Forest Management Decentralization in Kenya: Effects on Household Farm Forestry Decisions in Kakamega

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The New Forest Management Regime in Kenya: Effects on Household Farm Forestry in Kakamega

Abstract

This study investigates the factors that influence participation of households in devolved system of forest management by joining community forest associations (CFA). It further employs Propensity Score Matching (PSM) to measure the impact of household's participation in CFA on farm forestry decisions. The analysis uses cross-sectional data from a survey of Kakamega forest communities in Kenya in 2010. Generally, our findings reveal that participation in CFA by households is influenced broadly by socio-economic and institutional factors, and that participation in CFA has a positive impact on farm forestry development. Policy makers and development practitioners, therefore, need to devise, implement and sufficient fund interventions that would promote development of community forest associations with the ultimate goal of increasing forest cover in the country.

Keywords: Participatory Forest Management, Selection Bias, Farm Forestry Development, Kenya

JEL Classification: Q12, Q28, D52

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1. Introduction

Decentralized forest management regime has gained currency in developing countries in the recent years (Agrawal, Chhatre and Hardin 2008), being viewed as a means of enhancing economic efficiency, public accountability, community and individual empowerment, and allocative efficiency in the forest sub-sector (World Bank, 2009). These reforms are expected to reconcile conservation and livelihood needs. In particular, forest decentralization is aimed at enhancing peoples' livelihoods, poverty alleviation and preservation of the forest condition.

Decentralization policies, however, do not affect forest users' behaviour directly. Rather they change local incentive structures by altering security, access and the power structure of local governance which in turn lead to behavioural change. The expected outcomes of regime change are mediated by forestry regulations that impose conditions for use of forest resources, and by the capacities of small holders and communities to adapt to those regulations. For instance, communities are required to implement workable systems of governance for their collective lands, exclude third parties and engage in competitive conditions with the forest markets. Indirectly, the outcomes of the reform are also influenced by access to financial and non-financial services. In the absence of these conditions, forest tenure reforms are unlikely to achieve their livelihood and conservation goals. Thus, decentralization policies may produce a variety of outcomes, both desirable and undesirable. For example, many of the Community Forest Associations (CFAs) formed in Kenya were driven by expectations beyond what the legislation provided for (Ongugo, 2007; Ongugo *et al*., 2007). Indeed some CFAs anticipated converting forests into farmlands for production of cash and food crops (Ongugo *et al*., 2004). Basically, the diverse outcomes are dependent on community experiences and traditions, and the capacity of the local communities to take advantage of the prevailing market conditions (Monterroso, 2008).

Numerous benefits are expected to accrue to individuals from participating in community forest associations through increased access to forest products such as fuel wood, herbal medicine, honey, tree seedlings, thatch grass and fodder. Other activities allowed within the co-management framework include eco-tourism, bee-keeping, fish farming and growing of crops. With these benefits, it would be expected that communities would fast embrace the system and participate effectively. However, the progress has been slow and, in some cases, CFAs have been formed only to collapse after a short while (Ongugo *et al*., 2007). But it is also important to note that, decentralization of forest management may not necessarily yield desirable environmental outcomes as has been revealed by evaluation studies elsewhere in the World (Agrawal and Ribot 1999). Thus, it is critical and urgent to understand what drives individual households to participate in community forest associations and how this participation impacts on specified environmental outcomes in Kenya.

Several studies have been conducted on community participation in forest management, effects of PFM on household poverty and opportunity cost of forest conservation (Emerton, 1999; Mogaka *et al*., 2001; Colfer, 2005; Mbuvi *et al*., 2007; Ongugo, 2007; Guthiga *et al*., 2008; and Borner *et al*., 2009). Decentralization policies interact with numerous context-specific pressures and interactions to change governance institutions, forest user behaviour and resulting forest conditions and livelihood outcomes (Andersson *et al*., 2008). While there are several theoretical arguments relating benefits and costs of forest decentralization, these fail to generate consistent predictions (Andersson, *et al*., 2008). These studies ignore behavioural changes resulting from decentralization among forest users in their empirical investigations.

