

# THE CARDINAL POINT

*A periscope of the earth, the home of man*

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## ASSESSMENT OF THE IMPACT OF HIV /AIDS PREVENTIVE AWARENESS EFFORTS IN PARTS OF KADUNA METROPOLIS

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### 1.0 INTRODUCTION

HIV/AIDS has been known to show the most destructive and disruptive influences of all epidemic since its inception. It is one of the leading cause of death, with over 25million people already dead (UNAIDS, 2016). Even with the recent improvement in antiretroviral treatment all over the world, the pandemic still continues to claim lives (Fawole, et al, 2015).

According Stokes 2003, because most of the hardest hit countries are still overwhelmingly rural, the

epidemic represents an enormous threat to rural development. This is why with HIV/AIDS and related diseases, African potential has reduced over the years, its human resources wasted, a complex mix of social and political problem are created making life and progress more difficult as it is largely rural (Chukuezi, 2002). More frightening is the fact that Sub-Saharan Africa is the worst hit as it houses two thirds of the people living

### ABSTRACT

*Since the discovery of AIDS there has been effort put in place to mitigate the challenges posed by the disease in Nigeria. The efforts have been from government, NGOs and the international community. However according to this thesis the effort has not met the need of the general population in terms the awareness of the prevention of the disease, especially in parts of Kaduna metropolis. Four specific objectives were set for the work with corresponding research questions. The area of study covers parts of Kaduna South and Chikun LGA in the metropolis from which a population of 775,003, from which 120 households were sampled with a total of 668 respondents. The work adopted the qualitative and quantitative data gathering method with a structured questionnaire used as a means of gathering quantitative variables. The study found out that majority of the respondents were aware on some aspects of HIV/AIDS infection, transmission and prevention implying that awareness creation on infection with HIV/AIDS was necessary among them. However, in the areas of prevention that directly relates to sex, respondents are not adhering to the prevention and control of the disease. For example, a situation where 39% think withdrawing before orgasm would prevent HIV is alarming. The study also found that the testing rate of the health facilities in the study area does not commensurate the population of the area.*

Key words: Awareness, Perception, HIV, AIDS

with majority of the occurrence being through heterosexual intercourse, mother to child transmission and unsafe blood transfusion (Walker, 2004).

The epidemic of HIV poses major public health problems in Nigeria. The country has the second highest population of people living with HIV/AIDS with over 2.9m people after South Africa's 5.6m people (FMH/NACA, 2017). Since the first case was discovered in Nigeria in 1986, HIV has been a topical issue in all parts of the country. It accounts for 10% of the global HIV burden and majority of the infected, to the tune of 52%, are women (US Embassy, 2015).

AIDS cases are becoming very visible in Nigeria. About one out of every four persons in Nigeria had seen someone with HIV or known someone who died of AIDS. In addition, awareness of HIV and AIDS was generally very high (93.8%). However, correct knowledge of all the routes of HIV transmission and methods of prevention have remained low (FMH, 2014).

Since the discovery of the disease the government of Nigeria has been making efforts to mitigate the challenges by way of campaigns and the efforts of Non-Governmental organisations cannot be left. However, the rate of infections is still rising and most people who are tested positive find out only when they are critically ill. (Fawole, et al, 2015) The youth are the worst hit by this scenario since they are the most sexually active (Ibe and Ibe, 2003).

Knowledge of its prevention is the first 'line of defence' against its spread and the country is scoring low in that aspect as it is the least counselled tested population in the world (Fawole, et al, 2011). The population with a comprehensive and correct knowledge of HIV as of 2008 was 33% for men and 22% for women (US Embassy, 2011). But the efforts as to the prevention and reduction of the further spread of the disease have been there and ongoing. This includes effort by international agencies and counselling and testing are primal in the efforts (Ibid).

In Kaduna, it is not any different as not a Secondary Health Care Centre is existing that does not give care, support and awareness services to the fight against HIV. Even Primary Health Centres give support to pregnant women and infant as regards HIV. So the crux of this study is to assess the level of HIV awareness these efforts have achieved in Kaduna Metropolis, specifically, Kaduna South and Chikun Local Government Areas. The study measured it in terms of how much of the people are offered testing and counselling and how much of the people are informed enough to accept it.

### **1.1 Objectives of Study**

- (a) Ascertain peoples' sources of information about HIV/AIDS.

- (b) Determine the level of availability of HIV counselling and testing
- (c) Assess the people's perception of vulnerability to HIV.
- (d) Determine, if any, reason(s) why people do not accept voluntary counselling and testing.

## 1.2 Research Questions

- (a) How many people have been given HIV education and since when?
- (b) What is the accessibility to HIV counselling and testing like?
- (c) What is the perception of vulnerability to HIV?
- (d) Are their reason(s) why people don't accept counselling and testing?

## 1.2 AREA OF STUDY

### 1.2.1 Location and Extent

Kaduna state is the successor to the old Northern Region of Nigeria, which had its capital at Kaduna (Fig. 1.1). In 1967 this was split up into six states, one of which was the North-Central State, whose name was changed to Kaduna State in 1976 and in 1986 Katsina State was carved out of it, under the Gen Babaginda administration. The metropolis or Kaduna city remained as the capital of the state. The metropolis is made up of

two local government areas (Kaduna North and Kaduna South) and parts of two other local governments (Chikun and Igabi).

### 1.2.2 Physical Setting

Kaduna metropolis is located between Long  $7^{\circ}15'$  and  $7^{\circ}30'$  of the median and between Lat  $10^{\circ}15'$  and  $11^{\circ}17.5'$  of the equator. The city is located about 220km north of the federal capital city, Abuja.

The climate is the tropical continental climate with both wet and dry seasons. The dry season lasts for about five months and starts around November while the rainy season lasts for about seven months and starts around the month of April. It has an average rainfall of 1000mm and an average temperature of  $30^{\circ}\text{C}$ .



## **2.1 CONCEPTUAL FRAMEWORK**

This study focused on the level of awareness of HIV prevention and a conceptual frame work for this study should attempt to investigate the relationship between levels of awareness, sexual and(or) other risky behaviours and perceived vulnerability towards HIV/AIDS among communities that constitute the catchment areas of the health facilities in Kaduna metropolis.

HIV transmission in any community, according to this framework, is directly affected by the level of awareness of the people towards the disease. From the framework, the level at which an individual is aware or have information on the virus, affects their behaviours and the likelihood of further spread of the disease, and questions the capacity of preventive measures against the disease.

## **2.2 THEORETICAL UNDERPINNINGS**

### **2.2.1 Rational Choice Model**

This is one strand of thought that guided the study. The RCM is a simplified set of assumptions about human behaviour in which social action is a sum total of individuals acting to maximize their interests through the calculation of costs and benefits. Behaviour thus reflects a rational calculus of gains and losses. This is the key to understanding human phenomena, including sex (Philipson and Posner, 1995).

To explain the spread of HIV we need to look at the extent to which rational choices made by individuals influence personal decisions predicating indulgence in risky sex (Philipson and Posner, 1995). It answers, for example, what a man thinks about first when faced paying for unprotected sex: the cost or the enjoyment derivable from the encounter.

As Arrow (1987) pointed out, people may act out of habit. Many of our actions are not only non-rational but may even be irrational. We act out of impulses or emotions. The youths may be less of rational actors and more of phenomenological actors proceeding on the basis of the here and now reasoning (Hughes and Malila, 1996).

### **2.2.2 The Attribution Theory**

The attribution theory is other strand of thought for the study and is a conceptual analysis of causality and extinction (Kelley, 1967). This implies that one has to look for the causes of a particular thing and how to avoid it or how to bring it to an end. This is analogous to the relevance of information to the spread or prevention of HIV/AIDS in communities of mutual interaction like the study area.

Attribution theory concerns the allocation of responsibility for an event. Attribution theorists assume that man is motivated to find causes of events, and to understand his or her environment.

Although incorrect or motivated inferential errors may be made, man is conceptualized as a rational organism, acting as a scientist, testing and discarding hypotheses about the world. With reference to HIV, the theory tries to find out what people give as reasons, whether rational or irrational to explain their ability or inability to protect themselves from the disease. In other words, where do the myths they build around the disease come from?

### **3.0 RESEARCH METHODOLOGY**

#### **3.1 Sources of Data**

The work used both qualitative and quantitative data gathering methods. A structure questionnaire interview was employed as a quantitative means of gathering variables like levels of awareness, access to and availability of VCT and perceived vulnerability toward HIV/AIDS. Three health facilities were the source, namely; Gwamna Awan General Hospital, St Gerard Catholic Hospital and Sabo General Hospital located which have as their catchment areas for HIV service the following communities; Kakuri, Nassarawa, Sabo and Barnawa.

The Focus Group was a means of gathering data on perception and HIV awareness. This was complemented with purposive interviews conducted with HIV counsellors drawn from the named facilities. All these formed the primary data.

The secondary data included data on HIV/AIDS, its infection, prevention and control. The data acquired included those on intervention projects embarked upon, projected national targets regarding people reached with HIV services, how much was met, gaps, if any, and how they were resolved. This was to ascertain how much of the HIV investment has done and relating it to the study area.

#### **3.2 Sampling Technique and Sample Size**

The two local government areas involved in this study, namely, Kaduna South and Chikun, make up a population of 775,003 (NPC, 2006) and 30 households each in the districts that totalled 601 people in a total of 13 districts from which 4 were selected, 2 districts from each LGA. It is noteworthy to state here that of the 600 respondents 481 turned up for the survey/questionnaire.

Systematic random sampling was adopted, picking one household each on the tenth building on every two streets.

A hundred and fifty households were selected in this way in each district making a total of 600 households (see table 3.2).

**Table 3.1 Sampled Districts in the Study Area**

<b>District</b>	<b>Sub-District</b>	<b>Household</b>
Sabo	Television	50
	Ugwan Sunday	50
	Ugwan Pama	50
Nassarawa	Ugwan John	50
	First Corner	50
	Nassarawa Hausawa	50
Kakuri	Makera	50
	Kurmin Gwari	50
	Kakuri Hausawa	50
Barnawa	Barnawa GRA	50
	Barnawa High Cost	50
	Barnawa Low Cost	50

More so, using the same sampling framework, 8 strategic focus groups of not less than 4 people per group were formed; two from each district in the study area.

### **3.3 Instrument of Data Collection**

The research instrument used in this study was the questionnaire survey. this was to ensure that respondents noted down freely what they thought as truthfully as possible without supervision or monitoring.

### **3.4 DATA ANALYSIS**

Upon data collection, the questionnaire was sorted out to find whether all had been responded to and given the identification numbers which were useful for data cleaning. Questionnaire were coded manually and in the computer, data entry, data cleaning and editing the results as collected from the field.

was then carried out using Statistical Package for Social Sciences (SPSS) for analysis. The entered data was analysed quantitatively since data involved in this study was reduced to numerical values.

The presentation of the analysed statistical data was done with frequency distribution and tables.

## **4.0 RESULT AND DISCUSSION**

It should suffice to note that the total questionnaire forms returned were 481 making a return rate of 80%. Below are the tables and chart and discussions.

### **4.1 Profile of Respondents by Age**

On this section, respondents ticked the age category they belonged. Table4.2 presents

**Table4.1 Distribution of Respondents by Age Cohorts**

Age Cohorts	Frequency	Percentage
15-19	15	3
20-24	102	21
25-35	150	31
36-45	125	26
46-49	69	14
50 and above	20	5
<b>Total</b>	<b>481</b>	<b>100</b>

**Field Study (2018)**

From the table above, most of the respondents belonged to the 20-49 age cohort, making up 92% of the total respondents. The lowest cohort is the 15-19 age group which made up 3% of the total respondents. This cohort (20-49) is known

to be the most socially active population and thus prone to risky behaviours. This is the cohort that would form the crux of the discussion in this research.

**4.5 Levels of Awareness towards HIV/AIDS****Table4.3 Respondents' Awareness of HIV/AIDS Modes of Infection**

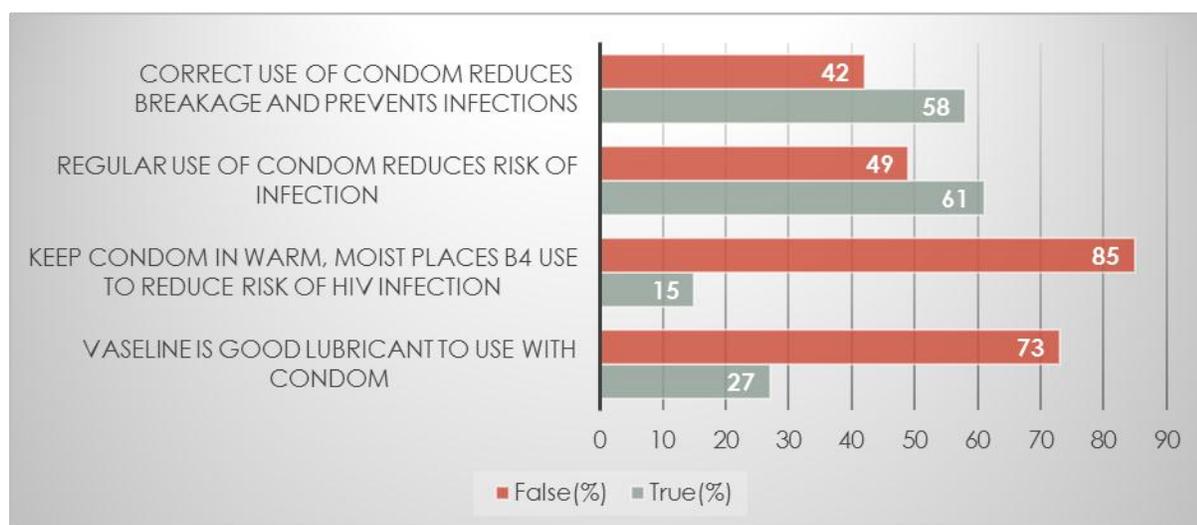
Aspects of HIV/AIDS infection Statements	T	%	F	%
A person can be infected with HIV and not even know it	425	88	56	12
Only a person who is sick of AIDS can infect other people	355	74	126	26
HIV infected people generally feel well	85	17	396	83
The incubation period between infection and showing full blown AIDS may be 7years or more	286	59	195	41
Withdrawing immediately before orgasm eliminates HIV infection	154	32	327	68

Having sex with a virgin can cure AIDS	37	7	444	93
People living with HIV are usually thin and Sickly	107	22	374	78
Presence of STI increases risks of HIV infection	288	60	193	40
Being tested for HIV is the first line of prevention	341	71	140	29

**Researcher’s Field Study, 2018**

From Table 4.3 above, there is an appreciable knowledge of the virus and its mode of infection. But much needs to be done with the perception of the disease. For example, 74% of the respondents still think only those sick with

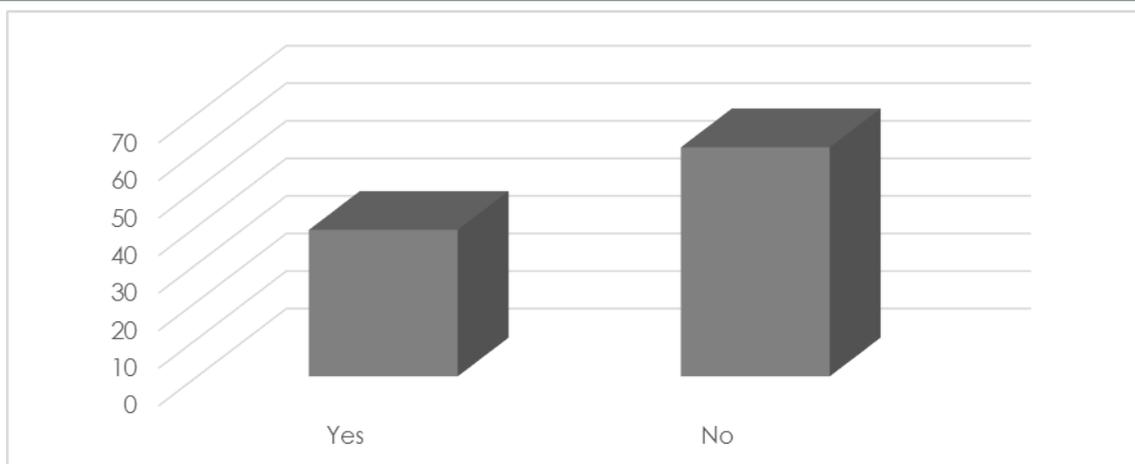
the symptoms can infect others with the virus and 83% don’t think people infected with the virus are generally well. These perceptions are that which push the fight against the disease forward.



**Fig4.1 Respondents’ Knowledge of use of Condoms Field Study, 2018**

On the whole, from fig4.1 above, the respondents’ knowledge of safe condom use is above par. Where they think correct condom use cannot eliminate breakage, they are suggesting that condom cannot give 100% protection from

the infection of HIV. In order words this group is advocating for abstinence and being mutually faithful. However, these respondents are the few who contemplate the use of condom as a safe mode of sex.

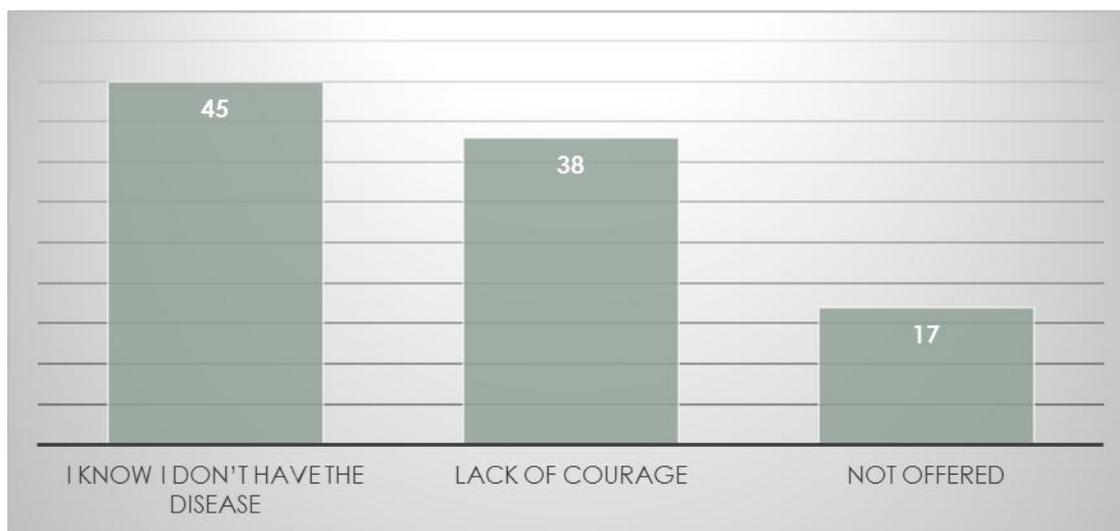


**Field Study (2018)**

**Fig.4.2 Respondents Who Have Had an HIV Test**

From fig.4.2 above one will discover that the knowledge of HIV and condom use though not a hundred percent, it does not add up to the rate of access to the test. Most of the respondents who

have not had the test claim they have not been offered the test. But the few others were scared of taking the test as a result of the risky behaviours they have indulged in.

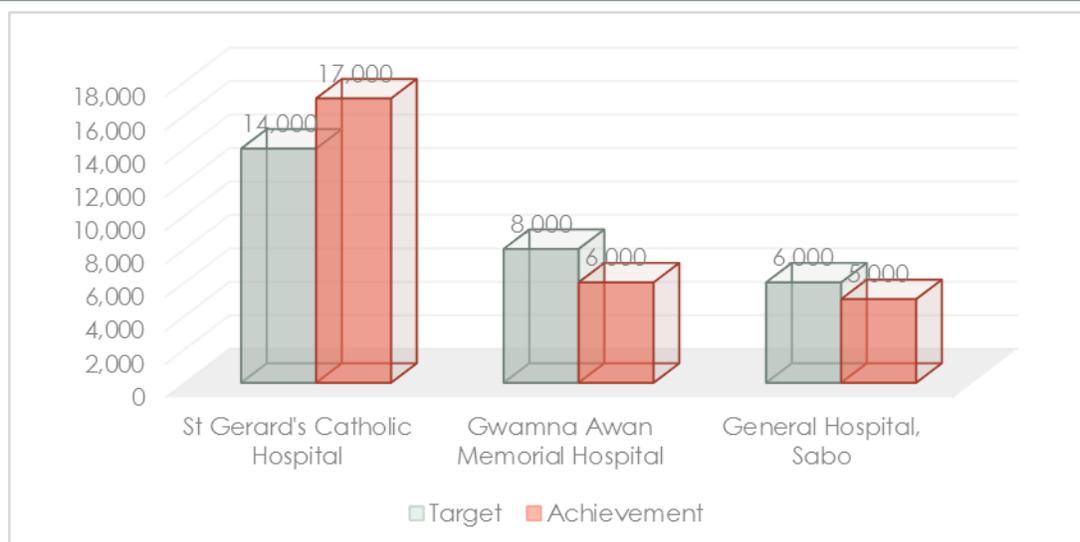


**Field Study (2018)**

**Fig4.3 Reasons for not Taking HIV Test**

From fig4.4, most of the respondents who have not conducted HIV test think they do not have the disease (45%). Management of affairs needs to re-strategise awareness communication plan

to meet this cohort. This is because most people simply condemn themselves inwardly and evade the test simply to avoid what they think is the obvious.



### Field Study (2018)

**Fig4.4 Facilities, their Targets and Achievements for 2016**

From Fig4.5, the lowest target given to facilities in the Study Area is 6000 and the highest is 14000. However, when this target is superimposed with the population of the area and the dearth in the access of VCT, a line will be finely drawn. More so, only one facilities went beyond the target.

## 5.0 Summary and Conclusion

### 5.1 Summary of findings

The first objective of the study was to establish the levels of awareness of respondents' in the various aspects of HIV/AIDS. This was based on their knowledge on infection, transmission and prevention. The study found out that majority of the respondents were aware on some aspects of HIV/AIDS infection, transmission and prevention, implying that awareness creation on infection with HIV/AIDS was necessary among them.

In the areas of prevention that directly relates to sex, respondents are not adhering to the prevention and control of the disease. For example, a situation where 39% think withdrawing before orgasm would prevent HIV is alarming.

From the above it was found that more should be done about awareness, not just on how HIV is transmitted but on how to handle the possibility of an encounter with people living with the virus. People in the study area need to be made aware of the possibility that we always have encounter with people living with the virus and as such risky behaviours exposes us to the risk of contracting the disease.

The study also found that the test rate of the health facility is not adequate for the needs of the communities. This lays intellectual merits to the fact that Nigeria is among the most under-

tested countries in the world (Fawole, 2015) and perhaps if the test was done adequately, more patients that have died without knowing would have been commenced on treatment. The recommendation is to get tested every three months. However, from the data in the study, if the target were divided into four quarters in the year, the facilities were given a target to test 7,500 in a general population of over 775,000 people.

The foregoing has a rippling effect on the relationship between perceived vulnerability and sexual behaviour, the study found out that 52% of the respondents who engaged in sex did not use condoms and were therefore vulnerable to risks associated with unprotected sex including HIV/AIDS. A further analysis shows that 31% of the respondents were at a higher risk than the rest because they had multiple sexual partners and were not using condoms.

On a final note when it comes to HIV awareness or any of the assessments under study in this project, any percentage is too much. In other

words, we ought to have a 100% awareness and this is supposed to reflect in the reduction of infection rates because there will be an increase in the rate of access to counselling and testing.

## **5.2 Conclusion**

This study has reported high levels of awareness among the respondents on the means of transmission of the disease. However, there are HIV/AIDS issues that they were not aware of in as much as they are aware of some aspects of HIV/AIDS, they were equally not aware of others. Incomprehensive awareness of aspects of HIV/AIDS can be fatal especially to the youths due to such factors as peer pressure, vulnerability, and experimentation with sex and drugs, among others that affect them.

The respondents did not show a totally positive attitude towards people living with HIV/AIDS, HIV testing, and condom use. Moreover, they stated that they would not insist on using condoms during sexual intercourse. This lack of insistence would increase the risk of HIV infections among the students and slow down the fight against the disease.

