Impact of traditional beekeeping on Mgori Village Land Forest Reserve in Singida District, Tanzania

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ABSTRACT

A study was conducted in villages around Mgori Village Land Forest Reserve (VLFR), Singida District in Tanzania to assess the impact of traditional beekeeping on the condition of forest resources. Data collection involved participatory rural appraisal, questionnaire survey and forest inventory. Data was analysed using Statistical Package for Social Sciences and Ms Excel. The Shannon-Wiener index was used to analyse evenness in species diversity. Results indicated that the majority of households practice traditional beekeeping using log hives. There is no proper management system of traditional beekeeping apart from regular forest patrols. The majority (82%) of respondents viewed traditional beekeeping as an effective way of managing forest resources as it helps to protect the forest against destruction and results in increased plant productivity through pollination. Results further showed that although not statistically significant ($p>0.05$), sites where beekeeping was practiced had more stems per hectare (ha) for dbh $\leq$10 cm compared to sites where there was no beekeeping implying high regeneration of species due to minimal disturbances in beekeeping sites. Forest destruction, decreasing bee forages and drought were identified to be the main threats to traditional beekeeping. If well implemented, traditional beekeeping can be a tool for sustainable forest management. The need to promote best beekeeping practices which contribute to sustainable forest management in the area and beyond is recommended.

Keywords: Traditional beekeeping; Participatory Forest Management; Mgori; Tanzania

INTRODUCTION

Tanzania Mainland has 48.1 million hectares (ha) covered with forests and woodlands representing 55% of total land area. About 93% of the total forest area is woodland and 7% is composed of mangroves, coastal forests, humid montane forests and plantations (URT 2013). Forests are recognised as an important resource base for social and economic development of Tanzania and also in environmental conservation. They also provide multiple benefits and opportunities to rural and urban communities. The majority of the rural communities depend on forest products for their livelihoods and therefore forests contribute to poverty reduction. The woodlands and dry forests in Tanzania are mainly the miombo forests, dominated by species of the genera *Brachystegia, Julbernardia* and *Isoberlinia* (MNRT 1998).

Tanzania's forests and woodlands support beekeeping which plays roles in socio-economic development as source of income for communities living adjacent to these resources. Due to this, the industry has received primary attention in recent years (Famuyide *et al*. 2014). Beekeeping provides local people and the government economic incentives for the protection of natural habitats and a useful activity in any

forest conservation initiatives (Lalika 2008; Agera 2011). There is a strong link between forests and woodlands and traditional beekeeping which provides an incentive for sustainable forest management. According to Campbell *et al*. (2007), the dominance of different vegetation types provide the basis for beekeeping as a highly significant (culturally, socially and economically) form of land use in miombo woodlands. Nevertheless, as the majority of population depend on forests and woodlands, they are often subjected to high pressure hence deforestation due to clearance for agriculture, charcoal making, wildfires, overgrazing, persistent reliance on wood fuel for energy, lack of efficient production and marketing; over-exploitation of wood resources; and poor land use plans and non-adherence to existing ones (URT 2013). The forest and woodland resources thus need sustainable management for the benefit of the present and future generations.

Since the colonial era, forests and woodlands in Tanzania have been managed without full participation of the local communities and other relevant stakeholders living around the resources. The Tanzania Forest Policy of 1998 advocates fort promoting the participation of communities in management of the forests and woodlands through the establishment of Village Land Forest Reserves (VLFRs) where the communities become both managers and owners of the resources (MNRT 2009). The policy is enacted by the Forest Act of 2002, which provides the basis in law for communities to own, manage, or co-manage forests under a wide range of conditions and management arrangements. The Forest Act is notable in embracing the principle of subsidiarity, stating its aim as "to delegate responsibility for the management of forest resources to the lowest possible level of local management consistent with the furtherance of national policies" (URT 2002).

Local communities therefore, have an important role in improving forest condition and their participation can contribute significantly to effective management of these resources. Involvement of communities and other stakeholders in forest management in Tanzania through Participatory Forest Management (PFM) have been going on in many parts of the country and have generally made good progress in some places. PFM was adopted by the Government in order to ensure sustainability of forest resources and generation of benefits to local communities (Monela *et al*. 2000; Adams and Hutton 2007). This was a significant step to increase attention to local communities' access rights and improvement of management of forest resources (Abdallah *et al*. 2012). There are two approaches to community involvement in forest management. The first and more dominant recognises communities as forest users, seeking to secure their co-operation by granting them legal access to certain products or a share in forest-derived benefits through Joint Forest Management (JFM). The second approach is directly concerned with how a forest is managed and aims to deliver a cheaper, more effective and sustainable regime i.e. Community Based Forest Management (CBFM). The regime focuses on forests and local communities as potential managers or co-managers and devises arrangements with them which give them varying degrees of authority (Wily 2001).

