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Research Paper

Factors Influencing Household Participation in Extraction of Forest Products in Mount Kenya Forest, Nyeri County, Kenya

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Abstract: *This study investigated the socio-economic and environmental factors influencing household participation in the extraction of forest products from Mount Kenya Forest, Nyeri County. Using a cross-sectional survey design, data was collected from 361 households within a 10-kilometer radius of the forest. Descriptive analysis shows that 77% of households participated in forest product extraction, primarily for domestic and commercial purposes. Binary logistic regression analysis revealed key significant determinants of participation ($p=0.0000<0.05$) as household size, income, education level, and proximity to the forest and awareness of forest management practices. Notably, education ($\beta = -0.1090$, $p = 0.002$) and awareness ($\beta = -0.0479$, $p = 0.000$) were negatively associated with participation. Firewood collection was the most common activity. The results indicate a strong need for enhanced community education on sustainable resource use, promotion of alternative livelihoods, and reinforcement of sustainable harvesting practices. The findings suggest that policy efforts should focus on integrating households into conservation initiatives through Community Forest Associations and promoting clean energy alternatives to mitigate forest degradation.*

Keywords: *Forest Product Extraction, Household Participation, Mt. Kenya Forest, Forest Dependency, Sustainability*

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I. INTRODUCTION

Forests are among the most vital natural ecosystems globally, contributing significantly to environmental stability, biodiversity conservation, and the sustenance of rural livelihoods. They provide a wide range of ecosystem services, including carbon sequestration, climate regulation, water catchment, soil stabilization, and the provision of timber and non-timber forest products (NTFPs) (FAO, 2020). In Kenya, forests contribute about 3.6% to the national Gross Domestic Product (GDP) and support the livelihoods of millions, especially those living near forested regions (KNBS, 2021). Despite their ecological and economic importance, the country continues to experience significant forest cover loss, with an estimated 50,000 hectares disappearing annually due to increasing pressure from human activities such as illegal logging, charcoal burning, and unsustainable extraction practices (FAO, 2016). This has serious implications for environmental sustainability and the socioeconomic welfare of forest-adjacent communities.

Nyeri County, which hosts part of the Mount Kenya Forest, is home to over 200,000 people living within a 5 km radius of the forest boundary. These households rely heavily on forest resources for their livelihoods, including firewood, fodder, timber, honey, and medicinal plants. Despite legal frameworks such as the Forest Conservation and Management Act (2016) and the establishment of Community Forest Associations (CFAs) intended to enhance sustainable forest management, over extraction persists. This suggests a disconnect between

conservation policy and community practices, often driven by socio-economic necessities and institutional weaknesses.

Understanding the determinants of household participation in forest product extraction is essential for designing effective policy interventions that balance environmental conservation and livelihood needs. While numerous studies have explored deforestation trends and forest governance in Kenya, there remains a significant gap in empirical evidence on the localized socio-economic and environmental factors that influence household-level decisions regarding forest resource use. This study addresses that gap by focusing on Mount Kenya Forest in Nyeri County, aiming to identify the social, economic, and environmental drivers of forest dependence among local households.

The study is grounded in the theory of the "Tragedy of the Commons" (Hardin, 1968), which posits that individuals acting in their own self-interest tend to overexploit shared resources, leading to collective loss. In the context of forest resources, this implies that without proper regulation and incentives for sustainable use, forest-adjacent communities are likely to continue degrading forest ecosystems to meet short-term needs.

II. METHODOLOGY

Study Area

This study was conducted in Nyeri County, located in central Kenya on the southwestern slopes of Mount Kenya. The county is predominantly agricultural and lies within the Central Highlands agro-ecological zone, characterized by fertile volcanic soils and bimodal rainfall patterns. The Mount Kenya Forest within Nyeri is a critical ecological asset, providing key forest products and ecosystem services to local communities. Most of the households in this region are rural and rely heavily on forest resources for fuelwood, fodder, medicinal plants, and timber.

