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Land Use and Land Cover (LULC) classes in Ogbaru Local Government Area of Anambra State, Nigeria

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Abstract

Land Use and Land Cover (LULC) classification plays a critical role in understanding the dynamics of environmental change and its impact on land resources. The evolution of these land cover types is essential for assessing the region's land management strategies, agricultural productivity, and environmental conservation. This study investigates the Land Use and Land Cover (LULC) classes in Ogbaru Local Government Area (LGA) of Anambra State, Nigeria, using satellite imagery to analyze spatial and temporal changes from 1986 to 2020. This study explores Land Use and Land Cover (LULC) classes in Ogbaru Local Government Area (LGA) using both primary and secondary data sources. The area, with a population of 261,018 as of 2010, is characterized by tropical climate, agriculture, and fishing. Primary data were collected through GPS-based field surveys for ground-truthing, while secondary data were derived from LANDSAT imagery (1980, 2000, 2020) with 30-meter spatial resolution. Image pre-processing was conducted, and supervised classification using the Maximum Likelihood Classification (MLC) method was applied for LULC classification. Pearson's correlation analysis was utilized to explore the relationship between LULC and land surface temperature. Five distinct LULC classes were identified: Forested Areas, Urban Surfaces, Bare Surfaces, Light Vegetation, and Water Bodies. The study utilized LANDSAT satellite data to assess the dynamics of these classes over a 34-year period. Results show a significant shift in land cover, with urban areas increasing from 1% of the total land area in 1986 to 5% in 2020, reflecting the impact of urbanization and infrastructural development. Conversely, forested areas decreased substantially, while light vegetation initially increased but later declined. Water bodies experienced minor changes, while bare surfaces showed a gradual rise, especially between 1986 and 2002. These findings highlight the rapid urbanization and the corresponding decline in natural vegetation, underscoring the need for sustainable land management strategies to balance development with environmental preservation in Ogbaru. The study demonstrates the utility of satellite imagery in monitoring LULC changes for effective urban planning and resource management.

Keywords: Land Use and Land Cover, Ogbaru Local Government Area, Satellite Imagery, Urbanization, Vegetation Change, Sustainable Land Management.

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INTRODUCTION

Land use is defined as "the arrangements, activities and inputs people undertake in a certain land cover type to produce a change or maintain it" (FAO/UNEP, 2016). The rapid expansion and growth occurring in towns and cities of developing countries play significant roles in altering the environment, causing changes in ecological processes at local, regional and global level. Human

activities causing these expansions and growth are many and varied; consequently, considering the geometric rise in global population, there is increasing need for more settlements, roads, increased agricultural production, increased demand for food and shelter, changes in life style which has invariably led to increased encroachment on natural vegetation (Nzoiwu et al, 2017). The presence of vegetation within a locality ensures ecosystem sustainability and services such as prevention of soil erosion, reduction in soil and nutrient loss and maintenance of hydrological cycle's (Nzoiwu, *et al*, 2017). Greater percentage of the vegetal cover is lost due to increasing infrastructural development, exploration of minerals and settlements expansion. Thus, Land use/land cover changes altering the local climate are the drivers for global climate change as their loss contributes to greenhouse gases (GHGS). Increasing concentrations of greenhouse gases due to the natural and anthropogenic factors alters temperature trends.

Land Use and Land Cover (LULC) studies have become essential for understanding the relationship between human activities and the environment. LULC refers to the physical characteristics of the earth's surface and its use by humans (Odoh et al, 2024). A significant body of research has demonstrated that changes in land use and cover are largely driven by urbanization, agriculture, and climate change. Urbanization, for instance, leads to the conversion of forests, wetlands, and agricultural lands into urban areas, as seen in the studies of Mao et al, (2018) in China and Uchegbulam and Igben (2024) in Nigeria. These studies highlight the critical role of satellite remote sensing and Geographic Information Systems (GIS) in tracking such transformations over time.

Landscape dynamics involving Land use/land cover changes have contributed to the increase in land surface temperature (LST). The different land use types show variability with different land surface temperatures (LST). The Evidence shows that non-radioactive forces such as Land use/land cover change can equally be major factors contributing to regional climate change given that the climate is altered locally and at regional scales when Land use and land cover is varied. There has been an increase in surface temperature due to alterations and conversions of vegetated surfaces to impervious surfaces. LST (land surface temperature) has an effect on the environment and atmosphere, since it is involved in the process of rising land radiation and heat flux exchanges in the atmosphere. LST is a key parameter to estimate the surface and atmosphere energy exchanges and for studying local, regional and global environmental change.

The forest ecosystem provides a wide range of ecosystem serves such as supporting biodiversity, providing critical habitat for wildlife, remove carbon dioxide from the atmosphere, intercept precipitation, slow down surface runoff, and reduce soil erosion and flooding. These important ecosystem services will be reduced or destroyed when forest lands are converted to either agricultural or urban uses. Land use change is arguably the most pervasive socio-economic force driving changes and degradation of ecosystems. Agricultural land use and practices, despite being beneficial in ensuring food security, it can cause water pollution. Runoff from agricultural lands is a leading source of water pollution both in inland and coastal waters (Nzoiwu et al, 2017). Conversions of wetlands to crop production diversions have brought many wildlife species to the verge of extinction. Habitat destruction, fragmentation, and alteration associated with

urban development have been identified as the leading causes of biodiversity decline and species extinction.

Nigeria is currently undergoing rapid and wide-range changes in its land due to urbanization and climate change and this is majorly due to the practice of slash-and-burn or shifting cultivation and other agricultural practices/activities, and urbanization which brings about rapid infrastructural development. Ogbaru Local Government Area of Anambra State mainly known as an area of high agricultural produce, has been experiencing changes on the rate of their agricultural produce due to urbanization and migration changes in the area which brings about diverse anthropogenic activities, this calls for proper land use and land cover assessment to harness on the direction and mode of these diverse changes and still maintain the rate of agricultural produce of the area. This study is driven by the need to conduct a proper investigation into the appropriate ways of managing and monitoring the rate of Urbanization and migration changes using remote sensing and geographic information system (GIS) while maintaining the agricultural activities of the region. This will help to proffer some solution towards ameliorating the devastating change taking place in the area.

