

# THE VIABLE CONSERVATION MEASURES IN CHEPALUNGU FOREST; BOMET COUNTY, KENYA

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**Abstract:** Biodiversity values at ecosystem depend on how people use, manage and interact with the forest trees and trees outside the forest. Between 1990 and 2010 Kenya's forest cover significantly reduced by 6.5%. The aim of this study was to discern viable conservation measures in CF. Primary data constituted responses from randomly sampled local community, the herbalist, cultivators and foresters interviewed. Their response rate was 96%, 100%, 100% and 60% respectively that were analyzed in SPSS. Obtaining firewood, grazing fodder, honey, herbs among others occurred very frequently in 88%, 83% 93% and 90% respectively. Cutting, trampling and browsing as disturbance on trees accounted for 73%, 15% and 12% respectively. 98%, 81%, 75% and 40% of the respondents considered charcoal making, grazing, and browsing and firewood collection to be very destructive human activities occurring in CF respectively. The forest has decreased in a margin of 9% between 1985 and 2010 in its area with 7% attributed to clear-cutting established using change detection technique. CF has a tree diversity of 0.6, 0.4 and 0.3 in the edge, core and middle zones respectively measured on Simpson Species Diversity Index. It is dominated by *Acokanthera schimperi*, *Teclea simplifolia* and *Euclea divinorum* with common height of 3 m and range of 1 m to 7 m. This data was collected using stratified random sampling with established square quadrats along line transects. The forest is managed by protecting and replanting trees which 91% and 76% of residents and forest officers considers inadequate. Chi-square was conducted to test the significance of association. The forest has been over exploited by unregulated use. It has low tree diversity and diminishing potential for natural regeneration without which no conservation can be said sustainable. It is recommended that clear guidelines on the legal activities be developed by the forest department with public participation to regulate use of its resources. The forest department to develop inventory on what they are conserving to allow periodic audit that will guide conservation strategies. Determine and guide annual allowable cut. The forest department to embrace participatory management by encouraging and supporting the formation of community forest association.

**Keywords:** Conservation, Ecosystem, Acetones.

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## 1. INTRODUCTION

### Background of Conservation Measures

Forests represent one of the principal natural formations (biomes) of the world, the most complex in structure and richest in composition (genetic diversity) and acts as watershed, store of genetic resources, protection against soil erosion, flood and climatic stabilizers (Kerich, 1990). Conservation measures are supposed to maintain and improve biodiversity in a protected area. These include regulated activities in the area that control agents of degradation and allowing for self-sustenance of a natural ecosystem. Ecologists emphasize the need for conservation through scientific management development to ensure the sustained yield of natural resources. Despite legislation of Forest ACT 2005 and implementation efforts, it is evident that there is inadequacy in policy framework and or implementation (Mathu, 2007)

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Conflicting policies diminish the effectiveness of environmental and natural resource policies because they conflict with other policies. Often, these conflicting policies have been promulgated and justified on economic grounds resulting in trade-offs between environmental and economic goals concludes Ludeki, *et al* (2006).

Conservation policy needs to be developed in the light of public opinion, which can indicate the social benefits of the policy, (Hamblen, 2004). The underlying causes of logging and other crimes include, lack of stakeholders' strategic participation in the conservation and management of forests, illegal crimes and deforestation driven by poverty associated with demographic pressure and inadequate and or weak structural/institutional capacity for forest law enforcement and governance (Mathu, 2007, Kimani, 2011).

**Statement of the Problem**

Rapid population increase exerts pressure on natural resources; census record in the study area indicates 723,813 persons in 2009, 782531 in 2012 and expected to reach 891,168 by 2017 of which 80% are youth active and likely to overstretch available resources in all respects. Vegetation exhibits continued change in canopy structure, species density abundance and dominance and species richness driven by the impact of unregulated human activities. Degradation of natural ecosystem is an environmental concern currently. Wetlands are being converted to farmland, cultivation along riverbanks, mountain top cultivation, deforestation to pave way for settlement, all lead to loss of such fragile habitats. Undisturbed forest habitats are capable of self-sustenance in terms of vegetative productivity, and without serious fluctuation in species density, richness, abundance and canopy structure. The exploitation of is unsustainable indicating that the conservation measures in Chepalungu Forest are not effective.

