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# Effects of Participatory Forest Management on Livelihoods of Communities Adjacent to Forests in Redd+ Pilot Areas of Mufindi, Iringa Rural and Mbozi Districts, Tanzania

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## ABSTRACT

Participatory Forest Management (PFM) has been introduced as a strategy for sustainable forest management. The extent to which forests managed under PFM strategies contribute to the livelihoods of its adjacent communities remains poorly understood. The objectives of this study were to (i) analyse socio-economic characteristic of respondents in the study area (ii) assess forest products accessed by the communities living adjacent to the forests, (iii) analyse the local communities' perception on the importance of forests under PFM to their livelihoods and (iv) analyse socio-economic factors influencing the households' perception on the importance of PFM. Methods of data collection were household survey, direct observations, key informant interviews and focus group discussions. Data analysis was done using chi-square analysis and binary logistic regression. Findings revealed that $\chi^2$ test on the importance of PFM forests (compared to non-PFM forests) was statistically significant. Binary logistic regression analysis revealed that household size was a statistically significant factor influencing the household's perception on the importance of PFM forests on livelihoods. We conclude that PFM forests are perceived to have positive effects on their livelihoods. Further studies are recommended explicitly to paint a picture on benefits attributable to PFM.

**Key words*:*** Community Based Forest Management - Livelihoods - Joint Forest Management.

## INTRODUCTION

Forests and woodlands in Tanzania cover about 48.1 million ha of forests and woodlands representing 55% of the total country land area (URT 2015). Forest resources even under participatory management regime face many challenges including deforestation, which is estimated at a rate of 401,000 ha per year (URT 2015). Approximately 41% of total deforestation in Tanzania is attributable to household wood fuel consumption (Lusambo 2009) making forest resources consumption unsustainable. Based on the National Forest Monitoring and Assessment (NAFORMA) inventory report of 2015 (URT 2015), the total annual supply (growth) of wood at national level is estimated at 83.7 million $m^3$ but only about 42.8 million $m^3$ is available for harvesting at a sustainable level. On the other hands, the annual demand (consumption) of wood in Tanzania is estimated to be 62.3 million $m^3$ mainly for household energy and loss due to land area conversions. These statistics indicates that the consumption exceeds the sustainable supply, causing an annual wood

deficit of 19.5 million $m^3$ (URT 2015). While the estimated average demand for wood is 1.39 $m^3$/year/capita, the annual allowable cut (the sustainable supply) is estimated at 0.95 $m^3$/year/capita implying a shortage of about 0.44 $m^3$/year/capita. This wood fuel deficit has perilous consequences such as deforestation, land and forest degradation, biodiversity loss, soil erosion, climatic variability, and declining hydrological balance. The problems are further aggravated by the proportionate increase in human population growing at about 2.7% per annum (Agwanda and Amani 2014), economic growth of about 6.9% per annum and high urbanization rate.

Participatory Forest Management (PFM) was introduced in Tanzania as a means of slowing the deforestation rates and ensuring sustainable forest management. The framework provides a clear legal basis for communities, groups or individuals across mainland Tanzania to own manage or co-manage forests under a wide range of conditions. PFM is divided into: (a) Community Based Forest Management – CBFM that enable local communities to declare and ultimately gazette Village, Group or Private Forest Reserves (b) Joint Forest Management – JFM which allow communities to sign joint forest management agreements with government and other forest stakeholders. CBFM can take place on village land or private land, and the trees are owned and managed by a village council, a group, or an individual, JFM takes place on reserved land owned and managed by either central or local government. The status of PFM in Tanzania is given in in the Appendix 1 (URT 2006).

Community-Based Forest Management (CBFM) is one kind of PFM approach that takes place on village land, on forests that are owned or managed by the Village Council on behalf of the Village Assembly and leads to the establishment of Village Land Forest Reserves (VLFR), Community Forest Reserves (CFR) or Private Forest Reserves (PFR). Community-Based Forest Management refers to forest management that takes place on village land, where local people play a role as both managers and forest owners. Management is exercised through village institutions elected by all community members. The role of the districts is to support and assist the communities to manage their own forests sustainably. CBFM may apply to any kind of forest – those which are rich or poor in biodiversity, intact or degraded, large or small, moist montane, woodland or mangrove. What is important to understand is that CBFM takes place inside Village Lands and outside National and Local Authority Forest Reserves. The objectives of the CBFM regime may be protection or production or a mixture of both. In some cases, villages may wish to conserve their village forests for traditional or sacred purposes, in other cases it may be to protect an important water source (MNRT 2007). 'Management' in CBFM includes all aspects of forest management, such as forest protection, regulation of access and use of the forest, and actions to rehabilitate or develop the productive capacity of the forest. It includes not just the practical responsibilities of management but the authority to make the decisions, which guide those operations.

