# Site Selection of Electoral Polling Unit Using Geospatial Technology for Zaria, Kaduna State Nigeria

Kaka Zenabu ATTA, Taiye O. ADEWUYI, Ahmed A. MUSA, Olalekan A. ISIOYE, Ebenezer A. AKOMOLAFE, Abdulazeez ONUTO, Lukman Olawunmi GIWA.

## ABSTRACT

This study gives an insight to the site selection of electoral polling unit using geospatial technology for Zaria, Kaduna State Nigeria and aimed at creating an appropriate model for citing polling units for other locations in the country. For the purpose of this work, a base map, SRTM data population data and Landsat 8 satellite imagery were used to generate the land-use map of Zaria and to as well show the nature of the topography of the study area using ArcGIS 10.1, and IDRISI software. A seven parameters criterion was extracted from INEC objectives and summarized as follows: proximity to voters, accessibility, land use (public buildings, and open spaces), Clinic proximity, slope and elevation, GMS masts and water bodies. The generated thematic maps of these criteria were standardized using fuzzy logic approach. A weight for each criterion was generated by comparing them with each other according to their importance. The weights and criteria was used to prepare the final site suitability map which was analysed for relative suitability and finally reclassified into three categories of high, medium and low suitability. Comparison of existing and proposed polling units' area was made with the aim of determining areas of similarity and areas of disparity. A final suitability map was created for locations of proposed polling units. The result obtained from the map and after validation shows that the suitability map of Zaria produced has 0.09 consistency ratio and average of 36% of area not suitable, 56% of area fairly suitable and 8% suitable. Thus, polling units that fell within the not suitable region can be redistributed or removed from the lists, also electoral polling units should not be cited in area that fall within not suitable area/constraints (rock/highland and water), while areas with high suitability are expected to have more polling units.

**Keywords:** Electoral polling units, Fuzzy logic, Geospatial technology, GIS and AHP, and Suitability Mapping.

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## 1.0 INTRODUCTION

Over the years, the perceived increased level of corruption in Nigeria has procured enormous complaints and agitation for a better government and thus a general demand for credible elections in the country. The Independent National Electoral Commission (INEC), an independent body charged with the responsibility of conducting and supervising elections in Nigeria has over the years modernized its information technology infrastructure from the outdated voting system of inaccurate paper records, and polling cards to the newer electronic/digital system. (African Report, 2007).

The Independent National Electoral Commission also, before the 2015 general elections in Nigeria saw the necessity to reconfigure the structure of polling units in the country as well as create additional ones in other to improve upon the electoral process for free, fair, peaceful and credible elections in 2015 and beyond.

Polling units (PUs) is a place where a citizen can either register to vote or to vote. The essence of suitable polling units in an electoral process cannot be over emphasized so much that INEC has to create additional 30000 polling units before the 2015 elections and still planning more before the 2023 elections. This decision of increasing the polling units faced a lot of criticism from certain interest before and after the election. The criticism was centred largely on an alleged conspiracy theory, that the Commission has done a disproportional distribution of the polling units across Nigeria under the new arrangement, which is aimed at foisting the dominance of one section of the country over the others for political advantage The Independent National Electoral Commission in its defence claims the decision was an exercise undertaken to ease the access of voters to their ballot boxes by: Decongesting overcrowded polling units and dispersing voters as evenly as possible among all the Polling Units (PUs), locating PUs more effectively within commuting distances of voters, given that movement is usually restricted on election day, relocating the PUs from “the-front of” private houses, and such other unsuitable places, to public buildings or where this is not possible, to public open spaces where tents can be provided; Locating the PUs inside classrooms or such other suitable enclosures, in line with International best practices; Splitting large PUs such that they have an average of 500 registered voters; and creating additional PUs to cater for the splitting of large polling units as well as new settlements not serviced by any existing PU (INEC, 2015).

Consequently, this study focuses on the suitability analyses of polling units in Nigeria as it meets with the above mentioned objectives in other to achieve free, fair, peaceful and credible elections using Zaria, Kaduna State as case study. It involves using Geographic Information System (GIS) for analyses by integrating the map of Zaria, its land use map, ~~its~~ slope map, existing location of polling units to derive the Independent National Electoral Commission suitability criterion for appropriate analyses.

## 2.0 METHODS

### 2.1 Description of Study Area

The study area considered in this research is Zaria metropolis which lies within geographical coordinates of longitudes 7°36'0" E to 7°46'0" E and latitude 11°2'0" N to 11°12'0" N. It comprises two local government areas namely: Zaria and Sabon- gari LGA. Zaria has an average of 894,600 square meters (894.600km$^2$) in area and majority of the area at present been used as farmland. The population of registered voters is about 415432 with Sabon Gari LGA having 242276 and Zaria LGA having 173156.

Zaria is a very large heterogeneous city whose approximate 1.1 million populations (2006 Census) comes from different parts of the world. It is second in size only to the State capital Kaduna. Zaria is easily accessible from different parts of the country by air via Kaduna, Kano, and Abuja by rail and road via Kaduna, Jos, Kano and Sokoto. It is located on the high plains of Northern Nigeria; 652.6 meters above the sea level and some 950 km away from the coast. The Zaria region is characterized by gently rolling plains dotted with groups of rocky residual hills developed on granite bedrock. The land uses include agricultural, commercial, residential, institutional and open spaces. Zaria is also known for its educational growth. It is home to many federal and state institutions.

Generally, agricultural activities form the mainstay of the people's economy in the study area and this engages directly or indirectly more than 70 percent of the population. The climate, rich annual rainfall and availability of wide variety of mineral and agricultural resources all attest to the economic potential of the study area. The area is a major region of animal husbandry. Major food and cash crops produced includes, cotton, groundnut, guinea corn, millet, beans, rice, sugar cane and maize.

Zaria consists of an existing 24 voters Registration Areas (RA) and 601 Polling Units (PUs) recognized by INEC as at the 2015 general elections. Below is a graphical representation of its location with respect to the map of Kaduna State.

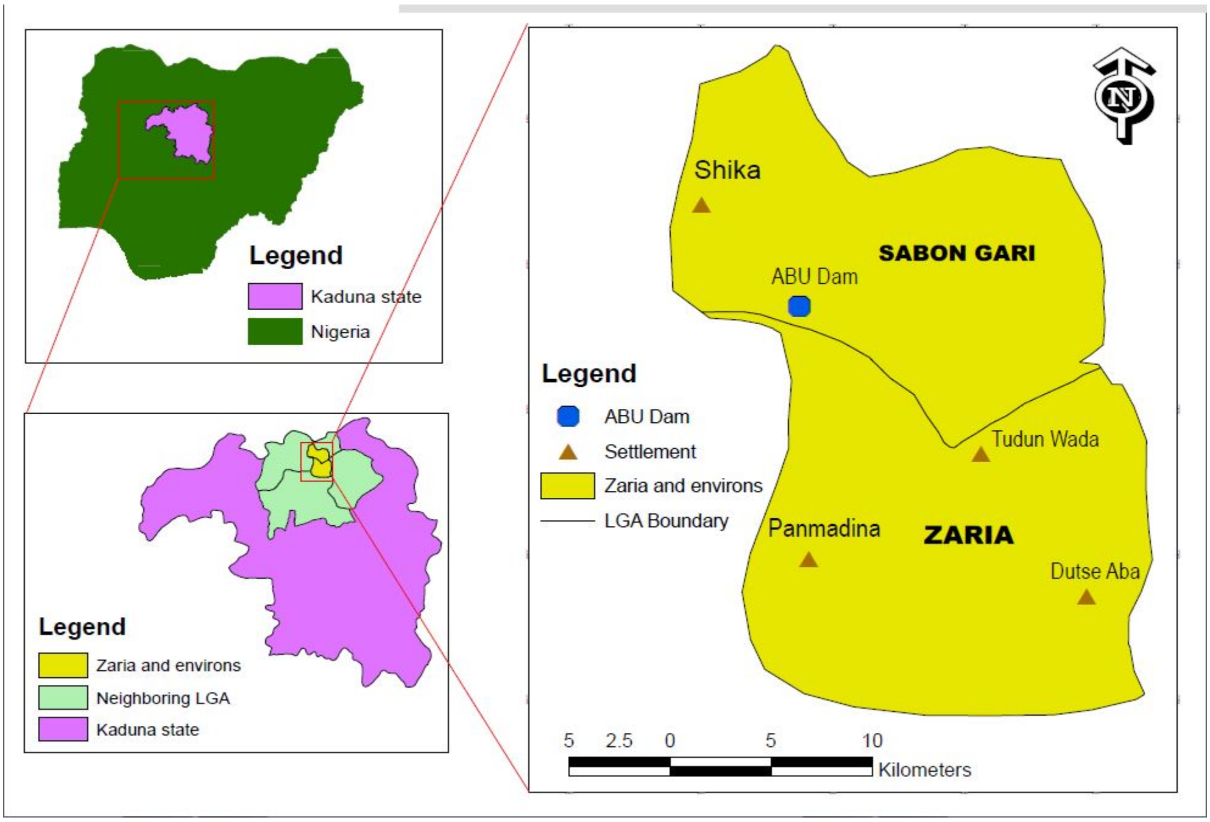
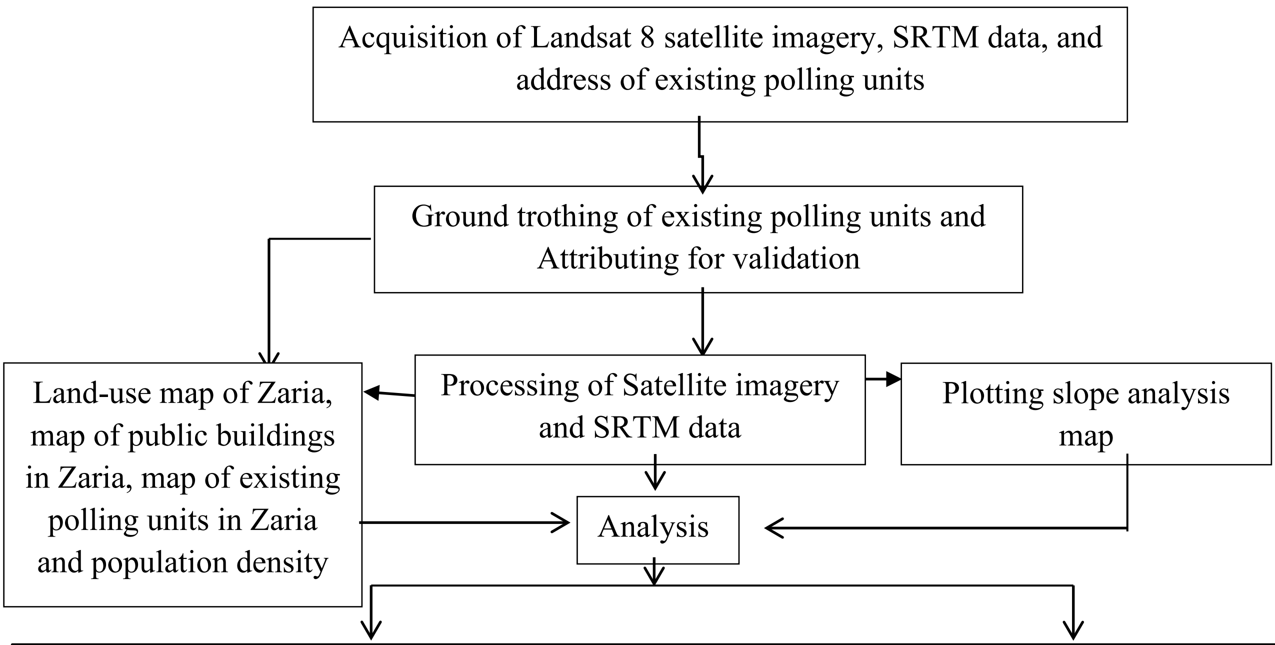



