

Full Length Research Paper

Determining the potential for introducing and sustaining participatory forest management: A case study of South Nandi Forest of Western Kenya

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The South Nandi Forest is the most important site for the conservation of the globally threatened *Eremomela turneri*. The growing human population is the main threat to its biodiversity and the forests provision of ecosystem services. In order to address the above threat, Kenya Forest Service and partners perceived that the introduction of participatory forest management would mitigate the challenge. This study was conducted to provide socio-economic baseline information about the forest adjacent community members and other forest stakeholders who are the key blocks upon which the joint management strategies and programmes would be anchored. Information was gathered using participatory rural appraisal tools such as mapping, transect walks, focused group discussions, respondents recall and the livelihood framework analysis. Firewood was the most accessed forest product with the others being poles and posts. Even the very presence of the forest in the midst of the community presented several livelihood improvement opportunities within the settlement areas such as on-farm tree growing, fish farming, grazing and microclimate for high agricultural production. It was noted that the community were highly interested in participating in forest management (93.7%). The key challenge was that the forest adjacent community perceived South Nandi forest resources to be on the decline. This shall have to be converted into an opportunity that would be utilized to introduce and implement PFM in South Nandi.

Key words: Wellbeing, participatory forest management, livelihoods, opportunity and interest.

INTRODUCTION

Forests are being depleted at an alarming rate in recent decades in developing countries (World Bank, 2009). The depletion has been witnessed to be higher in forests which are centrally managed by the state because of low capacity and limited incentives to protect and manage the forests. Community forestry among many management approaches has been adopted more widely as it has

shown that it can lead to better forest management and improved community livelihoods which are dual incentives for government and community to support the approach which addresses their needs. This is premised on the current theory and narrative that decentralization of forest management leads to sustainable forest management and improved livelihoods (Tacconi et al., 2006).

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This is based on three assumptions that (i) democratic decentralization is a means of institutionalizing and scaling up community based natural resource management (ii) If rural people benefit from the forest they shall conserve it (iii) the success of decentralization can be measured by lack of (or lower rates of) deforestation.

In Kenya, indigenous forests which are state managed have undergone a decade of degradation between 1980s up to mid-1990s. As noted by Otsuka and Pokharel (2014), the state lacks the resources to protect forests and the motivation to manage trees hence it cannot manage the forests sustainably. Though the government reacted by declaring a ban on utilization of indigenous trees, this was not very successful. In 1997, a pilot on community forestry was started buoyed by the success in other parts of the globe especially Nepal. This should be viewed against a review of the Kenya's history which reveals that the country has for the better part of its independent life been a unitary state with a highly centralized government that has had overbearing control over the sub national government and the other arms of the government, namely the legislature and the judiciary (Institute of Economic Affairs, 2010). It is against this background that the country does not have a long experience with decentralization of natural resources. Despite this, the stakeholders planned to introduce participatory forest management (PFM) in South Nandi forest.

Together with Kakamega and North Nandi forests, South Nandi forest forms part of the Western rainforest region, and the Eastern most fragment of the Guinea – Congolian phyto-geographical region. The area occupied by the forest was once extensive, but has steadily declined due to high population pressure and inadequate management which was centralized with no formal community participation. The forest has been under the state management through Kenya Forest Service (KFS) formerly Forest Department (FD).

South Nandi forest is almost certainly the most important site in the world for the threatened *Eremomela turneri* (Otieno et al., 2011). The area supports exceptionally high densities of this little-known species. South Nandi forest has a total of 70 species of butterflies, majority of which are forest species of Western Kenya. South Nandi forest was heavily logged in the past and this affected the vegetation structure severely resulting in some of the areas getting reverted to thickets. Currently, the common trees include *Tabernaemontana stapfiana*, *Macaranga kilimandscharica*, *Croton megalocarpus*, *Croton macrostachyus*, *Drypetes gerrardii*, *Celtis africana*, *Prunus africana*, *Neoboutonia macrocalyx* and *Albizia gummifera*. This justifies the need to implement PFM which is expected to enhance conservation of these flora and fauna.

Forest adjacent communities continued to use the forest resources due to exacerbated decline of forestry products on their farms. The community use of the forest remains the single largest threat to the forest's conservation.

Additionally, the increasing human population coupled with the commercialization of forest products whose demand is increasing places extreme pressure on the forest whose management is poorly resourced. This has made the management of the forest by Kenya Forest Service (KFS) ineffective thereby the need to have other stakeholders participate in the management of the forest. This has started with the participation of several local, national and regional stakeholders who are contributing in diverse ways towards the management and use of the forest.

In line with the Forest Act 2005, and PFM guidelines which provides the framework under which stakeholders especially communities should participate in forest management, KFS through support from development partners has been initiating PFM. Through this approach, communities and other stakeholders participate in forest management under a framework that also supports livelihood. This new management approach is at infancy and it is a pre requisite that the partners get a very good understanding of the community: their needs, interests and how they would wish to be involved in the management of the forest. This shall be complimented by a good assessment of the resources available so as to determine the demand and supply with a view of proposing a partnership framework that shall ensure that partnership is sustained, the resource is sustainably managed and the community needs are met through regulated access and provision of goods from other sources including their farms to supplement unmet demand.

