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DEFORESTATION OF IGWE FOREST AND ITS EFFECTS ON LIVELIHOOD PATTERNS OF PERIPHERAL COMMUNITIES IN BUGIRI DISTRICT, UGANDA

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ABSTRACT: *Forests have since ancient times played an important role of food provisioning to indigenous people and regulatory functions in the environment in general. In spite of their immeasurable benefits to life sustenance, the sustainable management of forest and forest resources in Uganda is oppressed with numerous challenges such as the conflicting roles of the various stakeholders involved in forest management. Descriptive analysis was done for mean frequencies and chi square using SPSS version 21 for Windows XP. The results showed that, the farmers in the study area are largely engaged in the cultivation of food crops which are mainly subsistence in nature. It was realized that the farmers practice mixed cropping with slash and burn as the predominant land preparation method. The study showed that deforestation has affected crop production in the areas of delayed planting seasons, pest and diseases infestation, level and quality of crop yields, reduction in the income levels of farmers and reduction in various tree species. The study recommended among other things, the continuous education and sensitization of farmers, strengthening of the public institution stakeholders and promotion of active research that will ensure a decline in deforestation.*

KEYWORDS: Deforestation, Environmental Degradation, Crop Failure, Livelihood Change

INTRODUCTION

The Food and Agriculture Organization (FAO) of the United Nations estimates the world's net forest change from 2000 to 2005 as -7.3 million hectares per annum. Of those7.3 million hectares, 4.0 million were lost (FAO -GFRA, 2005). In other words, over 55% of the world's net forest loss from 2000-2005occurred on a continent which is home to less than 17% of the world's total forest area (FAO – FOSA, 2005).

While more than two-thirds of Africa's population depend directly and indirectly on forests for survival (Olufunso, 2010). According to FAO (1982), about 37 000 km2 of forested areas in tropical Africa is cleared per annum. Recent estimates by Salih (1992) shows that the rate of deforestation in tropical Africa outstrips the rate of tree planting by 29 to 1. If the present trend of deforestation continues, all of tropical Africa's closed and open, productive forests are expected to be depleted within nine decades.

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). The forest goods and services enable the forest adjacent communities to diversify their livelihoods and also provide environmental functions that are crucial to the sustenance of community economy (Mamo *et al.*, 2007). The forest's role in air and water purification, production of healthy soils, cycling of nutrients, pollination, fodder, and regulation of erosion, pests and climate are of great essence for the Forest Adjacent Communities agricultural related livelihood activities (Kimenyi, 2002; Aruwajoye *et al.* 2013).

Uganda's forest reserves were gazetted with the aim of ensuring continuous supply of forest goods and services to the people of Uganda (Obua, Agea, & Ogwal, 2010). Today, forest and woodland cover in Uganda stands at 49,000 km² or 24% of the total land area. (FAO, 2015). Drastic changes in the forest cover have taken place in Uganda during the past century. In 1890, forests covered approximately 10,800,000 hectares or 52% of Uganda's surface area. By 1996, forest cover had declined to about 20%. Tropical high forest cover declined from 12% of total land area in 1900 to 4% by 2000 (FD, MWLE, 2003). This trend is worrying and has already claimed Bugala Islands for palm oil plantation, Namanve CFR for an industrial park, part of Pian Upe Wildlife Reserve for large scale agriculture and is likely to affect the South Busoga forests which are some of the few remaining forests at the shores of Lake Victoria.

However, despite the various conservation efforts the country's forest resource continue to be degraded and this jeopardizes both individual livelihoods and the country's economic development**.** The trend in loss of forest cover shows an accelerated rate of deforestation in Uganda compared to a number of other countries. The National Biomass Study Project (FD, MWLE 2003) estimates that per capita forest area will decline from 0.3 hectare in 1991 to 0.1 hectare in 2025, if there is no serious investment in forestry. Today, while 50% of all the tropical high forest on private land is degraded, only 15% in forest reserves is degraded.

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).

