areas to ensure that all questions were clear, and a final version of the tool prepared before sampling took place

4.3 SOURCES OF DATA

4.3.1 Primary data

Primary data was gathered through face-to-face household interviews, key informants and direct observation.

4.3.2 Secondary data

This was used to provide information about the study area location, land use, physical, and socioeconomic contexts. Numerous documents and archival records such as statistics (census, relevant Policies in place and Legislative Acts, results of previous studies of NTFPs, and other relevant reports and publications were used.

4.4 DATA COLLECTION AND SAMPLING

The sampling was done in all three locations of Kibauni division bordering the forest. The three locations were purposively chosen because they are located near the forest. The locations are homogenous and NTFP's found in Ikalaasa are likely to be found in Katulani and Ngomano locations. Stratified sampling method was used based on characteristics of the population such as age, sex, education, occupation and economic information.

In this research work, the various locations were divided into three sections, A, B and C. In each section, a house was picked at random to begin with. From there, every third house was selected and the head of household was interviewed. The head of household here was defined as a member of the house who was aged 18years and above and whom the researcher meets in the house. This method was used so as to prevent the research work from being biased. According to Trochim (2006) stratified sampling helps to represent the entire population as well as some key

subgroups of the population. Besides this method has an advantage over simple random sampling due to the fact that it can provide statistical precision for homogeneous group. Questionnaire was administered on different households across section of members of the communities. A total number of 37 respondents were interviewed at Ikalaasa location while in Ngomano, there were 28 respondents and 34 in Katulani location totaling to 99.

a) Questionnaire

Data from the respondents was collected using questionnaires (Appendix 1) which had precise and closed questions with a list of possible answers to each question, and a broad and open questions giving respondents an opportunity to freely express their opinions. The questionnaires were administered to the 99 respondents. Before beginning the interview, the general purpose of the study was explained to each willing respondent and the confidentiality of their information assured. The household heads were targeted as the respondents but in case where they were absent, another permanent resident adult (above 18 years) was interviewed.

b) Key informant interview

This approach entailed a focus interview in which key informants were interviewed for a certain period. The key informants interviewed were traditional authorities, forest officials, provincial administration and related governmental officers to gather vital and relevant information on collection, management and utilization of NTFP's in Kibauni hills forest

c) Direct observation

This was completed during the researcher's stay in the villages and locality, providing an opportunity to observe what was actually going on in the NTFPs markets. It helped to capture data about level of engagement in utilization of NTFP's, collection trends and utilization of the

products, etc. As a rule, data from direct observations were used to crosscheck the data gained from interviews. This multi-methods approach is necessary to attain the required insights, depth and contextual setting for each case study (Cunningham, 2001).

4.5 DATA ANALYSIS

Data collected was checked, corrected, coded and entered into a computer. It was then analyzed to extract meaningful information. Various data analysis techniques were employed since both qualitative and quantitative data were collected. The qualitative data that was obtained through key informant interviews and group discussion were narrated and summarized through thematic areas. The quantitative data that was obtained through formal survey was entered into a computer and analyzed by use of Statistical Package for Social Sciences (SPSS) and analyzed using descriptive statistics. The results were presented using tables, charts and frequency distribution.

Other data on boma

CHAPTER FIVE

RESULTS AND DISCUSSION

5.1 INTRODUCTION

This chapter presents the analysis and interpretation of the findings from the 99 respondents who participated in the study. Data was analyzed, using statistical package for social sciences (SPSS) version 16.0. Percentages and correlation tests were used in the data analysis and summaries to determine the relationships between keys variables.

5.2 SOCIO ECONOMIC CHARACTERISTICS OF THE STUDY AREA

5.2.1 Age and gender of respondents

The average age bracket of the respondents was 40-49 years of age, of which 55% were female.

Of the sampled household heads' the majority (52%) were male headed whereas only 48% were female headed. Majority (26.3%) were in their productive working age of up to 40-49 years, while only 9 % of the households were headed by people older than 70 years (Table 5.0). Family labor is the basis for both on-farm and off-farm income generation and age affects the household's labor supply, which in turn affects natural resource use. Households with greater control over labor often have greater access to natural resources.

Related to this is the household's dependency ratio – whilst household size may suggest enough labor, this is not relevant if the members are either too young or too old to make a beneficial

contribution. Cavendish (2000) draws attention to the relationship between the household development cycle and NTFP utilization: for example, a young household in the process of establishing a home and a family has a greater need for construction materials than more established households; a more developed household which has accumulated assets such as livestock, has a greater need for fencing materials whilst, a household with elderly household members is constrained by the shortage of labor.

Age differences matter in labor allocation, aside from the division of labor among men and women. The respondents' ages also indicate the available labor force in the households. When there are more old people in the households, it indicates that there is low population growth rate, and there is less labor force because they cannot do heavy work. On the other hand, it can imply that those households have practiced excellent health care. Traditionally, labor pooling is common in the study area to overcome bottlenecks during peak seasons in agricultural production.

Age group (Years)	Percentage
20-29	4.0
30-39	21.2
40-49	26.3
50-59	23.2
60-69	12.1
70-79	9.1
80 and above	4.0
Total	100.0

Table 5.0: Age of respondents:

Source: (Researcher 2014)

Gender	Percentage
Male	44.4
Female	55.6
Total	100.0

Table 5.1: Gender of respondents

Source: (Researcher 2014)

In the study area, the percentage of female respondents was higher than the male respondents. From the findings, 56% were female while 44% were men (Table 5.1). Interestingly, in different contexts, findings show that women rely more on NTFP's by virtue of the sexual division of labor. Women are primarily responsible for the gathering of fuel, fodder and wild foods, whereas men are mainly responsible for the growing of cash crops for profit (Locke 1999; Agarwal 1997; Malhotra *et al*, 1993). In the South African context, 85% of rural households use NTFPs for consumption purposes (Shackleton *et al*, 2003) and women collect 73% of total NTFPs whereas men who only gather 27% (Paumgarten, 2005)

5.2.2 Level of education

Of the respondents interviewed, 38% had primary education while 33% had secondary education. Only 16% had no education at all, as illustrated in the chart below (Figure 5.1)

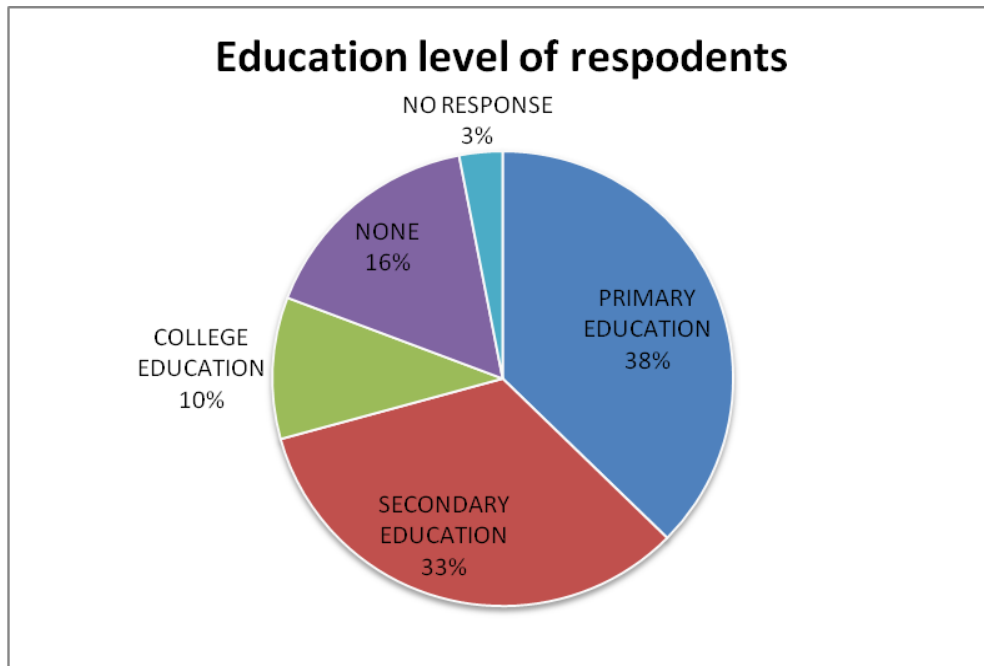


Figure 5.1: Level of education

Source: (Researcher 2014)

Similar studies of low literacy levels of people living in high altitude areas of Himachal Pradesh were observed by Sharma *et al.*, (1992) who reported that the tribals were leading a very tough and hard life. The literacy level was found to be very low (43.77 %). Agriculture was the mainstay with 60 % of the workers being cultivators. Farming, sheep and goat rearing were the main means of livelihood. More than half of the income was contributed by agricultural sector alone, but in some livestock keeping played a dominant role.