This management shift is premised on the evidence that: "when forests are managed by the state, population pressure create a higher demand for firewood and agricultural and grazing land, which results in deforestation, whereas favourable market access lead to the felling of large trees for sale. The assumption is that once the forest is handed over to the community forest user groups (CFA in Kenya), the larger the demand for forest resources, the greater becomes the incentives to manage the forests, thereby leading to faster rehabilitation of the forest condition through the regeneration of young trees" (Rajpoudel, 2014). The evidence from other countries has pushed many countries to start implementing some form of community forestry which has been referred to as PFM in Kenya (KFS, 2007).

The SNF forest adjacent communities are mostly farmers engaged in the growing of tea and maize as cash crops. They also keep dairy cows in their homesteads and rear beef cattle which graze in the forest for a fee. The average land holding by forest adjacent households is 2.5 acres. In 2008, the population of Nandi South was 150,335 people with a sex ratio of approximately 1:1. Forestry contribution to the economy is through products such as timber (48%), firewood (40%) and poles (18%). There are a few people (8%) engaged in forest related activities such as saw milling and carpentry (GoK, 2008).

Problem statement

The forest was under intense use by the forest adjacent community but was not adequately managed by KFS. The increased demand of forestry resources and increasing population poses a challenge. The community and other stakeholders' needs were not known and the modes of their involvement in forest management were not available though it is supported by the policy.

Justification

Management of forest resources globally is changing from state management to management by various stakeholders but with the state playing a regulatory role. South Nandi forest was facing management challenges and it was perceived that the involvement of forest adjacent communities and other stakeholders through PFM would mitigate the challenges. The study was to provide baseline information and status necessary for planning and implementing the approach in South Nandi forest which would be applicable in other forests with similar socio ecological conditions.

Study questions

1. What does the community use from the forest?
2. How does the community wish to be involved in the management of the forest?
3. What is the status of the forest products from the forest and the farms?
4. What are the challenges and how do they wish to have them mitigated?

Study/research objectives

1. To undertake social mapping of the forest adjacent community and stakeholders
2. To determine community forest resources' needs
3. To determine the on farm resource status
4. To determine the most feasible forest management institutional arrangement
5. To develop a baseline for monitoring the impact of community involvement in forest management on forest conservation and community livelihoods.

METHODOLOGY

Study site

South Nandi Forest is located in Western Kenya and is one of the main fragments of a contiguous forest block that included the North Nandi and Kakamega. The forest is located approximately between longitude 37°05 E to 37°23 E and at latitude 0°18 N and 0°32 N (Figure 1). It became a legally protected area in 1936 on gazettelement as a Trust Forest as per legal notice number 76 of

1936 and defined by boundary plan no.75/68 LN 89 of 1937. It has a total area of 49,880 ha which later reduced to 24,683 ha through excisions. The forest is managed under two stations namely Kobujoi with 17,960 ha and Kimondi with 6,723 ha. The excised forest areas were for settlement (2,200 ha), a buffer zone of tea plantations (340 ha) and plantations of fast growing exotic trees (1,400 ha). Of the current stand of South Nandi forest trees, at most 13,000 ha is closed-canopy forest, the rest being shrubs, grassland or cultivated area. Its altitude ranges from 1,700 - 2,000 m with a mean annual rainfall ranging from 1,600 – 2,000 mm per year (Njunge and Mugo, 2011).

The forest is drained by the Kimondi and Sirua Rivers, which merge to form the Yala River flowing into Lake Victoria. The landscape is gently undulating and underlain by granitic and basement complex rocks, which weather to give deep, well-drained, moderately fertile soils.

Sample size

South Nandi Forest is surrounded by 18 administrative locations overseen by a chief. The communities listed the 18 locations, followed by listing of the sub location in each location. The villages in each sub location were listed and the key socio ecological factors were also listed through focused group discussion with local knowledgeable persons. A socio-ecological representative sub location was selected from each location to provide the village for sampling. One village was selected from each of the 18 forest adjacent locations giving a total of 18 selected villages which were representative of the socio-economy of the villages in each forest adjacent locations. The selection was done by a team of forestry stakeholders who were well conversant with the local area. Each village represented several villages determined by the local population size and physical features. Households interviewed were randomly selected from each village ensuring that the four wellbeing categories (very rich, rich, poor and very poor) are well represented in each village. A total of 1278 respondents were interviewed in all the villages selected.

Data collection instruments

FGD was used to list household in each village with community selecting locally knowledgeable people who included: old men, women, youth (both male and female), local leaders and staff of development organizations. These were individuals with vast understanding of the village and the community. The households were clustered into four well-being categories from A to D with A representing a well off household and D the least well off.

In each village, representative households were interviewed guided by set of socio-economic parameters. This was precedent by community led FGD where participatory household well-being characterization through community criteria was done including getting information on perceived community resource status trends and management trends over time.

Questionnaires were administered to respondents of randomly selected households in the identified villages.

