Journal of Tropical Forest Research 4 (2) : 1-12 (2020)

Original article

Forest Resource Utilization and Rural Livelihoods: A Case of Mumbwa Game Management Area, Zambia

Peter Bunonge[1,2*] **Vipak Jintana[3]**

Surin Onprom[3]

[1]Sustainable Land Use and Natural Resources Management Program, Graduate School, Kasetsart University, Bangkok, 10900 THAILAND
[2]Ministry of Water, Sanitation and Environmental Protection, Provincial Administration Eastern Province, Chipata, ZAMBIA
[3]Faculty of Forestry, Kasetsart University, Bangkok, 10900 THAILAND
[*]Corresponding author, E-mail: peter.bu@ku.th

Received: Jul 3, 2020 Revised: Aug 27, 2020 Accepted: Sep 17, 2020

ABSTRACT

Forest resource utilization for livelihoods frequently conflicts with conservation, raising challenges of integrating rural livelihood issues into conservation agendas. This study aimed to investigate how unstable livelihoods in Mumbwa Game Management Area are affecting conservation awareness. Data were collected using face to face semi-structured questionnaire interviews with 175 households sampled in Mumbwa Game Management Area. The results indicate that effects of climate change on agriculture, which is the most important livelihood activity among households have forced households to adopt forest-based livelihoods. The drivers of forest resource utilization that were identified included income, food, culture, energy, construction and medicinal use. An interrelationship exists between livelihood strategies and conservation awareness. The study further showed that conservation programs often do not compromise local livelihoods even though most people do usually access required livelihood resources illegally. The challenge to conservation awareness is that even when residents are aware of practices which are detrimental to forest resource conservation (over-harvesting of forest resources) they still go ahead and harvest. Forest resource utilization has become an alternative primary livelihood activity as agriculture is affected by climate change. The study concludes that persistent low diversity in livelihood options intensifies utilization of forest resources by the households. This further, highlights the vulnerability of rural households as well as the need for viable alternatives in times when primary livelihoods are under stress. Findings can be used by policy makers as baseline information to improve community-based forest management activities.

Keywords: Rural livelihoods, Forest resource utilization, Conservation awareness, Mumbwa Game Management Area.

INTRODUCTION

About 1.6 billion people globally are substantially reliant on forests for livelihood sustenance. According to an estimation made by Cheng *et al*. (2019), 20% of the global population is dependent on forest resources to meet their essential livelihood needs. These people live within or adjacent to the forests and have relied on these wild and natural resources to meet their basic needs for survival and livelihoods for many generations (Bwalya, 2011; Chao, 2012; World Bank Group, 2002) Globally, empirical evidence has quantified and qualified the proportion of forest dependency from the entire household livelihood matrix. The seminal work by (Vedeld *et al*., 2007) drawing upon 51 case

studies across 17 developing countries revealed that the contribution of forests, mainly through forest income accounted for about 22% of the total household income. In North and South America, the contribution of forest income rangedbetween 14 and 20% of the total household income (Córdova et al., 2013; Uberhuaga et al., 2012). In Asia, forest income varied from 10 to 20% of the total household income (Mukul *et al*., 2016). While in Sub-Saharan Africa, forest income ranged from 30 to 45% of the total household income (Appiah *et al*., 2009; Kalaba *et al.*, 2013; Mamo *et al*., 2007). These studies demonstrated the significant contribution of forests towards household economies. (Chilalo and Wiersum, 2011).

Africa is said to have the highest percentage of people in the world that live on less than a dollar a day (Anderson *et al.*, 2006), and almost 60% of rural Africans live below the poverty datum line and in Sub-Saharan Africa, more than 90% of the poor reside in rural areas where poverty is particularly acute. In spite of the significant role of forests in livelihoods, human reliance on forest resources is a different facet (Ali *et al*., 2020). Further studies have indicated that rural households are vulnerable to a wide range of shocks and stresses which affect their livelihood assets and options (Debela *et al*., 2012; Scoones, 1998). Shocks are sudden events that have negative impacts on livelihoods while stresses are predictable events such as seasonal shortages that affect livelihoods (Chambers and Conway, 1992). To cope with these stresses and shocks, households use various strategies such as engaging in off-farm employment, or reducing the frequency and amount of consumption (Debela *et al.*, 2012; Dercon, 2002), while others increase extraction of forest resources for consumption especially among very poor households.

