Community Use and Product Valuation of Forest Resources in Maasai Mau, Kenya

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ABSTRACT
Forests play an important role in the livelihoods of local people in most developing countries. Local communities depend on forest resources for various products such as fuel wood, construction materials, medicine, and food. The Maasai Mau forest plays an important role in supporting the livelihood of people living around the forest. The forest has been degraded by habitation and uncontrolled exploitation of forest resources and services. Honey (36.9%), Medicine (35%) and firewood (26%) and water (30.9%) were all mainly sourced from the public forest. Exploitation of forest resources should be undertaken in a sustainable manner to ensure posterity. To reduce dependency on the forest, alternative means of livelihood should be provided to reduce dependency on the forest. Rehabilitation efforts have been supported by local communities and other government agencies. Aerial seeding and tree planting are two methods that have been adopted to aid in Maasai Mau rehabilitation and restoration.

Keywords: Community use and product valuation of forest resources
INTRODUCTION

Many people of a great variety of cultures and land-use practices live in or around tropical forests. Although these people are all in some way dependent on forests, they have little else in common. In recent years, however, it has become much harder for forest-dependent people to use local forests and their products, owing to deforestation, logging, population pressure or legal initiatives such as the declaration of state forests, national parks or wildlife reserves. In many countries, plans to protect forest ecosystems have failed to address the needs and knowledge of local forest-dependent communities (Kumar, Singh & Kerr, 2015). According to Isager, Theilade & Thomsen (2001) participation by local people is essential to any conservation effort. In forest conservation, participation is often associated with community forestry, which refers to forest management or management by people living close to the forest. Legal, political and cultural settings for community forestry vary widely, and the term covers a wide range of experiences and practices. Community forestry is often associated with South and Southeast Asia, but it is also common in other regions.

Forests play an important role in the livelihoods of local people in most developing countries. Local communities depend on forest resources for various products such as fuel wood, construction materials, medicine, and food. An estimated 1.6 billion people depend to varying degrees on forests for their livelihoods and about 60 million forest dwellers are almost fully dependent on forests. Furthermore, 350 million people who live adjacent to dense forests depend on them for subsistence and income (World, 2004). It is estimated that 20-25% of rural peoples’ income is obtained from environmental resources in developing countries (Vedeld et al., 2007) and provide food reserve for use in periods of crisis or during seasonal food shortages (Langat, Maranga, Cheboiwo & Aboud, 2015). The ecological and economic significance of forest ecosystems in Kenya is widely acknowledged.

Statement of the Problem

In the last three decades, the East Mau forest area in Kenya has declined primarily due to anthropogenic activities. Central to the anthropogenic activities is the dependence of the people on forest products and services for livelihoods. These human perturbations threaten biodiversity and future ecosystems functions of this forest and thus livelihoods. The full values of the ecosystem benefits have not been adequately quantified, and their role in socioeconomic development has not been examined.

Most natural ecosystems services are not traded in the market and therefore often true values of forest ecosystems are obscured. Consequently, the total economic values of forest ecosystems are incomplete and undervalued (Langat, 2016). Such undervaluation has resulted in marginalization of forest ecosystems in budget allocations, land-use change decisions, leading to excisions and degradation.

Despite its importance as a resource for local livelihoods, there is hardly quantitative information on direct use values and the role of the forest to the household and the wider economy. Studies have found that the relationship between socio-economic and external factors on forest resource dependence are contestable and can vary between locations, product types, or specific forest (Langat, 2016). However, there are few studies in Kenya which have analyzed the role of socioeconomic and external factors on household dependence on forest

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resources. To address the information gaps articulated above economic, Economic valuation of forest ecosystems services was undertaken in East Mau forest.

The main objectives of the study are:

1. Determine the level of community dependence on Maasai Mau forest
2. Determine socio economic factors influencing community dependence on Maasai Mau forest
3. Assess the perception of the community on the restoration of Maasai Mau forest
4. Determine the total Economic contribution of Maasai Mau forest to the community and other stakeholders.

Valuation of forest resources
Forest ecosystem goods and services, and the natural capital stocks that produce them, make significant direct and indirect contributions to national economies and human welfare. There have been many attempts to value these contributions. In the past two decades a good deal of progress has been achieved in developing valuation methods for forest ecosystem services and promoting their inclusion in national economic accounts.

The valuation of a natural resource or environmental service is usually based on the monetary value individuals place on it. The maximum amount of money an individual is willing to pay for obtaining a benefit or avoiding a loss in most situations reflects the preferences for such a benefit or loss. Preferences are based on the values he or she attaches to the goods or services in question. The maximum willingness to pay (WTP) can be considered therefore an expression of the individual’s values. Analogously, the minimum Willingness to Accept (WTA) an amount of money as compensation for giving up a benefit or for receiving a loss reflects the value of such a benefit or loss. As an example, it might be of interest in estimating the aggregate WTP of people to maintain the environmental quality and amenity benefits of Mau Forest Complex. Alternatively we could estimate the WTA compensation where a development project might compromise these values, by changing the water flow upstream or damaging the forest.

