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Impact of Deforestation on Rural Livelihood in Mbieri, Imo State Nigeria

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ABSTRACT: *Globally the rate of deforestation and forest degradation is around 13million hectares, occurring mostly in developing countries. This study aimed at assessing the impact of deforestation on livelihood sources in Mbieri a rural community in Imo State, Southeast Nigeria. Multi-Temporal Satellite Images were analyzed for changes in land use and land cover in the area, while random sampling method was used to administer the questionnaire, and participatory rural appraisal (PRA) method was used to elicit information on drivers of deforestation, income levels and perceived effects of deforestation in the study area. Six land use/cover types were identified namely; farmland, bare soil, built-up surface, water bodies, secondary forest and primary forest. GPS coordinates of the sampled deforested areas were also recorded and used to overlay on the Satellite processed data on land use and land cover. Data were further obtained from the satellite imageries of Landsat 4, thematic mapper (TM) and Landsat 7 and 8 ETM+ covering the year 1986, 2000, and 2016 respectively. Results from satellite image analysis revealed that land use changes have negatively impacted deforestation leading to loss of primary forest and reduction in secondary forest. Built-up areas and farmland increased from 13.92% and 11.47% in 1986 to 32.86% and 21.97% in 2016 respectively. While the primary forest reduced from 35.94% in 1986 to 10.78% in 2016. Population increase and agricultural expansion were identified as the major drivers of deforestation in Mbieri. Impacts of deforestation on the people include loss of valuable species of flora and fauna, decreased earnings from the sale of forest resources and loss of farmland to erosion of exposed surfaces. It is recommended that forest plantations be increased by using vacant and unused lands which will have net positive benefits also, deliberate reforestation should be embarked on to avoid environmental degradation and possible increase in ambient temperature.*

KEYWORDS*:* deforestation, forest, landuse, livelihood, population increase, satellite image, urbanization

INTRODUCTION

Deforestation means the process of changing forest land from its original state to other permanent forms of non forested land use such as agriculture, grazing land as well as urban development (Vankooten and Bulte, 2000). Wikipedia (2017) views it as, the irreversible destruction or end of forest cover to make land available for residential, commercial or industrial purposes. Aina &

Salau, (1992) and Fiset, (2011), agree that it is an extensive removal of forest converted to different purposes without replanting them. The earth's surface is covered by forest which provides a lot of environmental benefits such as water cycle, soil conservation, mitigation of climate change and biodiversity preservation (Sheram, 1993). Nzeh (2004) had posited that activities performed in the forest that can enhance rural households' income include the gathering of forest products, processing of the various forest products and marketing of the forest products. Forest makes provision for a variety of services which are ecological, economic and social, including the conservation of biodiversity, carbon sequestration, soil and water conservation, provision of job opportunities and enhanced livelihood, enhancement of agricultural productivity and improvement of urban and per urban living conditions (FAO, 1999).

However, this very valuable resource has come under serious threat as a result of deforestation triggered mostly by anthropogenic activities. Adeofun (1991) reported that about 11 million hectares of forest are being cleared yearly in developing countries, while FAO (1997) estimated that in tropical Africa, the loss of forest cover between the years 1990 and 1995 amounted to about 18million hectares at the rate of 7% per annum. Also, FAO (2001) reported an estimated loss of forest cover in Nigeria from 17.5 million hectares in 1990 to 13.5 million hectares in 2000, averaging 400 thousand hectares per annum or 2.6%. Eboh (2005), Eboh, *et al*. (2006) had asserted that more than 50% of woodland loss resulting from forest degradation has occurred within the last 4 to 5 decades. Generally, the socioeconomic consequences of forest exploitation and consumption are overlooked. The social effect of forest degradation usually occurs at the local level as evidence by the loss of ecological services which the forest provides. Therefore deforestation is viewed as a social injustice symbol (Colchester and Lohmann, 1993). Despite the rate of deforestation, forests play an important role in moderating both microclimate and local weather in an area.

The causes of deforestation differ and can be grouped into natural factors and anthropogenic factors. The anthropogenic factors include degradation of the forest for agricultural activities, fuel wood production, illegal and uncoordinated timber extraction, social and environmental disagreement, industrialization and urbanization (FAO, 2002). The natural factors are mostly drought and natural forest fires (FAO, 2010). In Sub-Sahara Africa including Nigeria, a lot of households depend on the forest for fuel wood which they use for cooking. This is responsible for about 75% of the energy consumed in the country annually as reported by Ardayfio-Schandorf (1993) & NBS (2006[a]). Most industries and food processing enterprises run by women depend largely on fuel wood. This dependence on fuel wood has resulted in the increased exploitation of the country's forest. However, forest reserves in forest communities experience more pressure from anthropogenic factors as a lot of the people residing in such communities depend on the access, availability and utilization of forest products for their livelihood (Appiah, 2009). For instance, FAO (2011) reported the loss of massive expanse of forest reserve in Nigeria to farm settlement, industrial development and urbanization. Most forest communities are characterized by extreme poverty levels and rely mostly on rain-fed agriculture, and having little or no access to modern farming techniques (Blay *et al.*, 2008). The imbalance that occurs in the forest ecosystem, such as the depletion of the forest cover poses a major challenge to the livelihood of people

