PERCEIVED EFFECTS OF DEFORESTATION ON LIVELIHOOD PATTERNS OF COMMUNITIES IN MICHIKA LOCAL GOVERNMENT AREA OF ADAMAWA STATE, NIGERIA

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(M.Tech/Zoo/17/0582)

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By

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A Thesis Submitted to the Department of Zoology, School of Life Sciences, Modibbo Adama University of Technology, Yola in Partial Fulfillment of the Requirements for the Award of M.Tech Degree In Ecology and Environmental Biology

FEBRUARY, 2020

DECLARATION

I hereby declare that this thesis was written by me and it is a record of my own research work. It has not been presented before in any form for high degree. All references cited have been duly acknowledged.

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TARI, Malime Nganduna Date

DEDICATION

This work is dedicated with love to my father Mr Tari Guna and my mother Mrs. Kwarmba Tari Guna, my dear wife Mrs. Ruth T. Malime and my lovely children.

APPROVAL PAGE

This project report has been read and approved as having met the requirement for the award of Master Degree in Ecology and Environmental Biology in Modibbo Adama University of Technology Yola.

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ABSTRACT

This study assess the perceived effects of deforestation on livelihood patterns of the communities in Michika Local Government Area of Adamawa State, Nigeria. The specific objectives of the study were to identify the causes of deforestation in Michika Local Government, sources of livelihood for communities, effects of deforestation on the livelihood patterns and to assess how the people have been adapting to the perceived effects of deforestation in the study area. The study made use of well-structured Questionnaire (Open-ended and close-ended) administered to One hundred and fourty (140) residents covering 8 districts in Michika Local Government Area. The data was analyzed using descriptive statistics (frequency and simple percentage) .The study revealed that, the major causes of deforestation in the study communities are farming practices such as slash and burn. Though some respondents indicated that, lumbering, charcoal production and fuel wood gathering are rampant in their communities. Aside farming, the study revealed that, the other sources of livelihood in the study area are livestock rearing, trading and hunting among others. The study showed that deforestation has affected crop production in the areas of delayed commencement of planting seasons, pests and diseases infestation, level and quality of crop yields and reduction in the income levels of farmers. The study indicated that, application of fertilizer, rearing of livestock, fish pond and trading among others have been adapted by the respondents against the effects of deforestation in the study area. The study recommended among other things , afforestation programmes, policy formulation and implementation, legal reforms in aspect of environmental conservation, strengthening of the public Institution stakeholders and promotion of active research that will ensure a decline in deforestation.

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LIST OFACRONYMS

CIFOR	Center for International Forestry Research
FAO	Food and Agricultural Organization
ITTO	International Tropical Timber Organization
NPC	National Population Commission
UNECA	United Nations Economic Commissions for Africa
NGOs	Non Governmental Organizations
NTFPs	Non Timber Forest Products
SPSS	Statistical Package for Social Sciences
WDI	World Development Indicator

CHAPTER ONE

INTRODUCTION

1.2 Background of the Study

Defining what constitutes a forest is not easy as forest types differ widely. It should also be kept in mind that, different definitions are required for different purposes and at different scales. A basic definition of a forest is that, it's an ecosystem or assemblage of ecosystems dominated by trees and other woody vegetation. The Food and Agriculture Organization (FAO, 2010). However, provides a more comprehensive definition of the term. According to FAO (2010), a forest is a land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds situated naturally and uninterrupted.

The importance of forest in the life of any nation cannot be over-emphasized. In technologically advanced nations where iron and steel compete with wood for supremacy, comparatively wood has the largest users (Etukudo and Udofia, 2014). Tropical rainforests are the world's most important repository of biological diversity, and they are regarded as "the lungs of the planet. Tropical rainforest are a natural reservoir of genetic diversity which offers a rich source of medicinal plants, high-yield foods and a myriad of other useful products (Panayotou and Ashton, 2009). They are an important habitat for migratory animals and sustain as much as 50 percent of the species on earth, as well as a number of diverse and unique indigenous cultures. They also play an elemental role in regulating global weather in addition to maintaining regular rainfall, while buffering against floods, droughts, and erosion (Taylor, 2005). They store vast quantities of carbon while producing a significant amount of the world's oxygen. The important ecological functions of tropical rainforest provide numerous goods and services that contribute significantly to human well-being at local, national, and global levels (Amisah and Gyampoh, 2009).

The causes of the continuous forest loss are multi-dimensional and they include both internal and external factors. The internal factors include; unsustainable agriculture, conversion to agriculture, wildfires, firewood collection and charcoal production, mining, population pressure, poorly defined land and resource tenure. On the other hand, the external factors include; market failure, international trade, and the imposition of economic programs such as the structural Adjustment program (Appiah *et al.,* 2009).

Deforestation can be defined as the removal or damage of vegetation in the forest to the extent that it no more supports its natural flora and fauna. In other words, deforestation is the transformation of forest land to non-forest land (Karkee, 2004).

1.2 Statement of the Problem.

In most African countries the state of deforestation has increased over the past four decades, with significant effects on rainfall, temperature, water resources, wildfire frequency, agriculture and livelihoods (Amisah, 2009). In less developed countries, particularly those in Africa, livelihood insecurity remains a major problem (Shepherd, 2005). Forest dependent communities in these countries, rely heavily on their farmlands. Many forest dependent people employ a diversity of means to help meet basic needs: food and cash crop production, forest and tree product gathering and income-earning enterprises both on and off the farm. Often, the poorer the household, the more diverse the sources of their livelihood, as the needs for the year must be made up from various off-farm as well as on-farm natural resources, and often from migrant laboring as well (Shepherd *et al.*, 2005).

This frightening spate of forest degradation potentially poses enormous adverse effects on forest reserves. These communities exert excessive pressure on forest reserves as many of those living in such communities have their livelihoods predicated on the availability, access and utilization of forest products (Appiah, 2009). The concomitant repercussions associated with this forest degradation include exposing such degraded communities as well as their farmlands to high risk of erosions and floods. Additionally, forest degradation risks the quality of life in forest communities and beyond, militates against the stability of climate and local weather, threaten the existence of other species and undermine the valuable services provided by biological diversity. Ultimately, these effects affect the livelihoods of communities in Michika.

An important location in Michika where communities have suffered considerable setbacks in their livelihoods due to forest cover (deforestation) are Vamma Ghumchi, Garta District, Medzi and Bazza Districts. The forest loss has occurred as a result of farming practices and other land use activities. Communities in the area are characterized by high poverty levels and rely on rain-fed agriculture with little or no access to modern agricultural technology (Blay *et al.*, 2008).

The implication of this is the importance and necessity for adequate care of the forest through appropriate planning and management as to the utilization of the forest resources. The reasons being that, these forest resources are in a web within a system and any disturbance of one element will dislodge the equilibrium. Besides the imbalances created in the forests' ecosystem, the depletion of the forest cover poses significant repercussions on the livelihood of people, particularly those in forest communities who depend heavily on the forest and its resources. It is in this vein that this study was conducted to assess the perceived effect of deforestation on livelihood patterns of communities in Michika Local Government.

1.3 Research questions

Based on the afore-stated problem, the study provided answers to the following questions:

i. What are the causes of deforestation in Michika Local Government?
ii. Are there sources of livelihood for communities in Michika Local Government?
iii. Do deforestation affects the livelihood patterns in the study area?
iv. Are the people adapting to the perceived effects of deforestation in the study area?

1.4 Research Objectives

The overarching purpose of this research was to assess the perceived effects of deforestation on the livelihood patterns of the communities in Michika Local Government. In line with that, specific objectives have been set to help realize this ultimate purpose. The specific objectives of the study were:

i. To identify the causes of deforestation in Michika Local Government Area.
ii. To identify the sources of livelihood for communities in Michika Local Government.
iii. To examine the perceived effects of deforestation on the livelihood patterns in the study area.
iv. To assess how the people have been adapting to the perceived effects of deforestation in the study area.

1.5 Justification

Research is advanced in trying to understand the alternative livelihoods of communities. This work will go a long way to add to knowledge about the social and economic impacts of forest on the surrounding communities in Michika Local

Government. The study will not only achieve its purpose but will also open up other avenues for further research to be done to add to the body of literature that exist on forestry and livelihoods as well as the impacts which forests have on communities that surrounds these areas in question.

The research is worth undertaking considering the frightening spate at which the study area is losing its forest cover. It is obvious that the wave of deforestation is now knocking at the doors of existing forest and exerting maximum pressure on the regulatory processes of forest. The study will provide some useful reasons why we should preserve our forests beside sustainability reasons.

1.6 Significant of the Study

Deforestation activity is one major environmental problem that has bedeviled the world, especially in the developing nations. Findings from this research will bring awareness on vegetation resources importance to all particularly forest dependent communities. The study will aid decision making and policy formulation. Also, the study will serve as baseline for further studies since there are few on this topic in the study area.

1.7 Scope of the Study

The scope of the study covers the eight districts in Michika Local Government Area namely; Garta, Futu, Moda, Nkafa,Vi/Bokka, Madzi, Bazza, and Zah district.

CHAPTER TWO

LITERATURE REVIEW

2.1 Deforestation

According to Naoto (2006), between 1990 and 2000 Africa had the highest rate of deforestation of about 0.8 percent, followed by Latin America with 0.4 percent, and 0.1 percent in Asia. Hence, the over-reliance on forest resources and non-timber forest products (NTFPs) has accounted for the huge change in forest cover and that; deforestation in Africa is estimated at around 3.4 million hectares per year (CIFOR, 2005; FAO, 2010).

According to FAO (2000), tropical forest covers 814 million ha, of which 110 million ha is located in Africa, 168 million ha in Asia and the Pacific, and 536 million ha in Latin America. However, only 25 million ha are exploited in a sustainable way and 11 million ha of tropical forests are conserved with an effective political protection. All the tropical humid forests in Africa suffer from a massive deforestation (Soury, 2007). Loss of biodiversity of tropical forests is mainly due to degradation and destruction of habitat by anthropogenic activities. Currently, it is a global problem (Sukumaran and Jeeva, 2008) because the annual rate of global deforestation is about 13 million hectares, most of which occurs in the developing world. Forest loss in Africa is particularly troubling, however, two-thirds of the continent's population depends on forest resources for income and food and 90% of Africans use fuel wood and charcoal as sources of energy. However, most of these species have been vulnerable to different factors that led to the devastation of natural forest resources and diminishing of the forest cover.

