# Influence of Forest Plantation Establishment Schemes on Community Livelihoods: A Case of Makutano Forest Kericho County, Kenya

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***Authors' contributions***

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## ABSTRACT

Exploitation of forest resources has been a thorny issue to many countries. In efforts to restore degraded forests, countries have resulted to establishing forest plantations. There is also need to sustain livelihoods of these populations living around forests. Kenya on its part, adopted Plantation Establishment and livelihoods Improvement scheme (PELIS) program as part of participatory Forest management (PFM). PELIS involves the planting of food crops together with tree seedlings. It is however not clear whether balance has been strike between attaining forest cover and improving community livelihoods as was the intent of the program. Consequently, this study sought to shed light on this issue by looking at the influence of forest plantation on community livelihoods.

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This study adopted the decentralized forest management theory. Cross-sectional research design was adopted. Quantitative and qualitative methods were employed in data collection and analysis. The target population was 1719 which included forest adjacent community (FAC) members, and community based organization (CBO) leaders. From this a sample of 212 was selected. Systematic sampling was used in selecting the households and snowball sampling in selecting the CBO leaders involved in two tire focused group discussion. Questionnaire schedules were prepared to be used among household members.

The findings indicated a significant influence of PELIS on community livelihood ($f = 221.642$, $P=0.000$). Those near the forest registered to have derived more economic benefits than those far away from the forest ($f= 3.127$, $P= 0.000$). A strong relationship between the frequency of attending CFA and CBO meetings, the level of involvement in decision making and planning of forest activities ($B = 3.479$, $P< 0.05$) was noted. The size of land available for cultivation was found to be statistically significant to food security among the community ($f= 221.642$, $P= 0.000$). The most important and most utilized forest products were firewood at 95%, fodder at 71% and droppers from tree pruning at 68%. Further research is needed on how more benefits from products like herbs, wild vegetables and honey cold be realized.

## 1. INTRODUCTION

Forests form part of the most important ecosystems to the human race. Many people depend either directly or indirectly on forest products and services. Agevi et al. (2016) notes that, the livelihoods of 1.6 billion people globally depend on healthy forests: of this, 1 billion are among the poorest populations. Deforestation and forest degradation has resulted to massive erosion of fertile agriculturally viable soils thereby threatening food security (Food and Agricultural Organization of United Nations, 2017). This in turn affects the lives of people living at forest peripherals and even those away from the forests. Agevi et al. (2016), identifies that, Forest Adjacent Communities (FAC), that is, people living at a 10 km radius from the forest edge highly rely on the forests for their livelihoods.

Deforestation and forest degradation has greatly reduced land under forest in the world. The exponential increase in world's population has resulted to overdependence on forest products and services hence the increase in deforestation and degradation of the forests. It was estimated that the total forest cover in Africa would drop by about 3.9 million hectares from the year 2010 to 2020, which would be the highest net loss rate in the world (Xiao et al. 2022). This has created the need for the establishment of forest plantations. About 4% (123.7 million ha.), of the world's 3.4 billion hectares under forests, is estimated to be under forest plantations (Musyimi et al. 2018). These forests are essential for the provision of different forest goods such as timber, fuel, medicine, honey, poles, paper and food; also,

these forests provide services such as recreational services, research, carbon sink/air purification, and climate modification, conservation of water catchment areas and biodiversity (Gichuru, 2015).

In establishing forest plantations and ensuring sustainability in forest management, resources are needed. It has been noted that there was a remarkable increase in forest cover in well of countries like North America, Europe and China while in the tropics, there was a decrease. The biggest drop was recorded in countries like the Democratic Republic of the Congo (DRC), Zambia, Nigeria, Tanzania and Botswana, Sudan, Namibia, Somalia, Angola, Ethiopia, Cameroon, Mozambique, Cote d'Ivoire, and Chad (FAO, 2020; Xiao et al. 2022). This shows that African countries have a lot to do in terms of increasing the continent's area of forest cover. Musyimi et al. (2018) notes that forests in Africa accounts for 21.4% of the total land surface which is about 674 million hectares.

If well managed, forest plantations can, to a great extent, serve the needs of the ever increasing population and at the same time prevent further destruction and degradation of the existing natural forest. In comparison to natural forests, plantation forests have been noted to produce better quality of wood and non-wood forest products (NWFP) not forgetting that they take relatively short period of time of 3-30 years to grow (Babak et al. 2011; Hashim et al. 2015). Further argues that, the forest plantations with short rotational time and that have high yielding species and varieties has enabled sustainable

supply of timber and non-timber products from smaller areas of land. Forest plantations therefore offers an opportunity in supplementing wood demands, thus reducing the resource exploitation of natural forests, and also help in recovering degraded lands and improve biodiversity conservation for the benefit of future generations (Hashim et al. 2015). Nevertheless, management of this forest plantation has been faced by various challenges in terms of maintaining the forest ecosystem, biodiversity, soils, and adaptation to the changing climate.

Here in Kenya, the Ministry of environment and Forestry in its report of (2018), notes that, of Kenya's total land area, 7.4 percent is estimated to be covered by forests. This is below the 10% forest cover as recommended globally. It further states that, of this 7.4 percent forest cover in Kenya, only about 2% is closed canopy forest and which is mainly montane. This is still below the average Africa's and world's continuous forest cover of 9.3% and 21.4% respectively. Logging and forest clearing in Kenya's natural forest has been in a very high rate. Numerically, the report notes that in Kenya, the rate of forest depletion is about 5,000 hectares per annum. This calls for concerted efforts to save the forests from further degradation and deforestation. Currently, it is noted in the same report that, gazetted forest reserves are the most hit and are in the process of being rehabilitated by starting up forest plantation with an estimated 135,567 hectares having been developed by 2018. Many of these tree plantations are found in the five major Kenya's Water Towers which includes, Mount Kenya forest, the Mau Complex, Aberdare forest, Cherangani Hills and Mount Elgon.

