MAGNITUDE AND DRIVERS OF LANDUSE CHANGE IN NSIT IBOM LGA, AKWA IBOM STATE, NIGERIA

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ABSTRACT

This study aimed at assessing the magnitude and drivers of land use change in Nsit Ibom LGA, Akwa Ibom State, Nigeria. The land use of the study area was characterized into four classes: forest, bush fallow, farmland and built-up area using the supervised classification modules. The magnitude of land use change in Nsit Ibom LGA was analysed for the period of thirty-four years (1986 -2020) and it revealed that thick forest experienced a decrease of about 1409.61ha during the period, while bush fallow, farmlands and built-up areas experienced an increase of 333.04ha, 85.43ha and 991.13ha respectively. The study identified housing development (3.82), proximity to a city (3.66), population growth (3.42) and the exploitation of forest resources for economic reasons (3.38) as prime determinants of land use change in the area. Based on the findings, it was recommended that an action area plan should be prepared for the Local Government area, also the enforcement of development control activities and provision of basic facilities and utilities is also recommended.

Key words: Urban Development, Landuse Change and Housing Development.

Introduction

Land use depicts how the biophysical features of land are modified, as well as the rationale behind such modifications (Etim, 2021). Land use change refers to the set of biophysical transformations of land surface and water bodies driven by an interconnected complex of human and natural processes such as building construction and unplanned disaster (flood) which in turn take charge of the inhabitant's lands (Edewede, 2018). The magnitude of land use change varies with the time being examined, the geographical area, the nature of land cover and the anthropogenic activities going on (Etim, 2021).

Information on land use change is very important in understanding both the past, present and future human interactions with the environment. Khadka (1997) noted that human activities have directly altered between one-third and half of the earth's surface. Moreover, the impacts of such interactions can be better

understood when the current status of the land use is known. In Nigeria however, most land development projects have evolved without an appreciation of the value of land use information. Consequently, Planners plan and executes schemes without facts of the existing land uses and which area should be conserved. This often leads to uncoordinated development which does not guarantee environmental sustainability. This study is intended to enable Town Planners, environmental managers, policy makers and researchers alike to visualize the nature and determinants of land use change in Nsit Ibom Local Government Area. The study makes recommendations which will aid in the sustainable management of urban development in the area.

Literature Review and Empirical Findings

Changes in land use and land cover have environmental and socioeconomic consequences that regularly feedback and modify biophysical and socio-cultural elements, ushering in new rounds of change (Helen, 2000). Land use changes result from not only man-made modifications and conversion processes, but also from other eco-systemic interactions.

Munthali *et al* (2019) analysed the trend at which the land use/land cover of Denza District, Central Malawi was changing within 1991 and 2015 and found that water bodies reduced from 1380.60 hectares to 899.55hectares; a change of -0.13% at an annual rate of -1.78%, wetland areas reduced from 3626.73 Hectares to 2680.29 hectares representing a loss of -0.25% at the annual rate of change of -1.26%. The forest experienced a reduction from 9939.15 hectares to 6237.63 hectares representing a change of -0.98% at the annual rate of change of -1.94%. Agricultural land use reduced from 267,977.43 Hectares to 260,879 Hectares at an annual change rate of -0.11%. Barren land increased from 761.67 to 7999.56 Hectares at a rate of 0.22%/ year while built up areas increased from 761.67 hectares to 7999.56 Hectares, a change of 1.93% at an annual change rate of 9.8%.

In another study, Dami, *et al.*, (2011) used remote sensing and GIS techniques to examine the trends in land use changes in Maiduguri urban area between 1961 and 2002 and that Maiduguri grew at a fast rate. Zubair, (2006) analyzed land use change in Ilorin between 1972 and 2001; the result showed a rapid growth in built-up land between 1972 and 1986, while the periods between 1986 and 2001 witnessed a reduction. It was also observed that change by 2015 may likely follow the trend in 1986/2001 which was attributed to the many projects embarked upon after creation of the state and the period fell within the oil boom era of 1970s. But reduction between 1986-2001 attributed of what the researcher called austerity measures known as structural Adjustment Program (SAP) introduced into the country at the period to restore the country economy.

Fred (2019) investigated how land use changes in Abak LGA affected agriculture. According to the study's findings, the thick forested areas declined by 2312.82 hectares between 1986 and 2016 at a rate of 77 hectares per year, and the amount of disturbed forest decreased by 433.07 hectares at a rate of 14.43 hectares per year. As built-up areas grew by 3338.56 hectares at a rate of 111.29 hectares per year, farmlands fell by 40,992 hectares at a rate of 1366 hectares per year. It was noticed that the region's agricultural practices were under severe threat from unchecked land use change.