especially those in the forest communities who rely so much on the forest and its resources. Deforestation can result in economic losses in a country. When forests are removed it will reduce the rate of returns from resources and products gotten from the forest such as timber and non-timber forest products (NTFPs). Loss of biodiversity is imminent with the depletion of forest cover as species become endangered or threatened with extinction (Roper and Robert, 2006). Equally valuable agricultural land is lost to soil erosion as has been observed in Southeastern Nigeria (Adeofun, 1991 & Okoji, 2001).

This study was therefore carried out to assess the effect of deforestation on the livelihood of the people in Mbieri, a rural community in Mbaitoli local government area of Imo State Nigeria.

MATERIALS AND METHODS

Study Area

The study was carried out in Mbieri, one of the rural communities in Mbaitoli Local Government Area, Southeastern Nigeria. The area lies on latitude 5º 34' and 5º 56' North of the equator and longitude 7º 03'09" and 7º 03'28" East of the prime meridian as shown in figure 1. The climate of the area is characterized by two distinct seasons, the wet and dry seasons, each prevailing at different times of the year. The dry season usually starts in November and ends in March, while the rainy season starts in March and terminates in October. The average annual temperature in the area is 28ºC. Average humidity is about 75% during the rainy season and 45% during the dry season. The area is situated in the tropical rainforest belt and the vegetation is typical of the rainforest. However, anthropogenic activities have significantly altered this forest structure. The LGA has a total population of 237,555 (NBS, 2006[b]), with a projected annual growth rate of 3.0%. Predominant economic activities in the area are farming, trading, artisanal work, and a few Civil servants. By virtue of its proximity to the State capital, the area is undergoing a rapid transformation from a rural to a semi-urban area.

