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## Effect of Forest Logging on Socioeconomic Status of Households in South West Mau Sub County, Kenya

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### **Abstract:**

*Extensive degradation of the Mau Forests Complex has been happening as a result of encroachment, excisions and illegal forest resources extraction. The degradation is a major threat to water resources, biodiversity and livelihoods of households surrounding the forest. Political interference, weak law enforcement, limited management capacities of mandated institutions, and inadequate governance systems have accounted in part for this wanton degradation. Considering the negative consequences albeit socioeconomic benefits, one of the objectives of this study was to examine the effects of forest logging on the socio-economic status of households in South West Mau Sub County. The results further revealed that logging affected households' health through pollution from the activities and loss of traditional medicinal trees. The households also lost property and other sources of livelihood due to logging of the Mau forest. From the findings of the study, it is concluded that Mau forest logging is still high in the study area as households depend on the forest for their energy supply in terms of charcoal and firewood, which is a common product obtained from the forest and used in households for cooking. The degradation of the forest by human and nature activities had affected their livelihood as they were now susceptible to flash flood, drought which brought a lot of loss in the family. Besides, conservation and sound management of the forests cannot be achieved by one agency alone. All forest conservation agencies including NEMA, KFS, KWS, KWTA, the Kenya Police Service and the Ministries of Interior must come together to formulate an interagency plan of action to enhance synergy, and highlight areas of collaboration and coordination.*

**Keywords:** Forest logging, socioeconomic status, households, Kenya

### **1. Introduction**

Unembellished forest disturbances such as those by logging, wildfires and windstorms are part of the natural dynamics of forest ecosystems across the world (Banerjee & Madhurima, 2013), yet, World Bank (2016) estimates that 1.3 billion people globally depend directly on forests for livelihood and another 800 million people live in and/or near forests, relying on forest resources for their survival. Moreover, 350 million people who live adjacent to dense forests depend on them for subsistence and income (Chao, 2012). In a rapid modernizing and resource-deficit environment, managing forests successfully, while at the same time sustaining forest-dependent livelihoods, is critical (Balmford & Bond, 2015). Crouzeilles et al. (2017) explicate that identifying and adopting management strategies that promote regeneration and maintain ecosystem functions of post-disturbance forests, whether through proactive interventions is paramount.

However, logging has been a major barrier to forest management practices in many countries. In this study, logging is the process of felling and extracting timber from forests. Until after World War II, logging operations in tropical forests were for the most part mechanized, relying largely on human and animal power. Some of the early studies and interventions on forest management of tropical forests emphasized the significance of careful logging to protect future crop trees and support people's livelihoods effectively (Dawkins and Philip, 1998). Vedeld et al. (2004) found that forest products contribute between 20% and 40% of total income of households in forest areas, and that poor households tend to be disproportionately dependent on forest resources. In countries such as Indonesia, timber production poses significant threats to forest ecosystems in tropical regions (Lawson et al. 2014). For instance, between 2000 and 2010 1.8 Mha of forests (12.8%) of all deforestation during that time period were lost within commercial logging concessions in Indonesia.

In Pakistan, there is rapid degradation of the ozone layer, soil resources, as well as air and water pollution and affect human well-being, especially on their socio-economic status (Alam, 2010). The natural resources have depleted remarkably resulting from accelerated pace of economic and social transformation (Nkonya et al. 2011). According to Jouanjan et al. (2014) socio-economic status of rural populations are increasingly constrained by environmental

concerns, in this case, forest degradation. In Nigeria, there are many socio-economic challenges associated with forest degradation as statistics reveals that approximately 67% of Nigerians falls within the low income category attributable to environmental degradation (Ogboru & Anga, 2015). Pouliot, Treue, Obiri and Ouedraogo (2015) conducted a study to investigate the effect of deforestation to rural livelihoods in West Africa a case of Burkina Faso and Ghana. This was in the light of concern that forest degradation in West Africa is generally thought to have negative consequences on rural livelihoods but there is little overview of its effects in the region because the importance of forests to rural livelihoods has never been adequately quantified. The study found that agricultural spaces and the non-forest environment such as parklands were considerably more valuable to the poor as well as better-off rural households than forests.