This study seeks to address this gap by first examining the drivers of household's participation in community forest associations (CFA) which is the framework through which communities take part in forest management before analyzing how this participation impacts on household farm forestry investment decisions. We seek to understand how decentralization policies filter down to local forest users. Economic theory does not provide clear predictions about the effects of decentralization policies on

forest users' behaviour. Instead we must derive from studies of how such policies interact with existing biophysical, socio-demographic variable such as age, gender and educational variables, wealth and other factors change incentives at the local level. We test the effects of forest decentralization, arguing that the effects of decentralization need to be understood according to specific contexts. We investigate the effects of decentralization drawing on data collected from Kakamega forest in Western Kenya in 2010. In particular, we test the effects of decentralization on the farmers' participation in community forest associations and how this affects on-farm forestry investment decisions. Increased forestry cover is a key policy requirement in Kenya, where forest cover is only 3 percent, much lower than the globally recommended rate of 10 percent.

The rest of the paper is organized as follows: In the next section we review the history of decentralized forest reforms in Kenya. In section 3 we draw on existing literature to derive factors that influence household farm forest investment decisions. Section 4 examines methodological issues while Section 5 outlines the study area and provides summary statistics of the variables used. In section 6, we report our empirical results and discuss these findings and in section 7 we conclude and draw policy recommendations.

2. Forest Decentralization trends in Kenya

The colonial government of Kenya created a forest department in 1902, which alienate most prior existing community-managed forests. The Forest Department managed and controlled all forests in the country with policy focused on conservation. Following independence in 1963, a series of donor funded forestry programs focused on afforestation and reforestation on farms, with the goal of alleviating fuel wood shortages. The Forest department managed the forests without consultation outside the relevant government ministry. Conflicts increased in the late 1980s between communities who needed fuel wood from neighbouring forests, and the forest department (Ongugo and Njuguna 2004).

The Forest Act of 2005 saw the formation of the Kenya Forest Service (KFS), a semi autonomous government agency with representation from various government ministries.

Under the Act, the KFS is expected to devolve powers to the private sector and to forest conservation committees and community forest associations (CFAs). Community participation is achieved primarily through CFAs, and integrated management of forests is the central principle motivating the new policy (Ongugo, *et al*., 2007).

A number of CFAs have been formed through sensitization of communities adjacent to the major forests in the country by the Kenya Forest Action Network (FAN) and the Kenya Forests Working Group (KFWG) (Ongugo *et al*., 2007). Lately, the Kenya Forest Service has also been spearheading the formation of CFAs as a step towards meeting the requirements of the Forest Act (2005). The CFAs rely only on membership fee and subscription by members as their main sources of funds (Kinyanjui, 2007).

3. A review of farm forestry decisions by rural households

This section reviews the link between participation in community forest management groups and households' farm forestry investment decisions. It also explores other factors that may motivate households to undertake on-farm tree growing.

It is generally recognized in the literature that a number of factors explain the differences in farm tree growing decisions by smallholder farmers. However, the specific socio-economic and institutional variables affecting the decisions differ across countries, regions, villages, and farms. Moreover, the direction of influence of a given variable is not often consistent across studies.

Participation in forest management groups has been shown to influence decisions to plant more trees on-farm (Emtage and Suh, 2004). Perhaps this is due to the fact that it enhances people's attached value to forest ecosystems and the need to protect them; which in turn results in their desire to increase forest cover on their farms. Moreover, participation in community-based conservation groups enhances farmers' access to diversity, quality and quantity of tree species (Boffa *et al*, 2005).

Besides Participation in community forest management, households' decisions to plant trees may be directly influenced by household-specific, plot-specific and institutional factors. For instance, farm forests have enormous environmental advantages beyond direct benefits to the farm households. To comprehend these indirect benefits, the decision-maker at household level requires some education, either formal or informal, obtained through schooling or extension services. Thus, better educated household heads or households with access to government or farmer-farmer extension services are better adopters of farm forestry (Muneer, 2008), either because they view tree planting as a means of improving the land (Dewees, 1995) or because they are able to appreciate other non-quantifiable benefits as ambiance, micro-climate modification or carbon sequestration. This also explains why households with good social networks may have a higher possibility of planting trees because they are able to get extension services through such networks (Gebreegziabher *et al*., 2010; Muneer, 2008).

