Kenya's Water Towers Protection and Climate Change Mitigation and Adaptation (WaTER) Programme

Assessment of indigenous technical knowledge on production and utilization of Non Wood Forest Products (NWFPs) in Cherangany and Mt. Elgon Water Towers of Kenya

Jonah Kiprop, Violet Oriwo, Meshack Muga, Roxventa Othim and Collins Obonyo

Component 4: Science to Inform Design of Community-Level Actions and Policy Decisions

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Activity ER 3.5:

Promotion of Sustainable Utilization of Non Wood Forest Products in Mt. Elgon Ecosystem

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LIST OF ACRONYMS

CBO	Community Based Organizations
CFAs	Community Forest Associations
EU	European Union
FAO	Food and Agriculture Organization
FGD	Focus Group Discussion
GoK	Government of Kenya
ICRAF	International Centre for Research in Agroforestry
ITK	Indigenous Technical Knowledge
KEFRI	Kenya Forestry Research Institute
KFS	Kenya Forest Service
KFS	Kenya Forest Service
KWS	Kenya Wildlife Service
KWTA	Kenya Water Towers Agency
LVBC	Lake Victoria Basin Commission
MEWNR	Ministry of Environment, Water, and Natural Resources
NGO	Non-Governmental Organization
NTFPs	Non Timber Forest Products
NWFPs	Non Wood Forest Products
PDM	Pebble Distribution Method
PRA	Participatory Rural Appraisal
UNEP	United Nations Environment Programme
WRMA	Water Resources Management Authority

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EXECUTIVE SUMMARY

Forest ecosystems provide critical livelihood support to majority of households and indigenous communities in Kenya. Among these benefits are non-wood forest products (NWFPS) which are derived from both natural forests and plantations. These products include: fodder, wild fruits, and vegetables, roofing material (thatch roofing and mats), edible gum, incenses, tannins, dyes, medicine (human and veterinary), fibre used for making rope and cosmetic and cultural products. The extraction and utilisation of these products is associated with unique cultural traditional knowledge which has over the years been applied and passed on to the next generation. This report presents the results of an Assessment of indigenous technical knowledge on production and utilization of Non Wood Forest Products (NWFPs) in Cherangany and Mt. Elgon Water Towers of Kenya.

Identification of the major NWFPs extracted and used locally for subsistence and commercial use within the two forest ecosystems indicates that the following ten (10) products are the major utilized; Indigenous fruits, Herbs/Traditional medicine, Bee products (honey), Exotic fruits, Indigenous vegetables, Fibre, Fodder, Gums, Mushrooms and Bush meat. Most of these and to a smaller extent the exotic fruits are obtained mainly from the natural forest and a few from planted forests and non – except the exotic fruits being grown on farms. This report as summarized a checklist of the major non wood forest products describing their use, assessing their contribution to local communities and documenting the local knowledge regarding production and utilization in Kenya and coming up with specific interventions to conserve these important forest products.

CHAPTER ONE: INTRODUCTION

1.1 Background of the study

About 7% of Kenya's total land area is forest (MENR, 2016). These forests provide multiple economic benefits such as water catchment, biological biodiversity, employment and livelihood sources. The forests supply approximately 60% of the national energy supply (ESDA, 2005). The vegetation embedded in Kenyan forest contains many useful trees, shrubs and non-wood forest products. According to FAO (1999b) Non Wood forest products consist of goods of biological origin other than wood derived from the forests, other wooded land and trees outside the forests. Following this definition the term NWFP excludes all woody raw materials. Consequently timber, chips, charcoal and fuelwood, as well as small woods such as tools, household equipment and carvings are excluded. Non timber forest products (NTFPs) in contrast generally include fuelwood and small woods, this is the main difference between NWFPs and NTFPs. NWFPs are derived from both natural forests and plantations these products include fodder, wild fruits, vegetables, roofing material (thatch roofing and mats), edible gum, incenses, tannins, dyes, medicine (human and veterinary), fibre used for making rope and cosmetic and cultural products. These NWFPS form an integral part of the rural household's economy meeting the needs of hunter-gatherers, subsistence and small scale farmers. Although globally human food is sourced from agricultural crops, the uncultivated plants are an important source of vitamins and minerals and daily dietary intake. Their role and contributions in subsistence and rural economy in Kenya therefore cannot be underestimated. The importance of NWFPs for rural households, particularly in times of adversity such as droughts and famine is well documented (Arnold 2001; Falconer 1992, 1997; Falconer and Arnold 1992; ICRAF 2004; Hackleton and Shackleton 2004).

With the increasing deforestation and encroachment into indigenous forests the overlooked indigenous plant resources and non-wood forest products have come under severe pressure. These pressures have led to the domestication of many of these indigenous plants (Leakey & Newton 1994a). Currently, there is high and increasing global demand for bio-products and *nutraceuticals* derived from NWFPs. Global market for medicinal plants, for instance, was estimated at over USD 14 billion/yr in 2010 (Mafimisebi,2013). This increase in demand is providing new income opportunities for the rural populations and attracting more attention from

researchers worldwide. With the increasing population, there will be more pressure on land, simultaneously there will be an increasing need to preserve and sustainably use these resources.

1.1.1 Indigenous knowledge and utilization of non-wood forest products

Indigenous knowledge is knowledge of an indigenous community accumulated over generations of living in a particular environment. It is a broad concept that covers all forms of knowledge technologies, knowhow, skills, practices and beliefs that enable the community to achieve stable livelihoods in their environment. It is traditional cultural knowledge that includes intellectual, technological, ecological and medical knowledge (Martin *et al.,* 20010). According to UNESCO 1999 the knowledge is developed outside the formal education system and is embedded in culture within a given society. Indigenous knowledge in Kenya, as in the rest of the world, has historically been dynamic, responding and adapting to changing environmental, social, economic and political conditions to ensure that forests and associated agricultural lands continue to provide tangible (food, medicine, wood and other non-timber forest products and water) and intangible (spiritual, social and psychological health) benefits for present and future generations.

