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Geographical Analysis of Urbanization Development Between 2000 and 2023 in Part of Ogun State

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Abstract:- This study aimed at analyzing the spread of Urbanization development in part of Ogun state between the year 2000 and 2023, using Geographic Information Systems and Remote Sensing techniques. Landsat Thematic Mapper (TM) of 2000, Landsat Enhanced Thematic Mapper Plus (ETM+) of 2013, Landsat Enhanced Thematic Mapper Plus (ETM+) of 2018 and Landsat Enhanced Thematic Mapper Plus (ETM+) of 2023 were used. Supervised classification was employed using maximum likelihood classifier to classify the images into Landuse /Land Cover (LULC) classes. Also overlay analysis was used to determine the changes of other feature classes such as vegetations and woodland savannah (Agricultural Farmland) to built-up area and the development and spread of housing generally within the period of study were noted. The built-up area showed a consistent increase over time and this is basically because of increased in population, the presence of many industries across the state which led to creation of job opportunities and thus attracts immigrants, as well as over-spillage of populations from Lagos state and consequent conversion of other landuse classes into residential areas. Also, the extent of the spread of housing developments throughout the study period witnessed the highest growth and spread between the year 2000 and 2013. Between the year 2000 and 2013, housing in urban area grew by 612.26%, while in the 5 years period between 2013 and 2018, the urban development grew by 176.55%, and between the years 2018-2023, the growth rate was 13.132%. The overall period of study (2000-2023) witnessed an urban growth of 2,128.374%. This finding shows that Ogun State is experiencing rapid expansion as a result of increase in built up areas which is mostly facilitated by Estate developments project by the government and other private real estate organizations and individual buildings. The study has indicated that housing developments in urban area and its functional activities are gradually taking over the marginal lands and it is therefore recommended that there is a need to encourage and plan for balanced growth within the state. From the results generated from the analysis made, it was discovered that the spread and growth of urbanization encroached majorly on Woodland Savannah (Agricultural area) and other vegetation which houses several tons of untapped mineral resources beneath the soil such as gold, iron ore, gemstone, bitumen, feldspar, limestone, phosphate kaolin, clay etc. The balance can be done in such a way that seismic survey can be carried out on the surface across the study area, and area with less significant or less expensive mineral resources should be allocated for residential development by the government.

Keywords:- *Remote Sensing, GIS, Supervised Classification, Landuse/Land Cover (LULC), Built-up, Change, Growth, Landsat, Settlement, Urbanization.*

I. INTRODUCTION

Studies have shown that there remain only few landscapes on the Earth that is still in their natural state. Due to anthropogenic activities *(such as pollution, deforestation, industrialization, urbanization etc),* the Earth surface is being significantly altered in some manner and man's presence on the Earth and his use of land has had a profound effect upon the natural environment thus resulting into an accelerated growth in settlement expansion.

Urbanization is a process through which the productive agricultural land, forests, surface water bodies and ground water prospects are being irretrievably lost (Tali & Murthy, 2012). Rapid urbanization results in a tremendous growth of population and buildings in cities, as well as an increasing replacement of natural landscapes by impervious surface areas (Owen, Carlson, & Gillies, 1998). Human dependence on the physical environment for his basic needs has generated actions and inaction in various areas and at various times, often translating into land conversion, alteration and modification, much of which degrade and severely damage the abiotic and biotic components of the environment. For instance, since humans have controlled fire and domesticated plants and animals, they have cleared forests to wring higher value from land (Mittermeier, Mittermeier, Gil, & Pilgri, 2003).

Land use and Land cover (LULC) data provides useful information regarding developmental, environmental and resource planning applications at regional as well as global scale (Ramachandra et al., 2012). LULC dynamics are analysed through changes in the state of an object or phenomenon by observing it at different times. Accurate and timely detection of change in natural resources provides the basic understanding of the relationships and interactions between human and natural phenomena (Sabzar and Ramachandra, 2016).

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Urbanization as a process of landuse and landcover changes has been a universal and important socio-economic phenomenon taking place all around the world. This process, with no sign of slowing down, could be the most powerful and visible anthropogenic force that has brought about fundamental changes in land cover and landscape pattern around the globe. In the developing world, urban growth is continuing to be one of the crucial issues of global change in the 21st century affecting the physical dimension of cities (Mohan, 2010). In addition, Lindgren (1974) noted that urban areas represent a complex association of population concentrations, intensive economic activities, and diverse lifestyles. They are a microcosm of human activity, and frequently experience rapid changes that need to be monitored and understood. Today changes made on cities are more extensive and take place more rapidly than ever before. Not only the city centres but also the urban fringes are under pressure because of their environmental significance such as forestry areas and water resources (Lindgren, 1974).

II. STATEMENT OF THE PROBLEM

Ogun State, has witnessed remarkable expansion, growth and developmental activities such as building, road construction, deforestation and many other anthropogenic activities since its inception in February, 1976 just like many other states in Nigeria. Ogun state's rapid development can also be considered as a spill-over from Lagos state's development since it is the next state to the fastest growing and developed state in the country. This has therefore resulted in increased land consumption, and a modification and alterations in the status of her land use and land cover over time. But unfortunately, there is no detailed or comprehensive attempt to evaluate this status as it changes over time with a view to detecting the rate (i.e the speed) at which land is being developed. It is therefore necessary for a study such as this to be carried out on housing Development and spread across the state so as to avoid the associated problems of a growing and expanding states like many others in the world.

➢ *Aim of the Project*

The aim of this project is to identify the spread and growth of urbanization, and then document this development within Ogun state as obtained from satellite data and GIS between 2000 and 2023.

➢ *Objective of the Project*

In order to achieve the aim mentioned above, the following objective should be put into consideration, which includes:

- Reconnaissance
- Data acquisition: (which entails obtaining the existing base map of the study area, identification and location of area of Interest, acquisition of satellite imagery in series of year)
- Data processing: (Image registration, Image subsetting, Image classification, Vectorizing).
- Data analysis: (Overlaying of Imageries on base map, overlay analysis, change detection analysis and Preparation of a detailed map showing the series of event at each area of interest and their respective development stage per year of study), and
- Report writing.

III. SIGNIFICANCE OF THE STUDY

In Urbanization development, housing developments plays a vital role in economic growth, meeting housing needs, infrastructure development, urban revitalization, social development, investment opportunities, environmental sustainability, and improving the overall quality of life for individuals and communities. Its significance extends beyond providing physical structures and encompasses the creation of sustainable, inclusive, and thriving environments. Likewise, geographical analysis is an essential tool in studying urbanization development as it aids in site selection, market research, infrastructure planning, environmental assessment, risk management, and community integration. Since this project deals with analyzing the development and spread of housing generally within the state, then this study will help to create a framework at the end of this project which will help the government, investors and individuals to identify the pattern at which urban develops and spread for future considerations.

IV. STUDY AREA

The project site covers part of Ogun with geographical coordinate that lies between latitude 7°00′N, and longitudes 3°35′E. Ogun state other information includes:

Table 1: Information about Ogun State

Population [2022]	**6,379,500**
Projection	16,667 km²
Area	16,981 km²

V. DATA ACQUISITION

Several data were acquired and applied for the execution of the research goal. Data used include remotely sensed imagery of the earth and the administrative map of Nigeria. The major data set used for this study and their sources are tabulated below and further details of the datasets are given in Table 2.

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Table 2: Attributes of Datasets

S/N	Date Type	Data format	Spatial Resolution	Data Source
1.	Vector (point, line and polygon	Shapefile		DIVA-GIS http://www.diva- gis.org/gdata
2.	Landsat Thematic Mapper (TM) 6th of February, 2000	TIFF	30m	United state Geological Survey (USGS): www.earthexplorer.usgs.gov
3.	Landsat Enhanced Thematic Mapper Plus (ETM+) 28th of December, 2008	TIFF	30m	United states Geological Survey (USGS): www.earthexplorer.usgs.gov
4.	Landsat Enhanced Thematic Mapper Plus (ETM+) 18th of December, 2013	TIFF	30m	United state Geological Survey (USGS): www.earthexplorer.usgs.gov
5.	Landsat Enhanced Thematic Mapper Plus (ETM+) 1st of January, 2019	TIFF	30m	United state Geological Survey (USGS): www.earthexplorer.usgs.gov
6.	Landsat Enhanced Thematic Mapper Plus (ETM+) 12th of January, 2023	TIFF	30m	United state Geological Survey (USGS): www.earthexplorer.usgs.gov

