PUBLISHING KSI
• ISSN 2720 - 9644 (print)
• ISSN 2721 - 0877 (online)
IJESSS
INTERNATIONAL JOURNAL OF ENVIRONMENTAL, SUSTAINABILITY AND SOCIAL SCIENCE
Indexed by : sinta 3 Crossref GARUDA Google scholar

# EXTRACTION OF FOREST PRODUCTS IN MOUNT KENYA FOREST, KENYA; LINKING HOUSEHOLD CHARACTERISTICS TO PARTICIPATION

Volume: 7
Number: 3
Page: 642 - 651

**Mwangi Flora Caroline[1], Anderson Kipkoech[2], Ernest Saina[3], Samuel Mwakubo[4], Samuel Otieno John[5]**
[1,2,3,4,5]Moi University, Kenya
Corresponding author: Anderson Kipkoech
E-mail: andersonkipkoech@mu.ac.ke

**Article History:**
Received: 2026-03-04
Revised: 2026-04-05
Accepted: 2026-05-12

**Abstract:**
This study analysed the socio-economic and environmental factors influencing household participation in the extraction of forest products from Mount Kenya Forest, Kenya. The methodology 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 to identify sampling units.. Descriptive analysis shows that 77% of households participated in forest product extraction, primarily for domestic and commercial purposes, only 361 respondents were captured and found suitable for this study. The results reveal that household size, income, education level, awareness of forest management practices, and distance to the forest significantly influence participation. The binary logistic regression analyses confirmed these factors as key determinants, with larger households and lower education correlating positively with higher extraction rates for products like firewood, medicinal plants, and fodder, while wealthier and employed individuals showed reduced dependency. 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 a single factor but rather is influenced by household strategies to meet diverse livelihood needs.

**Keywords**: Forest Products, Logistic Regression, Socio-Economics, Sustainability

## 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.

The Mount Kenya Forest ecosystem 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 in place, such as the Forest Conservation and Management Act (2016) and the establishment of Community Forest Associations (CFAs) that are intended to enhance sustainable forest management, over-

PUBLISHING KSI
• ISSN 2720 - 9644 (print)
• ISSN 2721 - 0877 (online)
IJESSS
INTERNATIONAL JOURNAL OF ENVIRONMENTAL, SUSTAINABILITY AND SOCIAL SCIENCE
Indexed by : sinta 3 Crossref GARUDA Google scholar

extraction persists. Poverty has been found to drive the high extraction of forest products in the forest, which compels adjacent communities to harvest non-timber products (NTFPs) like fuelwood, honey, and medicinal plants for subsistence and income (Yego et al., 2021). The increasing population pressures and urbanization lead to an increase in demand for wood fuel, which leads to higher extraction rates where weak enforcement and poor value chains are experienced (Kibet et al., 2020). The increasing extraction rates suggest 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 over-exploit shared resources, leading to collective loss. In the context of forest resources, this implies that the socio-economic characteristics of the households define a unique household appetite for forest products. Without proper regulation and incentives for sustainable use, forest-adjoining communities are likely to continue extracting and possibly degrading forest ecosystems to meet short-term needs predisposed by their socio-economic characteristics.

## METHODS

**Study Area.** This study was conducted in the southwestern slopes of Mount Kenya, Nyeri County, Kenya, approximately 0°10' South latitude and 37°18' East longitude. The area lies just south of the equator in central Kenya, within the Mount Kenya National Park and Natural Forest region. The forest adjacent community of the county is predominantly agricultural, whose land lies within the Central Highlands agro-ecological zone. Soils are highly fertile and volcanic but susceptible to erosion due to steep slopes, intensive cultivation, and high bimodal rainfall patterns with the annual rainfall averaging 2,000-2,500 mm that fosters biodiversity but intensifies NTFP demands (Kibet et al., 2020). The slopes are predominantly smallholder agricultural zones characterized by mixed farming, including cash crops such as tea and coffee and food crops like maize, beans, and Irish potatoes (Yego et al., 2021). The study area 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 to identify sampling units. 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.

