Journal of Resources Development and Management
ISSN 2422-8397 An International Peer-reviewed Journal
Vol.95, 2025

Unpacking The Determinants Of Community Participation In Payment For Environmental Services Schemes: The Case Of The Plantation Establishment And Livelihoods Improvement Scheme In The Dundori Forest Socioecological System In Kenya

Caxton Kaua

Africa Research and Impact Network, P.O. Box 10718 – 00200, Nairobi, Kenya

* E-mail of the corresponding author is: caxtonk2008@gmail.com

Abstract
The world's forests are being rapidly degraded despite their vital importance in ecosystem services. This could be addressed through payment for environmental services (PES) that offer incentives to those involved in their conservation and management. However, there is a lack of a good understanding regarding the participation of local communities in payment for environmental service schemes in Africa. Therefore, this study undertook an analysis of factors that affect people's participation in the payment of environmental services schemes within forest contexts in Kenya based on the case of the plantation establishment and livelihood improvement scheme. Data analysis was done using the probit regression model. The study found that various factors had a significant positive and negative relationship with the adoption of payment for environmental services. The study will inform the development and implementation of effective payment for environmental services schemes-related policies and programs.
Keywords: Payment, Services, Environmental, Participation, Factors, Forest
DOI: 10.7176/JRDM/95-05
Publication date: March 31st 2025

1. Introduction

The world's forests are being rapidly degraded despite their vital importance in ecosystem services (Food and Agriculture Organization, 2018; Wunder et al., 2014; Waruinge et al., 2021). This rapid degradation of forests is mainly caused by a lack of effective approaches such as incentive-based mechanisms that offer incentives to those involved in their conservation and management (Millenium Ecosystems Assessment, 2005; Robertson et al., 2014; Chang et al., 2018). The payment for environmental services (PES) conservation model thus emerged to address the urgent need for new conservation models (Wunder et al., 2008; Adhikari and Agrawal, 2013; Wunder, 2005). The escalating threats and hence scarcity of environmental which evolved their provision into a potential economic good also led to the emergence of the payment for environmental services schemes (Beeju et al., 2021).

The payment for environmental services scheme model uses market-based incentives whereby beneficiaries of environmental services pay providers who in turn alter their practices and forego benefits to sustainably manage and restore ecosystems (Beeju et al., 2021; Adhikari and Agrawal, 2013). These market-based incentives internalize environmental externalities associated with the production of ecosystem services and are thus more effective than indirect financing and command-and-control mechanisms that are marked by market failure (Adhikari and Agrawal, 2013; Ferraro and Kiss 2002). The payment for environmental services, therefore, helps solve the problem of the lack of a market price for ecosystem services which leads to an unfair situation whereby providers are largely uncompensated (USAID, 2018).

Therefore, payment for environmental services schemes provides resources for securing ecosystem services through sustainable management while delivering sustainable livelihood benefits to communities (AfDB 2015; Food and Agriculture Organization, 2014; Jack and Jayachandran, 2018; Shapiro-Garza et al., 2020; Wunder et al., 2018). According to Wunder (2005), ''Payment for environmental services is a voluntary transaction for a well-defined ecological service, with at least one buyer, at least one provider, and based on the condition that the buyer(s) only pay if the provider(s) continue to deliver the defined ecosystem service over time". DEFRA (2013)

noted that the involvement of the providers in payment for environmental schemes should be voluntary, the providers should be paid directly by the beneficiaries, and there must be additionality, permanence, conditionality, and no leakage.

An example of a payment for environmental services scheme in forest contexts is the Plantation Establishment and Livelihood Improvement Scheme (PELIS), formally known as the Shamba System, which is practiced in Kenya. Under the Plantation Establishment and Livelihood Improvement Scheme, local people are allocated plots inside government forests on which they cultivate crops while growing trees (Kenya Forestry Research Institute, 2014). The agreement is that the farmers will cultivate crops on the allocated plots over three to four years as they tend the grown trees, after which they are moved to another degraded or deforested area after the trees have established a closed canopy (Waruinge et al., 2021). The farmers earn an income and improve their household's food security from the cultivated crops which motivates them to restore and sustainably manage the forests (Waruinge et al., 2021; Kenya Forestry Research Institute, 2014; Okumu and Muchapondwa, 2020).