5.2.3 Time respondents had lived in the area

21% of the respondents had settled the area for up to 10years, while 20% had settled for between 11 to 20 years (Fig 5.2). Thus, indicating the kind of land tenure system in the study area a proxy for establishing a permanent dependence on the forest land for NTFPs and other income generating activities as access to NTFPs is governed by a myriad of rules and tenure arrangements.

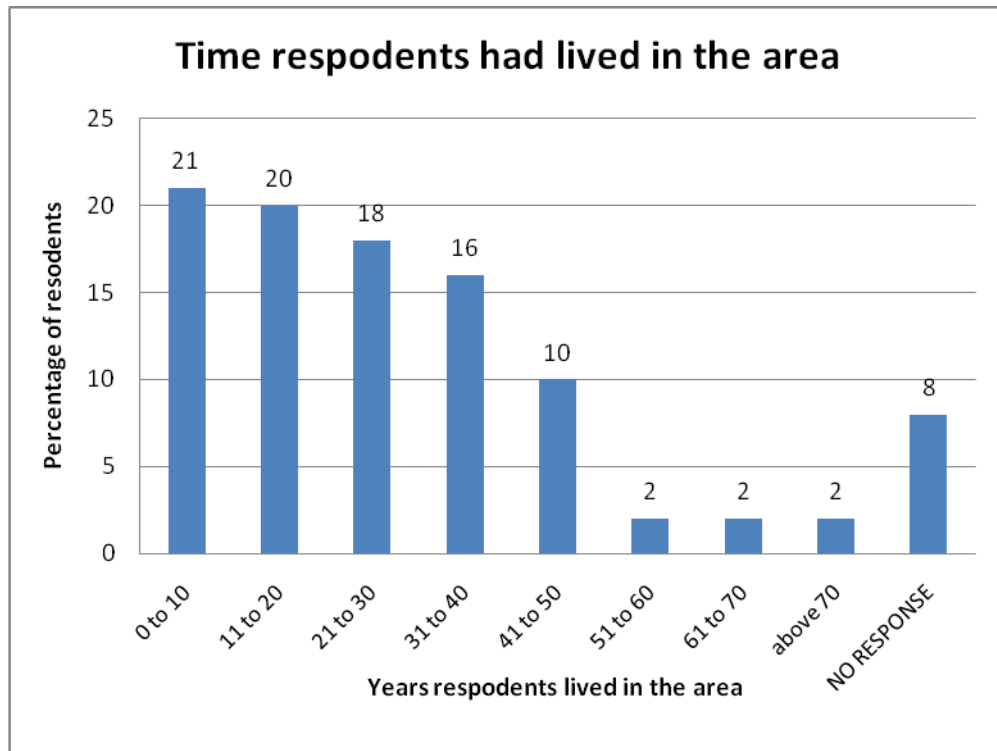


Figure 5.2: Time respondents had lived in the area

Source: Researcher (2014)

5.2.4 Livelihood activities

The livelihood activities of households in the study area include: crop production, production, forest related activities such as extraction of NTFPs and on and off farm activities animal such as petty trade and daily labor. The study findings showed that among the sampled households crop production, animal husbandry grouped as farming accounted for 66% were while a further 17% were small scale business people. A further 4% practiced both farming and business as their main occupations. Collection of NTFPs by households in the study area is a traditional activity for their livelihoods. Earlier, these NTFPs had only value in use. Of late, due to commercialization, some of these products have additionally acquired exchange value. Due to this, NTFPs collected by forest dwellers are not only meeting their subsistence needs but also for earning cash income. Thus, collection and selling of NTFPs is an important source of income. In

this way, NTFPs contribute to food security by increasing their purchasing power, which increases their economic access to food (Table 5.2)

Occupation of respondents	Percentage
Small scale farmer	65.7
Small scale trader	17.2
Teacher	6.1
Accountant	1.0
Others	8.0
NO RESPONSE	2.0
Total	100.0

Table 5.2: Livelihood strategies

Source: (Researcher 2014)

5.3 SOURCES OF NON-TIMBER FOREST PRODUCTS

29% of the respondents were getting their NTFPs from the forest, while 30% were getting them from their farmlands. 6% got them from around the homestead, with 12% getting them from both their farmlands and the forest (Figure 5.3). It can be depicted from Figure 5 that contribution of NTFPs from the forest is an important source of livelihood for the communities around the forest and collection of NTFPs forms an important source of their livelihoods. Moreover, for the forest adjacent communities not having agriculture land, it becomes the primary activity during certain periods of the year. Thus households depend on NTFP from the forest not only for their livelihood but also to earn cash income.

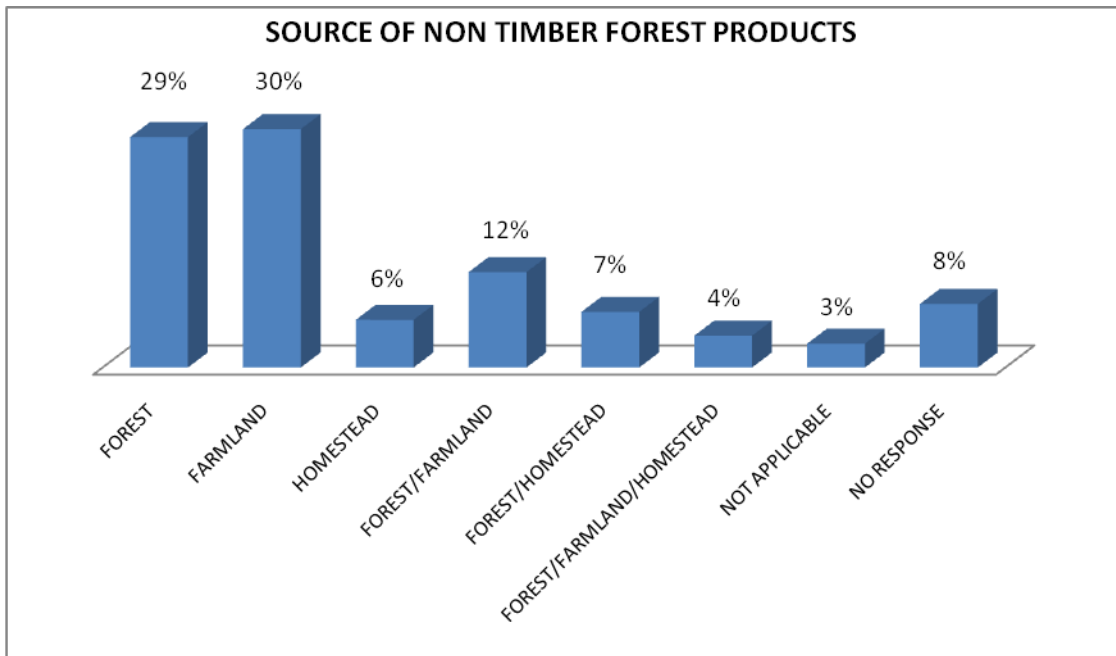


Figure 1.3: Sources of NTFP's

Source: (Researcher, 2014)

5.4 DIVERSITY OF NTFP'S IN KIBAUNI HILLS FOREST

Kibauni hills forest is an important source of NTFPs for commercial and subsistence use in the area. 83% of the respondents utilized plants for medicine. Other non- timber uses were firewood (2%), shade (4%), food (4%) and aesthetic value (1%) (Figure 5.4).