In Kericho County, there are eight forest stations. These forest stations includes: Londiani, Makutano, Kuresoi, Sorget, Malaget, Tendano, Masaita, and Kericho. The largest part of these forest stations is made up of forest plantations or are in the process of being reforested after the natural forest were cleared. 3561.84 ha of Makutano forest is occupied by exotic trees while 1343.01 ha is covered by natural indigenous trees. Of the eight forest stations, Makutano station is noted to have the second largest area of natural forest (KFS, 2018).

Plantation establishment and livelihood scheme (PELIS) was initiated in Kenya under participatory forest management (PFM) in order to increase forest cover while also improving the people's livelihoods. Consequently Makutano

community forest association (MACOFA) was formed in the year 2008.

In other forests where this program was started, many of the community members have benefited; for example, Tobias (2015) notes that 93.3% of the CFA members at Uasin Gishu County depend on forest farm cultivation for their livelihoods. Additionally, Nicodemus (2013) in his study at Gathiuru forest confirms that PELIS had contributed to food security in the area and improved household income. The PELIS program however, has been criticized of predisposing the forests to exploitation and allot of control by the government through the KFS. This control has denied the forest adjacent community the many diverse opportunities available under the program. The forest report, (2018) for example recommends the scraping off of the program due to the challenges that have been associated with it like illegal extension to the natural forest and river banks and interference of water infiltration. It also cites exploitation of some CFA members by the forest authorities and lack of a framework on benefit sharing. Kagombe & Gitonga, (2005) recommends that more research need be done on benefits of PELIS to FAC.

There are many studies done on the contribution of PELIS to forest cover change like studies carried out by Agevi et al., (2016) at Malava forest, Mutwiri et al., (2017) on Londiani forest tree height and biomass and a paper by Michael et al., (2015) on changes in planted forests and future global implications. Some of these studies like that by Agevi et al., (2016) touch on the livelihoods of forest adjacent communities (FAC). Makutano forest community is unique geographically, demographically, socially, politically and even economically as compared to other areas where influence of PELIS to community livelihoods has been carried out. Times have also changed with the government outlawing the growth of maize on forest land in the year 2019. There is no much data on opportunities still available for communities around Makutano forest, how the cut cost of forest plantation establishment translate to improved community livelihoods and the level of household participation in forest plantation establishment. This study was directed at bridging this gap of knowledge by investigating on the available opportunities under forest plantation establishment schemes for the forest adjacent communities, how they could exploit them in improving their livelihoods and how they

could increase their involvement in forest plantation establishment activities as envisioned by the forest act 2016.

## 2. LITERATURE REVIEW

This study relates to decentralized forest management theory. This theory is derived from the concept of decentralization. The concept is about transfer of powers from the central governments to institutions and lower levels of administrations (Ribot et al., 2006). Under right circumstances, the theory has been noted to work very well. This is mainly through improved efficiency, equity, democracy and proper resource management (Agrawal et al., 2005).

Land is a scarce resource especially among the poor populations and when made available could change lives. Decentralization of forest management, which led to the formation of CFAs, made it easier for the communities living adjacent to forest access arable land as forest plantations were being established. Besides PELIS achieving its main objective of promoting forest plantation development, it has brought with it other benefits such as availing land for agriculture to the landless and contributing to food production (Tobias, 2015). Further, Agevi (2016) notes that the program has bettered the peoples' livelihoods through increased and varied food supplies of beans, potatoes, maize, carrots and kales. This has in turn assured the community of enough food supply throughout the year as well as increasing their income made from sales of the surplus harvests. In the planted forest, clear cut tree harvesting method is used. After the land is left free of trees, every block demarcated using firebreaks is assigned to a particular user group who are members of a given CFA. The land is subdivided into half acre plots. Members of the user groups lease the half acre plots land at a small fee of Ksh. 850 per year paid to the Kenya forest service (KFS) through the leaders of the user groups.

Apart from land for cultivation, the community is involved in the pruning of the trees. The pruned branches are used as firewood or rafters for construction and fencing. According to a survey done by Elizabeth et al. (2018) at the Aberdare forest ecosystem, identifies water, firewood and grazing land as the most vital forest products derived from the forest ecosystem at 98%, 70% and 67% respectively. Many conservation managers today look forward to accelerating income flows for the poor communities living adjacent to the protected areas (Adams et al., 2004; Caroline et al., 2018). Tobias (2015) quotes Prince Osei et al., 2008 as having found out that, MTS was of great benefit to the whole community since the parents could now afford to take their children to senior high schools where enrolment had increase significantly.

Participatory forest management (PFM) program which started in Kenya back in 1997, as a way of increasing community involvement in forest conservation and management. Under this, the forest adjacent community would be involved in different forest activities in the plantation establishment schemes. Bremer et al. (2014), argues that the extent to which local communities participate and benefit from plantation establishment schemes had a big influence on the sustainability and success of the programs. Additionally, Josephine et al., (2016) delves in understanding the factors influencing level of participation of CFA members in PFM and identifies perceived benefits as the major factor. According to Mbuvi et al., (2022) in Kakamega and Loita forests, Community Based Organizations (CBOs) are involved in seedling production, ecotourism enterprises among others.

Many people derive their livelihood from exploiting the forest resource such as, firewood, timber, pulp, poles, medicinal herbs etc., and services derived from the forest such as recreational services and research. It is estimated that globally, forests support the livelihoods of 1.6 billion people. In Africa, 6% of the Gross Domestic Product (GDP) is credited to forest and forest resources. These statistics are the highest compared to other continents.

## 3. METHODOLOGY

### 3.1 Location of the Study Area

The study was carried out at Makutano forest which borders Masaita forest block to the south, Sorget forest to the north. The forest is part of the larger Mau conservancy to the west. The forest is about 2100m above sea level experiencing tropical type of climate with double maxima around May to July and September to November. The forest station office is situated in Kipkelion East sub-county, Kericho County, Kenya. The forest station office can be accessed from Makutano at Nakuru-Eldoret highway. The forest is approximately 9km from Londiani town which is along Nakuru-Muhoroni road. It lies at

latitude $0^05`59``$ South to $0^00`5``$South and longitudes $35^036`16``$ to $35^039`26``$East, (Fig. 1).