RESULTS AND DISCUSSION

Socio-economic factors influencing community interest in PFM

Well-being characterization

This focused on characterization of well-being status of

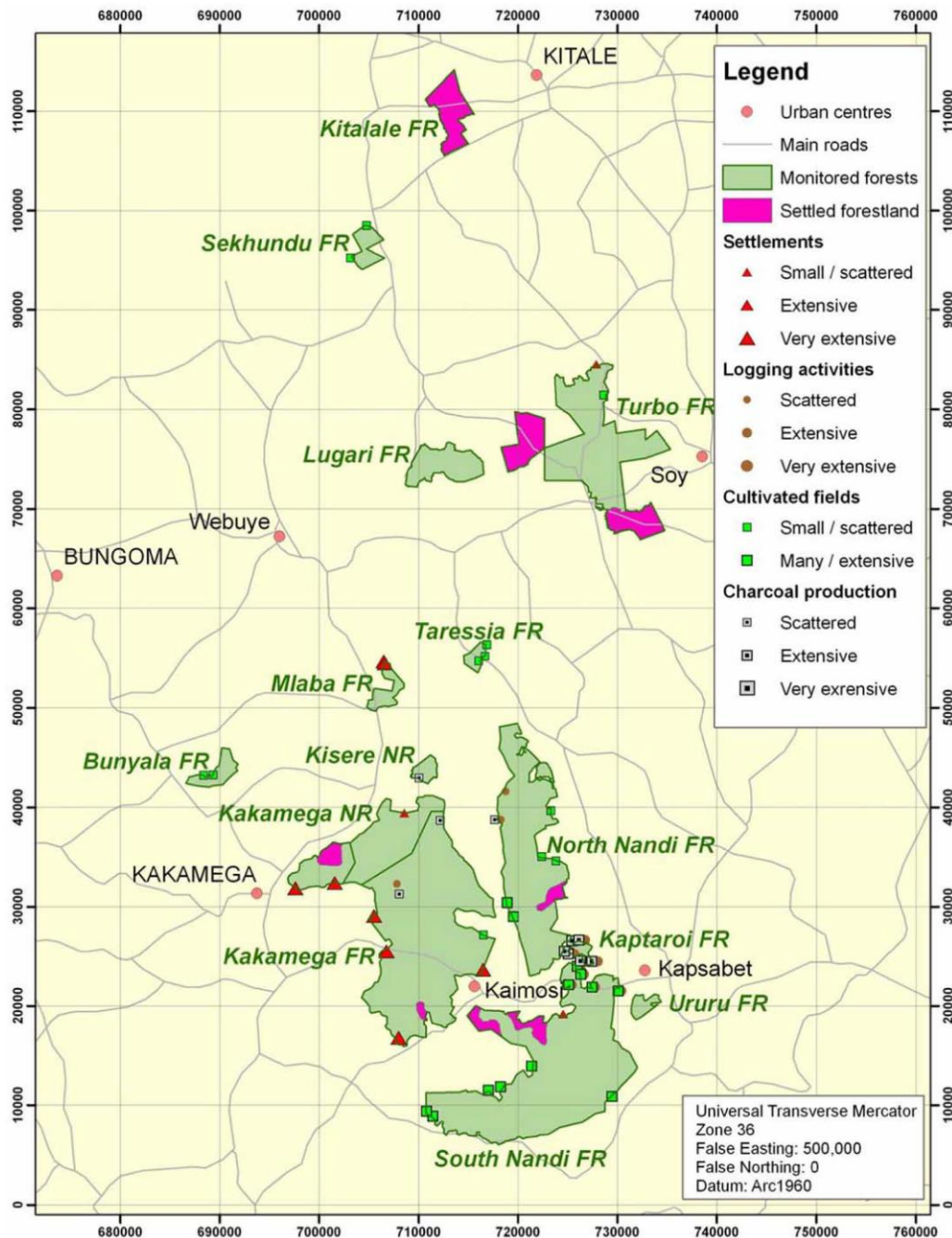


Figure 1. South Nandi Forest Location (Kenya Wildlife Service and UNEP, 2007) (Source: Klopp, 2012).

the forest adjacent households through use of FGD based on community perceptions. The household livelihood sources and assets were the basis of the categorization. The criteria by which the communities gauged socio-economic well-being of its member households included: the type of house in terms of building and roofing materials; land size; number of wives and children; hospitals attended for treatment; source of

energy for cooking and lighting; schools and university attended by children; number of meals eaten per day; number of trees planted; contribution to social welfare of others and to community development projects; whether they own vehicles and type of clothing among others.

Four well-being categories were arrived at, each with clear differentiating characteristics generated at the FGDs in relation to the household richness (Tajiri A (very

Table 1. Well-being ranks for SNF adjacent households.

Conventional wellbeing rank label	Other rank labels
Wellbeing A	Tajiri (A) – Mutuji (Luhya) Mogoriot (Nandi) (Richest)
Wellbeing B	Tajiri (B), Mogoriot (B)(rich)
Wellbeing C	Tajiri (C), Mogoriot (C)(average)
Wellbeing D	Maskini; Mogoriot (D); Kibananiat (poor)

This was guided by a community based household wellness criteria.

rich), Tajiri B (rich), Tajiri C (poor) and Maskini (very poor). The households were ranked as guided by the characteristics developed by the community in Table 2.

The 1278 respondents selected randomly were accorded different wealth ranks (A, B, C and D) on the basis of the above criteria set by the community and as per field observation during the household interviews. Analysis of the wellbeing categories revealed that 81.5% of the respondents were poor, 18.4% were very poor, 11.7% were rich and 5.1% were very rich. Therefore, majority of the community members living adjacent to South Nandi Forest are in poor wellbeing category.

As concerns interest in forest management, 93.7% of all the respondents were interested in PFM out of whom 5.2% were very rich, 11.7% were rich, 64.7% were poor and 18.4% were very poor. Therefore, due to the majority of community members being poor, majority of those interested in PFM were poor.

Analysis of interest in forest management based on each well-being category (Table 1) revealed that their interest was not determined by their well-being (Figure 2). Therefore, there was no significant association between wellbeing categories of the respondents and their interest in forest management ($\chi^2 = 1.050$, $p = 0.7$).

