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Understanding forest users' participation in participatory forest management (PFM): Insights from Mt. Elgon forest ecosystem, Kenya

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ABSTRACT

Participation of local communities in forest management decision-making has been promoted as a mechanism of improving livelihoods and forest conditions, yet the level of participation in many programs remains low. Using data from a cross-sectional survey of 924 forest-dependent households in Western Kenya, we examine the factors that support or constrain forest dependent people's participation in a Participatory Forest Management (PFM) program. We run a probit model to assess households' choice to join PFM and then compute a Participation Index (PI) for forest users' participation across different stages of the PFM program – planning, implementation and Monitoring and Evaluation (M&E). The determinants of participation are then analyzed using the fractional regression approach. Results show that over half (52%) of the respondents participated in PFM. While vulnerability to shocks, being in a farmers' group, a household's access to the forest within the previous 12 months and access to extension were associated with the likelihood of participating in PFM, the influence of the household head's age and education, access to credit and food insecurity had a negative influence. Our results reveal PIs of 41%, 49%, and 42% at the planning, implementation, and M&E stages respectively, indicating a moderate participation level. The fractional regression model shows that transaction costs associated with access to markets, gender (being male), household expenditure and expected forest benefits positively influence household participation in PFM, while the opportunity costs associated with off-farm income, distance to the forest and lack of extension have a negative influence on participation. These results point to the need to take the household context (gender, education, household expenditure and vulnerability) into consideration during planning and implementation of the forestry programs. The implication is that forest authorities should identify and implement mechanisms to enhance benefits from forests but also reduce costs of participation, especially for women.

1. Introduction

Historically, tropical forests in most countries have been managed through centralized approaches, with state forest authorities exercising control over the access, utilization and management of forest resources (Agrawal and Gupta, 2005; Blaikie, 2006; Ribot et al., 2010). Following massive failures of centralized systems, many developing countries have experimented with some form of decentralized forest governance (Ribot et al., 2006; Lund et al., 2018). This involves a shift in forest governance towards increased involvement of local communities in the management of forests (Agrawal and Gupta, 2005; Ribot et al., 2010; Kairu et al., 2018; Lund et al., 2018). Decentralized forest management has been promoted on the basis that it can improve efficiency and equity in natural resource management (Agrawal and Gupta, 2005; Ribot et al., 2010). As a result, different forms of Participatory Forest Management (PFM) approaches have emerged through which forest authorities work together with local governments and communities to make decisions in forest management (FAO and PROFOR, 2011). PFM has been promoted as a mechanism that can improve local decision-making and enhance equitable utilization, conservation and livelihood outcomes (Agrawal and Ribot, 1999; Lund and Treue, 2008). The underlying assumption is that communities living near forests have the required incentives to manage and conserve the resources on which they depend (Ribot et al., 2010; Okumu and Muchapondwa, 2020a).

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While it is widely acknowledged that active participation of forest-dependent people will lead to greater acceptance of decisions made (Dolisca et al., 2006; Coulibaly-Lingani et al., 2011; Mbeche, 2018) and improvements in social and biophysical outcomes (Blaikie, 2006; Lund and Treue, 2008), a growing body of research shows that participation continues to be relatively low in a number of the PFM schemes in developing countries (Wollenberg, 2009; Chomba et al., 2015; Kairu et al., 2018; Lund et al., 2018). This is despite empirical evidence showing that success of conservation initiatives is largely dependent on the extent to which local people participate and benefit from forest resources (Bremer et al., 2014).The implication is that communities living near forests continue to be marginalized in decision-making and benefit sharing (Ribot et al., 2006; Mustalahti and Lund, 2009; Coulibaly-Lingani et al., 2011; Adhikari et al., 2014; Degnet et al., 2020; Apipoonyanon et al., 2020). Therefore, understanding what influences community participation is very important, not least because many rural communities globally depend on forests (Angelsen et al., 2014; Nguyen et al., 2015; Okumu and Muchapondwa, 2020a) and their livelihoods are threatened by unsustainable use of the forests.

Majority of existing studies on factors shaping participation are from Asia (Agrawal and Gupta, 2005; Wollenberg, 2009; Islam et al., 2013; Adhikari et al., 2014; Apipoonyanon et al., 2020) and Latin America (Dolisca et al., 2006; Bremer et al., 2014). The limited but emerging literature from Sub-Saharan Africa (Mustalahti and Lund, 2009; Coulibaly-Lingani et al., 2011; Tadesse et al., 2017; Degnet et al., 2020) shows low levels of local community participation in PFM. This is despite the fact that forest-adjacent communities in Africa comprise of households with limited sources of income making them dependent on income derived from the forests (Okumu and Muchapondwa, 2020a). In Kenya, the regulatory framework for PFM has been in place since 2005, yet existing studies have shown only limited involvement of local peoples in forest governance processes (Mogoi et al., 2012; Chomba et al., 2015; Mutune and Lund, 2016).

The empirical research suggests that participation varies by context and some factors such as socio-economic characteristics of local populations, resource characteristics and program design may support or constrain local people's participation in collaborative forestry programs. However, the direction of influence of these attributes remains uncertain (Bremer et al., 2014; Coulibaly-Lingani et al., 2011; Degnet et al., 2020). This may be because of differences in the way participation is measured among scholars and practitioners. Participation is commonly measured as a binary decision based on a household's choice to join a PFM program or not (Musyoki et al., 2016; Mutune and Lund, 2016). However, there is evidence to show that participation in local forestry decision-making may differ across the different stages of a forestry program – planning, implementation and M&E (Cohen and Uphoff, 1980; Islam et al., 2013; Obadire et al., 2014). There is limited literature which has disaggregated participation by the different stages (Chowdhury, 2004; Dolisca et al., 2006; Tadesse et al., 2017). As Blaikie (2006) observes, forest communities and their environments are diverse and complex. Therefore, assessing participation as a binary choice can conceal local differences for example with regard to wealth and political power. Thus, the understanding of the factors that support or constrain household participation across different stages of PFM needs to be understood in order to enhance participation of forest-dependent people.

Participation in planning entails involving local actors in decision-making, creating new rules or modifying old ones, formulating alternative planning activities and allocation of rights, responsibilities and resources among the forest management actors (Agrawal and Ribot, 1999; Chowdhury, 2004; Tadesse et al., 2017). Participation in planning allows the dynamic nature of stakeholder needs, priorities and interests to be captured and integrated throughout project implementation (Reed et al., 2009). Implementation involves bringing the forest associations into forest management activities (FAO and PROFOR, 2011). As observed by Chowdhury (2004), local people should be informed of the plans designed for their areas if they are expected to consent and to co-operate in program implementation and beyond. M&E entails assessing planning and implementation actions to determine whether desired end-points (e.g. improved livelihoods and forest condition) have been reached and aims to improve collaborative decision-making and feedback (Evans et al., 2018).

