

**An Analysis of the Changing Land Use and its Impact on the Environment of
Anyigba Town, Nigeria**

By

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ABSTRACT

Urbanization is a process that always initiates the continual transformation of land from one use to the other. Land transformation is presently being experienced in and around fast growing towns, like Anyigba in Kogi State. This study used Remote sensing and GIS techniques to identify, mark, and measure the extent of the various land uses from the Land use map of 1995 and Nigerialsat 1 imagery of 2006. The study revealed that there have been tremendous transformation in the various land uses, with the built-up area expanding more than other land uses with 398.4%. Gaining 167 ha, 613.45 ha, 159.62 ha from Vacant land, Cultivated land, and vegetation, respectively, but losing 176 ha to Vacant land. This spatial and temporal changes in the unplanned growth of the built-up area is exacerbating and impacting negatively on the environment. Environmental phenomena, such as erosion, indiscriminate waste disposal, siltation, and contamination, of River Ofu are on the increase. There is, therefore, a need for an urgent review and update of Anyigba Master plan and the enforcement of development control laws in order to achieve a sustainable urban growth and development.

Key words: Development control, Environment problems, GIS, Land use, Satellite imagery, Sustainable Development

INTRODUCTION

Urban growth is one of the prominent features of the industrial era and is also a major driving force altering local and regional environments. The simultaneous rapid growth in both population and economic output per capita, and the consequent changes in land use pattern comes at a cost to the natural environment (Cohen, 2004; Tang et al., 2005; Ifatimehin and Ufuah, 2006b; Ifatimehin and Musa, 2008). Kombe and Kreibich (2000) perceived that rapid urban growth would initiate improvement of both living conditions and the quality of environment, but it is well understood that the conversion of agricultural, vegetation, and wetlands to urban areas and the unattended population growth usually come with a vast increase in impervious surfaces, consumption and utilization of goods, and building on natural drainages (USEPA, 2001; Ifatimehin, 2007).

The impending ecological and environmental threats resulting from rapid urbanization comprises of climate change, ozone depletion, alterations in biogeochemical cycles, widespread dispersal and disposal of non-biodegradable solid wastes and persistent liquid and gas chemical pollutants, deforestation, increase in the volume and rate of surface runoff, a decrease in ground water recharge and base flow, flooding, altering of natural hydrologic condition within a watershed and modifying water balance (Fohrer et al., 2001; Rosa et al., 2004) .

The impervious surfaces which abound in many urban centers degrade the quality of storm water runoff, collect pollutants either dissolved in runoff or associated with sediment, such as nutrients, heavy metals, sediment, oil and grease, pesticides, fertilizers, and fecal coliform bacteria. These pollutants are moved and discharged into water bodies by runoff (Gove et al., 2001).

In the developing countries, like Nigeria, this uncontrolled growth of urban areas in terms of population and area coverage have become a very crucial issue stressing environmental scientist because of the escalating problems of urban congestion, poor housing, crowded transportation, lack of basic services, ill health, epidemic, low educational status and high unemployment. As urbanization do not come with its expected economic growth, the complication is increased due to poor urban planning and uncontrolled land use, lack of financial resources and inadequate investment in environmental management, thereby causing more impact on the environment (UNCHS, 1996).

Anyigba town is one of the fastest growing university towns in Nigeria today as commerce is fast evolving and shaping the town (Ifatimehin and Ufuah, 2006a). The pressure exerted by the growing

population on the land and other resources and the continual changing of the various land uses is noticeable on the environment of the town.

The objectives of this paper are to:

- i. Analyse past and present land use pattern in anyigba,
- ii. identify the land uses that are most vulnerable to change in the town, and
- iii. Justify the consequences of the change in land uses on Anyigba Environment.