Indigenous knowledge on production and utilization of non-wood forest products has assisted rural based households in exploiting the economic benefits of this valuable natural resource. According to Warren (1991) Indigenous knowledge is unique to a given society or culture. In Kenya local communities have well developed indigenous knowledge systems which they apply in many aspects of their livelihoods. This knowledge had, and still has, a high degree of acceptability amongst the majority of populations in which it has been preserved. These communities can easily identify with this knowledge and it facilitates their understanding of certain modern scientific concepts for environmental management including forest conservation and climate change mitigation. Indigenous knowledge of local forest use patterns and practices are therefore key information on which to base decisions on forest management. Despite their importance and contribution to sustainable rural livelihoods, indigenous forest related knowledge and practices are at a risk of disappearing in most African countries due to changing natural environment, economic, political and socio-cultural conditions. Therefore there is need to capture, preserve and disseminate this knowledge widely. It is therefore imperative that researchers, development policy makers and forest managers need to document, revive and replicate wherever possible this knowledge and practices and further synergize them with

modern scientific knowledge especially in the context of promoting sustainable forest management.

1.1.2 Interventions of the Kenya's Water Tower Protection and Climate Change Mitigation and Adaptation (WaTER) Programme

Recognition of Kenya's water towers economic importance and threats posed by their degradation has necessitated various rehabilitation and restoration actions. Communities adjacent to forested and multifunctional landscapes rarely sustain the ability of Kenya's forested landscapes to provide critical ecosystem services. This is because their livelihood activities are short-term and often lead to negative externalities in downstream areas. It is in line with this that The Kenya's Water Tower Protection and Climate Change Mitigation and Adaptation (WaTER) Program pursues innovative institutional approaches for linking ecosystem services providers and beneficiaries through the design and implementation of rewards and/or payments for ecosystem services.

The Kenya's Water Tower Protection and Climate Change Mitigation and Adaptation (WaTER) Programme, is a programme funded by the European Union and being implemented by KEFRI alongside other partners. The overall objective of the programme is to contribute to poverty reduction and sustainable livelihoods by applying scientific principles to inform design of community level actions and national policy decisions on rehabilitation and conservation in Cherangany and Mt. Elgon water towers. Under component 4 of this programme, KEFRI is working with key organizations including the Kenya Forest Service (KFS), Kenya Wildlife Service (KWS), the Kenya Water Towers Authority (KWTA) and the 11 participating County Governments to improve the management of Mt. Elgon and Cherangany forest ecosystems which are key in the management of western Kenya water resources.

One of the expected results of the programme (ER 3) is: ***Integration of selected rehabilitation and conservation technologies for improved Natural Resource Management, Sustainable Land Management and Agricultural Water Management in the 2 water towers demonstrated.***

This objective seeks to leverage integrated natural resource management technologies to improve the rehabilitation and conservation of the water towers catchments. Building on the land degradation maps and other tools developed in ER 1 this work was expected to use

socioeconomic assessments to understand priority technologies to be disseminated for adoption by communities undertaking conservation of waterways, wetlands, and water springs. One of the efforts to raise community appreciation of natural forest areas would involve the promotion of sustainable utilization of non-wood forest products (NWFPs) around the project areas.

Though Kipkore *et al.,* 2014 has documented ethno botanical information on 111 medicinal plants used by herbalists in Elgeyo Marakwet District there is very scanty information on other NWFPs in Ecosystem. This programme therefore examined the existing indigenous technical knowledge targeting NWFPs with commercial value such as bee and bee products, edible indigenous fruits, medicinal plants, mushrooms in Cherangany and Mt. Elgon Water Towers. The generated information was expected to strengthen the available local knowledge and provide critical information for the development of the sub-sector. Furthermore, the generated information would also contribute to the improvement of these products; enhance their sustainable production through their domestication and natural regeneration; improve market access and linkages for the products; contribute to the development of enabling policy, institutional and regulatory frameworks for the products. It is desired that the local people would apply the information to diversify their incomes and improve their livelihoods through sustainable commercialization of prioritised and viable products.

1.2 Purpose and Objectives of Study

The purpose of this study was to undertake an Assessment of Indigenous Technical Knowledge (ITK) on production and utilization of Non Wood Forest Products (NWFPs) in Cherangany and Mt. Elgon Water Towers of Kenya

1.2.1 Specific Objectives

The objectives of the study were to:

1. To map and audit indigenous technical knowledge on NWFPs among communities living in Cherangany and Mt. Elgon Water Towers
2. To find out the extent to which the communities apply ITK on production and utilization of NWFPs
3. To establish how communities preserve, share and integrate ITK in the utilization of NWFPs

4. To suggest and recommend measures to be taken to improve the use of ITK

1.3 Scope of study and study sites

This study was carried out in Mount Elgon and Cherangany forest ecosystems. Key target respondents were households living adjacent to the six forest blocks in Mt. Elgon Forest ecosystem namely: Kaberwa, Saboti, Kimothon, Kaboiywo, Kiptogot and Cheptais and in seven (7) forest blocks in Cherangany Forest ecosystem namely; Kapolet, Toropket, Kapkanyar, Kiptaber, Chemurkoi, Koisungur and Sogotio.

1.3.1 Mt. Elgon Ecosystem

Mt. Elgon is one of Kenya's five main water towers, enabling a range of productive activities including irrigated agriculture and industry to an estimated watershed population of over 1.5 million with a majority depending on the forest for a wide range of forest products (LBVC, 2011). Mount Elgon's forest ecosystem covers an area of 236,505 ha to the Kenyan side and overlaps with Trans-Nzoia and Bungoma counties (KWS, 2011). It was gazetted in 1932 (Ongugo *et al*, 2001) and receives maximum rainfall, designating it as one of the Kenya's five "water towers" (Synnot, 1968), supporting a huge population (Van Heist, 1994). It holds a high percentage of forest resources, crucial to local community' livelihoods (van Heist, 1994). Major products contributing to socio-economy are firewood, poles or timber, vines, water and fodder (Scott, 1994). In addition, Mt. Elgon hosts the headwaters of the Nzoia River which provides hydrological services to a range of economic sectors including irrigated agriculture with an estimated watershed population of over 1.5 in Kenya's Western region, but when excessive also threatens the lives and livelihoods of thousands of people due to flooding (Nyacha *et al*, 2005).