This paper addresses the gaps in the literature by analyzing the complex set of factors that interact to explain the different levels of participation across key stages of the PFM program. Kenya is an especially relevant case because little is known about the drivers of the success of PFM in the country (Okumu and Muchapondwa, 2020b). Moreover, the limited studies on PFM in Kenya (Musyoki et al., 2016; Mutune and Lund, 2016) consider participation as a binary outcome (i.e. whether households choose to participate in PFM or not) and therefore fail to specify what kinds of participation, and under what conditions they produce the desired results. In addition, there is rising forest dependence in Kenya, so strengthening participation of the landless forest-adjacent communities across different stages of PFM may help them to avoid activities that may offer short-term gains in favor of activities with long-term payoffs (Chomba et al., 2015; Okumu and Muchapondwa, 2020a). Specifically, we address the following questions; i) what are the factors influencing household membership in PFM? ii) How does participation of forest-dependent households differ across the various stages of PFM? And iii) what are the factors that influence forest households' participation at the different stages of a PFM program? Understanding the factors which support or constrain local peoples' participation is critical to improve livelihood and conservation outcomes in decentralized forestry programs. The rest of the paper is organized as follows: Section 2 outlines the context of PFM in Kenya. The methods used including the conceptual framework, data sources and estimation strategies are described in section 3. In section 4, we present and discuss the results and conclude with policy implications in section 5.

2. The context of PFM in Kenya

The legal framework for the PFM approach in Kenya can be traced back to the Forest Act of 2005 (Republic of Kenya, 2005). Subsequent forest policy documents (Republic of Kenya, 2014), including the 2015 Participatory Forest Management Guidelines (Republic of Kenya, 2015), and the revised legal framework, the Forest Management and Regulation Act of 2016 (Republic of Kenya, 2016) all reinforce the importance of strengthening local people's participation in forest governance. The Forest Acts entrench community participation through Community Forest Associations (CFAs); a CFA is a registered community organization made up of people residing adjacent to a forest (Republic of Kenya, 2005; Mogoi et al., 2012; Republic of Kenya, 2016). Consequently, there were 325 registered CFAs in the country by 2018 (Republic of Kenya, 2018). Under the Forest Acts, CFAs acquire access and user rights and responsibility of co-managing state-owned forests with the Kenya Forest Service (KFS), the agency in charge of protected forests (Chomba et al., 2015; Kairu et al., 2018). But CFAs only acquire the PFM rights and responsibilities after approval of their management plan and signing of a management agreement with KFS (Chomba et al., 2015; Thygesen et al., 2016). The management plan outlines the forest activities that the community will undertake, while the agreement confers management rights and responsibilities to the CFAs. The user rights may include the collection of non-timber forest products (e.g. harvesting of honey, poles, grass, grazing and collection of medicinal herbs) and cultivation or growing of crops on degraded forest land. These rights are accompanied with responsibilities including development of management plan, establishment of plantations, forest patrols, attending CFA meetings and payment of forest user charges (Okumu and Muchapondwa, 2020a). However, while the PFM governance framework, at least on paper, gives CFAs the right to co-manage and benefit from forests, the understanding on the circumstances under which local people participate and therefore benefit from these programs is limited.

3. Methodology

This section highlights the conceptual framework of the study, study sites and data collection approaches and the estimation strategies.

3.1. Conceptual framework

In this study, we employ a framework for analyzing incentives for community participation in resource governance, depicted in Fig. 1 (Thomson and Freudenberger, 1997; Ostrom, 1990; Adhikari et al., 2014). In the framework, incentives, which is a motivation to take a certain action (Thomson and Freudenberger, 1997) is considered to be the principle variable affecting individuals' choice to participate in resource governance. Participation in resource governance is assumed to be directly influenced by different types of incentives which include; (1) incentives related to the characteristics of the resource base (2) incentives related to the user of the resource, including community attributes; and (3) incentives related to the rules and institutional arrangements that are in place with regard to resource governance (Thomson and Freudenberger, 1997).

The characteristics of the user (e.g. age, gender, household size, level of education and household endowments) interact with the attributes of the resource base (e.g. access rights, forest condition) and the set of institutional arrangements to affect the resource governance outcomes (in our case participation). A higher level of participation is likely to be achieved if these factors interact to reduce the costs and enhance the benefits from participation (Lund and Treue, 2008; Coulibaly-Lingani et al., 2011; Mutune and Lund, 2016). The cost of participation may take the form of monetary contributions, time taken in forestry management activities, or even the distance to the forest (Ogada, 2012) while the benefits may be direct economic benefits, opportunities to socialize or provision of public goods (such as forest protection) as a result of collective efforts (Adhikari et al., 2014).

There is a wide body of literature which suggests that the socioeconomic status of an individual may limit the opportunities of participation in forestry programs and also determine the extent of transaction costs (e.g., Ogada, 2012; Adhikari et al., 2014). High transaction and opportunity costs of participation often yield low participation for the poor and marginalized. As an example, women may not participate due to high opportunity costs of time – due to high demands for productive and reproductive responsibilities (Yego et al., 2021). While education may make people more aware of the potential benefits of participating in forestry programs, it could also open up opportunities outside the village which makes members less available and less interested in participation (Adhikari et al., 2014). Okumu and Muchapondwa (2020b) who empirically study PFM participation in Kenya also provide evidence to show that higher off-farm income presents higher opportunity costs of participation and therefore reduces their interest in forest conservation. Conversely, transaction costs reflected in distances to the nearest road or market means that accessing other livelihood opportunities could be costly; hence, participation in CFA activities offers a fallback option (Okumu and Muchapondwa, 2020a; Yego et al., 2021). This is consistent with other literature showing that better access to physical capital such as paved roads can lower engagement with forest-based livelihood (Zenteno et al., 2013; Ofoegbu et al., 2017).

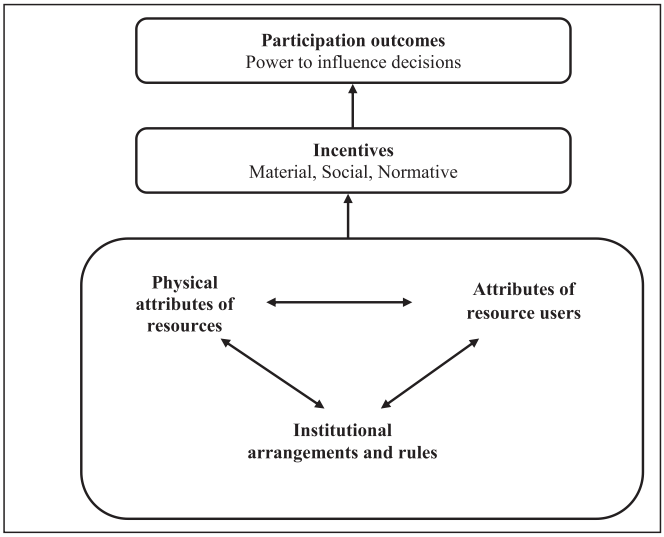

Fig. 1. Framework for analyzing incentives for community participation in resource governance (Ostrom, 1990; Thomson and Freudenberger, 1997; Adhikari et al., 2014).

