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Effect of Urbanization on Greenareas In Calabar Metropolis

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----------ABSTRACT----------
The study examined the effect of urbanization on green areas in Calabar metropolis. The aim of the study was to see how changes in land use due to urbanization have affected the green area in Calabar. Data for the study was obtained from aerial photographs and was considered within the period of2004 to 2012. Remote sensing and geographic information systems (Arc view GIS 9.3 software) technology was used in change detection analysis. The study revealed there was anincrease in the amount of urban developed space from80.96 sq. km in 2004 to 111.26 in 2009 and125.125 in 2012. Therefore, a total of 44.165 sq.kmof urban green space have been lost to built-up areas (urbanization). Based on these, caution should be applied in this increased and sudden urban expansion, as urban green areas play very significant roles in the maintenance and sustenance of ecological balance on the environment and urban ecosystems.

KEY WORDS: *Effect, Urbanization, Urban Green Areas, Calabar Metropolis, Arc GIS 9.3.*

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I. INTRODUCTION

Urban growth and the concentrationof people in urban areas are creating societal problems world-wide. Onehundred years ago, approximately 15percent of the world's population wasliving in urban areas. Today, the percentage is nearly 50 percent. In the last 200 years, world population hasincreased six times, stressing ecologicaland social systems. Over that sametime period, the urban population hasincreased 100 times, concentratingmore people on less lands even as thetotal land devoted to urbanization expands (Acevedo, 1999). Urbanization has been identified as one of the most powerful and visible anthropogenic forces on earth (Dawson, Hall, Barr, Batty, Bristow, Carney, Walsh, 2006, 2006; United Nations Habitat Report, 2011; Oloke, Ijasan, Ogunde, Amusan & Tunji-Olayeni, 2013). It is a process and outcome of social changes, in-flow andconcentration of people and activities in cities (Adeniji & Ogundiji, 2009; Oloke et al. 2013). The dynamics of the process is drivenby changes in population, employment opportunities associated with industrialization, consumption patterns,international migration and accessibility (Dawson, et al., 2006; Oloke et al. 2013).

Within the last two and a half decades, Calabar has experienced unprecedented urban growth. This has led to alternation and alteration of several land uses. These land use alternation and alteration has led to varying degrees of landcover change on features such as urban green areas, wetlands, riparian mangrove forest and other forest and grassland ecosystems;which are currently giving way for the construction of new roads, new residential and industrial layouts, recreation and amusement parks etc. (Hansen et al. 2005; Oka, 2009). According to Atu, Offiong, Eni, Eja, &Esien, (2012),), in the past decade, the city's built up area burst outward in an explosion of sprawl that consumed former agricultural land at a break-neck pace. Thousands of hectares of agricultural land are covered by concrete and asphalt as new roads are created and existing ones are extended. Over 5,200.09 hectares of the former agricultural land at Ekorinim, Esuk Utan, Edim-Otop, Anantigha, and Ikot Efanga have been converted to low density residential, commercial and industrial uses as these areas are merged with the urban areas. This development is consequent on the growth of the population of Calabar. For instance in 1991, the population of Calabar was 328, 876, with a density of less than a thousand person per square kilometer. In 2006, it was 375, 196. At present, the population of Calabar is estimated to be over 399, 761 (National population Commission 2010) while the population density is above 1,237 persons per square kilometer (Cross River State Economic Blueprint 2007-2008).

The current status of Calabar as a tourism destination in Nigeria and the entire West African sub – region has attracted continued influx of people and investors into the towns that make up the Calabar metropolis, this has added to the already existing population increase induced by the Calabar Port, TINAPA business resort, the Calabar, Free Trade Zone,the University of Calabar Community and now the ongoing construction of the International Conference Centre with a seating capacity 2000 persons. Thishave led to the continued buildup of pressure on the available land resources, leading to continual landcover change and the consequent loss of important ecological and environmentalfeatures such as earlier mentioned. Ecological and environmental features must be planned along with other city policies because they are important spaces that maintain the quality of the urban environment. The pattern of urbanization, especially with cities in the developing world, has negatively influenced these features and, as a consequence, reduced the environmental benefits provided by them (Gomes & Moretto, 2011; Sun, McNulty, Myers, & Cohen 2008; Oka, 2009; Polyakov and Zhang, 2008).