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## PERSPECTIVE ON BIODIVERSITY AND HUMAN ACTIVITIES DISRUPTING AND IMPAIRING THEIR EXISTANCE IN THE NORTH- EAST REGION OF NIGERIA

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### 1.0 INTRODUCTION

Biodiversity and associated habitats are important both locally and globally in a variety of ways to provide valuable ecosystem services, present and future economic benefits as well as spiritual values. But, unfortunately many people do not appreciate the function and value of these natural biological resources as increase in human population and urbanization over the years have resulted to unsustainable pattern of resource consumption. About 106 species and subspecies of fauna have been lost over the decades, where two thirds of

these losses have occurred due to the depletion of the world's fauna that have been aggressively over used by the civilized man (UNDP, 2006). More so, forests that formed part of the world vegetation dominated by trees of many sizes, which also have the potential to regulate temperature, contribute to the high amount of rainfall annually as well as serves as habitats to wild animals, and bird species were excessively destroyed, this has altered the ecological formation of the natural resource (Karim, 1999).

### ABSTRACT

*Biodiversity in the north east region of Nigeria have been recognized for long due to its plant and animal species richness as well as its importance in terms of natural resource that support human livelihood through the provision of ecosystem services. However, little attention has been given to the evolutionary consequences or implications of human activities that fundamentally change the environmental features of the region. Anthropogenic activities such as agriculture, industrialization, pastoralism among others have caused the loss of adaptive biodiversity such as animals and plants in the sampled area of Adamawa and Yobe states as analyzed through the use of table to indicate animal and plant abundance (table 1). This was revealed through the use of observation and survey as instruments of data collection as well as through the assistance of indigenous residence that provided some of the information analyzed in this study. Persistent and unsustainable consumption of these biological resources have undoubtedly limited the ability of species to survive under unfavorable environmental condition with hundreds of animals and plants that were rarely or occasionally found in the region and this may lead to further loss of available species with long term effect on man survival. Therefore, the study recommended that there is the need for government and stakeholders to design a framework that will not only curtail human dangerous activities in the region, but also subject the culprits under legal procedure where appropriate punishments will be assigned. In conclusion, biodiversity is aggressively*

Biodiversity loss is related to overpopulation, as exponential growth of human population is usually proportionate to a wide range of environmental problems. Therefore, sustainable utilization of these resources calls for understanding of variables arising from livelihood activities that may disrupt the conservation of forest and wildlife species (Koos, 2000).

Vegetation is one of the most precious ecosystems on earth, it serves as home to more than half of all animal and plant species on our planet, these natural habitats carry out important functions that make life on earth possible, including producing oxygen, regulating the climate, offering food and serving as a source of various kinds of medicine. But human action and inaction is carelessly destroying these natural wonders for short-term profit while, overlooking the bigger profit.

The world has experienced unsustainable exploitation of forest resources in the 21<sup>st</sup> century due to human activities which have seen the perennial rivers that originate in the mountains to reduce their volume of water. The greatest cause of natural resource destruction that comes from human activities is unlike natural damage that has the capacity to replenish the resources to its natural state. Although, most of these human activities are driven by national and international economic forces and its significant benefit to national development does not serve long term

purpose (Lynam, 2009). Many of the effects from human induced destruction of these resources are probably irreversible in the nearest future.

In Nigeria, there has been an overbearing impact of human activities on biodiversity. Suffice to say that the country is one rich in biodiversity content but human activities like farming and hunting has impinged negatively. It is therefore the crux of this paper to assess the kinds of human activities that impact on the biodiversity in the Northeast region of the country.

## **2.0 Conceptual Framework of Biodiversity**

Biodiversity is a neologism and a portmanteau word, from bio and diversity. The term biological diversity was coined by Thomas Lovejoy in 1980, while the word biodiversity itself was coined by W. G. Rosen in 1985 while planning the national forum on biological diversity organized by the National Research Council (NRC) which was held in 1988 when entomologist E. O. Wilson used it as the title of the proceedings of that forum. The word biodiversity was deemed more effective in terms of communication than biological diversity. Since 1986 the terms and the concept have achieved widespread use among biologists, environmentalists, political leaders, researchers and concerned citizens worldwide. It is generally used to equate to a concern for the natural environment and nature conservation. This coincided with the expansion of concern over extinction observed in the last decades of the 20<sup>th</sup>

century. The term has also been linked to electromagnetic radiation due to denaturation of carboxylic acids in the equilibrium constant of radiocarbon dating of 1657 in Scotland (McGill, 2007).

## 2.1 Meaning of Biodiversity

The most straight forward definition is "variation of life at all levels of biological organization". A second definition holds that biodiversity is a measure of the relative diversity among organisms present in different ecosystems. Diversity in this definition includes diversity within a species and among species, and comparative diversity among ecosystems.

A third definition that is often used by ecologists is the totality of genes, species, and ecosystems of a region (GreenFacts, 2001). The advantage to this definition is that it seems to describe most circumstances and present a unified view of the traditional three levels at which biodiversity has been of great benefit to man as identified in figure 1.

i. **ECOSYSTEM DIVERSITY**- This is the diversity of ecosystems on earth or within a region or landscape. For example, an interspersed of grassland, shrub land and woodland GDF-SUEZ, (2010).

ii. **GENETIC DIVERSITY**- This is the genetic variability among the individuals and the populations of the same species.

iii. **SPECIES DIVERSITY**- This refers to the variety of species in an ecosystem.

## 2.2 Groups of Life forms that Constitute Biodiversity

According to Akosim, (2012) biodiversity is the variability of life forms existing within a given ecosystem or biome. The biodiversity found on earth consists of millions of distinct biological species that can be categorized into groups or taxa. The various groups or taxa of both fauna and flora are discussed below;

### 2.2.1 Taxa of Animals

The animal kingdom is divided into two major groups thus; invertebrates and vertebrates.

i. **INVERTEBRATES**: The invertebrates are categorized into 11 groups, which include protozoans acellular or non- cellular animals e. g amoeba; coelenterates e. g hydra and jellyfish; Platyhelminthes e. g the tape worm; acanthocephalans e. g Acanthella spp; nematode e. g Dorylaimus spp; free living and Capillaria spp; parasitic; rotifera e. g Rotaria rotaria; annelids e. g earth worm; arthropods e. g the arachnids, crusta ceans, insects and myriapods; molluscs e. g snails; echinoderms e. g star fish,

urchins and sea cucumbers and chaetognatha e. g These are the lowest and more primitive plants. They are flowerless or seedless plants. They are grouped into three main taxa as follows;

ii. VERTEBRATES: The vertebrates are grouped into 6 major divisions thus; the protochordates (these are marine or brackish water animals with some chordate characters such as the presence of notochords, postanal tail and gill slits), others are pisces e. g fish; amphibians e. g toads, frogs etc.; reptiles e. g lizards, snakes etc.; aves e. g birds and mammals e. g bats, shrews, rats, rabbits, lions, elephants, antelopes, monkeys, apes and man Natural Resources Conservation Council (NRCC, 1992).

### 2.2.2 Taxa of Plants

There are three major plant groups, these include; Cryptogams, Gymnosperms and Angiosperms

#### i. ANGIOSPERMS

These are divided into 2 major groups thus:

Dicotyledons and Monocotyledons. Dicotyledons are divided into 2 divisions:

- a. Herbaceae with 28 orders and 96 families
- b. Lignosae with 54 orders and 246 families

Monocotyledons are divided into 3 divisions

- a. Calyciferae with 12 orders and 29 families
  - b. Corolliferae with 14 orders and 34 families
  - c. Glumiflorae with 3 orders and 6 families
- Dutta, 1999).

#### ii. CRYPTOGRAMS

- a. Bryophyta: The liverworts, horned liverworts and mosses are members of this taxon
- b. Pteridophyta: Members of this taxon include the ferns and their allies
- c. Thallophyta: This includes algae, fungi, bacteria and lichens

#### iii. GYMNOSPERMS

These are the immediate groups between the cryptogams and the angiosperms. Unlike the cryptogams the gymnosperms bear flowers and seeds like the angiosperms and also have their bodies clearly differentiated into roots, stems and leaves. Gymnosperms comprises of eight orders of which four have become extinct. The remaining four orders are as follows;

- a. Coniferales: It is the largest order and is represented by 6 families with 41 genera and over 500 species e. g Pinus
- b. Cycadales: This order is represented by the family Cycadaceae with 9 genera and over 100 species e. g Cycas
- c. Ginkgoales: The order is represented by the family Ginkgoaceae with 1 genus 1 species e. g Ginkgo
- d. Gnetales: Three families with 3 genera and over 70 species represent this order e. g Ephedra and Welwitschia

### 2.3 Global Macroscopic Species Diversity

Akosim, (2012) revealed that the number of species discovered as of 2008 are as follows;

- i. FAUNA: About 1,250,000 species of animals including 1,190,000 invertebrates consisting of 950,000 species of insects, 70,000 species of mollusks, 40,000 species of crustaceans have been discovered and classified while other invertebrates were discovered but yet to be classified. Others are 58,808 species of vertebrates, which include 29,300 species of fish, 5,743 species of amphibians, 8,240 species of reptiles, 10,234 species of birds and 5,416 species of mammals which have all been classified.
- ii. FLORA: About 287,655 plant species including 15,000 species of mosses, 13,025 species of ferns, 980 species of gymnosperms, 199,350 species of dicotyledons and 59,300 species of monocotyledons have been discovered and classified.
- iii. FUNGI: About 120,000 species of fungi have also been discovered and classified.
- iv. LICHENS: Not less than 10,000 species of lichens have been discovered and classified.

### 2.4 Contextual Issues of Biodiversity

It is of enormous importance to know and believe the reasons in conservation of biodiversity. This is possible to achieve through looking at the benefits we derived from biological diversity and the things we lose or things that happens as a result of species extinction. However, this is revealed through the healthy ecosystem functions of uninterrupted interactions at the three levels of biodiversity (Ecosystem diversity, Genetic diversity and Species diversity) which generate values that support human livelihood.

On a general perspective, the benefits derived from biodiversity cannot be over emphasis as this lies in the values such as agriculture, aesthetics, culture, ecological processes, industry, leisure and medicine. Others are spiritual and knowledge systems.

#### 2.4.1 Human Activities Disrupting and impairing Biodiversity in the North- East Region of Nigeria

Human activities in the north east region of Nigeria have tremendously disrupted and impaired biological resources since the last century which also have negative impact on the environment. Many human activities including pastoralism, war and extension of agricultural land areas among others contribute to the loss of biodiversity in the region. Industrialization and urbanization have also fast track economic

development of short term booms that encourage unplanned settlements. These booms have resulted to settlements that attracted large number of poor seeking population to look for better life thereby cleared the surrounding land for agricultural practices and livestock rearing, for example, the surrounding settlements at Ashaka Cement Company in Gombe State. Once the land is unproductive, farmers move on to new areas, leaving behind a degraded environment with few or no livelihood options. So, the available forest that remains in the surrounding settlement may be cleared for subsistence agriculture thereby exposing the land to all kind of danger (Orubu, 1999).

Like most environmental assets, forest resources in the region are endangered by their status as open access resources or as common property. Depending on forests as open access resources is not entirely right, in light of the lack of formal property rights in the country and the limited capacity of government to manage and regulate the forest through its policy, many people see that as an opportunity that will lift them out of their poverty.

The following are some human activities disrupting and impairing biodiversity in north east region of Nigeria.

1. Extension of agricultural land areas
2. Industrialization

3. Over- exploitation of biological resources
4. Pastoralism
5. Urbanization and development of new human settlement areas
6. War

#### **2.4.2 Other factors related to biodiversity loss**

The causes of biodiversity loss discussed above may be considered as immediate or proximate causes of biodiversity loss. However, there are other factors such as government policies, social, cultural practices and economic considerations underlying the immediate causes. Cultural practices that encourage the use of specific species of fauna or flora for festivals often limit the population of species particularly occurring under narrow ecological range.

Ineffective and unfavorable government policies have contributed immensely to biodiversity loss, particularly in the region. The social factor such as poverty is directly connected with population growth, which results in constant pressure that is brought to bear on biodiversity in order to meet the needs of the growing human population in the areas of shelter, food, clothes etc. that entails new technology for mass production. Another dimension of biodiversity loss is the economic perspective. This is within the context of property rights. Consequently, under the property rights, open- access common property right has non-

rival consumption and is non-exclusive. Unfortunately, because open-access resources are owned by nobody, it has no incentive to an individual for their conservation. Hardin, (1968) referred to it as the "tragedy of the commons".

### **2.4.3 Consequences of Human Activities Disrupting and Impairing Biodiversity in the North East Region of Nigeria**

Human activities have tremendously disrupted and impaired biological resources in the region, with negative impact on the environment. Details of these consequences include;

1. Climate change
2. Depletion of soil and water resources
3. Environmental calamities (desertification and flood)
4. Habitat destruction

5. Loss of biodiversity
6. Pollution (air, water and soil)

## **3.0 Material and Method**

### **3.1 The North East Region**

The north east region consists of six states thus: Adamawa, Bauchi, Gombe, Taraba and Yobe states that were at one time collectively refer to as "North Eastern State". The north east region has a total landmass of about 279,203 km<sup>2</sup>. The region is situated within Longitude 8<sup>0</sup> 34' 58" to 9<sup>0</sup> 47' 13"E of the Greenwich meridian and Latitude 11<sup>0</sup> 21' 2" to 13<sup>0</sup> 44' 27"N of the Equator and a total population of 18,971,965 (2006 Population Census). But, if projected to mid-2014, the population was 24,051,418 (Tukur, 2015). These figures are distributed among the six states of the region in table 1 below

Table 1: Percentage of Landmass and Population according to the States of the Northeast

S/N	State	Landmass (%)	Population (%)
1.	Adamawa	12.61	16.64
2.	Bauchi	22.07	24.64
3.	Borno	24.31	21.88
4.	Gombe	6.31	12.40
5.	Taraba	19.11	12.13
6.	Yobe	15.57	12.23

Source: Tukur, (2015)

### 3.2 Sample Area

The sample area considered for this study include two states (Adamawa and Yobe) out of the six states in the north east region due to the simple fact that these two states were more vulnerable and have lost species of fauna and flora for almost a decade since the region suffered from insurgency activities.

### 3.3 Sample Collected

The sample collected for this study includes some common animal and tree species through observation, survey and visits to the sample sites in Adamawa and Yobe states. In each of the sampled states both animals and trees that were commonly found were sampled. The identification of these biodiversity was carryout on the field with the assistance of the local people.

### 3.4 Biodiversity Abundance

The relative abundance of biodiversity identified was carried out based on the three senatorial zones of each sampled states. However, the criteria for measuring of species abundance was considered to be 20 for species that were rare, 40 for species that were occasionally found, 60 for those species that were frequent, 80 for species that were abundant and 100 for species that were very abundant in the region. These figures also indicated the average number of each species found in all of the senatorial zones.

### 4.0 Results and Discussion

Table 1 below revealed an average number of 10 animal species and 10 tree species that were identified in two states of the study area. There was great diversity in the distribution of animals and trees across all the senatorial zones in this study but, the state with more biodiversity richness was Adamawa state which has 58.70% of animal abundance and 50.79% of tree abundance. Consequently, Yobe state was identified as one of

the frontline states that have suffered from the effect of desertification over the years which also resulted to unfavorable condition to both animals and trees as some have gone into extinction while others were endangered (Tukur, 2015), this state has 41.30% of animal abundance and 49.21% of tree abundance.

However, the result revealed that five animals were identified as rare species in the sampled site namely; Antelope, Baboon, Elephant, Hippopotamus and Lion while, animals that were found to be abundant include Grass cutter, Rabbit, Red monkey and Squirrel. More so, all of the common species of trees that were abundant in the sampled site include Baobab tree, Black pluru, Gum Arabic tree, Locust bean tree as well as Tamarind. Furthermore, most of these species of animals and trees that were abundantly found in the sampled site fall within the southern senatorial zones of both Adamawa and Yobe states.

The lower percentage of biodiversity distribution recorded in some of the identified senatorial zones could be attributed to some of the human activities disrupting and impairing the existence of animals and trees in the area. However, the outcome of this research agrees with the report of Akosim, (2012) that north east region is so much blessed with almost uncountable number of animal and tree species that have been destroyed through anthropogenic activities.

The study area however, has been described as an agrarian region where large percentage of the populace (Tukur, 2015) engaged in farming activities such as rearing of animals and cultivation of crops example; maize, cassava, sorghum and beans. These activities have seriously affected the existence of biodiversity negatively without balance between the uses of biological resources and their conservation for their future benefit.

Table 1: Inventory of biodiversity abundance in the sampled site

S/N	Class: Animal				Class: Tree						
	(Name) English	Scientific	Hausa	(site)	(Name) English	Scientific	Hausa	(site)	Adamawa	Yobe	
1.	Antelope	<i>Alcelaphinae</i>	Barewa	20	20	Boabab tree	<i>Adansonia digitata</i>	Kuka	100	80	
2.	Baboon	<i>Papio</i>	Gwaggon biri	40	20	Black pluru	<i>Vitex doniana</i>	Dinya	80	60	
3.	Elephant	<i>Loxodonta Africana</i>	Giwa	40	20	Dates tree	<i>Phoenix dactylifera</i>	Dabino	40	60	
4.	Grass cutter	<i>Thryonomys swinderianus</i>	Gafiya (burgu)	80	60	Dumpalm	<i>Hyphaena thebaica</i>	Goruba	40	60	
5.	Hippopotamus	Hippopotamus amphibious	Dorinar ruwa	40	20	Gum Arabic tree	<i>Acacia nilotica</i>	Karo	60	80	
6.	Hyena	<i>Crocuta crocuta</i>	Kura	60	40	Jugube tree	<i>Ziziphus mauritiana</i>	Magarya	60	60	
7.	Lion	<i>Pantheraleo</i>	Zaki	20	20	Locust been tree	<i>Parkia biglobosa</i>	Dorawa	80	60	
8.	Rabbit	<i>Oryctolagus cuniculus</i>	Zomo	80	60	Soapberry tree	<i>Balanites aegyptiaca</i>	Aduwa	60	40	
9.	Red monkey	<i>Presbytisrubicunela</i>	Biri	80	60	Tallow tree	<i>Detarium micropum</i>	Taura	40	60	
10.	Squirrel	<i>Sciuridae</i>	Kurege	80	60	Tamarind	<i>Tamarindus indica</i>	Tsamiya	80	60	
Overall diversity status (%)				58.70	41.30					50.79	49.21

Source: Field Work (2019)

## **5.0 RECOMMENDATION AND CONCLUSION**

### **5.1 Conclusion**

Biodiversity in the north east region of Nigeria is under threat from multiple human activities. These activities include deforestation, agriculture and war that cause changes to the environment and are ultimately unsustainable. The region biodiversity is one of the richest biological resources in terms of animals and trees however; most of these biodiversity have been threaten because of high population growth that irreversibly converts the environment into agricultural land. Some of these biodiversity were rarely and occasionally found as some are endangered while others have gone into extinction. Human activities have therefore, caused serious damage to the region and if not averted, it will multiply in the nearest future.

### **5.2 Recommendation**

1. Individual members of the society should have respect for the living space of animals by not destroying their habitats as this will promote biodiversity conservation in the region
2. The existing laws on biodiversity conservation at federal, state and local governments should be strengthened through effective enforcement of legislation against indiscriminate deforestation and bush burning

3. The federal government should ensure full implementation of national policy that will mainstream biodiversity issues into all developmental project

4. Government and philanthropist should create awareness on the importance of biodiversity within all strata of the society as well as encourage the conservation of biodiversity through giving of incentives and effective monitoring among rural dwellers

5. Individual members of society should carry out ecological agriculture through the adoption of ecological friendly farming practices and the utilization of land based on land capability that will support the cultivation of indigenous species without using chemical, fertilizer or pesticide

6. Individuals, interest groups and government should plan, manage and promote biodiversity conservation in all areas of developmental project in such a way that the biodiversity are not destroyed but are taken to a new site

7. Individual members of communities should ensure that they revive the traditional knowledge and practices for the protection of biodiversity as well as support community based organizations to make donations and participate as a volunteers in biodiversity conservation

8. Government should establish functional grazing reserves and encourage intensive and semi- intensive management of livestock and

the practice of grazing management on the rangelands

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# SPATIO-TEMPORAL ANALYSES USING GEOGRAPHIC INFORMATION SYSTEM AND REMOTE SENSING TECHNIQUES – A CASE STUDY OF LAGOS METROPOLIS, LAGOS STATE, NIGERIA.

BY

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## 1.0 INTRODUCTION

The definition of urban differs across scientists as well as countries. Urban refers to a particular type of place where the economic concentration of non-agricultural activities and the social concentration of particular types of values, behaviour, organization, and institutions are presented. Continuous rise in this concentration is termed as urban growth that leads to the change of land use and land cover in many areas around the world, especially in developing countries. Urban growth is the expansion of town and cities with respect to the increase of the size of the built-up area. Urban expansion mainly depends upon the city

requirements, facilities available and industrialization. These cause migration of people from rural to the urban areas, putting immense pressure on infrastructure, natural resources and lead to formation of slums, increase traffic congestions, reduced farmlands, increase deforestation and threaten wild life. To some researchers, it is termed as “urban sprawl”. There are many tangled terms used in the context of urban studies such as urban development, urban growth, and urbanization. It is instructive in this introduction to draw a clear and firm distinction among these terms. Clark (1982) defined urban

## ABSTRACT

*The study of urban dynamics has been a herculean tasks, prior to this technology the use of photogrammetry and manual cartography has been the way out, but the use of remote sensing and GIS techniques in the spatio-temporal analyses has taken a new dimension both in 2D and 3D, showing what is taking place in the urban space and with ground truthing or not, we can know why those changes have taken place? This study focuses on the use of Remote Sensing and Geographic Information System in mapping urban growth and land use change detection of Lagos Metropolis between 1964 and 2015. Topographic maps of 1964, street map of 1999 were acquired, scanned and georeferenced. Satellite imagery of 2015 was downloaded from Google earth and together with the maps digitized to map urban area of Lagos metropolis for three different periods. Search and overlay operations were carried out to detect the extent of urban growth and land use change in the study area for the different periods. The results of this study show that the total built-up area has expanded tremendously between 1964 and 2015.*

*Keywords: Remote Sensing, Change detection, GIS, Mapping, and Temporal Analysis*

development as the process of emergence of a world dominated by cities and urban values and the main processes of urban development are urban growth and urbanization. Urban growth is a spatial and demographic process and refers to the increased importance of towns and cities as concentrations of population within a particular economy or society, while Urbanization is a spatial and social process which refers to the change of behaviour and social

The world is going through the largest speed of urban growth today. The developing world especially, has seen an unprecedented expansion of urban areas and growth of urban population at such a pace that it is expected that sixty percent of the world's population will live in urban areas by the year 2030, and most of the urban growth will occur in less developed countries. During the course of 2008, more than half of the world's population was dwelling in towns. In 2012, this number has crossed the seven billion mark. Almost most of this population will be concentrated in Africa and Asia. The current and estimated growth has been related to political turmoil and dependence on exports of oil and labour (United Nation, 2002).

The megacities of which Lagos in Nigeria is an emerging one are the cynosures for high growth potential. Up to the middle of twentieth century, land use change has resulted into a big issue around the whole world (Lambin, 2001). With the rapid growth in population, economics and social upliftment, the extensity and intensity of land cover change tended to be severer. Because of

relationships which occur in society as a result of people living in towns and cities (Clark, 1982). This research work aims at dealing with urban growth with its spatio-temporal elements.

sheer numbers, the civic bodies have already been wavering; they could not manage the fast growth of the population and therefore, urban centres are expanding in an unplanned way. This has become a complex phenomenon, which not only has environmental impacts, but also social impacts. In order to checkmate these, the governing bodies need to understand the trend of this growth. Thus to know the trend of this City, long time series data of past and present years must be monitored and documented.

The recent technologies like Geographic Information Systems and Remote Sensing help in identifying the pattern of growth and its rate. Mapping urban growth provides a "picture" of where this type of growth is occurring and to suggest (model) the likely future directions and patterns of sprawling growth. Modelling is essential for analyzing, especially for the prediction of the dynamics of the urban growth (Clarke & Silva, 2002). GIS technology is an integral part of all the land use models. The physical expressions and patterns of growth on landscapes can be detected, mapped, and analyzed

using Geographical Information Systems and Remote Sensing technologies in conjunction with the secondary and ground truth data. The remotely sensed images give a lot of data which can be beneficial for the development of spatial resolution in remote sensing for a time series.

### **1.1 STATEMENT OF THE PROBLEM**

In the last forty years, the unprecedented population growth coupled with the unplanned developmental activities in the city of Lagos and environs lead to change in land use and land cover. As population increases as a result of influx from near and far rural areas, so does the need for new housing, schools, and transportation networks. To manage this high rate of urban growth and expansion, the three tier of government, the federal, the state and local governments have instigated a series of developmental plans to make it habitable. In order to make it a success, there is need for change detection and modeling which is referred to as spatio-temporal analysis. Change detection is the process of identifying differences in the state of an object or phenomenon by remotely observing it at different times.