One of the most significant developments in PFM in Tanzania has been the effort to strengthen indigenous knowledge and practices in managing and protecting forests. According to MNRT (2009), although the Forest Policy emphasis on the development of an enabling legal and policy environment that encourages the

spread and adoption of PFM, many parts of Tanzania have a long and established history of sustainable CBFM. Forests have been reserved by rural communities for a range of objectives, including cultural, traditional, ceremonial and more utilitarian purposes such as the conservation of dry season grazing areas. There have been few attempts to document these traditional practises, or to assess their effectiveness in the light of growing demands for land and natural resources. Wiersum (2000) further pointed out that indigenous knowledge plays an important role in local decision-making with regard to management of forest resources, which involves not only technical practices, but also social institutions that organize technical practices.

Tanzania has been implementing PFM for quite some time based upon long traditions by rural communities with regards to the protection and management of natural forests and woodlands in which traditional beekeeping is amongst activities. The impact of traditional beekeeping practices on the condition of forest resources in rural areas remains unknown. This paper provides an understanding on the impact of traditional beekeeping on the condition of Mgori VFR in Singida District. Specifically, the study identified the different types of traditional methods of beekeeping and examined the gender involvement and management of traditional beekeeping to ensure sustainable use of forest resources. Further, the ecological benefits and threats to long-term survival of traditional beekeeping were investigated. Findings could form basis for proper implementation of PFM in Tanzania by providing facts to assist policy makers and other stakeholders regarding traditional beekeeping and sustainable forest management.

METHODOLOGY

Study location

The study was conducted in two selected villages namely Ngimu and Pohama around Mgori VLFR. The selection of the two villages based on their long term history of practising traditional beekeeping in Singida region. The reserve is about 40,000 ha of miombo woodland vegetation, lying on the Great Lift Valley escarpment in the northeast corner of Singida District (Massawe 1997). The forest reserve is located at an altitude ranging from 1400 and 1600 metres above the sea level. Soils are sandy to sandy loamy and modified due to basalt flows from old volcanoes. Higher elevated areas comprise a sandy loam soil whose fertility is slightly lower and cannot hold water for a long time. Annual rainfall ranges from 700 to 1000 mm and occurs from November to April. The dry season is from May to October. Temperature varies between 15ºC and 30ºC (CAWM 2002). Before 1995, Mgori VLFR was administered by central government. When the FBD demarcated the forest, the community demanded that the western part be excluded for their use. This was granted but it was soon realised that neither the FBD nor the Singida District Council could manage the reserve. The government consequently allowed the communities in the five adjacent villages (Pohama, Ngimu, Unyampanda, Mughunga,and Nduamughanga) and Singida District Council to manage the whole forest. Between 1995 and 1997, the forest was managed using a joint management approach. The vegetation of the area has a diversity of species including *Afzelia quanzensis*, *Dalbergia melanoxylon*, *Brachystegia* spp., *Pterocarpus angolensis*, *Combretum* spp., *Lannea schimperi* and *Julbernardia globiflora*. The major land based economic activities in the area include agriculture, livestock keeping and beekeeping. Dependence on rain-fed agriculture by the local community is very high. Villages adjacent

to Mgori VLFR are inhabited by a number of ethnic groups that include Wanyaturu who constitute 97.9% of the total population followed by a small number of Wabarbaig, Warangi, Wanyiramba, Wamaasai and Wataturu ethnic groups. There has been a demographic change between the periods before and after establishment of the forest reserve, with the population increasing from 6,281 people in 1995 to 9398 in 2009 (Abdallah *et al*. 2012).

Data collection methods and analysis

Participatory rural appraisal, questionnaire survey and forest inventory were used to collect data. Questionnaire survey through face to face interview was done with households and key informants such as beekeepers and Forestry and Beekeeping Extension Officers to collect both qualitative and quantitative information regarding traditional beekeeping and sustainable forest management. A sampling intensity of 5% or more of the population has been recommended in social science studies (Boyd *et al*. 1981). However, for the case of this study, a sampling of 30 respondents in each selected village was adopted and used as it is deemed adequate for statistical analysis (Bailey 1994).

