PRIORITY NON-WOOD FOREST PRODUCTS IN CHERANG'ANY HILLS ECOSYSTEM

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ABSTRACT

Cherang'any forest is one of Kenya's water towers that the Kenya's Water Tower Protection and Climate Change Mitigation and Adaptation (WaTER) programme aims at raising community appreciation of natural forest areas through the promotion of sustainable utilization of non-wood forest products (NWFPs) from the forest. This is however hindered by very scanty information on NWFPs in Ecosystem. In order to bridge the gap, the programme conducted a baseline survey of key non-wood forest products (NWFPs) of socio-economic importance in Cherang'anyforest ecosystem. The survey was done by administrating semi-structured questionnaires on 266 randomly selected respondents and conducting focused group and key-informant interviews. The data was analysed for descriptive statistics using SPSS. The survey revealed that: 98% of the respondents collected, utilized or sold NWFPs to neighbours, the NWFPs that were collected in large quantities included roots and tubers, indigenous fruits, fodder and gums and saps (annual per capita collection ranged between 19 – 80kg). Households earned up to KES 66,000 and KES 50,000 from sales of honey and other NWFPs respectively in 2016. It can therefore be concluded that NWFPs play a significant role in the day to day livelihoods of the communities living adjacent to Cherang'any ecosystem and have a potential of reducing poverty level. The earning from the NWFPs and therefore appreciation of the forest by the community can be enhanced through the sustainable commercialization of fodder, roots and tubers, indigenous fruits, gums and saps, vegetables, medicine, and honey.

Key words: NWFPs, Utilization, earnings, Cherang'any forest.

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INTRODUCTION

As a consequence of short term livelihood activities with often negative downstream externalities, communities adjacent to forests will rarely have the ability to sustain Kenya's forested landscapes that provide critical ecosystem services. It is in line with this that the Kenya's Water Tower Protection and Climate Change Mitigation and Adaptation (WaTER) Programme pursues innovative institutional approaches for linking ecosystem services providers and beneficiaries through the design and implementation of rewards and/or payments for ecosystem services.

Non-wood forest products (NWFPs) are goods of biological origin other than wood, derived from forests, other wooded land and trees outside forests (FAO, 1999). They are major sources of food, medicines, fodder, gums, resins, fibre, cosmetic and cultural products. Currently, there is high and increasing global demand for bio-products and nutraceuticalsderived from NWFPs. Global market for medicinal plants, for instance, is estimated at over USD 14 billion/yr. The importance of NWFPs for rural households, particularly in times of adversity, is well documented (Jama *et al.*, 2008, Shackleton *et al.,* 2007). With the exception of medicinal plants used by herbalists in ElgeyoMarakwet County, whose information was documented by Kipkore*et al.,* 2014, there is very scanty information on other NWFPs in Ecosystem. In order to provide additional information on NWFPs in the forest, the programme therefore examined the existing indigenous technical knowledge and conducted baseline survey socio-economic surveys targeting NWFPs with commercial value. The generated information was expected to strengthen the available local knowledge and provide critical baseline 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.

The overall objective of the study was to undertake a baseline survey of key non- wood forest products (NWFPs) of socio-economic importance in Cherang'any forest ecosystems and had the following specific objectives:

1. To obtain information on key sources of livelihood
2. To identify and rank the key non-wood forest products in the ecosystem
3. To assess participation of the community in environmental conservation activities

MATERIALS AND METHODS

Sampling of respondents

The study was carried out by a team of KEFRI and WaTERstaff in collaboration with local stakeholders. A desk review on NWFPs in the study areas was done and the lessons learned from previous studies, opportunities and gaps documented. Semi-structured questionnaire(s) were used by trained enumerators to obtain information from selected households. The team used multi-stage stratified purposive sampling procedures to select appropriate households and villages. Firstly, Forests stations were purposively selected to reflect three different agro-ecological zones (high, high-medium and low-medium). One forest block was then selected from each station. In the third stage, three villages were purposively selected from each block using altitude as the criterion of selection. Finally, 10 households were randomly selected from each village. The selected forest stations included Chemukoi, Kipteberr, Kapolet, Koisungur, Kapkanyur, Sogokio and Toropket.