### **1.2 OBJECTIVES**

The following aspects are the objectives of this study.

- i. Acquisition of satellite imagery of the study area.

- ii. Acquisition of topographic and street maps of the study area.
- iii. Georeferencing and Digitalization of the aerial photographs, satellite imagery and maps of the study area.
- iv. Attribute data acquisition
- v. Analyze the urban land cover and existing land use.
- vi. Investigate the structure and patterns of land use.
- vii. Detect changes of urban growth.
- viii. Examine the urbanization impact on the land cover/land use changes.
- ix. Information presentation.

### **1.3 SIGNIFICANCE OF STUDY**

This study will lead to the production of land use/land cover map of Lagos and Environs at different years which will assist the three tiers of governments in monitoring urban land use and land cover change. Subsequently in predicting the rate and trend of urban growth and help in taking good decisions and formulating better policies.

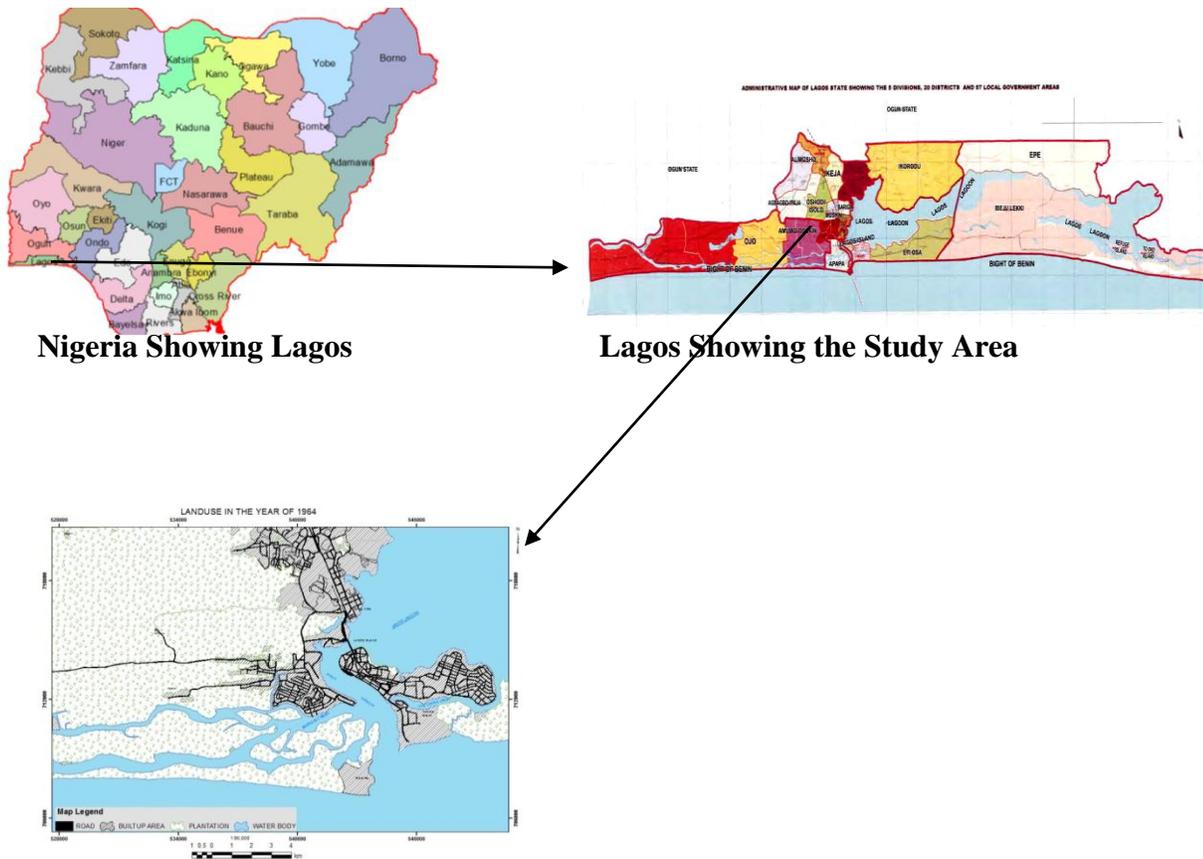
### **1.4 SCOPE OF STUDY**

The study covers Lagos Island extending to Ikoyi, Victoria Islands and Maroko area in the East, the Atlantic Ocean in the south and Ebute Meta, Yaba, Surulere and Apapa in the mainland areas including the lagoon. The major inputs are the topographic map covering the area of 1964, street map of Lagos metropolis of 1999 and satellite imagery of the area of 2015 from Google earth.

### 1.5 STUDY AREA

The study focuses mainly on Lagos Island and it's environ. Geographically, the study area lies within latitude 6° 23' to 6° 31' north of the Equator and

longitude 3° 15' to 3° 30' east of Greenwich Meridian. The total area covered by the study area is 35,710.220 hectares and cut across Lagos, Ikeja and Badagry divisions of the State.



**Fig. 1.0 Map of the Study Area**

Source: Lagos State Government, Ministry of Physical Planning and Urban Development 2009

### 2.0 LITERATURE REVIEW

The definition of urban has differed across scientists as well as countries. Urban refers to a particular type of place where the economic concentration of nonagricultural activities and the social concentration of particular types of values, behavior, organization, and institutions are presented. While according to McIntyre, Knowles-Yáñez et al. (2000), Urbanization, is conceived as characteristic of the population, as

a particular kind of land uses and land covers and a characteristic of social and economic processes interacting and affecting both population and land. Understanding urban growth and change is critical to city planners and resource managers in these rapidly changing environments. A number of analytical and static urban models have been developed based on diverse theories such as urban geometry, size, and relationship between cities, economic,

functions, and social ethnic patterns with respect to city structures. Land use in urban areas can frequently change, influenced by the construction of new buildings, roads, and other transformations. Temporal land use mapping and urban growth modeling are developed to explore the urban sprawl pattern, rate, and trend in land use change.

Urbanization takes place either in radial direction around a well-established city or linearly along the highways. This dispersed development along highways, or surrounding the city and in rural countryside is often referred as urban sprawl (Theobald, 2001). The expanding networks of roads and increasing reliance on the automobile, population began shifting from cities to fringe. Highway expansion allowed workers to commute greater distances between their residences and central cities and encouraged businesses and industries to locate or relocate to suburban. The spatial patterns of urban sprawl over different time periods, can be systematically mapped, monitored and accurately assessed from satellite data (remotely sensed data) along with conventional ground data (Lata et al., 2001). The recent technologies like GIS and remote sensing helps in identifying the pattern of growth and its rate. Mapping urban sprawl provides a "picture" of where this type of growth is occurring and to suggest the likely

future directions and patterns of sprawling growth.

Remote sensing is the "science and art of obtaining reliable information about an object area or phenomena through the analysis of data acquired by a device that is not in contact with the object, area or phenomena under investigation" (Lillesand and Kiefer, 1994). Remote sensing systems are commonly used to survey, map and monitor the resources and environment on earth. Omer and Ceylan (2009) emphasized that there are satellite systems with different technical properties and resolutions around the world which are used for various purposes. The Geos, Sesat, Landsat, Spot, Ikonos and Quickbird satellites have satellite display systems with 0.5 m to 1 km resolutions which are intensively used in the fields of cartography and remote sensing.

### **Monitoring, Modelling, and Managing Urban Growth**

Today urban growth all over the world is one of the most significant geographic phenomenon, this is particularly true for developing countries like Pakistan where number of urban centers are increasing with the passage of time (Bhalli, 2011). There is a threatening situation of rapid urbanization, especially in the developing countries (Kumar et al. 2007) like Pakistan. This is mainly due to uncontrolled population growth resulting in serious problems with regards to

informal settlements, scarcity of food, environmental pollutions, destruction of ecological structure, unemployment, and so on (Maktav and Erbek, 2005). Urban growth maintains a different relationship with population and socio-economic data (Sudhira et al. 2004). Managing and modelling urban growth is, however, a multi-faceted problem. Cities are now increasingly being recognized as complex systems through which nonlinear processes, emergence and self-organization occur (Allen, 1997; Portugali, 2000; Batty, 2007).

The prediction and simulation of urbanization is very important among the studies of land use. Modeling is essential for analyzing, especially for the prediction of the dynamics of the urban growth (Silva & Clarke, 2002). Some failures occur for modelling the use of land but later on there was rebirth in the two-three decades due to better availability of data. High computing ability also gives impetus for modelling use. Numerous models emerged in this time; these models included cellular automata type, simulation type or some part of it related to agent based type. Cellular automata are extremely capable to predict land use change (Dietzel & Clarke, 2006). During the course of time, some models were developed to forecast the future land use condition to evaluate and assess different land use policies.

Remote sensing and GIS are furnishing new tools for advanced management of ecosystem. The remotely sensed data facilitates the critical synopsis of earth's function patterning and their changes throughout locally, regionally and globally (Mishra and Subudhi, 2006). The marvelous growth in geographical information science has provided us the availability of different types of land use models. They differ in terms of data collection, spatial modelling. The data can provide a crucial connection between ecological, national and regional conservation and management diversity (Wilkie and Finn, 1996). GIS technology is an integral part of all the land use models. The spatial and temporal process can be easily handled by the capability of the GIS technology. The remote sensed images give a lot of data which can be beneficial for the development of special resolution in remote sensing for a time series.

Existing land use models range from rule-based programs that provide information and guidance on the process of allocating growth to different sub areas, to sophisticated models that incorporate economic theories and market mechanisms. The models employ a wide range of approaches, such as spatial interaction, spatial input-output, and rule-based (Waddell 2002). Spatial interaction, spatial input-output, and linear programming models were used in the early operational models of the 1960's and 1970's. The 1980's saw discrete choice models

and cellular automata becoming the newest modeling approaches. In the 1990's, several land use models implemented a rule-based set of procedures to apportion population, employment and land use on the GIS (Geographic Information System) platform.

### **Visualizing Urban Growth**

Before the introduction of Geographic Information Systems, mapping any phenomenon took an extremely long time. Maps produced through manual cartography for comparison were planned well in advance of a due date. Computer aided maps without GIS were very rudimentary and were not very aesthetically pleasing to say the least. The availability of different types of spatial data allows a GIS user to map virtually any phenomena with a geographic dimension applied to it. In addition, large amounts of data are processed before the creation of a map with much less work than with manual cartographic techniques. With a GIS, maps can be compared in a fraction of the time and can be done at variable scales with ease.

Mapping urban growth helps to identify areas where environmental and natural resources are critically threatened and to suggest likely future directions and patterns of sprawling growth (Simmons C, 2007). The physical expressions and patterns of sprawl on landscapes can be detected, mapped, and analyzed using remote

sensing and geographical information system (GIS) technologies in conjunction with the secondary and ground truth data (Barnes, K. B. Morgan, J. M., Roberge, M. C. and Lowe, S. 2001). Urban growth mapping and monitoring is one of the operational applications of satellite remote sensing data, irrespective of its spatial and spectral resolution of the satellite-borne sensors.

From the earliest (Landsat-MSS-1973) 70m resolution data, with comparatively coarse resolution TM 28.5m to the present high spatial resolution data (IRS-P6 MSS) 5.8m, have been proved efficient and more accurate in detecting the changes in land cover and urban sprawl (Alabi M. O. and Ufuah, M. E. 2007). GeoEye-1 is equipped with the most sophisticated technology ever used in a commercial satellite system. It operates in four spectral bands (0.45–0.92 m). The use of Geographic Information Systems modelling has become quite prevalent within the field of urban sprawl research. Some research on urban sprawl uses GIS as a tool in understanding the effects of urban sprawl on the natural environment. GIS reveals spatial patterns of urban sprawl by measuring distances of new urban growth areas from town centers and roads for example (Gar-On Yeh et al, 2001). Because urban development is irreversible, GIS simulates future land development (Lee et al, 1998). A Geographic Information System is a

decision support system that can facilitate urban planning.

### **3.0 METHODOLOGY**

#### **3.1 DATABASE DESIGN**

For successful and effective implementation of any Geographic Information System project, there is need for proper planning and design of spatial database at the beginning which is the pivot of any GIS project. Database is an organized, collection of well integrated data stored and capable of being used by relevant applications with the data being accessed by different logical paths. Often in GIS project, data is combined from different themes, contents, scale, projections, methods, formats, schema or even levels of uncertainty, so that they can be understood and analyzed.. This is called data integration. Obtaining a GIS database requires two main phases, the design phase and the construction phase. (Kufoniyi,1998).

#### **3.2 DATABASE IMPLEMENTATION**

This is the actual creation of the database in the system. It involves the following steps:

- Hardware and software selection based on data storage requirements and storage format.
- Physical database creation to input data into the database.

- Scanning the existing maps, satellite imagery and the aerial photographs of the area using an A0 scanner.
- Digitization on the maps, aerial photographs and satellite imagery were also done.
- The data were checked for errors.
- The graphical display of the spatial data context of the database.

##### **3.2.1 System Selection**

Appropriate system must be selected before any GIS can be implemented. The selection constitutes the various hardware and software used in the implementation of a GIS. After thorough planning, the hardware and software selection for the study are as given below:

##### **3.2.2 Hardware and System Requirement**

- Brian laptop computer with 4.0GB RAM, 280hdd, 15.6 screen and 2.80GHZ speed.
- HP LaserJet professional M1132 MFP printer.
- Colortrac Smartlf ci 40 AO Scanner.

##### **3.2.3 Software**

The software include

- Arc GIS 10.1.
- Microsoft Office word 2010.
- Microsoft office PowerPoint 2010.
- Microsoft excel.

### **3.3 DATA SOURCES**

In GIS, acquisition of both spatial and attribute data are of paramount importance. It is important to note that the sources of data used in any GIS must be reliable and the data sets are accurate and qualitative. A reconnaissance visit was made to the study area for familiarization. The data used for this study came from both primary and secondary sources.

#### **3.3.1 Primary Data Source**

This is the spatial acquisition of the coordinates of control points to be used for the Georeferencing of the aerial photographs and satellite imagery.

#### **3.3.2 Secondary Data Source**

These are data sets not collected from the field. They are already existing data sets. These sets of data were acquired from the topographic an, street maps; aerial photographs and satellite imagery.

#### **3.3.3 Data Conversion**

##### **Analogue to Raster Conversion**

The street map, topographic maps and the aerial photographs of the study area were scanned and loaded into ArcMap environment in the system. The imagery of the study area was also downloaded from Google Earth.

### **3.4 DATABASE MANAGEMENT SYSTEM**

The database created must be well managed especially with respect to data security and integrity. This is a set of computer programs for

organizing the information in a database. It contains routines for data input, verification, storage, and retrieval. It provides facilities for data security, integrity and database maintenance. A DBMS is very critical to the function of a GIS – it determines the speed and ease at which GIS operates. In order words, ultimately, the sustainability of GIS will depend on DBMS and if poorly designed, the GIS can fail.

#### **3.4.1 Database Security**

Data security is very important in Geospatial Information System. It ensures that the only means of accessing the database is through the proper channel. Hence authorization checks are carried out whenever access to sensitive data is to be made. This entails:

- (1) Protection of resources from damage so that the data can always be recreated if they become corrupted or are lost.
- (2) Use of passwords and authorization rules to protect data against intentional disclosure to unauthorized person, or their unauthorized modification or destruction.

#### **3.4.2 Data Integrity**

Data Integrity refers to the correctness and consistency of data in the database. Integrity rules should be programmed into the system such that cases of violation of integrity are automatically detected by the system. The system should either resolve the violation

(through predefined procedure) or warn the human operator immediately.

### **3.4.3 Database Maintenance**

The quality of a database depends on its currency and fitness for use as a Spatial Decision Support system (SDSS). Database must be kept up to date and properly maintained. Regular backup of the database and program must be done frequently.

classification functions, overlay functions, neighbourhood functions, connectivity functions and topographic functions.

ArcGIS 10.3 provides the necessary tools to perform analytical operations on spatial data to obtain required useful information. Linking attribute data and spatial data was achieved by assigning identifiers to spatial features and the identifiers were used for the analysis. In this research, functions like query and overlay were the major functions made use of.

## **4.0 SPATIAL ANALYSES AND PRESENTATION OF RESULTS**

### **4.1 DATABASE ANALYSIS**

What distinguishes GIS from all other information system is its ability to perform spatial analysis. GIS analytical capabilities are classified into measurement, retrieval and



**Fig 4.1: Topographic map of 1964 showing the study area.**  
*Source: Office of the Surveyor General of the Federation.*



**Fig 4.2: The Lagos street map of 1999 showing the study area.**  
*Source: Office of the Surveyor General of the Federation.*

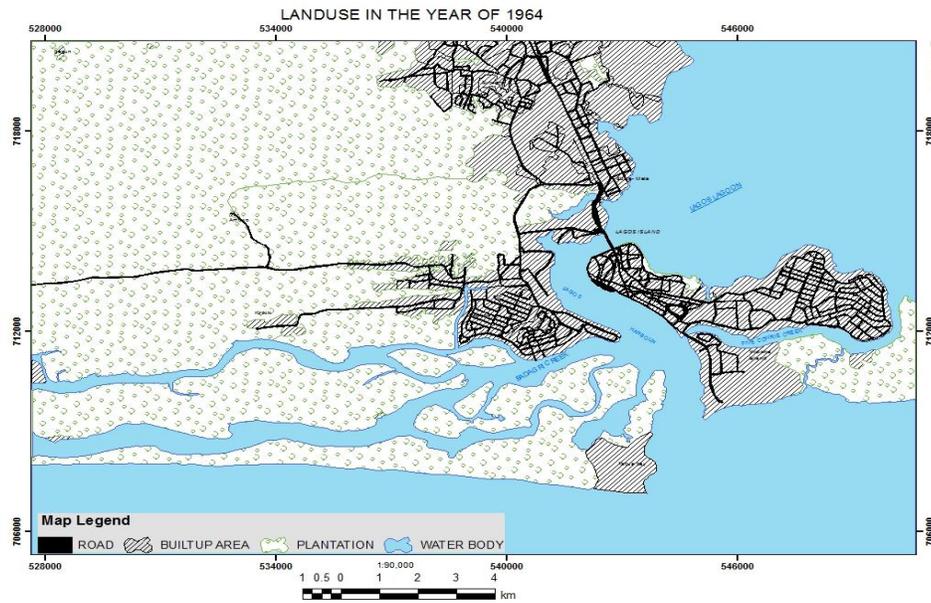


**Fig 4.3: The Imagery of Lagos and Environs of 2015.**  
*Source: Google Earth.*

#### 4.2.1 OVERLAY OPERATION

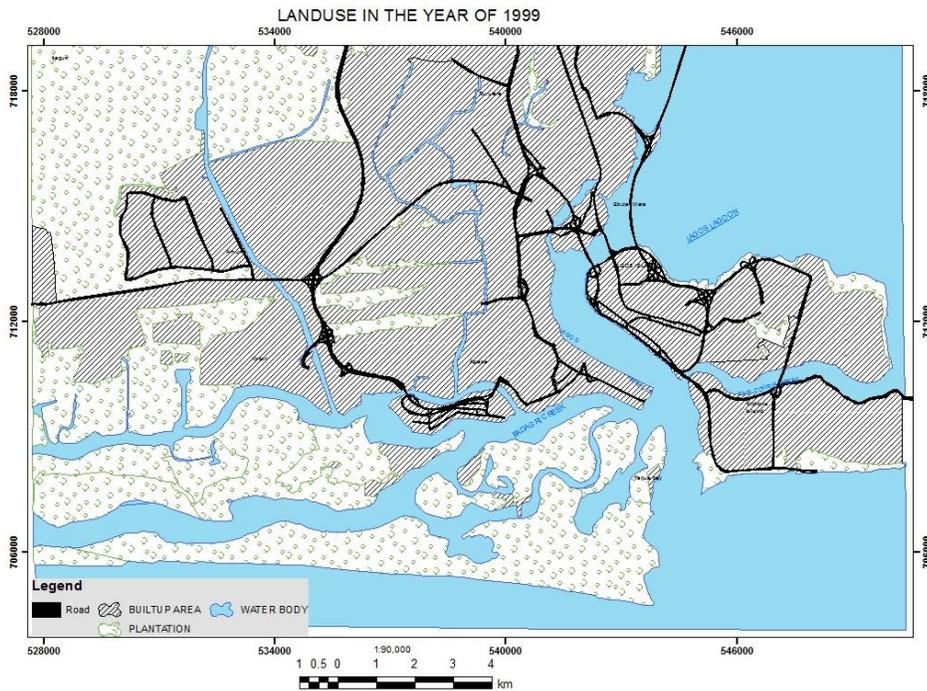
Overlay operation involves bringing different data sets (theme) which are available in the database together for meaningful analysis to be carried out. Based on epoch, overlay of both the topographic map of 1964 and street map of 1999 was performed and also that of street map of 1999 and satellite imagery of 2015 was done.

By this, map showing the area covered by different types of land use including urban growth between 1964 and 1999 was produced and that of between 1999 and 2015 was also produced. The maps showing the different types of land use generated from the secondary data are shown below.



