# The Implications of Non-timber Forest Products' Access By-laws on Household Food Security in Semi-arid Zones of Iringa District, Tanzania

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## Abstract

Local communities in semi-arid zones of Iringa district are vulnerable to household food insecurity. Their vulnerability is mainly due to their dependence on climate-sensitive livelihood sources, especially rain-fed smallholder crop farming. Consumption and sale of non-timber forest products (NTFPs) from Kitapilimwa Forest Reserve (KFR) which is under Joint Forest Management (JFM) offer an opportunity to the local communities to improve their resilience to food insecurity. Though NTFPs are also affected by climate change they are more resilient compared to agricultural crops and livestock. Several management by-laws have been passed to protect KFR from anthropogenic degradation and loss. However, the extent to which the KFR access by-laws affect the availability of NTFPs for enhancing household food security had not been examined.. Findings indicated that 76.2% of the respondents were food insecure. Also, it was found that 40.9% and 20.1% of the food insecure households ate and sold NTFPs to enhance household food security respectively. The few types of NTFPs they were permitted to collect, low quantity of NTFPs to be collected, a few visiting days and license fee were reported to be the main KFR management by-laws which impacted on availability of NTFPs for enhancing household security. It is noteworthy that forest conservation by-laws should not compromise local communities' access to NTFPs. Also, it is good to mainstream customary forest management laws in the formulation of the conventional forest management by-laws.

**Key words**: Non-timber Forest Products, Semi-arid, Household Food Insecurity, By-laws

## Introduction

Forests provide different ecosystem services including Non-timber forest products (NTFPs) crucial for sustainable livelihoods (Kalame, 2011). According to Shackleton *et al*. (2011) NTFPs consist of all wild goods of biological origin other than timber which are extracted from forests, woodlands and trees outside forests for human use. Generally, NTFPs include wild food (e.g. mushrooms,

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wild fruits and wild vegetables), cultural materials, household utensils (e.g. mats, cups, spoons and pots), building materials (e.g. poles, ropes and thatching grass), fuel wood (firewood and charcoal) and medicinal plants (Carr and Hartl, 2008; Girmay, 2013; Endamana *et al*., 2016). Carr and Hartl (2008) observed that NTFPs serve as a source of food and income to millions of local people in rural areas of developing countries. This is mainly the case in dry lands where crop farming and livestock keeping opportunities are limited. The role of NTFPs in poverty alleviation through provision of income, medicine, energy, foreign exchange and biodiversity conservation has been further emphasized by Carr and Hartl (2008) and Olaniyi *et al*. (2013). Recent attention has called for evaluation of the role of NTFPs in food security.

Tanzania has not yet succeeded to ensure food availability to all its citizens and at all times, hence food insecurity is eminent (URT, 2010). Mende *et al*. (2015) and Mongi *et al*. (2010) stated that though food shortage may be caused by a broad spectrum of drivers such as crop and livestock diseases and food prices, climate change plays a predominant role. Also URT (2012) observed that most of the food shortage incidents in Tanzania correspond to years with floods and or drought disasters.

Though food production has increased in Tanzania, there are great local level variations in food availability, accessibility, affordability, acceptability, adequacy and stability (URT, 2010). Tanzania, especially in rural areas, faces high food and nutritional insufficiency. For instance, about 39.3% of Tanzanians are affected by undernourishment whereas 33.9% suffer from low dietary energy intake (NBS, 2014). Similarly, the country suffers from micronutrient deficiency, especially among women aged 15-49 years and under five children. For example, women and children suffering from anaemia were 45% and 58% respectively. In addition to that, women and children with vitamin A deficiency were 37% and 33% respectively (URT, 2014). The increase of hungry people in the world challenges the likelihood of realizing the second Sustainable Development Goal (SDG 2) of ending hunger by 2030. Moreover, sustainable food supply is a constant challenge for communities in semi-arid zones. For forest-adjacent communities NTFPs offer another lifeline. According to Sharma *et al*. (2015) NTFPs ensure household food security directly through the provision of edible NTFPs and indirectly through commercialization of the NTFPs and exchange.

Also, access to NTFPs is a function of the interplay of many factors including socio-economic and mainly formal and informal rules and regulations. For

instance, strict access by-laws, especially in reserved forests, may compromise the availability of NTFPs for enhancing household food security (Topp-Jørgensen *et al*., 2005). Persha and Blomley (2009) observed that JFM implemented without complete decentralization of power to local communities with stringent restrictions on utilization of the forest resources may impact on community livelihoods. Thomas (2008) contends that since the majority of the rural poor depend on forest products for their livelihoods, stringent access by-laws can affect these households badly. In the words of Zahor (2014:252), "although they have been set aside from human exploitation, it has become increasingly recognized that protected areas should play a role in benefiting and sustaining the local communities adjacent to them. These benefits are important to the people as they help them to perceive environmental conservation positively."

According to FAO (2010) a household is food secure when all household members have a constant ability to secure adequate and nutritious food to meet their dietary requirements. FAO (2008) observed that food availability, food accessibility, food utilization and food stability are the major pillars of food security. Dewees (2013) observed that each of the pillars of food security can be enhanced by NTFPs. Therefore, access to NTFPs is related to household food security. On the other hand, a household is regarded to be food insecure when it is not able to secure sufficient, safe and nutritious food to meet the dietary requirements of all members of the household (FAO, 2010).

A large part of Iringa district is semi-arid whereby most of the local communities are characterized by low income and over-dependence on climate-sensitive livelihood sources such as crop farming and livestock keeping (URT, 2013). Erratic climatic conditions in terms of severe drought, high inter-annual rainfall variations, late onset and early rainfall cessation, among others, negatively affect agricultural production leading to low crop and livestock productivity. This, in turn, subjects households to low income and food insecurity (Kihupi *et al*., 2015). A study by Njau (2005) concluded that due to low rainfall, rising temperatures and recurrent drought, the semi-arid part of Iringa district experiences recurrent household food shortages. To exemplify, URT (2013) observed that in the district, under one year children face severe malnutrition. For instance, the trend of severely underweight children increased from 0.5% in 2010 to 4.9% in 2012. Forests can serve as buffers to climate change impacts on food production and supply systems through provision of ecosystem services and NTFPs to the needy communities. The extent of NTFPs'

role on household food security calls for analysis of forest governance structures and institutions which determine community control and access to NTFPs.