According to Global Forests Resources Assessment, 2011, there was a 25.3 percent (135, 000 ha) loss of forest annually from 1990-2000 in Uganda (FAO, 2011). In the Eastern Region the 21,870 ha of West Bugwe, Igwe-Luvunya and South Busoga CFR are the only natural forests remaining in the whole region. These have now been degraded by encroachment.

As a result of the high outbreak of deforestation, a lot of indigenous tree species like, *Milicia excelsa* and *Milicia regia, the mahoganies (Khaya and Entandrophragma species), Pericopsis elata, Nauclea diderrichii, and Triplochitonscleroxylon* which generate substantial revenues for Uganda's economy have drastically reduced over the past decades (Benhin and Barbier, 2003).

The Food and Agriculture Organization (2010) report indicated considerable deforestation in the world during 1990-2010 but this was almost entirely confined to tropical regions. Deforestation occurred at the rate of 9.2 million hectares per annum from 1980-1990, 16 million hectares per annum from 1990-2000 and decreased to 13 million hectares per annum from 2000-2010. The net change in forest area during the last decade was estimated at 5.2 million hectares per year, the loss area equivalent to the size of Costa Rica or 140 km2 of forest per day, was however lesser than that reported during 1990-2000 which was 8.3 million hectares per year equivalent to a loss of 0.20 per cent of the remaining forest area each year. The current annual net loss is 37 per cent lower than that in the 1990s and equals a loss of 0.13 per cent of the remaining forest area each year during this period. By contrast some smaller countries have very high losses per year and they are in risk of virtually losing all their forests within the next decade if current rates of deforestation are maintained.

Annually, the rate of global deforestation is around 13 million hectares, most of which occurs in the developing world (CIFOR, 2005; FAO, 2010). According to Bisahw (2003), the increasing population of Nigeria has resulted in excessive forest clearing for agricultural use, overgrazing and exploitation of the existing forests for fuel wood, fodder and construction materials. Deforestation has many far-reaching consequences. The environmental functions and services of the forest ecosystem are reduced or even lost depending on the level of deforestation. Asfaw(2003), describes deforestation as continued land clearing for agriculture due to an exploitive farming system, tree cutting for fuel, logging due to population growth accompanied by stagnating agricultural production, a lack of alternative energy and a lack of security of tenure which precludes long-term land improvement measures. Studies conducted by different researchers indicate that deforestation has already reached alarming proportions. The situation has been exacerbated by the rising demand for wood and the benefits it provides. Consumption of wood for fuel occurs not only in rural areas, but also in urban areas. Area attributed to deforestation stands at 150, 000 to 200,000 hectares per year (Haile *et al*., 2006).

2.1.1 Effects of Deforestation on Livelihoods

A study conducted by Appiah *et al.* (2009) in tree forest districts, suggests that income from forest products contribute about 38 per cent more household income than any other income-generating activity. Throughout the 1990s, World Bank figures estimate the

rate of deforestation worldwide as between 15 to 17 million hectares per year. (World Bank Forest Strategy).

According to the International Tropical Timber Organization (ITTO, 2005), the annual rate of deforestation in Ghana is around 65,000 hectares and the Country's substations forest cover could completely disappear in 25 years. This stark prediction underlies the fact that deforestation is not only a serious national policy challenge at present, but has been a chronic problem facing a number of past governments that have failed to implement a viable national mitigation plan. Between 1990 and 2005, for example, Ghana lost about 1,931,000 hectares of forest, equivalent to 26 per cent of total tree cover (Amisah, 2009). The WDI 2002 looks at deforestation as the major causes of losses in biodiversity and habitat. It reports that worldwide, nearly 34,000 plant species, 21.5% of the total, are threatened with extinction.

Deforestation is a serious problem that affect land productivity and threatened the livelihoods since the 1980s and its negative impact on rural livelihood have been aggravated by deforestation. Additionally, as noted by Claus (2006), deforestation impacts economic activity and threatens the livelihood and cultural integrity of forest dependent people at local level. Annual net loss for 2000-2010 AD were Togo (-5.1 per cent), Nigeria (-3.7 per cent), Mauritania (-2.7 per cent) and Uganda (-2.6 per cent). The area of other wooded land globally decrease by about 3.1 million hectares per year during 1990-2000AD and by about 1.9 million hectares per year during the last decade (Anon, 2010).

Angelsen and Balcher (2005) report that the disappearance of natural forests in developing countries is a major problem because it negatively affects the livelihoods of people dependent on forest products and services. However, deforestation and land degradation are rapidly becoming the most serious problems in rural areas where the majority of the population live and depend on the forest products for energy (Tumbe, and Husselman, 2005).

Forest loss in Africa is particularly troubling, and this is due to the fact that; two-thirds of the continent's population depends on forest resources for income and food supplementation and 90 percent of Africans use fuel wood and charcoal as sources of energy (FAO, 2010). Hence, the over-reliance on forest resources and non-timber forest products (NTFPs) has accounted for the huge change in forest cover and that; deforestation

in Africa is estimated at around 3.4 million hectares per year "Center for International Forestry Research" [CIFOR] (CIFOR, 2005; FAO, 2010).

According to Naoto (2006), between 1990 and 2000 Africa had the highest rate of deforestation of about 0.8 percent, followed by Latin America with 0.4 percent, and 0.1 percent in Asia. Some scholars associated the deforestation rate in Africa to their sluggish economic growth. However, the significance of deforestation to Africa has led to a number of recommendations on how to reduce the rate of deforestation on the continent. Poverty on the African Continent has led to continued loss of tree cover. According to the United Nations Economic Commission for Africa (Henceforth referred to as UNECA), the proportion of land covered by forests in Sub-Saharan.

Deforestation reduces biological diversity, increases soil erosion and the siltation of rivers and streams can endanger hydroelectric schemed (Karkee, 2004). Deforestation depletes the natural resource of poor rural households who rely on wild fruits, vegetables, bush meat, medicinal plants, wood for fuel, and timber. Illegal forestry activities also negatively impact environmental services. Vital to rural households such as the provision of clean water, pest and disease control, pollution and regulation of the climate, stream flow, and ground water levels (Wunder, 2005).

Profits from deforestation vary from less than a dollar to thousand dollars per hectare depending on location, technologies and land use systems (Chomitz *et al*.,2007). It is also argued by the workers that richer farmers were better able to finance deforestation while a poor farmer can't afford to clear much forest. Conversely, through transfers, stronger credit markets and better opportunities for off-season employment can increase income as well as deforestation by small land holders.

Deforestation affects wind flows, water vapour flows and absorption of solar energy thus clearly influencing local and global climate (Chomitz *et al.*, 2007). Deforestation on lowland plains moves cloud formation and rainfall to higher elevations (Lawton *et al.,* 2001). Deforestation disrupts normal weather
patterns creating hotter and drier weather thus increasing drought and desertification, crop failures, melting of the polar ice caps, coastal flooding and displacement of major vegetation regimes.

2.1.2 Causes of Deforestation

In Nigeria, the major causes of deforestation are the result of a number of economic activities: legal and illicit logging, clearing trees to increase arable land, fuel wood extraction and mining. These causes are differentiated across the various forest zones in the country, however in the south, timber exploitation and mining and agriculture expansion have been identified as predominant causes (Boafo and Barbier, 2012), while in the north, unsustainable charcoal and firewood production, forest fires and agriculture expansion are the major causes (Agyeman *et al.*, 2012). Without realistic mitigation policies and coordination on a national level, these activities and their deforestation consequences are likely to continue and even increase as Nigeria's growing population demands more forest products and land area for settlements, construction, energy and food (Amisah, 2009).

Gebremarkos and Deribe (2005) pointed out that, lack of proper forest management and utilization, land tenure policy, lack of compatible forest proclamation and other legislations, and extensions of cultivation to marginal lands were indicated as major causes of deforestation. According to Demel, (2003), the underlying causes of deforestation are, closely linked with the vicious cycle of mutually reinforcing factors that means poverty, population growth, poor economic growth and the state of the environment. With regard to the effects of deforestation, Legesse (2003) argued that the decimation of natural forests results in the loss of a large number of forest products, drought, flooding, interrupts water flow, declines in land productivity and exacerbates misery and poverty of the rural people. Moreover, as illustrated in Ermias (2003), in Amhara regions alone, about 2 to 3.5 billion tons of fertile top soil is washed away per annum and deposited into rivers. Demel *et al.*, (2003) argued that the reduction of vegetation cover and the associated negative impact on land, threaten ecosystems, flora and fauna by depleting genetic resources as well as loss in biodiversity. Considering the longitudinal profile of deforestation in Ethiopia, it should be clear at the outset that there have been no reliable records on the extents of the country's forest prior to recent times (Yigremew, 2001). However many authors, based on existing indigenous remnant forests available in portions of the country and ecological settings, have tried to reconstruct the forest cover in remote and recent pasts. The various estimate made by different authors show that once in the remote past, about 30-48% of the country and as much as 87% of the highlands, were covered by forests vegetation (Yigremew, 2001). Towards the beginning of the 1900s, however, the forest cover of the country was

estimated at 40% of the area of Ethiopia. Depletion of forests had been 6-20% in 1950-1960, and had accelerated since the late 1960 and early 1970, the rate in this period, was estimated in the range of 2-6%. The acceleration of forest degradation in this particular period, according to Edessa (1993), was due to changes in climate of the country.

Millions of people live on the tropical forest with less than a dollar a day where a third of a billion are estimated to be foreign settlers. However, as the land degrades people are forced to migrate, exploring new forest frontiers increasing deforestation (Wilkie *et al*., 2000; Amor, 2008; Amor and Pfaff, 2008). Deforestation is proxied by the expansion of agricultural land.

This is because agricultural land expansion is generally viewed as the main source of deforestation contributing around 60 per cent of total tropical deforestation. Shifting agriculture also called slash and burn agriculture is the clearing of forested land for raising or growing the crops until the soil is exhausted of nutrients and/or the site is overtaken by weeds and then moving on to clear more forest. It is been often reported as the main agent of deforestation.

2.2 Livelihoods of Forest Communities

Livelihood is defined as adequate stocks and flows of food and cash to meet basic needs.Bakele (2001), maintains that the energy sector remains heavily dependent on wood for fuel. Wood provides 78 % of the energy required, while dung and crop residues provide 16%. Land cultivation is the main livelihood of the farming community members that constitute 85% of the Ethiopian population (World Food Program, 2005). The concept of "livelihoods" has gained scholarly attention in the past three decades. It has been found by many to be a people centred concept that aims at addressing poverty related issues (Kaag, 2002).