## 3.2 Research Design

The study adopted a cross-sectional research design. This design was preferred because the data collected aimed to represent a very large population. Hence helped gather data from a representative sample of the forest adjacent community. The target population was 1719. The population is stratified as shown in Table 1.

**Table 1. Target population**

| Strata | Total population |
|---|---|
| FAC household | 1649 |
| CBO leaders | 70 |
| **TOTAL** | **1719** |
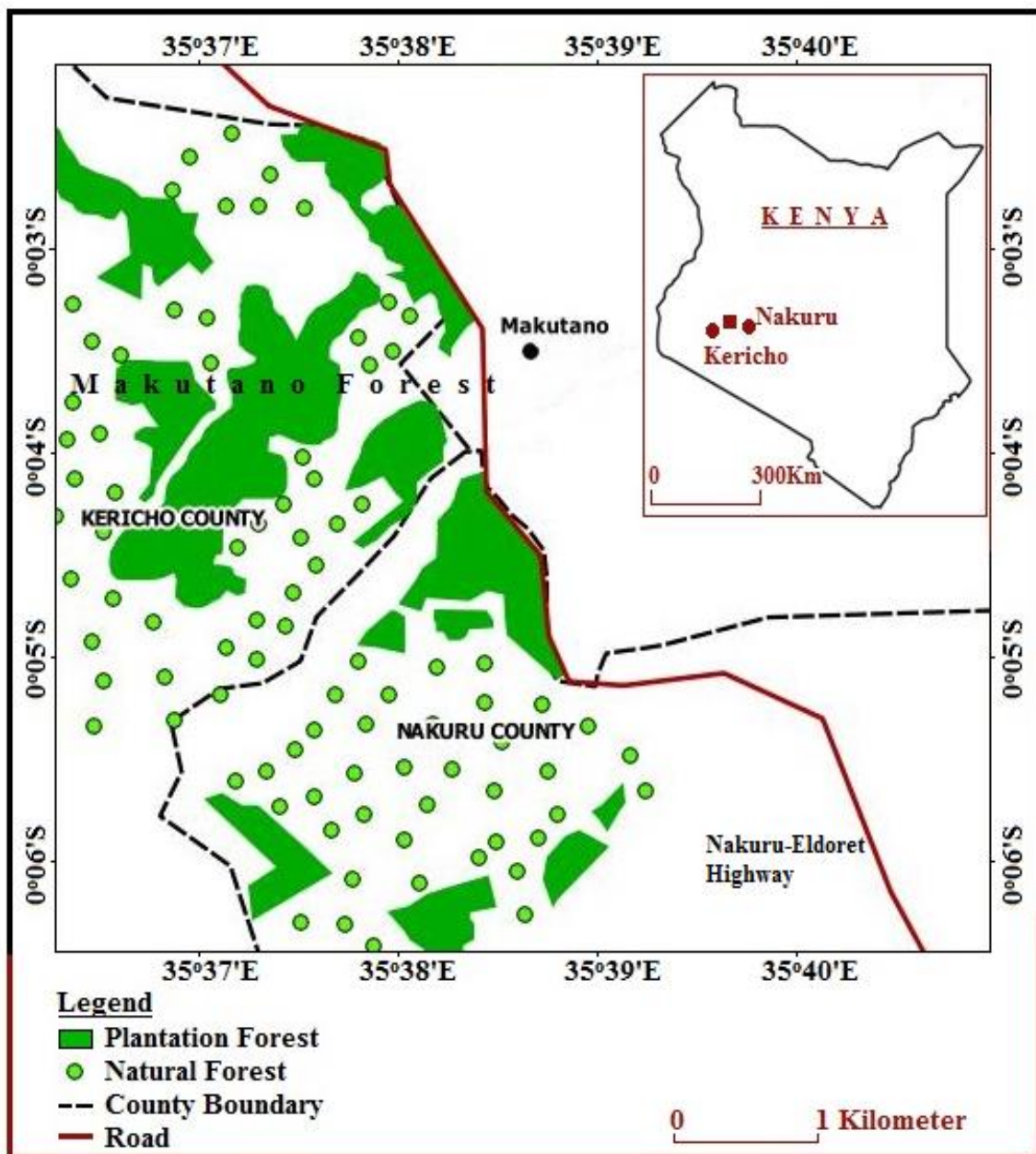


**Fig. 1. Map of Makutano forest**

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In coming up with sample population from the first strata, Nassiuma (2000), formula was used. Nassiuma (2000), gives the formula as follows; $n = Nc^2/c^2 + (N-1)\ e^2$.

Where; n= Sample size,
N= population,
c= covariance,
e= standard error.

Nassiuma observes that, most surveys adopts a variation coefficient of between 21% and 30% and a 2% to 5% standard error range which in most cases are acceptable. This study employed a 30% variation and a 2% standard error. The sample was hence calculated as shown below:

$$n = \frac{1649(0.3)^2}{0.3^2 + (1649 - 1)\ 0.02^2} = 198$$

Therefore, the sample size for FAC households was 198.

To help come up with the number of households in each CBO, to which household questionnaires were employed upon, the following formula of assigning proportions (Raghunath, 2017) was used;

(X/Y)*N where  X=the number of households in each CBO
Y=total number of FAC households, and
N=sample size.

Systematic sampling method was then used in selecting particular FAC members.

For the case of the second strata of the target population, there were 14 Community based organizations (CBOs) forming Makutano Community forest association (CFA). Each CBO had 5 leaders totaling to 70 leaders. Snowball sampling was employed in selecting one leader from each CBO. The 14 leaders were randomly placed into two groups for the focused group discussions.

The total sample population therefore was 212 which included, 198 households and 14 CBO leaders. The Table 2 illustrates a summary of the sample population.

**Table 2. Sample population**

| Strata | Target population | Sample population |
|---|---|---|
| CFA members | 1649 | 198 |
| CBO leaders | 70 | 14 |
| **Total** | **1719** | **212** |

The main source of data for this study were questionnaires administered to the CFA members and focused group discussions with the leaders of the respective CBOs. Research assistants with the guidance of the researcher administered the questionnaires. The questionnaires were reconciled each day as a way of taking stock of the day and to help avoid any compromise of the data collected. In collaboration with the participants and with the help of research assistants, the day for the focused group discussion was scheduled. Participants were informed on the date and venue.

