EFFECTS OF POPULATION GROWTH ON LAND COVER CHANGE IN CALABAR SOUTH, CROSS RIVER STATE NIGERIA

Offiong, R.A.*

Eteng, E.O

ABSTRACT

The study examined the resultant effects of population growth onland cover changes that were currently taking place in Calabar South.Features like urban green areas, wetlands, riparian forest and other forest and grassland ecosystems are currently giving way for new roads construction, residential and industrial layouts, recreation and amusement parks et. This is attributed to the current trends in rapid economic, social, cultural and political development that is taking place in Calabar. Data for the study was obtained from aerial photographs and was considered from 2004-2012. An arbitrary interval between 2005 to 2009 and 2010 to 2012was adopted in determining the changes that have occurred in the area. Remote sensing and geographic information systems (Arc view GIS 9.3 software) technology was used in change detection analysis. The study revealed that the population of Calabar South has witnessed a steadyupward trend

from 185,787 to 191,630between 1991 and 2006. On the other hand, the amount of built up area has correspondinglyincreased from19.791square kilometers from 2005 – 2009 (with an average of 0.756 square kilometers natural land cover change per year) to 26.495 square kilometers from 2010– 2012 (with an average of 2.235 square kilometers natural land cover change per year). Within the said period of 2005 to 2012, about 10.485 square kilometers ofland cover change has occurred. It was further observed that theaccelerated land cover changewasmore rapid between 2010 and 2012, a period that is also synonymous with severe environmental challenges, most particularly flooding.

Key Words: Calabar South, Land cover Change, Populationgrowth,CalabarSouth, Urban Green Areas.

* Dept. of geography & Environmental Science, University of Calabar, Nigeria

Introduction

Population growth is an important factor in land cover change, this is typified in the corresponding increase in land use for farming, grazing, office buildings, recreation and amusement centres, establishment of new settlement layouts and expansion of old ones.Land use changes, while driven by maximization of economic benefits to land owners, sometimes produce negative externalities such as air and water pollution, loss of biodiversity wildlife habitat fragmentation, and increased flooding. Population is a vital factor in socio-economic development, but while it might be considered as an asset, it could be, as well, a liability… (Ottong, Ering, &Akpan, 2010).

Within the last two decades, Calabar South has witnessed a near double increase in population size. According to the 1991 national population census, the population of the area stood at 185,787 – about 9.72 % of the entire population of Cross River State; and by the 2006 population census,the population figure had increased up to191,630 – about 6.63 % of the entire population of Cross River State. It is estimated that by the year 2025, the population will be doubled its current size, considering the 3.0 national population growth rate index (Ottong et al., 2010). This current population increase has led to an unprecedented increase of land use leading to the arbitrary conversion of urban green space for various purposes like road construction, housing, to including the reclamation of wetlands for residential purpose recreation centres etc. translating into unprecedented urban development within this periods.

More so, 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, and now the ongoing construction of the International Conference Centre with a seating capacity 2000 persons. The pressure continues to build up on the available land resources, leading to continual land cover change and the consequent loss of important ecological features like urban green areas, wetlands,riparian vegetation and forest ecosystem.

Urban green areasmust 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 green areas and, as a consequence, reduced the environmental benefits provided by them (Gomes &Moretto, 2011;

Sun, McNulty, Myers, & Cohen 2008). Such environmental benefits include micro climate regulation and flood control, a phenomenon that is currently becoming an issue of great concern in Calabar South.

Materials and Methods

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, [in this case on the spatiotemporal land cover change of Calabar South] (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 land cover change imageries from 1980 to 2010.

Study Area.

The study area is Calabar South is a Local Government Area of Cross River State, Nigeria.It has an area of about 115.4691square kilometers and forms an integral part of the Calabar metropolis,which has a land area of about 274.349 square kilometers and a total population of 503,819 according to 2006 population census (Cross River State development project 2007). But the population of Calabar South alone according to the 2006 population figure is 191,630.

Calabar South is bounded to the North by Odukpani L.G.A, to the East by Akpabuyo L.G.A, to the south by the Calabar Estuary and to the West by Calabar River. This area isgenerally affected by weather conditions due to its unique coastal location and high rainfall associated with its location along tropical rainforest belt. 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. This was based on an 8 yearperiod from 2004 – 2012, with 2004 serving as the reference point. This was achieved throughthe 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).

Also, 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 from that (Woodwell et al. 1984, Williams 1984).

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.