MATERIALS AND METHODS

Study Site
This study was carried out among communities adjacent to the Maasai Mau Forest, Narok County. The Maasai Mau forest ecosystem forms the southern part of the Mau Forest Complex; Kenya’s largest closed-canopy forest area which lies at approximately 0.0° to 0.91° South and 35.30° to 36.10° East in the South Rift region of the Rift Valley, Kenya at an altitude of 1,800 - 3,000m above sea level. The Maasai Mau forest is a Trust Land, managed by the Narok County. It covers 46,278 hectares; comprised exclusively of indigenous forest and is located in West Kenya, 17 kilometres northwest of Narok Town (Kipkoech et al., 2011). The Ecosystem is surrounded by thirteen administrative locations including Ol Posimoru, Olokurto, Naisoya, Nkareta, Ereteti, Ololulunga, Ol Shapani, Melelo, Enabelibel, Sogoo, Sagamia, Tendwet and Naituyupaki.

Research Design
The research design for this study was a descriptive survey. In view of this, the study adopted the field survey method to collect both quantitative and qualitative data. The field survey
implies the process of gaining insight into the general picture of a situation, without utilizing the entire population (King, 2004)

**Data Analysis**

Qualitative data generated from open-ended questions was analyzed in themes, content analysis and categories identifying similarities and differences that emerged. Qualitative analysis includes analysis of what some respondents said in the open ended questions. Quantitative data was scrutinized for completeness, accuracy and uniformity. Data from questionnaires were analyzed using descriptive statistics, and came out with frequencies and percentages using Statistical Package for Social Sciences (SPSS) - this is the reliable tool for quantitative data analysis.

**RESULTS**

**Forest use and economic dependence**

*Time taken to walk to nearest forest*

From data collected, the time taken by the respondents to walk to the forest averages to 40 minutes with the maximum time being 2 hours 10 minutes and minimum time taken is a minute.

| Statistics |       |
|-----------|-------|
| Time taken to walk to the forest (minutes) |       |
| N         | 69    |
| Mean      | 40.93 |
| Std. Deviation | 32.292 |
| Minimum   | 1     |
| Maximum   | 130   |

**Shortest distance from homestead to the forest**

The shortest distance from the respondent’s homestead to the nearest forest is at an average of 2 kilometers, with a maximum distance being 5 kilometers and the shortest distance being less than a kilometer.

| Statistics |       |
|-----------|-------|
| Shortest distance from homestead to the forest (Km) |       |
| N         | 69    |
| Mean      | 1.69  |
| Std. Deviation | 1.069 |
| Minimum   | 0     |
| Maximum   | 5     |

**Sources of six key products**

Six key products were identified as the most sought after by the locals, namely Firewood, Timber, Honey, Medicine, Animal fodder/browse and Water. Honey, Medicine and water were mainly sourced from the public forest and the other three from own farms implying that public forest and own farms were the main sources of the products.
Importance of six key products
Importance of the six products according to the respondents was assessed and it was found that all six of high importance since they were to be ranked mostly as either more important or most important.

Forest products (Commodities)
Most the products were sourced from their own farms with the exception of honey (36.9%), Agricultural tools (yoke, tool handles etc.) (28.8%), mushrooms (35.5%), fibres (37.3%) and water (30.9%) which were majorly sourced from public forest.
## Table 3: Forest products (Commodities)

| Product                          | Source                  | N   |
|----------------------------------|-------------------------|-----|
|                                  | Public forest           |     |
| Firewood                         | 39(26%)                 | 150 |
| Timber                           | 13(9.9%)                | 131 |
| Charcoal                         | 6(5.4%)                 | 112 |
| Honey                            | 48(36.9%)               | 130 |
| Medicine                         | 48(35%)                 | 137 |
| Poles (fencing, building etc.)   | 10(10.1%)               | 99  |
| Thatch grass                     | 24(21.6%)               | 111 |
| Fruits                           | 20(15.9%)               | 126 |
| Animal fodder/ browse            | 22(18.6%)               | 118 |
| Agricultural tools (yoke, tool handles etc.) | 36(28.8%) | 125 |
| Murram                           | 6(6.6%)                 | 91  |
| Building stones                  | 8(7.7%)                 | 104 |
| Mushrooms                        | 38(35.5%)               | 107 |
| Fibres                           | 38(37.3%)               | 102 |
| Meat                             | 9(9.2%)                 | 98  |
| Water                            | 42(30.9%)               | 136 |

### Level of importance of the products

It can be noted from the table that most the products were more important or most important. Firewood (18.6%) and (30%), Timber (31.4%) and (20.3%), Charcoal (17.6%) and (16.8%), Honey (23.8%) and (27.9%), Medicine (25.8%) and (25.4%), Poles (fencing, building etc.) (22.8%) and (17.5%), Thatch grass (24%) and (21%), Fruits (24.2%) and (18.5%), Animal fodder/ browse (26.5%) and (16.9%), Agricultural tools (yoke, tool handles etc.) (24%) and (19.1%), Murram (20.6%) and (17.6%), Building stones (22.1%) and (16.3%), Mushrooms (23.8%) and (16.5%), Fibres (20.2%) and (17.9%), Meat (21.1%) and (13.9%) and Water (23.3%) and (27.8%).