A total of 266 questionnaires were administered to households living adjacent to the different forest blocks in the ecosystem. Among other variables, the questionnaire was design to measure the following indicators: Household profile, land ownership; key sources of livelihood and key non-wood forest products in the ecosystem. Focus group discussions and key informant interviews were held to verify and validate some of the information generated from the questionnaires.

One Focused Group Discussions (FGD) was held for the three selected villages per forest block and 2 key informant interviews (KII) were conducted in the County. The FGD and KII questionnaires were developed to address the following key issues related to NWFPs:

- Availability, sources, production, harvesting, processing, sustainability and marketing
- Resource and conflict management including indigenous rules and regulations
- Strategies for sustainable utilization of the resources
- Key stakeholders in the value chain
- Capacity building and community participation
- Key challenges and opportunities
- Social services, infrastructure

Data organization and analysis

To ensure data and procedural quality control, strict supervision, guidance and backstopping were done by the team members. The training of data entry clerks emphasized the importance of care and attention to detail in coding and data entry. Coding was done based on forest block and categories of NWFPs and responses. The data was entered in MS Excel spread sheets. Further data cleaning was done on the completed data sets prior to analysis. Analysis of the baseline survey data was carried out using SPSS (21) and MS Excel. Quantitative data was analysed for proportions, frequencies and means. Qualitative data synthesis and analysis techniques largely involved systematic synthesis, or putting the material collected into a narrative account of the availability and utilization of NWFPs. In order to translate the local names of indigenous fruits and vegetables into scientific and/or common name, the team used the work of Maundu *et al.* (1999) and relied on expert advice too.

Study site description

Cherang'any Forest sits astride the watershed between the Lake Victoria and Lake Turkana basins. Spatially, Cherang'any Hills is 35° 26" East and 1°16" North at an altitude range of 2000-3365m above sea level (Republic of Kenya, 2015). Cherang'any Hills forest ecosystem comprises of 12 forest blocks, cutting across three counties, Trans-Nzoia, ElgeyoMarakwet 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 and 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 (Republic of Kenya, 2015). The least affected forests are those on the Cherang'any hills with only 174.3 ha deforested. However, this loss is occurring in indigenous forest cover (KFWG and DRSRS, 2004). The Cherang'any Hills are largely covered by a series of indigenous forests and made of 13 forest blocks; Kapolet, Kapkanyar, Kiptaber, Sogotio, Chemurkoi, Kaisungur, Kerrer, Embobut, Kipkunur, Lelan, Toropket, Cheboi and Kapchetumwa. 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 4,000 ha of cultivation and plantations.

RESULTS AND DISCUSSION

Respondent characterization

TABLE 1 -SOCIO ECONOMIC CHARACTERIZATION OF THE RESPONDENTS

Demographic characteristics	**Frequency (%, n = 266)**
Gender	
Female	25
Male	75
Age class of household head (in years)	
< 25	6.0
25-34	21.1
35-44	24.8
45-54	19.2
55-64	12.8
65-74	12.0
>74	4.1
Marital status	
Married	89.8
Widow/widower	4.9
Single	3.8
Divorced/separated	1.5
Education level of household head	
Illiterate	7.2
Basic (can read and write)	20.5
Primary	46.2
Vocational	0.4
Secondary	19.7
Tetiary (college and University)	6.1
	Means
Size of household	7 persons
Years lived in area	31.9 year
Distance of homestead to the forest edge	1.7 Kilometres

Seventy-five (75) percent of the respondents were male and twenty-five (25) percent female. About 90% of the respondents were married with the remaining percent were either single, widowed or divorced (Table I). Slightly less than 50% of the heads of households and about 20% of the heads had primary and secondary education respectively. Illiterate households' heads were 7.2 % (Table I). This implies that vast majority of the households are literate. Majority of the respondents were married (89.8%), followed by widows/widowers. The least number was the divorced/ seperated at 1.5% as shown in Table I. The respondents had an average household size of 7 persons and the heads of household had lived in the locality an average of 31.9 years. The mean age of the head of household was 45.8 years with 25 – 54 years being most frequent age brackets accounting for about 65% of the households (Table I). The distance of the homesteads from the forest edge was on average 1.7 km.

Resource endowment of households in Cherang'any Hills Forest

The mean landownership was 2.26 hectares, and the households had on average, 9 shoats, 6 poultry, 4 cows, 3 pigs and 2 donkeys (Table II). About 82% of the households relied on crop farming as the major source of income. Other major sources mentioned included livestock rearing, casual jobs, salaried jobs and self-employment/business (Table II). The survey found that highest annual earning was from wages and salary at KES 95,500 while earning from NWFP was lowest at KES. 7,729 (Table II).

