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

Socio-economic status of households and utilization of public areas: baseline survey of Cherangany Hills ecosystems

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

Disclaimer

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Cover Photograph: Shows a team member, Ken Oburah explaining to community members the reason for team' visit and the processes that will be involved during data collection in Cherengany Hills Ecosystem. **Photograph by Roxventa Othim.**

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Executive Summary

Kenya's Water Tower Protection and Climate Change Mitigation and Adaptation (WaTER) Programme objectively focuses 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 Hills water tower. Cherangany Hills water tower provide ecosystem services crucial to forest proximate communities. More so, these communities depend on goods derived from forests for their livelihoods. These include timber, firewood, fodder for their livestock, and other non-timber forest products. However, the ecosystems have been degraded reducing their capability to provide those goods and services in the long term. Worse still, the most degraded areas in the water catchment areas also referred as "hotspots" or the "vulnerable areas" threaten the provision of key ecosystem services to communities living downstream who also rely on those services.

Understanding the socio-economic status of inhabitants living close to forested areas is important for decision makers who will make informed decisions on target actions for improving their livelihoods, and at the same time address factors that lead to degradation of the ecosystems. The purpose of this survey was to obtain baseline socio-economic data on households; data on utilization of public areas; and, information on demographic and economic status of "hotspots" and vulnerable areas on public and community land in the project area.

The following information was provided by this baseline survey;

In terms of household level analysis: the household size was an average of 7 family; the male headed households were higher than female headed households; about 72 % of the households had settled in Mt. Elgon area for less than 30 years; the settlement was characterized by more indigenous community members than immigrants coming from other settlements for various reasons such as fertile land, access to resources amongst others. While more female than male had no formal education (19% and 17%) respectively, the transition for both male and female from primary was lowest at secondary and tertiary levels.

For land ownership; almost all forest land was owned by the state. Land under plantation was state owned whereas crop land, pasture and agroforestry are found in individual owned land. Forest land was under natural, plantation or managed forest. About 77% of households owned less than 1.1ha of land in the settlement whereas 10% had over 5ha. Most of the land had been put under agricultural production, where maize and beans were the major crops. A higher percentage of the land was owned by male household heads, and in few households, female were the household heads.

As far as their living standards and conditions were concerned; majority of the households (85%) owned their houses, while some rented the houses or lived with other households. Most houses (73%) were mud walled followed by brick-walled houses (16%) and very few wooden walls and iron sheet walls. Majority of the houses (89%) had iron-sheet roofing with a few grass thatched

roofs (9%), while few (2%) had wooden board as roofing material. Over 60% of households owned phones, radios and furniture whereas few households owned assets such as tractors, cars/trucks, motorcycles, stoves, water-pumps and chainsaws. Villages with highest mean value of assets were Kapkoros (Ksh 108,626) and Kipkiring (Ksh 39,916) whereas the lowest mean value of assets were from the villages of Kaptarakwa and Sokobei (Ksh 800 and Ksh. 500) respectively. Most households (83%) had savings of less than Ksh. 50,000. Most of the debts accrued by households from Cherangany were less than Ksh. 20,000. Sachangwaa and Chogoo were the only villages in the ecosystem that had debts of more than Ksh.100, 000. The major outstanding debts were from table banking, agricultural inputs, financial loans and dowry.

On survey of the forest resource: the mean distance of household's home to the edge of the forest was 1.3 km, with majority of the households collecting firewood from the forest live between 0-6 km from their homes. Majority of the households indicated that they spent more time now collecting firewood, compared to 5 years ago and this was due to the fact that firewood availability has declined. This information was confirmed by 86% of the households who indicated that firewood availability had declined. The coping strategy in response to the decline in firewood was use of agricultural residues as fuel, increase in the collection time and planting of trees on private land. In terms of the forest user groups, majority of the households 87% of the households were not members of any user group. This was due to non-existence of user groups (44%) or lack of information (25%) in the settlement. The major reasons for joining the user groups were to ensure better forest management in future (22%) and to learn new skills and information (18%). Household indicated that they attended FUG meetings with 70% of those attending the meetings being husbands.

Infrastructure in Cherangany was still weak: about 87% of the households did not have access to electricity; 68% of the households didn't have access to piped water in the settlement whereas the district market where major consumption goods, and agricultural products were sold were 2km, 9km, 21km and 12.5km respectively. Most households (53%) did not have access to a health center within their villages. Motor cycles were the main mode of transport used, with vehicles, foot, donkey and bicycles also used.

In terms of crisis and unexpected expenditures; the respondents in Cherangany hills indicated that they experienced crises in paying school fees, serious illness in the family and major livestock loss in the last 12 months. The coping strategies adopted by the households were sale of assets and extra casual labor work

For welfare perceptions and social capital in the past 12 months; 37% of the households were satisfied with their lives while 3% were very satisfied. In terms of food sufficiency, about 37% of the households had reasonable food production and income to support their households for the past 12 months. Comparing household wellbeing level to 5 years ago; 70% of households were about average, with 14% indicating they were worse off and 16% mentioning that they were better off than the other households in the village. Most of the households (60%) were better off

now due to acquisition of land. Majority of the households (90%) considered their village as a good place to live; 5% indicated the village as partly good while 5% percent indicated the village as not a good place for the household to live in.

Utilization of public areas: the main public areas within the ecosystem were gazetted forests, communal land, markets and schools. The public areas were either owned communally or by the state. The establishment of gazetted forests and market centers was by *de jure* rights, except for schools which were under *de facto* rights. The public areas were mostly used as sources of firewood, herbal medicine and animal feeds. Most communal land was used for farming while schools offered education and employment opportunity, whereas school playing grounds were used to graze animals. The gazetted forests provided indirect benefits such as water catchment, soil fertility improvement and cultural activities such as circumcision. Varied technologies were used to access tangible products such as animal/crop husbandry, fertilizers/pesticides, bee hives, piped water, Mpesa and mobile banking. The main products of economic benefits were timber and charcoal. Rules governing access to communal land were set by the community while rules governing access of gazetted forest were set by both government and KFS, whereas rules to access of markets and schools was by the government. The penalties on users breaking the set rules were mainly fines, and arrests. Due to increased access, products from the public areas such as firewood, fodder, posts and honey have declined in the past 15 years. Increase in food production is associated by allocation of more land for PELIS, improved technology in beekeeping and harvesting. The decline was due to increased harvesting of trees due to population increase.

During the village analysis; the following were recorded – in terms of the forest resource base, the most important products from the ecosystem were food, fito and medicinal plants. The village elders noted that availability of poles/posts and firewood had declined the most. Forage from the forest, timber, medicine and water had decreased in the past 5 years. The villages had access to formal and informal credit facilities. The road networks in the villages sampled was not good since majority of the respondents (65%) stated that there was no presence of at least one useable road for all seasons. The elders indicated that the forest is managed by KFS. However, clear customary rules regulating the use of most important products existed in the extraction of these products, except very few rules regulating timber extraction and honey harvesting. The forest institutions were formed through local initiatives with the rest emerging from government initiatives.

The above findings will form good background information on socioeconomic factors relevant to project planning and implementation of water tower project activities.

1.0 INTRODUCTION

Kenya has several water towers with the main ones being, the Aberdares, Cherengany Hills, Mau Complex, Mt. Elgon and Mt. Kenya. The water towers are important for provision of goods and ecological services that have economic and social value and livelihood. The various services provided by the water towers include; local climate regulation, habitat for flora and fauna, water flow regulation and purification, carbon sinks, improving soil fertility, and reducing soil erosion and sediment loads in river waters. Communities adjacent to the water towers depend on goods derived from forests ecosystems for their livelihoods. The main goods include; timber, firewood, fodder for livestock, and other non-timber forest products.

However, these water towers are threatened by degradation caused mainly by over-exploitation, deforestation and poor resource use, which has necessitated urgent rehabilitation, restoration and sustainable management actions. Conservation of the water towers is a flagship project under Vision 2030, Kenya's long-term planning blueprint. Given the importance of Kenya's water towers in terms of the economic, social and ecosystem services they provide, the government is implementing several initiatives towards their restoration. One such initiative is the 'Kenya's Water Tower Protection and Climate Change Mitigation and Adaptation (WaTER) Programme being under taken in Mt. Elgon and Cherangany Hills water towers.'

Cherangany hills ecosystem is located within a defined area of 1°16' North 35°26' East. The ecosystem comprises of a series of forest reserves. Out of the total 110,181.3 ha, about 60,500 Ha is closed-canopy forest while the rest is comprised of formations of bamboo, scrub, rock, grassland, moorland or heath, with about 4,000 Ha of cultivation and plantations.

The Cherangany hills forest serves as a water catchment, which straddles the watershed between Lake Victoria and Lake Turkana basins. The water streams to the west of the watershed drain into Nzoia river system, which flows into Lake Victoria (shared by Kenya, Uganda and Tanzania) while streams to the east flow into the Kerio river system and feed Lake Turkana. Cherangani Forest ecosystem is a source of several rivers which include: Nzoia, Moron, Kapolet, Saiwa, Embobut, Siga and Weiwei which into either Lake Victoria through River Nzoia or to Lake Turkana through Kerio River to the east (Cherangani Hills strategic ecosystem management plan, 2015-2040).

The Cherangani Forest Ecosystem can be described as an old fault-block formation of non-volcanic origin characterized by undulating upland plateau on the western edge of the Rift Valley. To the east, the Elgeyo Escarpment drops abruptly to floor of the Kerio Valley, while westwards the land falls gently to the plains of Trans-Nzoia County. The altitude ranges from 2,000 m reaching 3,365 m above sea level (asl) at Cheptoket Peak in the north-central section. Cherangani Hills strategic ecosystem management plan, 2015-2040).

The annual rainfall in the ecosystem varies from approximately 1,200 mm in the east to at least 1,500 mm in the wetter west. The rainfall is influenced by the moist prevailing winds from Lake Victoria. On the other hand, the average annual rainfall varies from 800 mm in the northern part

to more than 1,400 mm in the central part. The main rainy season falls from April to August and dry season occur in December to February (Cherangani Hills strategic ecosystem management plan, 2015-2040).

The hills are characterized by metamorphic rocks, with conspicuous quartzite ridges and occasional veins of marble. The whole area is occupied by Precambrian rocks of the basement systems, and consists of gneisses and schists (Cherangani Hills strategic ecosystem management plan, 2015-2040).

The soils in the ecosystem are moderately deep of good structure and high organic matter content and variable acidity (mainly Cambisols). The north-western and northern parts of the area have deep to shallow soils which are in general, prone to sheet erosion. The mountainous areas and hills have shallow to very shallow soils and are often stony and rocky (Cherangani Hills strategic ecosystem management plan, 2015-2040).

Cherangany hills ecosystem is important biodiversity hotspots holding diverse floral and faunal species. The forests are characterized by different vegetation types. The lower western parts covering the Kiptaberr-Kapkanyar forest blocks are dominated by *Aningeria-Strombosia-Drypetes* forest, with a large area of mixed *Podocarpus latifolius* forest on the higher slopes. The southern slopes hold *Juniperus–Nuxia–Podocarpus falcatus* forest, with heavily disturbed *Podocarpus falcatus* forest on the eastern slopes. Valleys in the upper peaks area shelter remnants of Juniperus–*Maytenus undata–Rapanea–Hagenia* forest. Tree ferns *Cyathea manniana* occur in stream valleys there also exist patches of bamboo (*Arundinaria alpina)*, though with no distinct zonation. *Acacia abyssinica* dominates the cleared areas occurring among scrubby grassland with a diversity of flowering plants. At higher altitudes, the forest is interspersed with a mixture of heath vegetation and swamps, the latter with *Lobelia aberdarica* and *Senecio johnstonii*. Much of this heath land may be maintained by burning and grazing. Relict Juniperus and Hagenia treesare scattered in the forest. In the east especially, there is a mosaic of vegetation types with little obvious altitudinal zonation, possibly as a result of the hills' varied topography and the long history of interchanging practices of cultivation, grazing and bush fires, and the establishment of plantations of *Cupressus lusitanica*, *Pinus patula* and a few Eucalyptus species (Cherangani Hills strategic ecosystem management plan, 2015-2040).

The ecosystem is faced with several conservation challenges. They have been identified as encroachment especially in Embobut forest block with over 5000 squatters living within the bounderies of the indigenous forests, degazettement for settlement, illegal cutting of trees for timber, posts and poles and for charcoal production, overgrazing, and tree felling by honey gatherers (for honey, or for manufacturing bee hives) Forest fires are occasionally experienced caused by honey gatherers. Conversion of most forest blocks into farmlands is occurring rampantly, for instance most of the Kapolet forest have been converted to farmland in the last 20 years but is currently experiencing natural regeneration. Grazing is emerging to be the greatest threat; hundreds of cattle are left to roaming the forest for the entire dry season period, a key

hindrance to regeneration. As the population outside the forest increases, the available pastureland diminishes and subsequently the pressure on the forest rises.