Several studies (Robinson *et al*., 2009; Shemnga, 2015; Suleiman *et al*., 2017) have examined the contribution of NTFPs from conserved forests to household food security. Empirical studies have mainly noted the more obvious role of NTFPs in supplying households with a variety of foods. While formal and informal institutions govern local access NTFPs in the name of forest conservation, this area has not received comprehensive research attention. There is dearth of information on how NTFPs access by-laws affect the availability and access to NTFPs for enhancing household food security in semi-arid areas of Iringa district where agriculture is vulnerable to semi-arid conditions and climate change. Though both agricultural crops and NTFPs are affected by climate change, NTFPs are more resilient (Nkem *et al*., 2007). This study was undertaken to fill this knowledge gap. The study was guided by three specific objectives: (i) to examine the state/extent of food insecurity in the study area, (ii) to identify the existing NTFPs access by-laws and (iii) to examine how NTFPs access by-laws affected the availability of NTFPs for enhancing household food security.

## Methodology

### *The Study Area*

This study was conducted in the semi-arid areas of Iringa district. The district lies between latitudes 7° 00' and 8° 30' south of the Equator and between longitudes 34° 00' and 37° 00' east of Greenwich (Figure 1).

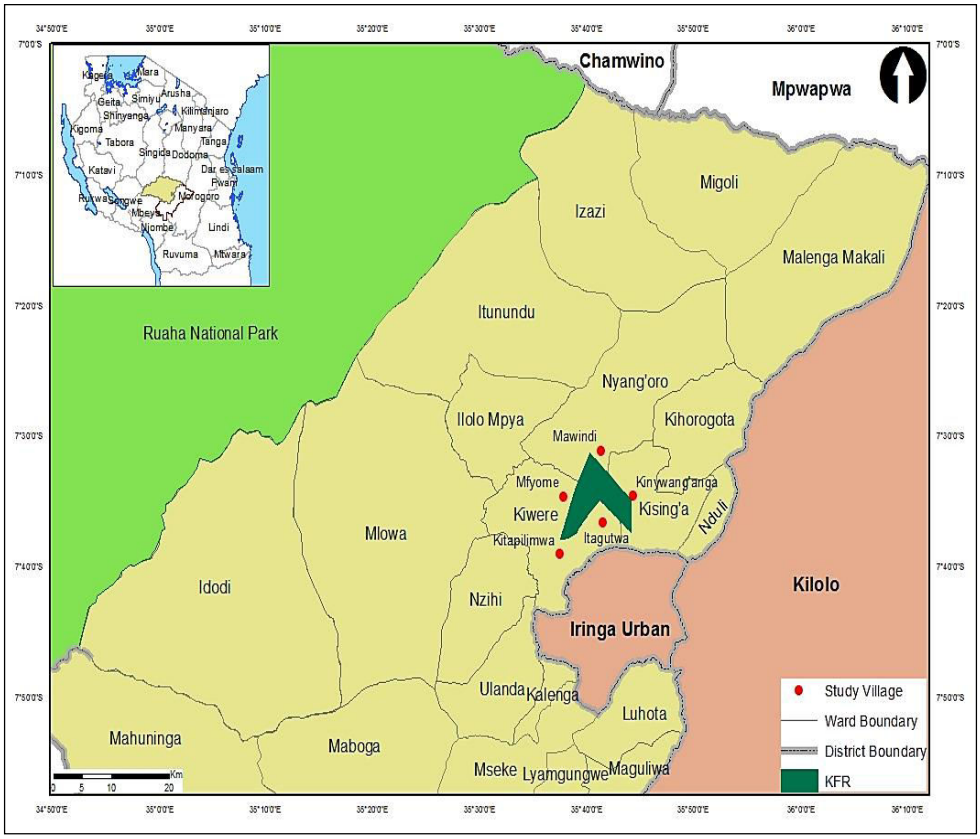



**Figure 1: A Map of Iringa District showing Location of KFR and the Study Villages**

**Source**: Field Study 2017

The district has an area of 20,413.98 square kilometres (URT, 2013). The study surveyed five villages surrounding and jointly managing Kitapilimwa Forest Reserve (KFR) which is under Participatory Forest Management (PFM) since 2002. The villages are Itagutwa, Kinywang'anga, Kitapilimwa, Mawindi and Mfyome. It is worth noting that the National Forest Policy of 1998 and the Forest Act of 2002 give rights to local communities and other stakeholders to participate in forest management in a form of Joint Forest Management (JFM) (Blomley and Iddi, 2009). The forest was declared a reserve in 1952 by Act. No. GN1952/299 and it is owned by the central government. It has an average size of 3,699 hectares (URT, 2001). KFR was selected for this study because it is jointly managed by the government and the five surrounding villages and, secondly, being a production forest, the management by-laws permit the surrounding villages to extract NTFPs. Besides, no study had been undertaken in the district to examine how the KFR management by-laws affect access to NTFPs for enhancing household food security.

Climate in the district varies with altitude which is divided into 2 zones, namely; the midland and lowland zones. The midland zone receives moderate mean rainfalls ranging from 600 mm and 1,000 mm annually with mean annual temperature of 15ºC-20ºC. The lowland zone receives low mean rainfalls which range from 500 mm to 600 mm annually with temperature ranging between 20ºC-25ºC (URT, 2013). A large part of the district is covered with dry miombo woodlands, with *Brachystegia* and *Acacia* being the dominant tree species (Tairo, 2011). According to the 2012 National Population and Housing Census, Iringa district had a population of 245,032 persons of whom 138,284 (56.4%) were females, and 60,484 households. Though vulnerable to climate change, smallholder agriculture is the dominant economic activity in the district, contributing almost 99% of the district's GDP whereby crop farming contributed 83.9% while livestock subsector contributed 14.8% (URT, 2013).

***Research Design***

The study followed a Case Study research design (Yin, 2003) to explore and describe the by-laws governing local access to NTFPs, examine their implementation and evaluate their implications on household food security in communities adjacent to KFR. The design was chosen to improve the validity and reliability of findings through triangulation of qualitative and quantitative research approaches in data collection and analysis (Benton and Craib, 2001). Both primary and secondary data sources were used based on the demands of the study objectives.