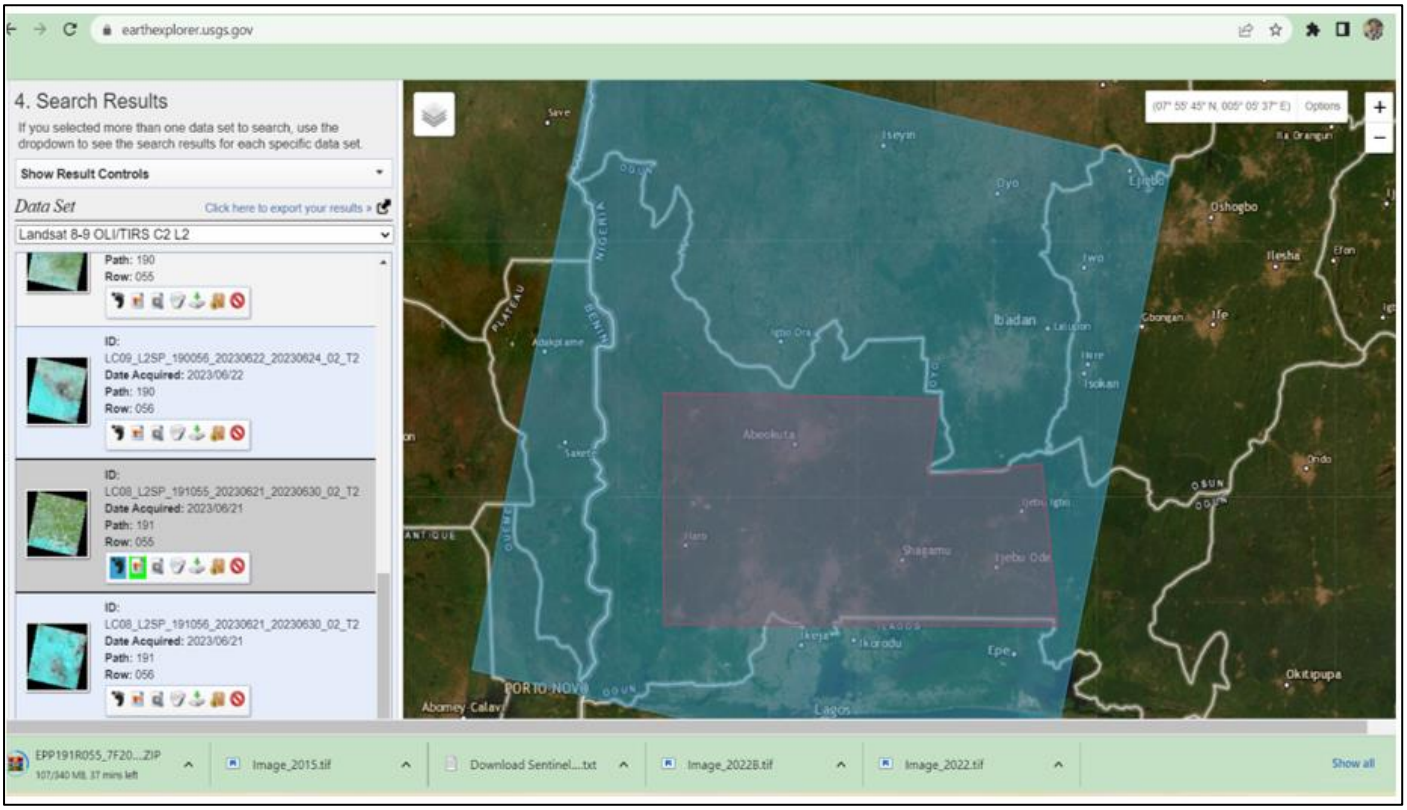

Fig 1: USGS Earth Explorer (www.earthexplorer.usgs.gov) Downloading Interface.

VI. PROCESSING OF SATELLITE IMAGERIES

The satellite imageries obtained for the study area were imported into ArcMap environment for image processing, classification and analysis.

A. Image Classification

For the purpose of this study, supervised classification was employed based on the classes shown in table 3. Supervised classification is much more accurate for mapping of classes. The maximum likelihood class algorithm was used, maximum Likelihood Classifier assumes that a pixel has certain probability of belonging to a particular class. These probabilities are equal for all classes and the input data in each band follows the Gaussian (normal) distribution function (Lillesand & Kiefer, 2004).

Based on prior knowledge of the study area and a brief reconnaissance survey, a classification scheme was developed which gave a broad grouping for the land use land cover as identified in the table below. (See Table 3). This classification done on each series of imageries downloaded will aid in tracking and identifying the spread and growth of urbanization within the Study area.

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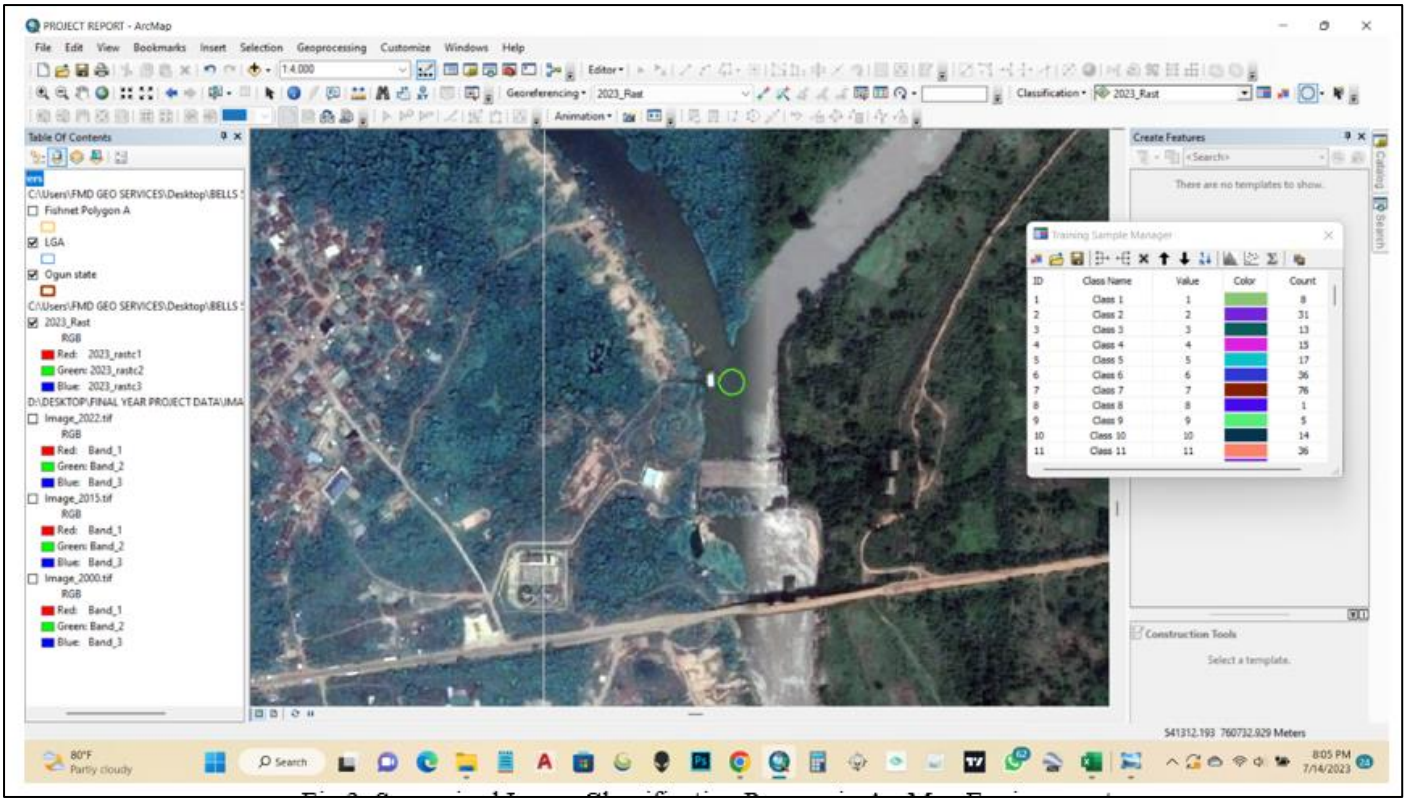

Fig 2: Supervised Image Classification Process in ArcMap Environment

Table 3: Classification Scheme

Code	Landuse/Land Cover Categories	Descriptions
1	Settlements	All residential, institutional, commercial, and industrial areas, villages and settlements.
3	Vegetations	All land areas covered by both agricultural and non-agricultural vegetation including natural and man-made forest and other vegetations.
3	Water Bodies	Rivers, damns, permanent open water, lakes, ponds, canals and streams.
4	Woodland Savannah	All agricultural land under cultivation, Open spaces and vegetations that are or are similar to Woodland Savannah

The image classification process was done by a supervised method of classification by activating the "image classification" tool bar and the image to be classified was loaded into the image classification layer using the drop-down arrow.

Then features of the same class are then selected (even if they are of different shades), and are shown in the training sample dialogue box. All training samples of the same class are then merge into one class and named after the respective feature. This was done for every other feature class such as Settlements, Water bodies, Vegetations and Woodland Savannah and the maximum likelihood classification tool was used to generate the classification.

VII. DATA ANALYSIS

The extent of development in the study area in the year 2000, 2013, 2018 and 2023 was achieved using satellite imageries. Having classified all imageries, built-up areas which was classified as Settlements in the classification categories was extracted and Change detection analysis was carried out to determine the growth between 2000-2013, 2013-2018, and 2018-2023. Image for the year 2008 was skipped because the settlements has almost the same reflectance (colour) with Vegetation type 1 (the imagery was probably taken in the dry season to have resulted to this, and keeping the data from such image will definitely lead to inaccuracy as it was noted that the settlements were allocated to some places that consists of Vegetation type 1).