The characteristics of a resource may also provide positive or negative incentives for participation. The ownership of private woodlots may imply interest in environmental conservation activities or a search for options other than farming (Waruingi et al., 2021). Similarly, a greater forest cover can reduce the incentive of participating in conservation activities. As Okumu and Muchapondwa (2020a) note, when the forest cover or condition is good, there is an abundant supply of forest ecosystem services and hence no incentive for communities to self-organize and conserve the forest. Conversely, distance to the forest may present higher opportunity and transaction costs and therefore limited participation in forest conservation (Ogada, 2012). The nature of institutional arrangements – defined as a set of rules that determine the level of actions by communities – are also critical in supporting or dissuading participation of users in resource governance.

The institutional arrangement includes rules which define resource utilization, collective decision making and those that define the right to membership and leadership structure (Ostrom, 1990). Literature suggests that participation in forest governance is likely to be higher when local people's rights to access resources are not curtailed (Adhikari et al., 2014). There is also evidence to suggest that incentives for collective action and access to information (e.g. through extension) have an influence on participation. Forest user groups act as a space to enlighten members on the value of sustainable forest conservation and therefore enhance participation (Bremer et al., 2014), Additionally, participation in group meetings supports the creation of trust and confidence among the participants in collective decision-making which has a positive influence on participation (Luswaga and Nuppenau, 2020).

The incentives for participation in resource governance framework proposes a long list of potential determinants for participation in resource governance (Thomson and Freudenberger, 1997; Adhikari et al., 2014: Tadesse et al., 2017; Okumu and Muchapondwa, 2020b). We however, concentrate on some of the key variables whose significance has been highlighted in most recent theoretical and empirical literature (discussed above), as well as some intervening variables at household and community level. The variables from the framework employed in the study are presented in Table A1 in the Appendix. The table presents the grouping of the variables we employed in the empirical models, a description of these variables, how they are measured, and their expected signs.

We conceptualize that participation in PFM happens in two phases: The choice to register in a CFA and the decision to participate at the different stages of the program. Following the classical works of Cohen and Uphoff (1980) and more recent literature (Chowdhury, 2004; Tadesse et al., 2017), we conceptualize that the incentives for participation at the different stages of the forestry program – planning, implementation and evaluation – may vary, resulting in different outcomes. This may be because individuals who choose to engage in certain program activities may decide not to participate in others (Segerstedt and Grote, 2016). Based on a review of literature (e.g. Tadesse et al., 2017), 24 indicators to measure participation were constructed and validated through focus group discussions (FGDs) with local communities. Broadly, indicators for participation at the planning stage measured local people's decision making on forest boundary

demarcation, extraction of forest products, election of officials, development and approval of management plans and setting up of forest charges. The indicators at the implementation phase assessed involvement of local people in key CFA activities, including reforestation of degraded lands, planting trees, bee keeping, enforcement of forest rules and involvement in Plantation Establishment Livelihood Incentive Scheme (PELIS) – a program which allows local communities to grow crops on allocated degraded forest plots while establishing tree seedlings (Kenya Forestry Research Institute – KEFRI, 2014). The key indicators at M&E included follow-up on forest management by-laws, management plans, auditing of CFA expenditure and involvement in CFA annual general meetings (Table A2 in Appendix).

3.2. Description of study sites and data collection

3.2.1. Study sites

The study was undertaken in the Mt. Elgon forest ecosystem which lies on the border between Uganda and Kenya along longitude 01° 07′ 06″ N and latitude 34° 31′ 30″ E, (KEFRI, 2018). Mt. Elgon forest ecosystem was selected because of its high levels of forest dependence, a history of communal forestry and degradation of forest resources (Yego et al., 2021). The Kenyan side of Mt. Elgon falls between Bungoma and Trans-Nzoia Counties in Western Kenya and comprises of large protected areas, including a forest reserve (73,705 ha) under the management of the Kenya Forest Service, a national park (16,916 ha) which is managed by the Kenya Wildlife Service and a nature reserve (17,200 ha) managed by Bungoma County Government (County Government of Bungoma, 2018). The ecosystem has eight (8) CFAs evenly spread across the study area which can provide lessons for the promotion of PFM in the country. The lower parts of Mt. Elgon ecosystem are inhabited by local communities whose main economic activities are mixed farming, especially dairy farming and crop production (County Government of Bungoma, 2018; County Government of Trans Nzoia, 2018). Mt. Elgon is also one of Kenya's five 'water towers' – an upland area which is a source of many rivers and springs. The other water towers are Aberdare range, Mt. Kenya, Cherangani hills, and Mau Complex forests. Data were collected from communities in three forest stations – Kaberwa, Saboti-Sosio and Kimothon (Fig. 2).

3.2.2. Data collection

The study was conducted in two phases – an in-depth qualitative exploration which involved FGDs and key informant interviews (KIIs). The objective in this phase was to develop a broad understanding of the structure of the PFM program and the nature of participation in CFA activities. Specifically, data were collected on the different actors in PFM, process of joining CFA, the various activities conducted by CFA members and the factors that support or dissuade local people from participating in CFA activities. In total 30 FGDs were conducted in August and September 2018 each lasting 2–3 h. The information collected from FGDs were analyzed based on the identified themes and was also used to validate the survey tool. Participants in FGDs were identified with the help of CFA leaders and local forest officers. In addition, 15 key informant interviews with forest officers, leaders of the CFAs and local government officials were conducted to get a broad understanding of the PFM program and to triangulate survey data. This qualitative phase was also useful in informing the design of the sampling approach for the survey.

The second phase of data collection employed a three-stage procedure to collect survey data. At the first stage, three[1] forest stations – Kaberwa, Saboti-socio and Kimothion – were purposively selected to represent the different administrative areas across the Mt. Elgon catchment. At the second stage, we purposefully sampled 30 villages falling within the boundaries of the selected forest stations.[2] We then worked with village elders to generate lists of households in each of the selected villages. During the last stage, 20–35 households were randomly selected proportionate to the village population. In total, 924 forest-dependent households proportionate to the village's population were interviewed (Fig. A1 in Appendix). The field survey to collect the data took place between November 2018 and January 2019. In order to assess the determinants of household choice to participate in PFM program, the questionnaire contained information on household choice to register in CFA and a set of variables representing household and institutional characteristics. The questionnaire also contained 24 indicators used to measure levels of participation across different stages of the PFM program. Following our conceptual framework, the questionnaire had items which were hypothesized to influence the level of household participation in the PFM program. These include: characteristics of the user (e.g. age, gender, household size, level of education and household endowments), attributes of the resource base (e.g. access rights, forest condition) and institutional characteristics (e.g. access rights, membership in groups and access to extension).

3.3. Estimation strategy

A three -step strategy was adopted in meeting the objectives of the study. First we estimate the determinants of a household's choice to become a CFA member, and then proceed to assess the local peoples' level of participation at the different stages of a PFM program. In the third stage, we examine the factors influencing participation across the stages.