Mt. Elgon vegetation can be zoned into four: open woodland, tropical moist forest, bamboo and afro-alpine zone (above the bamboo zone). *Juniperus procera*, *Hagenia abyssinica*, *Olea welwitschii*, *Oleahochstetteri*, *Prunus africana*, *Podocarpus falcatus* and *Podocarpus latifolia* dominate the moist tropical forest. Moorlands, swamps and rocks form a major part of the afro-alpine zone. The forest is divided into three management units namely: the natural forest reserve, the commercial exotic plantations and the national park. These are named Kimothon forest, Mt. Elgon and Chorlem forest blocks respectively.

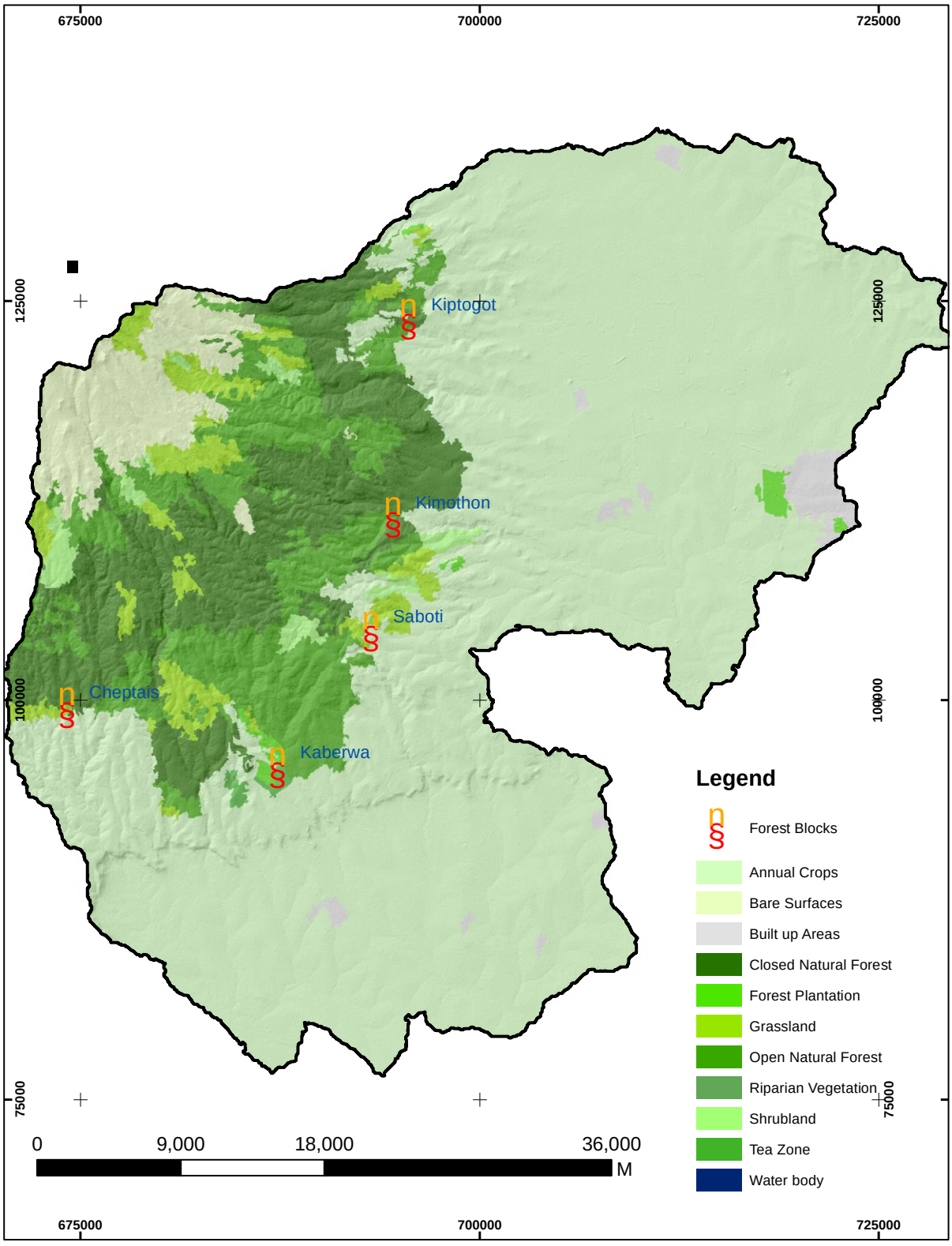

Figure 1: Map of Mt. Elgon forest ecosystem showing location of study sites

Over the years, Mt. Elgon's forest ecosystem has experienced loss in terms of vegetation diversity and density attributed primarily to a combination of encroachment by local communities and large illegally allocated logging concessions (Nield *et al*, 1999). Forest fires have also destroyed some trees, causing overgrowth of non-palatable species. The destruction caused on trees by medicine harvesters, and big animals have also contributed to decrease in tree species diversity and density. Mt. Elgon forest is in danger of being completely destroyed yet has many plant species of economic value such as *Olea welwitschii* (Elgon teak) (Ochuoga, 2002). The Mt. Elgon Integrated Conservation and Development Initiative (MICDI) estimated that the local communities have illegally excised over 5,000 hectares of Chepyuk forest; over 2,000 hectares of Kitale forest and hundreds of acres of Kaboywo forest had been cleared and converted to cultivation of maize and wheat (Ochuoga, 2002).

1.3.2 Cherangany Hills Ecosystem

The Cherangany forests are important for water catchment also referred to as one of Kenya's five ''Water Towers'' and sit astride the watershed between the Lake Victoria and Lake Turkana basins. The Cherangany Hills cuts across four administrative districts in Rift Valley Province that is Trans-Nzoia, West Pokot, Marakwet and Lelan. Spatially, the location of Cherangany Hills is defined by 35^{o} 26'' East and 1^{0}16'' North at an altitude range of 2000-3365 m above sea level (CHFESp 2015). Cherangany hills forest ecosystem comprises of a number of forest blocks (12), cutting across three counties, Trans-Nzoia, Elgeyo Marakwet and West Pokot, on the Western ridge of the Great Rift Valley. It covers an area of 120,000 ha, forming the upper catchment of Nzoia, Kerio and Turkwel rivers (KFWG & DRSRS 2004). The watershed not only underpins livelihoods of communities within Lakes Victoria and Turkana Basins, but stretches its significance to national and global capacity. However, this ecosystem has never been an exemption to anthropogenic disturbances of land use pressure, demographic characteristics and even climate change (Cherangani Hills Forest Ecosystem Strategic Management plan 2015). The least affected forests are those on the Cherangani hills with only 174.3 hectares deforested. However this loss is occurring in indigenous forest cover (KFWG & DRSRS 2004).