The data collected was then analyzed using the statistical package for social sciences (SPSS) and excel packages. With the help of this packages, inferential statistic was used to test the relationships and association of the dependent and independent variables. Frequency tables were also used in analyzing some of the variables. In cases where categorical data was collected, logistic regression was employed in analyzing the data, while in case where numerical data was collected, ANOVA was used.

## 4. RESULTS

### 4.1 Households' Basic Information

#### 4.1.1 Gender

Data on the gender of the respondent was collected, recorded and analyzed as shown in Table 3.

**Table 3. Gender of the respondents**

| Gender | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| male | 96 | 48.5 | 48.5 | 48.5 |
| female | 102 | 51.5 | 51.5 | 100.0 |
| Total | 198 | 100.0 | 100.0 | |

From the Table 3, more women (51.5%) than men (48.5%) were involved in the study. This was a good representation in terms of gender balance in the study since the disparity was not a big margin.

### 4.1.2 Respondents' educational level

The researcher sought to know the educational level of the respondents. This was important so as to understand how well they could interpret the PFM policy and laws. Table 4 illustrates the educational levels attained by respondents.

The data showed that 177 (89.4%) of the respondents had at least acquired some form of basic education though out of those, majority (51.0%) had only been up to primary level. Those who had never attended school were 10.6%. This indicates that most of the respondent could at least read and employ proper farming methods and could easily take up education on forest conservation offered through their CFA and the Kenya forest service. The literacy levels could also help in communication and coordination of the forest programs with ease.

### 4.1.3 Age bracket of the respondents

The study also sought to understand the age of the respondents. Age is one of the parameters of how active and able the society is in terms of producing viable labour. This would in turn help in exploiting the available resources effectively and efficiently. The results were as recorded in Table 5.

The results shows that majority of the respondents (56.6%) were of the age bracket of 31-50 years. This was a good percentage of the productive age bracket, who still had their children in school. This vibrant age bracket was ideal for the program of forest plantation establishment for they could easily take up the education on sustainable use of the forest resource to improve their livelihoods, not forgetting those of their children. The young people were few at 7.6% of the respondents. Those who were of age over 60 years and could be considered as aged and less productive, were also very few at 7.1%.

### 4.1.4 Household heads' main source of income

The main source of income in the household usually contributes to the largest part of the households' budget and therefore may be the largest contributor to the social welfare of the people. The researcher therefore sought to know the main source of income of the household heads. The results were as indicated in Table 6.

Majority of the household heads (62.1%), derived their livelihoods from farming. This was a significant portion owing to the fact that the main activity they could be involved in, during the process of forest plantation establishment was farming. This group of people would help in planting tethering and taking good care of the trees as they cultivate the forest land. Those whose main of source income was business came second with 13.6%, while from informal and formal employment trailed with 12.6% and 11.6% respectively.

**Table 4. Educational level of the respondents**

| Level of Education | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| Never been to school | 21 | 10.6 | 10.6 | 10.6 |
| primary level | 101 | 51.0 | 51.0 | 61.6 |
| Secondary | 59 | 29.8 | 29.8 | 91.4 |
| Tertiary | 17 | 8.6 | 8.6 | 100.0 |
| Total | 198 | 100.0 | 100.0 | |

**Table 5. Age bracket of the respondents**

| Age bracket | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| 21-30 | 15 | 7.6 | 7.6 | 7.6 |
| 31-40 | 37 | 18.7 | 18.7 | 26.3 |
| 41-50 | 75 | 37.9 | 37.9 | 64.1 |
| 51-60 | 57 | 28.8 | 28.8 | 92.9 |
| over 60 | 14 | 7.1 | 7.1 | 100.0 |
| Total | 198 | 100.0 | 100.0 | |

**Table 6. Main source of income of the household head**

| Main source of income | Frequency | Percent | Cumulative Percent |
|---|---|---|---|
| formal employment | 23 | 11.6 | 11.6 |
| business | 27 | 13.6 | 25.3 |
| Farmer | 123 | 62.1 | 87.4 |
| informal employment | 25 | 12.6 | 100.0 |
| Total | 198 | 100.0 | |

*Source: Researcher (2023)*

**Table 7. Size of the forest land available for utilization by the forest adjacent community**

| ANOVA[a] | | | | | | |
|---|---|---|---|---|---|---|
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 20.883 | 1 | 20.883 | 221.642 | .000[b] |
| | Residual | 21.482 | 197 | .094 | | |
| | Total | 42.365 | 198 | | | |

*Source: Generated from SPSS, Researcher (2023)*

## 4.2 Influence of Forest Land Cultivation under Forest Plantation Establishment on Community Livelihoods

### 4.2.1 Size of forest land available

The size of land available to the household for cultivation was one of the independent variables used. The researcher sought to find out whether there was any significance influence of the size of forest land available for cultivation on the food security of the forest adjacent community. The average size of land that the households cultivated in the forest was found to be 1.9 acres. The household with the largest parcel having 4 parcels and the minimum being 1 parcel, each of half an acre.

The size of land available for cultivation was found to be statistically significant to food security among the community *(f= 221.642, P= 0.000).* From the coefficients' table, the chances of a household being food secure or able to get harvests enough for the whole year would increase by 70.2% if the land available for food crop production was increased by 1 acre. It was therefore noted a need to clear the already mature trees in order to increase land for cultivation and establish the plantation afresh.

From the focused group discussions, the average size of forest land allocation for each household is two parcels, equivalent to one acre. The maximum amount of land that could be allocated to each farmer was not set but was dependent on the amount of forest land available

in relation to the number of farmers. As of the time of this study the amount of forest land available for cultivation at Makutano forest station stood at 1200 acres. Of these, almost half of it had young trees which could not allow cultivation in the next two years.