3.3.1. Assessing forest-dependent household's choice to participate in PFM program

Participation in PFM is based on registering as a member in a CFA through payment of a one-off fee of KES 1500 (US$15) by 2019. In order to assess the factors influencing the household decision to join a CFA (D_i), we estimate the empirical model specified in Eq. 1.

$$D_i = \Phi\left(\beta_0 + \sum_{j}^{k} \beta_j Z_j\right) + \varepsilon \quad (1)$$

where, Φ(.) is the standard normal cumulative density function, β_j are the parameters to be estimated and Z_j is a vector of household and resource characteristics and other institutional arrangements hypothesized to affect the household decision to join a CFA program. The model was estimated using a probit specification based on the distributional assumptions about the error term (ε).

3.3.2. Assessing the level of local peoples' participation in the PFM program

We measured the levels of participation in PFM using a participation index computed using 24 participation indicators (ten indicators for planning CFA activities; seven indicators for implementation of CFA activities and seven indicators for participation in monitoring CFA activities). Following Pretty (1995), we employed a three-point Likert scale to rate the indicators, with 1 = low (I have never been involved), 2 = medium (I have been involved occasionally) and 3 = high (I am regularly involved). The indicators were used to calculate a participation index (Eq. 2), following Bagdi and Kurothe (2014) and Tadesse et al. (2017).

$$P_i = \frac{1}{K}\sum_{i=1}^{M} PS_{ij} \quad (2)$$

[1] KFS manages of the eight forest stations in Mt. Elgon forest ecosystem; three in Bungoma County and five in Trans-Nzoia. A forest station is considered as a governance structure through which KFS interacts with local communities and therefore is a unit through which one can assess forest governance.

[2] According to the PFM rules of 2015, a household must be living within 5 km radius of the forest boundary to be eligible to be a CFA member.

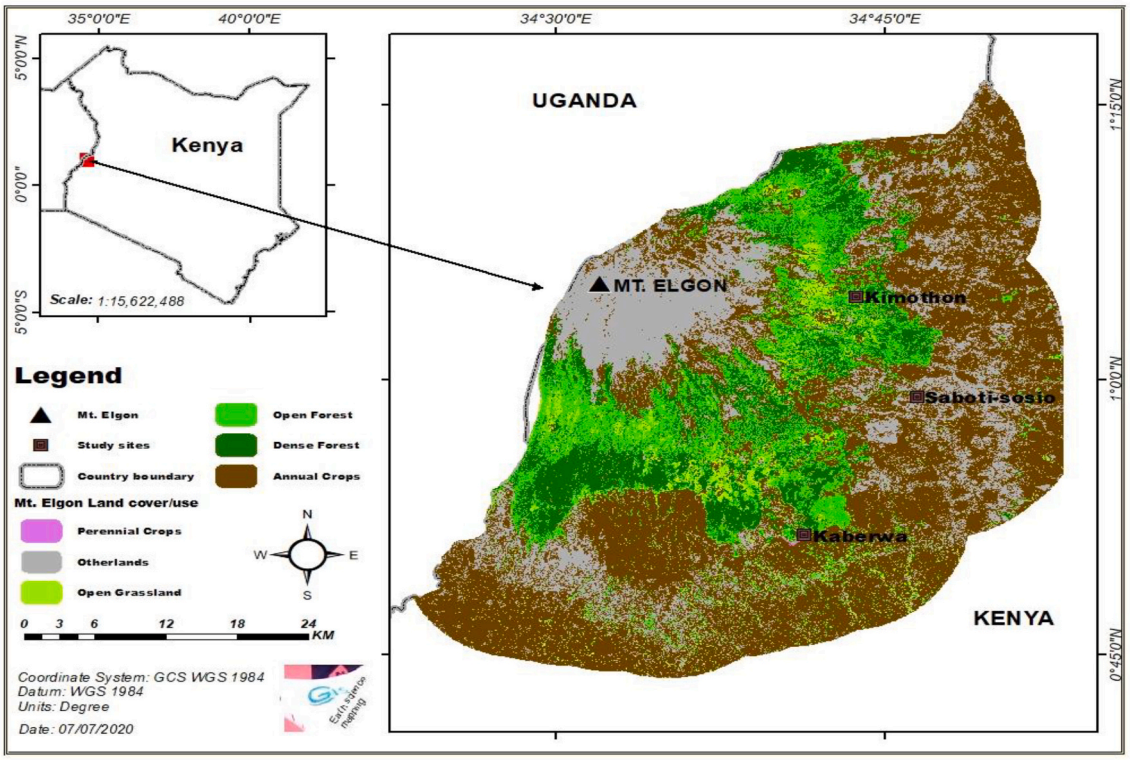

Fig. 2. Map of study area.

where P_i is the participation index for ith respondent; PS_{ij} is the score of jth item for ith respondent; K is the maximum participation score.

For robustness checks, we used Principal Component Analysis (PCA) to construct an index of participation across the three different stages of PFM, based on the responses of the 24 participation indicators.

3.3.3. *Assessing determinants of participation in PFM program*

To assess the factors that influence participation in PFM, we employed the fractional regression model (FRM) (Papke and Papke and Wooldridge, 1996). The model is appropriate for analyzing the estimated participation scores given their fractional nature and the fact that they are typically bounded within the unity interval [0,1] (Wooldridge, 2010). The FRM specification shown in Eq. (3) keeps the conditional mean of the estimated indices within the unit interval and therefore represents an appropriate approach to modelling participation in PFM (Ramalho et al., 2010).

$$E(P_i|X) = g(X\beta) \tag{3}$$

where, the vector X contains variables assumed to influence participation and $g(.)$ is some nonlinear function satisfying the condition that $0 \leq g(X) \leq 1$ for all $Z \in R$ (Papke and Papke and Wooldridge, 1996). In order to assess robustness of the results, alternative participation indices across the PFM stages were generated through PCA and then regressed against the covariates contained in X (see Eq. 3). The results are presented in Table A3 in Appendix.

4. Results and discussion

4.1. *Household choice to join Community Forest Association*

Table 1 compares CFA members and non-members in terms of household, resource and institutional characteristics. The *t*-test reveals that there are statistical differences between the two groups on most of the household, resource and institutional characteristics. CFA households have relatively younger heads and more members. In addition, they participate more intensely in collective action (group membership). But they have a higher exposure to shocks, lower levels of education, off-farm income and overall household expenditures. While women participation is promoted within PFM, the results show that significantly less female-headed households participated in PFM. Most household heads in the sample belonged to the indigenous ethnic group Sabaot, but other ethnic communities, including the Luhya, Kikuyu and other Kalenjin sub-groups have migrated into the area. The data also reveals that participants have lower asset values and a higher food insecurity experience score (FIES).

The probit results in Table 2 reveal that participation is significantly related to the age and gender of the household head, education, level of vulnerability (shocks and food security) and various variables representing institutional arrangements (membership in farmers' group, access to the forest, extension and credit). Educational attainment has a negative association with the household's decision to take up CFA membership. This may be explained by the fact that having higher levels of education increases the probability of accessing alternative livelihood options. Other studies have also found lower forest dependence among households with higher education (e.g. Jumbe and Angelsen, 2007). These results were corroborated with FGDs about the reasons for not joining CFAs. A lack of transparency in utilizing registration and other fees collected by CFA officials and inability to afford cash payments were identified as most important reasons.