Land holdings

The average land holding for all respondents was 4.47 acres. Based on the well-being categories, the average land holdings were 13.74 acres for very rich, 7.56 acres for rich, 3.80 acres for poor and 2.29 acres for very poor hence a significant difference among the different categories was observed ($F = 38.370$, $p < 0.001$).

Analysis of land holding among the 2 interest groups revealed that those interested in PFM had an average of 4.57 acres while those not interested had 3.04 acres hence no significant difference among them ($F = 2.170$, $p = 0.141$). This implies that the community members living adjacent to SNF may not necessarily be interested in PFM for the purpose of owning the land hence land size is not an important factor in determining interest in involvement in PFM

Distance from forest edge

The average distance from the forest edge for all households

interviewed was 1.11 km. There was no significant difference in mean distance from the forest among the respondents in the different well-being categories (very rich- 1.16 km, rich- 1.06 km, poor- 1.15 km and very poor- 1) hence well-being was not a determinant factor in proximity to the forest.

All the respondents interviewed were within a distance range of 0.01 to 5 km from the forest where by 50.1% of them were within 0.01 to 0.50 km while 49.9% were at a distance beyond 0.50 and up to 5 km. About 17.5% of all the respondents were within 0.50 km distance from the forest. Considering the difference in mean distance from the forest among those interested in PFM and those not interested, it was noted that those interested were closer to the forest edge (1.04 km) than those not interested in PFM (2.19 km). The difference was highly significant ($F = 87.004$, $p < 0.001$). This calls for the government to concentrate its efforts in encouraging PFM among the interested groups who are nearer the forest since distance from the forest is an important determinant for interest in PFM. The highest numbers of those using timber poles and posts (139), withies (134) and herbs (276) were within a distance range of 1.1 to 5 km from the forest while the highest number using grass was within 0.11 and 0.5 km from the forest. Timber users' location away from the forest is a strategy to avoid arrest.

Gender

There were more male headed households (79.2%) interviewed than female headed households (20.8%). From analysis of interest in PFM based on gender, it was observed that a higher percentage of the males were interested in PFM than the female hence a significant association between household head gender and interest in PFM ($\chi^2 = 12.463$, $p < 0.001$) was deduced from this study. This could be associated with the fact that in African culture, men are the key decision makers and even where households are headed by women due widowhood or other reasons, and there are men who are consulted in making key decisions in the household whether as father figures, brothers or friends.

However analysis of mean consumption of firewood and forest contribution for the different gender revealed that the male headed households used 1.79 headloads while female headed households used 1.87 headloads per

Table 2. Community perceived well-being rank characteristics for households adjacent to South Nandi Forest.

Tajiri A (very rich)	Tajiri B (rich)
Permanent house roofed with gal sheet and brick walled	Owns a permanent house
Owns land between 20 and 50 acres	Owns 10-20 hectares of land
Uses river water	Uses river water
Have one or two wives	Have one wife and several concubines
Have 3-8 children	Have 4 - 8 children
Attends private hospital	Attend private hospital
Connected to national grid or uses generator and or solar	Level of education Diploma
Children attend private schools and universities locally and abroad	Children attend public and a few private schools
Eats four to five times a day including meat, bread, rice, blue band, spaghetti and chapatti	They are church goers
Have between 1000 - 3000 on farm trees	Use pressure lamp to light
Employed earning between 50,000 to over 100,000KES	Eats three times per day
Have income from other income generating activities	Attend both private and government hospitals
Contribute between 1000 and 2000KES during self-help functions	Have three meals a day
Have vehicles and tractor	Water source, well, bore holes, water tanks and rivers
Own exotic high grade dairy cows	Monthly income 20,000 to 40,000KES
Source energy: gas, charcoal and firewood	More than 2000 on farm trees
Owns five acres under tea crop	Have 3 cows Source energy: charcoal and firewood
Clothing imported and very expensive	Transport mode motorbike or vehicle
	Owns 2 acres of tea
	Clothing ordinary
Tajiri C (poor)	Maskini (Kibananiat) (very poor)
Have a semi-permanent house with mud wall roofed with iron sheets	Owns grass thatched house
Have one wife and several concubine	Have one wife
Owns 1-10 hectares	Uses river water
Have 8-12 children	Have more than 10 (12 to 14) children
Attends local dispensary and herbal clinics	Have few (0 to 100) on farm trees
Eats twice or three times per days	Use lantern for lighting
Have about 200 on farm trees	Use herbal medicine and attend local dispensary
Do casual jobs for 2,000 – 10,000 KES per month	Children rarely complete primary level of education attaining class five mainly
Water source river	Casual main source of livelihood, or house help or herds boy
Children attend polytechnic and public Schools	Owns 0.1 acre-0.3 acres of land
Have 1 – 2 cows	Attends local dispensary and also uses herbs
Source energy: firewood	Eats once or twice in a day
Owns ½ to 1 acre of tea crop	Children attend public schools
Mode of transport public	Have no cows
Clothing second hand	Means of transport walking
	Clothing second hand

Source: Survey FGD.

week. It was also noted that the forest contributed 1.06 and 1.11 headloads per week to male and female headed households respectively. In both cases, it was realized that there were no significant differences between the mean consumption and mean forest contribution for both male and female headed households.