To address the negative impacts of the people-forest interaction, forest conservation has become an important course of action with the maintenance of diverse natural habitats through regulation of people's access to and utilization of forest products (Rao *et al*., 2002; Uhl and Vieira, 1989). Conservation proponents argue that formal forest conservation actions provide the best possible way to achieve resource sustainability (Wollenberg and Ingles, 1998). The response to the perceived threat to the world's natural resources, particularly forests and wildlife, was conservation. This involves the scientific planning and wise use of the resources to ensure that they are not depleted. Conservation therefore arose out of concern that the world would run out of its vital resources if wanton exploitation was not arrested. It became popular particularly in the first decade of the twentieth century (Hays, 1999). However, several challenges have emerged regarding the ways of creating a balance between forest conservation and utilization without compromising on ecological values, especially in developing countries (Cocks *et al.*, 2001; Otuoma and Odera, 2009).The challenge of reconciling forest livelihood and forest conservation in developing countries is daunting and largely unmet. Many forest-related activities that forest-dependent communities undertake as part of their survival strategies are illegal under current forest regulations (Colchester, 2006). Enforcement of forestry and conservation laws and regulations has the potential to negatively affect rural livelihoods. However, when regulatory control is particularly weak, protected areas can even exacerbate forest cover change by creating de facto open-access regimes (Wittemyer *et al.*, 2008). According to (Kowero, 2003) forests and forest sector in sub Saharan Africa face a number of difficulties: which include population increase thus growing demand for resources, decreased crop yield as a result of scarce and unreliable rainfall and long dry spells (climate change) thus looking for alternative livelihoods (Forest resources). Zambia is not left out as it is regarded as an area of biological significance as it is rich in plant diversity and is the center of endemism for *Brachystegia* tree species (Malaisse, 1978). However, the unstable livelihoods for communities in Mumbwa Game Management Area poses a serious threat to the quality and quantity of these plant diversities due to an increase in the extraction of these forest resources. Therefore, investigating the factors influencing forest dependency is very crucial to formulate effective policies for biodiversity

conservation (Ali *et al.*, 2020; Gunatilake, 1998).

The objectives of the study included the following; To understand the main determinants of unstable livelihoods in Mumbwa Game Management Area

- To understand the livelihood strategies adopted to stabilize livelihoods
- To understand how livelihood strategies affect conservation awareness in Mumbwa Game Management Area.

MATERIALS AND METHODS

Study area

The Mumbwa Game Management Area is located in Mumbwa District in Central Province of Zambia. It is one of the 9 Game Management Areas surrounding the Kafue National Park. It is bordered by the Kafue National Park in the North and West. The GMA lies between 25^0 45'0E, 27^0 00'.E, and 14^0 45'0S, 15^0 30; 0S (Figure 1). Mumbwa GMA lies about 190 kilometers west of Lusaka the Nation's capital (Chomba *et al.*, 2013). Relief and drainage comprise of an undulating land-scape with a general elevation of approximately 1,000 m above sea level broken only by a ridge of over 1,200 m in a South West-North East direction. The Nansenga and Nagoma Rivers dominate the drainage system. Mean annual rainfall ranges from 1,000 mm with mean annual rainy days of 80 except for the southern tip which has 70 days. The mean date for the onset of rains is 10th November and the mean date for retreat is 20th March. The evaporation rates reach the peak of 295 mm in October, falling to 115 mm in February. These figures may however, change in view of the threats of global warming and changing weather patterns.(Chomba, 2013) Miombo (Brachystegia) woodland is the major vegetation type in the Mumbwa Game Management Area. This is two-storeyed woodland with an open and semi-evergreen canopy of 10 – 20 m high. The predominant tree genera are *Brachystegia, Julbernadia* and *Isobelinia*. While the predominant grass species are *Themeda triandria, Hypharrhenia* spp. and *Heteropogon contortus.* This vegetation type is found in patches across the GMA but prominent in the central eastern and north western sections of the GMA. Termitaria Woodland-this type of vegetation is mainly associated with termite mounds. Common trees include *Acacia nigrescens, Tetradenia riparia, Garcinia livingstonei* and *Syzygium guineense.* This is commonly occurring in the eastern extreme of Mumbwa GMA and some few patches in distinctive areas. Baikiaea Forest-this vegetation is the smallest in the Mumbwa Game Management Area and is only located in the south west of Nansenga River near Tepula Wildlife Police Camp. Dominant tree species include *Baikiaea plurijuga* and *Pterocarpus lucerns.*

Target population

Mumbwa GMA has a population of over 18,000 people. The GMA has a total of 1,745 households (U.S. Census Bureau, 2012). The Mumbwa GMA has 3 chiefdoms namely; Chibuluma, Kabulwebulwe and Mulendema respectively. The number of households in each chiefdom is different. In Chibuluma chiefdom, there are 602 households. Kabulwebulwe has 543 households while Mulendema has 600 households. Each chiefdom has about 15 registered villages which have varied number of households.

Sample size

The sample size for this study was determined using Srisa-ad's method (Srisa-ad, 2002). The method states that if the target population is $\geq$ 100 then 15 to 30% can be sampled, also if the target population is $\geq$ 1,000 then 10 to 15% can be sampled and finally if the target population is $\geq$ 10,000 then 5 to 10% can be sampled. Therefore, since the target population was 1,745 households then 10% was decided on and eventually 175 households were sampled from the total number of households. Sampling was done using simple random sampling method.