Contrary to other studies, forest degradation is profitable for and, hence, probably performed by rural people at large. This was attributed to rural people's high reliance on non-forest versus forest resources to the two countries' restrictive and inequitable forest policies for conservation. In Kenya, the forest sector is key to socioeconomic wellbeing as most of the country's economic sectors rely on environmental based resources for their sustenance (MoEF, 2018). According to the Green Economy Strategy and Implementation Plan 2015 (GoK, 2015), the natural resource-related sectors contribute about 42% of Kenya's GDP and 70% of overall employment. The Kenya Forest Conservation and Management Act, 2016 (FCMA) defines a forest as land which is declared or registered as a forest, or woody vegetation growing in close proximity in an area of over 0.5 of a hectares including a forest in the process of establishment, woodlands, thickets (FCMA, 2016), while FAO (2012) defines forest as land with trees capable of occupying a minimum area of 0.5 hectares and trees likely to grow over 2 meters and with a minimum of 15% of canopy cover.

The forest sector in Kenya contributes about 7 billion Kenyan shillings to the economy, while creating employment to over 50,000 people directly and 300,000 people indirectly. In the country's water towers, particularly the Mau Complex forest, it provides environmental services that include water quality and quantity, reduction of soil erosion, and creation of micro-climatic conditions that maintain or improve productivity (Smith et al. 2011). Ogwora (2017) conducted a study to investigate the environmental implications of charcoal production in Narok County. The study established that charcoal business had led to increased deforestation. Chepngeno (2015) conducted a study to investigate the struggle between livelihoods and forest conservation: a case of Mau Forest in Kenya. The findings showed that households' dependence on forests and activities they engage in have had a significant impact on forest, and thus hindering the effort to conserve and sustain forest resources. Furthermore, the efforts to protect and conserve forest resources through conventional approaches used by the government such as formal forest laws and regulations are shown to be serious limitations that thwart forest access and thus, household's livelihoods.

Overall, the study revealed evident struggle between accessing forest resources for livelihoods by the local households and efforts to enhance forest conservations. Despite the various benefits forest have on communities, in recent years, the Mau Complex Forest has been depleted at an alarming rate. It has been particularly hard hit by illegal abstraction of forests resources (GoK, 2009). The illegal logging of indigenous trees for instance, is a major threat to MCF. This is despite logging being banned in 1986. Overall, it is estimated to lead to an annual reduction in water availability of approximately 62 million cubic metres, translating to an economic loss to the economy of over USD 19 million (MoEF, 2018). Forest excisions in 2001 alone amounted to 61,587 hectares, affecting in particular Eastern Mau Forest Reserve (35,301 hectares), South Western Mau Forest Reserve (23,296 hectares), Molo Forest Reserve (901 hectares).

At least 2,436 hectares was illegally allocated to public utilities, such as schools and police stations, as well as for private development like churches. The land allocated for these public utilities and private developments is still gazetted as forest reserve. Allocations were often being decided upon by leaders or Government officers who have no authority on such matters, in violation of the applicable laws, and/or for supporting private interests. In addition, the size of the land requested for public facilities is too often well in excess of what is actually required, providing opportunities for land grabbing. Wambugu, Obwoyere and Kirui (2017) found that forest ecosystems are important to ecological, economic and social wellbeing, particularly for the adjacent communities who depend on it. A 2016 elephant census and forest health survey conducted across the entire Mau Forest Complex by WCS, KWS and RAKCT showed a high level of illegal logging of indigenous trees of which 79% were cedar (*Juniperus procera*). Logging was by far most intense in Maasai Mau forest followed by OI Pusimoru Forest Reserve, Lembus FR, Mount Londiani FR, South Western Mau FR, Western Mau FR and Tinderet FR (WCS, KWS & RAKCT, 2016).

In a 2018 study on the valuation of ecosystem services in the Mau Forests Complex, Cherangani Hills and Mt Elgon by KEFRI & USFSIP, the annual contribution of the plantations to the national economy were estimated at KES 10.7 billion against a total economic value of the three water tower ecosystems estimated to be KES 339 billion (KEFRI & USFSIP, 2018). To address this challenge, the Government declared a moratorium on harvesting of timber on all public and community forests for 90 days with effect from 24 February 2018. The purpose of the moratorium was to allow for reassessment and rationalization of the entire forest sector in the country. In Kenya, where this study was conducted, local people depend on forest resources for various products such as fuel wood, construction materials, medicine and food (Langat et al. 2016). Forest resources are perceived to provide a stepping stone out of poverty (Angelsen & Wunder, 2013). Many of the characteristics that make environmental resources attractive to the poor also limit their potential to accumulate assets and lift people out of poverty. MFC logging has created negative externalities for communities at large.

