

Research Article

Status of Local Structures in Community Participation in Participatory Forest Management Within Ol Bolossat Forest (Kenya)

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Abstract

Forests offer a wide range of benefits to humanity, including environmental, ecological, cultural, social, and economic contributions. Traditionally, forest management practices have largely excluded local communities. However, recent years have seen a growing emphasis on involving local residents in forest management a concept referred to as Participatory Forest Management (PFM). This study aimed to assess the effectiveness of local structures in facilitating community participation in PFM within Ol Bolossat Forest in Kenya. Data collection methods included interviews with members of the Community Forest Association (CFA), key informant interviews, and direct observations. The results indicated that local structures, as defined in the study, consist of groups or organizations responsible for executing activities in communities adjacent to the forest. These included the Ol Bolossat CFA, various user groups, and the Forest Level Management Committee (FLMC). Notably, 75.8% of households reported current membership in the Ol Bolossat CFA. The user groups were established to enhance forest management and ensure sustainable practices in conservation, protection, production, and utilization. Most members were involved in activities such as cultivation through the Plantation Establishment and Livelihood Improvement Scheme (PELIS), livestock grazing, and firewood collection. These groups contributed to increased agricultural output and provided resources like livestock fodder and firewood. Key indicators of effective forest governance identified in the study included heightened community involvement, equitable participation, inclusivity, and fair distribution of benefits. The findings suggest that a significant portion of the local population has actively engaged in the conservation and management of Ol Bolossat Forest, resulting in widespread benefits from PFM. This study adds to the body of knowledge on forest governance, conservation efforts, and the enhancement of rural livelihoods among communities bordering Ol Bolossat Forest.

Keywords

Forest Degradation, Forest Restoration, Forest Conservation, Participatory Forest Management, Sustainable Forest Management, Ol Bosolot Forest, Kenya

1. Introduction

Forests are accredited with numerous ecosystem services, such as climate regulation, water purification, soil conserva-

tion, biodiversity support, and various provisioning services like food, timber and medicine, all of which are important for

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human well-being and the global health [1-3]. Because of the benefits derived from these ecosystem, they are currently under pressure from the growing human population which often leads to forest degradations [4, 5]. Therefore, conservation of forest is important by ensuring sustainability to residents, for whom forest resources often represent their primary or secondary source of livelihood [6]. Sustainable forest management (SFM) is one of the crucial factors of ensuring that local community members can obtain socioeconomic and environmental goals benefit as well as allow the forests to benefit the future generation [7-9]. In many countries, sustainable forest governance is still relied on a central authority such as national or local government to the total exclusion of the local communities. This witnessed a campaign by many local communities members to be incorporated into forest governance structure [10, 11].

The involvement of local community members in forest management, often referred to as Participatory Forest Management (PFM), is widely regarded as a vital element for achieving sustainable forest conservation and ensuring the protection of community rights through such frameworks [12]. This model enables forest governance systems to strike a balance between conservation goals and the developmental needs of surrounding communities [10, 11]. Since the World Forestry Congress held in Jakarta in 1978 under the theme "Forests for People," there has been a notable shift toward forest management strategies that incorporate community participation while addressing their social, cultural, and economic interests [13]. On a global scale, Nepal is among the countries with the most extensive history of community engagement in forest management, primarily through its Community Forestry programs [14, 15]. In the African context, several nations including Cameroon, Ethiopia, Uganda, Tanzania, and Kenya have adopted participatory forest management practices [16, 17].

Participatory Forest Management (PFM) was introduced in Kenya due to the local and national pressure led by communities and civil society organizations to reduce forest destruction in the backdrop of global clamour for partnerships in forest management [18]. The adoption of Participatory Forest Management (PFM) signified a shift away from the traditional, government-dominated "command and control" model, which primarily focused on industrial wood production rather than the provision of forest goods and services for the direct benefit of local communities. [19, 20]. The government allowed PFM piloting to be done in a small area, 42 km² in Arabuko Sokoke Forest [21]. The successful implementation of the pilot resulted in an increase in the number of forests stations being managed through PFM and by 2018, there were over 177 Participatory Forest Management Plans (PFMPs) signed [22]. PFM is being implemented in virtually all forest stations in the country with CFAs actively contributing to forest management.

