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Urban Growth and Landuse Cover Change in Nigeria using GIS and Remote Sensing Applications. Case Study of Suleja L.G.A., Niger State.

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Abstract **- Urbanization is among the problems confronting most cities of the world which is attributed to rapid settlements expansion and population growth. The contemporary issues of urbanization are common in the developing countries where development goes ahead of urban planning. Geographic Information System (GIS) and Remote Sensing Applications was used and three set of Landsat high resolution imageries were captured at different time interval (1980, 2000 and 2015)and projection of the Suleja Local Government Area (L.G.A) for both the landuse and the population was made for 2035. However the study monitored the landuse changes with focus on built-up (settlements) growth in Suleja L.G.A to detect and estimate the rate of changes over the periods. The proximity of Abuja the Federal Capital Territory also contributed to the speedy growth of Suleja L.G.A. The study revealed that built-up increased from 650.60Ha 5% (1980) to 3061.13Ha 26% (2015) with an increase to 4637.49Ha 39% (2035 projection) along with the projected population from 116,358 (1980) to 441,955 (2035). The settlement (built-up) increase has encroached into the vegetation and agricultural landuse which is decreasing due to growth in population, constructions and other human needs. The effects are unplanned settlements, slums, social vices and decreasing biodiversity and agricultural land among others. There is the need for Niger State Government and Suleja Local Government to take proactive measures to address the future scenario when preparing the new Suleja Master Plan that will replace the old 1978 Master Plan. The information obtained from the study will be useful to researchers, institutions and policy makers.**

Keywords: GIS and Remote Sensing, Settlement Growth, Landuse Change, Master Plan.

1.0 INTRODUCTION

Globally most of the land cover have lost their natural state, as most the landscapes have been altered by anthropogenic activities. The Earth surface is being significantly altered in some manner by man's presence on the Earth and his activities has created a profound effect on the natural environment thus resulting into an accelerated growth in settlements expansion, Riebsame (1994). Viewing the Earth from space is now very crucial to the understanding of the influence of man's activities on the earth over time. In situations of rapid and often unrecorded growth in settlement, observations of the earth from space provide objective information of human utilization of the landscape, Bankole (2011). Over the past years, data from Earth sensing satellites has become vital in mapping the Earth's features and infrastructures, managing natural resources and studying environmental change, Bankole (2011).

Land is becoming a scarce resource due to immense agricultural, city growth (settlements expansion) and demographic pressure on land. The information on landuse / landcover change and possibilities for their optimal use is essential for research, planning and implementation of landuse schemes to meet the increasing demands for basic human needs, welfare and sustainable development. This information also assists in monitoring the dynamics of landuse caused by changing demands of increasing population. The collection of remotely sensed data facilitates the synoptic analyses of Earth - system function, patterning, and changes at local, regional and global scales, over time. Such data also provide an important link between intensive, localized ecological research, regional, national and international conservation / management of biological diversity (Wilkie and Finn, 1996). Landuse, land cover and its pattern of change is a major element that is very important in the history of global expansion and landuse cover change (LUCC) with its impacts on the environment has been one of the increasing focus of global changes (Chase et al., 2000). However, expansion of human settlements and its accompanying activities, especially the rapid urbanization occurring in the developing countries played an important role in global landuse cover change, causing changes in the ecological processes at both local and global scales.

Urbanization has created adverse effects on the land such as loss of vegetation and agricultural land due to rapid population increase and migration leading to settlement growth with people competing for limited available land and other resources. Urbanization enhances the erection of substandard and illegal houses, overcrowding, unplanned settlement and slums with unpleasant living environment. Urban centres in developing countries particularly Nigeria

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is faced with similar urbanization problems, such as congestion, overcrowding, building collapse, poor drainage system, illegal construction, social vices, juvenile delinquency, slums and of utmost importance is the lack of comprehensive planning. Suleja the study area in Niger State is faced with similar problems.

Studies have shown that Suleja L.G.A, has witnessed remarkable expansion, growth and developmental activities due to its proximity to Abuja the Federal Capital Territory (FCT) of Nigeria. The relocation of the FCT from Lagos to Abuja in 1991had lead to massive movement of people from other parts of the country to settle at the suburbs of the FCT, due to high cost of accommodation within the Abuja City. Suleja had witnessed large influx of people from some demolished areas within the FCT and people from the North-Eastern part of the Nigeria who left their state due to terrorism or insurgencies. Suleja is a town serving as residence to people working in Abuja and other neighbouring towns of the metropolitan. According to His Royal Highness, the Emir of Zazzau Suleja Malam Muhammadu Auwal Ibrahim who said "whenever Abuja sneezes Suleja catches cold", the accumulated problems in Suleja arose from immigration to Suleja since 30years ago. That there is the need to produce new master plan for Suleja to replace the old designs that had already been overtaken by the rapid development of the towns. (http://en.afrikinfos.com.).

According to Meyer (1995), the ability to forecast landuse / land cover change and ultimately, to predict the consequences of change, will depend on our ability to document and understand the past drivers of landuse / land cover change. Historical land use and cover change has occurred primarily in response to population growth, technological advancement, economic opportunities and public policy. However, this study attempts to access how landuse changes over time with the aid of GIS and Remote Sensing Applications and make attempt to predict the possible changes that may occur in the future. It is therefore essential to know how fast is the rate of development in order to establish the rate of urban growth in Suleja using GIS and Remote Sensing Applications. The data obtained will help the city planners, researchers, policy/ decision makers in administrative and infrastructural planning for the achievement of sustainable living environment in Suleja Local Government Area.

1.1 Aim and objectives of the study

The aim is to monitor the trend of urban growth /landuse change in Suleja L.G.A between 1980, 2000, 2015 using GIS and Remote Sensing Applications and make projection on the population and landuse. The specific objectives are to:

i. Examine the socio-cultural dynamics responsible for urbanization in Suleja L.G.A.
ii. Determine the settlement growth and rates of land use change in Suleja from 1980 – 2015.
iii. Examine the spatial extent and rate of Landuse Change in Suleja.
iv. Project the population and possible landuse change for the next twenty (20) years.
v. Make recommendation for sustainable development of Suleja L.G.A.

1.2 The use of GIS/ Remote Sensing and Other Researchers Focus

Remote sensing has an important contribution in documenting the actual change in land use/land cover on regional and global scales from the mid-1970s (Lambin et al., 2003). Land use/cover change detection is very essential for better understanding of landscape dynamic within a known period of time for sustainable environmental management. Land use and land cover change has been recognized as an important driver of environmental change on all spatial and temporal scales (Tansey and Millington, 2006), as well as emerging as a key environmental issue on a regional scale. Studies have been carried out using GIS and Remote Sensing to establish the rates of landuse / land cover change and urban growth over the periods in Nigeria and other parts of the world by different scholars of higher institutions.

Conventional ground methods of land use mapping are labour intensive, time consuming and are done relatively. These maps soon become outdated with the passage of time, particularly in a rapid changing environment. Monitoring changes and time series analysis is quite difficult with traditional method of surveying, Olorunfemi (1983). Hence, in order to effectively monitor settlement growth, it is not only necessary to have the information on existing landuse land cover but also the capability to monitor the dynamics of landuse, due to changing demands of increasing population and forces of nature changing the landscape. The techniques of observing change detection with satellite imageries have become numerous as a result of increasing versatility in manipulating digital data and increasing computer power, Zubair (2006). Research on this subject shows the rates of changes over time and consequences of rapid urbanization in cities. The accuracy and quality of the study depends on the tools/applications used and the time frame of data acquisition for better presentation.