Objectives

1. To identify and map LULC classes in Ogbaru Local Government Area using LANDSAT imagery.
2. To assess spatiotemporal changes in LULC across Ogbaru Local Government Area over time.

METHOD

The research adopts an experimental design to explore the Land Use/ Land Cover (LULC) classes in Ogbaru Local Government Area, Anambra State. Ogbaru Local Government Area in Nigeria located in the southwestern part of Anambra State. It is located within latitudes $6^{o}\ 38^{1}\ 0^{11}$N and $6^{o}\ 38^{1}\ 0^{11}$N and longitudes $5^{o}\ 49^{1}\ 0^{11}$N and $6^{o}\ 5^{1}\ 0^{11}$N. Iit is bounded in the north by Onitsha South LGA, to the east by Ihiala LGA, to the south by Imo State and to the west by River Niger. Ogbaru Local Government Area of Anambra State consists of 15 towns within its region and they include Atani, Akili-Ogidi, Akili-Ozizor, Amiyi, Mputu, Obeagwe, Ohita, Odekpe, Ogbakugba, Ochuche Umuodu, Ossomala/Ossomari, Ogeu-aniocha, Umuankwo, Umuzu, Okpoko and Ogwu-Ikpele.

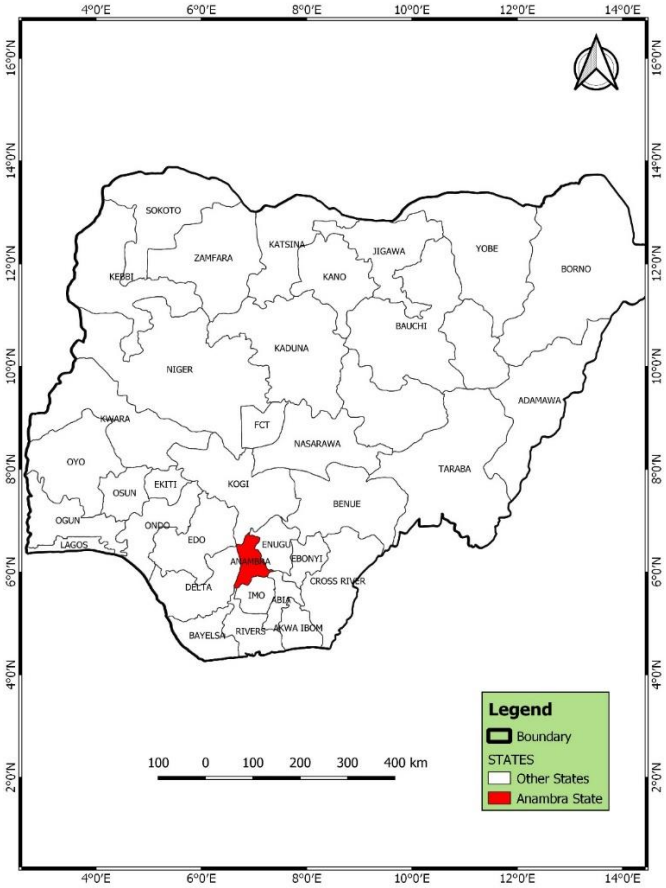


Fig 1: Map of Nigeria

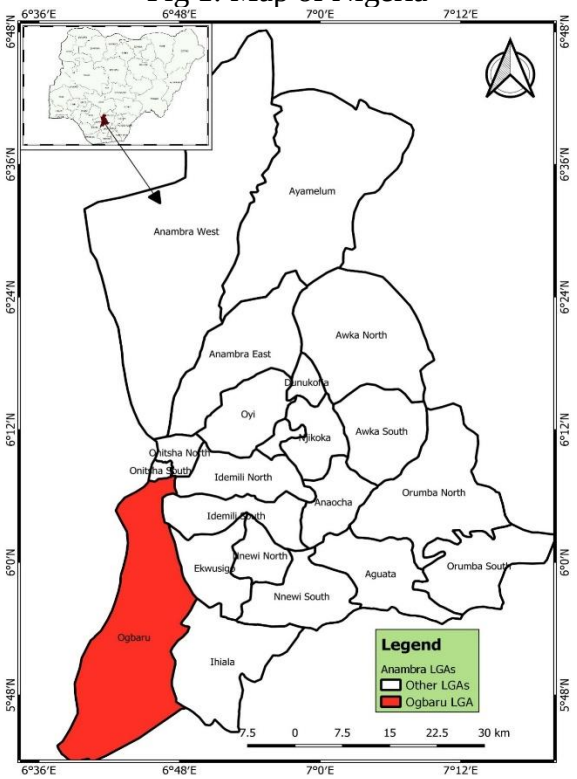


Fig 2: Map of Anambra showing Ogbaru

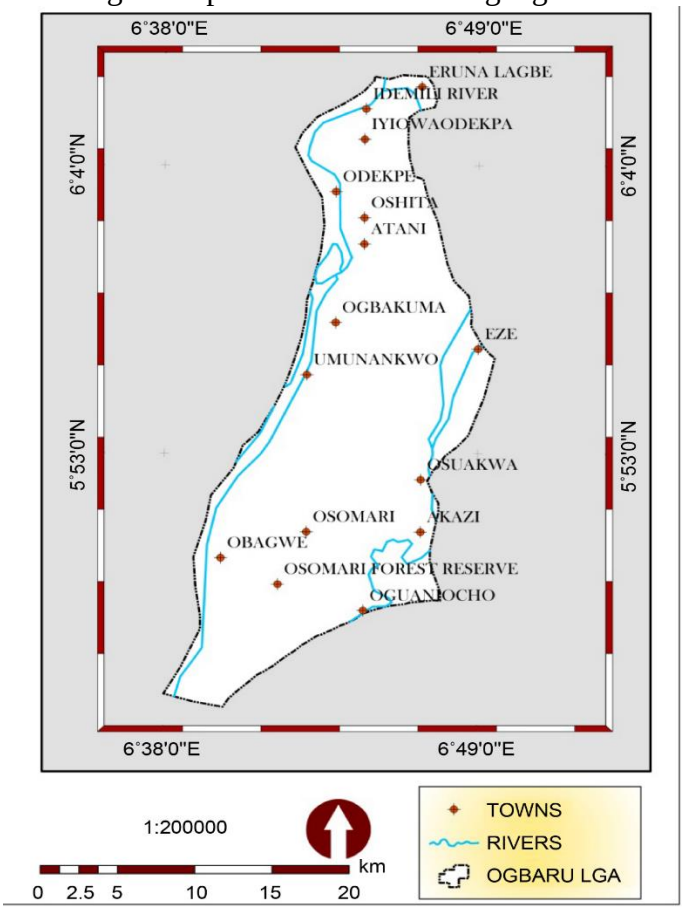


Fig 3: Map of Ogbaru Local Government Area of Anambra State

Ogbaru Local Government Area of Anambra State experiences a tropical climate with a lengthy rainy season lasting from March to October, followed by a short dry period from November to February. The region has high relative humidity, rarely falling below 60%, and typically experiences flooding towards the end of the rainy season. Dominated by freshwater swamp forests, the land is either seasonally or permanently flooded, influencing land use. Agricultural activities thrive in well-drained areas, while fishing is prevalent in the swampy zones. The fertile alluvial soils support continuous cropping, making agriculture a key economic activity. The area is primarily agro-based, with most residents engaged in farming or related businesses. Fishing is also significant, given the abundance of freshwater rivers and lakes teeming with fish throughout the year. As of 2010, Ogbaru's population was 261,018, predominantly from the Igbo tribe, with people from other parts of Anambra State, southeastern Nigeria, and even Delta State. The area is part of a large sedimentary basin in the lower Niger River region, marked by low-lying terrain, annual flooding, and the accumulation of mineral-rich sediments. This geography influences both the climate and the economic activities in the area.

The study utilizes both primary and secondary data sources. Primary data are collected through field surveys, which involve using GPS to establish ground control points for various land use classes. This process, known as ground-

truthing, helps correlate image signals with on-ground conditions. It is essential for training data sets, enabling accurate land use and land cover classification. The field survey provides both qualitative and quantitative data to interpret and understand the major land use types. Secondary data form the core of the study. The primary source is remotely sensed LANDSAT imagery, chosen for its high spatial resolution and availability at no cost. Images from different timeframes—1980 (Thematic Mapper), 2000 (Enhanced Thematic Mapper Plus), and 2020 (Operational Land Imager)—are acquired from USGS Earth Explorer. These images offer spatial resolutions of 30 meters and capture critical spectral ranges for detailed analysis. Additional secondary data include vector shapefiles obtained from NASRDA, which specify the boundary of the study area, and digital maps from Google Earth, which aid visual interpretation and ground-truthing.

