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ASSESSMENT OF THE IMPACT OF URBANIZATION ON FOREST RESOURCES IN OTUKPO LOCAL GOVERNMENT AREA BENUE STATE, NIGERIA

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ABSTRACT

The study was conducted to determine the impact of urbanization on forest resources in Otukpo Local Government Area of Benue State, Nigeria with a view to assessing the present status of forest resources and the extent to which forest is depleting due to urbanization. Landsat satellite images were used. The study covered a period of 35 years; from 1985 to 2020. Four multi-date images made up of Landsat Thematic Mapper (TM), Landsat Enhanced Thematic Mapper (ETM+) were acquired for 1985, 2000, 2010 and Landsat Operational Land Imager (OLI) was used for 2020. The images were sourced from United States Geological Surveys (USGS) earth explorer. The images were processed and a supervised classification using maximum likelihood classifier in Idrisi Selva was used. The classification resulted in five land use and land cover classes of built-up areas, forest cover, grassland, agricultural land and water body. The results of the study showed that agricultural land decreased by -70.2 km^2 representing a change of (11.18%), forest cover decreased by -243.9 km^2 representing (38.84%), built up area increased by 252.31 km^2 representing (40.18%) having the highest rate of total change for the period. The period witnessed an increase in built up area, grassland and water body. The land use and land cover changed from forested area to other land use categories which indicates that, expansion in built up areas and other developmental activities have greatly reduced forest resources resulting to the loss of natural vegetation. The study recommends constant monitoring, planning and controlled urban development.

Key Words: Impacts, Urbanization, forest resources, Otukpo Maximum likelihood classifier, Idrisi Selva

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INTRODUCTION

Urbanization is increasing globally and is considered a main driver of environmental change (Grimm *et al.,* 2008). The current global trend shows a massive expansion of urban areas, this growth being actually generated by the numerical population growth and migration. Urban development determines changes regarding the organization of places, economic and social changes but these effects exceed the territorial barriers and generate a broad impact. Urbanization is seen as an effect of the current globalization phenomenon, with social aspects as well as the economic ones, representing the migration process of the population organizing in urban areas, areas considered to be true centers of progress that offer multiple options to resident. Cities are centers of changes, placed in a relationship of interdependence with demographic growth and economic growth. Substantial expansion of urban areas is due increased population and migration to these

areas, the identification of new feature options that can ensure the raising of welfare levels of individuals and improve their conditions of life. Emphasis on the process of urbanization intensifies pressure on resources, environment and its ecosystems (Bradbury, 2009).

Forest resources are key component of the natural resources base of any rural community, region or country and they play a fundamental role in the socio-economic well-being of the people of these rural communities. (Powell et al., 2013). As more and more people tend to leave the villages and farms to live in cities, it results in urban growth and as population becomes urbanized, there is increasing demand for forest products leading to urban forest destruction. Forest is degradable through selective logging, industrial uses, grazing, land clearing, bush burning, deforestation and urbanization. This is particularly so in sub-Saharan Africa where most of the countries have large rural population that depend on forest resources exploitation for their livelihood. Urbanization directly alters forest ecosystems by removing or fragmenting forest cover and indirectly alters forest ecosystems by modifying hydrology, altering nutrient cycling and introducing non-native species, modifying disturbance regimes, and changing atmospheric conditions. Collectively, these changes significantly affect forest health and modify the goods and services provided by forest ecosystems since forest losses to urban uses have increased since the 1970s (Boyce and Martin ,1993).

Urbanization has resulted in the loss of forest habitat and fragmentation of forested area in Nigeria. Based on the current trend of urbanization it is likely that forested habitat will continue to be permanently altered with decrease in forest resources, the environmental impacts of this transformation are devastating (Richards and VanWey, 2015). A report by the United Nation's Food and Agriculture Organization, FAO (2010) on deforestation trend in Africa, revealed that Nigeria has lost more than half of her forestland within the last fifty year making it one of the countries with the highest rate of deforestation in the world.

In Benue State, the situation could be said to be the same. Sorkwagh (2012) reported that many Forest Reserves and plantations established in the state during the colonial era have overwhelmingly been deforested and degraded, as a result of an increase in demand for farmland and expansion of urban centers. Since the economy of Benue State is agrarian in nature, more than 70% of the population is engaged in one form of agriculture or the other. The pressure from increase in human population have also resulted in demand for more land for the purpose of food production and settlement, population growth and the resultant human activities generate pressures to the natural forest and as well the man-made environments; thus, conserving peri-urban forested areas from urbanization is a priority (Gorte, 2009; Harmon, 2001; Jandl *et al.*,2007).

Otukpo as a traditional home of the Idoma in Benue State, Nigeria has witnessed tremendous growth over the years. Physical and proximity factors were identified as major factors driving urban growth in the area (Jande *et al.,* 2020). This has given rise to a steady upsurge in urban population especially of the town which increased the burden on the available resources. According to Dagba *et al.,* (2017) urbanization, fuel wood collection, bush burning, logging and land clearing ranked the major anthropogenic activities affecting sustainable forest management and degradation of forest and could lead to complete loss of forests. The continued increase in population in this area results in increased anthropogenic activities leading to modification in the land use and land cover at the urban fringes. By the time these forest resources are depleted, the society or community risk their lives, the stability of weather and climate would be altered, and threaten the existence of valuable services provided by these forest resources. This study was therefore, conducted to provide information on the present status of forest resources and the extent to which forests are depleting due to urbanization in Otukpo LGA of Benue State, Nigeria for decision making and policy.