Effective conservation measures are supposed to facilitate the self-sustenance of nature while maintaining complexity of any forest. Chepalungu Forest reserve faces challenge of transformation by human disturbance forms and increased edge effects. It has poor potential for closed canopy growth. Illegal activities include forest clearing, tree poaching, setting on fire vegetation, charcoal making using traditional kilns and driving goats into the forest. Being a gazetted forest property of the government, the community has alienated itself from their resource allowing over exploitation. This situation should be managed to avoid total loss of natural habitat. Chepalungu Forest is at verge of extinction. In view of this problem, there was need to determine key factors in degradation and viable conservation strategies in protection, reforestation and restoration for optimal conservation.

**Research Question**

1. What viable conservation measures are in place now in Chepalungu Forest reserve?

**Research Hypotheses**

Chepalungu Forest is a protected area managed by Kenya Forest Service of the Ministry of Forestry and Wildlife with authorized and non-authorized human activities taking place in the forest. This study formulated the following research hypotheses;

H01. There is no association between conservation measures and vegetation characteristics in Chepalungu Forest.

**2. RESEARCH DESIGN**

Based on method of data analysis, Mugenda and Mugenda, (1999) descriptive research is a process of collecting data in order to test hypotheses or answer questions concerning the state of subject in the study and descriptive research determines and reports things the way they are. The advantages of using both qualitative and quantitative methods is that research had several objectives which others were better assessed by either method which supplements each other in that qualitative method provides for in-depth explanation while quantitative provides hard data needed to meet the required objective.

Survey research provide for a questionnaire or numeric description of trends, attitudes or opinions of population by studying a sample of that population. Questionnaires or structured interviews are used for data collection with the interest of generalizing from a sample to a population (Creswell, 2009).

This study designed and used questionnaire to collect data from Bomet foresters regarding the conservation programmes, stakeholders involved, activities degrading the forest, challenges they face in line of duty, critical species they protect and proposal for conservation.

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Interview schedule was used to acquire data from the local community in Chepalungu forest on the resources they obtain, the legal and illegal activities their views on conservation programmes and suggestion for sustainable use of Chepalungu forest resources. Observation schedules were applied to derive data on vegetation diversity and observed disturbance within the forest ecosystem.

### 3. DISCUSSION

The researcher randomly sampled out 40 cultivators working in 4. Sq. km area under Shamba system to be interviewed. The researcher was able to interview 40 of them hence the response rate was 100%.

#### Proportion of Gender

Cultivators of both genders were interviewed in the study it indicates that the proportion of cultivators of either gender.

#### Cultivators of Chepalungu classified by gender

Gender	Frequency	Percent
Male	15	37.5
Female	25	62.5
<b>Total</b>	<b>40</b>	<b>100.0</b>

It shows that 25 of the cultivators were female while 15 were male.

This suggests that there are more female cultivators compared to male.

#### Respondents' Age

The researcher interviewed cultivators of different ages as shown below.

#### Age distribution of cultivators in Chepalungu forest

Cultivators' age	Frequency	Percentage
18 to 25 years	5	12.5
26 to 35 years	20	50.0
36 to 45 years	10	25.0
46 to 60 years	5	12.5
<b>Total</b>	<b>40</b>	<b>100.0</b>

half of the cultivators interviewed were between 26 and 35 years old. Ten of them were between 36 and 45 years old.

#### Duration of Cultivation in Chepalungu forest

The cultivators were asked to state how long they had been cultivating. Their responses are summarized below;

#### Duration farmers have been cultivating in Chepalungu forest

Duration of cultivation	Frequency	Percentage
0 to 2 years	4	10.0
3 to 5 years	23	57.5
5 or more years	13	32.5
<b>Total</b>	<b>40</b>	<b>100.0</b>

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As the findings above show, most of the farmers had been cultivating for more than three years. Thirteen of them had been cultivating for over five years. The results lead to a number of conclusions. There were more women working in the farms than men. This suggests that more women engage in farming activities compared to men. It is probable that men engage in other economic activities while women work in the farms. The findings suggest that most of the farmers are between 26 and 45 years old. This is the age group that is most productive hence they can be found working in the farms. Finally, according to most of the farmers had been cultivating for more than three years. This suggests that they have been exploiting the forest for a long time.