CBFM is a power-sharing strategy. It builds upon the national policy to enable local participation in forest management and the real need to bring control and management to more practical local levels. It aims to secure forests through sharing the right to control and manage them, not just the right to use or benefit from them. Therefore, CBFM targets communities not as passive beneficiaries but as forest managers. The methodology of establishing CBFM relies upon foresters as facilitators (encouraging, supporting, guiding). The key stakeholders in the forestry sector (and therefore CBFM) and their different tasks include: Forestry and Beekeeping Division (MNRT) provides for

policy, legislation, donor co-ordination and overall sectoral leadership as well as co-financing for planned activities at the local levels. FBD also provides services for capacity building, facilitation, monitoring and evaluation to be conducted from the central and regional levels. Regional Administrative Secretariats (PO-RALG) provide a link between FBD and the local government authorities by advising and facilitating implementation of sector reforms at the local government level. Tanzania Forest Service (TFS) is an Executive Agency, mandated for revenue collection and revenue retention in the forestry sector. District Councils are responsible for planning and implementation through local leadership, extension, providing technical assistance and capacity building and mobilising financial resources for implementation of planned activities from different sources. Private sector, NGOs, CBOs, Villages, Sub-Villages (vitongoji), hamlets (matawi) and specific resource users, other service providers and investors provide human and financial resources for the sustainable management and development of natural forests and woodlands, plantations and on-farm resources. According to Blomley *et al.* (2009), the estimated annual revenues per district from sustainable harvesting ranges from USD 57,900-USD 784,000 (Appendix 2).

The long-term viability of PFM will depend on how the local communities adjacent to PFM forests will realise benefits for their livelihoods improvement. Piloting the national REDD+ Program in Tanzania in these PFM forests to address the benefits realization and sharing is therefore important (Vyamana 2009). The importance of PFM in managing the forests notwithstanding, the empirical data and information on the extent to which forests managed under PFM practices contribute to the livelihoods of its adjacent communities remains skimpy.

Blomley and Iddi (2009) further argued that in addition to improving the overall management of forests in Tanzania, a key policy objective of PFM is to improve the livelihoods and wellbeing of poor rural communities who live close to, or inside forests and woodland areas. Unfortunately, the availability of research on linkages between PFM and livelihoods is fairly limited. Therefore, this study aimed at assessing, and hence provides a better understanding of the contribution of PFM forests to the livelihoods of its adjacent communities. Specifically, the study aimed to: (i) analyse socio-economic characteristics of respondents in the study area (ii) assess forest products accessed by the communities living adjacent to the forests, (iii) analyse the local communities' perception on the importance of forests under PFM to their livelihoods and (iv) analyse socio-economic factors influencing the households' perception on the importance of PFM. The information on the impacts of PFM forests to the livelihoods of the adjacent communities are instrumental in motivating them to effectively participate in PFM related activities.

## MATERIALS AND METHODS

### Description of the study area

The study was conducted in villages adjacent to the forests in Mufindi and Iringa Rural Districts in Iringa Region and Mbozi District in Mbeya Region in the Southern Highlands of Tanzania (Appendix 3). In these regions, PFM was developed and implemented since 2004 (Elmer *et al.* 2005). The regions are among the best in implementing PFM practices in Tanzania (MNRT 2008). Ecologically, the study sites represent miombo woodland forests with annual rainfall of about 500-600 mm, mean annual temperature 21$^{o}$C. The soils in the area are nutrient-poor and natural vegetation is dry miombo woodlands (Frost 1996). Agriculture is the major occupation and

economic activity of the local communities where about 80% of the households depend on small-scale crop production and the rest are engaged in livestock keeping, forest extraction and petty businesses.