A study by Onyango (2018) highlighted that forest deforestation had contributed to extensive drying off rivers around the Mau Forest for example Elwaso Nyiro, as well as the drying off surrounding areas such as Masai Mara Game reserve which had contributed to loss of tourism sites. Illegal logging are the main contribution to forest degradation. The continuous flooding is attributed to continuous logging which has contributed to loss of forest cover. However, the evidence base is fragmented across the literature (McKinnon et al. 2015), thus limiting the ability of decision-makers to

propose effective interventions. Besides the above observations, there is little empirical data on the effects of forest degradation on the socio-economic status of communities. Despite the above findings from the literature, some scholars argue that logging in the forest threatens justify external conditional compensations to households for conserving rather than degrading environmental services, perhaps creating a new engine for forest-based livelihood contributions (Deweese et al. 2010). The question however is; do communities surrounding the MFC understand the effects of forest logging on household socio-economic status? The answer is, not much is known on this area.

To other scholars such as Oksanen & Mersmann (2013) and Kundu et al. (2015) increased human population demanding land for settlement and subsistence agriculture disintegrated forest management, and policies have not adequately recognized the variable nature of the forest adjacent communities. This has resulted in conflicts over the use and management of forest resources and forest conservation. The above is partly because forest incomes to community remain widely overlooked by policymakers in their poverty reduction strategies. The question here is that: if forest income is that important, then why has it so far not led to a paradigm shift in the minds of development practitioners? It is on this backdrop that this paper examines the effects of forest logging on the socioeconomic status of households in South West Mau Sub County, Kenya. The study hypothesized that there is a statistically significant relationship between forest logging and socio-economic status of households in South West Mau Sub-County, Kenya

### 1.1. Methodology of the Study

The study was based on Social Forestry Intervention Theory. The study utilized ex-post facto research design. The target population was 19450 residents of South-West Mau Sub County. Simple random sampling technique was employed to select a sample of 400 residents and census approach was employed in which the Head of Conservancy Mau, Secretary of Community Forest Association, VillageElder and the Chief of the village were involved in the study. The researchers employed questionnaire, interview schedule, focus group discussions and direct observation as the main methods of data collection. Data collected was analyzed in both descriptive and inferential statistics. Independent t-test was employed to test the hypotheses.

## 2. Findings and Discussions

### 2.1. Demographic Information

This study begins with a brief socio-economic and demographic analysis of the target population as represented in a sample population drawn from the study area. This provides a background context in which the findings are anchored. The main socio-demographic characteristics were the respondents' age, gender, level of education, marital status, occupation and household size of the participants. Data obtained was analyzed below.

Variables	Unit of Analysis	Frequency	Valid Percent
Gender	Male	279	74.0%
	Female	98	26.0%
	Total	377	100.0
Highest level of education	Secondary form Four	97	25.9%
	Certificate	74	19.7%
	Diploma	53	14.1%
	Graduate	41	10.9%
	Masters	15	4.0%
	Primary School	95	25.3%
	Total	375	100.0%
Age	21-30 Years	65	17.2%
	31-40 Years	72	19.1%
	41-50 Years	140	37.1%
	51-60 Years	100	26.5%
	Total	377	100.0%
Occupation	Farmer	156	43.1%
	Business person	91	25.1%
	Employed	115	31.8%
	Total	362	100%
Household size	1-2	46	12.2%
	3-4	73	19.4%
	5-6	92	24.4%
	7-8	102	27.1%
	9-10	64	17.0%
	Total	377	100.0%

Table 1: Demographic Characteristics of Respondents

Table 1 reveals that a majority 74% of the respondents were male while 26% were female. More 25.6% of the respondents had attained secondary school form four as 25.3% were primary school graduates, 19.4% had certificate followed by 14.9% diploma holders and 10.9% university graduates. Very few 4% of the respondents had attained masters as their highest level of education. More 37.1% of the respondents were aged between 41-50 years, 26.5% were 51-60 years followed by 19.1% aged between 31-40 years and 17.2% aged between 21-30 years. The above findings showed a normal distribution of age groups in the study area. Respondents were from various occupations as shown, most 43.1% of the respondent were farmers, and 31.8% were employed in different sectors while 25.1% were business persons within the Mau south west area. On family size of the respondents, more 27.1% of the households had between 7-8 members, 24.4% had 5-6 members while 19.4% ad 3-4 members. Few 17% and 12.1% of the respondents had 9-10 and 1-2 members in their households. These results show family having an average of 6 members per household.