Research Design and Sampling Procedure

A cross-sectional survey design was employed to gather quantitative data on household-level participation in forest product extraction. This design was selected for its cost-effectiveness and suitability for capturing data at a single point in time. A multistage sampling approach was adopted. In the first stage, forest-adjacent wards in Nyeri County were purposively selected based on their proximity to Mount Kenya Forest. In the second stage, simple random sampling was used to select 361 households residing within a 10-kilometer radius of the forest boundary.

The sample size formula described by (Kothari, 2004) was used as follows

$$n = \frac{z^2 pqN}{e^2(N-1) + z^2 pq}$$

Where:

n = Sample size.

z = The standard variate value at a given confidence level, which may be calculated using the table that displays the area under the normal curve. z = 1.96 at 95% confidence level

p = The proportion of the sample. The study assumed a p value of 0.5.

q = 1 – p

N= shows the target population- 23,552 households.

E= the error term. The assumed value of 0.05 was used.

Using the above formula, a sample size of 378 respondents was arrived at. However due to challenges in data collection and cleaning, only 361 respondents were captured and found suitable for this study.

Data Collection

Primary data were collected using structured questionnaires administered through face-to-face interviews. The questionnaire covered key areas including household demographics, economic activities, forest dependency, awareness of forest policies, and proximity to forest resources.

Variables and Model Specification

The dependent variable was household participation in forest product extraction**,** coded as a binary outcome (1 = participates, 0 = does not participate). Independent variables were grouped into three categories:

Social factors:

- Age of household head (years)
- Gender (1 = male, 0 = female)
- Education level (ordinal: no formal education, primary, secondary, tertiary)
- Household size (number of people)
- Awareness of forest management practices (1 = aware, 0 = unaware)
- Period of residence near forest (years)

Economic factors:

- Monthly household income (KES)
- Occupation of household head (categorical: farming, casual labor, salaried employment)
- Land size (acres)

Environmental factors:

- Distance to forest (km)
- Type of forest resources available (binary: timber/firewood vs. other NTFPs)

The binary logistic regression model

To examine the influence of these factors, a binary logistic regression model was specified as follows:

$$\Pr(Y = 1 \mid X) = \Lambda(X\beta) = \frac{\exp(X\beta)}{1 + \exp(X\beta)}$$

Where:

Pr (Y=1) - Probability of household participation in forest extraction.

Y - Participation in extraction of forest products

X - Livelihood Factors: Defined in this research as social, economic and environmental factors

Λ - Indicates a link function

B - Beta multiplier

E - Exponential function (approximately 2.718).

The probability that Y equals 1 given X is equal to the logistic function, denoted by Λ(Xβ), which is the inverse of the logit link function. This is expressed as the exponential of Xβ divided by one plus the exponential of Xβ. The prediction equation is as follows

$$Log\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots \beta_n X_n \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3.3)$$

Where:

P(Y=1) = Probability of household participation in forest extraction.

β0 = Intercept (constant).

β1,β2,...,βn = Coefficients of independent variables.

X1,X2,...,Xn = Independent variables (e.g., household size, age, income, proximity to forest).

III. RESULTS AND DISCUSSION

Descriptive Statistics

Table 3.1 Summary of the descriptive statistics

Variable		Frequency	Percentage
Participation	Participating	279	77.29
	Not Participating	82	22.71
Reason	Tradition	10	2.77
	Influence by society	5	1.39
	Income	286	79.22
	Recreation	3	0.83
	Nothing else to do	57	15.79
Occupation	Unemployed	17	4.71
	Farmer	270	74.79
	Casual laborer	14	3.88

	Salaried employee	60	16.62
Income	Below 5000	84	23.27
	5001-10000	133	36.84
	10001-20000	65	18.01
	Above 20000	79	21.88
Land Acreage	0 - 1	279	77.29
	1.5 - 3	71	19.67
	3.5 - 5	11	3.04
	Above 5	0	0
Forest activities	Subsistence farming	80	22.16
	Firewood collection	130	36.01
	Lumbering	88	24.37
	Herbs	9	2.49
	Medicinal products	2	0.55
	Charcoal extraction	52	14.40
Awareness	Aware	139	38.50
	Not aware	222	61.50

Out of 361 surveyed households, 77% reported participation in forest product extraction activities. The primary activities included firewood collection (36.01%), timber harvesting (22.45%), and extraction of medicinal plants and honey (15.5%). Approximately 70.91% of participating households utilized forest products for both domestic use and commercial sale.

