



Identification of suitable income generating activities to reduce pressure on Ruvu North Forest Reserve from surrounding communities

¹Mndolwa, M. A. and ²Hussein, I.

Tanzania Forestry Research Institute,

¹P.O. Box 95, Lushoto.

²P.O. Box 30021, Kibaha.

Corresponding author E-mail: mathewmndolwa@yahoo.com

ABSTRACT

A study aimed at identifying suitable Income Generating Activities (IGAs) for reducing pressure on Ruvu North Forest Reserve (RNFR) from surrounding communities was conducted in 2013. Four hamlets (Mwendapole, Msangani, Miswe and Kiromo) bordering RNFR were purposively selected for the study. Primary data were collected through Focus Group Discussions (FGDs), structured questionnaire, key informant interviews, direct/participant observations and secondary data through literature review. Quantitative data from structured questionnaires were analyzed using Statistical Package for Social Science (SPSS) while that from FGDs and key informant interviews were subjected to content analysis. It was found that 86.7% of respondents undertake subsistence farming. Illegal harvesting of forest products from RNFR is not uncommon. On average, people in Miswe use more firewood followed by Msangani, Kiromo and Mwendapole hamlets. Income realized from domestic IGAs ranged from TZS 170,000 to 262,000 per household per annum. Six existing and six potential IGAs in the study area are discussed. It was concluded that IGAs can make a big change in economic status of households around RNFR. Given resources and proper management, improvement of the existing IGAs and establishment of new IGAs can contribute significantly to enhanced conservation of RNFR.

Key words: Ruvu North Forest Reserve, IGAs, firewood, existing, potential

INTRODUCTION

Ruvu North Forest Reserve (RNFR) which covers 32,000 ha is one of the biggest forest reserves in Tanzania. The reserve contains patches of coastal forests which make it an area of remarkable level of biodiversity. It provides both ecosystem services and forest products such as firewood, poles and other non-wood products to the surrounding communities. The reserve is within Bagamoyo and Kibaha districts. Most of the forest products extracted from RNFR are used in Kibaha and Bagamoyo towns and Dar es Salaam city. RNFR is facing escalated pressure resulting from increasing human population (urbanization) around it, increasing demand for forest products in nearby towns and Dar es Salaam City, increasing poverty among households, and improved infrastructure (roads) and facilities (communication networks). The adjacent towns of Kibaha (with 128,488 people), Bagamoyo (311,740) and Dar es Salaam City (4.36 million) (URT 2013) create needs for more forest products and services and serve as a potential driver for more forest degradation.

The government of Tanzania, through the Ministry of Natural Resources and Tourism (MNRT), piloted Participatory Forest Management (PFM) in RNFR through Ruvu Fuelwood Pilot Project (RFPP). This was considered as one avenue to saving the reserve from severe encroachment and



illegal harvesting. The project enhanced forest conservation and livelihood improvement (Msuya *et al.* 2003). However, it did not cover all surrounding hamlets and was phased out in 2006 leaving behind the problem of heavy dependence on RNFR for livelihoods by the forest adjacent communities to continue.

Dauson (2011) reported heavy dependence on forest products particularly firewood, charcoal and poles by the surrounding communities. The author recommended the need for establishment of suitable IGAs that can act as livelihood strategy to reduce dependency on forest products from RNFR. The main objective of this study was to identify alternative IGAs to reduce dependence on RNFR by surrounding communities. Specifically, the study looked at the level of dependence on forest products and services from RNFR by the surrounding communities, the existing and potential IGAs in hamlets surrounding RNFR and IGAs that have been successfully established under similar circumstances in other places outside RNFR.

MATERIALS AND METHODS

Study area description

The study was conducted in four hamlets bordering RNFR. The reserve is located between latitudes 6°33' and 6°43' S and longitudes 38°48' and 39°03' E. It borders Bagamoyo and Kibaha districts on the northern and on the southern parts respectively. The area receives irregular rains averaging 900 mm per year (Ezekiel *et al.* 2014). Rains fall in two seasons with long rains falling between March and May and short ones between November and December. Some irregular and unexpected light showers are frequently experienced in between. Temperatures range from 18°C to 33°C. Soils are free draining mainly sandy, sandy loam and gravel, varying substantially within short distances. The soil is poor and can support mainly subsistence agriculture. Vegetation in the area is a complex mix of moist and dry forests, with coastal thickets,

fire-climax and savanna woodlands. Seasonal and permanent swamps can be found in the forest. The flora is dominated by trees, but lianas are also common as are shrubs, herbs, grasses, ferns and epiphytes. RNFR is surrounded by 12 hamlets with average population density of 34 people/km² (URT 2013).