## 2.2. Effects of Forest Logging on Socioeconomic Status of Households

This study aimed to examine the effects of forest logging on socioeconomic status of households. This was based on the fact that there is a concern that the additional logging-related disturbance can imperil eco-system recovery and affect biodiversity and ecosystem services by scholars such as (Karr et al. 2004; Beschta et al. 2004; Donato et al. 2006; Lindenmayer et al. 2008). In order to understand the effects of forest logging, respondents were asked several questions using a five-point Likert scale where 1= strongly agree 2=Agree, 3=Undecided, 4=Disagree and 5=strongly Disagree. Data obtained was analyzed and presented in table 2 below. The results are shown below.

Statement		Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Total
The government officials Ngo are supposed to protect government forest from being logged has been giving illegal permit	Count	86	212	4	60	15	377
	%	22.8%	56.2%	1.1%	15.9%	4.0%	100.0%
There has been extensive logging of traditional trees in Mau forest	Count	166	193	0	11	0	370
	%	44.9%	52.2%	0%	3.0%	0%	100.0%
Traditional trees have been logged for charcoal and timber	Count	184	162	6	17	4	373
	%	49.3%	43.4%	1.6%	4.6%	1.1%	100.0%
We experience flash floods because our forest cover has been logged in Mau forest	Count	57	175	39	93	9	373
	%	15.3%	46.9%	10.5%	24.9%	2.4%	100.0%
Flash floods led to extensive loss of properties and our livelihood	Count	44	206	38	82	7	377
	%	11.7%	54.6%	10.1%	21.8%	1.9%	100.0%
I have lost my source of traditional medicine due to logging of traditional trees	Count	85	157	36	77	21	376
	%	22.6%	41.7%	9.6%	20.5%	5.6%	100.0%
I often experience health problems caused by pollutants from timber products such as saw mills, charcoal pollutants	Count	56	171	27	87	36	377
	%	14.9%	45.4%	7.2%	23.1%	9.5%	100.0%
The heavy poaching of firewood and charcoal from Mau forest has led to forest degradation	Count	172	180	7	16	2	377
	%	45.6	47.7%	1.9%	4.2%	0.5	100.0%

Table 2: Forest Logging on Socio Economic Status of Households

Table 2 above shows that a majority 212(56.2%) of the respondents agreed that government officials have been giving illegal permits that has led to extensive logging in Mau forest, 86(22.8%) strongly agreed, 60 (15.9%) disagreed 15(4%) strongly disagreed while 4(1.1%) were undecided on this statement. When asked if there was extensive logging of traditional trees at Mau forest a majority 193(52.2%) of the respondents agreed 166(44.9%) strongly agreed while 11(3%) disagreed with this statement. Majority 184(49.3%) of the respondents strongly agreed that traditional trees from

Mau forest have been logged for charcoal and timber. More 162(43.4%) agreed 17(4.6%) Disagreed, 6(1.6% were undecided while 4(1.1%) strongly disagreed with this statement. Majority 175(46.9%) of the respondents agreed that they experience flash floods due to logged forest cover 93(24.9%) disagreed, 57(15.3%) strongly agreed, 39(10.5%) were undecided while 9(2.4%) strongly disagreed. Slightly more than half 206(54.6%) agreed that flash floods had caused them loss of property and destroyed their livelihoods.

Contrary to the above findings, a study by Pouliot, Treue, Obiri and Ouedraogo (2015) on the effects of deforestation to rural livelihoods in West Africa found that agricultural lands and the non-forest environment including parklands were considerably more valuable to the poor as well as better-off rural households than forests. This implies that rural households do not value forest management as they give priority to land used for agricultural practices. The researchers observe that this perception encourage more forest logging and clearance to create space for agricultural production. The respondents were asked whether they had lost source of traditional medicine due to logging of traditional trees 157(41.7%) agreed, 85(22.6%) strongly agreed, 77(20.5%) disagreed, 36(9.6%) were undecided while 21(5.6%) strongly disagreed with this statement. From the above findings the majority (41.7%) of the respondents who agreed that they had lost source of traditional medicine due to logging of traditional trees concurred with World Bank (2015) study, which avers that globally, thousands of key compounds derived from plants and animals in forests are used routinely to manufacture medicines, and 80% of developing societies rely on traditional medicine for their basic health care. However, high rates of forest logging are threatening this global industry.