MATERIALS AND METHODS

Study Area

The study area is Otukpo LGA located in the Southern Guinea Savannah Zone in the middle belt region of Nigeria. Otukpo LGA lies between

longitude 7° 50' and 8° 15' East and latitude 7° 00' and 7° 40' North of the equator. It has a land mass of about 1,385sq.km and a population of 266,411 according to the National population commission (NPC, 2006) and was projected to be 359,600 in 2016. However, Otukpo being the oldest, the traditional headquarter and most developed part of Idoma land came into existence in 1923 is bounded by Apa LGA in the North, Gwer-West and Gwer-East LGA to the East, Ado and Obi LGA in the South, Okpokwu LGA in the Southwest, Ohimini LGA in the West and Ankpa LGA of Kogi State in the Northwest. The Map of Otukpo LGA is shown in Figure 1. Otukpo LGA of Benue State comprises of four districts namely Otukpo, Akpa, Ugboju, and Adoka, also with the local government reforms of 1972 and subsequent local government creation exercises, Otukpo LGA now have thirteen (13) council wards which are Adoka-haje, Adoka-icho, Allan, Entekpa, Ewulo, Okete, Otobi, Otukpo Town Central, Otukpo Town East, Otukpo Town West, Ugboji-ehaje, Ugboju-icho, and Ugboju-otahe.The relief of the study area ranges between 83m above sea level and 162m above mean sea level. The study area is a valley given the area an undulating to gentle sloping in the North South direction.

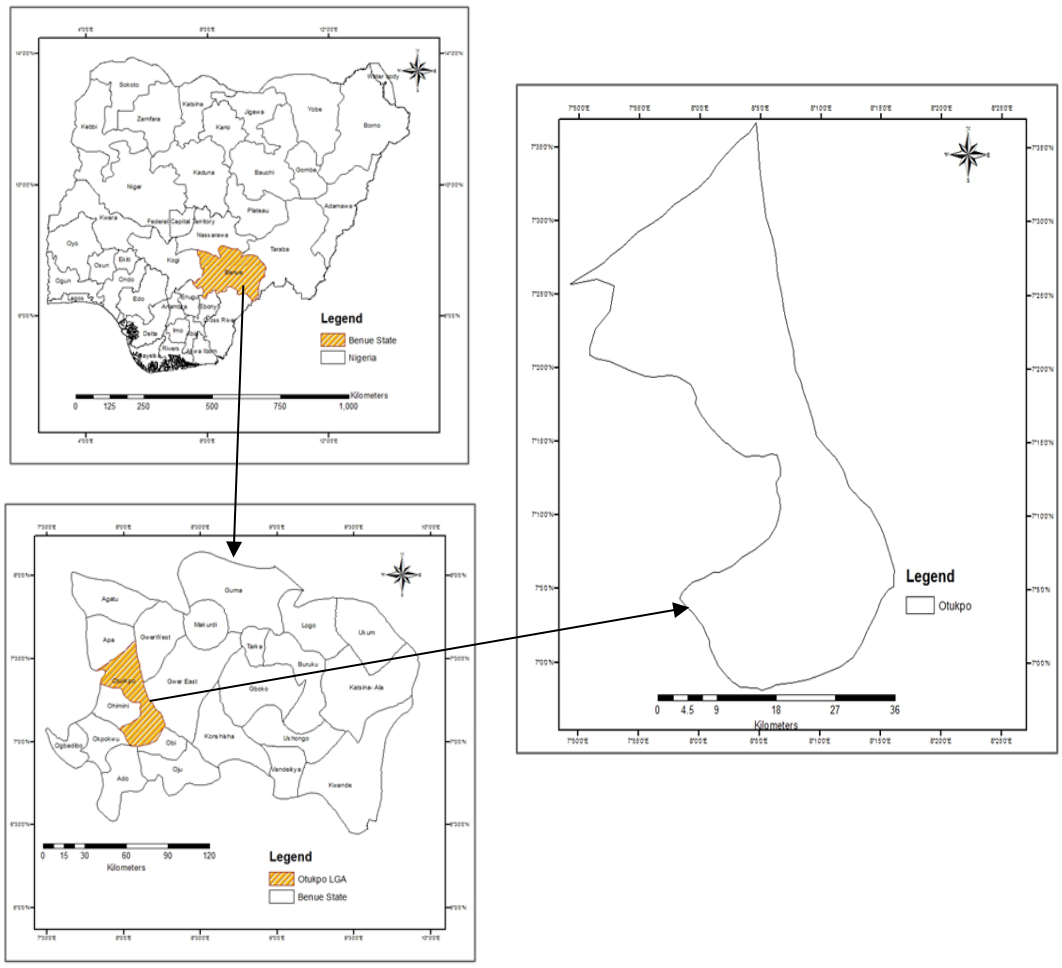

Figure1: Map of Otukpo Local Government showing the study area
Source: Produced from Global administrative Area Database (GADM) 2021 Shape files.

There are two system of drainage in the study area, there are the permanent streams and the semi-permanent streams, and the local government is drained mainly by river Otobi, Ukplo, Okoklo and they all drains into river Benue where they are carried to the sea. There is

an abundance and even distribution of water points in the area. The mean annual and minimum temperature of the area is 33°C and 27°C respectively, it has an annual rainfall of about 124cm and usually comprises of two seasons namely the rainy season spanning in the month of April through October and dry season from November to March. The study area is dominated by three major soil types which are Alluvial soil, clayey loamy soil and Sandy soil. The study area comprises of undifferentiated open woodland and savannah type with trees that are tall possessing short bold and broad leaves such as Neem, *Daniela oliveri, Khaya senegalensis, Gmelina arboreal, Tectona grandis* and others.