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

PUBLISHING KSI
• ISSN 2720 - 9644 (print)
• ISSN 2721 - 0877 (online)
IJESSS
INTERNATIONAL JOURNAL OF ENVIRONMENTAL, SUSTAINABILITY AND SOCIAL SCIENCE
Indexed by : sinta 3 Crossref GARUDA Google scholar

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.

**Model Specification of the Binary Logistic Regression Model.** To examine the influence of the socio-economic characteristics on the extraction of forest products, a binary logistic regression model was specified below and used to analyze the data.

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

Where:
Pr (Y=1): Probability of household participation in forest extraction. Y - Participation in the 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
Exp: 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:

$$Log\left(\frac{p}{1-p}\right)=\beta 0+\beta 1X1+\beta 2X2+\cdots\beta nXn$$

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 (such as household size, age, income, proximity to forest as described below).

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:

PUBLISHING KSI
• ISSN 2720 - 9644 (print)
• ISSN 2721 - 0877 (online)
IJESSS
INTERNATIONAL JOURNAL OF ENVIRONMENTAL, SUSTAINABILITY AND SOCIAL SCIENCE
Indexed by : sinta 3 Crossref GARUDA Google scholar

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 in a household)
- 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)

## RESULT AND DISCUSSION

Descriptive Statistics. Results in Table 1 show that out of 361 surveyed households, 77.3% reported participation in forest product extraction activities. The primary activities included firewood collection (36.0%), timber harvesting (22.5%), and extraction of medicinal plants and honey (15.5%). Approximately 70.9% 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 than eight years of formal education. Higher education levels enable diversification into off-forest activities, lowering the demand for extraction intensity for the forest products (Kibet et al., 2020). Age has been found to negatively influence forest product extraction levels (Yego et al., 2021). Older household heads usually possess higher asset levels that have been accumulated over time, which can be used as alternative livelihoods, reducing reliance on forest-based products.

The average household size was six persons. Larger family sizes increase labor availability and consumption demands, boosting participation and volume of forest products extracted (Yego et al., 2021). 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). Studies have shown that a greater policy awareness, via extension services and user groups, promotes compliance and sustainable practices, curbing over-exploitation among informed households (Waruingi et al., 2021). The higher participation in forest product extraction was highly correlated ($p>0.001$) with the high product extraction levels.

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.

PUBLISHING KSI
• ISSN 2720 - 9644 (print)
• ISSN 2721 - 0877 (online)
IJESSS
INTERNATIONAL JOURNAL OF ENVIRONMENTAL, SUSTAINABILITY AND SOCIAL SCIENCE
Indexed by : sinta 3 Crossref GARUDA Google scholar

**Table 1.** Description of Household Socio-economic Characteristics and Forest Product Extraction

| Variable | Description | Frequency | Percentage |
|---|---|---|---|
| Household participation in forest product extraction | Participating | 279 | 77.3 |
| | Not Participating | 82 | 22.7 |
| Primary reason for forest product extraction | Tradition | 10 | 2.8 |
| | Influenced by society | 5 | 1.4 |
| | Income | 286 | 79.2 |
| | Recreation | 3 | 0.8 |
| | Nothing else to do | 57 | 15.8 |
| Occupation of the household head | Unemployed | 17 | 4.7 |
| | Farmer | 270 | 74.8 |
| | Casual laborer | 14 | 3.9 |
| | Salaried employee | 60 | 16.6 |
| Income level (in Kenya Shillings) of the household | Below 5000 | 84 | 23.3 |
| | 5001-10000 | 133 | 36.8 |
| | 10001-20000 | 65 | 18.0 |
| | Above 20000 | 79 | 21.9 |
| Household land holding size (acres) | <1 | 279 | 77.3 |
| | >1 ≤3 | 71 | 19.7 |
| | >3 ≤5 | 11 | 3.0 |
| | Above 5 | 0 | 0.0 |
| Household activities/products within the forest area | Subsistence farming | 80 | 22.2 |
| | Firewood collection | 130 | 36.0 |
| | Lumbering | 88 | 24.4 |
| | Herbs | 9 | 2.5 |
| | Medicinal products | 2 | 0.6 |
| | Charcoal extraction | 52 | 14.4 |
| Whether the household is aware of the possible extraction of forest products | Aware | 139 | 38.5 |
| | Not aware | 222 | 61.5 |