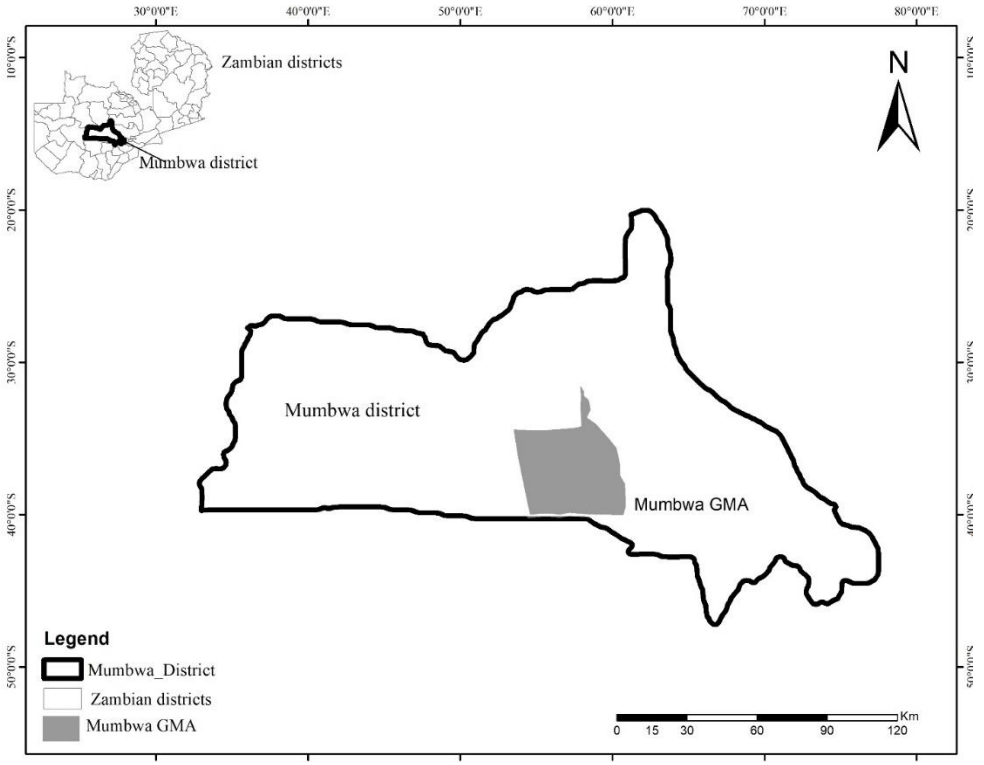

Figure 1 Location of Mumbwa GMA in Mumbwa district, Zambia.

Sampling procedure

From each chiefdom, 5 villages were sampled bringing the total to 15 villages considered for data collection. These villages were sampled using simple random sampling method. The sampling process was such that village names per chiefdom were written on small pieces of paper and placed in a small box. From which only 5 villages were sampled by picking one paper with village name at a time. This was repeated until all the 5 villages were picked per chiefdom. 10% of the total household population in each chiefdom was used to determine the number of households to interview. The next step was determining the number of households to interview per village. The number of households to interview per sampled village was determined by dividing the number of villages sampled in each chiefdom against the 10% value of the total number of households per respective chiefdom. Finally, the last step involved sampling the actual households to be interviewed per village. This was achieved by writing the names of all households in each village on placards and put in a small box from which household names for interview were drawn. Simple random sampling method was used in all the sampling cases. The limited time and resources for data collection made it a challenge to consider a greater number of villages in each chiefdom of the GMA.

Data collection

Primary data was collected through face to face semi-structured household interviews within communities in Mumbwa GMA. Secondary data was collected from various published and unpublished sources. Information was collected from existing literature to compliment and extend the research findings. Secondary data was also used to provide a wider understanding of current research within the context of my study, and helped in consolidating my research findings.

Data analysis

Completed questionnaires were pre-processed before analysis (cleaning), then coded to identify recurrent themes and responses, particularly for qualitative information. Basic demographic data were analyzed using statistical package for social

sciences software. The analyzed data were presented in tables showing the proportions such as percentages, frequencies and later interpreted and discussed. Quantitative data analysis was done using descriptive statistics (mainly frequencies and proportions such as percentages) were used for analysis. Conservation awareness was analyzed by rating the households' participation in conservation activities using a derived criteria. These include Criteria 1: type of agriculture practiced, Criteria 2; the frequency of participation in tree planting programs, Criteria 3; the membership to conservation groups and Criteria 4; households' perception of traditional conservation measures. The four criterias were analyzed by using excel to find the range, minimum and maximum scores to determine the level of awareness among the households. The maximum value for the scores among the 4 criterias was 12, minimum value was 4 and the range was 2.6667. Therefore, the levels of awareness were rated as follows: 1) Poorly aware- 4.00 - 6.67, 2) Moderately aware- 6.67 - 9.33 and 3) Strongly aware- 9.33 - 12.00.