Figure 1: Map of the area of study.

Source: (Modified after http://www.gadm.org) (2013).

The techniques used in the study are encapsulated in the flowchart diagram in Figure 2.



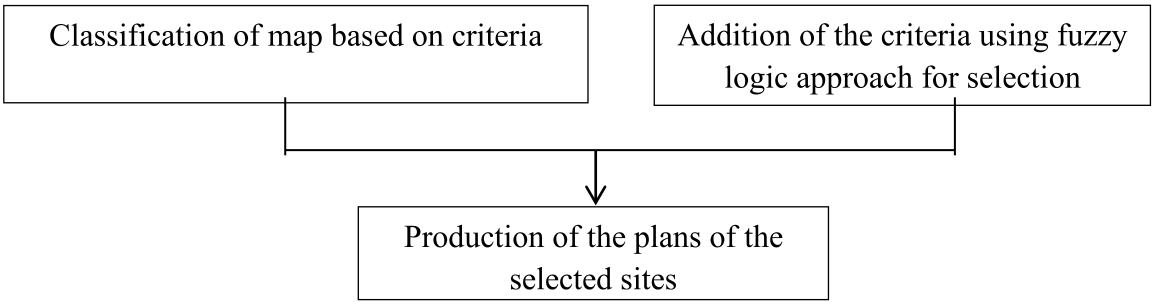


**Figure 2:** A flow chart of the methodology employed in this study.

### 2.2 Datasets and Sources

The dataset are both the primary and secondary data which are tabulated below. The primary dataset are required to provide detailed information to be used, the description of such information is shown in the Table 2.1 while the secondary data set would aid in the reviewing past jobs, knowing the limitations, recommendations and how to improve on such in carrying out the research.

Table 1: Description of datasets used in this study

| S/N | Data Type | Date | Resolution/Scale | Source |
|---|---|---|---|---|
| **1** | Interview | May 2015 | Not applicable | INEC office Abuja |
| **2** | GPS coordinates | 2015 | | Field work |
| **3** | Imagery of Zaria (LANDSAT 8) | 2015 | 30m | USGS website |
| **4** | SRTM | 2015 | 90m | USGS website |

The data used in this study as tabulated above is obtained from two basic sources:

2.2.1 Primary Data Source:

a) The interview was conducted by having discussion with INEC official at their Abuja Office and also asking of the location of the address of the existing polling unit from the people staying at each ward.
b) A handheld GPS (Garmin eTrex 10) was used in picking of the Coordinates of the address of the existing polling unit for validation test. And the Imagery for processing and derivation of land use while the SRTM data for the plotting of the Topography.

### 2.3 Data Processing and Analysis

Using IDRISI selva, data from ArcMap 10.1 was imported by creating a new project on the idrisi explorer menu bar. Then using the file menu, importing of vector and raster can be converted to .vct and .rst respectively.

The maps are then displayed using the display menu tool. The maps imported as vectors include; built up area, industrial area, institutional area, highway, major road, other road, railway, track, hospital, masts, and schools while the maps imported as rasters include classified map, and slope (degree) map. The vectors were then rasterized by using the RASTERVECTOR command in IDRISI selva. During the rasterization, an initialization process was carried out for the entire vectors.

The copy spatial parameter from other image is selected and the classified image parameter is used so as to ensure the same cell numbers for each row and column for all the images (780 X 1147) during image addition and multiplications. The distance map for each rasterized vector is created using the keyword DISTANCE and the resultant map for each factor was created.

The BREAKOUT function was used to separate all the six (6) classes in the classification map. Each class became criteria, and the factors (Open space, farmland, settlements, and wetlands) and constraints (water and rock). For the purpose of this work the farmland which covers majority of the area was discarded to avoid depicting the whole area as unsuitable.

#### 2.3.1 Standardization

Using the key word FUZZY in IDRISI selva, a dialogue box arrear where by each rasterized vector is selected and given a user-defined value ranging from a-d and having a data output format in byte (0-255).

The Table 3 below gives the value of each factor in meters that was assigned for this project. The fuzzy logic map generated for each factor is shown in Figure 3 below using other road as an instance.

Table 3: Fuzzy membership value in meter assign for each factor

| **Factors** | **A** | **B** | **C** | **D** |
|---|---|---|---|---|
| Hospital | 100 | 600 | 800 | >1000 |
| Mast | 100 | 500 | 1000 | >1500 |
| School | 50 | 400 | 700 | >1000 |
| Built-up | 100 | 500 | 700 | >1000 |
| Settlements | 100 | 500 | 700 | >1000 |
| Industrial area | 300 | 700 | 800 | >1500 |
| Institutional area | 100 | 400 | 1000 | >1500 |
| Highway | 200 | 500 | 700 | >1000 |
| Major road | 100 | 400 | 800 | >1000 |
| Other road | 100 | 400 | 700 | >1000 |
| Population | 100 | 400 | 800 | >1000 |
| Railway | 100 | 400 | 800 | >1200 |
| Tracks | 100 | 600 | 800 | >1000 |

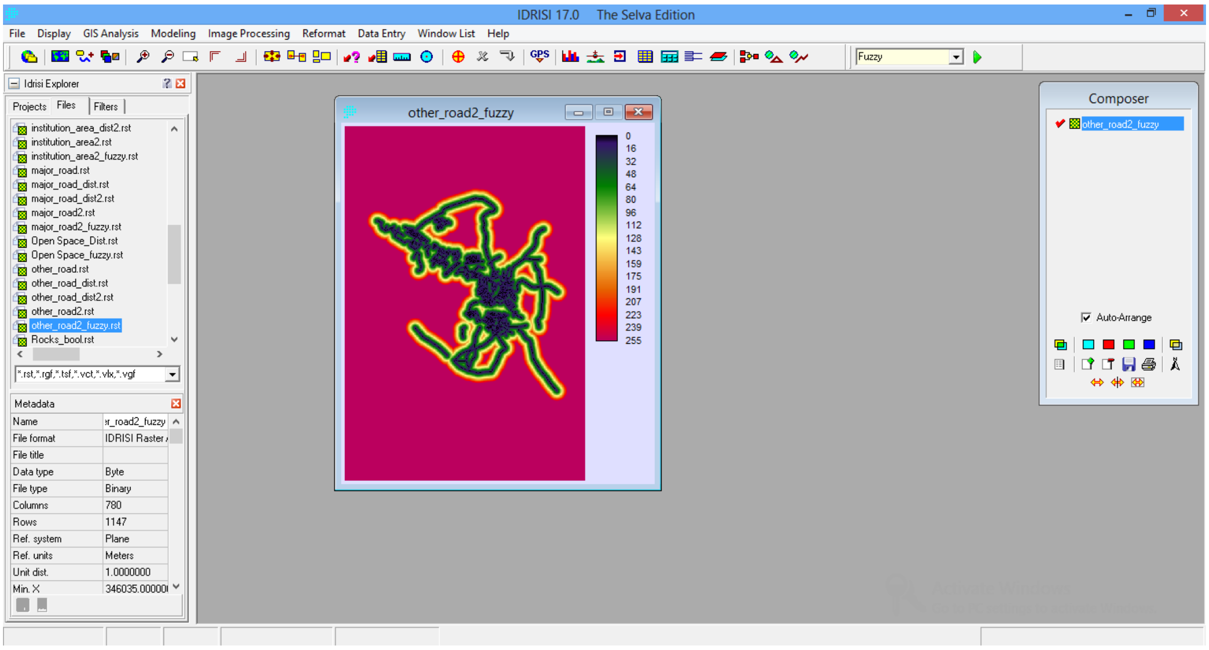



Figure 3: Print screen of the fuzzy logic of other road

## 2.4 Analytic Hierarchy Process (AHP)

The word Weight was used to generate the eigenvector of weight of each factor tabulated above. The lower triangular matrix was filled based on the consistency ratio of factor compared to the others. Below is showing the relationship between the factors ranging from extremely less important (1/9) to extremely more important (9).