Result and Discussion

Sequel to the general objective of this study, it was generally observed that there has a growth in the city's population from 185,787 in 1991 to 191,630 by 2006. This population increase has led to the quest for more land, housing and other facilities/infrastructures,which have given rise to spatiotemporal land cover loss. As presented in the table below, out of the 115.691 square kilometers total land area of Calabar South, about 10.485square kilometer of wetlands, urban green areas, riparian forest and other forest vegetation land cover, have been removed for the purpose of urbanization between 2005 and 2012. However, this land cover change has been much more rapid between 2010 and 2012, with about 6.704 square kilometerthis constitutes about 94% of the total loss of vegetation land cover within the period of 2005 to 2012 as presented in table 1 below.

Table 1: Land Cover Change Status of Calabar South (2004 - 2012)

Year	**2004**		**2005 - 2009**		**2010 - 2012**	
	(Area Sqkm)	**%**	**(Area Sqkm)**	**%**	**(Area Sqkm)**	**%**
Vegetation Cover	99.681	86.16	95.9	82.89	89.196	77.10
Built up Area	16.01	13.84	19.791	17.11	26.495	22.90
Total Area	**115.691**	**100.00**	**115.691**	**100.00**	**115.691**	**100.00**
Land Cover Change	--	--	**3.781**		**6.704**	

Source: Ministry of Lands and Survey, 2012.

It is within the periods between 2010 and 2012 that Calabar South has witnessed more environmental challenges in the form of regular and destructive flooding. This is the case because several wetlands along the Anantigha axis that served as buffer zones to runoff water has completely be sand filled and converted to residential areas. Areas that were initially prone to flooding (like the EkpoAbasi – New Airport axis) have experienced escalated flooding like never before. The scenario could be worse as the Nigerian Meteorological Agency (NIMET) has warned of more devastating flooding in 2013.The several economic, social, cultural and political

transformations thathave attracted more people to the town and even neighboring towns could become a problem in if not checked.