***Sampling Design***

The study targeted local communities adjacent to KFR with heads of households forming the unit of analysis. Sampling procedures were based on purposive sampling (Kothari, 2004; Mason, 2002) of study villages based on their high dependence on and co-management of KFR, and selection of participants in Focused Group Discussions (FGDs) based on their availability and conversancy of the study topic. The procedure was also used to select District Forestry Officer (DFO), Tanzania Forest Services Agency (TFS) district Manager, village executive officers (VEOs) and village natural resources committees (VNRCs) members as key informants. Proportional sampling procedures (Kothari, 2004) were used to draw a total of 328 heads of households with proportional representation from each of the five study villages. Table 1 presents a summary of the respondents and informants of the study.

**Table 1**: **Respondents and Informants of the Study**

| Category of Participant | Itagutwa | Kitapilimwa | Kinywang'anga | Mawindi | Mfyome | Total |
|---|---|---|---|---|---|---|
| Heads of Households | 79 | 46 | 36 | 38 | 129 | **328** |
| FGDs Participants | 8 | 8 | 8 | 8 | 8 | 40 |
| DFO | | | | | | 1 |
| District TFS manager | | | | | | 1 |
| VNRC members | 5 | 5 | 5 | 5 | 5 | 25 |
| VEOs | 1 | 1 | 1 | 1 | 1 | 5 |
| **Total** | **93** | **60** | **50** | **52** | **143** | **400** |

**Source**: Field Survey 2016

***Data Collection***

In this study, the quantitative approach was used to collect data related to, *inter alia*, socio-economic and demographic characteristics of the respondents, the status of household food security and types of permitted NTFPs. Similarly, the qualitative approach was used to collect data related to, among others, respondents' perceptions of their vulnerability to household food insecurity, accessibility to KFR for NTFPs and whether the KFR management by-laws compromised the availability of NTFPs for enhancing household food security. Quantitative data were collected using household socio-economic survey whereby structured questionnaires with both closed and open-ended questions were administered to the respondents. Qualitative data were collected using in-depth interviews with the key informants, field observation and FGDs. One FGD consisting of eight participants was conducted in each village.

***Data Analysis***

Quantitative data collected through socio-economic household survey were edited, coded and entered into IBM SPSS (Statistical Products and Service Solutions) version 20. Descriptive statistics (frequency and percentages) were calculated. Also, logistic regression analysis was used to determine the impact of socio-economic and demographic characteristics of the respondents on household food security. Binary logistic regression model was used because the dependent variable was categorical and binary. The study used the following logistic regression equation:

$$Y = \beta_0 + \beta X_1 + \beta X_2 + \ldots\ldots\ldots \beta nXn + \varepsilon$$

Where Y= household food security condition (1=household food security; 0=household food insecurity); $\beta_0$ = regression constant; $X_1$, $X_2$.....$X_n$=

explanatory variables: $X_1$=age, $X_2$=gender, $X_3$=marital status, $X_4$=education, $X_5$=household size, $X_6$=income, $X_7$=occupation; $\beta n$ = regression coefficient; $\varepsilon$ = error term. Also, the logistic regression model was used to test the statistical significance of collection fee, number of days for entering KFR for NTFPs, quantity of NTFPs permitted to be collected and types of NTFPs permitted to be collected on availability of NTFPs for enhancing household food security. The results were taken to be statistically significant at $p<0.05$. Analysis of qualitative data was done with the use of Nvivo 11 through which the code book of related data needed to address the study objectives was developed and guided content analysis.

## Results and Discussion

### *Characteristics of the Respondents*

Household vulnerability to food insecurity and adoption of a wide range of strategies for adapting to food insecurity are greatly influenced by the socio-economic and demographic characteristics of the respondents (Ekwugha, 2016). Due to this the study surveyed socio-economic and demographic characteristics of the respondents as shown in Table 2.

**Table 2: Socio-economic and Demographic Characteristics of the Respondents (N=328)**

| Characteristic | Category | Frequency | Percent |
|---|---|---|---|
| Age | 30-39 | 84 | 26 |
| | 40-49 | 92 | 28 |
| | 50-59 | 86 | 26 |
| | 60+ | 66 | 20 |
| Gender | Male | 212 | 64.6 |
| | Female | 116 | 35.4 |
| Marital Status | Married | 236 | 72 |
| | Single | 14 | 4.3 |
| | Divorced | 5 | 1.5 |
| | Separated | 20 | 6.1 |
| | Widow | 39 | 11.9 |
| | Widower | 14 | 4.3 |
| Education | Illiterate | 20 | 6.1 |
| | Primary education | 276 | 84.1 |
| | Adult education | 8 | 2.4 |
| | Ordinary level sec. education | 23 | 7 |

| | | | |
|---|---|---|---|
| | Tertiary education | 1 | 0.3 |
| Household size | 1-3 persons | 85 | 25.8 |
| | 4-6 persons | 183 | 55.8 |
| | 7-9 persons | 48 | 14.8 |
| | 10+ | 12 | 3.6 |
| Occupation | Crop farming | 248 | 75.6 |
| | Mixed farming | 79 | 24.1 |
| | Formal employment | 1 | 0.3 |
| Income | 10,000-39,000 | 164 | 50 |
| | 40,000-69,000 | 83 | 25.4 |
| | 70,000-99,000 | 33 | 10 |
| | 100,000-129,000 | 26 | 8 |
| | 130,000-159,000 | 22 | 6.8 |
| | 160,000+ | 0 | 0 |

**Source**: Field Survey 2016

The findings in Table 2 revealed that the majority of the respondents (28%) were aged 40-49 years whereas 20.1% were aged 60+ years. Male and female respondents were 64.6% and 35.4% respectively. Indeed, most of the respondents (72%) were married. About 84.1% of the respondents had primary level education. Most of the surveyed households (55.8%) had 4-6 members. Crop farming occupied 75.6% of respodents and mixed crop farming had 24.1% hence forming the main economic activities of the respondents. About 50% of the respondents earned an average monthly income of Tsh. 10,000-39,000. Therefore, there was a greater dependence on agriculture which is climate-sensitive together with low income level connoted higher vulnerability to household food insecurity thus implying a high demand for forest-based food stuffs (Islam and Quli, 2016).

