

# POPULATION GROWTH AND URBAN LAND USE CHANGE ALONG RIVER KADUNA FLOODPLAIN

Oladunni Oyetola OPATOYINBO, Adebowale Abudu ADEPETU and  
Muhammad Lawal ABDULLAHI, Nigeria

MAY, 2015

## Outline

- Introduction.
- Literature Review.
- Study Area.
- Significance of the Study.
- Materials and Methods.
- Results.
- Discussion.
- Conclusion.
- Recommendation.

## INTRODUCTION

- *Unprecedented growth rates and creation of extensive urban landscapes have been the experience in metropolitan areas in Nigeria.*
- *Many farmlands, river floodplains and forests have been transformed into human settlements.*
- *Sprawl, loss of natural vegetation and open space and a general decline in the extent and connectivity of wetlands and wildlife habitat which are generally attributed to increasing population are major problems faced by these metropolitan areas*
- *Problems of population explosions and the inherent characteristic effect of the population growth has been a source of concern in developing countries.*
- *Resultant effects of Nigeria's population on land use changes received little attention as a result of contentious issue in determining Nigeria's population since 1866 when population census started in Nigeria.*

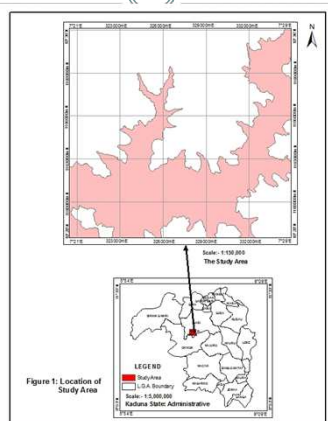
## AIM OF THE STUDY

*The study seeks to find out the effect of population growth on urban land use change along River Kaduna floodplain*

## LITERATURE REVIEW

- ✘ **Nigeria's Population Policy**
- ✘ Started in the Second National Development Plan, 1970-1974, where the government clearly indicated that the population was growing at an estimated rate of 2.5% annually. From 1991 annual population growth rate was estimated 2.75% (NPC) and from 2006, the annual population growth rate estimation increased to 3.18%
- ✘ The official population measure used in Nigeria by the National Population Commission (NPC) since 1990 was the Nigeria Demographic and Health Survey (NDHS).
- ✘ **Population Change and Urban Land Use**
- ✘ Population growth is one of the key factors for urban land use changes from the analysis of urban land uses structure theories
- ✘ Different dimensions of population change such as numbers of people, numbers of households, age structure and birth rates influence land uses in general and changes over time in a fraction of land
- ✘ Marriages, childbearing, migration and changes in living arrangements all stimulate consumption of land in any environment.
- ✘ Increasing trend in population change will result to less land devoted to other land uses
- ✘ **Urban Land use Changes in River Floodplains**
- ✘ Urban land use changes occur essentially for socio-economic and ecological reasons at local and national levels
- ✘ **Main Trends in Kaduna Population Growth.**
- ✘ A flow data type which shows the rate of population growth and its components over a certain period of time along River Kaduna floodplain.

## LOCATIONAL MAP OF KADUNA STATE AND RIVER KADUNA FLOODPLAIN WITHIN THE STUDY AREA



Source : Kaduna State Ministry of Land and Survey

### Study Area

Chikun, Igabi, Kaduna South and Kaduna North. The localities and communities that make up the study area include Rafin Gusa, Ungwan Gwari kawo, Malali, Ungwan Rimi, Kamanzo, Kabala Doki, Narayi, Ungwan Mejeiro, Barnawa, Doka Makera (Down Quarters), Tudun-wada, Nassarawa, Kudende, Ungwan Mu'azu and Nariya wards. Spatially, located on latitude  $10^{\circ} 28' 00'' - 10^{\circ} 36' 00''$  North and longitude  $07^{\circ} 21' 00'' - 07^{\circ} 29' 00''$  East, covering a total distance of 28.732Km along the river. Area coverage within the study area is 9082.327Ha.

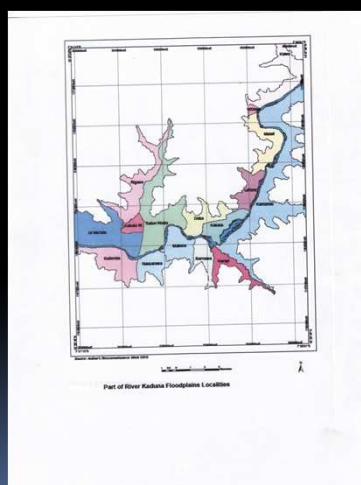
**Climate**- temperature values are higher than  $20^{\circ}\text{C}$  even in the cooler Harmattan months. annual mean rainfall values range from 145.37mm to 318.67mm while monthly mean rainfall values range from 17mm to 320.96mm.