Data collection

Reconnaissance survey was carried out to select study hamlets. Four hamlets were purposively selected from all geographical directions around and adjacent to RNFR. The selected hamlets were Mwendapole on the South, Msangani on the East, Miswe on the West and Kiromo on the North of the reserve. Structured questionnaire, Focus Group Discussions (FGDs), key informant interviews and direct/participant observations were used in data collection. For structured questionnaire, a total of 83 households were sampled and the head of each household was interviewed. Collected information included socio-economic characteristics of the households, type and level of dependency on forest products and services from RNFR, other livelihood options, and existing and potential IGAs. Literature review was carried out to supplement primary data.

Data analysis

Quantitative data collected through household structured questionnaires was analyzed using Statistical Package for Social Science (SPSS). Data collected through FGDs and key informant interviews were subjected to content analysis (Stemler 2001) where the recorded dialogues were broken down into smallest meaningful units of information or themes.

RESULTS

Characteristics of respondents

Results showed that 55% respondents were males and 45% were females. On average, each household had approximately 3.8 people. Many (75%) people had primary education while 16% had no formal



education and 9% had secondary education and above. Results further showed that 86.7% of the respondents depend on subsistence farming. Other sources of income included small businesses (e.g. small kiosks and local restaurants) and poultry keeping (local chickens and ducks). Many people who are involved in subsistence farming are found in Kiromo, Miswe and Msangani. Livestock keeping is not very common in the study area as only 1.6% respondents reported keeping small number of goats.

Dependence on forest products

Households in the study area use mainly firewood and charcoal as main source of energy. Despite the fact that they obtain firewood from around homes but the larger part is obtained from RNFR. Harvesting of forest products (woodfuel and poles), was common in the study area and was in most cases done illegally. The main products extracted were firewood, poles and honey. About 60% of respondents reported a decrease of timber size trees in RNFR. Small animals like dik dik (*Madoqua kirkii*) are sometimes hunted in the reserve. These products were sometimes extracted not only for domestic use but also transported to nearby markets in Bagamoyo and Kibaha towns and Dar es Salaam city. Access to the reserve is favoured by flat topography and existence of several connecting roads. Bicycles are in most cases used to transport products outside the reserve as dealers cannot easily be caught by forest guards as they make no noise and can go through very narrow routes.

It was found that on average, the amount of firewood used by households per month in Miswe, Msangani and Kiromo ranged from 3 to 5 head loads (each weighing about 20-30 kg). However, residents of Mwendapole hamlet use relatively less firewood (1-2 head loads)/household per month. In terms of charcoal, Mwendapole hamlet use about 2-3 bags per month per household. Most of the wood (for firewood and charcoal) is taken from RNFR.

Few (5%) people extract honey from RNFR and its consumption in the area is also very low. It was reported that only 5% of households consume about 0.5 litres of honey per month as food but also for other purposes. Generally, many (92%) respondents reported that the cash generated by extracting wood and non-wood products from the forest and that by other means (e.g. subsistence farming and poultry keeping) does not meet their households needs.

Income derived from RNFR versus that from existing household IGAs

Results (Table 1a) showed that 8% of respondents engage in illegal collection and selling of firewood while 6% engage in illegal harvesting of poles from the reserve. Tables 1a and 1b summarize average incomes obtained from RNFR and domestic IGAs respectively.



Table 1a. Average household income from RNFR

Item/activity	Units	Unit cost (TZS)	Income (TZS) /year	Remarks
Illegal collection and sale of firewood	4 bicycle loads per month per household	3,500	168,000	8% of households
Illegal collection of poles	6 loads (15-20 poles)/year	12,000	72,000	6% of households
Average			120,000	

NB: Values for collected materials for domestic use was not considered; Bicycle load weighs between 20 and 40 kg.

Table 1b. Average household income from domestic sources

Item/activity	Reported mean annual household income (TZS)	Remarks
Poultry	90,000 - 120,000	Eggs and live birds
Gardening/farming	150,000 - 255,000	
Small/petty businesses	200,000 - 360,000	E.g. kiosks, small local restaurants
Charcoal making	80,000 - 120,000	From farm trees like mango and cashewnut trees
Selling fruits	70,000 - 180,000	E.g. coconuts, mangoes, oranges
Beekeeping (especially honey)	432,000 - 540,000	4 - 5 litres per month each sold at an average of TZS 9,000 per litre
Average		170,000 - 262,000

From Tables 1a and 1b, it is clear that families which participate in illegal collection of forest products for sale (firewood and poles) realize relatively lower income at an average of TZS 120,000/= per annum compared to those undertaking domestic IGAs who realize between TZS 170,000/= and 262,000/=.