RESULTS AND DISCUSSION

Results

Basic demographic characteristics

The gender in Mumbwa GMA is characterized by a high percentage of females. The females are represented by 56.00% while that of the males is represented by 44.00%. This potentially shows that many households are female headed since only household heads were targeted for interviews. The most dominant age group lies between 20-40 years representing 44.00%. The age group between 41-60 years was the second dominant representing 29.10%. The age group with more than 60 years followed representing 14.90% of the total sampled households. The least age group is that of people with less than 20 years representing 12.00%.

The education status of Mumbwa GMA stands at 31.40% for those who attained primary and junior high school respectively, 28.60% for those with secondary education and 8.60% for those who did colonial standards type of education. Household size is an important factor in forest management since decisions about patterns and extent of resource extraction from the forest are made at the household level (Sumati, 2006). The size of most households ranged between 6 and 10 members representing 59.40% of the total sampled households. Households with less than 6 members represented 30.30% of the total sampled households, and 3.40% represented households with more than 15 members.

Forest utilization and the degree of forest dependency are highly determined by the households distance to forests (Sapkota and Odén, 2008). The findings from Mumbwa GMA study shows that 57.70% of the sampled households live less than 2 kilometers from the forests. 23.40% of the respondents live between 2 and 4 kms and 18.90% of the sampled households live over 4 kilometers radius from the forest. Families living close to the forest have the advantage of less time required to reach a particular forest resource. Their links with forests are, therefore, expected to be high (Gunatilake, 1998).

Most important livelihood activity

When the households were queried about their most important livelihood activity in Mumbwa GMA, agriculture was overwhelmingly mentioned as shown in figure 2 below. Earlier studies such as (Wunder and Sunderlin, 2004) have shown that fertile forest land provides forest farming communities with important livelihood benefits through its conversion to agricultural land, either for shifting or (semi) permanent agricultural purposes. Indigenous forest farmers clear forest land to practice shifting cultivation, primarily for subsistence purposes.

This can be seen in Figure 2 above in which 75.43% households believe agriculture is their most important livelihood activity, 9.14% believe that firewood and charcoal is most important, 5.71% believe formal employment is the most important livelihood activity, 5.14% believe that timber trading is the most important livelihood activity and 4.57% believe that retail business is the most important livelihood activity. However, in spite of agriculture being the most important livelihood activity, climate change has affected households too. Earlier studies i.e. (Kotir, 2011) predicted that Zambia was most

likely to experience continued rising temperatures, but with a very minimal decline in precipitation. The rising temperature would lead to increased evaporation, and thus even if precipitation would remain the same, moisture stress, as a result of rising temperatures, would present a challenge for agricultural development in Zambia. Furthermore, there is evidence both from meteorological records and farmers' observation and experiences of highly variable and declining rainfall in Zambia (Mulenga *et al*., 2017). With high confidence, (IPCC, 2007) projected that climate variability and change would severely compromise agricultural production, food availability, access and utilization. The compromise of agriculture production due to climate variability and change has made household livelihoods in Mumbwa GMA to be unstable. When asked what their livelihood activities for survival were, 34.90% of the total sampled households stated that forest products were now their primary livelihood activity key for their survival. (Jumbe *et al.*, 2008)

