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RESEARCH ARTICLE OPEN ACCESS

ASSESSMENT OF THE IMPACT OF URBAN SPRAWL ON INDIGENEOUS AGRICULTURE LAND IN IBADAN BETWEEN 2009 AND 2019: A CASE STUDY OF AKINYELE LGA

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Arc GIS,
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ABSTRACT

This work was aimed at monitoring the effect of urban sprawl on indigenous agricultural areas of Ibadan using Akinyele local government area as a case study with GIS and remotely sensed data as a tool for the analysis. Arc GIS 10.5 was used in processing and detection of changes in the imagery. It was revealed that by 2009 vegetation cover was dominant in Akinyele LGA with 59% of the total land cover and built up area was 38%, at the beginning of 2019 a total of 20% out of the initial 59% of vegetation cover has been loss to urbanization and development, vegetation cover was reduced to 39% and built up area increased to 55%. The total area covered by vegetation in 2009 was about 180 sqkm, in 2014 it was 216 sqkm and in 2019 it was 185 sqkm. Built up area as at 2009, 2014 and 2019 covered an area of about 180 sqkm, 231 sqkm and 262 sqkm, respectively. Finally, more land in the study area will expose to direct sun ray and the affected areas will be exposed to erosion thereby posing a threat to agriculture. The study recommended that effective policy implementation be embarked upon as a check against increase in urban centres, there is need to take adequate care of vegetation and there should be smart decision about how to solve human needs and policy makers should consider employing remote sensing and GIS techniques in providing solution to spatial problems.

I. INTRODUCTION

Urbanization has rapidly transformed urban environments into highly dynamic systems, with cities now housing nearly half of the global population. This trend, which started in the 19th century, continues to expand at an alarming rate [1]. Urban sprawl, as defined by the European Environment Agency (2006), refer to unplanned and gradual urban development that involves low-density land use patterns on the outskirts of cities, often encroaching on farmland areas." Population growth and territory expansion are inextricably related to urban growth or sprawl. [2] established three stages of urban growth and created cases to assess the effects on key environmental metrics such as land usage, air quality, water and energy demand. According to their forecasts, by 2020, all accessible area suitable for development will be urbanized, resulting in increasing air pollution due to an increase in the number of automobiles.

[3] described the peri-urban area as the contiguous space surrounding a city that is impacted both positively and negatively by its proximity. It represents an interface that lies between the rural and urban systems. However, compared to rural areas, the provision of urban services is increasingly limited in the peri-urban

area, and ecological services are also diminished. The peri-urban population is made up of both rural and urban residents, with the rural component lacking access to clean air, productive farmland, and property ownership, while the urban component lacks access to essential urban services. The peri-urban communities are predominantly composed of low-income earners who rely on resources from both rural areas and cities for their livelihood and sustenance. These communities bear the consequences of urban encroachment, as their land uses are fragmented by various forms of urban development. The inclusion or exclusion of peri-urban areas from urban and regional strategies raises conceptual issues. As cities grow in population, complexity, and geographic extent, rural hinterlands and peri-urban communities suffer invasion without enough consideration for the effects on these vulnerable areas. In addition to improved accessibility, population growth, and the availability of large, inexpensive lots, these factors contribute to dynamic changes in land use. Consequently, the physical development pattern of peri-urban areas undergoes continuous transformation, particularly in cities of the developing world.

The scenario painted above on the effects of city urbanization on its surrounding peri-urban areas, especially as it concerns sub-Saharan African cities, is not very different from what is evident in Ibadan city core and its surrounding peri-urban areas.

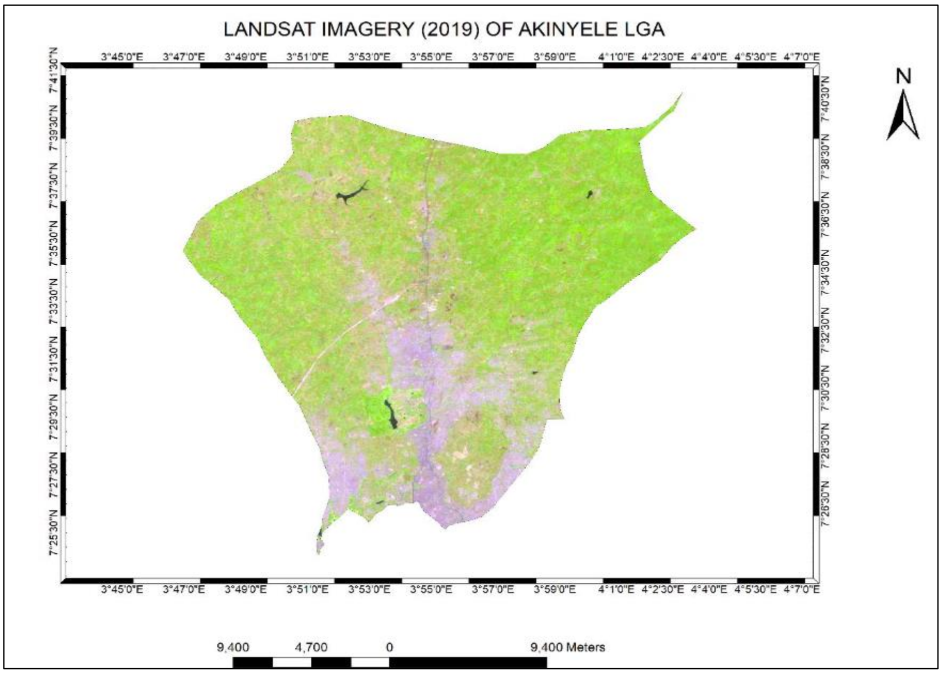

Figure 1: The map of the studied area (Akinyele local goverment area).
Source Authors, (2023).

II. LITERATURE REVIEW AND THEORETICAL FRAMEWORK

According to [4], the city of Ibadan, established in 1829, is the largest traditional urban center in Sub-Saharan Africa and symbolizes the pinnacle of pre-colonial urban development in Nigeria. The earliest village, now known as the core area, was held by indigenous settlers. This portion of the city now has the oldest and least developed residential districts, as the buildings were built without regard for building standards or regulations. The pre-colonial city grew over time, encompassing an outlying territory impacted by modern activities. There is an obvious separation between the ancient parts of the city and the newer regions, which emerged from the British colonial authorities' enactment of the Town and Country Planning Ordinance in 1946. To some extent, the newer areas were subjected to planning interventions and development control. They also demonstrated the impact of population expansion on land cover in Ibadan further. Rapid national economic expansion during the oil boom period began in the 1970s, causing significant changes in the city's land use. In 1972, vegetation covered 92% of the total land, with peri-urban development accounting for 3.7% and the urban center accounting for 3.0%, respectively. Residential zones predominated in the peri-urban areas. Prior to 1972, there were no high-density regions, but by 1984, 11.42 square kilometers of the urban area had been designated as high density. This amount grew steadily, reaching 64.8 square kilometers in 2003. Meanwhile, the proportion of land covered by vegetation decreased from 63% in 1984 to 39% in 2003.

[5] investigated the impact of urban sprawl on sustainable urban development using remote sensing and social media data in Morogoro, Tanzania, from 2011 to 2017. Their findings revealed that population-driven urban expansion negatively affects ecosystem services, replacing essential grasslands and forests with built-up areas. The study's novel approach with social media data can inform urban planning in African cities where data is often limited or outdated. [6] focused on the impacts of urbanization on ecosystem services and societal perceptions in Boise, Idaho. They found that agriculture faces the highest risk of conversion due to urban growth. Differences in the perceived importance of ecosystem services were observed between the general public and experts, indicating the importance of incorporating social demand in urban planning for policy resilience and diverse perspectives. [7] explored the relationship between urbanization and agricultural land conversion in Hyderabad, Pakistan. The study analyzes population growth and land use changes, particularly in the Qasimabad sub-district. It reveals significant agricultural land conversion for urbanization, raising concerns about potential food and infrastructural challenges. Policymakers can use these findings to address sustainable land use planning for the city and beyond. [8] examined the consequences of urban expansion on green spaces and ecosystem services in Accra, Ghana. The study utilizes remote

sensing, the i-Tree Canopy model, and stakeholder interviews. Findings indicate a decline in green spaces due to urban growth, posing challenges to sustainability. The valued benefits of existing green areas underscore the necessity for effective management and conservation strategies to bolster the city's resilience amid climate change. [9] assessed the vulnerability of East Kolkata Wetland (EKW) to urban expansion. The rapid growth of Kolkata megacity encroaches upon the wetland, posing environmental threats. Using the Fuzzy MCDM method, the research identifies around 60% of EKW as highly to very highly vulnerable areas. Urgent conservation measures are needed, especially for wetland zones adjacent to urban development. The Fuzzy MCDM method's high reliability (AUC 93.7%) validates its use. The study calls for immediate action by local authorities to protect this ecologically valuable wetland. [10] analyzed urban sprawl, land use change, and agglomeration in Makassar City, Indonesia. The expansion of the city area impacts spatial dynamics and leads to environmental degradation in suburban areas. Urban sprawl, land-use change, agglomeration, activity systems, and transportation systems show positive correlations with environmental quality degradation, accounting for 85.9% determination coefficient. [11] evaluated the impact of urban sprawl on agricultural livelihoods in peri-urban Kumasi, Ghana. Through interviews with farmers, the research identified various responses, including agricultural intensification, extensification, diversification, and off-farm strategies. Livelihood outcomes varied based on assets like human and social capital. To address these challenges and reduce vulnerabilities, effective spatial planning, legislative enforcement, and expanding the market for agricultural goods and non-farm jobs were suggested as key policy interventions. [12] conducted a study on land use/land cover changes in Ghana's Greater Accra region using GIS and remote sensing techniques. The research revealed a significant increase in built-up areas by 277% over 24 years, leading to a decline in forest areas from 34% to 6.5% during the same period. The study projected a massive increase in urban extent, covering 70% of the area by 2025 compared to 44% in 2015. Spatial models proved valuable for sustainable city planning and environmental management, especially in developing countries like Ghana. [13] conducted a study on urban sprawl in China from 2006 to 2014 using urban land census and population data. The results showed significant urban sprawl (average USI of 3.16%), but with a declining rate after 2010. They identified regional disparities and factors like urban size, hierarchy, population density, GDP per capita, and industrial structure as influencing urban sprawl. Tailored urban planning and land use policies are essential considering these differences. [14] developed an innovative approach using machine learning and cellular automata integrated Markov Chain (CA-MC) to accurately predict urban expansion in South Auckland. The model outperformed traditional methods and predicted a significant expansion of urban areas to 1340.55 ha in 2026, mainly encroaching on grassland and open-bare land within planned growth zones. [15] conducted a comprehensive GIS and remote sensing analysis to assess the impacts of land use/land cover change on environmental sustainability in Ekiti State, Nigeria. By using supervised image classification, the study mapped land use/land cover change over a 4.5-decade period (1972–2017) and analyzed vegetation dynamics through normalized difference vegetation index and land surface temperature for temperature dynamics. The results revealed a significant decrease in forests and woodlands (-51.25% and -0.72%, respectively) and a notable increase in built-up areas, croplands, rocks/bare soils, and water bodies (267.58%, 197.30%, 714.11%, and 4421.43%, respectively). [16] conducted a study utilizing remote sensing and GIS to analyze the spatio-temporal patterns of urban sprawl in the fringe area surrounding Ibadan, Nigeria. Focusing on Egbeda Local Government Area, they utilized aerial photos from different time periods and found that the urbanized part of the area expanded significantly over time. In 1964, it covered approximately 33 km², which increased to 76.50 km² in 2000, with a projected expansion to 191.7 km² by 2020. Low-density sprawl was observed between 1986 and 2000, and the expansion resulted in the loss of several villages and extensive consumption of agricultural land. [17] analyzed land use dynamics and the expansion of Benin City's built-up area. They discovered that the spatial structure of urban sprawl corresponded to ideas like the concentric zone, sector, and multiple-nucleus models. Economic activity focused in the city center drew sellers from the outskirts, resulting in human agglomeration and interaction. They identified commercial locations as development hubs, lending credence to the multiple-nuclei explanation. They also discovered a link between population expansion and built-up land use, which led to a decline in plant cover. The analysis emphasized housing demand as a result of population expansion and the move from agriculture to other land uses for higher economic returns. [18] highlighted the significance of infrastructure and public services in addressing the challenges of urbanization, particularly in developing countries. They estimated that $40 trillion of infrastructure spending is required to meet the needs of cities in developing countries. However, the main challenge lies in finding means of financing such vast expenditures.