Table 4: Weight matrix showing comparism of each factor against one another

| Factors | BtU | Hwy | Ind | Ist | Mrd | OpS | Otr | Sch | Stm | Trk | Hsp | Mst | Rly |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Built-up (BtU) | 1 | | | | | | | | | | | | |
| Highway (Hwy) | 1/3 | 1 | | | | | | | | | | | |
| Industrial (Ind) | 1/3 | 1/3 | 1 | | | | | | | | | | |
| Institutional (Ist) | 9 | 7 | 8 | 1 | | | | | | | | | |
| Major road (Mrd) | ½ | 3 | 3 | 1/5 | 1 | | | | | | | | |
| Open space (OpS) | 7 | 8 | 8 | 3 | 8 | 1 | | | | | | | |
| Other road | 3 | 3 | 3 | 1/3 | 3 | 1/5 | 1 | | | | | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Otr) | | | | | | | | | | | | | |
| School (Sch) | 7 | 7 | 8 | 7 | 7 | ½ | 4 | 1 | | | | | |
| Settlement (Stm) | ½ | 3 | 7 | 1/3 | 3 | 1/3 | 3 | 1/3 | 1 | | | | |
| Track (Trk) | 3 | 3 | 5 | 1/3 | 3 | 1/5 | 2 | 1/3 | ½ | 1 | | | |
| Hospital (Hsp) | 3 | 5 | 5 | 1/3 | 3 | 1/5 | 3 | 1/3 | ½ | 3 | 1 | | |
| Mast (Mst) | ½ | ½ | 2 | 1/5 | 1/3 | 1/9 | 1/5 | 1/3 | 1/3 | 1/3 | ½ | 1 | |
| Railway (Rly) | 1/3 | 1/3 | 3 | 1/3 | 3 | 1/9 | 1/3 | 1/5 | 1/3 | 1/3 | 1/3 | 3 | 1 |

The eigenvector of weight derived from the above matrix consistency is given below;
For builtup_area2_fuzzy.rst : 0.0353, highway2_fuzzy.rst : 0.0255, industrial_area2_fuzzy.rst : 0.0127, institution_area2_fuzzy.rst : 0.1345, major_road2_fuzzy.rst : 0.0279, Open Space_fuzzy.rst : 0.2358, other_road2_fuzzy.rst : 0.0530, sch2_fuzzy.rst : 0.2075, Settlement_fuzzy.rst : 0.0798, track2_fuzzy.rst : 0.0594, hosp_2_dist_fuzzy.rst : 0.0765, mast2_fuzzy.rst : 0.0222, and railway_2fuzzy.rst : 0.0298. This resulted to a Consistency ratio of 0.09, which is acceptable.

From the result, it is clear that open space is most important followed by schools, institutional areas, settlements, hospital, track, other road, built up area, railway, major road, highway, mast and industrial area in order of most to less importance for this analysis. The summation of the vector values is 1.

The map of existing polling units was created after the geocoding process using ArcMap 10.1. The data of the coordinates picked were imported into ArcMap 10.1 against the boundary of Zaria showing the local government divisions. This is to see the way the result fall so that it can be used for proper validation.

LandSat8 imagery was imported into the view and the composite imagery produced with a false colour composite of 7, 5, 2 for Red, Green and Blue respectively. This shows the areas of vegetation, settlements, and water bodies as shown in the Figure 4 below shows the satellite imagery of Zaria after the colour composite has been added to the bands.

Figure 4: Landsat 8 satellite imagery of parts of Zaria acquired in 2014

Then the SRTM data was clipped for the whole of Zaria and the slope analysis map made in degree is as shown below. The height which ranges from 603-800m running from low to high land ranging from black to white respectively as shown in the Figure 5 below.

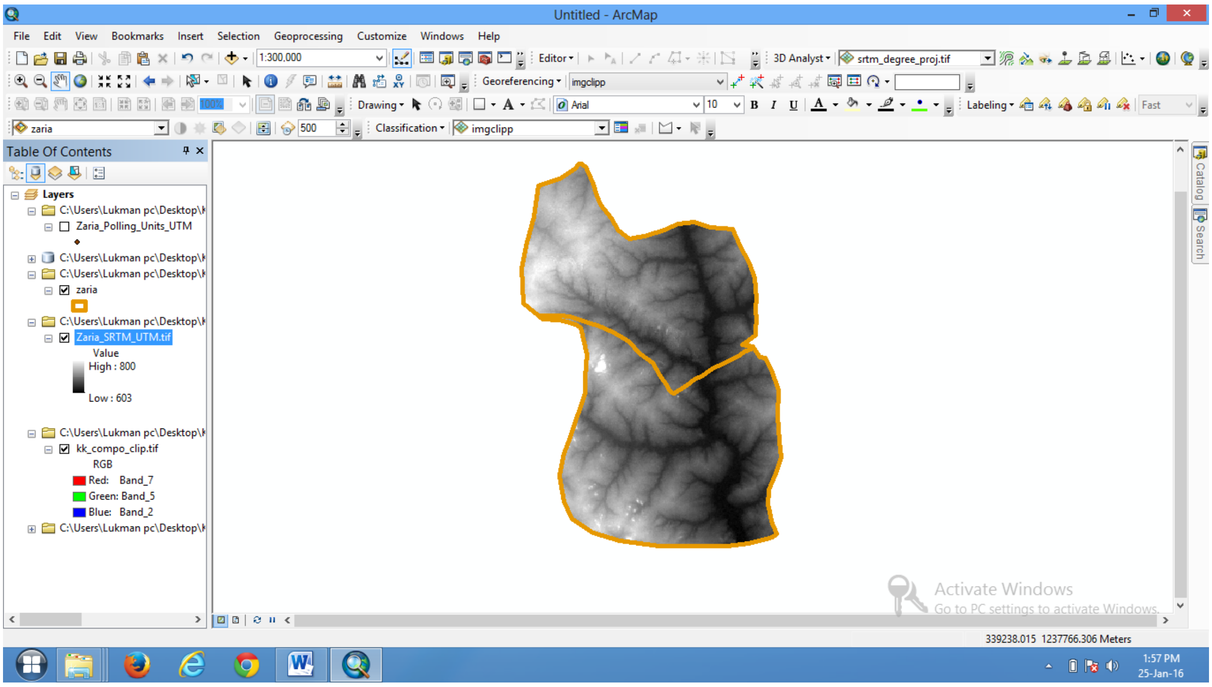


Figure 5: SRTM Data of Zaria in ArcMap view window

The map of the slope analysis in degree was carried out using the slope command in ArcMap 10.1, importing the SRTM data and also specifying the slope in degrees. The resultant map produced show the values ranging from 0-26.451° ranging from blue to yellow colours respectively as shown in Figure 6 below.