Key economic activities in Cherangany hills Ecosystem are hosted within 11 major land uses, mainly dominated by agriculture (Figure 1). The main agricultural activity is growing of maize and beans. Beside agriculture as the major activity, forest product access is also important as a source of community livelihoods and income.
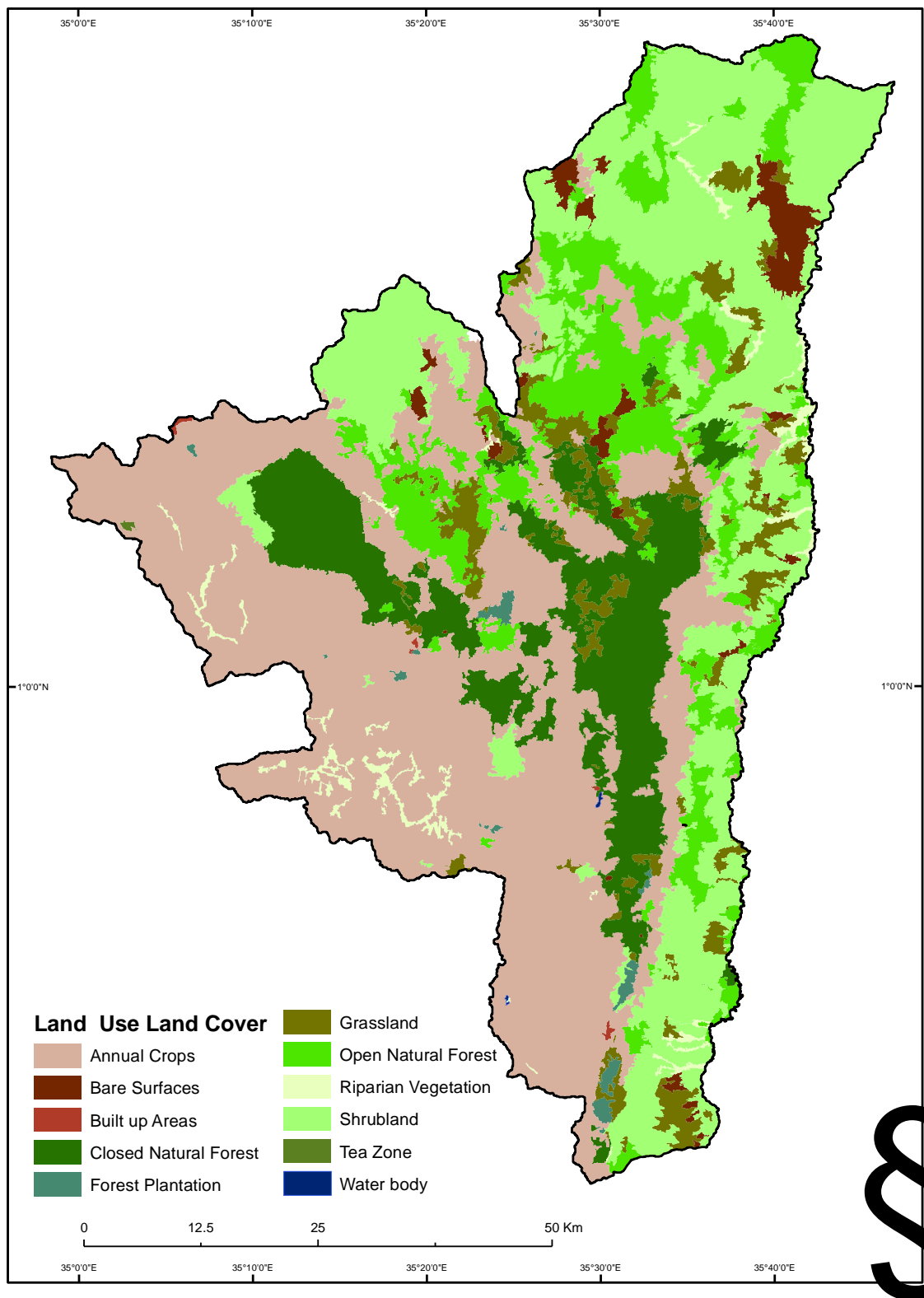
Figure 1 Land use land cover map for Cherangany hills ecosystem

The increasing human population and their uncontrolled settlement in some fragile areas of the ecosystem have exerted enormous pressure, resulting in over-exploitation and degradation of

resources in the ecosystem. Rehabilitation and conservation of the water tower is therefore a priority to restore its capacity to sustainably provide goods and services not only for adjacent communities but also within its catchment.

The WaTER Programme intervention aim at contributing to poverty reduction and sustainable livelihoods by applying scientific principles to inform national policy decisions and design of community level actions on rehabilitation and conservation in Cherangany hills water tower. To track on the impact of the interventions on the livelihood status of inhabitants living close to forested areas, a baseline survey was undertaken to provide information on the actual situation of socio-economic aspects within Cherangany hills ecosystem to provide a basis against which the performance of the programme will be measured, reported and verified.

The objective of the survey was to obtain baseline socio-economic data on; households and villages relying on ecosystem services from Cherangany hills. The survey also documented utilization by adjacent communities of public areas including: gazetted forests, and community lands.

The specific objectives were to:

- Assess the socio-economic status of households relying on ecosystem services;

- Assess the socio-economic status of villages relying on ecosystem services;

- Conduct a survey on utilization of public areas which include: gazetted forests, community lands and other public areas with the two ecosystems.

2.0 METHODOLOGY

2.1   Sampling for data collection

Study site selection was based on area maps generated during ground truthing activity, in which the hot spot areas were identified. The hot spot areas covered 11 major land uses within the ecosystem.

The target population within Cherangany hills ecosystem were communities adjacent to the following forest blocks (0-5 km); Kapolet, Cheboyit, Chemurkoi, Embobut, Kaisungor, Kerer, Kipkunurr, Kiptaberr, Sogotio, Toropket, Kapkanyar and Lelan. Village elders were identified to help in participatory mapping of the forest block and villages. Focus Group Discussions (FGDs) with community elders were held in each of the sites to provide information on the village though participatory mapping and further identify and list the households in which the questionnaires would be administered. It is from these lists that the 10 households were randomly selected for the study.

A maximum of 7 villages were selected randomly per forest block in consultation with the village elders. The selected villages were picked to represent villages close to the forest edge, in the middle and the far edge. However, due to household to household proximity, terrain, weather effects amongst other challenges, 60 villages were sampled in the ecosystem.

From the selected villages two elders were used to provide household names where a maximum of ten households were randomly selected for the household interviews.

2.2   Data Collection

Quantitative and qualitative data was collected using semi-structured questionnaires and from secondary data. Three different questionnaires were administered to collect data on household, village and utilization of public areas respectively. A total of 259 households were interviewed. Data collected at household level included household composition, land ownership, assets and savings, forest resource base, forest user groups, forest services, forest clearing, infrastructure, crisis and expected expenditures, welfare perceptions and social capital. A total of 30 village questionnaires were administered. Data collected at village level included; village demography, infrastructure, forest and land cover/use, forest resource base, forest institutions, and forest user groups. A total of 30 questionnaires on utilization of public areas were administered to the elders at the village level. Data collected on utilization of public areas included; categorization of public areas, legal status of the public areas, size, uses, economic benefits, rules governing access and resource status over time. Secondary data included information on public land such as size, dates of gazettment and ownership.

Photo 1 Participatory mapping activity in Lelan settlement

Photo 2 Data collection at the village level

Photo 3 Participatory map of villages in Kapcherop Forest block

Photo 4 Household identification and listing

2.3   Questionnaires and data sets

A combination of village, household and utilization of public area questionnaires derived from Poverty Environment Network (PEN) and International Forestry Resource and Institutions (IFRI) were used in the study.

Table 1: Description of questionnaires used in the study

Questionnaire	Description	Outputs
Village	Assess the socio-economic status of villages relying on ecosystem services.	Socio-demographics, infrastructure, forest and land cover use, forest resource base, forest institutions, risks, wages and prices, forest services
Household	Assess the socio-economic status of households relying on ecosystem services.	Household composition, land ownership, assets and savings, forest resource base, forest user groups, forest services, forest clearing, infrastructure, crisis and expected expenditures, welfare perceptions and social capital.
Utilization of public areas	Conduct a survey on utilization of public areas which include: gazetted forests, community lands and other public areas with the two ecosystems	Demographics, type and description of public areas, direct and indirect uses of public areas, benefit and rules to access of public areas

2.4 Data management and analysis

Collected data was cleaned, coded entered and analysed using Statistical Package for Social Sciences (SPSS V.21).

3.0 FINDINGS OF THE SURVEY

3.1   Household analysis

This section presents results collected on the social, economic and demographic status in the Cherangani ecosystem at household level.

3.1.1   Demographics

This section covers demographic characteristics of population around Cherangany Ecosystem including household composition, education level, household formation, land ownership. It is envisaged that these characteristics will influence levels of adoption of the proposed interventions towards rehabilitation and restoration actions. In some projects, decisions on project activities have neglected incorporation of demographic information resulting in poor decisions resulting low uptake of proposed activities.

3.1.1.1 Household composition

The mean number of household members in Cherangany was 7 (Mean = 7, SD = 1.701, Min = 3, Max = 11). Kasanger, Nerkwa, Tabunyer, Chebosai and Kamongoes villages had a mean of 10 members. Kabarakwet, Katee and Gatanga villages had the least members with a mean of 4 members.

Overall composition of the interviewed households comprised 50.2% of male population and 49.8% female. The male headed households comprised of 87% while 13% were female headed. %). A higher percentage of all household heads were married and living together as shown in (Figure 2).

In terms of education level, there were more female respondents with no formal education (19%); 58% at primary level and 21% at secondary level. Overall, more male household heads attained secondary and tertiary levels (Figure 3).
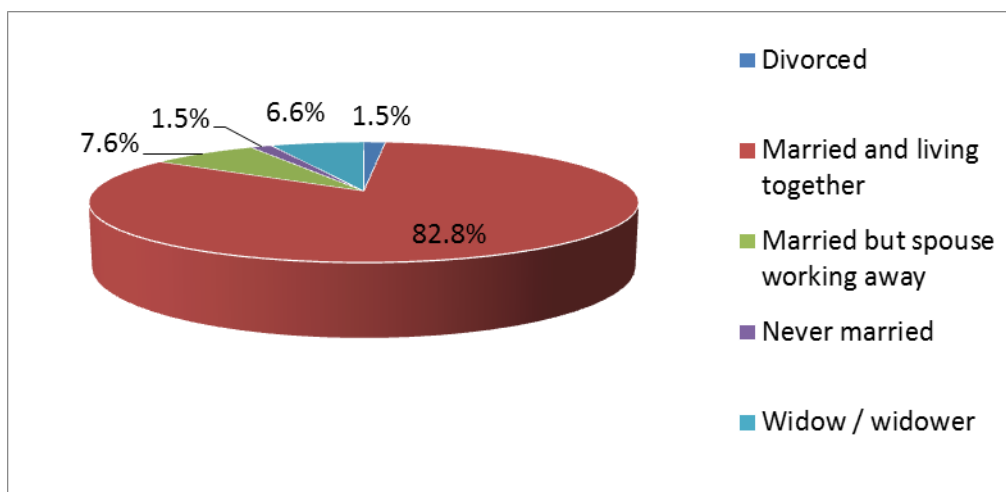
Figure 2 Marital status

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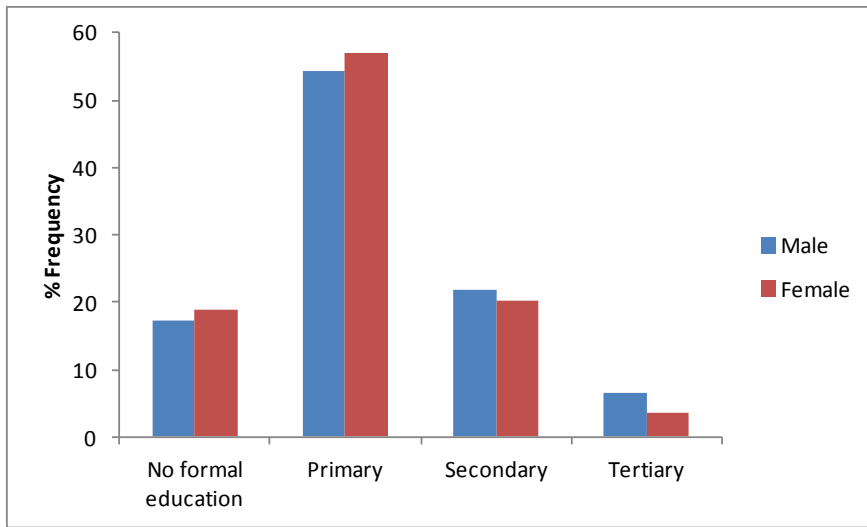
Figure 3 Household head gender education level