***Status of Household Food Security***

Communities living in semi-arid areas are prone to adverse climatic events including below average rainfall, seriously reducing crop productivity which increases household vulnerability to food insecurity (Lyimo and Kangalawe, 2010; Moyo *et al*., 2012). An analysis of household food adequacy in a previous season provides a quick picture of household food status. The study surveyed households on their experience of food shortage in the previous year and the findings are as shown in Table 3.

**Table 3: Household Food Shortages (N = 328)**

| Response | Villages | | | | | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Itagutwa | | Kinywang'anga | | Kitapilimwa | | Mawindi | | Mfyome | | | |
| | Freq | % | Freq | % | Freq | % | Freq | % | Freq | % | Freq | % |
| **Yes** | 46 | 18.4 | 28 | 11.2 | 37 | 14.8 | 29 | 11.6 | 110 | 44 | 250 | 76.2 |
| **No** | 33 | 42.3 | 8 | 10.3 | 9 | 11.5 | 9 | 11.5 | 19 | 24.4 | 78 | 23.8 |

**Source**: Field Survey 2016

The results showed that the majority (76.2%) reported to have experienced food shortage in the study area in the year before this study was undertaken. A village-wise analysis showed that food shortage has been critical in Mfyome (44%) and not much reported in Kinywang'anga (11.2%). FGDs revealed that adverse climatic conditions, poor soils and lack of capital are some of the causes of household food shortages in Mfyome. The findings, generally, suggest that in the study area food insecurity is a critical issue. Similar results were reported by Mdachi (2014) who studied the effects of food insecurity among pastoralist families in Iringa district. His study found that 75% of the respondents had food shortages. Similarly, a study by Knueppel *et al*. (2009) in Iringa district found that 79.3% of the respondents were food insecure. A study by Dagno (2011) on the factors for food insecurity among forest-adjacent communities in Mbulu district, Manyara, found that 81.7% of the respondents faced food insecurity. In South Africa, a study by Hendriks (2005) revealed that households that were food insecure ranged between 58% and 73%. Also, WFP (2015) observed that in rural Tajikistan, 76% of the population was food insecure. The findings suggest that food shortage is a serious problem in rural areas of developing countries. Logistic regression was run to determine how socio-economic and demographic characteristics of the respondents were linked to household food security as presented in Table 4.

**Table 4: Logistic Regression Model on Determinants of Household Food Security**

| Explanatory Variables | B | S.E. | Wald | df | p-value | Exp(B) |
|---|---|---|---|---|---|---|
| Age | -0.024 | 0.012 | 4.299 | 1 | 0.038* | 0.976 |
| Gender | -0.144 | 0.307 | 0.221 | 1 | 0.638 NS | 0.866 |
| Marital status | 1.001 | 0.323 | 9.628 | 1 | 0.002* | 2.721 |
| Education | 0.931 | 0.470 | 3.924 | 1 | 0.048* | 0.394 |
| Household size | -0.615 | 0.212 | 8.401 | 1 | 0.004* | 0.541 |
| Income | 0.041 | 0.010 | 15.794 | 1 | 0.000* | 1.042 |
| Occupation | -19.664 | 40192.970 | 0.000 | 1 | 1.000 NS | 0.000 |

NS = Non-significant at $p<0.05$; * = Significant at $p<0.05$

The findings showed that age ($p = 0.038$), marital status ($p = 0.002$), education level ($p = 0.048$), household size ($p = 0.004$) and income of the household head ($p = 0.000$) significantly predicted food security status of the household. Also, the findings revealed that marital status, education and income affected household food security positively i.e. married couples, high education and households with high income were more likely to be food secure. On the other hand, age and household size affected household food security negatively i.e. as age and household size increases household food security was more likely to decrease. This is because aged persons are weaker and cannot produce enough food. Also, large households imply many mouths to feed, bearing in mind that in Tanzania about half (48%) of the household members are dependants (NBS, 2013). Occupation did not predict household food security because almost all respondents in this study were smallholder farmers. The findings are similar to Sekhampu (2013) who noted that in South Africa, income and household size predicted household food security, though household size had a negative effect. In addition, his study found no significant statistical influence of gender on household food security, as it has also been found in this study. This is because almost all respondents in the current study were smallholder farmers dependent on climate sensitive rain-fed agriculture and, in addition to that, they both command low income. Regarding marital status, Kaloi *et al*. (2005) had similar observation that in Kenya married household heads had a high likelihood of being food secure than their single counterparts. Furthermore, the results concur with those by Adebayo (2012) whose study found significant statistical relationship between education, household size, income and household food security in Nigeria. The findings of the current study imply that programmes geared towards provision of higher education, off-farm and non-farm income sources may improve household food security.

Moreover, availability of NTFPs enhances household food security to local communities (Olaniyi *et al*., 2013). This study found that 15 common types of NTFPs and 210 species of NTFPs were reported by the respondents to be available in KFR. This high awareness of availability of NTFPs suggests high dependence of the local communities on NTFPs from KFR for their livelihoods. NTFPs play a crucial role in enhancing household food security though their contribution differs across spatio-temporal scales (Compton *et al*., 2010; Olaniyi *et al*., 2013; Ekwugha, 2016). The study examined the strategies adopted by households to respond to food shortages as presented in Table 5.