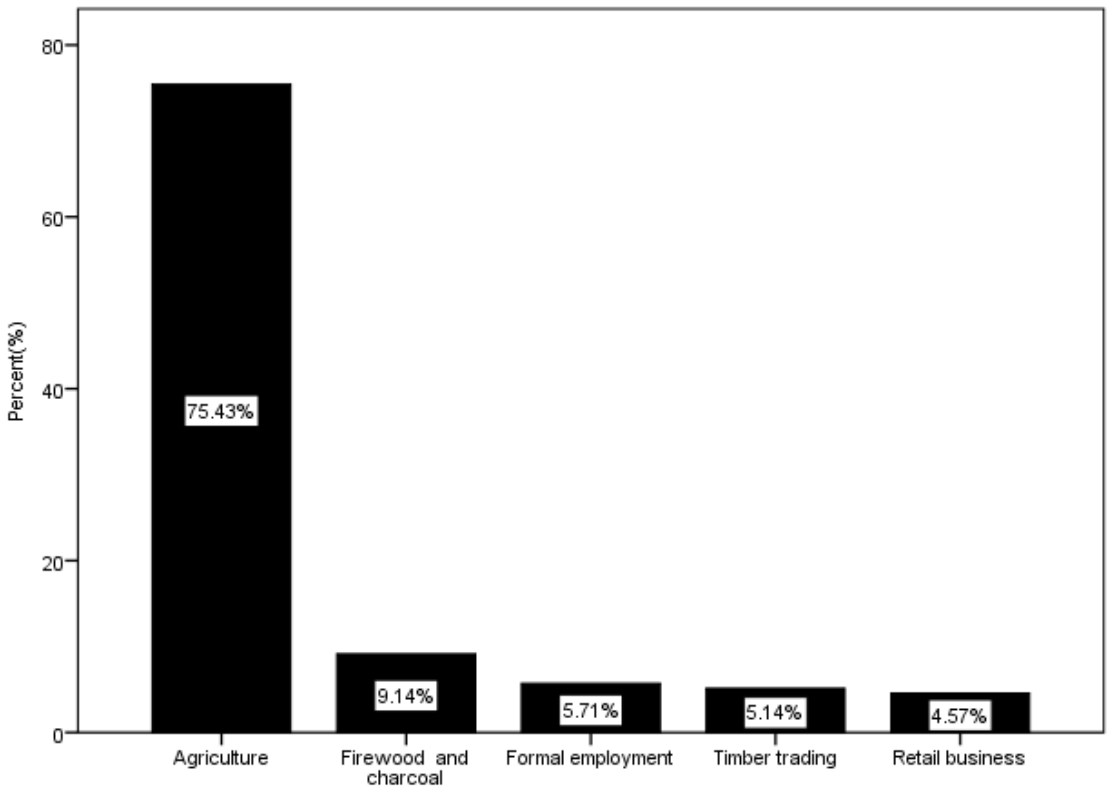

Figure 2 Percentage of most important livelihood among households in Mumbwa GMA.

Livelihood strategies

With agriculture production being compromised by climate change, households adopted other livelihood strategies such as on-farm, off-farm, forest-based and others combined the three strategies just in order to survive. The majority of households adopted forest based (34.90%) as it can be noted in Table 1 below. This strategy was characterized by use of products such as timber, firewood, charcoal, poles, medicinal herbs, wild fruits, wild vegetables, mushrooms and edible roots, 22.90% households adopted off-farm livelihood strategy for their survival. This livelihood strategy included activities such as retail businesses, temporal work, remittances, construction and formal employment, 21.70% households adopted the combination of three livelihood strategies and finally, 20.60% households adopted the on-farm based strategy for survival. Livelihood activities in this strategy include cropping, livestock raring and a mixture of cropping and livestock.

Table 1 Livelihood strategies adopted by households in Mumbwa GMA.

Strategies	Activities	Frequency (HH)	Percentage (%)
On-farm based	-Cropping only	15	8.58
	-Livestock only	7	4.01
	-Mixture	14	8.01
		36	**20.60**
0ff-farm based	-Formal employment	6	3.44
	-Retail businesses	12	6.87
	-Builders	7	4.00
	-Temporal employment	10	5.73
	-Remittances	5	2.86
		40	**22.90**
Forest based	-Firewood and charcoal	21	12.01
	-Timber	9	5.15
	-Poles	15	8.58
	-Grass	8	4.58
	-Other NTFPs (mushroom, edible roots, fruits, vegetables)	8	4.58
		61	**34.90**
Combination of the above		**38**	**21.70**
Total		**175**	**100.00**

Remark: HH =Households

Forest resources utilization

Special attention was given to the quantities of firewood used by the households annually. The measure of firewood use was a bundle (head load). The average weight for a bundle of firewood was around 24 kilogram of dry wood. In winter, a 24 kilogram firewood bundle would only last between 2-3 days while in hot season the same bundle would last between 5-6 days in a 6 member household. This however, translated into 80 bundles (1,920 kilogram) of firewood per year per household (Table 2). The nature of firewood collection ranges from picking dead fallen trees, felled standing dead trees and felled living trees and leaving them to dry for a given period of time.

Table 2 Quantities and monetary value of most used forestry products by households annually.

Forest Products	Number of households	Quantity per year	Unit of measurement	Unity price (ZMK)	Average value per year (mean±std)
Firewood	11	1,920	kg	15	24.97 ± 20.57
Charcoal	10	1,750	kg	30	31.75 ± 10.65
Timber	9	12	log	120	26.02 ± 13.42
Poles	15	120	pole	3.5	16.65 ± 14.14
Grass	8	45	bundle	10	9.32 ± 4.41
Other NTFPs (mushroom, edible roots, wild fruits, wild vegetables)	8	Never weighed	Small heap	Varies	6.77 ± 3.83

Remark: kg= Kilogram, ZMK=Zambian Kwacha

Interrelationship between conservation awareness and livelihood strategies

Table 3 shows that 54.80% of households who adopted forest based livelihood strategy had low conservation awareness. The table also shows that only 3.20% households with combined strategies had low conservation awareness. The table further shows that households which adopted forest based had the highest conservation awareness representing 32.70%. Meanwhile the majority of households which adopted the combined strategy were moderately aware with 29.40%.

Table 3 Cross tabulation of Livelihood strategies and conservation awareness.