Data Collection

Secondary data were obtained from four (4) multi-date Landsat satellite imageries, Enhanced Thematic Mapper (ETM+) of 1985, Enhanced Thematic Mapper (ETM+) 2000, 2010 and Operational Land Imager (OLI) of 2020. The study area was extracted from the scene, and a supervised classification method was carried out based on level 1 classification scheme of Anderson *et al.* (1976) was used to classify the identify land use and cover categories of the study areas. Five land use and land cover classes were identified in the study (i.e., built up areas, forest, Grassland and agricultural land).

Image processing: Four basic pre – processing operations namely image reconstruction to extract area of interest from the general satellite scene and image enhancement to improve visual interpretation by increasing apparent contrast among various features in the image. A band combination of 4,3,2 was used for 1985, 2000 and 2010 images while 5,4,3 combination was used for the 2020 Landsat 8 (OLI) because it produces superior results due to the sensitivity of band 4 and 3 to vegetation cover and sensitivity of band 4 to water contents.

Visual Image Interpretation

Image interpretation is the act of examining images with a goal of identifying objects and judging their significance. Various image interpretation styles were tested in the study since the study area has a heterogeneous land cover, supervised classification gave satisfying results which was adopted and therefore visual image interpretation was made. Image interpretation process was important in training site selection which contributed to true image classification. Training sites were areas in the image that represented a land cover type that is for each land cover type of interest. Elements of image interpretation which will aided in identifying the sites during the process of training site selection include Height, shadow, shape Tone/color, texture, size, pattern and site, and association. Such classes in image interpretation acted as training sites. Table 1 shows the characteristics of Landsat images and Table 2 shows the hardware and software component used for the study.

Table 1: Characteristics of Landsat images used for the study

Date Acquired	Sensor	Path/ Row	Bands	Spectral Range	Resolution	Source
1985	TM	188/55	1to5 and 7	10.45-12.45	30	
2000 &2010	ETM+	188/55	1to5 and 7	10.45-12.45	30	USGS
2020	OLI and TIRS	188/55	1to7 and 9	10.60-12.51	30	

Table 2: Hardware and Software Components of the Research

S/N	Software	Purpose
1	Idrisi Selva & ArcGIS 10.3	GIS analysis & classification of the Landsat images
2	Microsoft Excel	Statistical analysis for the calculation of percentage
3	Global Positioning System	For picking geographic co-ordinates

Data Analysis

Histograms of the classified images were used to provide the information of the total area coverage of each class theme from the different images. Simple percentage tables were used for the statistical analysis. Change analysis was carried

out to examine the change in built up area between 1985– 2020 in order to determine the extent of land use and land cover change.
The extent of land use change was analyzed by subtracting the reference year (2020) from the base year (1985). It is represented mathematically as:

E_T=B-A …… [1]

Where: A= the base year (1985), B=the reference year (2020) and E_T =total extent of forest land

Change detection techniques
Three main change detection methods which have been previously applied by (Ikusemoran *et al.*, 2013) were employed, they are:

Change detection by area calculation
There were three steps used in calculating change detection by area calculation.

a) The first step was the calculation of the magnitude of change, which is derived by subtracting observed change of each period of years from the previous period of years.

b) The second step was the calculation of the trends, that is, the percentage change of each of the land-use, by subtracting the percentage of the previous land-use from the recent land-use divided by the previous land-use and multiplied by 100 (B-A/Ax100).

c) The last was the calculation of the annual rate of change by dividing the percentage change by 100 and multiplied by the number of the study years, that is, thirty-five (35) years (1985-2020).

Normalized difference vegetation index (NDVI)

The Normalized Difference Vegetation Index (NDVI) is a numerical indicator that uses the red and near-infrared spectral bands. High NDVI values correspond to areas that reflect more in the near-infrared spectrum. Higher reflectance in the near-infrared corresponds to denser and healthier vegetation. This was determined using the general equation for Normalized Difference Vegetation Index (NDVI) is expressed using the equation below:

$$NDVI = \frac{(NIR - RED)}{(NIR + RED)} \text{ ….. [2]}$$

Where:
NDVI = Normalized Difference Vegetation Index
NIR = Near-Infrared reflectance value (spectral band 0.76 – 0.9ῳm)
RED = Visible Red reflectance value (spectral band 0.6 – 0.7ῳm)
Where: NIR is reflectance in the near-infrared band and RED is reflectance in the visible red band. The NDVI algorithm takes advantage of the fact that green vegetation reflects less visible light and more NIR, while sparse or less green vegetation reflects a greater portion of the visible and less near-IR.

RESULTS
Analysis of Land use/Land Cover Classification (LULC) for Otukpo
LULC Classification for Otukpo for 1985
The areal extent of these classes as shown in Table 3 revealed that the dominant class is agricultural land with 433.94 km^2 (32.58%), this is followed by grassland which covers 423.73 km^2 (31.82%), built up areas covered 56.96 km^2 (4.28%). This is seen more at the central region, forest cover on the other hand occupies an area of 412.78 km^2 (30.99%) and water bodies with 4.37 km^2 representing (0.33%) of the total area as the less dominant land use and land cover class.