The sustainability and success of the payment for environmental service schemes are largely determined by the participation of local communities in the scheme's decision-making processes and activities (Bremer et al., 2014; Sorice et al., 2018). This is because it secures greater benefits for the communities, enhances efficiency by reducing implementation costs, and enhances the relevance of the intervention and local ownership thus decreasing conflicts and resistance (Chhatre, 2012; Aganyira et al., 2020; Larson and Petkova, 2011). Therefore, the extent to which policymakers and development practitioners understand the factors that underlie local communities' participation in the payment for environmental services schemes determines their effectiveness and success (Beeju, 2021; Aganyira et al., 2020; Beeju et al., 2021). These factors could include land use and access to services, the existing governance frameworks, and household and community characteristics (Adhikari, 2009; Zbinden and Lee, 2005), and factors that influence the eligibility, the desire, and the ability to participate (Wunder, 2005).

However, there is a lack of a good understanding regarding the participation of local communities in payment for environmental service schemes, and hence their success and sustainability in Africa (Aganyira et al., 2020; Kagata et al., 2018). Moreover, there are no adequate empirical studies on the factors that influence community participation in payment for environmental services schemes (Adhikari, 2009; Pagiola et al., 2005; Kagombe et al., 2018; Kwayu et al., 2014; Kagata et al., 2018). Studies on payment for environmental services schemes in Africa have also mainly focused on a narrow band of factors such as tenure, equitable sharing, and willingness to participate (Aganyira et al., 2020).

The lack of adequate studies in Africa, therefore, means that most lessons regarding participation in payment for environmental services schemes are drawn from Latin America (Bremer et al., 2014; Kasoy et al., 2008; Murtinho and Hayes, 2017) and Asia (Pham, 2015, Shreshtha and Shreshtha, 2017). However, since the effects of these underlying factors are contextual, there is a need for context-specific studies that consider the diversity of participants (Bottazzi et al., 2018; Coulibaly-Lingani et al., 2011; Meantymaa et al., 2018; Hegde et al., 2014; Beeju et al., 2021).

Therefore, this study undertook an analysis of factors that affect people's participation in the payment of environmental services schemes within forest contexts in Kenya based on the case of the plantation establishment and livelihood improvement scheme. The study will inform the development and implementation of effective payment for environmental services schemes-related policies and programs.

2. Methodology

2.1. Study area.

The study area was Dundori Forest in Kenya and the surrounding community which together form the Dundori Forest socioecological system. Dundori Forest is situated in Nakuru County in the Rift Valley, Kenya. It covers an area of 3,609.3, without considering the settled and degazetted areas. The forest forms an important water catchment, being the source of several rivers that drain into Lake Nakuru, Olpunyata swamp, and Lake Elmentaita. Dundori Forest currently has an ongoing Plantation Establishment and Livelihood Improvement Scheme (PELIS) program.

The forest faces various threats that have led to severe degradation including encroachment and over-exploitation of forest resources due to among other factors the rapid population growth and poverty in forest adjacent areas.

This leads to greater dependence and demand for resources, inadequate institutional capacity for forest management, poor land use practices, and a lack of financial resources for forest management and restoration activities. This has led to the loss of biodiversity and the deterioration of ecosystem services. There is also a low capacity to mitigate and adapt to the effects of climate change and variability hence a reduction in the resilience of ecosystems and community livelihoods.

2.2. Research and sampling design.

The study used a descriptive study design and a multistage sampling design. This first involved the identification of the Dundori Forest socioecological system as the study area using purposive sampling due to the presence of a plantation establishment and livelihoods improvement scheme program. Secondly, the number of households to be involved in the study in each of the twelve sublocations surrounding Dundori Forest was done proportionately using stratified sampling. Further, the households to be involved in the study within a sublocation were determined using systematic sampling. The number of respondents to be involved in the study was determined using Cochran's method (Cochran, 1963). Based on this method, the number of respondents to be involved in the study was 385 respondents.

2.3. Data collection.

Data collection was done using various methods. Firstly, a household questionnaire survey was used to collect data in the households. Focused group discussions and key informant interviews were then undertaken to gain greater insights into the study area regarding the study subject. This also enhanced an understanding of some of the observations made from the analysis of the household questionnaire survey data.