3.1.1.2 Household existence

Most of the households interviewed had been in existence for less than 30 years (71.5%) with 28.5% being in existence for over 30 years ((Figure 4).
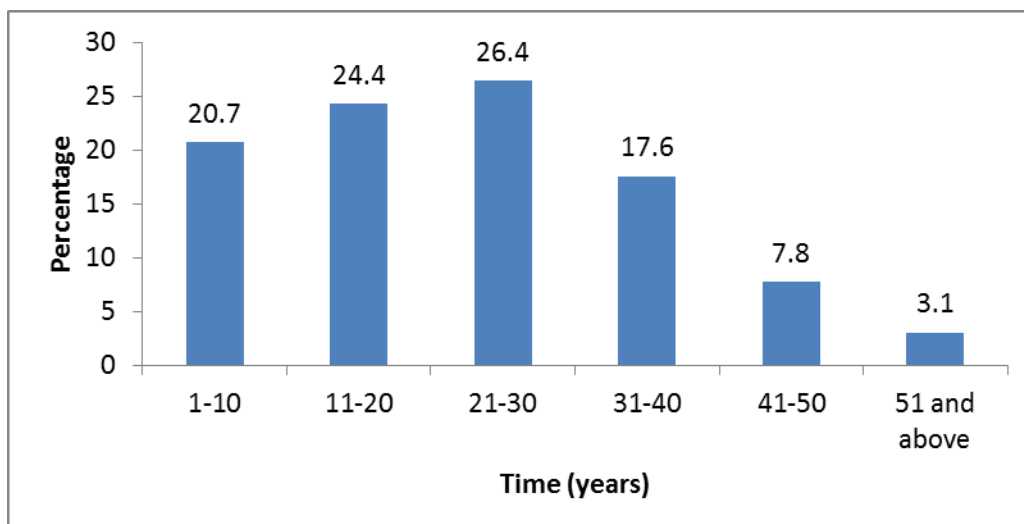
Figure 4 Number of years the household has existed

Most household heads (73.1%) of the of the sample population in Cherangany were born in their respective villages while 26.9% moved in as immigrants. Of the 26.9% of household heads not born in the village of residence, 73.3% have lived in their respective villages for 20 years while 26.7% have lived for over 20 years (Figure 5).

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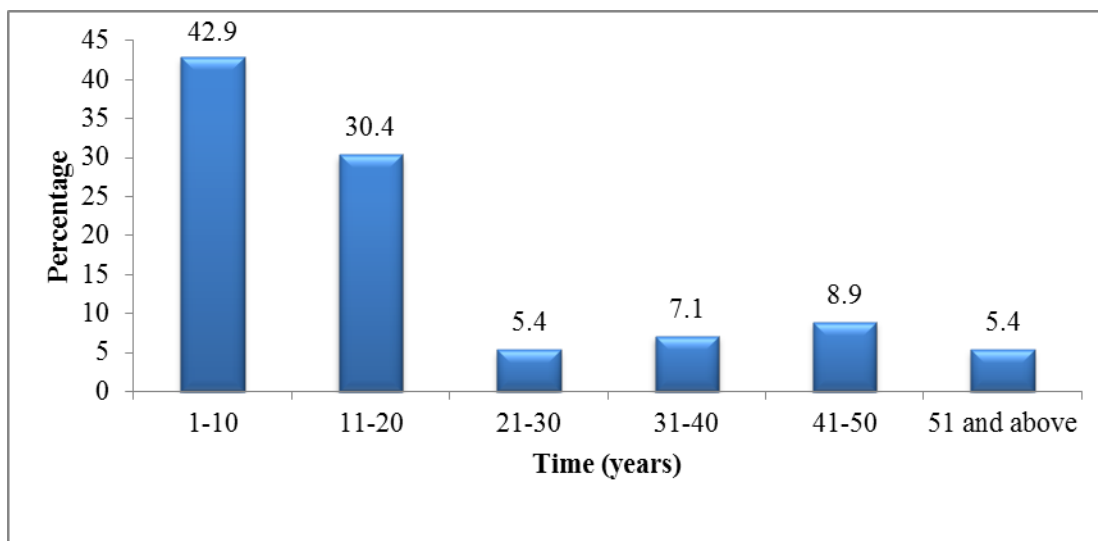
Figure 5 Number of years the household has lived in the village

3.1.2   Land ownership

Most of the land in Cherangany is individually owned as shown in (Table 2), however, Forest plantations are mainly state owned (52.2%). About 54% of households owned less than 1.1ha of land in the settlement, 1.2 – 2.3ha (23%) whereas 10% had over 5ha (Figure 6).

Table 2: Land ownership categories

Land use	Mean Acreage (Ha)	Ownership % frequency		Frequency (n)
		State	Individual	
Cropland	2.1	1.1	98.9	179
Residential	0.6	3.2	96.8	126
Pasture (natural or planted)	0.3	1.4	98.6	72
Agroforestry	0.8	2.4	97.6	42
Managed forests	1.2	11.1	88.9	36
Forest plantations	0.7	52.2	47.8	23
Fallow	0.4	0	100	22
Silvipasture	1.7	0	100	5
Natural forest	0.4	50	50	4
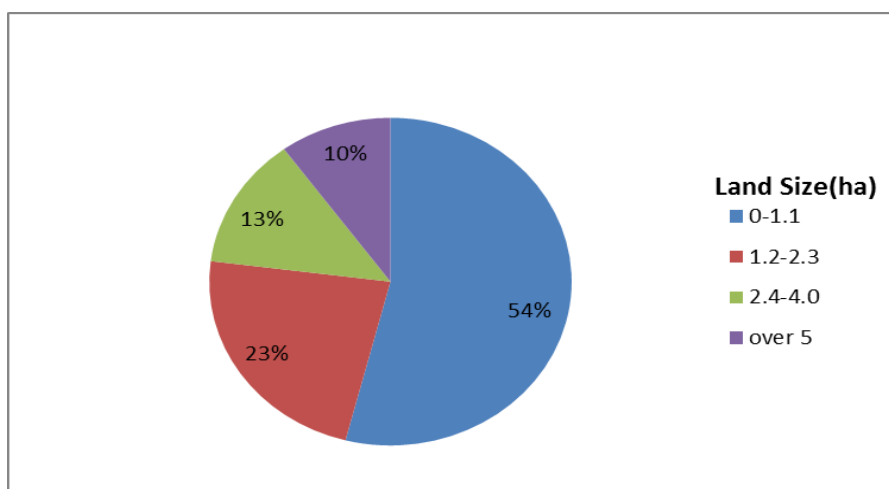
Figure 6 Land size in households within Cherangany hills ecosystem

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3.1.3   Assets and savings

3.1.3.1 Housing characteristics; ownership, structure and size

3.1.3.1.1 House ownership

In Cherangany, about 83.2% (n =163) of households owned their own houses while 14.3% owned the houses with other households, those that did not own houses were 0.5% and 2% rented the houses alone. There was no substantial difference at the village level in house ownership.

3.1.3.1.2 Wall, roof and house characteristics

Most of the houses had mud walls (73.3%), walls made of brick (15.9%) whereas houses that had wooden walls were 9.7%. Only a very small percentage (1%) of houses had iron sheets walls. The most preferred roofing material among the sample household population was iron metal at 88.5%, followed by thatched housing structures at 9.4%, while 2.1% had wooden board as their roofing materials, (Table 3). Majority (93.2%) of the houses in Cherangany were smaller than 100 m^2. Houses that were between 100 m^2 – 200m^2 were 4.7%. Bigger houses between the ranges of 202 m^2 - 400 m^2 were represented by only 2.1% of the respondents..

Table 3 Wall and roof materials used in villages within Cherangany

Structure characteristics		
	Frequency	Valid Percent
Wall materials		
Mud/soil	143	73.3
Wooden (boards, trunks)	19	9.7
Iron (or other metal) sheets	2	1.0
Bricks or concrete	31	15.9
Roof materials		
Thatch	18	9.4
Wooden (boards, trunks)	4	2.1
Iron or other metal sheets	170	88.5

3.1.3.2   Household assets

Majority of the households in Cherangany owned phones (25.5%), radios (21.7% and furniture (21.1%) as the main assets (

Table 4). Kapkoros and Kipkiring villages had the highest mean total value of household assets of Ksh. 108,626.00 and Ksh. 39, 916.00 respectively; whereas, Kaptarakwa and Sokobei villages had the least mean total value of household items i.e. Ksh. 800 and Ksh. 500 respectively.

Table 4 Household assets

Item	Frequency (n)	% frequency
Phone	170	25.5
Radio	155	23.5
Furniture	141	21.1
Solar panel	59	8.8
TV	35	5.2
Wooden cart or wheelbarrow	25	3.7
Motorcycle	24	3.6
Bicycle	23	3.4
Car/truck	8	1.2
Water pump	8	1.2
Stove for cooking (gas or electricity)	7	1
Plough	6	0.9
Chainsaw	3	0.4
Tractor	2	0.3
Refrigerator/freezer	1	0.1
Total	**667**	**100**

3.1.3.3 Household savings in Banks, credit associations/saving clubs, non productive assets and debts

Most households (82.6%) had savings of less than Kshs. 50,000; as the amount of savings increased to more than Kshs. 150,000, it was households with secondary and tertiary level of education who had more savings (Figure 7). In Cherangany ecosystem, there are no households with savings in non-productive assets such as gold and jewellery. Savings between male and female headed households was relatively similar across the savings range. Majority of female (88.2%) and male (86.1%) headed households saved less than Kshs. 50,000 (Figure 8). Most of the debts by the households in Cherangany were less than Ksh. 20,000. Sachangwaa and Chogoo were the only villages in the ecosystem that had debts of more than Ksh. 100,000. The major outstanding debts included those from table banking, agricultural inputs, financial loans and dowry
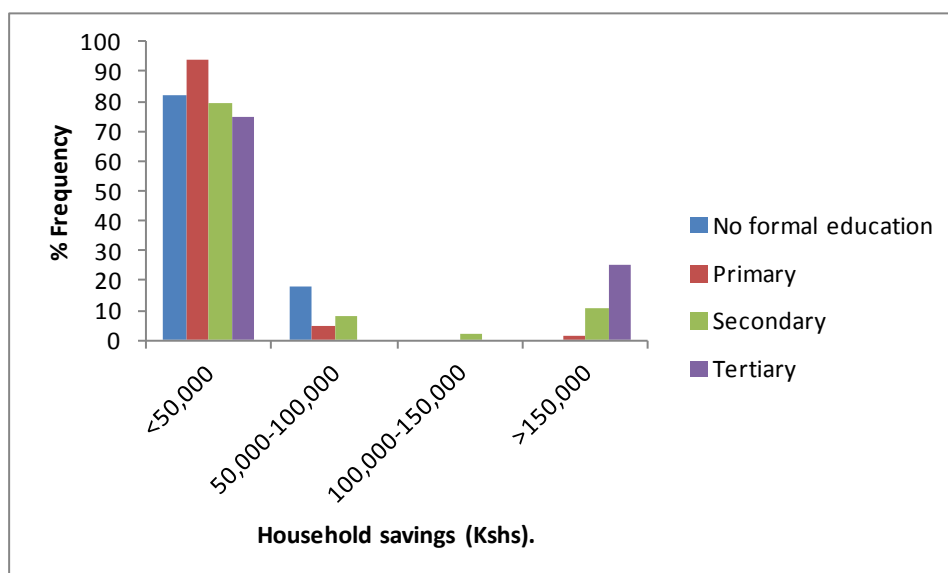
Figure 7 Household savings against education level
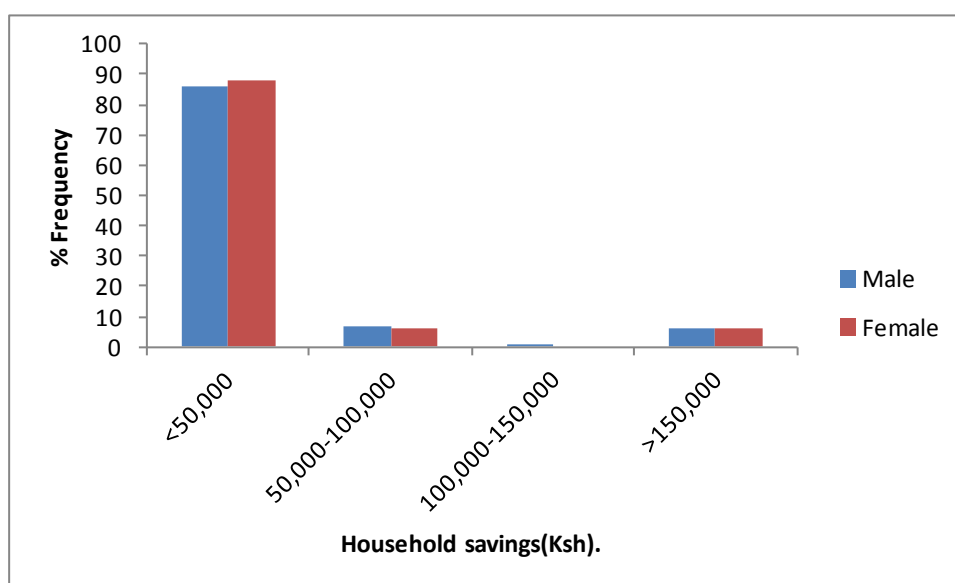
Figure 8 Household head savings against gender

3.1.4   Forest Resource base

3.1.4.1 Distance of households to the forest edge

The mean distances of households to the nearest natural forest was 1.3 km. About 78.6% of households collected firewood from Cherangani forest, while 22% did not have access to the forest for firewood. Of those that collected their firewood from Cherangani forest, 81.4% of them were between 0 – 2 km from the edge of the forest as shown in (Figure 9). Beyond 6km, the number of households accessing the forest declined. This indicated that those closer to the forest were more engaged in firewood collection than those farthest. The villages farthest from the forest were Ngorngoro (4.1 Km) and Kapkrongwa (3.0 Km); Cheptobet and Sokobei villages were 0.2 km to the edge of the forest; while Moogun and Kabarnet villages were at the forest boundary.