The operation of several Participatory Forest Management (PFM) initiatives has been examined in various studies [23,

24], with particular attention given to the role and influence of local community structures within these frameworks [24, 25]. These evaluations have, in turn, sparked critical discussions concerning the design of PFM models specifically relating to the allocation of rights, responsibilities, and decision-making authority in managing forest resources. In light of these issues, the present study investigates the current status and effectiveness of local structures in facilitating community participation in PFM, using Ol Bolossat Forest in Kenya as a representative case.

2. Methodology

2.1. The Study Area

The study was undertaken in Ol Bolossat Forest, a designated catchment protection zone for Lake Ol Bolossat and part of the larger Aberdares Ecosystem located in Nyandarua County, Kenya (Figure 1). The forest is positioned between latitudes 0°01" North and 0°05" South and longitudes 36°17" East and 36°22" East, at an elevation of approximately 2,400 meters above sea level. It is situated near Nyahururu town, on the western flank of the Aberdare Ranges. The region experiences temperature fluctuations ranging from nighttime lows of 6.0 °C to daytime highs of around 23 °C. Annual rainfall lies between 750mm and 1,500mm, with the main rainy season from April to July and a shorter rainy period occurring between November and December. Population density in the surrounding area varies from 130 to 910 persons per square kilometer [26], and the majority of residents are involved in both commercial and subsistence farming. The total forest area is approximately 3,328 hectares.

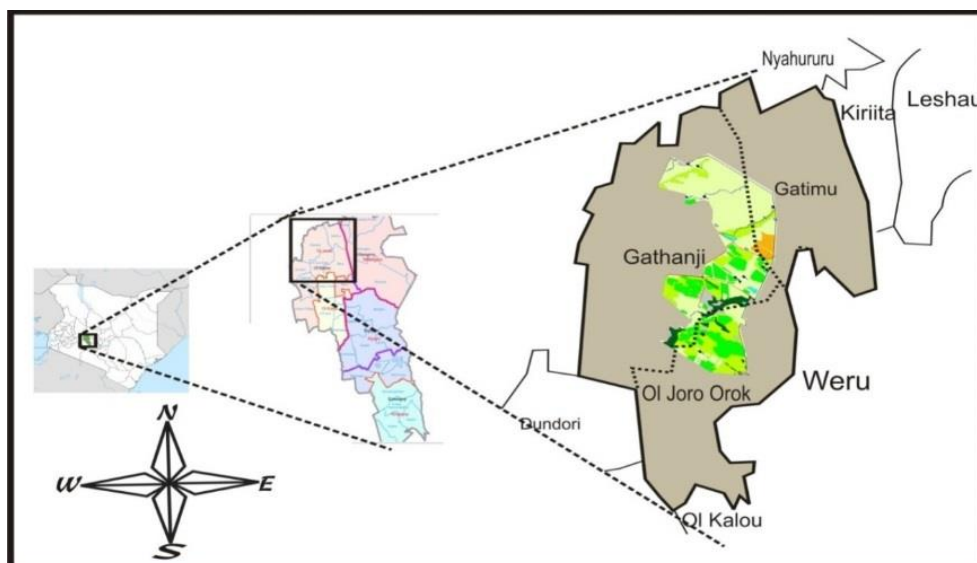
2.2. Research Design

The study adopted a descriptive survey research design [27]. This approach is typically used to gather information from members of a given population to assess their status concerning one or more variables. It is particularly useful for generating statistical data on different aspects of a current phenomenon, often informing policy development and implementation. The selection of this design was guided by the nature of the study, which explored an existing situation namely, forest conservation and management.

2.3. Target Population, Sample Size and Sampling Technique

The study targeted the households of Ol Bolossat forest adjacent communities, and Community Forest Associations (CFA). The other respondents such as the Forest User group officials were key informants. The population adjacent to the forest was 85,825 in 15,311 households [26]. Ol Bolossat CFA

has a membership of 2,899 [28]. The distribution of households and CFAs are provided in Table 1.



Source: Department of Resource Survey and Remote Sensing; Lands at satellite image (27 Jan 2000, 169/060).

Figure 1. Map of Ol Bolossat Forest within Nyandarua County.

The sample size for the CFAs was determined by using the formula $n = \frac{z^2 p(1-p)}{d^2}$ [29].