Many livelihood are predetermined by where one is born, gender or through socialization. It could also be improvised or acquired by choice. An example of livelihood determined by the social status derived from the circumstances into which somebody is born is the caste system. For instance, being born into a or a particular ethnic group where specific roles are assigned. A person may also be born, socialized and apprenticed into an inherited livelihood for example as a carpenter, farmer or cooked food vendor. Some people also improvises livelihood with degrees of desperation with what they do being largely determined by the social, economic and ecological environment in which they find themselves.

Most forest communities are rural in nature and that, the rural economy is primarily agricultural although some trading, small-scale production and food processing, collection and processing of non-timber forest products (NTFPs) and services take place in the community (Abane*et al.*,2016). Some of the dominant livelihood activities include farming (crop production and animal rearing.), gathering, hunting, trading and fishing. Among these livelihood activities, crop production and animal rearing are the most common source of livelihoods for most rural dwellers. Gathering is a seasonal livelihood activity since most of the items collected do not appear throughout the year. These products are usually gathered in the forest and are called Non Timber Forest Products (NTFPs). Examples include canes, fruits and leafy vegetables. They are particularly important among the rural poor who have access to few resources beyond the forest. Hunting is another form of livelihood, mainly practiced by males. Small rodents are hunted during the day and bigger animals hunted during the night. Women are normally not involved (Aduse-Poku *et al.*, 2013).Forest loss in Africa is particularly troubling, and this is due to the fact that; two-thirds of the continent's population depends on forest resources for income and food supplementation and 90 percent of Africans use fuel wood and charcoal as sources of energy (FAO, 2010).

About three million people in Uganda living adjacent to forests depend on them for survival (Kimenyi, 2002). The forest-adjacent Communities extract forests often to meet their subsistence needs for wood- fuel, herbs, fruits and other food stuff, forage, building materials among other products (Howell *et al.*, 2010; Kabubo-Mariara, 2013). While more than two-thirds of Africa's population depend directly and indirectly on forests for survival (Olufunso, 2010).

2.2.1 Effects of regulation enforcement on forest based livelihoods

Most often than not, various bodies such as governments, public agencies and suchlike, in their efforts to prevent or check deforestation introduce new laws/regulations to debar people from intruding the forest reserves. These laws sometimes deny forest communities the right of accessing NTFPs which form important part of their livelihood.

Sunderlin *et al.*, (2005) make an elaborate analysis of forest-based livelihoods activities that capture relevant human-forest interactions. Three types of forest based livelihood activities are classified. The first activity encompasses hunting and gathering of food and other non-timber forest products. The second is "swidden cultivation", which defines forest resources of agricultural land. The last forest-based livelihood activity is

sedentary agriculture at forest frontier that is defined by agricultural land and marketing of forest products (Sunderlin *et al.,* 2005).

The first forest-based activity of hunting and gathering has been identified as a major livelihood activity for those who live near the forest. This type of forest-dependency includes the gathering of a wide variety of non-timber and forest products, such as fuel wood, bush meat, fruit, herbal medicines, weaving materials and wood for construction. These products are harvested for both subsistence and commercial use on regular basis or for seasonal dependence (Shackleton, 2004).

Many of the above mentioned forest-based livelihoods are greatly affected by policy and regulations in relation to the forest (Sunderlin *et al.,* 2005). Kaimowitz (2003) presents several scenarios under which the livelihoods of poor rural households and communities will be affected due to the strict enforcements of forest management laws. Depending on the character of the forest laws, rural households can be negatively affected or can be strengthened. Some existing legislations have severe negative implications for rural livelihoods. Major negative effects include government interference with traditional and indigenous forest regulations concerning the use of the forest, loss of social capital, threat to physical security, loss of job opportunities and loss of access to forest resources such as fuel wood and food. Ultimately, enforcements of these laws can result in further degradation of the forest. Other legislations however can contribute to the livelihoods of local communities near the forest areas. this can be done by assuring access for poor rural households to various non-timber forest products, decreasing the level of physical violence by stricter control and punishment of illegal activities, helping to maintain the long-term supply of forest products and serves poor households, promoting poor people's participation in decision-making and respecting poor household's rights, cultures and traditions.

2.3 Alternatives to Deforestation

In the context of exploring alternative land use strategies to current and widespread slash and burn agricultural expansion, interviews and other types of investigation were conducted. In this manner, a variety of efforts and options currently underway in Panama were examined.

2.3.1 Agroforestry: a Happy Compromise

Agroforestry refers to practices that integrate trees with agricultural crops Schroth, G., Fonseca, A. B., Harvey, C., Gascon, C., Vasconcelos, H., Izac, A.-M. (2004).

Agroforestry has the potential to reduce deforestation for agriculture and decrease forest degradation by relieving pressure on surrounding forests (Schroth *et al.*, 2004).

2.3.2. Reforesting with Plantations: Good Trees and Bad Trees

Often, there is great difficulty in developing projects that provide both ecological and social benefits. One option that can resolve this conflict is plantation projects, because they provide income and jobs while maintaining, at least in the relatively short term, forest cover. Forest plantations are a significant source of reforestation, and of the 130 million ha of plantations worldwide, more than 50% are located in the tropics (Kraenzel *et al.*, 2003). However, there is a wide range of plantation types. In Panama, teak monocultures make up a considerable percentage of all plantations (Simmons, 2002), but other kinds of reforestation projects, like polyculture with native species and communitymanaged projects should be considered as well. Teak (Tectonis grandis) is an exotic species in Panama, but its cultivation has been encouraged though government incentives and it is now a frequently planted species of tree in the country. Its popularity stems from its rapid growth rate and high market value as exported timber. However, there are many reasons to be critical of this type of reforestation, even though it is commonly supported by government incentives. Ecologically, teak is very problematic when planted in extensive monocultures. Futuro Forestal, a German-based reforestation investment company, has apparently solved this problem by planting teak in smaller areas surrounded by other kinds of trees (Futuro Forestal, oral communication, 2010).

At the same time, teak has been shown to have appreciable carbon storage capacity (Kraenzel *et al.*, 2003), making teak plantations potential beneficiaries of carbon sequestration projects. On top of its ecological complications, teak does not tend to be very beneficial socially. In our personal research, we found that a large percentage of rural inhabitants in Aguas Claras have very low opinion of teak. Reasons cited were that it dried out soil and nearby water sources, and that the money produced by teak plantations does not stay in the community. In effect, teak plantations tend to be owned by foreigners and are centered on an export economy. Furthermore, they are labour-extensive and so do not employ many locals. These environmental and social problems have led us to conclude that teak plantations are not a very desirable solution for forest conservation and human development at a local level. In Aguas Claras, there are presently a number of plantations composed largely of teak and certain other species, such as pine, which is also exotic. These plantations are foreign-owned and place pressure on locals by limiting their access to land. We therefore would not recommend more teak plantation as a solution in the area.

Forest Stewardship Counsel (FSC) is an organization that certifies sustainable forestry (Oral Commu Nication, 2007). Part of their current work involves supporting a community managed, mixed native species forestry project in the Darien (Oral communication, 2007). This system is beneficial socially because it will provide income and jobs directly to locals. Simultaneously, it is ecologically less detrimental to the environment than many other forms of timber harvest because it involves selectively and sustainably harvesting timber from an already existing forest without over-harvesting any particular species. These systems create direct incentive for the users to maintain the forest resources, so they may continue to make use of them. This type of operation requires a fair amount of outside resources, mostly in the form of technical expertise, knowledge and financial investment.

A further difficulty is a general lack of a domestic market for certified forestry products (FSC, oral communication, 2007). Futuro Forestal is an example of a FSC-certified forestry company that is based on foreign investment. The land is sold to the investors and is managed by the company for 25 years. Selective logging is done after 10, 13 and 25 years. When the contract is up, the investors have the option to renew it, but can equally chose to use the land as they wish. Although this company is very environmentally conscious and socially sensitive, we do not see this as generally applicable strategy because of the numerous complications that arise with foreign land ownership, and the uncertainty of what will happen to the land after 25 years.

On a more local level, it is possible to develop agreements to create and manage a plantation funded by individuals or groups wishing to neutralize their carbon emissions. Funding can be channelled through Kyoto accord structure or though independent organizations like Carbon Care (A. Senikas, oral communication, 2007). An example of this small small-scale carbon sequestration project is being implemented by PFSS student interns, who are creating a plantation of native species in an indigenous community in order to compensate for the carbon emitted by the travel of students and teachers between Panama and Canada (A. Senikas, oral communication, 2007).

CHAPTER THREE

MATERIALS AND METHODS

3.1 Study Area

The Study area was Michika Local Government, one of the twenty one Local Government Area of Adamawa State. The area lies between latitude 10^0 36'N-$10^0$40'N and longitude 13^0 21' E-13^0 35'E (Google Map data 2011, see figure 1).The area occupies a land area of about 967KM^2 with a density of 2146/KM^2 (NPC, 2006). It has eight (8) Districts comprising Garta district, Futu district, Moda district, Nkafa district, Madzi district, Bazza district, Vi/Bokka district, Zah district. The eight districts comprises of 27 chiefdoms and 84 villages around the mountains. The study area is located in the northern part of the state, Northern Senatorial District. It is bordered on the East by the Republic of Cameroon. On its Northern border is Madagali Local Government while it shares border to the West by Askira/Uba Local Government Area of Borno State. Southward it is bordered by Mubi North and Hong Local Government areas (Kwache, 2016).