MATERIALS AND METHODS

Study Area

This study was carried out among communities adjacent to the Igwe forest complex in Bulesa sub-county, Bugiri district. Bugiri district is located in the south Eastern part of Uganda. It lies between longitude 33010' east, 3400 East and latitudes 00 6' north and 1012 North. The district

along its boarders are Tororo to the northeast, Iganga to the west, Namutumba to the North West, Mayuge to the southwest and Busia to the south east. The Igwe forest complex is managed by the Bugiri District.

It covers 749.9 hectares; comprised exclusively of pines and other indigenous tree species like *Milicia excelsa* (Welw.) C.C.Berg (muvule), *Maesopsis eminii* Engl. (musizi), Grevillia. The Ecosystem is surrounded by and Namayemba west Village. The study was specifically conducted in the Kasagaza and Namayemba west Village in Igwe Parish location, Bulesa Sub-county.

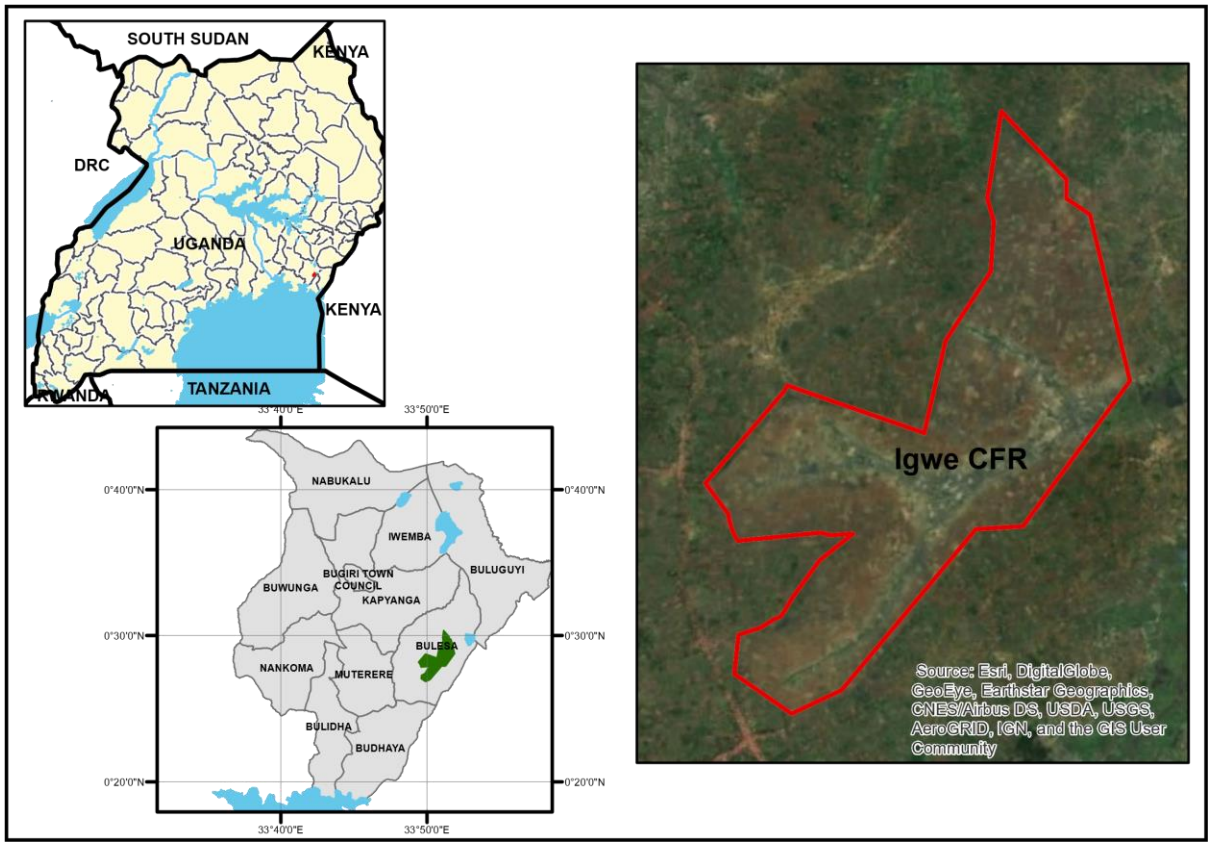

Figure 3.1: A Map Showing the Study Area

Research Design

The research design used for this study was the descriptive research design. Since data characteristics will be described using frequencies and percentages.