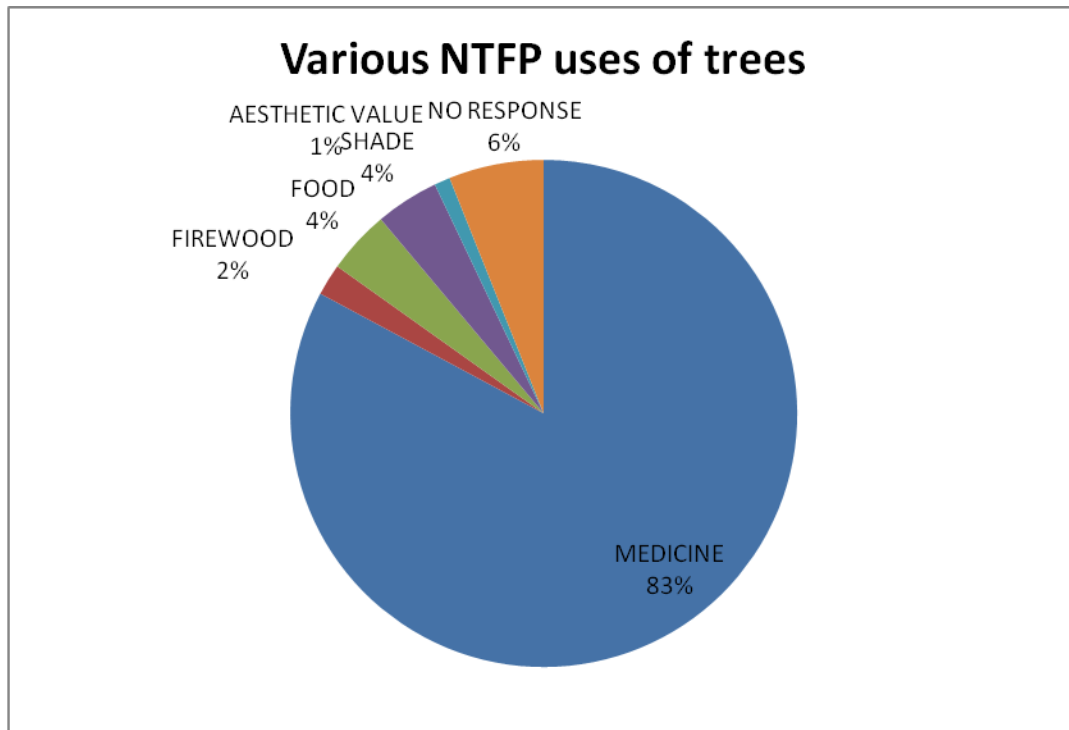


Figure 5.4: Various NTFP uses of trees

Source: (Researcher, 2014)

The study result showed that the local people of the study area depend on portfolio of income sources for living. Crop production, animal husbandry, forest and non-farm activities are the main livelihood strategies of the households.

Dependence on such diversified livelihoods activities is what has been observed under numerous case studies. For instance, Shackleton and Shackleton (2004) and Ros-Tonen and Wiersum (2005) indicated that forest product extraction (NTFPs) does not stand alone to support households but forms an integral component of a diversified livelihood strategies of rural household in the tropics. They combine extraction of forest resources (NTFP'S) with other livelihood activities to improve and sustain rural welfare as well as act as important cushion during periods of drought.

Despite its limited practice, agriculture is still the main source of income (66 %) for local people in the study area, and this is in line with several similar studies. For instance, (Getachaw *et al.*, 2007) found that agriculture contribute 40% of the total household income. Yet, the rural community also highly depends on the forest resources for their livelihood. From the results, Maize (95%) and beans (94%) are the most popular crops in the study area. This poses a threat to the management of the NTFPs of this forest owing to the high amount of firewood that is utilized in the preparation of a single meal of their staple food (Maize and beans). There is need to promote low risk crop varieties owing to the fact that maize and beans are high risk in the light of drought and eminent negative effects of climate change in the area.

5.5 CONTRIBUTION OF NON TIMBER FOREST PRODUCTS TO IMPROVED LIVELIHOODS

Extraction of NTFP makes a significant contribution to the livelihood of the rural people through collection and utilization. It is the second most important contributor next to crop production (66 %). This finding also agrees with studies conducted in, India by Campbell and Tewari (1995) and Getachaw *et al.*, (2007) where these independents studies reported that NTFPs contributing about 40 - 63% and 39% of the total annual household income, respectively as compared to crop production household income.

5.5.1 Animal grazing

Of the respondents interviewed, 47% grazed their livestock in private grazing lands, with a further 37% grazing in the forest while 9% grazed in communal lands (Fig 5.5)

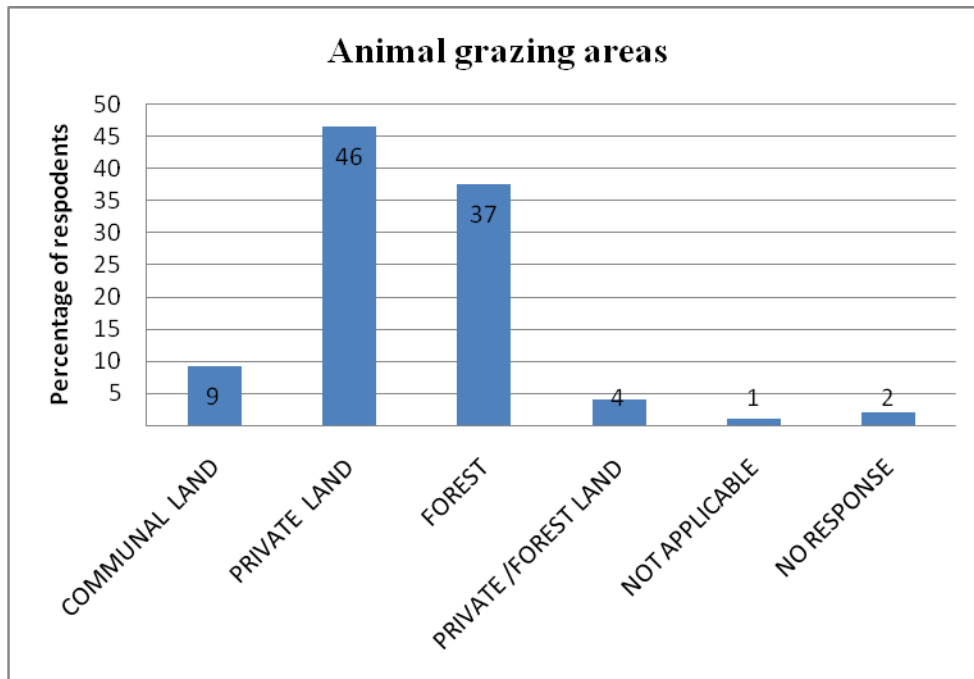


Figure 5.5: Animal grazing

Source: (Researcher 2014)

Livestock such as cattle, sheep donkey and goat are the major types of livestock reared in the study area. Most of the time, livestock graze in the private and forest land (46% and 37% respectively). For those who graze in the forest, 29% grazed throughout the year, while a further 29% grazed between 4 and 8 months. 42% grazed in the forest for 2-3months in a year. Of the respondents interviewed, 4% said they value forest grazing as very important, where as 60% valued it as important. 7% of them valued it as a supplementary grazing area, while rest gave no response.

Most households normally take their animals to graze in the forest on a free ranging mode for part of the day while others collect fodder to feed their livestock. Other villagers normally collect fodder and store to cater for periods of low fodder availability and during the dry season. Similar studies were observed in Ghana by Falconer, 1992.

Asset endowments are often important for utilization of forest resources, particularly with regards to livestock and fodder extraction. This means increment in livestock size relate to an increment of the value of fodder to household income. Households with more head of cattle utilize more resources inform of fodder from the forest. This is worsened by the fact that the forest is a free access facility and no restrictions or access rights. Studies by Getachew *et al.*, (2007) also concluded similar result. As indicated in the report, 72% of the respondents keep cattle while 95% of the respondents keep goats. Forest authorities should strive to zone the forest, create buffer zones and user rights to the communities to avoid overgrazing and resource exploitation.

How much do you value forest grazing	Percentage
Very important	29.3
Supplementary	7.1
Important	59.6
No response	4.0
Total	100.0

Table 5.3: Importance attached to forest grazing

Source: (Researcher 2014)

Goats were the most kept animal in the study area, with 95% of those interviewed keeping them. This was followed by both cattle and donkey, both at 72%, while chicken came 4th at 70%. Only 33% kept sheep (Figure 5.6).