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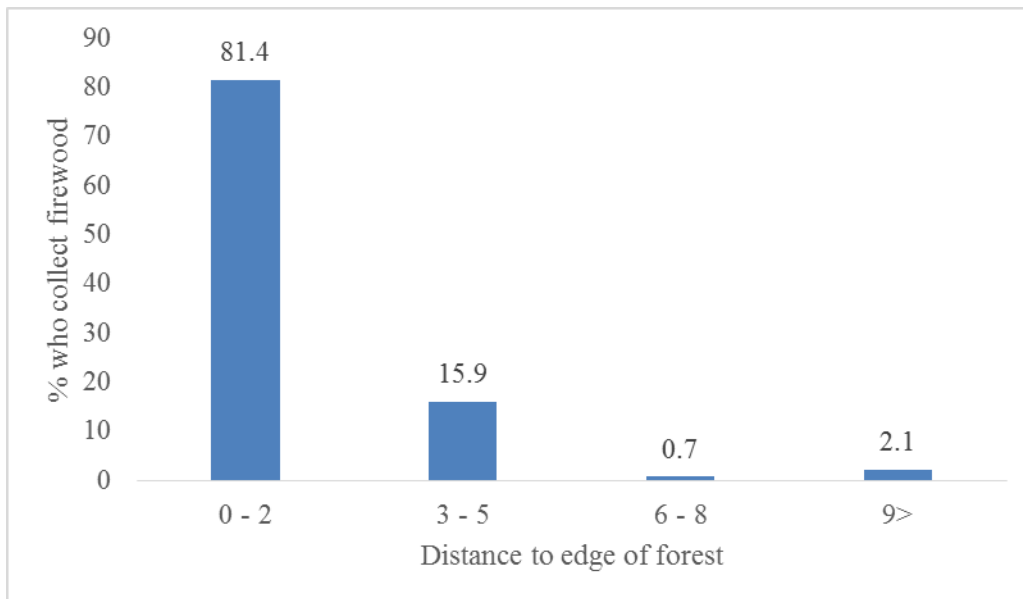
Figure 9 Distance of the household to the edge of the forest

3.1.4.2 Time spent in collecting firewood

Majority of those interviewed indicated that their households were spending more time collecting firewood now than they spent 5 years ago (85.6%). 11.0% indicated that they spend less time collecting firewood now while 3.4% now collect less firewood than they collected compared to 5 years back Figure 10.
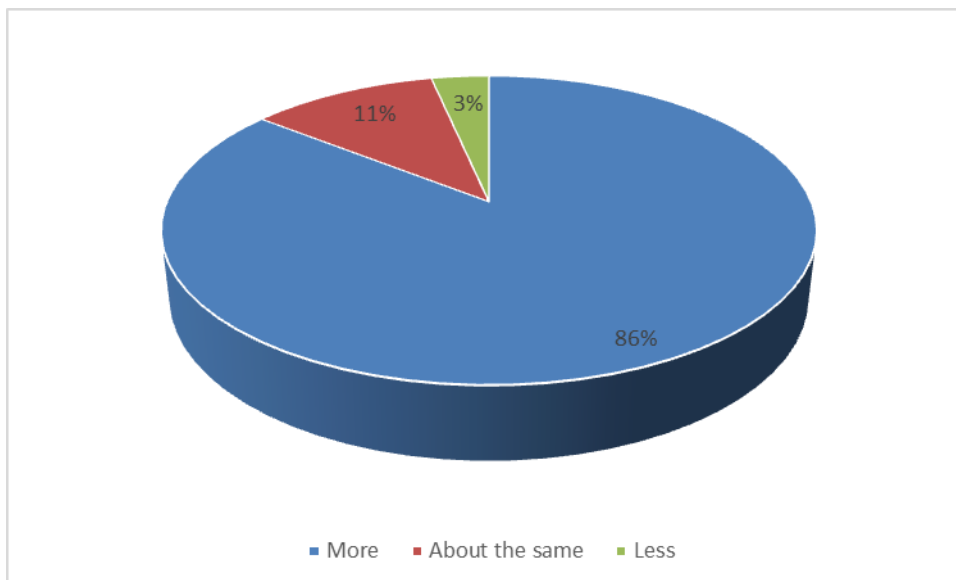
Figure 10 Time spent collecting firewood now compared to 5 years ago

3.1.4.3 Trends in firewood availability

Majority of the respondents in Cherangany perceived that there was a change in firewood availability now than five years ago. Decline in firewood availability was reported by majority of the respondents (84.8%) Figure 11.
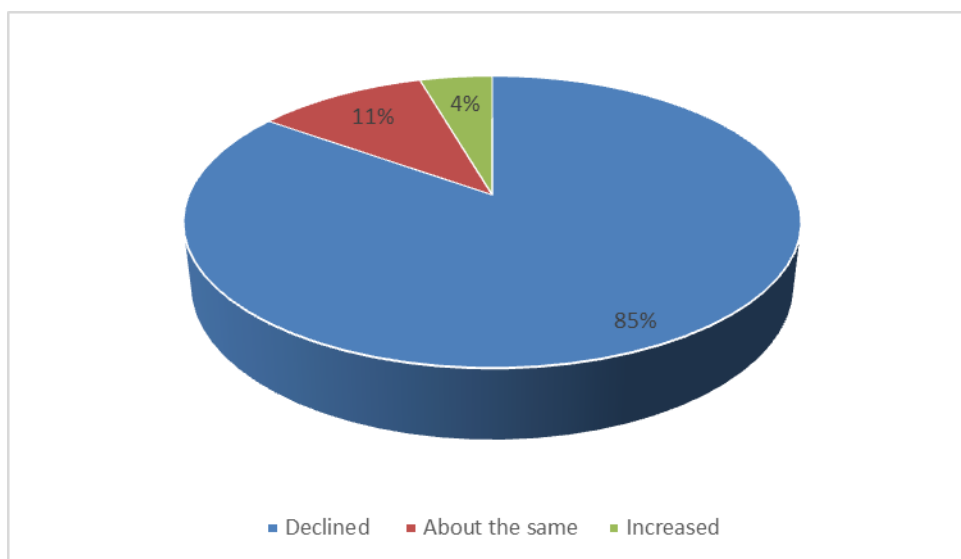
Figure 11 Time spent in collecting firewood now, compared to 5 years ago

In Karbun village, 100% of the respondents indicated that there had been a decline in the availability of firewood. The main reasons to decline in fuel wood availability included; forest clearing, population increase and land use change. Survival mechanisms in response to declined firewood availability included use of alternative sources of fuelwood increased use of agricultural residues as fuel (27.5%) planting trees on private land (18%), and buying firewood/charcoal (9.7%) (Table 5).

Table 5 Responses to decline in firewood availability

| Response	Frequency (n)	% frequency
Increased use of agricultural residues as fuel	82	27.5
Increased collection time	78	26.2
Planting of trees on private land	54	18.1
Buying more fuel wood and/or charcoal	29	9.7
More conservative use of fuel wood for cooking and heating	17	5.7
Restricting access/use to own forest	17	5.7
Making charcoal	8	2.7
Increased use of non-wood wild products	6	2.0
Buying more commercial fuels	5	1.7
Reduced the need for use of fuels, such as using improved stove	1	.3
Conserving standing trees for future	1	.3
Total	**298**	**100.0**

3.1.4.4 Establishment of Woodlots

The percentage of residents planting woodlots were 65%. The woodlots were mainly for firewood for domestic use (28.4%) and timber/poles for own use (24.1%). The other uses are shown in (Table 6).

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Table 6 Reasons for establishing woodlots

Purpose	Frequency (n)	% frequency
Firewood for domestic use	91	28.4
Timber/poles for own use	77	24.1
Timber/poles for sale	44	13.8
Other environmental services	44	13.8
Land demarcation	30	9.4
Other domestic uses	13	4.1
Firewood for sale	11	3.4
Fodder for own use	4	1.3
Fodder for sale	2	.6
To allow my children/grand children to see these trees	2	.6
To increase the value of my land	1	.3
Rain	1	.3
Total	**320**	**100.0**

3.1.5   Forest user groups

Majority (86.9%) of the households in Cherangany are not members of any Forest user groups (FUGs). The main reason for not joining FUGs include non-existence of FUG in the village (44.1%) and inadequate information on FUGs (24.9%) as shown in (Table 7). The household's main reason for joining FUGs was to ensure better forest management in future (22%) and to learn new skills and information (18%) Table 8.

Table 7 Reasons for not participating in FUG

Reason	Frequency (n)	% frequency
No FUG exists in the village	78	44.1
Inadequate information	44	24.9
Constraint on time	17	9.6
Not interested in FUGs activities	13	7.3
FUG exists in village, but household unaware of its presence	13	7.3
Competition from other community groups	3	1.7
Forest authorities	3	1.7
Lack of trust in FUGS	2	1.1
New in the village	1	0.6
High subscription fees	1	0.6

	1	0.6
Lack of forest products	1	0.6
Corruption in FUG	1	0.6
Total	**177**	**100.0**

Table 8 Reasons for joining the FUG

Reason	Frequency(n)	% frequency
Better forest management benefits in future	11	22.0
Learn new skills/information	9	18.0
Access to other benefits	7	14.0
My duty to protect the forest	7	14.0
Social aspect	6	12.0
Increased access to forest products	5	10.0
Makes harvest of forest products more efficient	2	4.0
Receipt of direct payment	1	2.0
Know forest resource better	1	2.0
More secure land title	1	2.0
Total	**50**	**100.0**

3.1.5.1 Attendance of FUG meetings, time spent in meetings and monetary issues related to FUG

Households in Cherangany who are members of the FUGs indicated that they attended all the meetings. The meetings were mainly attended by husbands (69.6%) (Table 9) as most women engaged in domestic chores. Most of the FUG members (52.2%) in Cherangany spent 10 – 30 working days whilst 34.8% spent less than 10 days in FUG meetings in the past 12 months (Figure 12). Majority of the FUG members (82.6%) made contributions to the FUGs. It was noted that 63% of the members contributed between Kshs 1,000- Kshs 5,000; less than Ksh.1,000 (26.3%), whereas 10.5% of the members contributed more than Ksh.5,000. Most of the households (63.6%) had not received any cash payment from the FUG in the past 12 months. Of those who received cash payment, 42.9% received less than Kshs 5,000 (Figure 13). Majority of the households (48%) in Cherangany had experienced large positive effect from the FUG (Figure 14). There was no negative FUG impact indicated by households in the ecosystem. In Cherangany, Samaki and Kamole were the only villages that experienced small and large positive effect of FUGs. In Samaki, 33.3% experienced small positive effect while 66.7% experienced large positive effect. In Kamole, 50% of the households experienced small positive effect, while 50% experienced large positive effect.