Utilization of NWFPs by the Community

Respondents' opinion on availability of NWFPs

Cosmetics, ropes, indigenous fruits, and fodder were considered easily available by more than 50% of the respondents. All the above listed NWFPs were considered between moderately to easily available by at least 75% of the respondents. About 20% of the respondents were of the opinion that mushrooms, honey, bush meat, root and tubers, and aloes were difficult to get (Table III).

TABLE II-. HOUSEHOLDS' RESOURCE ENDOWMENT IN CHERANG'ANY HILLS FOREST

Resource endowment		**Mean**
Size of household		7 persons
Size of land		2.26 hectare
Livestock Ownership		**Mean number**
Shoats		9
Poultry		6
Cattle		4
Pigs		3
Donkey		2
Source of household income	**Frequency (%)**	**Mean household annual income (KES)**
Crop farming	81.6	78,923
Livestock farming	4.1	58,124
Business income	5.6	95,500
Wages and salary	6.8	39,228
Casual work	1.1	Not available
Bee keeping	-	14,890
NWFP	-	7,729

TABLE III - RESPONDENTS' PERCEPTION ON AVAILABILITY OF NWFPS

	Respondents' perception on availability		
NWFP	**Easily**	**Moderately**	**Unavailable**
Medicine	43.2	47.9	8.9
Mushrooms	22.4	55.6	22.0
Ropes	55.4	41.8	2.7
Honey	21.5	54.7	23.8
Vegetables	48.7	46.7	4.5
Exotic fruits	41.0	53.2	5.8
Bush meat	31.8	33.5	34.7
Cosmetics	61.8	32.2	6.0
Roots and tubers	44.4	33.3	22.2
Gums and saps	27.4	56.5	16.1
Indigenous Fruits	58.7	39.7	1.5
Fodder	51.8	42.4	5.9
Dyes	0.0	100.0	0.0
Aloe	47.4	28.9	23.7
Medicine	43.2	47.9	8.9

Usage and sales of NWFPs in Cherang'any

TABLE IV - UTILIZATION OF THE NWFPS

Non-wood forest product	**Percent of households using product**	**Mean total quantity collected (in Kg)**	**Mean Qquantity used (Kg)**	**Mean quantity sold (Kg)**	**Quantity sold as % of collected amount**	**Price per unit (Kshs)**
Medicine	49.6	6.1	5.1	1.0	16.4	9.0
Mushrooms	45.5	13.3	11.0	2.3	17.3	
Ropes/Fibre	77.4	6.6	5.4	1.2	18.2	
Honey	64.7	3.2	2.8	0.4	12.5	460.6
Vegetables	72.6	4.1	3.8	0.3	7.3	
Exotic fruits	45.1	12.4	7.6	4.8	38.7	127.6
Bush meat	33.5	10.0	8.5	1.5	15.0	
Cosmetics	63.5	6.3	6.0	0.3	4.8	
Roots and tubers	36.5	80.3	23.1	57.1	71.1	5.0
Gums and saps	63.9	18.9	3.0	15.9	84.1	
Indigenous fruits	77.8	25.1	17.6	7.5	29.9	100.2
Fodder	60.9	21.6	17.5	4.0	18.5	1.0
Dyes	41.0	2.0	2.0	0.0	0.0	
Aloe	24.8	2.4	2.3	0.1	4.2	

The four most utilized NWFPs across household were ropes, indigenous fruits, indigenous vegetables and honey while the least utilized were Aloes (Table IV). Unlike the findings of Rotich (2019) that suggests honey is the most harvested NWFPs in Cherangani forest, our findings indicate that the most harvested product is indigenous fruit. This different findings can be attributed to the fact that the study by Rotich only covered Embobut block where as our this study covered that entire Cherangani forest. The study With the exception of dyes, a surplus was sold for all the other products. It was however only for indigenous fruits, exotic fruits, roots and tubers, gums and saps that a proportion of 30% or greater that was sold (Table IV). The major market outlet for all the NWFPs was direct sales to consumers with only honey and with only exotic fruits being sold in to rural assemblers, middlemen and exporters in small quantities.