This Change detection analysis was done by converting the raster generated from the supervised classification to Polygon using the "Data management tool", and then the "Dissolve tool" which merges all the polygons of the same class into a single feature class using the gridcode of the selected raster as the dissolve field factor.

After successfully generating this as explained above, then the attribute table of the generated raster was opened, the table option was click and new fields were added for the features' names, and another field for the area of each feature class. The field for the area was populated by right-clicking on the column at the upper part and then "Calculate geometry" was clicked on.

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The overlay analysis was then performed by using the "Intersect" tool in the "Overlay menu" of the Analysis tool. After generating it, the attribute table of the result was opened and two more tables were added. One to show the relationship of one feature class to another which denotes the changes between the two feature classes and the other field which shows the area of the change between the two feature classes.

The above procedures were repeated for the year 2013-2018 and 2018-2023.

The extent of landuse/landcover changes that have taken place in the area between 2000 and 2023 was achieved using same technique as the previous, in this case, the changes in all the other classes with the exception of built-up area were extracted and analysis was carried out.

The magnitude of the developments noted in the landuse/landcover changes in the study area between 2000-2023 was achieved by carrying out a change detection analysis and an overlay analysis of each class of environmental variables with respect to another so as to determine the extent and rate of the development for the study area. ArcGIS software and Microsoft Excel was used in determining the magnitude of environmental change due to urbanization within the study area. The magnitude of urban induced change was then calculated by subtracting the area coverage of the base year from the reference year thus:

Magnitude of change = Reference year - Base year
(e.g., 2013-2000)

While the rate of developments of the landuse/landcover changes in the study area was determined following these steps:

- *Step 1*

Percentage change was calculated by dividing magnitude change by the base year (the initial year) and multiplied by 100 thus:

$$\text{Percentage change} = \frac{\text{Magnitude of change} \times 100}{\text{Base Year}}$$

- *Step 2*

The Annual rate of change is calculated by dividing the percentage change by the number of study period 2000 – 2013 (13years), 2013-2018 (5years), 2018-2023 (5years) thus:

$$\text{Annual rate of change} = \frac{\text{Percentage Change}}{\text{Period}}$$

VIII. THE EXTENT AND DIRECTION OF DEVELOPMENT IN THE STUDY AREA

A. The Extent of Development in the Study Area

This section presents the result from the analysis of extents of development in the study area. The extent of urbanization was obtained by selecting the Settlement area layer from each of the classified images. Table 4 shows the quantitative extents of the urban growth.

Table 4: The Extent of the Development of Settlements (Urban Growth) Rate in the Study Area

Development growth and rate per year					
Period	**Year**	**Hectares**	**Change (Hectares)**	**% Change (Hectares)**	**% Average Annual Rate**
2000-2013 (13 years)	2000	13,206.7148	**80,859.1175**	**612.257**	47.0967
	2013	94,065.8323			
2013-2018 (5Years)	2013	94,065.8323	**166,068.93**	**176.545**	35.309
	2018	260,134.763			
2018-2023 (5Years)	2018	260,134.763	**34,160.3603**	**13.132**	2.6264
	2023	294,295.123			
2000-2023 (23 years)	2000	13,206.7148	**281,088.408**	**2128.374**	92.538

Source: Author's Analysis, 2023

Table 4 shows a progressive increase in urban development extent throughout the study period. Between the year 2000 and 2013, urban area grew by 612.26% in hectarage, while in the 5 years period between 2013 and 2018, the urban development grows by 176.55%, and between the year 2018-2023, the growth rate was 13.132%. The overall period of study (2000-2023) witnessed an urban growth of **2,128.374%**. This finding shows that Ogun State is experiencing rapid expansion as a result increase in built up areas which is mostly facilitated by Estate developments project by the government and other private real estate organizations and individual buildings. However, the period 2018-2023 witnessed the lowest urban development increase of (**13.132%**). This could be attributed to the drawdown in the economy of the country and sudden increase in building materials price which was witnessed towards the last 4 years regime of Ex-President Muhammodu Buhari.

B. The Direction Spread of Development in the Study Area

Figures 3, 4, 5 and 6 shows the direction and the spread of development in the study area between the study period 2000, 2013, 2018 and 2023 respectively.

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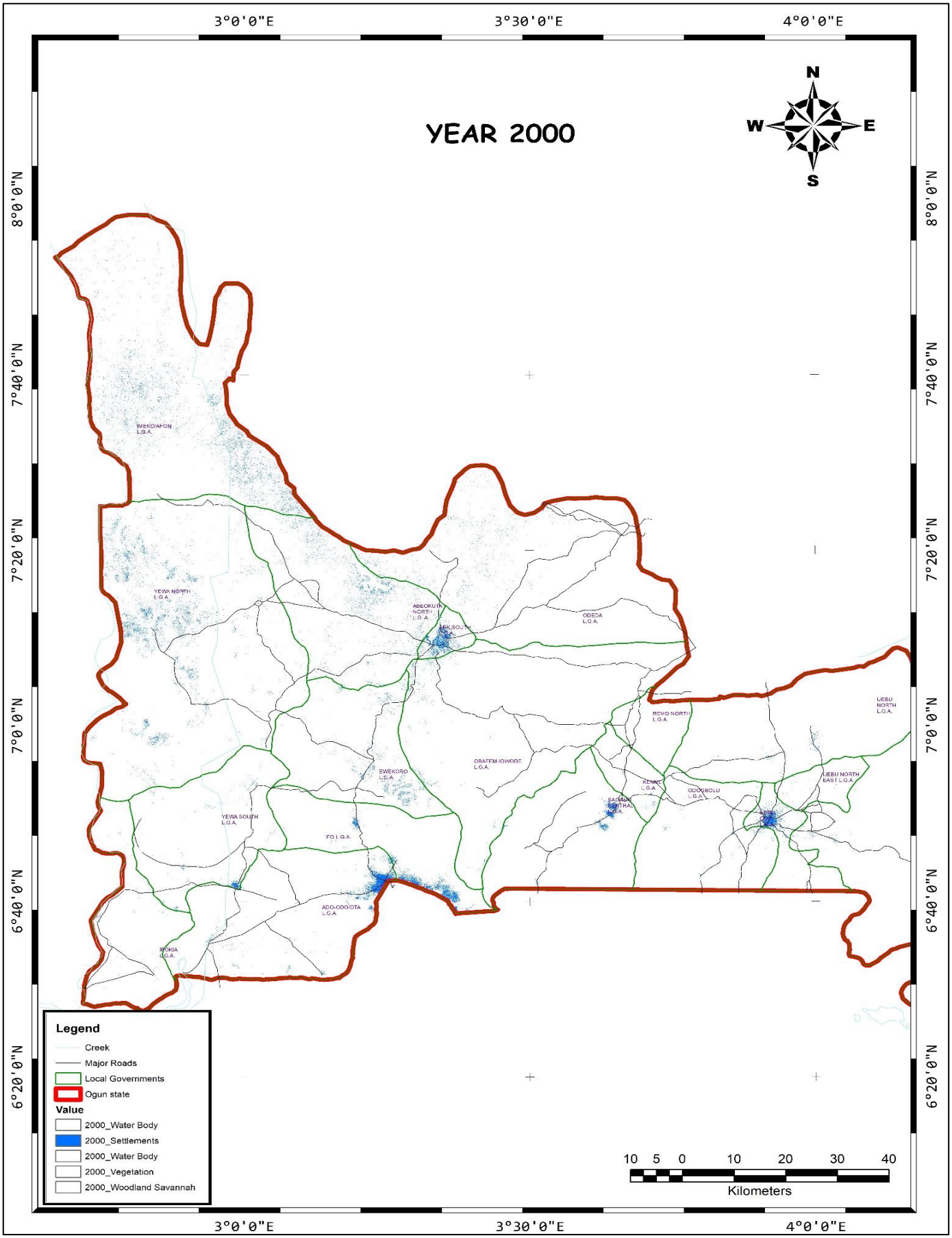

Fig 3: Showing the Spread of Existing Settlements within the Study Area as at the Year 2000

