Journal of Economics and Sustainable Development
ISSN 2222-1700 (Paper) ISSN 2222-2855 (Online)
Vol.9, No.14, 2018

Socioeconomic Factors Influencing Dependence of Households on Non-Timber Forest Products in South Nandi Forest, Kenya

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Abstract
Forests are some of the key natural assets that provide a wide range of goods and services to forest adjacent communities. However, there is inadequate information on the factors that influence community members' level of dependence on forest resources. This study examined and analyzed factors that influence dependence of households on non-timber forest products from South Nandi forest, Kenya. 431 household heads from 9 villages were interviewed using proportional random sampling in May to August 2016. Descriptive statistics and logistic regression was used to analyze the data. Results clearly indicated that 90% of the household heads obtained NTFPs from the forest pointing to the importance of this forest to the households. Twelve variables were significantly associated with dependence on the forest. These included locations of the village from the forest, time spent by household to get NTFPs, membership in CFA and ethnic groupings. The logistic regression results revealed that age, occupation of household head and distance to the market were positively and significantly correlated with dependence on NTFPs. On the other hand, years of formal education, land size, and distance to the forest were negatively and significantly correlated with dependence on NTFPs. In order to utilize NTFPs in a sustainable way, development of management plans and strategies should incorporate the socioeconomic factors.
Keywords: Socioeconomic factors, NTFPs, dependence, households, South Nandi forest

1. Introduction

Many studies have shown that forests play an important role in global carbon cycle, biodiversity habitats and provision of tangible and intangible benefits to communities living around them (Mutenje et al., 2011; Suleiman et al., 2017). Non-timber forest products (NTFPs), broadly defined as any forest-derived tradable products other than commercial timber (FAO 1995; Shackleton & Shackleton, 2004), are known to contribute significantly to the economies of these communities (FAO, 1997; Stanley et al., 2012; Melaku et al., 2014). Forests are reported to provide domestic subsistence and consumption needs which increase disposable incomes to the households (Sumukwo et al., 2013); serve as insurance premiums during times of economic hardships (Paumgarten et al., 2009); and contribute to direct monetary benefits through sales (Shackleton et al., 2007).

A number of socioeconomic factors influence dependence of households on forests. These factors include, age (Godoy et al., 1997; Lacuna-Richman, 2002); gender of the household head (Hecht *et al*. 1988; Falconer 1990; Malhotra *et al*. 1993; Terry and Cunningham 1993 and Ghatak 1995; Campell, 1991); land tenure (Lacuna-Richman, 2002; Pandit & Thapa, 2003; Coomes et al., 2004; McSweeney, 2004; McElwee, 2008; Robinson et al., 2013) and income (Siebert and Belsky, 1985; Gunatilake et al., 1993; Cavendish, 2000 and Mahapatra & Tewari 2005; Heubach *et al*., 2012; Garekae et al., 2017). The other factors that also influence household dependence that include, labour availability, distance to the forest, involvement in non-agricultural activities and incorporation into market (Gunatilake, 1998; Hassan et al., 2002; Kar, 2010).

The influence of these factors points to the urgent need for better understanding of determinants of NTFPs utilization from forests in view of the ever-increasing population pressure. This study determined and analyzed the socio-economic factors that influence the dependence of forest adjacent household heads on the South Nandi Forest. These findings will be key in the design of target-specific interventions that reduce dependence on the forest, planning, policy development and sustainable management strategies.

2. Research Methods

2.1 Study Site

The South Nandi forest (figure 1) forms part of the eastern-most remnant of the Guineo–Congolian rainforest, which in the past millennium stretched across the entire expanse of West and Central Africa to the East African highlands (Young, 1984; KIFCON, 1994). It is one of the last remnants of pristine sub-humid tropical rainforests that is located in a densely populated and intensely cultivated region. The forest is located within the Nandi County and borders Kakamega County to the west, Uasin Gishu County to the North East, Kericho County to the South East, Kisumu County to the South and Vihiga County to the South West. Geographically, the unique jug-shaped structure of Nandi County is bound by the Equator to the south and extends northwards to latitude $0^0$34'N. The Western boundary extends to Longitude $34^0$45'E, while the Eastern boundary reaches Longitude $35^0$25'E.