Etim (2021) evaluated urban growth and land use change in Ikot Ekpene LGA of Akwa Ibom State, Nigeria. Using supervised classification modules on remotely sensed imageries, the land use of the research region was divided into four classes: dense forest, cultivated farmland, built-up area, and water bodies. The trend of land use change was examined over a forty-year period (1980–2020), and it was discovered that dense forest decreased at a rate of 15.996% annually, cultivated farmland decreased at a rate of 3.272% annually, while built-up areas increased at a rate of 20.008% annually and water bodies decreased at a rate of 0.724% annually. Residents highlighted three indicators of urban

development—the availability of services and infrastructure, housing development, and population growth—as the main drivers of land use change in the region, garnering nearly 75% of responses.

The effects of the growing human population on land resources have led to a variety of land uses, including production, shelter provision, recreation, material extraction and processing, and production, shelter provision, and production (Roy & Arijit 2010). Population growth affects both rural and urban areas equally, and it is a significant factor that has had a negative impact on peoples' ability to support them. This is because areas of land that were previously used for agriculture have been put to other uses, which has reduced agricultural production and reduced peoples' access to livelihoods. Yet, it was found in a research by Etim (2021) that while population growth is a possible driver, it is not a prerequisite for landuse. It was observed that the socio-economic characteristics of the population were better drivers of land use changes than population numbers.

Ofem *et al.* (2019) looked at the factors causing land use change in the capital city of Uyo, which they represented as urban sprawl. Responses were tabulated and evaluated using frequency counts and percentages after respondents were asked to identify the causes of the change in land usage in Uyo. The study found that of the 390 respondents, 43.3% identified population growth as the primary cause of land use change, 22.0% identified economic growth as the primary driver, 9.0% blamed physical limitations or impassible landforms for uncoordinated land use change, 13.7% mentioned a desire for home ownership, and 12.0% blamed a lack of coordination and affordable housing for land use change.

Conceptual Framework
Concept of Sustainable Development

In order to balance the complementary goals of delivering environmental, economic, and social opportunities for the benefit of both the present and future generations, as well as maintaining and improving the quality of land (soil, water, and air) resource, the concept of sustainable development seeks new ways of managing urban development in an intentional, comprehensive manner. When it comes to land use management, the terms "sustainable development" and "smart growth" are frequently used interchangeably (Akanmu *et al.*, 2018).

Smart growth was developed as a response to what many planners perceived as unfavourable aspects of ongoing increase through urban sprawl. It has a set of principles that drive spatial development into more compact, interconnected, and mixed-use patterns, resulting in more dynamic communities, healthier land, and a more sustainable settlement pattern. Through mixed land uses, compact building design, diversity of transport options, walkable communities, and a reliance on participatory planning to foster a strong sense of place, sustainable development attempts to coordinate development within the city center with an attempt to bring about the sustainable development of the adjacent suburbs (Nelson & Wachter, 2002). In this sense, participatory planning includes everyone, including the people's choice of activities (agriculture inclusive). Reversing the current growth trends that frequently waste valuable resources deteriorate the built and natural environments, and increase resident inequality is known as sustainable development. It is intended to encourage development while safeguarding the environment, as well as lowering the daily distance that people must travel by automobile to promote low fossil fuel combustion (Akanmu *et al.* 2018).

Study Area

Nsit Ibom Local Government Area is a continuation or an extension of Nsit Clan which is acknowledged as the largest Ibibio Clan, but further splinters of western and eastern Nsit. Nsit Ibom is one of the Local Government Areas in Akwa Ibom State and it is located within the central axis of the State. It is located between Latitudes 4^0 47'N and 5^0 25'N and longitudes 7^0

50' E and 7^0 57'E (Etuk, 2021). Nsit Ibom is situated about 30km from Uyo the State Capital and has a land mass of about 140.6 square Km^2. It shares boundaries with Ibesikpo Asutan, Etinan, Uyo and Nsit Ubium Local Government Areas.