**Fig. 4.4: Map of study area showing different types of land use in 1964.**

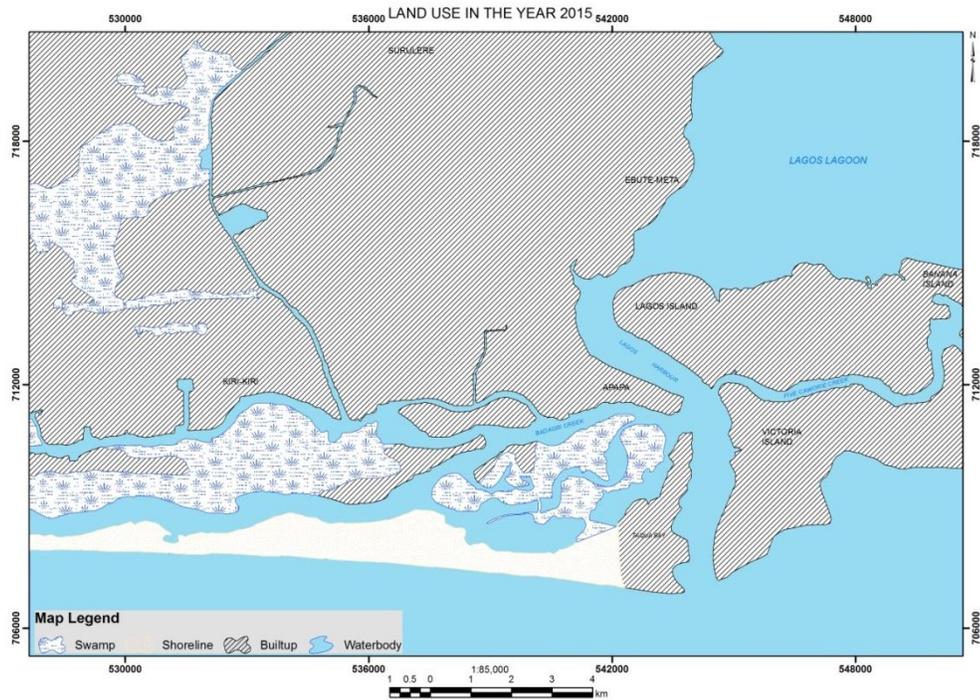
*Source: Researchers' Desk Review,*



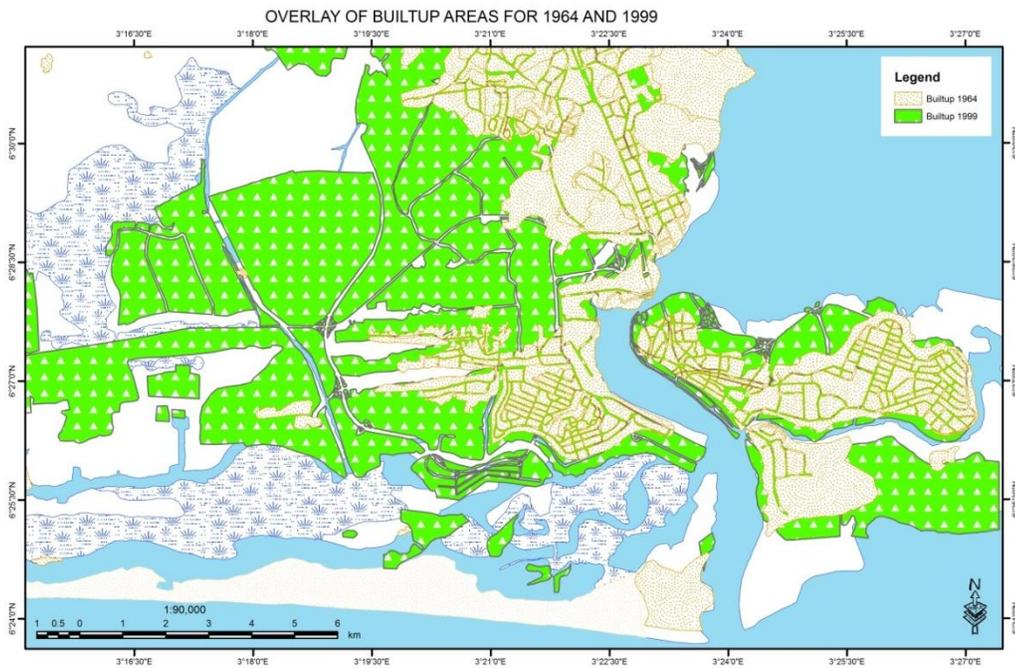
2019

**Fig. 4.5: Map of study area showing different types of land use in 1999.**

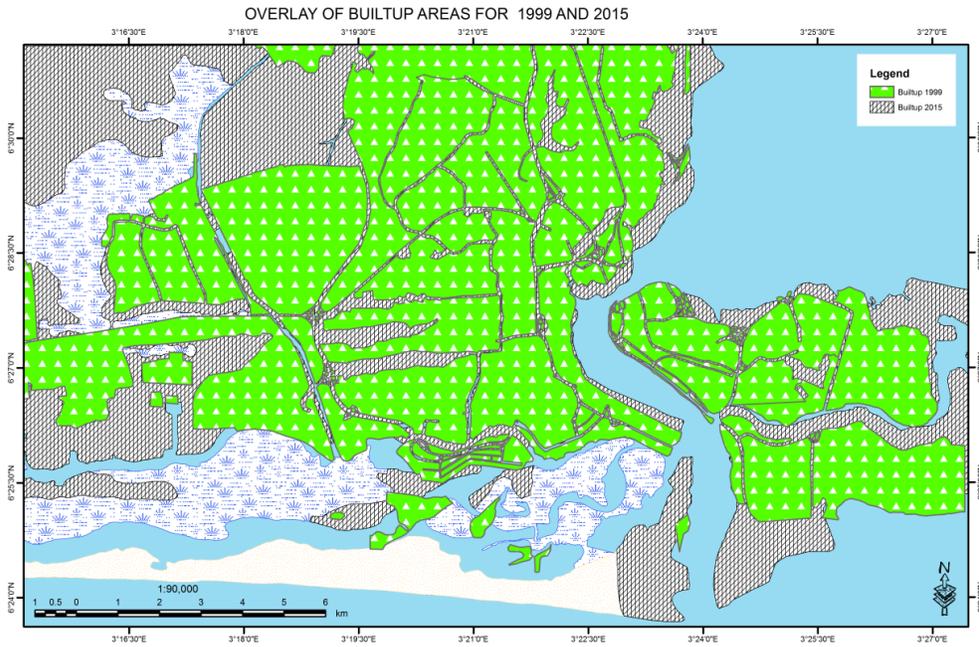
*Source: Researchers' Desk Review, 2019*



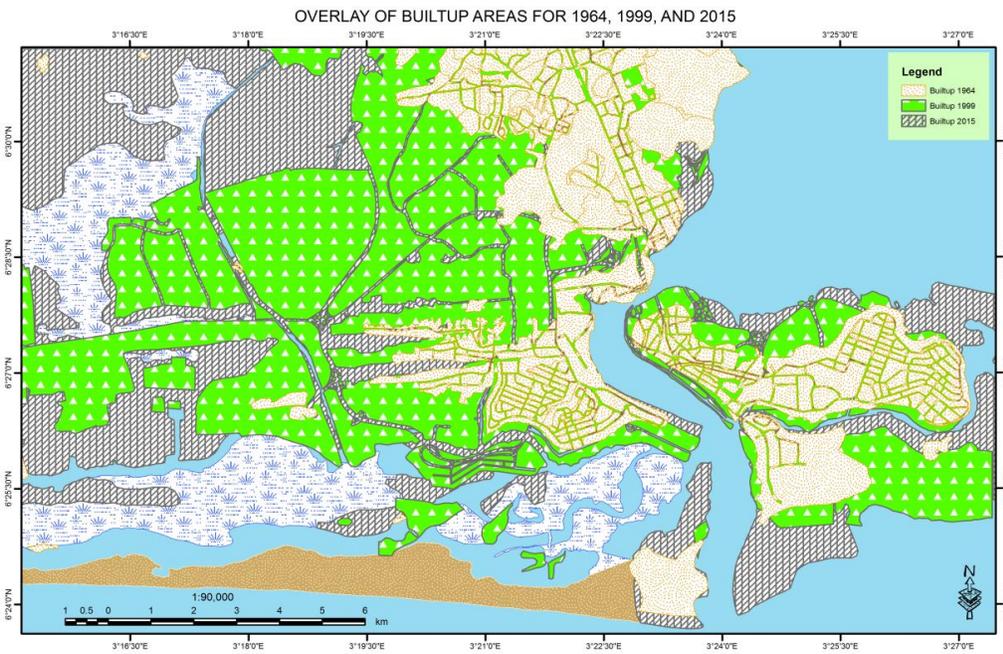
**Fig. 4.6: Map of study area showing different types of land use in 2015.**  
*Source: Researchers' Desk Review, 2019*



**Fig. 4.7: Map of study area showing overlay of built-up areas for 1964 and 1999.**  
*Source: Researchers' Desk Review, 2019.*



**Fig. 4.8:** Map of study area showing overlay of built-up areas for 1999 and 2015.  
*Source: Researchers' Desk Review, 2019.*



**Fig. 4.9:** Map of study area showing overlay of built-up areas for 1964, 1999 and 2015.  
*Source: Researchers' Desk Review, 2019.*

### 4.3 DISCUSSION OF RESULTS

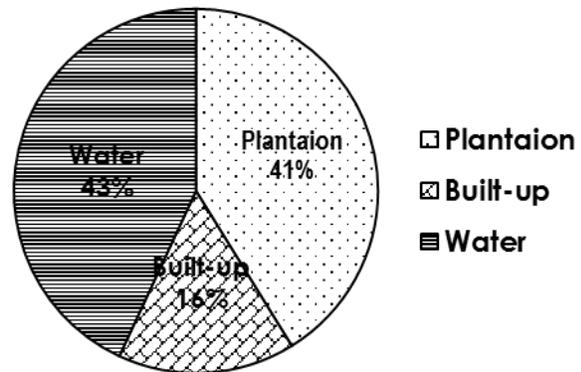
#### 4.3.1. LAND USE IN 1964

In 1964, the areas covered by the different types of land use are as shown in the table below.

The results showed that as at 1964, the built-up area was just 16% of the total study area. While areas occupied by water and plantation was 84%.

**Table 4.1: Table showing the areas covered by different land use in 1964.**

Land use type	Area (in hectares)
Plantation	14,932.944
Built-up	5,704.261
Water body	15,619.515



**Fig. 4.12: Chart showing the percentage of areas covered by different land use in 1964.**  
Source: Researchers' Field Study.

**4.3.2 LAND USE IN 1999**

In 1999, the areas covered by the different types of land use are as shown in the table below.

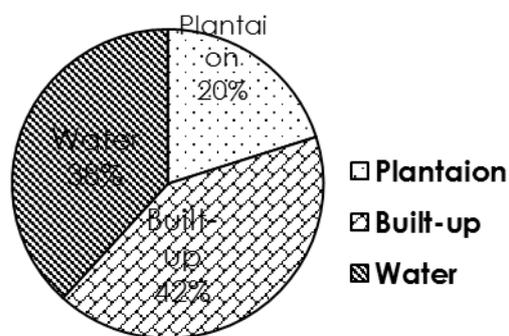
It was revealed that the area covered by both water and plantation had reduced while that of built-up increased especially towards the western part of the study area which comprises of the settlements like

Isolo, Ijegan, Apapa, Amuwo Odofin and Okota. Also the shore lines of Lagos Island in northern and southern parts were reclaimed by sand filling. The results showed that as at 1999, the built-up area has increased to 42% as against 16% of 1964. While areas occupied by water and plantation was 58%. The growth of the built-up area is 164% of the one that existed as at 1964.

**Table 4.2: Table showing the areas covered by different land use in 1999.**

Land use type	Area (in hectares)	Percentage
Plantation	7,285.863	20
Built-up	15,104.796	42
Water body	13,866.061	38

Source: Researchers' Field Study



**Fig. 4.13: Chart showing the percentage of areas covered by different land use in 1999.**

Source: Researchers' Field Study

**4.3.3 LAND USE IN 2015**

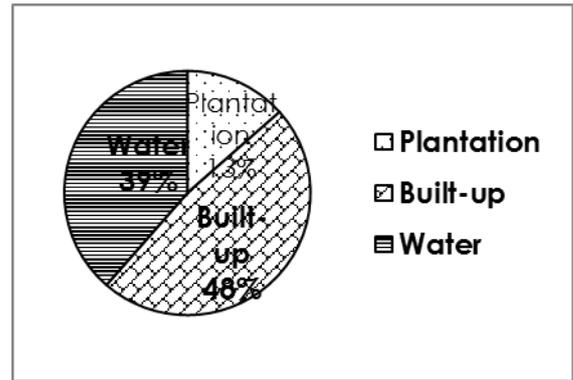
In 2015, areas covered by the different land use are as shown in the table. From the result it was discovered that the areas covered by plantation as at 1999 had reduced drastically to 9% by 2015 due to clearing for developmental or recreational activities. The increase in the built-up area which had gone to 48% may be due to the increase in population and also as a result

of land reclamation activities along the shore lines as evidenced in the north eastern part of Ikoyi Island and also in the northern and southern parts of Lagos Island. An increase of about

1% was noticed on water body, this may likely be due to incessant sea erosion along the shore line.

**Table 4.2: Table showing the areas covered by different land use in 2015.**

Land use type	Area (in hectares)	Percentage
Built-up	17,393.737	48
Water body	13,986.201	39
Plantation	4,876.782	13



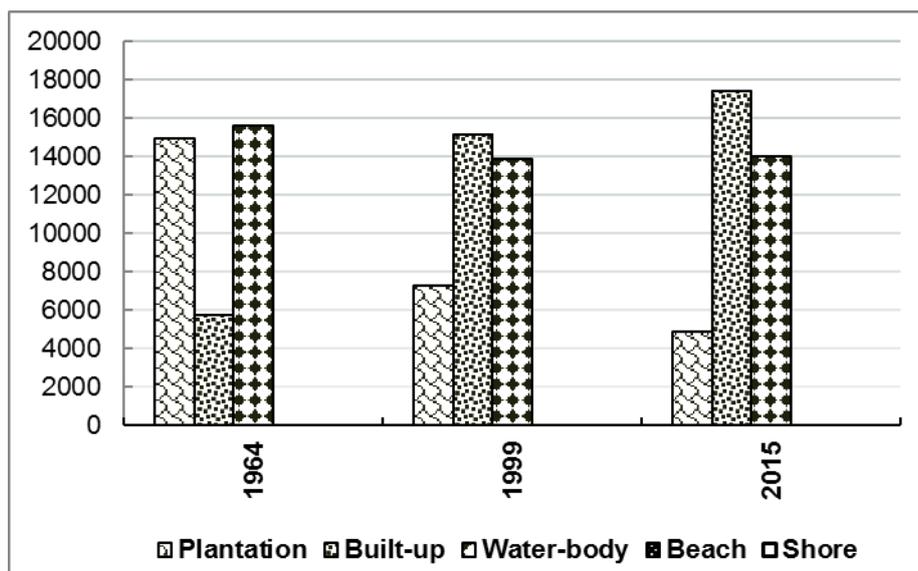
**Fig. 4.14: Chart showing the percentage of areas covered by different land use in 2015.**

Source: Researchers' Field Study

**Table 4.2: Table showing the areas covered by different land use between 1964 and 2015.**

Land use type	1964	1999	2015
Plantation	14,932.944	7,285.863	4,876.782
Built-up	5,704.261	15,104.796	17,393.737
Water body	15,619.515	13,866.061	13,986.201

Source: Researchers' Field Study



**Fig 4.15: Bar chart showing the areas covered by different land use from 1964 to 2015.**

Source: Researchers' Field Study

## **5.0 SUMMARY, CONCLUSION AND RECOMMENDATIONS.**

### **5.1 SUMMARY**

The main purpose of this study was the application of Geographic Information system combined with Remote Sensing techniques in assessing the degree of urban growth of Lagos metropolis from 1964 to 2015. Various datasets were integrated from the database created and conversion carried out. The data sets for this study were topographic map and street map which were converted to digital format by scanning and also satellite imagery which was downloaded from Google earth.

Different analyses were carried on the maps and satellite imagery using ArcGIS 10.3. These analyses were necessary in order to show the extent of urban growth of the study area at different times. The spatial search analysis was carried out on each map and imagery to know the extent of growth for different periods while the overlay analysis was carried out to know the degree or the amount of growth for the different periods.

### **5.2 CONCLUSION**

The urban growth is one of the human-induced potential threats to sustainable development where urban planning, with effective resource utilization and allocation, is a crucial concern. Thus,

identification and analysis of the growth would help in effective land-use planning in an urban area.

In the current study, Lagos has witnessed a huge urban growth in the second half of the twentieth century that might be due to the enormous national income expansion due to the oil discovery in the Delta region. That economical growth commenced an urban development revolution for the city, being the seat of the government then a commercial centre. It was this revolution that forced the government to move the capital to a virgin area in the late seventies which today is known as Federal Capital Territory.

GIS-based technology provides state-of-the-art analytical and management tools to spatially analyze and study patterns and spatial variations and correlations to make more informed decisions. Therefore, applying Geographic Information System spatial analysis tools and Remote Sensing Techniques produces more valuable pieces of information. It is concluded that the utilization of Geographic Information System in urban growth researches is quite powerful and provides an effective technical tool that helps in analyzing and understanding such phenomena.

It is recommended that the attained results should be taken into account by decision-makers in implementing new development planning of emerging Lagos Megacity.

### 5.3 RECOMMENDATIONS

Geographic Information System as a decision making tool is inevitable in planning and management of geospatial information. GIS is now an integral and important tool in solving and managing environmental problems and the environment itself. Especially problems associated with influx of people from the rural areas or villages into major cities like provision of utilities inform of electricity, roads, portable water. In view of this I hereby recommend that spatio-temporal analysis should be carried out frequently about five years interval in order to assist the government in planning for the provision of social infrastructures for the populace.

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## EVALUATION OF CONTEMPORARY CHALLENGES OF PUBLIC PARTICIPATION IN ENVIRONMENTAL IMPACT ASSESSMENT IN YOLA NORTH L.G.A ADAMAWA STATE

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Economic activities arising from rapid industrialization and urbanization have been affecting components of the environment which lead to rapid loss of natural resources and environmental pollution. However, on 1st January, 1970, the United State of America had the distinction of becoming the first country in the world to adopt legislation requiring Environmental Impact Assessment (EIA) on major projects through the National Environmental Policy Act

(NEPA) of the United States of America as a tool for environmental protection and sustainable development at the UN Conference on Environment and Development in Rio de Janeiro. However, the Rio Declaration proclaims that: EIA as a national instrument shall be undertaken for proposed activities that are likely to have adverse impact on the environment (Ogola, 2007).

Globally, EIA has become a requirement for project development. However, EIA

### ABSTRACT

*This study was carried out among residents of Jimeta town, with the aim of evaluating people's perception on contemporary challenges influencing public participation in EIA process. Sixty respondents (twenty in each ward) were sampled from three wards of Doubeli, Gwadabawa and Jambutu in Jimeta town for the purpose of this study. Data were analyzed using descriptive statistics of table of frequency and percentage. The study revealed that public participation in EIA process was relatively affected by factors mentioned in this study (table 1.2), which consequently has its effect on the environment. Results from this study also revealed that members of the public were only allowed occasionally by government officials to participate in EIA process in order not to hinder the success of a project. These factors have made the study area to be vulnerable to environmental problems which may have serious effect on the people in the nearest future if not averted. It is recommended that ministry of environment and stakeholders should strengthen and implement policies that will improve public participation in EIA process. In conclusion, developers should recognize and incorporate members of the public at all stages of any development project with the aim of promoting environmental management and economic growth.*

*Keywords: EIA, Contemporary, Challenges, Participation, environment.*

was resisted as a major project development and requirement in the process of public

participation is mostly ignored by many developers who argued that it was anti-development because laws and policies supporting it dictated that land development causing negative impacts should be discontinued. Moreover, EIA in developing countries tends to be very different from developed nations for the fact that in developing countries, EIA has been carried out because of pressure from donor agencies rather than demand for environmental protection (Makarenko, 2012).

Environmental Impact Assessment is a process of evaluating the likely environmental impacts of proposed projects or activities, including both favorable and harmful impacts. EIA is normally conducted before implementing the project in order to identify the environmental, social and economic impacts. EIA is used as a tool for environmental conflict resolution (Kakonge, 1998), environmental sustainability (Bruhn-Tysk and Eklund, 2002), environmental protection (Wood, 2003) and environmental management (Jay, Jones, Slinn, and Wood, 2007; Polonen, Hokkanen, and Jalava, 2011).

Like most developing countries, economic growth, urbanization and industrialization takes place in Nigeria without proper planning for the environmental effects of such projects. To put

this to a stop, several regulations have been put in place. One of the regulations is the EIA Decree No. 86 of 1992 now known as EIA act No. 86 of 1992. The most important aspect of the EIA process is the public participation. This process is clearly stated in Part II Section 25, 32-39 of the EIA act. The EIA Act makes it mandatory for all projects that are to be undertaken by Federal, State and local governments, parastatals/agencies as well as private sectors to undergo EIA process. In Nigeria, the EIA Act empowers the Federal Ministry of environment (FMENV) to enforce the implementation of EIA (Yusuf, 2008).

In Nigeria, in spite of elaborate environmental impact assessment process that precede development projects, there are increasing social action and crippling protests against these projects (Enukora, 2010). In most cases beneficiaries cannot point to the fact that EIAs were carried out on projects that are meant to meet their needs. It is against this background that the paper examines the level of public participation in EIA in the study area. This is measured mostly against how people perceive EIA in development projects in the study area.

### **The Study Area**

The study was carried out in Doubeli, Gwadabawa and Jambutu wards all of Yola North L. G. A Adamawa state (Figure 1), it has a total landmass of 831km<sup>2</sup> and total population of 392,854. The area lies between Longitude

12° 15' 38" to 12° 34' 45"E of the Greenwich meridian and Latitude 9° 7' 50 to 9° 18' 33"N of the Equator. The area is characterized by two seasons which are dry and raining season, with an annual temperature ranges between 30° to 48°.

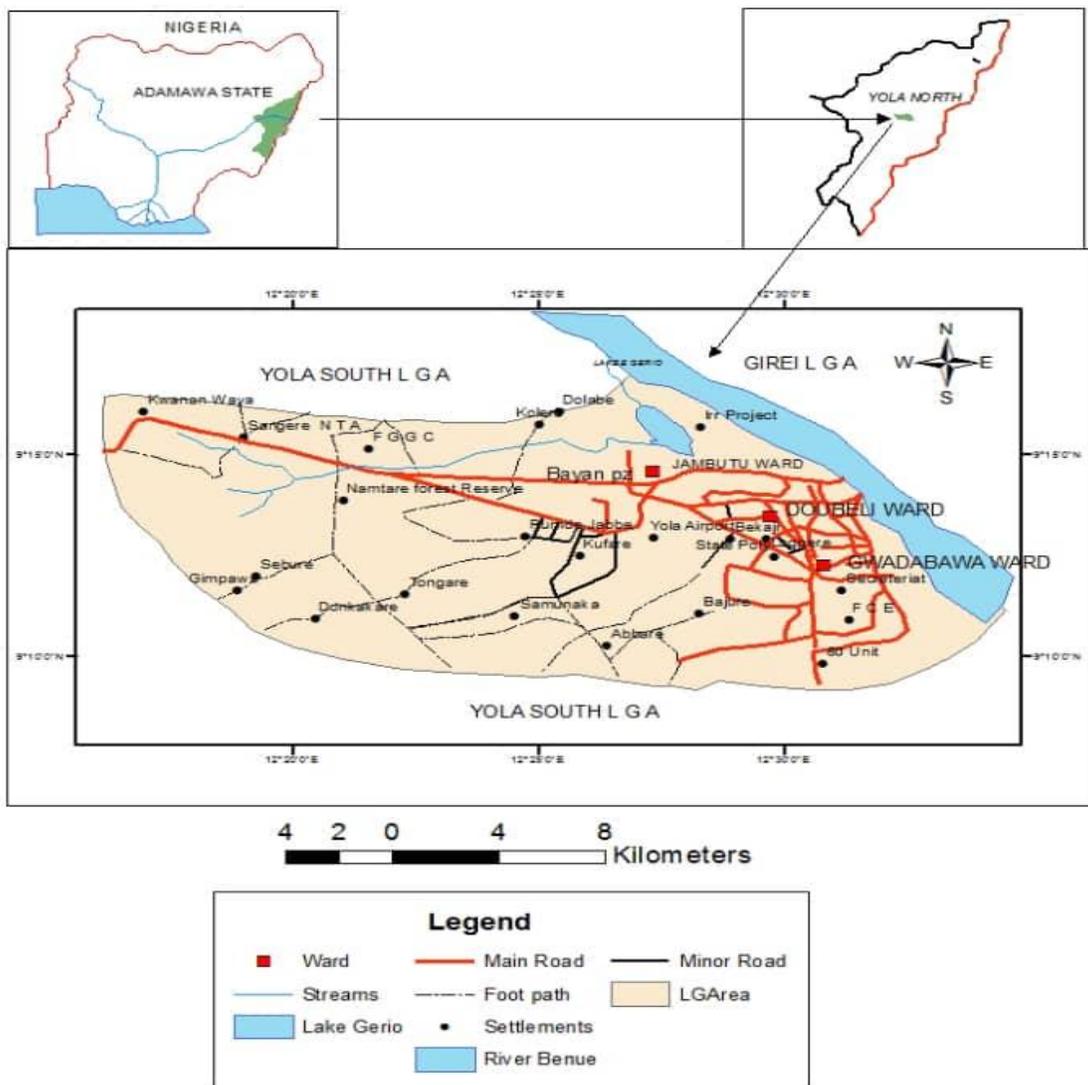


Figure 1: The Study Area

Source: Adamawa State Min. of Lands

## 2.0 REVIEW OF LITERATURES

According to Momin, (2007) the following should be incorporated into the EIA process in order to solve problems arising from development projects thus;

1. Involvement of public/community in scoping exercise.

2. Public participation during EIA report writing should not be restricted to traditional rulers, district heads and notable people. A community gathering of not less than 100 people must be Part of the consulting process.

3. More community members must be involved in the assessment of the draft EIA report during mandatory public display.

4. Comments of experts must be made available to the public.

5. A mandatory registry containing all records and information produced, collected or submitted in respect of EIA project must be available at the Local government Secretariat where the project is situated.

6. Involvement of Non- governmental Organizations (NGO's) and Community Based Organizations (CBO's) in planning, evaluation, and monitoring of EIA should be made mandatory.

According to the general principles of public participation, there should be an equal representation of each stakeholder. Any person or group of people, who have some link or

interaction with the proposed project, should be considered to avoid risk from the project.

The following are the different stakeholders involved in the process of public participation;

1. The people

This is the individuals, groups and communities affected by the proposed project, which they have local knowledge that can be collected and integrated into the baseline data.

2. The proponent

The proponents are those who propose to carry out the project, mostly those trying to create a public understanding of the project to ensure its success.

3. Government agency

This is most likely the EIA agency (FMENV) who will try to ensure that their regulatory responsibilities are addressed to avert controversy at the later stages of the project.

4. NGOs / Interest groups

These are independent groups that that can contribute to the success of EIA process because of their vital roles in the society. They most likely provide alternative discourse and perspective on the project.

5. Other interest groups

These groups of individuals for example include; experts in particular fields related to the project

## **Public participation in Environmental Impact Assessment**

Public participation is a process of involving the public in a program, project or policy. The inclusion of public participation in such processes is considered as a requirement. According to United Nations, (1992) all human being shall have the right to live in dignity and freedom and enjoy the fruits of social progress and should on their part contribute to it. However, Top- down approach in handling and management of development project that lacks the need of public participation will have harmful and costly consequences (Tang, Tang and Lo, 2005).