The Cherangany Hills are largely covered by a series of indigenous forests. These forests are made up of 13 administrative blocks namely; Kapolet, Kapkanyar, Kiptaber, Sogotio, Chemurkoi, Kaisungur, Kerrer, Embobut, Kipkunur, Lelan, Toropket, Cheboi and Kapchetumwa

administrative blocks namely; Kapolet, Kapkanyar, Kiptaber, Sogotio, Chemurkoi, Kaisungur, Kerrer, Embobut, Kipkunur, Lelan, Toropket and Cheboi. The total gazetted area is 95,600 ha, out of this, 60,500 ha is closed canopy forest, the remainder being formations of bamboo, scrub, rock, grassland, moorland or heath, with ca. 4,000 ha of cultivation and plantations.

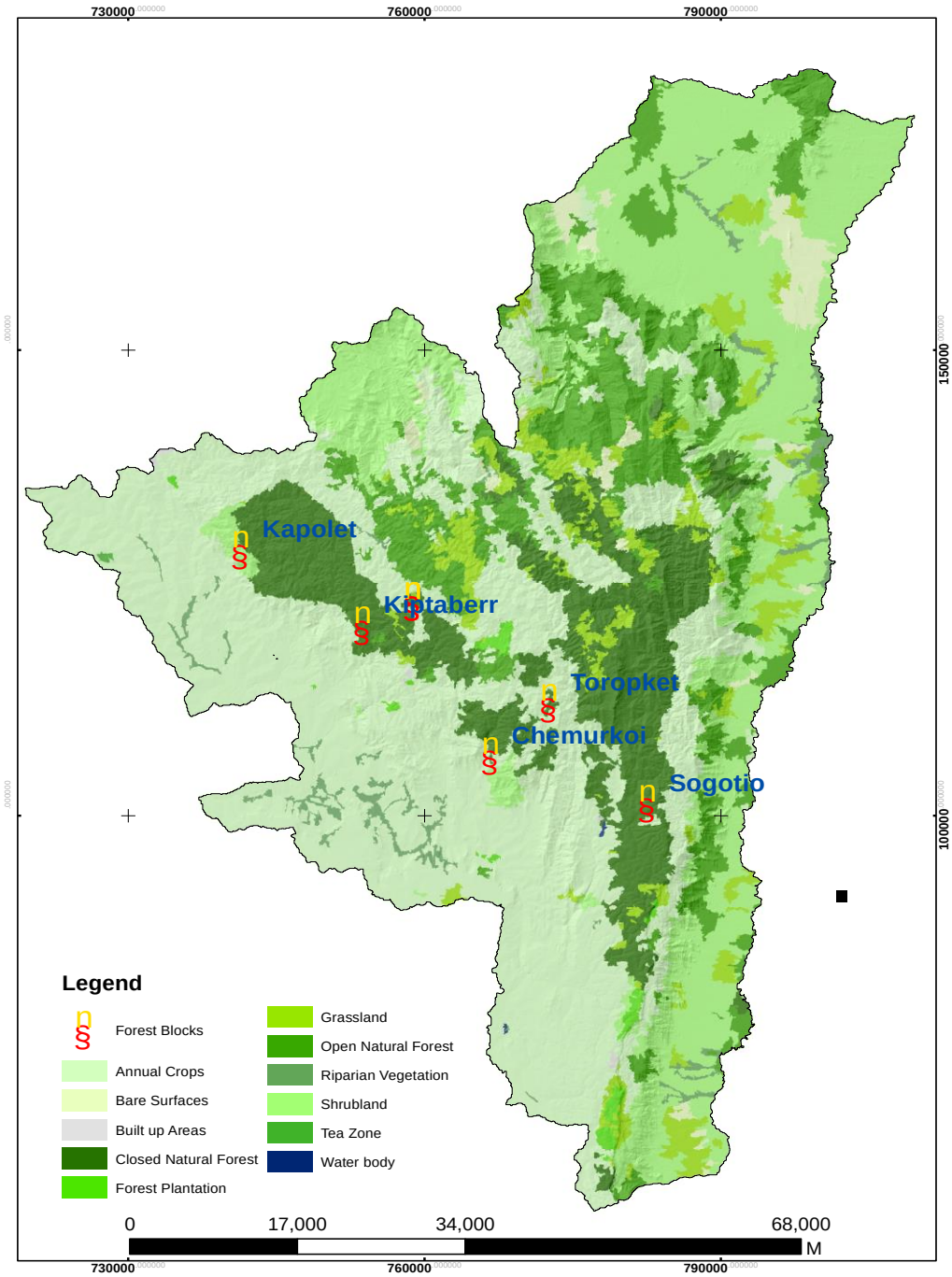

Figure 2: Map of Cherangany forest ecosystem showing of study sites

1.4 Limitations

The study has used mainly data obtained from Focus group discussions and key informants from selected forest blocks within the two forest ecosystems because of limited resources. However, this study is supplemented by additional data obtained from a baseline survey on key non- wood forest products (NWFPs) of socio-economic importance in Mt. Elgon and Cherangany ecosystems. Despite these limitations, the information obtained provides a robust insight on how communities within the two forest ecosystems use and apply Indigenous Technical Knowledge (ITK) for production and utilization of Non Wood Forest Products (NWFPs).