Table 3: Land use and land cover Distribution of Otukpo (1985, 2000, 2010 and 2020)

Land Cover Category	1985		2000		2010		2020	
	Area (km^2)	Area (%)	Area (km^2)	Area (%)	Area (km^2)	Area (%)	Area (km^2)	Area (%)
Built up areas	56.96	4.28	160.71	12.07	200.15	15.03	309.27	23.22
Forest cover	412.78	30.99	259.58	19.49	185.35	13.92	168.88	12.69
Grassland	423.73	31.82	655.85	49.25	603.31	45.3	481.98	36.19
Agricultural land	433.94	32.58	246.02	18.47	333.33	25.03	363.74	27.31
Water body	4.37	0.33	9.62	0.72	9.64	0.72	7.91	0.59
Total	**1331.78**	**100**	**1331.78**	**100**	**1331.78**	**100**	**1331.78**	**100**

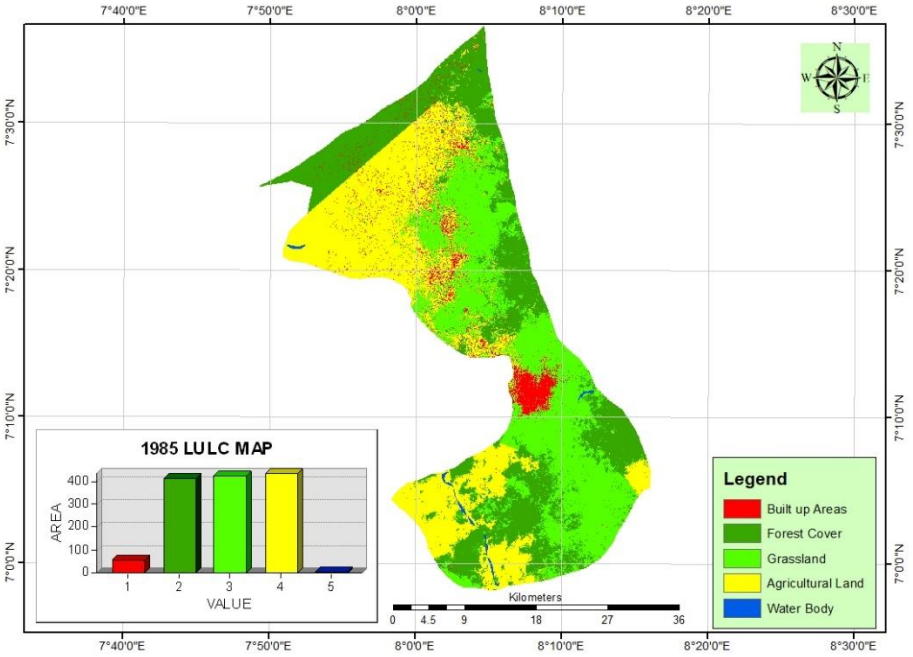

Figure 2: Otukpo 1985 Land use/Land cover distribution map generated from LandSat 4 TM

Analysis of Land use/land cover Classification of 2000 Satellite Imagery for Otukpo

The land use and cover map of Otukpo for 2000 (Figure 3), reveals that there was a drastic increase in built up areas. Result shows that built up area increase from 56.96 km^2 (4.28%) in 1985 to 160.71 km^2 (12.07%) in 2000. The built up expands towards the center due to continuous influx of people. This sharp increase can be attributed to continuous influx of people as a result of the mark of a new era of democracy and the quest for people to get better job opportunities so as to improve their standard of living and improved socio-economic development in the area. Agricultural land area; findings reveal that cultivated land reduces from 433.94 km^2 (32.58%) in 1985 to 246.02 km^2 (18.47%) in 2000. The decline in agricultural land may be due to increased rural urban migration resulting to the depletion rural population and subsequent decline in agricultural area. However, there was an increase in grassland area as findings indicate that grassland areas increase from 423.73 km^2 (31.82%) in 1985 to 655.85 km^2 (49.25%) in 2000. This may be attributed to conversion to build-up areas, agricultural land and other land use and land cover categories. Similarly, forest cover also witnesses a decrease from 412.78 km^2 (30.99%) in 1985 to 259.58 km^2 (19.49%) in 2000. The decreased may be attributed to increased lumbering activities in the area. Furthermore, water body witnessed a slight increase to 9.62 km^2 (0.72%) respectively.