Over the years, several authors have identified criteria for effective public participation. These authors include Glasson et al, (1999) and UNEP (1992). The criteria identified include:

1. Identification of the individuals/groups interested in or affected by the proposed development.
2. The information flow must be two way traffic that must establish a dialogue between the public and decision makers.
3. It must cater for different levels of technical sophistication and for special interest.
4. Project developer must provide pertinent and timely Information.
5. Members of community, general public as well as local authorities must have access to the decision process.

Public participation in EIA therefore, has a critical role to play in helping to integrate economic, social and environmental objectives in order to move towards more sustainable development by acting as a driver to strengthen and increase public awareness of the delicate balance between economic and environment. It also safeguards against bad or politically motivated decisions. Public participation can make a positive contribution to the EIA process through minimizing or avoiding public controversy, confrontation and delay (Silas, 2013).

The EIA process makes provision for some public involvement. The involvement included in EIA process are public consultation and public participation; however, the latter is a more interactive and intensive process of stakeholder engagement. Most EIA processes are undertaken through consultation rather than participation (Wathern, 2013). Public consultation is a regulatory process by which the public's input on matters affecting them is sought, while public participation is a democratic process of engaging people in thinking, deciding, planning, and playing an active role in the development and operation of services that affect their lives (Wathern, 2013). The minimum, public participation must provide an opportunity for those directly affected by a proposal to express their views regarding the proposal and its environmental and social

impacts. In this way, participation may reduce conflict and avert the situation that can cause major damage to a project (Andre et al, 2006).

The purpose of public participation is to inform the stakeholders about the proposal and its likely impacts, canvass their inputs, views and concerns, and take account of the information and views of the public in the EIA process and in the decision making process (NEMA, 2003). The key objective of public participation in the EIA process is to obtain local and traditional knowledge that may be useful for decision making, facilitate consideration of alternatives, mitigation measures and trade-offs. It also ensures that important impacts are not overlooked, benefits are maximized and damages are minimized through early identification of contentious issues. Public participation also provides an opportunity for the public to influence project design in a positive manner, improve transparency and accountability of decision making and increase public confidence in the EIA process (Wathern, 2013).

Without adequate and meaningful public participation, the EIA process lacks the necessary social component that makes it an effective tool for sustainable environmental management and development. This is because public participation bridges the gap between relying on theoretical, technocratic, and governmental exclusivity of decision making

and face the reality at hand. Furthermore, public participation allows government to implement policies, endorse laws applicable to community environmental management, and consider their needs (Andre et al, 2006).

Public participation at different levels of EIA process raises accountability and reliability of decisions, lessens risks of possible conflicts and inconsistencies and facilitates implementation (Gugushvili, 2005). It allows and informed citizenry to contribute to the efforts of a transparent and accountable government in producing higher quality decisions concerning the environment (Agaja, 2013).

Formal opportunities for public participation in EIA are defined in legislation. While rights of participation in many countries are limited to opportunities for viewing and commenting on finalized reports, in principle, public participation can occur at every stage in the EIA process however, there are a number of advantages in involving the public early in the EIA process. Public participation should occur early in the EIA process through the effective interaction among the public, developer and decision making body if the full benefits are to be achieved. (Ogola, 2007).

According to the general principles of public participation, there should be an equal representation of each stakeholder. The views of an individual or group of people associated with

the proposed project should be considered to avoid any risk factors. Also World Bank argued that consultation with affected communities is a key to the identification of impacts and the design of mitigation measures (World Bank, 1999). The most vulnerable in society have very little influence on government decision yet they are the ones mostly affected by such decisions (Kende-Robb and Van Wicklen, 2008). Therefore, public participation in EIA reverses this status quo and affords them a voice in the formulation of policies (Jackson, 2001). In reference to environmental management, the vulnerable population are classified as those that rely on the environment as their source of livelihood such as farmers (Kende-Robb and Van Wicklen, 2008).

Many, but certainly not all, countries with EIA programs have mandated public participation in EIA. A continuing problem plaguing many EIA process is that public participation occurs too late to take advantage of full information that citizen can contribute concerning values, impacts and alternative projects. Public participation is often reduced to public relations or defending a decision that has already been made (Ngonge, 2015).

### **Public Participation in Environmental Impact Assessment process in Nigeria**

The basis for public participation and consultation in EIA process in Nigeria was enacted in the Environmental Impact

Assessment Act No. 86 of 1992. In the Act: Section 7 and 22 (3) of the Act stipulates that government agencies members of the public experts in any relevant discipline and interested groups should be given opportunity to examine and comment on the EIA of a proposed project. Section 25 provides that FMENV should publish a notice setting out the date and place the mandatory report shall be made available to the public as well as the deadline and the address for filling comments on the conclusion and recommendations of the report. Section 37 provides that mandatory report shall be subjected to review panel and FMENV shall ensure that: the information required for an assessment by a review panel is obtained and made available to the public as well as hold public hearing in a manner that offers the people an opportunity to participate in the assessment (Yusuf, 2008).

The Public participation takes three forms: the initial consultation during the assessment process, the public is further committed in the involvement of the EIA process by a public display of the draft of EIA report for 21 days mandatory in the Local Government Secretariat, State Ministry of Environment, Zonal Offices of Federal Ministry of Environment and at the National Office in Abuja. The final stage is public participation in review of the project (Yusuf, 2008). In Nigeria, public participation in EIA process can be consider as poor, weak

and did not address the actual issues in our communities in comparison to the provision of the Act that established the EIA process (Silas, 2013).

In view of public participation in EIA process a survey was conducted to evaluate the participation of the general public in the various aspect of the EIA process in Nigeria, with five major projects carried out in Lagos State as case study. It was observed that 42 percent of participant took part in the first stage of the public participation, 5 percent took part in second stage, while 10 percent of participant took part in the third stage. It was generally observed that the surveyed participants did not see or read the EIA document before the public review and were not informed or given access to

### **3.0 METHODOLOGY**

The study employed both primary and secondary sources of data to collect information. The primary data were raw data collected from the respondents in the study area. The secondary data which include related literatures of the study were sourced from published and unpublished materials such as magazines, articles as well as journals. A questionnaire was used as a tool of data collection.

#### **Objective**

The objective of this study is to evaluate people's perception on the contemporary

records relating to environmental impact assessments after the panel review or public review which is contrary to section 37 of the EIA Act. Example of this is the expansion of Lekki- Epe expressway and Lekki- free trade export zone where communities raised several issues after the projects were been issued an Environmental Impact Statement and certificate (Yusuf, 2008).

The inability of the public to be fully integrated in the EIA process often lead to delay in carrying out project, conflicts and other social and political interference of the project. In order to reduce community conflicts in carrying out projects, members of public must fully be involved in the EIA process.

challenges affecting public participation in EIA process in the study area.

#### **Sampling**

Data were sampled from the three wards of the study area (Doubeli, Gwadabawa and Jambutu) to ascertain the level of respondent's participation in EIA process. Random sampling was used to sample the total of 60 respondents, with 20 respondents each from the three wards in the study area. This was achieved through the use of a questionnaire.

### **Data Collection**

For effective data collection of this study, a questionnaire was used to collect data from the respondents in which it was designed into two sections. Section “A” consist of demographic characteristics of respondents while, section “B” address the challenges of public participation in EIA where the respondents responded to the items as; Agreed, Undecided or Disagreed. Descriptive statistics of tables of frequency and percentage as well as bar graph were employed for the analysis of data in this study.

## **4.0 RESULTS AND DISCUSSION**

### **Demographic Characteristics of Respondents**

The data on demographic characteristics of respondents in this study were presented in table 1.1. The result shows that about 72% of respondents were male while 28% were female. There is wide discrepancy in the percentage of male respondents as against that of the female respondents in the study area because of the easy access to male respondents compare to the female respondents in the study area due to the fact that females are restricted from going out or attending to opposite gender except with permission. In terms of age, none of the

respondents was less than 18 years of age, because this study deliberately covered respondents from 18 years and above, since these are people considered as responsible adults with the intellectual ability that can respond to environmental issues (Ziadat, 2010).

Table 1.1 revealed the percentage of respondents in terms of age where the highest percentage consists of those between the age cohorts of 41- 60 years which represent 42%. This was also the group with highest number of respondents (25 respondents) that have attained secondary education. Those from 61 years and above were 30% and about 28% of the respondents were in the age cohort of 18- 40 years. In terms of educational attainment, 12% of respondents never attended formal education, 33% of the respondents went to primary school and those who attended up to tertiary education were about 13%. A substantial number of respondents that had attained secondary education were 42%. In respect to income level, out of the sixty respondents that responded to the question on average monthly earnings, 47% of respondents earned between ₦1, 000- ₦30, 000 monthly, 41% earned between ₦31, 000- ₦60, 000 and 12% of the respondents earned ₦61, 000 and above.

The above analysis revealed that, the dominant respondents for this study were males within their active and productive ages. The result also revealed that most of the respondents in this study were literate because they have attained up to secondary level of education this, can serve as an advantage to public participation in EIA process only when information on EIA and infrastructures are made available and not restricted. However, as level of income increases so also the percentage of respondents' decreases, this revealed that dominant respondents in the study area were

of low income group which is one of the factors influencing public participation in EIA process. The low economic status of the people residing in the study area explains the low level of public participation because of the fact that most of them used to be engaged in different work, in order to meet up with their daily needs. This is also revealed by Duflo, (2012) that members of the public participate less in environmental management programs due to poor empowerment, low access to information, poverty, and illiteracy.

Table 1.1 Demographic characteristics of respondents

	SEX		AGE			EDU. LEVEL				INCOME LEVEL			
	Male	Female	18-40yrs	41-60yrs	61yrs >	Pri.	Sec.	Ter.	Non-formal	1,000-30,000	31,000-60,000	61,000>	
W1	14	06	05	09	06	05	08	03	04	10	08	02	
W2	17	03	08	09	03	07	08	04	01	05	11	04	
W3	12	08	04	07	09	08	09	01	02	13	06	01	
<b>Total</b>		<b>43</b>	<b>17</b>	<b>17</b>	<b>25</b>	<b>18</b>	<b>20</b>	<b>25</b>	<b>08</b>	<b>07</b>	<b>28</b>	<b>25</b>	<b>07</b>
<b>Percentage</b>	<b>72</b>	<b>28</b>	<b>28</b>	<b>42</b>	<b>30</b>	<b>33</b>	<b>42</b>	<b>13</b>	<b>12</b>	<b>47</b>	<b>41</b>	<b>12</b>	

Source: Field work, (2018)

NB: W1= Doubeli Ward, W2= Gwadabawa Ward and W3= Jambutu Ward

### **Respondents Response on Lack of Public Consultation**

Regarding public consultation in EIA process during a project planning and design, the responses are shown in table 1.2. From the table below it is evident that low level of consultation during the planning and design phase happened. The result revealed that majority of the respondents with 48.33% agreed that members of the public were not consulted regularly during project planning and design in the study area. 26.67% did not have idea about public consultation in EIA process while, 25.00% of the respondents were optimistic that members of the public were consulted in EIA process. This result revealed a failure in terms of consultation of members of the public in EIA process. The low level of public consultation indicated how public participation is often overlooked, the weakness of the legislations governing the EIA process, and the existence of weak administrative and procedural frameworks.

In a study carried out by Marara et al, (2011), it was noted that communities are facing challenges in public consultation in the EIA process, because public participation are often ignored by government and developers, as the legislations governing the EIA and the process are restricted from members of the public. In view of this, members of the public need to be consulted early to avoid the conflicts that may arise at the final stage of a project.

### **Respondent's Response on Lack of Communication between Government and the Local People**

Respondent's response on lack of communication between government and local people in the study area shown in table 1.2 revealed that 50% of the respondents agreed that there is lack of effective communication either through dialogue or mutual agreement between government and members of the public in EIA process Yola North L. G. A. 30% did not have any idea and 15% disagreed with this option.

Therefore, mechanism should be put in place to promote two way traffic communications. This can be achieved through good dialogue and mutual agreement framework because it will serve as a starting point for building a relationship with stakeholders for better environmental management. In some instances, language used create barrier for effective communication between the government and members of the public as explained by some of the respondents. Okello and Douven, (2008) in their study identified that language is a barrier to lack of familiarity with EIA guidelines, which also serve as hindrance to public participation in EIA. Language barrier influence the understanding of some of the aspects of the EIA, such as maps, technical data and environmental concepts such as policies and laws. Language barrier can be reduced through

the use of translators, simplification of technical data, and use of the local native language.

#### **Response on lack of legal framework**

Table 1.2 revealed the response of respondents on lack of legal framework in EIA process. The result shows that 21.67% of the respondents agree that legal framework did not exist in EIA process, 45% did not have idea as well as 33.33% were optimistic that legal framework exist by disagreeing to the statement. For any EIA to become more effective a legal framework needs to be provided for the process. Without mandatory guidelines, the EIA process will be ineffective in terms of implementation. Most countries have developed a legal framework for the EIA process. In the absence of a legal framework, other developmental pressures take over, making the EIA process somewhat ineffective. However, the legal framework that should be considered for EIA must, of course, reflect the local environmental management. In many cases, various outdated environmental related laws in African societies need to be streamline into a coherent framework, with a mandatory EIA process becoming part of the larger restructuring of environmental legislation.

#### **Respondent's Response on inadequate Government Capacity**

Response on inadequate government capacity in EIA process shows that highest percentage of respondents with 60% agreed that government lack the capacity to conduct effective

development project in the study area. 28.33% have no idea and 11.67% disagreed with the statement. When government capacity in terms of infrastructure and monitoring of project is inadequate, it can easily translate into a challenge of public participation in EIA process. Inadequate government capacity may serve as a basis for conflicts and have effect on development project. Therefore, government should take adequate measures to ensure that EIA processes are well designed and monitored in such a way that public participation is given priority.

#### **Response on Lack of Transparency**

In table 1.2, the result shows that 53.33% of the respondents were of the opinion that there was lack of transparency in EIA process. 35% did not decide with any of the options and 11.67% disagreed with the options. The result also revealed that most members of the community were not given the adequate opportunities to participate in EIA process due to lack of transparency. Transparency in respect to public participation in development projects has been made mandatory. Accordingly, the government should put more effort to ensure transparency through involving members of the public in the decision making process during development project. One approach that can make EIA process to be transparent is giving stakeholders sufficient time to allow the assessing of the implications of a project and submission of their

report. More so, developers should ensure that enough opportunities are given to the public such as holding consultative meetings in different venues for everyone to participate in the EIA process, as enough opportunities help realize the effectiveness of public participation. Developers should also ensure that adequate information on the negative and positive impacts of the project is provided. Information is important as it helps the public to evaluate the projects and decide on its viability. A project's benefits should outweigh its demerits to guarantee sustainability.

### **Response on Late Preparation of EIA**

Table 1.2 shows respondent's opinion on late preparation in EIA process, 55% of the respondents agreed that there was late preparation of EIA, 30% have no idea and 15% disagreed with the statement. The result therefore, revealed that there was late preparation of EIA in the study area which have an effect and usually deny the public the right of participation to give their input on the impact of a development project. Late preparation of EIA has been recognize to be one of the advantages taken by developers to avoid any input from the members of the public that may hinder the success of their project.

Table1.2 Respondents Responses on Challenges of Public Participation in EIA Process

S/N	Items on Contemporary Challenges	Frequency and percentage of responses					
		Agreed Frequency (%)		Undecided Frequency (%)		Disagreed Frequency (%)	
1.	Lack of Consultation	29	48.33	16	26.67	15	25.00
2.	Lack of Communication between Government and Local People	33	55.00	18	30.00	09	15.00
3.	Lack of Legal Framework	13	21.67	27	45.00	20	33.33
4.	Inadequate Government Capacity	36	60.00	17	28.33	07	11.67
5.	Lack of Transparency	32	53.33	21	35.00	07	11.67
6.	Late Preparation of EIA	33	55.00	18	30.00	09	15.00
<b>Total</b>		<b>177</b>		<b>116</b>		<b>67</b>	
<b>Percentage (%)</b>		<b>49.17</b>		<b>32.22</b>		<b>18.61</b>	

Source: Field work, (2018)

Figure 1.1 below, provided the summary of contemporary challenges of public participation in EIA process. 49.17% of the respondents agreed to the challenges affecting public participation in EIA process. 32.22% did not decide while, 18.61% disagreed. In a nutshell, the summary of the result revealed that most of the statement items were not in support of public participation where the respondents also

agreed to that. However, only few of the respondents disagreed and some did not decide with either of the options. This result therefore, concord with the findings of Kakonge, (2012) where the study revealed that public participation in EIA process is affected by some contemporary challenges such as lack of Consultation, inadequate Government Capacity and lack of transparency among others.

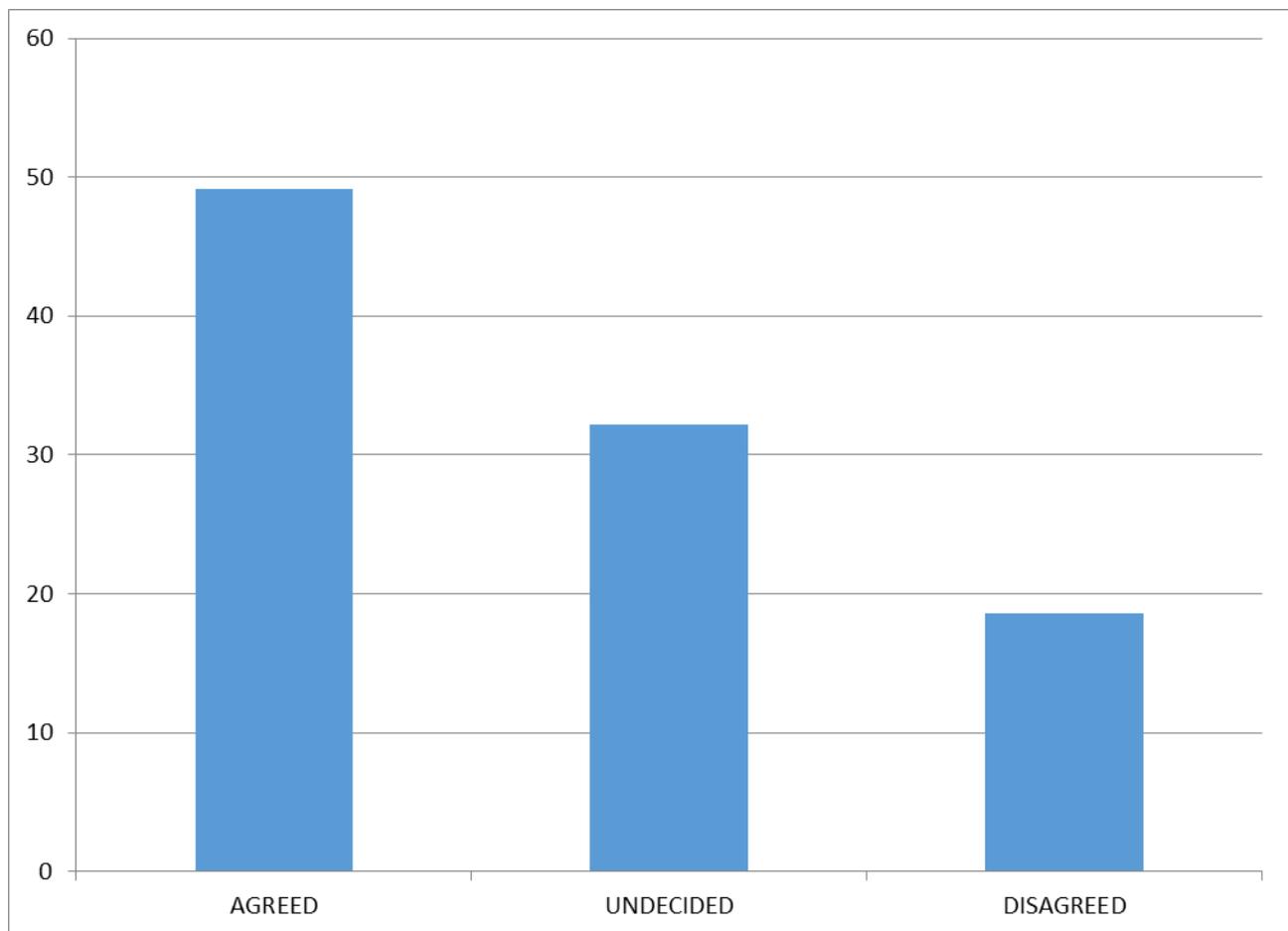


Figure 1.1: Summary of respondent's responses on contemporary challenges of public participation in EIA process

Source: Field Study, 2019

## 5.0 RECOMMENDATION AND CONCLUSION

### Conclusion

EIA certainly has a crucial role to play in addressing environmental issues surrounding any development of a project in the study area. One of the most important components of EIA process is public participation. Public participation promotes effective EIA process, transparency and acceptability of a project. The findings of this study shows that public participation was influence by a number of challenges that serve as hindrance to the EIA process. Therefore, stakeholders responsible for the regulation of EIA must ensure that mutual trust exists between them and the local people during EIA process to promote sustainable environment through economic growth.

### Recommendation

1. Ministry of environment should strengthen and implement policies that will improve public participation in EIA process.
2. Developers should recognize and incorporate members of the public at all stages of development project with the aim of promoting environmental management and economic growth.
3. Local people should ensure that there is corporation among themselves so that they can

engage stakeholders towards environmental sustainability in EIA process.

4. Ministry of environment should ensure that the appropriate techniques and experts in the relevant disciplines are employed, including use of traditional knowledge
5. Government should ensure that EIA process address the interrelationships of social, economic and biophysical aspects

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# CONCEPTUAL FRAMEWORK FOR DESIGNING A SPATIAL DATABASE AND MODELING LANDUSE INFORMATION IN THE FEDERAL CAPITAL TERRITORY ABUJA, NIGERIA.

by

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## 1.0 Introduction

In many parts of the world, it is inevitable that land uses are most times influenced by change in time and space due to growth in physical, demographic, social, economic and political development at smaller and larger-scale. However, land is the stage on which all human activity is being conducted (Maisamari, 2015). Similarly, Pandey and Nathawat (2000) observed that land is becoming a scarce commodity due to immense agricultural and demographic pressure. More so, the use to which land is put may be cyclic (repetitive) or longitudinal (continual and progressive) (Adejuwon and Adesina, 1998, Odeyemi,

1999 cited in Dami 2002) with such changes occurring over long and short periods. Hence, a given land use may take place on one, or more than one piece of land and several land uses may occur on the same piece of land (FAO 1997). Many interests are at stake when discussions involve transforming land or existing structure into other forms. Hence, the vital issue is that the pressure on land availability is thus becoming tremendous. This has continued to increase into the foreseeable future.

Human use of land resources gives rise to "land use" which is based upon function and varies with the purposes for which the land is

## ABSTRACT

*The research problem focuses on applying GIS as a potential tool in database design and creation. Yet with the recent development in computing, a dearth of data and poor geo-database exist with most land use studies being largely limited to mapping operations. Till date, the population in the FCT has grown at a phenomenal rate over a relatively short period of time. This has thus affected most land use patterns thereby making it the fastest growing city in the country today. Noteworthy is the vital issue on land availability is thus becoming tremendous in studying land use patterns due to their exerting pressure and is today one of the most important global issues particularly within the paradigms of sustainable development. In order to resolve the research problem, the study is therefore expounded on in terms of motivating an investigation of spatial and modeling concepts in database design for effective land use assessment studies. Thus, the noble objective is to be able to provide a strong information on land use patterns, develop robust spatial databases in a timely and cost effective manner and augment non-existing GIS databases that can be centralized, made accessible to all user agencies in order to avoid duplication of effort and help maximize efficiency in data management. Hence, the present findings will be more abundant and instructive.*

**Keywords:** *Land use, GIS, Remote Sensing, Spatial Concepts, Data Models and Database design*

being used (FAO, 1995). Land use refers to human activities occurring on the land and emphasizes the principal role of land in describing a region's economic activities which may include recreation, wildlife, refuge, timber production, or residential development (State of Illinois Department of Agriculture 2001) that alter land surface processes including hydrology and biodiversity (Efiong-Fuller, 2008) as well as are evident in critical problems due to several factors including increasing population, demolishing natural resources, environmental pollution and land use planning (Mohsen, 2006).

However, the bulk of such change in land use patterns is rapidly taking place today in the Federal Capital Territory owing to the political undertone attached to its creation and the need to speed up implementation at the expense of laid down procedures has brought about the rapid City development (e.g infrastructural and residential developments) by the FCDA and agricultural production by the indigenous farmers is still on the increase due to pressures from the rising population (Maisamari, 2015). Neither one of these stays still; they are in a constant state of flux as change is the quintessence of life. Noteworthy is the study of land use processes as one of the most important global issues particularly within the paradigms of sustainable development.