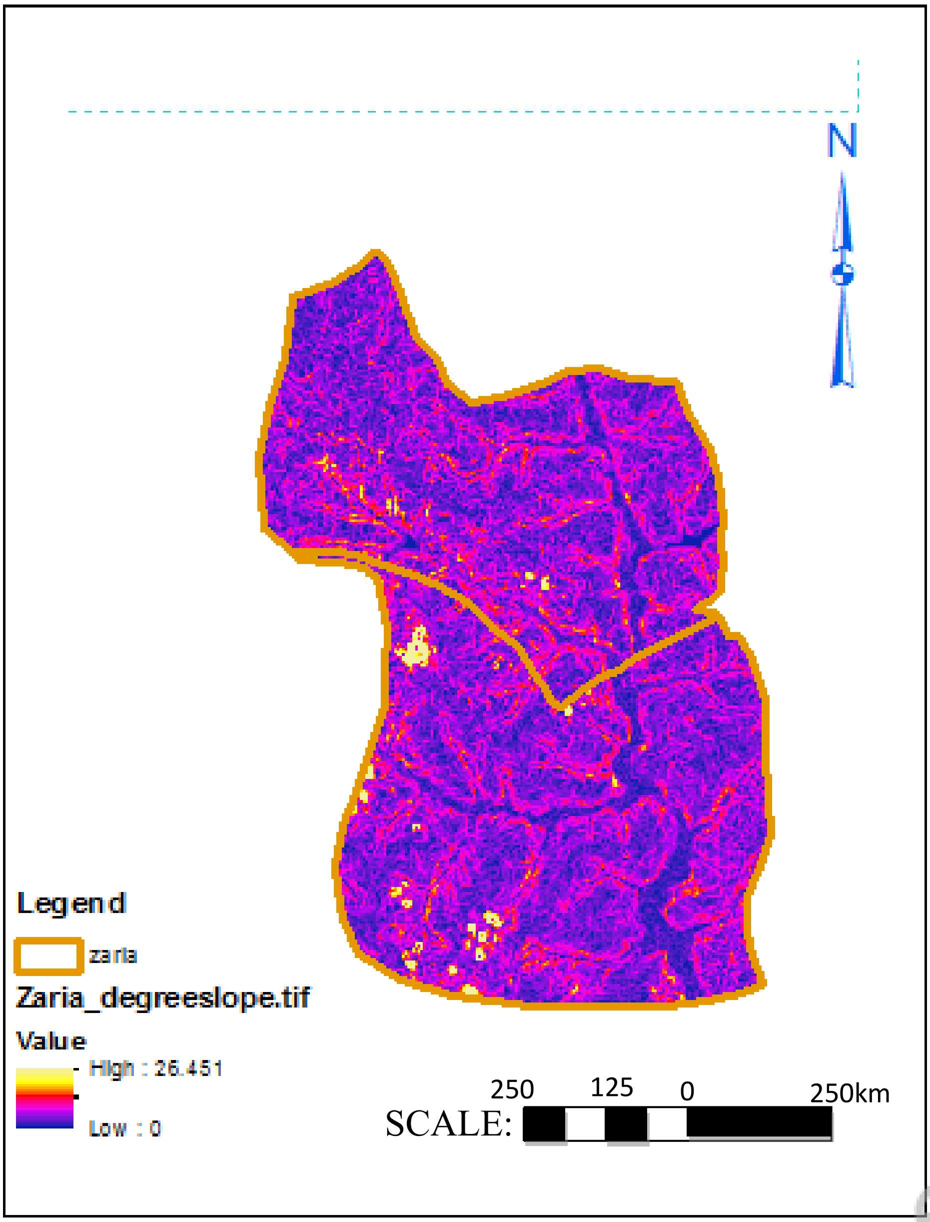


Figure 6: The nature of terrain in Zaria

More so, the image was classified into Six (6) classes which are water, open space, farmlands, rock, settlement, and wetlands shown by colour blue, yellow, green, black, red, and light blue respectively as shown in Figure 7 below. This was derived using the image classifier tool in ArcMap 10.1 and by saving training samples and the signature class for future editing.

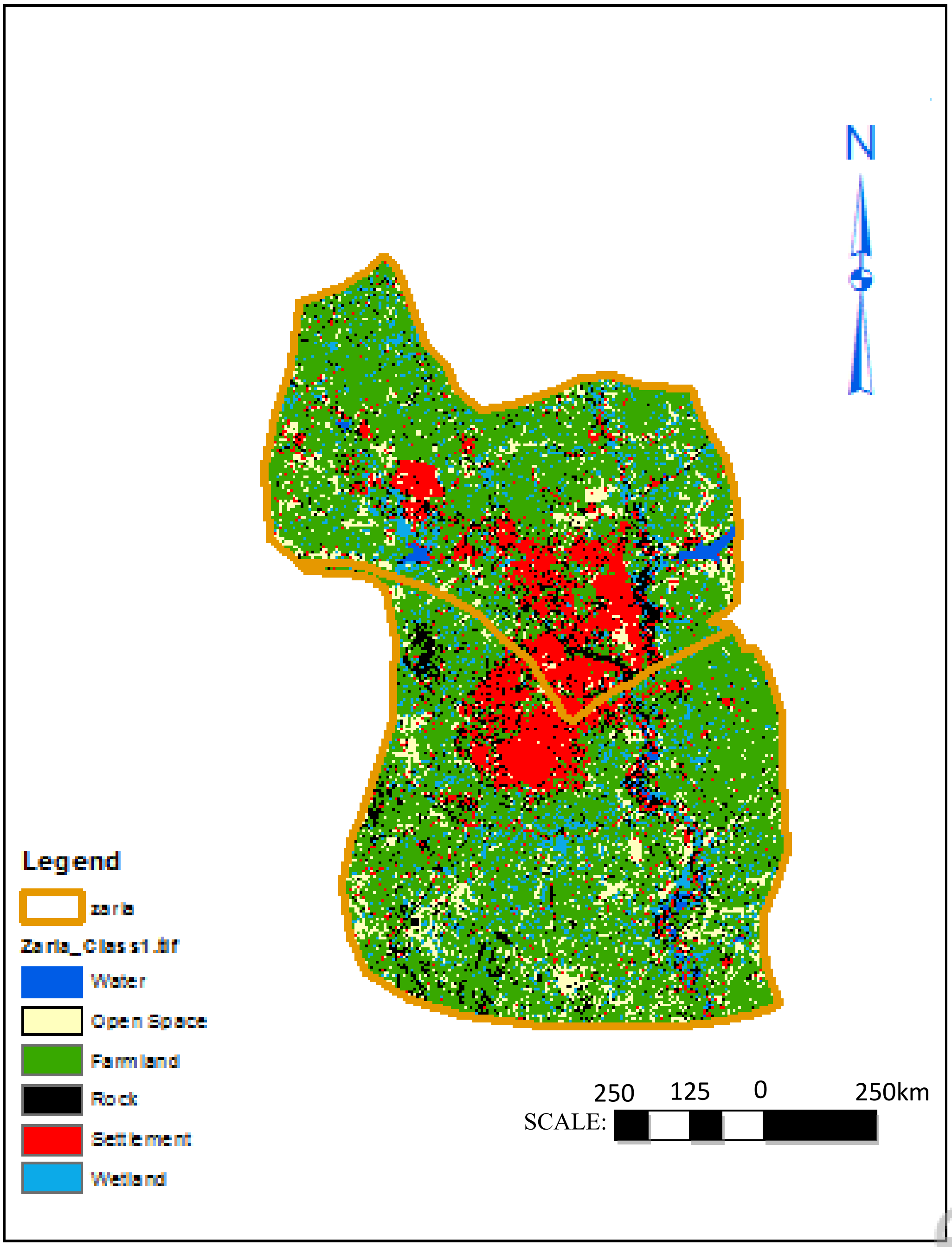



Figure 7: Classified imagery of Zaria

Also, the Landuse map showing the hospitals, road network, Railway line, settlement (High, Medium, and low), stream, industrial area, and institution area was imported into ArcMap 10.1 and the plan is produced as shown in Figure 8.