### Forest Officers Response Rate

The researcher sought to interview 20 of the forest officers working in Chepalungu Forest but only 12 of them were available to be interviewed. Thus the response rate for this group of respondents was 60% which was adequate for analysis and reporting of results (Mugenda and Mugenda, 2003).

### Gender of Respondents

The researcher interviewed both male and female forest officers. Table 4.11 shows the proportion of male and female forest officers.

#### Forest officers' gender in Bomet forest station

Gender	Frequency	Percent
Male	8	66.7
Female	4	33.3
<b>Total</b>	<b>12</b>	<b>100.0</b>

As indicated, eight of the forest officers interviewed were male while four were female. This reveals that there are more male forest officers than female forest officers probably due to the nature of the job.

### Duration of Stay at the Bomet Forest Station

The forest officers interviewed in this study had been at their present work stations for varying amounts of time as summarized below;

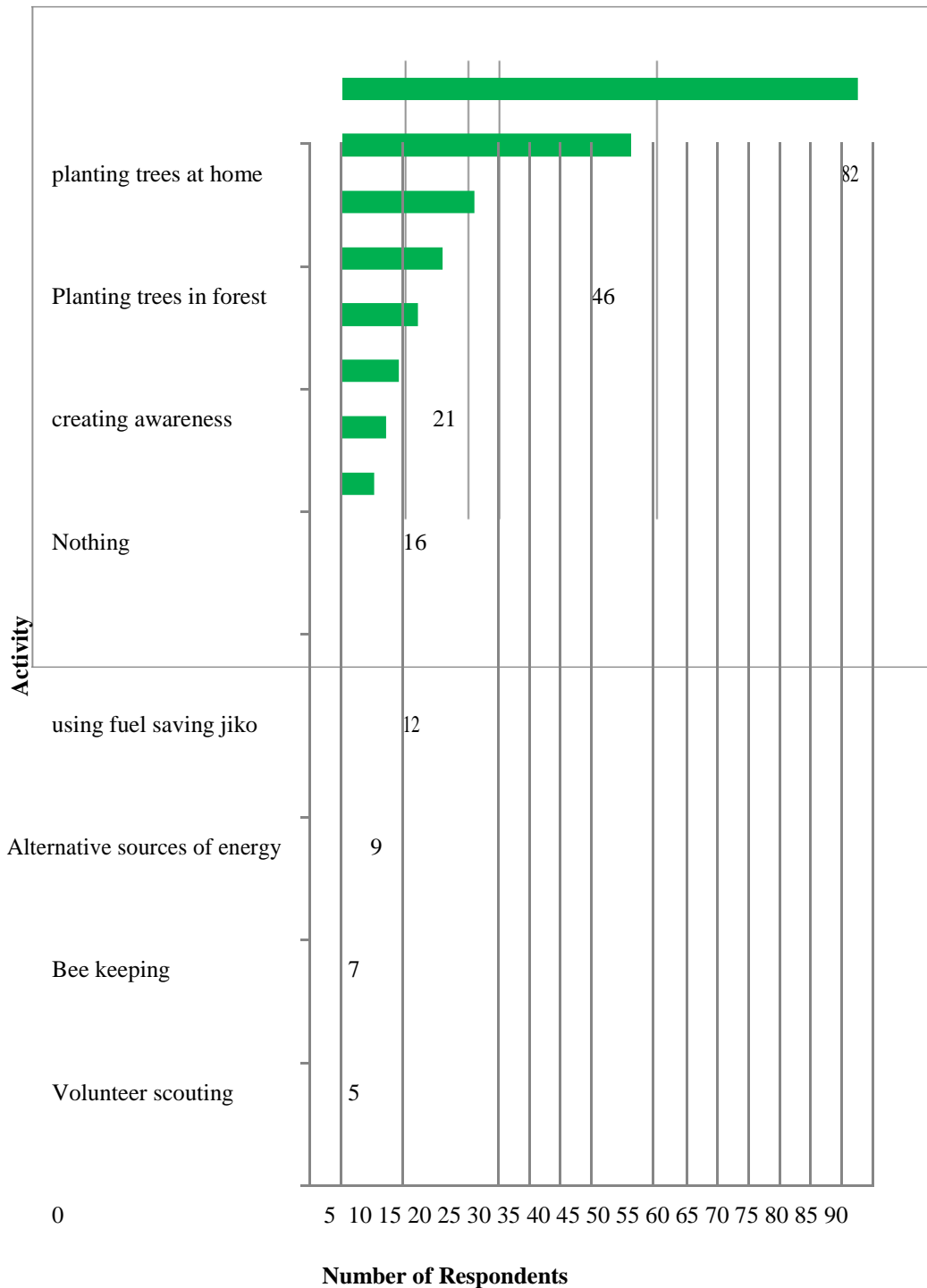
#### Time spent at Bomet Forest Station

Years spent at current station	Frequency	Percent
1	3	25.0
2	2	16.7
3	2	16.7
4	4	33.3
8	1	8.3
<b>Total</b>	<b>12</b>	<b>100</b>