Ethnic composition of the FAC

From the sampled population, Nandi (71.9%) were the majority followed by Luhyas (17.8%), Kipsigis (4.7%) and Maragoli and Tiriki tying (2.3%) other tribes (1.2%) including Banyore, Kikuyu, Basuba, Bashirima, Nyagori,

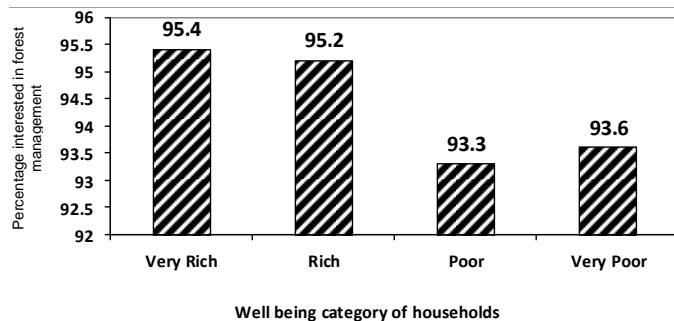


Figure 2. Interest in forest management based on well-being categories.

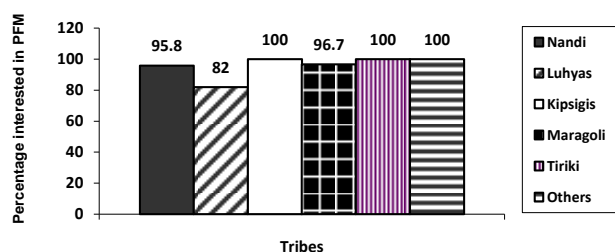


Figure 3. Interest in PFM among the ethnic groups in SNF.

Turkana and Idakho.

It was noted that all the tribes represented in this study were highly interested in PFM (Figure 3). The community will be practising good governance if the composition shown is reflected in its organizational structures like community forest association committees and benefit and costs sharing mechanisms taking cognizance of these factors. Further, the household well-being ranks, tribe composition, marital status and sex of household head should form the basis for any future community engagement in addition to:

1. A balance on equality and equity in representation
2. Equity in benefits and costs sharing
3. Resource access and tenure arrangement (*in-situ* and *ex-situ*).

There was a very high number of married household heads (89.2%) and very few widowed (6.6%), single (0.2%), separated 3.5%) and divorced (0.5%) household heads. The low social status accorded to single, divorced and widows categories in society may have their access to resources negatively affected as they are likely to be locked out of decision making organs. Female headed households remained low (18%) with male headed household comprising 88%. Deliberate affirmative action shall be necessary to ensure the minority and disadvantaged members of the community benefit through the forest management and livelihood activities.

This includes single, divorced and widows considering that the community is patrilineal.

Forest adjacent community livelihood sources and resources

This was assessed to provide options to community members interested in forest management with a view of improving their benefits and participation in forest management.

The community indicated that mixed farming was their main source of livelihood as indicated by 71% of all the respondents interviewed. The other livelihood sources included; tea 20%; business 17%; salary 14%; casual work 25%; trees 4%; donations 2% and horticulture 1%. Though a lot of interest in forest management was indicated, only 4% of the respondents indicated to be entirely dependent on sale of trees as source of livelihood. The rest did not depend on trees for their entire livelihood.

The level of dependence on each source of livelihood varied within each of the source. For instance, among those depending on trees for their livelihood only 63% depended on them to a range of 50 to 100% level. More so, only 4% of those using trees as source of livelihood were entirely (100%) dependent on them while the rest had it with combination of other sources of livelihood.

The fact that forests/trees were not indicated as a major source of livelihood yet the community members were interested in their management could be due to the possibility that most of the forest goods and services were being used to meet domestic needs without evaluating their value in economic or financial terms. The forest supports dairy farming as it is a major source of fodder for dairy animals with grazing indicated as a major reason for community involvement in forest management.

River and streams were indicated as the major sources of water with 74.8% of the households relying on them. Springs as sources of water were relied upon by 12.4%, 5.6% using piped water, boreholes providing water for 3.6% and roof catchment for 1.6% of respondents. The streams and rivers have their source in the forest which also acts as reservoir which holds the water and releases it during the dry season. The forest contributes highly to the livelihood sources of the community calling for its better management.

Use of forest as source of fuel wood

The mean fuel wood consumption for interviewed households was 1.8 headloads per week. There was a significant difference in weekly consumption of fuel wood among the different wellbeing categories ($F=5.831$, $p=0.001$) as shown in Figure 4.

Considering interest in PFM and consumption of fuelwood, the mean consumption for interested group was

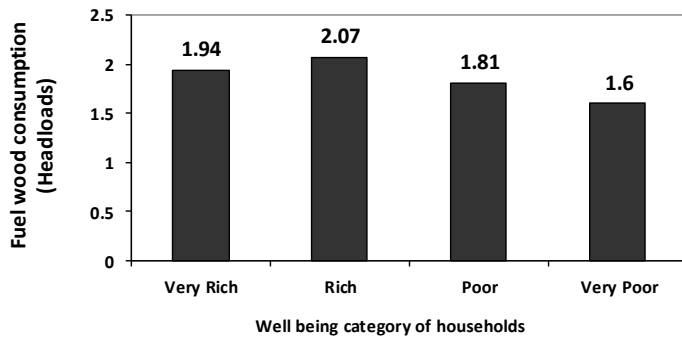


Figure 4. Consumption of fuelwood among different well-being categories.

1.79 headloads per week and for non-interested group it was 1.98 headloads per week. Hence there was no significant difference between the 2 groups ($F=2.186$, $F=0.14$) because fuelwood is a basic forest commodity needed by all the community members irrespective of whether interested in PFM or not.