Other Researchers and Scholars have different focus using the same GIS and Remote Sensing Applications and tools. Arvind and Nathawat (2006) carried out a study on landuse land cover mapping of Panchkula, Ambala and Yamunanger districts, Hangana State in India and observed that landuse/ land cover pattern in the area are generally controlled by agro – climatic conditions in the districts. Ikusemoran and Olokor (2013), carried out a study on Monitoring the land-use and vegetation cover changes in the Kainji Lake Basin, Nigeria (1975-2006) and revealed that the Lake Reservoir and settlements around the lake were gradually increasing along with intensive agriculture capturing the basin at alarming rate. Yohanna et al. (2015), carried out a study on Landuse / landcover change detection of Mubi Metropolis, Adamawa State, and observed physical changes with urban sprawl encroaching into agricultural land. Sunday and Umar (2013) carried out

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similar study on Spatiotemporal Analyes of Land Use and Land Cover Changes in Suleja L.G.A, Niger State, Nigeria within the period of (1987 – 2012) and revealed the rates of changes, which urbanization is largely responsible for the landuse changes. However, the paper formed the basis for this study, but there was no thorough assessment on the population growth changes over the periods and there was an issue on the actual position of Suleja L.G.A delineated boundary. (figure 3.3, 4.1,4.2, 4.3 and 4.4).
However, this paper has its main focus on settlements growth (built-up) in the general landuse of Suleja Local Government Area along with the population growth between (1980 – 2015). In addition, future projection for the population/ landuse changes was made for the next twenty (20) years 2035. The urbanization and unplanned growth of Suleja L.G.A requires more informed physical planning strategies and recommendation for sustainability.

2.0 CONCEPT OF THE STUDY

2.1 Land Cover Changes

Land cover changes may occur due to various factors, which may be broadly divided into natural and human induced or anthropogenic causes. United States Environmental Protection Agency (EPA, 1999 report), identified the general causes of land use and land cover changes, which are: (1) natural processes, such as climate and atmospheric changes, wildfire, and pest infestation; (2) direct effects of human activity, such as deforestation and road-building; and (3) indirect effects of human activity, such as water diversion leading to lowering of the water table. Even though, natural processes may also contribute to changes in land cover, the major driving force is human induced land uses (Allen and Barnes, 1985). These human induced causes of land cover change, which are critical and currently increasing in alarming rate; and can be categorized into two broad divisions: proximate and driving causes. The proximate causes are causes which results immediate land cover change; while driving causes are causes which drives behind the immediate causes.

2.2 Urbanization

Urbanization is a population shift from rural to urban areas, "the gradual increase in the proportion of people living in urban areas", and the ways in which each society adapts to the change. It is predominantly the process by which towns and cities are formed and become larger as more people begin living and working in central areas. Urbanization is therefore regarded as a major driving factor of land use changes. It is therefore referred to as a transformation process from a traditional agricultural society to a modern metropolitan society, associated with major changes in social and economic structures. As an important component of land use and land cover change, its significance will undoubtedly continue to increase as the majority of the world's population is swarming into cities (Ottensmann, 1977; Zhao et al., 2002).The United Nations predicted that by 2050 about 64% of the developing world and 86% of the developed world will be urbanized. That is equivalent to approximately 3 billion urbanites by 2050, much of which will occur in Africa and Asia. Notably, the United Nations has also recently projected that nearly all global population growth from 2016 to 2030 will be absorbed by cities, about 1.1 billion new urbanites over the next 14 years. (https://en.wikipedia.org/wiki/Urbanization).

2.3 Population increase and natural resources

Malthus had long hypothesised that populations growing exponentially would takeover food production growing linearly. This scenario of arithmetic food growth with simultaneous geometric human population growth predicted a future when humans would have no resources to survive on. To avoid such a catastrophe, Malthus urged controls on population growth and considered that the population increase should be kept down to the level at which it could be supported by the operation of various checks on population growth, which he categorized as "preventive" and "positive" checks. Malthus strongly opposed birth control within marriage and did not suggest that parents should try to restrict the number of children born. Malthus was clearly aware that problems might arise from the postponement of marriage to a later date, such as an increase in the number of illegitimate births, but considered that these problems were likely to be less serious than those caused by a continuation of rapid population increase. He saw positive checks to population growth as being any causes that contributed to the shortening of human lifespan. He included in this category poor living and working conditions which might give rise to low resistance to disease, as well as more obvious factors such as disease itself, war, and famine. Malthus (1798).

On the other hand, Karl Marx (1818-1883) the Father of Communism, opposed and criticized the Malthusian theory of population. According to Marx, population increase must be interpreted in the context of the capitalistic economic system. A capitalist gives to labor as wage a small share of labor's productivity, and the capitalist himself takes the lion's share. The capitalist introduces more and more machinery and thus increases the surplus value of labor's productivity, which is pocketed by the capitalist. The surplus is the difference between labor's productivity and the wage level. A worker is paid less than the value of his productivity. When machinery is introduced, unemployment increases and, consequently, a reserve army of labor is created. Under these situations, the wage level goes down further, the poor parents cannot properly rear their children and a large part of the population becomes virtually surplus. Poverty, hunger and other social ills are the result of socially unjust practices associated with capitalism. Population growth, according to Marx, is therefore not related to the alleged ignorance or moral inferiority of the poor, but is a consequence of the capitalist economic system. Marx points out that landlordism, unfavorable and high man-land ratio, uncertainty regarding land tenure system and the like are responsible for low food production in a country.(cgge.aag.org/).
Boserup (1965, 1981) hypothesized that increasing population pressure will lead to adjustments in production and hence the quality and productivity of the land

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improves. This has been true because agricultural production managed to outpace population growth due to green revolution, which allowed for a much increased productivity. Hence, growth in agricultural production exceeded population growth for almost three decades (Squire, 2000). In any case, population growth has an important influence on land use, even though other influences, such as increased per capita income, governmental policies and instabilities, technological change, national and international markets for goods and agricultural products, are also likely to play key roles in land use changes. The direct impact of population growth is increased consumption of resources which would lead to increased demand for food and shelter and necessitate more intensive use of agricultural land.

3.0 THE STUDY AREA AND METHODOLOGY

3.1 The Study Area

Niger State was created by the Late Head of State General Murtala Ramat Mohammed on 3rd February, 1976 from the defunct North-Western State of Nigeria with eight Local Government Areas. The State presently has twenty five Local Government Area including Suleja L.G.A. Suleja L.G.A was established by the Local Government reform of 1976 from the defunct Abuja native authority. Suleja lies between Latitude 9º12′1.17″ N and Longitude 7º10′20.25″ E of WGS84. It shares boundary with Gurara to the North-West, Tafa to the East in Niger State and Gwagwalada, Zuba to the south, in Federal Capital Territory. Suleja is about 20km North of Abuja the Federal Capital of Nigeria and about 100km North East of Minna the State Capital of Niger State. (Aminu, et al., 2013). Suleja has about ten (10) Wards within the Local Government Area namely; Bagama 'A', .Bagama 'B', Magajiya, Iku South I, Iku South II, Hashimi 'A', Hashimi 'B', Maje, Kurmin Sarki and Wambai. According to 2006 provisional population census, Suleja Local Government has a population of 216,578 and covers a land mass area of 118,910 Sq.km with 2,142 Density/Square Kilometer (Niger State Facts and Figures, 2011). (figure 3.1, 3.2, 3.3 and 3.4).

The area has gentle rock and the soils are derived from geological parent materials developed on sand stone formations. The soils are usually deep, red and enriched with clay sub-soil. Suleja has tropical climate and summers are much rainier than the winters in Suleja. The average annual temperature is 26.3 °C and the average rainfall is 1328 mm. The driest month is December. The highest precipitation occurs in September, with an average of 272 mm. March is the warmest month of the year with average temperature of 29.0 °C. The lowest average temperature is in August, at 24.5 °C. (http://en.climate-data.org/location/31737/).