Nsit Ibom local government area has a total population of sixty-three thousand five hundred and forty-three (63,543 persons) which comprises of both male and female. This figure when projected to the year 2022 is one hundred and fifty-two thousand, seven hundred and sixty-three (152,763) persons, using the geometric method with a growth rate of 2.87%. The Local Government Area has a total number of forty-seven (47) villages which are divided into 3 districts (Ndiya, Itreto and Ibia Akpan/Oboetim district). The people of Nsit Ibom engage much in trading and farming. Major farm produce in the area are yams, cocoyam, sweet yam, water yam, plantain, banana, and palm fruits. The products traded include palm oil, palm kernel palm wine, mats and cassava and illicit gin.

Research Methodology

This study adopted data from satellite imagery, questionnaire and direct observation. The satellite imagery for this study consists of Landsat Tm 1986 and Landsat 2020. These are acquired from the United State Geological Surveys (USGS). The study employed two major types of data: spatial and socioeconomic data. The spatial data consisted of imageries captured at different scales, while the socioeconomic data comprised information on the livelihood conditions of the people as well as factors driving the change in land use patterns. The 1991 population of Nsit Ibom was projected to 2022, while Taro Yamane model was employed to determine the sample size of 399. The perception of households concerning drivers of land use change was explored using the Household Perception Index (HPI). However, this was measured with weighted values of 5, 4, 3, 2 and 1 which were used in the rating. The summation of weight value (SWV) for each variable were obtained from the addition of the product of weight value of each rating and the number of responses to each rating (Yaode at al, 2017). The HPI was obtained by dividing MWV (Mean Weight Value) by the total respondents that rated each variable. It is mathematically expressed as follows;

$$HPI_{i\text{-}j} = \frac{MWV_{ij}}{N_{ij}}$$

Where: HPI_{ij} = Household Perception Index i-j, MWV_{ij} = Mean Weight Value of facility i-j, Nij = Respondents' rating each variable i-j (Adapted from Yaode *et al.,* 2019)

Table 1: Projected Population, Number of Heads of Household, Sample Size and Skipping Range

S/N	Villages	Population (1991)	Projected Population (2022)	Head of Household	Sample Size	Skipping Range
1	Ikot Ntuen	956	2201	367	6	61
2	AfahaNsit	291	670	112	2	56
3	AfiaNsit	1023	2356	393	6	65
4	Ikot Asat	800	1842	307	5	61
5	MbakNsit	324	746	124	2	62
6	NduoEduo	395	910	152	2	76
7	Ikot Otong	576	1327	221	4	55
8	Mbiokporo I	3423	7884	1314	21	62
9	Ikot Oku Nsit	1556	3584	597	10	59

10	Ikot NtannNsit	1305	3006	501	8	62
11	EkpeneIkpan	1439	3314	552	9	61
12	Ikot Ukat	605	1393	232	4	58
13	Ikot Offiok	533	1227	205	3	68
14	Oboyo Ikot Ita	3056	7039	1173	19	61
15	ObotimNsit	2905	6691	1115	18	61
16	Obiokpok	1603	3662	615	10	61
17	Asang	649	1495	249	4	62
18	Okukuk	1061	2444	407	7	58
19	ObioAtai	1941	4470	745	12	62
20	Mbiakot	443	1020	170	3	56
21	Ikot ObioEdim	185	426	71	1	71
22	Ikot Obok	1194	2750	458	7	65
23	Obo Etok	1330	3063	511	8	63
24	Obo Ntong	1522	3505	584	10	58
25	Ikot Idem	994	2289	382	6	63
26	AnyamNsit	1074	2474	412	7	58
27	OkwotNsit	835	1923	321	5	64
28	Ikot Offiong	311	716	119	2	59
29	Nditung	279	643	107	2	53
30	NkwotAbia	680	1566	261	4	65
31	AfahaAbia	993	2287	381	6	76
32	Ikot ObioAsanga	866	1995	332	5	66
33	Ikot Idiong	219	504	84	1	84
34	Ikot Iwud	887	2042	340	6	56
35	Ikot Akpan 1	633	1458	243	4	60
36	Ikot Obio Etan	1166	2686	448	7	64
37	Edebom 1	4601	10597	1766	29	60
38	AfahaOffiong	6243	14379	2397	39	61
39	Ikot Ebre	847	1951	325	5	65
40	AfahaNsitUruaNko	4006	9227	1538	25	61
41	Mbiokporo II	2669	6147	1025	17	60
42	Ikot Nya	2031	4678	780	13	60
43	Ikot Akpan Etang	531	1223	204	3	68
44	Afaha Ikot Ide	858	1976	329	5	65
45	Mbiaso	539	1214	202	3	67
46	Afaha Ikot	2189	5042	840	14	60
47	AfahaNtup	977	2250	375	6	59
		63543	146322	24386	399	

Source: National Population Commission, 1991 and Field Survey (2023).