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### Table 4: Level of importance of the products

| Product | Rank | Not important | Somewhat important | Important | More important | Most important | N  |
|---------|------|---------------|--------------------|----------|----------------|----------------|----|
| Firewood | 67(25.5%) | 29(11%) | 39(14.8%) | 49(18.6%) | 79(30%) | 263 |
| Timber | 65(24.9%) | 27(10.3%) | 34(13%) | 82(31.4%) | 53(20.3%) | 261 |
| Charcoal | 73(27.9%) | 48(18.3%) | 51(19.5%) | 46(17.6%) | 44(16.8%) | 262 |
| Honey | 35(13.2%) | 43(16.2%) | 50(18.9%) | 63(23.8%) | 74(27.9%) | 265 |
| Medicine Poles (fencing, building etc.) | 63(24.6%) | 33(12.7%) | 50(19.2%) | 69(26.5%) | 44(16.9%) | 260 |
| Thatch grass | 60(22.9%) | 40(15.3%) | 44(16.8%) | 63(24%) | 55(21%) | 262 |
| Fruits | 50(18.9%) | 38(14.3%) | 64(24.2%) | 64(24.2%) | 49(18.5%) | 265 |
| Animal fodder/browse | 64(24.6%) | 33(12.7%) | 50(19.2%) | 69(26.5%) | 44(16.9%) | 260 |
| Agricultural tools (yoke, tool handles etc.) | 55(21%) | 55(21%) | 39(14.9%) | 63(24%) | 50(19.1%) | 262 |
| Murram Building stones | 62(23.7%) | 47(17.9%) | 53(20.2%) | 54(20.6%) | 46(17.6%) | 262 |
| Building stones | 73(27.8%) | 47(17.9%) | 42(16%) | 58(22.1%) | 43(16.3%) | 263 |
| Mushrooms | 58(22.2%) | 54(20.7%) | 44(16.9%) | 62(23.8%) | 43(16.5%) | 261 |
| Fibres | 70(26.7%) | 41(15.6%) | 51(19.5%) | 53(20.2%) | 47(17.9%) | 262 |
| Meat | 75(28.2%) | 47(17.7%) | 51(19.2%) | 56(21.1%) | 37(13.9%) | 266 |
| Water | 60(22.2%) | 27(10%) | 45(16.7%) | 63(23.3%) | 75(27.8%) | 270 |

**Level of importance of sources of the products**

The findings indicate that the sources indicated in the table below are more important and most important. This is supported by the score of their higher percentages. The average percentage of the importance is (25%).
Table 5: Level of importance of sources of the products

| Source          | Rank          | Not important | Somewhat important | Important | More important | Most important | N  |
|-----------------|---------------|---------------|--------------------|-----------|---------------|----------------|----|
| Public forest   | 299(30.1%)    | 134(13.5%)    | 137(13.8%)         | 179(18%)  | 246(24.7%)    |                | 995|
| Own farm        | 125(14.5%)    | 112(13%)      | 120(13.9%)         | 220(25.5%)| 287(33.2%)    |                | 864|
| Neighbors       | 173(20%)      | 137(15.9%)    | 196(22.7%)         | 224(26%)  | 133(15.4%)    |                | 863|
| Market          | 158(18.6%)    | 154(18.1%)    | 200(23.5%)         | 209(24.6%)| 130(15.3%)    |                | 851|
| Others          | 223(35%)      | 115(18%)      | 103(16.1%)         | 141(22.1%)| 56(8.8%)      |                | 638|

Time spent for a trip
From the data collected the average time spent per trip by a respondent is 7 minutes with the maximum time spend being an hour.

Table 6: Time spent for a trip

| N   |          | Where  | 68  | 7.45 | 12.595 | 0   | 60  |
|-----|----------|--------|-----|------|--------|-----|-----|
| Mean|          |        |     |      |        |     |     |
| Std. Deviation|      |        |     |      |        |     |     |
| Minimum|      |        |     |      |        |     |     |
| Maximum|      |        |     |      |        |     |     |

Number of trips per week
The average number of trips taken by a respondent per day are 3 with the maximum number of trips taken per day being 14 while the least number being 1 trip.

Table 7: Number of trips per week

| N   |          | Where  | 68  | 2.47 | 2.048  | 1   | 14  |
|-----|----------|--------|-----|------|--------|-----|-----|
| Mean|          |        |     |      |        |     |     |
| Std. Deviation|      |        |     |      |        |     |     |
| Minimum|      |        |     |      |        |     |     |
| Maximum|      |        |     |      |        |     |     |

Number of items collected per trip
From the data collected, it is evident that the average number of trips that the respondents’ takes to the forest in a week are 5, with the maximum trips being 40 trips per weeks and the least could be 10 trips per week.