### 4.2.2 Amount of harvests

The amount of harvest realized from the forest land was another indicator of a cushioned community livelihood. The harvests could be used to feed the people or sold to generate income and help in educating their children or in diversifying the community livelihoods. First, the researcher sought to know the crops grown, mainly in the forest land, and whether the harvests realized were enough to feed their families throughout the year. From the 198 respondents, 100% admitted to grow maize, 55% grew potatoes, 48% grow beans, 30% grow peas and 13% grow pumpkins. Most of these crops were grown together in the same parcel of land. The results on whether the harvests were enough to feed their households were as shown in the Table 8.

Majority of the respondents (75.8%) admitted that the harvests were enough to feed their families throughout the year. Only 24.2% were unable to get enough harvests to take them through the year. This shows how important the harvests realized from forest land cultivation were to the forest adjacent community. The 75.8 percent was a good indicator of food security among the forest adjacent community which largely attributed to forest land cultivation.

**Table 8. Produce harvest to feed family throughout the year**

|  |  | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | no | 48 | 24.2 | 24.2 | 24.2 |
|  | yes | 150 | 75.8 | 75.8 | 100.0 |
|  | Total | 198 | 100.0 | 100.0 |  |

*Source: Generated from SPSS, Researcher (2023)*

**Table 9. Source of food for those who do not get enough harvest from the forest land**

|  | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| Harvest from my own farm | 13 | 27.1 | 27.1 | 27.1 |
| Donations | 14 | 29.2 | 29.2 | 56.3 |
| Buying | 20 | 41.7 | 41.7 | 98.0 |
| Other sources | 1 | 2 | 2 | 100.0 |
| Total | 48 | 100.0 | 100.0 |  |

*Source: Generated from SPSS, Researcher (2023)*

**Table 10. Economic significance of the total harvest in relation to; household size, level of education, land size, and distance of the household from the forest**

| ANOVA |  |  |  |  |  |  |
|---|---|---|---|---|---|---|
|  |  | Sum of Squares | df | Mean Square | F | Sig. |
| total membership of household | Between Groups | 127.314 | 44 | 2.894 | 1.264 | .145 |
|  | Within Groups | 423.473 | 185 | 2.289 |  |  |
|  | Total | 550.787 | 229 |  |  |  |
| level of education of the respondent | Between Groups | 24.574 | 44 | .559 | .881 | .683 |
|  | Within Groups | 117.269 | 185 | .634 |  |  |
|  | Total | 141.843 | 229 |  |  |  |
| How many plots do you own? | Between Groups | 94.685 | 44 | 2.152 | 99.152 | .000 |
|  | Within Groups | 4.015 | 185 | .022 |  |  |
|  | Total | 98.700 | 229 |  |  |  |
| How far is the homestead from the forest | Between Groups | 62.767 | 44 | 1.427 | 3.127 | .000 |
|  | Within Groups | 84.390 | 185 | .456 |  |  |
|  | Total | 147.158 | 229 |  |  |  |

*Source: Generated from SPSS, researcher (2023)*

It was also important to understand source of additional food for those households who did not get enough harvests from the forest land to help feed their people for the rest of the year. Table 9 shows this.

Most of these households were well cushioned from extreme lack of food since they admitted to afford buying food from other sources of income (41.7%). 27.1% could get other harvests from their own farms to supplement the harvests from the forest. Only 31.2% of the 48 households were venerable; that is, those who relied on donations at 29.2% and those who relied on other unspecified sources at only 2%.

**4.2.3 Economic value of harvested products from forest land cultivation**

The research sought to understand the economic value of harvests realized per year by farmers.

This would help to measure and tell how much the household head accrued from forest harvest, distance of the household from the forest, and the size of the land allocated per household. The economic value of the harvests was measured against household size, education level of the. The results were as illustrated in Table 10.

The results indicates that the income realized from the sales of the produced was highly dependent on the number of plots/size of the land allocated per household *(f=99.152, P=0.000)*, and the distance from the forest *(f=3.127, P=0.000)*. This indicates that the chances that the household would gain more economically from the forest harvest would increase by 99.152 percent if land allocation was increased by one acre, and by 3.127 percent if the distance from the forest land was reduced by one kilometer. Those with bigger parcels were

noted to benefit more as compared to those with smaller parcels. Also, those at the radius of about 2-3 kilometers from, the forests realized higher economic benefits from the sale of the harvests as compared to those at a radius of one and four to five kilometers from the forest. However, the total household membership and the educational level of the household head did not have any significance to the much realized from the sales with *(f=1.264, P>0.05)* and *(f=0.881, P=0.683)* respectively.

## 4.3 Influence of Forest Products Available under Forest Plantation Establishment Schemes on Community Livelihoods

### 4.3.1 The number of forest products available to the community and the number of people benefiting from the scheme

The respondents were requested to state the products that they were able to access from the forest as a result of forest plantation establishment schemes initiated at Makutano forest. These products were from the predetermined list and they had the liberty to add to the list any other products that was from the list and they could access from the forest. The summary of the responses given is as shown in Table 11.

The results indicates that 95% of the respondents were able to access firewood from the forest. From the focused group discussion, the community was allowed to collect firewood from the forest provided they had a permit from the forest office. They were also able to get firewood from pruning of the trees tantamount to the same condition of having a permit and a pruning saw from the forest office. This statistics shows a high reliance on firewood as a source of energy among the adjacent forest community. Falling at number two, in terms of accessibility was fodder at 71%. Many of the people around the forest fetch fodder for their animals from the forest or graze them there. This is an indication

that the community highly depend on the forest for the feeding of their animals'. Droppers were at 68%, wild vegetables at 17%, herbs at 6%, honey at 1% and other products at 0% accessibility. The 0% accessibility of other products indicates that only the six predetermined products were accessible to the community. Very few community members were involved in bee keeping for honey production at only 1%. This was one product that had the potential of improving the community livelihoods but was not yet well utilized.

### 4.3.2 Influence of the available forest products on the community livelihoods

The products identified as having been made available under the forest plantation schemes, could be sold to generate income, and help the community in their day today expenses like educating their children, feeding their families or even used in starting of other income generating activities. The researcher sought to find out whether the access to these products significantly influenced the peoples' livelihoods. Table 12 is a summary of the products available and their benefits that the community accrued from them.

