

# Sustainable Livelihood Approach For Assessing Household Adoption To Eviction: Mau Forest, Kenya

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**Abstract:** Studies have shown that there is a challenge in protecting both natural resources and livelihoods simultaneously. However, little is known when considering the number of livelihoods strategies affected by the effect of conservation methods. This paper seeks to investigate the outcome of sustainable livelihood diversification by considering the number of strategies affected by eviction on households neighboring the boundaries of the Mau forest in Kenya. It is well understood that double sustainability is achieved when environmental protection of biodiversity is attained and the livelihood of households affected focuses on a pro-poor strategy at the same time. The study employs the Negative Binomial Regression and ANOVA to estimate the effect of being a victim of eviction on the number of alternative livelihood strategies. The results indicate a significant difference in diversification between households that were victims of eviction from non victims. Significantly evicted households dominantly engage in low income earning agricultural activities. The findings suggest that evicted households diversify but depend on forests and agricultural activities as a coping mechanism towards eviction. This information is important to policy makers in assisting to achieve double sustainability by looking at forest eviction conversation and household livelihood adoption needs.

**Index Terms:** Conservation, Eviction Livelihoods, Sustainability,

## 1. Introduction

Disturbance like drought, eviction, climate change will affect livelihoods and will push households to both farm and non-farm activities (Baird et al., 2009; Chilongo., 2014). But unlike other disturbances eviction is essential and unique in that it is a conservation measure to protect natural resources. Natural resources like forests in Sub-Saharan Africa provide for a number of ecosystem services which include: timber; non timber products; regulating services such as flood and climate regulation; cultural services such as spiritual and aesthetic; recreational and supporting services which include primary production, nutrient cycling and soil formation (International Assessment of Agricultural Knowledge, Science and Technology for Development IAASTD, 2009). The widespread occurrence of eviction in developing countries is an evidence of major threat to forests from several literature: Anderson et al., (2011); Brockington (2002); Neumann (1998); Feeney (1998) and Carina (2009). Forest biodiversity conservation through eviction is urgent despite the present gaps on the underlying opportunities and constraints (Miller et al., 2012). Baird et al. (2013) study showed that eviction plays a role in shaping diversification strategies in the developing world.

However Kipkoech (2011) establishes that the general scenarios of households living adjacent to forest pose a threat to conserving of natural resources through: high levels of poverty, limited employment opportunities and small land acreage. With the circumstance of household in mind resources from forest are under pressure from human population growth, poverty and limited option survival Cleaver et al. (1994). Further the study establishes that there exists a "vicious circle" in which the rural poor are both agents and victims of resource degradation. Policies on conservation can neither ignore households' livelihoods nor the threat at hand on natural resources. Lack of balance on livelihoods of household will frustrate conservation measures such as eviction at the expense of degrading forest resources while households still experience poverty. The question should be is there a double sustainable solution rather than going back and forth? There is need to link eviction policies and household livelihoods adoption towards resilience and vulnerability to facilitate sustainability. Several studies: Barrett 2011; Baird et al., 2013; Cernea et al., 2006; Schama, 1996; Coleman, 2011 generally agree that conservation and local livelihoods are linked thus ultimately a multiple approach to deal with both simultaneously is paramount.

### 1.1 CONCEPT ON SUSTAINABLE LIVELIHOOD

Barrett et al. (2001) establishes that livelihoods cannot be identified by a single activity variable only but as the diverse mix of assets available to individual households facilitating for a wide range of different asset allocation choices. Livelihood also refers to the access households have to different types of capital (natural, physical, human, financial and social), opportunities and services (Ellis., 2000). A livelihood is defined to be sustainable when it is can cope with and recover from stress and shocks and maintain or enhance its capabilities or assets both now and future, while not undermining its natural resource base (Chambers et al, 2000). A Sustainable livelihood approach therefore as argued by United Kingdom Department for International Development (DFID) strategy (DFID. 1997) is guided by a multiple capital approach where sustainability is considered in terms of available capital (natural, physical, human and financial). The International