Earnings from NWFPs

The number of households relying on the NWFPs for inome generation ranged from 1 to 6 per block. The average income from honey production and other NWFPs ranged from KES 500 to KES 66,000. Across all the blocks, the income from honey production was higher than from the other NWFPs. The income from NWFPs was highest in Toropket block and lowest in Sogotio block (Table V). This results suggests that honey, is the NWFP of choice for income creation and it has the highest potential Toropket block. This finding of relatively high income from honey is in agreement with Langat *et al*. (2016) that suggests that household income from honey in East Mau Forest is on average KES 69,424.00. The finding by Rotich (2019) that is honey is the most harvested NWFP can therefore be explained by the high income generation potential of honey potential .

TABLE V - ANNUAL HOUSEHOLD INCOME FROM NWFPS IN CHERANG'ANY

Forest block	Source of income	Average annual income (KES)	Frequency (n)
Toropket	Bee keeping	66,000.00	3
	Other NWFPs	50,000.00	1
Sogotio	Bee keeping	4,666.67	3
	Other NWFPs	500.00	1
Kipteber	Bee keeping	1,125.00	2
	Other NWFPs	1.000.00	2
Chemurkoi	Bee keeping	13750.00	4
	Other NWFPs	800.00	2
Kapolet	Bee keeping	12,333.33	6
Koisungur	Bee keeping	2,333.33	3
	Other NWFPs	0.00	1
Kapkanyar	Bee keeping	5,500.00	4

Collection of NWFPs as per gender

TABLE VI -. COLLECTION OF NWFPS AS PER GENDER (PERSON RESPONSIBLE FOR COLLECTING)

	Equally distributed among household members	Equally distributed between adults	Mainly male adults	Mainly female adults	Equally distributed between children	Mainly boy	Mainly girl
Medicine	XX	XXX	X	X			
Mushrooms	XX	X	X	XXX			
Ropes	XXX		XX	X			
Honey		X	XXXX				
Vegetables	X	XX		XXX			
Exotic fruits	XXXX				X		
Bush meat	X		XXXX				
Cosmetics	XX	XX	X	X			
Roots and tubers	XXX			XX	XX		
Gums and saps	XX	X	X		XX		
Indigenous fruits	XX				XXX		
Resins	XX	X		X		X	
Fodder	XX	XX	XX				
Dyes		XXX		XXX			
Aloe	XXXX	XX					

Key
Adult is > 15 years
Child is < 15 years
X means in 10 – 20 % of the households,
XX means in 21 – 40 % of the household
XXX means in 41 – 60 % of the households
XXXX means in > 60% of the household

TABLE VII - SUMMARY OF RESPONSIBLE GENDER FOR COLLECTION OF NWFPS

NWFPs	Responsiblegender
Medicine	Both adult females and males, all members
Mushrooms	Adult female, all members of the household
Ropes	All members of the household, adult male
Honey	Adult male
Vegetables	Adult female
Exotic fruits	All members of the household
Bush meat	Adult male
Cosmetics	All members of the household, adult male and female
Roots and tubers	All members of the household, boys and girls
Gums and saps	All members of the household, boys and girls
Indigenous	Boys and girls, all members of the household
Resins	All members of the household, employed persons, boys
Fodder	All members of the family
Dyes	All members of the family, adult male and female
Aloe	All members of the family

With the exception of vegetables, honey and bush-meat, harvesting of the other NWFPs was in general the joint responsibility of all household members in more than 10% of the households with harvesting of exotic fruits and aloes being greater than 60% of the households. Harvesting of honey and bush-meat was the responsibility of adult male in greater than 60 % of the households while vegetables and mushrooms was the responsibility of the adult female in greater than 40% of the households (Tables VI and VII)

Detailed information on available NWFPs in Cherang'any Forest

Indigenous fruits

A total of 40 indigenous fruits were named by the respondents. The ten most known fruits by the respondents were;Lamai (*Syzgiumguinense*), Monmoon (*Rubuspinnatus*), Mendililwa (*Dovyalisabyssinica*), Siryowo (*Rhusnatalensis*), Tangururuo (*Flacourtiaindica*), Simat (*Ficasthonningli*), Siriekwo, Mboni(Table VIII, Figure 4). A vast majority (> 70 percent) were of the opinion that fruits were abundant (Table VIII). Apart from the indigenous fruits the following exotic fruits were also mentioned by the respondents and are available in varying quantities: passion, avocado, tree tomato, guavas, loquats.