Latitude 10º 00′ N, Longitude 8º 00′ E Source: United Nations, 2015

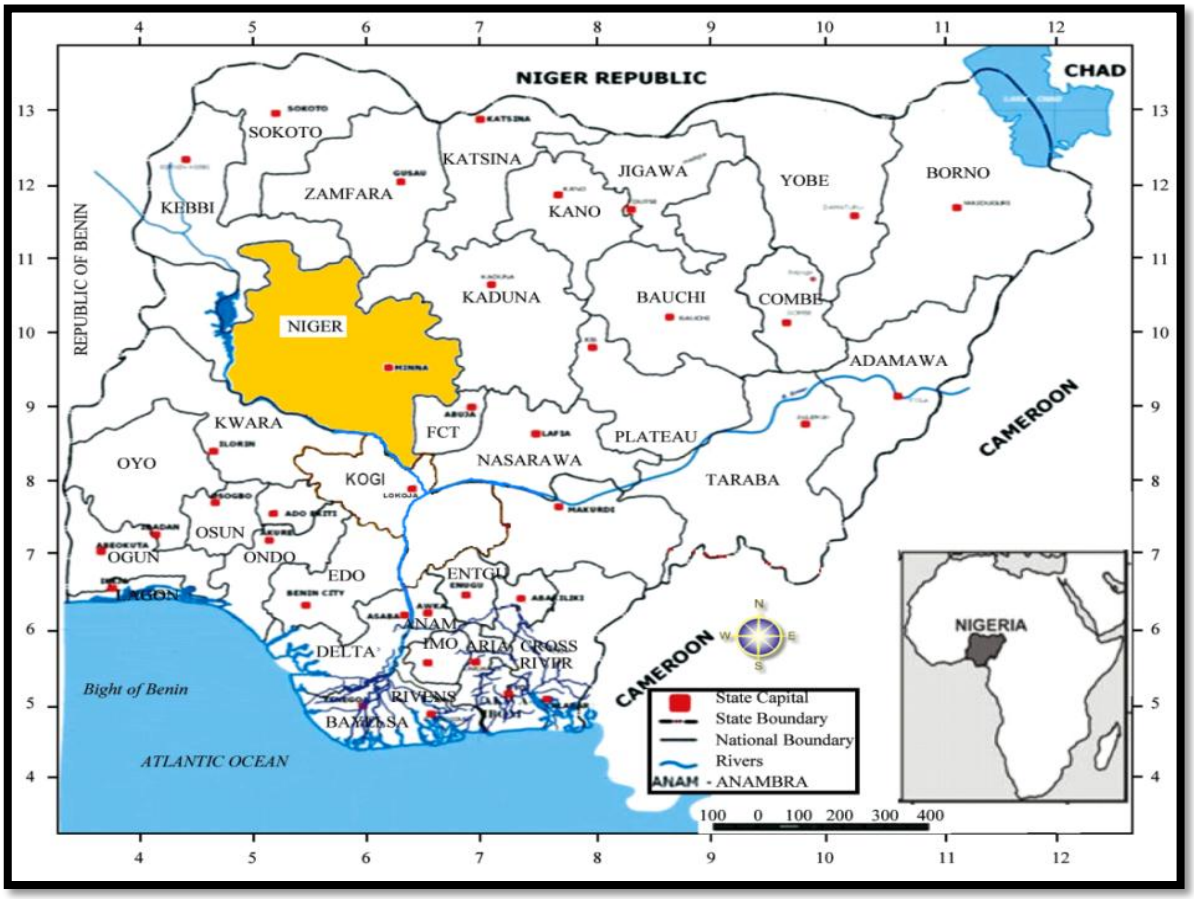

Figure 3.1 Nigeria showing Niger State

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3.1.1 History of Suleja

Suleja is a city in Niger State but it is sometimes confused with the nearby city of Abuja. Suleja was formally called Abuja, before the Nigerian Government adopted the name for its new Federal Capital in 1976. The name was adopted during the reign of the late Emir Sulaiman Barau who was a descendant of Abuja (the first person to establish Abuja), that was driven from Zaria, by Sheik Usman Fodio during the Hausa/Fulani jihad. The Suleja community decided to use the name of the late Emir Suleiman Barau, Sule (shortened from Suleiman) and Ja (fair complexioned). The town became known as Suleja and Abuja means the fair complexioned. However, two third of the Federal capital Territory was formally Suleja land including Kwali and Gwagwalada. The Suleja L.G.A has different ethnic groups such as the Nupe, Gbagyi, Hausa, Fulani, Kanuri, Jikun, Birom, Eggon, Mada, Tiv, Idoma, Igala, Boju, Michika, chibok, Yoruba, and Igbos. Suleja is known as centre for traditional West African pottery, the famous Gbagyi pottery Ladi Kwali Pottery Centre, was established by Michael Cardew in 1950. Other activities in Suleja are cotton weaving/dyeing, mat making and farming remains the main occupation. (https://www.thenigerianvoice.com/thread/43229/69612/1).

3.1.2 Land Use of Suleja

The existing land use of the study area includes residential, commercial, recreational, Industrial, Agricultural and educational land uses. These land use types creates spatial imbalance due human needs. The relocation of the seat of Government from Lagos to Abuja in 1991, has led to the emergence of satellite towns such as Karu Urban Area, Suleja, Gwagwalada, Lugbe, Kuje and other smaller settlements. The influx of people to suleja leads to rapid construction of houses to accommodate people who commute to work in Abuja on daily basis. The ethnic culture of the people in Suleja L.G.A has influenced the types, pattern and design of housing construction.

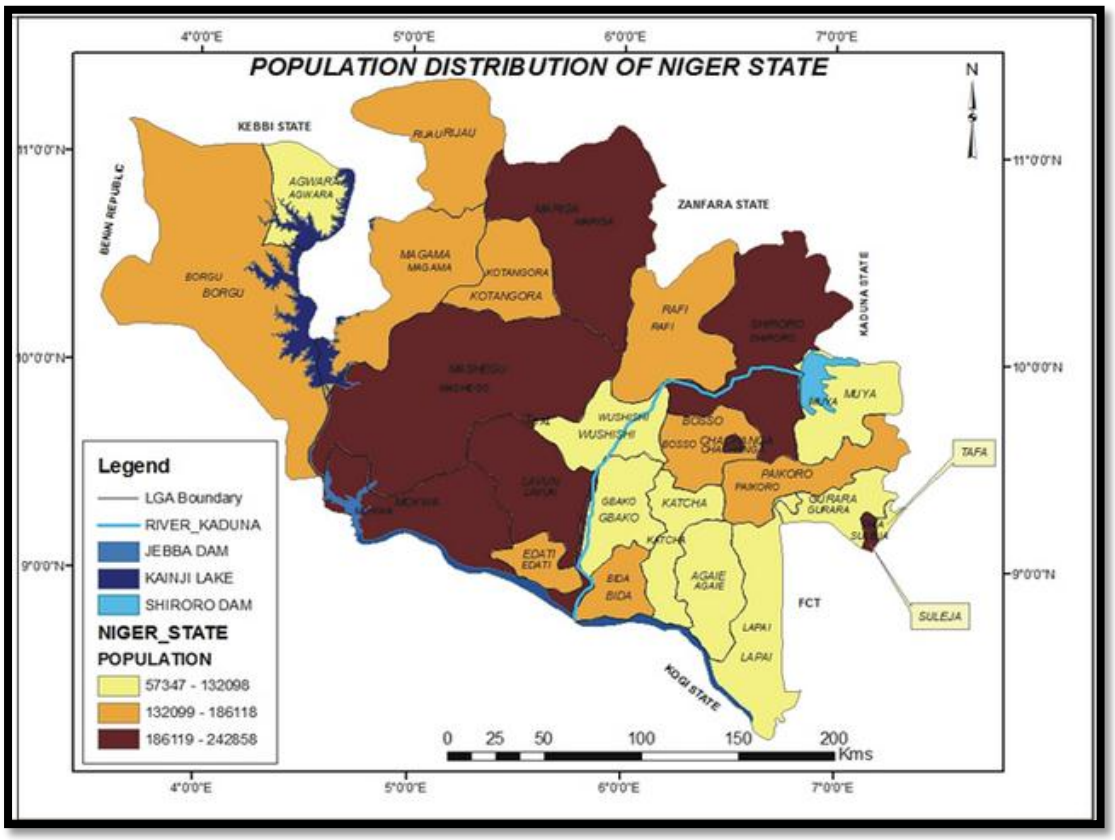

Figure 3.2 Niger State Population Distributions of the Local Governments.