Existing and potential IGAs

Existing IGAs

A number of IGAs were found in the study area. Preference to each differed from one hamlet to another depending mainly on location, availability of running/operational materials and working forces. The IGAs are poultry keeping, gardening, petty businesses, beekeeping, charcoal making, and fruit growing.

Poultry keeping

Many (62%) respondents reported keeping/domesticating local birds (chicken, ducks and guinea fowls). This has been taken as the easiest way of raising some extra income and also as source of protein for the households. In all four study hamlets, the activity is divided into those who keep local chicken (*Gallus*

domesticus), who keep ducks (*Domestic mallard*), and those who keep both including other birds like guinea fowls (*Numida meleagris*). It was noted that the birds are kept in very poor conditions where they are exposed to dangers of being stolen, infection by various diseases and even falling prey to hunting birds and wild animals. Very few (1%) people have managed to build enclosures for security and feed the birds regularly. Even when this is done, it is not in accordance with the required standard.

Gardening

This is among the dominant IGAs especially in Miswe and Mwendapole hamlets growing mainly tomatoes, okra, amarath, egg plants and pepper. Miswe hamlet borders Ruvu River which flows throughout the year. Some 20% of the respondents in Miswe hamlet have plots close to the river where they grow vegetables by irrigation. In Mwendapole hamlet, 12% of respondents reported participating in vegetable growing by irrigation using shallow wells and seasonal streams. Among biggest challenges facing



the activity included leaf diseases and water shortage in parts of the year.

Petty businesses

The activity is found in all hamlets but more prominently in Mwendapole hamlet. About 26% of participants in Kiromo, 18% in Miswe, 17% in Msangani and 31% in Mwendapole have one kind of petty business or another. Prominency of petty businesses in Mwendapole has been stimulated by the increasing population in the area. The businesses vary from small kiosks to medium ones selling bigger items like building materials. Efficient timber workshops and furniture marts are common in Mwendapole utilizing wood mainly from outside the district. A similar situation was experienced at Kiromo as it is growing very fast. Being along the highway to Bagamoyo tourist town, Kiromo attracts a lot of investments in terms of small businesses.

Beekeeping

On average, 5% of the respondents participate in beekeeping. It was reported that awareness on beekeeping and high cost of modern beehives (> TZS 70,000/=) limiting the development of the activity for many households. Most of the beehives are sited in the reserve. A few (2%) people with farmlands have decided to site beehives in fruit trees like mango and cashew-nut trees.

Charcoal making

This activity used to be one of the leading income generating activity at the time when illegal harvesting within the reserve was rampant. However, with improved protection of RNFR, the activity is now limited mainly around settlements and making use of old fruit trees such as mango trees for charcoaling. Very few (2%) people are involved in this activity. Production is done mainly by using local mud kilns.

Fruit growing

The fruit trees commonly grown are mango, jack fruit and oranges. Many (45%) respondents reported to have fruit trees either around homes (as source of fruits but at the same time shade) or in their farms. Some small farms of fruit trees were seen in Miswe, Msangani and Kiromo hamlets as opposed to Mwendapole hamlet where land shortage is a limiting factor.

Potential IGAs

Potential IGAs considered were those which are environmentally friendly, easily manageable, of low capital cost, high in returns, technically feasible and comply with culture, local and national laws. The potential IGAs are fish farming, establishment of furniture workshops, livestock keeping, establishment of fruit and tree nurseries, butterfly farming and mushroom farming.

Fish farming

Many (60%) respondents ranked fish farming high among potential IGAs in the study area. Despite the fact that initial investment might be relatively high, once established the activity can be a long term and sustainable supplier of both food and income for the households. There are valleys in the study area where fish ponds can easily be constructed and managed by individual households. The study area is warm throughout the year which is suitable for steady fish growth.

Establishment of furniture workshops

Furniture workshops range from those using wood as raw materials to those using metal. They are involved with manufacture of items like tables, beds, windows and door frames. Promoting manufacture and use of metal instead of wood in manufacturing such items has positive impact in conservation of adjacent forests.