Data Sources and Collection Methods

Both the secondary and primary data was comprised of quantitative and qualitative data. The primary data was collected using a combination of interview guides and structured questionnaires was used to collect data from the farmers, Municipal/sub-county Meteorological Department, District Forestry Department, Municipal/Sub-county Agricultural Development Units and Agricultural Extension Officers.

The secondary data was sourced from books and publications of various scholars and authors which are related to deforestation and livelihood patterns.

Plant spacemen was collected and deposited at the national herbarium for identification.

Sampling Technique and Sample size Determination

A simple random sampling was applied in the study. To get the sample size from the unit of analysis. The respective community population was divided by the entire Gross-total population and then multiplied by 100% as derived from the formulae Booth *et al.* (2008). The list of villages was derived by the help of four research assistants among whom one was a village elder. Booth *et al.* (2008) study on the craft of research's rigorous scientific formulae, which provides for 95% confidence level, was used to compute a sample size of 72 households from the Igwe forest complex peripheral communities.

Data Analysis

The data was entered into Statistical Package for Social Sciences (SPSS) and excel work sheet for cleaning and sorting to allow for the analysis. The analysis of the data was carried out using qualitative and quantitative techniques. Tables, figures and graphs was used for the quantitative analysis.

RESULTS

Socio-Demographic Characteristic of the Respondents

The total number of respondents was 72. The study revealed a male dominated agricultural sector with males constituting (62.5 %) of the population. The study focused on respondents who were eighteen and above. Thus, the average of the respondents was 44 years and was found to constitute (34.7%) of the respondents. From the study, it was found out that, respondents without any form of formal education were the highest with approximately (55.5%). From the study it was found out that a large majority that is (71%) of the respondents are married.

Table 1: Descriptive Summary of Respondents' Characteristics

Socio- Economic Characteristic N=72		Frequency	Percent
Sex	Males	45	62.5
	Females	27	37.5
	Non formal	40	55.5
	Primary	27	37.7
	Secondary	3	4.1
Education Level	Tertiary	2	2.7
	Married	51	71
	Single	7	10
	Divorced	4	6
Marital Status	Widowed	10	13

Non-Timber Forest Products (NTFPs) Households Rely on for a Livelihood

Majority of residents around Igwe forest in eastern Uganda depend on forest products for a livelihood. Several products are harvested from the forest to meet different family needs. Key among these are non-timber forest products like herbs, pasture, honey and wild fruits. Community member harvest these products at different periods of the year all year round. The results revealed that 52% of the respondents' collected herbs, while 36% depended on pasture, 8% collected honey, and 4% depended on wild fruits for food.