**Table 5: Strategies Adopted to Enhance Household Food Security (N = 250)**

| Responses | Villages | | | | | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Itagutwa | | Kinywang'anga | | Kitapilimwa | | Mawindi | | Mfyome | | | |
| | Freq | % | Freq | % | Freq | % | Freq | % | Freq | % | Freq | % |
| Sell household assets | 44 | 21.6 | 21 | 10.3 | 32 | 15.7 | 12 | 5.9 | 95 | 46.6 | 204 | 62.2 |
| Food aid from the government | 36 | 24.8 | 27 | 18.6 | 19 | 13.1 | 23 | 15.9 | 40 | 27.6 | 145 | 44.2 |
| Eat edible NTFPs | 19 | 14.2 | 20 | 14.9 | 30 | 22.4 | 26 | 19.4 | 39 | 29.1 | 134 | 40.9 |
| Skip meals | 22 | 25.9 | 13 | 15.3 | 8 | 9.4 | 16 | 18.8 | 26 | 30.6 | 85 | 25.9 |
| Sell NTFPs | 9 | 13.6 | 15 | 22.7 | 16 | 24.2 | 11 | 16.7 | 15 | 22.7 | 66 | 20.1 |
| Begging from relatives | 15 | 26.8 | 5 | 8.9 | 10 | 17.9 | 2 | 3.6 | 24 | 42.9 | 56 | 17.1 |
| Migration | 10 | 23.8 | 10 | 23.8 | 5 | 11.9 | 5 | 11.9 | 12 | 28.6 | 42 | 12.8 |
| Food aid from institutions/NGOs | 16 | 41 | 0 | 0 | 10 | 25.6 | 0 | 0 | 13 | 33.3 | 39 | 11.9 |

**Based on Multiple Responses Analysis;* Source: Field Survey 2016

The findings in Table 5 revealed that 40.9% and 20.1% of the respondents enhanced household food security through eating and selling NTFPs respectively. FGDs in Itagutwa and Mfyome revealed that during crop failure and lean seasons, villages turned to NTFPs for both food and income. An in-depth interview with the district TFS manager suggested that the local communities extracted a lot of NTFPs even the restricted ones from KFR to meet their household needs, more often illegally and unsustainably. The findings suggest that despite the contribution of other strategies to household food security, the contribution of NTFPs was quite significant. Similar observations were made by Suleiman *et al*. (2017) who found that NTFPs from Falgore Game Reserve in Nigeria helped the adjacent communities as a safety net during crop failure in a form of food and income. Similarly, the findings are confirmed by studies by Foppes and Ketphanh (2004) in Lao People's Democratic Republic (Lao PDR) and Islam and Quli (2016) in tribal Jharkhand, India who found that NTFPs contributed to household food security through direct consumption and commercialization of the NTFPs to buy food

particularly grains. Saha and Sundriyal (2012) further affirm that NTFPs serve as households' vital source of diet, food and nutrition during food scarcity in developing countries.

Also, NTFPs provide substantial proportion of household income which is used to meet various livelihood needs including buying food (Clendon, 2001; Foppes and Ketphanh, 2004). FGDs revealed that a large part of the income earned from trade in NTFPs was used to buy food related household needs. They include food grains (maize or maize flour, rice and beans), to buy salt, sugar, farm inputs (fertilizer) and livestock (pigs, goats and sheep). It is worth noting that livestock play a key role in enhancing household food security directly or indirectly. The results corroborate a study by Foppes and Ketphanh (2004) in Lao PDR that noted that almost all the income derived from trade in NTFPs was used to purchase rice to improve household food security. The results are also consistent with those of Abdulla (2013) who found that forest-adjacent households in Ethiopia spent the income generated from selling NTFPs to buy food and farm inputs. Shemnga (2015) found that 65% of the respondents in Lushoto, Tanzania spent the income derived from selling NTFPs to buy food.

***Existing NTFPs Access By-laws***

Local communities' awareness of the forest management by-laws and rights shapes their attitude towards the by-laws, making enforcement of the by-laws relatively smooth (Blomley & Iddi, 2009). It was found during household survey that all the respondents were aware that there were by-laws which regulated access to KFR and appropriation of NTFPs. In-depth interviews with the VNRC members and VEOs revealed that more often villagers were informed through village meetings, mass media and signboards of the need to know and abide by the KFR management by-laws. Field observation found several signboards (Plate 1) which were installed around the reserve, pinpointing some of the prohibited anthropogenic activities.

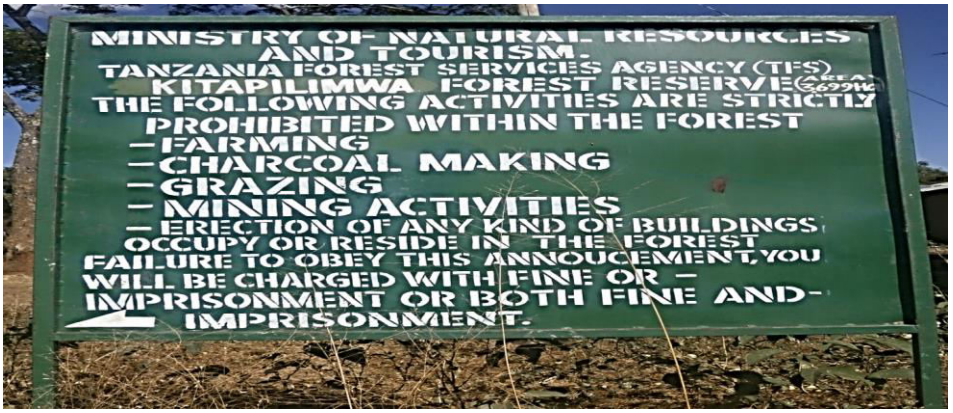



**Plate 1: Some of the Anthropogenic Activities Restricted to be undertaken in KFR**
**Source**: Field Survey 2016

Plate 1 is one of the signboards erected around KFR educating the general public on the need to conserve the reserve. The findings concur with those of Vyamana *et al*. (2008), Blomley and Iddi (2009) who observed that the presence and communities' awareness of forest governance rights and responsibilities are vital for forests conservation. The findings contradict those of Mombo *et al*. (2011) who observed that in Kilombero valley in Morogoro region the majority of the respondents were unaware of most of the forest management regulations. The difference is due to the fact that local efforts to impart environmental education tend to differ from place to place.

In addition, JFM by-laws usually state the types of NTFPs which local communities are permitted to collect (Topp-Jørgensen *et al*., 2005). Through household survey, the study established that according to the JFM plan, the types of NTFPs that local communities were permitted to extract from KFR were five (Table 6).