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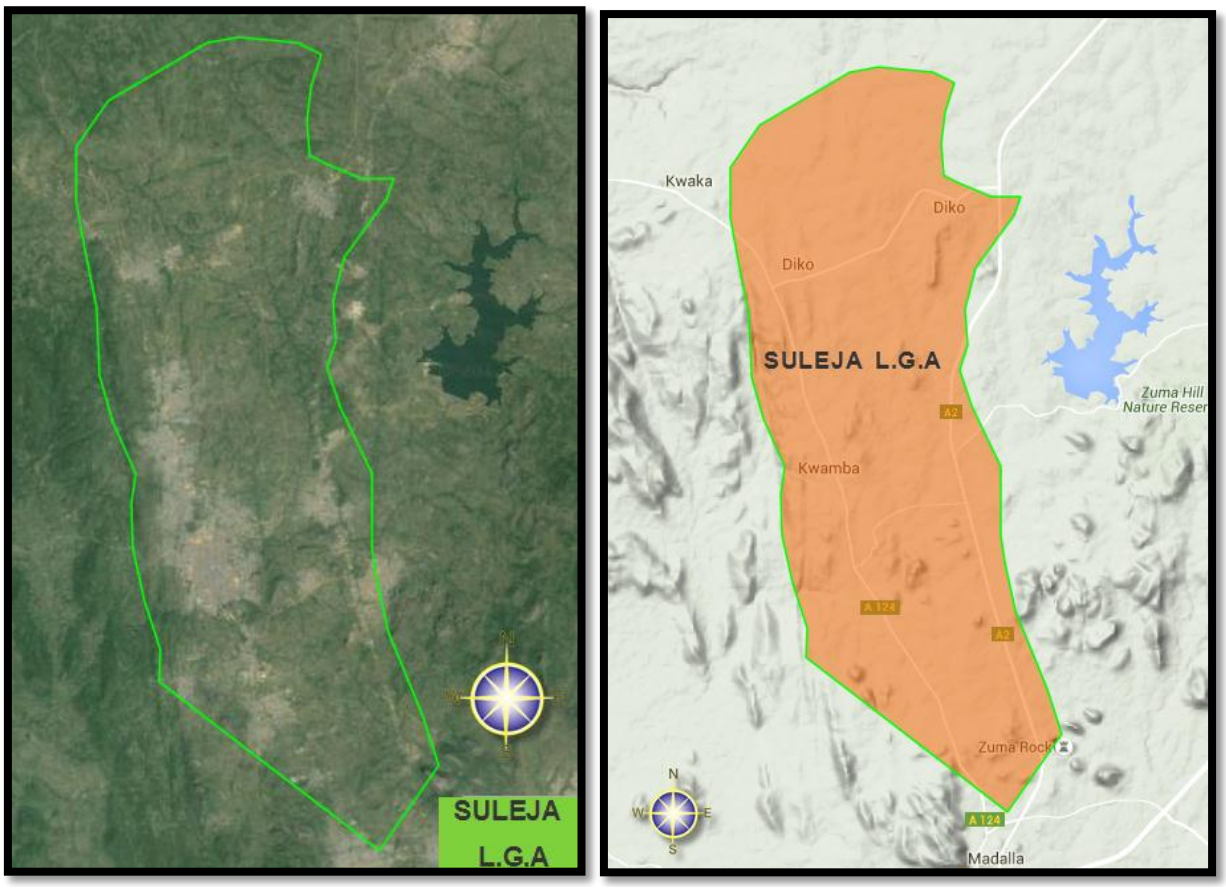

Figure 3.3 Suleja L.G.A Topo Map/ Satellite Imagery
Source: SALB,2009/UNOCHA/ROWCA,2012.(Google Map Data 2015)

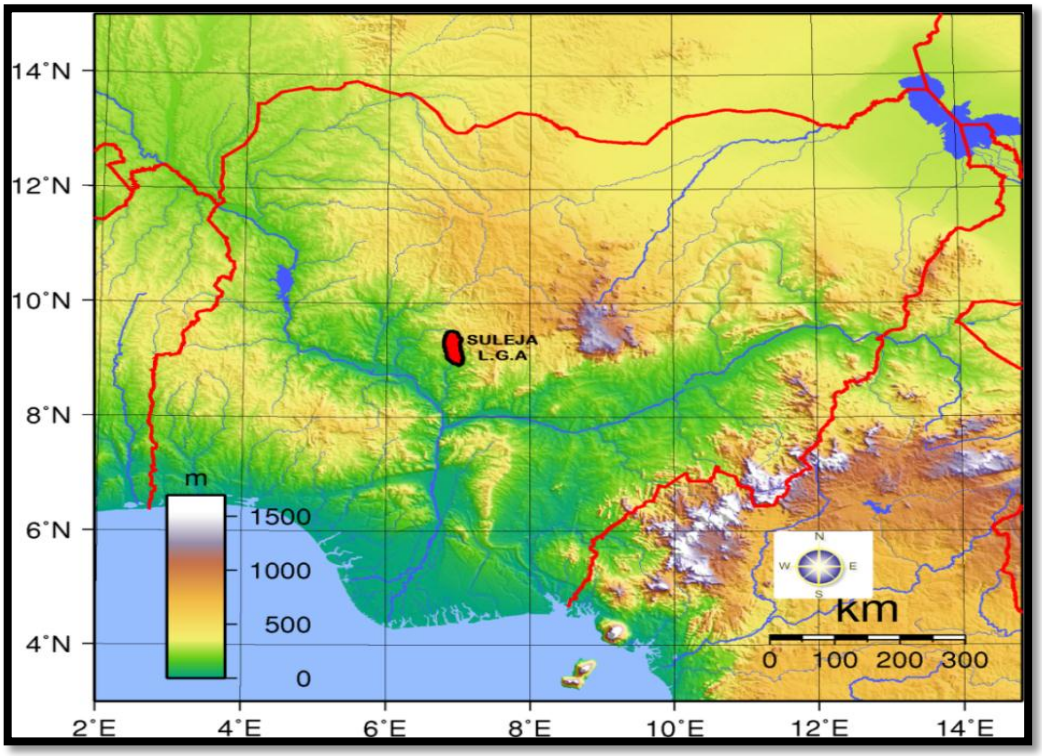

Figure 3.4 Topographic Map of Nigeria showing Suleja L.G.A Source: Google map, 2015

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3.2 Methodology of the Study

3.2.1 The Primary Sources of Data:

Three sets of satellite raw imagery of Suleja for 1980, 2000 and 2015were acquired and used in the analyses. The Land-sat Thematic Mapper (TM) for 1980, Land-sat 7 for the imagery of 2000 and Land-sat 8 for the imagery of 2015 each at 30 meter Resolution. Future projection for the settlement growth using Markov Model and population projection was made.