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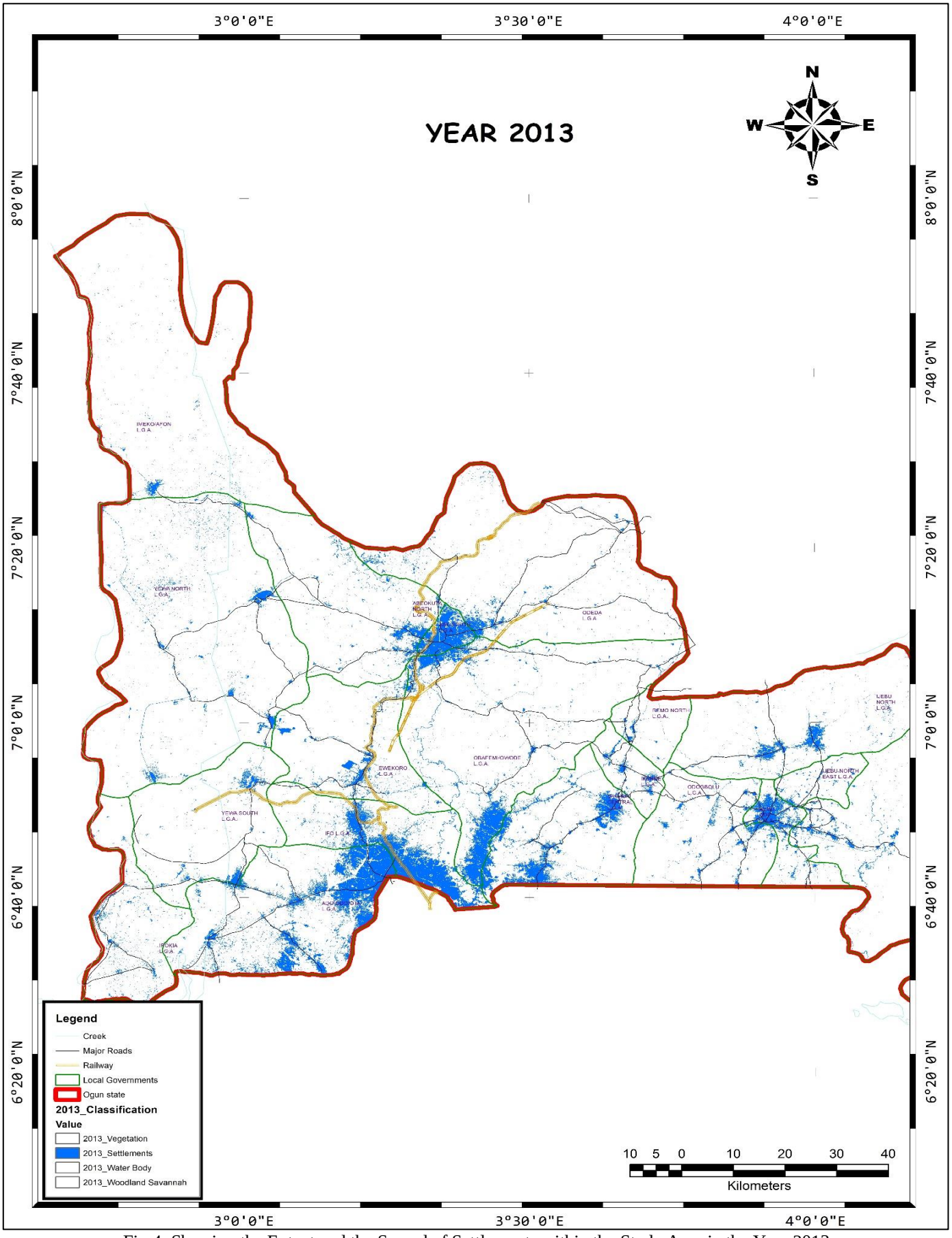

Fig 4: Showing the Extent and the Spread of Settlements within the Study Area in the Year 2013

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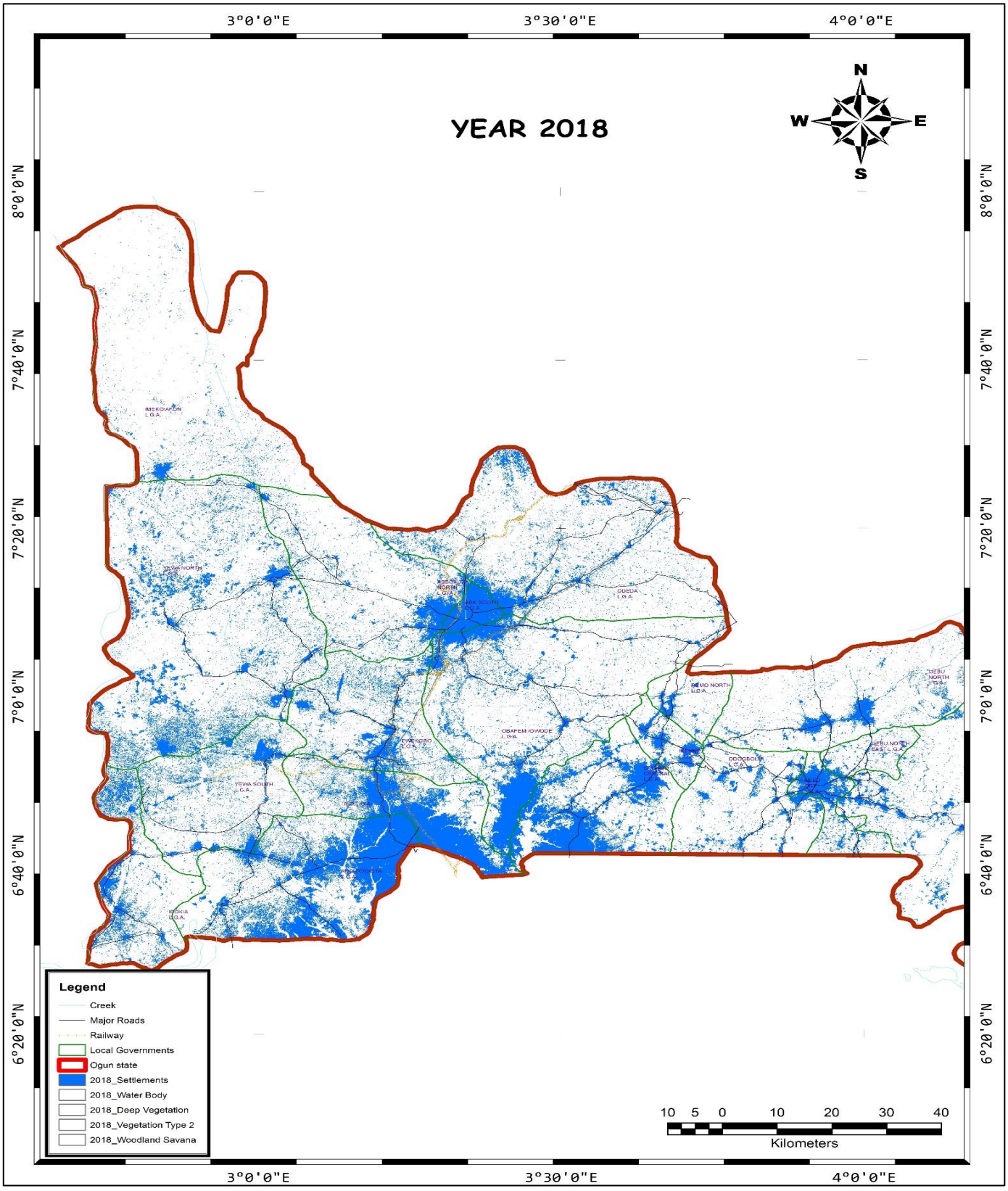

Fig 5: Showing the Extent and the Spread of Settlements within the Study Area in the Year 2018

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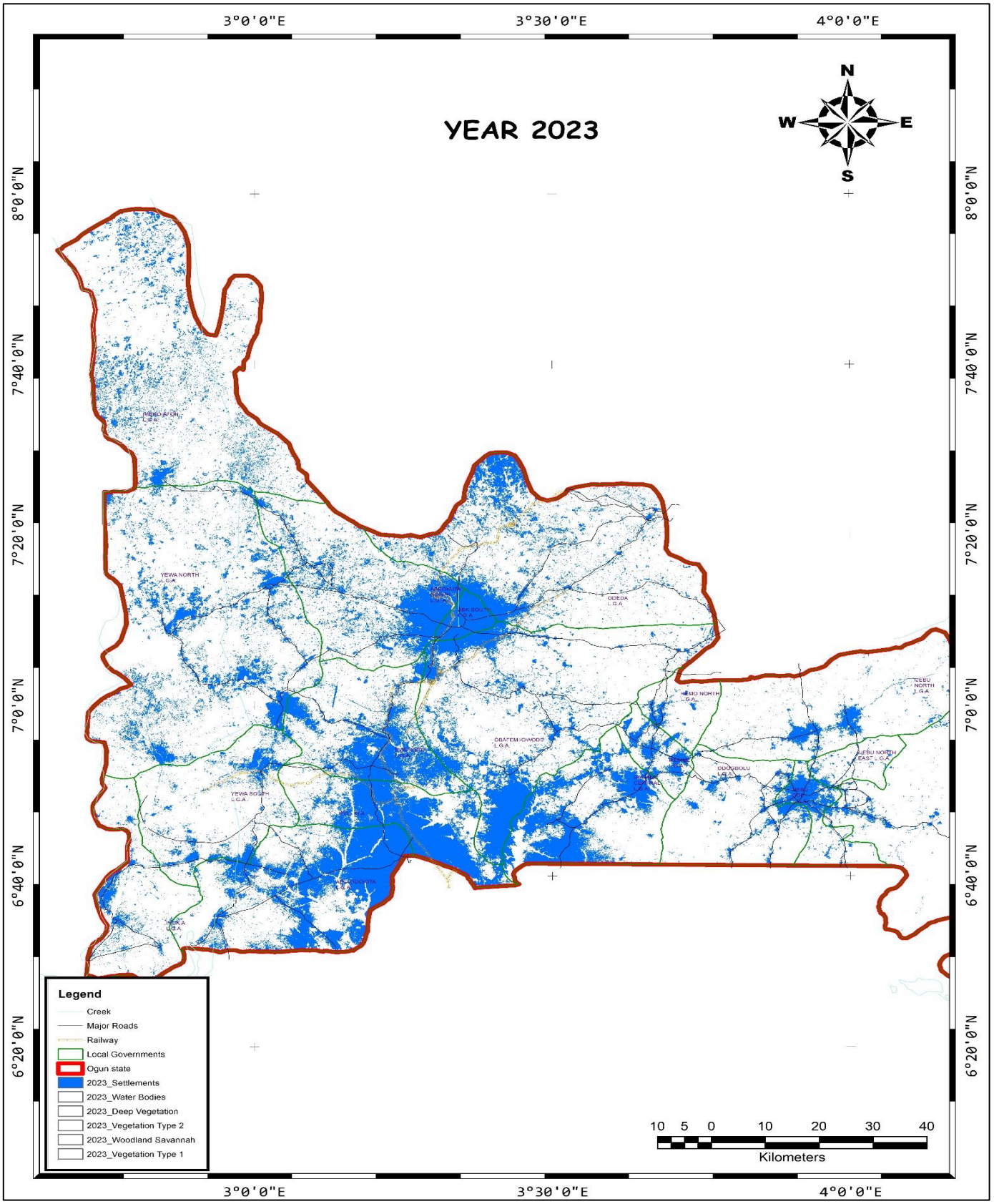