Where: n = the desired sample size; z = the z score at the desired confidence level (i.e $z = 2.475$); p = the proportion community with positive impacts on forest management, conservation and rehabilitation ($p = 10\% = 0.1$); d = permissible marginal error (i.e the level of statistical significance, set at $\alpha = 0.05$). Using the values of z , p and d , the value of n was

computed as:

$$n = \frac{2.475^2 \times 0.1(1-0.1)}{0.05^2} = 220.5 \approx 221.$$

Therefore, the sample size for the CFAs was 221. The distribution of sample size of the CFAs are provided in Table 1.

Table 1. Population Distribution, and sample size of the households and CFAs in Ol Bolossat Forest Adjacent Community.

Households			CFAs		
Area (Sub-Location) ¹	Population 1	Households	CFA Units	Population	Sample size
Oraimutia	3,834	944	Bahati	500	38.1
Lesriko	7,376	1,969	Boike	700	53.4
Silibwet	13,621	3,265	Busara	350	26.7
Gathanji	7,710	1,831	Gathanji	264	20.1
Kanguo	3,577	909	Gatimu	250	19.1
Gatimu	13,600	3,675	Gikingi	235	17.9
Gikingi	9,164	2,718	Nyakarianga	200	15.2
Total	58,882	15,311	Oljoro-orok	400	30.5
			Total	2899	221

¹Source: [26]

The study utilized a combination of stratified, proportionate, and systematic random sampling techniques. Initially, stratified random sampling was applied to categorize the Community Forest Association (CFA) members into eight distinct units. Within each of these strata, proportionate sampling was then employed to determine the number of respondents selected from each unit. At the final stage, systematic random sampling was used to draw participants. This involved organizing the list of potential respondents in a systematic order and selecting every *n*th individual from the sampling frame. This method ensures that all members of the population have an equal opportunity of being included in the sample.

2.4. Data Collection Tools, Validity and Reliability

The study used primary data collection methods to obtain information from the sampled units. The data sources included using oral interviews, structured questionnaires and content analysis. The researcher also strengthened the response from the questionnaires and interview schedule using response from the key informants.

Validity is the accuracy and meaningfulness of inferences obtained from the research instrument [30]. Expert judgment was used to ensure validity of the instrument [31] where experts are asked their opinion on whether the intended concept is measured by an instrument.

2.5. Methods of Data Collection

The study was conducted in two phases; the first one was a Comprehensive Participatory Rural Appraisals (PRAs) comprising of interview with the CFAs complemented with the user group officials. The second phase was questionnaire survey among the households'. A total of 221 members of the Community Forest Association (CFA) were selected from a population of 2,899 members across the eight units. The primary approach involved interviewing the head of each household. In cases where the household head was unavailable, a spouse or an adult child (aged 18 years and above) was interviewed as an alternative. In the second phase of data collection, key informant interviews were conducted to complement and validate the information gathered through questionnaires and household interviews.

2.6. Data Analysis

Data were analyzed descriptively, which involved the use of means $\pm$ SD and frequency distributions for categorical data sets. Descriptive analysis therefore, gave general description of the collected responses.

3. Results and Discussion

3.1. Response Rate

A sample size of 202 interview guides were dully answered and used for the analysis. The duly filled and returned interview guides represented a response rate of 91.4%. A response rate of 50% is adequate for analysis and reporting; a rate of 60% is good and a response rate of 70% and over is excellent [32]. Therefore, for this study, the response rate of 91.4% was excellent for analysis and reporting.

3.2. The Socio-economic Characteristics of the Respondents

The socio-economic characteristics of the respondents are shown in Table 2. The result shows that there was a higher number of male-headed households as compared to female-headed households. This was not surprising since in African society, most of the households are headed by males who are in charge of the land resources. The result of the current study compares well with gender differences in Eastern and Western regions of Kenya where 77% of the households are male headed compared to female headed households [33]. The current study agrees with several other studies on the gender composition of farming communities in the Sub Saharan Africa. These include findings by Adisa and Adekunle (2010) who found that males were 70.3% and female = 29.7 in North Central Nigeria. In Free State South Africa, [34], found that male were 87.6% and female 12.4%. In three Regions of Northern Ghana, a study by Adams and Ohene-Yankyer (2014) found that males were 71.5% and female = 28.5%.

