

The Application of GIS into LIS for Effective and Efficient land Management in Nguru town

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Abstract:- The population and economic growth in Nguru town have not only increase the demand for land but also posed a lot of challenges in land management. This paper hypothesizes that the current or analogue system of land management can no longer be sustained in the face of the rising growth of information technology. Instead it has inherited over 150 litigations both in High and Sharia court of Nguru annually. This study has therefore utilised this technology to create a GIS database that can resolve and sanitise land problems and form a solid base for effective and sustainable land management.

The methodology adopted were collection of primary data for both the parcels and land owners, generation of GPS coordinates, digitisation of maps and formulation of excel data tables.

The final outcome was the GIS database system. This system can input, edit, update and retrieve information faster and easier. The system allow for spatial and attribute queries through the data embedded in the GIS database system. The system have also encourage revenue generation through the payment of searches' fee, authentication fee, update fee, vat and tax. This database have created a reliable registry that makes land transactions much cheaper, timely and certain, reduce corruption, decision making and formulation of policies. The paper therefore, advocate for immediate adoption of the GIS system for land management in Nguru and Yobe state at large.

Keywords: GIS, LIS, land management and Database

I. INTRODUCTION

Land is one of the most valuable natural resource endowed to mankind. According to (Pindiga & Orisakwe, 2013), land form the basis for all forms of human activity; thus, it served as a basis for living, working and shelter. It is an important asset that determines a country's wealth. The economic development of a country depends upon the availability of land and its usage. Land is considered to be fixed and scarce in nature. Thus it is essential to survey and manage effectively and efficiently for the use and good of mankind. It is apparent, therefore, any information concerning land is valuable key to financial investments, commerce, industry and agriculture (Musa et al., 2016). Land is depicted to include land of any tenure, tenements, hereditaments, corporal, or incorporeal, an undivided share in land, houses, other buildings and anything attached or permanently fastened to earth but does not include minerals (Yusuf Y. D 2009).

One unfortunate consequence of this growth has been the deterioration of the urban environment and the resulting reduction in the quality of life in cities. Today

Land as a valuable asset is owned and controlled by individuals, public and private sectors. Thus land becomes a necessity of life. These needs warrant the transformation into a myriad of uses. And thus land becomes a scarce commodity. This of course, is due to the rapid population growth of man on earth and his desires to explore land in myriad of ways (Usman & Sc, 2013). The consequence of this growth affect environmental quality (Williamson, I. P 1994), result in an illegal transactions, conflicts, partitions, grabbing and snatching etc. The consequences led to over 41 land cases in Nguru high court every year. Lack of Digital land information system has made Nguru local government to lose valuable tax collections and fail to promote economic and sustainable development. An Ideal land administration provide easy access to land for development, increase efficiency in land use for management, promote social equity, revenue generation, conservation of environmental quality and promote security of tenure (Usman & Sc, 2013). This means that Digital land information is essential for land administration (Musa et al., 2016).

LIS refers to Land Information System which focuses on how to acquire, manage, retrieve, analyse, display and record information regarding land. It is a tool for Cadastral and land use mapping. LIS provide a current, accurate and reliable land records and its attributes as well as spatial data that represent the legal boundaries of land and also provides a foundation or base layer for assimilation into other geographic system. It will allow stewards to retrieve, create, update, store, view, analyse and publish land information. According to (Musa et al., 2016), Digital Cadastral system can facilitate effective and efficient land market as well as land-use administration so as to promote economic development, social cohesion and sustainable development. According to (Obayomi Abiola Benjamin) A computerised LIS will help address issues such as multiple allocations of the same plot of land to more than one applicant, rampant cases of land records forgeries, theft of files and illegal smuggling of forged land documents into the land registry; unauthorized persons within the land management system allocating lands contrary to the provisions of the constitution and the Land Use Act.

GIS is a Geographic Information System that served as a tool for managing and analyzing any geographic feature. GIS is a peculiar technology with the essential features of spatial references and data analysis. (Akeh & Mshelia, 2016). GIS has Spatial and Attribute data. The Spatial data describes the location with respect to earth surface while attribute data defines the characteristic or quality of the spatial feature. The application of GIS technology has aroused interest and concern of government and professionals in policy and decision making and using natural resource in a more optimal way. Thus, many organizations are moving LIS into GIS. In many developing countries such as India, have pioneered the use of this technology in land Information system. The analogue system has gradually been phase out. The GIS is multifunctional in nature, time saving and high precision. Geographic Information System (GIS) is a robust, reliable and versatile technology that can be used in managing land records (Akeh & Mshelia, 2016).

This study explores GIS capabilities to create a database for effective and efficient revenue collection, land use planning, managing land disputes, etc. The study will also provide a details record of rights (ownership) to a particular piece land/building, use, locations such as neighbourhood, ward, village, town as well as value of real properties. This record could be used for land planning, infrastructure development and maintenance, economic activities, environmental protections and resource management, render emergency services, research, and other social programs.

II. AREA OF STUDY

The area under study is a portion of Tsohon Nguru ward, in Nguru LGA of Yobe State. Figure 1 (E and F) below shows Block 1 of Digire District and Block 1 of Talbari District. The Block 1 of Digire district has a total area of 89, 142.2 sqm with 35 parcels out of which 30 were developed and 5 were vacant plots. The Block 1 of Talbari District has a total area of 104,447.5sqm with 23 parcels out of which 21 developed while 2 undeveloped. Digire block 1 has the Following Universal Transverse Mercator (UTM) Coordinates (Point 1) 10°27'6.87"E, 12°53'9.52"N(Point 2) 10°27'9.06"E, 12°53'9.92"N (Point 3) 10°27'9.16"E, 12°53'7.03"N (Point 4) 10°27'6.95"E, 12°53'6.86"N. Similarly Talbari Block 1 has (Point 1) 10°27'9.41"E, 12°53'10.09"N, (point 2) 10°27'11.58"E, 12°53'10.40"N, (Point 3) 10°27'11.84"E, 12°53'7.08"N and (Point 4) 10°27'9.72"E, 12°53'7.08"N.

Types of property transaction

According to Yusuf Y. D (2009), the followings are the processes of acquisitions of land and devolution of properties in Nigeria.

1. First settlement and deforestation of virgin land
2. Conquest during tribal war
3. Customary grants of land
4. Gift of land
5. Sales of land

6. Inheritance or devolution of land

The first three are hardly obtained presently in Nigeria. While the last three are still being practice.

Procedure for land transactions

In Nigeria there are two clear and distinct ways in which land is sold and title validity transferred. They are either through Customary Law or English Law. (Yusuf Y. D 2009)

Customary law: According to Yusuf Y. D (2009), customary law regulate the usages, dealings and transactions, on land and Interest in land. Is a set of rules of conduct applying to persons and things in a particular locality, which exist at the relevant and material time and is recognised by the inhabitants of the community as binding on them.

The English Law requires payment of the money, acknowledgement of the receipt of payment and execution of deed of conveyance in favour of the purchaser.

The Benefit of GIS in land Management

To ensure a good land administration a number of data and procedures are required for demarcation and recording. It may entails details such as ownership, land use, land value, land use plan, site development plan, utility plan, survey information, other attributes such as name of owner, plot number, size, use, location, transaction records such as deed of assignment, sublease, mortgage, devolution, release etc. All these and many others may accumulate into a large stream of information. Managing such huge information manually will be difficult. According to (Akeh & Mshelia, 2016) GIS, being a computerized system, has the capabilities to handle such huge data not only effective but also efficient, secured, faster, and transparent.