Livelihood strategies	Level of resource conservation awareness expressed by households (%)			Total
	Low	Moderate	High	
On-farm based	4(12.90)	7(20.60)	25(22.70)	36(20.60)
Off-farm based	9(29.00)	9(26.50)	22(20.00)	40(22.90)
Forest based	17(54.80)	8(23.50)	36(32.70)	61(34.90)
Combination of the above three	1(3.20)	10(29.40)	27(24.50)	38(21.70)
Total	**31(100.00)**	**34(100.00)**	**110(100)**	**175(100.00)**

Discussions

Livelihood strategies adopted by households and the level of conservation awareness play an integral part in forest resource conservation. Forest based livelihood strategy was the highest adopted strategy accounting for 34.90% and involved the use of forest resource products for their survival. It was clearly noted from the high percentage rate of adoption that forest products were not only important for income purposes but a range of other uses. The common products used included timber (*Baikiaea plurijuga, Tectona grandis* and *Pterocarpus angolensis*), firewood, poles and charcoal frequently used species include (*Pericopsis angolensis, Julbernardia paniculata, Brachystegia boehmii* and *Brachystegia spiciformis),* grass (*Pennisetum purpureum, hypertheria disoluta)* and other NTFPs (edible roots from orchids i.e *Disa, Habenaria* and *Satyrium* genera, wild fruits (*Anisophyllea boehmii, Azanza garckeana, Uapaca kirkiana and Strychnos cocculoides),* Mushrooms *(Amanita zambiana, Termitomyces titaniscus, Lactarius tataniscus*). This livelihood strategy was the most adopted strategy in all the three chiefdoms. Among the products collected from the forests, it was noted that firewood was most prominent. It is a primary source of household energy and most of the respondents in this study considered firewood to be extremely important for their livelihoods. Firewood is used mainly for daily cooking, lighting as well as heating. The quantity of firewood consumed/used per household largely depended on household size and season of the year. Meanwhile, no trees are planted back to replenish those felled. This negatively affects conservation awareness.

However, conservation laws in Mumbwa GMA restricted households from accessing these forest resources making their livelihoods even more unstable. Another study conducted in three provinces of Zambia by (Jumbe *et al.*, 2008) concluded that dry forests do not appear to function as a means to poverty elimination, by themselves, but are crucial to poverty mitigation providing livelihood security to some of the poorest households. Furthermore, a study conducted by (Torri, 2011) in India reveals that recent conservation policies and the creation of protected areas in developing countries have often given rise to considerable conflict between governments, development institutions and local populations, and have led to the expulsion or marginalization of the populations living in these territories. In the wake of the creation of protected areas, local communities have frequently been subjected to evictions often with grave consequences to their identity and future development. Ultimately, the

lack of guaranteed access to resources in protected areas has become an impediment to a truly participatory approach at the community level (Torri, 2011). All these studies show that restrictions to accessing forest resources make livelihoods more unstable. The key issue is how to preserve the role of forests as safety nets in locations where other forms of social insurance cannot take place. Two interrelated problems need to be solved: lack of security of access to the woodlands for the poor, and issues related to unsustainable harvests.

Despite residents being aware of detrimental practices to conservation awareness, they have continued harvesting forest resources for utilization. This is because forests have become an alternative primary livelihood activity as agriculture fails. It can also be seen from results in the cross tabulation table that forest adopters had the highest percentage of people with low conservation awareness (54.80%). This high percentage of low conservation awareness among forest based adopters has serious negative impacts on the overall conservation of forest resources. However, results from the study indicates that the major causes of low conservation awareness includes but not limited to gender segregation, lower education levels, very low levels of access to employment opportunities and exposure to current affairs news. Many women, whose percentage is higher than that of men in Mumbwa GMA cannot read or write because of lower education levels. Women tend to be even more disadvantaged than men because of prevailing attitudes of lodges not wanting to hire women and there is lack of exposure of most people especially women to current affairs.

The combination based strategy had the highest (29.40%) moderate levels of conservation awareness among all the strategies possibly because of exposure to TV sets, radios, higher/moderate levels of education and formal employment. The higher/moderate education levels could have positive influence in household's understanding of conservation programs on TVs and radios. Off-farm livelihood strategy included livelihood activities outside on-farm and forest based livelihood strategies. This livelihood strategy accounted for 22.90% of the total sampled households and included activities like retail businesses, remittances, builders, formal employment and temporal employment for their survivor. The adopters of this strategy are more exposed to current affairs although a good number have low conservation awareness. Under on-farm livelihood strategy, 20.60% adopted this strategy and it was noted that some households are into cropping only (mainly maize and sorghum) others are into livestock raring only (cattle, goats and chickens) while others mix cropping and livestock rearing. Adopters of this strategy had relatively better awareness levels due to the many conservation programs that come under conservation agriculture.