Most of the respondents were older (>55 years) which is line with age structure of many household whose households heads are often older. The current finding may indicate that a higher proportion of farmers were old due to the possible migration of the youths to towns to look for better opportunities at the expense of farming [35]. The high number of older farmers population may also be related to the fact that land ownership is quite hard for young people to acquire [36]. The current results are in convergence with other study findings such as those of [37] who found that the mean age among farmers in Tigania East Sub-County in Meru County was 46 years. Further, Abot, (2020) and [38] found the mean ages of livestock farmers to be 44.8 years and 45.4 years in Kajiado and Makueni counties, respectively. The current results also converge with the mean age of 46 years for ruminant farmers in Northern Ghana [39], and 47 years dairy of farmers in Mekelle, South Africa [40].

The majority of household heads in the study area had attained education up to the primary school level. These results imply that there were low levels of literary among farmers in

the study area. Kenya has a literacy level of 78% where 54% have secondary education [41]. The high proportion of primary-level education in the current study concurs with other studies that have determined that the majority of Kenyan farmers often drop out of primary or secondary schools to concentrate on farming activities [42].

The occupations of the household heads considered in this study area were farmers, followed by business, while casual workers were few. This result agree with a study among farmers in Nakuru and Nyandarua counties who reported that 81.1% depend on farming as the main source of income [43], as well as with another study where 70% of small scale farmers in Rift Valley province in the Kenyan highlands were full time [44]. The results also compare well with farmers in Free State in South Africa [34] found that the main occupation for 77.2% of the respondents was farming, while 12.8% were employed and 10% were doing business. In Boditti, South Ethiopia, the majority of the small-scale farmers' occupation were farming activities (48.5%), government works (25%) and traders (16.7%) [45].

The study found that most of the household had sizes ranging from sizes range from 2 to 4, which is lower than 5

provided by the provincial and national average family size of 5 members in Kenya [46]. This result also compares well with a study finding by [47] that was conducted in Kiganjo Sub-location in Kiambu and found the mean size to be 4 members, as well as in Mbeere District of Eastern Kenya which had a household size of 4 members [48].

The results for the annual farmer income were 51 to 100 USD. Although it is often difficult to compare the income of farmers across different countries due to constant fluctuation of the rate of exchange, and cost of living, the current average income levels compares well with farmer income in several regions in Kenya such the research findings by Otieno *et al.* (2021), who found that the income levels of farmers was 60 USD in Nakuru. Similar findings to the current study was reported by Ouma *et al.* (2004) while studying the socio-economic dimensions of smallholder management in Kenya and found that the mean household income was 55 USD in Kisii and Rachuonyo Districts. The current farmer income levels were however, lower than in other studies done in Kenya where income level among farmers was 121 USD during a KIPPRA household survey [49], 165 USD in Kangema, Murang'a County [50].

Table 2. Socio-Economic Characteristics of the Respondents.

Socio-economic Status	CFAs	
	Frequency	Percent
Male	105	52.0
Female	97	48.0
Total	202	100.0
Age		
16-25	6	3.0
26-35	40	19.8
36-45	45	22.3
46-55	51	25.2
>55	60	29.7
Total	202	100.0
Level of Education		
Primary	107	53.0
Secondary	72	35.6
Tertiary	23	11.4
Total	202	100.0
Occupation		
Farmers	171	84.7
Business	20	9.9
Casual worker	11	5.4

Socio-economic Status	CFAs	
	Frequency	Percent
Total	202	100.0
House hold size		
<2	13	6.4
2 - 4	97	48.0
5 - 6	62	30.7
7 - 10	21	10.4
> 10	9	4.5
Total	202	100.0
Income per month (USD)		
Less than 20	29	14.4
20 - 50	44	21.8
51 - 100	66	32.7
101-200	34	16.8
201-500	20	9.9
>500	9	4.5
Total	202	100.0

3.3. Local Structures in Community Participation

In this study, local structures referred to organizations or groups mandated to carry out various activities within communities adjacent to the forest. These included the Community Forest Association (CFA) of Ol Bolossat Forest, user groups, and the Forest Level Management Committee (FLMC). The operations of these entities were assessed based on their approaches to facilitating community participation in the implementation of Participatory Forest Management (PFM). However, particular emphasis was placed on the presence and function of CFAs, especially in relation to their role in forest conservation and management. The findings related to these aspects are presented in the following sub-section.