As cities expand, they take over surrounding land, including natural green spaces, to build houses, roads, and paths to suit the demands of their citizens. urban sprawl refers to the growth of metropolitan areas into rural areas, farmlands, and woods on the periphery of cities. Both developed and underdeveloped countries are affected by urban sprawl. The implications can be particularly severe in developing countries, posing major dangers to health and hygiene. While industrialized countries may be in a better position, continual urban land growth at the expense of bordering areas poses a substantial risk to sustainability and quality of life. In the long run, the consequences can be devastating. Therefore, the focus of this research is to look into the impact of urban sprawl on the peri-urban area of Ibadan.

This study aims to investigate the effects of urban activities on peri-urban areas in Ibadan. It distinguishes itself from previous research, which predominantly focused on issues like resettlement, housing problems, and population growth within specific settlements, without specifically considering their impact on the spatial structure and well-being of peri-urban residents. The findings of this study will be valuable to urban policymakers in both the public and private sectors. Additionally, environmental monitoring agencies will benefit from the insights provided. Administrators responsible for development control and land regulation in the rural-urban fringe will find the information generated in this study useful for planning, development, and land management in Ibadan, as well as in other new towns within Nigeria and beyond. This study is confined to small study areas within the larger geographical region of Ibadan. Nevertheless, this study represents a significant effort in understanding some of the impacts of urban growth on the peri-urban areas of Ibadan land.

III. RESEARCH METHODOLOGY

The methodology involves the techniques and materials used in the execution of the project which the extraction of data processing and manipulating of data, thematic classification, database creation, buffering, overlay analysis and network analysis of data.

III.1 DATA DESIGN

The described process pertains to the creation of a detailed data model for a database, aiming to represent real-world entities and their relationships in an optimized manner, maximizing benefits while minimizing data usage [19]. In the context of computerized information systems, a database serves as a collection of interrelated data that supports one or more applications, relying on computer programs for its utilization. It may encompass multiple data files, and the design of such a database, referred to as data modeling in GIS, involves three interconnected phases.

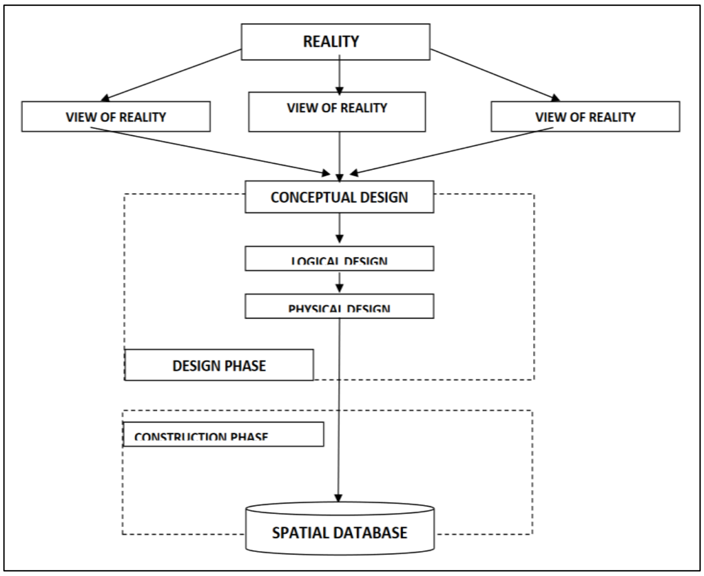

Figure 2: Design and Construction Phase of a Spatial Database. Source: [19].

III.2 CONCEPTUAL DESIGN

This is the arrangement of human conceptualization of reality. It refers to how the view of reality could be presented in a simplified manner but still satisfy the information required of the organization concerned. There are three basic schemes for conceptual design, they are; Vector data model, Tessellation data model, Object oriented data model

III.3 LOGICAL DESIGN

This is the representation of data model, designed to reflect the recording of data in a computer system, the conceptual data model for this project was translated into relational data structure. The conceptual model was translated into logical schema and the following table relationship was derived.

1. VEGETATION/FARMLAND (VF_id, VF_use, VF_area, VF_location)
2. WATERBODY (WB_id, WB_area, WB_location, WB_name)
3. BUILT-UP AREA (BU_id, BU_name, BU_location, BU_use)

III.4 DATA ACQUISITION AND SOURCE

Generally, there are two major sources of data which are primary and secondary data, for the study, secondary data was used,LANDSAT imagery and shape file of Akinyele local government area for three period; 2009, 2014 and 2019 were acquired. Field survey was carried out to locate and validate the satellite imagery gotten.

III.5 SYSTEM SELECTION

Hardware refers to the computer components that form the visible frame work on which GIS runs; where data input, manipulation, analysis, and display takes place. For this project, the hardware used includes;

- HP ENVY TS 17 notebook PC with configuration of 1 Terabyte hard disk, 12GB RAM and core i7 2.20GHz processor.
- HP photosmart D5300 series printer
- Arc GIS 10.5 version software was used for digitizing, manipulation and performing the analytical functions employed in this project.

III.6 DATA CONVERSION

The satellite images of the study area were acquired and classified using ARC GIS 10.5. The shape file of Akinyele local government was used to clip and get the extent of the study area and the features that were created include waterbody, vegetation and built up area.

- Launch "ArcMap" on your desktop
- On ArcMap, go to file click on "add data"
- After clicking on "add data", go to the folder you save your Landsat imagery and click OK to import to Arcmap environment.
- Once the image has been imported into Arcmap, navigate to "table of contents" and right click the data(image)
- After right clicking the data(image), scroll down to the "properties" and click for it to display numerous options.
- Go to "symbology" and go to "unique values" in order to perform a task to remove background valueto "zero" after that you click "apply" and "ok".
- Back on the image on ArcMap, navigate to "catalogue" and go to the folder you save the particular shape file of the "AOI" and import it to the table of contents.
- In order to perform a processing extent of the AOI with the imported imagery, go to "Arc tool box" and drop down on "spatial analyst tools" and drop down on "extraction" and then click on "extraction by mask". This extraction is done in order to extract the satellite imagery on the specified AOI shape file.
- Once extraction is done, right click on the empty pane of the ArcMap interface and navigate to "image classification " in order for the tools to be displayed on the screen.
- Now to perform supervised classification, go to the image classification tool box and drop down the arrow button to display different options. Click on "Maximum likelihood classification "
- After clicking on the maximum likelihood classification, it will display some options in a window pane and input the necessary information needed, then click "ok" for it to perform supervised classification of the AOI.
- Once the supervised classification process has been performed, it will be displayed in the table of content
- Go to the supervised classification in the table of content to change the classified image colour classes to the desire colour of choice.
- Rigth click on the classified image and go to open attributes table to perform numerous task like Area, Percentage, etc.

- Once all this is done then you can move your image to layout view of the ArcMap in order to embellish your map
- Once the image classification tools has been displayed on the screen, go to the tools and click on "training sample" to display another window on the ArcMap
- After the training sample window has been displayed, go to image classification tools again and click on "draw polygon" and start drawing polygons on the features that is to be classified.
- After drawing the desired numbers of polygons on the feature, it will be displayed on the training sample window. Go to the training sample window and perform a task by merging all the drawn polygon classes as one, and name it the desired name of the feature.
- Once completed, on the training sample window, you save your training sample to a preferred file location and also navigate to the signature file icon and click on order to save the "signature file" and save it in any folder of your choice.

III.7 DATABASE MANAGEMENT

A database management system (DBMS), is a batch of tools that help to access the database by querying it, updating it, making back-ups, e.t.c. this includes the host of computer hardware and software, the procedure and structured data. It is used for the input, storage, analysis and retrieval of the data. It should also provide facility for data security, integrity and archiving. Database management system may be defined as a collection of software packages that facilitates the organization, storage, manipulation and retrieval of a data from the database. It allows one to interchange or cross reference data between different records.

Examples are Microsoft Access, Oracle Spatial, dBase, Sybase etc. DBMS comprises of user interface, data server, query optimizer, data dictionary, transaction handler and concurrent controller

III.8 DATABASE SUCURITY

The utmost important noticeable security to all database management system (DBMS) is the security of the data. The DBMS or some subsystem invoke by the DBMS must monitor user request and reject any attempt to violate the security and integrity defined by the DBA.

III.9 DATABASE INTEGRIY

Data integrity is used to refer to the accuracy or correctness of the data in the database. The following integration measures should be enforced

1. Entity Integrity: This restriction on primary key value ensures that no primary key attribute is null.
2. Referential Integrity: This is a restriction on foreign keys in a relation; neither foreign key's value must match the primary key value of some type in its own relationship table.

III.10 DATABASE MAINTENANCE

The accuracy of a database depends in its fitness for use as a Decision Support System (DSS). Database must be kept up to date and properly maintained in these ways.

1. Following the instruction in the user's manual.
2. Simplicity in the data process adopted.
3. Flexibility of the process of updating the database created.
4. The system should be prevented from heat, dust and probably operate the system in air-conditioned room.

IV. ANALYSIS AND PRESENTATION

Geographic Information System (GIS) has very powerful analytical capabilities because it can combine spatial and non-spatial data to create accurate findings that are excellent for long-term development planning and a critical decision-making tool. GIS operation and analysis are performed based on the nature of the project and end-user requirements.

GIS analytical capabilities differentiate it from other information systems. The capabilities are classified into measurements, retrieval, classification function, overlay function, neighbourhood, connectivity and topological functions (Aronoff, 1989).

IV.1 LAND AND USE MAPPING

A supervised classification technique was employed on three separate images, leading to the generation of final classification products.an overview of the land use of the study area in the year 2009, 2014 and 2019.