Table 8: Number of items collected per trip

| N   |          | Where  | 60  | 4.74 | 7.334  | 10  | 40  |
|-----|----------|--------|-----|------|--------|-----|-----|
| Mean|          |        |     |      |        |     |     |
| Std. Deviation|      |        |     |      |        |     |     |
| Minimum|      |        |     |      |        |     |     |
| Maximum|      |        |     |      |        |     |     |

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**Number of people collecting products from the forest**

From the data collected, it is evident that children are the people who collect products from the forest.

| Person    | Average Number |
|-----------|----------------|
| Adults    | 1              |
| Children  | 2              |
| **Grand Total** | **2** |

**How much of forest products do you extract for home consumption and sale**

The respondents stated that they extract much of the forest products for consumption and sale.

| Quantity extracted for home consumption (Kgs) |               |
|----------------------------------------------|---------------|
| Mean                                         | 1891.2500     |
| Std. Deviation                               | 2431.55989    |
| Minimum                                      | 0.00          |
| Maximum                                      | 13000.00      |

**Use of forest for spiritual purposes**

Form the data collected, 66.7% of the respondents use the forest for spiritual and cultural purpose while 33.3% do not.

![Figure 3: Use forest for cultural and spiritual purpose](image-url)
Frequency of using the forest for spiritual and cultural purposes

It was noted that frequency of using the forest for spiritual purposes was once a year (84.6%) with a small number stating that it’s done few times a year (11.5%).

| Frequency of using the forest for spiritual and cultural purposes | Frequency | Percentage |
|---------------------------------------------------------------|-----------|------------|
| More than once a week                                         | 1         | 1.9        |
| Once a week, 2 or 3 times a week                              | 1         | 1.9        |
| Few times a year                                              | 6         | 11.5       |
| Once a year                                                   | 44        | 84.6       |
| **Total**                                                     | **52**    | **100.0**  |

Majority of the respondents stated that they do not graze their animals in the forest (54.7%).

Figure 4: Domestic animals grazed inside the public forest

Type, number and period in months grazed inside the forest

For those who stated that they do graze their animals in the forest they were to own four different types of domestic animals, with goats being the most owned (average = 10) and donkeys being the least (average = 3). Besides number owned Donkey was found to be the most grazed animal (average = 9 months) and goats were the least grazed (8 = months).
Table 12: Type, number and period in months grazed inside the forest

| Animal | Statistic          | Number owned | Number of months in a year |
|--------|--------------------|--------------|----------------------------|
|        | Mean               | 6.57         | 8.9                        |
|        | Std. Deviation     | 4.198        | 3.897                      |
|        | Minimum            | 1            | 2                          |
|        | Maximum            | 16           | 12                         |
| Cattle |                    |              |                            |
|        | Mean               | 6.71         | 8.08                       |
|        | Std. Deviation     | 5.06         | 4.055                      |
|        | Minimum            | 2            | 2                          |
|        | Maximum            | 20           | 12                         |
| Sheep  |                    |              |                            |
|        | Mean               | 10.09        | 7.67                       |
|        | Std. Deviation     | 12.153       | 4                          |
|        | Minimum            | 3            | 2                          |
|        | Maximum            | 45           | 12                         |
| Goats  |                    |              |                            |
|        | Mean               | 2.5          | 9.27                       |
|        | Std. Deviation     | 3.032        | 3.927                      |
|        | Minimum            | 1            | 2                          |
|        | Maximum            | 12           | 12                         |
| Donkeys|                    |              |                            |

Month and reason for usage of the forest

The respondents stated that they mainly utilized the forest during the months of January (n=45) and December (n=16) and the major reasons were due to cultural purposes in December (81.3%) and during dry season/drought in January (86.7%).

Table 13: Month and reason for usage of the forest

| Month   | Reason (n [%])                  | Dry season/drought | Floods/rainy season | Honey harvesting season | N  |
|---------|---------------------------------|--------------------|----------------------|-------------------------|----|
| January | 6(13.3%) Due to cultural purposes | 39(86.7%)          | 0 (0.0%)             | 0 (0.0%)                | 45 |
| February| 0 (0.0%)                         | 3(100%)            | 0 (0.0%)             | 0 (0.0%)                | 3  |
| March   | 0 (0.0%)                         | 2(100%)            | 0 (0.0%)             | 0 (0.0%)                | 2  |
| April   | 1(25%)                           | 1(25%)             | 1(25%)               | 1(25%)                  | 4  |
| July    | 0 (0.0%)                         | 0 (0.0%)           | 2(100%)              | 0 (0.0%)                | 2  |
| August  | 1(25%)                           | 1(25%)             | 1(25%)               | 1(25%)                  | 4  |
| September| 0 (0.0%)                          | 1(100%)            | 0 (0.0%)             | 0 (0.0%)                | 1  |
| November| 0 (0.0%)                          | 0 (0.0%)           | 3(100%)              | 3(100%)                 | 3  |
| December| 13(81.3%) Due to cultural purposes | 1(6.3%)            | 0 (0.0%)             | 2(12.5%)                | 16 |