**Research design**

Forests were stratified into PFM and non-PFM and purposively selected based on the following criteria: *(i) forest vegetation type should be miombo woodlands, (ii) management regime practiced should be PFM (either JFM or CBFM), (iii) Availability of non-PFM forest in proximity (i.e., bordering PFM forest) with the same vegetation type*. Respondent households from study sites were drawn using simple random sampling. In each study village, *hamlet(s)* were randomly selected. In each selected village, hamlets were identified. Random selection of *hamlets* was made possible through the use of the *playing cards* method: the names of *hamlets* were written on the lower parts of the cards, the cards were then thoroughly mixed together, and the desired sample size randomly selected from the pool of the cards. With the aid of village governments through focus group discussion (FGD), households in the selected hamlets were stratified into *low-income, medium income* and *high-income* and later randomly selected from each stratum using a random number table. During sampling of *hamlets,* the sampling frame was the *list of all hamlets* in the selected villages. When sampling households for the study, the sampling frame that was the *updated list of household's registers* in the sampled hamlets. In each of the selected households, we interviewed the head of the household. The sample size for the study was 500 respondents based on Bartlett *et al.* (2001) and Fisher *et al.* (2002) for ensuring greater precision of the estimates and to increase confidence in the results.

**Data collection**

Questionnaires for household surveys and checklists for Focus Group Discussion and interview of key informants were the main tools used for data collection. We conducted interviews using both structured and semi-structured questionnaires, focus group discussions (FGD) and key informant interviews using checklists, direct observations and literature review (project reports, books and other pertinent documents). In this study, One FGD was held in each study village to augment the data gathered through questionnaires and interviews, take advantage of the synergistic effects of focused discussions, and discuss possible questions arising from the study. Key informant interviews were also conducted with forest extension officers and village leaders from each study village.

***Selecting respondent households***

After determining the sample size from a respective target population, a stratified random sampling techniques (*using a random number table*) was used to draw the respondents for the survey. First, the households were stratified into *low*, *medium* and *high* wealth categories and their respective percentages (of the total population) were established. The standardised criteria established by Lusambo (2009) were used to stratify respondents into their respective wealth categories (Appendix 4). Then, the sampling of respondents across the three wealth categories was affected using the following formula:

$$Re\,s\,\text{pondents} = \left(\frac{n}{N} \times L\right) + \left(\frac{n}{N} \times M\right) + \left(\frac{n}{N} \times H\right) \quad (1)$$

Where: *n* is the required sample size, *N* is the households' sampling frame, *L* is the number of households in a *low wealth* category in the sampling frame, *M* is the number of households in a *medium wealth* category in the sampling frame, and *H* is the number of households in a *high wealth* category in the sampling frame.

***Household inter-person selection for questionnaire survey***

After the household had been selected to take part in the survey, either the *husband* or *wife* of the respective household (*for a married couple*) was responsible for answering the questionnaire. In the event both (husband and wife) were present at the time a visit for interview was made, then a *random sampling technique* (using playing cards) was used to determine who should be the respondent. Otherwise, for those households whose heads were single or at the time of the visit there was only one of the couple present, the questionnaire was administered to either single household heads or the available couple member (for the latter case). In case neither husband nor wife was present during the visit, any adult member of the household present was responsible for responding to the questionnaire.

**Data analysis**

Both descriptive and inferential statistical analyses were carried out using SPSS and Excel computer programmes. Findings were summarised in frequencies and percentages and presented in tabula forms. Content analysis was used to analyze qualitative data. This involved preparing and organizing the data for analysis, then reducing the data into themes through a process of coding and condensing the codes, and finally representing the data in simple sentences and where applicable in tables. Chi square test was performed for testing whether the perceptions of local communities on the importance of PFM forests and the contribution of PFM forests to the household physical assets have any significant statistical differences. The binary logistic regression analysis was performed to test socio-economic variables against perception on the importance of PFM. Two hypotheses were tested one for chi-square and one for logistic regression model. For the **Chi-square test, hypothesis** tested ($H_o$) was that there is no statistically significant difference among the opinions by respondent households regarding the importance of PFM.

Hypothesis ($H_0$) for logistic regression model was tha:

$$H_0 : \beta_1 = \beta_2 = \beta_3 = ... = \beta_k = 0$$

(i.e. household socio-economic and demographic factors have no effects on perceptions on the importance of PFM).