Livestock keeping

The introduction of zero grazing for cows accompanied with other agriculture techniques was found to have potential of raising household economy. Another profitable activity is goat keeping. If properly done, goats can provide 2-4 offsprings per year, which can be sold for bigger farm animals or start up capital for other businesses. Keeping small animals like guinea pigs/cavy (*Cavia porcellus*) was also proposed by 12% respondents in the study area. These are small animals which can be reared in house and become cheap source of protein and income to families. They feed on small plants and grain remains which are cheap feeds. They reproduce very fast and can therefore keep their numbers increasing proportionally. If these can be introduced in the study area, they can lead to a big leap in household economy.

Establishment of fruit and tree nurseries

Planting of fruit trees was noted to increase with time and this was considered a potential IGA in the area. It was found that many people prefer to purchase different fruit tree seedlings and other multipurpose trees instead of raising them. Furthermore, the purchased plants were not necessarily being planted around the study area but taken even further outside the study area. Fortunately, raising fruit trees at the nursery does not require very high knowledge and skills. Some individuals within the study area have the required knowledge and skill and can be used as trainers of their fellow hamlet residents.

Butterfly farming

This IGA was proposed by very few (2%) respondents. Although the activity looks very new in the study area and that people don't have the required skills, efforts can be made to make sure that it is started in the area.

Mushroom farming

Mushroom farming looks a bit delicate to handle but it is one of the IGAs which can support and increase household purchasing power within a short time with remarkable returns. The hardest part of the activity is control of growth of other fungi among mushrooms which requires a bit of care and thorough knowledge. However, local communities can be trained to produce mushrooms.

DISCUSSION

Characteristics of respondents

The population in the study area reflects characteristics of the rural population of Tanzania. However, the reported population (86.7%) engaged in subsistence agriculture is slightly higher than the reported (80%) country's population living in rural areas with agriculture as their mainstay (URT 2001). The slight difference might have been caused by the fact that the study area is within Bagamoyo and Kibaha towns whereby towns' population densities are normally high.

The population consists of relatively more men household heads than women. While women are more involved in collection of wild vegetables and firewood, men take the role of harvesting timber, wood for charcoal, wild honey and other non-wood forest products for sale (Bwalya, 2011). If there is no control over these men they can bring much more negative impact in conservation of RNFR. On the other hand characteristically married households appear to be more reliant on forest incomes than those who are single (Peckham 1993). This is because married households have more labour (family members) for collection and marketing of forest products.

Sufficient family labour force is ensured in the study area as each family has enough members capable of implementing IGAs. However, the reported family size (3.8



members/family) is a bit lower than the mean household sizes of 4.4 and 4.1 members/household for Bagamoyo and Kibaha district councils respectively. This might have been contributed by shifting of people especially young to the town centres. The presence of many (84%) people with basic education (standard seven and above) is expected to have positive impact in improvement of existing IGAs and adoption of new IGAs. The positive role of education in forest conservation and IGA implementation is reported by various authors. Generally education helps in conservation and sustainable use of the forest resources (Kumar 2012). Education is necessary to enable someone to easily adopt and transform new technologies in economic activities. Mhinte (2001) pointed out that education increases working efficiency, productivity, high income and food security at household level. They can read and understand books, flyers, newsletters, policy statements and other sources of information for their personal improvement and gains and then circulate the information to the community members (Adusei and Dunyah 2016).

Dependence on forest products

Despite the fact that dependency on forest products from RNFR has decreased tremendously, there is still some illegal harvesting which contributes to households' income. Some dependency on the reserve for firewood and poles have been documented (Dauson 2011). Dependency on tree resources from RNFR by nearby surrounding hamlets (Buma and Kerege) is also reported (Nepal 2004). The earnings from forest resources (for households which took part in illegal harvesting of forest products) in the study area was between 31.4% - 41.4%. Very close to this, Bwalya (2011) reported that rural households earn 30% of their cash income from harvesting and selling forest products. This is on the lower side of that obtained percentage from the study area.

Furthermore, Bwalya (2011) indicated that the ratio is influenced by market and household level factors as well as the occurrence and abundance of forest products. However, dependency on forests as a source of income may vary over time and across households. In some cases the returns obtained from the forest may equal that obtained outside the forest. Nepal (2004) reported from the nearby hamlets of Buma and Kerege that households received almost the same or above 30% income from tree resources out of forest. With this scenario the role of trees outside forest can not be overemphasized. These values vary from place to place. Experiences from Ethiopia showed that income from forest products contributed 39% of the average household income (Mamo *et al.* 2007).