Table 2 also shows that resource characteristics do not have a significant influence on the decision to join CFA. FGDs and KIIs all revealed that non CFA members can still extract forest products upon payment of required charges and fees. For example, local people are required to pay Ksh 100 (US$ 1) per month for each animal grazed in the forest or Ksh 100 per month for a daily head lot of firewood per month irrespective of

Table 1
Description of CFA membership groups.

Full sample (N = 924)			CFA member (N = 467)	Non-CFA member (N = 457)	Statistic
Variable	Mean	SD	Mean	Mean	T-value
Household context					
Gender	0.12	0.33	0.09	0.16	3.06**
Age (years)	46.42	13.60	44.92	47.95	3.40***
HH Size (Number of members)	6.17	2.19	6.44	5.89	3.83***
Land Size (acres)	1.66	6.63	1.32	1.98	1.36
Occupation: None (Yes =1)	1.13	0.42	1.12	1.13	0.19
Occupation: Farming (yes = 1)	0.01	0.12	0.01	0.01	0.24
Other occupation (yes =1)	0.90	0.30	0.90	0.89	
Education (None)	0.01	0.10	0.01	0.01	0.37
Primary (yes =1)	0.66	0.47	0.66	0.65	0.31
Secondary (yes =1)	0.31	0.46	0.31	0.30	0.64
Tertiary (Yes =1)	0.03	0.17	0.01	0.04	2.44**
Ethnic group (Sabout)	0.78	0.42	0.82	0.73	3.03
No. of Children	3.21	1.89	3.45	2.96	3.91***
Wealth Index	0.00	1.00	0.12	−0.12	3.70***
Distance to market (km)	3.14	2.86	3.40	2.87	2.80**
Distance to road (km)	14.11	8.47	14.59	13.61	
Asset value (Kes)	28,785.47	114,915.60	27,209.7	30,395.8	0.42
Log Asset value (Kes)	9.21	1.77	9.37	9.04	2.81**
Shocks value (Kes)	38,700.64	64,594.88	41,921.4	35,070.58	1.47*
Log of Shocks (Kes)	8.19	3.83	8.68	7.69	3.94***
Total income (Kes)	106,660.30	165,328.60	114,028.90	99,113.1	1.37*
Log of farm Income (Kes)	5.70	5.39	5.17	6.23	2.99***
Share of forest income (%)	14.99	40.55	27.72	1.96	16.74***
Total Expenditure/year (Kes)	141,884.10	93,117.41	148,809.00	134,776.6	2.29**
FIES (score)	4.66	3.22	4.28	5.04	3.64***
Food expenditure (Kes)	1164.45	787.24	1209.48	1118.33	1.76**
Resource characteristics					
Perceived forest benefits	0.46	0.50	0.81	0.11	29.50***
Firewood collection (yes =1)	0.49	0.50	0.60	0.38	6.67***
Distance to forest (km)	2.58	2.36	2.63	2.53	0.61
Institutional arrangements					
Extension Access (Yes = 1)	0.52	0.50	0.60	0.43	5.12***
Membership in group (yes = 1)	0.56	0.50	0.78	0.32	15.85***
Forest access (%)	79.28	34.98	97.41	60.70	15.36***
Access to credit (%)	14.25	34.98	14.19	14.32	0.0535

* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

whether they were CFA members or not.[3] As observed by Adhikari et al. (2014), characteristics of a resource which do not limit benefits to only the registered members can dissuade participation in PFM. Some community members mentioned in the FGDs that they had joined CFAs as a mechanism of reducing conflicts in the area. The Mt. Elgon area has experienced sporadic conflicts between communities living in the area often associated with extraction of forest resources (Petursson et al., 2013).

4.2. Participation across the stages of PFM programs

Table 3 presents findings on forest users' participation across the three key stages of a PFM program (planning, implementation and M&E). Overall, the results show a mean participation index of 44% which varies from a low of 41% at monitoring to a high of 49% at implementation. This level of participation reported here is much lower than in other countries (Dolisca et al., 2006; Tadesse et al., 2017; Adams et al., 2017). KIIs indicated that the low level of participation could be explained by the fact that the execution of forest plans in Kenya face severe funding constraints in the context competing financing needs and declining fiscal allocations for conservation in many developing countries (Kairu et al., 2018).

The results show a mean participation index of 41% during planning which is medium (greater or equal to mean and standard deviation). However, there is a high variability of PIs in planning ranging from a low of 37 to a high of 50. While there are higher levels of participation for PFM promotional activities such encouraging others to participate (PI of 50), there are low levels of participation for critical activities such as preparing the forest management plan, getting approval of the plan and developing forest management by-laws (below the mean). FGDs revealed that many community members were not even aware of the existence of management plans. This observation was corroborated by interviews with forest officers who indicated that they are not able to involve forest users in development of management plans due to lack of resources, an observation that is consistent with Kairu et al. (2018). The low levels of participation in planning could also be explained by low education attainment among forest-adjacent communities. Our data shows that over 65% of the respondents had primary level education which would make them prone to elite capture (see also Okumu and Muchapondwa, 2020a). Elsewhere, low participation in planning of forest management activities has been associated with limited support for the plans afterwards (Islam et al., 2013; Tadesse et al., 2017).

The results in Table 3 also show that participation in implementation was medium (49%) but higher compared to the planning stage (41%). This may be because forest users associate implementation directly with

[3] While the PFM rules of 2015 (Republic of Kenya, 2015) indicate that only CFA members can benefit from extraction of forest resources, we observed that non-CFA members in Mt. Elgon were still able to access the forest – particularly for the collection of firewood and grazing of livestock upon payment of the required fees.

Table 2
Probit results on household choice to join CFA.

Variable	Coefficient	P > z
Household context		
Age of Household head	−0.009*	0.085
gender	0.380*	0.081
Household size	0.049	0.145
Primary education	−1.554***	0.046
Secondary education	−1.753***	0.026
Tertiary education	−2.360***	0.021
Log asset value	0.052	0.249
Log of HH expenditure	0.063	0.613
Log shocks	0.037**	0.038
Food insecurity	−0.070***	0.003
Wealth1 (wealthiest)	−0.012	0.967
wealth2 (medium wealth)	−0.067	0.763
Characteristics of the resource		
Distance to forest	−0.003	0.881
Log of forest value	0.042	0.447
Land owned	−0.014	0.415
Collect firewood	0.216	0.183
Institutional arrangements		
Membership in farmer group	1.081***	0.000
Access to forest	1.621***	0.000
Extension	0.309**	0.032
Access to credit	−0.544***	0.007
Constant	−2.342	0.179

* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

the benefits they received. The PIs during this stage ranged from 39% to 60%; with tree nursery establishment (58%), planting of trees and management (60%) and reforestation of degraded areas ranking highest. The higher rates of participation in establishing tree nurseries and planting of trees is linked to PELIS. Recent evidence shows that participation in PELIS could contribute up to 30% of household total income (Waruingi et al., 2021) which could provide a strong incentive for local people to participate in the program. However, it is notable that the implementation index reported here is much lower than the level of participation at implementation reported in other studies (Tadesse et al., 2017; Adams et al., 2017). FGDs confirmed that except for PELIS, the costs of engaging in other activities often outweigh the benefits.