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Institute for sustainable Development defines sustainable livelihoods as being “concerned with people’s capacities to maintain and generate their means of living, enhance their wellbeing and that of their future generations”. Thus the difference of a livelihood and a sustainable livelihood will require an assessment which can be achieved by looking at how individual households behave under a specific set condition. Assessment of livelihoods analysis can assist policy makers to understand the coping or adaptive strategies of households towards disturbances such as policy failures and natural outcomes in general. In addition the question of sustainability arises by looking at response whether it is derived towards coping or adopting where one is based on short term and the latter is on long term as a result of shocks. A Sustainable Livelihood Assessment (SLA) method is used to measure the impact of a policy on a community’s coping and adaption characteristics along various parameters: there are various which include DFID sustainable livelihood model based on 5 capitals and vulnerability context as described in Figure 1; use of the Livelihood assessment tracking system uses indicator approach is based on proxy of using pictures as the main tool for gathering and reorganizing data and use of qualitative and quantitative indicators or a combination of both are used as shown (Elasha et al., 2005). Farrington (2001) defines the SLA as an analytical framework to understand what is and what can be done. Thus the logic is to appreciate capitals present, vulnerability context and involvement of institutions. This framework can be used to analyze the impact of sustainable livelihood measures in increasing adoption to eviction. Sustainable livelihood adaptation to eviction calls for households being able to adopt potential impacts or harness to benefit from opportunities available and ensure that natural resources are not over depended so as to consider future use by also pushing to diversify and eradicate poverty. All these issues show that a direction is needed urgently to develop alternative courses that pursue double sustainability to protect both the forest biodiversity and people’s livelihoods simultaneously (Cernea et al. 2006; World Bank 2001). Therefore the paper seeks to address how sustainable conservation can be achieved by considering the number of livelihoods affected by the effect of eviction. To address the following concerns, the paper addresses the following questions: What is the effect of a household being a victim of eviction on the alternative choices of livelihood? What are the livelihood outcome differences available between the evicted and non evicted households?

## 1.2 STUDY APPROACH

The approach of the study was to have Mau forest as the location where research was to be done. The Mau forest is situated within the Rift valley province and geographically is network to eight administrative districts in Kenya: Baringo, Bomet, Bureti, Keiyo, Kericho, Nakuru, Nandi and Narok. In addition the forest is divided into several blocks which are South-West Mau (Tinet), East Mau, Ol’duonyo Purro, Transmara, Maasai Mau, Western Mau and Southern Mau. The Eastern Mau Forest block which was the focus of the study is located in Nakuru District and is managed by Kenya Forest Services (KFS). The Mau environmental contribution includes being one of the major important water towers in Kenya and upper catchment of major rivers that partially feed lakes such as: Victoria, Turkana, Naivasha and Nakuru. In addition the vital social and economic contribution of the forest

to rural and urban water supply from springs, wells, boreholes and rivers that support rural livelihoods cannot be ignored (Interim coordinating secretariat, 2009). The forest has a dynamic contribution to the Kenyan economy. Economically it supports key sectors such as energy, tourism and agriculture; its estimated potential hydropower generation is approximately 535 Megawatts and with regard to tourism the MFC is a source to Mara River that passes through the Maasai Mara National Park (Kundu et al., 2008). The Eastern Mau forest has had about 3,000 hectares under pine and cypress plantation and is the most exploited forest in terms of timber extraction and it is legally established as a government gazette forest (Kipkoech et al., 2011). The estimated size of the population of Mau forest of Eastern Mau is 47,802 (Kipkoech et al, 2011). East Mau has had eviction incidents that have been in the Mau forest since 2004 and a recent eviction in 2011.

## 1.3 SAMPLING AND DATA COLLECTION

Njoro division was purposively selected because of eviction incidents; In addition, 7 villages were purposively selected this included Chemunit, Imetoi, Kilumbero, Sigaon, Sigotik, Tagitech and Transmara. These villages were known to have displaced camps of victims of the eviction process. A list of evicted and non evicted households was made with the assistance of local administrators (Sub chief and local village elders). Respondents totalling 384 households who included evicted and non evicted households were selected using systematic random sampling technique from the lists. The structured household survey was conducted comprising of 180 non evicted households and 184 evicted households. The sample size was determined by the Cochran’s formula for determining the sample size (Cochran, 1977). The selected villages with the number of respondents were as follows: Chemunit 51, Imetoi 10, Kilumbero 17, Sigaon 169, Sigotik 36, Tagitech 63 and Transmara 18. Data collection was implemented through semi structured questionnaire survey and participant observation. Both quantitative and qualitative data were collected.