Three major categories of land use were/are identified; there are Water Body, Built Up and Vegetation

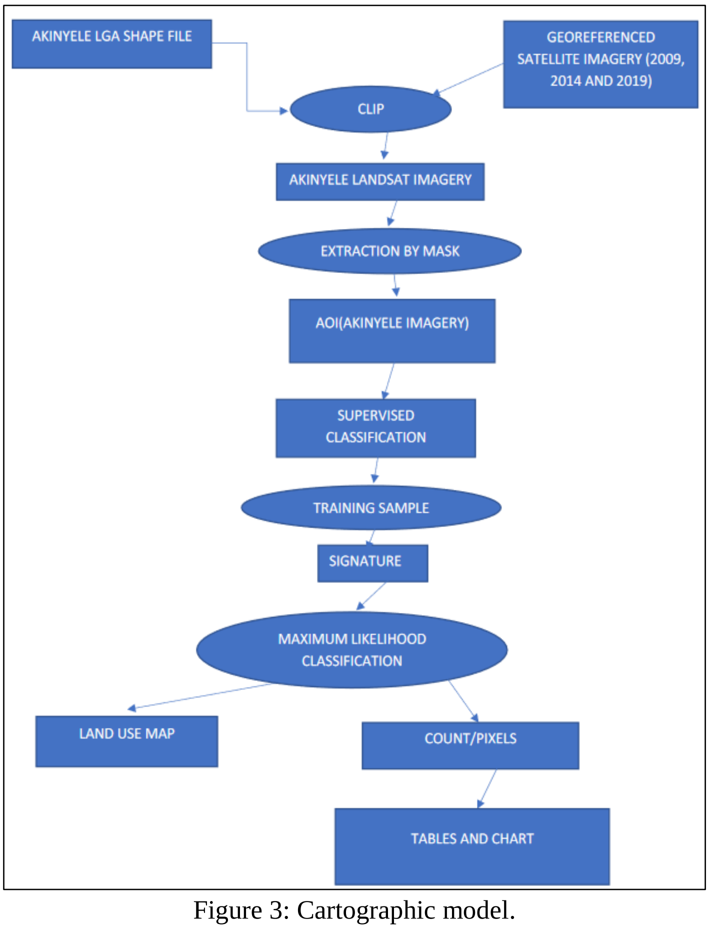

Figure 3: Cartographic model.
Source: Authors, (2023).

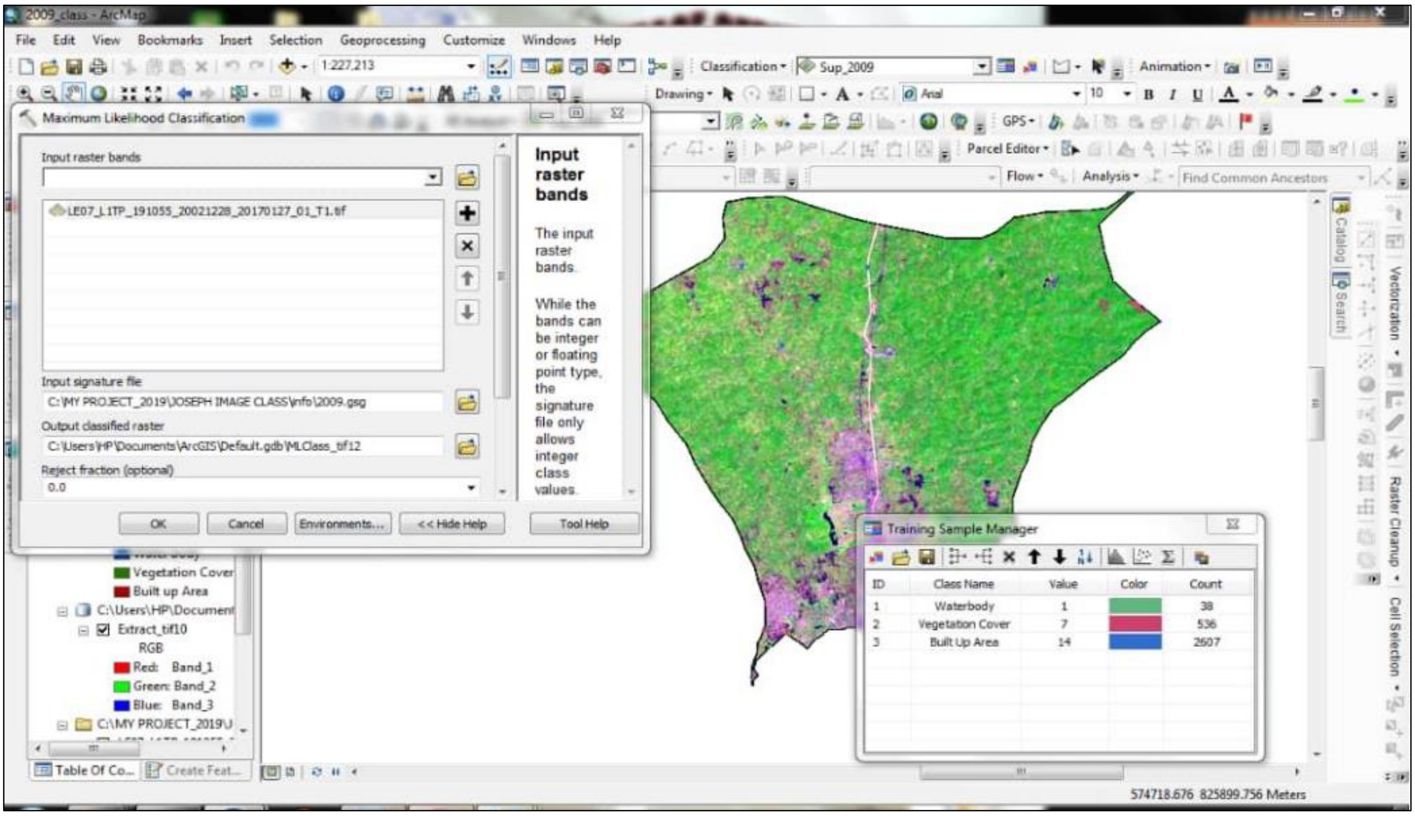

Figure 4: Landsat imagery of Akinyele LGA Before classification (2009).
Source: Authors, (2023).

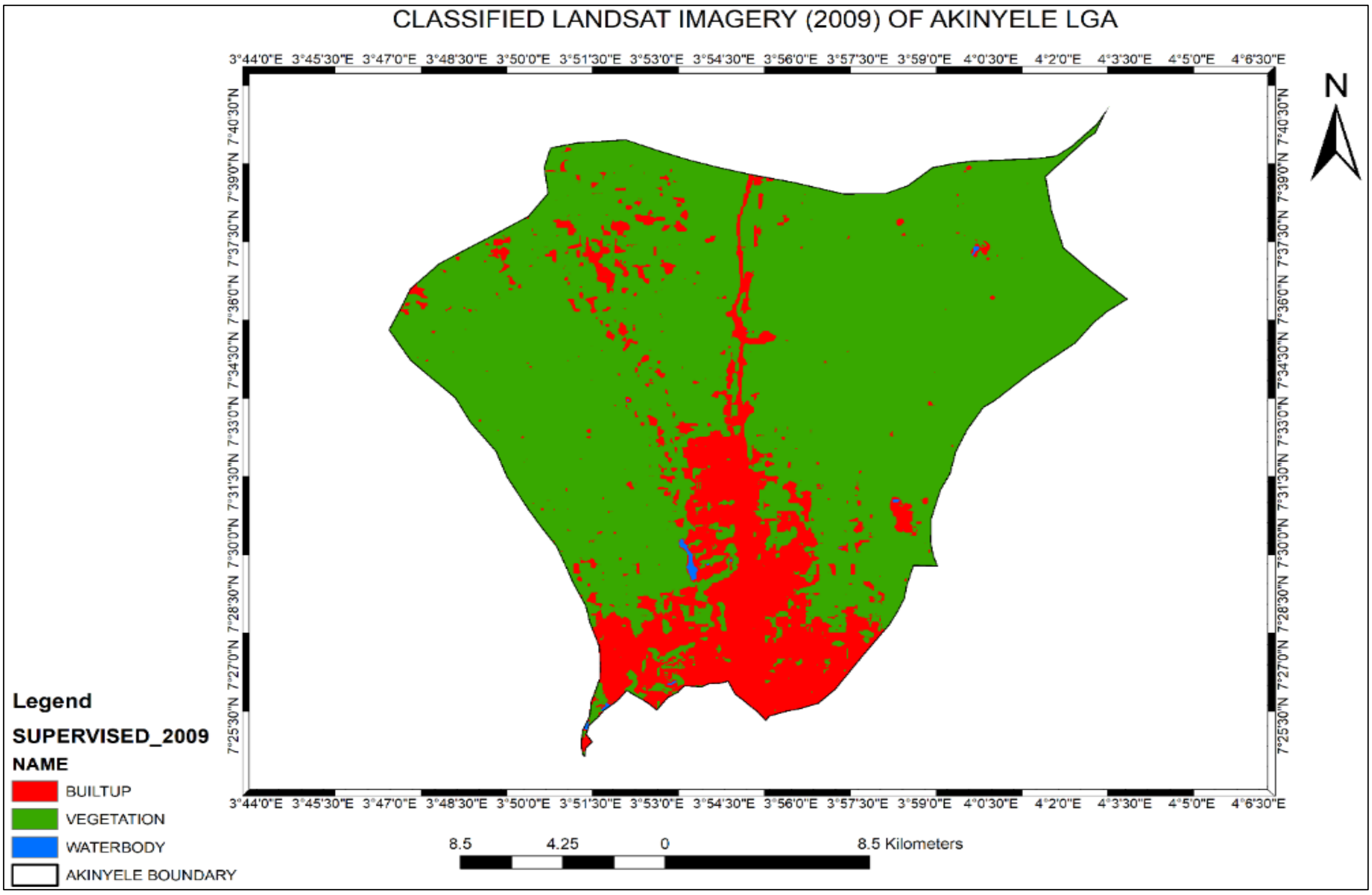

Figure 5: Supervised classification of Landsat imagery of Akinyele LGA (2009).
Source: Authors, (2023).