Fig 6: Showing the Extent and the Spread of Settlements within the Study Area in the Year 2023

The direction of growth and spread of developments of urban area within the study area over the period of 2000-2013 with respect to housing units otherwise referred to as Estate, shows remarkable rises in the number of housing units.

For instance, between the year 2000 and 2013 the largest notable growth and spread of urbanization was towards Lagos and Redemption camp in Mowe while other locations tend to spread due to population. As at the year 2000, the Mowe/Ibafo axis where Redemption camp is now located

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was experiencing little or no development in terms of housing, but over the years when the Redemption camp project was implemented, several Estate developers went to secure land in the neighbor and the development sprang forth. Also, moving from there towards Ojodu Berger in Lagos state (the boundary of Lagos state and Ogun state), the spread of developments was also obvious in that axis as a result of over-spillage in population from Lagos state. And as a result of high cost of accommodation in Lagos state, people prefer to work in Lagos state and then seek accommodation on the outskirt of Ogun state bordering Lagos state. All these factors attributed to the spread and development of Estates within the area as well as numerous individual's housing which are also part of the variables in this research.

The period between 2013 and 2018, the trend of the growth which had earlier been established then continued to thrive in addition to other key factors of growth such as population, job opportunities etc.

➢ *Other Locations Which also Experienced Rapid Developments and Spread of Housing are as Follows;*

- Ilaro and its environs: In the year 2000, Ilaro was just a little town, but a significant development started occurring from around 2010 which has grown to be a big town till date including her neighboring towns and this growth can be attributed to the launching of Dangote Refinery in 2012 which created many job opportunities in that area and housing are needed for workers and also the presence of The Federal Polytechnic Ilaro in that area contributed greatly to the growth as well.
- Abeokuta and its environs: Being the state's capital, Abeokuta's developmental growth and spread of housing can be attributed to the many job opportunities into government work and population expansion of the indigenous and non-indigenous citizens. Etc.
- Ota and its environs: Even though the development and spread of urbanization within this area can be attributed to its proximity to Lagos, there is also another factor that contributed to it, which is the presence of numerous industrial factories within this region which contributed to providing many job opportunities and thus attracts many immigrants.

IX. STATICAL ANALYSIS OF LANDUSE AND LANDCOVER

Tables 5, 6, 7, and 8, shows the respective quantitative and spatial extent of landuse/landcover change in the study area.

Table 5: Statistical Analysis of the Results Generated from the Landuse/Land Cover Of Part of Ogun State

Landuse/ Land Cover Categories	2000		2013		2018		2023	
	Area (Hectares)	%	Area (Hectares)	%	Area (Hectares)	%	Area (Hectares)	%
Water Body	30,169.37256	2%	3,109.83182	1%	144,522.90	11%	16,576.40599	1%
Settlements	13,206.71479	1%	94,065.8323	7%	260,134.76	19%	294,295.1231	21%
Vegetation	800,046.7213	60%	757,559.71	56%	357,036.05	26%	483,414.40	37%
Woodland Savannah	487,447.7976	37%	488,445.481	36%	601,264.46	44%	557,964.5952	41%
Grand Total	1,330,870.61	100%	1,343,180.86	100%	1,362,958.18	100%	1352250.515	100%

Table 5 shows the general spatial distribution and extent occupied by each feature class within the study area in a particular year. The settlement feature class which denotes the aim of this study was gradually increasing in the different time frame series. This steady increase shows that housing is on the increase yearly.

Table 5 clearly shows the static landuse and landcover distribution over the study period. Vegetation had the highest proportion covering almost 78% ((cumulatively) i.e the addition of Woodland savannah also known as the agricultural land and the general vegetation) of the entire area in 2023.

Meanwhile, back in the year 2000, all agricultural lands and vegetation lands had the highest proportion covering about 37% and 60% respectively. Whereas in the year 2000, settlements were only covering 1% of the entire study area and now in this present year 2023, settlements are covering 22% of the study area.

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X. THE MAGNITUDE SPREAD OF ESTATE/HOUSING DEVELOPMENTS IN LANDUSE/LANDCOVER CHANGES

The magnitude of the developments and spread of urbanization within the project area was determined using the change detection analysis of landuse/landcover between the year 2000 and 2023. This was done by using the dissolve and intersect (overlay) tools in ArcGIS as explained in the previous chapter. The magnitude of the changes within the study area between two timelines are shown in Table 6 to 8 below.

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Table 6: Extent of Spread of Housing Between Years 2000 to 2013.

Change Between 2000 to 2013	Area of Change Between 2000 to 2013 (Hectares)
Water Body-Settlements	97.033347
Vegetation-Settlements	629,278.29
Woodland Savannah-Settlements	48,706.80
Total Change Detected	678,082.1238

Table 7: Extent of Spread of Housing Between Years 2013 to 2018.

Change Between 2013 to 2018	Area of Change Between 2013 to 2018 (Hectares)
Water Body-Settlements	225.983888
Vegetation-Settlements	95,979.06
Woodland Savannah-Settlements	162,555.39
Total Change Detected	258,534.45

Table 8: Extent of Spread of Housing between Years 2018-2023

Change Between 2018 to 2023	Area of Change Between 2018 to 2023 (Hectares)
Water Body (Swamp)-Settlements	4,353.06
Vegetation-Settlements	17,229.49
Woodland Savanah-Settlements	272,666.35
Total Change Detected	294,248.89