An examination reveals that seven of the officers interviewed had been in their current work station for three years or less, four of them have worked there for four years and only one officer has worked there for eight years.

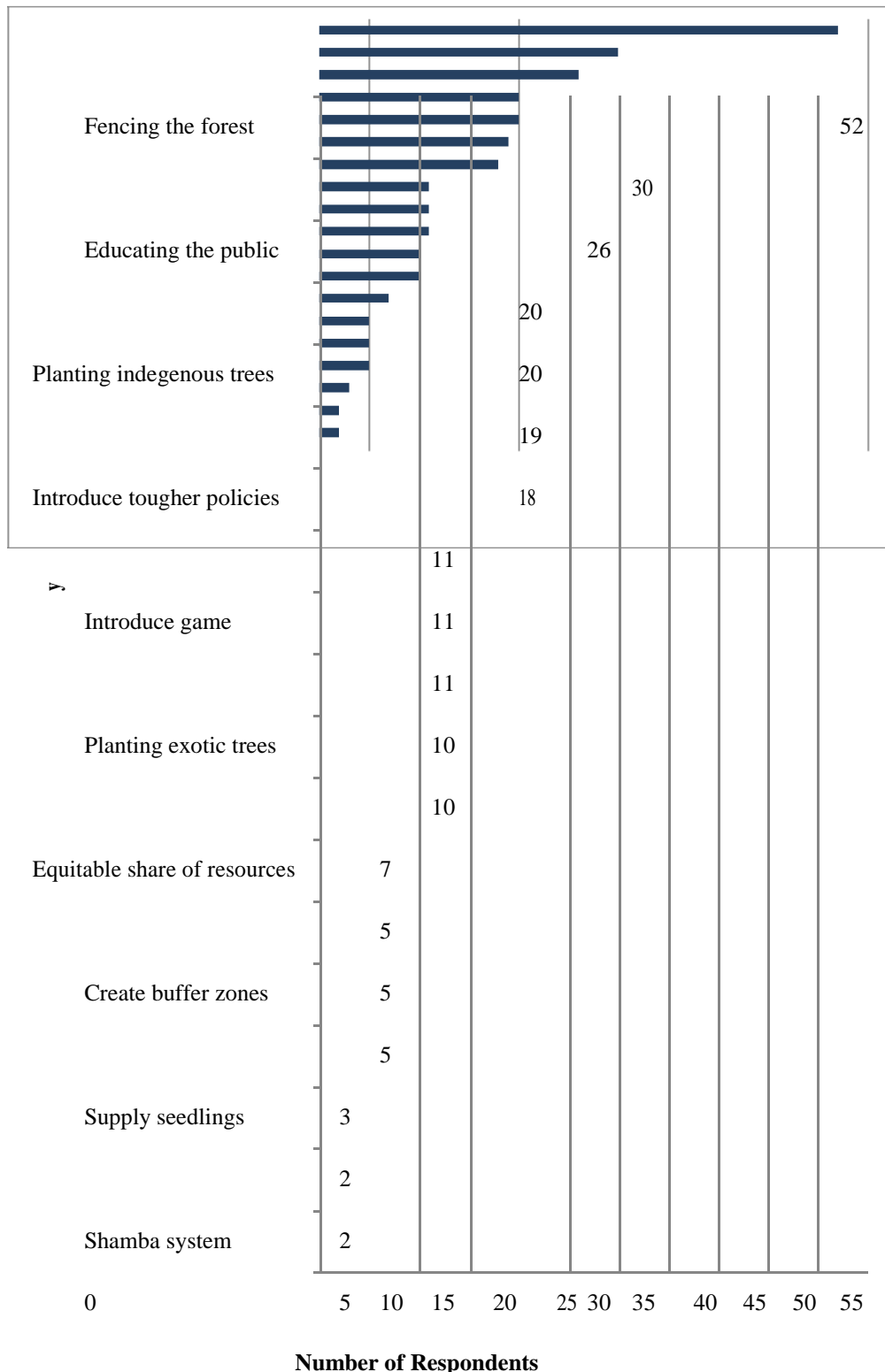
### Viable Conservation Measures in Chepalungu Forest

The final objective of the study was to establish which viable conservation measures were in place in Chepalungu Forest. The researcher asked the members of the community to state what they each did to conserve the forest.