CONCLUSION

The study concludes that persistent low diversity in livelihood options intensifies utilization of forest resources, highlighting the vulnerability of rural households as well as the need for viable alternatives in times when primary livelihoods are under stress. The study showed that conservation programs often do not compromise local livelihoods even though most people can usually access required livelihood resources. However, even when residents are aware of practices which are detrimental to forest resource conservation (over-harvesting) they still go ahead harvesting and utilizing forest resources because it has become an alternative primary livelihood activity as agriculture fails due to climate change. The study recommends the need to develop localized conservation programs because they help people to identify with conservation efforts. Adopting the Sufficiency Economy Philosophy being used by the Royal Thai Government is another route worth exploring to solve the challenge of forest conservation and the development of the rural communities. Sufficiency Economy Philosophy respects bottom-up solutions because they are almost always informed by local knowledge that understands local cultures and geographical conditions. More often than not, local wisdom is rooted in respect for nature. Bottom-up solutions based on local knowledge then tend to be practical and eco-friendly and in this case livelihoods will not affect conservation. People on the ground know best their problems, strengths, and constraints. When they have a say, they become active citizens, taking ownership of the efforts to solve the problems at hand.

ACKNOWLEDGEMENTS

Profound gratitude goes to Thailand International Corporation Agency (TICA) and Sustainable Land Use and Natural Resource Management (SLUSE) for providing the scholarship and technical support to Peter Bunonge for his Master's degree at Kasetsart University. Special thanks also go to the reviewers for their valued comments which helped to improve this manuscript.

REFERENCES

Ali, N., X. Hu and J. Hussain. 2020. The dependency of rural livelihood on forest resources in northern pakistan's chaprote valley. **Global Ecology and Conservation**. 22: 1-11. doi: 10.1016/j.gecco.2020.e01001.

Anderson, J., C. Benjamin, B. Campbell and D. Tiveau. 2006. Forests, poverty and equity in africa: New perspectives on policy and practice. **International Forestry Review**. 8 (1): 44-53.

Appiah, M., D. Blay, L. Damnyag, F. Dwomoh, A. Pappinen and O. Luukkanen. 2009. Dependence on forest resources and tropical deforestation in ghana. **Environ. Dev. Sustain.** 11 (3): 471-487.

Bwalya, S. 2011. Household dependence on forest income in selected rural communities in zambia. **Zambia Social Science Journal**. 2 (1): 67-86.

Chambers, R. and G.R. Conway. 1992. Sustainable rural livelihoods: Practical concepts for the 21st century. Institute of development studies (uk). **Discussion paper 296.** Brighton: IDS.

Chao, S. 2012. **Forest peoples: Numbers across the world**. Forest Peoples Programme, Moreton-in-Marsh. E-book.

Cheng, S.H., K. MacLeod, S. Ahlroth, S. Onder, E. Perge, P. Shyamsundar, P. Rana, R. Garside, P. Kristjanson and M.C. McKinnon. 2019. A systematic map of evidence on the contribution of forests to poverty alleviation. **Environmental Evidence**. 8 (1): 3.

Chilalo, M. and K.F. Wiersum. 2011. The role of non-timber forest products for livelihood diversification in southwest ethiopia. **Ethiopian e-Journal for Research and Innovation Foresight**. 3 (1): 44-59.

Chomba, C. 2013. Factors affecting the Luangwa (Zambia) hippo population dynamics within its carrying capacity band insights for better management. **International Journal of Biodiversity and Conservation**. 5 (3):109-121.

Chomba, C., V. Nyirenda and M. Silengo. 2013. Selective use patterns of woody plant species by local communities in mumbwa game management area: A prerequisite for effective management of woodland resources and benefit sharing. **Open Journal of Ecology**. 3 (8): 532-550.

Cocks, M., A. Dold and I. Grundy. 2001. Challenges facing a community structure to implement cbnrm in the eastern cape, south africa. **African Studies Quarterly**. 5 (3): 57-71.

Colchester, M. 2006. **Justice in the forest: Rural livelihoods and forest law enforcement**. Bogor: Center for International Forestry Research.

Córdova, J.P.P., S. Wunder, C. Smith-Hall and J. Börner. 2013. Rural income and forest reliance in highland guatemala. **Environmental Management**. 51 (5): 1034-1043.

Debela, B., G. Shively, A. Angelsen and M. Wik. 2012. Economic shocks, diversification, and forest use in uganda. **Land Economics**. 88 (1): 139-154.

Dercon, S. 2002. Income risk, coping strategies, and safety nets. **The World Bank Research Observer**. 17 (2):141-166.

Gunatilake, H.M. 1998. The role of rural development in protecting tropical rainforests: Evidence from Sri Lanka. **Journal of Environmental Management**. 53 (3): 273-292.

Hays, S.P. 1999. **Conservation and the gospel of efficiency: The progressive conservation movement, 1890–1920**. Pittsburgh: University of Pittsburgh Press.