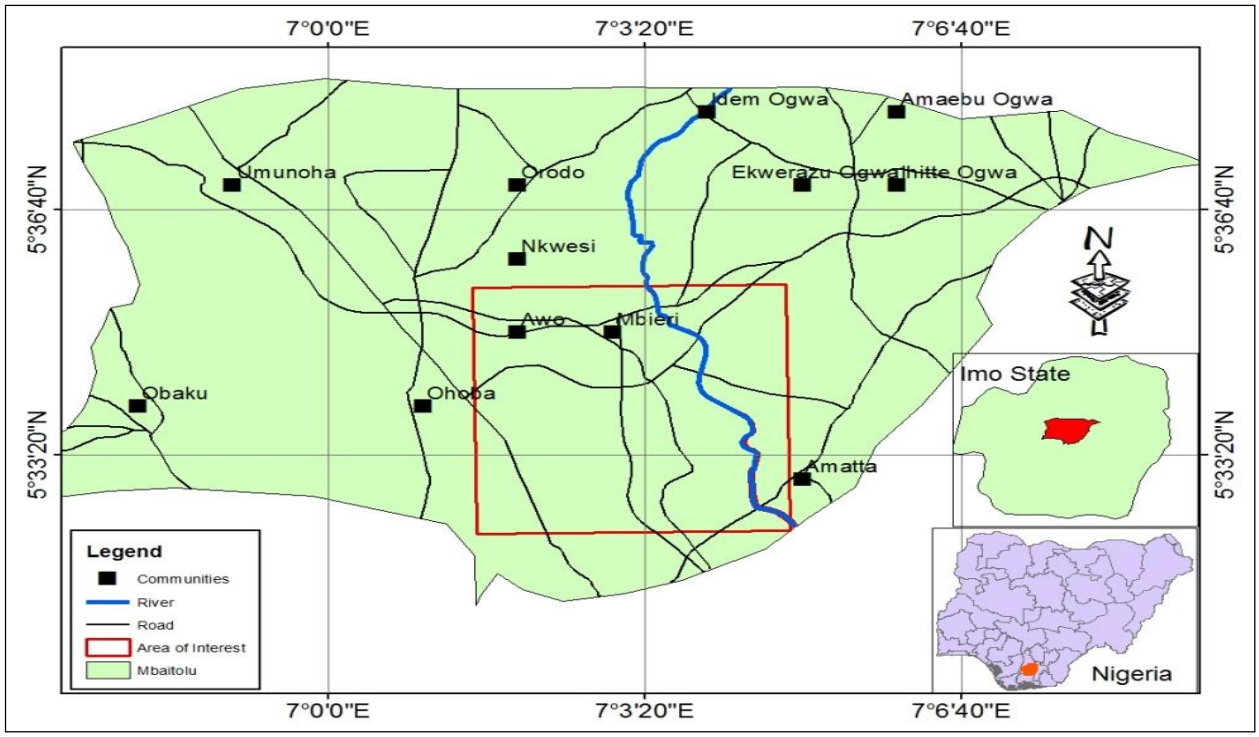

FIGURE 1: Location Map of the Study Area

Data Collection: Primary and secondary data were used in this work. The primary data were collected using a structured questionnaire. Participatory Rural Appraisal (PRA) method guided by a checklist was also used to conduct semi-structured interviews, while field observations and necessary measurements were taken and recorded appropriately during a transect walk. Information sought include among others, age of household heads, occupation of household heads, cash income from selected forest products, use of forest products, causes of deforestation, economic losses due to deforestation, etc. A handheld global positioning system (GPS) receiver (Etrex Garmin version1.0) was used to acquire GPS coordinates of deforested sites. Other primary data include satellite imageries of Landsat 4 Thematic Mapper (TM) of 1986, and Landsat 7 and 8 enhanced thematic mapper plus (ETM+) of 2000 and 2016 respectively. These were acquired from the data archive of Global Land Cover Facility (GLCF) University of Maryland, United States Geological Survey (USGS) data management unit, National Space Research and Development Agency (NASRDA), Abuja. Secondary data used in the study include the administrative and local government map of Nigeria obtained from NASRDA, and the landuse and infrastructure map of Mbieri obtained from Geosat Environmental consult, Owerri.

Sampling Technique: The purposive random sampling technique was used due to the mixed research strategy adopted. It served as a guide in the choice of appropriate sample points to ensure the generalization of sample findings to the true representative of the population which happens to be the key characteristic of all probability sampling techniques. This technique helped in the selection of household heads for the questionnaire administration.

Data Analysis Tools: The software used for the data analysis includes; Arc view 10.1, this was used to show the subsequent process and enhance the image. Arc GIS was used to complement the display and processing of the data. ERDAS 2014 was used for the development of land use land cover classes and change detection analysis of the study area. Microsoft Word was used for the presentation of the research. Microsoft Excel was used for producing graphs and charts.

Data Analysis Methods:
A land use/cover classification scheme was developed for this study after the model of Anderson *et al.* (1976), hence Six (6) categories of land use/cover were identified. The methods adopted for the image analysis include; band combination and image processing, maximum likelihood classification, area calculation of resulting land use/cover types for each study year, overlay operations, and change detection of LULC variability. The Landsat imageries are made up of seven bands and though the seven bands were acquired only three were combined for the Land use land cover analysis. Data from relevant aspects of the questionnaire were analyzed and presented using graphs and charts.

RESULTS AND DISCUSSIONS

The land cover classification result of the study area for 1986 is displayed in figure 2.