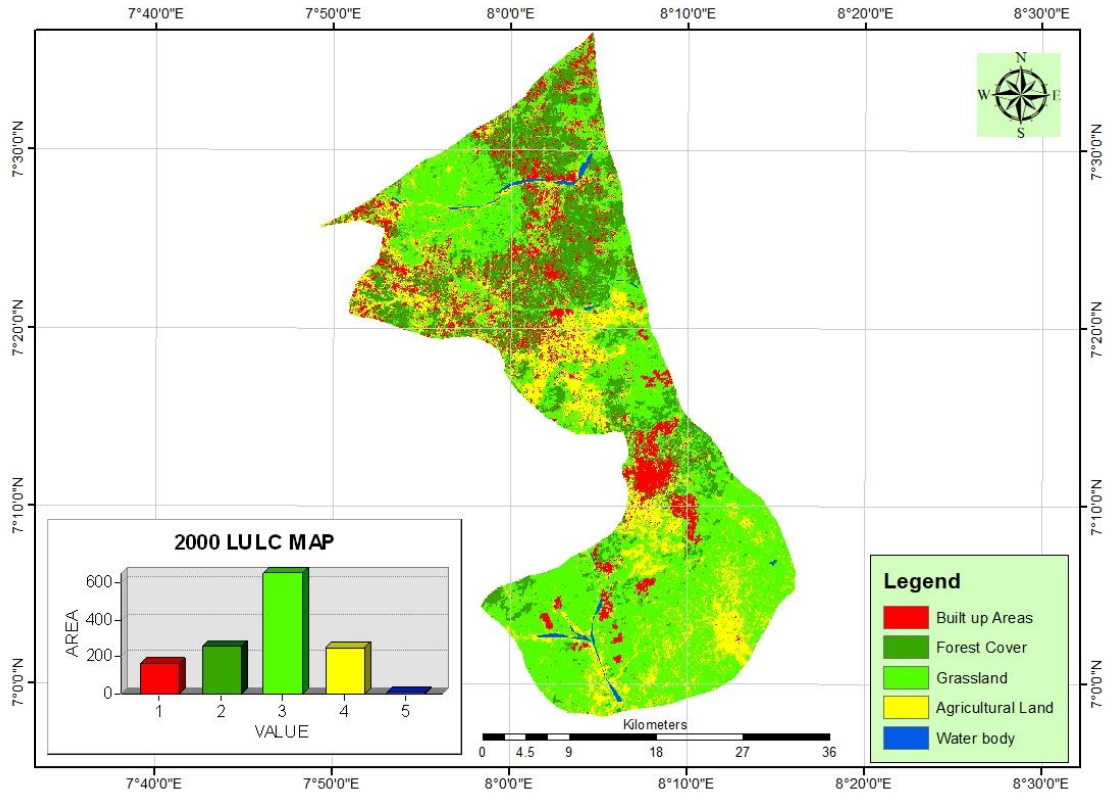

Figure 3: Otukpo 2000 Land use/Land cover distribution map generated from LandSat 4 TM

Analysis of Land use/land cover Classification of 2010 Satellite Imagery for Otukpo

Figure 4 shows the land use and cover map of Otukpo for 2010, findings shows that Grassland is the most dominant land use and cover type and continues to increase across the study area, an indication of increased urbanization. Result also shows that built up area increase from 160.71 km^2 (12.07%) in 2000 to 200.15km^2 (15.03%) in 2010. The built up expands from the city centre towards the west, south and north western section of the study area as more people to influx the area.

This is followed by agricultural land area and grassland areas as findings reveal that there was an increase in cultivated land but still occupies more land area than other land use category. Findings shows that agricultural land increases from 246.02 km^2 (18.47%) in 2000 to 333.33 km^2 (25.03%) in 2010. Similarly, there was a decrease in grassland area as findings indicate that grassland areas decreased from 655.85 km^2 (49.25%) in 2000 to 603.31 km^2 (45.3%) in 2010. This decrease in grassland may be attributed to conversion to build-up areas, agricultural and other land use and land cover categories. Similarly, forest cover also witnesses a slight decrease from 259.58 km^2 (19.49%) in 2000 to 185.35 km^2 (13.92%) in 2010. The decreased may be attributed to increased lumbering activities as well as other forest resource in the area. In addition, water body remains relatively stable 9.62 km^2 (0.72%) respectively.

Analysis of Land use/Land Cover Classification of 2020 Satellite Imagery for Otukpo

Figure 5 shows the land use and cover map of Otukpo for 2020. The findings reveal that grassland is the most dominant land use and cover type and continues to increase across the study area. This has attracted influx of people to the area. Result also shows that built up area increase from 200.15 km^2 (15.03%) in 2010 to 309.27 km^2 (23.23%) in 2020. The built up expands virtually across the study areas but more towards the, western, and north western section of the study area as more people to move to the area.

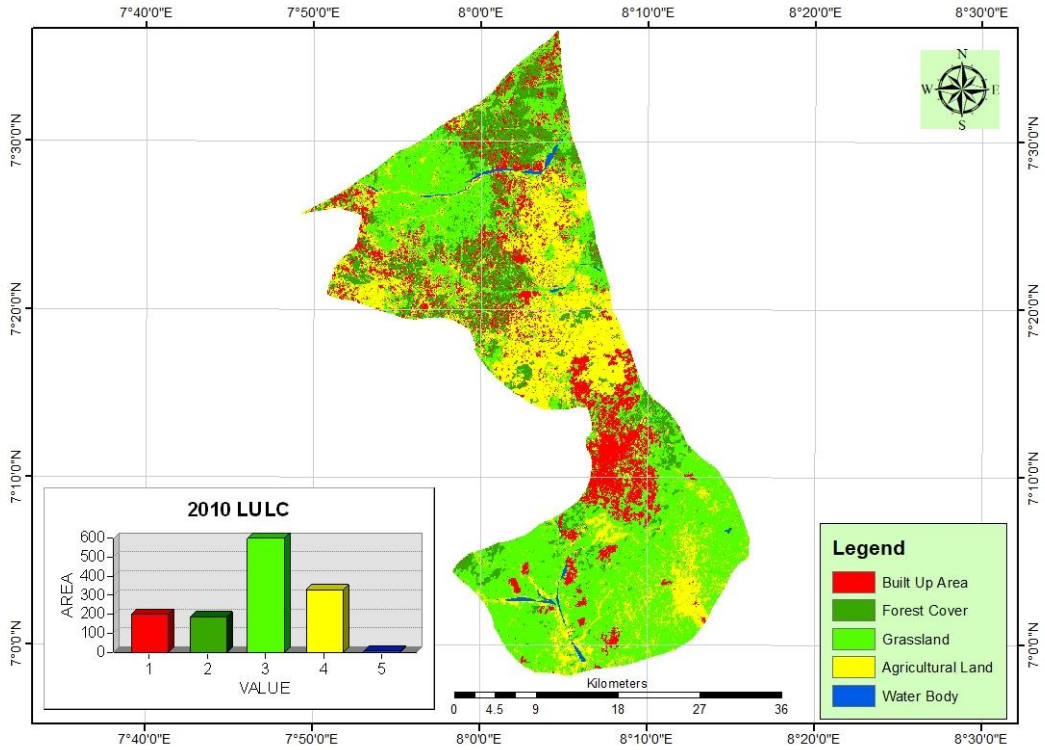

Figure 4: Otukpo 2010 Land use/Land cover distribution map generated from LandSat 7ETM