Vegetables

A total of 42 indigenous vegetables were identified by the respondents as being available in the forest. The nine most known by the respondents were;Kisoyo/Nderemia (African nightshade), Kimeley (Forest nettle), Saga (Spider plant), Dodo (Pigweed), Rachan (*Basellaalba*), Chepkerta, Socho, Kiskiap-Ndok, and Sarat (Table IX). A vast majority (> 75 percent) were of the opinion that fruits were abundant (Table IX)

TABLE VIII -AWARENESS ANDABUNDANCE OF INDIGENOUS FRUITS IN CHERANG'ANY HILLS FOREST

Local name	Scientific name	Proportion of respondents aware of the fruit (in %, n = 266)	Proportion of respondents perceiving fruits as abundant (in %)	Other Uses
Lamai	*Syzgiumguinense*	77	93	
Monmoon	*Rubuspinnatus*	64	90	Medicinal
Mendililwa	*Dovyalisabyssinica*	29	89	Medicinal
Tungururwa	*Flacourtiaindica*	9	90	
Simat	*Ficasthonningli*	7	72	
Mokoi/ Cheptolong/ Mboni		35	87	
Siriekwo		32	86	
Losiek		30	91	Vitamin, Helps In Digestion
Kimolon		17	86	Food Additive
Siryowo	*Rhusnatalensis*	12	71	Medicinal

Losiek, Kimolon and Mokoi/Cheptolong/

TABLE IX -AWARENESS AND ABUNDANCE OF INDIGENOUS VEGETABLES IN CHERANG'ANY HILLS FOREST

Local name	Scientific name	English/ common name	Proportion of respondents aware of the vegetable (in %, n = 266)	Proportion of respondents perceiving vegetable as abundant (in %)	Other Uses
Kisoyo/ Nderemia	*Solanumnigram*	African nightshade	65	84	Vitamins
Chepkerta			48	82	Vitamins
Kimeley	*Urticamassaica*	Forest nettle	35	99	Medicinal, local anesthesia
Socho			20	88	Quicken delivery
Saga	*Grandropsisgyanda*	Spider plant	16	91	
KisakiapNdok			11	93	Medicinal, Vitamins
Rachan	*Basella alba*		6	94	
Dodo	*Amaranthusspp*	Pigweed	6	81	Quicken delivery
Sarat			5	77	Vitamins

CONCLUSIONS

Most of the communities living around Cherang'any Hills Ecosystem are mainly full time peasant farmers with an average land size of 6 acre deriving 82% of income from farming activities. The Ecosystem has a number of non-wood forest products (NWFPs) that include: honey, medicines, indigenous fruits, indigenous vegetables, grass (for fodder and thatching), bamboo shoots, gums, mushrooms, fibre, dyes, tannins, bush meat, aloe and tubers. However, the priority NWFPs are: Fodder, vegetables, medicine, ropes and honey. Fodder was the most sold product. The study also established that there was a diversity of indigenous fruits (40) and indigenous vegetables (42) though some of these are currently under-utilized and some are not abundant. Pockets of some exotic fruits (mango, avocado and passion) were found in the forest. There were also some pockets of passion and avocado fruits which were considered easily available by more than 50% of the respondents. All the above listed NWFPs were considered between moderately to easily available by at least 75% of the respondents. Only mushrooms, honey, bush-meat, roots and tubers and aloes were considered difficult to get by about 20% of the respondents.

The study revealed that the community members know that there are other benefits of the forest. The reason why the NWFPs are not exploited is because the communities lack the expertise and the knowledge that they can also get income from these products while conserving them.

RECOMMENDATIONS

- There is need to carry out taxonomical identification of plants that produce non-wood forest products in Cherang'any Hills documented during the survey in order to provide their scientific names for future reference
- It is also necessary to produce a checklist of the plant species that produce the non-wood forest products with information on where they are found in this ecosystem, approximate quantities, their description and uses.
- There is need to promote the conservation and sustainable utilization of indigenous fruits and vegetables in the Ecosystem.

- There is need to promote sustainable commercialization of fodder, vegetables, medicine, and honey

- There is need to provide training on the extraction, production and even value addition to some of these NWFPs so that the community can make a living out of these products.

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