From these, we can be able to summarise the following advantages of GIS in land administration:

- ❖ It will facilitate land registration processes, data processing, storage and retrieval as well as reduce time, cost and space required for land record and management
- ❖ It will enhance academic research as access to information will be easy
- ❖ Guarantee tenure security and transparency among land owners. This will enhance sustainable development
- ❖ Revenue proliferation to government via consent fee, title ascertainment fee, re-validation of titles, deed of assignments, Mortgage, Lease, update fees, Map copies (for site plans, building plan,), power of attorney, etc.
- ❖ Since the GIS technology has the capability of allocating a distinct geographical coordinates to piece of land, thus, issues regarding multiple transactions and double allocations, illegal transactions will be phased out.

- ❖ The GIS technology will reduce dispute among land owners thus, mitigate court cases.
- ❖ It will sanitised the system of land transactions in general
- ❖ Provide security for credit from banks and thus, enhance efficient land market, housing, construction and financial institutions.
- ❖ GIS data base system for land management guarantee data backup in the event of system breakdown
- ❖ GIS database can provide previous and up to date Maps, layout, plans with details if require at fingertips
- ❖ GIS database can accept updates easily
- ❖ Since the GIS database is embedded with information, every potential buyer will want to authenticate (attest) whether the land is genuine and free from stains.
- ❖ GIS allow information sharing by different users at different time

Software and Method

Software

Developing GIS database for land management involve the use of the following software: -

- ❖ ArcMap 10.3
- ❖ QGIS 2.18.16
- ❖ Google Earth 7.1.8

- ❖ GPS software
- ❖ MS Excel 2013.

Methods

For the GIS software, QGIS was used to generate Nguru land use map (figure 1), ward map (figure 2), District map (figure 3), and Block map (figure 4). These map were further exported into the ArcMap for symbolisation. From the Google Earth the required satellite images of the township were imported into the ArcMap and georeferenced using UTM coordinate obtained from the field via GPS software. Parcel of plots and houses were digitised (traced). Details such as plot no., name, location, size and use were inserted.

Coordinates of identifiable points in UTM were obtained using GPS software to form tables in MS Excel. Attribute data were collected through primary survey using questionnaires; and these data were further processed using the MS Excel. Tables were created to accommodate such details as List of owners (to a parcel of plot since from inception), address, sex, date of birth, plot size, use, ward, neighbourhood, allocation no, value of purchase, list of witnesses, transaction date etc. After all these procedures and processes a rational database was created by integrating the different entities and linking them to their respective attributes.

Finally a database (User interface) was developed so that users of the program can have access to the database. Data can easily be entered, edited and updated.

Table 1 GPS Coordinates of Some Prominent Points in UTM.

S/N	Parcel ID	Northing (Latitude Y)	Easting (Longitude X)
1	Ngts/b1/P1	12°53'7.18"N	10°27'8.76"E
2	Ngts/b1/P2	12°53'7.21"N	10°27'8.25"E
3	Ngts/b1/P3	12°53'7.07"N	10°27'8.00"E
4	Ngts/b1/P4	12°53'7.42"N	10°27'8.01"E
5	Ngts/b1/P5	12°53'7.69"N	10°27'8.03"E
6	Ngts/b1/P6	12°53'7.05"N	10°27'7.61"E
7	Ngts/b1/P7	12°53'7.05"N	10°27'7.25"E
8	Ngts/b1/P8	12°53'7.58"N	10°27'7.38"E
9	Ngts/b1/P9	12°53'7.94"N	10°27'7.29"E
10	Ngts/b1/P10	12°53'7.61"N	10°27'8.25"E

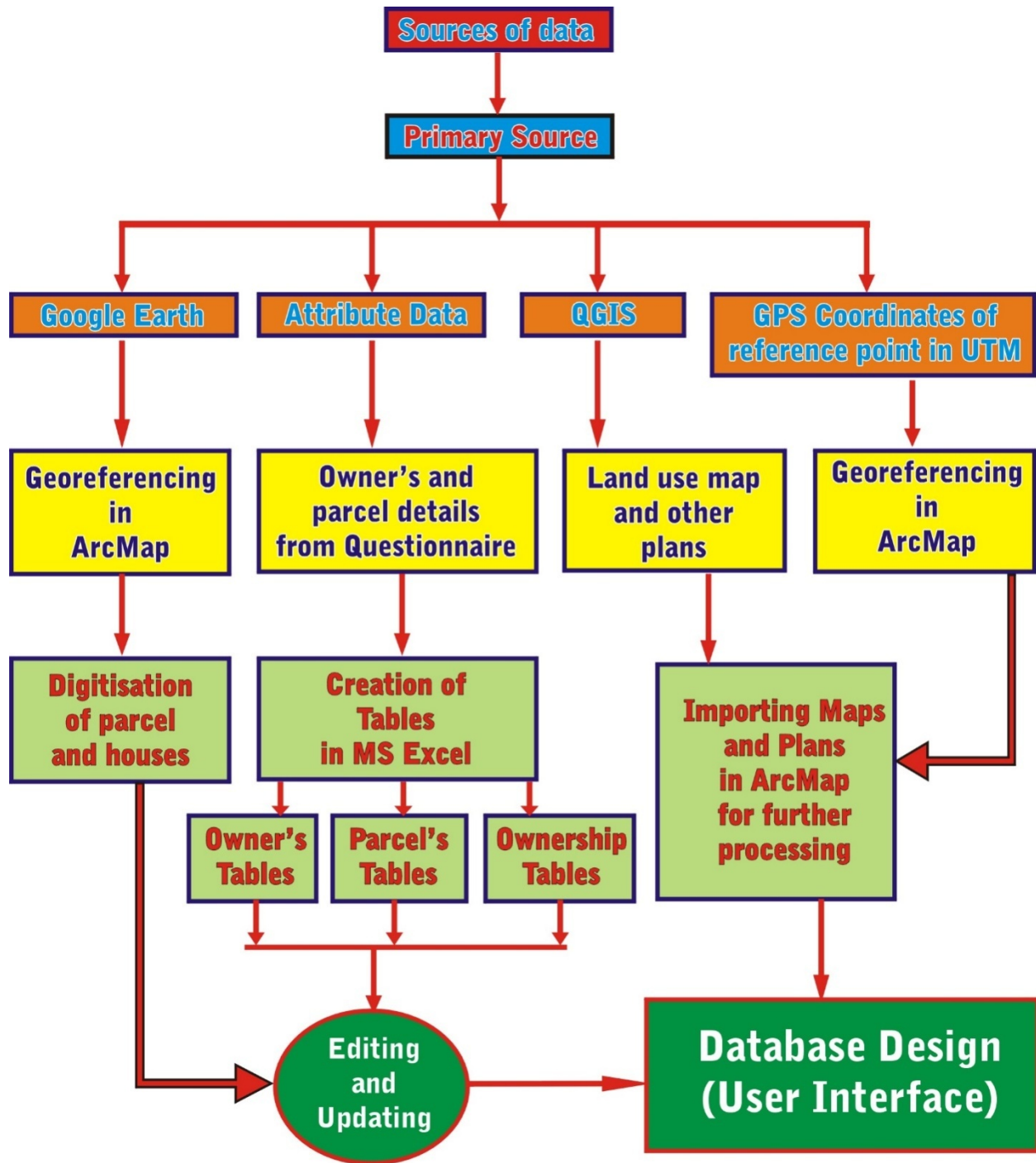


Figure 1: Flowchart of Methodology

Table 2: Owner's Table

Parcel ID	Name	Address	Occupation	Sex	DOB	Place of Birth	State	Nationality
Ngts/b1/p5								

Sample Parcel ID: Ngts/b1/p5 where “Ng” refers to Nguru. “ts” refers to Tsohon Nguru ward, “b1” refers to a block of

houses no. 1, and “p5” refers to plot no. 5 (vacant or developed).