**Soil** - are yellowish to reddish, deep, well drained and fine or medium textured. Bleached layers of ferruginous tropical soils associated with ferralitic soils are also found along the River Kaduna flood plain

**Vegetation** - Guinea Savanna.

**Population** - the study area were projected to be 331036 in 1976; 477012 in 1987; 587,917 in 1995 and 845,898 in 2010

### MAP SHOWING LOCALITIES OF THE STUDY AREA





## Significance of the Study

- Contribution to evolution and growth of knowledge on population growth and urban land use change along River Kaduna floodplain, Kaduna, Nigeria.
- Immense benefit to humanity by helping to reduce problem associated with hazard and disaster with river floodplain menace in Kaduna Metropolis and its environs.
- Benefit to individual and Academia as it would serve as reference materials.

## Materials and Methods

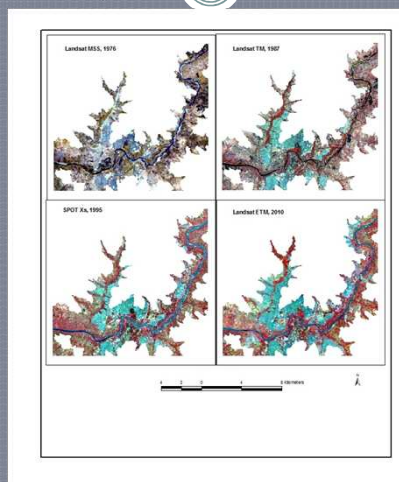
Spatial Data Acquisition Techniques -

- Remote sensing and Global Positioning System (GPS).

Data Types and Sources -

- Reference Data - 1973 Topographical map of Kaduna S. E. sheet 123 and Kakuri N. E. sheet 124 (1:50000); Satellite Imageries such as Landsat imageries MSS 1976 (50m resolution), Thematic Mapper 1987 (30m resolution) and Enhanced Thematic Mapper 2010 (15m resolution); Spots imagery Xs 1995 (20m resolution) and projected population census of Kaduna for 1976, 1987, 1995 and 2010.

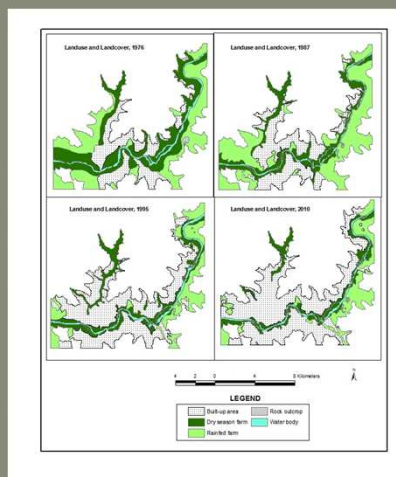
### Composite Satellite Imageries of the Study Area for 1976, 1987, 1995 and 2010



## Materials and Methods Cont.

- Sourcing for data.
- Production of River Kaduna floodplain boundary map from 1973 Topographic maps of Kaduna to depict the land use and land cover classifications of the study area.
- Overlay operations of the river floodplain boundary map on the satellite imageries to identify the actual location and magnitude of change in the different land uses in Arc GIS 9.3 environment.
- Imaging ERDAS 9.1 used to extract information from the satellite images.
- Combination of these processes resulted to composite map of land use and land cover as shown in Figure 4.2

### Composite Map of Land use and Land cover 1976, 1987, 1995 and 2010



### Area Under Different Classes of Land use and Land Cover Data 1976 -2010 in Hectares

S/	LAND USE/ LAND COVER TYPE	LANSAT MSS 1976 Area (Ha)	% DIFF	LANSAT TM 1987 Area (Ha)	% DIFF	SPOT XS 1995 Area (Ha)	% DIFF	LANSAT ETM 2010 Area (Ha)	% DIFF
1	BUILT-UP AREA	2155.883	23.737	2815.563	31.000	4859.660	53.507	5505.611	60.619
2	DRY SEASON FARM	3160.972	34.804	1973.535	21.729	1888.278	20.791	1406.256	15.484
3	RAIN-FED FARM	3251.092	35.796	3891.449	42.846	1801.710	19.838	1706.028	18.784
4	ROCK OUTCROP	52.606	0.579	23.857	0.263	22.181	0.244	21.391	0.236
5	WATER BODY	461.774	5.084	377.924	4.161	510.498	5.621	443.040	4.878
	<b>SUM</b>	<b>9082.327</b>	<b>100%</b>	<b>9082.328</b>	<b>99.999%</b>	<b>9082.327</b>	<b>100.001%</b>	<b>9082.327</b>	