The data acquisition process involves downloading and preparing the LANDSAT imagery. To ensure uniformity in analysis, image pre-processing is conducted to address radiometric and geometric distortions. This involves resampling the original pixel size of certain bands to match the 30-meter resolution of other spectral bands, using the nearest neighbor algorithm in IDRISI software. For land use and land cover classification, a digital approach based on the Anderson scheme is adopted. Satellite images are segmented into parcels, with each parcel assigned to a specific land use class. A supervised classification method, using the Maximum Likelihood Classification (MLC) algorithm, is applied. This method relies on training data to attach labels to image pixels, assuming unimodal spectral distributions. The MLC algorithm is effective in identifying classes with elongated characteristics by utilizing both mean vectors and multivariate spreads. However, when spectral classes deviate from unimodal distribution, the classification accuracy may decrease. Unsupervised classification methods, such as Migrating Means Clustering (MMC), are also acknowledged as alternatives but are not the primary focus of this study.

The Pearson's Product Moment Correlation Analysis is a statistical method that tests the measures of linear association between two quantitative variables, with the linear association going from +1 to -1. Pearson's Product Moment Correlation analysis will be used to determine the relationship between land use/land cover and land surface temperature.This equation is given as:

$$r = \frac{\Sigma XY - \frac{(\Sigma X)(\Sigma Y)}{N}}{(\Sigma X^2 - \frac{(\Sigma X)^2}{N})(\Sigma Y^2 - \frac{(\Sigma Y)^2}{N})}$$

where, r= Correlation Coefficient; x = Independent variable, which is the Land use classes; y = dependent variable, which is the land surface temperature readings associated with each class; n = observations

To test the strength of the correlation, the coefficient of determination was used and given by:

$$C/D = r^2$$

where C/D = Coefficient of determination

r^2 = correlation coefficient

RESULTS

Land Use and Land Cover (LULC) Classes in Ogbaru L.G.A.

This research implemented LANDSAT satellite imagery in detecting the various LULC classes within Ogbaru Local Government Area of Anambra State over the study period. Five classes were identified, viz; Forested Areas, Urban Surfaces, Bare Surfaces, Light Vegetation and Water Bodies. The classes were further analysed to detect the changes that have occurred between each of them. The total surface area of Ogbaru LG.A. is 48,351 hectares.

Spatiotemporal Assessment of LULC Variation

1 LULC of Ogbaru in 1986

In 1986, Ogbaru was still a highly rural area, as the old Anambra State comprised of Anambra and Enugu States. This is reflected in the visual interpretation of the LULC map of 1986 (Fig. 4), as urbanized areas were minimal or likely non-existent while vegetation dominated the region by this period.