Forest contribution to household fuel wood consumption

As indicated by the community members, there was a lot of interest in getting involved in forest management because of the forest provision of firewood. All members of the community were consuming fuel wood even if they were not obtaining it from the forest. About 45.8% of all the respondents indicated that each household was using at least one head load per week, 30.2% indicated 2 head loads per week and 16% indicated 3 head loads per household per week. The cost of headload at the local market ranged from Ksh 50 to 70. Therefore, for the sampled households this means that the forest was supplying fuel wood worth Ksh 4,329,000.0 to 6,060,600.0 respectively, per year. Therefore, firewood has an enormous value to the community.

It was also noted that the South Nandi forest contributed firewood to about 73% of the respondents interviewed. Considering an average weight of 30 kg per headload, the forest was therefore providing 2,164.500 tonnes of fuel wood to the community per year. Among these households obtaining their fuel wood from south Nandi forest, about 97.9% were among those who had indicated interest in forest management while 2.1% were among those who had indicated to have no interest in forest management. There was a 0.000 significant linear by linear association and correlation (at 95% confidence interval) between interest in forest management and consumption of fuel wood from the forest. Using actual figures of forest contribution to fuel wood consumption as indicated by the 925 respondents, it is clear that an average of 1.5 head loads of firewood per household were being

obtained from the forest per week. This implies that the forest had a very important contribution in terms of fuel wood to the adjacent community members. Hence the aspect of maintaining a sustainable supply of firewood to the community members adjacent to the forest need to be looked into while developing the Participatory Management Plan for South Nandi forest.

Considering the distance from the forest for those obtaining firewood from the forest, it was noted that those accessing the forest for firewood were at a mean distance of 0.82 km and those not accessing were at a distance of 1.86 km from the forest giving a highly significant difference ($F = 272.275$, $p<0.001$). It is therefore clear that those closer to the forest are accessing it more for fuelwood.

For group interested in forest management and able to access the SNF, the forest contributed 1.47 headloads per week while the non-interested group accessing the forest were getting 1.33 headloads per week. There was a significant difference among the 2 group considering those accessing and those not accessing the forest ($F = 969.026$, $p<0.001$). The difference was still observed when analysis on forest contribution was undertaken without considering those accessing and those not accessing getting respective averages of 1.12 and 0.30 of headloads of firewood contributing to both interested and non-interested group ($F = 53.918$, $p<0.001$). Therefore, forest contribution to household fuel wood is an important determinant for interest in PFM.

Further analysis of interest in PFM based on access to the forest firewood revealed that there was a highly significant association between interest in getting involved in PFM for SNF community members and the capacity to access the forest for firewood ($\chi^2 = 108.392$, $p<0.001$). At the time of this study, firewood (73%) was indicated by 73% of the respondents as one of the most highly accessed forest product from South Nandi forest followed by herbs, (53%) poles and posts (31%), withies (28%), grass (26%) and timber (17%). However, considering the quantities though the units are different for different products, higher quantities of firewood and timber were obtained than for other products. It was also pointed out through FGDs that some of the forest products were also getting accessed from the forest both formally and informally with some like water from the forest appearing to be God given.

Majority of the respondents (73%) indicated getting firewood from the forest as the main reason for interest in getting involved in PFM. The communities did not emphasize on stopping forest extinction and farming as important reasons for interest in management though the forest was facing threats for extinction and PELIS had been stopped nationally. Other reasons for the high interest were also related to accessing different forest products and services from the forest (Table 3). This is a clear indication that South Nandi Forest (SNF) adjacent community relies heavily on the forest for different

Table 3. Products accessed by forest adjacent community from South Nandi forest.

Forest goods/services	No. of respondents	Respondents (%)
Firewood	934	73
Herbal medicine	455	36
Grazing	359	28
Rain	830	65
Fruits	34	3
Timber	65	5
Charcoal	99	8
Honey	55	4
Pleasant air	10	1
Strict law	11	1
Tourism	6	0.5
Windbreak	2	0.2
Soil conservation	6	0.5
Stop extinction	1	0.1
Farming	1	0.1

Source: Mbuvi et al., 2010.

products and services.

The high interest in PFM on the basis of forest product access needs to be harnessed well. According to Otsuka and Pokharel (2014), community management system is efficient in the sustainable management of forests and the provision of substantial benefits to forest users, to the extent that collective interests are accounted for in the decision making and the cost collective action is reasonably low. This is a reflection of the value of the forest to the community and that though they are not highly benefiting they anticipate to access more benefits once they start participating in forest management. However, there is need to guard against elite and political capture realizing that in Kenya the core elite have mastered the art of self-reinvention with changing times (Nyanjom, 2011).

This interest is required to be managed to guard against a possibility where democratic local government could choose to authorize deforestation to stimulate economic development and reduce poverty (Tacconi et al., 2006). Additionally, the interest conforms to what many environmentalists are advocating for; participatory and community-based natural resources management (CBNRM) as a means to increase environmental management efficiency and improve equity and justice for local people (Ribot, 2002). This is possible as the legislation support community participation in forest management. The Forest Act 2005 and The Kenya Constitution 2010 provides clear opportunities for devolution and clear provisions for rights and opportunities to hold the state responsible and accountable. Thus devolution is rooted in the supreme law of the land and the constitution further is clear on relative roles of the different levels of government (Nyanjom, 2011).