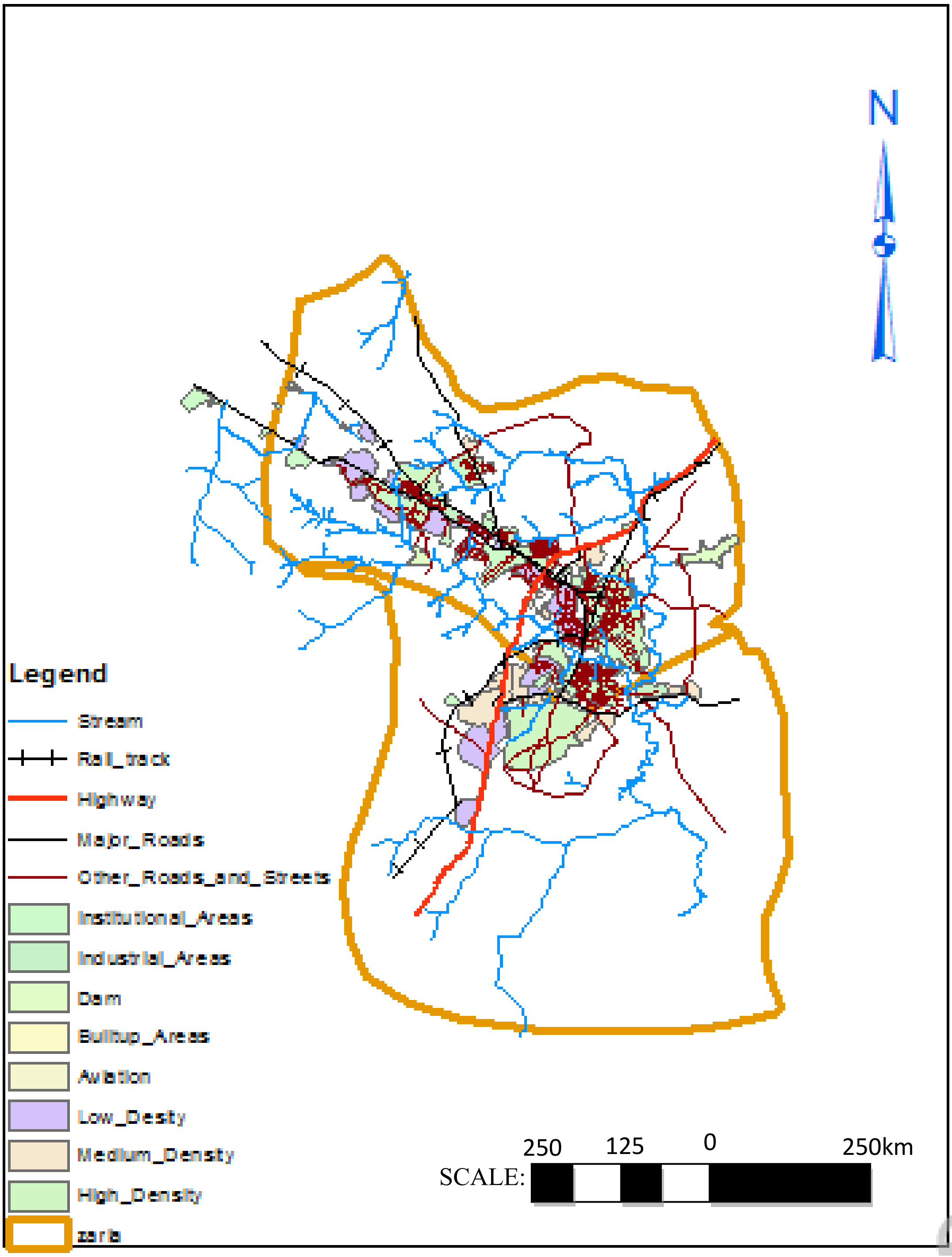



Figure 8: 2014 Landuse map of Zaria
Source: Department of Geography, ABU Zaria

However, the population density map was created using the estimate value of 500 people per polling unit in a ward. The arc catalogue tool was used in ArcGIS 10.1 to plot the map and the resultant map is as shown in Figure 9.

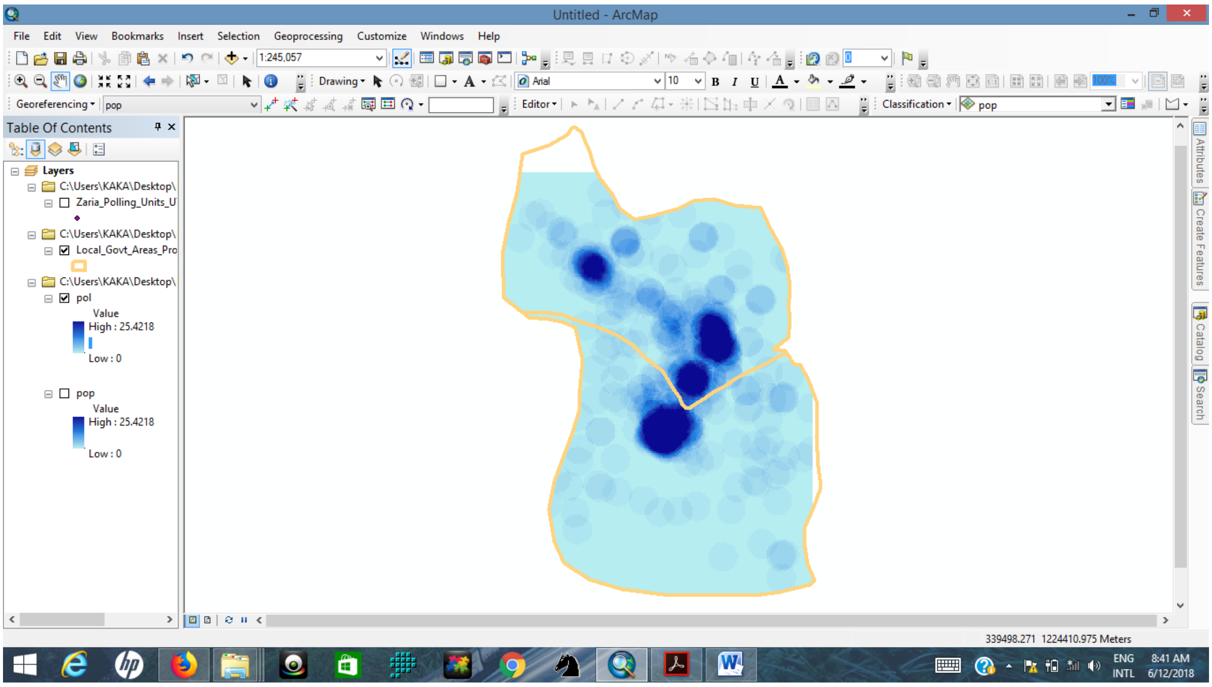


Figure 9: Raster image of population density in ArcMap 10.1 window

### 2.4.1 Weighted Linear Combination (WLC)

Using the image calculator function in IDRISI selva, the multiplication of each weight by the corresponding fuzzy map is done and then the addition of the thirteen (13) factors (including the slope map). The result obtained is shown in Figure 10 for the summation while the constraints were multiplied against each other and the resultant map is shown in Figure 11 below. The multiplication of the factors map by the constraint map gives the suitability map of the polling unit as shown in Figure 12. The RECLASS module was used to classify the map into highly Unsuitable, Unsuitable, fairly suitable, suitable and highly suitable as shown in Figure 13.