The level of participation in the M&E is medium (42%), though much lower than those reported in participatory M&E activities in Ethiopia (Tadesse et al., 2017) and in Ghana (Adams et al., 2017). The specific PIs during this stage ranged from 37% to 51%. It is not surprising that the index for supervision of management agreement was the lowest because most respondents in FGDs were not even aware of its existence. In addition, many respondents indicated that transparency for expenditure on user fee was low and mechanisms to hold CFA officials to account were lacking. The results also show that slightly over half of the respondents (51%) reported illegal activities, including extracting forest products without paying user fees and grazing livestock in the forest without a permit. It was reported in FGDs that grazing of livestock in the forest was associated with the high level of damage for crops and tree seedlings under the PELIS program which could explain the high level of reporting of illegal activities. The PI for attending CFA annual general meeting (AGM) is 49% suggesting that slightly more than half did not participate in this important activity. Many focus group participants reported that they were unable to participate in AGMs because of a perception that they could not influence the process, even if they attended. Other studies have shown that user groups respond by withdrawing their participation effort if they felt less powerful in influencing decisions that affect them (Mbeche and Dorward, 2014).

Table 3
Participation index across the stages of PFM programs.

	Variable	Mean SD	PI (%)
Planning	Forest boundary demarcation	1.24 (0.63)	41
	Encouraging others to participate in CFA activities	1.49 (0.83)	50
	Decision on whether to extract, what and how much	1.20 (0.58)	40
	How to distribute extracted products	1.14 (0.49)	38
	Forest management committee election	1.23 (0.62)	41
	Identifying forest users	1.25 (0.64)	42
	Preparing forest management plan	1.11 (0.42)	42
	Developing forest management bylaws	1.10 (0.40)	37
	Approval of the forest management agreement	1.10 (0.40)	37
	Setting up forest user charges	1.20 (0.58)	40
	mean	**1.21 (0.56)**	**41**
Implementation	Reforestation of degraded areas	1.68 (0.93)	56
	Planting trees and management	1.80 (0.96)	60
	Nursery establishment	1.73 (0.95)	58
	Beekeeping	1.16 (0.51)	39
	Forest fire fighting	1.35 (0.74)	45
	Forest patrols	1.27 (0.66)	42
	PELIS plot allocation (shamba system)	1.44 (0.81)	48
	mean	**1.49 (0.79)**	**49**
Monitoring	Follow ups forest management bylaws	1.19 (0.55)	40
	Forest patrols	1.24 (0.63)	41
	Reporting of illegal activities	1.54 (0.86)	51
	Supervise forest management plan implementation	1.11 (0.41)	37
	Forest boundary maintenance	1.19 (0.57)	40
	CFA annual general meeting	1.48 (0.84)	49
	Auditing forest user fee expenditures	1.12 (0.45)	37
	Mean	**1.27 (0.62)**	**42**
Overall	**Overall PI across the stages**		**44%**

4.3. Determinants of participation in the PFM program

Table 4 presents results of the fractional regression model (FRM) on the determinants of forest users' participation across the three phases of the PFM program. Following our conceptual framework, we present results for three categories of variables – characteristics of the forest users, the resource and institutional variables. The results show that the key household context factors associated with participation are opportunity costs associated with gender, distance to the market and household expenditure but their influence varies across the different stages of the program. While influence of resource and institutional variables was varied across the stages, their effect on participation was generally weak (influencing only one stage of PFM).

With regard to demographic and socioeconomic characteristics of

Table 4
Results of fractional regression model across stages of PFM program.

Variable	Planning		Implementation			M&E	Overall	P > z
	coefficient	P > z	coefficient	P > z	coefficient	P > z	coefficient	
Household context								
Age of Household head	−0.002	0.482	−0.002	0.527	0.001	0.817	−0.001	0.642
gender	0.076	0.441	0.167	0.259	0.182*	0.073	0.129	0.185
Household size	−0.010	0.454	0.005	0.800	0.004	0.771	−0.002	0.903
Distance market	0.020*	0.075	0.011	0.395	0.021*	0.090	0.017*	0.097
Distance to road	0.001	0.792	0.002	0.646	−0.002	0.615	0.000	0.904
Primary education	−0.470	0.337	0.005	0.992	0.073	0.866	−0.177	0.701
Secondary education	−0.601	0.221	−0.081	0.882	0.017	0.969	−0.271	0.558
Tertiary education	−0.281	0.635	0.012	0.986	0.250	0.658	−0.046	0.935
Occupation	0.002	0.976	−0.078	0.427	0.017	0.821	−0.016	0.831
Land owned	0.012	0.609	−0.023	0.394	0.012	0.645	0.003	0.901
Log off-farm income	−0.025***	0.000	−0.051***	0.000	−0.035***	0.000	−0.034***	0.000
Log of assets	0.034	0.192	0.039	0.136	0.038**	0.028	0.036*	0.082
Log of HH expenditure	0.139***	0.008	0.134**	0.034	0.130***	0.010	0.131***	0.006
Log shocks	−0.002	0.848	0.005	0.646	0.009	0.323	0.003	0.715
Resource characteristics								
Payment for forest plot	0.001***	0.000	0.000	0.494	0.000	0.327	0.000***	0.001
Forest plot size allocated	−0.048*	0.053	0.013	0.748	−0.020	0.512	−0.022	0.397
Distance to forest	−0.024**	0.050	−0.008	0.671	−0.011	0.392	−0.015	0.191
Forest extraction	0.058	0.342	0.167**	0.032	0.026	0.683	0.076	0.175
Institutional arrangements								
Membership of farmer group	0.012	0.876	0.032	0.747	−0.161**	0.039	−0.034	0.619
Rights of access to forest	0.166	0.362	0.536**	0.025	0.266	0.113	0.300	0.101
Access to extension	−0.228***	0.000	−0.106	0.191	−0.024	0.712	−0.130**	0.023
_Constant	−1.436	0.075	−1.771*	0.068	−2.231***	0.003	−1.710**	0.023

* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

the user, the results in Table 4 show that gender of the household head has a significant positive association with overall participation. This implies that male-headed households are more likely to participate in PFM and more particularly at M&E compared to other phases of the program. M&E activities such as supervising implementation of the management plan or attending AGMs have high time demands which could explain the limited participation of women headed households. Other studies have shown that gender differentiated roles such as domestic responsibilities and childcare may limit women's availability to participate (Coleman and Mwangi, 2013; Tadesse et al., 2017). Women participation in forest governance is a normative expectation within the forestry legal framework in Kenya (Republic of Kenya, 2005, 2015, 2016), yet many studies report low level of participation by women (Mutune and Lund, 2016; Musyoki et al., 2016) which shows a lack of effective gender responsive measures in PFM programs (Coleman and Mwangi, 2013).