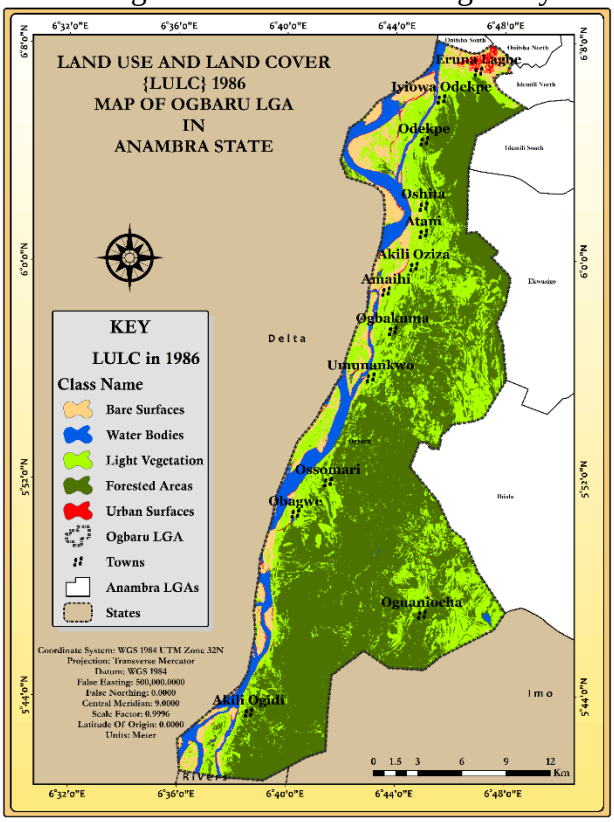


Figure 4: LULC Map of Ogbaru in 1986

Fig. 4 depicts the spatial extents of each LULC class, as it is evident that the dominant class during this period is the vegetative cover class consisting of Forested Areas and Light Vegetation. Some of the communities in Ogbaru such as parts of Odekpe, Oguaniocha and Akili Ogidiwere highly Forested while other areas like Atani, Akili Oziza, Oshita etc. were highly of light vegetation given the rurality of the area by this period. However, towards the northernmost part of the LGA close to Onitsha, urbanization was slowly taking place, as the region's proximity to the main Onitsha area made it attractive for rural-urban migration. Bare surfaces and water bodies equally dominated the area. However, given the soil characteristics of the area and the availability of bare surfaces, huge light

vegetation and water bodies, the Ogbaru Local Government Area of Anambra State was quite suitable for farming and other activities during this period.

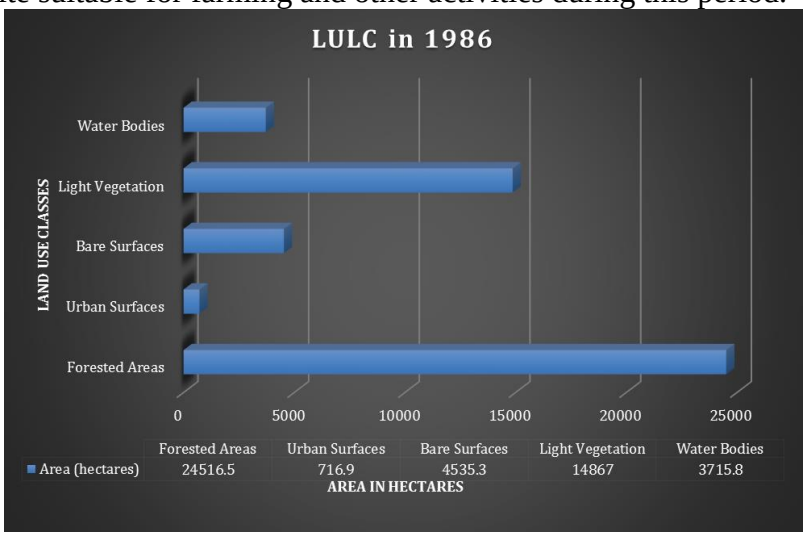


Figure 5: LULC Characteristics of Ogbaru in 1986

The aforementioned dominance of Forested areas and Light vegetation in 1986 is further depicted in Fig. 5, as the forested areas and light vegetative cover class covered 24,516hectares (51%) and 14,867hectares (31%) respectively. While bare surfaces accounted for 4,535.3 hectares (9%), water covered3,715 hectares (8%). However, 716.9 hectares of Ogbaru Local Government Area of Anambra State was visibly occupied by Urban surfaces (built up areas) accounting for just 1% of the total surface area of the LGA.

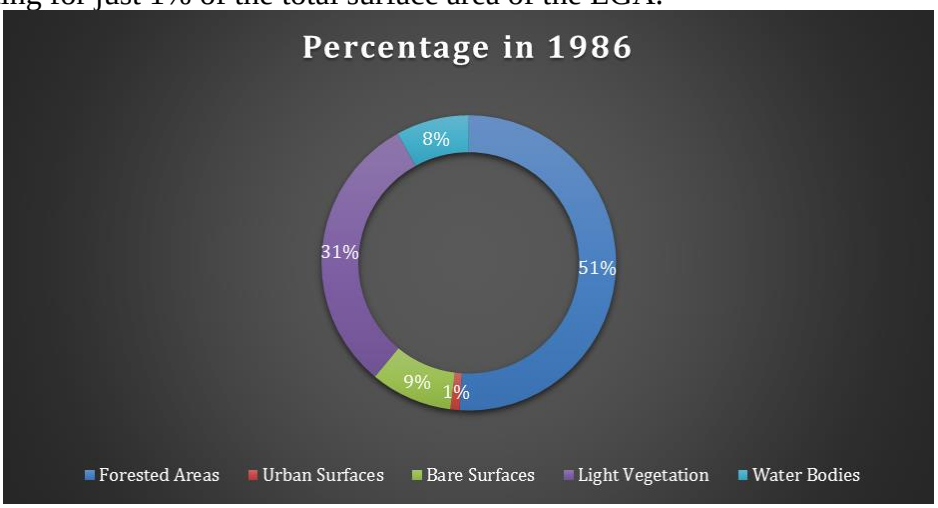


Figure 6: Percentage coverage of the LULC Classes in Ogbaru in 1986

LULC of Ogbaru in 2002

By 2002, the landcover classes within Ogbaru Local Government Area of Anambra State showed dramatic changes in their sizes given nature and the trajectories of the land use springing up as a result of developmental efforts in the state. As depicted in fig 4.4, the forested areas in Ogbaru reduced drastically from a land area of 24,516.5 hectares in 1986 to 13,682.7 hectares in 2002 indicating a drop from occupying 51% of the land area in 1986 to 28% in 2002. This implies a

loss of about 23% of its area to other landcover classes. Bare surfaces increased from 4,535.3 hectares (9%) in 1986 to 5371.5 hectares (11%) in