3.3.1. Community Forest Associations (CFAs) and User Groups

The study revealed that 75.8% of the surveyed households were active members of the Ol Bolossat Community Forest Association (CFA). Drawing from key informant interviews, the forest governance structure within the Ol Bolossat CFA was reconstructed and is illustrated in Figure 2. User groups have been institutionalized as part of efforts to strengthen forest management, uphold ecological integrity, promote

conservation, and enhance protection, production, and sustainable utilization of forest resources. The CFA is overseen by an executive committee composed of five members, which serves as the principal decision-making body. This committee is part of a broader 15-member management structure that includes leaders drawn from various user groups operating at the grassroots level.

Activities of the User Group Registered Members in Ol Bolossat CFA are summarized in Table 3. A significant proportion of the members were part of CFAs engaged in activities such as cultivation under the Plantation Establishment and Livelihood Improvement Scheme (PELIS), livestock grazing, and firewood collection. Over the past fifty years, there has been a substantial increase in the local demand for forest-based resources, including timber, food, fuel, medicinal plants, fodder, and materials for construction [51, 52]. PELIS previously known as the Shamba system or Taungya is an adapted approach to non-residential cultivation used in the establishment of forest plantations [53, 54]. It involves planting plantation tree species in combination with food crops in forestland over a defined period of time in exchange for cheap labour for planting and tending the tree plantation [53, 55]. By allowing farmers to utilize the forest land for cropping while tending for the young plantations during establishment potential land use conflicts with local communities that rely on forestland for their subsistence needs are

minimized. The adoption of PELIS system also confers the forest adjacent communities the moral obligation to of forest management [56]. Based on insights gathered from key informant interviews, the programmed cultivation method has

been shown to enhance the survival rate of tree seedlings to approximately 85%. In addition, the proportion of user groups dedicated to grazing and firewood collection was estimated at 25% and 23%, respectively.

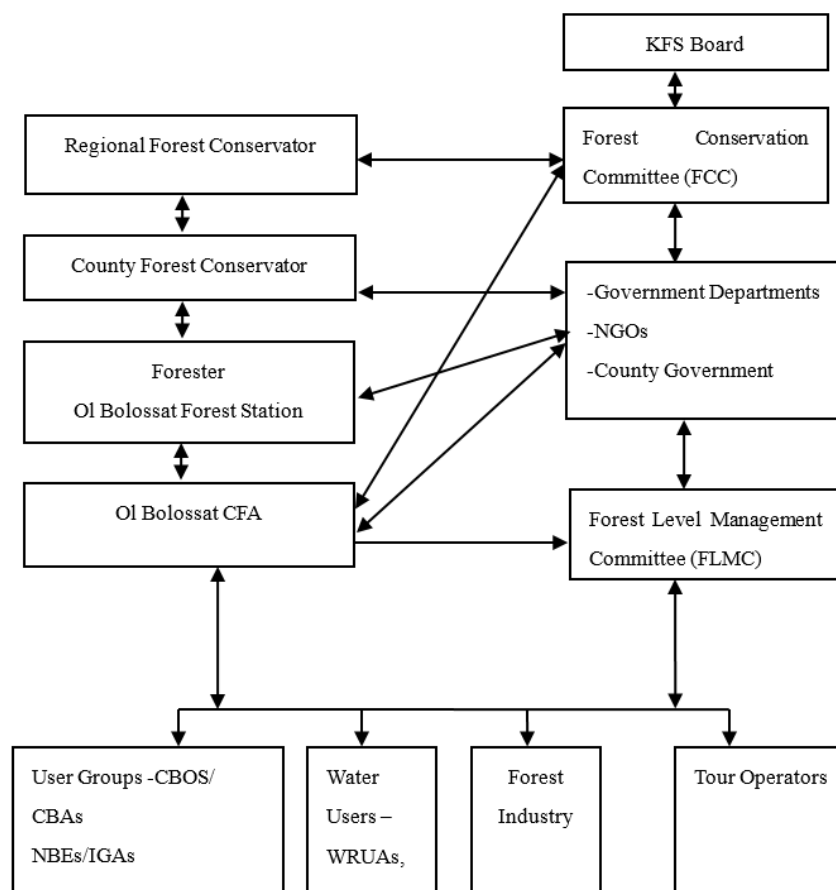


Figure 2. Reconstruction of Ol Bolossat CFA Institutional Arrangement Organogram.