We included the variable distance to market to represent the costs households incur to either access information or opportunities. Our results show that distance to the market has a positive and significant association with level of participation at planning and M&E stages of PFM program. This is perhaps because high transaction costs of accessing markets can reduce the opportunity costs of PFM which therefore encourages local people to participate (Ogada, 2012). However, the results show that off-farm income has a negative and significant influence on PFM participation across all stages; indicating that households with higher off-farm income are less likely to participate in PFM programs. Other studies have shown poor household to be more dependent on the forest resources (Blaikie, 2006; Lund and Treue, 2008). Conversely, the value of household assets has a positive association with participation at M&E phase. This finding is consistent with studies showing that asset ownership could provide the resources needed for a household to engage in forest decision making (Coulibaly-Lingani et al., 2011). Our results also show that annual household expenditure is positively associated with the level of participation across all the stages of the PFM program. This is perhaps because increase in household expenditure is associated with the need to diversify household livelihoods (Mamo et al., 2007).

In the second category, we included a set of variables representing resource characteristics that could have a positive or negative influence on PFM participation. The results show that resource characteristics have a strong influence on participation at the planning stage compared to the other stages of the program. The amount of money paid for a forest plot had a positive influence on participation at only the planning stage. This result is not surprising considering that allocation of plots is a critical activity during planning stage. Similarly, forest extraction, i.e. whether a household obtained forest products or not has a positive influence on participation at the implementation stage. These variables indicate that the perception of receiving benefits increases the likelihood of participating at the planning and implementation stages respectively. Other studies have also found a strong positive association between the level of PFM participation and their perceived level of benefit (Coulibaly-Lingani et al., 2011; Ogada, 2012; Adhikari et al., 2014; Mutune and Lund, 2016; Musyoki et al., 2016).

Surprisingly, the size of forest plot allocated had a negative influence on participation in the planning stage. This could be because larger forest plots increase the opportunity cost for time which would have a negative influence on participation. FGDs indicated a tendency where members with large forest plots participated less in planning activities due to preoccupations with farm operations in their plots . Distance to the forest has a strong negative association with participation at planning stage. This means that households who stay far from the forest margin are less likely to participate in planning, because of the higher transaction costs of engaging in these activities. There is evidence to show that household forest benefits reduce as distance from the forest edge increases (Matiku et al., 2013).

In the third category, we included a set of institutional variables hypothesized to influence households' participation in PFM. The results show that membership in farmer groups is negatively associated with level of participation at the M&E stage. While this is surprising, FGDs indicated that farmer groups in the study area have facilitated

commercialization of agricultural commodities which could increase the opportunity costs for participating in PFM activities. Other studies have found that group membership facilitates networks that accelerated diffusion and adoption of new ideas (Lund and Treue, 2008; Mutune and Lund, 2016). While extension is expected to enhance farmers' knowledge and experience and subsequently reduce information asymmetries, it had an overall negative association with level of participation in PFM. This could be linked to the fact that accessing extension allows households to be involved in higher value agricultural activities, which can therefore dissuade there participation. Other studies have found that access to extension improved households' knowledge and skills for good agricultural practices that are associated with better earnings than forest extraction (Mamo et al., 2007).

The results of the PCA model (Table A3) estimated to check robustness of our results reveal a consistent result that gender of the household head, opportunity cost in terms of off farm income, household expenditure, distance to the forest, membership in farmer group, access to the forest and extension services are the key variables influencing participation across the different stages.

5. Conclusions and policy implications

Decentralization of forest governance has been promoted as a promising mechanism for improving the quality of resource governance. By analyzing the differences in forest users' participation across different stages of a PFM program – planning, implementation and M&E – this paper, contributes to an improved understanding on the factors that support or constrain forest users' participation in forestry programs. The results revealed a medium level of forest users' participation, lower than what others have found in similar contexts in Sub-Saharan Africa. Key factors influencing PFM membership are; age and education of the household head, household's food insecurity and vulnerability to shocks, being in a farmers' group, access to extension, credit and a household's access to the forest within the previous 12 months. These results reflect the significance of household context, dependence on forests and institutional arrangements in influencing household participation in the PFM program. These factors therefore need adequate consideration in devolving forest management to local communities in the Elgon forest.

Focusing on incentives for community participation in resource governance, the article shows that transaction costs associated with access to markets, household expenditure and expected forest benefits, positively influence household participation in PFM, while off-farm income, distance to the forest and extension have a negative influence on participation. However, their influence differed across the different stages. The disaggregated results across the stages show that opportunity costs reflected in off-farm income, household expenditure and distance to markets have a strong influence on PFM participation. While influence of resource and institutional variables was varied across the stages, their effect on participation was generally weaker. Resource characteristics influenced participation at planning more than at other program phases. These results point to the need to take the household context (gender, education, household expenditure and vulnerability) into consideration during planning and implementation of the forestry programs. Consistent with many other studies, the results also suggest that participation is more likely to be enhanced if costs of participation are reduced. The implication is that forest authorities should identify and implement mechanisms to enhance benefits from forests but also reduce costs of participation, especially for women. Incorporating this understanding is important in in enhancing PFM participation, this is not least because enhancing participation of poor forest dependent communities can improve their livelihoods and ecological outcomes.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Appendix

Table A1: Name and description of variables used in the study.

Variable	Definition and Measurement
Household context	
Age	Age of household head in years
Gender	Gender of household head: 1 = male
Household size	Number of members in a household
Total income	Aggregated household income (agriculture, wage employment, business, remittances and PELIS)
Off farm income/year	Income from non-farm sources in KES
Annual total household expenditure	Yearly household expenditure in KES
Occupation	
Shocks value	Value of 3 main shocks suffered by household over the past year in Kshs
Migration status	Native or immigrant: 1 = native
Education level	Highest level of education attained: 1 = primary and below, 2 = secondary, 3 = tertiary
Wealth category	Household wealth group as per wealth index: 1 = wealthiest, 2 = medium wealth, 3 = poorest
Own farm size	Total land size in acres
Asset value	Value of all assets owned in KES
Distance to all weather road	Self-reported distance to the nearest all weather road in Km
Distance to market	Self-reported distance to the nearest market in Km
Characteristics of the resource	
Forest distance	Self-reported distance to nearest forest edge in Km
Own forest or woodlot	Household ownership of private woodlots or forest: 1 = yes

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(*continued*)

Variable	Definition and Measurement
Perception change in forest cover	Household's perception of forest cover change over last 5 years: 1 = increased
Forest extraction	Collection of forest products: 1 = yes
Forest plot size allocated	Size of forest plot allocated in acres
Payment for forest plot	Amount paid for forest plot in Kshs
Institutional arrangements	
Forest access rights	Household access to the forest in the past year; 1 = Yes
Extension	Received extension services in the past year: 1 = yes
Farmer group member	Member of a farmers group: 1 = yes
Access to credit	Received credit in the past year: 1 = yes

Table A2: Indicators used to measure participation across different stages of the CFA program.