Transects measuring 2 km long were laid in beekeeping versus non-beekeeping areas within Mgori VLFR to assess ecological benefits of indigenous beekeeping practices based on factors such as forest structure, fire, illegal tree cutting, charcoal production, overgrazing and pit sawing. Furthermore, along the transect, 20 x 20 m plots were established at 200 m apart to compare the diversity of species between the two areas. Forest structure was assessed in terms of number of stems, basal area and volume per ha and number of species per plot and Shannon-Wiener diversity index. Tree volume was calculated using the formula developed by Malimbwi *et al.* (2005):

$$V = 0.000011972D^{3.191672};$$

where V = tree volume (m^3) and

D = tree dbh (cm).

The number of species was used to indicate species richness whereas the Shannon-Wiener index was used to analyse evenness in species diversity (Magurran 1988). The Shannon-Wiener diversity index was calculated according to the formula (Kent and Coker 1992):

$$\text{Diversity} = -\sum_{i=1}^{s} p_i \ln p_i;$$

where $\sum$ = the summation symbol,

s = the number of species,

p_i = the proportion of individuals of species I, and

ln = the natural logarithm.

Data collected by using PRA techniques were analysed with the help of communities and results communicated back to them while; data from questionnaire survey were coded, and transcribed into the Statistical Package for Social Science (SPSS) prior to descriptive analysis. Forest inventory data were analysed using Ms Excel to determine the forest stand structure.

RESULTS

Characteristics of respondents

The majority (82%) of respondents were male while 18 % were female indicating low participation of women in beekeeping activities. The majority (69%) of respondents were aged between 30 and 50 years, followed by 25% who were above 50 years and only 6% were found to be below 30 years. According to Paullo (2007), the age above 30 years comprises a group of young and economically active people who can walk long distance and

collect forest products to secure household food security, primary health care and cash income. Further, results indicate the majority of respondents in selected wards of the study area were literate though most at primary level. Primary education is a level enough for an individual to understand and adopt new interventions (Paullo 2007). It has also been reported by Maro (1995) that primary education can foster human creativity, and hence having relationship with farmers' readiness to integrate innovations into traditional systems of land use and management. The majority (93%) of respondents were married depicting a typical characteristic of most traditional households in rural areas of Tanzania (Paullo 2007).

Beekeeping methods

Results indicated that 56% of households around Mgori VLFR were practicing beekeeping using both traditional and modern methods similar to the results obtained from PRA exercise (Table 1). The majority (56%) of respondents in the study site also mentioned to use log hives in their traditional beekeeping, followed by 42% who reported to use both log and box hives (Table2).

Table 1: Distribution of respondents on beekeeping methods in the selected villages around Mgori VLFR

Village	**Responses on beekeeping method**			**Total**
	Traditional	**Modern**	**Both methods**	
Pohama	53 (16)	nr	47 (14)	**100 (30)**
Ngimu	28 (7)	4 (1)	68 (17)	**100 (25)**
Total	**42 (23)**	**2 (1)**	**56 (31)**	**100 (55)**

Note: Numbers in parentheses are frequencies; nr represents no response

Table 2: Distribution of respondents on types of bee hives used in traditional beekeeping for selected villages around the study area

Village	**Responses on beehives types (%)**				**Total**
	Bark	**Trunk holes**	**Logs**	**Logs & Boxes**	
Pohama	nr	nr	53 (16)	47 (14)	100 (30)
Ngimu	nr	4 (1)	60 (15)	36 (9)	100 (25)
Total	**-**	**2 (1)**	**56 (31)**	**42 (23)**	**100 (55)**

Note: Numbers in parentheses are frequencies; nr represents no response

Results further showed that 80% of respondents mentioned to practice beekeeping in the forest reserve abiding by set zones of the forest management plan, followed by a few in general land (Table 3).

Table 3: Distribution of respondent's beekeeping locations in the study areas

Village	**Responses on beekeeping location**				**Total**
	Forest reserve	**General land**	**Farmland**	**Indoor**	
Pohama	90 (27)	nr	10 (3)	nr	**100 (30)**
Ngimu	68 (17)	24 (6)	4 (1)	4 (1)	**100 (25)**
Total	**80 (44)**	**25 (14)**	**7 (4)**	**2 (1)**	**100 (55)**

Note: Numbers in parentheses are frequencies; nr represents no response

Gender in traditional beekeeping practices

During household surveys and PRA exercises in selected villages around Mgori VLFR, men were found to be more active (82% responses) in traditional beekeeping activities at household level (Table 4). The participation in traditional beekeeping ranged from hives preparations, baiting, hives hanging in the forests, protection of the site, harvesting to selling of honey and beeswax.