However, the existing land use patterns, because of their strong influence on how land could be used in the future becomes a crucial factor in deciding how land development, management and planning activities should be undertaken. Therefore, the study intends to serve as a management prototype, as well as develop vast fundamental land use data of the Federal Capital Territory for sustainable land use planning and decision making. The general rule applied here is that priority was given to those literatures and models that treat land use more importantly while assuming no consideration for mapping and change over time. Thus, the aim of the study is to throw more light in the modeling philosophies that are good and acceptable for the study. However, the specific objectives of the research are;

- i. to identify the different land use patterns in the study area;
- ii. discuss the spatial concepts and data models adopted for designing a spatial database and
- iii. develop a spatial database of the Federal Capital Territory land use.

### 1.1 Remote sensing and GIS Technologies.

Future prospects of remote sensing and GIS are increasing by the day. As an adjunct, Remote sensing and GIS are known to be not only powerful, but also cost-effective tools for assessing the spatial distribution and dynamics of land use land cover (Tottrup and Rasmussen, 2004; Giridhar, 2008; Wilson and Fotheringham, 2008; Zhiliang *et al.* 2008; Dewan and Yamahuchi, 2009) and can combine diverse information into an integral context. The Government of many nations as well as private companies are rapidly increasing the use and application of GIS methods in various fields (i.e. in the creation of database, mapping of municipal areas and management of natural resources) of vital importance. In their study on participatory land use, Ekpenyong (2008) affirm the use of a GIS database to model land use/cover change between 1984 and 2003 for Akwa Ibom State. Similarly, Idoko and Bisong (2010) and Ujoh *et al.* (2010, 2011) in their studies of the FCT monitored landscape transformation, estimated rate of vegetal cover that has been lost due to urban expansion within the Federal Capital City and revealed rates, extent and consequences of urban sprawl. Conversely, Idoko and Bisong (2010) emphasized a dearth of data, poor geo-database and recommended for the incorporation of database in further studies. However, the authors utilized Remote sensing and

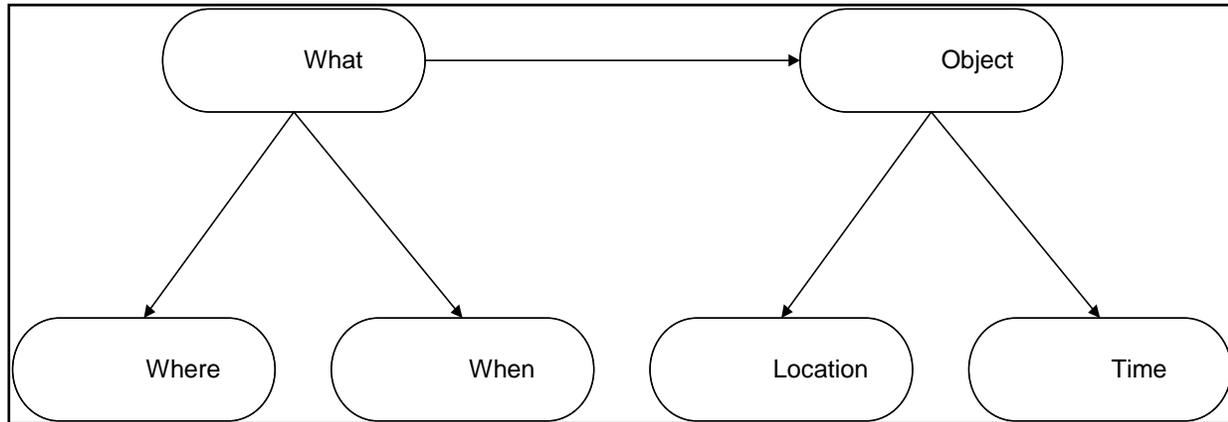
Geographic Information System to produce accurate results towards land use assessment without rearticulating the discourse on the validity of the database approach in their studies. This study further advances in this regard.

### 1.2 Concept of Spatial Data Modeling

A data model may be defined as a general description of a specific set of entities and the relationship between these sets of entities. Dates (1994) asserts that the purpose of any data model is to provide a formal means of representing information and a means of manipulating such representation. The modes of representation of these geographic primitives are largely dependent on the scale of communication and the 'view of reality' of the real world. Geographic Information System is tailored to operate on spatial data, which constitute space. Space is made up of infinite spatial objects taken to mean a relation defined on a set of objects and the basic philosophy is modeling. Hence, the land use pattern of a region is usually an outcome of both natural and socio-economic factors and their utilization by man in space over time (Maisamari, 2015). This means that entities (terrain objects) are measured with their relationships (refer to Figure 1.1). We can assume here that some of the components have to do with temporal change, which is constant while the remaining component, the geometric

value, is not known. In this process we are concerned with the abstraction process involving ‘What it is?’, ‘Where is it?’ and ‘When?’. The “what” becomes the phenomenon

or object while the “where” is the location of the object and the “when” is the time variation (i.e. date) (Kufoniyi, 1995).



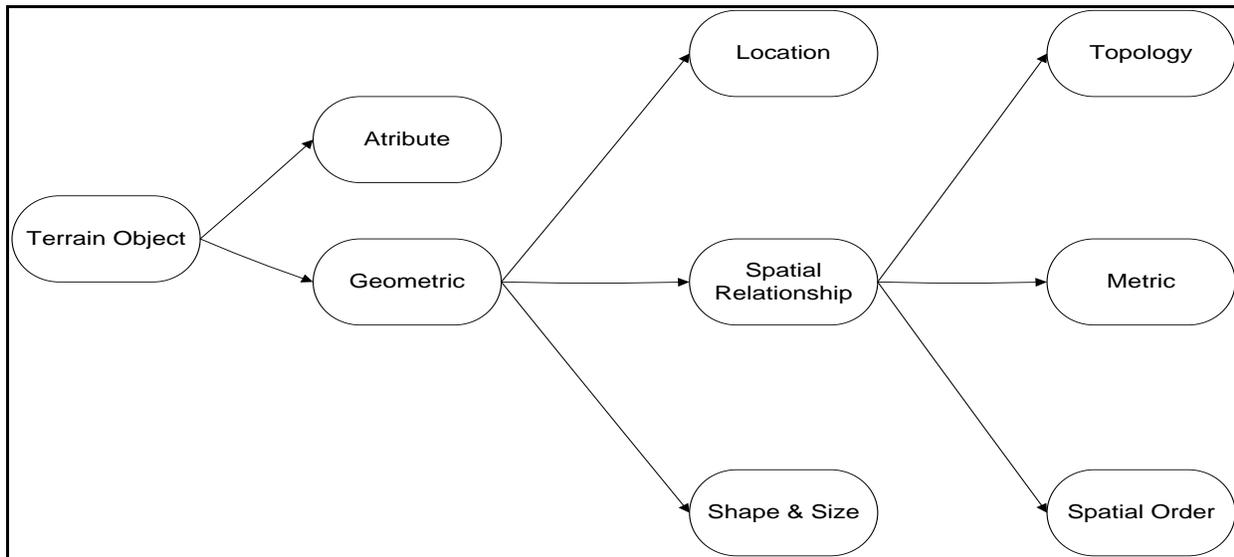
**Figure 1.1 Domain of Spatial Data Modeling (Kufoniyi, 1995).**

### 1.3 Concept of Geospatial Object

This is the identification of spatial data objects in terms of their attributes and geometric status. Geospatial object (refer to Figure 1.2) whether built up (urban), gallery forest, farmland, shrub land, dam and water body, political boundaries, hydrology and route network have two basic components, i.e. the thematic attribute data and the geometric data assuming time to be constant. The geometric components can further be classified into three components comprising location to be determined during the process of data acquisition and this can either be Object-Based approach through the use of GPS, or field-based approach through Digital Image Processing. Geospatial objects in space maintain spatial relationships with each other, and these

relationships are the basic mechanisms required for data modeling processes particularly in a vector data.

However, the nature of spatial problems becomes of interest when plans are to be made of spatial events. Finally, these concepts throw more light in mapping where, when and how land use will expand from or decline. The most important question is: which planning concepts and ideas are good or least acceptable. No wonder Ajala (2005) is of the assertion that GIS is the best technology for making faster, informed technical decisions, especially if such decisions are spatial as in this case. Therefore, the need for carrying out this systematic study becomes imperative.

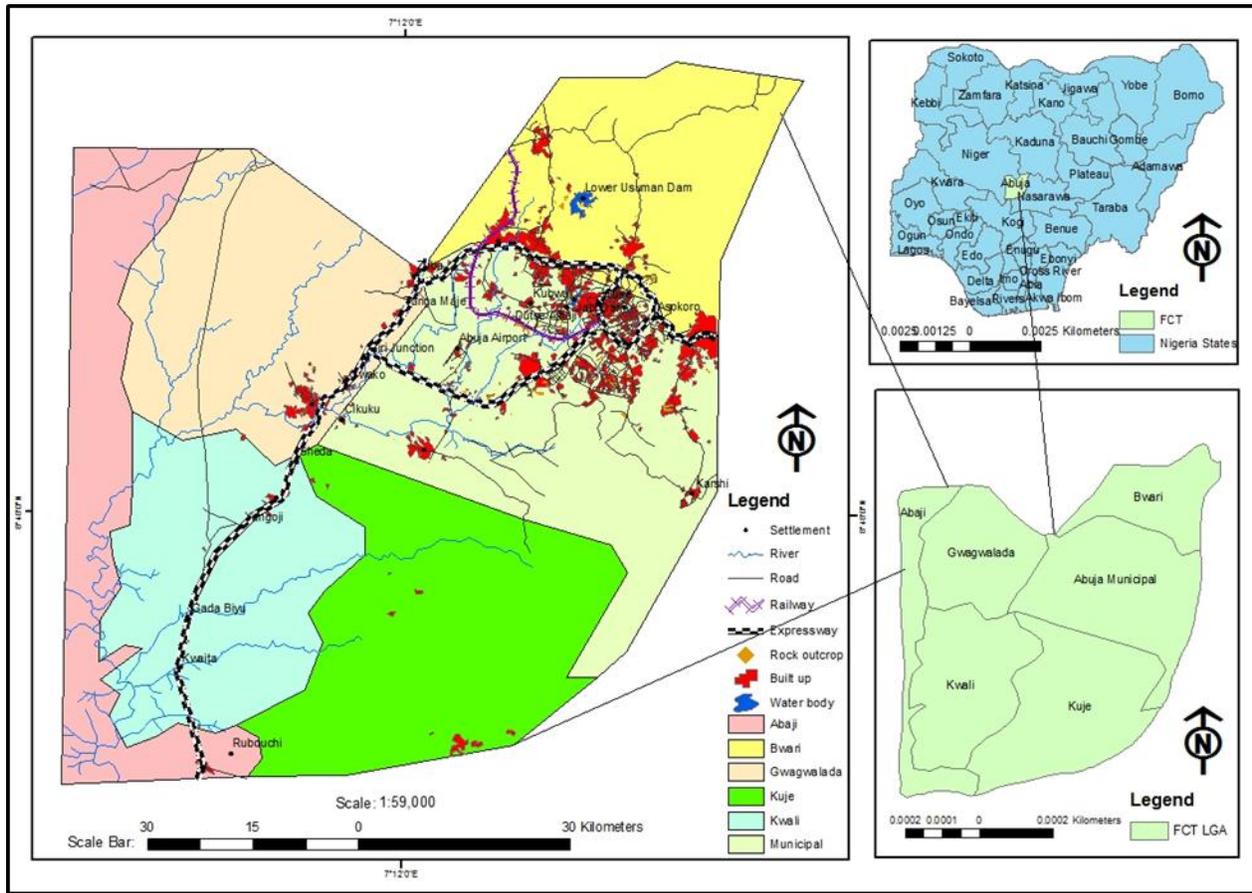


**Figure 1.2 Components of Spatial Data (Kufoniyi, 1995).**

#### 1.4 The Study Area

The study area the Federal Capital Territory (refer to Figure 1.3) lies along the centre of Nigeria between coordinates of Latitudes  $09^{\circ} 00''$  and  $14^{\circ} 08''$  North of the Equator and at Longitudes  $06^{\circ} 00''$  and  $07^{\circ} 58''$  East of the Greenwich Meridian (Maisamari 2015). It occurs at UTM Zone 32 covering an approximate surface area of  $8000 \text{ km}^2$ . The study area has a relative humidity of  $35^{\circ}\text{C}$ , Maximum temperature of  $37^{\circ}\text{C}$ , Minimum temperature of about  $25^{\circ}\text{C}$ , Mean temperature of about  $30^{\circ}\text{C}$ , Mean effective temperature of

thermal and discomfort of about  $22^{\circ}\text{C}$  and Relative strain index of about  $24^{\circ}\text{C}$ . (Eludoyin *et al.* 2013). The FCT has two seasons, rainy (April to October) and dry (November to March). The FCT also comprises six Area Councils (LGAs): Abuja Municipal, Abaji, Bwari, Gwagalada, Kuje and Kwali. According to Mabogunje *et al.* (1976) the area is considered the most ideal and conducive for human habitation and settlement development within the FCT. The centrality of the FCT with other settlements makes the town influential in various kinds of activities. (Hassan *et al.* 2008).



**Figure 1.3 Federal Capital Territory (Maisamari, 2015)**

**Research Methodology**

This section addresses the range of procedures (refer to Figure 3.1) used in the execution of the database design.

**1.5.1 Primary Data Collection:**

The primary data was achieved by using global positioning system (GPS) to obtain geographic coordinates of ground positions in the study area and are further used to juxtapose positions on the images with that of the topographic maps, ground truthing was carried out by conducting field survey to observe and verify surface samples and land use listing

includes writing out a list of observed land use patterns.

**1.5.2 Secondary Data Collection:**

The research made use of both spatial and non-spatial (attribute) data. The spatial data include topographic maps, satellite imageries and locational data (GPS). The secondary data includes the use of topographical map, land use map, and land sat ETM+ (2018) of the Federal Capital Territory.

**1.6 Field data collection**

The data was collected by systematic random sampling method based on a constant distance of 100m and mapped by ground truthing and

ground survey methods aided by the use of a global positioning system (GPS) (GARMIN eTrex Venture HC with accuracy = 1 m) in order to locate the ground verification points on the satellite image for further incorporation of details. Generally, in the process of data collection a high level of expert judgment and ground knowledge was utilized. Two kinds of information were collected including measurements of the ground conditions at a specified place (land use listing) and the location and size (GPS, elevation) of the samples. The GPS points were collected along trafficable roads intersections and edges of defined boundaries. The sample plots were mapped out for each selected land use category at a dimension of 100m by 100m along survey

lines. The data was collected by 100% enumeration of all sample plots. The total number of sample plots mapped out was forty-eight (48).

### 1.7 Identification, Coding and Declaration of Land use Class for FCT Spatial Database.

Based on field observation and general historical information gained from participants during the survey, it was decided to focus on the following major land use classes after Damilola (2012). Hence, classes of interest were carefully selected and coded (refer to Table 1.0) to successfully classify remotely sensed data into land use information (refer to Figure 1.3). Campbell (2002) opined that such classes are the categories of interest to the user of the data.

Table 1.0 Identifying, Coding and Declaring of Land use classes

Land use	Code	Classes and their Properties
Urban	URB	Built up, settlements (raster integer) taken as polygon and has area object's identity
Farmland	FL	Cultivated lands (raster integer) taken as polygon and has area object's identity
Gallery forest	GF	Thick vegetation (raster integer) taken as polygon and has area object's identity
Rock Outcrop	RO	Exposed soil, bare rock (raster integer) taken as polygon and has area object's identity
Shrub	SH	Scattered grasses, trees (raster integer) taken as polygon and has area object's identity
Dam & Water body	DWB	Lake, dam (raster integer) taken as polygon and has area object's identity
River	RV	Stream network (vector) classified as a linear object and has line

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object's identity

Road	RD	Route network (vector) classified as a linear object and has line object's identity
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(Source: Field Survey, 2019)

## 1.8 GIS and Database Creation

### 1.8.1 Considerations for a Database

This process involves identifying the kinds of data that the database will store as well as the relationships between data kinds. Before creating a database, careful consideration should be given for the selection and development of the particular type of database in mind. These considerations should be based on: User requirement analysis, the basic geometric and thematic components of the data (information) must first of all be identified, technical specification of the digital maps (scale accuracy), In-house data acquisition system, do they meet the technical as well as standard laid down rules governing the creation and design of databases, area of coverage i.e. database size, implications on types of hardware and software, All enterprise rules (constraints) must be identified and adhered to and all formal description of the objects, links and constraints must be adhered to.

### 1.8.2 User-Requirement Survey and Analysis

This is the very first and important phase of any GIS implementation. The study must be

conducted before any implementation, including purchase of hardware and software (Ojo, 2010). A proper study helps to determine; the information content of the planned database, the optimum data acquisition method, the data sources and equipment, the optimum data model and database structure, the type of operational system to purchase or build, the training needs, the cost implication and proper organization set-up. The goals of the requirement analysis (Kosoko, 2003) are: to determine the data requirements of the database in terms of terrain objects, to classify and describe the information about these objects, to identify and classify the relationships among the objects, to determine the types of transactions that will be executed on the database, the interactions between the data and to identify the rules governing the integrity of the data.

### 1.9 Database Design

A database is the heart of GIS. A geographic database is a critical part of an operational geographic information system (Kosoko, 2002). Data systems or data structure are usually classified according to the data model they use (Kosoko, 2003). In the past, there were the network and hierarchical data models, which are

being replaced in geographic information system today by three models namely; relational (RDBMS), object-relational (ORDBMS) and object-oriented (ODMBS) (Kosoko, 2002). The relational model was more appropriate for the study because of its simplicity and availability of a standard language for the manipulation of the database in various commercial relational systems e.g Oracle, Access, dBase, ARCGIS e.t.c. and can represent the database as a collection of relations.

Hence, Kufoniyi (1995) affirms that a database is described as fully relational if it supports

relational databases, observing all the integrity rules, constraint and uses a language as powerful as the relational algebra. The database design (refer to Figure 1.4) guides the existing relationship between the data to be stored in the database and logically expressing the relationship among the data as determined by some interpretation of the real world. The design phase is presented in four levels namely: Articulation of view of reality, conceptual data modelling (conceptual design), logical design (data structuring) and physical design (file structuring).

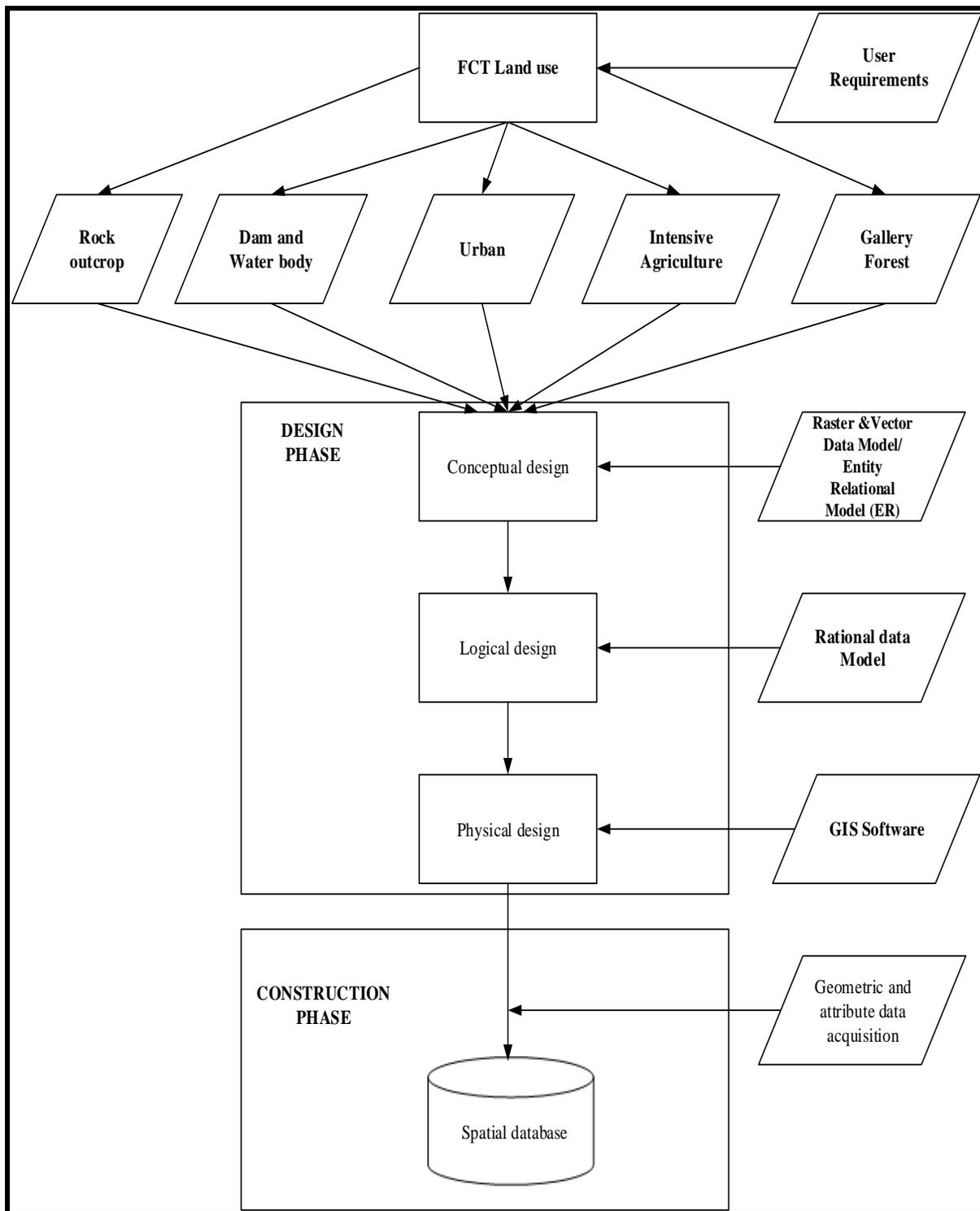


Figure 1.4 Design and Construction Phase in GIS (Kufoniyi, 1998)

### 1.9.1 Articulation of View of Reality

Reality refers to the phenomenon as it actually exists on the surface of the earth. The Federal Capital Territory (FCT) Land use database will consist of several realities such as urban (built up), rock outcrop, farmland, gallery forest, shrubs, dam and water body and transportation.

### 1.9.2 Conceptual Design

The conceptual modeling takes place outside the GIS system. It deals with the human perception and simplification of the real world by describing entities and the relationship amongst them. This phase also corresponds to the synthesis of all user views (Kosoko, 2002). Hence, it involves the abstraction of the real world incorporating properties thought to be relevant to the application at hand. In conceptualizing reality of the study area, two types of representation schemes were adopted; Tessellation (raster) and Vector. The conceptual design phase and the data modeling process are summarized as a series of stages in data abstraction.

#### 1.9.2.1 Raster data model

The raster model organizes space through the use of a tessellation model which is often represented as a regular square cell (or pixel) or irregular (triangulated area network). Each cell was characterized by the area it covers, i.e. one or several values describing non-spatial properties of the cell. With this information, the

raster representation for land use information of the FCT was defined of each land use class through supervised classification in IDRISI SELVA software. Of significance, this enabled considerable storage efficiencies to be achieved.