Planning	**Forest boundary demarcation**
	Encouraging others to participate in CFA activities
	Decision on whether to extract, what and how much
	How to distribute extracted products
	Forest management committee election
	Identifying forest users
	Preparing forest management plan
	Developing forest management bylaws
	Approval of the forest management agreement
	Setting up forest user charges
Implementation	Reforestation of degraded areas
	Planting trees and management
	Nursery establishment
	Beekeeping
	Forest fire fighting
	Forest patrols
	PELIS plot allocation
Monitoring	Follow ups forest management bylaws
	Forest patrols
	Reporting of illegal activities
	Supervise forest management plan implementation
	Forest boundary maintenance
	CFA annual general meeting
	Auditing forest user fee expenditures

Table A3

PCA regression results across stages of PFM program (PCA)

Variable	Planning		Implementation			M&E	Overall	
	Coefficient	P > z	Coefficient	P > z	Coefficient	P > z	Coefficient	P > z
Household context								
Age of Household head	0.000	0.965	0.002	0.577	0.008*	0.062	−0.002	0.555
gender	0.361*	0.057	0.257	0.113	0.372*	0.053	0.158	0.338
Household size	−0.022	0.400	−0.002	0.939	−0.007	0.809	0.008	0.741
Distance market	−0.018	0.323	−0.014	0.364	−0.004	0.845	−0.023	0.137
Distance to road	0.000	0.998	−0.002	0.749	−0.003	0.660	−0.004	0.414
Primary education	−0.173	0.764	0.051	0.918	0.422	0.471	0.720	0.152
Secondary education	−0.390	0.502	−0.052	0.918	0.423	0.473	0.687	0.175
Tertiary education	−0.185	0.799	−0.138	0.826	0.405	0.584	0.534	0.400
Occupation	−0.088	0.483	−0.076	0.479	0.120	0.345	−0.086	0.428
Land owned	−0.018	0.658	0.028	0.410	−0.028	0.497	−0.023	0.513
Log off-farm income	−0.043**	0.000	−0.038**	0.000	−0.054***	0.000	−0.057***	0.000
Log of assets	0.049	0.156	0.013	0.653	0.026	0.459	0.053*	0.076
Log of HH expenditure	0.204**	0.019	0.058	0.436	0.094	0.286	0.007	0.926
Log shocks	0.013	0.383	0.001	0.952	0.012	0.443	0.001	0.940
Resource characteristics								
Payment for forest plot	0.000	0.457	0.000	0.501	0.000	0.201	0.000	0.418
Forest plot size allocated	−0.005	0.932	0.050	0.292	0.051	0.370	0.040	0.409
Distance to forest	0.014	0.546	0.002	0.913	0.011	0.641	−0.042**	0.039
Forest extraction	0.047	0.662	0.167*	0.074	−0.169	0.125	0.002	0.984

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PCA regression results across stages of PFM program (PCA)								
Variable	Planning		Implementation			M&E	Overall	
	Coefficient	P > z	Coefficient	P > z	Coefficient	P > z	Coefficient	P > z
Institutional arrangements								
farmer group	0.296**	0.028	−0.013	0.911	−0.389***	0.005	0.014	0.903
Access to forest	0.499	0.137	0.862***	0.003	0.616*	0.071	0.555*	0.058
Extension	−0.341***	0.002	−0.033	0.729	0.000	0.997	−0.074	0.442
Constant	−2.561**	0.034	−1.194	0.249	−2.108*	0.085	−0.681	0.517

* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

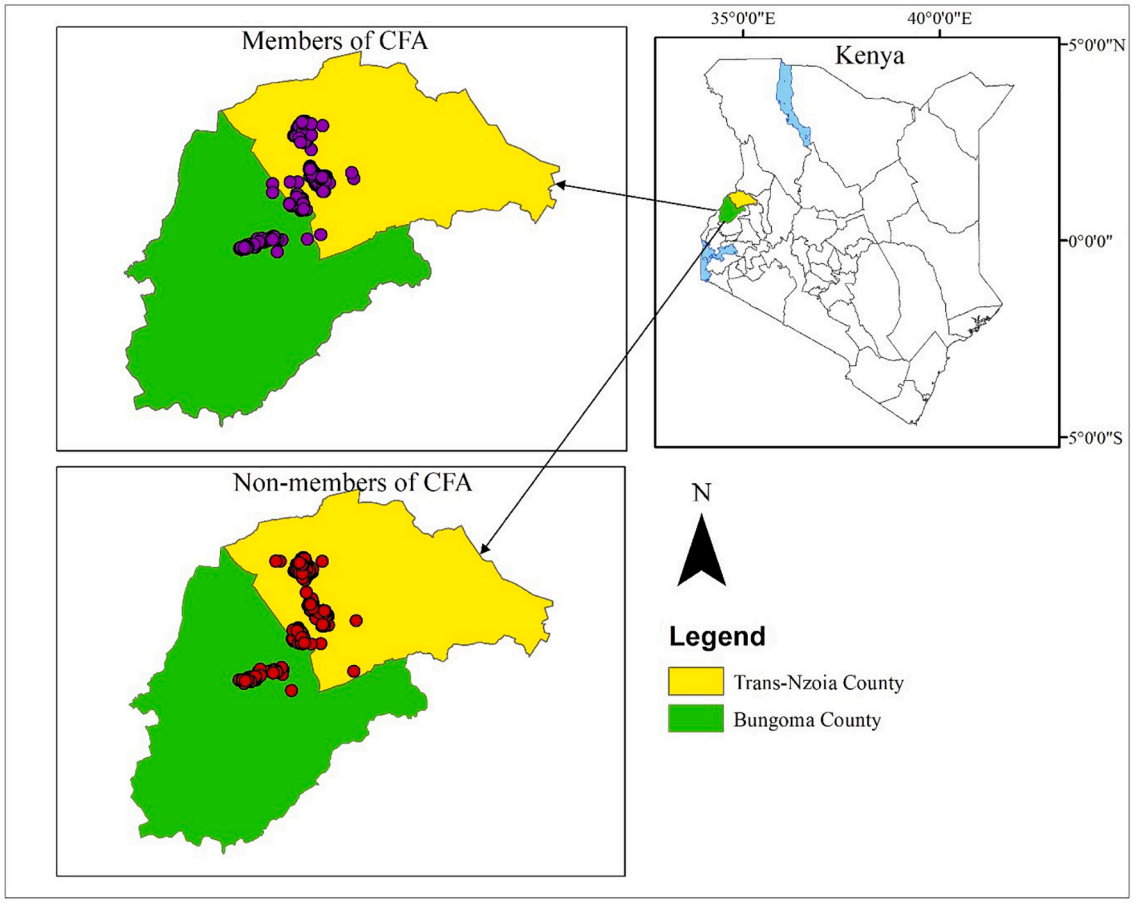

Fig. A1: Distribution of CFA vs non-CFA members.

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