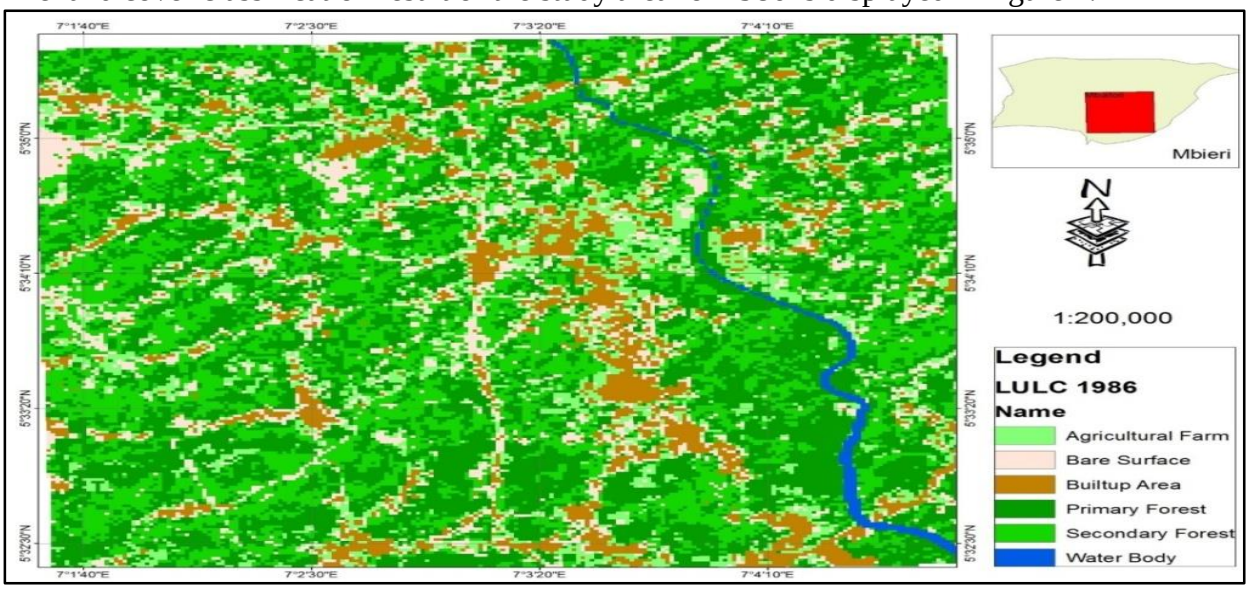

Figure 2: Land use land cover classification of Mbieri 1986

Analysis of the 1986 image revealed that primary forest constituted the largest proportion of land cover in Mbieri with a value of 35.94%, followed by secondary forest which accounted for 28.88% of the total area cover. Built-up area constituted 13.92%, while agricultural land, water bodies and bare surface occupied 11.47%, 2.23% and 7.56% respectively as displayed in table 1.

Table 1: Statistical distribution of the LULC of Mbieri 1986

LULC CLASS 1986	COUNT	AREA M^2	HA	% COVER
AGRICULTURAL FARM	4836	4352400	435.24	11.47
BARE SURFACE	3188	2869200	286.92	7.56
BUILTUP AREA	5872	5284800	528.48	13.92
PRIMARY FOREST	15154	13638600	1363.9	35.94
SECONDARY FOREST	12179	10961100	1096.1	28.88
WATER BODY	940	846000	84.6	2.23
TOTAL	**42169**	**37952100**	**3795.2**	**100**

Figure 3 shows the land use land cover classification result of the study area for the year 2000.

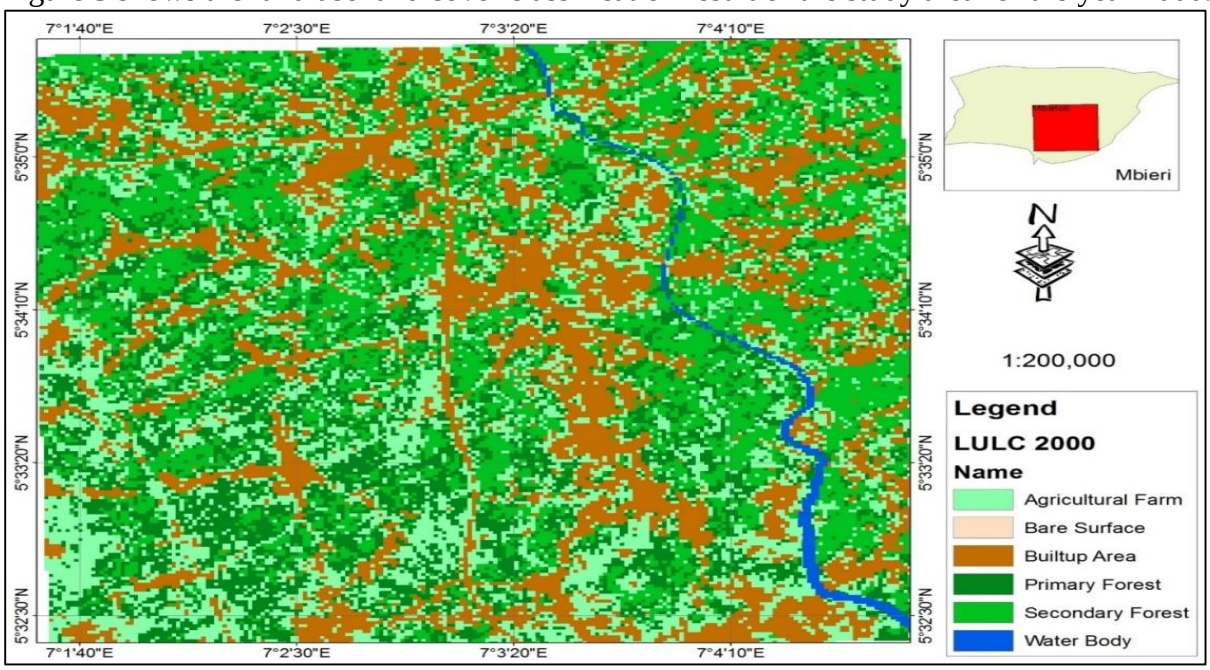

Figure 3: Land use land cover classification of Mbieri 2000

The result of analysis for the year 2000 shows that forest reduced to 21.36% and there was a slight reduction in the area cover of secondary forest to 24.06%. Furthermore, Built-up land expanded to 23.87% of the landscape as shown in Table 2. While agricultural land, bare surface and water body occupied 26.82%, 2.44%, and 1.46% respectively.