CHAPTER TWO: METHODOLOGY

2.0 Sampling Frame and selection of key informants

Participatory Rural Appraisal (PRA) techniques Focus Group (FGDs) and Key informant interviews were utilized to gather data from predetermined sample of communities in 13 forest blocks believed to be representative enough of the two forest ecosystems. The data collected was to compliment household baseline survey undertaken on non-wood products utilization in the two ecosystems. The focused group discussions were held in six (6) forest blocks in Mt. Elgon Forest ecosystem (Kaberwa, Saboti, Kimothon, Kaboiywo, Kiptogot and Cheptais) and seven (7) forest blocks in Cherangany Forest ecosystem (Kapolet, Toropket, Kapkanyar, Kiptaber, Chemurkoi, Koisungur and Sogotio). Each focused group discussion comprised of at least 8 members drawn from 3 villages within the target forest block. In Mount Elgon, six FGDs were held Kaberwa, Saboti, Kimothon, Kaboiywo, Kiptogot and Cheptais with each with a total of 48 participants respectively. Whereas, in Cherangani 7 FGDs were conducted in Kapolet, Toropket, Kapkanyar, Kiptaber, Chemurkoi, Koisungur and Sogotio with a total of 56. The communities were sensitized on the importance of non-wood forests products and the need to preserve the adjacent forests. Discussions focused on the major NWFPs used in the households for subsistence and income, Indigenous Technical Knowledge (ITK) practices with respect to utilization of non-wood forest products, their awareness, application of ITK and their methods of sharing and preservation.

The group discussions included key informants who were mainly village elders, local administrators, chiefs, Council of elders, representatives from Community Forest Associations (CFAs), Water Resource Users Associations (WRUAs) officials, religious leaders, community leaders (men, women and youth) and Indigenous people (People believed to have a set of specific rights based on their historical ties to a particular territory, and their cultural or historical distinctiveness from other populations that are often politically dominant) believed to have sufficient information on production and utilization of indigenous knowledge in NWFPs.

2.1 Data collection and analysis

Primary data was collected through participatory rural appraisal techniques namely key informant interview and focus group discussion. Trained field assistants together with KEFRI research officers assisted in the data collection. Before the actual data collection the interview schedule/checklist was subjected to pilot test. This was done to ascertain the quality, usability and adequacy of the survey instrument. Data on the utilization of NWFPs and the application of indigenous knowledge in its utilization was collected. Weighted ranking method (Pebble Distribution Method) was adopted as applied by Sheil *et al.*, 2002 and Lynam *et al*., 2006 in the ranking of major non wood forest products utilized by the households

CHAPTER THREE: RESULTS AND DISCUSSION

3.1 Socio-Economic Characteristics of respondents

3.1.1 Ethnic Composition and Indigenous Knowledge

Culture and ethnicity plays a key role on how communities utilise, preserve and apply Indigenous Knowledge on utilisation of non-wood forest products. An analysis of the ethnic composition of the communities living within the two ecosystems indicates that the Sabaot community is the most dominant within Mount Elgon ecosystem accounting for 80% of the total population of the original ethnic group. They settled in the area around the year 1900's. Other ethnic groups consist of Luhya, Turkana and Teso. In Cherangani Ecosystem the Kalenjin community composed of Marakwet, Keiyo, Nandi, Pokot, Tugen and Indigenous communities namely Sengwer and Ndorobo form a large part of residents. Each group gives specific names to identify the Non wood forest products. This means that there is a wealth of indigenous knowledge that exists regarding the use and management of non-wood forest products in their respective villages. Each community represented assisted in identifying the various species used and how they manage the non-wood forest products.

3.1.2 Major livelihood activities

Most people in the study area are engaged in farming (agriculturalist), of the interviewed respondents 87% are engaged in crop production mainly maize and beans integrated with livestock. Few of the respondents are purely pastoralists who entirely depend on livestock production.

3.2 Major NWFPs extracted/commonly used by households

Identification of the major NWFPs extracted and used locally for subsistence and commercial use within the two forest ecosystems indicates that the following ten (10) products are the major utilized; Indigenous fruits, Herbs/Traditional medicine, Bee products (honey), Exotic fruits, Indigenous vegetables, Fibre, Fodder, Gums, Mushrooms and Bush meat. Most of these and to a smaller extent the exotic fruits are obtained mainly from the natural forest and a few from planted forests and non – except the exotic fruits being grown on farms. Most of these are found

in the natural forest and few in planted forests. The pebble distribution method by Lynam et al., 2006 was then used to determine the relative important value of the identified non wood forest products. Products perceived to be very important were those used frequently by the households.

Table 1: Major non-wood forest products extracted and utilized within Mount Elgon and Cherangany forest Ecosystem and their relative importance to local communities

Ecosystem Services	**Relative Importance Value**	
	Mt. Elgon	**Cherangani**
Herbs/Traditional medicine	0.25	0.20
Fodder/pasture	0.15	0.14
Bee products (honey and wax)	0.10	0.10
Indigenous vegetables	0.08	0.17
Fibre	0.08	0.04
Exotic fruits	0.05	0.09
Indigenous fruits	0.04	0.11
Gums	0.14	0.08
Mushrooms	0.06	0.04
Bush meat	0.05	0.03
Total	**1.00**	**1.00**

The table 1 summarizes main non wood forest products extracted from the forest as ranked by the respondents in order of importance. Herbs/Traditional medicine, fodder/pasture Bee products (honey and wax) and indigenous vegetables are ranked as of high importance.

3.3 Indigenous Knowledge associated with utilization of Non wood forest products

3.3.1 Herbs/traditional medicine

Use of medicinal plants in the treatment and management of diseases has been an age long practise (Sofawara, 1982). Many plants have plant origin, and several are undergoing investigation to ascertain their therapeutic efficacies (Kipkore *et al*., 2014). Traditional herbal medicine use for human and animal health is still an important component in sub-Saharan Africa

largely due to poverty and lack of adequate health care systems. The plant derived medicine are usually preferred because they are cheap and readily available (Iwu *et al*., 1999). Communities have applied indigenous knowledge passed from one generation to the other on use of plants for medicinal 2014 purposes over the years. Various parts of the plants are used mainly roots, bark and leaves. The remedies are mostly prepared as infusions or decoctions. The participants in the focus group discussion and key informant interviews identified and prioritised key medicinal plants used by the households within the two forest ecosystems as follows (Table 2).