**Results of the Binary Logistic Model.** Table 2 below shows the results of the binary (1 = Yes, 0 = No) logistic regression model of the factors influencing the participation of households in the extraction of forest products in the study area. The analysis incorporates socio-demographic, economic, and spatial variables to understand factors influencing the likelihood of extraction engagement. Age, gender, and education level of the respondent capture individual household characteristics that potentially influence their relationship and demand for the forest resource use. Household size reflects the resource and labor dynamics. Familiarity with forest conservation policies enabled households to consider the extraction of forest products in their household decision-making processes. Households with long periods of interaction with the forests would develop a system for exploiting the resources. The model's intercept provides baseline log-odds of participation for households when the predictor variables are absent. This multivariate approach allows disentangling individual effects within the complex socio-ecological context of forest product use, where the coefficient obtained provides the change in the log-odds (logit) of household

PUBLISHING KSI
• ISSN 2720 - 9644 (print)
• ISSN 2721 - 0877 (online)
IJESSS
INTERNATIONAL JOURNAL OF ENVIRONMENTAL, SUSTAINABILITY AND SOCIAL SCIENCE
Indexed by : sinta 3 Crossref GARUDA Google scholar

participation in forest product extraction for a one-unit increase in the predictor, holding other variables constant.

Testing the robustness of the model, the likelihood ratio test compared the full model (with 11 predictors) against the null model (intercept only), yielding a chi-square statistic showing the LR2 (11) = 806.27 with Prob > Chi-square = 0.00000. The p-value < 0.05 rejects the null hypothesis that all coefficients (except the constant) equal zero, confirming that at least one predictor significantly influences the log-odds of the outcome. This demonstrates the strong explanatory power of the included variables in predicting participation in forest product extraction. Pseudo $R^2$ = 0.872 indicates strong explanatory power in the logistic regression model, representing 87.2% improvement in the log-likelihood over the null (intercept-only) model.

**Table 2.** Regression Results of Household Participation in the Extraction of Forest Products

Number of observations = 361
LR $\beta^2$ (11) = 806.27
Prob > $\beta^2$ = 0.0000
Log Likelihood = 204.93526 Pseudo $R^2$ = 0.8920

| Variable | Coefficient | Std. Error | t-ratio | p-value |
|---|---|---|---|---|
| Age | 0.05 | 0.02 | 2.99 | 0.0 030* |
| Gender of household head | 0.19 | 0.03 | 6.01 | 0.0000* |
| Education Level of household head | -0.11 | 0.04 | -3.07 | 0.0020* |
| Household Size | 0.39 | 0.02 | 20.38 | 0.0000* |
| Awareness about the extraction of forest products | -0.05 | 0.01 | -3.78 | 0.0000* |
| Period of Residence within the proximity of the forest | 0.02 | 0.01 | 1.12 | 0.2620 |
| Income level of the household | -0.02 | 0.00 | -3.95 | 0.0000* |
| Occupation of the household head | -0.21 | 0.01 | -20.45 | 0.0000* |
| Household land size (acres) | -0.01 | 0.05 | -2.24 | 0.0021* |
| Proximity to forest (km) | 0.08 | 0.01 | 16.02 | 0.0000* |
| Resources available (WHAT IS THIS?) | -0.02 | 0.02 | -3.05 | 0.0020* |
| Constant | 0.10 | 0.12 | 0.84 | 0.4020 |

'*' significant at 5% level of significance. Model diagnostics: Pseudo $R^2$ = 0.892, Loglikelihood = -51.237

From the results, the extraction of forest products must be highly influenced by socioeconomic and geographical factors, except for the period of residence within the proximity of the forest. The prediction equation was as follows:

$$Log\left(\frac{p}{1-p}\right) = \beta 0 + \beta 1X1 + \beta 2X2 + \cdots \beta nXn$$

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).