Table 2: Statistical distribution of the LULC of Mbieri 2000

LULC CLASS 2000	Count	Area M^2	Ha	% cover
AGRICULTURAL FARM	11308	10177200	1017.7	26.82
BARE SURFACE	1029	926100	92.61	2.44
BUILTUP AREA	10065	9058500	905.85	23.87
PRIMARY FOREST	9009	8108100	810.81	21.36
SECONDARY FOREST	10144	9129600	912.96	24.06
WATER BODY	614	552600	55.26	1.46
TOTAL	**42169**	**37952100**	**3795.2**	**100**

Figure 4 shows the land use land cover classification result of the study area for the year 2016.

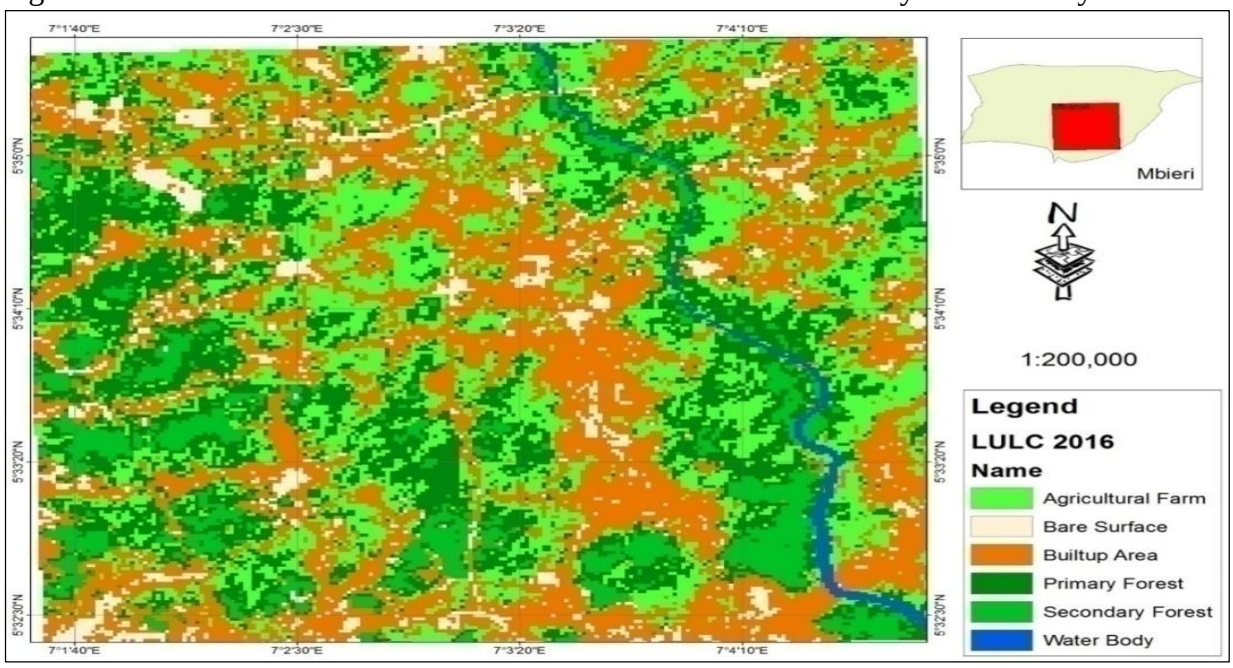

Figure 4: Land use land cover classification of Mbieri 2016

It can be seen in Figure 4 and Table 3 that built-up surface became the major land use class covering 32.86% of the landscape followed by secondary forest with 28.69%, agricultural farms followed with 21.97%, while primary forest shrank to 10.78%. Bare surface and water body followed with 3.92% and 1.78% respectively.

Table 3: Statistical distribution of the LULC of Mbieri 2016

LULC CLASS 2016	COUNT	AREA M^2	HA	% COVER
AGRICULTURAL FARM	9265	8338500	833.85	21.97
BARE SURFACE	1654	1488600	148.86	3.92
BUILTUP AREA	13858	12472200	1247.2	32.86
PRIMARY FOREST	4545	4090500	409.05	10.78
SECONDARY FOREST	12097	10887300	1088.7	28.69
WATER BODY	750	675000	67.5	1.78
TOTAL	42169	37952100	3795.2	100

Figure 5 shows the change detection analysis of the area for built-up cover in 1986, 2000 and 2016.