**Table 6: Types of NTFPs Permitted to be Extracted from KFR (N = 328)**

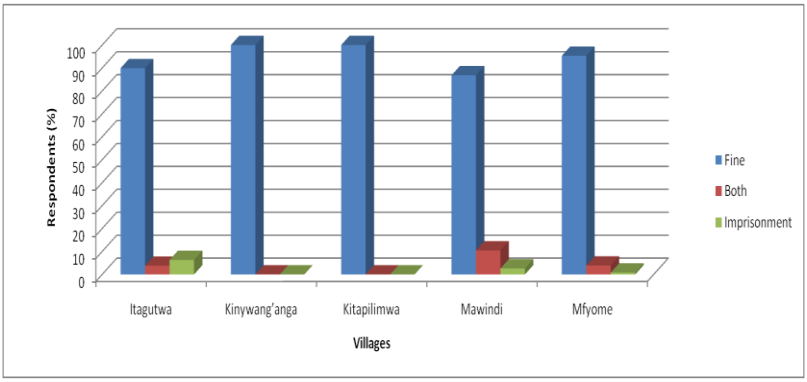
| NTFPs | Villages | | | | | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Itagutwa | | Kinywang'anga | | Kitapilimwa | | Mawindi | | Mfyome | | | |
| | Freq | % | Freq | % | Freq | % | Freq | % | Freq | % | Freq | % |
| Dead wood | 18 | 10.5 | 19 | 11.1 | 21 | 12.3 | 18 | 10.5 | 95 | 55.6 | 171 | 52.1 |
| Wild vegetables | 13 | 9.3 | 11 | 7.9 | 20 | 14.3 | 14 | 10 | 82 | 58.6 | 140 | 44.8 |
| Wild fruits | 14 | 9.8 | 11 | 7.7 | 21 | 14.7 | 16 | 11.2 | 81 | 56.6 | 143 | 43.6 |
| Mushrooms | 15 | 10.2 | 11 | 7.5 | 13 | 8.8 | 18 | 12.2 | 90 | 61.2 | 147 | 42.7 |
| Medicinal plants | 17 | 18.7 | 15 | 16.5 | 15 | 16.5 | 16 | 17.6 | 28 | 30.8 | 91 | 27.7 |

**Based on Multiple Responses Analysis*
**Source:** Field Survey 2016

The findings in Table 6 indicate that the types of NTFPs which the respondents were permitted to harvest from KFR. It can be noted that dead wood was most reported (52.1%) whereas medicinal plants were least reported (27.7). Moreover, a village-wise analysis showed that in Mfyome the most reported NTFP was mushrooms (61.2%) while in Itagutwa it was medicinal plants (18.7%). The results are in line with the reserve management by-laws which authorize the collection of the five NTFPs i.e. dead wood, wild vegetables, wild fruits, medicinal plants and mushrooms (URT, 2001). In-depth interviews with the DFO and the district TFS manager revealed that these NTFPs were allowed to be extracted because their extraction had least environmental damage.

Furthermore, FGDs and in-depth interviews with the VEOs found that the maximum amount of NTFPs allowed to extract for household consumption was a head load. However, extraction for trade could exceed the head load amount provided that one paid a license fee. Similarly, extraction for household use by the 5 villages was free but outsiders had to pay for the permit. It was further revealed that the local communities were permitted to enter the reserve to collect the permitted NTFPs twice a week (Tuesday and Saturday). Also, the VNRCs were responsible for issuing the permit (URT, 2001).

Usually, some people do not comply with the resources management regulations if they are not aware of the consequences for non-compliance (URT, 2001; Gunningham, 2011). The study examined local awareness of the consequences for non-compliance to KFR management by-laws. The household survey found that local communities were aware of fines (94.2%), imprisonment (2.1%) and both fine and imprisonment (3.7%) as the punishments for illegal entry and appropriation of forest products from the reserve. Awareness of encroachment punishment was analyzed in relation to the studied villages as presented in Figure 2.




**Based on Multiple Responses Analsyis*

**Figure 2: Awareness of Punishment for Illegal Entry into KFR**

**Source**: Field Survey (2016)

Based on Figure 2, the most known punishment for non-compliance was fine. Village-wise, in Mawindi the second most known punishment was both fine and imprisonment (10.5%). In Itagutwa, the second most known punishment was imprisonment (6.3%). Generally, field observation saw a signboard in Mfyome (Plate 1) with a clear message that the punishments for violation of KFR management by-laws were fine, imprisonment or both. The findings suggest that most of the respondents were aware of the punishment for non-compliance to KFR management by-laws. This implies that illegal harvest of forest products was driven by other forces, not ignorance of forest by-laws. The findings are affirmed by Horning (2004) and FAO (2005) who assert that most local communities are aware of the consequences of non-compliance to forest management by-laws. To them, illegal harvesting of forest products may be driven by, *inter alia*, weak law enforcement, lack of alternatives, high market returns and marginalization of the people whose livelihoods are forest-dependent, factors which were also reported in this study during FGDs.

***Effects of the By-laws on Access to NTFPs and Household Food Security***

By-laws governing forest access may enhance or impede the availability of NTFPs for stabilizing household food security (Suleiman *et al*. 2017). The current study found that some of the KFR management by-laws had implications on access to NTFPs for enhancing household food security. Discussants of FGDs in all the studied villages opined that the head load amount of NTFPs permitted per visit was not enough to fulfill household requirements of food and forest-based income to buy food and other needs. FGD participants argued that they should be permitted to extract NTFPs based on their household needs, only that the harvesting should be sustainable, an argument which was strongly opposed by the DFO and district TFS manager that this could lead to over exploitation.

Regarding visiting days, most of the FGD participants in Mfyome and Kinywang'anga asserted that they were not enough. They said that given the low amount of NTFPs they were permitted to collect from the reserve, three days (Monday, Wednesday and Friday) could suffice to meet their weekly household needs of NTFPs. In-depth interviews with all the VEOs and the district TFS manager revealed that most villagers encroached and collected NTFPs from KFR almost daily. The encroachment suggests high demand for NTFPs. The findings concur with those of Clendon (2001) who found that in Lao PDR, local communities collected NTFPs from Xe Bang Nouan National Biodiversity Conservation Area on daily basis despite the fact that the area was a conserved one. Meduna *et al*. (2009) noted that in Nigeria, protected forests

were being encroached by farmers and pastoralists for livelihoods, aggravated by low returns from agriculture and other off-farm income generating activities. Similarly, a study by Shemnga (2015) in Lushoto, Tanzania found that though local communities were permitted to collect NTFPs from Baga catchment forest twice a week, the majority collected NTFPs daily due to, *inter alia*, high demand for NTFPs. The results suggest that customary forest management by-laws may be integrated with the conventional by-laws to realize sustainable extraction of NTFPs.