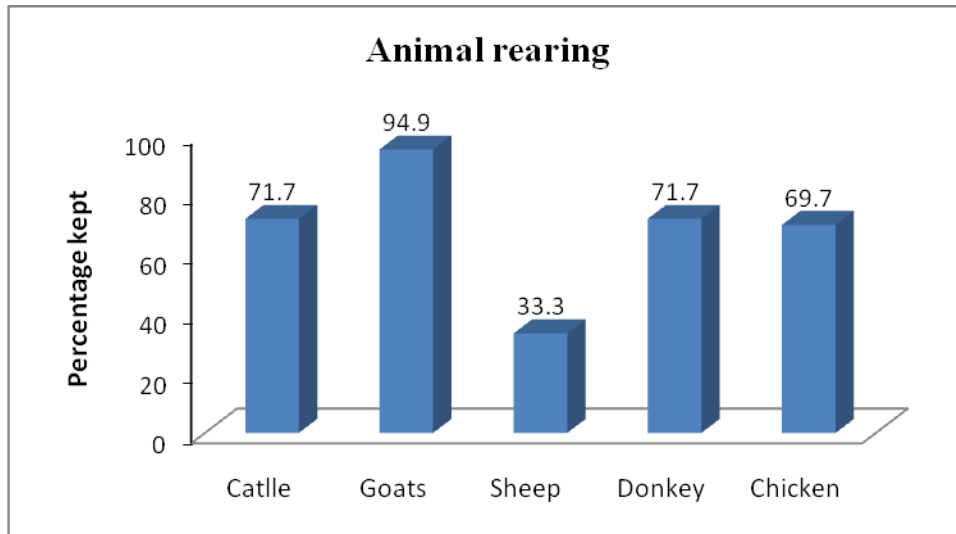


Figure 5.6: Animal production

Source: (Researcher 2014)

Grazing in the forest forms an important option for these rural populations in the study area. 29% of the households sampled graze in the forest throughout the year while another 42% of the respondents graze in the forest for 2-3 months. 60% of the respondents also said that they value forest grazing as important in sustaining their cattle.

This shows the importance of this forest to serve as a safety net (coping strategy) particularly during shortfalls and dry spells. This is in line with research findings by Shackleton and Shackleton (2004) and Byron and Arnold (1999) who showed that dependence on forest resources increases during period of a shortfall in agriculture production. Similarly, Pattanayak and Sills (2000) reported that commercial NTFPs can be an important natural insurance against unexpected agricultural risk.

Asset endowments are often important for utilization of forest resources, particularly with regards to livestock and fodder extraction. This means increment in livestock size relate to an

increment of the value of fodder to household income. In circumstances where the livestock size has positively and significantly correlated with NTFP income, which implies that households with more livestock could utilize more fodder than those with a few livestock size.

Studies by Getachew *et al.*, (2007) also concluded similar result. As indicated in the report, 72% of the respondents keep cattle while 95% of the respondents keep goats. This is an indication that pasture requirement is high by the community to provide this NTFP for the livestock especially during the dry spell and acting as an important cushion for their livelihoods. Livestock is quite an important asset for providing milk, labor for ploughing, as well as income for the communities.

5.5.2 Local medicinal value of NTFPs of Kibauni hills forest

Most of the people living around Kibauni hill forest are rural dwellers, hence the use of plants for Treatment of various diseases and ailments is very common. For instance, from key informants, many of the plants which were identified in this survey have also been reported to be used in the treatment of other ailments such as fever, to expel intestinal worms, influenza, colds, stomach problems, wounds among other common ailments (Table 5.4). This utilization of NTFP's for medicinal value agrees with research done by the World Health Organization which found that many local people use varieties of wild plants in traditional ways for their daily requirements as well as primary health care. Some 80 percent of the population of the developing world use NTFPs for health and nutritional needs (WHO, 2000).

According to the study, the following table shows plant species used for medicinal value by people around Kibauni hills forest

Species	Local name	Plant part used	Ailment treated
Aloe spp	Kiluma	Sap from leaves applied	Wounds
Aloe spp	Kiluma	Leaves boiled	Given to chicken-fever
Acacia xanthophloea	Musewa	Inner bark chewed	Yellow fever
Terminalia brownii	Muuku	Bark boiled and taken	Yellow fever
Solanum spp	Kitongu	Roots chewed	Stomachache
Acacia nilotica	Musemei	Pods applied	Wounds
Agave sisalamum	Ikonge	Leaves squeezed and sap applied	Wounds
Azadirandica indica	Muarubaini	Leaves boiled	Fever, colds and malaria
	Muti	Leaves are chewed	Stomachache

Table 5.4: Plant species utilized for medicinal value

Source: (Researcher 2014)

This survey has shown the vital roles that medicinal plants play in the primary health care of the people around Kibauni hills forest, especially in the treatment of alcohol-induced liver damage. Moreover, the use of plants in medicinal sector by local people over the past period takes a huge concern as they have long year's lineage of utilization and management. This has been achieved through many generations of age old, time-tested practices, and as a consequent accumulation of knowledge through a series of observations, interactions and innovations. Similar studies were carried out by Cunningham 1996, in Ethiopia. However, the need arises for future researchers to focus on detailed scientific studies of these plants in order to validate their traditional uses.

Plant parts that were popular in treating common ailments by respondents that were cited included, use of different parts. Among the tree parts used for various NTFPs were leaves (43%), bark (29%), branches (10%), fruits (5%) and roots (5%). Decoctions and infusions are the methods of preparation and the remedies are taken orally and continuously until the patient is healed

5.5.3 Firewood

Firewood and charcoal consumption is high in the community owing to the energy requirements to cook, heat and light most of the homesteads. The study findings revealed that firewood (98%), construction materials (60%), medicine (55%) and fruits (45%) were the most collected NTFPs at household level compared to other NTFPs. The high demand for firewood by communities living around Kibuani hills forest might be attributed by several factors including being obtained freely of charge from the forest, lack of other sources of energy in the area and cost of other sources of energy (Plate 1)



Plate 1: Charcoal Kiln in the forest

Source: (Researcher 2014)

Response from key informants revealed that most households within Kibauni hills forest have no access to power from national grid and they still use traditional three-stone stoves for cooking. This makes the use of firewood the most preferred choice by the locals of this study area. These open fire stoves normally consume huge amount of cooking biomass fuel which demand frequent access to forest to look for firewood. (Plate 2)



Plate 2: Inefficient cook stove versus efficient energy saving stove (Rocket stove)
Source: (Researcher 2014)

Collection of firewood is normally done by women and children in groups (plate 4) and most homesteads do it weekly. Some respondents also pointed out that they normally harvest large amounts of firewood during the dry season and stack it in heaps in their homesteads for use during the rainy season when availability is scarce. The same observation was made in Malawi by Malinski (2008) whereby fuel wood is used by 97% of rural household. On other hand, lack of alternative cooking energy at household level also influences high rate of firewood use. 95% of the respondents grew maize while 94% grew beans in the study area. The staple food in the area is popularly known as Githeri (Maize and beans cooked together). This is done using the

three open cooking stoves and requires about 3-4 hours to prepare a meal making consumption of firewood per household quite high (plate 3).



Plate 3: Firewood collection

Source: (Researcher 2014)

95% of the respondents planted maize, with 94% planting beans. Other crops were cowpeas (73%), peas (70%) and green grams (39%). Only 6% planted fruits (Figure 5.7).

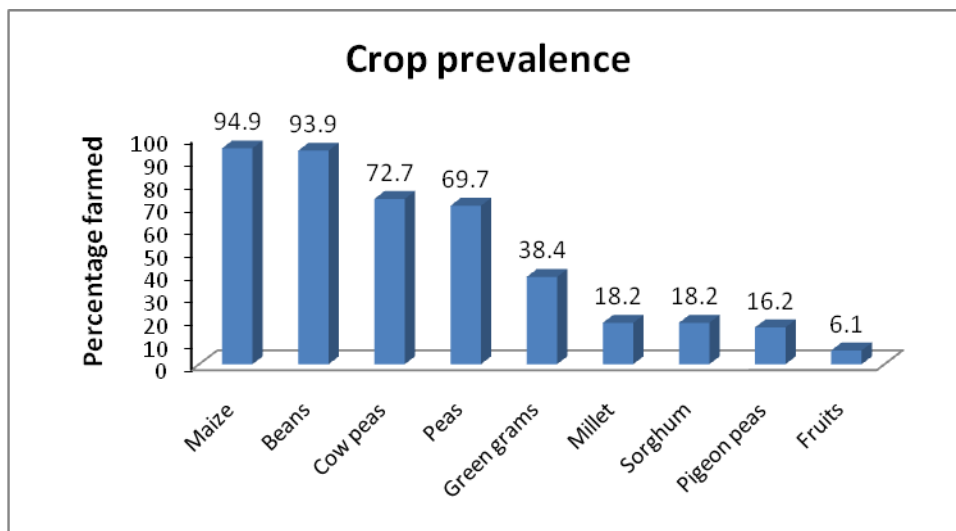


Figure 5.7: Crop production

Source: (Researcher 2014)

5.5.4 Construction materials and agricultural equipment

Construction materials like poles, roofing thatches, furniture materials, ropes are easily obtained from the forest reserve. The high demand of these materials was contributing to depletion of some of common tree species that are used locally for roofing rafts and agricultural materials including *Terminalia brownii* and *Acacia* spp. Mud walled, grass thatched housing units within the study area demand frequent rehabilitation to maintain structural functions of grass thatched roofs and mud walls which consume most of the materials fetched from the forest for the purposes of house construction. About 150 poles are needed for an average-sized rural house, which lasts between three and ten years.