**Activities engaged by community members to conserve the Forest**

An examination reveals that 16% of the respondents did nothing at all towards conserving the forest. It also shows that planting trees at home and in the forest was the conservation activity most people engaged in followed by creation of awareness and use of fuel saving *jikos*. The community members were also asked to state what could be done to improve conservation in the forest. Their suggestions are summarized in below.



**Community’s suggestions on how the forest can be conserved**

A look at Figure above reveals that 95% suggested fencing the forest should involve villagers in conservation and educating the public, were the conservation methods suggested by most of the people in the community. Replanting trees, protection campaigns, community education and community incorporation are the programmes that were in place to conserve Chepalungu Forest. The forest officers were asked to rate the effectiveness of these programmes and their views are summarized in Table below.

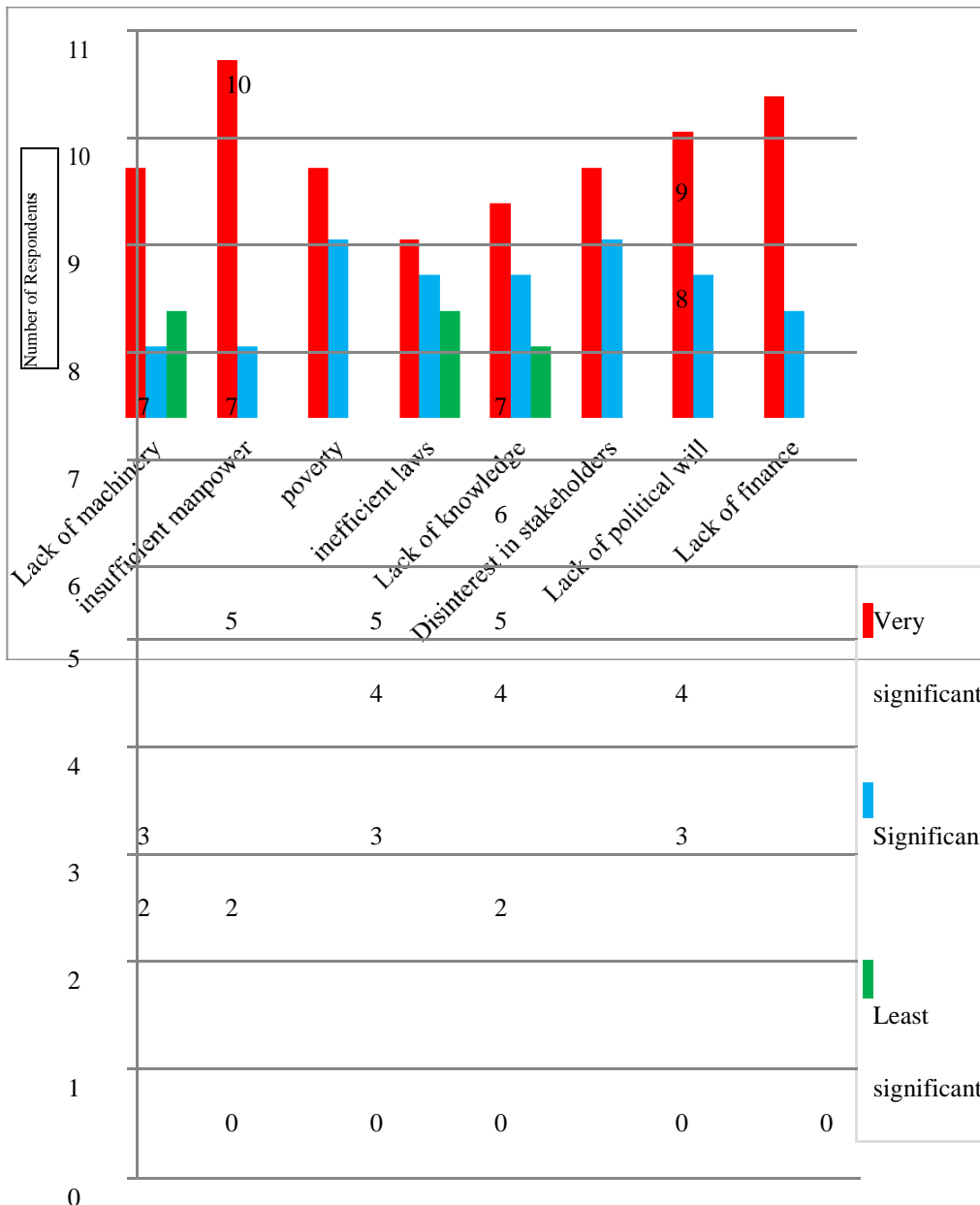
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Forest officers' rating of conservation programs