Institutional factors have also been shown to influence the decision by households to plant trees. Secure land tenure arrangements, for example, have been found to influence tree planting decisions among farmer groups. Trees take a longer gestation period and only farmers who are confident of continued use of a given plot would be encouraged to plant them (Bannister and Nair, 2003; Deininger and Feder, 2001; Gebreegziabher *et al*., 2010; Warner, 1995). However, some studies do not agree with the idea that secure tenure may encourage tree planting and cite cases where communal ownership of land has been more conducive for development of farm forestry (German *et al*., 2009). Perhaps tree planting in areas with ambiguous land tenure system is a means used by households to place a claim of legitimacy of ownership and/or access.

4. Methodology

This paper has twin objectives, to identify the determinants of a household's participation in CFA, and to estimate the impact of participation in CFA on farm forestry investment decisions. We discuss the approaches used to achieve these objectives in this section.

4.1 Analyzing the determinants of participation in CFA

Participation in CFA has potential costs and benefits which are perceived uniquely by different households. Costs may include membership fees, monthly/annual subscriptions, and time to undertake the association's activities while benefits may include access to forest products, contracts to undertake specified activities within the forest, grazing in the forest, access to information on care for trees and general benefits of maintaining forests, and better access to quality tree seedlings. The individual decision to participate in CFA can be modeled in a random utility framework, popular in analyzing innovation adoption under uncertainty (see Feder, Just and Zilberman, 1985). This implies that participation in CFA can be modeled as a binary choice based on utility maximization subject to household resource constraint (Manski, 1977). The utility function of the household can be expressed as:

$$U_i = f(\beta X_i) + \varepsilon_i \quad (1)$$

where X_i is a vector of exogenous variables and β is a vector of parameters to be estimated. The unobserved part of the household's utility is represented by ε_i which is assumed to be independently and identically distributed with mean of zero. A farm household will choose to participate in if the utility derived from participation, U_i^p is higher than the utility derived from non-participation, U_i^n. The probability of a household being a member of CFA is given by $P(\varepsilon_i < \beta X_i)$. Thus, the participation model to be estimated is:

$$P(p_i = 1) = P(\varepsilon_i < \beta X_i) = \beta X_i + \varepsilon_i, \quad (2)$$

where $p_i = \begin{cases} 1 & if \quad U_i^p > U_i^n \\ 0 & otherwise \end{cases}$

The behavior of each household is influenced by its transaction costs as influenced by its access to information, assets, services and markets (Barret, 2008). Whether a household participates in CFA or not is dependent on its evaluation of the costs and benefits.

Literature indicates that human capital is important for receiving and processing information with regards to new developments (Schultz, 1982). Education and

experience, captured by the level of education and age of the household's decision-maker are, thus, important to be included in the analysis. Other important factors are the physical assets such as land, labour and cash (Boahene, Snijders, and Folmer, 1999). We, thus, include the landholding size, household size (to proxy for access to labour) and access to credit to proxy for cash. Whether a household owns cows or oxen is also important in the analysis as they indicate the household wealth level. Moreover, ownership of such livestock may drive the need to participate in CFA to access fodder. Oxen ownership may also proxy for transport cost. Because households participate in CFAs because of perceived benefits (Ongugo *et al*., 2007), distance to the forest and the forest management agency are likely to influence participation. Households that are close to the forest are more likely to participate because they stand to gain more as they incur lower costs to access the forest. A management agency like the Kenya Wildlife Service (KWS) completely restricts entry into the forests and is likely to discourage participation.

Gender of the household head may influence participation. Men and women have different opportunities, motivation and capabilities to involve themselves in collective action (Pandolfelli, Meinzen-Dick, and Dohrn, 2007). Domestic responsibilities may also reduce chances of women to participate in groups (Meinzen-Dick and Zwarteveen, 1998). Because of this, we include the gender of the household head in the analysis.

The influence of social networks in decision-making among the smallholder households has been recognized in literature. Such networks are for farmer-to-farmer extension and may accelerate diffusion of new ideas (Matuschke and Qaim, 2009; and Conley and Udry, 2010). As a result, we include the number of social groups, other than CFA, that a household participates in.