Table 9 Attendance of Forest User Group meetings

Attendance of FUG meetings	Frequency (n)	% frequency
Only the husband	16	69.6

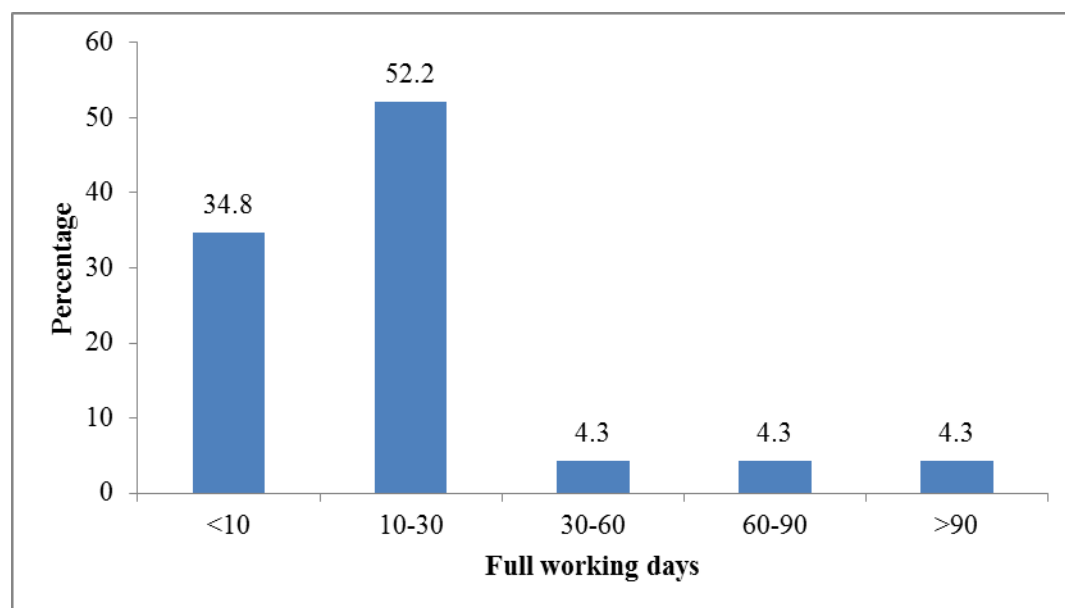|		
Only the wife	3	13.0
Both, but mainly the husband	2	8.7
Both, but mainly the wife	1	4.3
Both participate about equally	1	4.3
Total	**23**	**100.0**

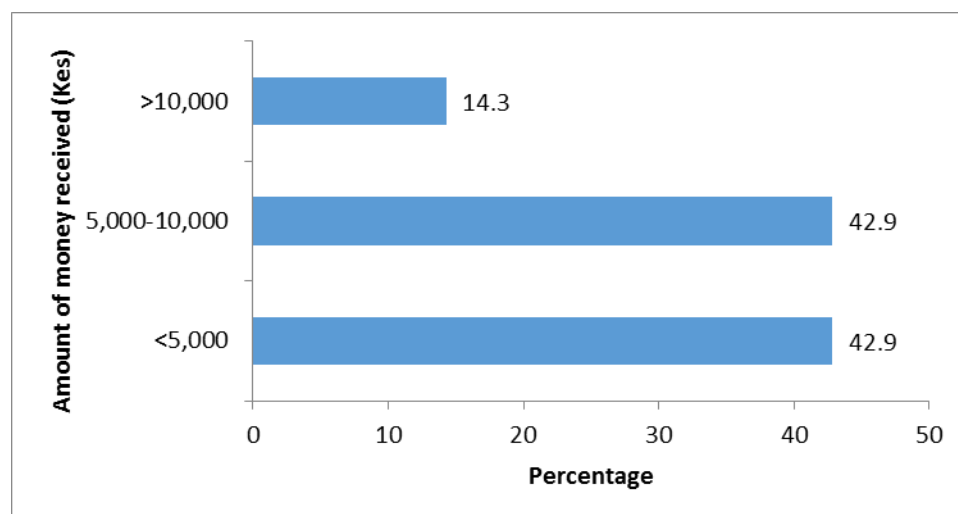Figure 12 Number of days members of FUG attend meetings per annum

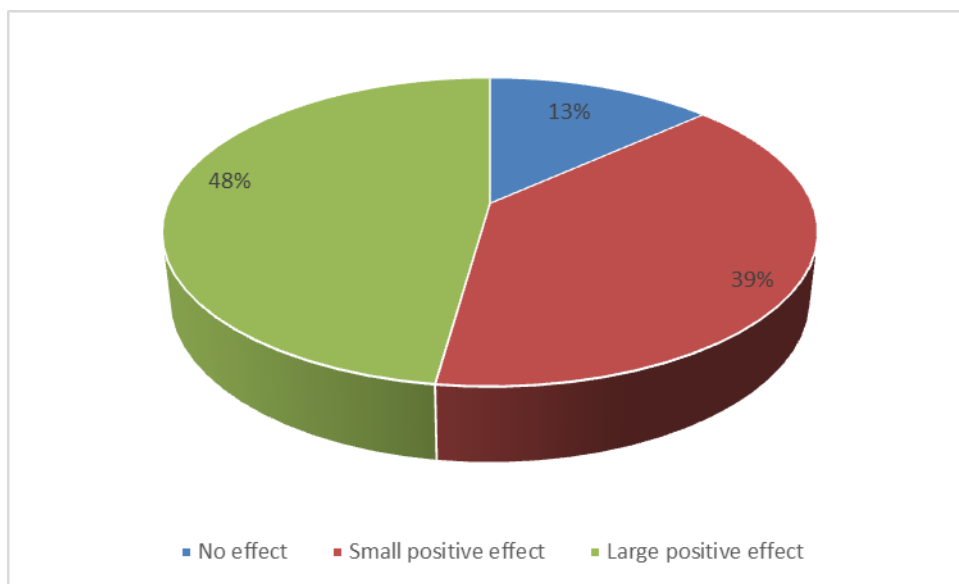Figure 13 Subscription fee (Ksh.) to FUG per annum

Figure 14 Effects of FUGs in the village

3.1.6 Forest services

Majority (95.1%) of the household population in Cherangany did not receive benefits from forest services. Minimal benefits were received from timber concessions (14.3%), tree planting (11.1%) and water catchment projects (4%), Table 10. Beneficiaries to these services are both members and non-members of forest user groups.

Table 10 Benefits from forest services

Principal purpose	Have received (%)		
	No	Yes	n
Tourism	100.0	0.0	25
Carbon projects	100.0	0.0	23
Water catchment projects	96.0	4.0	25
Biodiversity conservation	100.0	0.0	24
Tree planting	88.9	11.1	27
Timber concession	85.7	14.3	28
Mean %	**95.1**	**4.9**	

3.1.6.1 Forest clearing

About 96% of the households indicated that they had not cleared the forest in the past 5 years. Only three villages cleared 3.3 acres of gazetted forest in Cherangany hills; Kaplonge (0.5 ha), Kamole (1.8 ha) and Kipsaya (1.0 ha). However, almost all (99%) of household respondents indicated that they had not cleared the forest in the past 12 months with 1% having cleared a portion of 2 acres of gazetted forest adjacent to Kamole village which is approximately 3 km to the edge of the forest. The cleared section was utilized for non-agricultural purposes such as production of firewood, charcoal, and timber. Over the past 5 years, 4, 3 and 1ha of land were abandoned among households in Gatanga, Kamongos and Chebusal villages respectively Figure 15.
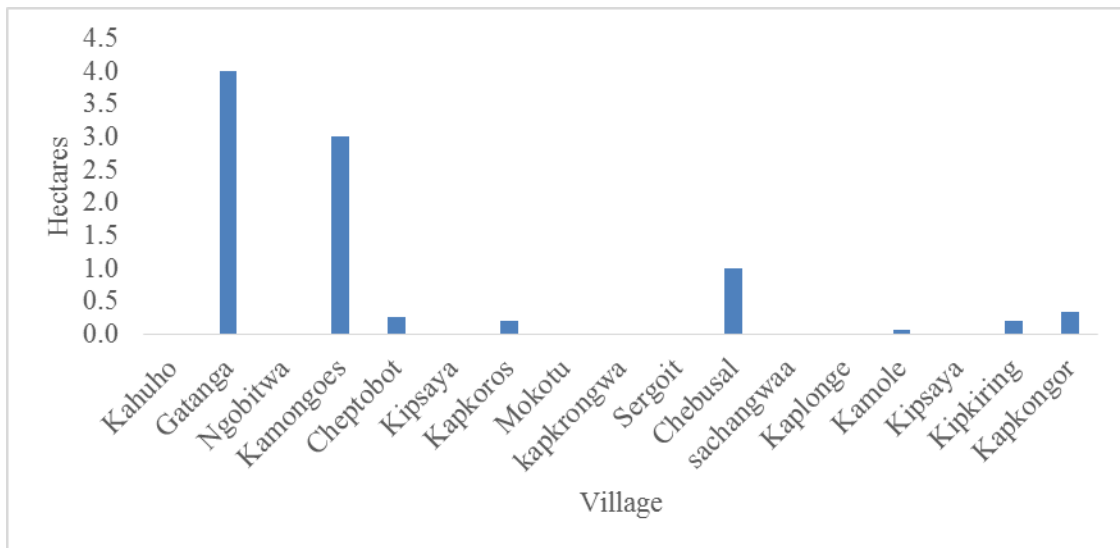
Figure 15 Land abandoned by households over the past 5 years

3.1.6.2 Infrastructure

3.1.6.2.1 Access to electricity and piped water

About 87% of households in Cherangany had no access to electricity. The villages which had some access to electricity were Kapsomai, Ngobitwa, Katee, and Kipkiring. Most of the electricity in the villages was connected to schools and homes in close proximity to a transformer. About 68% of the household population had no access piped water in Cherangany. About 79% of villages in Cherangany had rivers within their boundaries that were navigable during all seasons. Half the villages had no navigable rivers within their boundaries and these included Ngobitwa, Katee, Ngorngoro, Kapsingoria, Chogoo and Segerger/kapseon. In these villages, the households have to walk a lonfg distance to get water for domestic use and their livestock. The mean distance to the nearest navigable river in Cherangany was 2.45 km. Ngobitwa village was furthest to a navigable river at (11.75 km), followed by Kipsaya, Kapsingoria and Kamole, each at 5km away. The villages that were nearer to rivers were Karbun and Kapchel (0.4 and 0.8 km respectively).

3.1.6.2.2 Access to health centre

In Cherangany Hills, 53% of households had no access to a health centre within their villages, hence have to seek health care in adjacent villages with health centres. The mean distance to the nearest health centre was 5.15 km. The villages which were far from the health centres are; Nerkwa, Sokobei, Chogoo and Kamole at 15km, 10 km, 9.2 km and 8.67 km respectively; while those in close proximity were Kapsingoria, Tabunyer, Kapptarakwa and Kiplabai at 1.25 km, 1.5 km, 2 km and 2.3 km respectively.

3.1.6.2.3 Distance from the village centre to the nearest market facility

The average distance to the nearest district market, market for major consumption goods, market for agricultural products and market for forest products was 2 km, 9 km, 21 km and 12.5 km respectively (Figure 16). Motorcycle was the most common means of transport to all the market facilities. The use of vehicles and walking to the markets were relatively similar. Donkeys were only used to transport goods to markets for major consumption goods, though on a smaller scale Figure 17.

21
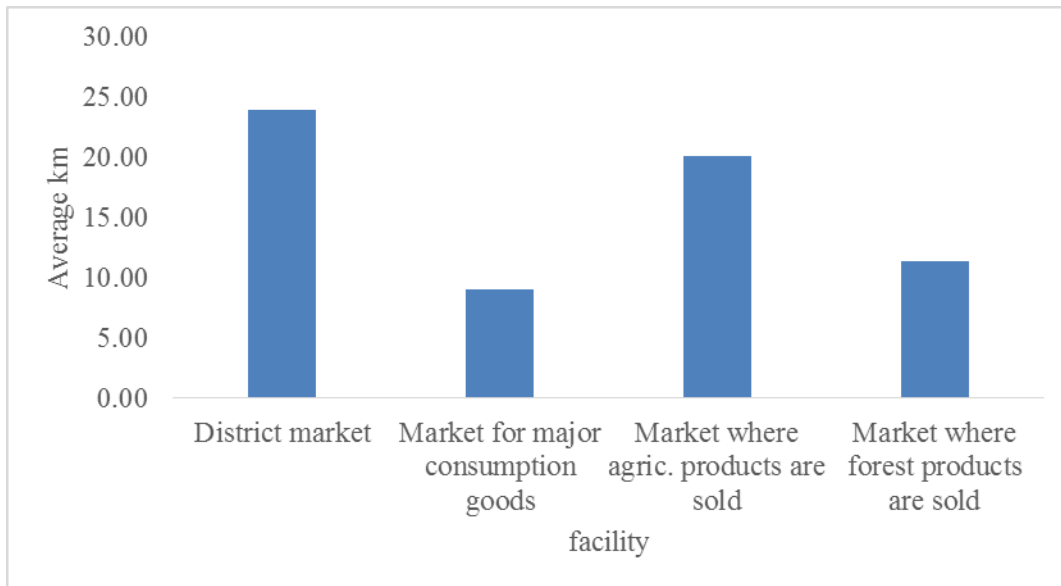
Figure 16 Distance from village centre to the nearest market facility
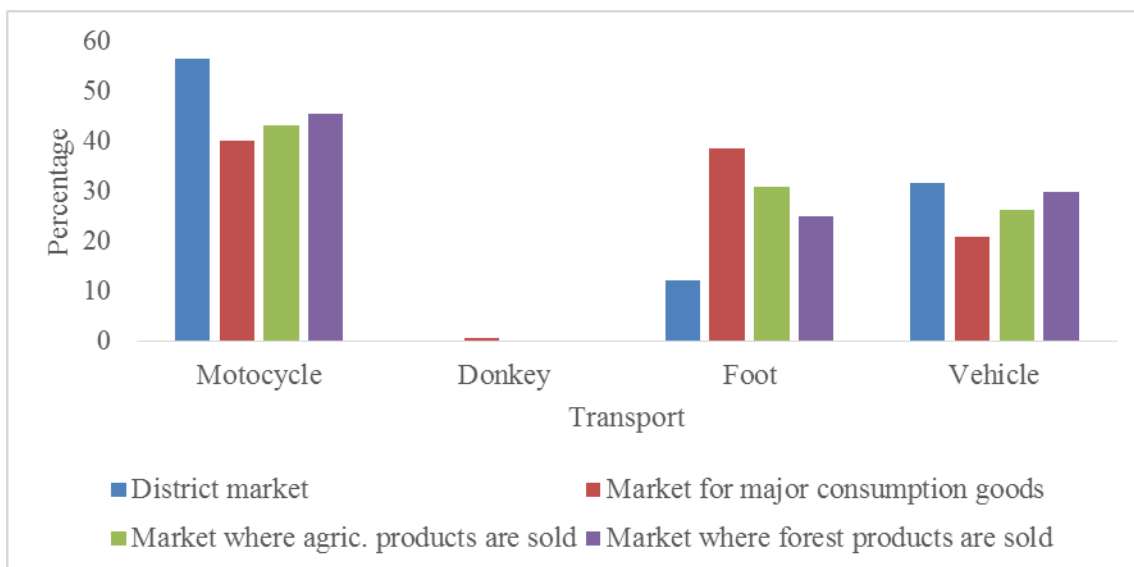
Figure 17 Mode of transport to nearest facility

3.1.7 Crisis and unexpected expenditures

3.1.7.1 Severity of events

In the last 12 months, most of households (59%) did not experience any crisis, those who experienced moderate crisis were 21% whereas 20% experienced severe crisis. However, the most severe crisis reported over the past 12 months in Cherangany was payment of school fees (84.2 %), followed by serious illness in family 40.9% and major livestock loss 35.9%. Financial constraints (64.7%) and serious crop failure (60%) were mentioned as moderate crisis.