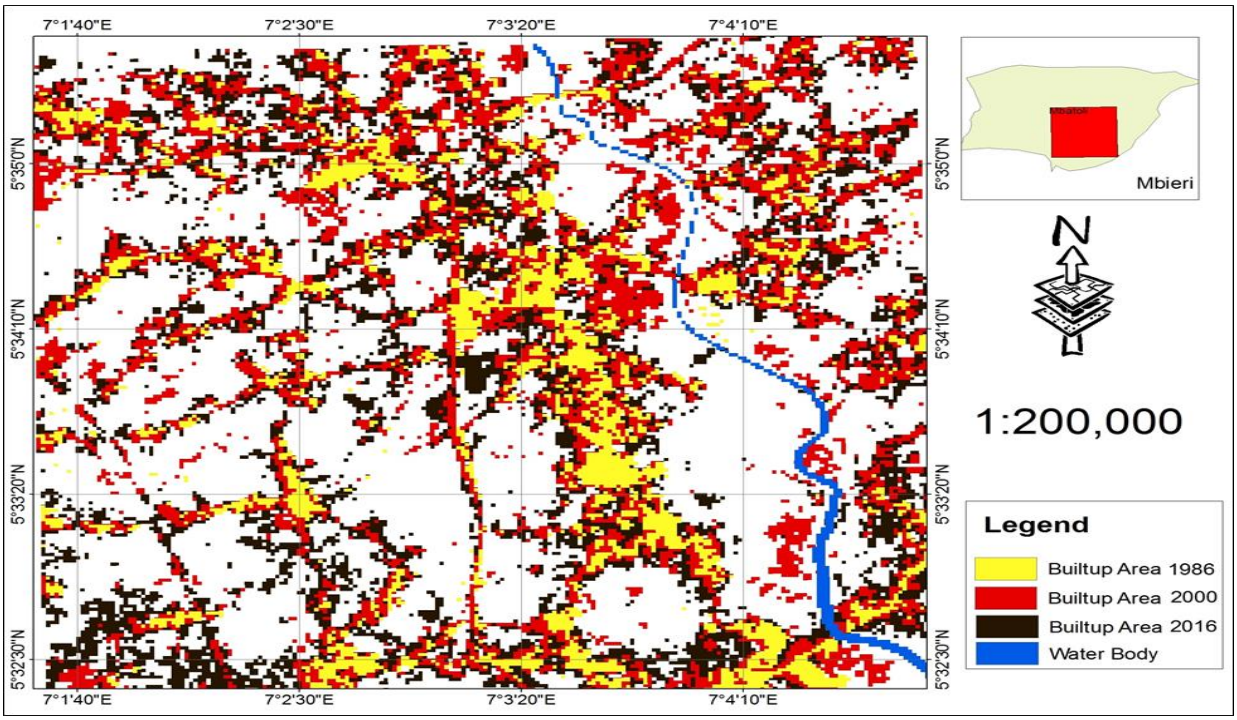

Figure 5: LULC Change detection map for Built-up Cover

Built-up surfaces followed an increasing trend starting with 13.92% coverage of the entire area in 1986, this increased to 23.87% in 2000 and subsequently to 32.86% in 2016. This trending increase was a result of increase in population that led to settlement expansion; equally the proximity of the community to the state capital makes it a good alternative for urban dwellers who want to move away from the congested city. There was a high marginal difference in the increase between 1986 and 2000 of 10% and 9% between 2000 and 2016.

Agricultural land occupied 11.47% of the landscape in 1986 and it peaked in 2000 at 26.82%, this was followed by a decline to 21.97% in 2016. This decline is attributed to the fact that a greater percentage of youths who hitherto have been involved in agriculture have now abandoned farming for other forms of economic activities such as trading and transportation. The magnitude and direction of land use and land cover change between the years 2000 and 2016 are further shown in Table 4.

Table 4: Distribution of LULC Change from 1986 to 2016 in the Study area.

LULC FEATURE	1986 _ Class	2000 Class	CHANGE	2000 _ Class	2016 Class	CHANGE
AGRICULTURAL FARM	11.47	26.82	**15.35**	26.82	21.97	**-4.84**
BARE SURFACE	7.56	2.44	**-5.12**	2.44	3.92	**1.48**
BUILTUP AREA	13.92	23.87	**9.94**	23.87	32.86	**8.99**
PRIMARY FOREST	35.94	21.36	**-14.57**	21.36	10.78	**-10.59**
SECONDARY FOREST	28.88	24.06	**-4.83**	24.06	28.69	**4.63**
WATER BODY	2.23	1.46	**-0.77**	1.46	1.78	**0.32**

Further illustration of this comparative change is depicted in Figure 6.