4.2 Analyzing Impact of Participation in CFA on Farm Forestry

The main interest here is to estimate the average treatment effect on the treated (ATT). That is, how participation in community forest association affects on-farm growing of trees. Because we are not able to observe what the results would have been without participation, we have to deal with missing data on the counterfactual. The remedy is to

identify non-participating households and use them as counterfactual. But we must also deal with selection bias because self-selection into CFA membership is non-random. Self-selection implies that mere comparison of outcomes of CFA members and non-members cannot yield reliable results.

Selection bias may arise from systematic differences between participants and non-participant. These arise from observable characteristics such as asset ownership and education. We use propensity score matching (PSM) to control for the observable characteristics. PSM constructs a suitable comparison with non-participants that are similar to the participants in all relevant observable attributes (Caliando and Kopeinig, 2008). Another potential source of bias is differences between participants and non-participants in terms of the unobservables. PSM cannot control for this kind of bias, and therefore we test for robustness of our impact results using different specifications.

Execution of PSM is undertaken in two stages. The first stage involves generation of the propensity scores, $P(X)$, from the probit model. These scores indicate the probabilities of respective households being members of CFAs. From the scores, we construct a control group by matching participants to non-participants according to their propensity scores. Participants for whom no matches are found and the non-participants that are not used as matches are excluded from further analysis. In the second stage, we compute the ATT of membership to CFA on extent of household farm forestry using the matched observations. PSM estimator of the ATT is obtained by computing the difference in acreage under trees between households participating in CFA and the non-participating ones which are appropriately matched by the propensity scores, expressed as:

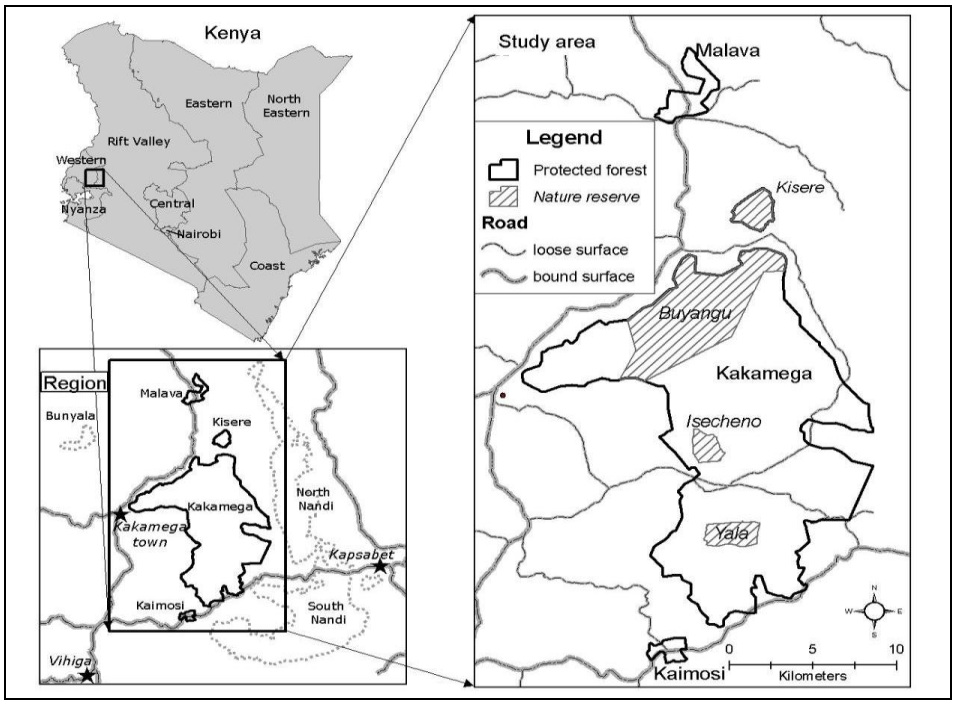
$$\tau_{ATT}^{PSM} = E(P(X)|p=1)\{E[Y(1)|p=1,P(X)]-E[Y(0)|p=0,P(X)]\}, \quad (3)$$

where $Y(1)$ and $Y(0)$ represent acreage under trees for participating households and non-participating households, respectively. $p=1$ indicates treated/participating households while $p=0$ indicates control/non-participating households. We use all the variables in the PSM probit in the outcome analysis with the belief that the inclusion of even non-

significant variables cannot bias the estimates nor can they make them inconsistent (see Caliendo and Kopeinig, 2008 for details).