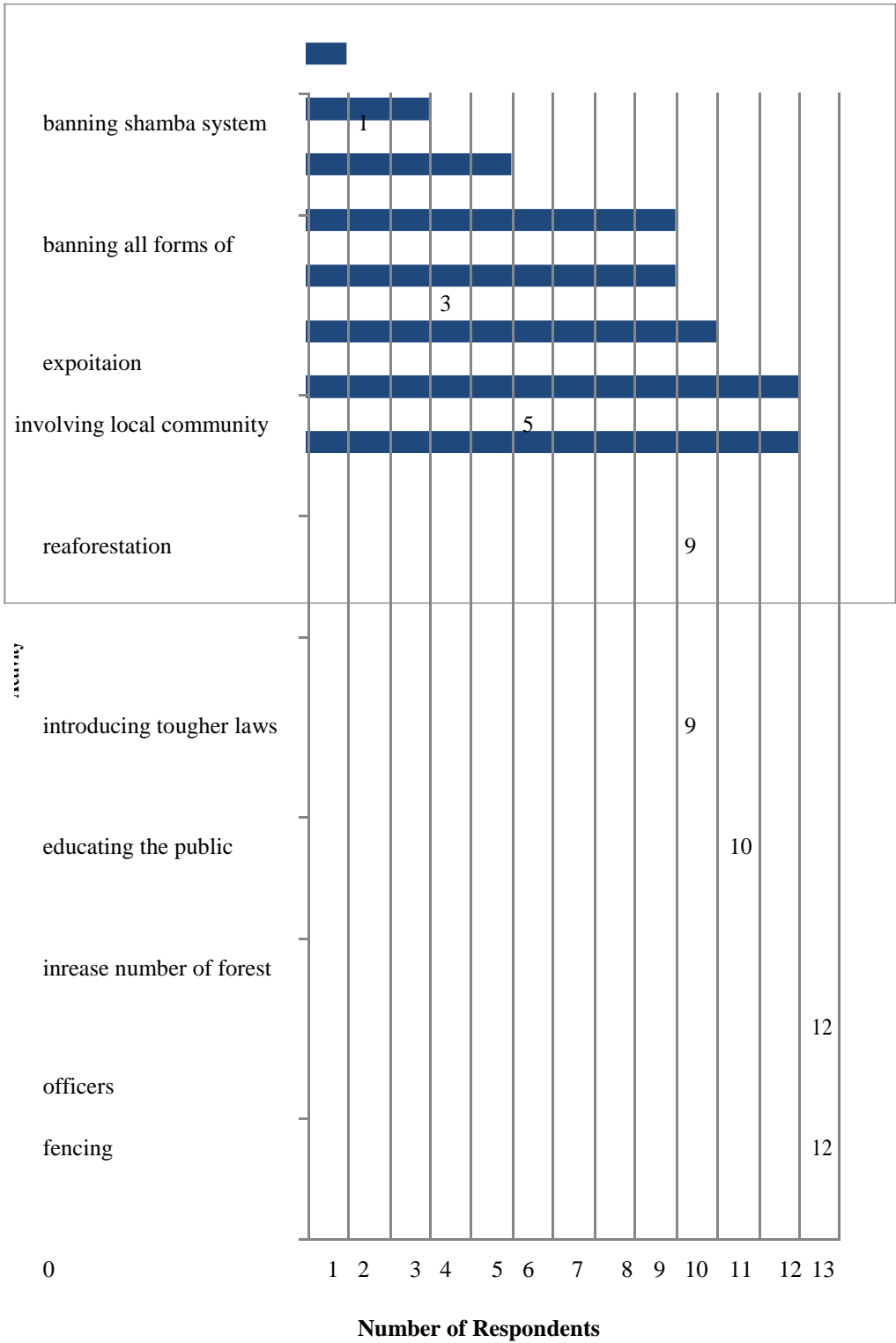
	Frequency	Percent
Very effective	1	8.3
Effective	6	50.0
Less effective	5	41.7
<b>Total</b>	<b>12</b>	<b>100.0</b>