In addition, majority 171(45.4%) of the respondents agreed that they were experiencing health problems caused by pollutants from timber products. Nowak et al. (2018) supports this finding that during dry periods, particles are constantly intercepted and re-suspended, partly, dependent upon wind speed. The accumulation of particles on the leaves can affect photosynthesis process and thus, potentially affect pollution removal by trees. During precipitation, particles can be washed off and either dissolved or transferred to the soil, hence causing human health problems. However 87(23.1%) disagreed, 56(14.9%) strongly agreed, 36(9.5%) strongly disagreed while 27(7.2%) were undecided about health problems caused by pollutants from the logging activities. Majority 180(47.7%) of the respondents agreed that heavy poaching of firewood and charcoal from Mau forest has led to forest degradation, 172(45.6% strongly agreed, 16(4.2%) disagreed, 7(1.9%) were undecided while 2(0.5%) strongly disagreed with this statement. In general, the results show that there is extensive logging through cutting of trees for timber and charcoal purposes. As explained by one of the village elders; "this situation is fueled by issuance of illegal logging permit by government forest officials". In relation to the existing literature, degradation of forest can be prevented by salvaging logging across the world (Muller et al. 2018). Additionally, Prestemon and Holmes (2010) argue that tree-killing disturbances trigger a set of processes that can rapidly reduce the timber value due to reductions in wood quality and to pulses in wood supply to the market.

The results further revealed that logging affected households' health through pollution from the activities and loss of traditional medicinal trees. The households also lost property and other sources of livelihood due to logging of the Mau forest. Although ecosystem services have seldom been explicitly addressed in the scientific literature on salvage logging, they provide a common framework that allows balancing economic benefits from timber against the wide array of ecological variables that are also affected by post-disturbance management (Leverkus and Castro, 2017). In order to ascertain whether there is a relationship between forest logging and socio-economic status of households in South West Mau. A chi square test was run for the following hypothesis.

- $H_1$ : There is a relationship between forest logging and socio-economic status of households in South West Mau.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	992.345 <sup>a</sup>	360	.000
Likelihood Ratio	602.507	360	.000
Linear-by-Linear Association	38.318	1	.000
N of Valid Cases	375		

Table 3: Relationships between Forest Logging and Socio-Economic Status of Households  
Chi-Square Tests a, 388 Cells (97.0%) Have Expected Count Less Than 5, The Minimum Expected Count Is .00

As shown in the Table 3 above, the chi-square test of association was .000 ( $p < 0.05$ ). This shows that there was a significant association between forest logging and socio-economic status of households. The observation from the above test is that income from forest resources is a common strategy of the poor to complement agricultural income from small and marginal land holdings. It is coping strategy by the poor to mitigate the risk inherent in the subsistence agriculture. The above study findings have implications in determining ways to which to create a balance between forest livelihoods and forest conservation. It calls for actions that enhance equity and thus, form the basis for developing and enforcing policies that recognize the different roles forest resources play in the livelihoods of local forest users and how it can be integrated in the sustainable systems for forest protection and conservation.

### 3. Conclusion

From the findings of the study, it is concluded that Mau forest logging is still high in the study area as households depend on the forest for their energy supply in terms of charcoal and firewood, which is a common product obtained from the forest and used in households for cooking. The degradation of the forest by human and nature activities had affected their livelihood as they were now susceptible to flash flood, drought which brought a lot of loss in the family. Finally, forest management in place are not effective in addressing forest logging thus, affecting efforts for forest protection and

conservation. Poor forest management practices directly have adverse effects on socioeconomic status of the households in South West of Mau forest.

#### 4. Recommendations

Based on the findings from this study, the study recommends that the government and other actors in the study area need to create awareness on the significance of Mau Complex Forest on the socioeconomic status of households. Besides, conservation and sound management of the forests cannot be achieved by one agency alone. All forest conservation agencies including NEMA, KFS, KWS, KWTA, the Kenya Police Service and the Ministries of Interior must come together to formulate an interagency plan of action to enhance synergy, and highlight areas of collaboration and coordination.

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