Source: Satellite Imageries of the Study Period

## Analysis of Land Use/Land Cover Changes in the Study Area

S/ N	LAND USE/ LAND COVER TYPE	LANSAT MSS 1976 Area (Ha)	DIFF B/W '76 & '87 (Ha)	LANSAT TM 1987 Area (Ha)	DIFF B/W '87 & '95 (Ha)	SPOT XS 1995 Area (Ha)	DIFF B/W '95 & '10 (Ha)	LANSAT ETM 2010 Area (Ha)	CHANGE IN AREA(Ha) 1976-2010
1	BUILT-UP AREA	2155.883	+ 659.680	2815.563	+2044.097	4859.660	+ 645.951	5505.611	+ 3349.728
2	DRY SEASON FARM	3160.972	-1187.437	1973.535	- 85.257	1888.278	- 482.022	1406.256	-1754.716
3	RAIN-FED FARM	3251.092	+ 640.357	3891.449	-2089.739	1801.710	- 95.682	1706.028	-1545.064
4	ROCK OUTCROP	52.606	- 28.749	23.857	- 1.676	22.181	- 0.790	21.391	-31.215
5	WATER BODY	461.774	- 83.850	377.924	+ 132.574	510.498	- 67.458	443.040	-18.734
	SUM	9082.327	0.001	9082.328	-0.001	9082.327	- 0.001	9082.327	-0.001

## Changes Experienced on Land Use/Land Cover within Classifications in the Study Area

S/ N	LAND USE/ LAND COVER TYPE	LANSAT MSS 1976 Area (Ha)	DIFF (Ha)	% DIFF	LANSAT TM 1987 Area (Ha)	DIFF (Ha)	% DIFF	SPOT XS 1995 Area (Ha)	DIFF (Ha)	% DIFF	LANSAT ETM 2010 Area (Ha)	CHANGE IN AREA(Ha) 1976-2010	% DIFF
1	BUILT-UP AREA	2155.883	659.680	25.372	2815.563	2044.097	46.955	4859.660	645.951	50.000	5505.611	3349.728	50.00
2	DRY SEASON FARM	3160.972	1187.437	45.669	1973.535	85.257	1.958	1888.278	482.022	37.311	1406.256	1754.716	26.192
3	RAIN-FED FARM	3251.092	640.357	24.628	3891.449	2089.739	48.003	1801.710	95.682	7.406	1706.028	1545.064	23.062
4	ROCK OUTCROP	52.606	28.749	1.106	23.857	1.676	0.038	22.181	0.790	0.061	21.391	31.215	0.466
5	WATER BODY	461.774	83.850	3.225	377.924	132.574	3.045	510.498	67.458	5.222	443.040	18.734	0.288
	SUM	9082.327	2600.073	100%	9082.328	4353.343	99.999	9082.327	1291.903	100%	9082.327	6699.457	100.008



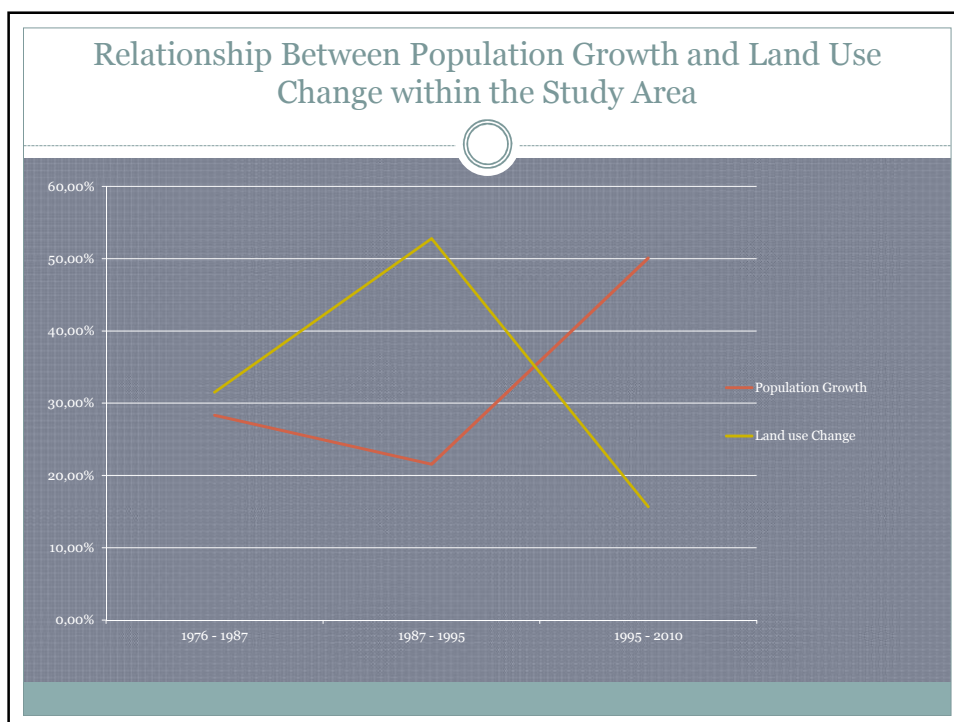
LULC Type	1976 – 1987 (11Yrs) Yearly Rate (Ha)	1987 – 1995(8Yrs) Yearly Rate (Ha)	1995 - 2010 (15Yrs). Yearly Rate (Ha)
<b>Built-up Area</b>	59.971	255.512	43.0634
<b>Dry Season Farm</b>	107.949	10.657	32.135
<b>Rain-Fed Farm</b>	58.214	261.217	6.379
<b>Rock Outcrop</b>	2.614	0.210	0.053
<b>Water Body</b>	7.623	16.572	4.497