Income derived from RNFR versus that from existing household IGAs

IGAs are very important in improving households' economy in the study area. Income obtained from domestic IGAs is higher than that obtained from illegal harvesting of forest products from RNFR. Beekeeping was leading IGA. Beekeeping can be considered a potential IGA in many other areas. According to Lalika and Machangu (2007), households which took part in beekeeping in Lindi region realized income of between 180,000/= and 804,000/= per year. The realized amount helped in purchase of various needs of households and used to check food balance during shortages. However, it is noted that both forest-based and non forest-based IGAs increase earning capacities and household income and improve livelihoods (Akinsoji 2013).

Existing and potential IGAs

Results of the study showed that a total of six IGAs were available in the study area. These were poultry keeping, gardening, petty businesses, beekeeping and planting of fruit trees. Regardless of where they are in the study hamlets, they are managed at



subsistence level. Six IGAs were identified as potential in the study area and these included fish farming, establishment of furniture workshops, livestock keeping, establishment of fruit and tree nurseries, butterfly farming and mushroom farming. These IGAs need to be emphasised so as to deliver on community livelihoods (Hasan 2009).

Existing IGAs

Poultry keeping

Keeping poultry at a subsistence level reflects a common scenario of many parts of the rural areas. The amount of cash realized by households from the activity is too little to provide substantial impact. Local chicken and ducks are preferred to exotic breeds as they are cheaper to raise and maintain. In some cases the poultry management can be accompanied with keeping some few guinea fowls (*Numida meleagris*). However, this non-farm economy plays a critical role in the income generation of households (Carletto *et al.* 2007). Poultry keeping is reported as a common IGA around reserves in many countries like in Bangladesh (Sheheli 2012) and Nigeria (Akinsoji 2013). On the other hand, chicken keeping faces a number of challenges. These include getting vaccine for the deadly New castle disease, treatments for other diseases like Coccidiosis (a parasitic disease of the intestinal tract *caused* by coccidian protozoa), chicken/fowl pox (*caused* by viruses of the family Poxviridae genus *Avipoxvirus*), fowl cholera (caused by *Coccobacillus Pasteurella multocida*) and bronchitis (a viral disease). Similar challenges are reported from Bangladesh (Sheheli 2012) and Bukina Faso (Oisepamela 2001). It was reported that availability of vaccines and other medicines for various fowl diseases will make a difference to the production chain and ultimate income to the farmers. Keeping ducks (*Domestic mallard*), was found the cheapest as the bird has been noted to have very few diseases. The only

challenge farmers face is keeping them in proper shelters.

Gardening

Gardening can be a good and potential avenue for improving households economies in the study area. For the activity to be successful, agriculture extension on raising, care and protection against diseases and pests, harvesting and packaging is crucial (Sheheli 2012).

Petty businesses

Petty businesses involve a number of small businesses ranging from small shops to local restaurants. They play a big role in relieving households' from economic stresses. Women can easily participate in the activity. However, they face different social, cultural, educational and technological challenges than men when it comes to establishing and developing their own businesses (Richardson *et al.* 2004). Petty businesses are reported to contribute into households' economy in many countries such as Bangladesh (Karim 2001).

Beekeeping

The activity is done locally and needs improvement. Bee keeping is also reported as a potential strategic IGA in forest resource conservation in Kenya (BirdLife International 2008). Reports from Nigeria (Meludu 2004) showed that incorporation of beekeeping and forest conservation has been indicated to have positive results for both. It eases management of the reserves by taking on board communities surrounding the reserve. Unfortunately, the activity is limited by high costs of modern beehives which goes even beyond 70,000/= per beehive. It was learned that if given technology, farmers can make their own good beehives. The activity can also easily be integrated with other farming systems which will allow for easy management. The good thing is; beside costs for the beehives other investment



costs are minimal and can easily be done in groups.

Charcoal making

Charcoal making is a common activity in many parts of Tanzania. It is among the leading IGA related very much with illegal harvesting of trees from natural forests. The use of fruit trees like mango and cashew nuts in charcoal making in the study area is encouraged by not only decreasing trees within RNFR but also improved law enforcement by the reserve's management. Charcoal producers are choosing less preferred species because the preferred ones are relatively scarce. In such a situation people change into using fruit and medicinal trees for charcoal production (Gumbo *et al.* 2013). In places where there are no alternative IGAs charcoal making ranks high in income generation of the poor peasants. It is reported from Gushegu District in Ghana that charcoal making around reserves ranked the second beside farming (Anang *et al.*, 2011).