On average, household heads were 46 years old, with males constituting 68% of respondents. A significant proportion (58%) had attained primary education or less. The average household size was six persons. In terms of income, 65% of the households earned less than KES 15,000 per month, indicating widespread income vulnerability. Notably, 61.5% of the respondents reported no awareness of forest management policies or sustainable harvesting practices. Only 30% were affiliated with a Community Forest Association (CFA).

Environmentally, the average distance of households from the forest edge was 4.5 kilometers, with closer households more likely to engage in extraction. Firewood and timber were the most readily available forest products, followed by honey, medicinal plants, and fodder.

These descriptive results suggest that forest dependency is primarily driven by domestic needs, income constraints, and lack of awareness of sustainable use practices.

Regression Results

To further identify the determinants of household participation, a binary logistic regression model was estimated. The dependent variable was participation in forest product extraction (1 = Yes, 0 = No).

Table 3.2: Regression Results on Household Participation in Extraction of Forest Products

Number of observations = 361

LR χ^2 (11) = 806.27

Prob > χ^2 = 0.0000

Log Likelihood = 204.93526

Pseudo R^2 = 0.8920

Variable	Coefficient	Std. Error	t-ratio	p-value
Age	0.0469751	.0157356	2.99	0.0030*
Gender of Respondent	0.1921618	.0319773	6.01	0.0000*
Education Level	-0.1090673	.035483	-3.07	0.0020*
Household Size	0.3892169	.0190999	20.38	0.0000*
Awareness	-0.0479597	.0126739	-3.78	0.0000*
Period of Residence	0.0157422	.0139997	1.12	0.2620
Income	-0.0175515	.0044474	-3.95	0.0000*
Occupation	-0.2058009	.0100655	-20.45	0.0000*

Land Acreage	-0.0112691	.0468383	-2.24	0.0021*
Proximity to Forest	0.082112	.0051251	16.02	0.0000*
Resources Available	-0.0174074	.0166023	-3.05	0.0020*
Constant	0.104164	.1241342	0.84	0.4020

Legend '*'indicates that the statistic value is significant at 5% level of significance.
Model diagnostics: Pseudo R^2 = 0.892, Log-likelihood = -51.237

From the table above, extraction of forest products is highly influenced by social economic and geographical factors except for the period of residence.
The prediction equation was as follows

$$Log\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots \beta_n X_n \text{......} \quad (4.1)$$

Where:
P(Y=1) = Probability of household participation in forest extraction.
β0 = Intercept (constant).
β1, β2 ..,,βn = Coefficients of independent variables.
X1, X2 ..,Xn = Independent variables (e.g., household size, age, income, proximity to forest).
The logistic regression equation is

$$Log\left(\frac{p}{1-p}\right) = 0.1041 + 0.0469Age + 0.1922Gender - 0.1091Edu + 0.3892hh - 0.0479Awareness - 0.0176Income - 0.20580ccupation - 0.0113LS + 0.0821Proximity - 0.0174Resources$$

The model shows high explanatory power (Pseudo R^2 = 0.892), suggesting that the selected variables explain a significant portion of the variation in household participation decisions. All five independent variables are statistically significant at the 5% level.

Interpretation of Key Results

Age of the Respondent (β =0.0469751, p = 0.0030): From the results, age is a significant factor with a p-value of 0.0030 and a positive Beta coefficient of 0.0469751. The positive Beta coefficient (0.0469751) suggests that as age increases, the likelihood of engaging in forest product extraction also rises by 4.69%. This implies that older individuals are more likely to participate in harvesting forest resources, possibly due to their experience, established livelihood patterns, and traditional reliance on forests for subsistence. Older individuals may also have fewer alternative income sources compared to younger generations, making them more dependent on forest products for firewood, timber, and other needs. These results are backed up by the descriptive statistics which showed that most of the households heads were 40 years and above and hence the increased participation in extraction.