## RESULTS AND DISCUSSION

### Socio-economic characteristics of respondents

The socio-economic characteristics for 500 respondents who took part in the present study are summarized and presented in Appendix 5. The number of male respondents was comparable to that of female respondents. Using mode as a measure of central tendency, the average household size in the study area was found to be five people.

### Forest products accessed by the communities

Communities in study districts were found to extract a variety of forest products throughout the year for their daily subsistence and income generation. These products are collected from both PFM and non-PFM forests. The products extracted from the forest were categorized into 9 major groups (Table 1). These results show that non-PFM forests are highly depended-upon by communities to derive timber and non-timber forest products. However, this can also be an indication of leakages and effective law enforcement for PFM forests. Therefore, intervention in non-PFM areas is required to reduce pressure from communities. Firewood is the major source of energy in most rural areas in Sub-Saharan Africa in general, and Tanzania in particular, used for cooking and heating. In this study, 4.4% and 74.9% of firewood consumed was collected from PFM and non-PFM forests

respectively. This was used mainly as the main source of energy used for cooking, heating and bricks burning. Thatch grass was found to be the most used materials for roofing, fencing, traditional rural housing and animal pens. About 36.4% of respondents collected thatch grass from both PFM and non-PFM forests in the study areas. Fruits were collected on seasonal bases by children or both men and women especially during food shortage periods

**Table 1: Forest products extracted from PFM and non-PFM forests in the study sites.**

| Forest product | Response that the product is from PFM only (%) | Response that the product is from non-PFM only (%) | Response that the product is from both PFM and non-PFM (%) |
|---|---|---|---|
| Firewood | 4.4 | 74.9 | 20.7 |
| Fruits | 5.1 | 64.5 | 30.4 |
| Charcoal | 16.7 | 66.6 | 16.7 |
| Honey | 0 | 100 | 0 |
| Mushroom | 0 | 72.2 | 27.8 |
| Local medicine | 0 | 66.7 | 33.3 |
| Poles | 6.2 | 59.4 | 34.4 |
| Thatch grass | 0 | 63.6 | 36.4 |
| Timber | 0 | 0 | 100 |

Results from this study observed that 5.1% and 64.6% fruits were collected from PFM and non-PFM respectively. The fruits are used to sustain main food especially during low harvests and are mainly collected during the rainy season. Results from this study observed that 16.7% and 66.6% of respondents collected charcoal from PFM and non-PFM forests respectively. This is sold to buyers coming from urban centers in the study districts. Surprisingly, illegal timber extraction activities were not reported by the respondents in all the three districts. However, probing through key informants' interview revealed that illegal extraction is experienced in all the districts. This might be due to strict restriction imposed by village government by-laws governing the management of forests under both PFM arrangements (CBFM and JFM). The study revealed that people in the study villages grow some exotic tree species including *Eucalyptus* and *Pinus* from which they extract both timber and fuel wood. Study findings also revealed that both CBFM and JFM have sizeable contribution to total household income (Figure 1 and Figure 2).