Table 2: List of various medicinal plants used in Mount Elgon and Cherangany hills ecosystem

No.	Botanical name	Local Name	Medicinal Uses	Part used
1.	-	Lobin	dewormer	roots
2.	-	Kipkoros	antibiotic	roots
3.	-	Cheptendere	stomach ailments	leaves
4.	-	Chesegerkat	antibiotic	leaves
5.	-	Ngechepcha	antibiotic	leaves
6.	-	Kamusian	antibiotic	roots
7.	-	Kosisit	venereal diseases	roots
8.	-	Mindililwo	venereal diseases	roots
9.	-	Borowo	venereal diseases	roots
10.	-	Kapchebin	venereal diseases	roots
11.	-	Sigowo	venereal diseases	roots
12.	-	Kurio	venereal diseases	roots
13.	-	Tangururwo	venereal diseases	roots
14.	*Podocarpus graciliar*	bennet		bark
15.	-	Lamaywo	allergy	bark
16.	*Faurea saligna harvey*	Sirirte	period pains	bark
17.	-	Chorwo	allergy	bark
18.	-	Sewerwa	allergy	bark
19.	-	Arrar	allergy	bark
20.	-	Seriat	allergy	bark
21.	-	Masat	dewormer	bark
22.	*Warbugia ugandensis*	Sokwo	Headache, antibiotic	bark
23.	-	Nerkwo	Milk preservation	Stem and bark
24.	-	Chemusar	Milk preservation	Stem and bark
25.	*Terminalia brownie*	Talaswo	stomach ache	roots
26.	-	Kosisit	antibiotic	
27.	-	Kipkesenchi	antibiotic	
28.	-	Tumeywo	stimulant	Leaves
29.	-	Chepnerwa	allergy	leaves
30.	*Croton macrostachyus del.*	Tabaswet	allergy	leaves
31.		Kipsuruny	venereal diseases	roots

32.		Kipkeres	cold and flu	roots
33.		Monmonwo	Stomach ache	roots
34	*Prunus africana*	Tendwo	Enlarged prostate	bark
35.		Tinwo	Livestock	Leaves
36.		sesimwo	Livestock	Leaves

Most of these herbal medicine listed above are used in a combination of several herbal preparations as part of the treatment of various ailments which include; stomach ache, heartburn, allergies, Venereal diseases, cancer, tooth ache, period pains, colds and cough, eye ailments, wounds and arthritis. The most commonly used medicinal plants were *Lobin, Kipkoros Cheptendere, Chesegerkat, Ngechepcha, Kamusian, Kosisit, Mindililwo, Borowo, Kapchebin, Sigowo, Kurio, Tangururwo, Pene, Lamaywo, Sirirte, Chorwo, Sewerwa, Arrar, Seria and, Masat* which are used in the treatment of various conditions as outlined in table 2.

3.3.2 Indigenous fruits

Most of the indigenous fruits consumed are from uncultivated species sourced from the adjacent forest and few have been domesticated. The consumption of individual fruits depends on various factors which include: The seasons some from fruits are available only during a particular time of the year, the productivity of the plant and the preference by the households. The consumption also varies with age groups for example most fruits are eaten by younger children.

Some fruits are consumed at household level and also sold in local markets such as *Tamarindus indica, Syzigium cordatum and Mbuunik*. Most of the fruits are collected from the wild and few have been domesticated by the households as summarized in table 3. Even though there is potential for value addition in the form of wines and jam there are no enterprises within the ecosystems that have taken it up at a commercial scale.

Table 3: List of Indigenous fruits consumed in Mount Elgon and Cherangany hills ecosystem and their domestication status

No.	Botanical name	Local Name	Uses	Domestication status
1.	-	Momon	food	Wild, domesticated
2.	-	Loss	food	Wild, domesticated
3.	*Syzigium cordatum*	Lamaek	Food, medicine	Wild
4.	*Ficus sur Forssk*	Mogoiwet	Food, medicine	Wild, domesticated
5.	-	Simat	food	Wild, domesticated

6.	-	Kapchebin	food	Wild
7.	-	Sumbeiywo	food	Wild, domesticated
8.	*Vangueria madagascariensis*	Kimolwo	Appetizer, stimulant	Wild, domesticated
9.	-	Legeteton	food	Wild, domesticated
10.	*Flacourtia indica*	Tangururon	food	Wild
11.	-	Takamik	food	Wild
12.	-	Lasiondet	food	Wild, domesticated
13.	-	Mboonik	Food, appetizer	Wild, domesticated
14.	-	Mindililwo	food	Wild, domesticated
15.	-	Siryat	food	wild
16.	-	Mosongor	food	wild
17.	*Tamarindus indica*	aron	food	Wild, domesticated
18	*Ensete ventricosum*	sasurwo	food	Wild, domesticated

3.3.3 Honey and other Bee products

Bee keeping is an integral part of the farming, for a long time communities within these two ecosystems have practised apiculture. Honey production is also a major source of livelihood in these areas. Honey is obtained from domesticated bees within the farming system and wild bees within the forests. The most common hives is the traditional log hive made by crafts men from *kurewso, Borowo, Tebenwo* and *Lamaywo (Syzigium cordatum)* woods this skill is passed from one generation to the next through hands on training and apprentice. Honey harvesting is mostly done during the dry season when there is sufficient honey. Some of the indigenous knowledge associated with bee and bee products are; use of honey in the treatment of bone fractures, dressing wounds, wine making (local wine known as *kipketin*) and also as an appetizer. Wax is mainly used in repair work

3.3.4 Indigenous vegetables

Households rely on indigenous vegetables as a source of vitamin most of this is obtained from the forest adjacent to the farmlands. The most commonly harvested and utilised indigenous vegetables include African night shade *solanum nigrum* (*Kisocho), basella alba (Nderem),*

Kipsicho, Kipsinyon, amaranthus (Chepkerta) and *Leek* – bamboo shoots. Most of these indigenous vegetables have been domesticated and are planted within the households. The vegetables are harvested and utilised, in case there is excess the vegetables are preserved by drying and stored for use in times of drought. Vegetables are also obtained from multipurpose perennial tress and shrubs during the rainy season and are not discussed here. *solanum nigrum Kisocho, basella alba - Nderem, amaranthus- Chepkerta* and *Leek* - Bamboo shoots in Mount Elgon are the most frequently used vegetables

3.3.5 Fibre, roofing material and thatches

Tree Species are an excellent source of fibre mainly used in construction and other household uses. Some of the common species used for fibre in the two ecosystems are *Sisal, Lobjo, Kipsikir, Tingwo, Bisiny, Nyalyat, Tiram, Borowet, Silip, Cheptonge, Motosyo, Singoro, Tabar, Chepetega* and *Chebanyiny*. The plant part used can be inner and outer bark or leaves. On further processing the fibre can be turned into baskets, traditional plates brooms and mats. Other uses associated with extraction are for house construction, aesthetic value in ceremonies, making traditional gourds, used in honey harvesting, trapping of wild animals and making arrows.