Family members employed by KFS or forest product industry

Majority of the respondents stated that their family members are not employed by KFS and that they don’t depend on the forest product industry (61.8%). Of the 38.2% who acknowledged that they have family members employed either in the forest industry or Kenya Forest Service the Maximum number stated was 16 people with a mean of 2 people.
Table 14: Number employed by KFS or forest product industry

| Descriptive Statistics | N | Minimum | Maximum | Mean | Std. Deviation |
|------------------------|---|---------|---------|------|----------------|
| Number of household members employed | 29 | 0 | 16 | 2 | 2.964 |

Forest products and services obtained from the forest

On average the amount time per trip made by locals to obtain forest products ranged from 2 hours to 5 hours, with the number of trips ranging from 2 to 16. The amount per trip was most costly for those going to collect honey at Kshs 3213 with timber being the least costly at Kshs. 121. The highest number of persons involved in collection was 10 for fibres the highest amount obtained for usage at home was Kshs. 3200 for charcoal same as that for sale at Kshs. 5700.

Table 15: Mean of Forest products and services obtained from the forest

| Product                     | Average of Time/trip (hrs.) | Average of Trips/week | Average of Amount/trip | Average of Number involved | Average of Amount/month (Home) | Average of Amount/month (Sale) |
|-----------------------------|-----------------------------|-----------------------|------------------------|---------------------------|--------------------------------|--------------------------------|
| Agricultural tools (yoke, tool handles etc.) | 3 | 2 | 384 | 1 | 848 | 830 |
| Animal fodder/browse        | 2 | 4 | 668 | 1 | 645 | 450 |
| Building stones             | 2 | 1 | 817 | 1 | 650 | 433 |
| Charcoal                    | 5 | 2 | 656 | 2 | 3200 | 5700 |
| Fibres                      | 3 | 16 | 227 | 10 | 333 | 664 |
| Firewood                    | 3 | 2 | 171 | 2 | 1449 | 4305 |
| Fruits                      | 3 | 2 | 341 | 1 | 617 | 703 |
| Honey                       | 3 | 2 | 3213 | 1 | 3264 | 1718 |
| Meat                        | 3 | 2 | 550 | 2 | 250 | 550 |
| Medicine                    | 2 | 1 | 308 | 1 | 454 | 436 |
| Murram                      | 3 | 1 | 500 | 1 | 200 | 433 |
| Mushrooms                   | 2 | 2 | 238 | 1 | 222 | 263 |
| Poles (fencing, building etc.) | 3 | 1 | 310 | 1 | 1150 | 450 |
| Thatch grass                | 3 | 2 | 438 | 1 | 2040 | 2100 |
| Timber                      | 4 | 3 | 119 | 2 | 1600 | 840 |
| Water                       | 4 | 7 | 121 | 2 | 333 | 0 |

Earnings from employment in forest product industry

The highest amount of earnings from forest product industry by household members was Ksh. 14000 with an average of Kshs. 4678.39.

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**Table 16: Earnings from employment in forest product industry**

| Descriptive Statistics | N | Minimum | Maximum | Mean    | Std. Deviation |
|------------------------|---|---------|---------|---------|----------------|
| Earnings for members of the household from employment in forest product industry (Kshs.) | 23 | 0 | 14000 | 4678.39 | 3114.125 |

**Source of water and whether it’s from the forest**

There were three sources of water mentioned namely stream/river, borehole/well and spring with stream/river being the most commonly used source (40.6%). It was for note that the overall source of the water irrespective of point of collection was the forest (73.8%) Error! Reference source not found.

![Chart of Water from the Forest](chart1.png)

![Chart of Source of Water](chart2.png)

**Figure 8: Source of water and whether it’s from the forest**

**Distance between water source and homestead**

The average amount of time spent collecting water from available source was noted to be 21.94 minutes with person who walks farthest spending 120 minutes with the one who walks the shortest distance spending a minute. Table 17. The number of jerry cans collected varied from 2 to 120 with a mean of 29.

**Table 17: Distance between water source and homestead**

| Descriptive Statistics | N | Minimum | Maximum | Mean | Std. Deviation |
|------------------------|---|---------|---------|------|----------------|
| Distance of the source of water (minutes) | 69 | 1 | 120 | 21.94 | 21.517 |
Table 18: Number of jerry cans per day

| Descriptive Statistics | N  | Minimum | Maximum | Mean  | Std. Deviation |
|------------------------|----|---------|---------|-------|----------------|
| Number of 20 jerry cans used per day | 70 | 2       | 120     | 29.39 | 32.635         |

Type of purification for drinking water and the quality of water collected from the forest
The quality of water collected from the forest was stated to be mainly good (55.9%), with a small percentage of the respondents stating that it was fair. No purification method was noted to be mostly used (41.4%).