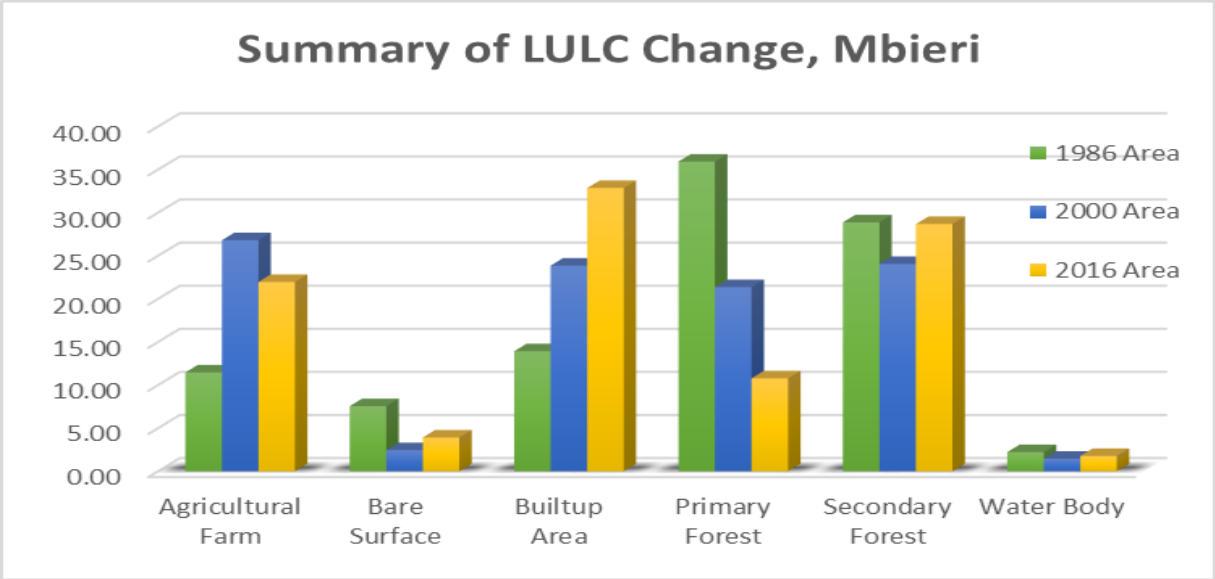

Figure 6: Summary of land use and land cover change in the study area from 1986-2016.

The extent of deforestation in the study area shows that a greater percentage of the population depends on farming especially on crop cultivation that requires cutting down of the forest trees and conversion of forest into farmland. Field investigation revealed that the principal way of increasing agricultural output was by clearing and converting primary forest into farmlands. Major drivers of deforestation in the area from the study as shown in Figure 7 are urbanization caused by population expansion and agricultural expansion, which has resulted in the conversion of forest to built-up surfaces and over-exploitation of forest resources, this agrees with the submission of Eboh, (1995).

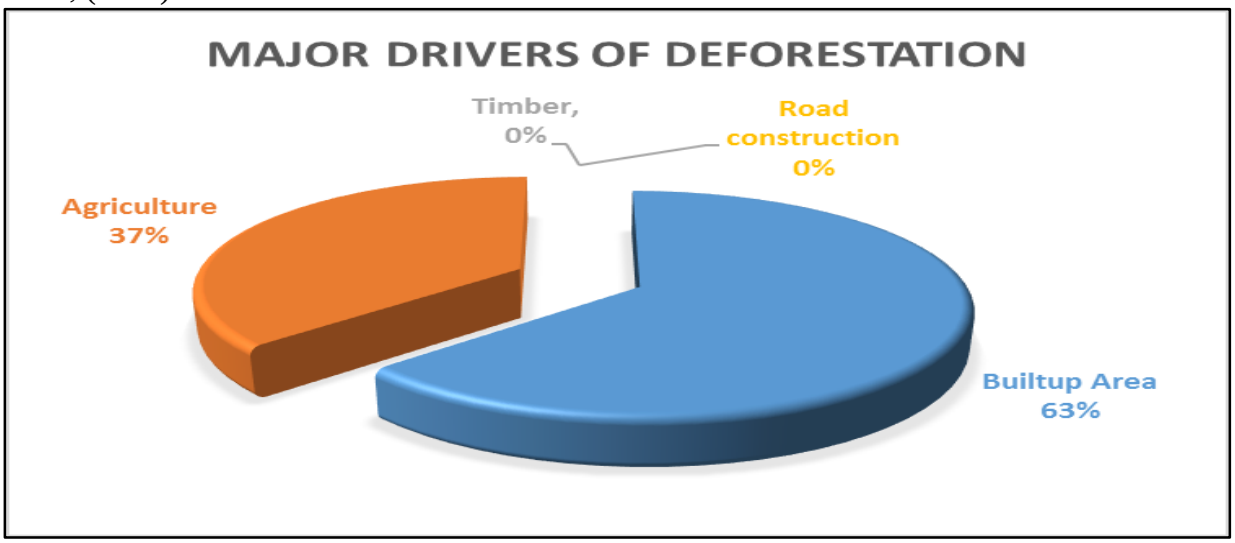

Figure 7: Major drivers of deforestation.
Source: Fieldwork by authors.