Table 4: Percentage distribution of responses on gender involvement in beekeeping activities in the study area

Village	Responses on gender involvement		Total
	Male	**Female**	
	87 (26)	13 (4)	**100 (30)**
	76 (19)	24 (6)	**100 (25)**
	82 (45)	**18 (10)**	**100 (55)**

Note: Numbers in parentheses are frequencies; nr represents no response

Management of beekeeping sites

Forty five percent of respondents (Table 5) reported during household and PRA survey to carry out regular patrol in the trees where hives are sited and sometimes clean the area around to minimize destruction of hives by humans, insects or wild animals.

Table 5**:** Percentage distribution of responses on management of beekeeping sites activities in the study area

Village	Responses on beekeeping management				Total
	Forage planting	**None**	**Uncertain**	**Regular patrols**	
Pohama	nr	40 (12)	7 (2)	53 (16)	100 (30)
Ngimu	8 (2)	44 (11)	12 (3)	36 (9)	100 (25)
Total	**4 (2)**	**42 (23)**	**9 (5)**	**45 (25)**	**100 (55)**

Note: Numbers in parentheses are frequencies; nr represents no response

Impact of beekeeping in forest management

The majority (62%) of respondents in Pohama and Ngimu villages agreed that beekeeping is an effective way of managing forest resources (Table 6), followed by 38% who viewed the beekeeping as ineffective as far as management of forest resources is concerned. Supporters of effectiveness of traditional beekeeping argued that where beehives are sited there is always total protection from destruction and also the bees are pollinators hence help to increase the plant productivity including agricultural crops.

Table 6: Percentage distribution of responses on effectiveness of beekeeping in forest management

Village	Responses on effectiveness in forest management		Total
	Agree	**Disagree**	
Pohama	70 (21)	30 (9)	**100 (30)**
Ngimu	52 (13)	48 (12)	**100 (25)**
Total	**62 (34)**	**38 (21)**	**100 (55)**

In terms of impacts of beekeeping in forest management, results showed that forest structure did not differ significantly between non and beekeeping areas (Table

7). However, the latter site had higher number of stems per ha with dbh of ≤ 10 cm implying high regeneration of species probably due to minimal disturbances. This could probably lead to sustainable forest resource management if the practice is well maintained.

Table 7: Forest structure statistics in non beekeeping and beekeeping areas around the study area

Variables	Non beekeeping areas	Beekeeping areas	Ft	*p*	Non beekeeping areas	Beekeeping areas	Ft	*p*
Dbh ≤ 10 cm						**Dbh ≥ 10 cm**		
No. Stems/ha	372 ± 288.30	430.50 ± 244.11	0.236	0.633	195.00 ± 76.1	155.60 ± 59.4	0.001	0.985
Basal area (m2/ha)	0.99 ± 0.60	1.11 ± 0.54	0.010	0.921	7.79 ± 3.68	10.56 ± 2.73	3.651	0.072
Volume (m3/ha)	1.55 ± 0.91	1.13 ± 0.79	1.188	0.290	60.52 ± 42.14	93.21 ± 52.60	2.353	0.142
No. Species/plot	7.70 ± 2.98	7.60 ± 2.07	0.008	0.932				
Shannon-Wiener Index of diversity	1.57 ± 0.44	1.40 ± 0.54	0.633	0.437				

Threats to traditional beekeeping

Results indicated that forest destruction caused by fire which decreases bee forage; unreliable markets, poor infrastructures (e.g. lack of harvesting equipment) and drought were the main threats to traditional beekeeping in the areas (Table 8). This may imply reduced productivity and or discourages majority of communities to engage in the practices.

Table 8: Distribution of responses on threats to traditional beekeeping system in the study area

Village	Responses on threats							Total
	A	**B**	**C**	**D**	**E**	**F**	**G**	
Pohama	7 (2)	7 (2)	27 (8)	nr	10 (3)	30 (9)	20 (6)	**100 (30)**
Ngimu	20 (5)	8 (2)	16 (4)	4 (1)	nr	40 (10)	12 (3)	**100 (25)**
Total	**13 (7)**	**7 (4)**	**22 (12)**	**2 (1)**	**5 (3)**	**34 (19)**	**16 (9)**	**100 (55)**

Note: Numbers in parenthesis are frequencies; nr represents no response; **A** = Forest destructions, decreasing bees forages; **B** = Unreliable markets & poor infrastructure; **C** = Drought **D** = Threats A&B; **E** = Threats B&C; **F** = Threats A, B &C; **G** = Thieves & destructive insects/animals

DISCUSSION

The combination of the two methods in beekeeping practices seems to help communities in maximizing yield of bee products and hence, increased income. Results concur with observations by Kajembe and Kessy (2000) who recommended beekeeping as an environmentally friendly income-generating activity that should be promoted in PFM in Tanzania.