Table 3: Parcel's Table

Parcel ID	Name	Area (sqm)	Ward	District	Street	Use	Status
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Table 4: Ownership Table

Parcel ID	Ownership	Status	Date of Possession	Mode of Possession	Cost	Witnesses
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III. RESULT AND DISCUSSION

Figure 1; shows the locational map of the study area; from the same figure 1 below, map “C” figured out Nguru Local government area; the local government is divided into 10

wards out of which 6 wards were located outside the local government headquarter. The area circled red are the remaining 4 wards which falls within the urban area (15km radius).

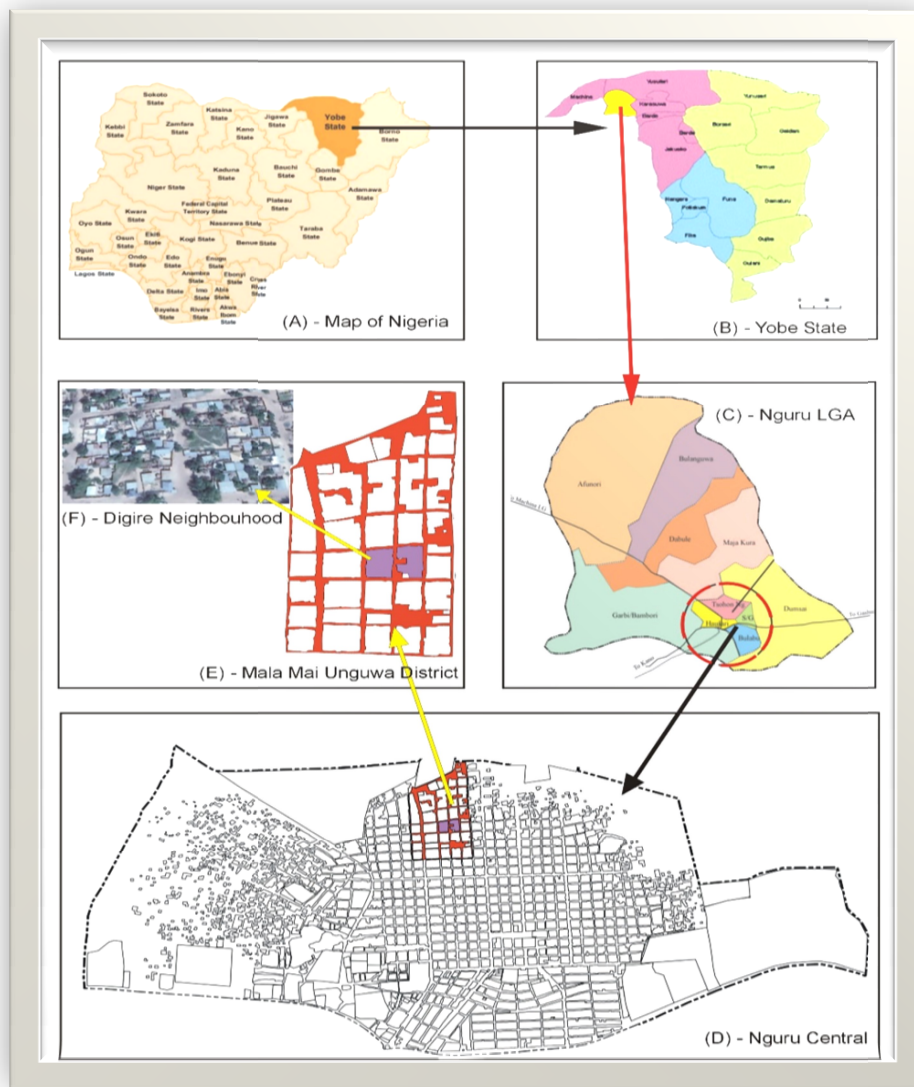


Figure 1: Locational Map of the Study area

From figure 1 above, map (D) was curved out to shows Mala Mai Unguwa District. The map also shows layout distributions of the four wards namely; Bulabulin, Hausari, Sabon Gari Kanuri and Tsohon Nguru wards (Figure 3

below). It is purely grid Iron pattern with an updated population of 227, 615 (Census Office Nguru 2018).

In map (F) of figure 1 above, the study area was demarcated out of Mala Mai Unguwa District (E). It covers part of Digire and Talbari ward.

Figure 2: below shows the land use map of the four wards in Nguru town, namely; Bulabulin, Hausari, Sabon Gari Kanuri and Tsohon Nguru ward. Six land uses were identified and symbolized. Residential is the dominant land use with 55% and Industrial as the least with 0.8%.