2.4. Data analysis.

Data analysis was done using the probit regression model. The probit regression model helps to understand the relationship between a binary independent variable and independent variables. In doing this, the independent variables were first tested for multicollinearity using the variance inflation factor (VIF) test. The adoption of the plantation establishment and livelihood improvement scheme was measured in a binary form, that is, if adopted (Yes), and if not adopted (No). Dummy coding was used to convert the categorical independent variables into continuous variables.

3. Results

3.1. Test for multicollinearity.

The variance inflation factor for each of the independent variables was found to be close to one with the average VIF being 1.319. This indicates there is no multicollinearity between the independent variables. Therefore, all the independent variables were used in the model. This is shown in Table 3.1.

3.2. Descriptive statistics

The descriptive statistics showed that 37.8% of the households in the Dundori Forest socioecological system did not participate in the plantation establishment and livelihood improvement scheme while 62.2% participated. This shows that a higher proportion of households in the study area participated in the plantation establishment and livelihood improvement scheme.

3.3. Goodness of fit tests.

The goodness of fit test was done to find out how well the probit regression model fits the data. The deviance test was found to be non-significant (Deviance test = 295.162, $P = 0.827 > 0.05$). Also, the Pearson Chi-Square test was found to be non-significant (Pearson Chi-Square X2 = 318.344, $P = 0.892 > 0.05$). The results of these tests indicate that the probit regression model fits the data.

3.4. Omnibus test of model coefficients

The omnibus test of model coefficients was done to find out the overall significance of the probit regression model. A significant P-value (Likelihood ratio Chi-Square = 203.344, $P = 0.000 < 0.05$) was found indicating that at least one independent variable is associated with the binary outcome of the dependent variable.

Table 3.1: Test for multicollinearity

Test for multicollinearity			
Multicollinearity		**Tolerance**	**VIF**
1	Age	0.729	1.372
2	Marital status	0.907	1.103
3	Education	0.857	1.166
4	Household size	0.796	1.256
5	Household's main income source	0.832	1.202
6	Household land adequacy	0.778	1.285
7	Soil condition	0.688	1.453
8	Forest ecological status	0.632	1.583
9	Community involvement in forest governance	0.694	1.440
10	Equitability in the sharing of forest resources	0.841	1.189
11	Conflict over forest resources	0.770	1.298
12	Membership to the CFA	0.644	1.553
13	Effectiveness of forest management	0.692	1.444
14	Household food security	0.792	1.262
15	Household crop production trend	0.767	1.304
16	Forest dependency	0.709	1.410
17	Level of climate change perception	0.902	1.109
	Average VIF		1.319

3.5. Parameter estimates.

Parameter estimates revealed significant effects of six of the predictors. The ecological status of the forest was found to have a positive relationship with participation in the plantation establishment and livelihoods improvement scheme (B = 0.370, SE = 0.1651, P = 0.025 < 0.05) with a 95% Wald Confidence Interval ranging from 0.047 to 0.694. This means a positive perception of the forest's ecological status increases the likelihood of participating in the plantation establishment and livelihoods improvement scheme. Besides, involvement in forest management was found to have a positive relationship with participation in the plantation establishment and livelihoods improvement scheme (B = 0.401, SE = 0.1596, P = 0.012 < 0.05) with a 95% Wald Confidence Interval ranging from 0.089 to 0.714. This means an increase in participation in forest management increases the likelihood of participating in the plantation establishment and livelihoods improvement scheme.

Equitability in forest resources/benefits sharing was found to have a positive relationship with participation in the plantation establishment and livelihoods improvement scheme (B = 0.330, SE = 0.1472, P = 0.012 < 0.05) with a 95% Wald Confidence Interval ranging from 0.041 to 0.618. This means an increase in equitability in forest resources/benefits sharing increases the likelihood of participating in the plantation establishment and livelihoods improvement scheme. Furthermore, membership in the community forest association was found to have a positive relationship with participation in the plantation establishment and livelihoods improvement scheme (B = 0.775, SE = 0.2261, P = 0.01 < 0.05) with a 95% Wald Confidence Interval ranging from 0.332 to 1.218. This means membership in the community forest association increases the likelihood of participating in the plantation establishment and livelihoods improvement scheme.