Results

Table 2. Magnitude of Land use Change in Nsit Ibom Local Government Area.

Land Use Classes	1986 (ha)	2020 (ha)	Magnitude of Change(ha)	Percentage Of Change (%)	Nature of Change
Forest	2512.33	1102.72	1409.61	50.00	Reduction
Bush fallow	6992.43	7325.47	333.04	11.81	Expansion
Farmland	2961.64	3047.07	85.43	03.03	Expansion
Built Up Areas	1428.84	2419.98	991.14	35.16	Expansion
Total	13895.2	13895.2	2819.22	100	

Source: Analysis of LandSat Imageries (2023).

i. **Forest Land Use Class**
Forest land use class experienced a reduction in size in the study area within the year 1986 -2020. On the mere inspection of the satellite imagery (Fig.1), it indicated that forest was the second most dominant class of land use which occupied a landmass of 2512.33hectares as at 1986. By the year 2020, area occupied by forest declined to 1102.72ha indicating a decrease in size of 1409.61ha. This however represents about 50% of the total change in land use in the area.

ii. **Bush Fallow Land Use Class**
Bush fallow experienced an increase in size. Thus in 1986, bush fallow covered 6992.43ha, while in 2020, it was 7325.47ha. The magnitude of change was 333.04ha representing about 12% of the total change in the entire study area. This expansion is understandable since forests in the area have actually shrunk.

iii. **Farmland Land Use Class**
From 1986 – 2022, farmland expanded from 2961.64ha to 3047.07 ha indicating a marginal increase of 85.43ha. This was the most stable of all the land use classes. This may be explained by the land tenure system practiced in the area which makes it difficult to extend the size of farmlands owned by an individual. Farming is the main occupation of the people of Nsit Ibom hence they intensify their agricultural activities in order for them to have food for the teeming population.

iv. **Built-up Area**
This land use pattern showed an expansion of 991.14 ha over the study period of 34 years. Built-up area covered about 35.16% of the total changes in the area. This is however not in doubt as developments are evident around Afaha Offiong and adjoining areas. Areas that were previously compound, farmland, bush fallow and even forests have been converted to built-up areas. As said earlier, this is made possible by road construction, markets establishments, government offices, etc. With the way this land use is expanding, there is every indication that in another 34 years, this area will comprise mostly built-up surfaces. This development impetus is largely due to a reduction in the travel distance between settlements in this study area and major towns like Eket, Uyo, Ikot Edibon, Nung Udoe, Ikot Abasi. Many people residing here prefers to settle here while moving daily

to neighbouring towns for business and work. Therefore, the wave of development which is felt across the study area has actually stimulated and induced expansion in the built environment, while at the same time speeding up the rate of reduction in the area coverage of farmland.
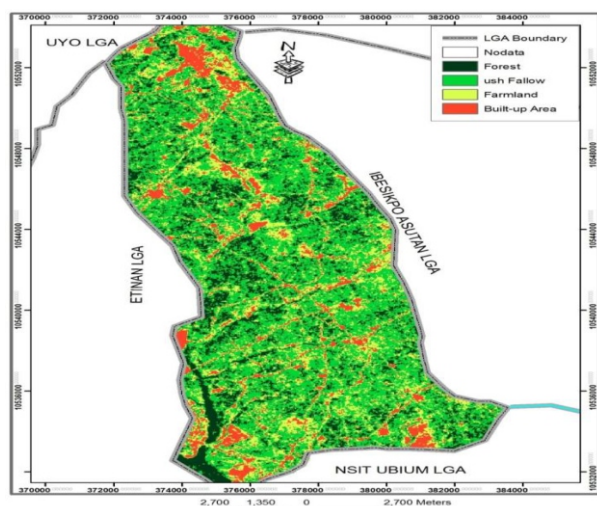