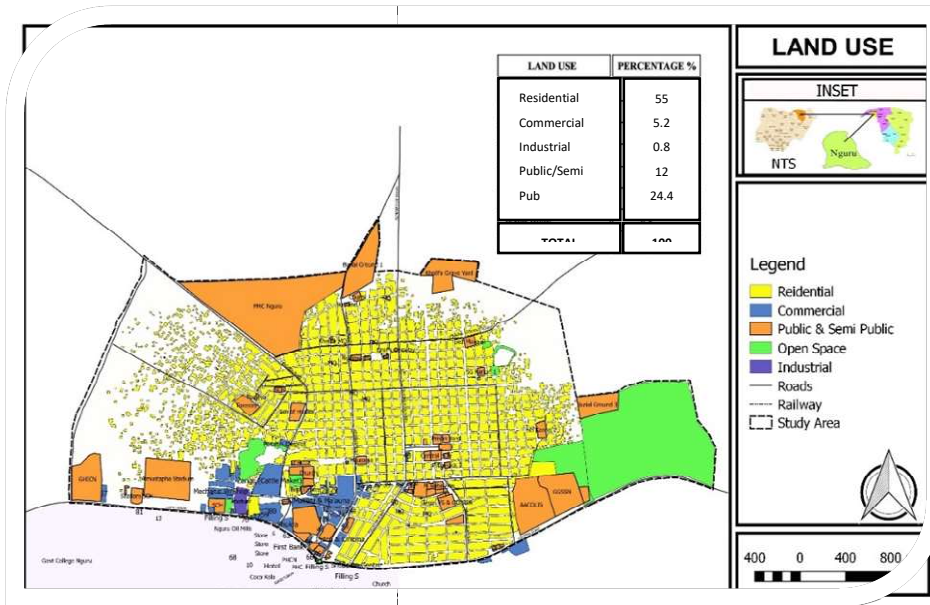


Figure 2: Land Use map of Nguru Town

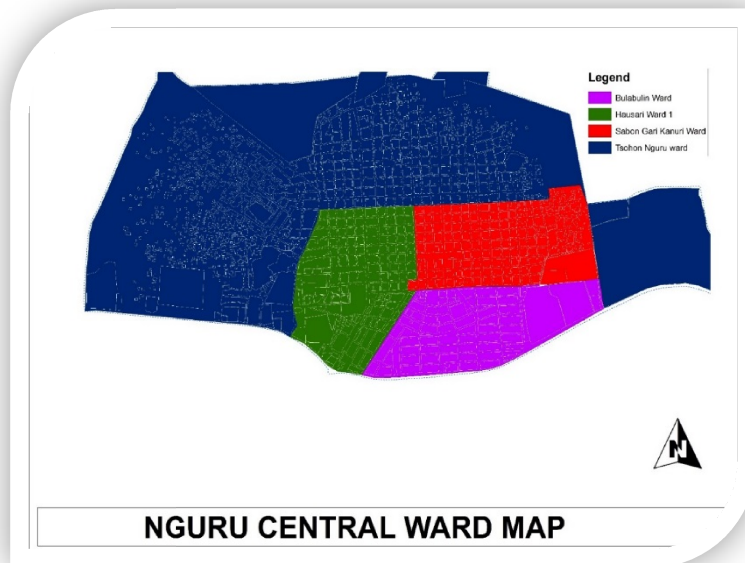


Figure 3: Nguru Central showing the four wards

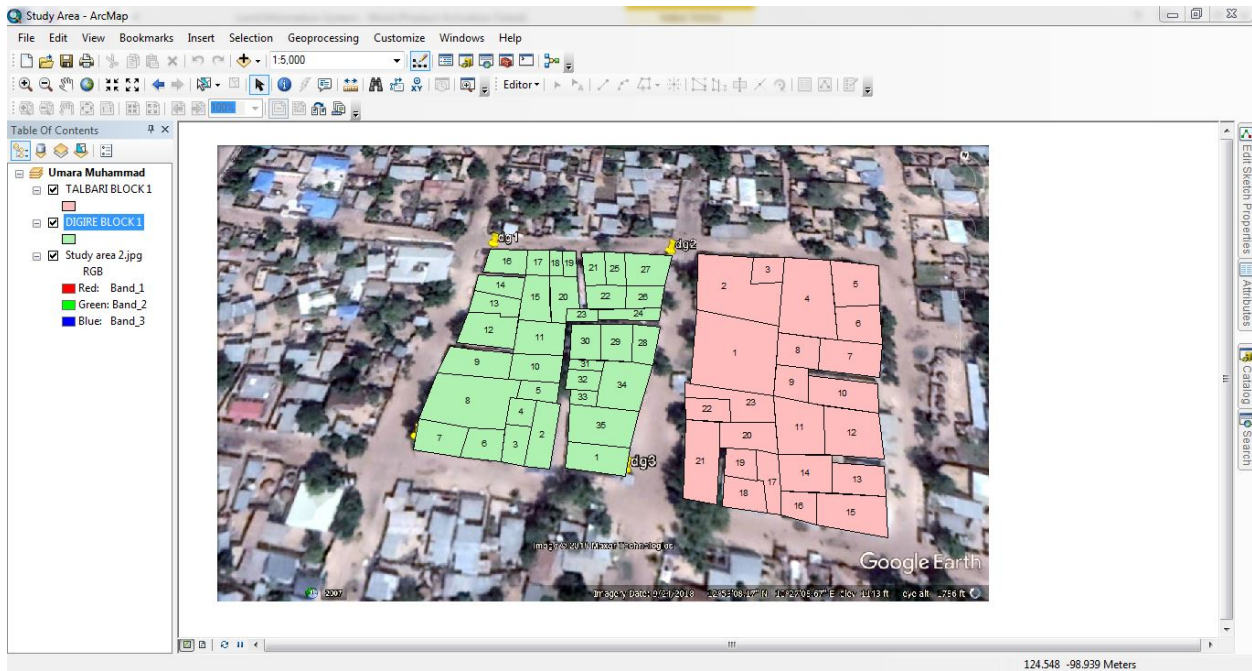


Figure 4: Geo-referenced and Digitised blocks

The figure 4 shows the geo-referenced and digitised blocks of Digire and Talbari neighbourhood. They were numbered according to their parcel ID.

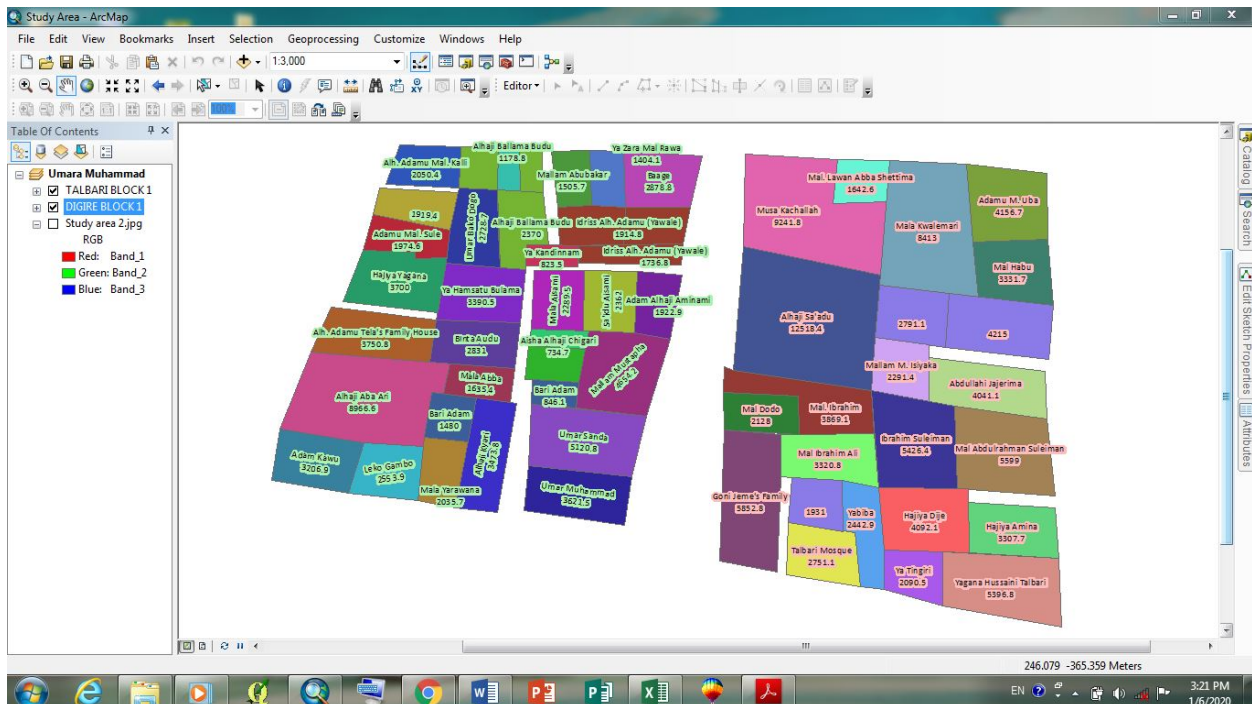


Figure 5: Labeled and symbolised Parcels

Figure 5 shows the two blocks of the study area symbolised and labeled with the names of owners and their respective sizes in meter square.