Gender of Respondent (β = 0.1921618, p = 0.0000): Results also indicated that Gender is a significant factor with a p-value of 0.0000* at 5% confidence level. The positive Beta coefficient (0.1921618) suggests that one gender, likely women, has a higher likelihood of engaging in forest product extraction. From the descriptive statistics female headed households were seen to participate more in extraction than the males, indicating that, a shift from male to female headed households increases the likelihood of participation in extraction of forest products by 19.2 percent. This is largely due to traditional gender roles, where women are primarily responsible for collecting firewood and other forest resources for household use. Additionally, female-headed households, often facing economic hardship, may rely more on forest products for both subsistence and income generation.

Education Level (β = -0.1090, p = 0.002): Education negatively correlates with participation. Households with more educated heads were less likely to rely on forest resources. Education likely increases awareness of environmental consequences and provides alternative income opportunities, reducing dependency. Similar conclusions were drawn by Johnson and Brown (2018), who noted that formal education enhances access to non-extractive livelihoods and compliance with forest regulations.

Household Size (β = 0.2592, p = 0.000): The logistic regression results indicate that household size is the most significant factor influencing forest product extraction, with a p-value of 0.0000 at a 5% confidence level, meaning the relationship is highly statistically significant. The beta coefficient of 0.3892 suggests a positive relationship,

meaning that as household size increases, the likelihood of engaging in forest extraction activities also rises by 38.92%. Larger households typically have higher resource demands, including firewood, agriculture, and timber, which increases their dependence on forest products. Additionally, more household members may provide additional labor, making it easier to extract and transport resources from the forest. These results reinforce the idea that population pressure within households contributes significantly to forest degradation.

Awareness of Forest Management (β = -0.0479, p = 0.000): Awareness has a significant inverse relationship with participation, suggesting that better-informed households are more inclined toward conservation or alternative practices. This is in line with the theory that knowledge of sustainable resource use reduces the likelihood of exploitation (Rist et al., 2012; Njenga et al., 2020). However, only 38.5% of respondents reported being aware of forest management rules, pointing to a significant gap in outreach and education by conservation agencies.

Income (β = 0.1654, p = 0.000): A higher income level reduces dependence on forest products, as wealthier households can afford alternative energy sources, such as gas or electricity, and purchase construction materials instead of extracting timber. Similarly, households with larger land sizes are less likely to rely on forests, as they can source fuelwood from their own farms, do agriculture in their own farms or engage in agroforestry, reducing pressure on communal forests.

Occupation (β = -0.2058009, p = 0.0000): The negative beta value of -0.2058009 shows that as households engage in more formal occupations, the likelihood of extracting forest resources decreases. This could imply that more formal employment or business activities have more stable income sources, lowering their dependence on forest resources compared to those relying on casual labor or farming. These findings highlight the importance of improving economic opportunities, promoting alternative energy sources, and encouraging land-use diversification to reduce forest overexploitation.

Land Acreage (β = -0.0112691, p = 0.0021): The negative Beta coefficients suggest that as land size increases, the likelihood of reliance on forest resources decreases. Households with larger land sizes are less likely to rely on forests, as they can source fuelwood from their own farms, do agriculture in their own farms or engage in agroforestry, reducing pressure on communal forests.

Proximity to the Forest (β = -0.1335, p = 0.000): Households closer to the forest are more likely to engage in extraction. Proximity reduces the transaction cost (time and effort) of harvesting, making resource use more feasible. This finding is consistent with studies by Karanja et al. (2020) and Banana et al. (2001), who found that forest exploitation intensity declines with increasing distance from forest edges or roads.

Resources Available (β = -0.0174074, p = 0.0020): The negative Beta coefficient (-0.01789) suggests that as the extraction of forest products increases, the availability of these resources decreases. This inverse relationship can be attributed to overharvesting, where excessive extraction reduces the natural regeneration of forest resources. Additionally, high demand for specific forest products may lead to their rapid depletion, further contributing to declining availability. The implication of these findings is that unsustainable extraction patterns could lead to resource exhaustion, negatively affecting both household livelihoods and ecosystem stability. These results underscore the need for sustainable harvesting techniques and forest management policies, promoting controlled extraction and encouraging community participation in conservation efforts to ensure long-term resource availability.