## 2. THEORETICAL FRAMEWORK FOR ANALYSIS

The theoretical framework for analysis was based on the multiple approach use of the Random Utility Model (RUM) and the DFID Sustainable Rural Livelihoods framework. The RUM theory states that households will choose to maximize their utility by choosing a maximum utility subject to the constraint they face (Thurtstone, 1972). A household in a rural area decides on which livelihood strategy to select based on the option to maximize their utility, subject to internal and external factors. If the household alternative livelihood is associated with coping with shocks and maintaining or improving the standard of living; households will be encouraged to select the strategies (Ellis, 2000). The decision maker has incomplete information and therefore uncertainty has to be accounted for. The utility theory is therefore modeled as a random variable in order to reflect the uncertainty. Use of DFID Sustainable Rural Livelihoods framework is based upon 5 capitals which are: (natural, physical, human and financial) in order to frame and capture adaptive capacity in analysis. Each of the 5 capitals also known as sustainable livelihood assets or capitals identified by the framework: are natural capital include natural resource stocks (soil, land and water) include; human capital include: skills, knowledge, labour; social capital include social

resource (networks, social affiliations, associations); physical capital include: social resource (networks, social affiliations, associations); physical capital include: (Infrastructure (buildings, roads) and Economic or financial capital include capital base and other economic assets (Scoones., 1988). A list of generic qualitative and quantitative were used as a proxy indicators around five capitals assets in the sustainable livelihood framework based on data captured explained in Table 1. Use of vulnerability context looks at trends, shocks in which assets exists. The vulnerability context in additionally helps to keenly note what is happening now but also in the future. It helps one to understand the resilience/adoption contribution of sustainable livelihood capitals based on livelihood outcomes. The assumption is that planned outcomes would feedback to enhance livelihoods assets to make them resilient. Expected livelihood outcomes that will be measured will be evidence of increased incomes, improved well-being, reduced vulnerability, and more sustainable use of natural resources. In this paper, the hypothesis is that the household will: 1. choose several number of strategies in order to diversify and adopt with eviction 2. Sustainability of livelihood is evident shown by livelihood outcome of evicted and non evicted having no differences. non-significant F-test would indicate no meaningful differences among the means while a significant F-test suggests real differences among the treatment means, (Armstrong et al, 2000), and therefore rejection of hypothesis one.

## 2.1 REGRESSION MODEL FOR DIVERSIFICATION

The examination of the effect of eviction on the number of livelihood strategies of households involved determination of estimates through regression analysis. The Poisson Regression Model PRM is the foundational building framework block in count data analysis. The implicit restriction of the PRM is that the mean and variance (equi-dispersion) should be equal to the distribution of observed counts. Berk et al., (2007) and Greene (2008) state that the Negative Binomial (NB) regression model takes care of any model misspecification and relaxes the functional form of the PRM. Researchers employ more general specifications such as the NB model which is the standard choice for a basic count data model (Hilbe, 2007). The NB model was used to estimate the effect of eviction on the number of livelihood while accounting for other factors. Maximum likelihood is used for estimating the parameters of the NB model ( $\alpha$ ,  $\beta$ ,  $\theta$ ) (Greene, 2007). One way Analysis of Variance (ANOVA) was used to test whether there was any significant difference between the livelihood outcomes of evicted and non evicted. The analysis involves carrying out a variance ratio test (F-test) to determine whether all group means are the same.

## 2.2 DESCRIPTIONS OF INDEPENDENT VARIABLES

Descriptions of the independent variables used in the analysis are presented in Table 1. The values for many variables used in the analysis were reported directly by survey respondents. Measures however were derived from a combination of information captured on the survey and information collected during the survey. The participation which was coded as 0 or 1 whereby one was for participation and zero for non participating. The measures of livelihood diversification included: participation in livestock keeping, crop farming, wage from agriculture, wage from non-agricultural activities, salary from skilled agriculture activities, salary from non-skilled

agricultural activities, income from forest products, income from non-wood products and income from other activities. Based on the DFID livelihood framework each of the 5 capitals were captured as shown below on Table 1.