The South Nandi Forest was declared trustland in 1936 vide Legal Notice No. 76, covering an area of about 26,903.1 Ha and in 1964, its status changed to a forest reserve. The forest has been converted to others land uses over the period through legal declarations starting with Legal Notice No. 15 of 1951 that excised 400 Ha and Legal Notice No 39 of 1968 (276 Ha) from the remaining 20,200 Ha. The Forest which is currently managed by Kenya Forest Service as a forest reserve, covering 18,000 ha after 2,200 ha was further excised for settlement (KFS, 2015). It consists of 13,000 ha of closed-canopy forest, 1,400 ha of plantations, 340 ha planted with tea and 3,260 ha of scrub, grassland or under some form of cultivation (Birdlife 2007). South Nandi Forest reserve was once adjoined to the Kakamega forest but has since been separated due to deforestation (Birdlife 2007). The forest lies west of Kapsabet town and south of the main Kapsabet-Kaimosi road. The forest elevation is between 1700 to 2000 meters above sea level. It receives average annual rainfall between 1600 and 1900 millimeters, which makes it classified as a 'moist forest' (under the Forest and Agricultural Organization of the United Nations (FAO) guidelines (Brown 1997). Currently, it is classified as a transitional forest between the lowland forests of West and Central Africa and the montane forests of Rift Valley and Central Kenya (KIFCON, 1994). The soils in the southern Nandi forest are composed of well drained, extremely deep dark to reddish brown with friable clay and thick humic top layer principally developed on biotite-gneisses parent material and is heavily leached with pH < 5.5. (Kagezi *et al*., 2011).

The major economic activity in the region is tea, maize, sugarcane and horticultural farming. South Nandi Forest Reserve is jointly managed by the Kenya Forest Service (KFS) and the forest adjacent communities through the Community Forest Association. The forest adjacent community uses the forest for their livelihoods by obtaining wood, non-wood forest products and environmental services (Muchiri and Mbuvi, 2010). The main reasons for managing the forest reserve are: conservation for water and biodiversity, controlled extraction for subsistence livelihood uses, industrial roundwood production and ecotourism. The South Nandi forest reserve like many other indigenous forests in the country is threatened by environmental degradation due to pressure from surrounding population. Sustainable management of South Nandi Forest Reserve is important considering that South Nandi Sub-County where the forest is located includes Kobujoi and Kaptumo locations that have high population density.