Table 3.1. Sources of data

Data type	Data Resolution	Date
Landsat TM	30 Meter Resolution	12/08/1980
Landsat 7	30 Meter Resolution	06/08/2000
Landsat 8	30 Meter Resolution	18/09/2015

Source: Center for Remote Sensing Jos (CRS) 2015

3.2.2 The Secondary Sources of Data:

The secondary sources involves review of literature, published/ unpublished dissertation, Journal publications, conference papers, Google earth, internet, population data, base maps and information from the Suleja Local Government.

3.2.3 Softwares Used for the Study

The software used for this study involves Global Positioning System (GPS), Geographic Information System and Remote Sensing Applications tools/ softwares such as ArcGis 10.0, ILWIS 9.3, ERDAS Imagine 9.1, IDRISI Andes, Global Mapper, Snagit 10.0, Microsoft word and Excel.

3.2.4 Data Presentation and Analyses

The data are presented in histograms, bar charts, pie charts, figures, plates, imageries and tables using descriptive method of statistics.

3.2.5 Population of Suleja L.G.A and Projection

The study involves the use of population data for 1996 NPC Population (167,420 Growth Rate 2.3%) as the base year population for year 2000 and population data for 2006 NPC Population (216,578 Growth Rate 2.49%) as the base year population for 2015 and subsequent population projection in Suleja L.G.A.

Geometric Population Projection Formula $P_2 = P_1 (1+r)^n$ (Source: Jennifer H. L.et al. 2007)

P_1 = Base Year Population, P_2 = Projected Population, r = Growth Rate, n = Number of Years

1. 1996 – 2000 PROJECTION (Using 1996 Base Year Population 167,420 NPC)

P_2= ?, P_1= 167,420, r = 2.3%, n = 4 years

$P_2 = 167,420 (1+2.3/100)^4$

P_2 = 183,362 People for year 2000

2. 2006 – 2015 PROJECTION (Using 2006 Base Year Population 216,578 NPC)

P_2=?, P_1= 216, 578 r = 2.49%, n = 9 years

P_2 = 270, 239 People for year 2015

3. 2015 – 2035 PROJECTION (Using 2015 Calculated Projection 270, 239)

P_2=?, P_1= 270, 239 r = 2.49%, n = 20 years

P_2 = 441,954.8 People for year 2035

OR

2006 – 2035 PROJECTION (Using 2006 Calculated Projection 216, 578)

P_2= ?, P_1= 216, 578 r = 2.49%, n = 29 years

P_2 = 441,954.5 People for year 2035, Projected Population FOR 2035 = 441, 955 approximately

4. Population Regression from 1996 – 1980 (Using 1996 Base Year Population 167,420 NPC)

$P_2 = P_1 (1+r)^n$ P_2= 167,420 P_1= ?, r = 2.3%, n = 16 years

$167,420 = P_1 (1+2.3/100)^{16}$

$P_1 = 167,420 / (1.023)^{16}$

P_1 = 116,358 People for year 1980

4.0 RESULT AND DISCUSSION

The three set of imageries for 1980, 2000 and 2015 were used and analyzed using time series analysis to establish the rate of landuse changes over time in Suleja L.G.A. CA Markov Model was used for the future projection of land use change for 2035.

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4.2 Landuse of Suleja L.G.A (1980 – 2015 and 2035 Projection)

4.2.1 Suleja Landuse in 1980

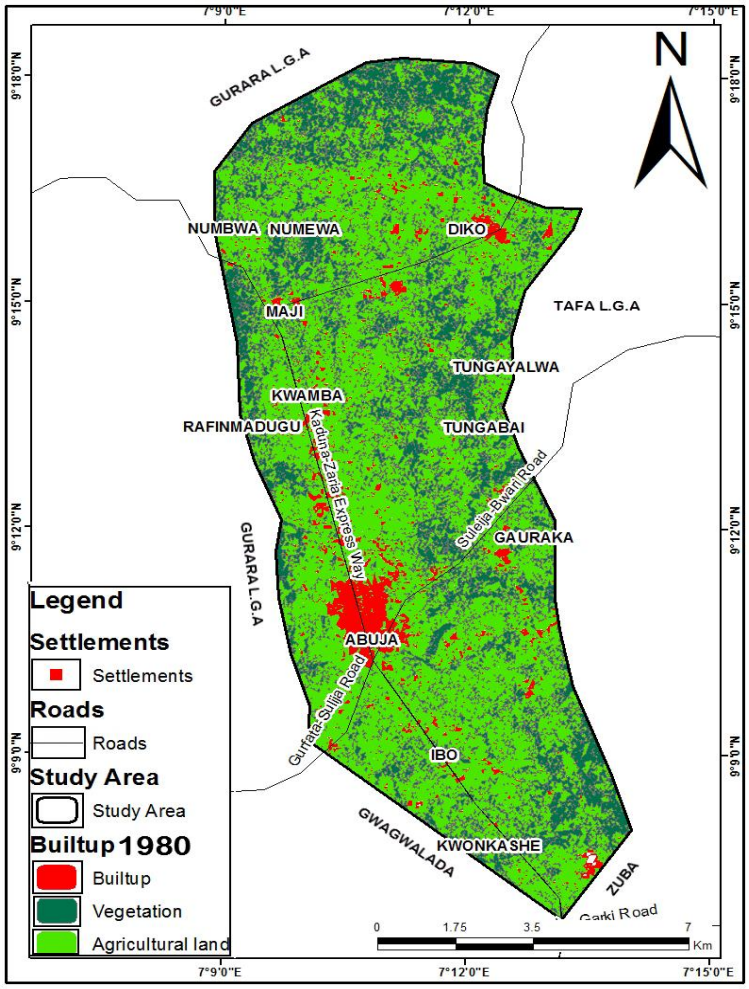

Figure 4.1: Land use / Cover 1980 Source: CRS Jos

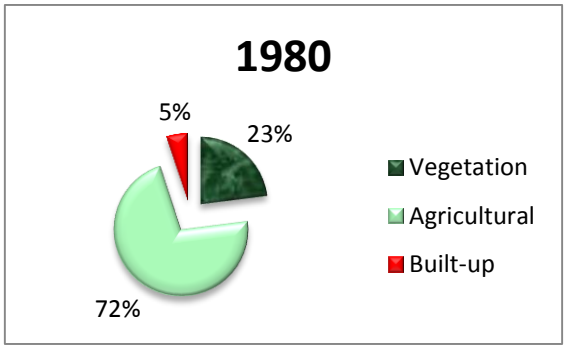

Figure 4.2: Landuse Analysis of Suleja L.G.A in 1980

The landuse of Suleja within the period 1980 had agricultural landuse covering 72% of the whole Local Government with 23% vegetation covering the area. The built-up was low at 5% because of the little population in the scanty settlements at that time. The people residing in the area were mainly the first settlers' or indigenes whose main occupation was farming as a means of livelihood. The main settlement was Abuja town before it was changed to suleja town (figure 4.1 and 4.2).