II. MATERIALS AND METHOD

This employs data from the 1991 and 2006 censuses of Nigeria, as published by the National Population Commission (NPC). This is because the use of census data is based on the fact that census is a compendium of population information, and therefore, constitutes a useful framework for population analysis and the interpretation thereof, (Ottong et al., 2010). Also, this paper relied on the 2011 urban and housing data collected from the Cross River Ministry of Lands and Survey. The, the Arc View GIS 9.3software was used in the processing landcover change imageries from 1980 to 2010.

Study Area.

Calabar is the capital of Cross River State. For the purpose of administration, the city is divided into Calabar Municipal and Calabar South Local Governments Areas. It has an area of 274.429sq. km and with a population of 371,022 by the 2006 census), currently the city's population is estimated at 399, 761(Google Maps, 2013; National population Census, 2006.The city is bounded in the North, by Odukpani Local Government Area in the North-East by the great Kwa River. Calabar is generally affected by weather conditions due to its unique coastal location and high rainfall associated with tropical rainforest regions. It is characterized by rainfall which starts from the month of April to October, reaching its climax in the month of June and September. The remaining four month make up the dry season with the Harmattan wind blowing over the area. The rain falls averagely at 172mm with temperature of 290^{C} at warmest and 170^{C} at coldest (www.google.com Calabar weather report 2011). The vegetation of the study area is mainly riparian and fresh water swamp forests. Also, a few derived savanna vegetation, cultigens and ornamental/avenue tree/shrub species are present in the area. The dominant soil type is the clayey- loamy soils. The topography of the study area is the low lying coastal plain of the Calabar River and Great Kwa River. It is relatively undulating with a few hills and valleys running east-west wards. Several rivers/streams exist in the area and are basically drained by the aforementioned rivers. The Geology of the area is mainly sand stone.

Procedure for Data Collection

Data was collected using stratified sampling. Data for the study was obtained from aerial photographs and was considered from 2004 – 2012. An irregular interval of2005 to 2009 and 2010 to 2012 was adopted in determining the changes that have occurred alongside effects on the spatiotemporal features. This was achieved through the aid of aerial photographs of the area, obtained from the department of Geography and environmental science cartography unit, university of Calabar, Calabar.Furthermore, the remote sensing and the geographic information system (GIS) technology and applications were applied in the determination of the land cover changes. The stepwise methodology was also used for careful examination of aerial photographs, development of an interpretation key, plotting of the green areas boundary, geo-referencing of digital data, interpretation of data, collecting of ground truth data, editing, finalizing of maps and extraction of statistical data for the different land cover (Njungbwen and Njungbwen, 2011; Singh and Loshali, 2005; Gourmelon, Bioret, & Le Berre, 2004; Acevedo et al., 2003, Ashbindu, Foresman, & Eugene, 2001; Geomatics International Inc. 1996). However, the Arc view GIS 9.3 software was used for the analysis of topology which was established among the lines and polygons and the coding of the various land cover. Appropriate colours were given to the different land covers. Layouts were developed for them and the final maps produced. Quantitative data for the different land cover for the different time periods were then extracted. The change detection analysis was carried out. This was done by subtracting the values of the previous inventory data from the current one and the rate of the changes was determined by calculating their respective percentage values (Woodwell et al. 1984, Williams 1984).

III. DATA ANALYSIS

The data obtained was analyzed using tables and maps. The size and area of the land cover changes were calculated and represented in square kilometers. Also, the Aerial photo imageries were processed using the Arc View GIS 9.30 software package.

IV. RESULT AND DISCUSSION

Sequel to the general objective of this study, it was generally observed that there was an exponential growth in the city population which have led to the quest for additional land for, housing and other facilities/infrastructures which have given rise to abrupt landcover changes. As presented in the table 1below, the total land area of Calabar is 232.94 square kilometers.The study revealed that, there has been a continual increase in the amount of urban developed space from80.96 sq. km in 2004 to 111.26 in 2009 and 125.125 in 2012. This has increased the urban build up space by 44.165sq. kmwithin the specified time frame. Consequently, the above situation has led to the continual reduction in the amount of natural vegetation cover from193.469 sq. km in 2004 to 163.169 in 2009 and 149.304 in 2012, which is about 16.09 percent loss of natural vegetation cover in Calabar.n