Implicit in this scenario is a higher tendency towards climate change in the study area and its surroundings since deforestation, as reported by Adesina and Adejuwom (1994), is a major driver of climate change. This is further supported by Chomitz *et al.*, (2007), who argued that deforestation has a serious effect on wind flows, water cycle and solar energy absorption, thereby influencing climate at both local and global scales.

Investigation reveals that the economic contributions of forest resources to the livelihood of the population of the study area which hitherto includes the derivation of timber and non-timber products, fuelwood, etc., have been greatly compromised. Fuel wood, for instance, accounts for about 73% of household energy in the study area as shown in figure 8. This agrees with the report of the NBS (2006[a]) that rural dwellers in Nigeria depend on fuelwood for up to 75% of their annual energy requirement. Unfortunately, a greater percentage of this energy requirement in the study area is currently met through purchases from neighboring and distant communities. Equally other derivatives such as local craft materials from the forest have been lost. However, non-timber products gotten from the forest accounts for 27% which includes, thatch, grasses and fodder, medicine, edible mushroom (often consumed as a meat substitute), fruits and vegetables. There is

also a reported decline in quality and quantity of both floral and faunal biodiversity in the study area.

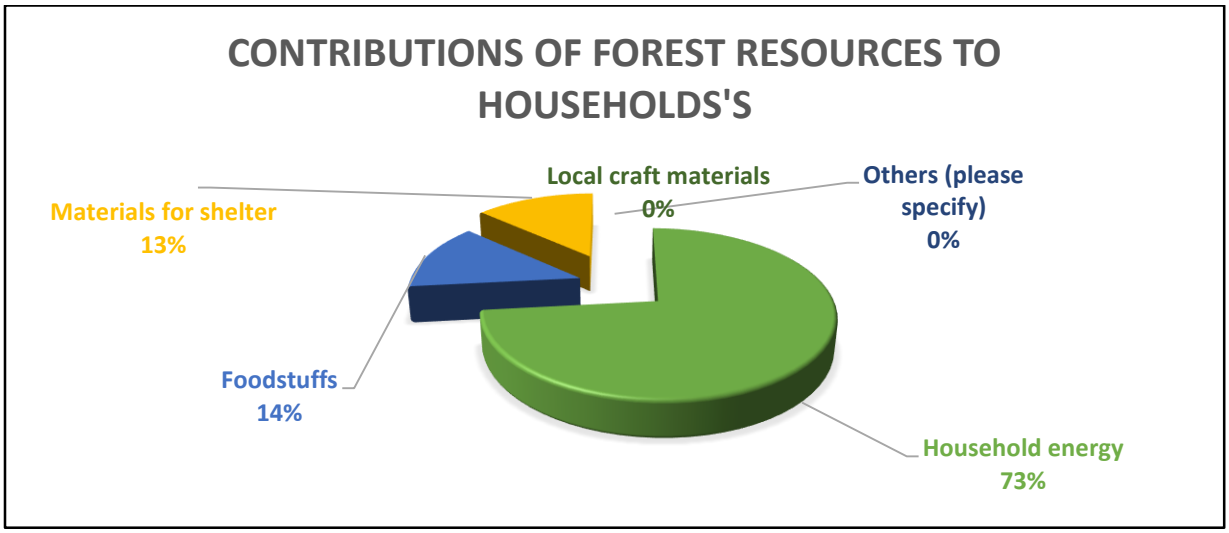

Figure 8: Economic contribution of forest resources
Source: Fieldwork by authors.

CONCLUSION AND RECOMMENDATIONS

Deforestation in the study area was concluded to result from anthropogenic activities like unsustainable agricultural practices and settlement expansion/urbanization which are exacerbating problems of environmental degradation especially soil erosion and loss of biodiversity in this rainforest area. Equally, the level of the income of rural dwellers has been on the decline in response to forest removal. This is because most of the resources generated from the forest such as palm oil, cash crops, bush meat, palm wine, non-timber forest products, etc., which directly sustained the economy of the local people have either declined or disappeared completely.

There is need to encourage reforestation programmes to help the people of Mbieri community ecologically, socially and economically. Government and non-government institutions need to be strengthened to work with the local people in enforcing rules and guidelines aimed at reducing the rate of deforestation. Local people need to be empowered to embark on sustainable agricultural practices which will be more intensive rather than extensive thus curbing the flagrant clearing of forest for agricultural expansion.

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