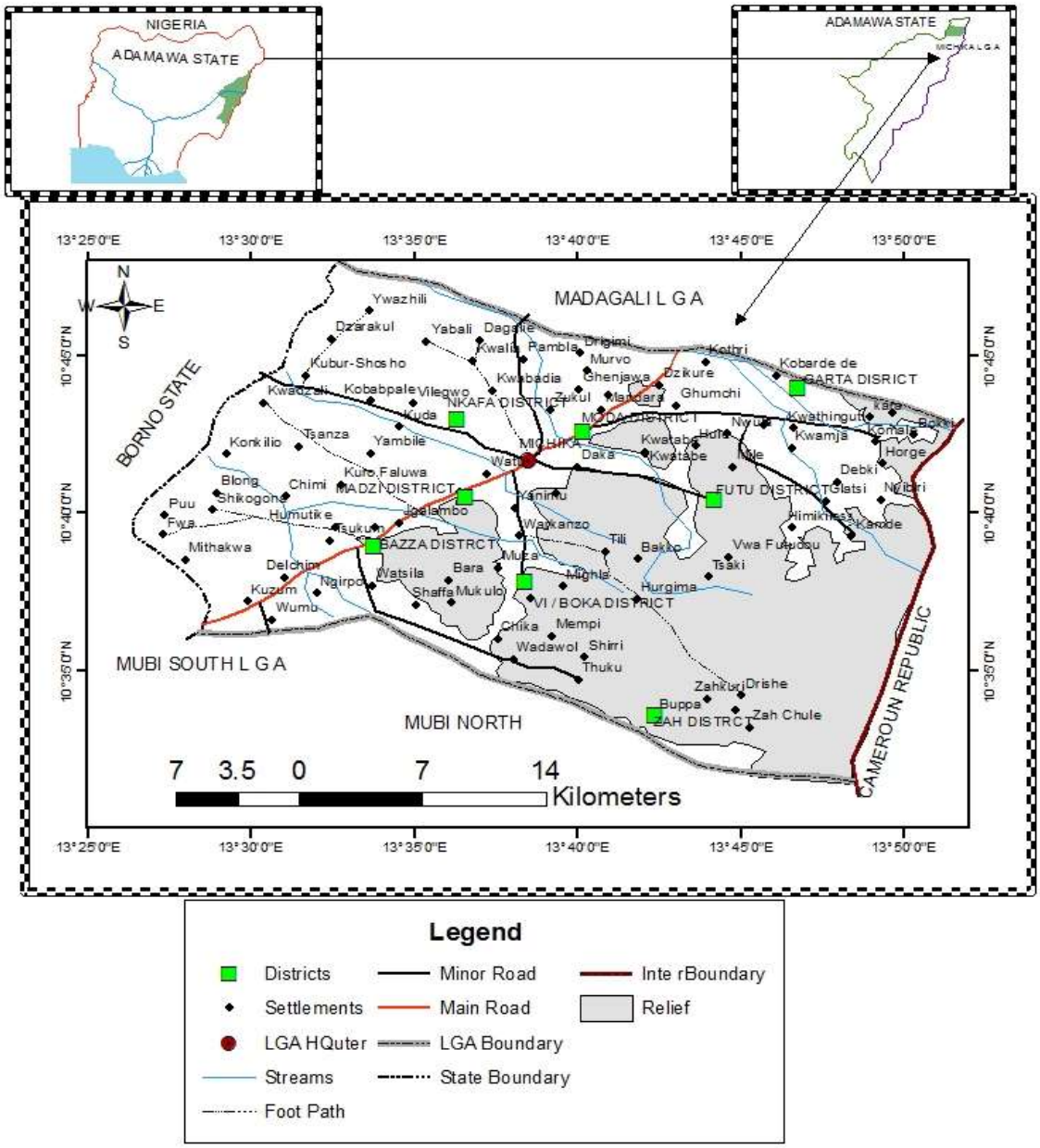

Figure 1: Map of Michika L G A Showing Districts

Source: @ GIS Laboratory, Geography Department MAUTECH Yola 2019

3.1.1 Climate of the Study Area

Air temperature characteristics in the study area are typical of the state and of the West African Savanna climate. Temperature is high throughout the year because of the high radiation income. The maximum temperature in the study area can reach 40^0C particularly in April, while the minimum temperature can be as low as 18^0 C between December and January. Mean monthly temperature is approximately 27.8^0C (Adebayo, 2010). Rainfall in the study area experiences two distinct seasons: The rainy season, which starts from April and ends in October, and long dry season, which lasts from November to March. The minimum monthly rainfall is 2.7mm: maximum is 215.2mm with a total rainfall of 911mm per annum (Adebayo, 2010). Rains begins normally in April and ends in October with the month of August recording the highest rain and a greater number of rainy days.

3.1.2 The Population and People in the Study Area

From the 2006 census data, Michika Local Government has a total population of one hundred and fifty five thousand, two hundred and thirty eight (155,238) people. Female are slightly more in population in the study area having eighty thousand, two hundred and two (80,202) (NPC, 20O6). The projected population by National Population Commission in 2016 is two hundred and seven thousand, five hundred (207,500) (NPC, 2016).

3.1.3 Ethnic Grouping and the Study Area

The major ethnic groups in the study area are Kamwe (Higgi) people. Other ethnic groups that live with kamwe people include, Marghi, Fulani, Hausa, Kanuri, Matakam and Gerra (Blench, 2019). Apart from the socio-economic activities of the people for livelihood, they have three dominant religions, Christianity, Islam and Traditional religion worshipers.

3.1.4 Primary Occupation in the Study Area

The major occupation in the study area is predominantly farming (Kwache, 2013).Animal rearing is also one of the important occupations of people in the study area. The animals include Cattle, Sheep, Goats, Donkeys, Pigs, Domestic fowl, Dogs, and Horses. Fishing is also an occupation in the study area. The presence of some streams, facilitate fishing activities in the area. Fishing is done both by men and women. The common methods used to catch fish are the use of nets and hooks. Hunting game animals

is an important activity in the area. Though at present the game animals have disappeared in the study area, animals such as Lion, Chimpanzee, African Elephant, (From Sabisa forest that normally comes through Lassa in Borno State), Hyena, Roan Antelope and water Buck are no longer seen. While the common game animals in the area are Reptiles; Such as Python, others are Rabbits, Monkeys, Rats and Squirrels (Adebayo, 2010).

Traditional industries in the study area vary with each ethnic group. The raw materials of the traditional industries and craft in the study area are essentially derived from wood, grasses, metals, hides and skin and agricultural products of different types. The traditional industries markets are determined by demand and supply of the industry products. Pottery making industry is a cultural activity carried by women in the rural area of the study area. The pottery making is done by Kamwe women. The raw materials are the clean deposits often found in almost every village in the study area. The industry generates income to women as the demand of products increase as well as supply. The products of the pottery industry are used for two purposes; (1). It is used in keeping water (2). It is also use for decoration in homes. Some were used in place of dishes and plates in those days. Calabash design and decoration is also an important traditional activity in the study area. The activity is done by women only. The design of the calabash involved the use of metal tools and forest wood. Wood carving, weaving and blacksmithing, these are important traditional activity in the study area. The various articles produced are used for domestic, social and economic purposes, prominent products include; stools, mortars, mat, baskets, cutlasses, spares, arrows, axe and hoe.

3.2 Study Design

The design for this study was descriptive survey which wasaimed at investigating the relationship between deforestation and livelihood. To achieve the objectives of this study, data was collected on issues like causes of deforestation, sources of livelihood, effects of deforestation on livelihood and methods adapted to mitigate the effects of deforestation in the study area.

3.3 Sources of Data

Two sources of data were used for this research. These are Primary and Secondary sources of data. The primary data was gathered directly from the field and from stakeholders like farmers, forestry Department, and Ministry of Agriculture; this was using combination of interview and questionnaires. The Secondary data was also served as another important source of data for this study. The secondary data was sourced from

books and publication of various Scholars and authors which are related to deforestation and livelihood patterns.

3.4 Sampling Techniques

This research used the administrative division of the study area. A total of eight districts formed Michika Local government area. In selecting the sample size, 10% of the villages in each district were purposively selected. Then random sampling was used to select villages in which questionnaire was administered. This formed the sample size of 14 villages out of the 8 districts, which include Garta village and Ghumchi from Garta District, Himike and Debki from Futu District, Dlaka and Moda from Moda District, Tumbara Nganbili and Kwabapale from Nkafa District, Madzi from Madzi District, Jigalambu and Tsukumu from Bazza District, Tili from Vi/Bokka District, Buppa and Thukku from Zah District. The total of 140 structured questionnaires was used and 10 questionnaires were distributed in each village among the fourteen (14) selected villages. The questionnaires were administered systematically at the interval of every fifth household beginning from the village head's house moving to each direction of the village.

3.5 Statistical Analysis

Descriptive statistics (Frequency and simple percentage) was used in analyzing the data generated. Then, the data was coded and then entered into statistical package for Social Sciences (SPSS) version 26 to allow for the analysis.

CHAPTER FOUR

DATA PRESENTATION

4.1 Results

This chapter presents the findings of the study. The study made use of well-structured Questionnaire (Open-ended and close-ended) administered to One hundred and forty (140) residents covering 8 districts in Michika Local Government Area namely; Garta, Futu, Moda, Nkafa, Vi/Bokka, Madzi, Bazza and Zah District. The SPSS Software (version 25) was used to analyze all data and the output of such analysed responses are presented below.

4.2 Farming Characteristics

Table 1 gives a concrete detail of the years in which the respondents have been into farming. Majority of the respondents have been into farming for more than fourteen years (14 years) representing sixty-three (63) of them (45.0%), twenty-seven (27) of the respondents have been into farming for 6-10 years, representing19.3%. Eighteen (18) of the respondents have been into farming for 11-14 years representing (13.0%). Only fifteen (15) of the respondents have been into farming for less than 5 years, representing just 10.7%. This indicates that majority of the respondents have been into farming for a good number of years.

Table 2 revealed the types of crops cultivated. Maize topped the list accounting for 50.7% of the total crops cultivated, Groundnuts came second in the list accounting for 15.0%, cowpea came third on the list accounting for 12.1%, Guinea corn came fourth accounting for 5.7%. Caasava and Groundnut came last on the list, accounting for 2.1% respectively.

Table 3 gives details of the size of farm. Majority of the farmers has a farm size ranging from 1-2 acres, representing 39.3%. Followed closely by farm sizes of 3-5 acres owned individually by 30.7% of the respondents. 15.7% owned a farm size of 1 acre while only 2.1% owned a farm size as large as 6-10 acres.

Table 1: Farming Experience among Selected Farmers in Michika LGA of Adamawa State.

Years of experience	Garta	Futu	Moda	Nkafa	Vi/Bokka	Madzi	Bazza	Zah	Total	%
1-5	2	2	1	2	1	1	3	3	15	10.7
6-10	4	5	2	4	2	2	3	5	27	19.3
11-14	3	4	2	2	3	1	1	2	18	13.0
> 14	10	9	8	11	4	6	8	7	63	45.0
Total	19	20	13	19	10	10	15	17	123	88.0

Table 2: Types of Crops Cultivated by Selected Farmers from Michika LGA, Adamawa State, Nigeria.

Crops	Garta	Futu	Moda	Nkafa	Vi/Bokka	Madzi	Bazza	Zah	Total	Percent
Maizi	10	9	10	11	5	7	11	8	71	50.7
Groundnuts	4	4	3	2	2	1	2	3	21	15.0
Cassava	1	-	1	-	-	-	1	-	3	2.1
Cowpea	2	3	-	5	1	1	3	2	17	12.1
Sugar cane	-	-	1	-	-	-	1	1	3	2.1
Guinea corn	1	2	-	-	1	-	-	4	8	5.7
Total	18	18	15	18	9	9	18	18	123	87.7

Table 3: Farm Sizes owned by Selected Farmers from Michika LGA, Adamawa State, Nigeria.