83% of the respondents owned houses, while 14% rented. 1% indicated they had inherited the houses they lived in. 92% of the respondents had brick-walled and iron thatched houses, while mud walled grass thatched houses were second in prevalence at 67%. Stone walled houses were prevalent in 5% of the households. (Table 5.5)

Type of house	Percentage	Average number of houses per HH
Brick walled iron thatched houses	92	3.2
Mud walled grass thatched houses	67	1.8
Brick walled grass thatched houses	13	2.1
Mud walled iron thatched houses	12	1.3
Stonewalled iron thatched houses	5	3.4

Table 5.5: House ownership

Source: (Researcher 2014)

The extraction of these construction materials has also been made easy owing to the fact most of the respondents were residing close to the forest and could easily ferry them with the help of family members and children. Key informants also stated that those people living further away from the forest ferry them with their domestic animals citing ox and donkeys as the most common mode of transport. Most of the respondents, 44% took only 15 minutes to walk to the forest making it easy to access these forest products.

Time taken to walk to the forest	Percentage
0 to 15	44.4
16 to 30	14.1
31 to 45	8.1
46 to 60	11.1
Above 1 hr	15.2
No response	7.1
Total	100.0

Table 5.6: Time taken to walk to the forest

Source: (Researcher 2014)

44% of the respondents walked for up to 15 minutes to the forest area, while 14% took between 15-30minutes to get to the forest. 15% walked for more than 1hr. (Table 5.6)

Such association between distance and forest extraction agrees findings from many other studies. For instance, Hegde and Enter (2000) noted that in total the extent of forest resource use was greater in proximal villages than in distant villages, possibly because the proximal villages had easy access to resources, while distant villages had very poor access. Similarly, Riadh (2007)

stated that households in interior villages collect more NTFPs than households in exterior village of a protected area, both in terms of number of NTFP types gathered and the cash value of the products collected, showing that distance is an influential factor.

5.5.5 Food products

The communities living around the forest utilize a number of food products from the forest. These ranges from fruits, berries, gum, vegetables found in the forest for their livelihood as well as earn substantial income from these products. Most of the vegetables are extracted during the rainy season for consumption at household levels while fruits and berries are harvested both during the rainy and dry season.

The NTFPs food products extracted in the forest act as important cushion during periods of food scarcity especially for little children who harvest them when grazing in the forest. Children normally take their animals to the forest and graze the whole day relying on fruits and food product from the forest and relieving their families the agony of having to provide for the three square meal. The availability for these products is often seasonal in nature and depends on natural growth and regeneration, which makes their productivity unpredictable. Collection of food products as NTFPs is an important source of insurance and it contributes to food security of the local communities. (Plate 4)



Plate 4: Some of the fruits found in the forest

Source: (Researcher 2014)

5.5.6 Honey

There is a regular engagement in the production of honey in the forest by the locals particularly the older generation. Honey produced in this forest and the surrounding neighborhood is consumed locally by the producing homesteads and little gets to the markets despite the product being in high demand. Much of the honey is produced by use of the traditional log hives which have low quality and quantities compared to the modern bee hives. This also demonstrates that there is need to build capacity of the local people to take up the enterprise on a commercial basis and also adopt modern bee keeping technologies so as to improve production efficiency as well as promote incentive obtained.

Bee keeping has been done for a long time in the study area. This practice is done by use of the traditional log hives. This practice is done by hanging the hives on trees and applying a certain herb to attract bees. It is a relatively inexpensive activity that is majorly done by the older

generation of people. Honey harvested is used at household level and the extra sold at local market generating additional or complimentary income for these rural households. It provides an important and often significant contribution to the overall household food and income security for households which keep bees.

This agrees with studies conducted by Shackleton and Shackleton (2004) that NTFPs provide livelihood benefits in assisting households to cope in times of adversity manifested as sudden changes in the economic, social or bio-physical environments in which households exist and function. Despite the fact that beekeeping is relatively an inexpensive income generating venture to undertake, few people are engaged in beekeeping and only few log hives were seen hang on trees.

From key informants, natural honey is available in the study area and people collect it during (April- May) and (September October) immediately after the flowering period (Plate 5). Bee keeping using traditional log hives. Reasons given by the key informants why the young generation is not taking up the activity is because of the tedious nature of the process of making the hives hanging the hives on trees and harvesting the honey (Each harvest in a tree may takes about one and half hour). Honey collection is done by adult males, as it requires skill to handle the bees. Gathering honey in the forest mainly depends on its availability. The quantity and quality of honey collected varies and depends on the season and the experience of the collector. It is a very laborious job and sometimes they need to stay the whole night for collection.

5.6 FORESTRY RELATED SERVICES

5.6.1 Ecosystem services

Kibauni hills forests provide a number of ecosystem services. These include: (1) protect water quality and quantity (including stream flow, source water for community drinking water supplies, and groundwater) by retarding runoff, (2) protect biodiversity by providing habitat and ability for wildlife to travel feed, and migrate, (3) sequester carbon that moderates global warming, (4) provide wood and other products that have economic value, and (5) provide an aesthetic element in the landscape that has both important economic, cultural and spiritual values. These services are an important in ensuring a delicate balance between nature and community and act as life a support system

5.6.2 Spiritual and Cultural values

Kibauni hills forest is a place of great spiritual and cultural importance for the indigenous people living around the forest. This can be shown by the spiritual attachment of the people to the many sacred places in the forest as their places of worship and other ancient ancestral rituals only and not for interference by other human activities. In this forest, there are over 20 known spiritual sites used for different cultural, spiritual and sacred purposes.

Each sacred natural site in the forest is protected by a different group of people who are the traditional custodians. Preservation of these sites forms a fundamental element in the maintenance and continuation of traditional ways of life as well as conservation of important biodiversity. They are hence important sources of seed banks for the forest species and are important in maintaining the health of the ecosystem and the communities. They are also rich in biodiversity. 9 shrines were identified by the respondents as important sacred sites with 2 shrines

being the most popular shrines in the forest namely Kwa matumo (36% of respondents and Mukameni 15% respondents identifying them)

5.7 MANAGEMENT PRACTICES OF KIBAUNI HILL FOREST

RESOURCES

The communities living around Kibauni hills forest extract diversity of goods from the forest. During discussion with the key informants they pointed out that people freely access the forest for almost any purpose except agricultural conversion. In return they very little conserve and manage the forest. There is little regulation of access and harvest, which is putting immense pressure on the forest resource of the area. Other studies (e.g. Ros Toneen and Jeannet, 2000) indicated that without clear use right or sense of ownership, local people were not encouraged to manage the natural resource in sustainable way.

Moreover, when the institution supposed to manage the resource fails it results in an open access resource regime (Melaku, 2003). Similarly, Andel (2006) noted that if extractors harvest wild plants from forests where they have no formal ownership or user rights, they will take little responsibility for the management of the resource to ensure a sustainable harvest. So communities should possess the legal authority to regulate and access the resource base while ensuring that people within the community retain access rights to collect these products.

From the study, 62% of the respondents said they employed management practices for the NTFPs. There management practices included practicing agro forestry (25%), pruning (12%), fencing (5%), weeding (5%), use of nursery seed beds (3%) and restriction on cutting down trees

(3%). Others included watering (1%), trimming (1%), digging terraces (1%) and construction of energy saving jikos (1%). 59% of the respondents answered to the presence of shrines in the forest areas.