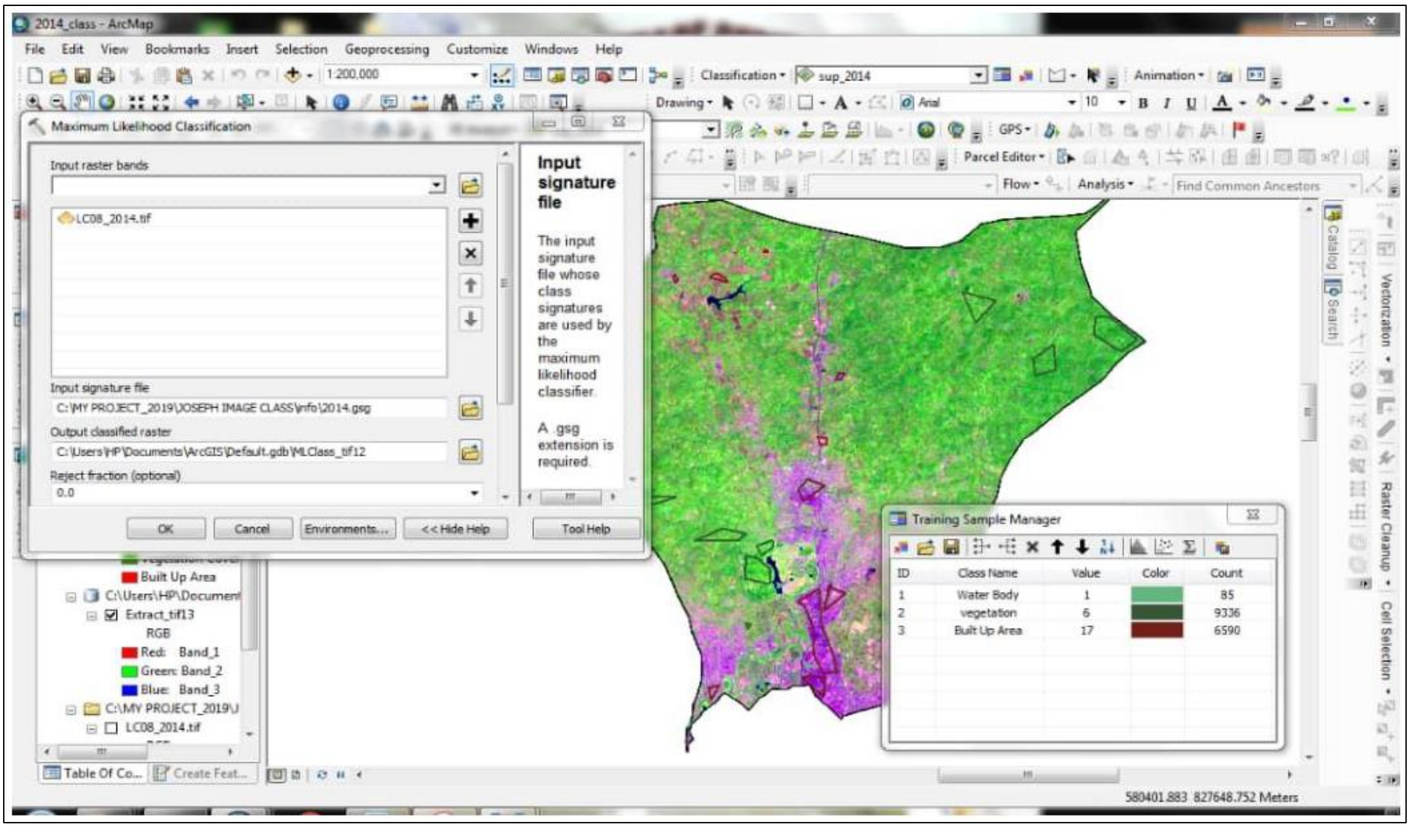

Figure 7: Landsat Imagery of Akinyele LGA Before Classification (2014).
Source: Authors, (2023).

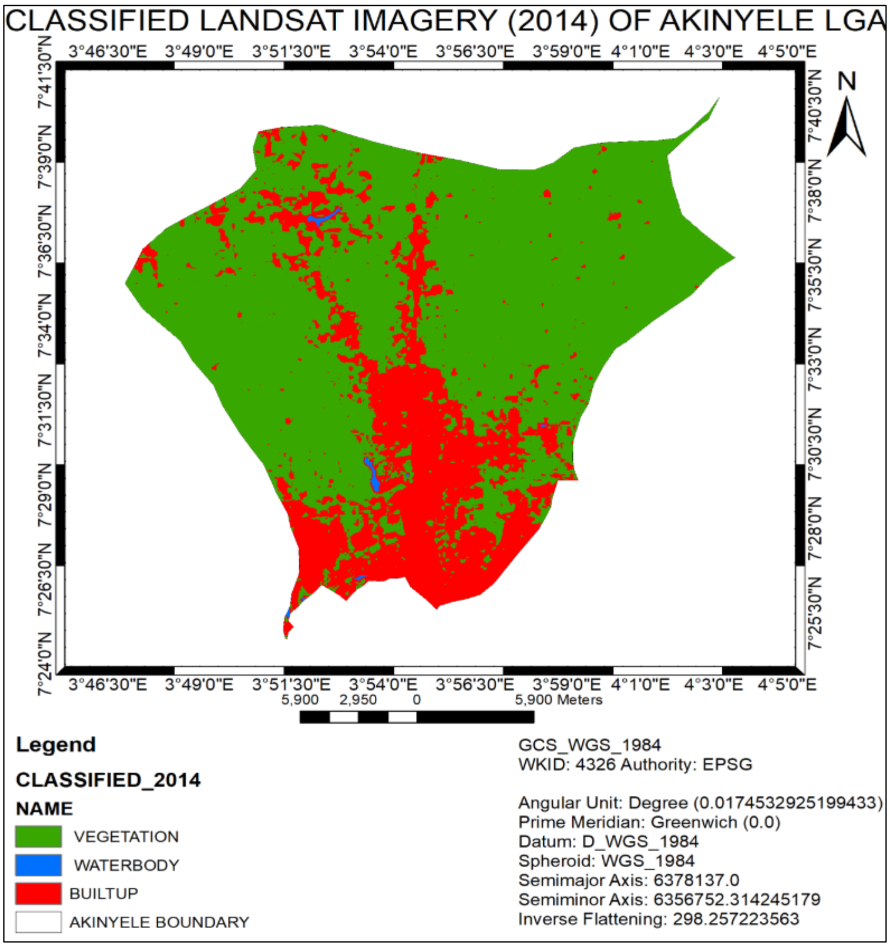

Figure 8: Supervised classification of Landsat imagery of Akinyele LGA (2014).
Source: Authors, (2023).

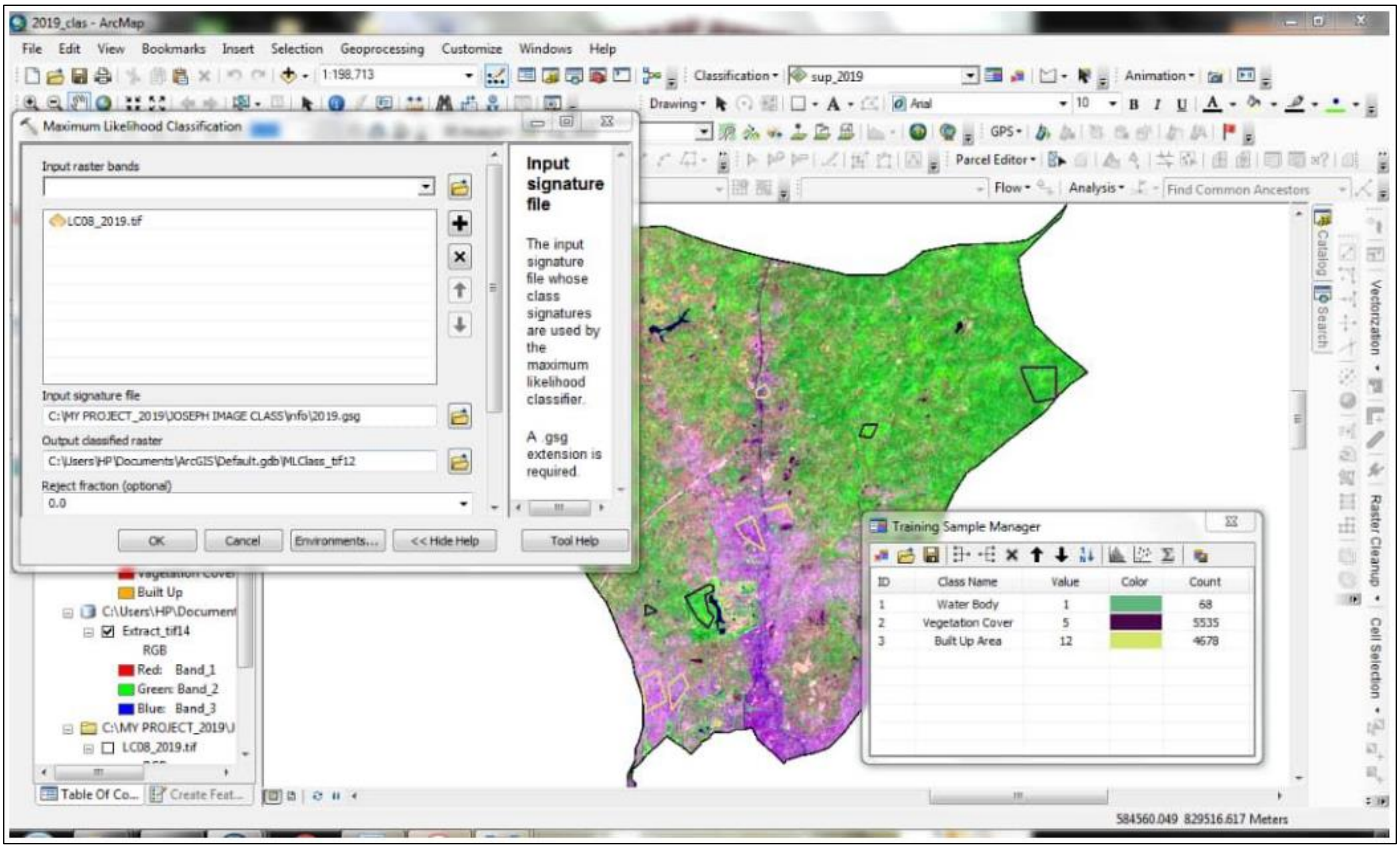

Figure 9: Landsat imagery of Akinyele LGA before classification (2019).
Source: Authors, (2023).