Fig. 1. Land Use map of Nsit Ibom (1986)
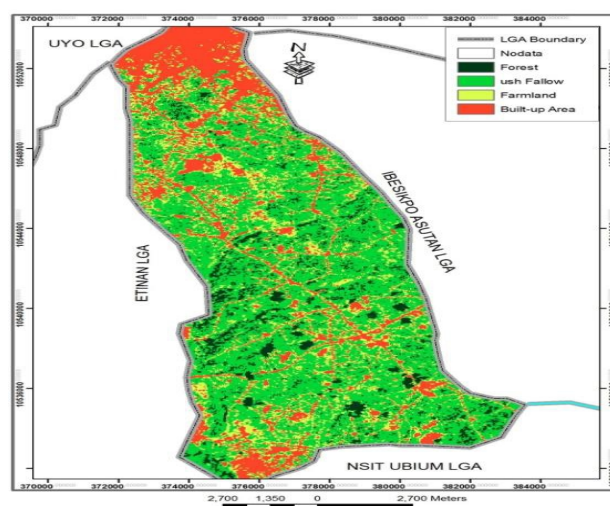Source: LandSat Imagery classification.

Fig. 2. Land Use map of Nsit Ibom
Source: LandSat Imagery Classification (2020).

Table 3. Drivers of Land use change in Nsit Ibom LGA

S/n	Drivers of Land Use Change	HPI
1	Housing Development	3.82
2.	Proximity to a nearby city	3.66
3.	Population Growth	3.42
4	Exploitation of forest Resources	3.38
5	Road Construction	3.20
6	Availability of Infrastructure and utilities	2.88
7	Climate Change	2.60

Source: Field survey (2023).

From the result in Table 3, the study identified housing development (3.82), proximity to a city (3.66), population growth (3.42) and the exploitation of forest resources for economic reasons (3.38) as prime determinants of land use change in the area.

Discussions

This study aimed at assessing the magnitude and drivers of land use change in Nsit Ibom LGA, Akwa Ibom State, Nigeria. The land use of the study area was characterized into four classes: forest, bush fallow, farmland and built-up area using the supervised classification modules. The magnitude of land use change in Nsit Ibom LGA was analysed for the period of thirty-four years (1986 -2020) and it revealed that thick forest experienced a decrease of about 1409.61ha during the period, while bush fallow, farmlands and built-up areas experienced an increase of 333.04ha, 85.43ha and 991.13ha

respectively.

From the result in Table 3, it could be seen that most respondents perceived housing development as the main driver of land use change in the area with a household perception index of 3.82. Housing development here does not imply residential buildings alone, but it encompasses all manmade structures that may be put into any use such as industrial, commercial, residential, and public. Proximity to a nearby city had a HPI of 3.66, implying that respondents perceived that the sprawling of other cities contributed to the land use change experienced in the region. This makes sense as most of the built-up areas are developed in the northern region of the Local Government Area which is bounded by Uyo, the state capital. Population growth had a HPI of 3.4, with the gradual sprawling of the population from Uyo Capital City into the area, there has been as offshoot of population growth. The establishment of college of Education at Afaha Nsit has also become a population magnet in the area. The exploitation of forest resources for income had a household index of 3.38, which infers that most residents of the area rely on forest resources for their economic survival. Road construction had an index of 3.20 on a scale of 5, meaning that respondents considered the construction of roads a major determinant of land use change, especially as the predominant settlement pattern in this area is linear.

Availability of infrastructures and climate change were not perceived as major drivers as land use change as they had indexes of 2.88 and 2.60 respectively. This is a pointer that there is inadequacy in the provision of basic infrastructures and utilities in the study area. This is a sharp contrast to the findings in Ikot Ekpene Local Government area as reported by Etim (2021) where majority (26.02%) of the respondents perceived that it is the provision of basic infrastructures that causes land use change. On the climate change issue, most respondents may not have been conversant with the term hence more need to be done in terms of educating the masses about climate change and its mitigating measures.

Conclusion

Land use change is a necessity as the land must be modified to cater for the needs of humans; this notwithstanding it must be regulated. There is need to minimize deforestation activities owing to the eco-systemic benefits embedded in the forest. The expansion in built-up should be regulated to ensure efficient use of land resources. All the major drivers of land use change in the study area are indices of urban development, hence there is need to ensure that the urban development of Nsit Ibom Local Government Area is controlled for it to be sustainable. The following recommendations are put forward based on the findings of this study:

1) The Area Planning Authority should prepare an action Area plan to guide the physical development of the Local Government Area.
2) Deforestation should be discouraged and defaulters should be made to pay exorbitant fines to serve as deterrent to others.
3) Development control activities should be carried out rigorously as housing development is on the rise.
4) Local Government Authorities should provide subsidies and farm inputs to farmers to help them maximize the productivity of their farms.

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