3.1.7.2 Income loss or costs coping strategy

The coping strategies adopted by the households included selling of assets (28.8%), doing nothing about it (15.2%), doing casual labour work (10.1%); harvest of more non-forest wild products, renting out land, and livestock diversification were the least mentioned coping strategies each at 0.4 %.

3.1.8   Welfare perceptions and social capital

3.1.8.1 Household satisfaction with life over the past 12 months

About 37% of the households were satisfied with their lives for the past 12 months, while 31% were unsatisfied (Figure 18).
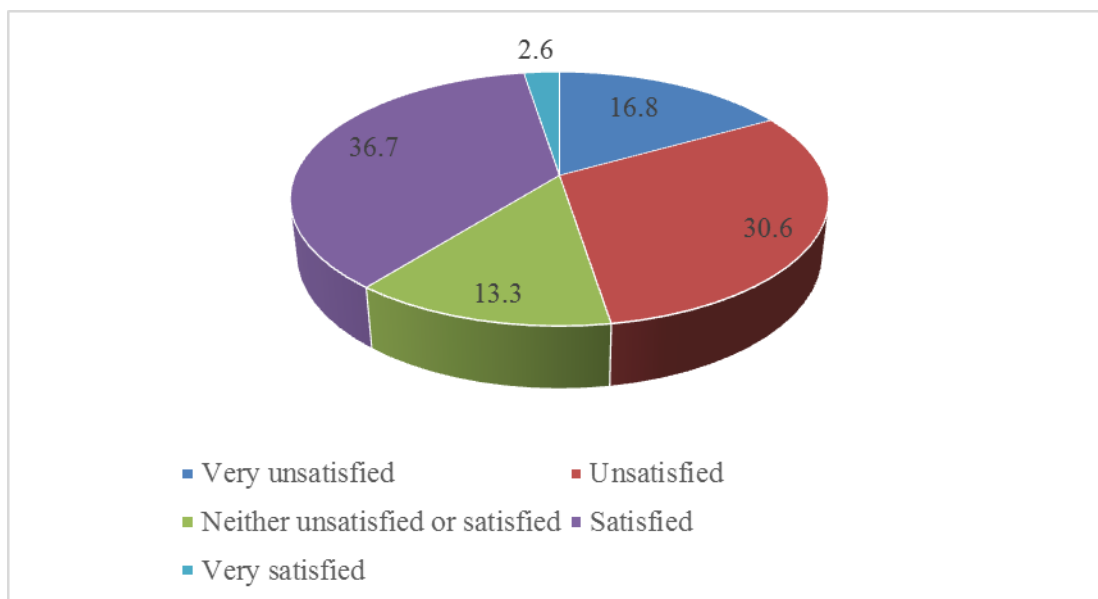
Figure 18: Household satisfaction with life over the past 12 months

3.1.8.2 Sufficiency of food production and income over the past 12 months

About 37.4 % of the households had reasonable food production and income to support their households for the 12 months (Figure 19). Food production was influenced by size of land owned; households with an average size of land of 2 acres had food sufficiency.
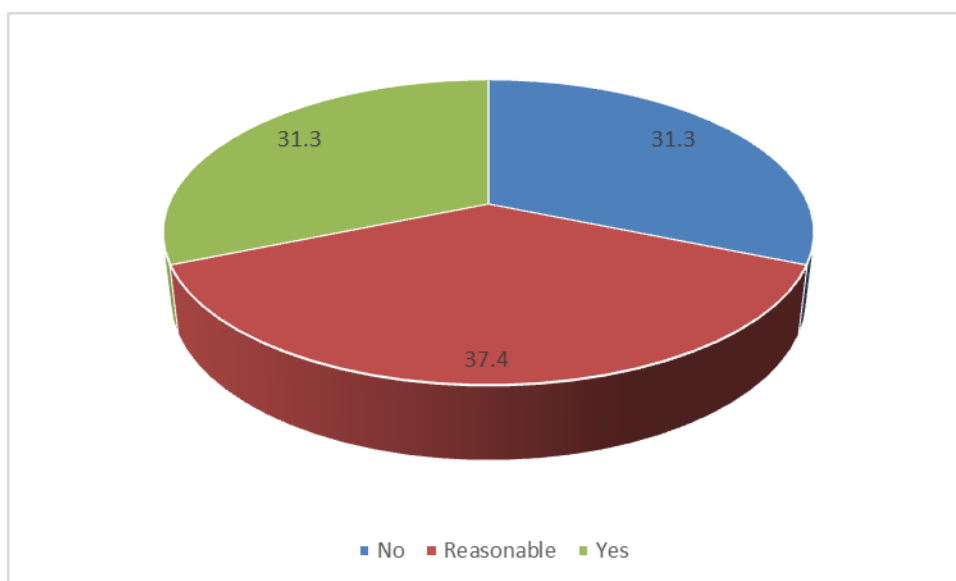
Figure 19 Sufficiency of food production and income over the past 12 months

3.1.8.3 Household well-being compared to other households now and 5 years ago

Majority of the households (70%) perceived their well-being as about average, 16% as better off and 14% as worse off in comparison to other households. In Kapchela, 50% of households were worse off compared to other villages. On the other hand, Mokotu (71.4%), Gatanga (66.7%) and Kamole (55.6%) were better off compared to the other villages. About 37% of households in Cherangany were better off now compared to 5 years ago while 41.7% were less well-off now, 21.4% indicated that their life remained about the same for the past 5 years. The main reasons

attributed to being less well-off now compared to five years ago were higher input prices and high cost of living,

3.1.8.4 Households consideration of a village as a good place to live in

About 90% of households' perceived their villages as a conducive place to live, partly safe (5%) and not safe to live in (5%). However, the households that considered the village to be a safe place to live in owned an average of 2.29 acres of land and lived at a distance of 18-20 km, while those who considered the village not safe or partly safe to live in owned less than 1.83 and 1.89 acres of land and lived between 0.5km-3km respectively from the edge of the forest.

3.2 Village analysis

This section presents results on the social, economic and demographic status in Cherangani ecosystem at village level.

3.2.1 Demographics

The number of sampled households in Cherangany ecosystem was 388 on average. The mean current population was 2469 (Table 11), with a mean of 4.1% persons having moved in the village in the last 10 years and a mean of 1.2% having left the village in the past 10 years. The rate of new settlement in the villages was higher than that of departures. Some of the villages had as high as 3000 households and some 1000 new settlements.

Table 11 Population dynamics

Statistics	Current Population,	Number of households	Number of persons living in the village that moved in 10 years ago	Number of persons who have left the village 10 years ago
N	37	37	36	37
Mean	2469	388	102	31
Std. Deviation	3185	574	199	44
Minimum	100	17	0	0
Maximum	15000	3000	1000	200

3.2.2 Forest resource base

The most important forest products in the ecosystem were food 26.3%, Fito (20.2%) and medicinal products (19.3%). The product extracted least from the forest was timber (1.8%) Figure 20.
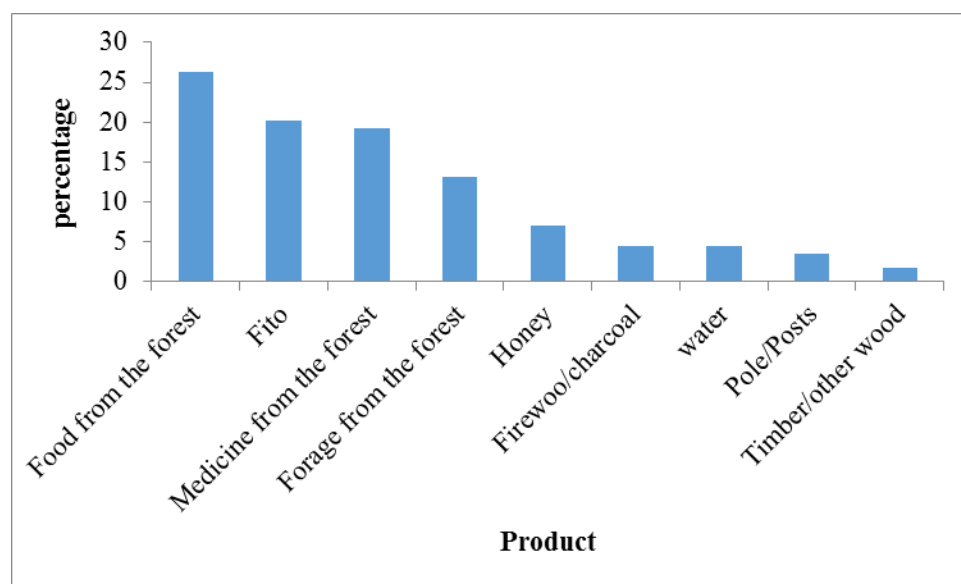
Figure 20 Most important forest products derived from Cherangany Ecosystem

Availability of the most important forest products declined within the last 5 years. For instance, those that declined most were poles/posts (77.8%) and firewood (74.5%); others were forage (66.7%), timber (62.5%), medicine (61.3%) and water (50%). The most important forest product that increased in the past 5 years was food (maize, beans and potatoes) from the forest (72.2%), Table 12. Extraction of withies remained about the same in the past 5 years.

Table 12 Dynamics of most important forest products in the last 5 years

Most important product for the	Change in the availability (%)	N

people's livelihood	Declined	About the same	Increased	
Firewood/charcoal	74.5	2.1	23.4	47
Medicine from the forest	61.3	29.0	9.7	31
Forage from the forest	66.7	16.7	16.7	24
Food from the forest	16.7	11.1	72.2	18
posts/poles	77.8	0.0	22.2	9
Timber/other wood	62.5	0.0	37.5	8
water	50.0	50.0	0.0	6
Fito	0.0	100.0	0.0	2

Decline in availability of firewood/charcoal and medicine was reported among some village respondents to be due to increased access/extraction at village level, where more firewood and medicine was collected. Forage from the forest declined mostly due to bush burning among other reasons, (Table 13). On the hand, some respondents reported an increase in the same products, for example, food from the forest increased due to improved access right to products while firewood increased due to less clearing of forests for agriculture. The increase in forest forage was mainly due to tree planting (Table 14).