Table 3. Activities of the User Group Registered Members in Ol Bolossat CFA.

User Groups Registered Under CFA	Respondents	Percent%
Cultivation PELIS	71	35.1
Grazing	51	25.2
Firewood collection	46	22.8
Grass cutting	13	6.4
Tree nursery seedlings production	11	5.4
Bee keeping & other NBEs	10	5.0
Total	100	100

Table 4 presents the range of products accessed through the activities of various user groups. The results indicate that food production improved considerably among members engaged

in PELIS. This increase was primarily due to the ability of households to grow crops within PELIS plots, thereby boosting household food supplies. Members also reported

deriving additional benefits from resources such as fodder and firewood-findings that are consistent with those of earlier studies [20, 57, 58]. Furthermore, in an effort to enhance

forest restoration and rehabilitation, some CFA members established a user group specifically focused on producing tree seedlings through community-run nurseries.

Table 4. Products Derived from Existence of Various User Groups.

Products obtained from forest	Respondents	Percent%
Food through PELIS cultivation	68	33.7
Fodder for livestock	56	27.7
Firewood	45	22.3
Poles and posts	21	10.4
Timber	12	5.9
Total	202	100

3.3.2. Participatory Forest Management Plans (PFMPs) and Forest Governance

Significant progress in forest governance and adherence to rule of law was observed at Ol Bolossat Forest, with local communities rating governance efforts very positively. Ac-

cording to key informant interviews, the most prominent indicator was public participation, cited by 29% of respondents, followed by equity and inclusiveness in decision-making at 20%. The overall responses by CFA members on key governance indicators are summarized in Table 5.

Table 5. Forest Governance Indicators.

Forest Governance Indicators	Respondents	Percent
Community Engagement	58	20.3
Fairness, Representation, and Shared Benefits	41	12.9
Adherence to Legal Framework	26	12.4
Agreement-Driven Decision Making	25	10.4
Sound and Resource-Efficient Administration	21	6.4
Timely and Adaptive Decision Making	13	5.0
Openness	10	4.0
Accountability	8	100
Total	202	20.3

The most prominent indicator of forest governance identified in the study was community participation, followed closely by equity, representation, and benefit sharing. These aspects have also been highlighted in other related studies [59]. According to senior forest officers, the implementation of capacity-building programs played a vital role in enhancing governance practices. These programs strengthened key governance elements such as responsive and timely deci-

sion-making, responsibility and answerability, efficient and sustainable administrative practices, and various leadership initiatives including orientation sessions on transformative and servant leadership. Through these efforts, leaders were equipped with a clearer understanding of their roles, duties, and accountability frameworks in forest leadership.

Aligned with the provisions of the Forest Conservation and Management Act 2016 and the Forest Status Report 2024

(KFS, 2024), more than 70 Participatory Forest Management Plans (PFMPs) are currently active, 49 are under different stages of review, and 57 have expired, including those developed for major forest stations such as the Ol Bolossat Forest Station.

The study also examined the structure and function of forest-level governance mechanisms, particularly the Forest Level Management Committee. This committee supports Community Forest Associations (CFAs) in the execution, monitoring, and assessment of the community forest management agreements. Its membership includes the Forest Station Manager, a Kenya Wildlife Service Warden, and representatives from the national government, water, agriculture, and livestock departments, as well as the executive committee of the Ol Bolossat CFA. However, the implementation of Participatory Forest Management (PFM) was found to be hampered by governance and organizational capacity gaps within some CFAs.

Additionally, sustainable forest management activities were observed to encourage public-private partnerships aimed at restoring degraded areas, engaging in carbon credit trading, and promoting eco-tourism. Communities around Ol Bolossat Forest had organized into formal groups and associations, which significantly increased their voice in local and national decision-making platforms. These collective bodies have played a pivotal role in developing benefit-sharing frameworks by integrating community perspectives into regulations, procedural rules, and the formulation of subsidiary legislation.