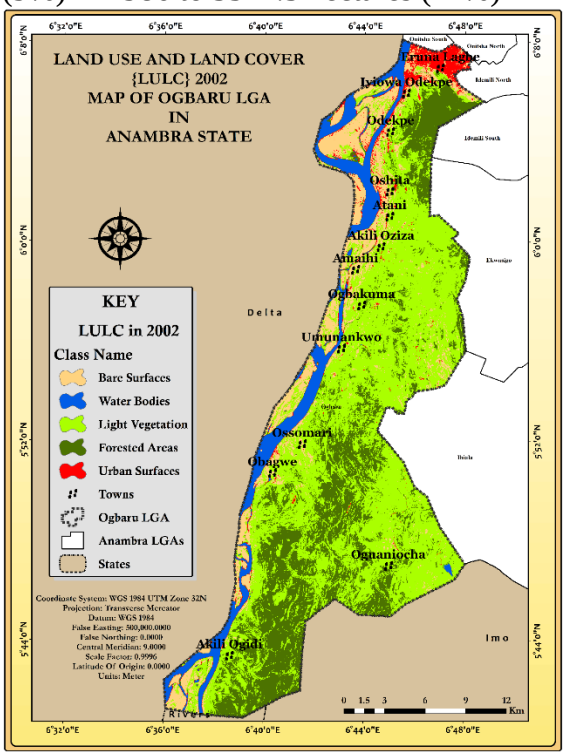


Figure 7: LULC Map of Ogbaru in 2002

2002, indicating an increase of 2% from its original area in the base year. More so, the light vegetation equally increased from occupying 31% of Ogbaru Local Government Area of Anambra State to 49% of the area of Ogbaru Local Government Area of Anambra State showing an increment of about 18% by 2002. That is, from 14,867 hectares in 1986 to 23,676.1 hectares in 2002. The water bodies increased to 3763.4 hectares in 2002 from 3715.8 hectares in 1986 but still maintained a percentage of 8% in area. That shows an increase in water bodies by 47 hectares. In addition, the urban surfaces depicting the built-up area increased by 3%, from 716.9 hectares in 1986 to 1857.8 hectares in 2002 thereby occupying 4% of the total area of Ogbaru by 2002. This could be attributed to the increased need for urban development in the state following the demerging of Anambra and Enugu states in 1992. This attracted increased urban development in the area, though this started from the Onitsha axis and parts of Ogbaru closest to the major route of the Enugu-Onitsha Expressway. Urban development sprawled inwards into the Iyiowa Odekpe as depicted in Fig. 7, with the attractions of Onitsha being a centre for commerce in Anambra State making it a suitable place for higher economic activities. Vegetation, both the forested areas and light vegetation, remained dominant in the area during this period while light vegetation increased in spatial extents as environmental influences contributed to the development of this class.