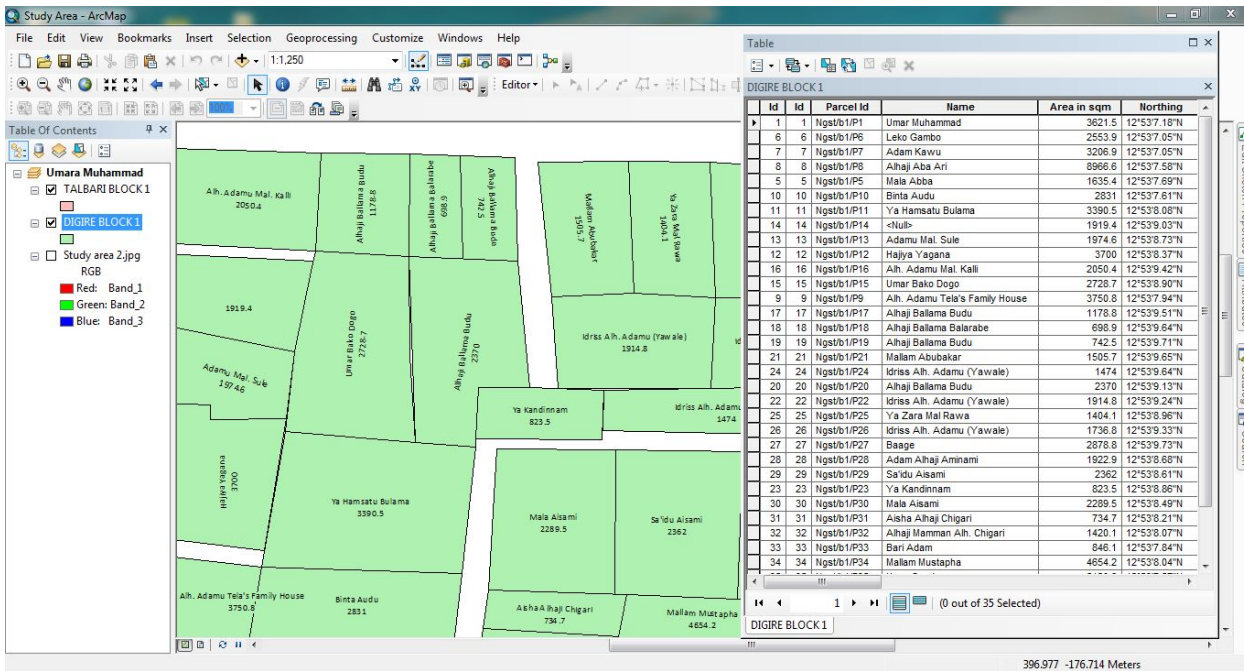


Figure 6: Parcels and part of their attribute table

Figure 6 shows labeled parcels with their respective attribute table side by side. The attribute table gives details such as parcel Id, Owner’s name, Area of parcels in square meter, northing and Easting etc.

Table 5: Attribute table for Digire Block 1

Id	Parcel Id	Name	Area in sqm	Northing	Easting	Address	Occupation	Sex	DOB	POB	State	Nationality	Ward	District	Street	Use	Present
1	Ngstb/1P1	Umar Muhammad	3621.5	12°53'7.18"N	10°27'8.76"E	Digire Tsohon Nuru Ward	Farming	M	35Years	Nuru	Yobe	Nigerian	Tsohon Nuru	Digire	<Null>	Residential	Developed
6	Ngstb/1P6	Leko Gumbo	2553.9	12°53'7.05"N	10°27'7.61"E	Digire Tsohon Nuru Ward	Civil Servant	M	<Null>	Nuru	Yobe	Nigerian	Tsohon Nuru	Digire	<Null>	Residential	Developed
7	Ngstb/1P7	Adam Kawu	3206.9	12°53'7.05"N	10°27'7.25"E	Digire Tsohon Nuru Ward	Civil Servant	M	47Years	Nuru	Yobe	Nigerian	Tsohon Nuru	Digire	<Null>	Residential	Developed
8	Ngstb/1P8	Ahaji Aba Ari	8966.6	12°53'7.58"N	10°27'7.38"E	Digire Tsohon Nuru Ward	Farming	M	94Years	Nuru	Yobe	Nigerian	Tsohon Nuru	Digire	<Null>	Residential	Developed
5	Ngstb/1P5	Mala Abba	1635.4	12°53'7.69"N	10°27'8.03"E	Digire Tsohon Nuru Ward	Civil Servant	M	1973	Nuru	Yobe	Nigerian	Tsohon Nuru	Digire	<Null>	Residential	Undeveloped
10	Ngstb/1P10	Binta Audu	2831	12°53'7.61"N	10°27'8.25"E	Digire Tsohon Nuru Ward	Housewife	F	60Years	Nuru	Yobe	Nigerian	Tsohon Nuru	Digire	<Null>	Residential	Developed
11	Ngstb/1P11	Ya Hamsatu Bulama	3390.5	12°53'8.08"N	10°27'7.97"E	Digire Tsohon Nuru Ward	Housewife	F	60Years	Birnin Ngur	Yobe	Nigerian	Tsohon Nuru	Digire	<Null>	Residential	Developed
14	Ngstb/1P14	<Null>	1919.4	12°53'9.03"N	10°27'7.21"E	<Null>	<Null>	F	<Null>	Nuru	Yobe	Nigerian	Tsohon Nuru	Digire	<Null>	Residential	Developed
13	Ngstb/1P13	Adamu Mai. Sule	1974.6	12°53'8.73"N	10°27'7.15"E	Digire Tsohon Nuru Ward	Business	M	35Years	Nuru	Yobe	Nigerian	Tsohon Nuru	Digire	<Null>	Residential	Developed
12	Ngstb/1P12	Hajya Yagana	3700	12°53'8.37"N	10°27'7.28"E	Digire Tsohon Nuru Ward	Housewife	F	38Years	Geldam	Yobe	Nigerian	Tsohon Nuru	Digire	<Null>	Residential	Developed
16	Ngstb/1P16	Ah. Adamu Mai. Kalli	2050.4	12°53'9.42"N	10°27'7.10"E	Digire Tsohon Nuru Ward	Business	M	<Null>	Nuru	Yobe	Nigerian	Tsohon Nuru	Digire	<Null>	Residential	Developed
15	Ngstb/1P15	Umar Bako Dogo	2728.7	12°53'8.90"N	10°27'7.66"E	Digire Tsohon Nuru Ward	Student	M	19Years	Nuru	Yobe	Nigerian	Tsohon Nuru	Digire	<Null>	Residential	Developed
9	Ngstb/1P9	Ah. Adamu Tela's Family House	3750.8	12°53'7.94"N	10°27'7.29"E	Digire Tsohon Nuru Ward	Tailoring	M	<Null>	Nuru	Yobe	Nigerian	Tsohon Nuru	Digire	<Null>	Residential	Developed
17	Ngstb/1P17	Ahaji Balama Budu	1178.8	12°53'9.51"N	10°27'7.46"E	Digire Tsohon Nuru Ward	Civil Servant	M	<Null>	Nuru	Yobe	Nigerian	Tsohon Nuru	Digire	<Null>	Residential	Developed
18	Ngstb/1P18	Ahaji Balama Balarabe	698.9	12°53'9.64"N	10°27'7.68"E	Digire Tsohon Nuru Ward	Civil Servant	M	<Null>	Nuru	Yobe	Nigerian	Tsohon Nuru	Digire	<Null>	Residential	Developed
19	Ngstb/1P19	Ahaji Balama Budu	742.5	12°53'9.71"N	10°27'7.89"E	Digire Tsohon Nuru Ward	Civil Servant	M	<Null>	Nuru	Yobe	Nigerian	Tsohon Nuru	Digire	<Null>	Residential	Developed