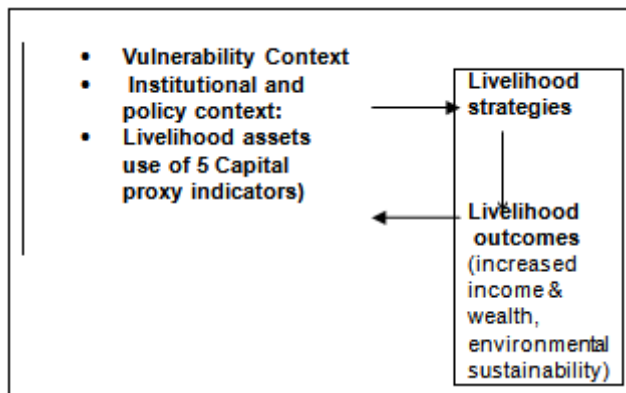
**Table 1: Description of explanatory variables using the DFID Framework**

| Variables explanation           | Variable type   | Capital Proxy indicator |
|---------------------------------|-----------------|-------------------------|
| Household size                  | Continuous      | Human                   |
| Household head education level  | Categorical     | Human                   |
| Physical evicted from land      | Dummy variables | Natural                 |
| Distance to input               | Continuous      | Physical                |
| Distance to primary             | Continuous      | Physical                |
| Group membership participation  | Continuous      | Social                  |
| Wealth                          | Continuous      | Financial               |
| Income                          | Continuous      | Financial               |
| Victim of eviction              | Dummy           | Institutional & policy  |
| Economical evicted              | Dummy variables | Institutional & policy  |
| Physical and Economical evicted | Dummy variables | Institutional & policy  |

Specifically measures of proxy of wealth included (total monetary value of household asset and livestock holdings) and income was derived by summing all sources in the last 12 months up to the time of survey. This measure included the value of all livestock and livestock products sold, crops harvested, household head employment remittances, Income from leased land estimated directly by respondents. The livelihood diversification participation Y represented the number of alternative strategies. The dependent variable measured the participation which was coded as 0 or 1 whereby one was for participation and zero for non participating. The measures of livelihood diversification included: participation in livestock keeping, crop farming, wage from agriculture, wage from non-agricultural activities, salary from skilled agriculture activities, salary from non-skilled agricultural activities, income from forest products, income from non-wood products and income from other activities. The measure of eviction was a categorical variable where by the coding of the groups were such that (0) were non evicted and evicted were (1). Stata version 11 and statistical package for social sciences (SPSS) was used for data entry and analysis. Based on the DFID livelihood framework each of the 5 capitals were captured as shown above with 5 capitals on Fig 1. The vulnerability and Institutional and policy context were captured by several indicators which were victim and being economical and physically and economically evicted respectively. Based on DFID framework outcome of livelihood strategies deliverables should entail both increase of income and wealth and environmental sustainability of households.



**Fig 1.** The DFID Sustainable Rural Livelihoods framework (Carney, 1998).



The fig 1. shows how the vulnerability context, Institutional and policy context and 5 capitals influence livelihood strategies. Livelihood strategies in turn influence livelihood outcomes which are a component of better household standards of living and proper protection of environmental sustainability. In effect livelihood outcomes play a role on the vulnerability context and success of institutional and policy context success.