According to Table above, five of the forest officers were of the view that the conservation measures were not effective, six of them felt they were effective and only one officer felt they were very effective. These figures suggest that about half of the forest officers were dissatisfied with the success of the conservation measures in place. The forest officers were asked to rate the significance of factors that hindered conservation in Chepalungu Forest. The figure below shows their responses.



**Forest officers’ ratings of factors that hinder conservation**

According to figure below, insufficient manpower, shortage of machinery and lack of political will were the three most important factors that hindered conservation. The researcher asked the forest officers to state some conservation measures they would like to see implemented.





### Conservation measures proposed by forest officers

An examination reveals that all the forest officers were in favour of fencing the forest and increasing the number of forest officers. Ten of them proposed that the public should be educated and nine officers were in favour of reforestation and introduction of tougher laws to protect the forest.

Several conclusions can be made after examining the results reveals that only a small number of the respondents (13 individuals) did nothing to conserve the forest. Planting trees at home, planting trees in the forest and creating awareness were the three activities most respondents engaged in to contribute towards conservation of the forest. This leads to the conclusion that many people in the community appreciate the importance of conserving the forest in whichever way they can use to plant trees. It indicates that fencing, involving the community and educating the public are the three recommendations most members of the community made when asked to give some suggestions on how the forest can be conserved. One conclusion that can be made from this finding is that many respondents felt that by fencing the forest, people would not be able to access it and destroy it.

These findings also show that the community is willing to be involved in conservation going by the number which recommended community participation. Willingness by the community to take part in conservation (Mathu, 2007) a vital ingredient for the success of conservation policies. (Pearl and Western, 1992) also emphasize the importance of educating the public on issues concerning conservation of the forest. It is clear that forest officers also favored the idea of fencing the forest, increasing the number of forest officers and educating the public. It also shows how forest officers rated the effectiveness of conservation programs and how they are rated to the factors that hinder conservation efforts. To begin with, about one half of the forest officers were of the view that the conservation measures were not effective. Insufficient manpower, inadequate financing and lack of political will towards conservation are the three greatest hindrances to conservation according to the forest officers. There is need, therefore, for the government to increase its funding of forest conservation.

### Hypothesis Test for Conservation and Vegetation Characteristics

To test the hypothesis that there is no association between conservation measures and vegetation characteristics, this study performed chi-square test on the observed tree height as an attribute associated with conservation. Conservation of trees must include conserving of their vegetative height which implies the quality of the canopy. Canopy structure contributes to diversity (Trapnell, 1997).



**Mature *Elaeodendron buch* grow to a height of 24 m**
**Average height of trees in Chepalungu forest**

S/N	1	2	3	4	5	6	7	8	9	10	11
Average H	23	57	14	12	23	14	24	20	12	16	18
Percentage	9.9	24.5	6	5.2	9.9	6	10.3	8.6	5.2	6.9	7.7

The known height of a mature *Elaeodendron buch* species being a common species in the study site was used as the expected (E) 24 m for the observed cases. The average heights of species in all the quadrats were regrouped in order to conduct  $\chi^2$  test. Calculated value for the  $\chi^2$  is 21.57 with 10 degrees of freedom and at 95 per cent confidence level. The table value is 18.307 at 0.5 critical level.

**Results of chi-square**

Calculated value	21.57
Degrees of freedom	10
Critical value at 0.5	18.307

Since the calculated value is higher than the table value, the  $H_0$  is rejected and the  $H_1$  is adopted that the vegetation characteristic is associated with conservation measures which have been rated above as inadequate by 76.1% of the local community and 41 % of the forest officers were of the opinion that the conservation measures were less effective.