Farm Size (Acre)	Garta	Futu	Moda	Nkafa	Vi/Bokka	Madzi	Bazza	Zah	Total	%
1	3	4	2	2	3	1	3	4	22	15.7
1-2	9	9	7	7	5	4	4	10	55	39.3
3-5	7	3	9	8	1	2	8	5	43	30.7
6-10	-	-	-	1	-	-	1	1	3	2.1
Total	19	16	18	18	9	7	16	20	123	87.8

Table 4 reveals that majority of the respondents practiced mixed farming, accounting for 36.4%. 31.4% accounts for mixed cropping, while 20.0% accounts for mono cropping.

Reasons for this Farming Systems: Most of the farmers practiced mixed farming because they use the dung (wastes) from the livestock farm to enrich the soil for their crops. In addition to this, some of the respondents practice mixed farming due to economical reasons (to supplements their incomes). Some hold this system dearly due to the fact that livestock farming can alternate crop farming in case of failure (vice versa). For mixed cropping majority of the respondents did not actually give varied reasons for this system as most of them see the possibility of farming more than one crop on their farmland as a reason. For Mono cropping, the farmers reason for not adopting this system is lack of sufficient fund to undertake other system of farming. Some complained of lack of land, only one of the farmers attributed specialization as his reason for mono cropping.

Table 5 shows mode of farming employed by selected farmers in Michika. Majority of the farmers used simple farm tools (such as hoe, axe, cutlasses, etc.) accounting for 67.1%. Only few of the farmers used machinery (such as tractor) accounting for just 2.1%. However, 18.6% of the farmers utilized both simple and mechanized farming.Table 6 shows land preparation methods used in Michika. Majority of the farmers used slash and burn, accounting for 43.6%. 32.9% of the farmers used herbicides and only 11.4% accounted for tillage.

Table 7 shows cultural practices employed by the farmers in Michika LGA. Fertilizer application accounts for 50.0% of the cultural practices employed by the farmers. Weedicides application accounts for 24.3%. Irrigation accounts for 11.4% while pesticides application accounts for just 2.1%.Table 8 detailed the type of fertilizer the farmers normally used. 50.7% of the farmers uses normal fertilizer, while 37.1% of the farmers uses artificial fertilizer. Table 8 shows type of fertilizers used by selected farmers in Michika Local Government Area. 50.7% of the farmers used organic fertilizer, while 37.1% of the farmers used inorganic fertilizer.

Table 4: Farming system Practiced by Selected Farmers from Michika LGA Adamawa State, Nigeria.

Farming system	Garta	Futu	Moda	Nkafa	Vi/Bokka	Madzi	Bazza	Zah	Total	%
Mixed farming	9	8	5	6	2	4	7	10	51	36.4
Mixed cropping	7	8	3	5	4	3	6	8	44	31.4
Mono cropping	4	3	6	5	2	2	5	1	28	20.0
Total	20	19	14	16	8	9	18	19	123	87.8

Table 5: Mode of Farming used by Selected Farmers from Michika LGA. Adamawa State, Nigeria.

Mode of farming	Garta	Futu	Moda	Nkafa	Vi/Bokka	Madzi	Bazza	Zah	Total	%
Use of simple farm tool	14	15	10	13	8	7	11	16	94	67.1
Use of machinery (such as tractor)	-	-	1	1	-	-	1	-	3	2.1
Both	2	3	4	5	2	2	5	3	26	18.6
Total	16	18	15	19	10	9	17	19	123	87.8

Table 6:Land Preparation Methods Employed by Selected Farmers in Michika LGA.

Method of land preparation	Garta	Futu	Moda	Nkafa	Vi/Bokka	Madzi	Bazza	Zah	Total	%
Slash and burn	10	7	8	11	4	5	9	7	61	43.6
Tillage	3	3	1	2	1	1	1	4	16	11.4
Herbicides	7	4	6	7	5	3	10	4	46	32.9
Total	20	14	15	20	10	9	20	15	123	87.9

Table 7: Cultural Practices of Selected Farmers from Michika LGA, Adamawa State.

Cultural practice	Garta	Futu	Moda	Nkafa	Vi/Bokka	Madzi	Bazza	Zah	Total	%
Irrigation	2	2	3	2	1	2	3	1	16	11.4
Fertilizer application	10	9	14	7	6	5	12	7	70	50.0
Weedicides application	6	9	3	7	1	1	5	2	34	24.3
Pesticides application	-	-	-	1	-	-	-	2	3	32.1
Total	18	20	20	17	8	8	20	12	123	87.8

Table 8: Type of fertilizer used by Selected Farmers in Michika LGA, Adamawa State.

Type of fertilizer	Garta	Futu	Moda	Nkafa	Vi/Bokka	Madzi	Bazza	Zah	Total	%
Organic fertilizer	12	11	5	8	6	7	8	14	71	50.7
Inorganic fertilizer	6	6	11	8	4	3	9	5	52	37.1
Total	18	17	16	16	10	10	17	19	123	87.8

Table 9 reveals the causes of deforestation in Michika Local Government Area. Farming accounts for 33.7%, Bush burning accounts for 25.0%, Lumbering accounts for 17.1% while fuel wood gathering accounts for 17.1% as well.

Other Causes of deforestation: Cattle grazing happens to be another reason believed by the farmers as a cause of deforestation.

4.2.1 Sources of Livelihood

Alternate economic activities outside farming carried out by the farmers is detailed in table 10. Table 10 reveals that,aside farming, 37.1% were engaged in livestock rearing, 26.5% are into trading, 9.3% are into fishing while 6.4% of the farmers were also engaged hunting activities. Moda, Nkafa, Madzi and Bazza districts had not reported hunting as their alternative livelihood. Futu, Vi/Bokka and Zah were reported not to have participated in fishing activity as they have no access to rivers. No respondent had any report on trading in Vi/Bokka district.

Table 11 revealed that 51.4% of the farmers were able to commence their farming activities on time during planting season in recent times while 36.4% of the farmers were unable to commence their planting activities on time in recent times.

Table 12 gives details of reasons for delay in farming activities as reported by some farmers. Late rainfall accounts for 44.3%, pest infestation accounts for 3.6% while rotting of produce accounts for 2.1%. Futu, Vi/Bokka, Madzi, and Zah districts did not report pest infestation as reason for delay in commencement of farming activities while Garta, Futu and Zah were the only districts that reported rotting of produce in the study area.

Table 9: Causes of Deforestation in Michika LGA

Causes	Garta	Futu	Moda	Nkafa	Vi/Bokka	Madzi	Bazza	Zah	Total	%
Bush burning	4	4	5	3	4	3	5	7	35	25.0
Farming	6	4	8	11	2	3	7	6	47	33.7
Lumbering	4	6	3	2	2	1	2	4	24	17.1
Fuel wood Gathering	5	5	2	2	1	2	5	2	24	17.1
Cattle grazing	1	1	2	2	1	1	1	1	10	7.1
Total	20	20	20	20	10	10	20	20	140	100

Table 10: Alternate Economic Activities of Farmers in Michika LGA, Adamawa State.

Activities	Garta	Futu	Moda	Nkafa	Vi/Bokka	Madzi	Bazza	Zah	Total	%
Hunting	3	2	-	-	2	-	-	2	9	6.4
Fishing	2	-	4	2	-	2	3	-	13	9.3
Livestock rearing	9	10	4	8	3	3	10	5	52	37.1
Trading	2	5	6	7	-	3	6	8	37	26.5
Others	4	3	6	3	5	2	1	5	29	20.7
Total	20	20	20	20	10	10	20	20	140	100

Table 11:Commencement of Farming Activities During the Planting Season in Michika LGA.

Response	Garta	Futu	Moda	Nkafa	Vi/Bokka	Madzi	Bazza	Zah	Total	%
Yes	11	15	9	7	5	3	14	8	72	51.4
No	8	4	6	10	5	6	3	9	51	36.4
Total	19	19	15	17	10	9	17	17	123	87.9

Table 12: Reasons for delay in commencement of Farming activities in Michika LGA.

Response	Garta	Futu	Moda	Nkafa	Vi/Bokka	Madzi	Bazza	Zah	Total	%
Late rainfall	11	8	9	6	4	5	12	7	62	44.3
Pest infestation	1	-	1	1	-	-	2	-	5	3.6
Rotting of produce	1	1	-	-	-	-	-	1	3	2.1
Total	13	9	10	7	4	5	14	8	70	50.0

Table 13 gives the estimates of the total yields of the farmers in the last planting season, of which they average 17± bags of maize, 6± bags of groundnuts, 2± bags of beans and 7± bags of other crops distinctly and individually. A comparison of yield and output was carried out in table 14. 38.6% of the farmers stated that their yields were on the increase. 19.3% of the farmers believed the yields to be normal when compared to that of recent season. 24.2% of farmers experienced decrease in yields when compared to recent seasons. Only 5.7% of the farmers didn't actually know if there was difference between yields.

Table 15 reveals inadequate rainfall and high temperature as major factors that caused of decrease in output/yields for some of the farmers (19.2%). Flood accounted for 3.6% and Excess Rainfall accounted for 3.6% as well. Some districts such as Garta, Futu, Vi/Bokka and Zah did not report excessive rainfall as reason for decrease in output/yields of the farmers while Garta, Futu, Vi/Bokka and Zah districts had no report on flood.Lack of money, fertilizer, still accounted for this decrease. Pest infestation and soil infertility were also factors that contributed to the decrease.

Table 13:Estimate of Average Total Yieldsof Crops Harvested from Selected Farmers in Michika LGA.

S/No	Yields	No of farmers	Total yields (Bags)	Average yield(Bags)	mean±
1	Maize	55	2,325	17	
2	Ground nuts	25	879	6	
3	Beans	20	286	2	
4	Others (Sorghum, Rice, Cassava, etc.)	40	1003	7	

Table 14: Comparison of Yields in the Year 2015, 2016, 2017 and 2018 with the Year 2019.

Yields	Garta	Futu	Moda	Nkafa	Vi/Bokka	Madzi	Bazza	Zah	Total	%
Decreasing	4	4	5	4	3	5	6	3	34	24.2
Increasing	6	8	5	9	5	4	10	7	54	38.6
Normal	4	5	3	5	1	1	4	4	27	19.3
Don't' know	1	1	2	1	1	0	0	2	8	5.7
Total	15	18	15	19	10	10	20	16	123	87.8

Table 15: Reason for Decrease of yields for some of the Farmers in Michika LGA.