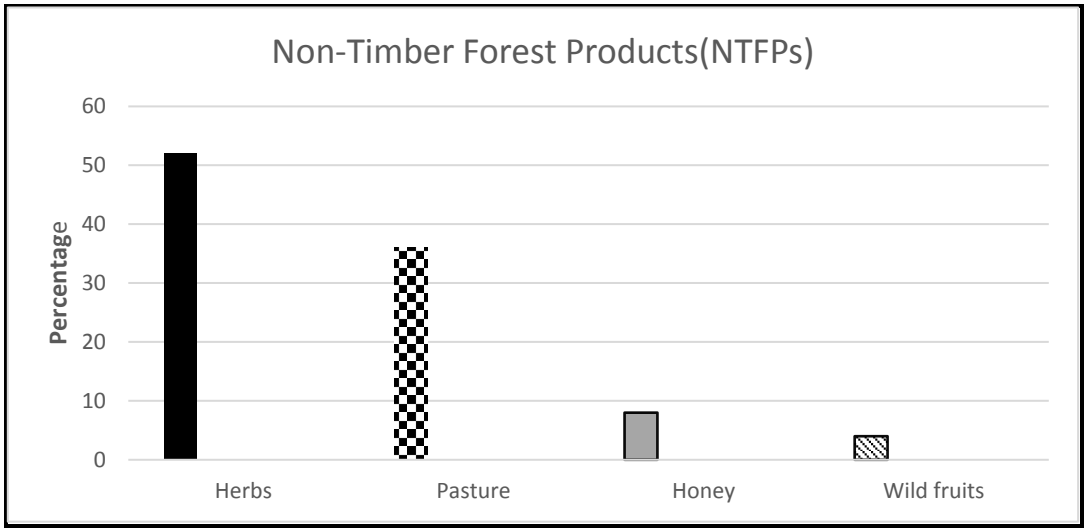

Figure 1 Non-Timber Forest Products Utilized for Livelihood

The results indicate that most of tree species collected are primarily used for firewood, with Lela tree species as the most preferred and highly collected (76%) for firewood, charcoal and timber/ It was followed by Musizi - *Maesopsis eminii* at 10%, Mugaire - *Ficus natalensis* (6%), Musita - *Albizia Coriaria* (5%) and Pine - *Pinus caribea* (1%). These tree species were mainly collected for purposes of firewood. Similarly, while Neem - *Azadirachta indica* tree (1%) was purposely collected for medicinal purposes, Mvule - *Milicia excels* (1%) was favoured for building material as seen in the table below.

Table 2: Tree Species Most Collected for Various use by Local Communities

Plant family	Trees Species	Reason for Collection	Status of Scarcity	Frequency	Percent
Moraceae	*Milicia excelsa* muvule	Building	No	1	1
Leguminosae	*Albizia coriaria* Musita	Firewood, timber, charcoal	Yes	3	5
Moraceae	*Ficus natalensis* Mugaire	Fire wood, charcoal	Yes	4	6
Meliaceae	*Azadirachta indica* Neem tree	Medicinal/herbs	Yes	1	1

Rhamnaceae	*Maesopsis eminii* musizi	Firewood	Yes	7	10
Bignoniaceae	*Stereospermum kunthianum* Lela/ Ndebeza	Timber, firewood, charcoal	Yes	55	76
Pinaceae	*Pinus caribea* pine	Firewood	Yes	1	1
Total				**72**	**100**

Other Livelihood Options

Apart from forest-based products, the study also revealed that the respondents in the study area depend on a variety of land use activities for a livelihood. The results show that 83% of the households relied on crop production as their primary livelihood activity. The results indicated that 4% of the respondents pursued livestock keeping either as their main livelihood activity. 13% of the respondents were dependent on forest products as their prime livelihood activity. However, 100% of the households entirely depended on forest products for all their Livelihood options.