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4.2.2 Suleja Landuse in 2000

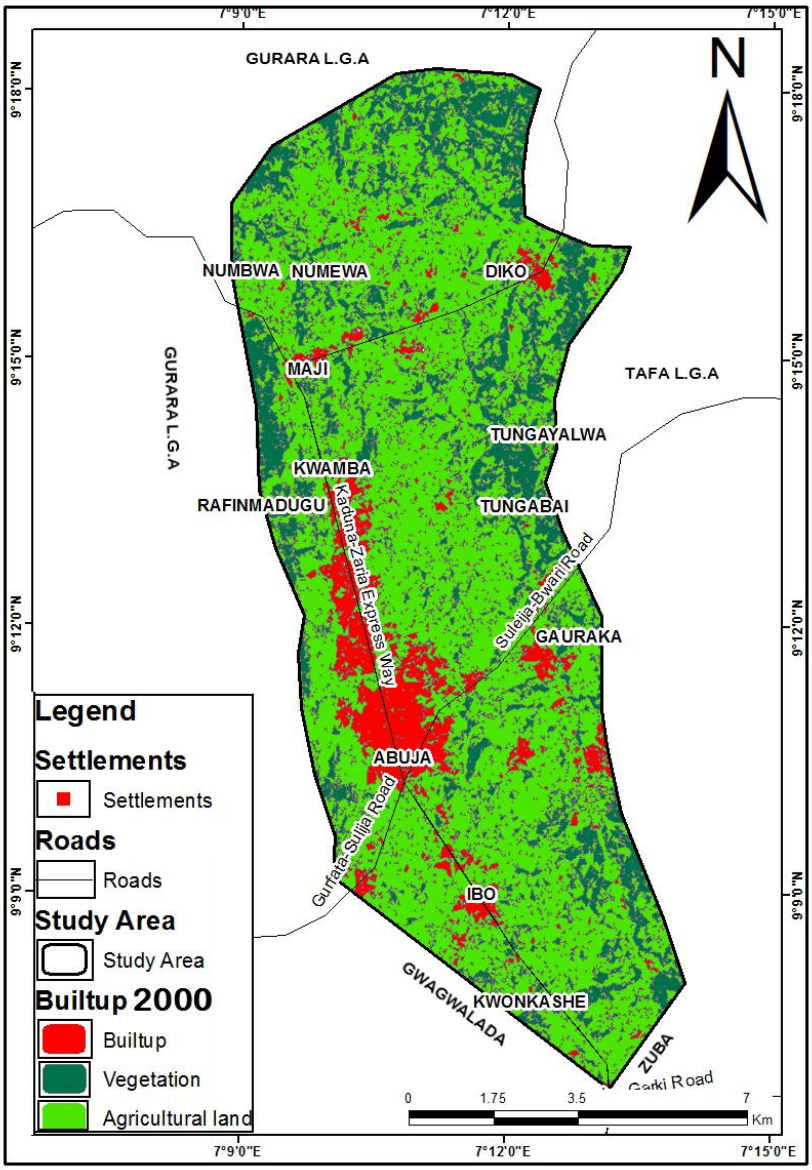

Figure 4.3: Landuse Land Cover 2000 Source: CRS Jos

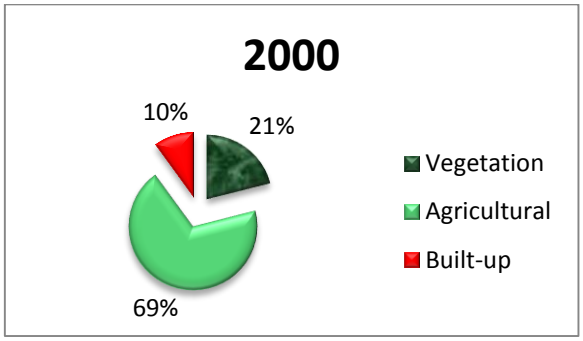

Figure 4.4 Land use Analysis of Suleja L.G.A in 2000

There was changes that occur from the year 1980 -2000, the built-up increased from 5% - 10% due to population increase, demand for houses and proximity to the federal capital territory that brought people from other parts of the country and some settled at the suburban areas. Both agriculture and vegetation decreased from 72% - 69% and 23% - 21% respectively due to human needs (buildings, constructions among others). The settlements such as Abuja (Suleja), Maje, Diko, Kwamba and Kwankwanshe among others are increasing in size with dispersed smaller settlements in the form of farmsteads, hamlets, villages and towns in Suleja Local Government Area (figure 4.3 and 4.4).

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4.2.3 Suleja Landuse in 2015

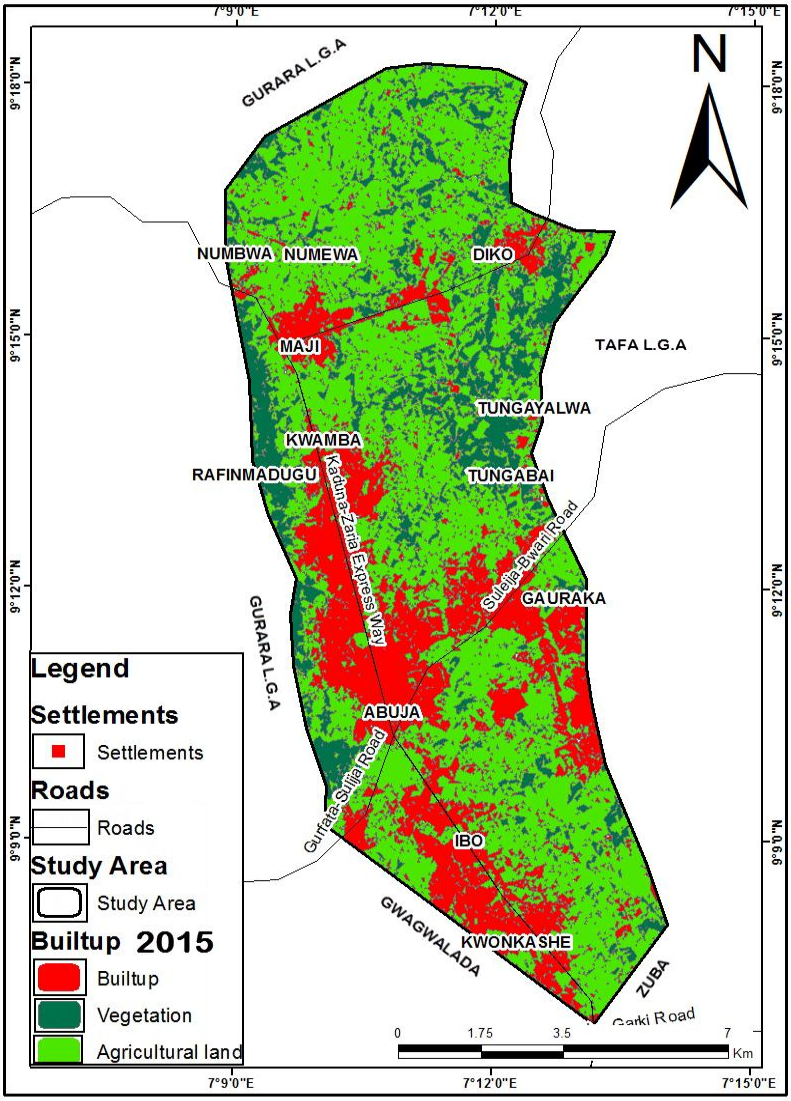

Figure 4.5: Land use /Cover 2015 Source: CRS Jos

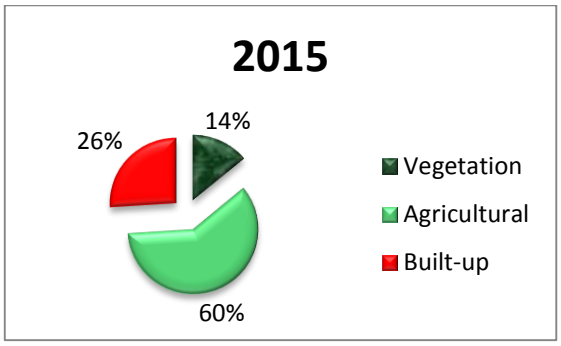

Figure 4.6: Landuse Analysis of Suleja L.G.A in 2015

The landuse analysis for 2015 shows significant increase in the built-up from 10% (year 2000) to 26% (2015) while vegetation and agricultural land further decreased to 14% and 60% respectively. The changes in the landuse occured due to increasing human demands such as residential, commercial and office complex constructions to meet the unlimited human needs. The increasing population is due to the proximity of the Federal Capital Territory Abuja and some of the people that live in Suleja commute to work in Abuja City on daily basis. The built-up (settlement) areas have encroached into the vegetation and agricultural land which is part of the landuse that provide foods and other resources to the residents of Suleja Local Government Area.