Within these two ecosystems almost every plants species has a potential use as a roofing material. The types of houses within the study area are predominantly huts made from plants material. Among the plant species, the leaves of palm are sued as thatches to build huts and shades.

3.3.6 Exotic fruits

Oranges (*Citrus reticulate*), Avocado (*Persea americana*), Laquats (*Eriobotrya japonica*), Lemons (*Citrus limon*) and Tree tomato (*Solanum betaceum*) were the major exotic fruits that have been established by farmers on farm even though some have grown wild within the forests adjacent to the two ecosystems.

3.3.7 Fodder

Apart from crop farming Livestock production is major occupation among communities living within the Mount Elgon and Cherangani. Grass and shrubs leaves constitute a major diet of cattle, sheep and goats. Over years specific trees and shrubs namely; *Turkon, Borowo, Chorwo,*

Kipkesenchi, Kipsot, Tabaswo, Tumeiywo, Kiteria, Sesimwa and Buriehwo have been utilised by the communities to supplement grass as animal feed especially during periods of drought and famine.

3.3.8 Mushrooms

There are various species of Mushrooms edible and non-edible. The edible mushrooms are used a vegetables and a are a rich source of vitamins and proteins. Some are also used a appetisers. When they manifest in plenty some are dried and sod in Local markets. The most common types of mushrooms are Bukenerek, *Kapchekoimetoi* and *bobek*

3.3.9 Bush meat

Communities in Kenya have over the decades used bush meat as a source of protein diet. Although; hunting is prohibited within the forests hunt non-domesticated animals, reptiles; amphibians and birds. These animals are *Boina/bongo, tomm, hare, dik dik, tora, kibire, sawe, kimurkeywo, tisia, soo, sabit, bungunwa, kipkereru, chepurukyo, kenyele, terkekyat, nywaya, taritik and quail.*

3.3.10 Gums

Within these two ecosystems there is a variety of gum yielding plant species. These are *Tinwo, Sirite, lele, chebito, sigot, Simotwo, Kireswo, acacia mearsii, Tendwo* and *Ewa.* The gums are extracted for various uses such as; insect repellents, in preparation of herbal medicine, chewing gum and as an adhesive in fixing holes in various household items.

3.3.11 Cosmetic and cultural products

Extracts from leaves, barks and wood yield cosmetic materials such as oils soap and perfumes mainly used during cultural ceremonies and events. The most important species used as a source of cosmetic products are *periploca linearifolia* (*Sinendet), Taboswet, Yemit, Senetwo* and *Kosisit.* Certain places also have a special spiritual significant and are used as locations for rituals and sacrifices for example, sacred grooves, shrines, mountains and rivers. These locations exist within Mount Elgon and Cherangany forest ecosystems are quite often patches of high biodiversity which are well conserved and protected by the community.

3.4 Traditional rules and knowledge associated with extraction of non-wood forest product

Some of the traditional rules associated with extraction of the various non-wood forest products are geared towards ensuring sustainable supply and availability of plants. For medicinal plants only known herbalists are allowed to deal in herbal medicine. To deal in herbs one has to get permission/blessing from an experienced/existing herbalist. For sustainability of herbal trees and shrubs, no uprooting of herbs is allowed. After the extraction of the bark from the trees the wound is smeared with soil to enable the tree to heal faster and also to prevent insect attack. Also, only one side of the tree is debarked. When removing roots from the tree only a few roots are removed. After removing the roots soil is put back to cover the remaining roots to prevent the herbal tree from dying. Others rules on herbs meant for effectiveness of herbal medicines include:

- Herbs must be collected in the morning
- No collection of herbs if it rains
- If one requests for treatment with the herbs he has to pay initial payment ‘umande’ for the treatment to be effective and pay the rest later.
- Herbs used during circumcision are only collected by those who have been circumcised and men who are of age
- Women in productive age are not allowed to collect herbs
- Women and men of 50 years are the ones allowed to collect herbs
- To ensure the conservation and preservation of knowledge on extraction and administering of herbal medicines is ensured, Herbalist parents transfer knowledge to their children interested in carrying on with the practice.

In the collection of honey, no logging of trees is allowed. In this case therefore, only the old/elderly/ those of age are allowed to collect honey from the forest because the young people are believed to destroy trees by felling them down. Since the traditional method used in honey collection involves use of fire, collection must be done by two people, one person carrying water which will be used in putting out of fire. Trees bearing hives are not supposed to be destroyed or felled as it is taboo.

3.6 Changes in NWFPS (availability and quantities) in the past 5 years

The findings from the respondents indicate that that there have been a general decline and reduction in quantities of NWPS within the two ecosystems, this is as a result of many factors including overexploitation and deforestation. Some of the non-wood forest products which are experiencing a reduction in extractable quantities include:

- Indigenous fruits like *Vitex keniensis* (meru oak) *Syzygian cordatum*, *Tamarindus indica* and *Annona squamosa* are no longer available in the forests due to destruction of forests by human activity, forest fires and illegal logging. Some fruits are also eaten by wild animals.
- Pressure on grass used for thatching has reduced due to use of iron sheets. However in some areas the pressure on grass for fodder has increased due to overgrazing
- Some herbs are not found at the moment due to misuse of forest and forest fires that has destroyed the herbs

3.7 Interventions by the community to conserve and ensure sustainability of NWFPS

The communities in the forest ecosystems have come up with interventions to ensure that NWFPs species are conserved for sustainability. The formation of Community Forest Associations (CFAs) has resulted in the development of Conservation Management Plans (CFDs). Forest rules through CFA management plans are applied for grazing of livestock in the forest. Areas marked for conservation purposes are not allowed for planting. CFAs and elders are also involved in sensitization of communities through 'barazas' on the need of conservation of forests. The communities have forest scouts from every clan who do policing to ensure that forests are not destroyed.