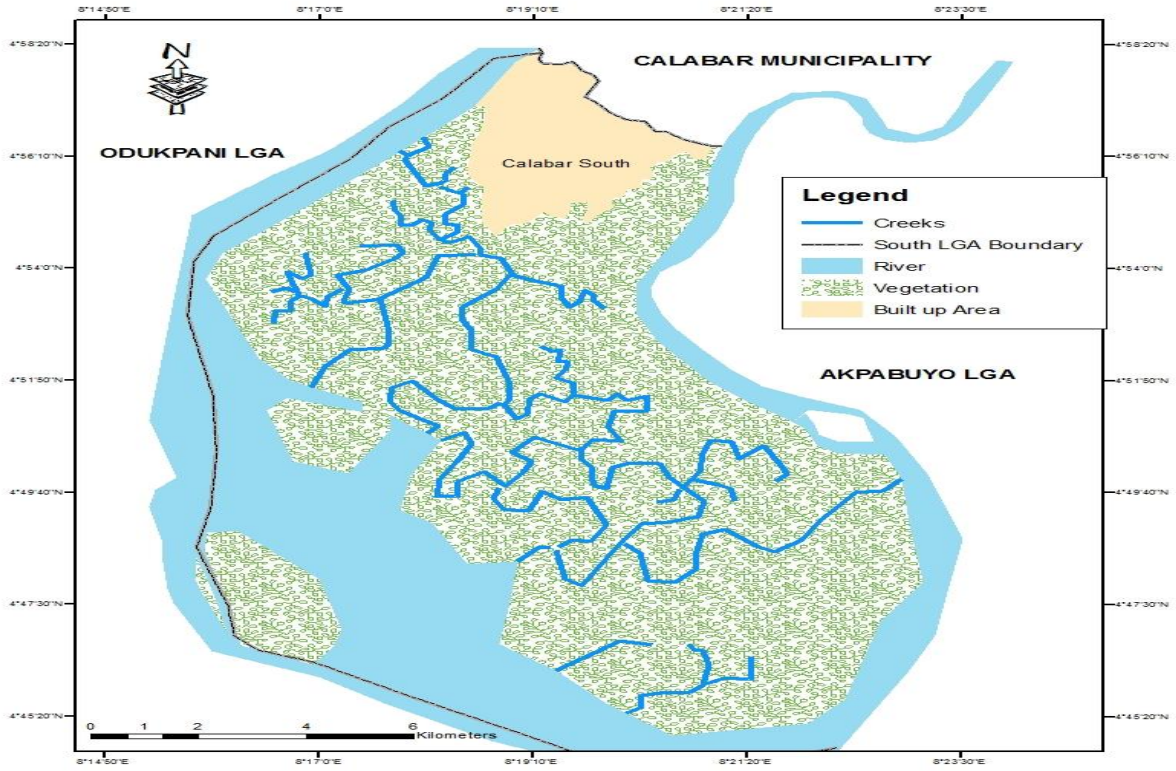

Figure1: Calabar South Land cover/Land cover change 2004

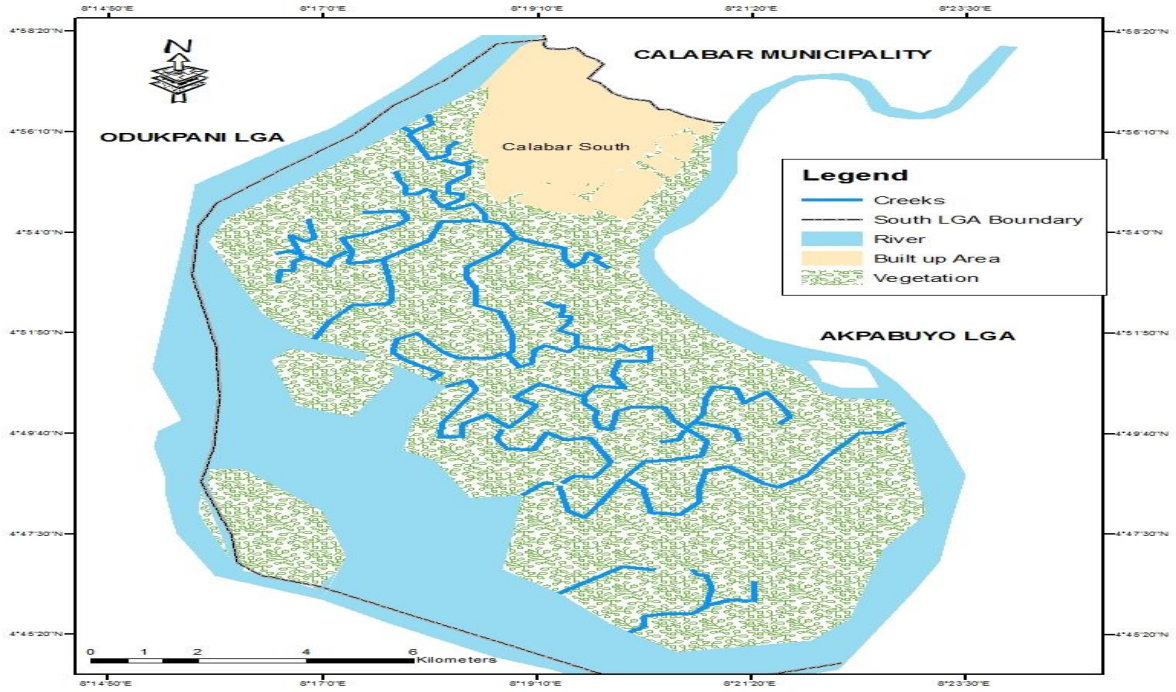

Figure 2: Calabar South Land cover/Land cover change 2005 - 2009

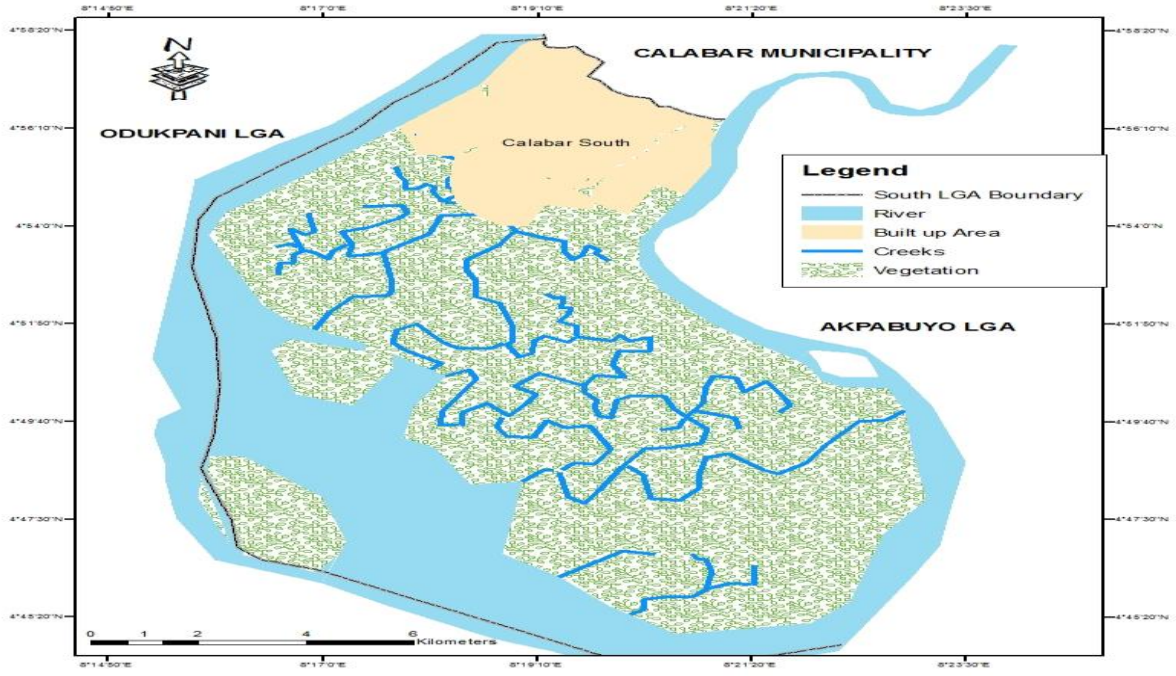

Figure 3: Calabar South Land cover/Land cover change 2010 - 2012

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 2005 to 2012. This expansion has led to drastic loss in the spatiotemporal features such as urban green areas, wetlands, riparian forest, and other forest vegetation. About 10.485 square kilometers of natural vegetation cover have been transformed into roads, residential areas and other infrastructures. However, it is obvious thatthe current trend of urbanization and other environmental factors have contributed to the current environmental challenges experienced in the area within the last few years

In the same vein, since the urban population is on the rise, viz-a-viz quest for more lands, there is a possibility for further conversion of land for urbanization purpose. Therefore, the ministries of lands and housing, commerce and industry, and ministry of environment should proffer a solution to this 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 will connect the Calabar sub-urban areas.Also as an immediate solution, the ministry of lands and housing should regulate housing and industrial development in Calabar South in order to ensure sustainable urban naturally natural ecosystem.

Reference

Acevedo, W., Gaydol, L., Tilley, J., Mladinich, C., Buchanan, J., S., Kruger, K., and Schubert, J. (2003). Urban land use change in the Las vegas Valley. U.S. Geological survey, Johnson controls world services (1-5). Retrieved March 25th, 2004 from *htt://geochange.er.usgs.gov/sw/changes/anthropogenic/population/las vegas/.i.*

Ashbindu, H. S., Foresman, T. and Eugene, A. F. (2001). Status of World's remaining closed forest: An Assignment using Satellite Data and Policy Options. *Ambio. A Journal of the Human Environment, Vol. xxxNo.1,67-69.*

Geomatics International Inc., (1996). The Assessment of Land use and vegetation changes in Nigeria between 1978-1993/95. Forest Resources Management Evaluation and Consultancy Unit, Ibadan.