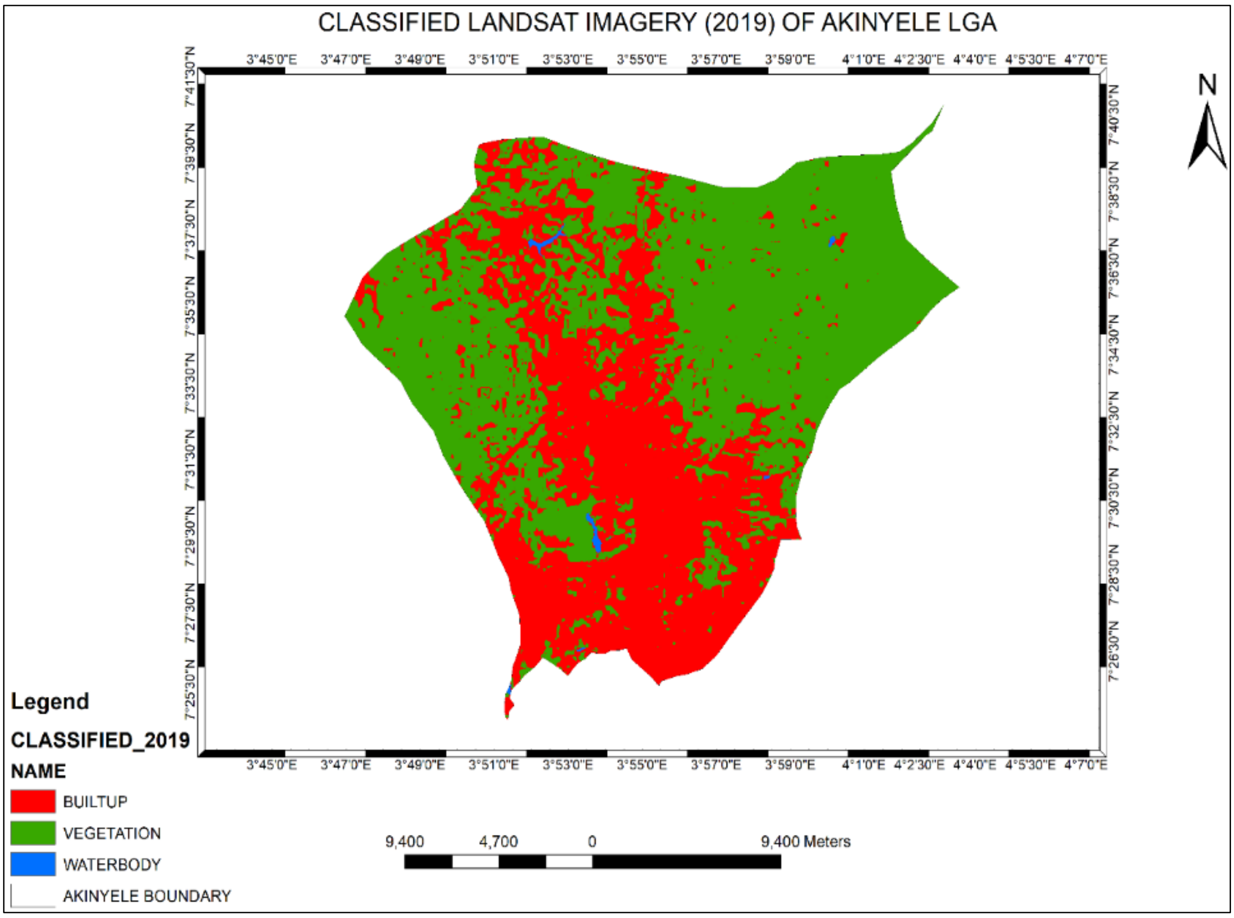

Figure 10: Supervised classification of Landsat imagery of Akinyele LGA (2019).
Source: Authors, (2023).

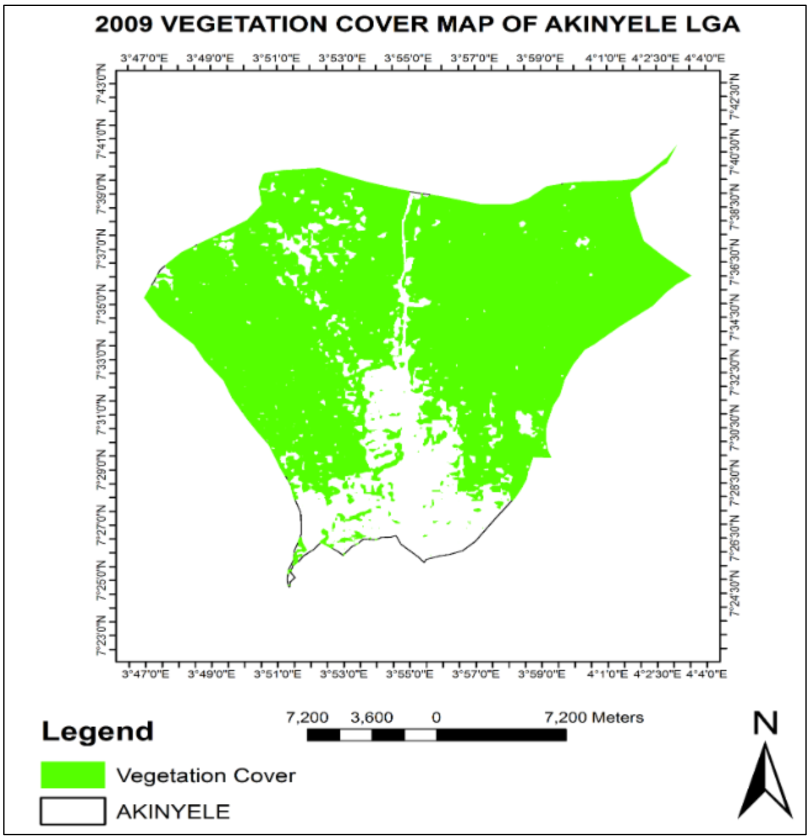

Figure 11: 2009 Vegetation Cover Map of Akinyele LGA.
Source: Authors, (2023).

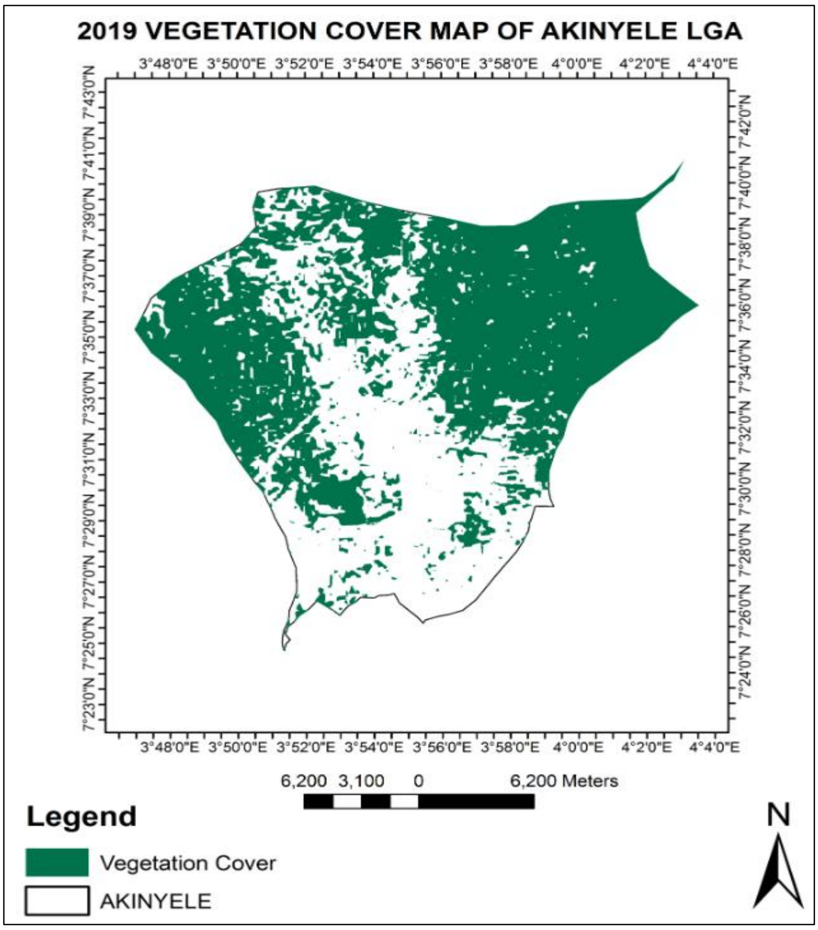

Figure 12: 2019 vegetation cover Map of Akinyele LGA.
Source: Authors, (2023).

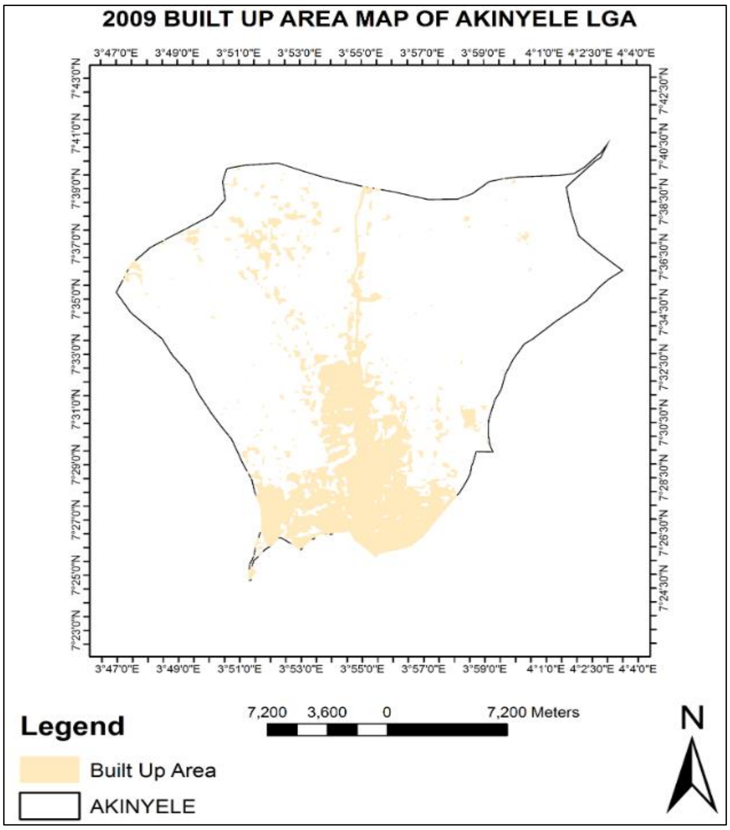

Figure 13: Map of Built Up Area of Akinyele LGA 2009.
Source: Authors, (2023).

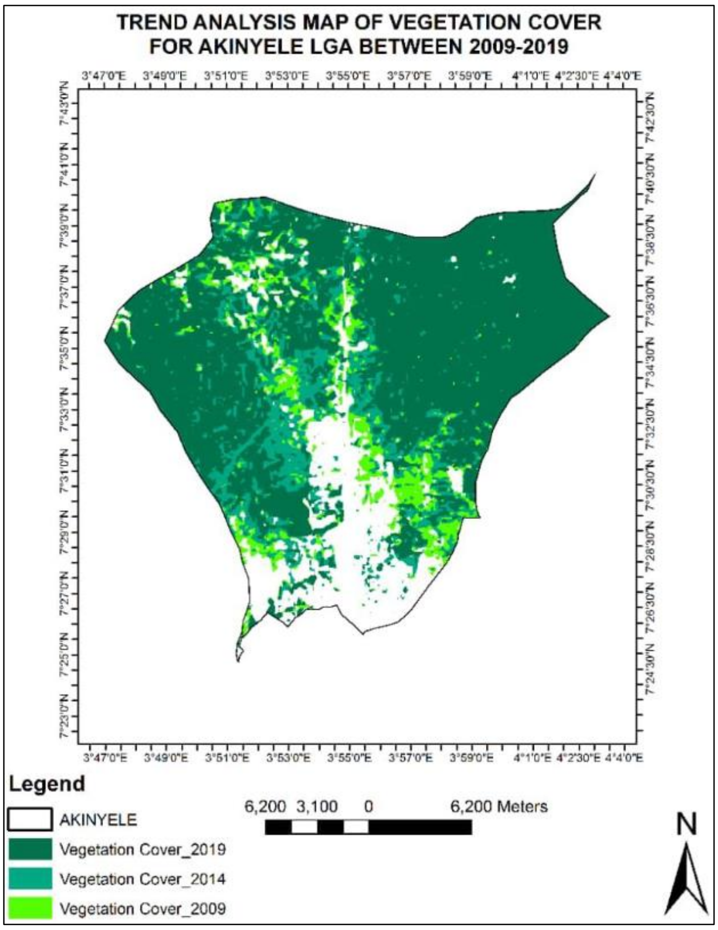

Figure 14: Map of trend of vegetation from 2009 – 2019.
Source: Authors, (2023).