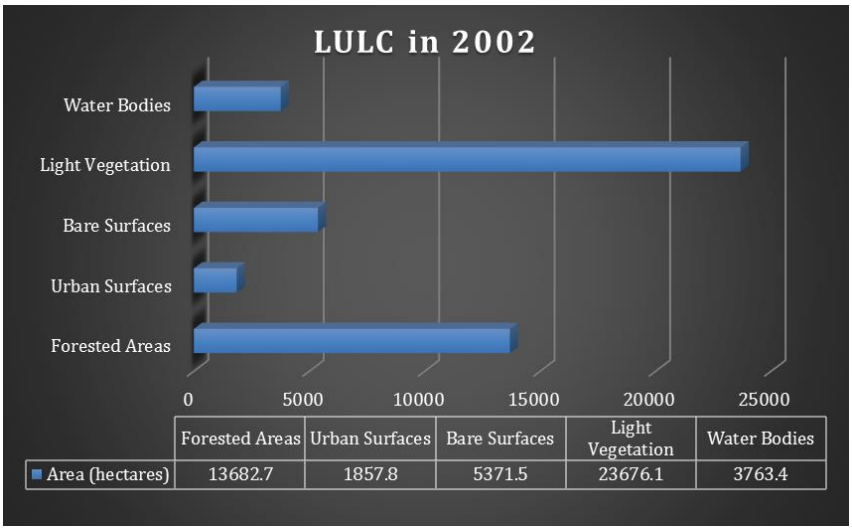


Figure 8: LULC Characteristics of Ogbaruin 2002

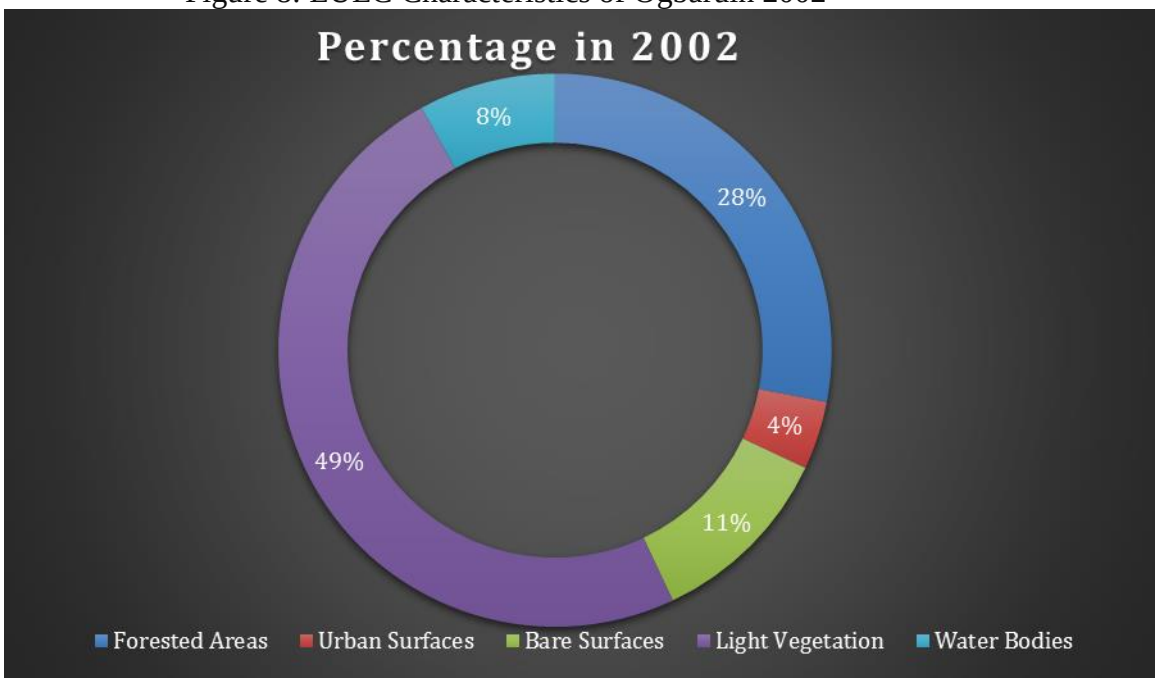


Figure 9: Percentage coverage of the LULC Classes in Ogbaru in 2002

LULC of Ogbaru in 2020

In 2020, Ogbaru Local Government Area of Anambra State equally experienced various shifts in its landcover classes. Based on the available evidence (see figs 10, 11 and 12), the light vegetation witnessed a setback in its area and it's shown to have reduced from the its size of 23,676.1 hectares in 2002 to 19,366.8 hectares (40% of Ogbaru Local Government Area of Anambra State) in 2020 indicating a loss of 9% from 2002. On the other hand, a positive outlook was shown by the trajectory of the forested areas having witnessed an increase in its surface covered by 6% from its 2002 size. Forested areas were shown to have increased from 13,682.7 hectares in 2002 to 16,491.6 hectares but still less of its original area in 1986. The urban surfaces maintained it's positive increase in area

as it rose from 1857.8 hectares in 2002 to 2,622,1 hectares in 2020. It showed a 1% increment in size from 2002 and this is quite unexpected as it appears that development slowed down in the area in the past 18years. This, however, can be attributed to the growing migration to other new developing areas or peri – urban areas close to Onitsha like Ogidi, Ogbunike, Obosi, Nkpor and following the relocation of various markets from Onitsha to the fringes of the city, forcing most people to relocate close these markets far away from Odekpe and Okpoko e.g., the relocation of the shoe dealers' market to Nkwelle. The bare surfaces increased by 1% in 2020 from its size in 2002 while water bodies maintained it's 8% area coverage but increased concomitantly in surface area from 3763.4 hectares in 2002 to 3998.4 hectares in 2020. This could be attributed to more areas within the LGA becoming swampier given the closeness to River Niger and flooding in this area.

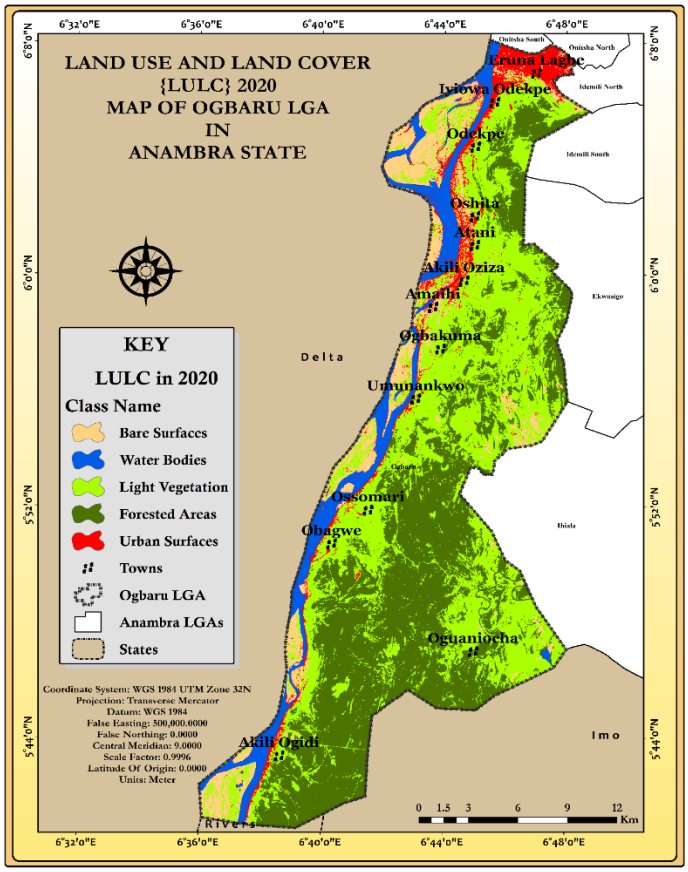


Figure 10: LULC Map of Ogbaru in 2020

Figure 11: LULC Characteristics of Ogbaru in 2020

However, by 2020, certain variations in the patterns of the LULC classes experienced can be attributed to the factors that influence transformation as they became more prominent compared to other years. Increase in populations across the study was prominent, alongside the aforementioned rural-urban migration due to the prospect of better standards of living in the city center for which parts of Ogbaru has been co-opted into Onitsha region, drove the growth in urbanized areas in 2020. Some parts of Ogbaru have developed into a semi – urban and peri – urban areas due to the influence of Onitsha, with communities such as Iyiowa Odekpe, Ishita, Arabi, Akiko Oziza and Amaihi experiencing increased amounts of urban development due to the urban sprawl to avoid overcrowding Onitsha. The rural regions towards the south observed minimal urban development as they are situated kilometers away from the main city. However, this has the potential to change, as the region continues to grow in urban surfaces.