Growing fruits

Growing fruit trees is common in many parts of Tanzania. Occurrence of fruit trees like mango, jackfruit and oranges proves that the species can grow well in the study area. Expansion of this activity is highly influenced by land availability. Its prominence in Miswe and Kiromo hamlets than Msangani and Mwendapole is basically a factor of land availability. Fruits are still a variety of crops which have limited commercial values but which can occasionally provide a means for diversification for poor households (Seppälä 1998). Thus seasonally fruits emerge among the most important crops to be sold out. Management plays a very big role in success of this activity. Reports from Ghana show that in some cases fruits like grafted mango and citrus fail as an IGA along the periphery of the forest reserve of Tain 1 forest in Sunyani Forest

District as a result of poor management (Adusei and Dunyah 2016).

Potential IGAs

Fish farming

The fact that many respondents identified fish farming as a potential IGA gives hope that it will be one of the highly accepted IGA in the future. This is a potential IGA in many parts of the world. It is noted that, mariculture has great potential for addressing food security and income generation (Samoilys and Kanyange 2008). It is reported as a potential IGA in Bangladesh (Sheheli 2012), Malawi (Fisher 2004; Anon 2012) and around Uzungwa Scarp proposed Nature Reserve (Sainsbury *et al.* 2015). However, Sheheli (2012) reports a failure because of seasonal climatic variations which involves a cycle of winter which limits fish growth. Because of this, many people did not earn good return from fish farming. However, this is not the case with the study area. The area is warm throughout the year hence encouraging steady fish growth.

Establishment of furniture workshops

This is one of the potential IGA which can play very big role in improvement of households' economies as well as conservation of RNFR. These businesses have positive impact to forest conservation especially when metals are used as raw material instead of wood. This IGA is as well reported in Malawi (Anon 2012). Improving small scale businesses and such industries has been reported to be a positive move in improving forest conservation in Kenya (Nduma *et al.* 2001). These small industries have been noted to contribute to market integration and can play big role in conservation of RNFR and also improve household economies. They also provide good returns and allows for individuals to re-invest their capitals easily and generate more profit as small trades returns can be realized much faster. The profit can be used in diversifying investment into other small



trades. These can easily be established as they use informal structures, flexible, need low capital cost, need modest education and in many cases depend on local raw materials (Nduma, *et al.* 2001).

Livestock keeping

The study area has potential for livestock keeping. Animal fodder can easily be grown. If the activity is combined with other agriculture techniques it can be potential in raising households economies. Farmers need be supported with parent stock. It can be accompanied with keeping improved stocks and fattening. Experiences from Bangladesh (Sheheli 2012) showed that those who received cows and received knowledge on fattening got good returns. Other animals like goats and sheep can be introduced in the area. Despite the fact that keeping animals like goats might be perceived as slow in multiplication rate but they are reported as potential IGA around reserves in Malawi (Anon 2012) and Nigeria (Akinsoji 2013).

Establishment of fruit and trees nurseries

This IGA is among the recommended potential IGA around forest reserves (Hasan 2009; Akinsoji 2013). Reports from Nigeria (Meludu 2004) showed that the activity can be taken together with other activities like bee keeping. Maledu (2012) further showed that those who participated in this kind of IGA had advantage of receiving the readily available services (advice and assistance) from Forest staff. Support on this is strongly needed as they contribute directly to households income as well as forest conservation through improved biodiversity within and around the reserves. Study from Uzungwa Scarp proposed Nature Reserve showed that IGA related to tree planting was the most socially beneficial (Sainsbury *et al.* 2015).

Butterfly farming

This is a very new IGA in the study area but common in coastal areas of Kenya

(Bird International 2008). It can easily be spilled over to other areas with suitable environment. Under proper management, butterfly farming was found to be alternative and progressive IGA with impact on the immediate surroundings around Amani Nature Reserve (Morgan-Brown 2003) and vital non-traditional IGA for export (Zanzibar Butterfly Centre undated). Compared with traditional farming methods which involves clearing and cutting of natural habitats, butterfly farming is dependent upon the native vegetation. At the lower level, a farmer must at least plant a number of local plants in and around the farm which will supply reliable food for the larvae.

Mushroom farming

The activity is common in many other areas and a potential IGA in raising households economies around forest reserves (Anon 2012). Mushroom farming looks a bit delicate to handle but it is one of the IGAs which supports and increases household purchasing power within a short time with remarkable returns. The hardest part of the activity is control of growth of other fungi among mushrooms which requires a bit of care and thorough knowledge. However, local communities can be trained to produce mushrooms within their range of production (Anon 2012). It is reported to be very successful around Arabuko-Sokoke Forest in Kenya (BirdLife International, 2008).