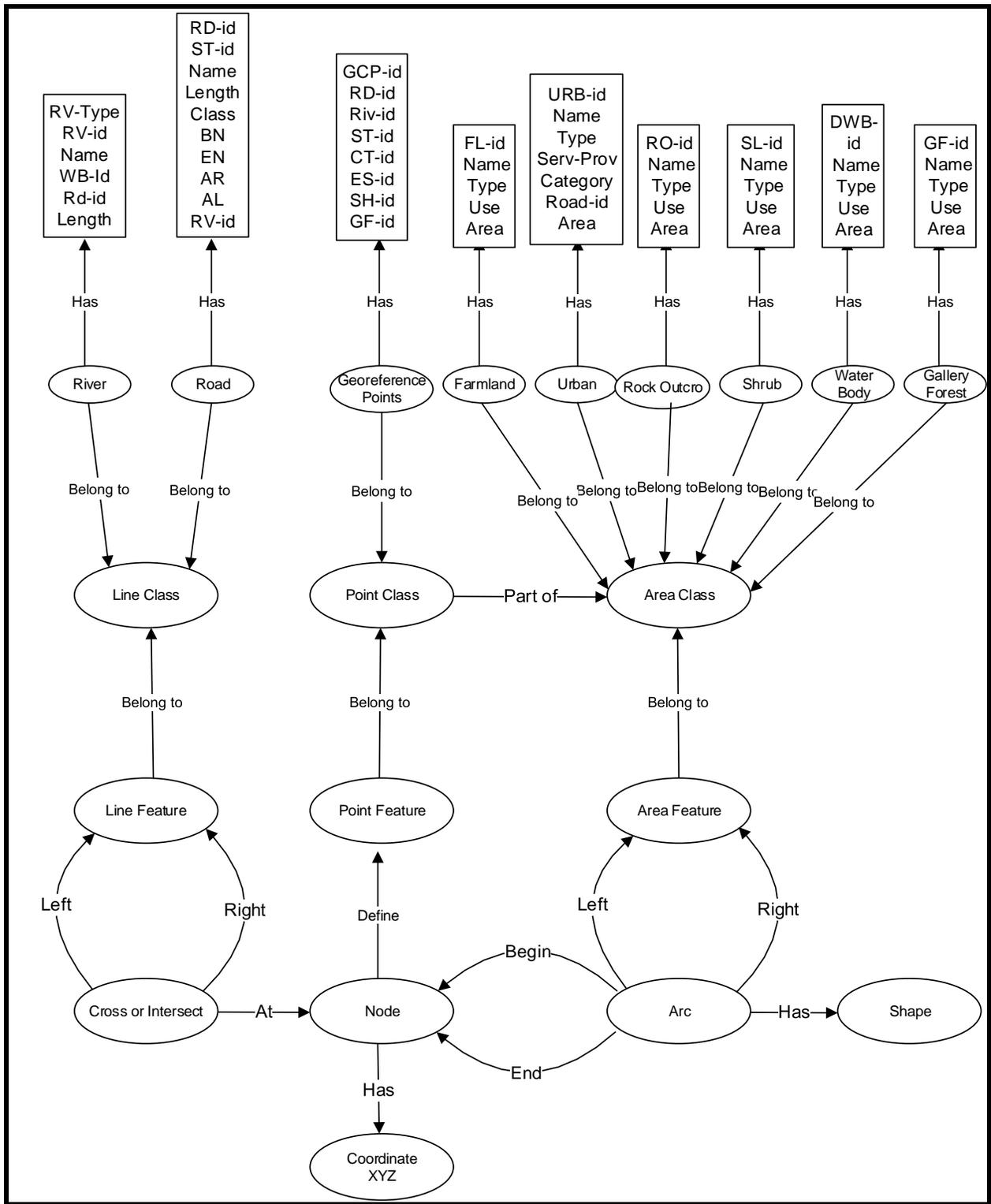
#### 1.9.2.2 Vector data model

These are terrain features represented typologically in the study as Point (0D); GPS coordinate points and settlements (village), Line (1D); contour lines, roads and watercourse and Area objects (2D); administrative boundary, urban, intensive agriculture, dam and water body, rock outcrop, gallery forest, shrub and finally body (3D) (not utilized) are semantically referred to as node, arc and polygon respectively. They are objects of a feature's geometric structure with locational data of objects given by x, y and x, y, z coordinates which has the advantage of efficient representation of topology. The vector data of various land use class of the FCT were digitized accordingly for node (point), linear (line) and area (polygon) classes in a structured manner. Based on this premise the land use information earlier generated from the raster model (in IDRISI SELVA software) was further vectorized (polygonised) in the implementing software ARC GIS 10.2 software to assume the instance of the vector model.

**1.9.3 Formal Data Structure** This is the representation of the data model in a diagram of the FCT. Figure 1.5 represents a typical example of the formal data structure for vector

maps (Molenaar, 1998). Each object in the diagram has attributes and methods. Such attributes refer to properties of an object while methods refer to the functions and procedures that operate upon the attributes. The formal data structure presented (refer to Figure 1.5) indicates that the ellipses represent the elementary data types and the labeled arrows represent the elementary link types among them and each data type represent a set. Consequently, the topologic vector data model

was chosen for the study due to the following; a line segment begins and ends at the intersection with another line, each individual line segment is recorded with the coordinates of its two endpoints, the identifier or names of polygons on either side of the line are recorded, and the spatial relationships are explicitly retained. Thus, this topologic information allows for spatial definitions of lines, polygons and entity types to be stored in a structured manner and used for analysis.



**Figure 1.5 Diagram Representing the Formal Data Structure for Vector Map of the F.C.T (Author's Analysis, 2019).**

#### 1.9.4 Entities and Relationships

The term entity is widely used in database management to mean any distinguishable object that is to be represented in the database (Kufoniyi *et al.* 1993). The relationship linking basic entities together is usually represented by diamonds, connecting lines and arcs. Basic components of entity relationship adopted in the study are entities which include; urban, rock outcrop, intensive agriculture, gallery forest, shrub, dam and water body, river and road, relation between entities, attributes of both entities and relationships, cardinalities of relationships and integrity constraints. The entity relationship diagram (refer to Figure 1.5) depicts the relationship existing between the non-spatial phenomenon to describe the application's view while the raster data model represents the spatial components of the application view in a detailed arrangement.

#### 1.9.5 Identification of Integrity (Semantic) Constraint for the Database

In general, semantic constraints are application dependent and are both spatial. They are convention and rules that govern the creation, use and updating of the database. The semantic constraints of the FCT's technical land use information identified are listed below:

1. The FCT boundary must not separate a LGA boundary
2. A land use type must not overlap
3. Every settlement must have a street address of only one street
4. Common land use must have a class name of only one type
5. A road must pass through a settlement
6. The FCT boundary must include one or more land use type
7. A river must flow into a water body
8. A cultivation type must be located close to a settlement
9. A rock outcrop/soil must be found in other land uses
10. A road must cross over a river
11. A river must flow through a settlement

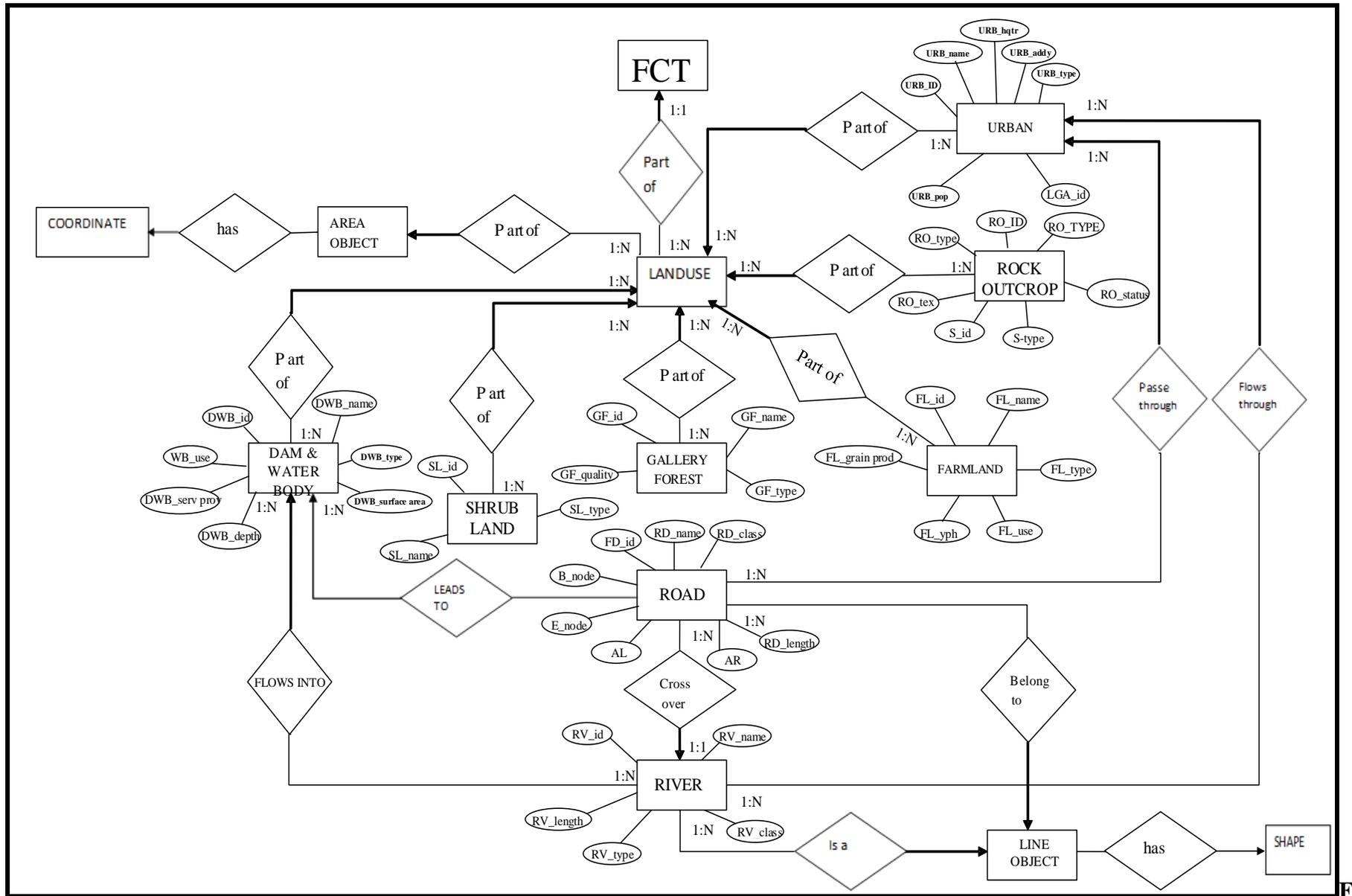


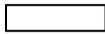
Figure 1.5 Entity Relationship Diagram for the FCT Land use (Author's Analysis, 2019)

From the above diagram the following represent the various shapes;

Attributes are represented as;



Entities are represented as;



Relationships are represented as;



1 : N refers to; one to many relations

### 1.9.6 Logical Design Phase

It refers to a data structure representation of the data model and the practical design for the database. The data model is often expressed in terms of diagrams, lists and arrays designed to

reflect the recording of the data in computer code (Aronoff (1989) with the topologic relationship explicitly or implicitly defined (Peuquet, 1990). The process includes translating the logical structure for the database into the design of chosen data base management system. The relational database structure decided in the study include; each land use theme, field names and types represented in a single manner was dependent on the database software (ARC-GIS 10.2) used.

#### 1.9.6.1 Geometric and Attribute Identification

**Land use:** LU\_id

**Urban:** URB\_name, URB\_id, URB\_type, LGA\_id, URB\_address, URB\_status, URB\_hqrts, URB\_pop, URB\_location, Area ha, Area total, Perimeter

**Farmland:** FL\_name, FL\_id, FL\_type, FL\_use, FL\_yld/hect, FL\_grain prod, Area ha, Area total, Perimeter

**Gallery Forest:** GF\_id, GF\_type, GF\_quality, Area ha, Area total, Perimeter

**Rock Outcrop:** RO\_id, RO\_type, RO\_status, RO\_texture, RO\_depth, Area ha, Area total, Perimeter

**Shrub:** SH\_id, SH\_name, SH\_type, Area ha, Area total, Perimeter

**Dam & Water body:** DWB\_id, DWB\_name, DWB\_type, DWB\_use, DWB\_depth, DWB\_surf area, Serv\_prod, Perimeter

**River:** RV\_id, RV\_name, RV\_type, RV\_lenght

**Road:** RD\_id, RD\_name, RD\_type, RD\_class, RD\_lenght, B node, E node, L arc, R arc

#### 1.9.6.2 Data Dictionary

WHEREATTRIBUTES

DOMAIN

L\_id

land use identifier

URB_name	urban name
URB_id	urban unique identifier
URB_type	urban type
LGA_id	local government unique identifier
ST_address	street address
URB_status	urban status
URB_location	urban location
URB_hqrts	urban head quarters
URB_pop	urban population
Area ha	area in hectare of urban
Area total	area total of urban
Perimeter	perimeter of urban covered
FL_name	name of Farmland type
FL_id	Farmland unique identifier
FL_type	Farmland cultivation type
FL_use	Farmland use
FL_yld/hect	Farmland yield per
hectare_grain prod	Hectare of grain production
Area ha	area in hectare of cultivation
Area total	area total of cultivation
Perimeter	perimeter of cultivation covered
GF_id	gallery forest unique identifier
GF_type	gallery forest type
GF_quality	quality of gallery forest
Area ha	area in hectare of gallery forest
Area total	area total of gallery forest
Perimeter	perimeter of gallery forest covered
RO_id	rock outcrop unique identifier
RO_type	rock outcrop type
RO_status	rock outcrop status
RO_texture	rock outcrop texture

RO_depth	rock outcrop depth
Area ha	area in hectare of rock outcrop
Area total	area total of rock outcrop
Perimeter	perimeter of rock outcrop covered
SH_id	shrub unique identifier
SH_name	shrub name
SH_type	shrub type
Area ha	area in hectare of shrub
Area total	area total of shrub
Perimeter	perimeter of shrub covered
DWB_id	dam and water body unique identifier
DWB_name	dam and water body name
DWB_type	dam and water body type
DWB_use	dam and water body use
DWB_depth	dam and water body depth
DWB_surf	area dam and water body surface area
Serv_prod	service provided
Perimeter	perimeter of dam and water body
RV_id	river unique identifier
RV_name	river name
RV_type	river type
RV_lenght	river length
RD_id	road unique identifier
RD_name	road name
RD_type	road type
RD_class	road class
RD_lenght	road length
B node	begin node of arc
E node	end node of arc
L arc	identifier of area object on the left side of arc
R arc	identifier of area object on the right side of arc

### 1.9.6.3 Translating to a Relational Database Schema

**Urban:** (URB\_name, URB\_id, URB\_type, LGA\_id, URB\_address, URB\_status, URB\_location, URB\_hqrts, URB\_pop, RD\_id, RD\_class, RV\_id, RV\_type, Area ha, Area total, Perimeter, LU\_id)

Primary key - URB\_id

Foreign key - RD\_id references ROAD, domain: road unique identifier

**Farmland:** (FL\_name, FL\_id, FL\_type, FL\_use, FL\_yld/hect, FL\_grain prod, URB\_id, Area ha, Area total, Perimeter, LU\_id)

Primary key - FL\_id

Foreign key - LU\_id references LAND USE, domain: land use unique identifier

**Gallery forest:** (GF\_id, GF\_type, GF\_quality, Area ha, Area total, Perimeter, LU\_id)

Primary key - GF\_id

Foreign key - LU\_id references LAND USE, domain: land use unique identifier

**Rock outcrop:** (RO\_id, RO\_type, RO\_status, RO\_texture, RO\_depth, RO\_id, Area ha, Area total, Perimeter, LU\_id)

Primary key - RO\_id

Foreign key - LU\_id references LAND USE, domain: land use unique identifier

**Shrubs:** (SH\_id, SH\_name, SH\_type, CT\_id, Area ha, Area total, Perimeter, LU\_id)

Primary key - SH\_id

Foreign key - LU\_id references LAND USE, domain: land use unique identifier

**Dam and Water body:** (DWB\_id, DWB\_name, DWB\_type, DWB\_use, DWB\_depth, DWB\_surf area, RD\_id, RD\_type, RV\_id, RV\_type, Serv\_prod, Perimeter, LU\_id)

Primary key - DWB\_id

Foreign key - RV\_id references RIVER, domain: river unique identifier

**River:** (RV\_\_id, RV\_name, RV\_type, RV\_lenght, URB\_id, URB\_type, DWB\_id, DWB\_type, LU\_id)

Primary key - RV\_\_id

Foreign key - URB\_id references URBAN, domain: urban unique identifier

**Road:** (RD\_id, RD\_name, RD\_type, RD\_class, RD\_lenght, ST\_id, B node, E node, L arc, R arc, URB\_id, URB\_type, DWB\_id, LU\_id)

Primary key - RD\_id

Foreign key - URB\_id references URBAN, domain: urban unique identifier

### 1.9.7 Physical Design

Finally, this phase is the implementation of the conceptual model in the database which is system dependent. It requires translating the generic relational structure, physical storage of data, modification and updating (i.e adding files, inserting new data into existing files, retrieval of data, updating into existing ones, and selecting data from existing files), monitoring and upkeep

(accuracy, integrity checks, completeness, etc).

A proper archiving policy and security measure must also be ensured (Ojo, 2010) of the implementation software in both graphic and relational structure. It also pertains to the hardware and software characteristics requiring such consideration of file structure, large memory and disk space, access and speed including evolving populated tables.

#### 1.9.7.1 Defining the Data Base Schema

##### URBAN

TABLE NAME	I-D	ENTITY DESCRIPTION	DATA TYPE	WIDT H
Urban	URB-Id	Describe the polygon identifier.	Text	10

##### DECLARE SCHEMA

```

URB_name : TEXT(VARIABLE_CHAR 12)
URB_id : TEXT(VARIABLE_CHAR 3)
URB_type : TEXT(VARIABLE_CHAR 8)
LGA_id : TEXT(VARIABLE_CHAR 12)
URB_address : TEXT(VARIABLE_CHAR 35)
URB_status : TEXT(VARIABLE_CHAR 5)
URB_hqrts : TEXT(VARIABLE_CHAR 12)
URB_pop : TEXT(INTEGER_RANGE (10)
Area ha : TEXT(VARIABLE_CHAR 8)
Area total : TEXT(VARIABLE_CHAR 12)
Perimeter : TEXT(VARIABLE_CHAR 12

```

**FARMLAND**

<b>TABLE NAME</b>	<b>I-D</b>	<b>ENTITY DESCRIPTION</b>	<b>DATA TYPE</b>	<b>WIDT H</b>
<b>Farmland</b>	<b>FL-id</b>	<b>Describe the polygon identifier.</b>	<b>Text</b>	<b>11</b>

## DECLARE SCHEMA

FL\_id : TEXT(VARIABLE\_CHAR 3)  
 FL\_name : TEXT(VARIABLE\_CHAR 12)  
 FL\_type : TEXT(VARIABLE\_CHAR 8)  
 FL\_use : TEXT(VARIABLE\_CHAR 12)  
 FL\_yld/hect : TEXT(VARIABLE\_CHAR 9)  
 FL\_grain prod : TEXT(VARIABLE\_CHAR 9)  
 Area ha : TEXT(VARIABLE\_CHAR 9)  
 Area total : TEXT(VARIABLE\_CHAR 12)  
 Perimeter : TEXT(VARIABLE\_CHAR 12)

**GALLERY FOREST**

<b>TABLE NAME</b>	<b>I-D</b>	<b>ENTITY DESCRIPTION</b>	<b>DATA TYPE</b>	<b>WIDT H</b>
<b>Gallery Forest</b>	<b>GF-id</b>	<b>Describe the polygon identifier.</b>	<b>Text</b>	<b>14</b>

## DECLARE SCHEMA

GF\_id : TEXT(VARIABLE\_CHAR 3)  
 GF\_type : TEXT(VARIABLE\_CHAR 8)  
 GF\_quality : TEXT(VARIABLE\_CHAR 6)  
 Area ha : TEXT(VARIABLE\_CHAR 9)  
 Area total : TEXT(VARIABLE\_CHAR 12)  
 Perimeter : TEXT(VARIABLE\_CHAR 12)

**ROCK OUTCROP**

<b>TABLE NAME</b>	<b>I-D</b>	<b>ENTITY DESCRIPTION</b>	<b>DATA TYPE</b>	<b>WIDT H</b>
<b>Rock Outcrop</b>	<b>ES-id</b>	<b>Describe the polygon identifier.</b>	<b>Text</b>	<b>17</b>

## DECLARE SCHEMA

RO\_id : TEXT(FIXED\_CHAR 3)

RO\_type : TEXT(VARIABLE\_CHAR 8)

RO\_status : TEXT(VARIABLE\_CHAR 15)

RO\_texture : TEXT(VARIABLE\_CHAR 7)

RO\_depth : TEXT(VARIABLE\_CHAR 9)

Area ha : TEXT(VARIABLE\_CHAR 12)

Area total : TEXT(VARIABLE\_CHAR 12)

Perimeter : TEXT(VARIABLE\_CHAR 12)

**SHRUB**

<b>TABLE NAME</b>	<b>I-D</b>	<b>ENTITY DESCRIPTION</b>	<b>DATA TYPE</b>	<b>WIDT H</b>
<b>Shrub</b>	<b>GF-id</b>	<b>Describe the polygon identifier.</b>	<b>Text</b>	<b>5</b>

## DECLARE SCHEMA

SH\_id : TEXT(FIXED\_CHAR 3)

SH\_name : TEXT(VARIABLE\_CHAR 9)

SH\_type : TEXT(VARIABLE\_CHAR 8)

Area ha : TEXT(VARIABLE\_CHAR 12)

Area total : TEXT(VARIABLE\_CHAR 12)

Perimeter : TEXT(VARIABLE\_CHAR 12)

**DAM & WATER BODY**

<b>TABLE NAME</b>	<b>I-D</b>	<b>ENTITY DESCRIPTION</b>	<b>DATA TYPE</b>	<b>WIDT H</b>
<b>Dam &amp; Water Body</b>	<b>DWB-id</b>	<b>Describe the polygon identifier.</b>	<b>Text</b>	<b>10</b>

## DECLARE SCHEMA

DWB\_id : TEXT(FIXED\_CHAR 3)

DWB\_name : TEXT(VARIABLE\_CHAR 12)

DWB\_type : TEXT(VARIABLE\_CHAR 8)

DWB\_use : TEXT(VARIABLE\_CHAR )

DWB\_depth : TEXT(VARIABLE\_CHAR 9)

DWB\_surf area : TEXT(VARIABLE\_CHAR 12)

Serv\_prod : TEXT(VARIABLE\_CHAR 9)

Perimeter: TEXT(VARIABLE\_CHAR 12)

**RIVER**

<b>TABLE NAME</b>	<b>I-D</b>	<b>ENTITY DESCRIPTION</b>	<b>DATA TYPE</b>	<b>WIDT H</b>
<b>River</b>	<b>RV-Id</b>	<b>Describe the line identifier</b>	<b>Text</b>	<b>5</b>

## DECLARE SCHEMA

RV\_\_id : TEXT(VARIABLE\_CHAR 3)

RV\_name : TEXT(VARIABLE\_CHAR 15)

RV\_type : TEXT(VARIABLE\_CHAR 8)

RV\_lenght : TEXT(VARIABLE\_CHAR 12)

**ROAD**

TABLE NAME	I-D	ENTITY DESCRIPTION	DATA TYPE	WIDT H
Road	RD-Id	Describe the line type.	Text	4