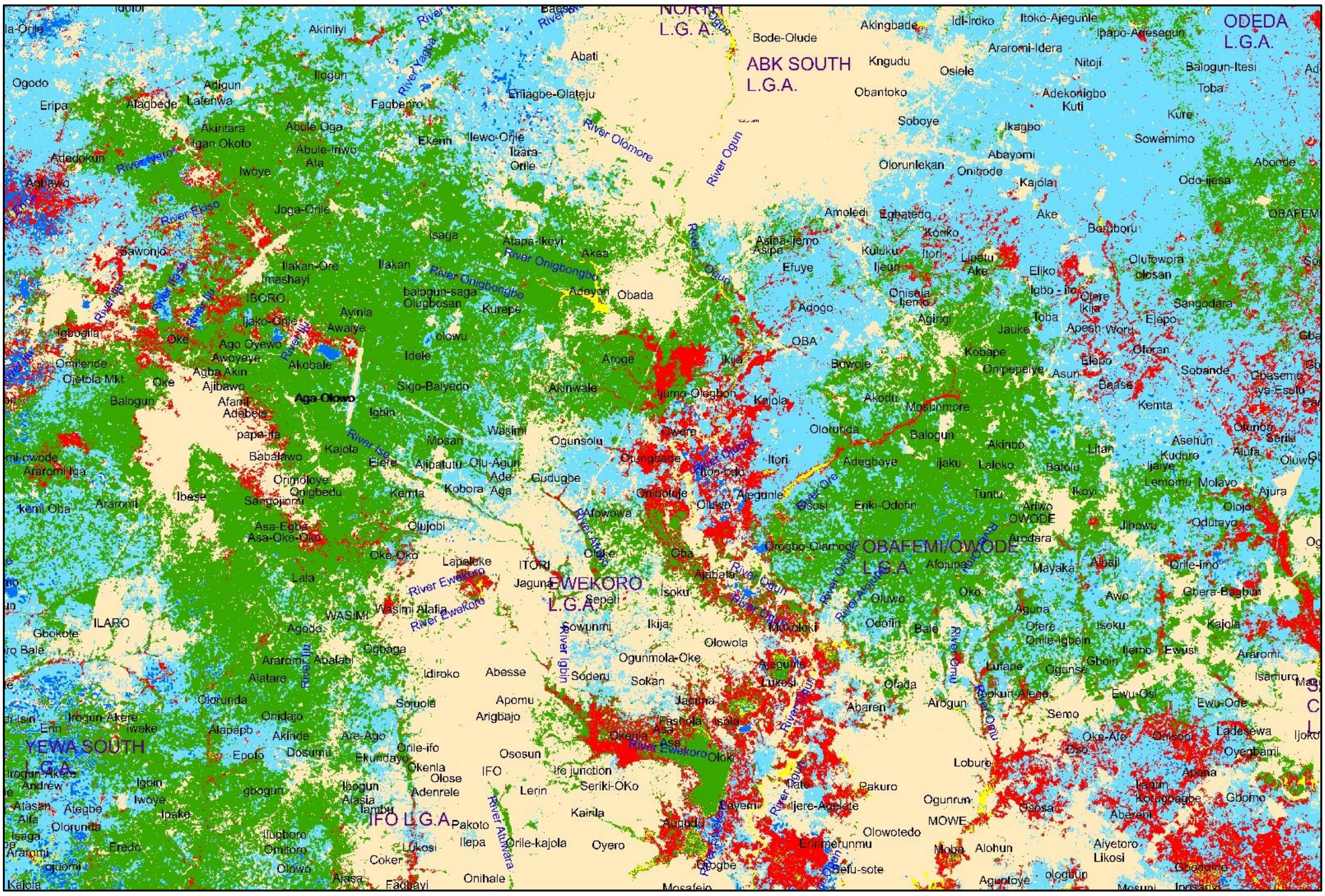

Fig 7: Showing a Zoom-in to the LULC Map Generated for 2023 to Ascertain the Accuracy of the Process

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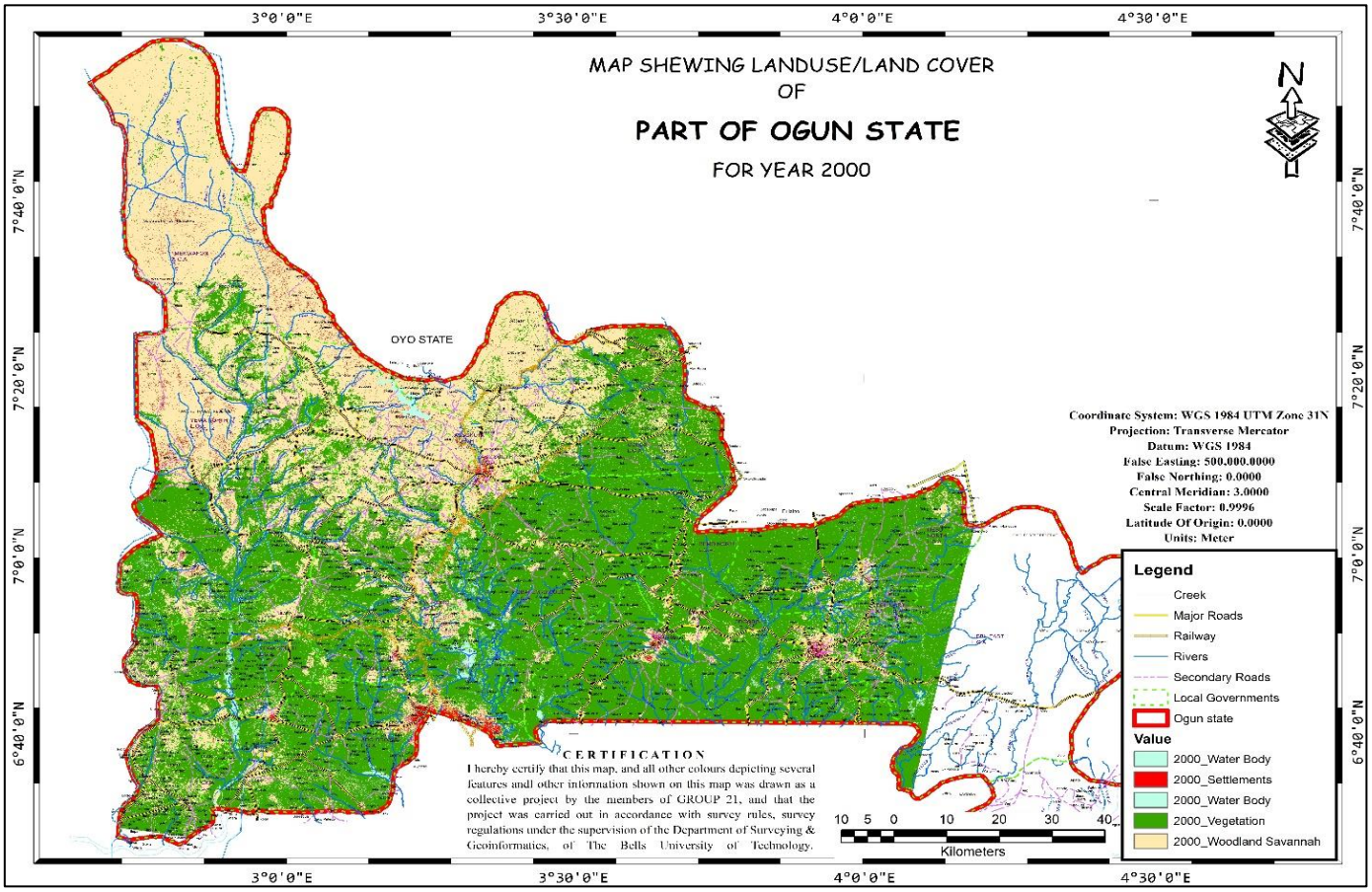