CONCLUSION AND RECOMMENDATIONS

Conclusions

This study has identified six potential IGAs which can make a big change in households' economies around RNFR if implemented. The existing six IGAs which operate at subsistence level can be improved. Establishment of new IGAs will improve households' economies the more. With the improvement of the existing IGAs and establishment of new IGAs in the study area will eventually lead to



reduced pressure on RNFR and therefore improved forest condition.

RECOMMENDATIONS

For ensured success, the following are recommended:-

- (i) Existing IGAs need be revived/improved before embarking on new ones.
- (ii) In order to secure household income, farmers should be encouraged to diversify IGAs.
- (iii) A strong monitoring system needs to be put in place.

ACKNOWLEDGEMENT

The authors are very grateful to Tanzania Forest Fund (TaFF) for funding the study which led to production of this paper. They are also indebted to the support provided by field officers and technicians from Kibaha Lowland Afforestation Research Centre and RNFR. Special acknowledgement goes to Ms Mwantumu Msilu for her participation in data collection and analysis.

REFERENCES

- Adusei, C. and Dunyah, J.Y. 2016. Forest Fringe Communities Participation in Forest Reserve Sustainability in Ghana. *Open Journal of Forestry*, 6,94-105.
- Akinsoji, A. 2013. Community - Based Forest Management In Buru, Taraba State, Nigeria. *Journal of Environment and Earth Science*, Vol. 3, No.12, 146-151.
- Anon 2012. Thuma Forest Reserve Project report on Income Generation Activities' assessment: iiiii': Salima, Lilongwe, Dowa and Dedza districts i, i, ii. 20pp.
- Anang, B.T., Akuriba, M.A. and Alerigesane, A.A. 2011. Charcoal production in Gushegu District,

Northern Region, Ghana: Lessons for sustainable forest management. *International Journal of Environmental Sciences*. Volume 1, No 7, 1944 - 1953.

BirdLife International 2008. Improved livelihoods at Arabuko-Sokoke Forest in Kenya. Presented as part of the BirdLife State of the world's birds website. <http://www.birdlife.org/datazone/sowb/casestudy/221>. Cited 31st October, 2013.

Bwalya, S.M. 2011. Household Dependence on Forest Income in Selected Rural Communities in Zambia, *Zambia Social Science Journal*, Vol. 2(1) 67 - 86.

Carletto, G., Davis, B., Stamoulis, K., Zezza, A., Covarrubias, K., Krausova M. and Winters P. 2007. Rural income generating activities in developing countries: re-assessing the evidence. *electronic Journal of Agricultural and Development Economics*, Vol. 4, No. 1; 146-193.

Dauson, K. 2011. Socio-economic factors affecting sustainable management of RuvuNorth Forest Reserve. Special project submitted for partial fulfillment of BSc. Eco-Tourism and Nature Conservation. Sebastian Kolowa University College of Tumaini University. 31pp.

Ezekiel, E., Chamshama, S.A.O., Ngaga, Y.M. and Mndolwa, M.A. 2014. Survival, growth and biomass production of *Moringa oleifera* provenances at Gairo inland plateau and Ruvu Coastal Region in Tanzania. *African Journal of Plant Sciences* Vol. 8(1), 54 - 64.