21	Ngstb/1P21	Malam Abubakar	1505.7	12°53'9.65"N	10°27'8.15"E	Digire Tsohon Nuru Ward	Farming	M	<Null>	Tarmuwa	Yobe	Nigerian	Tsohon Nuru	Digire	<Null>	Residential	Developed
24	Ngstb/1P24	Idriss Ah. Adamu (Yawale)	1474	12°53'9.64"N	10°27'8.50"E	Digire Tsohon Nuru Ward	Civil Servant	M	1982	Nuru	Yobe	Nigerian	Tsohon Nuru	Digire	<Null>	Residential	Developed
20	Ngstb/1P20	Ahaji Balama Budu	2370	12°53'9.13"N	10°27'7.99"E	Digire Tsohon Nuru Ward	Civil Servant	M	<Null>	Nuru	Yobe	Nigerian	Tsohon Nuru	Digire	<Null>	Residential	Developed
22	Ngstb/1P22	Idriss Ah. Adamu (Yawale)	1914.8	12°53'9.24"N	10°27'8.26"E	Digire Tsohon Nuru Ward	Civil Servant	M	1982	Nuru	Yobe	Nigerian	Tsohon Nuru	Digire	<Null>	Residential	Developed
25	Ngstb/1P25	Ya Zara Mai Rawa	1404.1	12°53'8.96"N	10°27'8.62"E	Digire Tsohon Nuru Ward	Civil Servant	F	<Null>	Nuru	Yobe	Nigerian	Tsohon Nuru	Digire	<Null>	Residential	Developed
26	Ngstb/1P26	Idriss Ah. Adamu (Yawale)	1736.8	12°53'9.33"N	10°27'8.83"E	Digire Tsohon Nuru Ward	Civil Servant	M	1982	Nuru	Yobe	Nigerian	Tsohon Nuru	Digire	<Null>	Residential	Developed
27	Ngstb/1P27	Beage	2878.8	12°53'9.73"N	10°27'8.82"E	Digire Tsohon Nuru Ward	Farming	M	<Null>	Jigawa	Jigawa	Nigerian	Tsohon Nuru	Digire	<Null>	Residential	Developed
28	Ngstb/1P28	Adam Ahaji Aminami	1922.9	12°53'8.68"N	10°27'9.05"E	Digire Tsohon Nuru Ward	Farming	M	<Null>	Nuru	Yobe	Nigerian	Tsohon Nuru	Digire	<Null>	Residential	Developed
29	Ngstb/1P29	Saidu Aisami	2362	12°53'8.61"N	10°27'8.75"E	Digire Tsohon Nuru Ward	Civil Servant	M	30Years	Nuru	Yobe	Nigerian	Tsohon Nuru	Digire	<Null>	Residential	Developed
23	Ngstb/1P23	Ya Kandinnam	823.5	12°53'8.86"N	10°27'8.31"E	Digire Tsohon Nuru Ward	Civil Servant	F	45Years	Nuru	Yobe	Nigerian	Tsohon Nuru	Digire	<Null>	Residential	Developed
30	Ngstb/1P30	Mala Aisami	2289.5	12°53'8.49"N	10°27'8.48"E	Digire Tsohon Nuru Ward	Civil Servant	M	1973	Nuru	Yobe	Nigerian	Tsohon Nuru	Digire	<Null>	Residential	Developed
31	Ngstb/1P31	Aisha Ahaji Chigari	734.7	12°53'8.21"N	10°27'8.48"E	Digire Tsohon Nuru Ward	Housewife	F	27years	Nuru	Yobe	Nigerian	Tsohon Nuru	Digire	<Null>	Residential	Undeveloped
32	Ngstb/1P32	Ahaji Mamman Ah. Chigari	1420.1	12°53'8.07"N	10°27'8.47"E	Digire Tsohon Nuru Ward	Farming	M	55Years	Nuru	Yobe	Nigerian	Tsohon Nuru	Digire	<Null>	Residential	Undeveloped
33	Ngstb/1P33	Bari Adam	846.1	12°53'7.84"N	10°27'8.54"E	Digire Tsohon Nuru Ward	Driving	M	50Years	Nuru	Yobe	Nigerian	Tsohon Nuru	Digire	<Null>	Residential	Developed
34	Ngstb/1P34	Malam Mustapha	4654.2	12°53'8.04"N	10°27'8.95"E	Digire Tsohon Nuru Ward	Civil Servant	M	55Years	Nuru	Yobe	Nigerian	Tsohon Nuru	Digire	<Null>	Residential	Developed
35	Ngstb/1P35	Umar Sunda	5120.8	12°53'7.57"N	10°27'8.84"E	Digire Tsohon Nuru Ward	Student	M	20Years	Nuru	Yobe	Nigerian	Tsohon Nuru	Digire	<Null>	Residential	Developed
3	Ngstb/1P3	Mala Yawana	2035.7	12°53'7.07"N	10°27'8.00"E	Digire Tsohon Nuru Ward	Farming	M	50Years	Nuru	Yobe	Nigerian	Tsohon Nuru	Digire	<Null>	Residential	Undeveloped
4	Ngstb/1P4	Bari Adam	1480	12°53'7.42"N	10°27'8.01"E	Digire Tsohon Nuru Ward	Driving	M	50Years	Nuru	Yobe	Nigerian	Tsohon Nuru	Digire	<Null>	Residential	Undeveloped
2	Ngstb/1P2	Ahaji Kyari	3473.8	12°53'7.21"N	10°27'8.25"E	Digire Tsohon Nuru Ward	Driving	M	35Years	Nuru	Yobe	Nigerian	Tsohon Nuru	Digire	<Null>	Residential	Developed