### Projected Population Figures of Localities along River Kaduna Floodplain

Localities	1991	1976	1987	1995	2010
Rafin Gusa	19,658	12,286	17,692	21,820	31,395
Ungwan Gwari kawo	10,781	6,738	9,703	11,967	17,218
Malali	22,677	14,173	20,409	25,171	36,217
Ungwan Rimi	52,717	32,948	47,445	58,516	84,193
Kamanzo	447	279	402	496	714
Kabala Doki	22,694	14,184	20,425	25,190	36,244
Narayi	23,674	14,796	21,307	26,278	37,808
Ungwan Mejeiro	302	189	272	335	482
Barnawa	32,684	20,428	29,416	36,279	52,198
Doka	13,566	8,479	12,209	15,058	21,666
Makera	77,374	48,359	69,637	85,885	123,572
Tudun-wada	60,299	37,687	54,269	66,932	96,302
Nassarawa	61,501	38,438	55,351	68,266	98,222
Kudende	754	471	679	837	1,203
Ungwan Mu'azu/Kabala West	37,713	23,571	33,942	41,861	60,230
Nariya	92,816	58,010	83,854	103,026	148,234
<b>TOTAL</b>	<b>529,657</b>	<b>331,036</b>	<b>477,012</b>	<b>587,917</b>	<b>845,898</b>

### Population Growth of Localities and Land use Change along River Kaduna Floodplain.

Period	Population Growth	%	Rate/Year	Land use Change	%	Rate/Year
1976 – 1987	145976	28.352	13270	2600.073	31.534	236.37
1987 – 1995	110905	21.541	13863	4353.343	52.798	544.168
1995 – 2010	257981	50.107	17199	1291.903	15.668	86.127
Total	514862	100%		8245.319		100%



## Discussion on Relationship Between Population Growth and Land Use Change within the Study Area

- Between 1976 and 2010, the population increased by almost 514862, or nearly 156%. This represents a mean annual increase of 15143 or nearly 5%.
- Within the same period of study, land use changes have an overall declining effect of 8245Ha or 110%. This represents a mean annual decrease of 2425 or nearly 3%.
- The study reveals that, the population growth takes an increasing trend while land use change takes a declining trend.
- No correlation exist between population growth and urban land use changes along River Kaduna.

## Summary of Findings

### Findings.

- The study focused on the impact of population growth in relation to urban land use change along River Kaduna floodplain, Nigeria.
- The study employed Remote Sensing and Geographical Information System to determine the trend of population growth and urban land use changes with reference to urban land use types along the river floodplain in Kaduna for the period of 1976-2010.
- Sum total of the land use and land cover area for the period 1976 to 2010 was 9082.327Ha.
- Table 5.2 shows that the areal extent has not experienced any change between 1976 to 2010. However, changes have occurred in land uses.
- The result of the study revealed amongst others that population growth is not the only factor that can effect change on urban land uses along River Kaduna floodplain within Kaduna metropolis.
- No correlation exist between population growth and urban land use change.

## Conclusion

- No appreciable effect of population growth on the urban land use change within the period 1976 to 1987.
- Urban land use change started witnessing a decreasing trend within 1987 to 1995 and continued till 2010 as a result of population growth.
- Population growth of Kaduna along River Kaduna floodplain could be a function of the changes experienced on the urban land use in the study area.

## Recommendations

- Effort should be made to mitigate the detrimental effects associated with population growth on urban land use change.
- Updating of land use mapping of Kaduna town North-western Nigeria should be intensified.
- Considerable effort should be made to control the effect of population on the changes in urban land use.