Fig 8: Showing Landuse/Land Cover Map for Part of Ogun State in the Year 2000

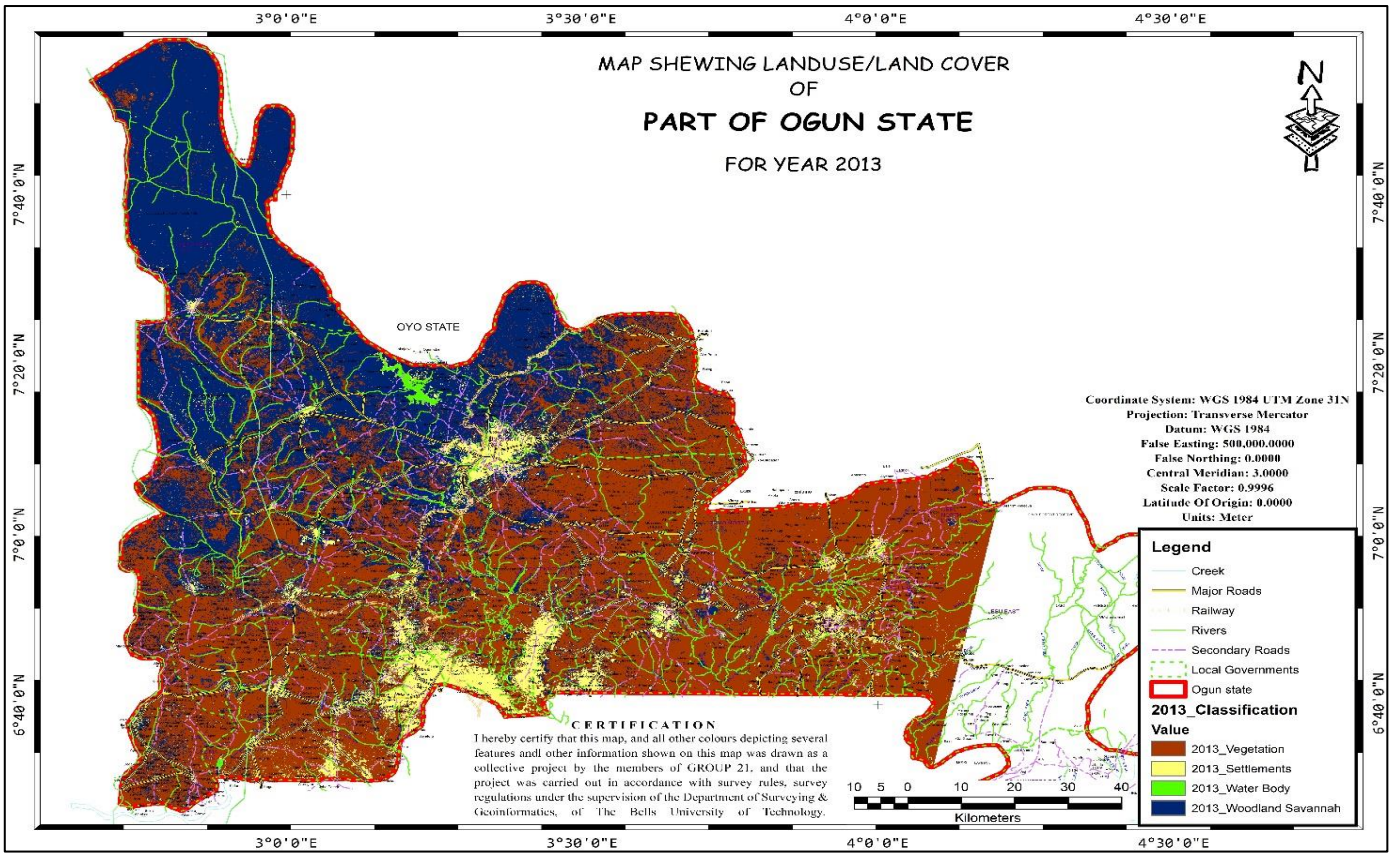

Fig 9: Showing Landuse/Land Cover Map for Part of Ogun State in the Year 2013

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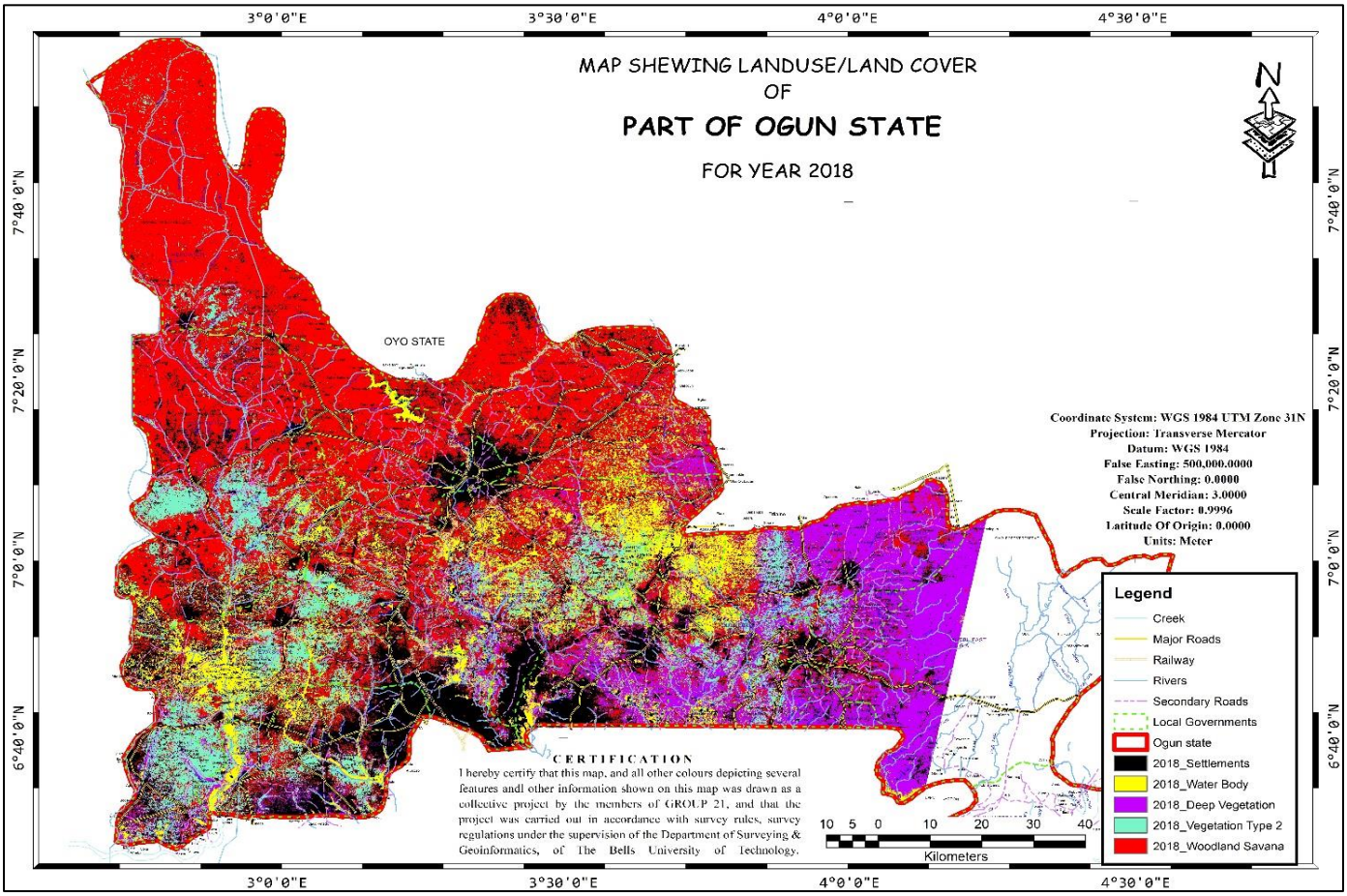

Fig 10: Showing Landuse/Land Cover Map for Part of Ogun State in the Year 2018.

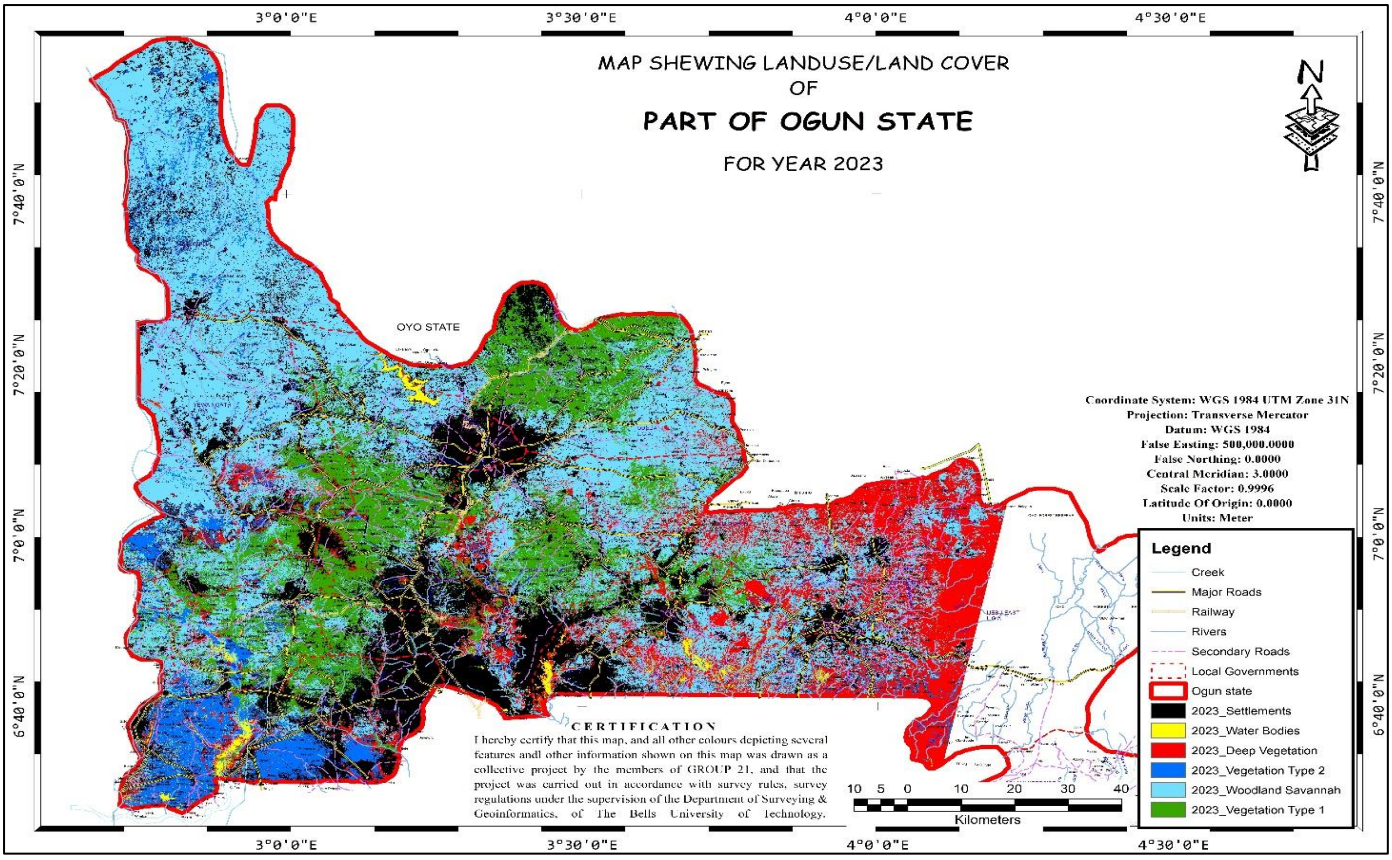

Fig 11: Showing Landuse/Land Cover Map for Part of Ogun State in the Year 2023.