Table 5 above and table 6 below give the details of the owners and parcel information.

Table 6: Attribute Table for Talbari block 1

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	
1	Id	Parcel Id	Name	Area in sqm	Northing	Easting	Address	Occupation	Sex	DOB	POB	State	Nationality	Ward	District	Street	Use	Present Status
2	1	Ngst/b2/P1	Alhaji Sa'adu	12518.4	12°53'8.82"N	10°27'9.98"E	Talbari Tsohon Nguru Ward	Business	M		Nguru	Yobe	Nigerian	Tsohon Nguru	Talbari		Residential	Developed
3	2	Ngst/b2/P2	Musa Kachallah	3241.8	12°53'9.54"N	10°27'9.94"E	Talbari Tsohon Nguru Ward	Farming	M	80Years	Nguru	Yobe	Nigerian	Tsohon Nguru	Talbari		Residential	Developed
4	3	Ngst/b2/P3	Mal Lawan Abba Shetima	1642.6	12°53'10.14"N	10°27'10.28"E	Talbari Tsohon Nguru Ward	Civil Servant	M		Nguru	Yobe	Nigerian	Tsohon Nguru	Talbari		Residential	Developed
5	4	Ngst/b2/P4	Mala Kwalemani	8413	12°53'9.66"N	10°27'10.80"E	Talbari Tsohon Nguru Ward	Farming	M		Nguru	Yobe	Nigerian	Tsohon Nguru	Talbari		Residential	Developed
6	5	Ngst/b2/P5	Adamu M. Uba	4156.7	12°53'10.21"N	10°27'11.39"E	Talbari Tsohon Nguru Ward	Thining	M	45Years	Nguru	Yobe	Nigerian	Tsohon Nguru	Talbari		Residential	Developed
7	6	Ngst/b2/P6	Mal Habu	3331.7	12°53'9.46"N	10°27'11.47"E	Talbari Tsohon Nguru Ward	Capentary	M	65Years	Nguru	Yobe	Nigerian	Tsohon Nguru	Talbari		Residential	Developed
8	7	Ngst/b2/P7		4215	12°53'9.08"N	10°27'11.43"E	Talbari Tsohon Nguru Ward				Nguru	Yobe	Nigerian	Tsohon Nguru	Talbari		Residential	Developed
9	8	Ngst/b2/P8		2791.1	12°53'8.95"N	10°27'10.90"E	Talbari Tsohon Nguru Ward				Nguru	Yobe	Nigerian	Tsohon Nguru	Talbari		Residential	Developed
10	9	Ngst/b2/P9	Mallam M. Isiyaka	2291.4	12°53'8.52"N	10°27'10.71"E	Talbari Tsohon Nguru Ward	Business	M		Nguru	Yobe	Nigerian	Tsohon Nguru	Talbari		Residential	Developed
11	10	Ngst/b2/P10	Abdullahi Jajerima	4041.1	12°53'8.58"N	10°27'11.24"E	Talbari Tsohon Nguru Ward	Farming	M	55Years	Nguru	Yobe	Nigerian	Tsohon Nguru	Talbari		Residential	Developed
12	11	Ngst/b2/P11	Ibrahim Suleiman	5426.4	12°53'8.09"N	10°27'10.83"E	Talbari Tsohon Nguru Ward	Civil Servant	M	1967	Nguru	Yobe	Nigerian	Tsohon Nguru	Talbari		Residential	Developed
13	12	Ngst/b2/P12	Mal Abdurrahman Suleiman	5539	12°53'8.01"N	10°27'11.33"E	Talbari Tsohon Nguru Ward	Teaching	M	60Years	Nguru	Yobe	Nigerian	Tsohon Nguru	Talbari		Residential	Developed
14	13	Ngst/b2/P13	Hajija Amina	3307.7	12°53'7.67"N	10°27'11.55"E	Talbari Tsohon Nguru Ward	Housewife	F	1963	Nguru	Yobe	Nigerian	Tsohon Nguru	Talbari		Residential	Developed
15	14	Ngst/b2/P14	Hajija Die	4092.1	12°53'7.51"N	10°27'11.01"E	Talbari Tsohon Nguru Ward	Housewife	F	1960	Nguru	Yobe	Nigerian	Tsohon Nguru	Talbari		Residential	Developed
16	15	Ngst/b2/P15	Yagana Hussaini Talbari	5396.8	12°53'7.23"N	10°27'11.49"E	Talbari Tsohon Nguru Ward	Housewife	F	1970	Nguru	Yobe	Nigerian	Tsohon Nguru	Talbari		Residential	Developed
17	16	Ngst/b2/P16	Ya Tingiri	2090.5	12°53'7.16"N	10°27'11.06"E	Talbari Tsohon Nguru Ward	Housewife	F	1967	Nguru	Yobe	Nigerian	Tsohon Nguru	Talbari		Residential	Developed
18	17	Ngst/b2/P17	Yabiba	2442.9	12°53'7.29"N	10°27'10.73"E	Talbari Tsohon Nguru Ward	Housewife	F	1968	Nguru	Yobe	Nigerian	Tsohon Nguru	Talbari		Residential	Developed
19	18	Ngst/b2/P18	Talbari Mosque	2751.1	12°53'7.18"N	10°27'10.40"E	Talbari Tsohon Nguru Ward				Nguru	Yobe	Nigerian	Tsohon Nguru	Talbari		Religious	Developed
20	19	Ngst/b2/P19	Ibrahim Suleiman	1931	12°53'7.46"N	10°27'10.28"E	Talbari Tsohon Nguru Ward	Business	M		Nguru	Yobe	Nigerian	Tsohon Nguru	Talbari		Residential	Developed
21	20	Ngst/b2/P20	Mal Ibrahim Ali	3320.8	12°53'7.83"N	10°27'10.28"E	Talbari Tsohon Nguru Ward	Teaching	M	32Years	Nguru	Yobe	Nigerian	Tsohon Nguru	Talbari		Residential	Developed
22	21	Ngst/b2/P21	Goni Jeme's Family	5852.8	12°53'7.37"N	10°27'9.96"E	Talbari Tsohon Nguru Ward	Teaching	M	57Years	Nguru	Yobe	Nigerian	Tsohon Nguru	Talbari		Residential	Developed
23	22	Ngst/b2/P22	Mal Dodo	2128	12°53'8.02"N	10°27'10.03"E	Talbari Tsohon Nguru Ward	Business	M		Nguru	Yobe	Nigerian	Tsohon Nguru	Talbari		Residential	Developed
24	23	Ngst/b2/P23	Mal Ibrahim	3863.1	12°53'8.22"N	10°27'10.39"E	Talbari Tsohon Nguru Ward		M	50	Nguru	Yobe	Nigerian	Tsohon Nguru	Talbari		Residential	Developed

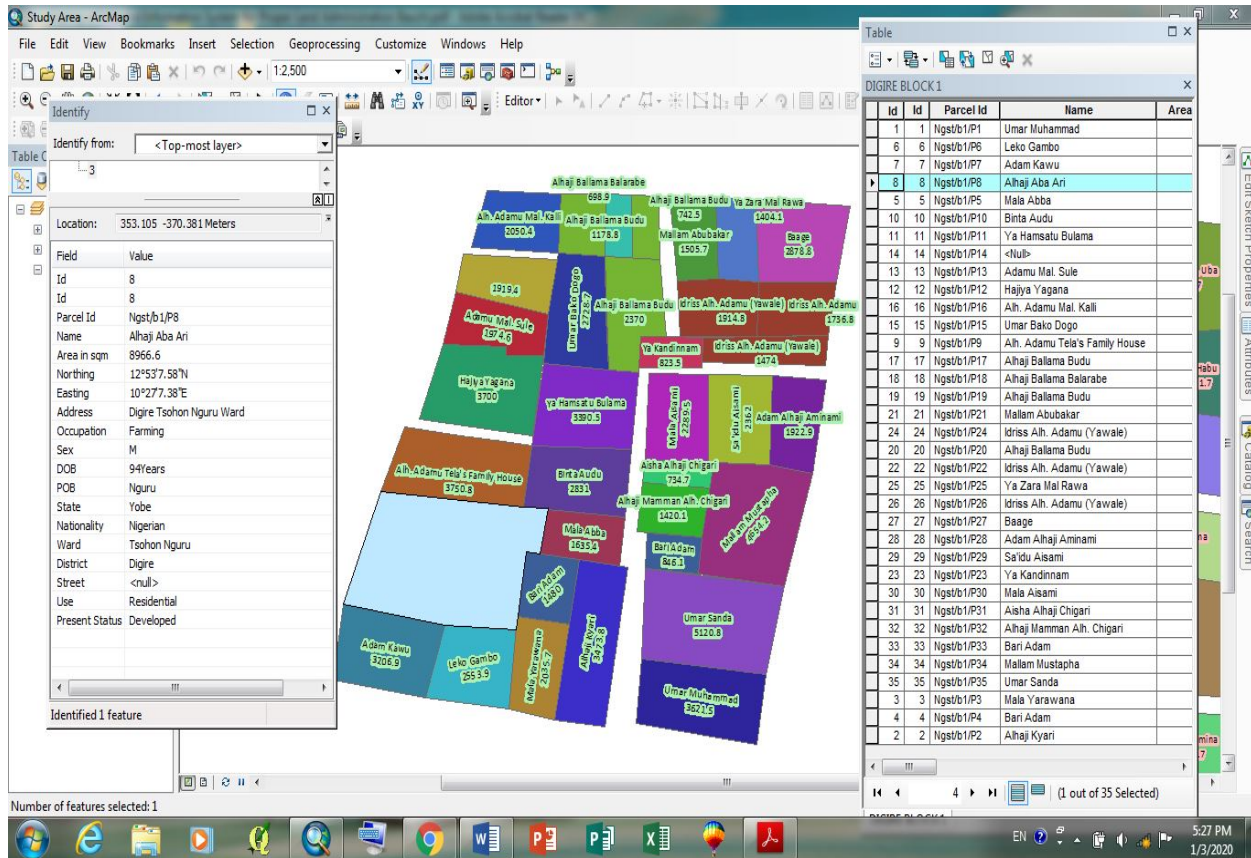


Figure 7: Query result showing details of parcel with ID (Ngts/b1/P8)

Figure 7 above gives the details of parcel with parcel ID Ngts/b1/P8 named Alhaji Aba Ari. This can easily be accessed through the use of the Identifier icon by clicking on the parcel; as you can see on the left hand side of the figure. The identifier gives all the information stored regarding the parcel. This information regarding each parcel can easily be

edited via the attribute table by removing it from the “join and relates” field, then edit in the excel environment and finally update it by rejoining it to the “join and relates” field. Another way of editing or updating a parcel information is through the “User Interface”. This will be discussed later in figure 9.