Sumbi (2004) observed that when local communities have an access to a great variety of NTFPs, they are assured of, *inter alia*, wild food and income. As shown in Table 6, the local communities were permitted to collect only five types of NTFPs from KFR. According to FGDs results in Itagutwa, Kinywang'anga and Mfyome, more types of NTFPs could have been added to the list. They noted honey, pasture, charcoal, poles and grass as in CBFM (Vyamana *et al*, 2008). Similarly, agro-pastoral FGD participants in Mfyome stated that pastures in the open forests were not enough and their cattle faced food shortage, decreasing breeding rates, meat and milk quality and quantity. Therefore, they should be allowed to graze in the reserve, a suggestion which was rejected by the DFO and the district TFS manager. Other participants suggested that they should be permitted to also collect honey from caves and tree holes in the reserve. The findings are affirmed by Blomley and Iddi (2009:41) who observed that most of the JFM projects are meant to enhance resources conservation and restricted use rather than promoting livelihoods returns to local communities through sustainable harvesting of forest products.

The study further found that KFR management by-laws affected household food security and income through permit fee that villagers had to pay in order to collect the permitted NTFPs for trade. In-depth interviews with the VNRC members revealed that villagers had to pay a certain fee to get permit to collect NTFPs for trade. Indeed, FGDs in all the studied villages revealed that those who were poor did not afford the fee, hence they felt they were excluded from enjoying the monetary benefits of the reserve. Not only that, the FGD participants explained that the rule of returning 5% of the fine to the village was not being implemented, demoralizing the villagers. One FGD participant in Mawindi asserted that the reserve was more beneficial to the community than to individual households. Blomley and Iddi (2009) affirm that JFM has transferred more management costs than benefits to forest-dependent communities, affecting the livelihoods of poor households. Furthermore, a study by Vyamana *et al*. (2008) in the Eastern Arc Mountains of Tanzania confirms that upfront

payments such as fees for colleting NTFPs under PFM, even for household purposes, puts high prohibitive costs on the poor, creating a conducive environment for elite capture of the NTFPs-based benefits.

Table 6 presents logistic regression model results on the statistical likelihood of collection fee, number of days for entering KFR for NTFPs, permitted quantity of NTFPs to be collected and types of NTFPs permitted to be collected to predict the availability of and access to NTFPs for enhancing household food security.

**Table 6: Logistic Regression Model on the Impact of KFR Access By-Laws on Availability of NTFPs**

| Explanatory Variables | B | S.E. | Wald | Df | p-value | Exp(B) |
|---|---|---|---|---|---|---|
| NTFPs collection fee | -0.647 | 0.171 | 14.334 | 1 | 0.000* | 0.523 |
| Number of days for entering KFR per week | 0.252 | 0.123 | 4.241 | 1 | 0.039* | 1.287 |
| Permitted maximum quantity of NTFPs | 0.928 | 0.465 | 3.973 | 1 | 0.046* | 0.395 |
| Permitted types of NTFPs | 0.078 | 0.052 | 2.261 | 1 | 0.133 NS | 1.081 |

NS = Non-significant at $p<0.05$; * = Significant at $p<0.05$

The findings in Table 6 revealed a significant statistical relationship between NTFPs collection fee ($p = 0.000$), number of days the local community was permitted to enter KFR to forage for NTFPs per week ($p = 0.039$), the maximum amount/size of NTFPs permitted to harvest per a visit ($p = 0.046$) and the supply of NTFPs to the local communities for enhancing household food security. The findings showed that NTFPs collection fee had a negative statistical influence in that an increase in NTFPs collection fee decreased the likelihood of entering the reserve to collect NTFPs especially to the poor households because they could not afford to pay the license fee. On the other hand, the number of visiting days had a positive statistical influence in that an increase in the number of visiting days increased the likelihood of the local communities to collect NTFPs more frequently in a week. Furthermore, an increase in the quantity of NTFPs to be harvested was associated with a positive probability of collecting more NTFPs per trip for enhancing household food security. The results of the logic regression model are in line with those of Vyamana *et al*. (2008) and Clendon (2001) who affirm that restrictive forest access by-laws, upfront payment of extraction fees and low of quantity of NTFPs permitted to extract affected the supply of NTFPs, especially to poor households; encouraging illegal extraction or transferring the degradation to less protected areas. Therefore, customary laws may be integrated with the KFR

management by-laws in order to meet local community's forest-based livelihood needs while attaining forest conservation goals.

Moreover, the study surveyed respondents' satisfaction with the KFR management by-laws and the results showed that 53% of the respondents were dissatisfied while 47% were satisfied with the KFR management by-laws. Satisfaction with forest management by-laws was analyzed in relation to the studied villages as shown in Figure 3.