Forest dependency was found to have a positive relationship with participation in the plantation establishment and livelihoods improvement scheme (B = 0.779, SE = 0.1800, P = 0.000 < 0.05) with a 95% Wald Confidence Interval ranging from 0.426 to 1.132. This means an increase in forest dependency increases the likelihood of participating in the plantation establishment and livelihoods improvement scheme. On the contrary, the level of household food security was found to have a negative relationship with participation in the plantation establishment and livelihoods improvement scheme (B = - 0.285, SE = 0.1335, P = 0.033 < 0.05) with a 95% Wald Confidence Interval ranging from - 0.547 to - 0.023. This means that an increase in household food security decreases the likelihood of participating in the plantation establishment and livelihoods improvement scheme.

The parameter estimates of the probit regression model were as shown in Table 3.2.

Table 3.2. Parameter estimates of the probit regression model.

Parameter Estimates							
Parameter	B	Std. Error	95% Wald Confidence Interval		Hypothesis Test		
			Lower	Upper	Wald Chi-Square	df	Sig.
(Intercept)	-0.658	0.7017	-2.033	0.717	0.879	1	0.348
Gender	-0.124	0.2303	-0.575	0.327	0.290	1	0.590
Marital status	0.090	0.1971	-0.296	0.476	0.208	1	0.649
Household size	-0.022	0.1227	-0.262	0.219	0.032	1	0.858
Age	-0.053	0.0938	-0.237	0.131	0.319	1	0.572
Education	0.067	0.1151	-0.158	0.293	0.343	1	0.558
Income source	0.266	0.1820	-0.091	0.622	2.133	1	0.144
Land size	-0.066	0.1215	-0.305	0.172	0.299	1	0.585
Household farm soil condition/Productivity	-0.137	0.1449	-0.421	0.147	0.896	1	0.344
Forest ecological status	0.370	0.1651	0.047	0.694	5.034	1	0.025
Involvement in forest management	0.401	0.1595	0.089	0.714	6.332	1	0.012
Equitability in resource/benefit sharing	0.330	0.1472	0.041	0.618	5.014	1	0.025
Conflicts over forest resources	-0.057	0.1252	-0.302	0.188	0.208	1	0.648
Community Forest Association membership	0.775	0.2261	0.332	1.218	11.744	1	0.001
Forest governance effectiveness	0.001	0.1447	-0.283	0.285	0.000	1	0.994
Household food security	-0.285	0.1335	-0.547	-0.023	4.557	1	0.033
Agricultural production	-0.165	0.0995	-0.360	0.030	2.763	1	0.096
Forest dependency	0.779	0.1800	0.426	1.132	18.710	1	0.000
Climate change perception	-0.059	0.1341	-0.322	0.204	0.193	1	0.660

4. Discussion

The study found that the ecological state of the forest had a positive influence on participation in the plantation establishment and livelihoods improvement scheme. This is because a good ecological state of the forest implies that communities will benefit more from participating in the program, especially regarding crop production. Households who participate in the plantation establishment and livelihoods improvement scheme are also more interested in improving the forest's condition thus the perception that the forest is in a better state gives them more motivation to participate. A better ecological state of the forest also indicates that the program is attaining good outcomes and thus this may increase the desire of environmentally conscious households to participate. These findings align with previous studies (Sorice et al., 2018; Waruingi et al., 2021; Mendez-Lopez et al., 2019; Bottazzi et al., 2018).

Furthermore, the study found that involvement in forest management increased participation in the plantation establishment and livelihoods improvement scheme. Communities' participation in forest management increases their access to information and understanding of the schemes which also increases certainty and trust in the scheme. They also have a greater possibility of accessing the related benefits. Moreover, it improves the implementation of the payment for environmental services schemes due to the reduction of conflicts and resistance and easing the implementation process. Those who are involved or attend the payment for environmental service meetings thus have a greater likelihood of participation in the actual project activities. Greater involvement of women and the youth in the payment for environment services development not only

enhances equality but also increases participation and the success of the schemes. These findings agree with previous studies (Aganyira et al., 2020; Chhatre et al., 2012; Larson and Petkova, 2011; Murtinho and Haye, 2017; Adhikari and Agrawal, 2013; Chepkonga et al, 2022; Fripp, 2014)