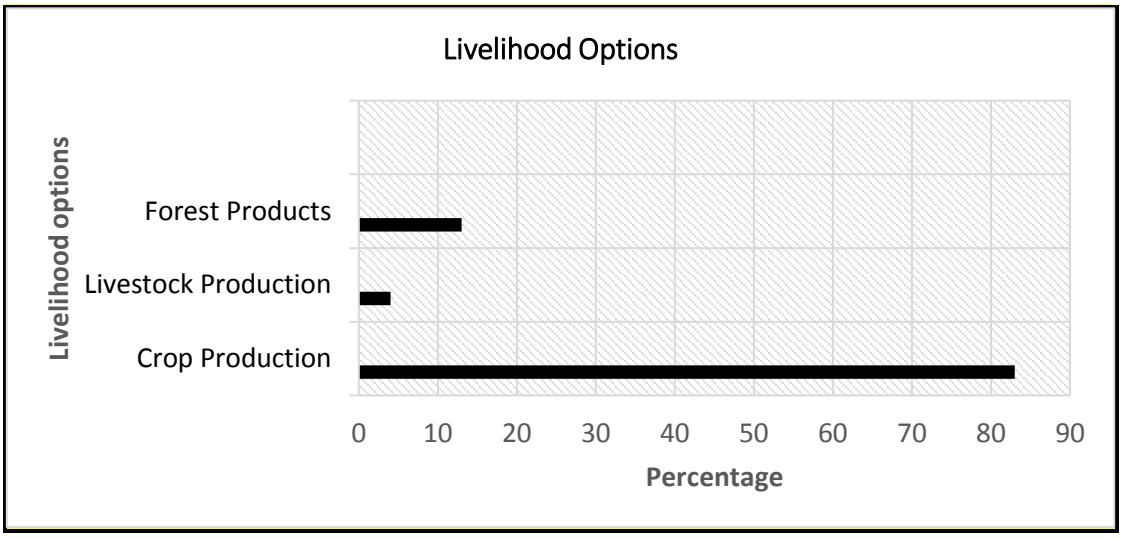

Figure 2: Livelihood Options Available for Local Communities

Our findings further revealed that 76%, 13% and 11% of the respondents use labour-intensive, capital-intensive and a combination of the two methods respectively. This means that, 76% of the respondents solely rely on simple farm implements such as hoe, cutlasses and axes to prepare land and manage farms for crop production, whereas only 13% relies on machinery for their cultivation.

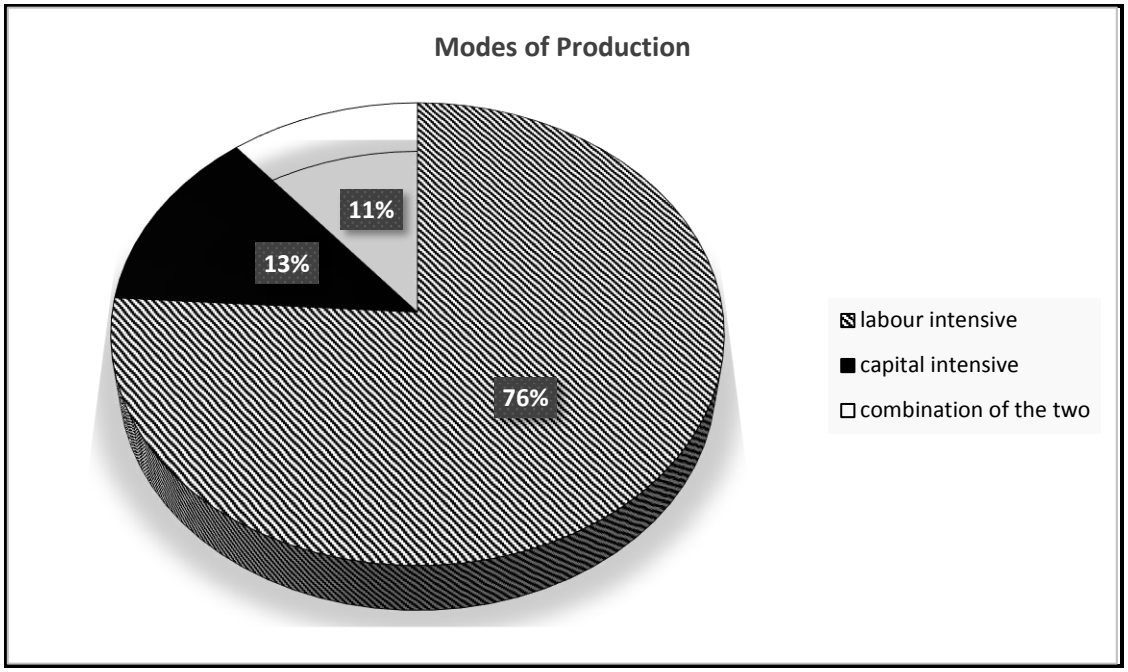

Figure 3: Modes of Crop Production Around Igwe Forest

Effects of deforestation on livelihoods

The survey revealed that 90 percent of the respondents have experienced changing patterns in the season for commencement of active farming activities. Figure 4 below illustrates the current trend of seasonal planting events in the study area.