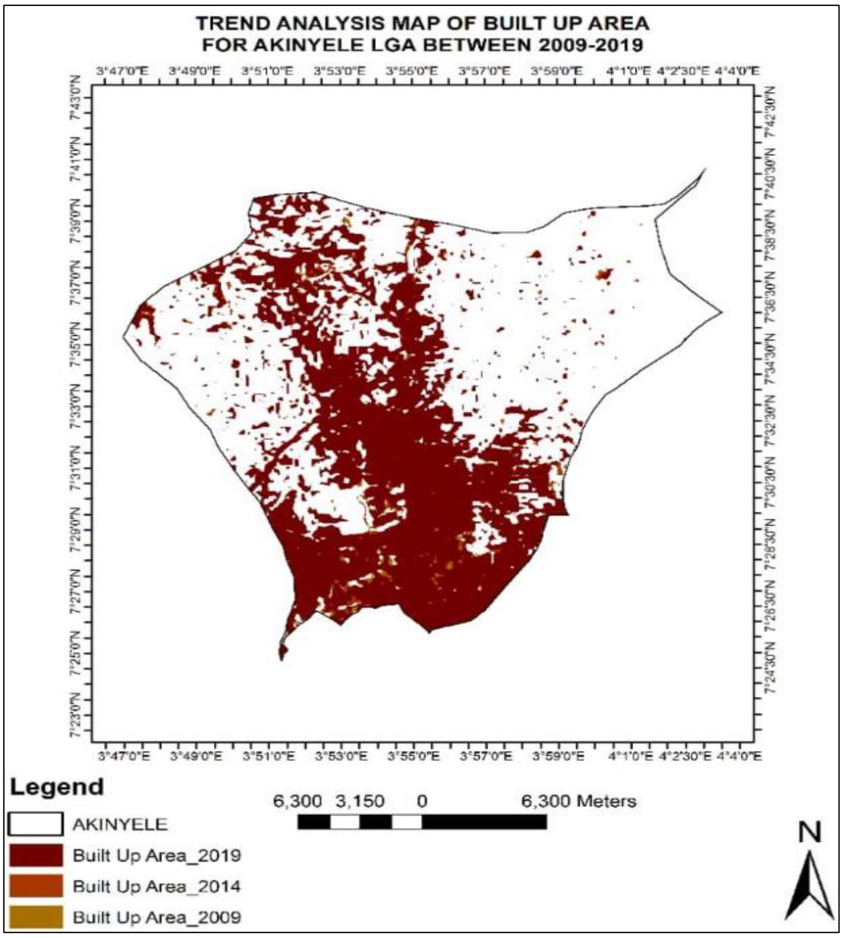

Figure 15: Map of trend of built up area from 2009 – 2019.
Source: Authors, (2023).

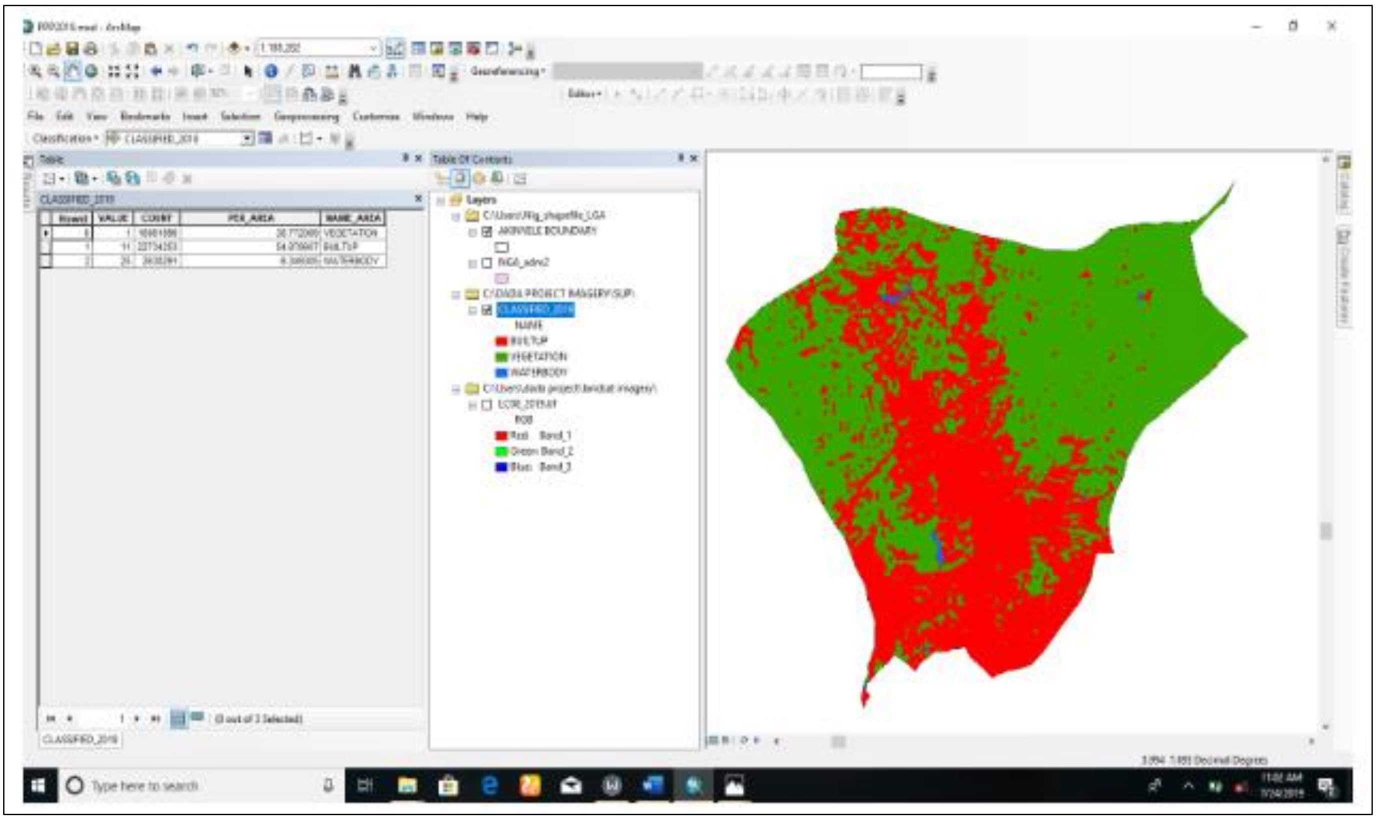

Figure16: Count of pixels on ARC GIS 10.5 (classified Landsat image of 2019).
Source: Authors, (2023).

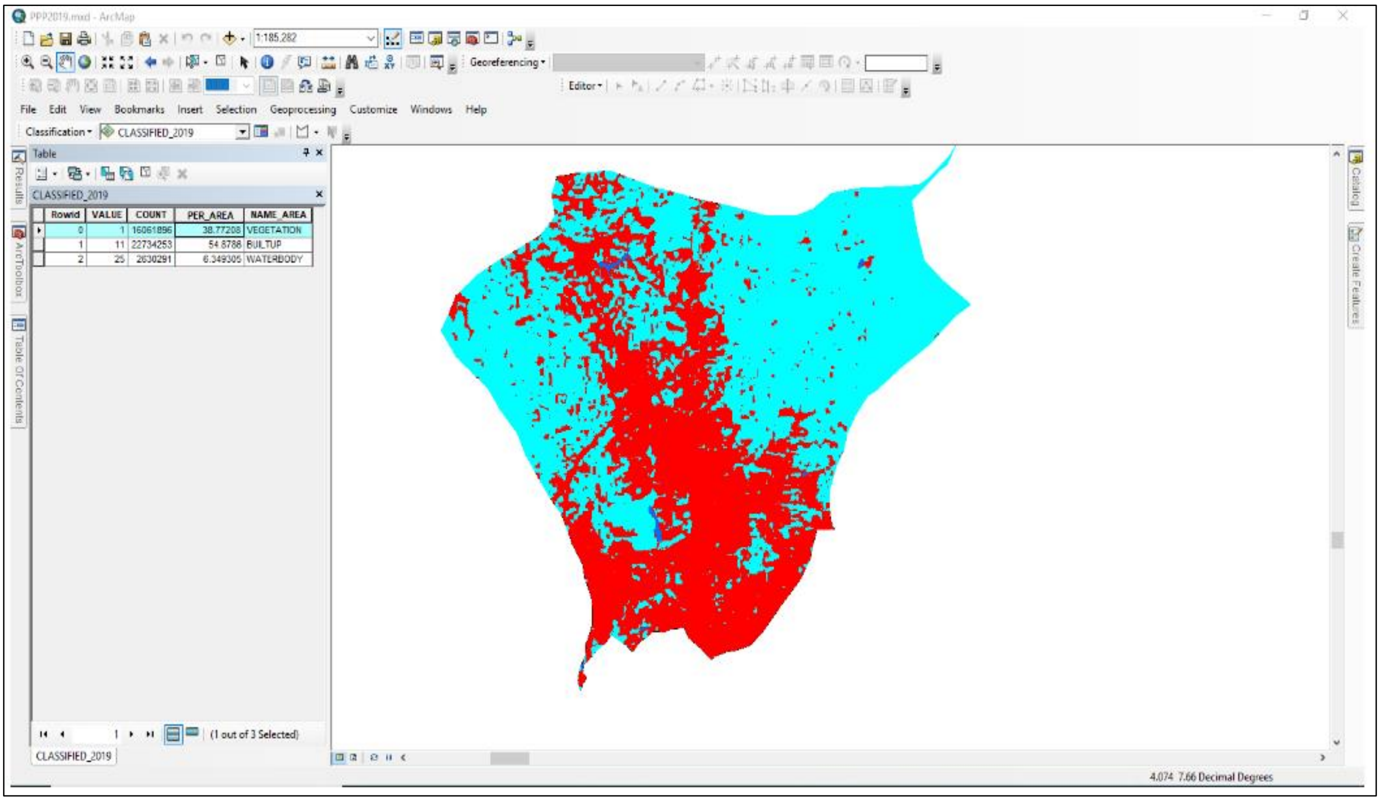

Figure 17: Query for selection of vegetation (classified image 2019).
Source: Authors, (2023).