#### DECLARE SCHEMA

```

RD_id : TEXT(VARIABLE_CHAR 3)
RD_name : TEXT(VARIABLE_CHAR 12)
RD_type : TEXT(VARIABLE_CHAR 8)
RD_class : TEXT(VARIABLE_CHAR 12)
RD_lenght : TEXT(VARIABLE_CHAR 12)
B node : TEXT(VARIABLE_CHAR 8)
E node : TEXT(VARIABLE_CHAR 8)
L arc : TEXT(VARIABLE_CHAR 8)
R arc : TEXT(VARIABLE_CHAR 8)

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#### 1.10 Conclusion

The study demonstrates the ability of remote sensing in articulating different data sets and GIS utilized to perform a holistic approach at developing a database for land use assessment. In addition, the synergy between both technologies situate themselves as promising tools employed to create a data ingestion platform which can be exploited for assessing natural ecological processes and environmental outcomes for sustainable development. The study also provides a clear understanding of what constitute our space and the data sets of interest relevant to the application under discussion. Thus, the noble objective is to be able to provide a strong information on land use

patterns, efficient data entry, handle larger volume of spatial and non-spatial data capable of complex analysis for informed decision, flexible and interactive information retrieval from existing spatial data, yielding quality service by ensuring prompt and accurate decision making, preempt large data management in a continuous integrated environment (raster or vector) and a centralized management of a wide variety of geographic information. In this regard, the need to undertake a synthetic land use investigation at developing a dynamic mapping system is necessitated to generate a fundamental land use database with better accuracy serving a management prototype for sustainable land use

planning in the Federal Capital Territory. The study recommends that the research be extended to other states in Nigeria by creating database's articulating different data sets which are useful for further studies while ensuring

implementation of key findings and a sustainable GIS unit, training and software acquisition should be encouraged to enhance better management.

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## LIVELIHOOD ACTIVITIES AND FOREST RESOURCES EXPLOITATION IN AKAMKPA, NIGERIA.

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### 1.0 INTRODUCTION

Today, the exploitation of forest resources within the rural forest communities has become a regular employment for most rural communities within the forest. Hook (2004) observed that until recently, majority of the poor rural dwellers within the forest communities do practice sedentary or peasant agriculture to meet the daily needs of their households with very little left for the market.

The rural forest communities have depended on the forest resources for their daily livelihoods and development including their income requirements. The quest for

man to improve his income for his daily sustenance and the reduction of poverty has placed him in various situations, struggling helplessly to get something from the environment irrespective of the climatic, ecological, social, and cultural implication of his action. In recent times, there has been an increasing discussion about the link between conservation, poverty reduction, and human livelihoods, which was fully discussed during the Rio Earth Summit in 1992. The International Union for the Conservation of Nature (IUCN), on its part, intensified efforts to

### ABSTRACT

*The study examined livelihood activities and forest resource exploitation in Akampa Local Government Area of Cross River State Nigeria. Five (5) communities were selected for the study using the tie and draw method. The communities have a total population of 4803 people, which constitutes the study population; stage wise sampling was adopted to select the study sample, such that from each village, only 10% of the population forms the sample size. The study used two data sets; these are the respondent socio- economic characteristics and data for assessing the livelihood activities in the study area. The data for the study were gathered through the administration of structured questionnaire to the respondents. Data generated from the field was analyzed using simple percentage and chi-square was employed to analyzed livelihood activities of the forest activities. The finding shows that there are relatively active young men/women who exploit the forest for income generation, and these results to higher forest exploitation. The findings also indicated that large populations of the respondents are farmers who engage in farming activities that results to forest degradation. The study further revealed that the most dominant livelihood activities in the study area are farming, wood carving/local crafts and sale of timber etc. It is hereby recommended that government should make adequate policies that should be in agreement with the needs and aspiration of the forest communities.*

**Key words:** Forest Resources, Livelihood, Poverty, Poaching

address questions on ethics, poverty, and human livelihoods in its conservation efforts (Pretty, 2000).

Bene *et al.* (2003) defined livelihood as a means of earning or securing a living or providing income which are the necessities of life that can be seen in an improved ways of life. In a study to assess the geographic distribution of livelihoods opportunities, Ibrahim (1998) asserts that livelihood is not equally distributed across any community or urban areas. To him, livelihood is a thing that has to do with time and space among different communities.

Toulmin (2000) also observed that to earn a living, everybody must be engaged in one form of activity or another, which brings in the needed income and other material benefits to satisfy human needs and wants in the communities. Studies have revealed that most of the forest communities are engaged in diverse livelihood activities as means of acquiring or sustaining their income (Shah, 2005).

In the study area, the livelihood activities depend on the forest resources base for improved household economy and wellbeing. Because of the poor state of these rural communities, the forest seems to be their last resort to making a living. It is on this premise that Ojobor (2003) observed that different NTFPs have been exploited, especially in

Akamkpa, and well over 400 species are harvested. The economic benefits of forest resources are of different dimensions. Oathes (2003) estimated that the economic benefits of most NTFPs are much higher than the total revenue that is derivable from timber product in Cross River State. For example, for only two NTFPs (Poles and Raphia), the market value is estimated at N92 million (Ojobor, 2003; Oathes, 2003; Bisong, 2004; and Eneji *et al.*, 2009b).

Therefore, with the unregulated exploitation of forest resources to meet livelihood, the study has as its crux to assess the different activities, aimed at meeting livelihood, that goes on in the forest of Akamkpa LGA of cross river state. This is aimed at two goals: first to aid assessment of the benefits of the forest products to the communities against the actual market value of the product and second to assess the impact of the exploitation to sustainability against the revenue accruable to the communities and Cross River State.

## 2.0 METHODOLOGY

Descriptive and inferential statistical techniques were adopted for the study. The study examined Akamkpa Local Government Area of Cross River State, Nigeria. Akamkpa lies between latitude 5° 25'-5° 50" N. and longitude 12° 30'-12° 35' E, and covers a landmass of 5,127.37 km<sup>2</sup>, which lies south and east of a loop of the Cross

River and extending along the Republic of Cameroun border. However, Odukpani and Akpabuyo Local Government Areas bound Akamkpa to the West and South; Biase and Yakurr Local government Areas to the North West; Obubra, Ikom, and Etung Local government Areas to the North; and the Republic of Cameroun to the East (see figure 1).

The population of this study consists of all the people residing within the forest communities using the rainforest and its resources for their wellbeing in Akamkpa Local Government Area. The population of the study consists of farmers, traders, civil servants and fishermen, unemployed, self-employed, students, staff of conservation agencies, community leaders, women group, youths etc. The study is limited to five selected forest communities in the area. The research is restricted to the rural people living in these forest communities selected for the study. However, a total of 480 (10%) respondents was drawn for the study from the five selected communities: Mkpote, Mfamusing, Iko Ekperem, Oban, and Ojor.

Five communities were selected for the study using the tie and draw method. The names of all the communities were written on a piece of paper, rolled into balls in a basket, and the communities were drawn without replacement. The researcher asked five people to pick any of the rolled papers from the basket to select the

communities at random. The five selected communities have a combined population of about 4803 persons (male and female) which constitutes the study population. Out of this number, 10% was selected to form the study sample. Stage-wise sampling was adopted to select the study sample such that from each village, only 10% of the population forms the sample.

The study used two data sets. These are the respondent's socio-economic characteristics and data for assessing the livelihood activities in the study area. However, these data sets were sourced directly from the respondents in the communities under study, through the use of questionnaire. The questionnaire was administered to respondents, and after which the information gathered was coded appropriately and feeding same into the SPSS, data generated from the field was analyzed using simple percentage. Also, chi square statistics was used for analyzing the livelihood activities of forest communities. The Statistical Package for Social Sciences, (SPSS Version 20.0) was used for data analysis after properly coding the data.

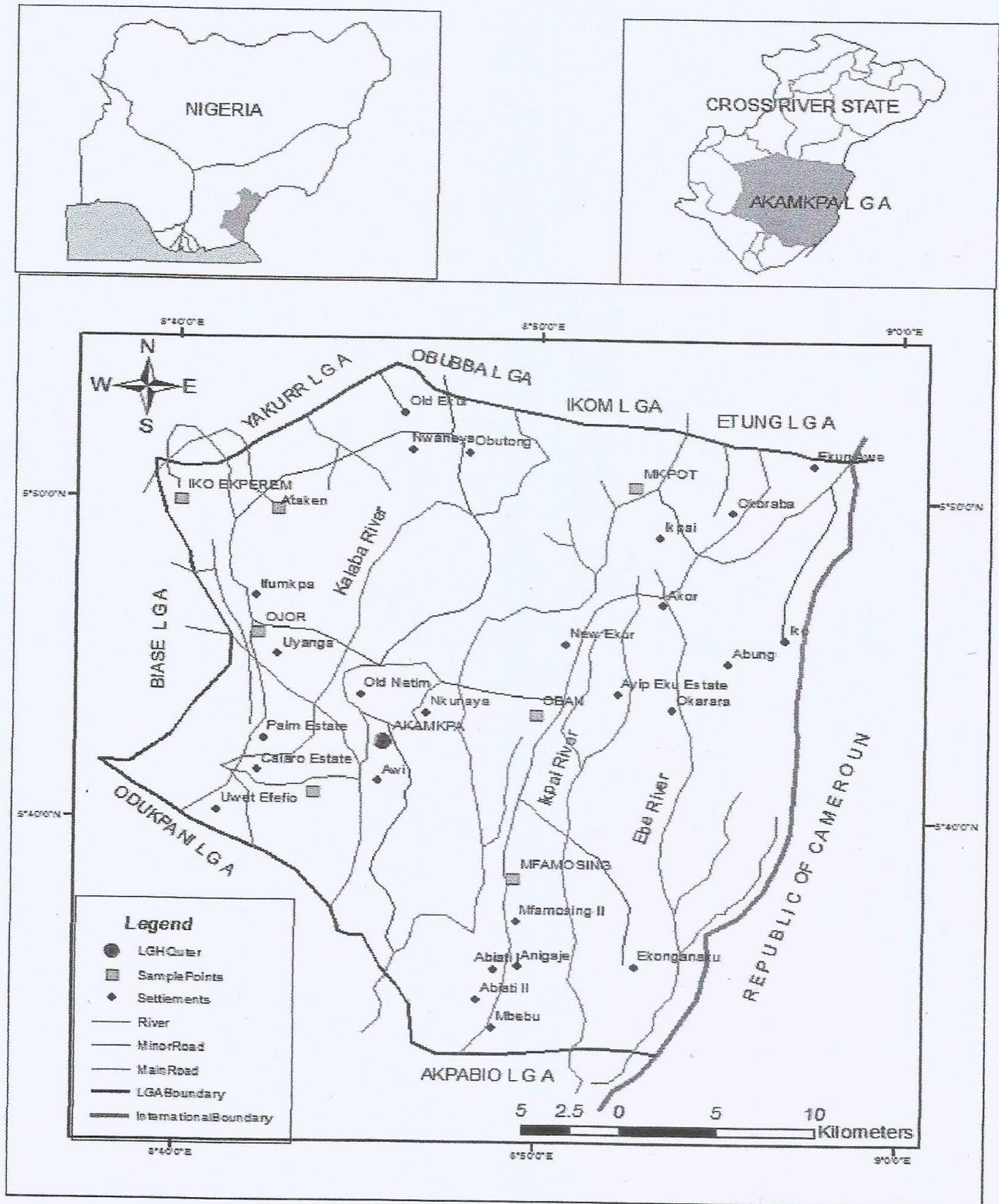
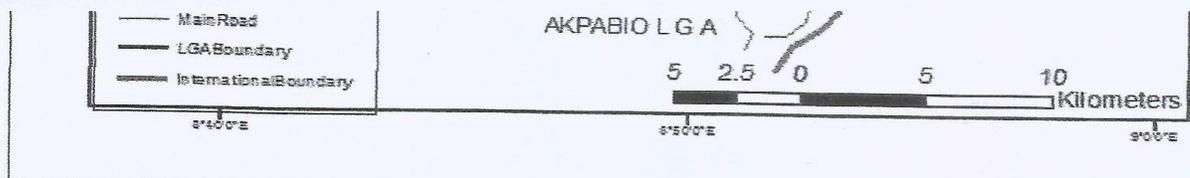


Figure 1: Akamkpa Local Government Area of Cross River State

(Produce @ GIS Laboratory, Geography Department MAUTECH Yola 2015)



### 3.0 DATA ANALYSIS RESULTS AND DISCUSSION

#### Socio-Economic Characteristics of Respondents

**Table 1: Sex and Age Distribution**

S/N	Variables	No of sample	Percentage (%)
1	Sex Distribution		
	Male	251	52.3
	Female	229	47.7
2	Age Distribution:		
	15-30	165	34.3
	41-45	167	34.8
	46-60	76	15.8
	61 and above	72	15

Source: Field survey (2014)

Table 1 shows that 251 (52.3%) of the respondents were male, while 229 (47.7%) of the respondents were female. This implies that a large percentage of the respondents are male. Age distribution shows that 165 (34.3%) of the respondents fall under 15-30 age group, 167 (34.8%) of the respondent fall under 31-45years, 76 (15.8%) of the respondents tall under 46-60, while 61 and above scored 72 (15%). Thus, this implies that there are relatively active young men and women who use the forest for income generation. This has an effect on forest resources because the young people are engaged in modern agricultural practices, while the aging population carry out fewer activities and operate

household farming to cater for the family. Therefore, since the youth and the middle age have the highest percentage, it therefore means that there is high level of livelihood activities that affects the forest.

Educational qualification in the area shows that about 112 (23.3%) of the respondents had no formal education, about 221 (46.04%) have primary school, 120 (25%) attained secondary school, and about 27 (5.6%) attained tertiary education. However, this indicates that majority of the respondents in the area have primary school education. This implies also that majority of the youth in the area are involved in vocational/skills acquisition training and

farming activities that could have implication for forest degradation.

**Table 2: Educational Qualification and Occupation**

S/N	Variables	No of sample	Percentage (%)
3	Educational Qualification:		
	Primary	112	23.3
	Secondary	221	46.04
	Tertiary	120	25
	Postgraduate	27	5.6
4	Occupation		
	Student	108	22.5
	Unemployed	80	16.6
	Civil/Public Servant	85	17.7
	Self-Employed	36	7.5
	Farmer	127	26.4
	Business/Trader	44	9.1

Source: Field survey (2014)

**Table 3: Marital Status and Major Source of Income**

S/N	Variables	No of sample	Percentage (%)
1	Marital Status		
	Single	10	2.1
	Married	432	90
	Divorce	6	1.2
	Widow/widower	32	6.6
2	Major Source of Income		
	Farming	341	71.04
	Business/Trading	82	17.0
	Civil/public Servant	26	5.4
	Others	31	6.4

Source: Field survey (2014)

The occupation of the forest communities has a great influence on the level of degradation. Findings of this study shows that about 108

(22.5%) of the respondents are students, 80 (16.6%) are unemployed, 85 (17.7%) civil/public servants, 36 (7.5%) respondents are

self-employed, 127 (26.4%) of the respondents are engaged in farming activities, and 44 (9.1%) are engaged in business activities. This shows that large numbers of the respondents in the study area are farmers who engage in farming activities that involves forest destruction. Also going by the percentage of the unemployed, 16.6% and 7.5% of the self-employed ones can also assume that they are involved in one form or activity in the forest for their livelihood, thereby agreeing with Bisong (2004) who observed that collection and sales of snails is a significant occupation for most rural communities in Nigeria. Marital status in the area shows that about 10 (2.1%) of the respondents are single, 432 (90%) are married, 6 (1.2%) are divorced, and 32 (6.6%) of the respondents are widows/widowers. This result indicates that majority of the respondents are married which is one of the evidence of population explosion that causes forest depletion. This result is in agreement with Food

and Agriculture Organization (FAO) (2000) who observed that, *the* dynamic nature of the local population has been uncontrollable and negligible, and that "deforestation can result from such uncontrollable population".

About 341 (71.04%) of the respondents engage in farming activities in the study area, 82 (17.0%) engage in business/trading activities in the area, 26 (5.4%) of the respondents were civil/public servants, and 31 (6.4%) seem to involve in other forms of activities. This study has revealed that farming activities are high in the study area and this could have implication on forest degradation.

Hook (2004) who observed that collection and sales of snails is a significant occupation for most rural communities in Nigeria.

## Types of Livelihood Activities of Forest Communities

Based on the initial question that states; what are the main livelihood activities of the forest

communities in Akamkpa? The following result is computed:

**Table 4: Mean and Standard Deviation of the Major Variables in the Study**

S/N	Variables: livelihood activities	Village 1 Mkpot	Village 2 Mfamusing	Village 3 Iko Ekp.	Village 4 Oban	Village 5 Ojor	No of sample	$\bar{X}$	SD
a	Farming/Harvesting of forest vegetable	48	39	44	52	37	220	16.21	3.24
b	Carving/ local craft	2	4	1	1	7	15	10.00	2.01
c	Sale of timber/Firewood	35	40	30	28	42	175	13.06	3.56
d	Bush meat and snail collection	14	11	17	13	15	70	12.67	3.21
	Total	99	94	92	94	101	480	51.94	12.02

Source: Field survey 2014

It was observed in table 4, that the most dominant livelihood activities of the study farming/harvesting of forest vegetables (for food/medicine) that has a total of 220 (45.8%) respondents. Carving/local crafts (dye making, mat weaving, mortar and pestle production, cane

industry) has 15 (3.1%) respondents, sale of timber and firewood (chewing stick and charcoal production) has 175 (36.5%) respondents, and bush meat/snail collection (fishing) has 70 (14.6%) respondents.

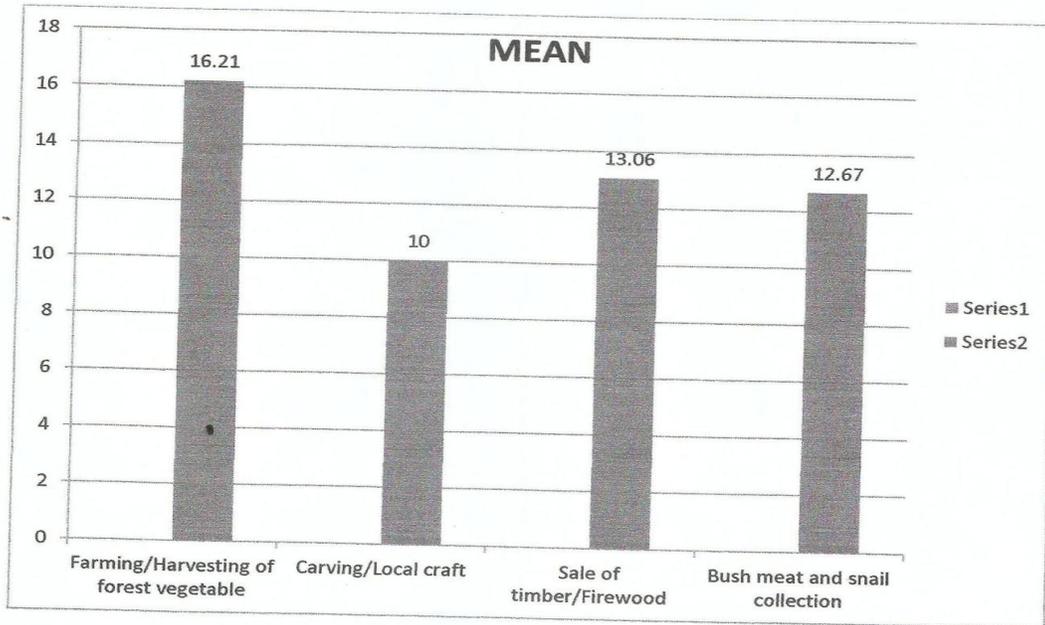


Table 4 also shows that in Mkpote (village 1), 48 (10%) were involved in farming/harvesting of vegetables, 2 (0.42%) carving/local craft, 35 (7.3%) in the sales of firewood, and 14 (3%) bush meat/snail collection. In Mfamusing (village 2), 39 (8.1%) were involved in farming/harvesting of vegetables, 4 (0.83%) carving/local craft, 40 (8.3%) in the sales of firewood, and 11 (2.3%) bush meat/snail collection. In Iko Ekperem (village 3), 44 (9.2%) were involved in farming/harvesting of vegetables, 1 (0.21%) carving/local craft, 30

(6.3%) in the sales of firewood, and 17 (3.5%) bush meat/snail collection. In Oban (village 4), 52 (11%) were involved in farming/harvesting of vegetables, 1 (0.21%) carving/local craft, 28 (5.8%) in the sales of firewood, and 13 (2.71%) bush meat/snail collection. While in Ojor (village 5), 37 (9%) were involved in farming/harvesting of vegetables, 7 (1.5%) carving/local craft, 42 (8.8%) in the sales of firewood, and 15 (3.12%) bush meat/snail collection.

**Table 5: Result of  $\chi^2$  Test of Association between Livelihood Activities and Forest Resources.**

S/N	Variable	No of Sample	Responses			
			Yes	%	No	%
1.	Farming/harvesting of forest vegetables	220	120	(25%)	100	(20.8%)
2.	Carving/ local craft	15	10	(2.1%)	5	(1.0%)
3.	Sale of timber/firewood	175	90	(18.8%)	85	(17.7%)
4.	Sale of bush meat and snail	70	40	(8.3%)	30	(6.3%)
Total		480	260	(54.2%)	20	(45.8%)

$P < .05$  of 4 critical  $X^2$  value = 9.49

Table 5 shows that about 25% (120) of the respondents agreed that farming/harvesting of forest vegetables is their main source of livelihood, while 20.8% (100) were of the opinion that their source of livelihood is based on other form of activities outside forest. This shows that the major occupation of the forest communities is farming and harvesting of forest vegetables, for a better livelihood. This result confirms the findings of Hook (2004), who reported that until recently, majority of the rural poor within the forest communities do practice sedentary or peasant agriculture to meet the daily dietary needs of their households with very little left for the market. 2.08% (10) mentioned carving/local craft as their source of livelihood, while 1.0% (5) of them uses other materials other than forest materials. Woods

from forest is the most common forest materials for artists/carvers to carry out their art work for income generation so as to sustain their families.

This result is *in* consonance with Bisong (2004) who observed that carving is a major occupation of most forest communities in Cross River State and the world as a whole. Carving of masks, wooden gung, mortar and pestle, vehicle wedge, weaving sticks, chairs, bed, bust, and figurines is a popular rural occupation of most of these forest communities in Akamkpa and other parts of the world. 18.8% (90) agreed that they trade on timber/fuel wood, 17.7% (85) of the respondents was said to have engaged in other form of activities outside the forest. It is a known fact that trading on timber and fuel wood

means cutting down trees (deforestation) for the purpose of income generation.

Therefore, this study has revealed that trading on timber/fuel wood is one of the occupations in the study area. The result is in line with Oloruntoba and Adetokumbo (2006), who observed that 95% of the wood consumed in Nigeria is for fuel wood. 8.33% (40) of the respondents opined that bush meat and snails are sources of household consumption and income generation, while 6.3% (30) stated other means aside forest. This revealed that most of the forest people trade on bush meat and snail as their source of livelihood. Consequently, the finding is in accordance with the conclusion of Ntsebeza (2004) who observed that in Africa, the major and cheapest source of protein is gotten from the forest (bush meat).

To estimate the extent of livelihood activities on forest resource, a Chi Square statistical technique was ran using the data on those variables. The findings have shown that the calculated  $X^2$  is 12.62 with 0.05 alpha level and a degree of freedom of 4. In addition, the critical value of 9.49 was found to be less than the calculated value.

The result in Table 5 implies that there is indeed an association between livelihood activities and forest resources exploitation. This result is to confirm the earlier finding and assertion of

Ojobor (2005), who asserted that different NTFPs have been identified in Cross River State especially Akamkpa; and well over 400 species are harvested in the state. Furthermore, Shah (2005) and Ahenkan and Boon (2008) also observed that the contribution of the forest resources to the livelihood of rural people can be traced to: art and crafts, fruit gathering, dye making, mat weaving, cane industry, wine tapping, snail collection, medicine, chewing stick, bush-meat, mortar and pestle production, and fuel wood and charcoal production. Thus, the finding of this study has also corroborated this fact.

#### **4.0 CONCLUSION AND RECOMMENDATION**

##### **4.1 Conclusion**

In conclusion, the study revealed that livelihood activities of the forest communities are; farming/harvesting of forest vegetable, carving/local craft, sale of timber/firewood and bush meat and snail collection. Livelihood activities in forest communities provide the demand for human existence and these pose illegal activities in the forest. However, this could have negative influence on the forest resources in terms of degradation. Therefore, policies governing the forest communities should be properly enforced.

##### **4.2 Recommendations**

Based on the findings of this study, the following recommendations are made:

- a. Government should make adequate policies that would be in agreement with the needs and aspirations of the forest communities.
- b. There should be a consensus agreement between the government and the forest communities in drawing forest management plan, and the co-management plan should always be updated annually to review both problems and progress.
- c. Government policies on land use proposals that might preempt the communities' livelihood should be properly guided not to crash with the community.
- d. The communities should adopt a self-help approach to combat illegal activities in the area. Much can be achieved when the various communities mobilize themselves and organize periodic exercise, and by contributing to or supporting in the security of forest resources. The residents can also act as watch dogs and make sure that they themselves adhere to proper harnessing of the forest products.
- e. The chiefs and other opinion leaders must be given additional roles to play in ensuring that the forest is well secured. This can be done through job offer like

community forest guard where majority of the youths will be involved.

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## Editorial Comments

This edition is another milestone towards the sustenance of the dream that is the Cardinal Point: Journal of the Institute of Certified Geographers of Nigeria. We have hoped over these three editions to actualize this dream by bringing geographical issues confronting our world.

Every day we are confronted with a wide range of environmental problems like climate change, population growth, overexploitation of natural resources and environmental degradation. Some of these issues have been well studied and documented while many still await investigation. Even those that have been investigated and documented have assumed new dimensions requiring new approaches. The Cardinal Point: Journal of the Institute of Certified Geographers of Nigeria therefore provides an avenue where the academia and private and

public practitioners in geography and geomatics can express their attempts at solving the topical issues.

The journal is open to accept contributions on geographical and spatial issues that lie in sync with the institute's mandate. More so, provided they meet the guideline for publication.

We welcome suggestions on how to improve on the quality of this journal in subsequent editions.

Finally, we are grateful to our review editors who painstakingly went through the entries and ensured they meet basic publishing standards in accordance with the guidelines for publication. We also congratulate those whose papers were accepted for publication and for those who did not make this pages in this edition, my advice is not to take it personal and try next time. It is our hope that readers will find the articles in this edition valuable.

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