5.7.1 Management practices of NTFPs

85% of those interviewed in the study area practiced some management practice for NTFPs. Of these products, 48% preserved firewood, 14% preserved fodder while 7% preserved water. Other products preserved included herbal plants (3%) and charcoal at (3%). (Figure 5.8)

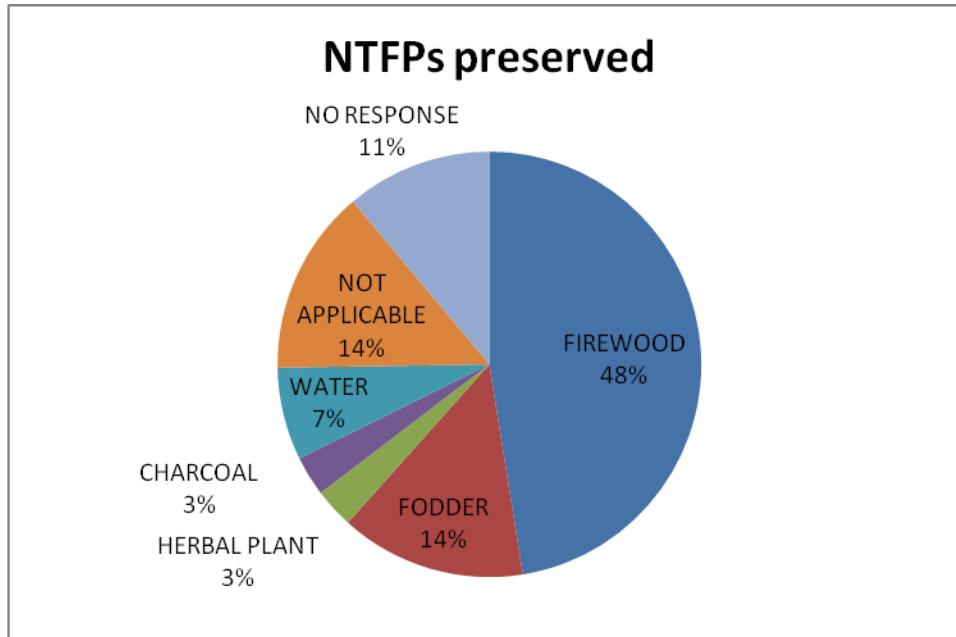


Figure 5.8: Management of NTFP's

Source: (Researcher; 2014)

5.7.2 Poles, charcoal and firewood

Management of Poles is done by use of metal poles instead (2%), felling old trees only (1%), planting more trees (1%), pruning (1%), staking (1%) and keeping bundles (1%). 90% of the respondents do not preserve poles. From the interviews, firewood is preserved by storing under shade (2%), using improved *jikos* (27%), putting in neat bundles (30%), using only dry wood (1%) and planting more trees. 37% of the respondents did not preserve firewood. Charcoal is managed by storing it in bags (20%), using improved *jikos* (20%), using a store (3%) and by using cooking gas (2%) as an alternative. 55% of the respondents do not have management practices for utilization of charcoal.

5.7.3 Fodder and grass thatch

Fodder is preserved in silos (7%), in open shades (22%), keeping the right number of livestock (2%) and building sub houses (10%). Other methods include zero grazing (2%), fencing plots (1%), digging terraces (3%) and putting in stores (3%). 50% of the respondents do not preserve fodder. Grass thatch is preserved by storing it in silos (5%), *vibandas* (6%) and by doing zero grazing (2%). Other methods include use of maize stalks (1%) and iron sheets (1%) thatch instead of grass. 85% of the respondents do not preserve thatch grass

5.7.4 Medicinal plants

Management of medicinal plants in the study area is done by weeding them (6%), avoiding to cut them (1%), relocating them to a safe place (1%) and fencing plots (1%). 91% of the respondents do not have management practices for medicinal plants. 30% of the respondents said they had a harvesting technique for the NTFPs. These techniques included shaping branches (20%), cutting

down branches (3%), harvesting barks sparingly, leaves and fruits (2%) and uprooting (1%). The techniques used were referred to as indigenous by 35% of the respondents, while 2% of the respondents said they had modern harvesting techniques. 90% of those interviewed experience problems while collecting NTFPs.

5.7.5 Water

Water as a NTFP is preserved by buying tanks (48%), and building shallow pans (2%). 50% of the respondents do not preserve water. Stones are preserved by piling in heaps (14%), Seeds as a NTFP are preserved by putting them in a nursery (7%) and using a seed bed (2%).

5.7.6 Domestication as a management option

24% of the respondents said they preferred domesticating herbal plants while 4% preferred agroforestry (Table 5.7)

Which NTFP do you plan to domesticate	Percentage
Plant herbal plants	24.2
Practice agroforestry	4.0
Planting <i>Acacia tortilis</i>	11.1
<i>Acacia nilotica</i>	4.0
<i>Croton megalocarpus</i>	5.1
<i>Grivellia robusta</i>	4.0
<i>Aloe spp</i>	6.2
<i>Sena siamea</i>	6.1

Which NTFP do you plan to domesticate	Percentage
Magnifera indica	19.2
Carica papaya	8.1
Vangueria madagascariensis	2.0
Others	4.0
No response	2.0
Total	100.0

Table 5.7: Domestication of Non Timber Forest Products

Source: (Researcher 2014)

5.8 REASONS FOR MANAGEMENT OF NON TIMBER FOREST PRODUCTS

Reasons for preserving poles given by the respondents were for future use (3%), to avoid deforestation (1%), to use less firewood (2%), to safe trees (1%) and to avoid desertification (1%). Other reasons included to use in future construction (5%). Of those interviewed, 53% preserved firewood for wet season cooking, while 5% did it to avoid desertification. Reasons given for preserving fodder were for zero grazing (7%), to have sufficient pasture (20%) and for use as animal feed during the dry season (28%).

Reasons given for preserving grass thatch were to have sufficient pasture (1%), for the grass to mature fully (1%) and for zero grazing during the dry season (1%) while reasons for preserving charcoal given by the respondents were for future use (9%), for cooking during the wet seasons (11%), and to reduce excess cutting of trees (1%)

Honey was preserved for sale at a future date (2%). Medicinal plants were preserved for better health (4%). The only reason given for conserving water was for future use during dry season

(49%) while Seeds were preserved for planting during the wet seasons (3%). 79% said they were aware of government policies regulating non-timber forest products. Some of the existing policies they were aware of included laws on cutting down trees (36%), the forest act (33%), and policies on building of gabions (1%) and overgrazing (1%).

5.9 MANAGEMENT CONSTRAINS TO THE UTILIZATION OF NTFPS IN KIBAUNI HILLS FOREST

Despite the large contribution of NTFPs a number of constraints are downplaying or constraining their enhanced role in livelihood and rural development. One important constraint identified is the declining forest cover which is affecting availability of the NTFPs. As a consequence availability of most of the NTFP's has been declining. Other constrains include: poor infrastructure, access to market, harassment by provincial administration and forest guards, and lack of market information limit the potential benefit of local people from the NTFPs. Such constraints seem universal as most NTFPs related studies reveal more or less similar conditions. For instance, Pierce *et al.*, (2002) reported almost similar constraints that limit potential benefit of NTFPs, and so do (e.g. Aramde, 2006; Mohamed, 2007). 92% of the respondents thought that extraction of NTFPs posed a threat to forest resources in the forest (Table 5.8)

Threats to NTFPs	Percentage
OVER EXPLOITATION	26.3
OVERGRAZING	2.0
DESERTIFICATION	10.1
OVERSTOCKING	7.1

Threats to NTFPs	Percentage
LOSS OF AESTHETIC VALUE	5.1
DROUGHT AND FAMINE	6.1
LOSS OF HABITAT FOR ANIMALS	3.0
SOIL EROSION	17.2
RAINFALL SCARCITY	5.1
REDUCED PASTURE	13.0
ENVIRONMENTAL DEGRADATION	2.0
NO RESPONSE	3.1
Total	100.0

Table 5.8: Threats to NTFP's

Source: (Researcher 2014)

So promoting conservation and rehabilitation efforts, Promoting participatory forest management, capacity building of the community members, as well as assigning user rights will enhance proportionally the potential benefit of NTFPs and rural household economy thereby rural livelihoods. Despite all the constraints and potentials different households extract different types and amount of NTFPs. In this study, it was observed that household head, proximity and other household characteristics affect the type and amount of NTFPs extracted from the forests. For example in a cross tabulation with amount of grass/fodder collected from the forest, female headed families collected 55% more times than male headed, with the bundled being more for the female headed. Such observation is common in most NTFPs related studies.

For instance, Berhanu (2004), Cavendish (2002), Getachew *et al.*,(2007) have reported similar results. In relative terms the poor depend more on NTFPs than the rich. This is mainly due to the

fact that poor households have few asset bases and mostly depend on NTFPs extraction and use to sustain their livelihoods than other household income categories. Most of them rely on natural resources mainly NTFPs as a source of income and subsistence since they lack alternative means of source of income.