Table 1: Landcover Change status of Calabar Metropolis (2004 - 2012)

Year	2004		2005 - 2009		2010 - 2012	
	Area (Sqkm)	%	Area (Sqkm)	%	Area (Sqkm)	%
Vegetation Cover	193.469	70.50	163.169	59.46	149.304	54.41
Built up Area	80.96	29.50	111.26	40.54	125.125	45.59
Total Area	**274.429**	**100.00**	**274.429**	**100.00**	**274.429**	**100.00**
Land Cover Change			**30.300**		**13.865**	

Source: Ministry of Lands and Survey, 2012.

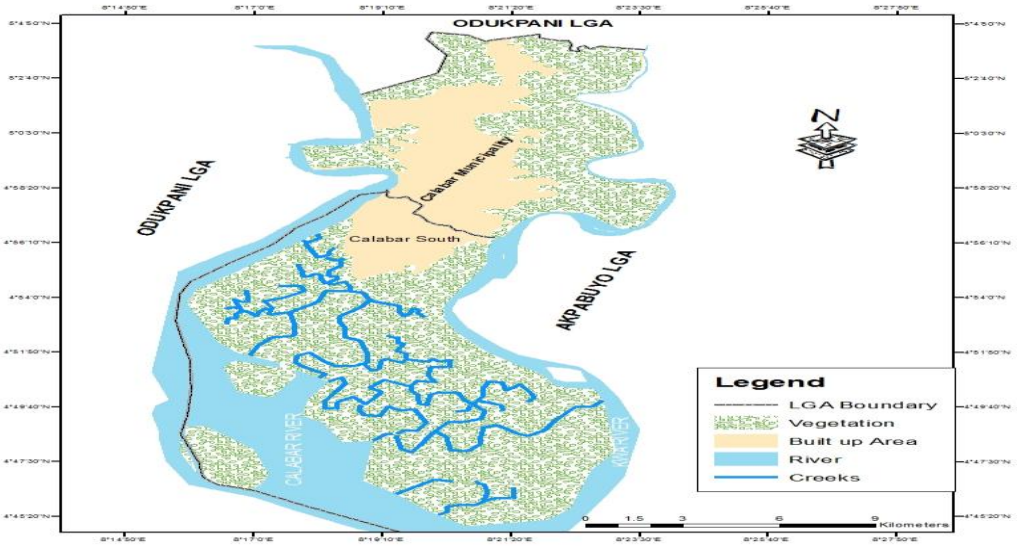

Figure1: Calabar Land cover/Land cover change 2004

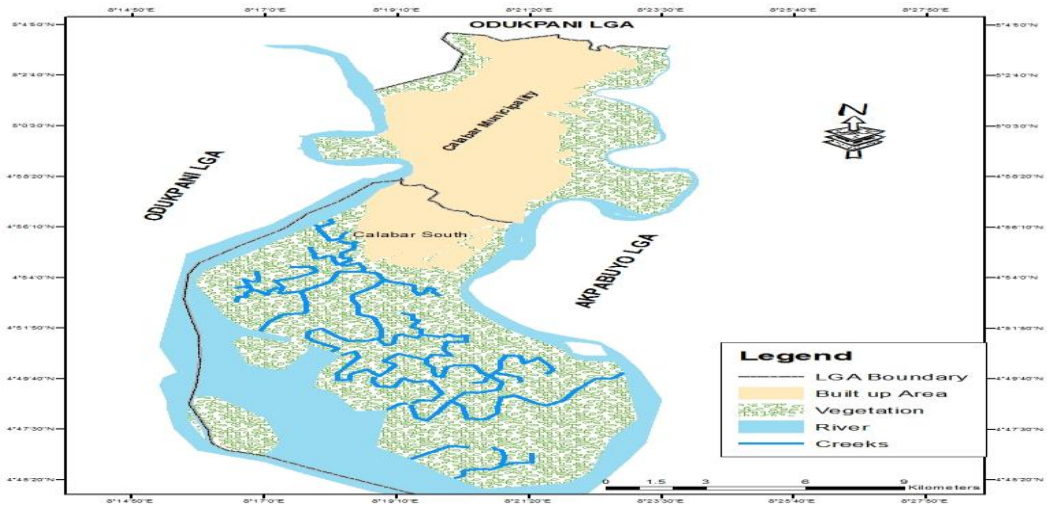

Figure 2: Calabar Land cover/Land cover change 2005 – 2009

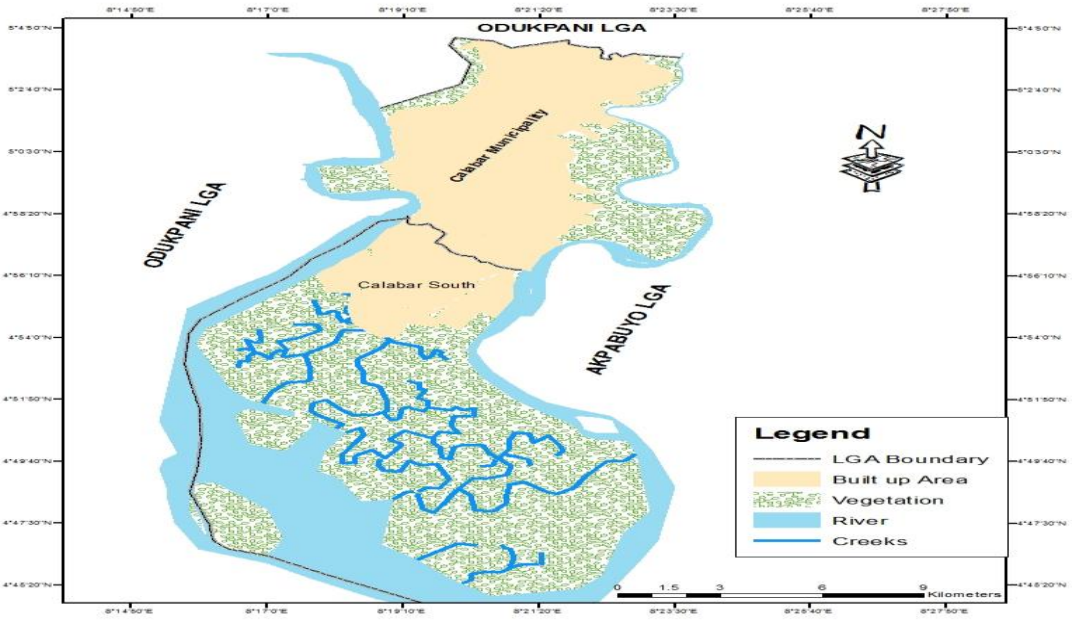

Figure 3: Calabar Land cover/Land cover change 2010 – 2012

Although with varying time frame, the data showed that there has been a slower rate of landcover change within the period of 2010 – 2012 with 5.05% change, than it was between the periods of 2010 - 2012 with about11.04% removal vegetation landcover. It is expected that the population will double its present size by 2025. This calls for great concern in the proper planning of the town to include natural green areas etc. how be it, some areas of the town to include marshy areas and wet lands should not be reclaimed for any reason unless the government is ready to face its attending environmental consequences.

V. CONCLUSION

In this paper, the changes in land cover from vegetation to built-up areas (Housing and industrial facilities) as determined by an integrated method using remote sensing and GIS and land use data showed that urban settlement expansion is on the increase from 2004 to 2012. This expansion is continuallydisrupting ecological balance via the loss ofvaluable ecological features like urban green areas, wetlands, riparian forest, and other forest vegetation. In the same vein, since the urban population is on the rise, viz-a-viz quest for land, there is a possibility for further conversion of land for urbanization purpose. The current estimation of a double increase in population size by 2025 simply implies that there will be little or no natural vegetation cover left in Calabar.Therefore, the ministries of lands and housing, commerce and industry, and ministry of environment should proffer solutions to this identified problem by encouraging the development of new residential layouts outside Calabar metropolis with access roads linking them to enable the ease of access for people working in the metropolis but living outside the metropolis. The department of public transport should also come up with efficient and affordable public transport systems that connect with Calabar sub-urban areas. As an immediate solution, the ministry of lands and housing should regulate housing and industrial development in Calabar in order to ensure maintenance of urban naturally natural ecosystem.

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