4.2.4 Suleja Landuse Projection for 2035 CA-Markov Model

Markov model has been widely used in ecological modeling and it takes into account the past states to predict how a particular variable changes over time. Muller, M.R., Middleton, J., (1994). Markov module in IDRISI were used to create transition probability matrix and transition area matrix by cross tabulation of two images of different time and determines the probability or number of pixels that are expected to change, to a land-use class from another class during a time period. Subedi et al. (2013). A homogenous Markov model for predicting land-use change can be represented mathematically as:

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$$L_{(t+1)} = P_{ij} * L_{(t)}$$

$$P_{ij} = \begin{pmatrix} P_{11} & P_{12} & - - - & P_{1m} \\ P_{21} & P_{22} & - - - & P_{2m} \\ - & - & - & - \\ - & - & - & - \\ P_{m1} & P_{m2} & - - & P_{mm} \end{pmatrix}$$

where, $L_{(t+1)}$ and $L_{(t)}$ are the land-use status at time $t+1$ and t respectively.

$(0 \leq P_{ij} < 1$ and $\sum_{j=1}^{m} Pij = 1, (I, J = 1, 2, - - - , m))$ is the transition probability matrix.

Source: Praveen Subedi et al. (2013)

The Land-use imageries of 1980, 2000 and 2015 were used to create transition probability matrix in order to project land use for the year 2035 using CA - Markov model.

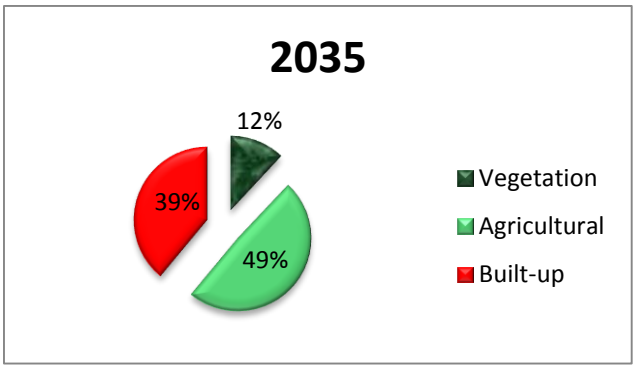

Figure 4.7: Land use Analysis of Suleja L.G.A for 2035

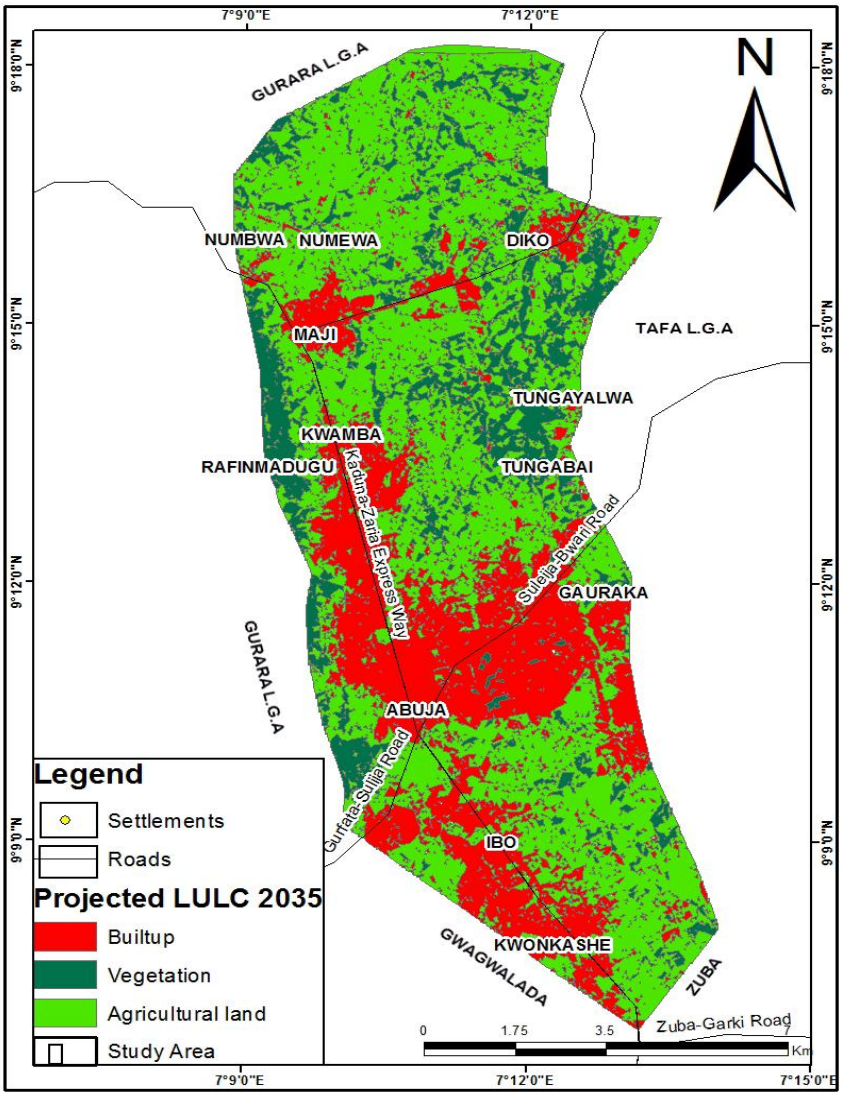

Figure 4.8: Projected Land use /Cover 2035 Source: CRS Jos

The projected land-use map for the year 2035 shows spontaneous increase in the built-up rates from 26% (2015) to 39% (2035) of the Land-use class category. Vegetation will decrease from 14% (2015) to 12% (2035) due to human needs for food and shelter. The Agricultural land will decrease rapidly from 60% (2015) to 49% (2035) as a result of settlement growth and other activities to meet the unlimited demands and needs of mankind. (Figure 4.7, 4.8 4.9 and table 4.1, 4.2).

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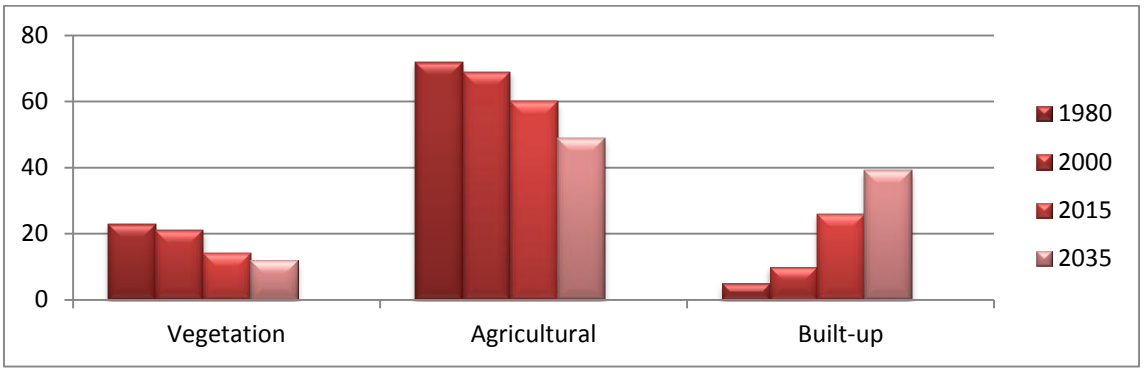

Figure 4.9: Landuse Land Cover Change (LULC) 1980 – 2035 Source: Authors Field Work 2015

The Landuse and Landcover change of Suleja Local Government Area shows decrease in vegetation from 23% - 12% (1980 – 2015) which occurred as a result of increase in population and construction. Agricultural land also shows sharp decrease from 72% - 49% (1980 – 2015) due to growth/ development and increased land demand for constructions. However Built-up has increased significantly from 5% - 39% (1980 – 2015) due to increased settlement expansion and population growth resulting from birth, migration and proximity to the Federal Capital Territory.