Results on types of beehives used imply that local communities around Mgori VLFR do not use bark hives as evidenced by lack of responses in all surveyed villages. The reason for not using bark hives was protection of trees from dying. Historical records indicate that traditional beekeeping was not confined to a single hive type. For example, a general trend towards harvesting bark from younger trees has already been recorded in Zambia. The use of logs, calabashes and pots as

hives have also being reported and suggest that traditional beekeeping was not confined to bark hives (Mickels-Kokwe 2006). It has also been observed in North-Western Province of Zambia that beekeepers experiment with several materials – logs, wood cuttings, reeds, grasses, mats, calabashes (Clauss 1992). At some point in time, beekeepers have been constrained from expanding production because of lack of hive material. This was also the case for beekeepers around Mgori VLFR. This situation requires remedial action by the government and other stakeholders in promoting beekeeping in the country.

The observed beekeeping activities in the reserve implies probably existence of good bee forage species composition of the reserve especially dominant *Brachystegia* trees, protection of household hives as well as diversity of plant materials where bees can forage. The argument concurs with Mickels-Kokwe (2006) who reported that the composition of the forest is not only important to ensure bee forage throughout the year but also abundance of the main nectar producing species in combination with off-season flowering, giving the best natural comparative advantage. This could be the reason for most beekeepers in the study area using the forest for beekeeping.

The reasons for higher involvement of men in traditional beekeeping activities was reported to be due to the harsh environments involved in the activity where women can't tolerate e.g. the remoteness of sites and harvesting of honey at night in the wild sometimes with dangerous animals including snakes. However, informal conversation with women in the study area showed that they are the ones who process and sell the bee products. Similar findings are reported by Maple (2002) in areas around Urumwa and Igombe Forest Reserves in Tabora Region Tanzania where men are more active in honey harvesting than women. Perez *et al*. (1999) reported that in Cameroon, men are often involved in large and high paying products such as honey than women. Nevertheless, both honey hunting and beekeeping have traditionally been considered as male activities, although women may occasionally participate in processing and transporting the product from the forest to the household (Ntenga and Mugongo 1991; Fischer 1993; Njovu 1993). Women's participation in traditional beekeeping may also be on the rise in densely populated agricultural areas where bee colonies tend to be more stable (Fischer 1993). With appropriate beekeeping gears, women do participate in the activities. A study by Clauss (1992) in some areas of Zambia reported that members of the female-headed households participated more in honey hunting to supplement household income.

Beekeeping seems to be the only cheapest income generating activity which could be done by women and youth, which are the globally claimed most disadvantaged and marginalized groups in most societies. The study suggests the need of sensitizing modern beekeeping practices around homesteads of the study area with specific attention to women and youth. This will not only assist the groups to improve their livelihood but also reduce pressure in the forest reserves, and thus contribute to sustainable management of forest resources.

The study observed that incidents of overgrazing and encroachment were rare in beekeeping sites since most communities abide to the set rules and regulations of utilizing forest resources. According to Lalika (2008), beekeeping has been used as an approach in management of forests since in areas where the activities are conducted bush fire, illegal logging and cutting poles is avoided. Further, where there is an apiary, people avoid trespassing for fear to be stung by bees. The indication of the

majority of local communities being aware of the negative aspects associated with bad beekeeping practices in the study site entail that traditional beekeeping could be used as a tool for forest management if well implemented.

Results on threats to traditional beekeeping especially fire agree with what has been observed and reported in the miombo woodland parts of Southern Africa as far as forest destructions are concerned. Grundy (1995) found that a woodland in north-west Zimbabwe suffered annual fires as a consequence of honey-hunting activities. As a result, the majority of trees were hollow and therefore useless for timber. In any case, burning at inappropriate times is also a major concern for beekeepers themselves (Clauss 1992). One of the most damaging effects of beekeeping in miombo woodland is the accidental spread of fire during honey collection (Fischer 1993). Fire not only kills seedlings and retards coppice regrowth, but also damages the base of the trees and increases the chance of fungal infection (van Wyk *et al*. 1993). The need to protect beekeeping sites from destructions such as fire burning, securing reliable bees products markets and improved infrastructure is suggested in order to improve the traditional beekeeping practices and hence promote sustainable forest resources management.

CONCLUSION AND RECOMMENDATIONS

The study concludes that traditional beekeeping has impact on improving the condition of forest resources as indicated by high number of regenerants in sites with beehives resulting from minimal disturbances. Species diversity is also higher in these sites. Therefore, if well implemented it can be a tool for sustainable forest management, considering the communities' awareness to the long term survival of resources to sustain livelihood. The need to promote sustainable beekeeping practices in the area and beyond is suggested emphasizing only practices contributing to sustainable forest management.

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