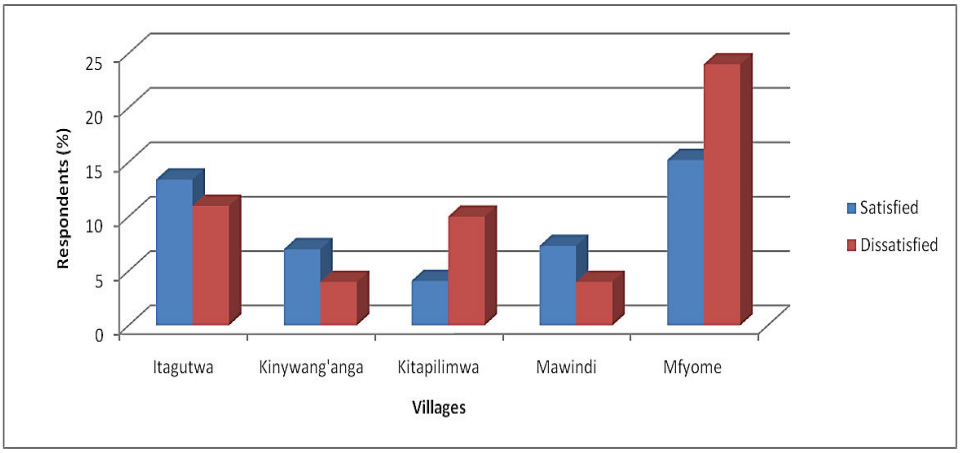
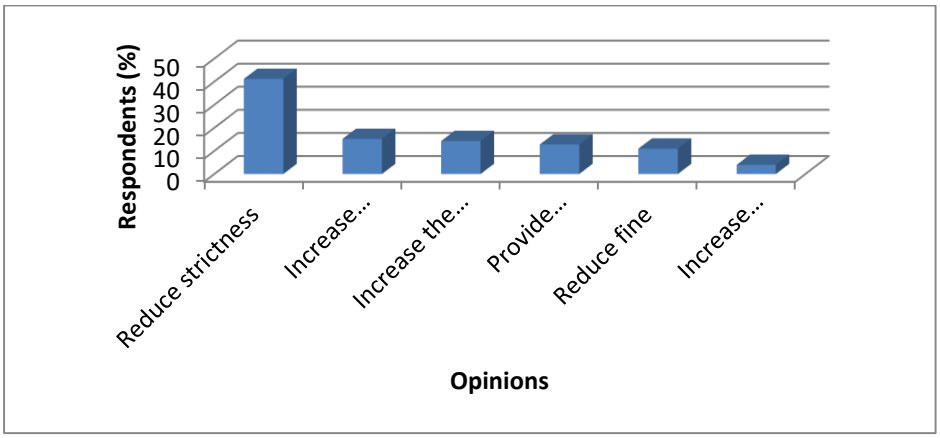



**Figure 3: Satisfaction with the KFR Management By-laws**
Source: Field Survey 201

From Figure 3, Mfyome had many respondents (24%) who were dissatisfied while Itagutwa had many respondents (13.4%) who were satisfied with the KFR management by-laws. Generally, the findings suggest that the majority were dissatisfied with the KFR management by-laws. In-depth interview with the VEO of Mfyome revealed that the relationship between villagers and the district TFS patrol guards was not cordial and the villagers felt marginalized from appropriation of NTFPs from the reserve. Besides, most of the by-laws came from the district level for implementation. A study by Yang *et al*. (2015) in China had similar results whereby 56% of the respondents were dissatisfied with the Bulong Nature Reserve management regulations. Nyamoga and Ngaga (2016) observed that some of the factors for dissatisfaction and non-compliance to forest regulations are marginalization of the local communities in making the by-laws and that the by-laws focus more on resource conservation at the expense of local communities' forest-based livelihoods. Robins and Harrell (2014) put it clear that restrictive regulations in a form of 'fences and fines' limit local communities' access to conserved forests for their livelihoods,

leading to resentment of the management regime. The findings suggest that it is vital to enshrine local livelihood needs in the forest management by-laws.

It is important to mainstream local perceptions in the design of forest management by-laws for sustainability of both forest resources and local forest-based livelihoods (Blomley and Iddi, 2009; Yang *et al*., 2015; Nyamoga and Ngaga, 2016). The study surveyed perceptions of the respondents who were dissatisfied with the KFR management by-laws on how to improve the by-laws in order to conserve the reserve in a win-win situation as shown Figure 4.




******Based on Multiple Responses Analsyis*

**Figure 4: Local Perceptions of Improving KFR Management By-laws**

**Source**: Field Survey 2016

The findings in Figure 4 revealed that 41.2% of the respondents felt that the forest access by-laws were too strict whilst about 4% had the opinion that strictness of the by-laws should be increased. FGDs in Kinywang'anga, Mfyome and Itagutwa revealed that the access by-laws were designed by the district officials and were brought to the villages for implementation. They noted the need to revisit the number of visiting days, quantity of NTFPs to be harvested and license fee to promote sustainable extraction of NTFPs. In fact, in-depth interviews revealed that the VNRCs simply enforced the KFR access by-laws, but they did not design or alter them. Similar observations were made by Nielsen (2011:109) who noted that "VNRCs do not have the power to make or change rules, and are in practice, restricted to enforcing objectives in the management plan…with limited input from the communities". This supports the findings of the current study whereby 15.4% of the respondents suggested that local communities had to be involved in formulating KFR management by-laws.

***Conclusion***

The study has revealed that Iringa district, especially the semi-arid parts, is vulnerable to household food insecurity caused by climate change and other factors. Local communities use NTFPs from KFR to enhance their resilience to regular food shortages. Since KFR is under JFM, there are forest management by-laws which define the types of NTFPs that the surrounding villages can harvest, the amount of NTFPs to be harvested, the days in which the villagers can enter the reserve with a permit to collect NTFPs and, lastly, the license fee that the villagers and outsiders should pay to harvest NTFPs for trade. The findings further showed that though NTFPs from KFR play an important role in enhancing household food security, the local community revealed that the KFR conservation by-laws hinder the effective role that NTFPs from the reserve play to improve households' resilience to recurrent food shortages. Due to this, respondents presented several suggestions for improving KFR access by-laws, including education on sustainable harvesting of NTFPs and increasing the number of visiting days. It is hereby recommended that formulation of forest management by-laws should not be guided by the 'one fits all' model, but rather be based on site-specific livelihood challenges and opportunities and be reviewed regularly in order to meet the dynamic livelihood needs of the local communities. Similarly, in order to improve household food security, it is vital to adopt sustainable agriculture which incorporates agro-forestry. Also, sustainable natural resources management should be encouraged whereby forest-dependent households could be permitted to harvest forest products sustainably and, in addition to that, local communities should be empowered to initiate sustainable alternative livelihood sources such as non-farm and off-farm income generating activities. It should be understood that local communities are key decision makers in the utilization and management of forest resources. Due to this, forest management by-laws should emanate from the blending of the 'top-down' and 'bottom-up' decision making models rather than the traditional 'top-down' model which is rich in orders and commands. If the opinions of local communities in the form of customary laws are mainstreamed in the forest management by-laws, the forest-dependent communities will see the benefits of conservation, not the costs only.

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