5. The Study Area and Data

The study site for this survey was around Kakamega Forest, situated in Kakamega District in Western Province of Kenya (Figure 1). It lies north-east of the Lake Victoria between latitudes of 00°10'N and 00°21'N and longitudes of 34°47'E and 34°58'E at about 1600 m above sea level. The forest area is drained by two main river systems, the Isiukhu River to the north and the Yala River to the south. The forest is the only remaining rain forest in Kenya and is the furthest east remnant of the Guinea-Congolean rain forest. According to the 1994 welfare monitoring survey, 52% of the population in the district lives below the poverty line, meaning that they can hardly afford basic necessities like food, shelter, clothing, and education. As such there is a heavy reliance on the forest to supplement their daily necessities. This region has also been considered by the Kenya Woodfuel and Agro-forestry Programme (KWAP) as one of the areas that could benefit most from policies that target improvement of forestry projects due to its high population and high agricultural potential.



Source: Biota Sub-project E13 data bank, 2006

Figure 1: Kakamega forest and its environs

The data for this study was collected from communities around Kakamega forest in western part of Kenya. The study focused on households residing adjacent to the forest. A random sample of 318 households was interviewed using a detailed semi-structured questionnaire. The sampled households were randomly interspersed in the study area and across the three management regimes. The management regimes were Kenya Wildlife Service (KWS), Kenya Forest Services (KFS) and the Quakers Church (QC). Table 5.1 captures the descriptive statistics for respondents that participated in Community Forest Associations (CFAs).

Table 5.1: Basic descriptive statistics for participants and non-participants in CFAs

	Participants in CFAs			**Non-participants**		
Variable	**Obs**	**Mean**	**Std. dev.**	**Obs**	**Mean**	**Std. dev.**
Individual attributes						
Age of head	153	48	13.2	182	46.6	15.07
Education level of the household head (0=no education, 1=primary, 2=secondary, 3=tertiary)	153	2.4	0.81	182	2.43	0.87
Number of household members	149	6	1.8	187	5	1.90
Gender of household head (1=male; 0=female)	153	0.79	0.40	182	0.69	0.46
Farm characteristics						
Farm size in acres	150	1.9	1.77	179	2.32	2.44
Value of total assets	153	18791	33779	195	21156.8	71025
Time to nearest forest edge (minutes)	153	22.2	59.0	195	24.6	23.6
Proportion of households owning cows	153	0.79	0.40	186	0.76	0.42
Proportion of households owning oxen	153	0.37	0.48	186	0.32	0.47
Access to credit facilities (1 if yes, 0 otherwise)	150	0.27	0.44	178	0.08	0.27
Acreage under trees on farm	153	0.41	0.45	195	0.26	0.29
Institutional attributes						
Participation in social groups other than CFAs	153	1.74	1.20	195	0.91	0.98
Forest management regime (0=KWS, 1= KFS)	153	0.91	0.29	195	0.8	0.40
Awareness of new Forest Act before joining CFA	150	0.85	0.35	165	0.37	0.48

The mean age of household head is 48 years and 47 years for participating and non-participating households, respectively. The education level for both participants and non-participants was generally fair, averaging at secondary school. The household size for participants and non-participants is 6 and 5 members respectively. Larger family sizes would have more demand for forest products due to high consumption. Having large family size could then act as an incentive to participate in CFAs. 79% of those who participated in CFAs were male headed households. It is presumed that male headed households may be better resourced and informed to participate in CFAs. Though male headed households also dominated among non-participants, the response rates were slightly lower (69%).

On farm characteristics, participants in CFAs had smaller land sizes (averagely 1.9 acres) relative to that owned by non-participants (2.3 acres). Non-participants would need larger farm sizes so as to be able to plant trees and compensate for the foregone benefits of forest products access enjoyed by participants. Another variable of significant interest is access to credit facilities which is likely to influence participation decision. 27% of participants had access to credit compared to a paltry 8% of non-participants who accessed similar facilities.

With regards to institutional attributes, households not participating in CFAs were, on average, belonging to 1 social group while participating households belonged to 2 none CFA social groups. Participation was also informed by the type of management regime one was in, whether KFS or KWS. KFS is more flexible and allows entry into the forest while KWS is more restrictive. Awareness about the new forest law also influenced the decision to join CFAs with 85% of participants having been aware relative to 37% of non-participants.