The communities extract diversity of goods from the forest except for agricultural purpose and timber production. During discussion with the key informants they pointed out that people freely access the forest for almost any purpose except agricultural conversion. In return they do nothing to conserve and manage the forest. There is little regulation of access and harvest, which is putting immense pressure on the forest resource of the area. Other studies (e.g. Ros Toneen and Jeannet, 2000) indicated that without clear use right or sense of ownership local people were not encouraged to manage the natural resource in sustainable way.

5.9.1 Change in availability of NTFPs

Reasons for change in honey availability was unreliable rainfall (94%) and few bees being reared (1%). 5% of the respondents had no response. Medicinal plants availability had changed due to stem cutting and debarking (90%), low rainfall (4%) and climate change (1%), according to those interviewed, while 4% did not give a response. Debarking of *Acacia xanthophloea* for medicinal purposes was widely practiced in the study area.

5.9.2 Open access to NTFPs

Communities living around Kibauni hills forest extract NTFPs at will and freely. This open access to the resources of this forest often results in over utilization, exploitation and

unsustainable management of the resources. When the institution supposed to manage the resource fails it results in an open access resource regime (Melaku, 2003). Similarly, Andel (2006) noted that if extractors harvest wild plants from forests where they have no formal ownership or user rights, they will take little responsibility for the management of the resource to ensure a sustainable harvest. So communities should possess the legal authority to regulate and access the resource base while ensuring that people within the community retain access rights to collect these products for their own use.

5.9.3 Charcoal burning and Firewood consumption

Firewood consumption and charcoal burning is high in the community owing to the energy requirements to cook, heat and light most of the homesteads. Staple food in this community is githeri (Maize and Beans) with 95% of the respondents planting maize and 94% planting beans. Preparation of this staple food is done on the less efficient three stones open cooking places (Jikos) which is a proxy for the high firewood demand and hence forest depletion (Plate 5).



Plate 5: Cutting of trees for charcoal making

Source: (Researcher 2014)

5.9.4 Resource degradation

The study also indicated that the most common constraint to collection of NTFP was dwindling of these resources, overexploitation, unsustainable utilization, soil erosion in the steep areas (Plate 6), lack of knowledge as well as lack of technical assistance to manage NTFP. This agrees with the study of Berhanu (2004) conducted at Gore, which stated limits the potential of NTFPs to contribute to the rural people income. Some of these constraints were even reflected during the discussions with key informants, particularly shortage of labor and land was a common problem associated with grass and honey collection.



Plate 6: Gully erosion at the foot of the hill

Source: (Researcher 2014)

Additionally some of the households reported that even though they have the desire to domesticate some of these products, they couldn't domesticate on a large scale due to shortage of land. So strategies and intervention by Governmental or NGO's must aim at improving productivity of some of these resources like honey, medicinal plants like aloe species with due attention to adding value to it, in order to generate income.

5.9.5 Organizations actively working in the area to manage the forest

Several organizations have been currently working in the area to promote sustainable utilization of Kibauni hill forest as well as participatory forest management. Some of them include Non-governmental organizations like Green Resources Initiative and INADES Formation. Kenya forestry service has also been able to initiate some monitoring program in the forest and the collaboration between these institutions has borne Kibauni Hills Community Forest Association which is a milestone in promoting participatory resource governance (Table 5.9).

Type of organization	Percentage
CBOs	79.8
NGOs	6.1
Government Ministries	2.0
Provincial Administration	5.0
No response	7.1
Total	100.0

Table 5.9: organizations working in the area

Source: (Researcher 2014)

85% of the respondents said the organizations were helpful and were improving their livelihoods. Community Based Organizations contributed greatly (80%) to the conservation activities in the area.

CHAPTER SIX

SUMMARY OF KEY FINDINGS, CONCLUSION AND RECOMMENDATIONS

6.1 INTRODUCTION

This chapter presents the conclusions and recommendations of the research. Recommendations have been proposed to both government non-governmental actors based on research findings to help sustainably utilize and conserve the forest as well as Non Timber Forest Products. These are based on the findings from the study

6.2 KEY FINDINGS

6.2.1 Respondent's characteristics

This study gathered opinion from all gender and age groups. However the female gender had a higher representation at 56% which was good for study because it corresponded the fact that most NTFP collectors were female. This high representation by the female gender also indicated that there was less gender disparity in households, and women were allowed to give information on behalf of the family.

6.2.2 NTFP for livelihood improvement

From the study, it was found out that NTFP's regularly provided a safety net for the poor to fall back on when other activities such as subsistence agriculture and food crops, fodder or firewood fail to deliver as expected. From the findings, a total of 37% of the sampled population grazed in the forest for the better part of the year while firewood was the most collected NTFP at 98%.

6.2.3 Technical know-how on the collection and sustainable management of NTFP's

Provision of technical know-how and skills on the sustainable collection, harvesting and management of NTFP's was lacking and interventions to address this through the existing institutions were not there. The need to provide greater opportunities through training for NTFP collection and commercialization was required.

6.2.4 Lack of Policy enforcement on extraction of Non Timber Forest Products

There was clear lack of enforcement of the existing policy provisions as per the forest Act 2005 on the sustainable utilization and joint management of forest resources through joint Forest Management Agreements. Firewood (98%), grazing for fodder, medicinal plants and herbs (55%), construction materials (60%) were all extracted from the forest free of charge. This free access and extraction NTFP's was consequently leading to their depletion

6.3 CONCLUSIONS

Based on the findings of this study, several conclusions can be drawn. First, Kibauni hill forest is very important in supplying the local communities with NTFPs namely: firewood, charcoal, livestock graze, herbal medicines, honey, environmental services, thatch grass and structural materials. These NTFPs play vital role in the livelihoods of local community in meeting basic needs that include energy, food, medicine and shelter.

Secondly, firewood and livestock grazing are the highly consumed products from Kibauni hills forest. These products play a critical role within households mainly by supplying domestic energy and sustenance of livestock that provide nutrition to most households as well as acting as safety nets during harsh climatic conditions

Similarly, households who reside nearer to the forest benefit more from NTFPs than those outside and at distant villages. Generally the major bottlenecks affecting productivity of NTFPs is dwindling availability, unsustainable resource utilization due to open access, and lack of an integrated approach to manage the resources of this forest.. Concerted efforts to rehabilitate and conserve the forest are required urgently,

Capacity building of the newly formed Kibauni Hill Community Forest Association to take up this challenge is paramount and the implementation of the principles of the Forest Act (2005).

It was also evident that communities around are aware of the imminent potential risk as a result of the rampant unsustainable exploitation of the forest resources and as a reaction to this, they have recently formed Kibauni Community Forest Association to promote participatory Forest Management of the resources of this forest. There is need to zone the forest and create buffer zones as well as grant user rights to the communities for sustainable utilization of its resources and reduce deforestation

Based on findings from this study and previous researches conducted within this forest, further comprehensive studies are needed to examine and quantify the amount of NTFPs collected over time against the existing stock. This will provide much needed information to be used for the sustainable utilization and management of the forest resources

The Kenyan Government and the Machakos county government should formulate new policies that will enhance the potential of NTFPs in poverty reduction and empower communities through clear institutional framework to respond to the increasing demand.

6.3 RECOMMENDATIONS

1. The forest adjacent communities, through the newly registered Kibauni Community Forest Association should be actively engaged in forest management and conservation and a structured way for sustainable utilization of the forest resources and accrued benefits including NTFPs
2. It is recommended that policies, strategies and interventions that aim at reducing peoples dependence on natural resource (forest and forest resource) should be put in place to give due attention to community based natural resource management and income generating opportunities.
3. More research on the amount of different NTFP's extracted from the forest is needed to give way to potential domestication of commercially viable products like bee keeping
4. Capacity building of the Kibauni Community Forest Association should be given priority by the government and supported in the preparation of a management plan as well as its implementation of the management plan

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APPENDICES

APPENDIX 1: QUESTIONNAIRE ON NTFP'S

The researcher is a Masters' student at the University of Nairobi conducting a study to find out how people around Kibauni Hill forest utilize Non Timber Forest Products for livelihood improvement to facilitate data for a project report leading to his masters' degree in Environmental planning and management at the University of Nairobi. The information generated will only be used for the intended purpose of academic study.

SECTION A: General Information

No.....