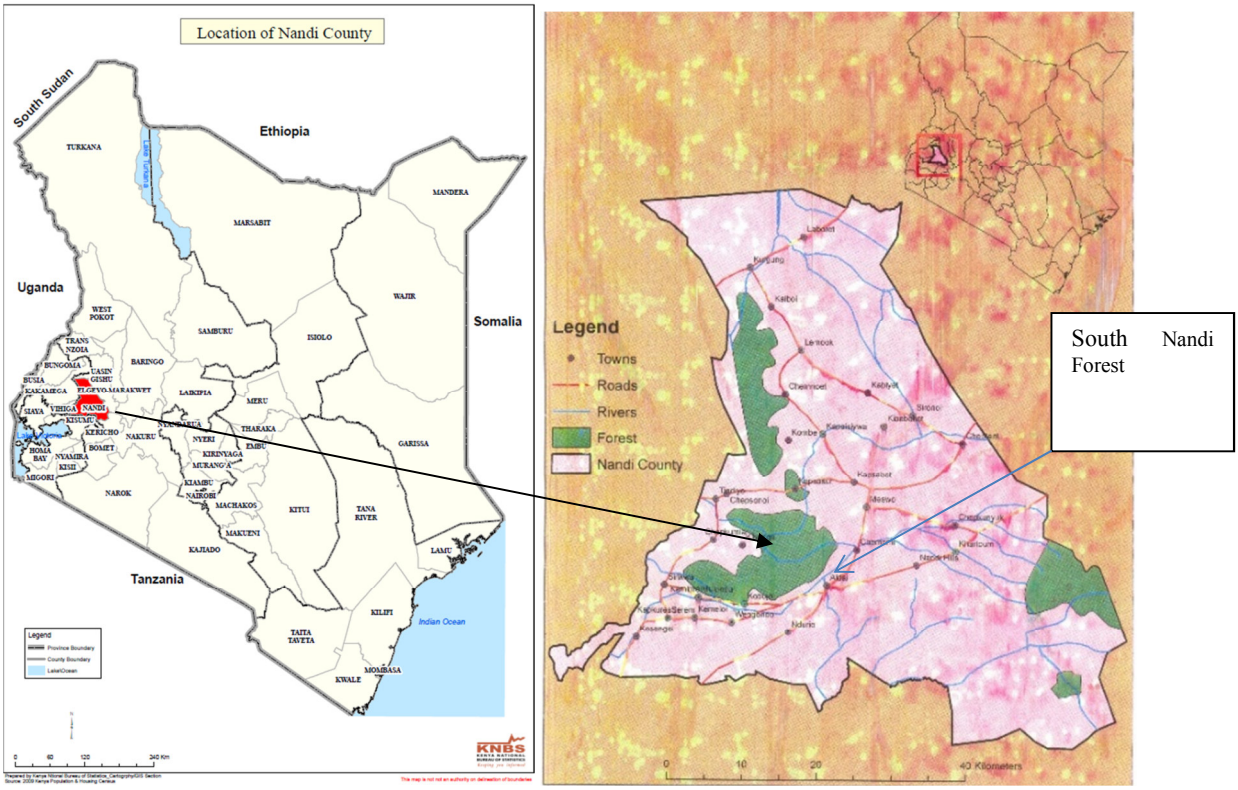

Figure 1: Location of the study area in Kenya and in Nandi County. (Source: Kenya National Bureau of Statistics, 2013).

2.2 Sampling Procedure

The sampling frame in this study was the household and the South Nandi Forest was purposively selected because of presence of forest dependent villages and the fact that limited research had been done in the forest reserve. There are 16 villages surrounding the forest. Seven villages were selected using a simple random

sampling. Two villages, Kimeloi and Ndurio, which were more than 5 km from the forest were purposively chosen as controls. Households' heads were randomly selected from each village from a list of households from an earlier study in South Nandi Forest (Mbuvi et al., 2010). Proportional random sampling was used to select the number of household heads per village to be included in the sample using the Nandi South and Central District population projections of 2008 (GoK, 2008). The number of households for sampling was determined using the formula by Yamane (1967), Israel (1992) and Singh & Masuku (2014).

$$n = N / [1 + N (e)^2] \quad (1)$$

where n is the sample size, N is the population size, and e is the level of precision. A 95% confidence level and P = 0.5 are assumed. P=0.5 i.e. assumes maximum variability. The minimum sample size required was calculated at 397, however, 431 households were sampled for this study. The key respondent during the household survey was the household head for they are presumed to be the decision makers for the households in the use of NTFPs (Kajembe, 1994). However, in his/her absence; a responsible person over 18 years familiar with the household setting was interviewed. If there was none, the next household in the list was chosen for interview.

2.3 Household survey

The household survey was conducted between May and August 2016. Participatory Rural Appraisal (PRA) methods was used to identify and document the availability and use of local NTFPs using the methodology of Chambers (1994) and Thiombiano et al. (2013). Pretesting of 10 questionnaires was done in three villages to ascertain instrument effectiveness and necessary adjustments to be done where ambiguity was noted (Mettrick, 1993; Reynolds *et al*., 1993). Semi-structured questionnaires with both closed and open-ended questions were administered by the researcher with the support of well-trained enumerators in the collection of data from households. The questionnaire was structured to capture data on household characteristics of the forest adjacent communities, NTFP status and utilization; NTFP incomes; rights associated with collection, transportation and sale of NTFPs and environment and forest conservation aspects of NTFP business.

2.4 Analysis of socioeconomic factors influencing dependence on NTFPs

The data was entered into the SPSS (Statistical Package for Social Science) version 23.0 and coding done. The different variables entered were analyzed to obtain descriptive statistics. A contingency table was used to show the relationship between the dependent and independent variables generated from the questionnaires. A binary regression analysis was used to analyze qualitative data generated from the questionnaires. Logistic regression was chosen because it is more flexible and results in fewer classifications of errors compared to other techniques such as discriminant analysis (Montgomery et al., 1987), and does not require that all of the predictors be continuous variables, normally distributed, or linearly related (Tabachnick and Fidell, 2007) and it has straightforward statistical tests and ability to incorporate non-linear effects and a wide variety of diagnostics (Hair et al., 1998). It is therefore preferred statistical technique for analyzing models of dichotomous dependent variables (Hosmer & Lemeshow, 1989).