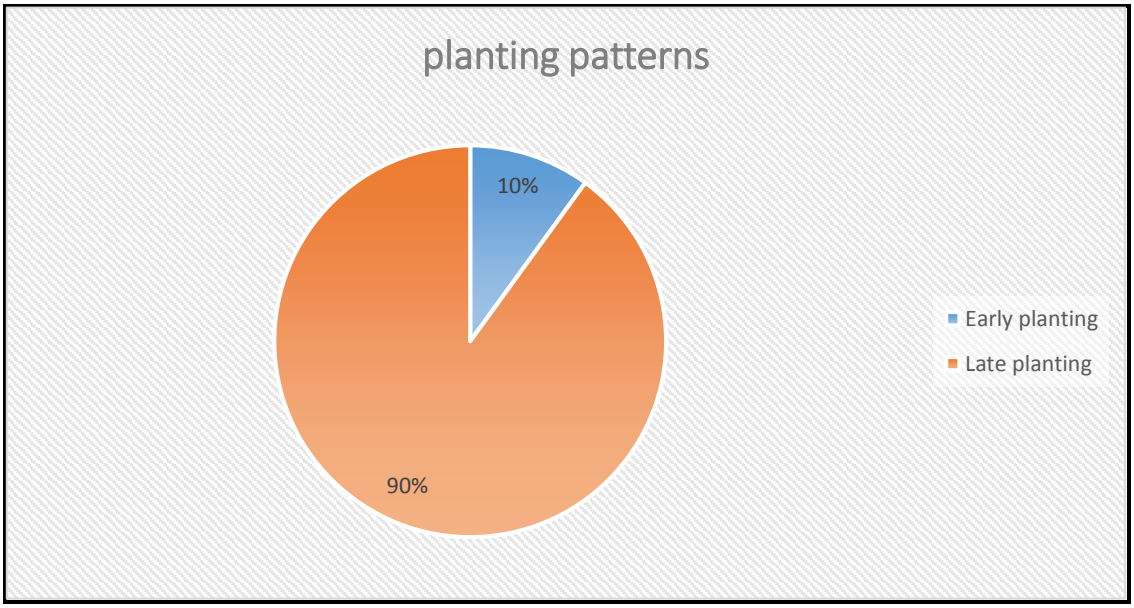

Figure 4: Changes in Planting Patterns

In addition, the yield of major crops has been decreasing over the 12 months of the study period and most probably in the previous years. The yield of maize which is one of the major crops cultivated in the study area experienced the highest marginal drop of yield at 8.62 percent from previous harvest, while beans had the least marginal drop of 0.03 percent on yields. On average, there was a marginal drop in yields from previous harvest by 5.5 percent.

Table 3: Crops Yield Marginal drop from Previous Harvest (in Kilograms)

Crop Type	Quantity produced (Kgs)/Past 12 Months			
	First six months	Last six months	Usage	% Change
Maize	81,278	74,266	Own & Sold	-8.62
Beans	63,140	61,189	Own & Sold	-0.03
Groundnuts	3,447	1,248	Own & Sold	-63.7
Sweet Potatoes	28,336	26,467	Own & Sold	-6.59

On livestock production, the survey revealed an increasing yield over the past one year. There was significant increase in cattle and goats, except for poultry where a decline was recorded over the same period.

Table 4: Livestock Type and Trends in Yield

Livestock Type	(Quantity produced in Past 12 Months			
	Beg. of Year	End of Year	Usage	% Change
Cattle	937	1,020	Own & Sold	8.85
Goats	590	745	Own & Sold	26.2
Chicken	875	534	Own & Sold	-38.9

Overall income of the farmers dropped by some margin in the last 12 months. For instance, income levels on beans and groundnuts in the past 12 months were drop by -3.09 percent and -63.3 percent respectively and the income levels of sweet potatoes was dropped by -6.59 percent between season 1 and season 2 of the past 12 months.

Table 5: Differences in Levels of Income from Crops Between Seasons

Crop	Prices per/kg (in UGX).	Income Levels (UGX)/Past 12 Months		
		Season 1	Season 2	% Change
Maize	800	65,022,400	59,412,800	-8.62
Beans	1000	63,140,000	61,189,000	-3.09
Groundnuts	4000	13,788,000	4,992,000	-63.3
Sweet Potatoes	1000	28,336,000	26,467,000	-6.59

Away from domesticated plants and animal sources of livelihood, our study further shows that the yield of major Forest products has been generally decreasing over the years. The fire wood which is the most used forest product had a marginal drop of 27.8 percent for the last 12 months then followed by the building materials which had a marginal drop of -20.3 percent for the last 2 months while charcoal and NFTPs (Non-Forest Timber products) had a marginal drop of -32.8 percent and -58.2 percent respectively for the last 12 months.