![Figure 5: Type of purification for drinking water and the quality of water collected from the forest](image)

Number residents with problem with crop raiding animals from the forest
Majority of the respondents stated that they have no problems with raiding animals from the forest (79.2%). Figure 6 with the cost of damage ranging from Kshs. 4000 to Kshs. 8000 with an average of Kshs. 6000.

![Figure 6: Number residents with problem with crop raiding animals from the forest](image)
Cost of damage caused
The cost of damages done by the wildlife animals is at a minimum of 4000 and a maximum of 8000. This very high according the residents.

Table 19: Cost of damage caused

| Cost of damage | N  | Minimum   | Maximum | Mean   | Std. Deviation |
|----------------|----|-----------|---------|--------|----------------|
| Damage         | 10 | 4000.00   | 8000.00 | 6000.00| 2108.19        |

Attitude/ perception on the status/ management of Maasai Mau forest
The findings indicate that 61.5% of the respondents argued that Environmental and biodiversity conservation is the most perceived of the management of the Maasai Mau forest with provision of raw materials for industry/ locals being the least with 4.6%.

Table 20: Perceptions on the management of maasai mau forest

| Purpose                                           | Frequency | Percent |
|---------------------------------------------------|-----------|---------|
| Environmental and biodiversity conservation        | 40        | 61.5    |
| Creating more employment opportunities             | 11        | 16.9    |
| Tourism                                           | 4         | 6.2     |
| Provide raw materials for industry/ locals         | 3         | 4.6     |
| I don’t know                                       | 7         | 10.8    |
| **Total**                                         | **65**    | **100** |

Importance of the forest to family members
The finds indicate that the forest products are the most important to the family memers in different aspects including Economic (income), Subsistence (Domestic uses), Cultural/ Spiritual/ Worship and Future use values

Table 21: Importance of the forest to family members

| Services/ values | Level of importance [n, (%)] | N  |
|------------------|------------------------------|----|
| Economic (income)| Least important              | 20 (29%) | 69 |
|                  | Somewhat important           | 3 (4.3%)  |    |
|                  | Important                    | 17 (24.6%) |    |
|                  | More important               | 11 (15.9%) |    |
|                  | Most important               | 18 (26.1%) |    |
| Subsistence (Domestic uses) | Least important              | 8 (11.4%) | 70 |
|                  | Somewhat important           | 5 (7.1%)  |    |
|                  | Important                    | 5 (7.1%)  |    |
|                  | More important               | 22 (31.4%) |    |
|                  | Most important               | 30 (42.9%) |    |
| Cultural/ Spiritual/ Worship | Least important              | 24 (34.8%) | 69 |
|                  | Somewhat important           | 9 (13%)   |    |
|                  | Important                    | 14 (20.3%) |    |
|                  | More important               | 8 (11.6%)  |    |
|                  | Most important               | 14 (20.3%) |    |
| Future use values | Least important              | 20 (29%)  | 69 |
|                  | Somewhat important           | 11 (15.9%) |    |
|                  | Important                    | 6 (8.7%)   |    |
|                  | More important               | 12 (17.4%) |    |
|                  | Most important               | 20 (29%)   |    |

Rating of the management of Maasai Mau forest
The findings shows that the forest is not well conserved and its somehow well conserved. It lies in between.
Species of trees/plants/animals that may have disappeared over the years

The findings indicate that Species of trees/plants/animals that may have disappeared over the years which is supported with 81.80% of the respondents.

Figure 7: Rating of the management of Maasai Mau forest

Figure 8: Species of trees/plants/animals that may have disappeared over the years
Support for the project
Most of the respondents agreed that they Support the project of the forest conservation

![Support for the project](image)

Figure 9: Support for the project

Reasons for not contributing to the project
For those who do not support the project, indicated they don't do it because of Lack of compensation to the evictees by the government with the highest percentage of 73.1%. others do not support due Due to nepotism, Political issues, Tribal issues, Believe of ownership rights and Violation of human rights in the process

| Reasons for not contributing to the project | Frequency | Percentage |
|--------------------------------------------|-----------|------------|
| Lack of compensation to the evictees by the government | 19 | 73.1 |
| Due to nepotism | 1 | 3.8 |
| Political issues | 1 | 3.8 |
| Tribal issues | 1 | 3.8 |
| Believe of ownership rights | 2 | 7.7 |
| Violation of human rights in the process | 2 | 7.7 |
| **Total** | **26** | **100.0** |

Ethnic groups
Most of the ethnic group of people who live around the forest are the kipsigis (91.4%) followed by the ogiek (5.7%) then the gusii with (2.9%).

| Ethnic group  | Frequency | Percent |
|---------------|-----------|---------|
| Kipsigis      | 64        | 91.4    |
| Ogiek         | 4         | 5.7     |
| Gusii         | 2         | 2.9     |
| **Total**     | **70**    | **100.0** |
Land usage
The findings indicate that the land is used in different ways including Natural forest/woodland, Planted forest (woodlot), Food crops (maize, potatoes etc.), Cash crops (pyrethrum, wheat, tea), Pasture land and Wetlands/marshy/rocky areas