Notably, the difference in mean acreage under tree cultivation between non-participating and participating households is different from zero with t-statistic of -3.64. This makes it important to investigate whether this difference indeed originating from CFA membership.

6. Results and Discussion

In this section we show and discuss the results of our analysis of the determinants of participation in CFA by households adjacent to Kakamega forest, and how this participation impacts on household farm forestry behavior.

6.1 Determinants of household participation in CFA

We estimate the probit model of household membership to CFAs as described in Eq. 2. The results are displayed in Table 6.1.

Table 6.1: Probit Model of CFA Membership

Variable	Marginal Effect	Standard Error	Z
Distance to forest (in minutes)	-0.006	0.004	-1.70*
Access to credit	0.253	0.097	2.43**
Owning cow(s)	0.049	0.091	0.53
Owning oxen	-0.002	0.079	-0.03
Household size	0.034	0.020	1.72*
Landholding size	-0.048	0.021	-2.31**
Male household head	0.039	0.088	0.44
Education level of head	0.017	0.051	0.34
No. of social groups	0.107	0.037	2.85***
Distance to forest Squared	0.00002	0.00004	0.70
Age of head	0.004	0.003	1.47
Log of household assets value	-0.009	0.034	-0.28
Aware of forest act before joining cfa	0.487	0.062	6.77***
Management agency is KFS	0.217	0.096	2.10**
No. of observations	297		
Pseudo R-Squared	0.33		

Note: * Significant at 10%, ** Significant at 5%, *** Significant at 1%

Distance to the forest has a negative effect on the probability of a household participating in CFA; each additional minute of walking time to the forest reduces the probability by

0.6 percentage points. This is reasonable because if households join CFA to benefit from extraction of forest products, households that are far from forests will have less impetus to participate because it would be more expensive for them to travel to the forests for such products.

Access to credit has a positive effect. It increases a household's chance of participating in CFA by about 25.3 percentage points. That is, households with access to credit have 25.3 percent higher probability of joining CFA than their counterparts without. This is plausible because such households are better endowed in terms of cash that would enable them to meet membership fees and the periodic subscriptions by CFA members. Such households may also be better endowed to hire labour or purchase equipments that would maximize their gains from participating in CFA. As a result, they would be more motivated to participate in CFAs.

Larger households have a 3.5 percent higher chance of participating in CFAs. The reason for this is fairly straight forward. The size of household proxies for household labour endowment. Thus, larger households have labour time to devote to the activities of CFAs. Moreover, such households would be better placed in terms of labour for extraction of forest products. Larger households may also be viewed as having greater demand for forest products which they may not satisfy front on-farm production. Thus, participating in CFAs and benefiting from forest products could be viewed as a viable livelihood alternative for the larger households.

Household landholding size has a negative effect on CFA membership. Each additional acre of land owned reduces the probability of participating in CFAs by 4.8 percentage points. Possible explanation to this is that households with larger pieces of land may produce a number of products which they would otherwise extract from forests on-farm. If this is the situation, such households would not be motivated to join CFAs.

In terms of social networks, participation in other social groups increases the possibility of a household joining CFA. This is understandable because through such groups

information on CFA is disseminated. Of course the herding behaviour may also lead members of a given social group to jointly decide to participate in a CFA. Furthermore, trust built from the previous social groups may encourage household to quickly accept new frontiers of collective action.

Those households that were aware of the Forest Act (2005) had 48.7 percent higher chance of participating in CFA. This could have been because such households were aware of the benefits that could be derived from participating in CFAs and wanted to take advantage. They may also have found it easier to believe the earlier efforts to encourage communities to join CFAs. But management agency is also important in determining participation of households in CFAs. Those households that are closer to forests managed by the Kenya Forest Service (KFS) have 21.7 percent higher probability of participating in CFAs than households closer to forests managed by the Kenya Wildlife Service (KWS). Partly this is because KWS has been at the forefront of educating and encouraging communities to join CFAs. However, it must also be noted that management by KWS is more restrictive, limiting forest entry by communities. People would be less willing to participate in CFAs if that does not give them any advantages in terms of extraction of forest products. Thus, gains from CFA membership would be lower in forests run by KWS, and households being rational would be less willing to participate in CFAs.