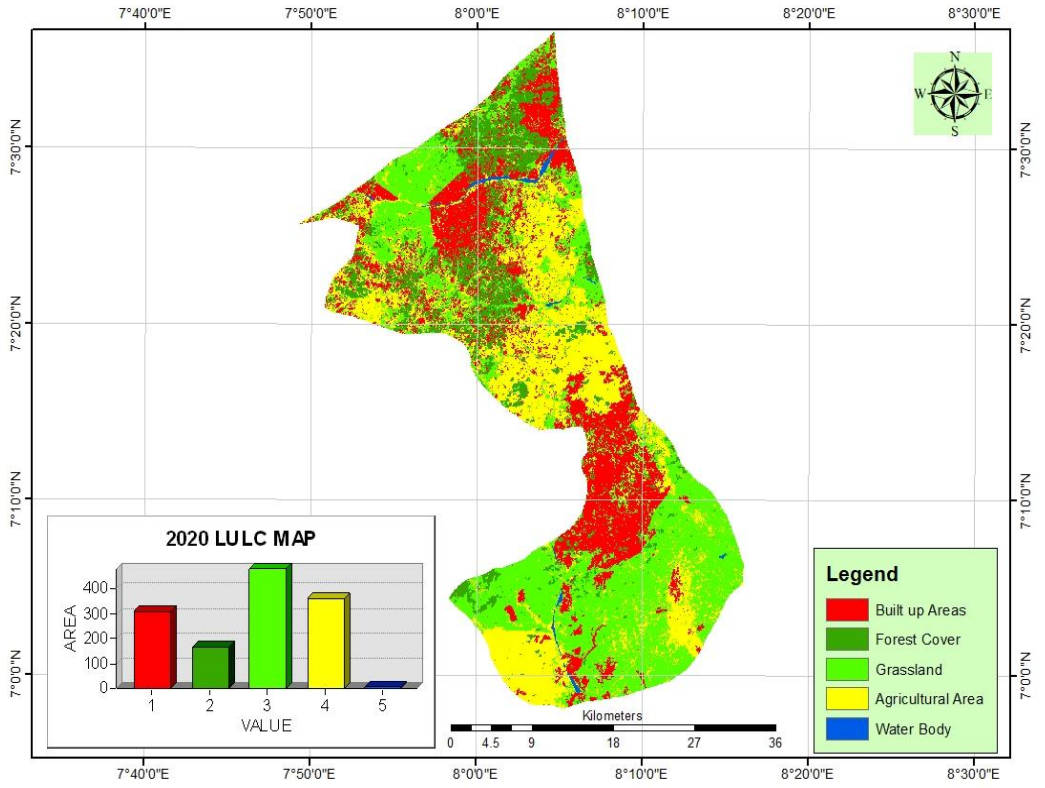

Figure 5: Otukpo 2020 Land use/Land cover distribution map generated from LandSat 8 OLI

This is followed by agricultural land category, there was an increase in agricultural land area as findings reveals that agricultural areas increased slightly from 333.33 km^2 (25.03%) in 2010 to 363.74 km^2 (27.32%) in 2020. In addition, water body witnessed a slight decrease to 7.91 km^2 (0.59%) respectively. Also, figure 6 shows the comparison chart map showing the trend across the various land use and land cover categories. It indicates that built up areas witnessed continuous increase in area cover while other land use categories showing different fluctuations levels.

Trend Analysis of Forest decline in the Study Area

The period from 1985-2000 covering 15 years, forest decline by (-11.5%). However, from 2000-2010 covering 10 years, forest decrease further by (-5.57%). In addition, forest decreased by -1.24% between 2010 and 2020 (Figure 4.6). There is an indication of continuous forest land use conversion to other land use activities.

Magnitude and Percentage of Change in Land Use/Landover between 1985 and 2000

The magnitude of change of forest area for 15 years between 1985 to 2000 showed that forest decreased by -153.2 Sq. km representing a percentage change of -37.11% at an annual rate of -2.47% as shown on Table 4. Built up area had the highest annual rate of change of 12.14%. The period also witnessed an increase in grassland area which increased by 232.01Sq.km representing a total change of 54.78%, while farmland decreased by 187.92 Sq.km (-43.31%). These changes could be attributed to the intensification of urbanization.