Fisher, M. 2004. Household Welfare and Forest Dependence in Southern



- Malawi, *Environment and Development Economics*, Vol. 9 (2), 135-154.
- Gumbo, D.J., Moombe, K.B., Kandulu, M.M., Kabwe, G., Ojanen, M., Ndhlovu, E. and Sunderland, T.C.H. (2013). Dynamics of the charcoal and indigenous timber trade in Zambia: A scoping study in Eastern, Northern and Northwestern provinces, CIFOR, 80pp.
- Hassan, M.B. (2009). Collaborative forest management and community livelihoods: A case of Budongo Forest Reserve, Uganda. A dissertation submitted to Makerere University in partial fulfillment for the award of Master of Science in Environment and natural resources, Kampala.
<http://makir.mak.ac.ug/handle/10570/3894> cited 04.04.2016.
- Karim, N.A. 2001. Jobs, Gender and Small Enterprises in Bangladesh: Factors Affecting Women Entrepreneurs in Small and Cottage Industries in Bangladesh, Working Paper No. 14, 107 pp.
- Kumar, De U. 2007. Livelihood, Dependence on Forest and Its Degradation: Evidence from Meghalaya. *Environment and Natural Resources Research*. Vol. 2, No. 3; 96 - 114.
- Lalika, M.C.S. and Machangu, J.S. 2007. Beekeeping for Income Generation and coastal forest conservation in Tanzania, *Bees for Development Journal* 88, pp. 4-6.
- Mamo, G., Sjaastad, E. and Vedeld, P. 2007. Economic dependence on forest resources: A case from Dendi District, Ethiopia. *Elsevier*, Vol. 9 Issue 8; 916-927.
- Mhinte, A.R. (2001). Analysis of Food Insecurity and Household coping strategies: The case study of Kilosa District. Dissertation for award of MSc. degree at Sokoine University of Agriculture, Morogoro, Tanzania. 122pp.
- Meludu N.T. 2004. Assessment of Income Generating Activities that influence sustainable livelihoods of forest communities in Nigeria: implications for policy enhancement in Nigeria *In: Baumgartner, David M.; ed. Proceedings of Human Dimensions of Family, Farm, and Community Forestry International Symposium, March 29 – April 1, 2004.* Washington State University, Pullman, WA, USA. Washington Pg 291-295.
- Morgan-Brown, T. 2003. Butterfly Farming in the East Usambara Mountains Findings to date from research covering the periods from November 2001 to October 2002 and from February 2003 to October 9, 2003. Research report Submitted to COSTECH.
- Msuya, T.S., Shilogile, E., Mndolwa, M.A., Sabas, E. 2003. Potentials of joint forest management embracing agroforestry in improving the livelihoods of communities adjacent to forest area: Observations from Ruvu Fuelwood Pilot Project, Tanzania. *Tanzania Forestry Research Institute (TAFORI) Newsletter* 3:32-39.
- Nepal, P. 2004. A Study of Livelihood Dependency and its Spatial Pattern in Three Villages in Bagamoyo District, Tanzania. Individual Final Assignment (IFA) Report submitted to the International Institute for Geo-information Science and Earth Observation in partial fulfillment of



- the requirements for the degree of Professional Master Degree in Geo-information Science and Earth Observation, Specialisation: Planning and Coordination in Natural Resources Management. International Institute for Geo-Information Science and Earth Observation Enschede, The Netherlands 31pp.
- Nduma, I., Kristjanson, P., McPeak, J. 2001. Diversity in income-generating activities for sedentarized pastoral women in northern Kenya. *Human Organization*. 60(4):319-325.
- Oisepamela, W.G. 2001. "Women Income generating activities in Burkina Faso as compared to the Kenyan Women." <http://profiles.uonbi.ac.ke/loisewambui/publications/women-income-generating-activities-burkina-faso-compared-kenyan-women>, cited 1st November, 2013.
- Peckham, J. 1993. "The Value of Indigenous Fruit-bearing Trees in Miombo Woodlands." RFDN Paper 15p.
- Sainsbury, K., Burgess, N.D., Sabuni, F., Howe, C., Puis, E., Killenga, R. and Milner-Gulland E.J. 2015. Exploring stakeholder perceptions of conservation outcomes from alternative income generating activities in Tanzanian villages adjacent to Eastern Arc Mountain forests. *Biological Conservation* 191; 20–28.
- Samoilys, M.A. and Kanyange, N.W. 2008. Natural resource dependence, livelihoods and development Perceptions from Tanga, Tanzania. IUCN Eastern and Southern Africa Regional Office, Tanga. 30pp.
- Seppälä, P. 1998. Diversification and Accumulation in Rural Tanzania: Anthropological Perspectives on Village Economics, Nordic Africa Institute, Political Science, 243pp.
- Sheheli, S. 2012. Improving Livelihood of Rural Women through Income Generating Activities in Bangladesh, Dissertation zur Erlangung des akademischen Grades doctor rerumagriculturarum, (Dr. rer. agr.), 233 pg.
- Stemler, S. 2001. An overview of content analysis. Practical Assessment, Research and Evaluation. [<http://PAREonline.net/getvn.asp?v=7&n=17>] site visited on 2/10/2014.
- URT 2001. Agricultural sector development strategy. Dar es Salaam. <http://www.kilimo.go.tz/publications/english%20docs/ASDP%20FINAL%2025%2005%2006%20%282%29.pdf>. Cited 05.04.2016.
- URT 2013. Population and Housing census 2012, National Bureau of Statistics Dar es Salaam and Office of Chief Government Statistician President's Office, Zanzibar 244 pp.
- Zanzibar Butterfly Centre. (undated). A live display of local butterflies supporting local community projects. <http://www.zanzibarbutterflies.com/>. Cited 20.06.2015.