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Research Article

The impact of community training on participatory forest conservation outcomes, a case of Kodera forest in Kenya

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ABSTRACT

Biodiversity is affected by the lack of forest cover around the world. On the other hand, Kenya has lost much of its forest cover in recent years. To reduce losses, the Kenyan government adopted community participation in forest management, known as participatory forest management. This paper attempted to analyze the influence of community training on the outcomes of participatory forest management through a descriptive survey design while targeting communities adjacent to the forest. 255 samples were taken from 671 households around the forest. The questionnaire and interview schedule facilitated data collection at the study site. Data analysis was performed using IBM SPSS version 20 while the results were later presented in the tables. The relationship between the independent and dependent variables was analyzed by *chi-square* test of independence. According to the results, a slightly higher percentage (51.9%) have applied training techniques learned on their farm compared to 48.1% who have not yet put these skills into practice. The implementation of certain forest conservation measures is related to whether a household member has received training in forest conservation. In general, households whose members had been trained in forest conservation factors were more likely to have implemented one or more forest conservation measures on their land, as opposed to those who were not trained. Therefore, training plays an important role in the application of forest conservation measures. Among untrained households, there is a significant gender difference in adoption between trained and untrained households.

Keywords: Community, Participatory forest conservation, Forest, Land

INTRODUCTION

In the global supply of commercial products and biodiversity, forests play a vital role (Wamae, 2013). The benefits of ecological services and functions to humans are innumerable (Sarvasova & Dobsinska, 2016). Forest resources help sustain life by providing products and services (Muigua, 2020). Only 31% of the world's land area is covered by forests, which is not enough to conserve biodiversity, requiring the conservation of the world's remaining forests (Powlen, et al., 2021). Deforestation remains a major threat affecting the lives of millions. Furthermore, it turns out that around 6 billion people have been negatively affected by deforestation, the majority of whom are directly dependent on forest products and services.

Despite the global decline in forest resources, local people around the world still depend on forestry for their livelihood (Okumu & Muchapondwa, 2020). Despite the benefits from forests, human disturbance has controlled and increased pressure on forest land, leading to severe loss of forest cover (Kimutai & Watanabe, 2016a). To regulate and promote forest conservation outcomes, countries have implemented a number of techniques. Cooperative forest management in Uganda has led to the registration of CFAs by local people for forest conservation (Mawa, et al., 2020). While 21 countries in the sub-Saharan region have subsequently supported participatory tactics to protect natural resources, only 15% of the world's forest resources accept people's participation (Mutune & Lund, 2016). Participatory forest management attempts to manage, protect, conserve and maintain forest resources in collaboration with local people (Kasymov, et al., 2022). PFM is widely recognized as

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an alternative to forest resource management in many Third World countries. Sustainable forest management requires community participation and goodwill (Lucungu, et al., 2022). For example, in Bangladesh, PFM was introduced in the early 1980s with the objective purpose of engaging indigenous peoples in forest resource management.

Knowledge of the relationship between forest conservation initiatives and their immediate and long-term consequences has culminated in the design of appropriate policies to help reduce deforestation and forest degradation (Hayes, et al. & Persha, 2010). Improved livelihoods through natural resource conservation also increase government revenues (Omala & Aglanu, 2020). On the other hand, forest degradation poses challenges for various stakeholders, including decentralized entities, the corporate sector and national governments (Leo, et al., 2022). Over the past 40 years, Kenya has seen significant degradation of its forest resources. To alleviate this, the government passed Kenya Forestry and Conservation Act No. 8 2005. This decision was prompted by a shift in global development strategy towards a "sustainable livelihoods" approach.", where forests serve as an important component of recognition. in compliance with article 42 of the Kenyan constitution. As a result, it is believed to have a positive effect on indigenous societies in their perception of the benefits of forest protection.

According to Global Forest Watch, in 2010 Homa Bay had a forest area of about three point eight (3.18 Mha) native trees accounting for about five point seven percent. By 2020, it has reduced by 17.2 kha (17.2 kha), roughly equivalent to 7.6 and 8 megatons (7.68 Mt) of CO_2 emissions. Kenya has benefited less from participatory forest management. This study aimed to establish the impact of training on participatory forest conservation outcomes using the Kodera Forest as a case study in Kenya. The results are useful in replicating the positive forest conservation outcomes needed to combat climate change and improve forest cover in line with Kenya's 2030 vision.

MATERIALS AND METHODS

The study was carried out in the Kodera Forest and its surrounding community in the Kadel Kamidigo subdivision of Homa Bay County in Kenya, which occupies three-quarters of the entire forest. According to several publications, there are ongoing reports of forest degradation due to illegal logging, grazing, forest fires and agricultural activities. Kodera Forest is located at the following coordinates:0033N:340 Latitude-0.55691° or 0° 33' 25" South, Longitude 34.66436° or 34° 39' 52" East and Altitude 1,329 meters (4,360 feet).

Kodera forest covers an area of 399 hectares. Hot and rainy weather is common in the area. Farmers make up the majority of the population and some of them use the "Shamba system". With rivers such as the Awach, Agido, Nyamache and other small streams pouring into Lake Victoria, the study site is located at an altitude of 1800 to 2000 mm according to Kenya's meteorological statistics.