3 RESULTS

3.1 Household dependence on forest for NTFPs

The location of the village of the household lived was strongly associated with the likelihood of getting NTFPs ($\chi2_{(9,431)} = 185.053$, $p<0.001$) from the forest. Overall, 90% of households in the villages got NTFPs from the forest compared with only 27.8% from Kemeloi, the control village. Interestingly, households in Ndurio, the other control village surprisingly obtained 97.3% of NTFPs from the forest.

The distance from households' house to the edge of the forest was significantly associated with harvesting of NTFPs from the forest ($\chi2_{(16, 431)} = 51.235$, $p<0.001$). Household heads who live closer to the forest obtained more benefits from the forest than those living further away (figure 2). The time spent (hours) by household to get NTFPs influenced the likelihood of going to the forest for NTFPs ($\chi2_{(10,431)} = 37.073$, $p<0.001$; figure 3). Availability of the NTFP also influenced harvesting of NTFPs from the forest ($\chi2_{(2,431)} = 4.972$, $p<0.083$). A greater majority (86.9%) of those who got NTFPs reported that the NTFP availability had decreased compared to ten years ago, thus diminishing the chances of getting NTFPs possibly due to degradation of the forest.

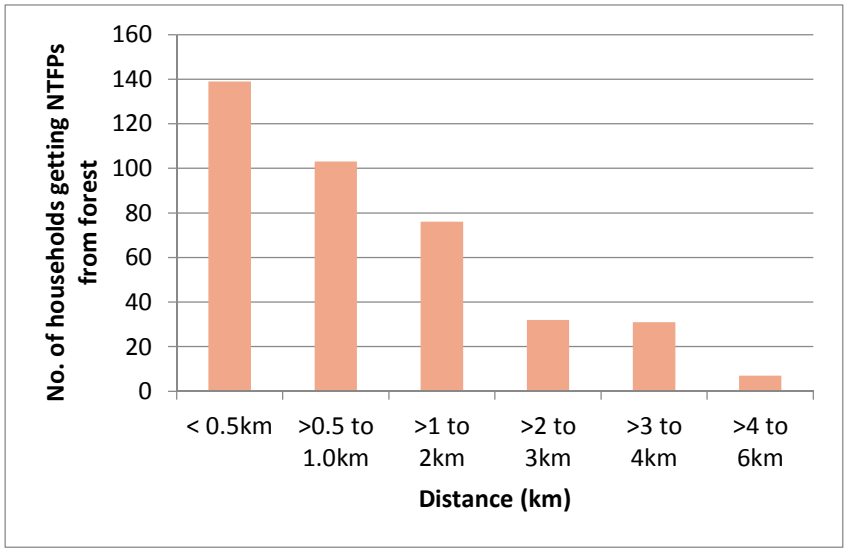

Figure 2: Trend in number of households getting NTFPs with increase in distance from forest to house

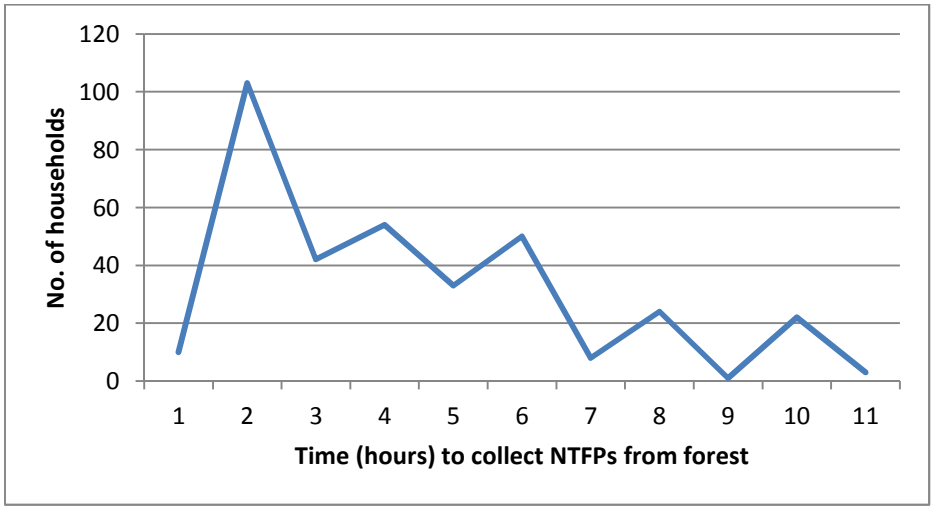

Figure 3: Number of households getting NTFPs versus time taken in hours

Membership in Community Forest Association(CFAs) greatly influenced the ease of obtaining NTFPs, with almost all members of the CFAs benefitting from the forest ($\chi 2_{(1,431)}$ = 9.481, p<0.05). This in turn greatly influenced percentage (96.5%) of non-CFA members willing to join CFAs in order to benefit from the forest. Overall, being a member of the CFA strongly influenced the ease obtaining NTFPs from the forest and hence the willingness for more people to join the CFAs ($\chi 2_{(1,431)}$ = 13.204, p<0.001).