Gomes, C S &Moretto, E M (2011). A framework of indicators to support urban green area planning: a Brazilian case study. *Proceedings of the International Academy of Ecology and Environmental Sciences*, 1(1):47-56

Gourmelon, F., Bioret, F. R. and Le Berre, I., (2004). Historic land use changes and implications for Management in a Small protected Island at Ushant, France, Patuxent wildlife Research centre, USGS.

National Population Commission (1997).The 1991 Population Census of Nigeria Federal Republic of Nigeria official Gazette, (2007) 94 (24) B183.

National Population Commission (2010).2006Population and Housing Census of the FederalRepublic of Nigeria, Cross River State Priority Tables, Volume 1.

Ottong J. G., Ering S. O., &Akpan F. U. (2010). The Population Situation in Cross River State of Nigeria and Its Implication for Socio-Economic Development: Observations from the 1991 and 2006 Censuses. *Journal of Emerging Trends in Educational Research and Policy Studies (JETERAPS)* 1 (1): 36-42

Polyakov, M. and Zhang, D (2008).Impact of Population Growth and Urban Sprawl on Land Use and Forest Type Dynamics along Urban-rural Gradient.*Journal of Agricultural and Applied Economics*, 40,2649–666

Singh, A. and Loghah, D. C. (2005). Land use mapping in KotlaKhad using Remote sensing Technique. *Environment and Ecology 23(1): 7-12.*

Sun G, McNulty S G, Myers J A M, & Cohen E C (2008). Impacts of Climate Change, Population Growth, Land Use Change, and Groundwater Availability on Water Supply and Demand across the Conterminous U.S. *Watershed Update* Vol. 6, No. 2

Williams, J. H. (1984). Forestry, Remote sensing and monitoring change.University College of North Eases, p.47.department of Forestry and Wood Science.

Woodwell, G. M., Hobbie, J. E., Honghton, R. A., Melillo, J. M., Mole, B., Park, AB., Peterson, B. J., Sharer, G. R. (1984). Measurement of changes in the vegetation of the Earth by Satellite Imagery. In: Woodwell (ed), the Role of Terrestrial vegetation in the Global Carbon Grade: measurement by Remote Scope Reporter Wiley, New York.