Table 6: Decline in Yields of Forest Products

Forest Products	(Quantity collected (Kgs)/Past 12 Months			
	First 6 Months	**Last 6 Months**	**Usage**	**% Change**
Firewood	19,434	14,012	Own & Sold	-27.8
Charcoal	11,673	7,835	Own & Sold	-32.8
Building Materials	16,064	12,787	Own & Sold	-20.3
NTFPs	640	267	Own & Sold	-58.2

Source: Field Survey, 2018

Faced with many challenges associated with changing environment and increasing demand for forest products and food, the respondents reported various strategies they are using to mitigate the effects of deforestation on their livelihood. The study revealed that 74 percent of the respondent have resorted to agro-forestry to address the challenges of deforestation and wood fuel in the study area.14 percent have resorted to mixed farming, 8 percent resorted to cultivating drought tolerant crops and 4 percent resorted to applying fertilizers in the crop land to address decline in soil fertility and improve the yields.

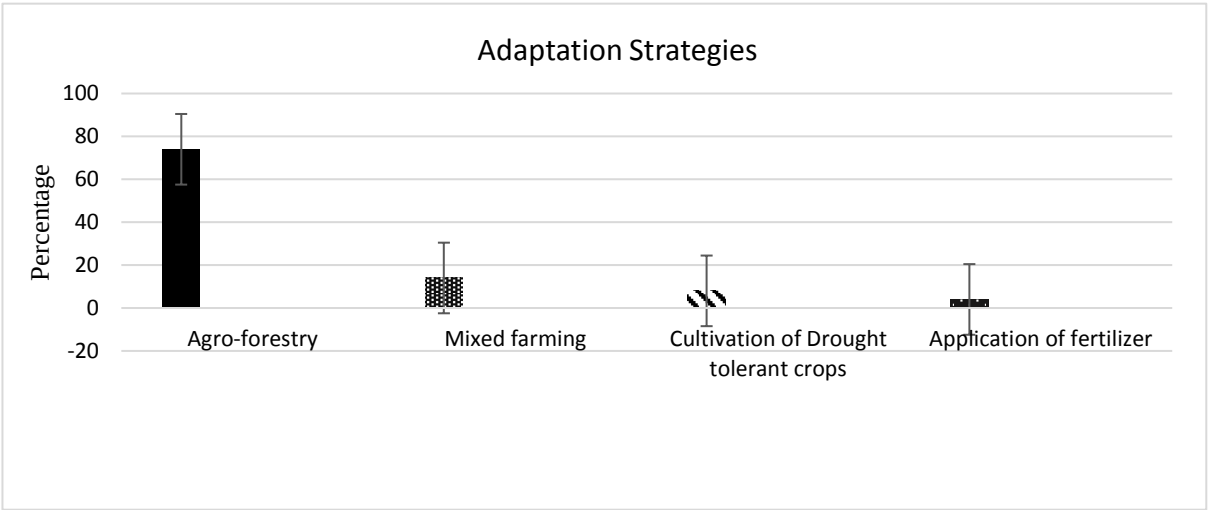

Figure 5: Adaptation Strategies of the Effects of Deforestation in the Study Area

DISCUSSION

From the findings, only a few respondents ranked forest products as their main livelihood activity, despite the fact that 100% of the respondents at some point during the year use forest products like firewood, charcoal, building materials, herbs, honey, fruits, pasture, tree seedlings and wild game. According the World Bank, (2004)'s forest strategy, more than 1.6 billion people depend on forests for their livelihood globally where in Kenya, an estimated 3 million people living within and adjacent to forests rely directly and indirectly on forests to make a living (Olufunso, 2010). Also, this finding concurs with numerous other studies such as Howell *et al.* (2010) in Malaysia and Kabubo-Mariara, (2013) in Kenya which demonstrates the contribution of forests to the adjacent communities' livelihoods and particularly in most parts of the less developed world including Kenya.