Utilization of NTFPs as a source of primary income significantly influenced their collection from the forest ($\chi 2_{(1,431)}$ = 6.213, p<0.05). Seventeen (17) percent of those whose derived benefits from the forest indicated that NTFP was their primary source of income. The primary sources of income were indicated as, farming and obtaining NTFPs (91.1%), others such as business, self-employment among others and getting NTFPs from forest (77.8%). The number of people who rely on the forest for NTFPs was significant ($\chi 2_{(1,431)}$ = 6.558, p<0.05). There was a strong association between households selling NTFPs and getting NTFPs from the forest ($\chi 2_{(1,431)}$ = 10.946, p<0.001).

Marital status significantly influenced dependence on the forest ($\chi 2_{(4, 431)}$ = 9.980, p<0.05). Majority of the household heads were married (90.5%). Sixty-three (63.6) percent of widowed, divorced and widowers and 89.5% of those who were single obtained NTFPs from the forest. Ethnic grouping also significantly harvesting of NTFPs from the forest ($\chi 2_{(4,431)}$ = 10.850, p<0.05). The dominant ethnic grouping in the study area was Kalenjin (81.1%) followed by Luhya (17.4%). The Luhya (98.7%) and the Kalenjin (88.5%) household heads obtained NTFPs from the forest.

Table 3 shows results of the logistic regression of factors influencing dependence on NTFPs. Dependence on NTFPs was negatively correlated with the number of years of education of the household head; land size; distance to the forest (Km); and grazing. However, there was a positive correlation between dependence on NTFPs with age and occupation and the distance to the market (kms) from the home of the household head.

Table 3: Summary of logistic regression result of the factors influencing dependence on NTFPs in South Nandi Forest

Variables	B	S.E.	Wald	df	Sig.	Exp(B)
Age (years)	0.18	0.09	4.40	1	0.04	1.20
Formal education in years	-0.76	0.28	7.58	1	0.01	0.47
Land-size	-1.17	0.43	7.54	1	0.01	0.31
Occupation			5.68	3	0.13	
Occupation (1 Farmer)	2.79	1.52	3.39	1	0.07	16.24
Distance to forest in Km	-3.41	1.62	4.45	1	0.04	0.03
Distance to market in Km	1.86	0.61	9.32	1	0.00	6.41
Constant	28.14	93872.48	0.00	1	1.00	$1.67 *10^{12}$
Model X^2 =230.37, df=67, p=0.00;						
-2loglikelihood =48.78						
Hosmer & Lemeshow: X^2 = 3.18, df =8, p=0.92						
Cox & Snell R^2 = 0.42						
Nagelkerke R^2 = 0.87						
Overall accuracy of classification (%) = 97.7						

3.2 Discussion

Results of this study clearly demonstrates that the location of the village of the household head lived was strongly associated with the likelihood of getting NTFPs from the forest. The distance from households' house to the edge of the forest was also significantly associated with harvesting of NTFPs from the forest. Further, Membership in Community Forest Association(CFAs) greatly influenced the ease of obtaining NTFPs. In addition, utilization of NTFPs as a source of primary income also significantly influenced their collection from the forest; and finally, marital status significantly influenced dependence on the forest.

Results of the logistic regression model revealed that age and occupation of household head as well as distance to the market had significant positive correlation on NTFPs extraction. In addition, land size, grazing need, years of formal education, demand for fuelwood had significant positive correlations with dependence on NTFPs from South Nandi forest. Age of the respondent had a positive association with collection of NTFPs in the forest. This implied that the older people are more likely go to the forest than the younger people in South Nandi Forest. This is unexpected because the older people have children who are more likely to go the forest on their behalf. However, for some NTFPs such as medicinal plants, older people are more knowledgeable on their sources in the forest thus are more likely to go for their extraction. Similar observation has been reported in the Philippines, where it was noted that the elderly people were more likely to collect NTFPs because of their extensive knowledge of forest plants and wildlife (Lacuna-Richman, 2002).