Table 24: Land usage

| Land use                  | Statistic | Size (acres) | Proportion of total land size |
|---------------------------|-----------|--------------|------------------------------|
|                           | N         | 10           |                              |
| Natural forest/ woodland  | Mean      | 1.10         |                              |
|                           | Std. Deviation | .316         |                              |
|                           | Minimum   | 1            |                              |
|                           | Maximum   | 2            |                              |
|                           | N         | 37           | 6                            |
|                           | Mean      | 1.32         | 22.17                        |
|                           | Std. Deviation | .699         | 9.174                        |
|                           | Minimum   | 1            | 13                           |
|                           | Maximum   | 3            | 40                           |
| Food crops (maize, potatoes etc.) | N     | 59           | 7                            |
|                           | Mean      | 2.33         | 31.80                        |
|                           | Std. Deviation | 1.785         | 11.545                       |
|                           | Minimum   | 1            | 20                           |
|                           | Maximum   | 10           | 50                           |
| Cash crops (pyrethrum, wheat, tea) | N     | 20           |                              |
|                           | Mean      | 1.50         |                              |
|                           | Std. Deviation | .761         |                              |
|                           | Minimum   | 1            |                              |
|                           | Maximum   | 3            |                              |
| Pasture land              | N         | 57           | 6                            |
|                           | Mean      | 1.97         | 30.67                        |
|                           | Std. Deviation | 1.972         | 14.514                       |
|                           | Minimum   | 1            | 7                            |
|                           | Maximum   | 9            | 50                           |
| Wetlands/marshy/rocky areas | N     | 19           | 4                            |
|                           | Mean      | 1.37         | 15.75                        |
|                           | Std. Deviation | .742         | 6.131                        |
|                           | Minimum   | 1            | 7                            |
|                           | Maximum   | 3            | 20                           |

Permanent Occupation
The findings indicate that the respondents have different forms of permanent occupations namely Farming, Business, Livestock keeping, Teacher, Poultry keeping, Household chores, Bee keeping, Doctor and Casual labourer with 55, 18.9, 8.1, 4.5, 4.5, 3.6 and 3.6 of percentages respectively.

URL: http://dx.doi.org/10.14738/assrj.810.10959
Table 25: Permanent Occupation

| Permanent occupation | Frequency | Percentage |
|----------------------|-----------|------------|
| Farming              | 61        | 55         |
| Business             | 21        | 18.9       |
| Livestock keeping    | 9         | 8.1        |
| Teacher              | 5         | 4.5        |
| Poultry keeping      | 5         | 4.5        |
| Household chores     | 4         | 3.6        |
| Bee keeping          | 4         | 3.6        |
| Doctor               | 1         | 0.9        |
| Casual labourer      | 1         | 0.9        |
| **Total**            | **111**   | **100**    |

Livestock type

Most the residents are farmers of Cattle, Sheep, Goats, Donkeys, and Chicken/Ducks/Geese.

Table 26: Livestock type

| Livestock type       | Statistic     | Number  |
|----------------------|---------------|---------|
| Cattle               | N             | 67      |
|                      | Mean          | 7.90    |
|                      | Std. Deviation| 6.876   |
|                      | Minimum       | 1       |
|                      | Maximum       | 30      |
| Sheep                | N             | 46      |
|                      | Mean          | 9.50    |
|                      | Std. Deviation| 8.479   |
|                      | Minimum       | 1       |
|                      | Maximum       | 40      |
| Goats                | N             | 45      |
|                      | Mean          | 10.64   |
|                      | Std. Deviation| 11.068  |
|                      | Minimum       | 1       |
|                      | Maximum       | 50      |
| Donkeys              | N             | 43      |
|                      | Mean          | 2.49    |
|                      | Std. Deviation| 3.261   |
|                      | Minimum       | 1       |
|                      | Maximum       | 20      |
| Chicken/ Ducks/ Geese| N             | 48      |
|                      | Mean          | 25.00   |
|                      | Std. Deviation| 23.963  |
|                      | Minimum       | 2       |
|                      | Maximum       | 120     |
Income sources
The result shows that the respondents income sources are Farming (annual crops), Livestock sales, Livestock products (milk, wool, hides, skins etc.), Remittances, Pension, Income from residential/commercial buildings, Income from business and Income from sale of forest products.