Some of the suggested ways of intervention include:

- Domestication of a few of the tree species that are threatened with extinction
- Provision of additional scouts to supplement forest guards
- Planting of fodder on farms to reduce pressure on grass from the forests
- Education on the importance of Zero grazing
- Establishing forest plantations to reduce pressure on forests
- Protection of areas planted such as riparian areas

- Formation of organized groups dealing in collection and selling of NWFPs

3.8 Conflicts during extraction and utilization

There are not many conflicts that arise during extraction NWFPs in the forest ecosystems. A few which were noted are mainly to do with local administration, KFS

Table 4 : Conflicts during extraction, utilization and how they are resolved

Conflict	**How it is resolved**
Bee keeping group - initially put hives in a homestead, the owner of the homestead assumed proceeds from the sale-brought conflict in the group	Group decided on neutral site for placement of the hives
Boundary – especially during grazing Grazing	Padlocking the grazing ground according to the clans
Local administration and the community over access to non-wood forest products in the forest	• Community policing • Training of community scouts • Local barazas

3.9 Constraints in extraction and utilization of NWFPs

Some of the constraint highlighted includes:

- Reinforcement of forest laws. This, for example, has affected production of honey in Cheptais Forest Block of Mt. Elgon Ecosystem. The production in the area stopped in 1978.
- Indigenous fruits are not known by current generation as such not collected
- Legal challenges-they have to seek permission from the authority.
- There is no registered group which is a requirement by the authority
- Insecurity within the ecosytems
- Lack of equipment especially for bee keeping
- Lack of information on the importance of NWFPs
- Human – wildlife conflict
- No feeling of ownership by communities on laws used
- Conflict in KFS/community laws/ rules governing use of forest products.

- Getting *Podocarpous latifolius* (tree) from KFS for use making bee hives in bee keeping takes a long process
- Use of chemicals in production of Irish potatoes- kills bees
- Human –wildlife conflict
- Forest fires
- Conflict with KWS rangers who think that the community members are poachers
- Limited knowledge on value addition of NWFPs
- Encroachment of forests

3.10 Suggestions to reduce the constraints

Despite the constraints faced by the community there are still ways that can be employed to enable sustainable management and utilization of NWFPs. The following suggestions to reduce the identified constraints were made during the FDGs.

- Training on value edition and awareness creation on the importance of NWFPs
- Training on entrepreneurship
- Training on group formation skills
- Training on domestication of trees
- Sensitization on NWFPs
- Training on bee keeping techniques and enterprise development
- Training on value edition for herbal medicine
- Training on domestication of herbal trees and shrubs
- Need for specific areas for bee keeping
- Licensing of herbalist
- Need for bee hive
- Sensitization on KFS laws –forest laws
- Training of the community on domestication of these products
- Train the community on modern technology of bee keeping

CHAPTER FOUR: CONCLUSION AND RECOMMENDATIONS

The role that non wood forest products play within forest adjacent communities cannot be underestimated. The findings of the study indicates there is presence of a wide body of indigenous Knowledge most of which are geared towards sustainable utilization of the products. Through further research and implementation of ITK such vital techniques can be preserved and adequately disseminated to ensure sustainable utilization of NWFPS.

It was also important to note that communities strive to preserve and share ITK especially in the utilization of herbal medicine and bee keeping. Development agents (CBOs, NGOs, governments, local leaders and private sector initiatives) need to recognize ITK, value it and appreciate it in order to integrate it in mainstream knowledge management practices

In order to further enhance the contribution of NWFPS within these ecosystems, there should be capacity building and support towards formation of organized groups which can extract and add value to high value products such as honey, mushrooms and herbal products such as Prunus tea and indigenous fruits such as *Syzigium cordatum*

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Appendix 1: Focus Group Discussion and Key Informant Interview Checklist

Assessment of indigenous technical knowledge on production and utilization of Non Wood Forest Products (NWFPs) in Cherangany and Mt. Elgon Water Towers of Kenya

Name of the Ecosystem: ……..……..

Name of the forest block…….…..……

Name of the village: …….

When did the community settle in the area?.....

1. What is the community's original name?.....
2. What is the % of the population of the original ethnic group?.....
3. What are the main non-forest products commonly used in the households (Villages)?

   (fill table below for major product)

Major NWFP extracted	**Uses**	**Quantities**	**Where is it mainly sourced**	**Price**
Herbs				
Bush meat				
Indigenous fruits				
Mushrooms				
Bamboo shoots				
Vegetables				
Fodder /grass				
Fibers				
Honey				

4. Which non forest products are used for subsistence?

   ……

   ……

5. Which non forest products are used for cash income in the local markets?

   ……

   ……

6. What are the traditional rules associated with the extraction of the non-wood forests products?

   ……

   ……

   ……

   ……

7. What is the tree species associated traditionally with the extraction of the non-forest products?

   ……

   ……

   ……

   ……

8. What are some of the traditional knowledge conservation practices that are used by the communities?
9. How has the non-forest products changed in the past 5 years?.....

   .....

10. Why has there been a change?

    .....

    .....

11. What are some of the interventions by the community to conserve and ensure sustainability of the non-forest products used by the community?

    .....

    .....

    .....

12. Are there any organized groups that deal with collecting and selling NWFPs?

    YES …√.. NO …..

13. Are there conflicts that are during in extraction and utilization of NWFPs in the areas?

YES …√.. NO ……

14. If yes in 14. Indicate the type of conflicts and how they are resolved

Conflict	**How it is resolved**

15. What are the constraints in extraction and utilization of NWFPs in this village?

……

……

……

……

16. In your opinion, what should be done to reduce the constraints mentioned above?

……

……

……

……

……

End