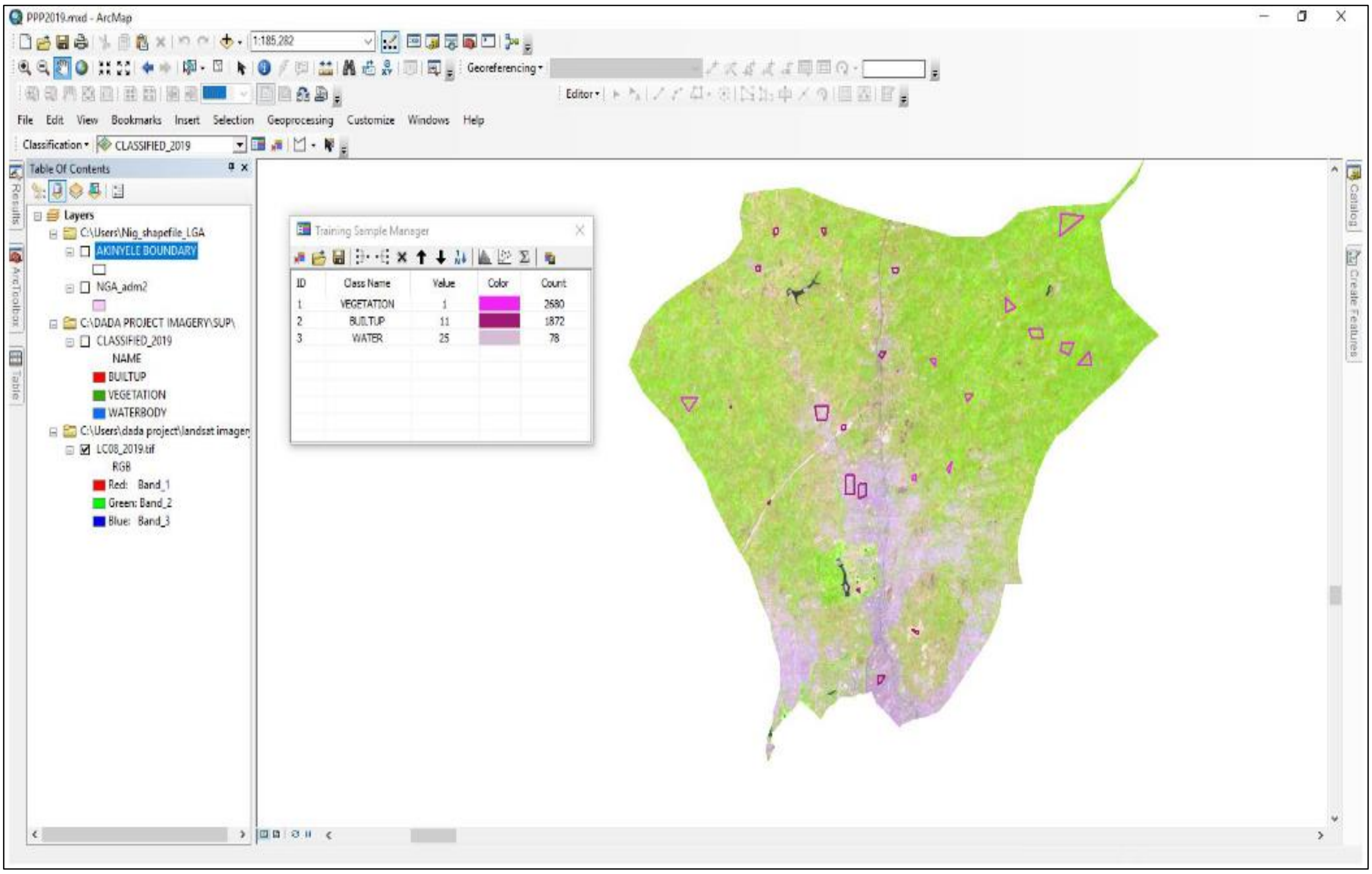

Figure 18: Training sample for 2019 Landsat imager.
Source: Authors, (2023).

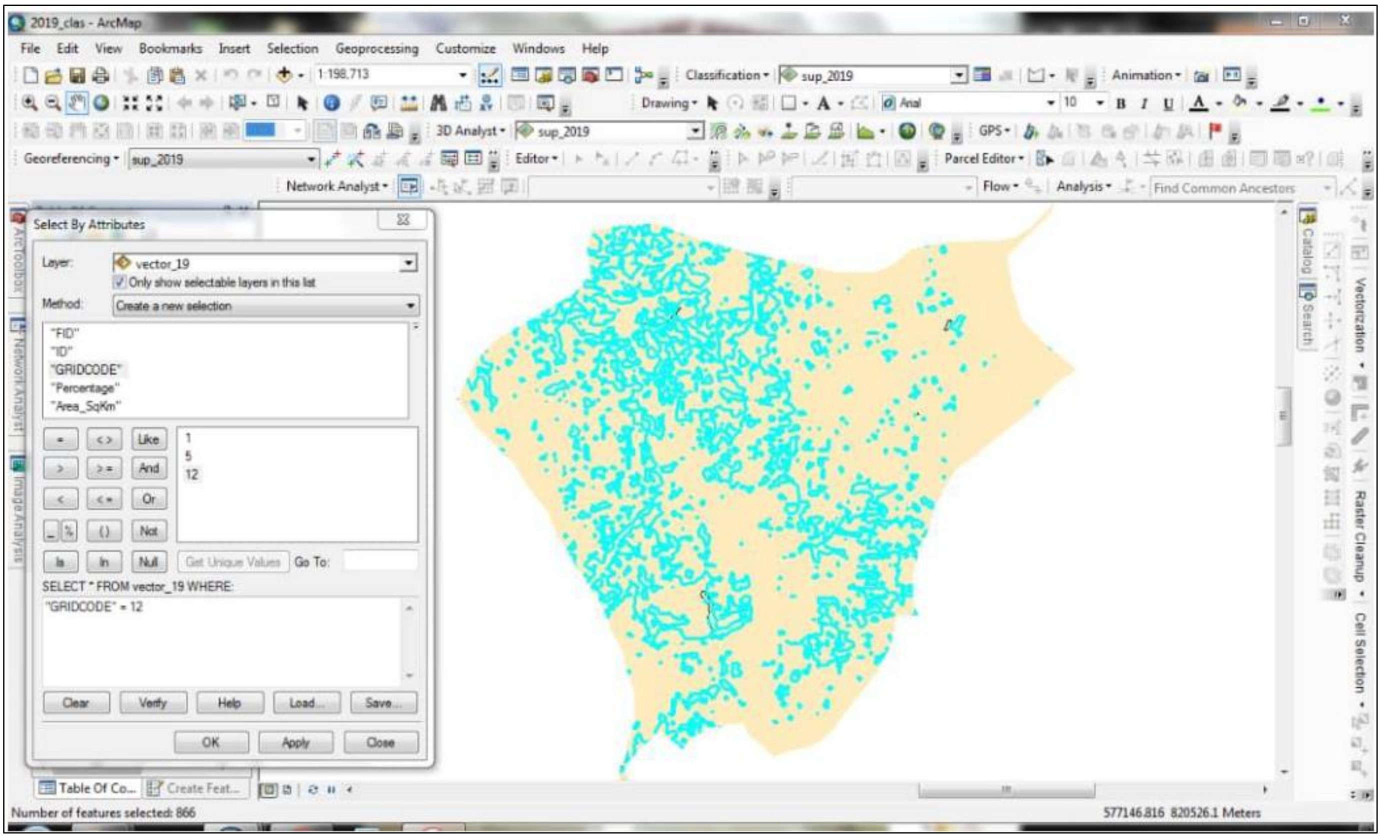

Figure 19: Query for Built up Areas 2019.
Source: Authors, (2023).

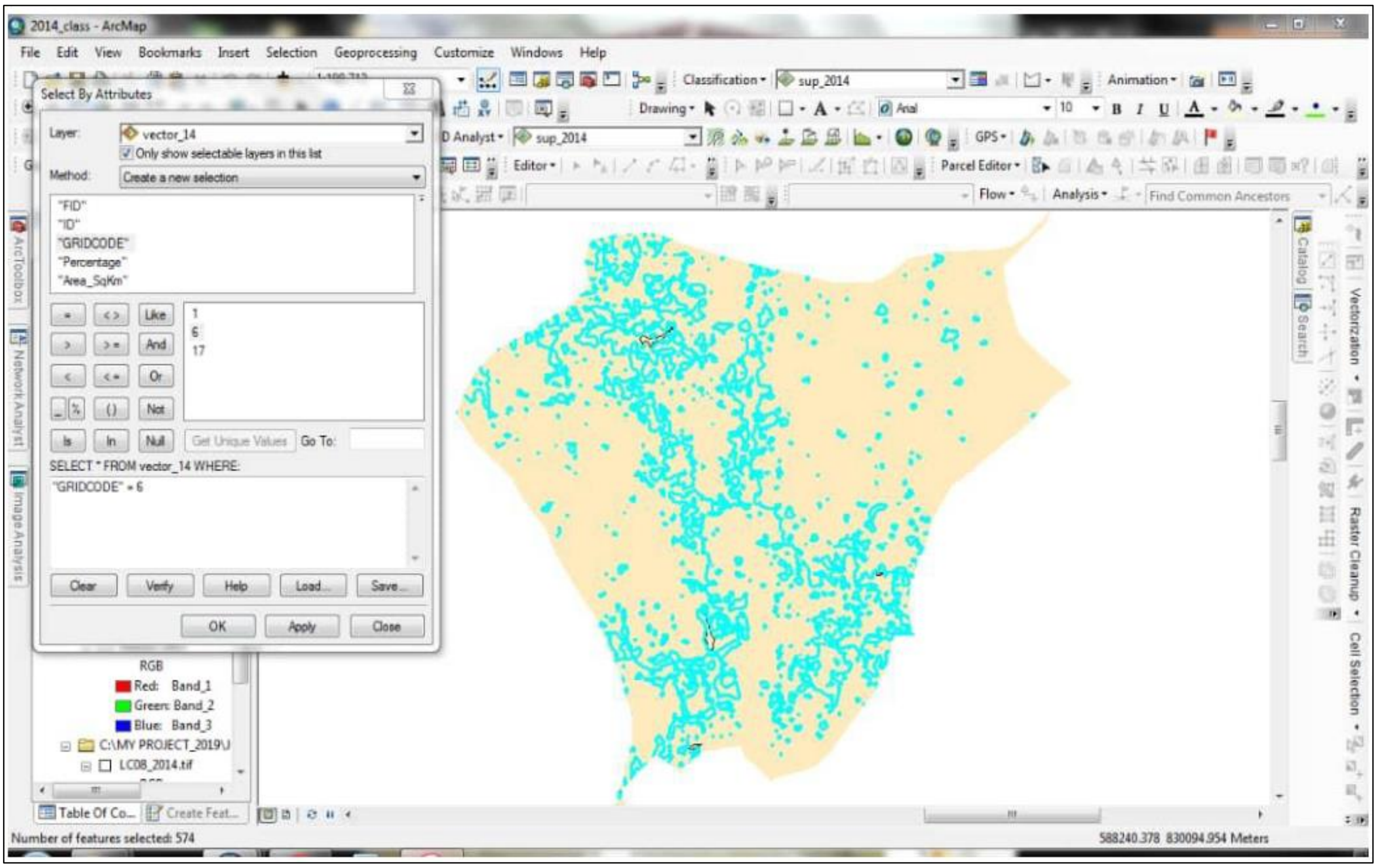

Figure 20: Query for Built up Area 2014.
Source: Authors, (2023).