PUBLISHING KSI
• ISSN 2720 - 9644 (print)
• ISSN 2721 - 0877 (online)
IJESSS
INTERNATIONAL JOURNAL OF ENVIRONMENTAL, SUSTAINABILITY AND SOCIAL SCIENCE
Indexed by : sinta 3 Crossref GARUDA Google scholar

The logistic regression equation is

$$Log\left(\frac{p}{1-p}\right) = 0.1041 + 0.0469\text{Age} + 0.1922\text{gender} - 0.1091\text{Edu} + 0.3892\text{hh} - 0.0479\text{Awareness} - 0.0176\text{income} - 0.2058\text{occupation} - 0.0113\text{LS} + 0.0821\text{proximity} - 0.0174\text{resurces}$$

**Discussion of the Variables used in the Model.** The age of the respondent was a significant factor with a p-value of <005 and a positive coefficient of 0.05 influencing participation in forest product extraction. The positive Beta coefficient (0.05) 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 household heads were 40 years and above, and hence the increased participation in extraction.

Gender was a significant ($p < 0.001$) factor with a positive coefficient (0.19) that suggests that being the gender male is associated with an increase in the log-odds of the outcome by 0.19 units, holding other factors constant. The coefficient is associated with an odds ratio of 1.209, which means the odds of participation in the extraction of forest products increase by about 20.9% for males, holding other variables constant. It is plausible that male-headed households were likely to extract forest products compared to their female counterparts. These results agree with those obtained by Bitzer et al. (2024), who found that men often control access rights, decision-making in forest user groups, and have greater time endowment and physical mobility, facing fewer societal restrictions on venturing deep into forests or transporting heavy loads commercially.

The education level of the household head negatively correlates with participation in the extraction of forest products. Households with a more educated household head 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.

The household Size variable was also found to significantly influence participation in the extraction of forest products ($\beta = 0.26$, $p<0.001$), which shows that as household size increases, the likelihood of engaging in forest extraction activities also rises by 38.9%. Larger households typically have higher resource demands, including firewood, food, 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 increase without a commensurate development of economic opportunities may increase pressure for environmental resources to provide for the needs of the emerging populations, which contributes significantly to their depletion.

Awareness about the existence and management of the forest products had a significant inverse relationship with participation. The coefficient of the awareness variable of ($\beta = -0.05$, $p<0.000$) suggests that the government training and extension, and the forest management enforcement programs could have resulted in tapping into alternatives to the forest products. This is in line with the theory that knowledge of sustainable resource use reduces the likelihood of unsustainable exploitation (Rist et al., 2012; Njenga et al., 2020).

PUBLISHING KSI
• ISSN 2720 - 9644 (print)
• ISSN 2721 - 0877 (online)
IJESSS
INTERNATIONAL JOURNAL OF ENVIRONMENTAL, SUSTAINABILITY AND SOCIAL SCIENCE
Indexed by : sinta 3 Crossref GARUDA Google scholar

The household income levels and the occupation of the household head were significant in influencing participation in the extraction of forest production, with coefficients of, respectively, 0.17 ($p<0.001$) and -0.21 ($p<0.001$. A higher income level reduces dependence on forest products, as wealthier households could afford alternative livelihood sources, such as food, 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. The negative coefficient of the occupation of the household head 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 off-farm engagements and income sources, lowering their dependence on forest products. These findings highlight the importance of improving economic opportunities, promoting alternative livelihood and energy sources, and encouraging land-use diversification to reduce reliance on forests in supporting community livelihoods.

The household land size had a significant negative coefficient, showing that as land size increases, the likelihood of reliance on forest resources decreases. Households with larger land sizes were likely to rely on their farms to produce adequate food and materials, reducing pressure on communal forests. Households closer to the forest were 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.