Reasons	Garta	Futu	Moda	Nkafa	Vi/Bokka	Madzi	Bazza	Zah	Total	%
Inadquate rainfall	4	5	3	5	2	2	2	4	27	19.2
Excessive rainfall	-	-	1	1	-	1	2	-	5	3.6
flood	-	-	1	1	-	1	2	-	5	3.6
High temperature	5	5	2	3	4	2	3	4	28	20.0
Total	9	10	7	10	6	6	9	8	65	46.4

4.2.2 Challenges of Deforestation on the Socio-Economic Development of Communities

Problem: High temperature, soil infertility, flood (soil erosion), burning and cutting down of trees for firewood production, have all affected the livelihood of the farmers and as such cause and raised expenses involved in farming activities. For hunters it has caused the extinction of some animals. Some of the farmers believed that the deforestation has brought some positive result in aspects of Fulani herdsmen as the pastoralists no longer parades their flocks on the farms due to the deforestation. Also, excess lumbering has led to scarcity of fuel wood. Finally, the deforestation has exposed the soil to erosion and consequently this erosion washes the soils nutrients making it infertile for farming. Deforestation has also affected the ecosystem of animals and has such affects animal diversity in the said area. Table 16 reveals the effects of deforestation on livelihood in the study area. Soil infertility accounts for 32.2%, high temperature accounts for 21.4%, disease and pest infestation accounts for 10.0%, reduction in level and quality of crop yields accounts for 17.1%, erosion accounts for 8.6, while other were 10.7%

Table 16: Effects of Deforestation on Livelihood of Selected Farmers from Michika LGA, Adamawa State.

Effects	Garta	Futu	Moda	Nkafa	Vi/Bokka	Madzi	Bazza	Zah	Total	%
Soil infertility	6	8	6	7	4	4	5	5	45	32.2
High temperature	6	1	4	5	1	1	4	8	30	21.4
Disease and pest infestation	1	2	2	2	1	1	3	2	14	10.0
Reduction in the level and quality of crop yields	2	5	5	2	1	2	5	2	24	17.1
Erosion	2	1	1	2	1	1	2	2	12	8.6
Others	3	3	2	2	2	1	1	1	15	10.7
Total	20	20	20	20	10	10	20	20	140	100

Table 17 revealed that 87.9% of the farmers agreed that there has been changes in the crop planting season in recent years. Only 12,1% of the farmers did not agree with such assertions.

New Planting Months: 35.5% of the farmers now asserts that the planting seasons now starts in June. 17.0% asserts that the planting season now falls between May/June. 17.0% asserts that the month of May solely is the start of the new planting season. 9.9% asserts that the new planting season is now June/July. 1.4% believes it starts at April/May. Only few of the farmers points out August, Late May, Middle June and July. The variations of this starts time might be due to the different crops being cultivated.

Old Planting Months: Before now, the farmers planting month was April as over 48.9% of the farmers asserts to this month. Aside April, majority of the remaining farmers all agreed that starting months for old planting season lies between April to Late May, on rare case did any of the farmers starts planting in June or July.

Reason for Changes in the Planting Season: The changes in the planting season has resulted to huge decline in crop produce and yields. This in turn has affected the availability of foods both for subsistent consumption as well as commercial availability.Majority of the farmers attributes the changes in the planting season to Climate and Weather Change. Consequently this has led to late and less rainfall, high temperature. Lack of farm equipment and late delivery of farm machinery and other inputs such as seedling and fertilizer.To some extent these contributed to the changes. Some farmers identified bush burning, drought and deforestation as minor contributors to changes in planting season.

Effects of the Changes in Planting Season on Agricultural Production: Majority of the farmers stated that the changes in planting season had led to scenarios of huge crop failure arising from crop wilting and as a result of seizure of rainfall in months of September and October. Before now some crops can be farmed twice a year, but now that's totally not possible.

Effects of Deforestation on Crop Productions: Deforestation has led to an increase in usage of artificial fertilizer, and also it has served as agent of flood, this has led to the destruction of crops and washing away of numerous farmlands and consequently impedes crop production. Deforestation has also caused biodiversity lost and aids soil erosion emanating from strong winds, this leads to soil infertility which in turns influence the increase the need and price of fertilizer.

Table 17:Changes in Planting Seasonsin Michika LGA, Adamawa State.

Changes	Garta	Futu	Moda	Nkafa	Vi/Bokka	Madzi	Bazza	Zah	Total	%
Yes	19	18	16	18	9	9	19	15	123	87.9
No	1	2	4	2	1	1	1	5	17	12.1
Total	20	20	20	20	10	10	20	20	140	100

Table 18 shows the methods in which the farmers have been using to adapt to the effect of deforestation. Application of fertilizer accounts for 44.3% of the method, rearing of livestock accounts for 27.1% while fish pond accounted for 5.7%.

Garta, Futu, Vi/Bokka and Zah districts had not report on fish pond as adaptation to the effects of deforestation. Trading accounts for 5.0%. Some of the farmers highlighted forestation, shelter and belt terracing among others.Major decline was reported in major crops like maize, groundnuts and beans.(Table 19).

Programmes and Projects to improve upon Deforestation in Michika

Majority of the farmers suggested that Afforestation Programme should be launched by the department of Forestry. The Tungya system of farming, bush fallowing should be encouraged as well. Forest conservation is so desired by the farmers, as they want controlled bush burning, controlled lumbering activities and proper irrigation to nurture newly germinated trees. Awareness programme was also suggested by majority of the farmers (Awareness on tree planting and adverse effect of deforestation).

Table 18: Adaptation to the Effects of Deforestation in Michika LGA, Adamawa State.

Adaptation	Garta	Futu	Moda	Nkafa	Vi/Bokka	Madzi	Bazza	Zah	Total	%
Application of fertilizer	7	8	10	12	3	2	6	14	62	44.3
Rearing of livestock	6	6	4	6	5	4	5	2	38	27.1
Fish pond	-	-	1	1	-	2	4	-	8	2.7
Others	7	6	5	1	2	2	5	4	32	22.9
Total	20	20	20	20	10	10	20	20	140	100

Table 19: Decline in Major Crops Grown on Farmlands in Michika LGA.

Crops	Average Yields (Bags)			
	2015	2016	2017	2018
Maize	31	21	18	9
Groundnuts	18	12	9	3
Beans	7	6	4	4
Others	16	14	15	15

CHAPTER FIVE

DISCUSSION

Major findings on deforestation and its effects on livelihood patterns were discussed in line with the objectives of the study.

5.1 Discussions of Findings

The study showed that, majority of the farmers had been into farming for several years. Most of the crops cultivated were maize, groundnuts, cowpea and guinea corn. Based on the finding of this study, majority of the farmers had farm sizes ranging from 1-2 acres. It was observed during the study that, the farmers practiced mixed farming compared to mono cropping. The study showed that, majority of the farmers used simple farm tools such as hoe, axe, etc. Majority of the farmers used slash and burn method of land preparation. It was observed during the study that, organic fertilizer were mostly used by the farmers. The study showed that, farming is the major cause of deforestation in Michika Local Government. This is followed by bush burning, lumbering and fuel wood gathering respectively. This agrees with the finding of Agyeman (2012) who was of the view that firewood production, forest fire and agriculture expansion are the major causes of deforestation. According to Bisahw (2008), the increasing population of Nigeria has resulted in excessive forest clearing for Agricultural use, overgrazing and exploitation of the existing forest for fuel wood, fodder and construction materials.During the field survey, it was also realized in the study communities that, charcoal production was widespread and thus serve as another livelihood activity that precipitates deforestation in the study area. During the study, it was observedthat, many of the charcoal producers undertake their production in the remaining forests and on the mountains, which makes it challenging to track and forestall their activities.

The study identified sources of livelihood in Michika LGA as farming, livestock rearing, followed by trading, fishing and hunting. This agrees with the finding of Abane (2007)p57 who reported that crop production and animal rearing are the most common sources of livelihoods for most rural dwellers. Hunting is another form of livelihood, mainly practiced by males. Small rodents are hunted during the day and bigger animals are hunted during the night and women are normally not involved (Aduse-Poku *et al.*, 2013).

The study revealed that, deforestation has affected the life of the respondents in the study area resulting to delayed commencement of planting seasons, reduced soil fertility, reduction in level and quality of crop yieldsproduction, increase in pests and disease infestation. The attack by these pests and diseases caused damage to the crops which reduced the quality and quantity of their yields. This is in line with a study conducted by Wunder (2005) who reported that, deforestation depletes the natural resource of poor rural households who rely on wild fruits, vegetables, bush meat, medicinal plants, wood for fuel, and timber. Illegal forestry activities also negatively impact environmental services. Vital to rural households such as the provision of clean water, pest and disease control, pollution and regulation of the climate, stream flow, and ground water levels. Deforestation reduces biological diversity, increases soil erosion and the siltation of rivers and streams can endanger hydroelectric schemed (Karkee, 2004).

Crops yield is one of the major yardsticks in crop production which can be used to assess the effects of changing forest cover on livelihoods. A comparison of crop yields in the study area revealed that, 38.6% of the farmers stated that their yields were on the increase. 24.2% of the farmers experienced decrease in yields when compared to recent seasons from 2015-2018. 19.3% of the farmers believed the yields to be normal when compared to that of recent seasons. Only 5.7% of the farmers didn't know if there was difference between yields. The situation was confirmed by the farmers as majority of the respondents described the yield or output levels from their farms to be increasing when they were asked to assess it. This is because; most of the farmers engaged in the cultivation of the improved varieties of crops and application of fertilizer. For the farmers that experienced decrease in yields; rainfall is one of the major determinants of crop yield in the study area due to over reliance on it.

5.1.1 Unpredictability of rainfall patterns and planting seasons

From the literature review, it was discovered that forests play a crucial role in enhancing both microclimate and local weather of an area. The study has confirmed this, as 87.9% of the respondents indicated that, they have observed changing patterns in the period for commencement of farming activities. 35.5% of the farmers revealed that the new planting season now start in June. 17.0% asserts that the planting season now falls between May/June. 17.0% asserts that the month of May solely is the new planting season. In recent past, due to the erratic nature of the rains, it has therefore affected the planting

seasons of the crop of farmers in the study area. Due to the difficulty in predicting weather and climate, making day-to-day and medium-term planning of farm operations have become more difficult. It was observed that it was becoming increasingly difficult for the respondents to predict the date for the commencement of farming in the study area which leads to late planting of crops. This late planting according to the farmers has been having negative repercussions such as low and poor quality of yield from their crops.