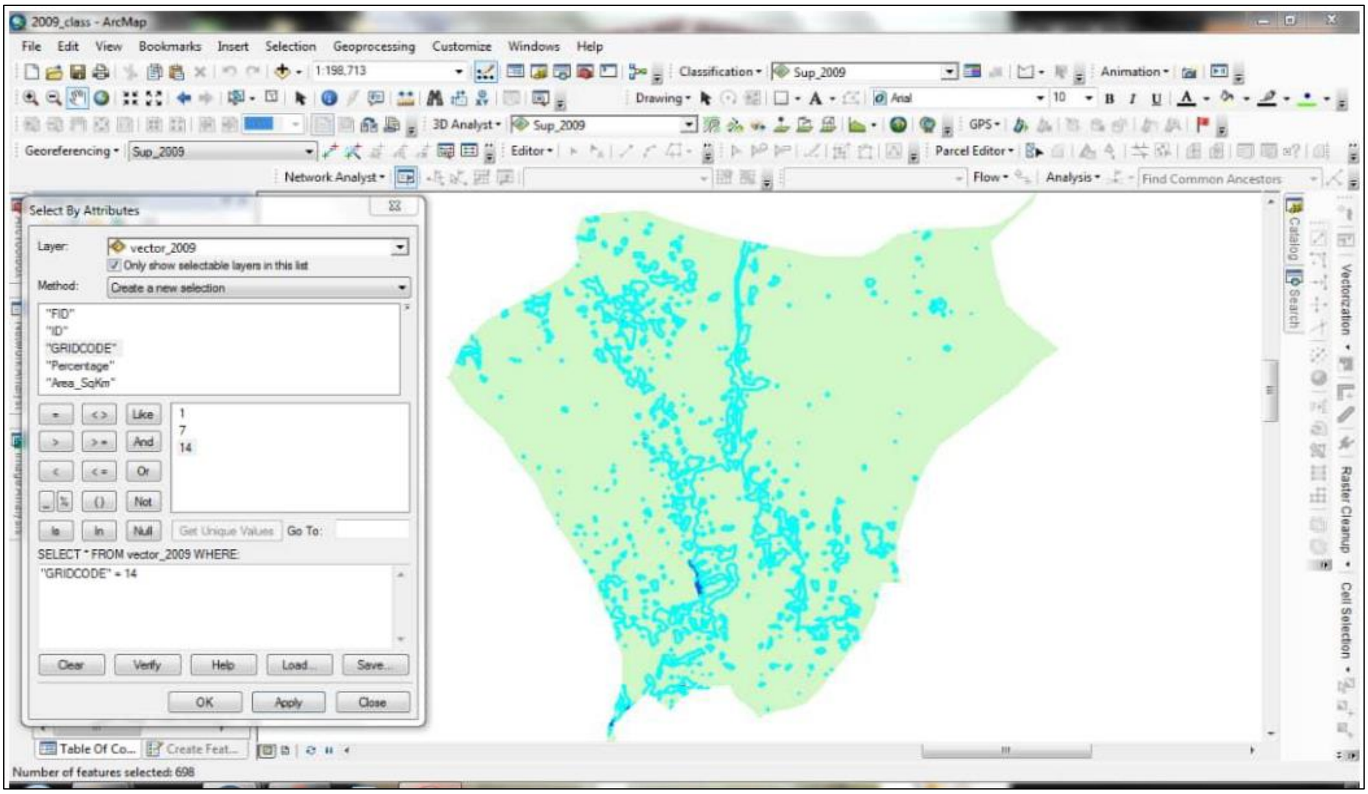

Figure 21: Query for Built Up Areas 2009.
Source: Authors, (2023).

IV.2 LAND COVER INVENTORY AND AREA CALCULATION

Below are area calculations in square kilometer and percentage of the overall land use showing the amount of change that has occur over the year.

IV.2.1 Land use for 2009

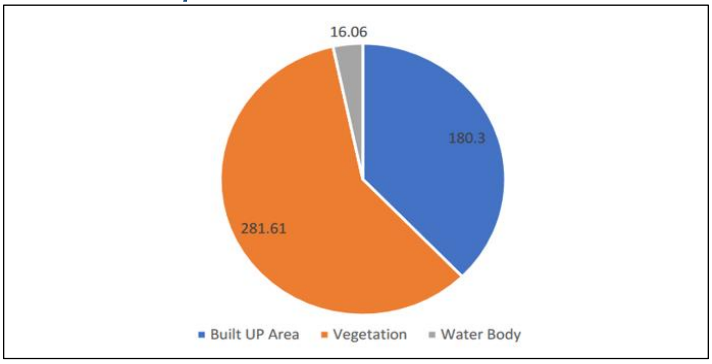

Figure 22: Pie Chart showing the area covered by different land use in 2009.
Source: Authors, (2023).

IV.2.2 Land use for 2014

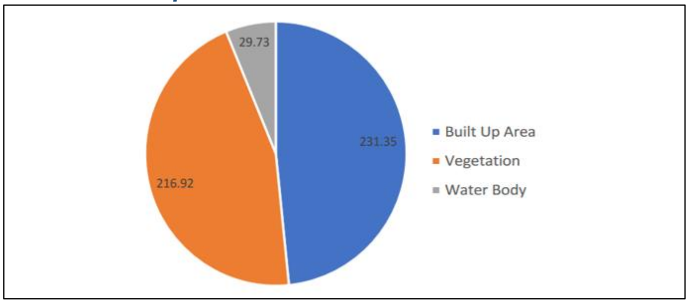

Figure 23: Pie chart of area covered by different land use in 2014.
Source: Authors, (2023).

IV.2.3 Land use for 2019

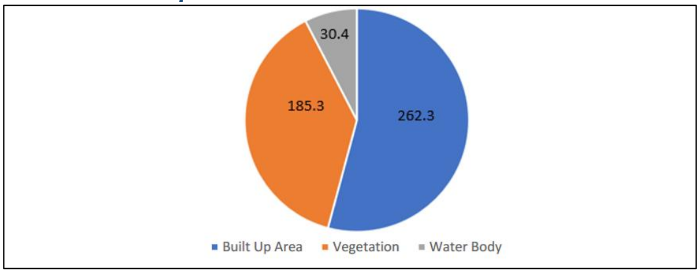

Figure 24. Pie chart of area covered by different land use in 2019.
Source: Authors, (2023).

Table 1: Summary of land cover inventory and area calculation.

Land use class	**2009**		**2014**		**2019**	
BuiltUp Area	Area (sqkm)	Area (%)	Area (sqkm)	Area (%)	Area (sqkm)	Area (%)
Vegetation	180.30	37.71655	231.35	48.396	262.28	54.87860
Water Body	281.61	58.914095	216.92	45.384	185.32	38.77208
	16.06	3.369355	29.73	6.2192	30.35	6.349305
Total	**478**	**100**	**478**	**100**	**478**	**100**

Source: Authors, (2023).

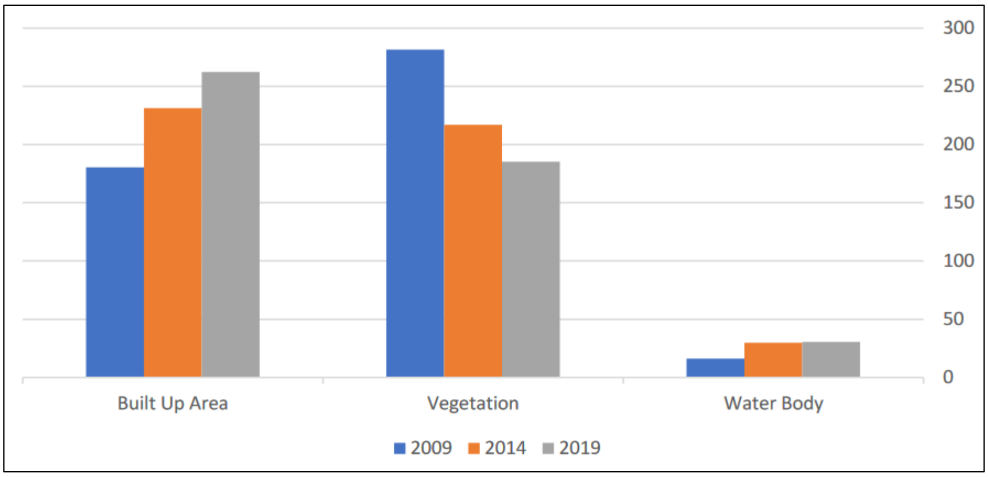

Figure 25: Multiple bar chart showing the relationship between different land use in 2009, 2014 and 2019.
Source: Authors, (2023).

V. DISCUSSION OF FINDINGS

Anthropogenic activities accounted for the nature of change in the study area which has led to rapid growth of human population and loss of indigenous agricultural land. From 2009 to 2019, built up area is increasing at an outrageous speed. By 2009, built up area accounted for about 38% of the total area, by 2014 this has increased by 10% making it a total of 48% at the end of 2014 and about 54% by January, 2019, an increase in built up area causes a causal effect in vegetation that is, an increase in the built-up area will lead to a direct decrease in the vegetation of the study area. Vegetation reduced drastically from 2009, 2014 and 2019. Vegetation reduced with a percentage of about 13% from 2009 to 2014, this is as a result of intense market activity in Akinyele market, there is also a marked decrease in vegetation from 2014 to 2019 which is about 8% decrease. The percentages of vegetation in 2009, 2014 and 2019 are 58%, 45% and 38% respectively. The creation of Oyo-Akinyele road has effect on the vegetation of the study area which resulted in linear type of settlement.

Landsat imagery of 2009, 2014 and 2019 of Akinyele LGA were analyzed in order to ascertain the changes in indigenous agricultural areas that was affected by an increase in urban areas of Ibadan city, which made people to move to Akinyele LGA. Three major classes were identified and use as the land use classes, which are: built up area, water body and vegetation.

V. CONCLUSIONS

This study checked the dynamics of vegetation change in Akinyele LGA, in a view to mapping, discovering the change rate using remote sensing and GIS techniques. This study is helpful in enhancing better decision making and policy formulation for policy makers. In the project, the landcover map for Akinyele LGA was generated using supervised classification of remote sensing operation using ARC GIS 10.5. Human activities such as urbanization plays a vital role in the vegetation modification/alteration which resulted in land cover changes as confirmed in this work.

The study shows that land cover changes significantly from 2009 to 2019, using three epoch year for analysis; 2009, 2014 and 2019. The vegetation reduced from 58% in 2009 to 38% in 2019. Built up area increased drastically from 37% in 2009 to about 55% in 2019, while water body increased from 3% in 2009 to 6% in 2014 and 2019 respectively, this is due to increase in built up area which increased run-off. The southern part of the study area shows concentrated disturbance of vegetation, which is due to sprawl move from Ibadan North LGA.

VI. AUTHOR'S CONTRIBUTION

Conceptualization: Joseph Olajuwon Dada, Ayodeji Olatunbosun Ajani, Adedayo Olujobi Alagbe and Oluwatosin Ibukunoluwa Ilesanmi.
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Investigation: Joseph Olajuwon Dada, Ayodeji Olatunbosun Ajani, Adedayo Olujobi Alagbe and Oluwatosin Ibukunoluwa Ilesanmi.
Discussion of results: Joseph Olajuwon Dada, Ayodeji Olatunbosun Ajani and Adedayo Olujobi Alagbe.
Writing – Original Draft: Joseph Olajuwon Dada.
Writing – Review and Editing: Joseph Olajuwon Dada and Ibrahim Ademola Fetuga.
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Approval of the final text: Ayodeji Olatunbosun Ajani, Adedayo Olujobi Alagbe and Oluwatosin Ibukunoluwa Ilesanmi.

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