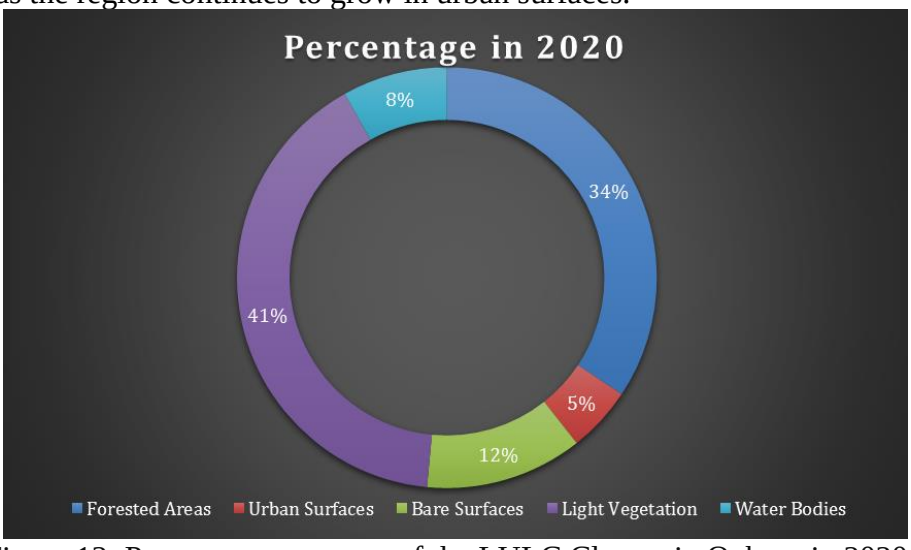
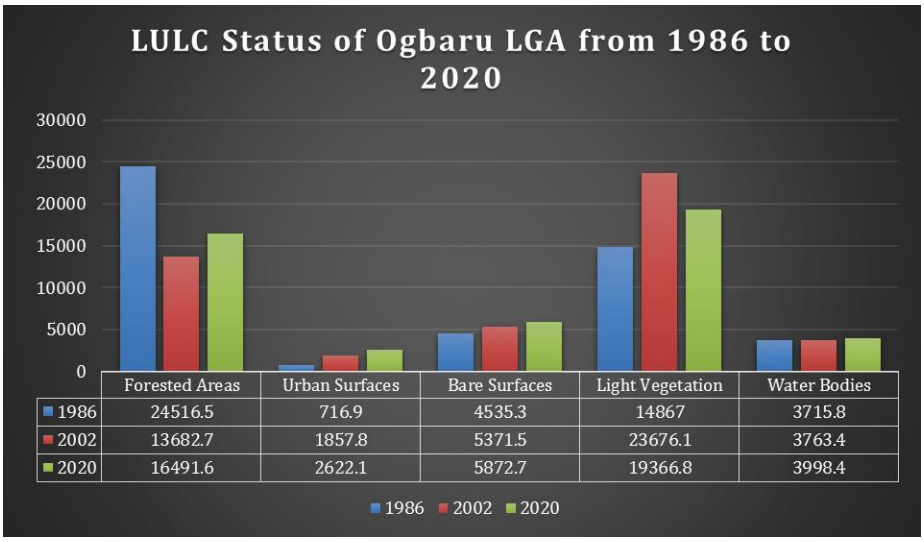


Figure 12: Percentage coverage of the LULC Classes in Ogbaru in 2020

The total transitions of the LULC classes in Ogbaru Local Government Area of Anambra State are displayed in Fig. 13 below.



	Forested Areas	Urban Surfaces	Bare Surfaces	Light Vegetation	Water Bodies
1986	24516.5	716.9	4535.3	14867	3715.8
2002	13682.7	1857.8	5371.5	23676.1	3763.4
2020	16491.6	2622.1	5872.7	19366.8	3998.4

Figure 13: LULC Spatiotemporal Dynamics of Ogbaru Local Government Area of Anambra State.

Change Analysis of LULC Classes

As observed from the results of the analysis, each of the classes have experience varying degrees of variation in spatial extents. Fig. 14 displays the transition each class underwent between study periods.

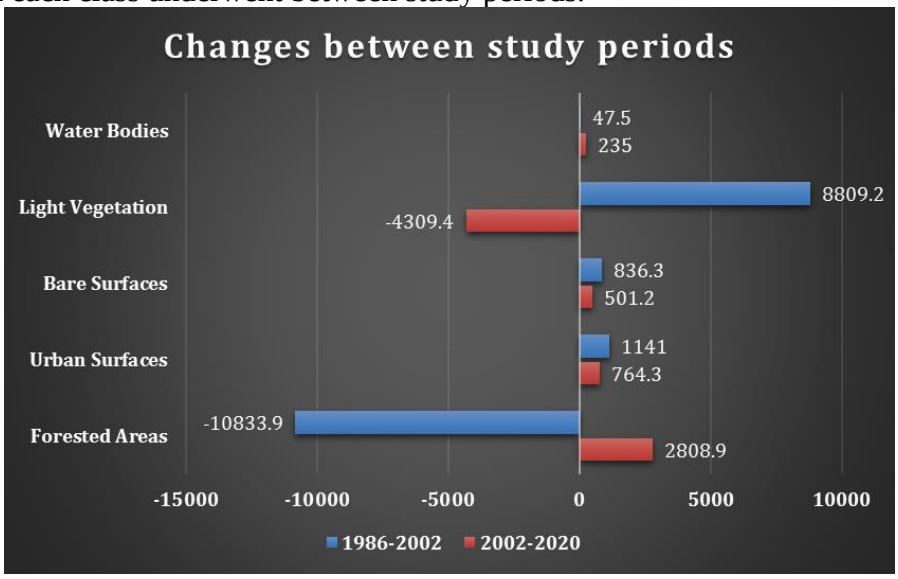


Figure 14: Change Detection between study periods

Between 1980 and 2000, bare surfaces increased by 4.1 sq.km., while it reduced by 2.6 sq.km. between 2000 and 2020, contributing to a total increase of 1.5 sq.km. over the entire study period. Built up areas, steadily increased, growing by 3.1 sq.km. between 1980 and 2000, and 8.2 sq.km. from 2000 to 2020. This amounted to an increase of 11.3 sq.km over the entire study period in urbanized areas. Vegetative cover increased by 33.4 sq.km. over Ogbaru Local Government Area of Anambra State from 1980 to 2000, and reduced by 21.2 sq.km. between 2000 to 2020, contributing to a total change of 12.2 sq.km. Riparian vegetations increased by 5.9 sq.km. between 1980 to 2000, and lost by 3.8 sq.km. between

2000 and 2020, which led to a total change of 2.1 sq.km. Sparse vegetation reduced by 46.4 sq.km. between 1980 to 2000, and increased by 19.5 sq.km. between 2000 and 2020, which contributed to a total loss of 26.9 sq.km. over the entire study period. Water bodies lost a total 0.2 sq. km.