#### 4. CONCLUSIONS

The study found that only 16% of the community members did nothing towards conserving the forest. Planting trees at home, in the forest and creating awareness were the conservation activities most people in the community engaged in. This finding also shows that the community is willing to take part in conservation efforts. The community also has some suggestions as to how conservation can be improved. Fencing the forest, involving the villagers and educating the public were the three most important suggestions from the community. The Forest ACT 2005, sufficient basis of promoting forest conservation. With regard to compliance and enforcement strategies on can be achieved through; prevention, detection and suppression. Prevention of degradation can be done in CF by reducing discretionary powers of the rangers, simplification of operational norms, increasing transparency and accountability in decision making by holding public hearing on decision pertaining the forest. Civil organization, groups and NGOs to join efforts in education and awareness on the provision of the law and the rationale behind them to minimize ignorance that contributes to illegal activities. Use of Bomet county administrative structures, national administration to provide checks and balances not rangers alone. It is important to increase the number of rangers and supported by local forest scouts all should have motivating welfare in remuneration. The Bomet forest office should have inventories for resources, clear boundaries that should be shift proof and progress towards economic equity in access to benefits and sustainability objective. Whistle blowers are important in all public sectors; it will do well for CF.

In order to detect and provide early warning system, there is need for the forest office to generate baseline information. Periodic comparison of events prescribed by law with actual occurrence is necessary especially for cutting grazing and browsing. Training of personnel and equipping personnel on modern surveillance method will aid in detection of crimes on forest. All government agencies should participate in conservation for instance making surprise monitoring to verify compliance management. To suppress crimes engage other law enforcement agencies like the national youth service, regular police, administration police, and Kenya wildlife service. arrest and impose heavy penalties for offenders.

Lastly, the study used the tree height as important attribute that among others the health of vegetation can be observed. The results were put into chi-square analysis in order to decide on the hypothesis that there is no association between conservation measures and vegetation characteristics in Chepalungu Forest. The study found that the results of chi-square, the calculated value was greater than the table value at 0.5 and 0.1 critical level. It was, therefore, concluded that there is significant association between the conservation measures and the vegetation characteristic in Chepalungu Forest. The success of conservation implies stability of vegetation productivity.

## 5. RECOMMENDATIONS

This study recommends enforcement of regulation on cutting and collection of firewood by forest department and all stake holders. Develop and stick to guidelines on annual allowable cut on firewood collection. The forest ACT of 2005 does not allow browser, its implementation has failed in CF. Impose strict penalties and limit grazers that trample on vegetation. Beekeeping should be promoted in Chepalungu Forest. All stake holders to encourage on farm forest with fuel efficient jikos for households and alternative fodder for livestock especially priority on 5 km radius round the forest in order to reduce their depending on forest for firewood as source of energy for households and to make a buffer zone around chepalungu forest which will reduce edge effects.

To mitigate habitat transformation in Chepalungu Forest; it is recommended that the Forest Department regulate the use of forest products through partial closure to allow micro ecosystem to stabilize and succession species to grow to maturity. It is important to introduce habitat restoration programmes with high adherence to ecological requirement of *in situ* species.

Since the local community is willing to take part in forest conservation, the public should be educated on the need to conserve the forest for both consumptive and non-consumptive benefits, diversify conservation programmes and involve them through the present administrative structures and social formations forest association community.

To conserve Chepalungu Forest, it should be fenced and specific entrance designed to protect it from encroachment. The forest department to make an inventory of actual tree species and other forest resources that will allow periodic audit hence appropriate action taken. Promote activities that reduce the pressure off the forest like sericulture, improved beekeeping, and development of fodder banks, bio intensive agriculture and on-farm forestry. Monitoring environmental changes with a view of counteracting the observed changes in order to enhance forest potential for natural regeneration.

Cultivation simplifies indigenous forest complexity by decimating herbaceous plants and undergrowth. In most cases exotic species are introduced that limit the potential of natural forest. Be regulated to allow forest to regenerate naturally to maturity. Management planning in Chepalungu Forest should be based on an ecosystem approach.

### Recommendations for Further Research

According to the findings of the study and gaps identified, the study recommends that other studies should replicate on:

1. Ways of involving the public in forest conservation, participatory forest management for sustainable forest use.
2. Gender and forestry with focus on influence on forest dynamics.

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