6.2 Impact of CFA Membership on Farm Forestry

As indicated earlier, the matching process is preceded by specification of the propensity scores for the treatment variable. Probit model was employed to predict the probability of a household being a member of CFA as outlined and discussed in sub-section 6.1. The effect of participation in CFA on a household's land area under trees (farm forestry) was estimated with Nearest Neighbour Matching (NNM) and Kernel-Based Matching (KBM). Common support condition was imposed in the estimation by matching in the region of common support. Figure 6.1 presents the distribution of propensity scores and the region of common support. The figure indicates the bias in the distribution of propensity scores

between members and non-members of CFA. It reveals the significance of proper matching and imposition of the common support condition to avoid bad matches.

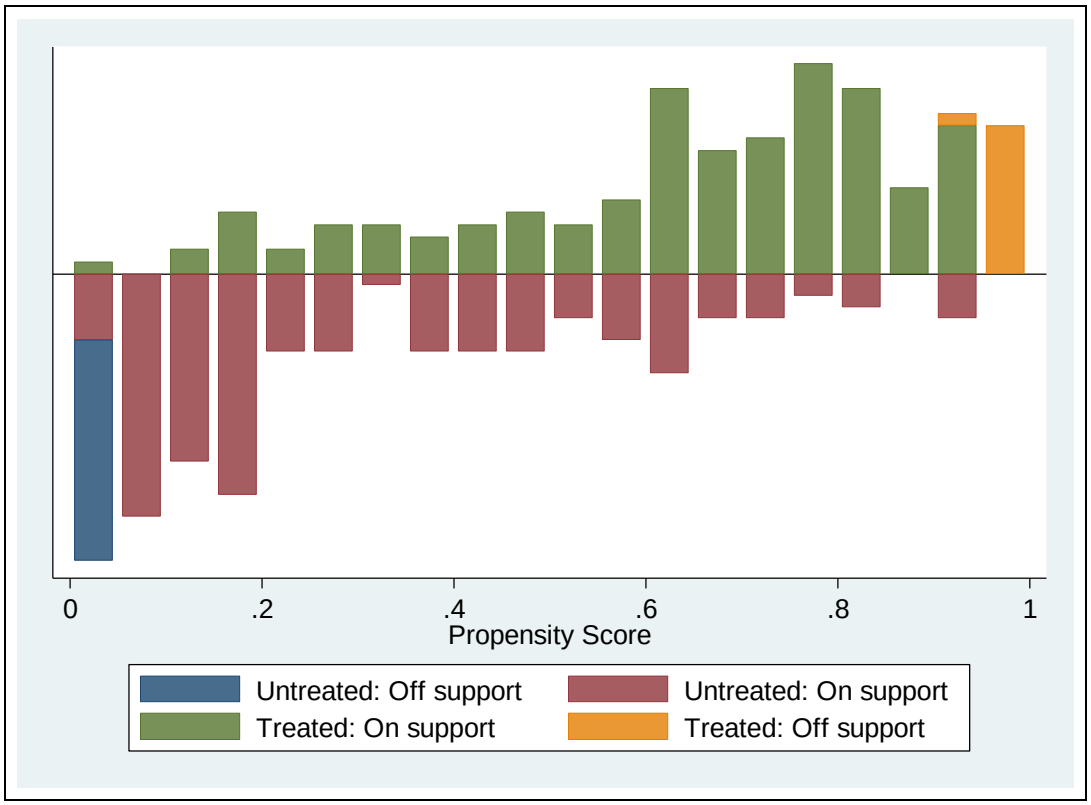


Figure 6.1: Propensity Score Distribution and Common Support for Propensity Score Estimation

Treated on-support shows CFA-member household which found suitable matches while treated off-support shows CFA-members household which did not find suitable matches. Similarly, untreated on-support represents non-CFA member households which found suitable matches whereas untreated off-support shows the non-CFA member households which did not find suitable matches. We present the average treatment effects and sensitivity analysis in Table 6.2.