Majority of those who fetch fuel wood on a weekly basis for home consumption often collect on back-loads (83%). This is often influenced by factors such as the household sizes which dictates the consumption levels and income generation needs. The latter option was however disputed by FGDs participants who unanimously indicated that there was no market for fuel wood and therefore all wood collected was exclusively for household consumption. Forest remains the major sources of energy for the FACs. Introduction of improved stoves and renewable energy fuels like briquettes in particular in the study area can contribute to less collection less firewood from the forests and also reduced emission of CO_2 via charcoal burning. This was confirmed to have been achieved in over 60% households in other areas in South Nandi (Gichuki *et al.*, 2014).

Although very few respondents reported cutting down trees for charcoal burning for home use, our field observation indicate that charcoal production was an important livelihood activity in the study area. We observed charcoal pieces here and there on the road sides, an evidence of it being ferried around. Also seen burning, several mounds of traditional charcoal kilns in hidden areas of the forest seemly to avoid any confrontation with the arm of the law. Commercial charcoal production and movement in the study area. Charcoal production is widely known to involve tree cutting which results to destruction of vegetation cover. If charcoal industry remains unsustainable which is likelihood of the study area, it may result in disruption of livelihoods of millions of people across the globe who rely directly on forests as fuel source.

The study revealed only 4% of the respondents had assembled building materials from the forest. They said that the building materials were harvested merely for building their houses. It was however established during the FGDs and Key informant interviews that illegal cutting down of trees was still ongoing. Some of the communities also bribe the officers on patrol while the officers themselves also accept the bribes thus colluding and allowing cutting and ferrying of poles and timber out of the forests on donkeys for sale irrespective of the DFD/NFA office stationed adjacent to study area.

It is worth noting that some efforts were however reported to been made to reduce on rampant illegal harvesting of trees by the DFD and NFA officers who make impromptu visits to the forest and reprimand culprits as revealed during the FGDs and key informant interviews. Building material remains an important livelihood source and there is need to enhance enforcement of the forest regulations to curb rampant illegal tree cutting to safeguard the carbon sinks and abate climate change. There is also need to consider promoting agro-forestry

activities and participatory forest management (PFM) which encompasses income and recreation issues to achieve sustainability.

The land under cultivation for the production of various food crops, namely: maize, rice, sweet potatoes, cassava and groundnuts has decreased substantially over the years due to fragmentation. The combined effect of the changes in land under cultivation over the past one-year period alone was 64. 53% with annual forest loss of 6.453%. From the resuts obtained through interactions with the respondents and communities around Igwe forest, the most common way of expanding farm sizes in the study area is by clearing additional virgin lands, which are usually forest fringes.

This practice of clearing virgin lands has accelerated the rate of converting forestlands into agricultural land (forest loss). Indeed, local rate of forest conversion into crop lands has exceeded that of the national forest loss rate of 2.3% over the last 11 years (FAO, 2012). What this means is that, if the trend is allowed to continue without proper mechanism in place to check the menace, the forest resources in these communities will be exhausted in not too distant future. This could lead to loss of alternative livelihood opportunities.

To avert the situation, local residents suggest punishment of the offenders as a deterrent measure aimed at saving the remaining forest cover. Our findings are consistent with those obtained in a study conducted in Mt. Elgon by Ongugo *et al.* (2008), who pointed out existing forest regulations as providing for punishment to those who damage the forest in search of wood products. The wood products usually harvested include logs for charcoal, firewood, and other commercial purposes such as furniture production.

CONCLUSION

The study established that deforestation impacts the lives of respondents in many areas including affecting crop production in the areas of delayed commencement of planting seasons, pest and diseases infestation, level and quality of crop yields, access to water for irrigation farming and reduction in the income levels of farmers. Although several efforts have been initiated to mitigate these impacts the study revealed that they have been thwarted by challenges such as low institutional capacity, unavailability of funds, unfavourable farming methods and low educational background of farmers. Given the critical role crop production in the livelihood of the residents as well as economy of the region, it is important that sensible measures are adopted to mitigate the negative impacts that deforestation is having on it. In this regard the study recommended continuous education and sensitization of farmers, strengthening of the public institutional stakeholders and promotion of active research as some of the ways for mitigating the impacts of climate change on crop production.

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Conflict of Interest

The authors declare that they do not have any conflict of interest

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