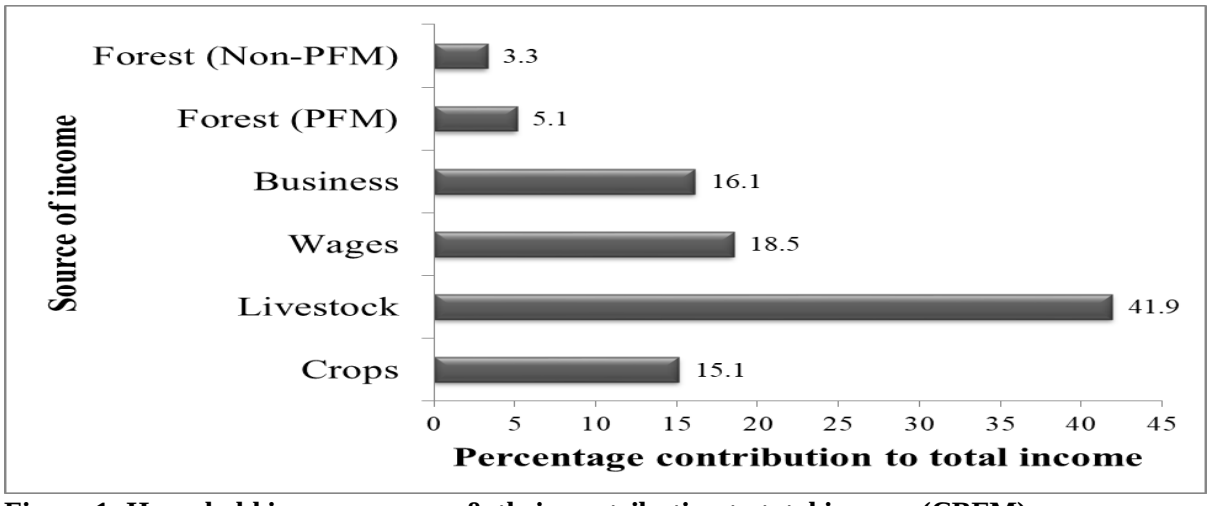


**Figure 1: Household income sources & their contribution to total income (CBFM).**

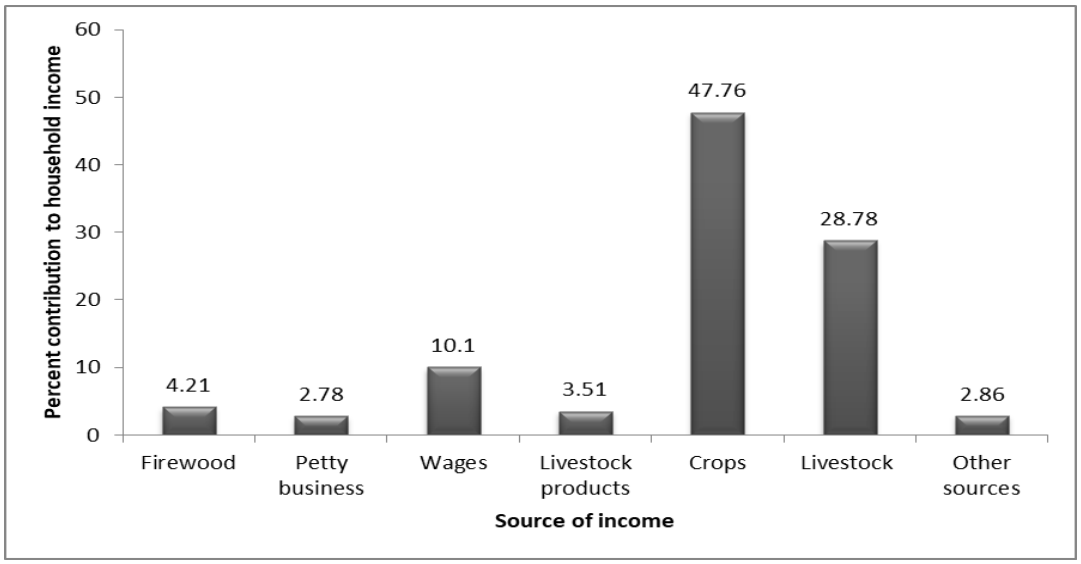


**Figure 2: Household income sources & their contribution to total income (JFM**).

Blomley and Iddi (2009) reported that an assessment of village forest incomes showed annual revenues of around USD 540 per year in 2002, rising to around USD 720 per year by 2005. The contribution of PFM to household income was also reported by MNRT (2005) who assessed the impact of the *Hifadhi Ardhi Shinyanga* (HASHI) project that worked in Shinyanga Region with the objective of restoring "*ngitili*" (enclosure), a traditional system of reserving pasturelands and dry season grazing areas by Wasukuma pastoralists that results in a rapid regeneration of trees. This system of land management, which is managed at individual, group and village level, resulted in the regeneration and re-establishment of large numbers of small acacia woodland patches of between 378,000 and 472,000 ha of degraded land across the region. The study showed further that the total monthly value of benefits from the re-establishment of *ngitili* per person was USD 11.7, a figure higher than the average consumption per person of USD 7.1 per month in the rural areas of Tanzania at that time.

Blomley and Iddi (2009) reported further that the monetary value per household per day for the reduced effort in collecting various *ngitili* products was found to be USD 0.7 for firewood collection, USD 0.5 for collecting poles, USD 0.8 for collecting fodder, USD 0.55 for thatch materials collection, USD 0.3 for collecting withies, USD 0.3 and USD 0.34 for domestic and livestock use of water respectively. The study further showed that the proportion of households whose economic well-being at the family level had increased and improved as a consequence of values of benefits from *ngitili* are as high as 64%. According to Ngaga *et al.* (2009) forests contribute approximately 6% of the total household income for the poor –which is consistent with finding of the present study which has found that the contribution of PFM to household income is between 4.21% to 5.1%.