DISCUSSION

The study of Land Use and Land Cover (LULC) variations in Ogbaru Local Government Area (LGA) of Anambra State reveals significant shifts in the landscape over the past few decades, driven by both natural and anthropogenic factors. Using LANDSAT satellite imagery, the study identified five primary LULC classes: Forested Areas, Urban Surfaces, Bare Surfaces, Light Vegetation, and Water Bodies. The analysis spans three key years: 1986, 2002, and 2020, each reflecting different phases in the region's socio-economic and developmental trajectory.

In 1986, Ogbaru was predominantly rural, with a significant portion of the land covered by forested areas (51%) and light vegetation (31%). These findings align with earlier studies showing a predominance of rural land uses in many parts of Anambra State during the 1980s (Akinbobola, 2015). Urban surfaces were minimal, covering only 1% of the total land area, which mirrors the low urbanization rate observed in similar rural settings in the 1980s. The spatial dominance of vegetative cover during this period indicates a largely agrarian landscape, where farming activities flourished due to the fertile soils of the region. The low urbanization levels in 1986 can be attributed to the limited infrastructure and development in rural parts of the area at the time.

By 2002, the landscape of Ogbaru had begun to change significantly, in contrast to the rural-centric land cover of the previous decade. The forested areas shrank from 51% in 1986 to 28% in 2002, a loss of about 23% of its coverage. This drastic change agrees with the findings of similar studies on land use changes in Nigeria, where rapid deforestation due to agricultural expansion and urbanization has been a major concern (Ayadiuno et al, 2020). On the other hand, light vegetation increased from 31% to 49%, reflecting a transformation in land use, likely driven by shifts in agricultural practices and environmental factors. Bare surfaces saw a modest increase of 2%, while urban surfaces experienced a noticeable growth, rising from 1% to 4%. This growth in urban areas can be attributed to the socio-political restructuring following the creation of Anambra State in 1991 and the subsequent urban sprawl, particularly from the city of Onitsha (Enwelu et al, 2014).

The year 2020 presented a more mixed landscape. Forested areas saw a slight recovery, increasing by 6% from 2002 levels, although they were still below the 1986 figures. This aligns with global trends, where efforts to restore forests and conserve natural resources have been intensifying (Sarkissian & Kutia, 2024). In contrast, light vegetation experienced a decline, dropping by 9% from its peak in 2002. This setback in vegetative cover can be attributed to urbanization pressures, agricultural expansion, and possibly climate-related factors. Urban surfaces continued to expand, albeit at a slower rate, reflecting a slowdown in development compared to earlier decades. This is consistent with observations in other peri-urban areas, where migration patterns and economic shifts have led to

the growth of semi-urban areas, particularly as populations spread out from central urban hubs (Gayduk et al, (2024).

Water bodies, which had remained relatively stable in the earlier years, showed a slight increase by 2020, possibly due to rising water levels from flooding or changes in the hydrological cycle. This finding aligns with other studies that have documented the increase in water bodies in flood-prone regions due to climate change and anthropogenic modifications (Islam & Wang, 2024). The increase in bare surfaces between 2002 and 2020, although modest, reflects the ongoing challenges of land degradation in the region, which has been attributed to both natural erosion and human activities such as construction and agricultural expansion. The transition analysis highlights the dynamic nature of Ogbaru's land cover, with clear shifts from forested and vegetative areas to urbanized surfaces. Between 1986 and 2002, urban surfaces expanded by 11.3 square kilometers, a trend that continued albeit at a slower pace from 2002 to 2020. These patterns are consistent with findings from other regions of Nigeria, where urban sprawl has outpaced rural development in the past few decades (Fox et al, 2018). The increase in urban areas by 2020 could also be attributed to migration from nearby urban centers such as Onitsha, as people sought better living conditions in less crowded, peripheral zones.

CONCLUSION

In conclusion, this study on the Land Use and Land Cover (LULC) classes in Ogbaru Local Government Area (LGA) has provided significant insights into the dynamic transformation of the region's landscape over the past few decades. The analysis of LULC changes from 1986 to 2020 revealed substantial shifts from a predominantly rural, vegetative landscape to a more urbanized and developed area, with clear evidence of the expanding urban surfaces and the gradual reduction in forested areas. These transformations were driven by a combination of factors, including socio-economic changes, urbanization pressures, agricultural expansion, and environmental influences such as flooding and climate variability.

The findings indicate that while urbanization has progressed, leading to the growth of built-up areas, there has also been a noticeable increase in the amount of light vegetation, reflecting shifts in agricultural practices and environmental conditions. However, challenges such as the degradation of vegetative cover and the expansion of bare surfaces highlight the need for sustainable land management strategies to preserve the region's natural resources. The recovery of forested areas in recent years suggests that efforts towards environmental conservation may be taking root, though further work is needed to restore the area to its former ecological state,

This study underscores the importance of monitoring and managing land use changes to ensure balanced development that integrates both urban growth and environmental preservation. It also emphasizes the role of satellite imagery in tracking and analyzing LULC dynamics, which is crucial for effective planning and decision-making. Future research should focus on exploring the socio-economic implications of these land cover changes and identifying sustainable practices that can mitigate the adverse effects of rapid urbanization while promoting ecological resilience in Ogbaru LGA.

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