The study used descriptive survey method. This design is suitable for collecting data describing existing phenomena by questioning individuals about their perceptions, values and attitudes necessary to establish the impact of training on outcomes. The paper adopted a mixed method. Proponents of this approach argue that this study design allows researchers to analyze the data with research independence. The study targeted the community around Kodera Forest as well as forestry-related organizations, including Kenya Forest Service officials, community forestry associations and local opinion leaders as sources as primary sources. Using purposive and systematic sampling methods, data were collected from March 22, 2023 to March 24, 2023 using questionnaires and corresponding interview schedules. In addition, interview panels and field observations were also used to verify participants' responses. The 250 households around the Kodera forest were sampled out of a total of 671 households around the forest using the Yomane Taros sampling formula.

In addition, five key informants were also interviewed, for a total of 255 respondents. On value and reliability, expert opinions were sought on this issue as well as those of senior researchers at the University, again 30 respondents were randomly interviewed for information. Validate the tool before the exercise is actually performed. For analysis, the generated quantitative data was analyzed descriptively using inferential statistics. This involved percentage distributions and number of frequencies correlation and regression analysis while qualitative data was reproduced and then reported in topics and sub topics. The questions were coded and marked to yield quantitative responses and measured as an interval or proportional scale, and then entered into the SPSS statistical software for further analysis. Data analysis was performed using inferential and descriptive statistics. The relationships between the variables are determined and then presented appropriately.

RESULTS AND DISCUSSION

This study evaluated the impact of training on participatory forest conservation outcomes using Kodera Forest as a case study. Twenty local young graduates, familiar with the study area, collected the data directly through the online Survey Monkey link. The target population includes households living in and believed to have direct contact with the study forest. 255 responses represent 100% bounce rate retained after QA testing and data cleaning.

Demographic characteristics of the respondents

Demographic are distinctive features of a given population or society that is categorized as age, education gender and income. Demographic characteristics of a community helps researchers to understand the population dynamics and attributes of the society or population in the study (Table 1).

Table 1. Demographic characteristics of respondents.

Demographics	Frequency	Percentage
Gender		
Male	119	47
Female	136	53
Level of education		
Primary	97	37.83
Secondary	81	31.85
Post-secondary	77	30.32
Age groups		
18-24	28	11.07
25-34	42	16
35-44	55	21.54
45-54	62	24.51
55-64	40	15.81
65plus	28	11.07
Main occupation		
Working on farm	143	56
Self-employed	51	20
Students	13	5.2
Paid employment	39	15.2
N=	255	100

As shown in the Table 1, the percentage of male respondents were 47%, while women were 53% respectively indicating that there could more female births than men as well as low life expectancy for men than women at Kodera forest at the time of survey. Among the respondents, the least recorded education level was post-secondary education at 30.32%. Secondary school education level stood at 31.85% while Primary school level was the most at 37.83% respectively.

The data depicted an improved level of literacy in the rural as shown by percentage distributions in Table 1. Regarding age, 45-54 age bracket (24.51%) formed the majority, followed by 35-44, 25-34, and 55-65 at 21.74%, 16.60%, and 115.81% respectively. The younger and older generations were the least represented, because of the rural nature of the case study area and the low life expectancy respectively, being that the survey was conducted during the day and schools were open, the younger generation could be in schools while the older generations indicate that community is risking inheritance of traditional resources and mentorship to the younger generation. On occupation, more than half of the respondents (56%) worked on their farms as a means of earning revenue while 20% were self-employed outside the farm and a further 3.6% were on wage labour by working on other people's farms for income.

Only 15.20% were in regular paid employment (working as civil servants or in the private sector) while students formed 5.20% of the respondents. The results indicate farming as a major economic activity of the community thereby making forest conservation to be vital in the area.

Forestry training and application of training skills on private land

Due to the absence of knowledge in forest management methods, deforestation and the production of low-quality forest products are continued. By minimizing deforestation and raising productivity in the production of timber, skill development can improve the living conditions of communities that depend on forests.

Through training, individuals can enhance and modernize their skills, which is crucial for better outcomes in forest conservation. According to Mwambeo, et al., 2022, the local community's facts and understanding of natural resource management are related to improved conservation results. The PFM goal of enhancing the livelihoods and wellbeing of disadvantaged communities is at odds with the restricted incentives of poor people combined with poor forest management methods that worsen communities' conditions (Table 2).

Table 2. Forestry training and application of training skills on private land.