## Perception of local communities on the importance of PFM

The opinions of households were sought over the popular notion that forests under PFM are more important than their counterpart non-PFM forests which led to mixed responses as presented in Figure 3. The chi-square test was further employed to analyse the responses and find whether or not they are statistically different. The results revealed that the $\chi^2$ ($df$ = 3, n = 500)

was 78.71 and the critical value of $\chi^2$ at α = 0.05 (*df* = 3) was 7.81.

Thus, there is statistical evidence to support the notion that forests under PFM are more important than non-PFM forests

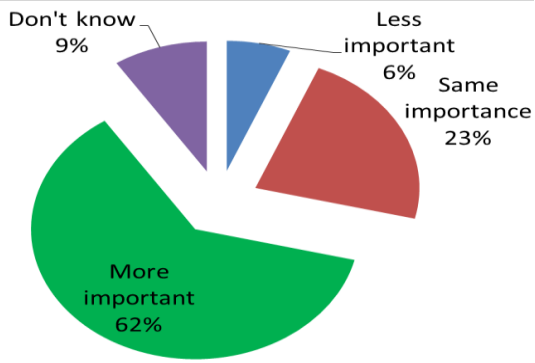


**Figure 3: Overall perception on *importance* of *post-CBFM* forests compared to *pre-PFM* forests.**

One important factor contributing to the positive perception of PFM compared to non-PFM could be that: under PFM, the logger will have to get permission from the village council on where to do the logging and will also have to pay a fee to the village. This fee would then be used for development projects in the community including building dispensaries or schools. Positive perceptions like the ones observed in this study could be replicated in other places.

**Socio-economic factors affecting household perception on the importance of the forests**

The binary logistic regression model was employed to analyze the socio-economic factors influencing the perception of households with regards to the importance of forests under PFM compared to its counterpart non-PFM. We used a standard equation of logistic regression model. The candidate variables used in the logistic regression analysis and the regression results are presented in Table 2. The *Hosmer-Lemeshow* goodness of fit test for the logistic model has a p-value of 0.99 which indicating that the model fits very well to data (Pallant 2005). Results from the binary logistic equation indicate that the variables influencing perception on importance of PFM contributed by 2.9% and 5.0% as explained by Cox and Snell $R^2$ and Nagelkerke $R^2$ values of 0.029 and 0.050 respectively, and the model classified correctly 84.6 percent of all cases included in the model as indicated by PAC in Table 2. The strongest contributor to the predictor of the model was again household size ($p < 0.05$).

**Table 2: Binary Logistic Regression Analysis for perception on the importance of the forests.**

| | **Perception on the importance of the forests** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Predictor | $\beta$ | SE $\beta$ | Wald's $\chi^2$ | df | P | Exp($\beta$) | 95% C.I of Exp($\beta$) Lower | Upper |
| Constant | -1.226 | 0.590 | 4.321 | 1 | 0.038* | 3.409 | | |
| $X_1$ | -0.317 | 0.345 | 0.846 | 1 | 0.358 | 0.728 | 0.371 | 1.431 |
| $X_2$ | -0.217 | 0.087 | 0.265 | 1 | 0.012* | 1.243 | 1.048 | 1.473 |
| $X_3$ | -0.006 | 0.009 | 0.420 | 1 | 0.517 | 0.994 | 0.977 | 1.012 |
| $X_4$ | 0.000 | 0.000 | 0.235 | 1 | 0.627 | 1.000 | 1.000 | 1.000 |
| Tests: | | | $\chi^2$ | df | p | | | |
| Model Evaluation (overall): | | | | | | | | |
| Likelihood ratio test | | | 8.408 | 4 | 0.078 | | | |
| Goodness-of-fit test | | | | | | | | |
| H-L statistic | | | 1.654 | 8 | 0.990 | | | |

Statistically significant at α = 0.05

**Notes:** PAC: Null model=68.9; Model with descriptors= 84.6.2; Cox & Snell $R^2$: 0.029; Negelkerke $R^2$: 0.050; Sample size used in the analysis (n) = 500.