Table 13 Reasons for decline of the most important forest product

Reasons for decline	Most important product (%)		
	Firewood/charcoal	Medicine from forest	Forage from forest
Reduced forest area-small scale clearing	8.8	0.0	7.1
Reduced forest area-large scale projects	11.8	0.0	0.0
Reduced forest area-people from outside buying land	5.9	0.0	7.1
More local (village) collecting more	47.1	44.4	21.4
More people from other villages collecting more	2.9	0.0	0.0
Restriction on use by central or state government	8.8	0.0	0.0
Climatic changes	0.0	0.0	14.3
Timber harvesting	0.0	16.7	0.0
Charcoal burning	0.0	11.1	0.0
Poor harvesting practices	5.9	16.7	14.3
Bush burning	2.9	11.1	35.7
Increased marketing potential	5.9	0.0	0.0
N	34	18	14

Table 14 Reasons for increase of the most important forest product

reasons for change (increase)	Most important product (%)		
	Firewood/charcoal	Food from the forest	Forage from the forest
Less clearing of forests for agriculture	40.0	15.4	33.3
Climatic changes, e.g., more rainfall	0.0	7.7	0.0
Forest clearing that increases supply of product	20.0	7.7	0.0
Tree planting	20.0	15.4	66.7
Improved access rights to products	20.0	53.8	0.0
N	**5**	**13**	**3**

3.2.2.1 Deliberate forest management

Of the mentioned management practices, the level of engagement among locals was low and in some instances non-existent. The major management practices were protecting areas of forest for particular environmental services like water catchment stands (17.6%) and extension/education about forest management and planting trees, both at 14.7%. Mapping practice was inexistent practice in Cherangany ecosystem Figure 21.
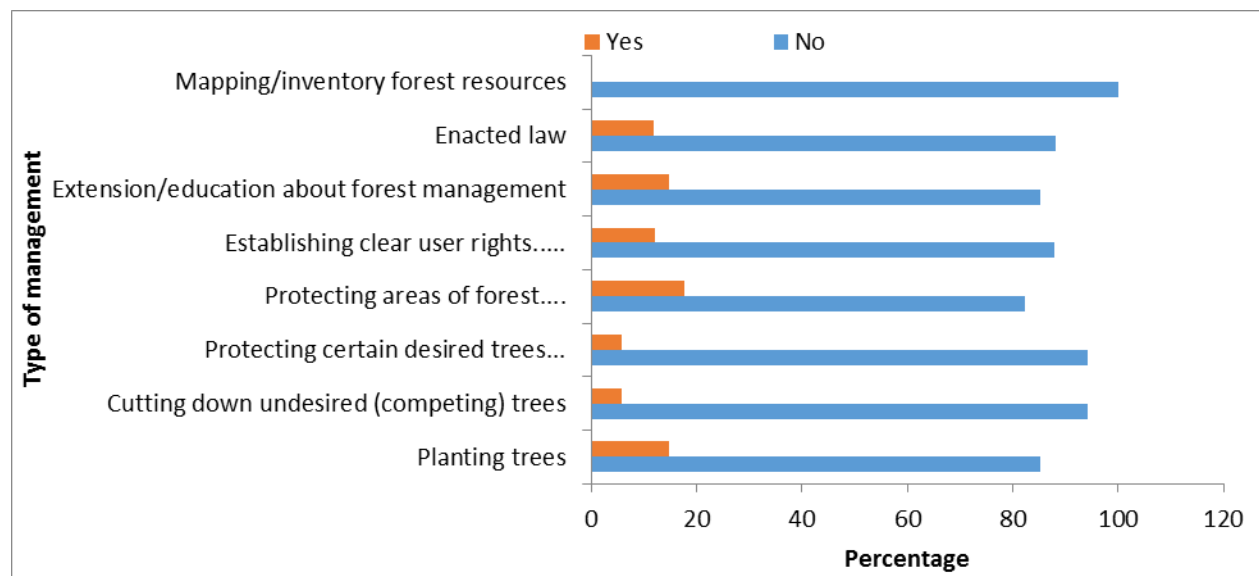

Figure 21 Forest management practices in Cherangany ecosystems

3.2.2.2 Forest institutions

In Cherangany ecosystem, the forests were state owned and managed by the government through KFS. Clear customary rules regulating the use of most important forest products existed in the extraction of these products, except very few rules regulating timber extraction and honey harvesting (Table 15).

Table 15 Customary rules regulating use of forest products

Most important product for people's livelihood	Status of customary rules regulating the use of the MIP in the village (%)			N
	None, very few	Yes, but vague/unclear	Yes, clear rules exist	
Firewood/charcoal	27.6	17.2	55.2	29
Forage from the forest	13.6	22.7	63.6	22
Medicine from the forest	19.0	23.8	57.1	21
Food from the forest	21.4	14.3	64.3	14
Honey	50.0	12.5	37.5	8
Timber/other wood	80.0	20.0	0.0	5
water	50.0	0.0	50.0	4
Fito	25.0	0.0	75.0	4
Pole/Posts	50.0	0.0	50.0	2

3.2.2.3 Forest user groups

Out of the sampled villages in Cherangani hills, 16 villages had existing forest user groups. Few of the existent forest user groups were formed through local initiatives (29%), with rest emerging from government initiative (71%), Table 16. The main purpose of all the FUGs was either getting of a particular forest product, or management of a particular forest area. Most of the FUGs in Cherangany ecosystem were formed purposely to access particular forest products from the forest Figure 22. Members of PELIS were the most effective FUG (57.1%), followed by

Grazing and Firewood groups although not widely practiced in the interviewed villages, (**Table 17**). There are rules and regulations governing operations of the FUGs and upon violation, certain penalties are imposed on the respective group. About 47.6% of law breakers are excluded from their groups while 42.9% pay fine in monetary terms Figure 23. In Cherangany forest ecosystem, the major staple foods were Ugali, beans and potatoes at 68%, 17.3% and 14.7% respectively.

Table 16 Formation of forest user groups

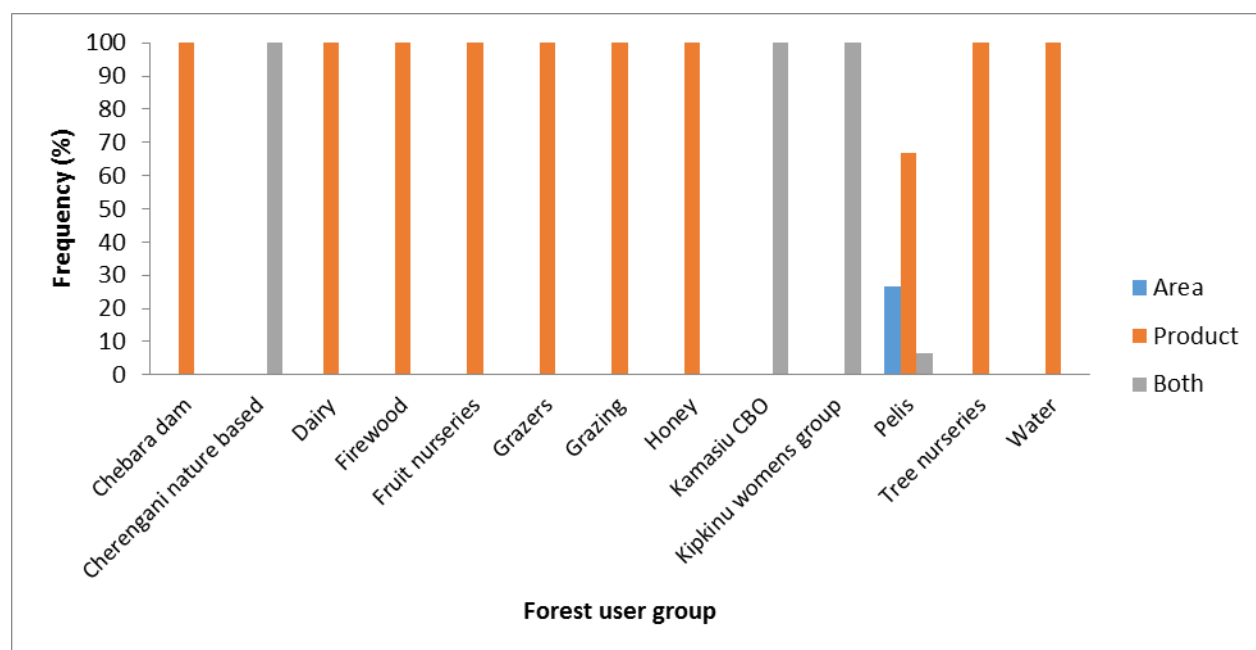| FUG	How the group was formed		
	Local initiative	**Initiative from government**	n
Chebara dam	100.0	0.0	1
Cherengani nature based	100.0	0.0	1
Dairy	100.0	0.0	1
Firewood	25.0	75.0	4
Fruit nurseries	100.0	0.0	1
Grazing	0.0	100.0	5
Honey	0.0	100.0	1
Kamasiu CBO	100.0	0.0	1
Kipkinu womens group	100.0	0.0	1
PELIS	0.0	100.0	15
Tree nurseries	100.0	0.0	2
Water	100.0	0.0	1
N	**10**	**24**	34

Figure 22 Purpose of FUG

Table 17 Effectiveness of FUGs

Name of user group	How effective is FUG in ensuring sustainable and equitable forest use		N	Mean score
	Most effective[3]	effective[2]		
Chebara dam	0.0	100.0	1	2
Cherengani nature based	0.0	100.0	1	2
Dairy	0.0	100.0	1	2
Firewood	66.7	33.3	3	3
Fruit nurseries	0.0	100.0	1	2
Grazing	100.0	0.0	4	3
Honey	100.0	0.0	1	3
Kamasiu CBO	100.0	0.0	1	3
Kipkinu womens group	100.0	0.0	1	3
Pelis	57.1	42.9	143	
Tree nurseries	0.0	100.0	2	2
Water	0.0	100.0	1	2
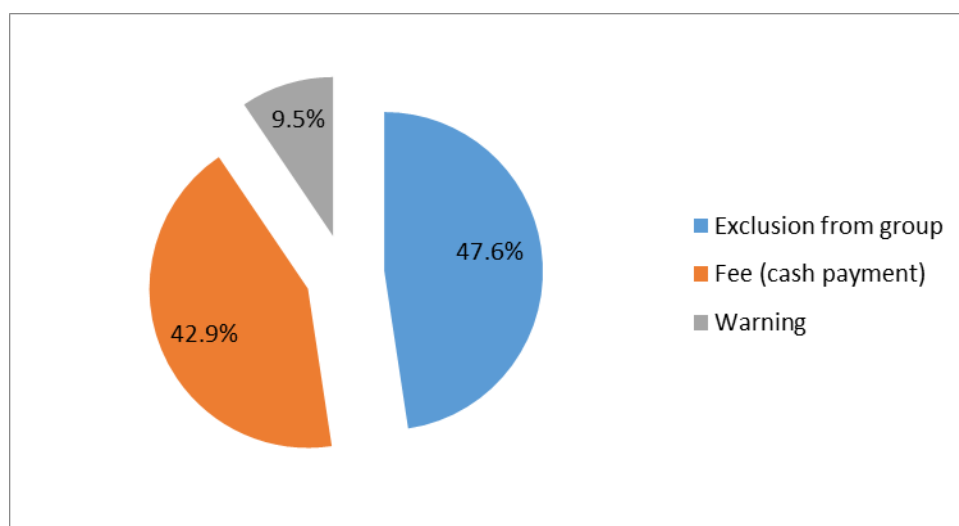
Figure 23 Penalties imposed on law breakers

3.2.3 Infrastructure

3.2.3.1 Number of households with access to electricity, piped water, formal credit and roads

About 12.2% of households had access to electricity and 22.4% had access to piped water. Out of 388 households, 41.0% had access to formal credit and 59.5% stated that there were informal credit institutions in the village. However, despite the availability of the institutions, few individuals had access to them (Table 18). Bondeni estate village had the most access to electricity, piped water and formal credit facilities. Within the villages sampled, majority of the respondents (65%) indicated that there was no all-weather road network (at least one useable road for all seasons).

Table 18 household access to electricity and piped water and formal credit facility

Statistics	Number of households with access to electricity	Number of households with access to piped water	Number of households with access to formal credit
N	37	37	22
Mean	47.35	86.95	159
Std. Deviation	234.101	221.842	209
Minimum	0	0	1
Maximum	1430	1200	848

3.12 Utilization of public areas

This section presents results collected on the utilization of public areas which include gazetted forests, community lands and other public areas within Cherangani ecosystem.

3.13 Description of public areas

The land size of gazetted forest in Cherangany ecosystem was 33,487 Ha owned and managed by state. Markets, schools, playing grounds and grazing land were under the custody of state, except communal land (Table 19). Establishment of the public areas; gazetted forests and market centers are by de jure rights (by right as established by law). Public schools are also established under legal rights, except a few cases under de facto (as exists, not necessarily by legal establishment) Table 20.

Table 19 Mean land size of types of public areas and ownership status

Type of public area	Size (Ha)	Ownership (%)			n
		State	Individual	Community	
Gazetted forest	33487	100	0	0	27
Communal land	51	0	0	100	2
Market	3.3	100	0	0	3
Schools	14.25	100	0	0	24
Playing ground	3	100	0	0	1
Grazing land	4	100	0	0	1

Table 20 Community's legal claim to public areas

Type of public area	Nature of the community's legal claim		n
	De jure	De facto	
Gazetted forest	100	0	33
Market	100	0	2
Schools	96	4	24

3.2.4 Most important direct uses to public areas

Gazetted forests were used as sources of firewood (27.9%), herbal medicine (22.1%) and forage/fodder (16.3%). Communal land in Cherangany forest ecosystem was used for farming. Market centers were used for trading, while schools offered education and employment opportunity, whereas school playing grounds were used to graze animals Table 21.