Table 6.2: Average Treatment Effects and Sensitivity Analysis

Matching Algorithm	Outcome	ATT	Critical level of hidden bias (Γ)	Number of Treated	Number of Control
NNM	Acreage under trees	0.428*** (4.43)	2.65-2.70	140	157
KBM	Acreage under trees	0.428*** (4.13)	2.00-2.05	140	157

Note: t-values in parentheses; *** Significant at 1%. ATT= Average Treatment Effect for the treated

The results indicate that membership to CFA exerts a positive and significant effect on household land put under tree cultivation. Precisely, the NNM and the KBM causal effects of CFA membership on household acreage under trees suggest that household that participate in CFA have 0.428 acres of land under tree cultivation more than the non-CFA members.

Results of sensitivity analysis for the presence of hidden bias are presented in the fourth column. Because sensitivity analysis for insignificant effects is not meaningful, we computed Rosenbaum bounds only for the treatment effects that were significantly different from zero (Hujer *et al*., 2004). The results indicate that, using NNM, impact of CFA membership on household land size under trees should be viewed critically at a level of Γ=2.70. The same caution on causal inference should be taken when Γ=2.05 while using KBM. Thus, the lowest critical value is given by Γ=2.00-2.05 and the highest by Γ=2.65-2.70. This shows that even fairly large amounts of unobserved heterogeneity would not alter the inference about the estimated effects of CFA membership on tree planting behavior of households.

The main objective of PSM estimation is to balance the distribution of relevant variables in the groups of CFA and non-CFA members rather than precise prediction of selection into treatment. We use the reduction in the median absolute standardized bias between the matched and unmatched models to examine the balancing power of our estimations. We show these results in Table 6.3.

Table 6.3: Indicators of Covariate balancing before and after matching

Matching Algorithm	Median absolute bias before matching	Median absolute bias after matching	% bias reduction (total)	Pseudo R^2 (unmatched)	Pseudo R^2 (matched)	P-value of LR (unmatched)	P-value of LR (matched)
NNM	21.5	7.9	63.3	0.325	0.054	0.000	0.164
KBM	21.5	2.9	86.5	0.325	0.017	0.000	0.963

As indicated by the third and fourth columns, substantial reduction in bias was achieved through matching. P-values show that joint significance of the regressors was rejected after matching and never rejected at any level of significance before matching. This suggests that there was no systematic difference in the distribution of the covariates between members and non-members of CFA after matching.

7. Conclusion and Policy Recommendations

The direct effect of households participating in community forest associations (CFA) is that more household land gets devoted to farm forestry. The study employed Propensity Score Matching (PSM) to examine the direct effect of CFA membership on acreage under tree cultivation using cross-sectional data from a survey of farm households adjacent to Kakamega forest. The analysis considered the causal relationship between participation in CFA and household land area under trees. It also examined the factors that drive households to participate in CFAs.

Empirical results indicate that CFA member households have 0.428 more acres of land under tree cultivation than the non-members. The implication of this is that decentralized forest management is a viable approach towards increasing forest cover in the country. To ensure that households effectively participate in the community forest associations, policy makers must device alternative livelihood and income-generation mechanisms to ease financial constraints among the forest-adjacent communities. Alternatively, funding mechanisms for the CFA operations may need to be devised so that it is less burdensome

particularly to the poor participating and/or intending-to-participate segments of the society.

Campaigns for participation in CFA by households should target educating the households on the relevant components of the Forest Act (2005) because those who understand the Act have a higher probability of joining CFAs. Moreover, the campaigns should motivate communities to form other social groups as well because those who participate in other social groups are more likely to later join the CFAs. More importantly, forest management agencies should guarantee entry into forests for extraction of specified forest products because restrictive entry discourages households from joining CFA and participating in the devolved forest management arrangements.

In a nutshell, promising policies include:

a) Increasing access to information, especially with regards to the content of the Forest Act (2005);
b) Increasing access to formal credit among the forest communities;
c) Promoting formation of social groups, other than CFAs, among the forest communities;
d) Improving infrastructure to link communities with the forests so as to minimize transport cost that individuals incur on harvesting forest products; and
e) Providing increased access to forests by the adjacent communities. Possibly, the range of products harvested and other activities allowed in the forest could be expanded to cater for the varying interests of households. This would make participation in CFAs more rewarding to households.

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