Use of forest as source of timber

A total of 211 (17%) indicated that they were using timber amounting to 66,608 feet per year hence giving an average of 316 feet of timber per household per year. It was also observed that 82.9% (175) of those getting timber from the forest (211) were those interested in getting involved in forest management. However, there were only 14.7% of all those interested in forest management. It was also noted that 42.4% (36) of those who had indicated to have no interest in being involved in forest management were getting forest products from the South Nandi forest. At 5% significance level, there was a significant correlation between interest in forest management and use of the forest as source of timber ($R = 0.186$, $p = 0$).

Use of forest as source of withies, poles and posts

About 31% (394) of the respondents were using an estimated amount of 56,499 poles and posts from the forest giving an estimated average of about 143 poles per household per year. It was also observed that 88.1% (347) of those using poles and posts were those interested in forest management while 11.9% (47) of them were those who had no interest. Chi-square tests at a 5% significance level indicated a significant (0.000) linear by linear association and correlation between interest in forest management and the use of forest as source of poles and posts. This implies that while developing the management plan for South Nandi forest in relation to its use as source of poles and posts, it is important to focus on those who are interested in being involved in forest management and propose measures to provide sustainable source of poles and posts. Withies were obtained from the forest by about 28% (359) of the respondents with each household obtaining an average of 291 withies per month.

Those interested in forest management formed 90% of those using withies from the forest while those not interested yet were using the forest as source of withies and formed only 10%. A significant (0.002) linear by linear association between interest in forest management and use of withies was observed.

Use of forest as source of grass

Grass was being obtained from the forest for thatching and for fodder by about 24.8% (317) of the respondents at an average of 18 bundles per household per month. Though animals were grazing in the forest, the respondents did not indicate (consciously as a way to avoid being found to be grazing for free in the forest) the forest as a source of grazing for their animals. It was therefore not easy to determine the number of animals grazing in the forest at any given time.

Use of forest as source of herbal medicine

About 53% (672) respondents obtained herbs from the forest. The frequency of obtaining herbs from the forest varied among the respondents with the frequency of once per month having the highest number of respondents (36.9%). A total of about 211 respondents forming 16.7% of those collecting herbs at a frequency of once per month were within the distance of 0.11- 0.5 km from the forest.

On-farm planted trees versus household use of forest resources

Most of the South Nandi Forest adjacent community members had planted trees in their farms as indicated by 87.5% (1118) of all the respondents interviewed. About 74.4% (157) of those using timber were those who had planted trees while 25.6% (54) were from among those who had not planted trees at all. However, 86% (961) of those who had planted trees were not using them as source of timber, an indication that the forest still serves as a major source of timber for the community.

For all the households to which the South Nandi forest was contributing fuel wood for consumption (925), 89.3% (826) of them were from among those who had planted trees. Therefore, we can deduce the fact that having planted trees in the farms did not imply that they were using them for fuel wood consumption. Only 26.1% (292) of those who had planted trees were not getting their fuel wood from South Nandi forest, the rest (73.9%) were wholly dependent on the forest for fuel wood. This is an indication that the trees were planted for sale and not for domestic consumption. This leads to the need to emphasize on managing the forest in a manner to enhance sustainable supply of fuel wood and also create awareness on the need to use own trees for fuel wood. This conforms to the view that while there are cases in which local people have conserved forests and other resources in their natural resources, conservation should not be presumed (Tacconi, 2000; Tacconi et al., 2006).

For poles and posts, 82.7% of those using them (326) were those who had planted trees while 17.3% were those who had not planted. The forest is a major source of poles and posts.

Only 26.9% (301) of those who had planted trees were using withies while 73.1% (817) were not using poles and posts. However, these respondents were 83.8% of all those using withies while 16.2% of those using withies were not planting trees.

Trends of forest and on-farm livelihood resources and Mitigation Measures by SNF stakeholders

The community provided a historical profile of livelihood sources availability status change for the valuable key

forest resources for the last twenty years. According to their perception, the resources were getting scarce. This is a scenario that requires joint intervention measures from all stakeholders and the proposed mitigation measures could be the starting point.

The community perceived a decline in forestry resources both on-farm and in the forest and they proposed conservation, planting trees under agroforestry system and stopping of charcoal burning as the main mitigation measures. They also proposed use of alternative sources of energy to reduce pressure on the forests and introduction of IGAs such as bee keeping for improvement of community livelihoods.

The community perceived a decline in farm animals but proposed rearing few but high quality animals as a mitigation measure. For wildlife protection, the community proposed rearing of wild animals, establishment of small game parks and avoiding poaching.

Perceived interests and needs of stakeholders in SNF

The perception of SNF stakeholders' interest and needs was undertaken to get their perceptions and proposed means to attain the desired status. The participants also assessed how they felt their needs were being addressed by KFS. KFS did a self-assessment on how it felt it was satisfying its obligations (Table 4).

The community expected to get products from the forest under minimal restriction to maximise benefits with measures like reducing KFS and KWS strength being some of the mitigation measures. Their level of satisfaction is an indication that they have a fair access to forest resources. KFS had very positive mitigation measures like strengthening patrolling, involving communities and having a functional CFA and a management plan.

Conclusion and recommendations

Majority of the community members living adjacent to SNF were of poor well-being category. Therefore, PFM incorporate IGAs programs to enhance the livelihood of the community members. There are opportunities for improved community livelihoods in PFM activities such as Plantation Establishment Livelihood Improvement System, on-farm tree growing, fish farming and grazing in the forest. As concerns governance, CFAs should be representative of all the different ethnic groups living adjacent to SNF forest. Power and authority should always be well shared between all the community ethnic groups to avoid marginalization of the minority and other disadvantaged members of the community. This shall provide a foundation for sharing of costs and benefits. Further as noted by Ribot (2002), the potential for decentralization to be efficient and equitable depends on the creation of democratic local institutions with significant

Table 4. Perceived interests and needs of key stakeholders in South Nandi forest.