Training on forestry practices	Frequency	Percentage
Application of training on Private land		
Yes	132	51.9
No	123	48.1
Soil and water conservation training received		
Fanya chini	10	4.02
Cut off drain	41	16.02
Napier grass	45	17.59
Contour farming	24	9.5
Tree planting	42	16.58
Terraces	15	5.71
None	78	31.16
Forest management training received		
Forest fire management	28	11
Nursery management	40	15.7
Tree planting	122	47.3
Soil conservation	28	11
Water conservation	37	15
Reasons for not having trained		
No need	53	20.83
Expensive	38	14.88
Not aware	82	32.15
Busy	41	16.07
No training provider	41	16.07
N=	255	100

From Table 2 notable training received by the respondents both in the conservation of soil and water were Napier grass (17.59%), tree planting (16.58%), and terraces (13.07%). Contour farming techniques had been received by 5.71% while both 'fanya chini' and cut-off drain had 4.02% and 16.02%. The argument here is that when communities are adequately trained on natural resource management, the application of the training must ensure the sustainability of such resources for the betterment of society. 11.0% of the respondents had received training on forest fire management, 15.7% received training on tree nursery management, 11% were trained on soil conservation. 15.0% of the respondents had been trained on water conservation practices while the remaining 47.3% received tree planting pieces of training at Kodera.

This implies that though the training is very important in the conservation of forests and the environment at large, respondents presented a very big gap in the above vital forest management practices which could hinder conservation efforts by the community *i.e.* the type of tree they plant on their lands in an attempt to conserve soil and water. On the other side, it reveals that the skills and expertise of the community forest association are still low in forest conservation which might contribute to poor forest conservation outcomes. The absence of technical knowledge of forest conservation can also result in negative management practices (Agarwal, 2009). Further literature shows that the local community's facts and knowledge of natural resource management is paramount in conservation (Mwambeo, et al., 2022). Additionally, communities often don't hold extensive knowledge and expertise of their indigenous surroundings which may contribute to unsuitable conservation practices (Mustalahti & Nathan, 2009).

Slightly a larger proportion (51.9%) adopted training techniques learned on their farm against the 48.1% who are yet to put the skills into action. This indicates that forest user groups are indeed contributing to skills development for communities whose main occupation is farming.

Those that had received training were further found to have joined one of the existing user groups. Additionally, those that had not joined any of the forest user groups had little silvicultural skills than their counterpart thus indicating the value of PFM as a strategy n forest conservation.

Respondents replied to not receiving one or more of the training identified above. Overall, slightly more than a third had received in all listed aspects of forestry. A worrying trend for not receiving one or more training by the respondents was pegged on lack of awareness (32.14%), implying that the need for conservation training hasn't been communicated widely within the community due to limited training providers and associated costs.

In addition to this indication, observation during the survey depicted respondents with little or no silvicultural skills as shown by how a majority of the trees were planted on their private land. The "I don't care" attitude contributed to 20.83% (no need) and 16.07% (busy), 14.88% (expensive) while 16.07% decried no training provider.

As noted earlier, community capacity in implementation of the silvicultural programs depends on skills and knowledge acquired by the community. To understand the relationship between training and application of forest conservation measures, the researcher proceeded as below (Table 3).

Table 3. *Chi-Square* test showing the relationship between 'Has anyone in this household ever been trained on forest conservation' and 'what forest conservation measures do you have in your land'

	Value	**Df**	**Asymp. Sig. (2-sided)**
Pearson *Chi-Square*	71.712[a]	18	0
Likelihood ratio	72.593	18	0
N of valid cases	265		
Note: a. 16 cells (53.3%) have an expected count of less than 5. The minimum expected count is .01.			

The *chi-square* test outcomes designate a significant relationship between the variables "Has anyone in this household ever been trained on forest conservation?" and the presence of "What forest conservation measures do you have in your land?" (Pearson *chi-square*=71.712, Likelihood ratio=72.593, df=18, p<.001). This means that the implementation of certain forest conservation measures is related to whether or not someone in the household has received training on forest conservation. Generally, households with a member who has received forest conservation-related pieces training are more likely to have had one or more the forest conservation measures on their land as opposed to those with completely no training.

Thus, training shows a significant role in application of the forest conservation measures. Among households that have not received there is a significant difference in adoptions between genders amongst those who have received training and those who haven't. For males who have received training, the Pearson *chi-square* value is 54.915, the Likelihood ratio is 56.704, and the p-value is .000<0.01. Similarly, for females who have received training, the Pearson *chi-square* value is 58.789, the Likelihood Ratio is 70.900, and the p-value is .000<0.05 level of significance. Overall, the total pearson *chi-square* value is 108.573, the Likelihood Ratio is 119.349, and the p-value is .000, indicating that there is a significant association between gender and the adoption of forest conservation measures.

Generally, more females need to be trained to improve the overall adoption rates of conservation measures of farms around Kodera forest. Training, the most talked of response is none/ no measure adopted (54.2%), followed by tree planting (23.9%) and grass strips/Napier grass (21.1%). These percentages deliver great indulgence in the dissemination of different forest conservation measures adopted by households based on their training status.

CONCLUSION

In summary, research on the impact of community training on participatory forest management outcomes provides valuable lessons from the Kodera Forest in Kenya. There is indeed sufficient evidence to support the relationship between training and positive conservation outcomes in forest conservation. As for the households whose members have been trained in silviculture, they have applied and applied the skills on their private land, thereby improving the tree and forest cover of the Kodera Forest and opposite. This implies that if all community members are trained in forest conservation skills, participatory forest management will improve forest cover in program areas to reduce climate change and global warming.

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