### 3. Results and discussion

#### 3.1.1 Sustainable Rural Livelihoods framework determinants of livelihood strategies

The results of the regression analysis for the control variables as indicators of capital are consistent with previous research summarized in Table 2 below. The coefficient values explain the influence of each explanatory variable on the probability of influencing number of strategies. The indicators of each capital had various variables were as follows: wealth and income (financial capital indicator ) and Household size (Human capital) were found to be significantly influencing the number of livelihood strategies that a household participates as shown from the regression results. These results were consistent with literature. Homewood et al (2002); Machingura (2007) and Dlova et al. (2004) state that households' with a higher number of family members meant more labour availability reflected by the high number of productive workers. Schwarze et al. (2005) established that wealth increases the diversification out of the agricultural sector. Physical land displacement was used a (Natural capital) indicator and had a significant influence on the number of strategies. Household size (human capital) positively influences the number of livelihood strategies that a household participates as shown from the regression results. Household size variable had a positive and statistical significance. This infers that households with large family members were better off in engaging in more number of livelihood strategies likely due to the availability diverse labour and skills from different family members. A household that had a larger size had a 2.9 % likelihood chance of increasing their set of livelihood strategies this is statistically proven by the variable household size being significant at one percent level of significance. This is consistent with literature: Homewood et al (2002); Machingura (2007) and Dlova et al. (2004) state that households' with a higher number of family members meant high labour availability reflected by the high number of productive workers. Time taken to walk to a primary school facility (physical capital)

had a negative influence on the livelihood strategy chosen and was statistically significant at one percent level of significance. Households that were near a primary school had a likelihood of adapting to more strategies as compared with those that were far. Barrett et al. (2000) argues that households with more children have more hands available for income earning off the farm, including: gathering and sale of firewood, management of valuable livestock, daily wage labor or petty commerce. Distance to access to an input facility source had a negative effect to the number of livelihood strategies whereby those who had a further distance to cover had their number of strategies significantly reduced. Distance to input (physical capital) had a negative influence and was statically significant at one percent level of significance. This means household that were close to input sources had more strategies and as the distance increased the number of livelihood strategies reduced. The conclusion is that households that are near input source are able to vary the application of technology and thus increase the number of livelihood strategy. This supports various literature for instance: Zhang et al. (2001) found that long distances to input markets (Physical capital) decreased the likelihood of adaptation. Luseno et al. (2003) and Mandleni et al. 2012 in their findings states that market access is an important factor in determining technology adoption choices among farmers. Contrary to prior expectation household head education and membership of a group did not influence the number of livelihood strategies a household would adopt. The vulnerability context based on the sustainable Livelihood framework showed that in the eviction context the differential intercept coefficient of the variable of victim of eviction suggests that evicted households increase their livelihood strategies by 18% as compared to non-evicted households. On observing the physical and economical displacement (Institutional context) has a major contribution to the influence on number of strategies. The variable being a victim of eviction (policy indicator) a household was used to assess the effect of eviction by using non evicted households as the control category. Households that were physically displaced from land (natural capital) had their number of strategies reduced by 48%. This variable was negative and statistically significant at one percent level of significance. The results infer that households that were physically displaced had their livelihoods' negatively affected likely as a result in the lack of a resettlement remedy. The physical displacement victims had lost access to land for shelter purposes and these made them more vulnerable and were likely to reduce their number of livelihood strategies. Delvingt (2001) and Cernea et al. (2001) had similar findings where they argue that loss of land as a result to conservation displacement or restriction to access of land results to the impoverishment that leads to de capitalization.

**Table 2.** Results from the Negative binomial regression model.

| Variables               | Coefficient. | Std. Err. | P>z      |
|-------------------------|--------------|-----------|----------|
| Hhsize                  | 0.029        | 0.010     | 0.005*** |
| Hhedclevl               | -0.013       | 0.035     | 0.715    |
| Economical displacement | -0.171       | 0.119     | 0.151    |
| Physical displacement   | -0.481       | 0.136     | 0.000*** |
| Economical & physical   | -0.450       | 0.073     | 0.000*** |

| displacement               |          |       |          |
|----------------------------|----------|-------|----------|
| Lnwealth                   | 0.070    | 0.014 | 0.000*** |
| Lnincome                   | 0.106    | 0.024 | 0.000*** |
| Membersgip to groups       | -0.004   | 0.035 | 0.903    |
| Distance to primary school | -0.001   | 0.000 | 0.017**  |
| Victim of eviction         | 0.182    | 0.063 | 0.004*** |
| Distance to input facility | -0.003   | 0.001 | 0.016**  |
| _cons                      | -0.727   | 0.277 | 0.009*** |
| /lnalpha                   | -28.795  | .     | .        |
| Alpha                      | 0.000    | .     | .        |
| Prob>chi                   | 0.000    | .     | .        |
| Wald chi                   | 254.82   | .     | .        |
| lnalpha                    | -28.795  | .     | .        |
| alpha                      | 0.000    | .     | .        |
| Log pseudolikelihood       | -533.456 | .     | .        |