The study revealed that, application of fertilizer, rearing of livestock, fish pond and trading among others have been adapted by the respondents against the effects of deforestation in the study area.It showed that, 44.3% of the farmers interviewed apply fertilizers excessively to their farms in order to restore the loss soil fertility so as to boost the yields of their crops. This is because of the excessive use of shifting agriculture known as the slash and burn agriculture that is predominant in the study area. Slash and burn agriculture is the clearing of forested land for raising or growing the crops until the soil is exhausted of nutrients and/or the site is overtaken by weeds and then moving on to clear more forest. It is been often reported as the main agent of deforestation. Smallholder production in deforestation and the growing number of such producers notably shifting cultivators were the main cause of deforestation (Dauvergne, 2006). Again, some of the respondents (27.1%) are now engaged in livestock rearing whiles those who are into it already have scaled up their livestock rearing activities to supplement their crop productions.

Ficsher (2002) has found that the implementation of agroforestry projects in Panama only minimally reduced the extent of slash and burn practices. Agroforestry techniques can take very varied forms, from externally supported intercropping efforts to the planting of fruit trees on individual plots of land. The requirements in terms of outside expertise and funding vary accordingly, but potentially can be quite minimal. This is a reason that some forms of agroforestry are highly generalisable, as it is often possible for poor individuals to plant trees that will improve their standard of living by providing fruit, fuel wood or construction wood, without the need for outside support (Fischer,2002)p59. Agroforestry is particularity interesting because it addresses two major concerns: environmental and societal wellbeing. Agroforestry has the potential to provide socioeconomic advantages to rural poor, largely because it is labour intensive, while producing environmental benefits such as reduced soil erosion, increased soil fertility, and

improved quality and quantity of water sources (Fischer, 2002) p59. Still, agroforestry faces challenges. For example, profitable agroforestry techniques can attract practitioners to a forested area in order to convert primary forest to these agroforestry systems (Angelsen and Kaimowitz, 2002).

CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1 Summary

The purpose of this research work was to assess the perceived effects of deforestation on livelihood patterns of the communities in Michika Local Government. The study covered the eight districts in Michika Local Government. The specific objectives were to examine the causes of deforestation in the study area, sources of livelihood for the communities, effects of deforestation on livelihood patterns, and to assess how people have been adapting to the perceived effects of deforestation in the study area.

One hundred and forty (140) questionnaires were administered systematically from the randomly selected villages. While data was analyzed using descriptive statistics (frequency and simple percentage). The study revealed that,the major causes of deforestation and forest degradation in the study communities are farming practices such as slash and burn method and clearing of vast forest lands for agricultural purposes. Though some of the farmers indicated that, lumbering and fuel wood gathering are rampant in their communities. The study also showed that hunting and fishing are other critical livelihood activities in the study area that diver state the forest of its resources such as wildlife including game, fishes, and among other things.

During the field survey, it was also realized in the study communities that, charcoal production was widespread and thus, serve as another livelihood activity that precipitates deforestation in the study area. The major food crops cultivated in the study area include maize, cowpea, ground nuts, guinea corn, cassava and sugar cane.

The predominant land preparation method found in the region was slash and burn (49.6 percent of farmers) while herbicides and tillage were practiced by 37.4% and 13.0 % of the farmers respectively. The study unraveled that the farming systems practiced were Mixed Farming, Mixed Cropping and Mono Cropping. The study revealed that majority(36.4 %) of the farmers preferred Mixed farming to Mixed cropping and Mono cropping. The mixed farming and mixed cropping are consideredto be less risky in the face of deforestation and hence the high preference for them.

As the communities in the study area are conscious and actually experiencing the effects of the changing forest cover on their livelihoods, they adapted various cropping strategies to salvage their livelihoods. The study showed that, 44.3% of the farmers interviewed apply fertilizers excessively to their farms in order to restore the loss soil

fertility so as to boost the yields of their crops. Again, some of the respondents (27.1%) are now engaged in livestock rearing whiles those who are into it already have scaled up their livestock rearing activities to supplement their crop productions. Furthermore, some of the farmers are engaged in fish farming and trading, which are all fetching them some guaranteed source of income, as a backstop to the dwindling problem in crop productions.

The study identified a number of programmes that should be implemented or undertaken to reduce the perceived effects of deforestation in the study area.These include afforestation Programme which should be launched by the Department of Forestry; The Tungya system of farming as against slash and burn methods which leads to bush fires should be discouraged; bush fallowing should be encouraged as well; forest conservation should be put in place with controlled bush burning, and lumbering activities as well as proper irrigation to nurture newly planted trees. Beside these, awareness programme should be put in place to educate and sensitize the publicon the correct and safe methods of fertilizers, pesticides and weedicides applications by the Extension Officers.

6.2Conclusion

From the outcome of the analyzed data presented in this study, the research revealed that, farming practices (such as slash and burn) constitute the major causes of deforestation in the study area. Livestock rearing, hunting, fishing and trading among others are the alternative sources of livelihood. The study established that deforestation imparts negatively on the lives of respondents in the study area as it affects the weather and climate that adversely affect crop yields.

The study identified that 27.1% of the respondents engaged in livestock rearing so as to adapt to the perceived effects of deforestation in the study area. While others indulge in fishing, hunting and trading.

6.3 Recommendations

Based on the findings of the study, a number of recommendations are being made to help reduce the perceived effects of deforestation on crop production and productivity and consequently livelihood alternatives in general. The recommendations have been offered to serve as explicit examples of strategies and measures that can be adopted to reduce deforestation and its impacts on crop production.

i.The respondents should be educated about the rules governing the forest reserve, methods of tree production, sustainable forest management practices, conservation and livelihood based approaches.

ii.Empower farmers in the area of skill acquisition, such as tailoring, trading and poultry.

iii.Bush burning, indiscriminate hunting and cutting down of trees should be checked.

iv. Tungya system of farming and bush fallowing should be encouraged to enrich soil fertility.

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Appendix I: Questionnaire

MODIBBO ADAMA UNIVERSITY OF TECHNOLOGY YOLA

SCHOOL OF LIFE SCIENCE

DEPARTMENT OF ZOOLOGY

Dear Sir/Madam

I am a post-graduate student of the above institution undertaking a study on the subject "Assessing the Rate of perceived Effects of Deforestation on Livelihood Pattern on Communities" in Michika Local Government in Adamawa State.

I would be grateful if you can furnish me with relevant information needed in this questionnaire. All information provided by you will be confidential.

Instructions; Tick in boxes provided or write in the blank spaces where applicable.

SECTION A

1 .Age of respondent…18-25yrs [ ] 26-35yrs [ ] 36-45yrs [ ] 46-55yrs [ ] 56years + [ ]

2. Sex of respondent (a) Male [ ] (b) Female [ ]

3. Educational status: Non-formal [ ] Primary School [ ] Secondary School [ ] Tertiary Education [ ]

4. Marital Status: (a) Married [ ] (b) Single [ ] (c) Widower/widow [ ] (d) Divorced [ ] (e) Separate [ ]

5. Size of household A. 1-3 [ ] B. 4-6 [ ] C. 7-9 [ ] D. 10+ [ ]

6. Occupation (a) Farming [ ] (b) Hunting [ ] (c) Fishing [ ] (d) Others specify……..

SECTION B: FARMING CHARACTERISTICS

7. How many years have you been farming? (a) 1-5 years [ ] (b) 6-10years [ ] (c) 10-14 years [ ] (d) More than 14 years [ ]

8. What types of crops do you cultivate? (a) Maize [ ] (b) Ground nuts [ ] (c) Cassava [ ] (d) Cowpea [ ] (e) Sugar cane [ ] (f) Guinea corn [ ]

9. What is the size of your farm(s)? (a) < 1 Acre [ ] (b) 1 -2 Acres [ ] (c) 3-5 Acres [ ] (d) 6-10 Acres [ ]

10. What type of farming system do you practice? (a) Mixed farming [ ] (b) Mixed cropping [(c) Mono cropping [ ] (d) Others specify……

11. Please, can you explain why you practice this system of farming?

……
……
……
……
……

12. What is your mode of production? (a) Use of simple farm tools (such as hoe, axe, cutlasses, etc…) [ ] (b) Use of machinery (such as tractor) [ ] (c) Both [ ]

13. Which of these land preparation methods do you use? (a) Slash and burn [ ] (b) Tillage [ ] (c) Herbicides [ ] (d) others (specify)……

14. Which of these cultural practices do you undertake? (a) Irrigation [ ] (b) Fertilizer application [ ] (c) Weedicides application [ ] (d) pesticides application [ ] (e) Others (specify)……..

15. What type of fertilizer do you normally use? (a) Organic fertilizer [ ] (b) Inorganic fertilizer [ ]

16. What are the causes of deforestation in Michika Local Government? (a) Bush burning [ ] (b) farming [ ] (c) Lumbering [ ] (d) Fuel wood gathering [ ] (e) Others (specify)……...

SECTION C: SOURCES OF LIVELIHOOD

17. Do you do other economic activities outside farming? (a) YES [ ] (b) NO [ ]

18. If YES, state them (a) Hunting [ ] (b) Fishing [ ] (c) Livestock rearing [ ] (d) Trading [ ] (e) other specify----------

SECTION D; IMPACT OF DEFORESTATION ON LIVELIHOOOD

19. Are you able to commence your farming activities on time during the planting season in recent times? (a) YES [ ] (b) NO [ ]

20. If NO, why? (a) Late rain fall [ ] (b) Inadequate sunlight [ ] (c) Pest infestation [ ] (d) Rotting of produce [ ]

21. Can you estimate the total yield of your crops in the last planting season? Fill in the table below.

Crops	Yield (bags)

22. How do you compare the output/yield with that of the recent season?

(a) Decreasing [ ] (b) Increasing [ ] (c) Normal [ ] (d) Don't know [ ]

23. If decreasing, what do you think has account for that? Please tick as many as possible.

(a) Inadequate rain fall [ ] (b) Excessive rain fall [ ] (c) Flood [ ] (d) High temperature [ ] (d) Soil infertility [ ] (e) Others specify…….....

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24. Does changing forest cover have any effect on your livelihood?

(a) YES [ ] (b) NO [ ]

25. If the answer in 24 is YES, what are the effects? Tick as much as possible.

(a)Soil infertility [ ] (b) High temperature [ ] (c)Disease and pest infestation [ ] (d)Reduction in level and quality of crop yields [ ] (e)Erosion [ ] (f)Others [ ]

26. Have there been any changes in the crop planting season in Michika Local Government in recent years? (a) YES [ ] (b) NO [ ]

27. If YES, in which month does planting season now start in Michika Local Government?..…….

28. What was/ were the starting month(s) for the old planting seasons for the past 15 years in Michika Local Government?.....