IPCC. 2007. **Climate change 2007: Impacts, adaptation and vulnerability**. New York: Cambridge University Press. E-book.

Jumbe, C.B.L., S.M. Bwalya and M. Husselman. 2008. Annex 1: Contribution of Dry Forests to Rural Livelihoods and the National Economy in Zambia. *In*: **Managing the Miombo Woodlands of Southern Africa**. Sustainable Development Department Environment and Natural Resources management Unit Africa Region, World Bank, pp. 1-27.

Kalaba, F.K., C.H. Quinn and A.J. Dougill. 2013. The role of forest provisioning ecosystem services in coping with household stresses and shocks in miombo woodlands, zambia. **Ecosystem Services**. 5: 143-148.

Kotir, J.H. 2011. Climate change and variability in Sub- Saharan Africa : a review of current and future trends and impacts on agriculture and food security. **Environ. Dev. Sustain.** 13: 587-605.

Kowero, G. 2003. The challenge to natural forest management in Sub-Saharan Africa rural development: Experiences from the miombo woodlands of Southern Africa. *In*: Kowero, G., B.M. Campbell and U.R. Sumaila (eds.). **Policies and Governance Structures in Woodlands of Southern Africa.** Centre for International Forestry Research, Bogor, pp. 1-8.

Malaisse, F. 1978. The Miombo ecosystem. *In*: **Tropical Forest Ecosystems: A State-of-Knowledge Report**. Unesco/UNEP/FAO, Paris. pp. 589-606.

Mamo, G., E. Sjaastad, P. Vedeld. 2007. Economic dependence on forest resources: A case from dendi district, ethiopia. **Forest Policy and Economics**. 9 (8): 916-927.

Mukul, S.A., A.M. Rashid, M.B. Uddin and N.A. Khan. 2016. Role of non-timber forest products in sustaining forest-based livelihoods and rural households' resilience capacity in and around protected area: A bangladesh study. **Journal of Environmental Planning and Management**. 59 (4): 628-642.

Mulenga, B.P., A. Wineman and N.J. Sitko. 2017. Climate trends and farmers' perceptions of climate change in zambia. **Environmental Management**. 59 (2):291-306.

Otuoma, J. and J. Odera. 2009. **Reconciling conservation and livelihood needs in got ramogi forest**. Kenya Forestry Research Institute; Nairobi.

Rao, M., A. Rabinowitz, S.T. Khaing. 2002. Status review of the protected-area system in myanmar, with recommendations for conservation planning. **Conservation Biology**. 16 (2): 360-368.

Sapkota, I.P. and P.C. Odén. 2008. Household characteristics and dependency on

community forests in terai of Nepal. **International Journal of Social Forestry**. 1 (2): 123-144.

Scoones, I. 1998. Sustainable rural livelihoods: A framework for analysis. **IDS Working Paper 72**. Brighton: IDS.

Srisa-ad, B. 2002. The introduction to research. 7th. Bangkok: Suviriyasarn Publishing.

Sumati, V. 2006. **Examining the socio-economic drivers of fuel-wood dependence in villages on the northern boundary of bandipur national park -m.Sc thesis**. M.Sc. thesis, National Centre for Biological Sciences. Bangalore, India.

Torri, M.C. 2011. Conservation, relocation and the social consequences of conservation policies in protected areas: Case study of the sariska tiger reserve, india. **Conservation and Society**. 9 (1):54-64.

Uberhuaga, P., C. Smith-Hall and F. Helles. 2012. Forest income and dependency in lowland Bolivia. **Environment, Development and Sustainability**. 14: 3-23.

Uhl, C., and I.C.G. Vieira. 1989. Ecological impacts of selective logging in the brazilian amazon: A case study from the paragominas region of the state of pará. **Biotropica**. 21 (2): 98-106.

Vedeld, P., A. Angelsen, J. Bojö, E. Sjaastad and G.K. Berg. 2007. Forest environmental incomes and the rural poor. **Forest Policy and Economics**. 9 (7): 869-879.

Wittemyer, G., P. Elsen, W.T. Bean, A.C.O. Burton and J.S. Brashares. 2008. Accelerated human population growth at protected area edges. **Science**. 321 (5885):123-126.

Wollenberg, E. and A.S. Nawir. 1998. Chapter 8: Estimating the incomes of people who depend on forests. *In*: Wollenberg, E. and A. Ingles (eds.). **Incomes from the Forest: Methods for the Development and Conservation of Forest Products for Local Communities**. Center for International Forestry Research, Bogor, pp. 157-187..

World Bank Group. 2002. **A revised forest strategy for the world bank group.** World Bank Group.

Wunder, S.and W.D. Sunderlin. 2004. Oil, macroeconomics, and forests: Assessing the linkages. Washington, D.C. : World Bank Group.

U.S. Census Bureau. 2012. **Z2010 Census of population and housing : Summary population and housing characteristics.** Wachington, DC: U.S. Government Pringing Office.