3.3.3. Community Action Plans (CAPs)

The study found that the Community Forest Association (CFA) at Ol Bolossat had developed a Community Action Plan (CAP) aligned with their Participatory Forest Management Plan (PFMP), which was officially launched on 26th May 2010. Subsequently, a five-year Community Forest Management Agreement (CFMA) was negotiated and formally signed on 5th October 2011, officially designating the Ol Bolossat Forest as a Participatory Forest Management (PFM) area (KFS, 2011). These foundational documents serve as a guide for preparing the Annual Work Plans and Budgets (AWP&B), which are used in the implementation of forest conservation, protection, and management activities in collaboration with the Kenya Forest Service (KFS) and other relevant stakeholders.

Formulating CAPs for forest stewardship is essential in fulfilling the objectives of the Kenya Constitution (2010), particularly those related to environmental governance, and also aligns with global targets such as the United Nations' recommendation of achieving a minimum 10% tree cover. The study also examined individual involvement in the functioning of local forest governance structures. Participants were first asked whether they had ever engaged in forest management or conservation activities. Among CFA members, 82% reported active involvement in forest conservation efforts. These findings indicate a substantial level of community

engagement in managing and preserving the Ol Bolossat Forest. The high rate of participation was largely attributed to the perceived tangible benefits accrued through involvement in PFM. In fact, 97.4% of the respondents acknowledged receiving benefits from their participation in forest-related activities under the PFM framework.

4. Conclusions

This study examined the adoption of Participatory Forest Management (PFM) among communities residing near the Ol Bolossat Forest. In assessing different elements of PFM, the research identified local structures as organizations or groups designated to carry out activities within the forest-adjacent communities. These included the Ol Bolossat Community Forest Association (CFA), user groups, and the Forest Level Management Committee (FLMC). Notably, 75.8% of households reported active membership in the Ol Bolossat CFA. The user groups were established to enhance forest governance by promoting sustainable practices in forest conservation, protection, production, and utilization.

A significant proportion of CFA members engaged in activities such as the cultivation of crops under the Plantation Establishment and Livelihood Improvement Scheme (PELIS), livestock grazing, and firewood collection. Benefits derived from participation in these user groups included increased food security, access to livestock fodder, and firewood for household use.

Regarding forest governance, the study found that public participation was the most frequently cited element, accounting for 29% of responses, while equity and inclusiveness in decision-making followed at 20%. The most significant governance indicators identified were community involvement, and equitable sharing of benefits and inclusion. Additionally, the Forest Level Management Committee played a key role in supporting CFAs by overseeing the implementation, monitoring, and evaluation of community forest management agreements.

The results also indicated that a majority of individuals in the surrounding communities actively engaged in the management and conservation of Ol Bolossat Forest and, in turn, reported receiving substantial benefits from their involvement in PFM activities.

There is a clear need for enhanced training and capacity building for community members, particularly in the areas of value addition, processing technologies, and marketing of Non-Wood Forest Products (NWFPs). Providing economic incentives can help foster the growth of nature-based enterprises. Equipping members of the Ol Bolossat CFA with knowledge on group dynamics, governance, transparency, and accountability in participatory natural resource management will contribute to improved forest stewardship.

To ensure sustainable use of natural resources, forest-adjacent communities must derive meaningful economic benefits through value addition chains. Moreover, increasing

awareness about local forest governance structures, PFM-related enterprises and activities, and conservation policies is essential in addressing the challenges and leveraging opportunities for effective PFM implementation.

Abbreviations

PFM	Participatory Forest Management
CFA	Community Forest Association
FLMC	Forest Level Management Committee
PELIS	Plantation Establishment and Livelihood Improvement Scheme
SFM	Sustainable Forest Management
PFMP	Participatory Forest Management Plan
PRAs	Participatory Rural Appraisals
SD	Standard Deviation
USD	United States Dollar
KIPPR	Kenya Institute for Public Policy Research and Analysis
KFS	Kenya Forest Service
CFMA	Community Forest Management Agreement
CAP	Community Action Plan
AWP&B	Annual Work Plans and Budgets
NWFPs	Non-wood Forest Products

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Author Contributions

Benjamin Kinyili is the sole author. The author read and approved the final manuscript.

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Data Availability Statement

The data is available from the corresponding author upon reasonable request.

Conflicts of Interest

The author declares no conflicts of interest.

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