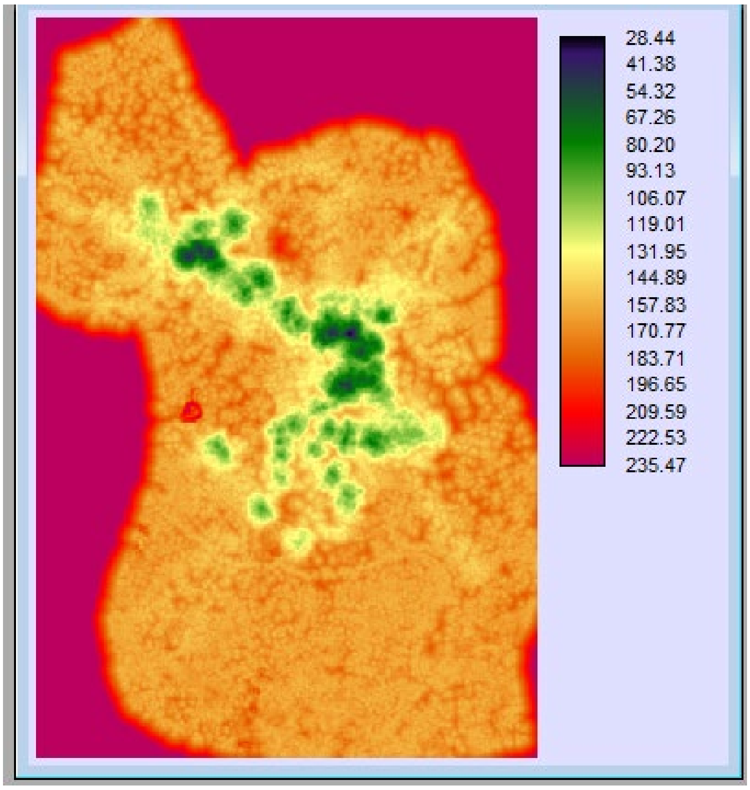



Figure 10: Pixel value summation of all the thirteen (13) factors

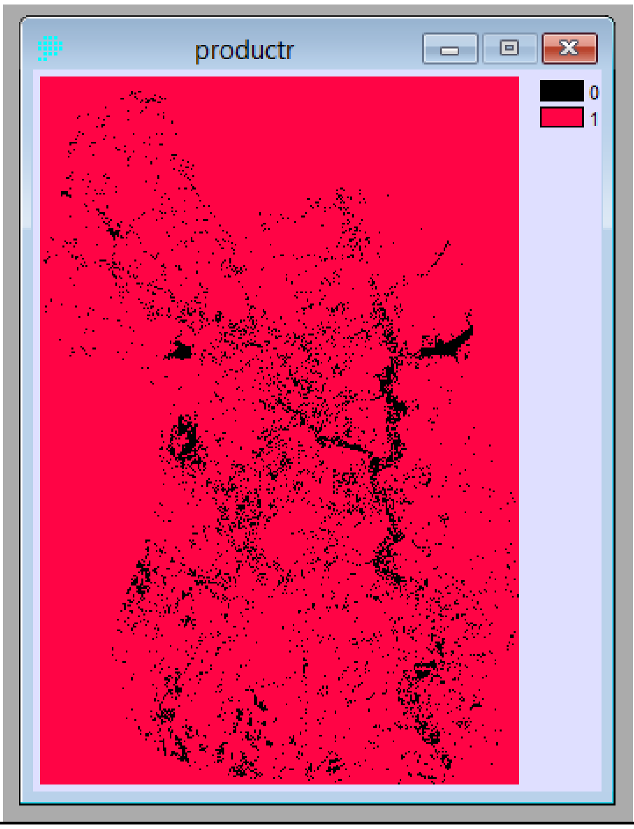



Figure 11: Pixel value product of the two (2) constraint; rock and waterbodies

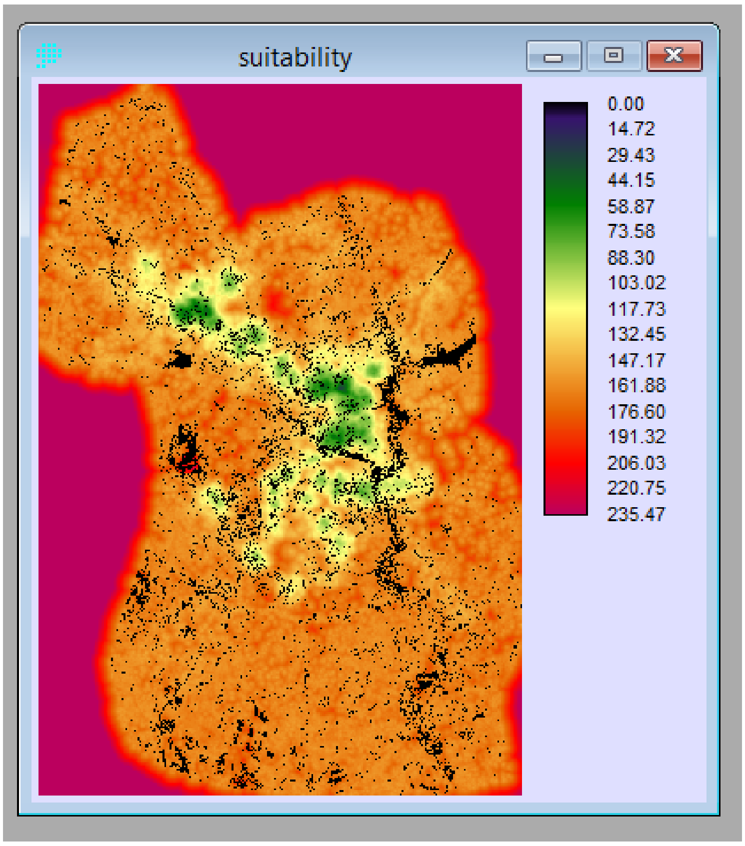



Figure 12: Pixel Values of Suitability of the polling unit

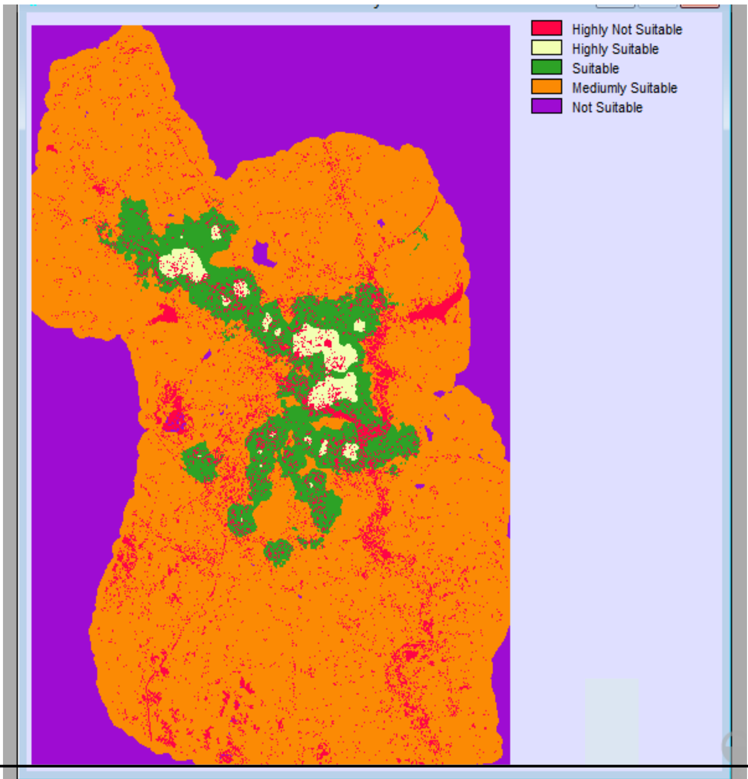



Figure 13: Reclassified Pixel value of suitability

The map is then exported to Arcmap 10.1, and the new raster map is as shown in Figure 14 below. This is required for the calculation of the area of each class defined based on the pixel values of each cell.

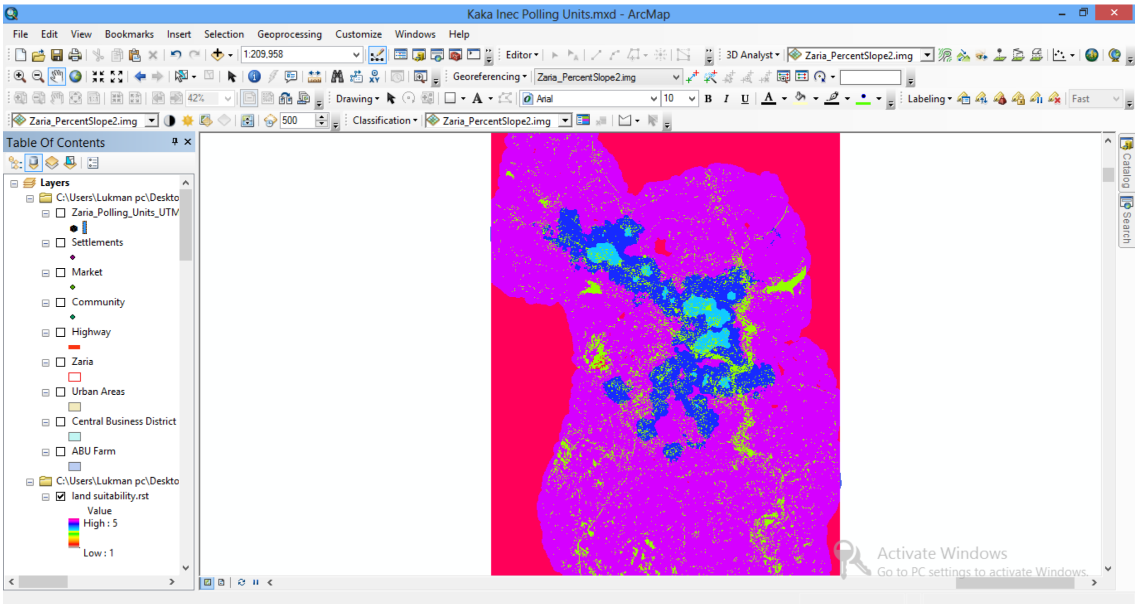



Figure 14: Raster map imported into ArcMap 10.1 window

## 3 RESULTS AND DISCUSSION

### 3.1 Distribution of Existing Polling Units

The map shows that areas which are residential have more polling units clustered around them while that of vegetation have polling units scattered around it whereas the very low and high land have no polling unit within its reach as seen in Figure 15. More so, there is cluster of polling unit between the Sabon-Gari local government and that of Zaria. Zaria local government had more polling unit compared to Sabon-Gari local government. It was noted that some points fell outside the boundary which are not supposed to be outside.

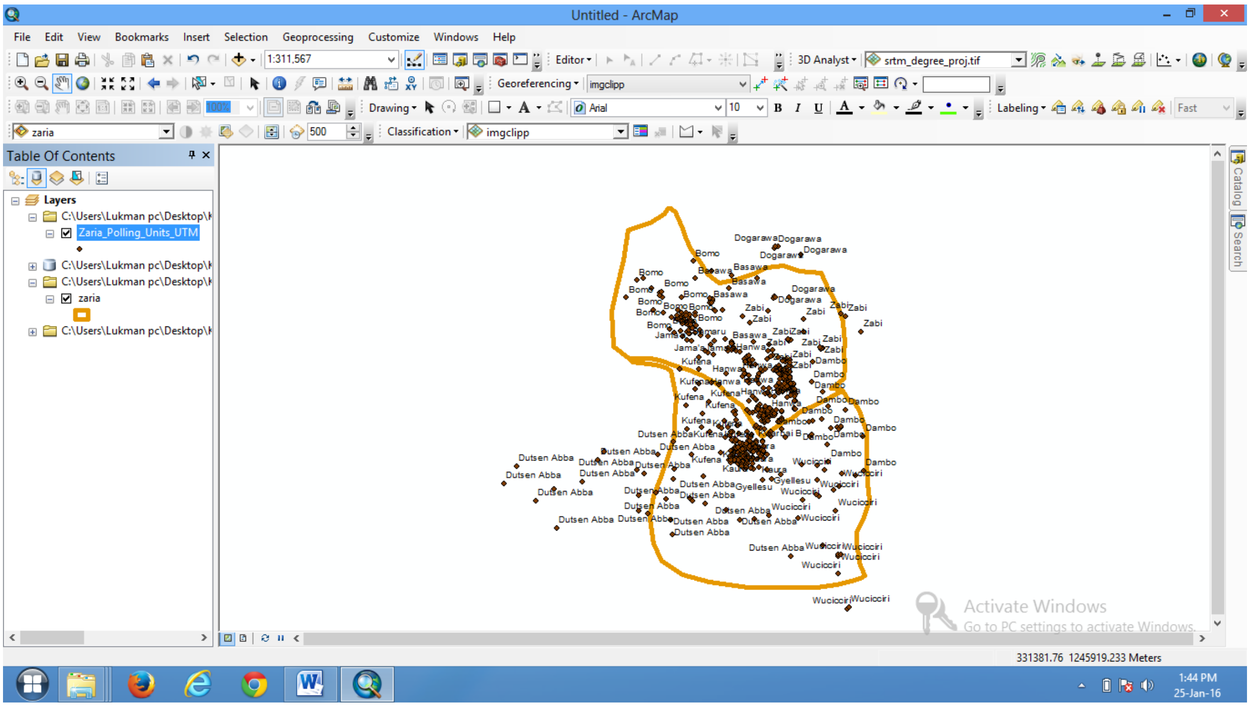



Figure 15: Map of existing polling units in Zaria in ArcMap view

### 3.2 Suitability model

The model derived shows that areas highly Unsuitable; are the high and low lands within Zaria environs. This places do not have polling unit around it that is why they are called highly unsuitable region, Unsuitable; these are regions that falls outside the boundary, they are not suitable points since they are outside the boundary, fairly suitable; they are open space used for vegetation where by small settlements are located, suitable; these are regions around the settlement area whereby polling units can be cited and highly suitable; are regions with high suitability. The Table 5 below show the results obtained while validating the model.