**Value level of significance \*=10%, \*\*=5% and \*\*\*= 1%)**

Physically and economically displaced (Institutional and policy context) household victims had their livelihood strategies negatively influenced at a statistical significance of 1% level of significance. Household who were both economically and physically displaced (Institutional and policy context) had their livelihood strategies reduced by 45 % as shown from the result. This displacement resulted to the reduction in the number of strategies of a household which could be likely as a result of losing both land for shelter and for pursuing farm economic activities. Cernea et al. (2006) explains that an economic and sociological sense is that displacement occurs not only when land takings compel physical relocations but when a particular conservation policy introduces restricted access to cultivatable lands such as fishing grounds and forests thus resulting to reduction in the number of strategies. World Bank in a new provision defines the introduction of "restricted access" as a form of involuntary displacement resulting in loss of income sources or means of livelihood whether or not the affected persons must move to another location (World Bank, 2001). Contrary to the prior expectation those who were economically displaced had their livelihood strategies negatively reduced but there was no statistical significance.

### 3.1.2 Results for livelihood outcomes between evicted and non evicted households

#### 3.1.2.1 Testing for variation in livelihood outcome: Analysis for variance (ANOVA)

To test whether there was any difference of livelihood outcomes affected by livelihood strategies between evicted non-evicted households on the outcome according to DFID, a one way ANOVA was carried out on the mean and results are presented in Table 3 below using explanatory variable in Table 2.

**Table 3.** One way ANOVA results for livelihood outcomes between evicted and non evicted households

| livelihood outcomes           | Sum of Squares | Mean square | F     | Sig     |
|-------------------------------|----------------|-------------|-------|---------|
| Income of households          | 49.355         | 8.225       | 13.36 | 0.00*** |
| income from forest products   | 6.621          | 1.103       | 3.06  | 0.00*** |
| Total asset Holdings (wealth) | 19403.862      | 3233.862    | 9.84  | 0.00*** |

**Value level of significance \*=10%, \*\*=5% and \*\*\*= 1%)**

With  $p = 0.000 < 0.05$ , the test supports the rejection of the null hypothesis that there is no difference in the livelihood outcomes available between evicted and non evicted households offered by livelihood strategies and conclusion means the livelihood outcomes are different offered by various livelihood strategies for evicted and non evicted households. Based on the Sustainable livelihood framework livelihood strategies have influence on livelihood outcome measured by income, wealth and sustainable use of natural resources. Evicted households had low income earnings, forest income earnings were very high and assets holdings were minimal as compared to non evicted households.

## 4 Conclusions

Based on the results analyzed using the Negative Binomial regression and ANOVA in the empirical analysis of primary data. Key findings based on the DFID sustainable livelihood model is that capitals measured using their proxy indicators affected the number of livelihood strategies. The four capitals included: human capital (household size), natural capital (physical land displacement), financial capital (wealth and income) and physical capital (access to a primary institution and input facility). However social capital (indicated by being a member in a group) had no influence on livelihood this could likely be as a result of volatility of movement of networks caused by eviction. The DFID model assists in capturing the effect of eviction policies and Institutional policy context and findings showed that both economical and physical displacement had negative influence on the number of livelihood strategies. In capturing the vulnerability context the variable being a victim of eviction was used and showed that evicted households were capable of diversifying to an increased number of livelihood strategies as compared to non evicted. However despite increased diversification of livelihoods of the vulnerable evicted households, observing the livelihood outcomes using results from ANOVA evicted households had low income earnings, were more dependent on forest income earnings and their assets holdings are minimal as compared to non evicted households. Thus diversification of strategies was a coping mechanism rather than adopting in the Mau forest. These findings provide policy insights on positive livelihood outcome interventions among evicted households with the rationale of enhancing productivity and equity of livelihoods and ensuring for sustainability use of forest especially for households vulnerable due to eviction. The findings thus provide policy insights on key areas of intervention as a sustainable approach in terms of using diversification adopting mechanism to influence positive livelihood outcomes in Kenya and other developing countries facing similar situation.

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