1) General information of the respondent:

- a) Date _____
- b) Respondent code: _____
- c) County.....Location
- Village _____ Sublocation _____
- d) Age of respondent: _____ Gender _____

2) Household characteristics (please tick)

House hold head		
Male headed		
Female headed		
Other (Specify)		
Education level		
Primary education		
Secondary education		
College education		
None		
Other(Specify)		

3) Ownership of house (please tick)

Own	
Rented	
Leased	
Other (Specify)	
Type	No. of houses
Mud walled-Grass thatched	
Mud walled-iron thatched	
Brick walled-grass thatched	
Brick walled-iron thatched	
Stone walled-iron thatched	
Other(specify	

3 a) Type of houses in the homestead (please tick)

4) Do you own land? Yes _____ NO _____

4 a) If yes, what is the type of land ownership?

- A) Individual b) Communal c) Leased d) Rented/contracted e) inherited
 e) Other (Specify

4 b) What size of land do you own in hectares _____?

5) What is your Occupation _____?

Section B: Livelihood and forest related activities

1) What are the main sources of livelihood for the family?

2)

No.	Farm activity	Ranking
1	Crop production	
2	Animal production	
3	Forest related activities	
4	Off farm/on farm	
5	Petty trade	
6	Others (Specify)	

Ranking:

Secure food security=1

Generate cash=2

Both=3

Others (Specify)

2) What crops do you grow in your farm? (Please List)

3) What animals do you rear in your farm?

Cattle_____ b) goats_____ c) Sheep_____ e) Donkey_____

f) Others (Specify)_____

4) Where do you graze your animals?

a) Communal grazing land

b) private grazing land

c) Forest grazing

d) Others-(Specify)

5) If your animals graze in the forest-for how many months do they graze?

a) 2-3months=1

b) 4-8 months=2

c) Throughout the year=3

5 a) How much do you value forest grazing?

Very Important=1

important=2

Supplementary=3

6) Does the forest provide you with any livelihood in the form of income or other services (Household uses)

a) Yes_____

b) No_____

6 a) If yes, what is the income that you get from the forest? (please List)

6 b) What other services do you get from the forest? (Please List)

No.	Type of Non Timber Forest Products	Amount collected/season	Amount consumed/season	Amount sold/season	Price	Remarks
1.	Poles					

No.	Type of Non Timber Forest Products	Amount collected/season	Amount consumed/season	Amount sold/season	Price	Remarks
2.	Firewood					
3.	Grass-grazing/fodder					
4.	Grass-thatch					
5.	Charcoal					
6.	Liannas					
7.	Honey					
8.	Medicinal plants					
9.	Wild fruits					
10.	Water					
11.	Seeds					
12.	Hunting					
13	Stones-construction					
14	Other(Specify)					

7) What Non timber Forest products (NTFP's) are available in the area?

No.	Type of Non Timber Forest Products	Domestic use (Tick as appropriate)	Use as Income source (Tick as appropriate)
1.	Poles		
2.	Firewood		
3.	Grass-grazing/fodder		
4.	Grass-thatch		
5.	Charcoal		
6.	Liannas		
7.	Honey		
8.	Medicinal plants		
9.	Wild fruits		
10.	Water		
11.	Seeds		
12.	Hunting		
13	Stones-construction		
14	Other(Specify)		

Key for Abundance 1=Very abundant

2= Abundant

3=rarely abundant

7 a) Where do you find these Non Timber Forest Products?

In the forest=1 On the farm land=2 Around the homestead=3 others=3

8) Are you engaged in the collection of Non Timber Forest Products?

Yes=1 No=2

8 a) If Yes, what type?

Poles =1 firewood=2 Grass/fodder =3 Grass/thatch=4
 Charcoal =5 Liannas=5 Honey =6 Medicinal herbs =6
 Wild fruits=7 Water=8 seeds=9 hunting=10
 Stones-construction=11 All=12 Others (Specify) =13

9) Are these Non Timber Forest Products available throughout the year?

Yes=1 No=2

9 a) If no, when are the products available?

No.	Type of Non Timber Forest products	Available time (months)	Remarks
1.	Poles		
2.	Firewood		
3.	Grass-grazing/fodder		
4.	Grass-thatch		
5.	Charcoal		
6.	Liannas		
7.	Honey		
8.	Medicinal plants		
9.	Wild fruits		
10.	Water		
11.	Seeds		
12.	Hunting		
13	Stones-construction		
14	Other(Specify)		

Key: During wet season=1 Dry season=2 both=3

10) What plant species and parts do you utilize for the various Non Timber Forest Products

	Name of plants used in local name	Scientific name	Utilization e.g. malaria treatment	Specific parts of plant used e.g. bark or root
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				

Section C: Local Knowledge and practices regarding management of plant resources

1) Do you practice preserving of Non Timber Forest Products? Yes=1 No=2

1 a) If yes, which ones? (Please list)

2) Why do you preserve it and how?

No.	Type of Non Timber Forest Products	How do you preserve	Reason for preservation
1.	Poles		
2.	Firewood		
3.	Grass-grazing/fodder		
4.	Grass-thatch		
5.	Charcoal		
6.	Liannas		
7.	Honey		
8.	Medicinal plants		
9.	Wild fruits		
10.	Water		
11.	Seeds		
12.	Hunting		
13.	Stones for-construction		
14.	Other(Specify)		

3) Do you employ any management practices for the Non Timber Forest Products' No=2

Yes=1

3 a) If yes, Please describe

4) Are there shrines in the forest? Yes=1 No=2

4 a) If yes, how many do you know? _____ Name them

5) Are you conscious about the future of Non Timber Forest Products that you collect?
Yes=1 No=2

5 a) If yes, Please explain

6) Do you have any harvesting technique? Yes=1 No=2

6 a) If yes, Please explain

6 b) Is the technique indigenous or modern?

7) Do you experience any problems while collecting Non Timber Forest Products
Yes=1 No=2

8) Are you aware of any existing government policies? Yes=1 No=29.

8 a) if yes, Please explain

9) Which organizations are actively working here on Non Timber Forest Products?

CBOs	NGOs	Government Ministries	Forest department	Provincial Administration	Others (Specify)

9 a) Are they helpful to improve your livelihood? Yes=1 No=2

Section D: Conservation of Non Timber Forest Products

1) How long have you been living in this settlement?

2) How many minutes do you walk before you reach the main forest area?

3) How do you perceive change in availability of Non Timber Forest Products in the last 10-15 years?

Increasing=1 Decreasing=2 No change=3

3 (a) In your own opinion, why is the availability of Non Timber Forest Products changing? (Reason in order of importance)

No.	Type of Non Timber Forest products	Increasing	decrease	Reason for change
1.	Poles			
2.	Firewood			

No.	Type of Non Timber Forest products	Increasing	decrease	Reason for change
3.	Grass-grazing/fodder			
4.	Grass-thatch			
5.	Charcoal			
6.	Liannas			
7.	Honey			
8.	Medicinal plants			
9.	Wild fruits			
10.	Water			
11.	Seeds			
12.	Stones for-construction			
13	Other(Specify)			

3 b) if it had significant impact, what are the reasons?

Collection method=1

part of tree harvested=2

Amount harvested=3

Others (Specify) =4

4) What is the likely effect in your daily life if the forest continues to decline and eventually

disappear?

No effect=1

some effect=2

significant effect=3

5) Do you plan to domesticate some Non Timber Forest Products?

Yes=1

No=2

5 a) If yes, Which ones?

Section E: Threats facing utilization of Non Timber Forest Products

1) Do you think extraction of these Non Timber Forest Products poses a threat to the forest resources?

Yes=1

No=2

1 a) If yes, What are these threats? (Please list)

Other general comments (End of session: Questions from the respondents and a vote of thanks by enumerate)

Annex 2: Botanical Uniqueness-Kibauni Hill Forest species

Family	Species	Life form	Conservation status (IUCN 1997 red list)	Endemism	Source
Euphorbiaceae	Synadenium compactum N.E.Br.	Tree	Rare, Endemic	National	EA;IUCN 1997,UFT (VOL1 NO.3) 1988; FTEA 1988, KTSL
Leguminosae	Acacia elatior Brenam	Tree	Endemic	National	FTEA, 1959; KTSL
Leguminosae	Millettia leucantha Vatke	Tree	Endemic, rare/Vulnerable	National	FTEA, 1971;
Vitaceae	Cissus quadrangularis L.	Shrub	Endemic	National	EA, FTEA, 1993