Equitability in accessing forest resources and benefits was found to have a positive relation with participation in the plantation establishment and livelihoods improvement scheme. Thus, increased perception of accessing the benefits of plantation establishment and livelihood improvement schemes including crop harvests and incomes could enhance participation. Access to benefits also incentivizes the scheme's implementation activities which could also participation. More equitable access benefits could imply that there was equitable participation in the payment for environment services scheme development and decision-making processes which enhances acceptance, capacity for implementation, and thus participation in the actual project's activities. Besides, greater equitability in access to benefits of the payment for environment schemes could mean greater participation of women and other marginalized groups in the community. These findings are in line with (Adhikari and Agrawal, 2014; Clements and Milner-Gulland, 2015; Wairunge et al., 2021; Horlings 2015; Lescourret et al. 2015; Kagata et al., 2018; Adhikari, 2009; USAID, 2018). However, according to Wichelns et al. (2016), greater access or the desire to access benefits may encourage participants to focus more time and other resources to focus more on production activities thus foregoing the conservation activities associated with conservation.

The study, also, found that membership in community forest associations increased participation in forest management projects. Institutions such as community forest associations provide the structures for the implementation of payment for environmental services schemes. This includes determining who will participate in the schemes and the distribution of associated benefits. This means memberships in community forest associations could increase the likelihood of participation. Community forest associations are also avenues for the provision of technical support hence capacity building such as through researchers, extension officers, and other development practitioners which could improve participation. Further, they are avenues for information dissemination hence awareness creation, and implementation of other associated projects that support participation. They also provide social networks and hence social capital which is critical in encouraging and support community members to participate, for example, due to the associated mutual support and peer pressure. The involvement of women and other marginalized members of the community in community forest associations could thus also enhance their participation in payment for environmental services schemes. These findings concur with (Wuscher et al., 2011; Adhikari and Agrawal, 2013; Iglesias, et al., 2009; Segnestam, 2009; Cesar et al., 2021; Beeju et al., 2021).

Additionally, forest dependency was found to have a positive relation with participation in plantation establishment and livelihood improvement schemes. High forest dependency means that a farmer is earning income from the forest and enhanced opportunities to increase income and hence dependency could lead to greater participation in payment for environmental services schemes. Farmers who depend more on forests are more interested in better forest conditions since they consider it a key asset, and hence could participate in activities that improve their ecological status. These findings align with (Musyoki et al., 2016; Lise, 2000; Coulibaly-Lingani et al., 2011). However, on the contrary, forest dependence could decrease participation in payment for environmental services schemes since those who depend on the forest for an income or subsistence, especially through extractive activities may see the associated activities as restrictive and cause of lesser gains (Kazungu et al., 2021; Agrawal and Bhattacharya, 2006; Jumbe and Angelsen, 2007; Luoga et al., 2007).

Additionally, food security was found to have a negative correlation with participation in the plantation establishment and livelihood improvement scheme. Since one of the main benefits from the scheme is crop production hence food security, farmers who perceive their households to be food secure may have less interest in the scheme. Such farmers could be satisfying their food-related needs from other adequate sources which may reduce the need to participate in the plantation establishment and livelihoods improvement schemes. This finding agrees with previous studies (Rosoulukhani et al., 2018; Beckers et al., 2013). However, these findings are contrary to previous findings that found that food security had a positive association with involvement in conservation activities (Jha et al., 2019; Thrupp and Magateli, 1992)

5. Conclusion and Recommendations

Community participation in payment for environmental services schemes is influenced by various factors whose effect is context specific. The design and implementation of payment for environmental services schemes should leverage on the factors underlying community participation to come up with effective and sustainable policies and programs. Based on the study, policy makers and developers should encourage community involvement in

forest management, membership to community forest associations, equitable sharing of forest resources and benefits, and improvement of forest ecological status to enhance community participation in payment for environmental services schemes. The study will therefore support the development and implementation of effective policies that will create an enabling environment for payment for environmental services schemes. Besides, the findings of the study will inform the development and implementation of effective and sustainable payment for environmental services programs.

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