This can be said to be the factor having high influence on perception of the importance of PFM versus non-PFM forests. The plausible reasons for this may be that larger households have possibilities of some members engaging in non-farm activities that may include collecting forest products for household use and selling. Such households are likely to perceive the PFM more positively than others. Moreover, large families are likely to face food shortages and may therefore be more likely to engage in collecting forest products to supplement them than small families.

## CONCLUSIONS AND RECOMMENDATIONS

Based on the findings it seems the pressure on non-PFM is much higher than in PFM forests. This indicates the importance PFM forests for sustainable use. Although the resources extracted in PFM forests are generally lower than in non-PFM forests, the villagers have a positive perception of PFM. The PFM forests may be perceived positively due to the fees collected by the villages and invested in developing community projects such as schools, village offices, dispensaries and roads. The study findings revealed that approximately 62% of respondent households were of the opinion that PFM has positive effects to their livelihoods. I was further revealed that CBFM and JFM contributed 5.1% and 4.21% of total household income respectively. Based on the findings of this study, we recommend further development of PFM-related activities such as beekeeping as a means of value addition to the forest so that communities can realize more benefits. Further studies should be carried out in PFM and non-PFM villages to assess the perception of the communities on PFM programs for ensuring sustainability in forests management in Tanzania.

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**Appendix 1: Status of Participatory Forest Management in Mainland Tanzania**

| **Participatory forest management (PFM)** | |
|---|---|
| Total area of forest covered by PFM arrangements | 3,672,854 hectares |
| Percentage of total forest area under PFM | 0.8% |
| Number of villages involved in PFM | 1,821 |
| Percentage of total villages involved in PFM | 17.5% 17.5% |
| Number of villages with approved management plans or signed Joint Management Agreements | 531 |
| Number of districts with ongoing PFM processes | 57 |
| **Community based forest management (CBFM)** | |
| Number of villages with CBFM established or in process | 1,102 |
| Area of forest covered by CBFM arrangements | 2,060,608 hectares |
| Number of declared Village Land Forest Reserves | 329 |
| Number of Gazetted Village Land Forest Reserves | 53 |
| Number of districts where CBFM is implemented | 50 |
| Primary forest types where CBFM has been promoted | Miombo, coastal and acacia woodlands |
| Public land forests now under CBFM arrangements (In %) | 10.2% |
| Villages on mainland Tanzania that are engaged in CBFM activities (In %) | 10.5% |
| **Joint forest management (JFM)** | |
| Area of forest covered by JFM management plans | 1,612,246 hectares |
| Percentage of total area reserved by National or Local Government under some form of Joint Management Agreement | 11.6% |
| Primary forest types where JFM has been promoted | Montane and Mangrove |
| Number of National Forest Reserves with JFM | 150 |
| Number of Local Authority Forest Reserves with JFM | 60 |
| Primary Regions where JFM implemented | Morogoro, Iringa, Pwani, Tanga, Kilimanjaro |
| Number of villages with JFM has been established or in process | 719 |
| Number of villages that have signed Joint Management Agreements | 149 |

**Source:** URT (2006)

**Appendix 2: Selected areas of forest under village management and their revenue generation potential**

| Forest name and location | Size (ha) | Status | Estimated annual revenue from sustainable harvesting (USD) | Number of villages managing forest | Potential revenue per village /annum (USD) |
|---|---|---|---|---|---|
| Angai Forest (Liwale District) | 141,000 | Management plan being developed | 784,000 | 13 | 60,300 |
| Suledo Forest (Kiteto District) | 164,000 | Village Land Forest Reserve | 213,000 | 9 | 23,700 |
| Mtanza Msona Forest (Rufiji District) | 10,713 | Village Land Forest Reserve | 57,900 | 2 | 28,700 |
| Ipole Wildlife Management Area (Sikonge District) | 247,500 | Wildlife Management Area | 730,000 | 4 | 182,500 |