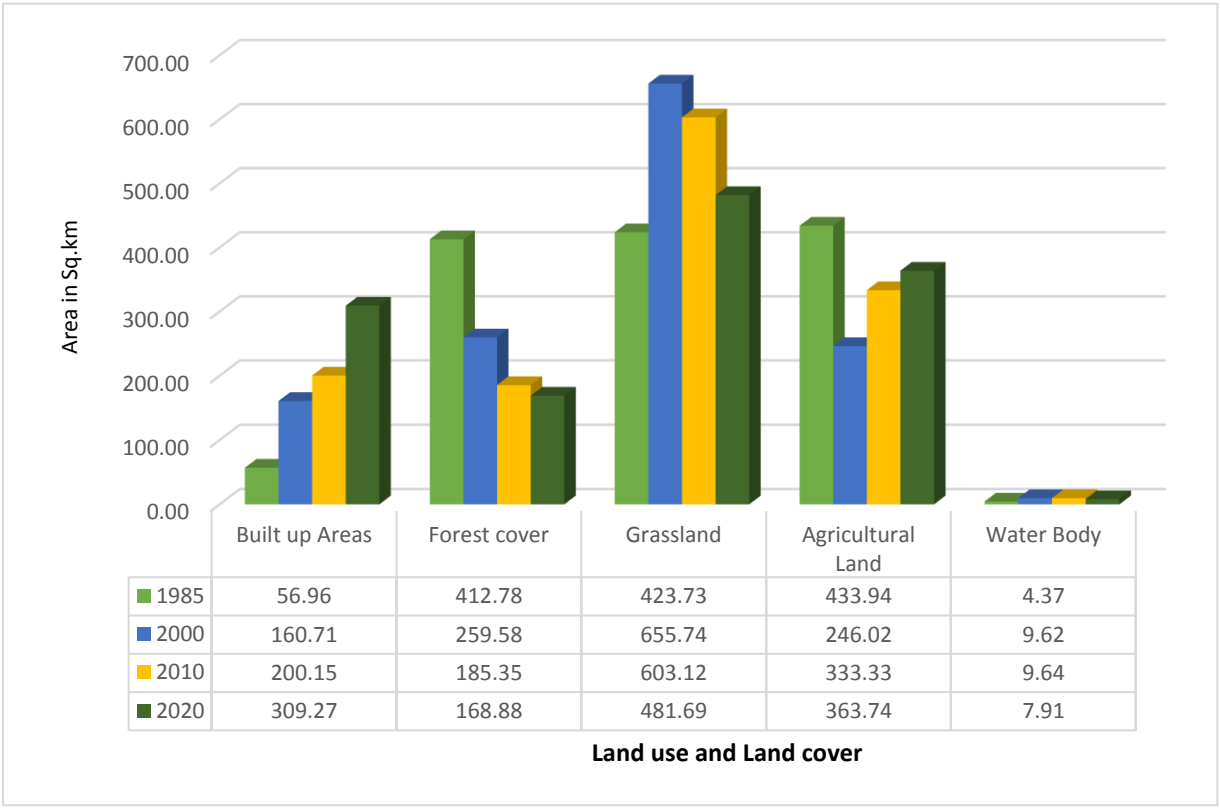

Figure 6: Land use and land cover Comparison chart

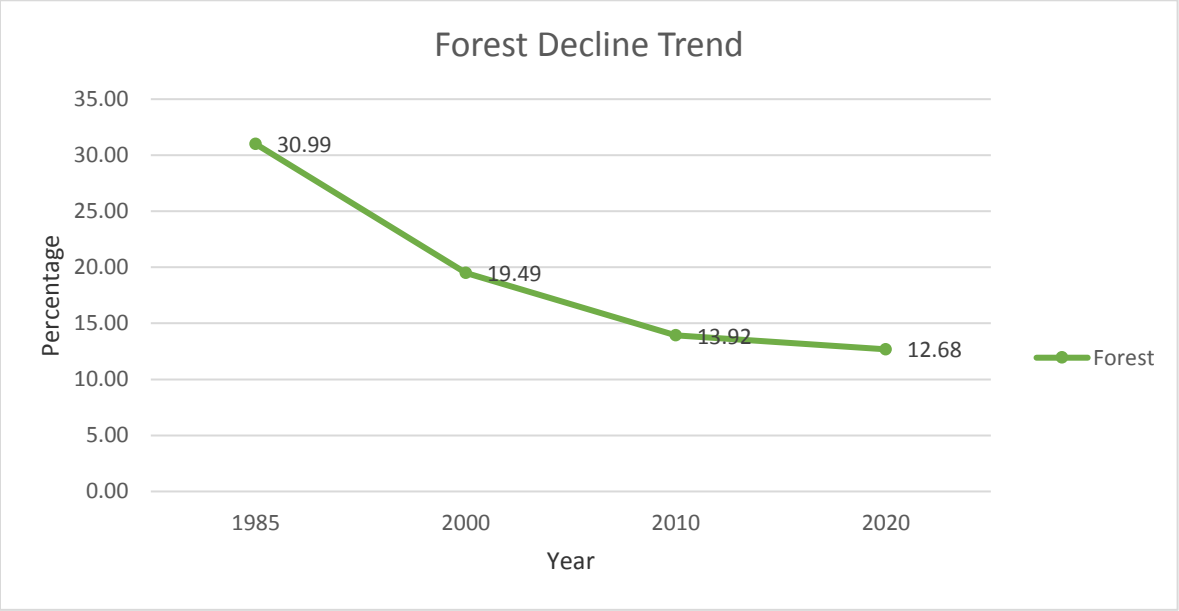

Figure 7: Trend Analysis of Forest Decline in Otukpo LGA from 1985-2020

Table 4: Magnitude and Percentage of Change in LULC between 1985 and 2000

LULC Class	1985 Extent (km^2)	2000 Extent (km^2)	Magnitude of Change (km^2)	Percentage of Change	Annual Rate of Change %
Built up areas	56.96	160.71	103.75	182.15	12.14
Forest cover	412.78	259.58	-153.2	-37.11	-2.47
Grassland	423.73	655.85	232.12	54.78	3.65
Agricultural land	433.94	246.02	-187.92	-43.31	-2.89
Water body	4.37	9.62	5.25	120.14	8.01
Total	**1331.78**	**1331.78**			

Magnitude and Percentage of Change in Land Use/Landover between 2000 and 2020

The magnitude of change of forest area for 10 years between 2000 to 2020 showed that forest decreased further by -74.23 sq.km representing a 28.6% percentage of change at annual rate of -2.86% as shown on Table 5. The period witnessed further increase in built up and farmland area. The built-up land increased by 39.44 sq.km representing 24.54% of the percentage of change at an annual rate of 2.45%. Agricultural land increased by 87.31 sq.km (35.49%) at an annual growth rate of 3.55%. These changes are attributable to the increase agricultural activities, built up encroachment, fuel wood and among others uses.