From the statistics above, firewood stood out as the product that the community mostly exploited at 90.9% for subsistence use, 1.7%, for cash income and 4.8% for both subsistence and cash income. The community heavily relied on firewood as a source of heat. At second, and third places were droppers (76.5%) and fodder (65.7%) respectively, both at subsistence level. Very few of the community member exploited these products for commercial purposes. Honey was the least exploited product at all levels.

Additionally the research sought to understand whether there was any correlation between the benefits accrued from the products and the contribution of the products to the household welfare. This is illustrated by Table 13.

**Table 11. Access from the forest plantation**

|   |         | Fodder | droppers | firewood | wild vegetables | herbs | Honey | other products |
|---|---------|--------|----------|----------|-----------------|-------|-------|----------------|
| N | Valid   | 198    | 198      | 198      | 198             | 198   | 198   | 198            |
|   | Missing | 0      | 0        | 0        | 0               | 0     | 0     | 0              |
| Mean |      | .71    | .68      | .95      | .17             | .06   | .01   | .00            |

*Source: Generated from SPSS, Researcher (2023)*

**Table 12. Benefits accrued from product derived from the forest plantation scheme**

| Benefits | fodder | Droppers | Firewood | Wild vegetables | Herbs | Honey | Others |
|---|---|---|---|---|---|---|---|
| Subsistence | 65.7 | 76.5 | 90.9 | 20.9 | 5.2 | 0.4 | 0 |
| Cash income | 0.4 | 7 | 1.7 | 0 | 0 | 0.1 | 0 |
| Both | 0.9 | 6.1 | 4.8 | 0 | 0 | 0.9 | 0 |
| Not applicable | 33 | 10.4 | 2.6 | 20.9 | 94.8 | 98.6 | 0 |

*Source: Researcher generation from SPSS (2023)*

**Table 13. Correlation between products' benefits and their contribution to the household welfare**

| Correlations | | Pbenefit | Pwelfare |
|---|---|---|---|
| Pbenefit | Pearson Correlation | 1 | .033[**] |
| | Sig. (2-tailed) | | .000 |
| | N | 198 | 198 |
| Pwelfare | Pearson Correlation | .033[**] | 1 |
| | Sig. (2-tailed) | .000 | |
| | N | 198 | 198 |

*[**]. Correlation is significant at the 0.01 level (2-tailed).*
*Source: Researcher generation from SPSS(2023)*

The Table 13 shows a strong relationship between the benefits accrued from the products and the contribution of the products to the household welfare with a correlation coefficient of r=*0.033* and *P =0.000.* There was immense contribution of the forest products available under the forest plantation establishment schemes to the community livelihoods. The households were able to meet their needs like food and educating their children from the benefits accrued from the collection, use and sale of the products.

### 4.4 Influence of Community Involvement in Forest Plantation Establishment Activities on Community Livelihoods

#### 4.4.1 Influence of the frequency of attending meetings on the level of involvement in decision making and planning

A binary logistic regression test was conducted and the results analyzed as illustrated in the Table 14.

The results indicated a strong relationship between the frequency of attending CFA and CBO meetings, the level of involvement in decision making and planning of forest activities *(B = 3.479, P< 0.05).* The people who frequently attended meetings felt that they were more involved in the decision making and planning than those who rarely attended the meetings.

These people could also be in a better position in making more informed decisions on forest activities than those who never or rarely attended the meetings.

The variable 'gender' was not found to significantly influence the involvement of the community in forest plantation establishment activities *(B = -0.011, P = 0.976).* This indicates that both gender were involved in the forest activities equally. This was a positive indicator of non-segregation among people on the basses of gender when it came to forest activities involvement.

#### 4.4.2 Influence of community involvement in tree planting, pruning and thinning activities to community livelihood

The forest adjacent community is involved in activities like tree planting, pruning and thinning, among others. The pruning and thinning is done after approval from the forest station office and a permit issued by the forester. Out of the sampled respondents, 100 percent were involved in one or more activities. These web of activities form the bases of the community livelihoods.

The study sought to understand how community involvement in these activities influenced their livelihoods in terms of the income generation, their general well-being, and improvement of

their living standards. The respondents were asked to rate the involvement in forest plantation activities according to how they felt the activities influenced their livelihoods. From the focused group discussions, the CBO leaders reported a low turnout of the members when called for seminars and workshops (45% to 50%), contrary to when they were called for plot allocation and payment (80% - 90%). Use of posters and announcements in the surrounding learning institutions and religious gatherings was identified as the most frequently used mode of communication from forest KFS office to the CFA, CBO leaders and finally to the forest user group members.

The respondents were also asked to rate to a scale of 1-5, their involvement in forest activities against their importance to their livelihoods. The data collected was analyzed as shown in the Table 15.

The Table 15 indicates that the respondents were not involved in any other activities apart from the ones predetermined in the questionnaires. Those rated as the most important to the community livelihoods were tree pruning and tree planting at 77.4 percent and 14.8 percent respectively. There were very few people involved and who attached benefits to bee-keeping (0.9%), thinning (3.2%), and tree nursery (3.9%). On involvement in any paid labour, only 3 percent of the respondents or a member of their household admitted to have been involved. Bee-keeping could be a viable venture for FAC in helping improve their livelihoods while they take care of the already established forests. The KFS office should also endeavor to involve the community more in the thinning and tree nursery establishment. This could go a long way in helping the community own up the process of forest plantation establishment and at the same time add into their income generation.

# 5. DISCUSSION

The demographics of the study indicated that both male and female were equally involved in the study. The families in most cases, were stable. This is because many of the households involved in the study were headed by parents, either the mother or the father with very few being headed by children or grandparents. Many of the respondents were Christians, though other religions like the Muslims and the traditionalists were recorded. The 81.3 percent of the Christians indicates that most of the respondents had something in common and could meet regularly during worship and therefore could be easier when it came to communication on matters forestry. Majority of the respondents were also noted to belong to the same ethnicity. Concerning the main source of income of the respondents, 62.1 percent of them were famers. This presented a good opportunity for the KFS to be able to bring them on board in establishing the forest plantation. Majority of them needed not much orientation in planting and taking care of the trees as they carried out farming in the forest land before the trees attained three years.