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Table 9: The coalition of the Magnitude of Changes from other Feature Classes to Housing Between Years 2000-2023

Landuse/Landcover Changed to Housing	2000-2013 (Hectares)	%	2013-2018 (Hectares)	%	2018-2023 (Hectares)	%
Water Body - Settlements	97.033347	1%	225.983888	1%	4,353.06	1%
Vegetation-Settlements	629,278.29	92%	95,979.06	36%	17,229.49	6%
Woodland Savanah (Farmlands) -Settlements	48,706.80	7%	162,555.39	63%	272,666.35	93%
Total Change Detected	678,082.1233	100%	258,760.4339	100%	294,248.90	100%

From Table 9 above, the magnitude of other land use feature classes that changed to housing shows that agricultural Farmlands and natural vegetations had the highest proportion of landuse/landcover that change to built-up areas. This signifies a progressive encroachment of built-up areas into these landuse/landcover types, where Woodland Savannah (agricultural land) and vegetation land had its highest magnitude of change between the year 2000 and 2023.

From the analysis in table 9 and figures 8, 9, 10 and 11, land use and land cover of the study area has undergone considerable changes over the examined period. While the built-up areas which constitutes several forms of housing have expanded and developed significantly during the twenty-three years period of study with intervals of 13 years, 5 years and 5 years respectively.

XI. LIMITATION OF THE STUDY

The first interval of 13 years stated above in the series of imagery dataset interval downloaded and used in this research was so because of the errors discovered in the image classification process as a result of similar shades of different feature classes in the imagery downloaded which led to inaccurate classification, and thus led to the images (for year 1988, 2003, and 2008) that fell victim of this being removed and substituted with that of year 2000. This error noted could be as a result of the roof type used in those days which turns brown when rusted and is similar to vegetation during dry season. An example of this error discovered is attached below in Figure 12 and a part of the wrong classification is highlighted.

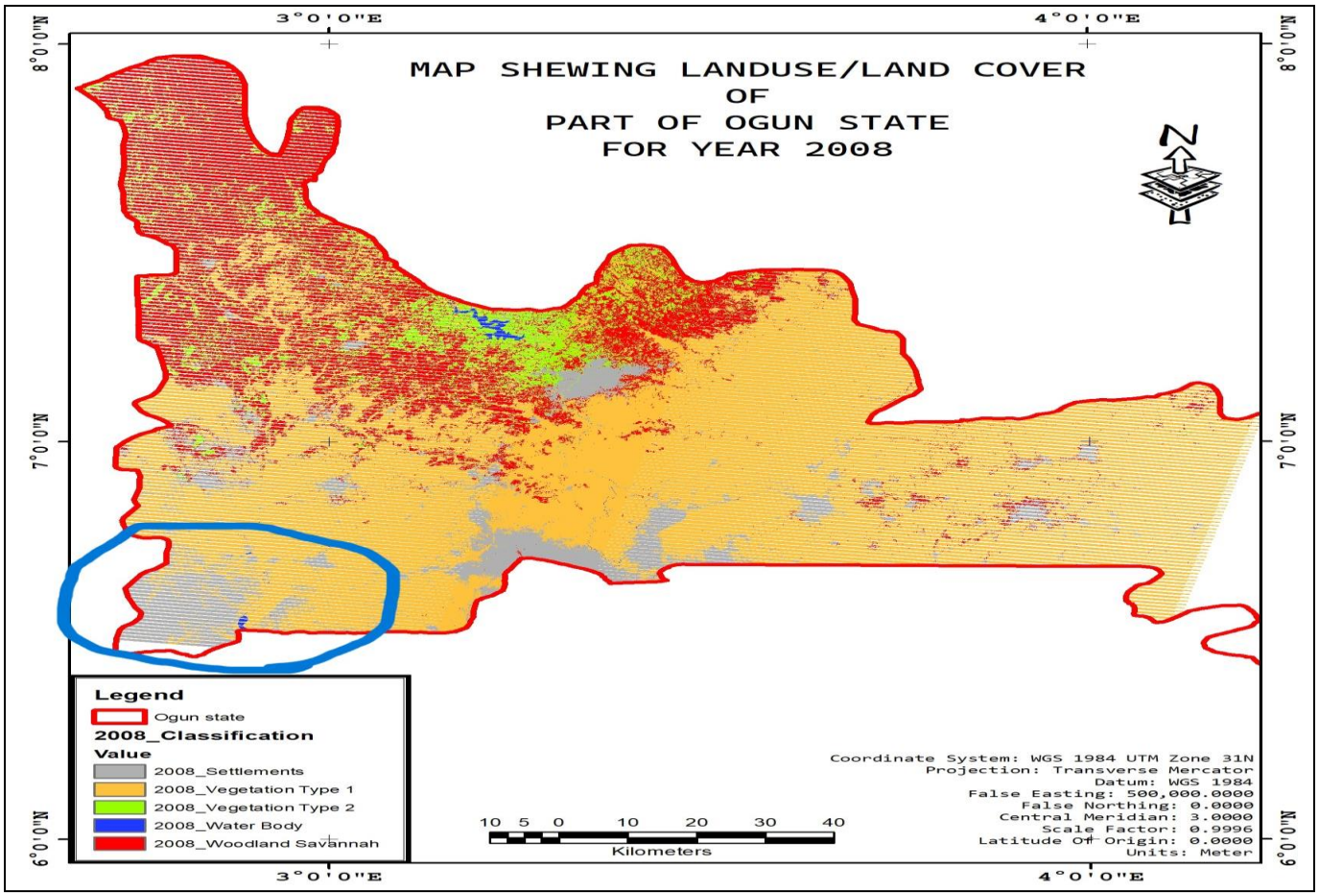

Fig 12: Showing the Inaccuracy Spotted in the Image Classification for year 2008.

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XII. SUMMARY OF FINDINGS

➢ *The Summaries of the Findings Gathered in this Research Work are as Follows:*

- This study on the Spread of urbanization in Ogun state which deals specifically with the spread and development of housing across the state was carried out using Geographic Information Systems and Remote Sensing techniques.
- The extent of this study covers almost all of Ogun state leaving out part of Ijebu East local government area and Ogun Waterside Local government area due to the coverage of the images tile downloaded from the USGS explorer website.
- This study identified the rapid development and spread of housing between year 2000 to year 2013 and also analysed the extent of urban growth in general, the extent of landuse/landcover changes, magnitude and rate of the spread of Settlements landuse/landcover changes in the study area between 2000 and 2013, 2013 and 2018, 2018 and 2023.
- From the results of this study, the built-up area showed a consistent increase over time and this is basically because of increased in population, the presence of many industries across the state which led to creation of job opportunities and thus attracts many immigrants, over-spillage of populations from Lagos state and consequent conversion of other landuse classes into residential areas.
- The rapid spread of developments throughout the study period was noted to have occurred the highest extent and spread between the year 2000 and 2013. For instance, between the year 2000 and 2013 the largest notable growth and spread of estate developments was towards Lagos and Redemption camp in Mowe while other locations tend to spread due to population.
- The magnitude of other landuse classes that changed to urban area showed that Woodland Savannah (agricultural Farmlands) and natural vegetation had the highest change to built-up areas throughout the study period. The percentage of each feature classes in the overall development encroachment between the year 2000-2023 is as follows: between year 2000-2013, Water bodies 1%, Agricultural farmlands 7% and Vegetations 92%; while between the year 2013-2018, Water bodies 1%, Agricultural farmlands 63% and Vegetations 36%; and finally, between year 2018-2023, Water bodies 1%, Agricultural farmlands 93% and Vegetations 6%. And all of these signifies a progressive extension and encroachment of settlements into other landuse classes. Please see Table 4.6, Page 41.
- The rate of the spread of housing developments as determined via the landuse/landcover change detection analysis showed an average annual rate of change to be 92.54% for the study period. Please see Table 9.
- Finally, it was observed from the landuse land cover that housing units significantly increased over the period of study (2000-2023 (23 years)). The settlements encroached majorly into vegetations. This encroachment is as a result of increase in population growth and other activities such as commercial activities, economical activities, educational activities, residential housing (by government, real estate firm, and individuals) and industrial activities.

XIII. CONCLUSION

This study has demonstrated that the recent advancements in remote sensing and GIS technologies provide powerful tool for mapping and detecting changes in land use/land cover which can be used to study many phenomena and, in this case, the spread of urban growth. For understanding the extent, rate and magnitude of land use and land cover dynamics which is essential in this study and other relevant studies, digital image processing techniques (Remote sensing and GIS) has enabled speedy, accurate and objective interpretation of the multispectral data received from satellites. This has helped in a major way to observe the LULC at local, regional and global levels.

- The study witnessed an increase in the spread of urban growth throughout the study period. Also, the extent of landuse/landcover changes showed an increase in built-up areas and a significant decrease in natural vegetation and agricultural lands.
- The factors which attributed to these urbanization developments all across the state are identified to be;
- Over-spillage of population from Lagos state as well as people who work in Lagos state but seeks a cheap and affordable housing for themselves both for leasing and outright ownership.
- One of the largest religious settlements in Africa which is situated at Mowe area of Obafemi Owode Local government area named is “The Redemption camp”.
- Industrial activities across the state. Ogun sate is said to house a notable number of industries in the South-West.
- Educational activities: Higher institutions which are being founded across the state also play a crucial role in the spread of this development.
- Financial activities: it is normal for people to relocate from one place to another in search for greener pasture and this also contributed to the spread of estate developments within the project area.

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