A unit increase in occupation results in an increase by a factor of 16.243 in the likelihood of depending on the forest for NTFPs. The households rely on the forest for products such firewood which is used by almost 90% of the households as well as fodder - 92% of the households have livestock therefore rely on the forest for fodder (Wambugu et al., 2014). In this study, 75.8% of the respondents were engaged in farming/agriculture which has also been reported as a common occupation among NTFP gatherers in many developing countries such as south-eastern Nigeria (Bisong and Ajake, 2000), Southern Cameroon (Brown and Lapuyade, 2001). Therefore, it is possible that these households also engage in NTFP gathering especially during the low peak seasons when their workload is low. This is confirmed by similar study on more than 9,500 African households in 11 countries in Africa namely Burkina Faso, Cameroon, Ghana, Niger, Senegal Egypt, Ethiopia and Kenya South Africa, Zambia and Zimbabwe that reported that agriculture was one of the most important economic sectors which provides livelihoods to high proportion of the population (Waha et al., 2016). In Kenya, Senegal and South Africa, more than 80% of the farms were small or medium scale farms that indicate that the small land sizes make households rely on the forests to increase their income levels from the use of NTFPs. It is reported that agriculture was one of the most important economic sectors and provides livelihoods to high proportion of the population.

A unit increase in years of formal education results in decrease by a factor of 0.467 in the likelihood that a household will depend on the forest, implying that those with more years of formal education are less likely to depend on the forest. Studies have shown that NTFP collectors in developing countries tend to have relatively low educational levels (Sherstobitoff, 2004), for instance, in Bolivia and Mexico and North eastern Honduras, low education levels was reported among both commercial and non-commercial NTFP extracting households with median education of 3.6 years (Velde, 2004; Mc Sweeney, 2005).

A unit increase in land size results in decrease by a factor of 0.311 in the likelihood that a household will depend on the forest. This relationship is expected because possession of land in Kenya and elsewhere increases

ones' economic potential and the ability to have adequate space for raising own NTFPs, for instance, paddocking land for grazing and a woodlot to provide various products particularly firewood which is a major source of cooking energy in the area. Similar findings have been reported in Orissa (India), by Fernandes & Menon (1987) who found out that dependence on forest was strongly correlated with the size of landholdings, with the landless being the most dependent.

There was a negative correlation between distance to the forest edge and dependence on NTFPs. A unit increase in distance to the forest results in decreases the odds by a factor of 0.033 in the likelihood that a household will depend on the forest. This relationship is expected because long distance from the forest increases the cost of collecting NTFPs in terms of money and time expended. Other studies have also reported that distance influences the household's decision to collect or sell NTFPs (Gunatilake, 1998; Kamanga et al., 2009; Timko et al. 2010; Dash et al, 2016).

4. Conclusions and recommendations

The findings of the study revealed that the households living adjacent to South Nandi forest were highly dependent on the forest for NTFPs. About 90% of the household heads derived benefits from the forest. The study revealed that 12 socioeconomic variables were associated with the dependence of household heads on NTFPs from South Nandi forest namely location of the village; distance to the forest edge; time spent by household to collect NTFPs; NTFP stock condition; membership in community forest association; willingness to join CFA; primary source of income; marital status; ethnic group; whether NTFP was the primary source of income; whether household head sold NTFP; and main occupation of household head.

The logistic regression results revealed that there were 3 variables that negatively influenced dependence on NTFPs from the forest namely number of years of education, land size, and distance to the forest from homestead. The study also showed that 3 variables positively correlated with dependence on NTFPs namely age of household head; main occupation of household head, and distance to market from household's homestead.

It is important to understand the above specific socioeconomic conditions of forest adjacent households (forest resource users) before or when implementing forest policy on sustainable participatory forest management at the local level. For instance, high level of dependence on NTFPs and time spent by household to collect NTFPs among others cannot be ignored when preparing forest management plans. This shows that the forests are critical resource base for local community hence potential motivation to participate in forest management that enhances flow of the NTFPs for it will be their best interest to do so, at the same time motivates them to conserve the forest. Therefore, the Kenya Forest Service and Community Forest Associations should take into consideration these aspects when preparing or revising the Participatory Management Plans. The forest resource users may come up with local initiatives which may be more effective than the forest policy on sustainable forest management.

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