Table 5: Validation of the results obtained

| S/No | Classes | Percentage (%) | No of Polling Units | **Recommended No** |
|---|---|---|---|---|
| 1 | Highly Suitable | 1 | 6 | **10** |
| 2 | Suitable | 7 | 42 | **50** |
| 3 | Fairly Suitable | 56 | 337 | **450** |
| 4 | Unsuitable | 29 | 174 | **90** |
| 5 | Highly not Suitable | 7 | 42 | **1** |

### 3.3 Discussion

Land suitability in this research has been extracted by weighted linear combination overlay technique based on Multi-Criteria Decision Analysis (MCDA) using GIS, a process that has resulted in suitability being portrayed in five classes namely: highly unsuitable, highly suitable, suitable, fairly suitable, and unsuitable ranging from 1-5 has shown in the histogram. The statistical module is explored for the discussion of the results obtained by plotting the histogram as shown in Figure 16. From the result the mean of the classes is 4.000, and the standard deviation is 0.994.

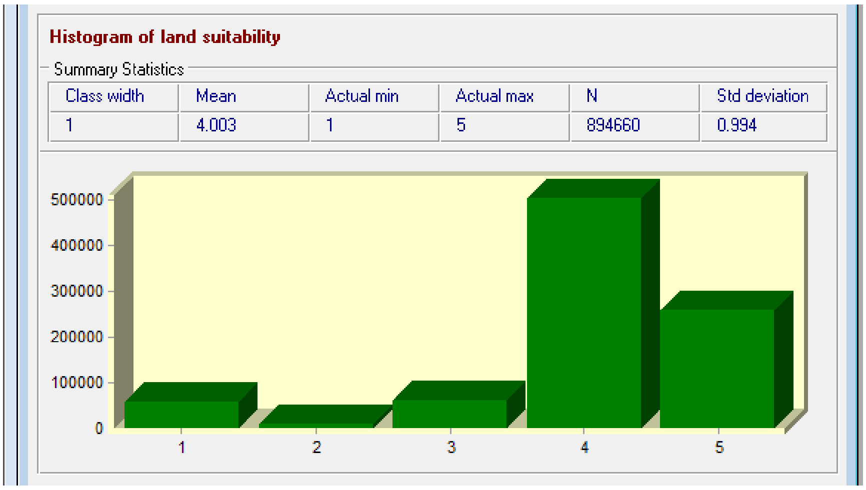



Figure 16: Histogram of suitability classes

Hence, the area of the cells area from 0-4 is as shown in figure 17 below.

With the above area derived the pie chart shown in Figure 18 shows that area with highly unsuitable covers over 7% of the area while that of highly suitable covers 1%, suitable covers 7%, fairly suitable covers 56% and unsuitable covers 29%.

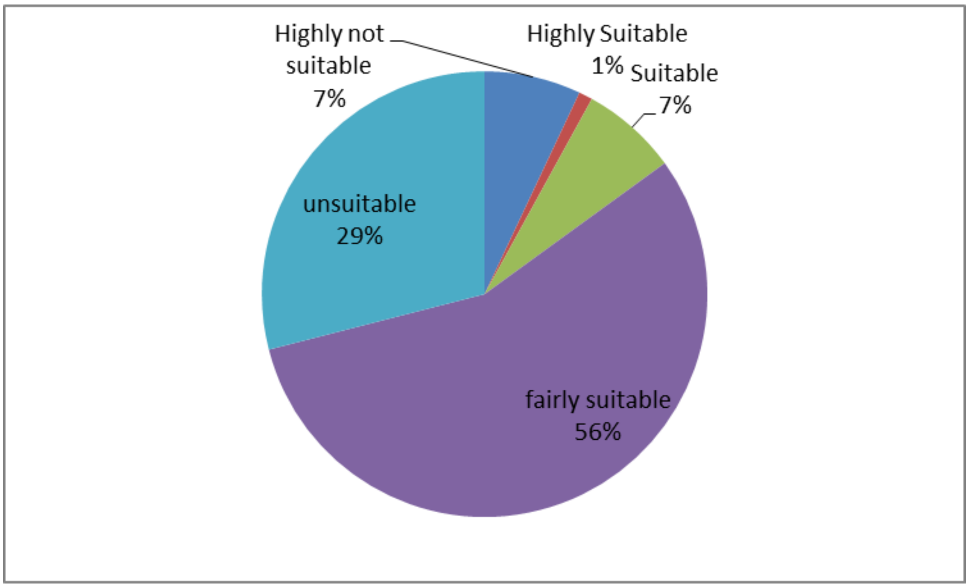



Figure 18: Pie chart of the five (5) classes

### 3.3.1 Comparison of existing and proposed polling units for validation

The above result was validated by plotting the existing polling unit on the suitability map as shown in Figure 19 below. It was observed that about 13 points of the 601 points fell outside the boundary region then for those within about 20 fell within the constraints (highly unsuitable), about 35 fell within the fairly suitable then the rest ranges fell within the range of highly suitable to suitable.

The similarities between the existing and proposed polling units are; regions highly suitable and suitable have more points within its pixel value, regions highly unsuitable have no points within its pixel values, and regions with fairly suitable have scattered points with denote areas of high farmland and less/ small settlement.

The disparity between found is that some points fell within the unsuitable region which ought not to be so. Also, areas around the hill have three polling units surrounding it.

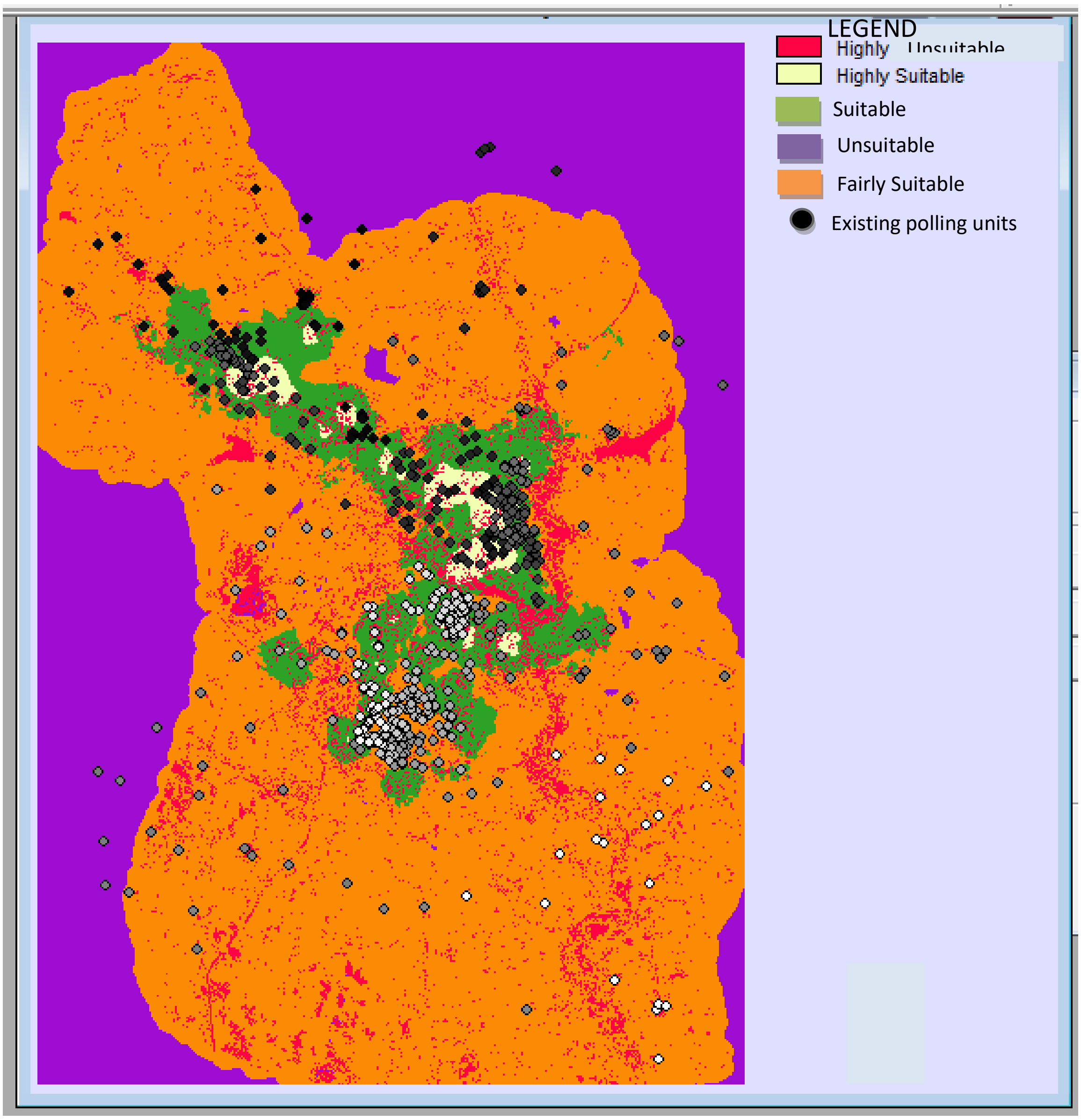



Figure 19: Existing polling unit superimposed on the suitability pixel values

**4.1 Conclusion and Recommendation**

In conclusion, it has been seen how AHP and GIS can be used to create a suitability model of polling unit sites. From the above result, Zaria has an average of 894,600 square meters (894.600km$^2$) in area and majority of the area at present been used as farmland. The result obtained from the map and validated shows that the suitability map of zaria produced has 0.09 consistency ratio and average of 36% of area not suitable, 56% of area fairly suitable and 8% Suitable (Most of the points which fall within this percentage). A 25m buffer was created and it was observed that areas with more intersections fell within region of high suitability and that with low suitability fell has no intersection.