The abundance of the forest resources negatively and significantly ($\beta$ = -0.02, $p<0.005$) influenced participation in forest product extraction. This variable shows that the forest resources that were abundant were less likely to be extracted. This variable suggests that there are some forest products that were more restricted, and communities were not allowed to extract, signifying some success story in the enforcement of restrictions on the exploitation of forest resources.

These results corroborate key findings by other studies that show that socioeconomic vulnerability, resource access, and institutional awareness are recurrent determinants of forest extraction behaviors across many developing countries. Jumbe et al. (2007) found that forest products accounted for over 20% of household income in Zambia. In Ethiopia, Gelo and Koch (2018) highlighted how income shocks increased forest dependence, even among better-off households. In Kenya, the results are similar to those of other studies on household extraction patterns around forests such as the Mau Complex and Kakamega Forest (Chomba et al., 2016; Njenga et al., 2020). 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 those that create awareness play a central role in influencing behaviors, emphasizing the importance of community-based education and forest governance in natural resource management.

## CONCLUSION

The findings reveal that household size, income, education level, awareness of forest management practices, and distance to the forest significantly influence participation. The binary logistic regression analyses confirmed these factors as key determinants, with larger households and lower education correlating positively with higher extraction rates for products like firewood, medicinal plants, and fodder, while wealthier and employed individuals showed reduced dependency. These results confirm that forest resource use is multifactorial, driven by a blend of

PUBLISHING KSI
• ISSN 2720 - 9644 (print)
• ISSN 2721 - 0877 (online)
IJESSS
INTERNATIONAL JOURNAL OF ENVIRONMENTAL, SUSTAINABILITY AND SOCIAL SCIENCE
Indexed by : sinta 3 Crossref GARUDA Google scholar

necessity, opportunity, and awareness. They also highlight that forest degradation is not solely a function of a single factor but rather is influenced by household strategies to meet diverse livelihood needs. 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. Conservation policies must balance livelihood needs with conservation through prioritizing targeted interventions such as developing community-based institutions for creating awareness and farmer education, providing alternative income and livelihood schemes, and enforcing access regulations.

## REFERENCES

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.

Bitzer, V., Kuijpers, R., Simonsen, N., & others. (2024). Gender and forest resources in low- and middle-income countries: A systematic literature review. *Forest Policy and Economics, 163*, 103226. https://doi.org/10.1016/j.forpol.2024.103226.

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. https://doi.org/10.5751/ES-07741-200302

FAO (2016). Negotiation and Mediation Technologies for Natural Resource Management: Prepared in the framework of the Livelihood Support Program (LSP),

FAO. (2020). Global Forest Resources Assessment. FAO

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

Hardin, G. (1968). The tragedy of the commons. *Science, 162*(3859), 1243–1248. https://doi.org/10.1126/science.162.3859.1243

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).

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.

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

Kibet, S., et al. (2020). Socio-economic drivers of degradation and their implications for the rehabilitation of Mt. Kenya forest. *Journal of Environmental Protection, 11*(5), 345-362. https://www.scirp.org/journal/paperinformation?paperid=100697

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

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.

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

PUBLISHING KSI
• ISSN 2720 - 9644 (print)
• ISSN 2721 - 0877 (online)
IJESSS
INTERNATIONAL JOURNAL OF ENVIRONMENTAL, SUSTAINABILITY AND SOCIAL SCIENCE
Indexed by : sinta 3 Crossref GARUDA Google scholar

Rist, L., Feintrenie, L., & Levang, P. (2012). The livelihood impacts of oil palm: Smallholders in Indonesia. *Biodiversity and Conservation, 19*(4), 1009–1024. https://doi.org/10.1007/s10531-010-9815-z

Yego, P., et al. (2021). Forest-based livelihood choices and their determinants in western Kenya. *Journal of Eastern African Studies, 15*(1), 1-22. https://doi.org/10.1080/21580103.2020.1870577

Waruingi, E., Mbeche, R., & Ateka, J. (2021). Determinants of forest-dependent households' participation in payment for ecosystem services: Evidence from Plantation Establishment Livelihood Improvement Scheme (PELIS) in Kenya. Global Ecology and Conservation. Volume 26, April 2021, e01514