Stakeholder	Responsibility	Community level of satisfaction with performance to address community needs ¹	Mitigation measures to attain the desired satisfaction
KWS	Conservation of wild animals	2	
	Conservation of indigenous vegetation for ecosystem sustainability	2	Increase strength (joint operations)
	Scientific research		Minimize charcoal burning
	Ecotourism development	2	
KFS	Increase biodiversity	4	Increase number of forest rangers Have functional CFA
	Increase volume of water and revenue	4.5	Planting indigenous trees
	High revenue	1	Tree planting
	Increase cover	4.5	Planting of trees
	High number of seedlings	1	Increase funding
	PFM	3	Develop management plan and agreements
	Well protected forest	2	Increase income, empowerment, awareness creation
	Well maintained forest boundaries	2	Erecting beacons planting of trees along forest boundaries, establishment of Nyayo tea zones
	High production of milk and meat	4	Reduce grazing fees
	Get enough firewood, income	2	Reduce the fees
Community	High production of honey, Increased income and food satisfaction	2	Allow apiaries in the forest
	Obtain medicinal plants in large quantities	3	Protection of medicinal plants
	Income	3	Reduce number of forest guards
	Obtain meat and skins	3	Reduce the strength of KWS
	Harvest enough timber, high income	2	Reduce restriction
	Income increment	2	Reduce restriction
	Large quantities to satisfy cultural sites	2	Reduce the fees No restriction
	Supply enough water	3	Free collection
	Know the forest more	4	No restriction
	Obtain large amounts for use	3	No restriction Protection of the plants

Source: Survey FGD discussion. ¹Level of satisfaction as perceived by the participants from a scale of 1 to 5. 1 being the lowest and 5 the highest satisfaction level.

discretionary powers.

The community members have a high interest in PFM hence the government should facilitate the process of initiating PFM in SNF while also taking care so that the forest condition is not compromised. High interest among the community members to manage forests should be considered to be an opportunity to introduce and implement PFM in new sites. However, this is likely to contribute to forest degradation considering that SNFR is a major resource contributing to the livelihoods of local communities through provision of firewood, fodder for grazing, poles, water among other forest products and

services. Local communities living adjacent to forests are conscious about the decline of forest resources which can be mitigated through community involvement in forest management as noted in Nepal (Rajpoudel et al., 2014). This is possible in Kenya since the government is supporting community participation in forest management through PFM. Majority of those interested in PFM and those accessing the forest for firewood are nearer the forest hence the government should seek to encourage participation of community members that are closer to the forest.

Diversification and sustaining current and potential

income sources from forest resources is essential. In the case of South Nandi forest, the major in-direct sources of income at the community level were rather varied but tea and milk were the major livelihood sources with the forest still acting as a major resource which they access with minimal costs. Casual work as a source of income was a major source of income in several villages. The seasonality and unpredictability of this income needs to be considered when PFM implementation is started. Supporting uniform livelihood sources shall not lead to better community livelihoods. Support should be geared towards interventions that are location and or village specific as major sources of income are rather varied with some villages having tea or milk as the major while others have maize. Tea producing villages seemed to have more very poor households as per the well-being categorization. These villages may require livelihood interventions to mitigate this situation. PFM activities were not mentioned as a solution though some process aspects and outputs were mentioned. There is need for more awareness on PFM among the communities living adjacent to South Nandi Forest. The communities were reluctant to release information on the use of forest products like grazing hence the need for consensus and trust building among the stakeholders. There is need to do further work to determine the medicinal plants and other forest products collected from the forest and the actual quantities so as to determine the impact it has on the forest with a view to design mitigation programmes like domestication. Due to the high interest in PFM with the major reason being to access firewood from the forest, there is need for the government in partnership with the community to plant fast growing tree species that are suitable for fuel wood and timber provision.

The key stakeholders are aware that they are not optimally implementing what they are supposed to as per their formal and informal mandates. This calls for creating awareness on the policy opportunities, PFM guidelines provisions and providing opportunities to enhance this capacity. The design of decentralized forest management programs has to be grounded on the potential environmental and economic benefits of alternative land uses at the various geographical scales. Additionally, in SNF, it has to take into account the ethnic representation of the FAC. Conclusively, the South Nandi forest adjacent community are aware of the contribution of the forest to their household livelihood. From the results, it is also evident that SNF provides the community with several products and services an opportunity that could be harnessed to introduce community participation through PFM.

Better forest management and optimal contribution to community livelihoods would be attained through a joint management partnership that shall facilitate multiple stakeholders' participation in forest management. Additionally, this shall work; Tacconi et al. (2006) referred to it as "under the right circumstances" which include democratic decentralization that shall improve efficiency, equity, democracy and resource management. The

stakeholders should be actively involved in the whole project cycle, particularly in defining what (activity) should be done, implementation process, (how it should be done), monitoring and evaluation (shaping the future). The local communities are being sensitized through training and adequate awareness on the importance of fully participating in the management of the forest. The existing direct and indirect community livelihood sources need to be formalized and enhanced to provide incentives for community participation in forest management.

Conflict of interests

Authors did not declare any conflict of interest.

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