Thus, polling units that fell within the not suitable region can be redistributed or removed from the lists.

The following recommendations are needed for the purpose of this work; which are Electoral polling units should not be cited in area that fall within not suitable area/constraints (rock/highland and water), Areas with high suitability are expected to have more polling units, To aid decongestion of polling units, there can be more than one polling unit in a ward to ensure proper voting is carried out, and to carry out the research for large scale, very high resolution imagery should be used.

At the completion of this research, the following contribution to knowledge were derived which are the study has been able to develop a suitable model for citing polling units in Zaria using Geospatial Technology and the study has also been able to establish a more comprehensive database to handle both spatial and non-spatial variables relating to polling unit in Zaria.

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## BIOGRAPHICAL NOTES

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Surv. Kaka is registered with the Surveyor Council of Nigeria (SURCON) and also a member with the Nigeria Institution of Surveyors (NIS), National Association of Surveying & Geoinformatics Lecturers (NASGL), Women in Surveying (WIS), FIG Young Surveyor s Network (FIG YSN), Surveyors Wives Association of Nigeria (SWAN), Geoinformation Society of Nigeria (GEOSON). She has barged numerous awards in the course of her career of which include; Selfless and dedication to service award (Folis Consults Ltd), Certificate of commendation (NEMA/NYSC), Merit and Achievement Award (ABU Geomatics Dept.), Geomatics Award Finalist (Geoqinetic awards), Certificate of Honour (NAPE/APPG treasurer), Certificate of Honour (NAPE/APPG Active Member), Best Female Mathematics Student in the college Award (FGCWukari), and Certificate of Award (MSS FGC Wukari Treasurer).

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**ABUBAKAR Musa Ahmed** has a PhD degree in remote sensing and GIS applications. He is a university lecturer with over twenty five (25) years working experience. He is also an author and a consultant in surveying and mapping to several state and federal agencies.

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**Olalekan Adekunle ISIOYE** is a Lecturer in the Department of Geomatics at the Ahmadu Bello University, Nigeria. He earned his Bachelor of Science at Ahmadu Bello University in Zaria, Nigeria, in 2004; a Master of Science at the University of Lagos in Nigeria in 2010 and his PhD in Geoinformatics from the University of Pretoria, South Africa in 2017. He is currently focussing on supervising postgraduate students in the field of remote sensing and satellite Geodesy with a particular interest in atmospheric science, earth observation systems and scientific applications of GNSS.

He is a registered (licensed) Surveyor with the Surveyors Council of Nigeria (SURCON) since 2011; he has the membership of other organisations, which includes the Nigerian Association of Geodesy (NAG), Nigerian Institution of Surveying (NIS), and African Association of Remote Sensing of the Environment (AARSE). He has authored and co-authored over seventy (70) scientific/technical publications with includes high impact journal and conference publications.

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**Ebenezer Ayobami AKOMOLAFE** is a lecturer in the Department of Geomatics at the Ahmadu Bello University Zaria, Nigeria. He is also currently a PhD. student in the same department. He is a researcher, Geographical Information System (GIS) analyst and remote sensing expert. He has gained several years of experience in land surveying and geoinformation science from some organizations including Geographic Integrated Services Ltd. and Polaris Digitech Ltd. both in Lagos, Nigeria before securing an appointment as an academician in 2017.

Ebenezer is currently undertaking his pupilage so as to qualify as a registered land surveyor with the Surveyor Council of Nigeria (SURCON) and he is a member of the National Association of Surveying & Geoinformatics Lecturers (NASGL).

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**AbdulAzeez Aliyu ONOTU**, is a lecturer in the Department of Geomatics at the Ahmadu Bello University Zaria, Nigeria, where he specializes in Earth Observation and Land Surveying. He has three (3) years' experience in lecturing and research. His researches are in the following subject areas: remotely sensed satellite image (visible, infrared and microwave) processing, mapping of flood extent, forestry, land degradation, crime incidents, Urban Heat Island (UHI), site suitability, utilities and infrastructure. He currently is working on precision agriculture for food security.

Surveyor Aliyu is a member of some professional bodies including the National Association of Geodesy (NAG), National Association of Surveying & Geoinformatics Lecturers (NASGL), Surveyors' Council of Nigeria (SURCON), Nigerian Institution of Surveyors (NIS) and Northern Surveyors Forum (NSF). He has authored and co-authored over 7 articles.

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**Lukman Olawunmi GIWA**, is a graduate from the Department of Geomatics at the Ahmadu Bello University Zaria, Nigeria, he is an entrepreneur who currently specialize in Engineering Surveying and has eleven (11) years' experience in cadastral and engineering survey.

He is currently undertaking his pupilage so as to qualify as a registered land surveyor with the Surveyor Council of Nigeria (SURCON) and he is a member of the Nigerian Institution of Surveyors (NIS) and Northern Surveyors Forum (NSF). He has barged numerous awards in the course of her career of which include; Certificate of commendation (NEMA/NYSC), Merit and Achievement Award (ABU Geomatics Dept.); Geomatics Award Finalist (Geoqinetic awards), and Labour Prefect (Foaud Lababidi Islamic Academy).

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# APPENDIX

## LIST OF EXISTING POLLING UNIT

| Polling Unit Name | Polling Unit ID | State | Local Govt Area | Wards | Latitude (°) | Longitude (°) |
|---|---|---|---|---|---|---|
| Fed. govt. girls college/ admin block | 18/19/04/001 | Kaduna | Sabon Gari | Basawa | 7.684798541 | 11.14783714 |
| Nat. inst. leather research/ admin block | 18/19/04/002 | Kaduna | Sabon Gari | Basawa | 7.682416962 | 11.17145616 |
| Basawa l.g.a i/ l.e.a. basawa | 18/19/04/003 | Kaduna | Sabon Gari | Basawa | 7.672733358 | 11.17777929 |
| Ung. sarki/ k/g sarki | 18/19/04/004 | Kaduna | Sabon Gari | Basawa | 7.673333189 | 11.18017297 |
| Basawa/ k/g makama | 18/19/04/005 | Kaduna | Sabon Gari | Basawa | 7.67366582 | 11.17938304 |
| K/g liman/ danladi | 18/19/04/006 | Kaduna | Sabon Gari | Basawa | 7.672161425 | 11.17898533 |
| Ung. gobirawa/ l.e.a. basawa | 18/19/04/007 | Kaduna | Sabon Gari | Basawa | 7.673860541 | 11.1804056 |
| Hayin yamma/ hayi | 18/19/04/008 | Kaduna | Sabon Gari | Basawa | 7.671907829 | 11.17791021 |
| Dupa dupa/ amfani house | 18/19/04/009 | Kaduna | Sabon Gari | Basawa | 7.673062242 | 11.20342359 |
| Basawa/ l.e.a. barracks | 18/19/04/010 | Kaduna | Sabon Gari | Basawa | 7.675659411 | 11.17163134 |
| Tudun muntsira/ tudun muntsira | 18/19/04/011 | Kaduna | Sabon Gari | Basawa | 7.671408492 | 11.18117338 |
| Unguwan makera/ makera house | 18/19/04/012 | Kaduna | Sabon Gari | Basawa | 7.689464578 | 11.20000533 |
| Unguwan na'inna/ na'inna house | 18/19/04/013 | Kaduna | Sabon Gari | Basawa | 7.693342209 | 11.13825124 |
| Unguwan rimi/ u.p.e ung rimi | 18/19/04/014 | Kaduna | Sabon Gari | Basawa | 7.687572474 | 11.18980797 |
| Gindin durumi/ gindin durumi | 18/19/04/015 | Kaduna | Sabon Gari | Basawa | 7.659544593 | 11.19736291 |
| Kofar kudu/ kofan kudu | 18/19/04/016 | Kaduna | Sabon Gari | Basawa | 7.672936541 | 11.17757699 |
| Palladan/ k/g sarkin palladan | 18/19/04/017 | Kaduna | Sabon Gari | Basawa | 7.691412281 | 11.14140215 |
| Gindin mangwaro layin zomo/ k/g m. dahiru | 18/19/04/018 | Kaduna | Sabon Gari | Basawa | 7.69682171 | 11.13773588 |
| Sarkin baka road/ k/g sarkin baka | 18/19/04/019 | Kaduna | Sabon Gari | Basawa | 7.689806248 | 11.14547467 |