29. What has brought about the changes in the planting seasons in Michika Local Government

……
……
……
……
……
…… 30. How has the change in the planting season affected agricultural production in Michika Local Government?.....
.....

31. What have been the effects of deforestation on crop production in Michika Local Government?.....

……
……

32. How have you been adapting to the effects of deforestation? Please tick as much as you can (a). Application of fertilizer [ ] (b). Rearing of livestock [ ] (c). Fish pond [ ] (d). Others specify……

33. What was the total output record for the following major crops grown on your same farm(s) over the years indicated in the table below?

Cops	Yield (bags)			
	2015	2016	2017	2018

34. What are some of the programmes/projects to improve upon deforestation in Michika Local Government?

i……
……
……

ii……..……
……
……

iii……
…….....
.....

35. How can these challenges be resolved?

……
……
……..
.....

Appendix II: Alpha Cronbach Test of Reliability

Reliability Statistics		
Objectives/Variables	Cronbach's Alpha[a]	N of Items
Farming Characteristics	.821	8
Sources of Livelihood	.685	2
Deforestation on Livelihood	.574	4
Deforestation on Socio-Economic Dev.	.625	3

Source: Field Survey 2019, SPSS output

Appendix two (2) shows the result of the alpha Cronbach reliability test, which measures the consistency of questionnaire responses. Alpha Cronbach value of 0.821 was obtained from Farming characteristics section, 0.685 was obtained from sources of livelihood section, 0.574 was obtained from impact of deforestation of livelihood, and 0.625 was obtained from Deforestation on socio-economic development. These all indicates very good reliability, and our instrument of data collection for this study, measures consistently what it is required to measure.

Appendix III: Charts

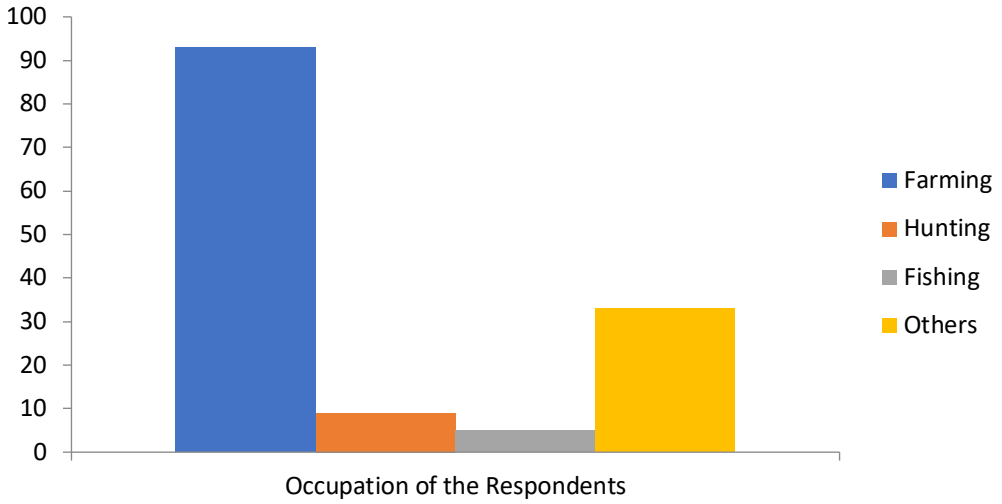

Figure 1: Chart virtualizing the occupations of the Respondents

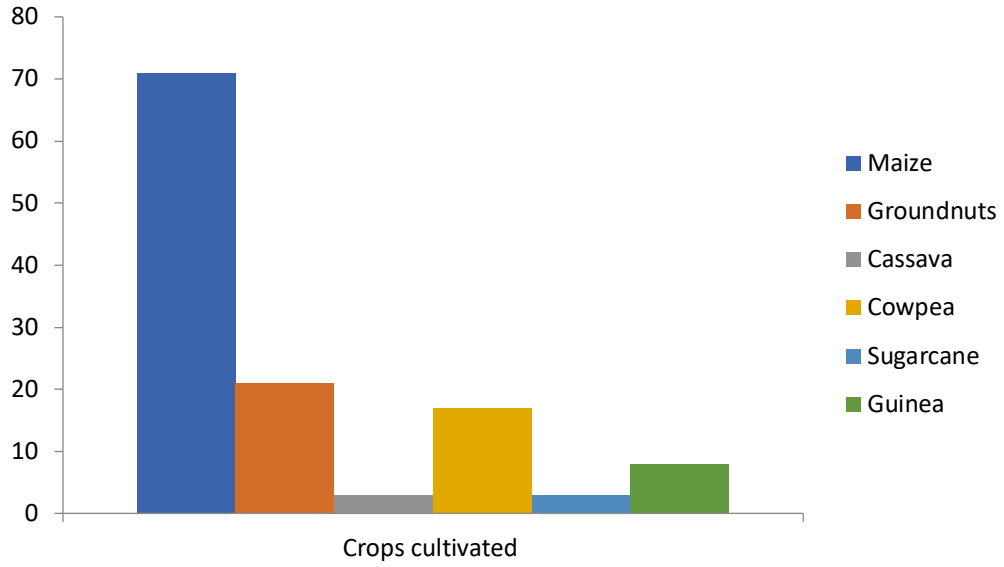

Figure 2: Chart virtualizing the types of crops cultivated

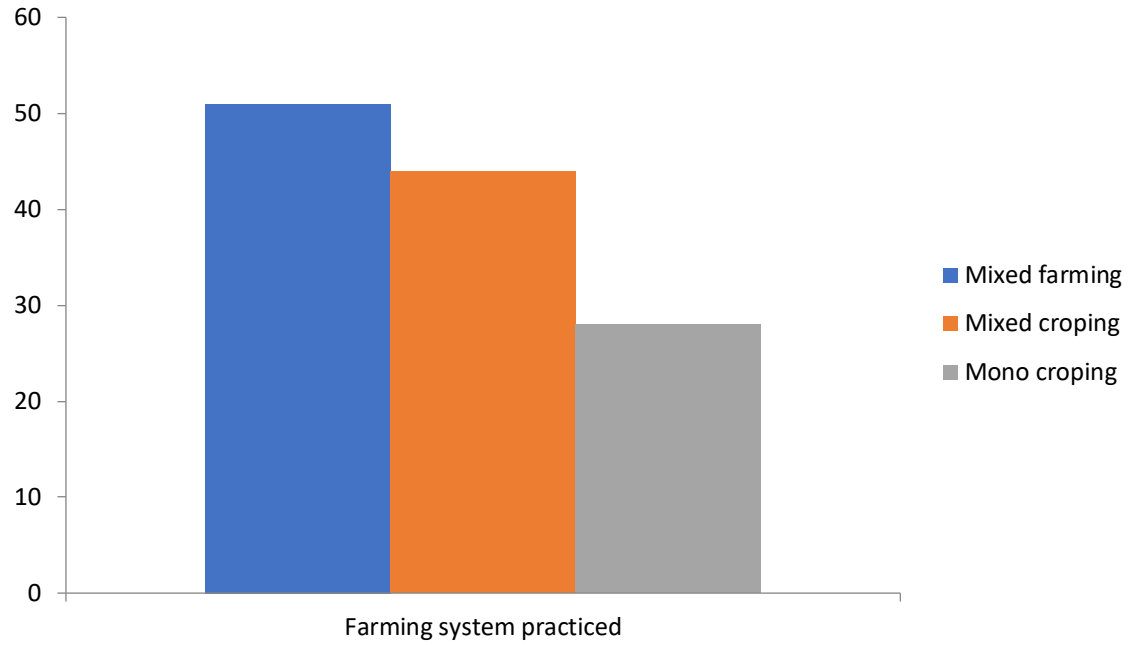

Figure 3: Farming System Practiced

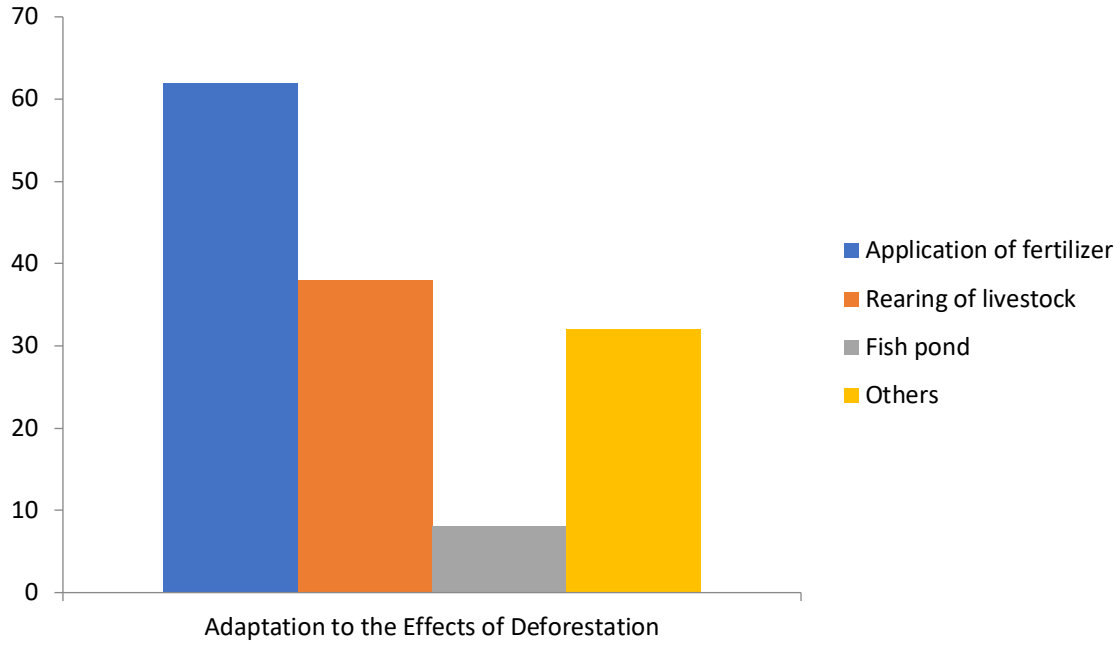

Figure 4: Adaptation to the Effects of Deforestation

Appendix IV: Plates

Plate 1: A respondent selling charcoal and firewood at Ghumchi Monday Market in Garta

Plate 2: A respondent selling charcoal and firewood at Moda Market.

Plate 3: A piece of land showing deforestation caused by illegal cutting of trees

Plate 4: Picture showing lumbering caused by illegal cutting down of trees

Plate 5: Lumbering on Futu Mountain