**Source:** Blomley *et al.* (2009).

**Appendix 3: Selected forests under PFM management regime used in the present study**

| Name of forests | District | Management regime | Area (ha) | No. of villages | Inhabitants | Inhabitants per ha | Studied/Sampled villages | No. of households | Sampled households |
|---|---|---|---|---|---|---|---|---|---|
| Mandumburu | Mufindi | CBFM | 450 | 2 | 3,236 | 7.19 | Igombavanu | 121 | 92 |
| | | | | | | | Tambalang'ombe | 98 | 78 |
| Ngombe | Mufindi | OA | 602* | 3 | 4,878 | 8.11 | | | |
| Shikula | Mbozi | CBFM | 1,265 | 3 | 5,619 | 4.50 | Senjele | 172 | 119 |
| Senjere | Mbozi | OA | 954* | 2 | 2,873 | 3.01 | | | |
| Kitapilimwa | Iringa (R) | JFM | 3,699 | 5 | 10,092 | 2.73 | Kinywang'anga | 90 | 73 |
| | | | | | | | Mfyome | 89 | 72 |
| Manyamimbi | Iringa (R) | OA | 2,706* | 3 | 5,113 | 1.89 | | | |
| Chumwarange | Mbozi | JFM | 12,298 | 6 | 13,214 | 1.08 | Namlonga | 80 | 66 |
| Isingana | Mbozi | OA | 4,923* | 2 | 1,987 | 0.41 | | | |
| **Total** | | | **26,897** | **26** | **47,012** | **3,62** | | **650** | **500** |

* OA = Open Access. These are open access forests referred as business as usual (BAU), the area is estimation based on respective District Forest Officers

**Source:** URT (2006)

**Appendix 4: Standardised criteria for household categories in different study strata***

| Category | Stratum | | |
|---|---|---|---|
| | *Rural* | *Peri-urban* | *Urban* |
| *Low* | ▪ Poor housing<br>▪ Food insecurity<br>▪ Less than 2 meals a day<br>▪ Works as causal labourer<br>▪ Physically disabled<br>▪ No bicycle/No radio | ▪ Works as causal labourer<br>▪ Poor housing<br>▪ Physically disabled<br>▪ Not sure of his meals | ▪ Unemployed<br>▪ Unreliable income sources<br>▪ Living in poor dwelling |
| *Medium* | ▪ Physically able and smart<br>▪ Modestly decent dwelling<br>▪ Modest land holdings<br>▪ Few animals (esp. goats/chickens)<br>▪ Sure of 3 meals a day | ▪ Petty business<br>▪ Own fairly decent houses<br>▪ Sure of 3 meals a day | ▪ Petty business<br>▪ Live in modern house<br>▪ Sure of 3 meals a day |
| *High* | ▪ Government employee<br>▪ Has a shop<br>▪ Have animals (cattle)<br>▪ Grinding machines<br>▪ Big farms<br>▪ Modern house | ▪ Government employee<br>▪ Has own-transport<br>▪ Have modern house | ▪ Government employee<br>▪ Whole sale shop<br>▪ Retail shop<br>▪ Own Guest house/hotel<br>▪ Has transport business |

* The household should have *one* or *several* of the criteria to qualify into a given category

**Appendix 5: Socio-economic characteristics of respondents in the study area**

| **Characteristic** | **N** | **%** |
|---|---|---|
| **Sex of respondents** | | |
| *Male* | 248 | 49.6 |
| *Female* | 252 | 50.4 |
| **Relationship of respondent** | | |
| *Husband* | 193 | 38.5 |
| *Wife* | 220 | 44.0 |
| *Son* | 15 | 3.0 |
| *Daughter* | 15 | 3.0 |
| *Widowed* | 13 | 2.6 |
| *Unmarried (male)* | 41 | 8.1 |
| *Unmarried (female)* | 5 | 0.9 |
| **Educational level of household head** | | |
| *No formal education* | 110 | 22.0 |
| *Primary education* | 361 | 72.1 |
| *Secondary education* | 28 | 5.6 |
| *College education* | 2 | 0.3 |
| **Main sources of income** | | |
| *Employee* | 6 | 1.2 |
| *Agriculture* | 408 | 81.5 |
| *Remittance* | 2 | 0.3 |
| *Clothing business* | 2 | 0.3 |
| *Livestock keeping* | 3 | 0.6 |
| *Trade/shop* | 2 | 0.3 |
| *Petty business* | 6 | 1.2 |
| *Pig meat vending* | 2 | 0.3 |
| *Local brew making* | 2 | 0.3 |
| **Ability to read and write** | | |
| *Able* | 389 | 77.7 |
| *Unable* | 111 | 22.3 |