Findings indicated that forest land cultivation under the forest plantation establishment scheme greatly influenced the community livelihoods. This was manifested from the variables tested on the forest land available under the scheme, the amounts of harvests realized from the land and the economic value of the produce. The three indicated a positive correlation to an improved livelihood. For example, the size of land available for cultivation was found to be statistically significant to food security among the community *(f= 221.642, P= 0.000)*. This was in agreement with the research done at Gathiuru forest Nyeri County by Nicodemus (2013), where he noted that cultivation work in the forest was the most undertaken activity in the area at a rating of 92.8 percent and that it had improved the food security of forest adjacent communities at a mean score of 4.32.

**Table 14. Influence of the frequency of attending meetings on the level of involvement in decision making and planning of forest activities**

|  |  | B | S.E. | Wald | df | Sig. | Exp(B) |
|---|---|---|---|---|---|---|---|
| Step 1ª | Howfreq | 3.479 | .442 | 61.881 | 1 | .000 | 32.411 |
|  | Gender | -.011 | .372 | .001 | 1 | .976 | .989 |
|  | Constant | -6.336 | .968 | 42.855 | 1 | .000 | .002 |

*Source: Researcher generation from SPSS(2023)*

**Table 15. Descriptive analysis (percentages) on how the respondents rated the involvement in forest activities according to importance to their livelihoods**

| Activities | Rating | | | | | |
|---|---|---|---|---|---|---|
| | **0** | **1** | **2** | **3** | **4** | **5** |
| Others | 100 | 0 | 0 | 0 | 0 | 0 |
| Tree pruning | 0 | .9 | 1.7 | 20.0 | 46.1 | 31.3 |
| Tree planting | 0 | 24.8 | 40.9 | 19.6 | 11.3 | 3.5 |
| Bee keeping | 99.1 | 0 | 0 | 0 | .9 | 0 |
| Thinning | 97.8 | .9 | .9 | .9 | .4 | 0 |
| Tree nursery | 96.1 | .9 | .9 | .9 | 1.3 | 0 |

*Source: Researcher generation from SPSS (2023)*

Secondly, the researcher found that there was a positive influence of the forest products available under the forests plantation establishment schemes to the livelihoods of the forest adjacent community. The variables tested here were forest products available for exploitation by the FAC and the number of people who exploited them, and how these products influenced their general welfare. Statistics showed that firewood as one the available products was the most exploited product at 90.9% for subsistence use, 1.7%, for cash income and 4.8% for both subsistence and cash income. The community heavily relied on firewood as a source of heat. At second, and third places were droppers (76.5%) and fodder (65.7%) respectively, both at subsistence level. Further, the data indicated a strong relationship between the benefits accrued from the products and the contribution of the products to the household welfare with a correlation coefficient of r=*0.033* and *P =0.000*. This was attributed to the income generated from the sales of these products. This findings concurred with those by Rahman et al. (2021), who observed that income from non-timber forest products (NTFPs), had a great positive significance to family income. There were also payments in kind from this products; like poles and droppers were used in constructing their own houses and fencing of compounds, the collected wild herbs in curing some mild illnesses, and wild vegetables for their own consumption. It was also in agreement with a survey done by Elizabeth et al. (2018) at the Aberdare forest ecosystem, which identifies firewood and grazing land as the most vital forest products derived from the forest ecosystem at 70% and 67% respectively.

Lastly a link was noted to exist between community involvements in forest establishment activities, on community livelihoods. The variables here included the number of people who attended meetings against the registered members of the CFA, frequency of attending meetings, the number of activities that the respondents involved themselves in and the benefits accrued from those activities. The results indicated a strong relationship between the frequency of attending CFA and CBO meetings, the level of involvement in decision making and planning of forest activities *(B = 3.479, P< 0.05)*. Access to information through meetings attendance also contributed to the community involvement in forest activities and therefore could be able to reap maximum benefits from the program. Kwayu et al. (2014), notes that access to information significantly influenced participation in decision making and hence would help the community to gain more. According to the ratings done by the respondents on benefits attached to involvement in forest activities more benefits were attached to pruning and planting of tree seedlings at 77.4 percent and 14.8 percent respectively. The benefits were either in kind like fencing and building materials or cash from the sales realized. There were very few people involved and who attached benefits to bee-keeping (0.9%), thinning (3.2%), and tree nursery establishment (3.9%). This was a strong indication that involvement in these activities greatly influenced the community livelihoods. However, the involvement in activities that did not attract many in the community like bee-keeping, and that had the potential of improving peoples' livelihoods needed to be emphasized and the community educated more on their benefits.

In the course of the study however there were some limitations. There was a problem of language barrier. Many of the CFA members come from different ethnic groups. This was overcame through hiring of an interpreter.

Other limitations were poor terrain, water logged soils and harsh weather conditions. These limitations presented a challenge during data collection since the study was done during the rainy season.

## 6. CONCLUSIONS

This study examined the influence of forest plantation establishment schemes on community livelihoods at Makutano forest, Kericho County. From the findings, it is evident that community livelihoods are highly influenced by the forest plantation establishment scheme. The community has been involved in various activities like food crop cultivation in the forest land before tree canopy, tree planting, grazing and fodder collection from the forest, tree pruning, and tree nursery establishment. This participation in forest activities helped the community in improving their livelihoods. Some of these activities like tree nursery establishment and tree planting offered paid labor for them. Many of the households were noted to be food secure courtesy forest land cultivation. They are also able to extract forest products like firewood, which was the main source of energy for majority of the households. Other products extracted were wild vegetables, herbs and honey. The sale of the farm produce and the other forest products have helped them diversify their income sources. It was also noted that the community involvement in different forest activities across both gender and age groups was fare. In terms of gender there was a 51.5% representation of women and 48.5% men. The study recommends that Kenya forest service hold meeting and seminars more frequently to sensitize the community on forest conservation and benefits of forest plantations save cultivation. Further research ought to be carried out on sustaining community livelihoods after 100 percent tree canopy has been achieved.

## DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

Adams, W. M., Aveling, R., Brockington, D., Dickson, B., Elliott, J., Hutton, J., Roe, D., Vira, B., Wolmer, W. (2004). Biodiversity Conservation and the Eradication of poverty. DOI:1126/science.1097920.Source:Pub Med

Agevi, H., Mwendwa, K., Koros, H., Mulinya, C., Kawawa, R., Calvince, K., Kipkorir, D., Wabusya, M., Khanyufu, M., & Jawuoro, S. (2016*). PELIS Forestry Programme as a Strategy for Increasing Forest Cover and Improving Community Livelihoods: Case of Malava Forest, Western Kenya. *American Journal of Agriculture and Forestry. Vol. 4, No. 5, 2016, pp. 128-135*. Doi:10.11648/j.ajaf.20160405.13

Agrawal, A., & Gupta, K. (2005). Decentralization and participation: the Governance of common pool resources in Nepal Terai. *World development*, 33(7):1101-1111
https://doi.org/10.1016/j.worlddev.2005.04.009

Babak, K., Hashim, R. (2011). Mangrove restoration without planting. Ecological Engineering.
https://doi.org/10.1016/j.ecoleng.2010.11.025

Bremer, L.L., Farley, K.A., Lopez-Carr, D. (2014). What factors influence participation in payment for ecosystem services programs? *An evaluation of Ecuador's SocioParamo program.*

Caroline, H., Esteve, C., Bhaskar, V., Daniel, B., & William, M. A. (2018). Distinct positions

underpin ecosystem services for poverty alleviation. Doi: 10.1017/soo30605318ooo261

Elizabeth, W.W., Gilbert, O. O., & Bernard, K. K. (2018). Effects of forest management approach on household economy and community participation in conservation: A case of Aberdare forest ecosystem, Kenya. *International journal of biodiversity and conservation.* Retrieved from https://doi.org/10.5897/1JBC2017.1161

FAO, (2020). Global Forest Resources Assessment 2020: Main report. Rome. https://doi.org/10.4060/ca9825en

Food and Agricultural Organization of United Nations, (2017). Forests and trees supporting rural livelihoods; Case studies from Myanmar and Viet Nam. *Planted forests and trees working paper series No. 50*

Gichuru, I. I. (2015). Factors contributing to the success of Pelis strategy in forest plantation establishment: Case study of Mucheene forest. *International Academic Journal of Social Sciences and Education, 1 (4), 15-45*

Hashim, M. N., Mohd, H. M.A., Syafinie, A. M. (2015). Strategies forest plantation establishment in Malaysia for future product development and utilization. Retrieved from https://www.researchgate.net/publication/289055887

Josephine, K.M., Jayne, M., Kennedy, M., & Mbae, M. (2016). Factors influencing level of participation of community forest associations in management of forests in Kenya. *Journal of sustainable forestry, 353,205-216,* DOI:10.1080/10549811.2016.1142454

Kagombe, J. K., and Gitonga J. M. (2005). Plantation Establishment in Kenya: The *shambaSystem* Case Study.

KFS, (2018). Londiani participatory forest management plan 2018-2022. Bogor, Indonesia: CIFOR.

Kwayu E.J., Sallu, S.M., & Paavola, J. (2014). Farmer participation in the equitable payments for watershed services in Morogoro, Tanzania. *Ecosystem Services 7: 1-9*

Mbuvi, M. T. E., Kungu, J. B., & Eshitera, A. (2022). The Impact of Governance Regime on Land Cover and Use Change and Forest Structure: Insights from Kakamega and Loita Forests, Kenya. Open Journal of Forestry, 12, 185-215. https://doi.org/10.4236/ojf.2022.122011

Michael, J. W., Tim, P., Jean, M. C., Peter, F. S., Mark, K., Walter, K., Shirong, L., Christophe, O., Luiz, R., Luis, N. S. (2015). Changes in planted forests and future global implications. https://doi.org/10.1016/j.foreco.2015.06.021

Ministry of Environment and Forestry, (2018). Task force report on forest resources management and logging activities in Kenya. Government printers. Nairobi Kenya

Musyimi, F. K., Koech, E., & Sirmach, P. (2018). Tree survival in forest plantation establishment and livelihood improvement scheme (PELIS) in Kericho County, Kenya. *Research Journal of Agriculture and forestry sciences Vol. 6(1)*

Mutwiri, F. K., Odera, P.A., & Kinyanjui, M. J. (2017). Estimation of tree height and forest Biomass using Airborne LiDAR Data: A case study of Londiani forest Block in the Mau Complex. *Kenya Open Journal of forestry 7, 255-269.* Retrieved from https://doi.org/10.4236/ojf.2017.7206

Nassiuma, D. K. (2000). Survey Sampling Theory and methods. University Press, Nairobi.

Nicodemus, M.M. (2013). Influence of plantation establishment livelihood improvement scheme on livelihood of forest adjacent communities: A case of Gathiuru forest Nyeri County.

Rahman, H., Roy, B., Islam, S. (2021).Contribution of non-timber forest products to the forest-dependent communities around the Khadimnagar National Park in northeastern Bangladesh. *Regional Sustainability, volume 2, pgs 280-295.* Retrieved from https://doi.org/10.1016/j.regsus.2021.11.01

Raghunath, A. (2017). Survey Sampling Theory and applications.

Ribot, C. J., Agrawal, A., Larson, A. M. (2006). Recentralizing while Decentralizing: How Natural Governments Reappropriate Forest Resources. World development. Doi:101016/j.worlddev.2005.11.020

Tobias, O. A. (2015). Influence of plantation establishment and livelihood improvement scheme on forest cover: A case of Uasin Gishu County, Kenya.

Xiao, H., Liu, J., He, G., Zhang, X., Wang, H., Long, T., Zhang, Z., Wang, W., Yin, R., Guo, Y., Cheng. B., & Cao, Q. (2022). Data-Driven Forest Cover Change and its Driving Factors analysis in Africa. *Front. Environ.*Sci.9: 780069. DOI:10.3389/fenvs.2021.780069

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