Table 5: Magnitude and Percentage of Change in LULC between 2000 and 2010

LULC Class	2000 Extent (km^2)	2010 Extent (km^2)	Magnitude of Change (km^2)	Percentage of Change	Annual Rate of Change %
Built up areas	160.71	200.15	39.44	24.54	2.45
Forest cover	259.58	185.35	-74.23	-28.6	-2.86
Grassland	655.85	603.31	-52.54	-8.01	-0.8
Agricultural land	246.02	333.33	87.31	35.49	3.55
Water body	9.62	9.64	0.02	0.21	0.02
Total	**1331.78**	**1331.78**			

Magnitude and Percentage of Change in LULC between 2010 and 2020

The magnitude of change of forest area for 10 years between 2010 to 2020 showed that forest decreased further by -16.47.km^2 representing a percentage change of -8.89% at an annual rate of -0.89% as shown on Table 6 The period witnessed much increase in built up and farmland area. The built-up land increased by 109.12 km^{2}representing 54.52% at the rate of 5.45% per annum. Agricultural land increased by 30.41 km^2 (9.12%) at an annual growth rate of 0.91%. These changes are attributable to the increased developmental activities.

Table 6: Magnitude and Percentage of Change in LULC between 2010 and 2020

LULC Class	2010 Extent (Sq. km)	2020 Extent (Sq. km)	Magnitude of Change (Sq. km)	Percentage of Change	Annual Rate of Change %
Built up areas	200.15	309.27	109.12	54.52	5.45
Forest cover	185.35	168.88	-16.47	-8.89	-0.89
Grassland	603.31	481.98	-121.33	-20.11	-2.01
Agricultural land	333.33	363.74	30.41	9.12	0.91
Water body	9.64	7.91	-1.73	-17.94	-1.79
Total	**1331.78**	**1331.78**			

Magnitude and Percentage of Change in LULC 1985 and 2020

The magnitude of change of forest area for 35 years between 1985 to 2020 showed that forest decreased by -243.9 Sq. km representing a change (59.09%) at an annual rate of -1.69% as shown on Table 7. Built up had the highest annual rate of change of 12.66% while forest had the third highest percentage change at the annual rate of -1.69%. These agree with the findings of (Jande and Amonjenu, 2018) who observed that natural forest areas in most Nigeria communities have been decreasing in recent years.

Table 7: Magnitude and Percentage of Change in LULC between 1985 and 2020

LULC Class	1985 Extent (km^2)	2020 Extent (km^2)	Magnitude of Change (km^2)	Percentage of Change	Annual Rate of Change %
Built up areas	56.96	309.27	252.31	442.96	12.66
Forest cover	412.78	168.88	-243.9	-59.09	-1.69
Grassland	423.73	481.98	58.25	13.75	0.39
Agricultural land	433.94	363.74	-70.2	-16.18	-0.46
Water body	4.37	7.91	3.54	81.01	2.31
Total	**1331.78**	**1331.78**	**627.91**	**100**	**35**

DISCUSSION

Our results indicated that urban expansion was a major contributor to loss of forested land in Otukpo LGA s (Table 7). This result is consistent with those from previous studies (Jande, *et al*, 2019, 2020; Jande, *et al*, 2019, 2020) conducted in other LGA and cities. The total area of loss in forested land caused by urban expansion, however, varied greatly among the epochs. The total areas of loss in forested land between 2000 and 2010 was the highest (-2.86%) while that between 2010 and 2020 was the least (0.89%). These differences were largely due to increased awareness campaign over the years that has led to the decline in forest loss. Much of the newly-developed land occurred in previously-forested land and other land cover types like grassland and agricultural land. The loss of forests has significant social and ecological implications which may include decline in ecosystem services, increased temperatures and other associated effects. The period of study also witnessed further increase in Grassland and farmland area. The grassland land increased by 58.25 km^2 representing 13.75% of the percentage change at an annual rate of 0.39%, while agricultural land lost-70.2km^2 (-16.18%) at an annual rate of 0.46%. These changes are attributable to increased built up encroachment as well as other construction activities. Also, these findings are consistent with the work of Ogunmola *et al.* (2014) who pointed out that forested lands in

most of urban settings in Nigeria has been decreasing due to the commercial activities and urbanization. The study is in agreement with the work of (Kipkemoi *et al.,* 2018) who found out that the total forest loss was continually on the increase.

CONCLUSION

From this study, it can be concluded that the rapid urbanization of Otukpo has affected different land use and land cover types especially the forest resources. Agricultural land areas were the most dominant land cover features which is found at different sections of the study area. This is followed by grassland, forest cover, built up areas and water bodies. This shows that there were few settlements as at that period (1985) in the study area. The change detection results of the study area show a steady increase in built up area from between 1985 and 2020, over a 35-year period. This increase in built up area can be attributed to influx of people to the area due to rural-urban migration with a resultant increase in deforestation activities leading to the conversion of forest area to build up areas and other land use category. The expansion in built up areas and other developmental activities have greatly reduced forest resources which result to the loss of natural vegetation in Otukpo Local Government Area due to expansion by urban growth, farming and other commercial activities. The land cover of the study area between 1985 and 2020 changed from forested area to other land use categories as a result of population increase, demand for agricultural land, fuel wood consumption, production of energy and for the purpose of infrastructural development.

RECOMMENDATIONS

The study therefore recommends that

i. Government should authorize relevant agencies to ensure control planning of urban development around existing land areas to prevent unsustainable intrusion into fragile area of land.
ii. The populace should be sensitized on the dangers of indiscriminate and unsustainable vegetation destruction which may lead to deforestation and loss of biodiversity.
iii. In addition, regular monitoring should be encouraged so that changes in land use and land cover could be detected early for adequate planning

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