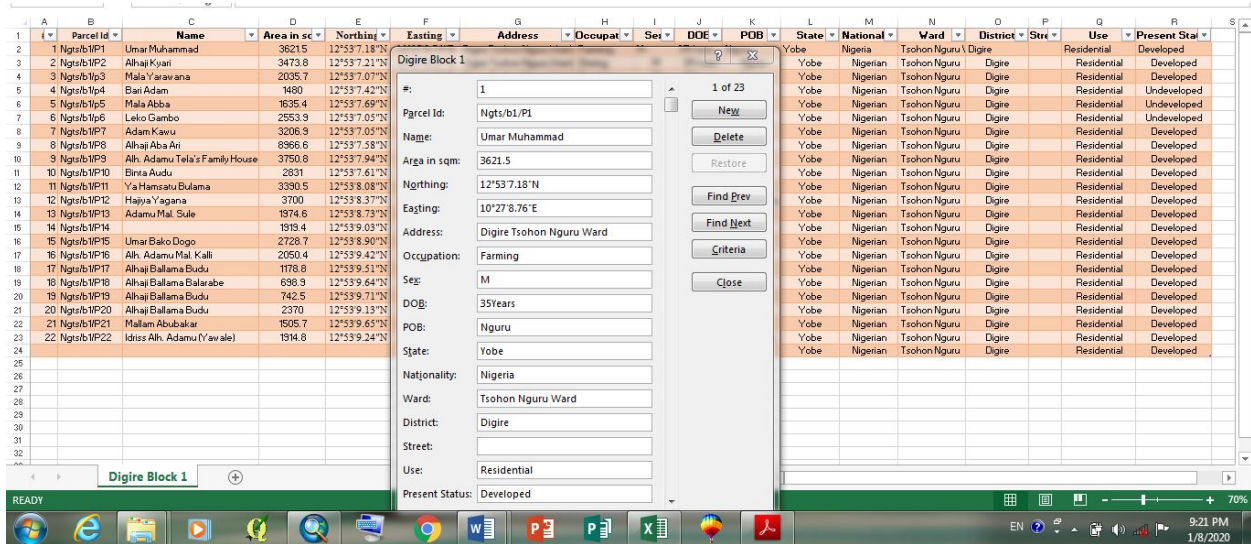


Figure 10: User Interface Showing parcel and owners information

The user interface in figure 10 above is the database entry form that generate all the information regarding the parcel and owners. All the fields require to enter the information are provided and can be transfer directly to the excel file for further processing. Data can easily be enter and by pressing enter key of “new” button on the interface it will automatically generate the next form for subsequent parcel. The data generated can later be attach to the parcels in the ArcGIS via “join and relates” field.

The interface has a “delete” button for removing any unwanted data from the database. The parcel can be selected and simply pressing delete to erase it out. On the event of mistake the “restore” button can be use. The “find previous” and “find next” buttons are searching buttons. The “criteria” button can be used to search for parcel or owners information by inserting the search item i.e. owners name, parcel id etc. Finally the “close” button is use to exit the form.

IV. RECOMMENDATIONS

For effective and efficient land management through the use of GIS, the following recommendations are necessary: -

- I. There is need for Yobe state government to established its Geographical Information System that will create a geospatial database for land management
- II. Adequate fund should be budgeted for the acquisition of the necessary hardware, software and other peripheral devices required for the successful establishment of the system
- III. Capacity training for staff members in the land registries and other professionals such as planners, estate managers, valuers, etc. that are directly and indirectly involved in the implementation of the new system.
- IV. Capacity training, orientations, workshops, seminars and certifications will also be required from time to

time to other personnel who are engaged in land transactions such as property dealers, land owners, village/ward heads, stewards or brokers etc.

- V. The property dealers and land brokers should be registered with the relevant authorities. And such persons should pay an annual tax and vat on every transaction.
- VI. There is the need for an enlightenment campaign to the general public on the relevance of this GIS system and its benefits in reducing land disputes.
- VII. It is also recommended to issue right of ownership certificate (C of O) to all the developed parcels within the existing area which have been documented in the GIS database; this will authenticate and guarantee tenure security and transparency among land owners as well as sanitised the system of land transactions in the future.
- VIII. It is recommended to rescue the large amount of valuable data such as hard copy maps, plans and other related data that are slowly decaying in offices into the GIS database.
 - I. To be build much trust and confidence and to avoid forging of illegal document in land transactions, it should be made mandatory to every potential buyer and seller of land to authenticate from the GIS office whether the parcel is genuine and free from stains.
 - II. All land brokers and anyone who contract in the name of land should pay for authentication of parcel from the GIS office. This will generate revenue to the office.
 - III. Similarly after every transactions of land, those concern should update such information from the GIS office so as to effect such changes of ownership into the database. And such updates should attract charges for revenue purpose.

V. CONCLUSION

This studies revealed that the application of GIS into LIS is an effective and efficient tool for land management. The current system or manual record can no longer phase with the contemporary system of information. The user interface can capture and digitised large amount of data within a short period of time; thus it is timely, reliable, simple, user friendly and easy to update.

The database syndicated the spatial (parcel information, owner's details and ownership record) non-spatial data via the join and relate field. For the state to achieve a sustainable development that will guarantee the security of tenure, reduce land dispute, organised land market and increase revenue generation; the adoption of GIS database is necessary.

REFERENCES

- [1] Akeh, G. I., & Mshelia, A. D. (2016). *The role of geographic information system in urban land administration in Nigeria*. 1(1), 16–20. <https://doi.org/10.15406/mojes.2016.01.00004>
- [2] Obayomi Abiola Benjamin: *The Need for Computerization of Land Information Systems in Nigeria*
- [3] Pindiga &Orisakwe, 2013. (2013). *Development of a Land Information System of Tumpure Residential and Commercial Layout in Akko Local Government Area of Gombe State*.
- [4] Musa, B., Umaru, W., Polytechnic, F., & State, K. (2016). *Developing a Cadastral Information System for Proper Land Administration in Tudun Salmanu Area of Bauchi Metropolis , Bauchi State , Nigeria*. 10(1), 76–86.
- [5] Usman, B., & Sc, M. (2013). *Cadastral Information System for Title Management in Nigeria . Cadastral Information System for Title Management in Nigeria .December*.
- [6] Williamson, I. P. (n.d.). *The Role of Land and Geographic Information Systems In Economic and Environmental Management*.
- [7] Yusuf Y. D (2009). *Property Law Practice in Nigeria*. Nigeria: Jos University Press Limited.