Further projection of the Built-up to 2035 shows an increase up to 49%, signifying future loss of vegetation and agricultural land in the projected year. (figure 4.9, 4.10 and table 4.1).Therefore measures should be taken to address the scenario of urbanization problems such as congestion, pollution, over-crowding, building congestion, over stretching of facilities/ utilities, crime and juvenile delinquency. The increase in population demands for more land for housing construction to accommodate rising population growth (table 4.1).

Table 4.1 POPULATION AND LANDUSE CHANGE OF SULEJA L.G.A

SPATIAL AREA EXTENT								
YEARS	1980		2000		2015		2035	
POPULATION	116,358		183,362		270, 239		441,955	
CLASS NAME	Hectare	%	Hectare	%	Hectare	%	Hectare	%
Vegetation	2707.15	23	2476.022	21	1701.169	14	1426.92	12
Agricultural Land	8533.373	72	8240.122	69	7122.989	60	5826.59	49
Built-up	650.60	5	1175.32	10	3061.13	26	4637.49	39
Total Area	11,891 Ha	100	11,891 Ha	100	11,891 Ha	100	11,891 Ha	100

Source: Authors Field Work 2015

4.2.6. Calculating the Rate Of Built-Up in Suleja L.G.A

Emphasis was on Built-up growth from 1980-2000-2015-2035 increased rates.

Table 4.2 BUILT-UP INCREASING RATES FOR SULEJA L.G.A

Class Name	1980	2000	2015	2035
Built-up (Ha)	650.60 (5%)	1175.32 (10%)	3061.13 (26%)	4637.49 (39%)
Population	116,358	183,362	270, 239	441,955

Source: Authors Field Work 2015

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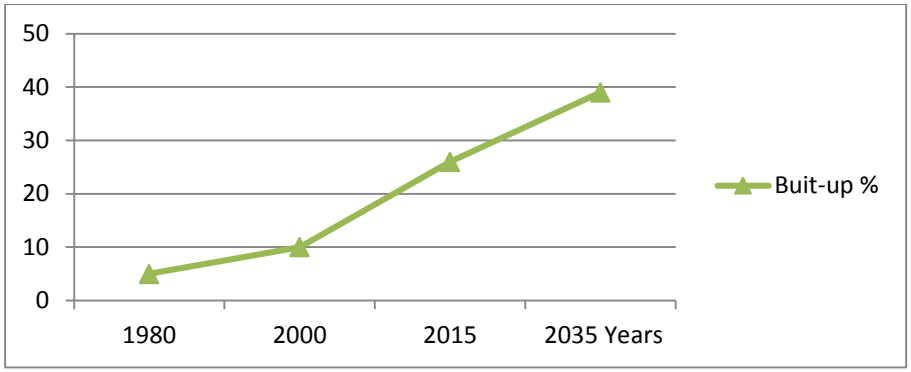

Figure 4.10: Built-up increase of Suleja L.G.A from 1980 – 2000 – 2015 - 2035
(Source: Source: Authors Field Work 2015)

The period of 1980-2000 shows built-up increase of 5%. However, from 2000 – 2015 shows built-up increase of 26% while the projected built-up will increase by 39% from 2015 -2035 (Figure 4.10).

5.0 CONCLUSION AND REMMENDATIONS

5.1 CONCLUSION

Urban planning is about the present, and to predict the future you need to have adequate information about the past and the present situation on population, socio-economic and physical development. Nigeria is experiencing rapid urbanization with significant increase in both the population and settlements growth. Developments in Nigeria go ahead of planning and the growth is quite unplanned. The urban peripheries are growing spontaneously without adequate planning and

without the provision of basic urban infrastructure and services. The study revealed increasing population with rapid settlement growth encroaching into vegetation and agricultural land making the area vulnerable to the risks of climate change. However is pertinent for the policy makers and all stakeholders in Niger State to embrace proactive sustainable measures of tackling Urbanization problems.

5.2 RECOMMENDATIONS

1. Niger State will soon commence the preparation of Suleja and Minna Master Plan, therefore the increasing rate of settlement growth and population growth with the projection made in this study should be considered when preparing the new Suleja Master Plan. The infrastructure and services should be provided adequately in line with the projection, to accommodate the rising population.
2. Urbanization comes with other challenges apart from traffic congestion, poor sanitary environment, slums generation with sub-standard buildings and unemployment, there are social vices like crime, theft, prostitution, and drug abuse that needs to be curtailed. The security personnel should be well trained and equipped with intelligence gadgets to fight crime and ensure sanity in urban areas.
3. The provision of job opportunities through tourism development and other public/private partnership ventures will create employment and revenue generation for the State and Local Government. The provision will further help to reduce traffic congestion and the number of workers commuting from Suleja L.G.A to Abuja, the Federal Capital Territory on daily basis.
4. The Government of Niger State should collaborate with National Board for Technical Education (NBTE) and Nigerian Building and Road Research Institute (NBRRI) on skill acquisition / training of Nigerian artisans in plumbing, tiling, painting, plaster of paris (P.O.P) design, iron bending, welding, carpentry and masonry among others, to create job opportunities and self reliance.
5. There should be more research on alternative local construction materials and make it affordable in the Country. The provision of good quality materials will reduce building collapse and discourage the use of sub-standard building materials.
6. There should be Community Driven Development (CDD) Projects aimed at reducing poverty, crime and strengthen the capacity of the communities in the entire Local Governments of Niger State.
7. The Government should make provision for subsidized Agricultural inputs and easy access to loans at single digit interest rates to farmers including the Youths, to boast the Nigerian Agricultural Sector.
8. Niger State should strengthen the enforcement capacities of the Urban Development Board in the Local Government Areas with the mandate to checkmate and regulate developments, illegal constructions and the use of sub-standard building materials.
9. Tree planting should be encouraged within the residential, commercial and educational areas of the Local Government. Trees planted within industrial areas will serve as buffer zones to regulate the temperature of the environment and reduce global warming.
10. All building plans approval in Suleja L.G.A should follow due process and in accordance with the Landuse provision of the New Master Plan, to prevent haphazard development and illegal construction without permission or approval. The buildings should have accessible roads, drainages and

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adequate setbacks within the residential areas for circulation, convenience and health purpose.

11. Rural – Urban Aforestation Projects should be re-introduced to replace the lost vegetation. Tree planting should be encouraged within Residential, Commercial, Industrial, Institutions and Office premises, for the purpose of reducing global warming and promoting environmental aesthetics.
12. The natural environment should be used wisely and the natural resources should be protected and preserved for the future generation. The sustainable development guidelines, principles and strategies should be incorporated in the National Development Plan or program.
13. Caution should be taken when locating commercial landuse in the Master Plan or Planning schemes. Some commercial activities along the road such filling stations, eateries, banks and groceries stores like shoprite, supermarkets among others normally generates traffic and causing vehicular congestion within the area.
14. The planners in the Nigeria should re-examine their tools/ techniques and embrace the use of strategic planning, participatory approach / public involvement and urban upgrading, to ensure that planning keeps pace with development or rather, plan ahead of development.
15. The Niger State Government needs to expand urban observatory for land information management system in the four Planning Regions (Kontagora, Bida, Minna and Suleja) of the State. The information on landuse or urban growth can be monitored or acquired remotely from the Stations.

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