Table 27: Income Sources

| Income source                                      | Statistic       | Gross income in 2018/2019 (Kshs.) |
|---------------------------------------------------|-----------------|-----------------------------------|
| Farming (annual crops)                            | N               | 63                                |
|                                                   | Mean            | 55777.78                          |
|                                                   | Std. Deviation  | 50615.389                         |
|                                                   | Minimum         | 3000                              |
|                                                   | Maximum         | 200000                            |
| Livestock sales                                   | N               | 52                                |
|                                                   | Mean            | 38307.69                          |
|                                                   | Std. Deviation  | 32189.109                         |
|                                                   | Minimum         | 0                                 |
|                                                   | Maximum         | 180000                            |
| Livestock products (milk, wool, hides, skins etc.)| N               | 61                                |
|                                                   | Mean            | 17959.02                          |
|                                                   | Std. Deviation  | 25196.371                         |
|                                                   | Minimum         | 300                               |
|                                                   | Maximum         | 150000                            |
| Remittances                                       | N               | 44                                |
|                                                   | Mean            | 14245.45                          |
|                                                   | Std. Deviation  | 25846.618                         |
|                                                   | Minimum         | 600                               |
|                                                   | Maximum         | 120000                            |
| Pension                                           | N               | 4                                 |
|                                                   | Mean            | 76500.00                          |
|                                                   | Std. Deviation  | 149000.000                       |
|                                                   | Minimum         | 2000                             |
|                                                   | Maximum         | 300000                            |
| Income from residential/commercial buildings      | N               | 2                                 |
|                                                   | Mean            | 35000.00                          |
|                                                   | Std. Deviation  | 21213.203                         |
|                                                   | Minimum         | 20000                            |
|                                                   | Maximum         | 50000                            |
| Income from business                              | N               | 13                                |
|                                                   | Mean            | 44384.62                          |
|                                                   | Std. Deviation  | 32030.034                         |
|                                                   | Minimum         | 2000                             |

URL: http://dx.doi.org/10.14738/assrj.810.10959
Financial and social assets

**Whether they have had an account with financial/credit institutions in the last 5 years**

The findings indicate that the majority of the respondents (60.3%) have had an account with financial/credit institutions in the last 5 years.

![Figure 10: Whether they have had an account with financial/credit institutions in the last 5 years](image)

**Savings in Account**

The majority of the respondents have savings in accounts with a maximum of 400,000 shillings.
Table 28: Savings in Account

| Statistics                  |       |
|-----------------------------|-------|
| N                           | 32    |
| Mean                        | 29418.75 |
| Std. Deviation              | 72384.464 |
| Minimum                     | 0     |
| Maximum                     | 400000 |

**Member of an environmental conservation group**

The majority of the respondents 52.9% are member of an environmental conservation group.

![Member of an environmental conservation group](image)

**Crisis and unexpected expenditures**

*Self-sufficiency in food throughout the year*

The findings indicate that 73.1% noted that there is Self-sufficiency in food throughout the year.
Figure 12: Self-sufficiency in food throughout the year

**Whether household have faced any major crisis in the last 5 years**

54% of the respondents agreed that there households have faced major crisis in the last 5 years

Figure 13: Whether household have faced any major crisis in the last 5 years

**Coping strategy with the crisis**

The respondents indicated that there are different ways of coping strategy with the crisis which includes; Harvest more forest products, spend cash savings, sell assets (land, livestock etc), do extra casual labour work, or get loan from money lender welfare association bank etc.

*Figure 14: Coping strategy with the crisis*
Ownership of Movable assets

*Earnings for members of the household from employment in forest product industry (Kshs.)*

The respondents indicated that they own different things (Bicycle, Car/ truck, Cassette/ CD/ VHS/ VCD/ DVD/ Player, Cell phone/ Phone, Chainsaw, Furniture, Motorcycle, Plough, Radio, Solar panel, Stove for cooking (gas or electric only), Tractor, TV, Water pump/ Money maker, and Wooden cart or wheelbarrow) of different values with a minimum of 1750 and a maximum of 40000.
Table 29: Earnings for members of the household from employment in forest product industry (Kshs.)

| Asset                                    | Average of Units owned | Average of Respondent valuation (resale value of all units) | Average of Computed value |
|------------------------------------------|------------------------|------------------------------------------------------------|---------------------------|
| Bicycle                                  | 1.0                    | 4100.0                                                     | 5500.0                    |
| Car/truck                                | 1.0                    | 525000.0                                                  |                           |
| Cassette/CD/VHS/VCD/DVD/Player           | 4.4                    | 2400.0                                                     |                           |
| Cell phone/Phone                         | 1.5                    | 4636.3                                                     | 6337.5                    |
| Chainsaw                                 | 1.0                    | 20000.0                                                   |                           |
| Furniture                                | 6.1                    | 11140.7                                                   | 16000.0                   |
| Motorcycle                               | 1.1                    | 94857.1                                                   | 40000.0                   |
| Plough                                   | 1.1                    | 5235.3                                                     | 5000.0                    |
| Radio                                    | 1.1                    | 3425.9                                                     | 2600.0                    |
| Solar panel                              | 1.4                    | 9815.8                                                     | 10833.3                   |
| Stove for cooking (gas or electric only) | 1.1                    | 5181.8                                                     |                           |
| Tractor                                  | 1.0                    | 1520000.0                                                 |                           |
| TV                                       | 1.0                    | 10400.0                                                    | 11500.0                   |
| Water pump/Money maker                   | 2.0                    | 3286.7                                                     |                           |
| Wooden cart or wheelbarrow               | 1.0                    | 3080.0                                                     | 1750.0                    |
| **Grand Total**                          | **2.1**                | **30712.1**                                                | **8643.2**                |

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