Table 21 Most important direct use of public areas

Most important direct uses	Type of public area				
	Gazetted forest	Communal land	Market	Schools	Playing ground
Food (PELIS)	7.7	0.0	0.0	0.0	0.0
Grazing	5.8	0.0	0.0	0.0	100.0
Firewood/dead logs	27.9	0.0	0.0	0.0	0.0
Water	2.9	0.0	0.0	0.0	0.0
Poles/posts	1.9	0.0	0.0	0.0	0.0

Fodder/forage	16.3	0.0	0.0	0.0	0.0
Fito	1.0	0.0	0.0	0.0	0.0
Medicinal	22.1	0.0	0.0	2.0	0.0
Honey	7.7	0.0	0.0	0.0	0.0
timber	3.8	0.0	0.0	0.0	0.0
Charcoal	1.0	0.0	0.0	0.0	0.0
Circumcision	1.9	0.0	0.0	0.0	0.0
farming	0.0	100.0	0.0	0.0	0.0
selling	0.0	0.0	50.0	0.0	0.0
Buying	0.0	0.0	50.0	0.0	0.0
Education	0.0	0.0	0.0	49.0	0.0
Employment	0.0	0.0	0.0	46.9	0.0
Meeting	0.0	0.0	0.0	2.0	0.0
N	**104**	**1**	**4**	**49**	**1**

3.2.5 Most Important indirect uses to the public areas

Gazetted forests offer a number of indirect benefits to the community such as improvement of soil fertility (44.8%), act as water catchment (26.9%), water shed (17.9%) and for cultural activities such as circumcision. Schools offer celebrations ground to the community, Figure 24.
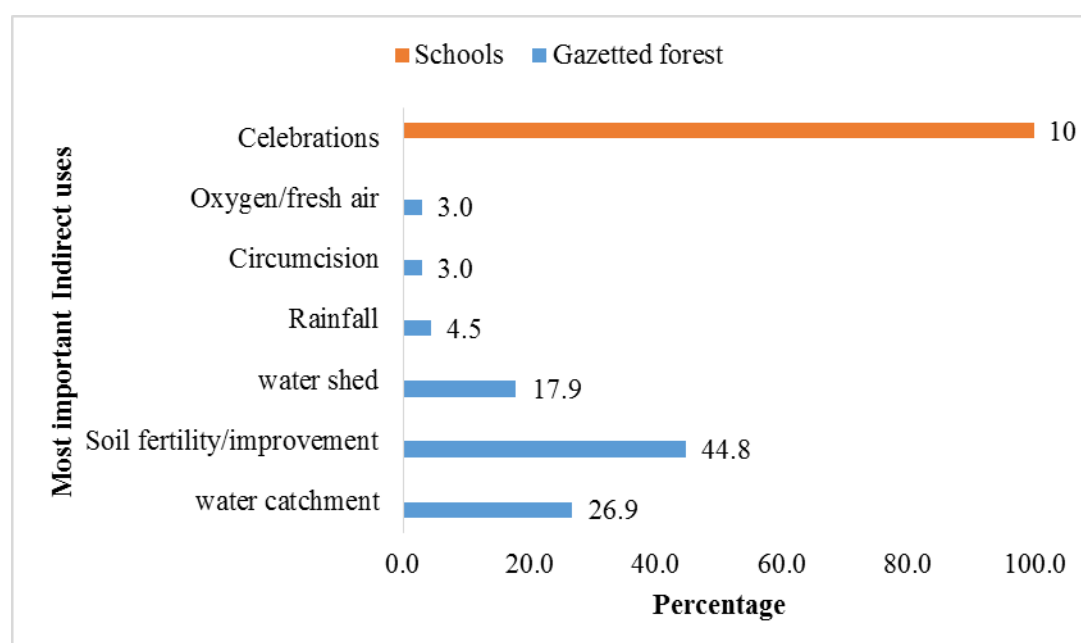

Figure 24 Important indirect use of public areas

3.2.6 Technology to access tangible products

Different tangible products from public areas were accessed using different technologies (Table 22).

Table 22 Technologies for accessing tangible products

Type of public area	Tangible products	Technology (%)									N
		Animal/crop husbandry	fertilizer/pesticides	Smoke	Bee hives	cutting and splitting	Grass harvesting/ slashing	Debarking	Mpesa	electricity	
Gazetted forest	Food	66.7	16.7	0.0	0.0	16.7	0.0	0.0	0.0	0.0	6
	Honey	0.0	0.0	11.1	88.9	0.0	0.0	0.0	0.0	0.0	9
	Firewood	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	1
	Fodder	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	1
	Medicine	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	2
	selling	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1
Market	Buying	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	50.0	2
	selling	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	2
Schools	Light*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	7

Light*- cannot be perceived by the sense of touch

3.2.7 Economic benefits from public areas

Almost all products were used for both subsistence and commercial purposes, except timber and charcoal which were utilized for commercial purposes, Table 23

Table 23 Products accessed from public areas

Product	Uses (%)			N
	Subsistence	Commercial	Both subsistence and commercial	
maize	0	0	100	6
Beans	0	0	100	2
potatoes	0	0	100	2
Vegetables	0	0	100	1
firewood	10	0	90	29
timber	0	100	0	4
Posts	33	0	67	3
Honey	15	0	85	13
Fito	50	0	50	2
Foliage/fodder	86	0	14	21
Charcoal	0	100	0	1
medicinal products	79	0	21	24

3.2.8 Rules governing access to public areas

Majority of the respondents (96.6%) indicated that access rules for public areas existed. Rules for access of communal land were set by the community while rules governing access of gazetted forests were set by both government and KFS, whereas rules for access to markets and schools were set by the government and school management (Figure 25).
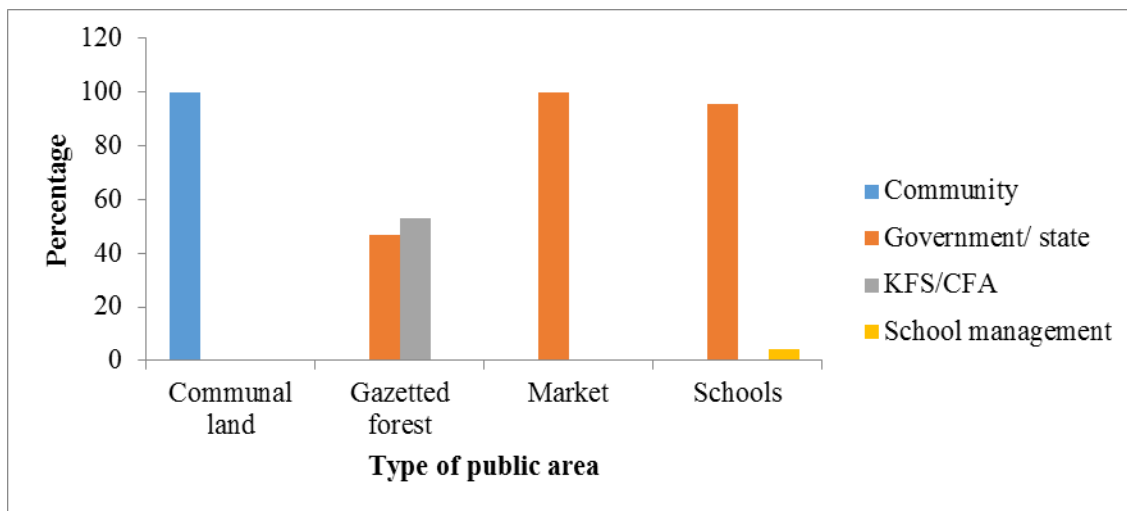
Figure 25 Type of public area and institutions setting rules

3.2.9 Restrictions on accessing, harvesting or selling tangible products from gazetted forests and communal land

Most respondents (66.7%) indicated that there were restrictions to access, harvest or sale of products from gazetted forests. The permits to firewood and fodder were issued monthly while permits on food cultivation through PELIS were issued annually. Restrictions on product access were; sustainable collection and harvesting the part needed on herbal medicine and no use of fire for honey harvesting (Table 24).

Table 24 Permits and restrictions to access tangible products from gazetted forests

Product	Restriction (%)								
	Annual permit	Monthly permit	Grazing only on dry seasons	No grazing in protected areas	No use of fire	Harvesting part needed	Collecting only fallen trees	Collecting sustainably	N
firewood	0.0	85.0	0.0	0.0	0.0	5.0	10.0	0.0	20
Foliage/fodder	0.0	73.3	6.7	20.0	0.0	0.0	0.0	0.0	15
food	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7
medicinal products	0.0	0.0	0.0	0.0	0.0	33.3	0.0	66.7	3
Honey	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	2
timber	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1
Fito	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	1
Charcoal	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1

3.2.10 Penalties

Fines and arrests were the main penalties imposed on users who broke access rules to public areas (Figure 26).
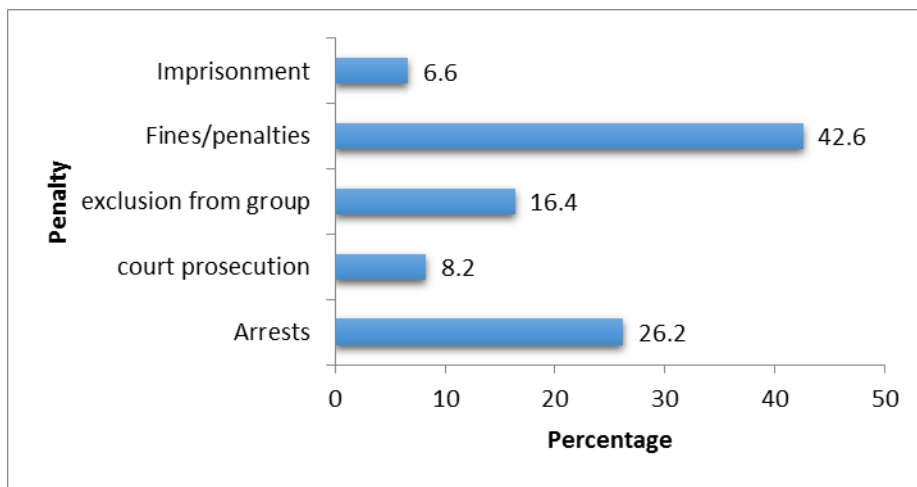
Figure 26 Penalties imposed on users who broke rules on access to public areas

3.2.11 Change in availability of tangible products

About 66.7% of the respondents indicated that tangible products had declined whereas 21.2% indicated that there was an increase, and 12.1% reported no change. The responses for changes in availability of products are captured in the (**Table 25**).

Table 25 Change in availability of tangible products

| Product | Type of change for products from gazetted forest, % frequency | | | |
	Increased	Declined	Remained the same	Frequency (n)
Firewood	15.4	84.6	0.0	26
Foliage/fodder	21.7	60.9	17.4	23
Medicinal products	5.0	70.0	25.0	20
Honey	25.0	75.0	0.0	8
Maize	80.0	20.0	0.0	5
Water	40.0	60.0	0.0	5
Posts	25.0	50.0	25.0	4
Timber	0.0	100.0	0.0	3
Potatoes	50.0	0.0	50.0	2
Beans	100.0	0.0	0.0	1
Fito	0.0	0.0	100.0	1
Charcoal	0.0	100.0	0.0	1

Reasons for Changes

The increase in beans and potatoes was attributed to more plot allocations (PELIS) and availability of piped water, modern technology also caused an increase in tangible products others included Cultivation near river rines and regeneration in the degraded areas. Increase in population lead to decline in firewood availability. Charcoal and timber declined as a result of increased harvesting of trees, while fodder declined due to overgrazing. Other reasons for decline in availability of products were: more planting of trees as opposed to food crops, increased population leading to less land, increased number of livestock and overgrazing and soil degradation.

3.3 Conclusion

The survey in Cherangany hills ecosystem looked at the overall socio-economic status of the households living adjacent to the ecosystem. The area is dominated by farmers who plant maize, beans and potatoes as the main crop for commercial and subsistence purposes. Results show that the households were mainly male headed, majority living in their own houses (mainly made of mud walls). Land ownership in the area was mainly private and majority owned 1.1 ha. However, due to land sub-division for agriculture, housing and grazing, most households perceived the land not to be sufficient for agricultural production, hence substituting agricultural income through monitored and unmonitored forest based income.

The education levels were characterized by low transition of male and female household heads attaining secondary and tertiary education from primary level. This is attributed to few education facilities and poverty.

Overall, the availability of important forest products have declined due to increased access. Although both customary and National forest laws (Forest Conservation and Management Act 2016) exist, the illegal forest activities still occur.

While participation in forest conservation through CFAs membership has been encouraged through PFM, membership is low. However, PELIS and grazing groups were the most preferred.

The sources of income are highly varied (formal and informal employment), the living standards were low, based on household savings, asset ownership, type of housing. Further to this, some households considered the village not to be a good place to live in due to lack of infrastructure such as access to all-weather roads, electricity, health center, piped water, financial institutions and markets.

The main public areas within the ecosystem were gazetted forests, communal land, markets and schools. These areas were either owned communally or by the state. The gazetted forests provided indirect benefits such as water catchment and soil fertility improvement. These forests need to be conserved because most of the livelihood of the communities is derived from there. In terms of the forest resource base, the most important products from the ecosystem were food, firewood and grazing as well as medicinal plants and withies. KFS, County government and communities need to work together towards the conservation of the ecosystem as it is a very important resource to the adjacent communities and the country as a whole.