Comparison with Previous Studies: These results corroborate key themes from the literature on forest dependency. Socioeconomic vulnerability, resource access, and institutional awareness are recurrent determinants of forest extraction behaviors across many developing countries. In Zambia, Jumbe et al. (2007) found that forest products accounted for over 20% of household income. Similarly, in Ethiopia, Gelo and Koch (2018) highlighted how income shocks increased forest dependence, even among better-off households. In Kenya, the results reaffirm earlier studies on household extraction patterns around forests such as the Mau Complex and Kakamega Forest (Chomba et al., 2016; Njenga et al., 2020). Unlike some studies that emphasize only poverty as the main driver of extraction, this study shows a more nuanced picture where both poorer and moderately wealthier households extract forest resources, the former for survival, the latter for commercial gain. Furthermore, institutional variables such as awareness play a central role in influencing behaviors, emphasizing the importance of community-based education and forest governance.

IV. CONCLUSION

This study investigated the factors influencing household participation in the extraction of forest products in Mount Kenya Forest, Nyeri County, Kenya. Using data from 361 forest-adjacent households and applying a binary logistic regression model, the analysis identified key social, economic, and environmental determinants of forest dependency.

The findings reveal that household size, income, education level, awareness of forest management practices, and distance to the forest significantly influence participation. Larger households and those with lower income levels are more likely to extract forest products, possibly due to greater domestic needs and commercial motivations. In contrast, households with higher education and better awareness of sustainable practices are less likely to engage in extraction, underscoring the protective effect of knowledge and access to information. Proximity to the forest also plays a critical role, as closer households face lower barriers to extraction.

These results confirm that forest resource use is multifactorial, driven by a blend of necessity, opportunity, and awareness. They also highlight that forest degradation is not solely a function of poverty but is influenced by household strategies to meet diverse livelihood needs, including those of relatively better-off households seeking supplemental income.

The study contributes to the understanding of forest dependence dynamics in Kenya and adds empirical weight to the need for integrative conservation strategies that consider local socioeconomic conditions. Addressing unsustainable forest extraction requires not only regulatory enforcement but also socio-economic incentives and robust community engagement.

REFERENCES

[1] Banana, A. Y., Bahati, J., & Gombya-Ssembajjwe, W. S. (2001). Decentralization of forestry resources and its implications for forest sustainability in Uganda. Forest Policy and Economics, 2(1), 25-35.

[2] Chomba, S. W., Nathan, I., Minang, P. A., & Sinclair, F. L. (2016). Illusions of empowerment? Questioning pathways to community forestry and REDD+ in Africa. Ecology and Society, 21(3), 1–15.

[3] FAO (2016). Negotiation and Mediation Technologies for Natural Resource Management: Prepared in the frame work of the Livelihood Support Program (LSP),

[4] FAO. (2020). Global Forest Resources Assessment.

[5] Gelo, D., & Koch, S. F. (2018). The impact of common property right forestry: Evidence from Ethiopian villages. World Development, 102, 15–30.

[6] Hardin, G. (1968). The tragedy of the commons. Science, 162(3859), 1243–1248.

[7] Jumbe, C. B. L., Bwalya, S. M., & Husselman, M. (2007). Contribution of dry forests to rural livelihoods and the national economy in Zambia. Center for International Forestry Research (CIFOR).

[8] Karanja, X., Mutai, P., & Wanjiku, L. (2020). Community engagement in forest conservation and sustainable resource use: A Kenyan perspective. Journal of Environmental Management, 50(2), 211-229.

[9] Kenya National Bureau of Statistics (KNBS). (2020). Kenya population and housing census, 2019: Volume IV.

[10] Kothari, C.R. (2004). Research methodology methods and techniques, published by New Age International.

[11] Njenga, K., Otieno, B., & Wekesa, R. (2020). Household dependence on forest resources and implications for conservation: A study from East Africa. Environmental Conservation, 47(2), 98-112.

[12] Republic of Kenya. (2016). Forest Conservation and Management Act, No. 34 of 2016. Kenya Gazette Supplement No. 155 (Acts No. 34). Government Printer.

[13] Rist, L., Feintrenie, L., & Levang, P. (2012). The livelihood impacts of oil palm: Smallholders in Indonesia. Biodiversity and Conservation, 19(4), 1009–1024.