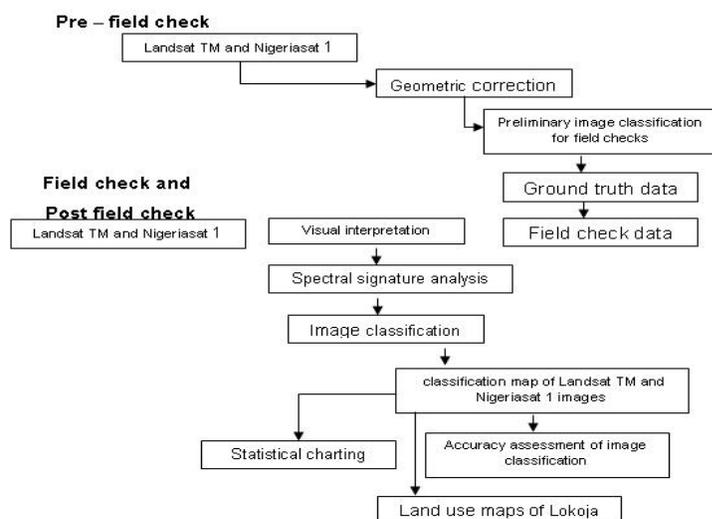
STUDY AREA DESCRIPTION

Anyigba, the study area is located on latitude $7^{\circ} 15' - 7^{\circ} 29'N$ and longitude $7^{\circ} 11' - 7^{\circ} 32' E$ and with an average altitude of 420 meters above sea level (Fig 1). The population is estimated to be 71,327 persons, based on 1991 growth rate of 3.25%. There are no significant differences with regard to socioeconomic status, and educational level in the study area (Ifatimehin and Ufuah, 2006a). The study area falls within the tropical wet and dry (Aw) climatic region and the guinea savanna, with mean annual temperature of $25^{\circ}C$ and rainfall 1600mm. It is situated on sedimentary formation of the Anambra basin and dominated by lateritic soil type with patches of hydromorphic and rich loamy soils. The presence of a university is rapidly initiating and transforming the land use type and economy from agrarian to a commerce driven economy.

MATERIALS AND METHODS

Land use and vegetation map of 1995 and Nigeriasat 1 imagery of 2006 were analysed using GIS techniques provided by ILWIS Academia 3.2 software. Training sample sets were generated using the Global Positioning System (GPS) during ground truthing. These imageries were appropriately classified using the Maximum Likelihood approach and information on land use, hydrological and other environmental parameters were drawn (Figure 2). Statistical analysis were employed to define the spatial and temporal variation in the various land uses over the period of the study.

Figure 2: Methodological Flowchart



Source : Ifatimehin and Ufuah,2006

RESULT ANALYSIS AND DISCUSSION

The rapid land use changes in Anyigba is largely due to its new status as a university town. In the last few years, the town and its surroundings has undergone radical changes in its land use types and in consumption and utilization of resources.

Land Use Types in Anyigba

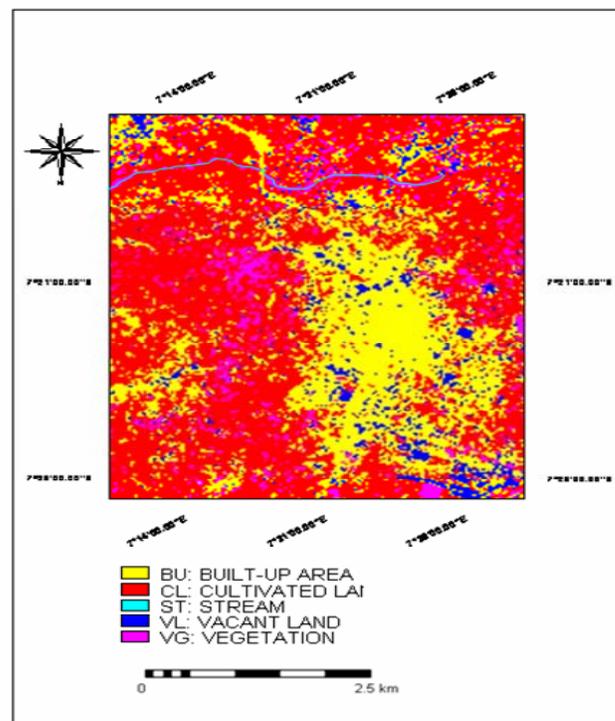
The total areal coverage of Anyigba measured 4206 hectares in this study. Five categories of land use types were identified (Table 1).

Table 1 : Anyigba Under Different Land Uses, 1995 and 2006

Land use type	1995		2006		% change 1995-2006
	Area (ha)	%	Area (ha)	%	
Vacant Land	176	4.19	215.34	5.12	122.4
Built-up Area	315	7.49	1255.07	29.84	398.4
Cultivated Land	2056	48.88	2334.75	55.51	113.6
Vegetation	1325	31.50	301.15	7.16	- 440.0
Stream	334	7.94	99.69	2.37	- 335.0
Total	4206	100	4206	100	

Source: Laboratory and Field Analysis, 2008

The juxtaposition of the 1995 and 2006 data revealed that there have been increase in vacant land (122.4%), built-up area (398.4%) and cultivated land (113.6%). On the other hand, vegetation and stream have reduced by 440% and 335% respectively. It is noteworthy that built-up areas recorded the highest gain and this is evident in the fact that many buildings sprang up in response to the new status of Anyigba as a University town. Both private individuals and government went into development of properties particularly residential, commercial and academic structures. Figure 3 depicts the various land use types in Anyigba as classified



Source: Laboratory and Field Analysis, 2008
Figure 3: Classified Anyigba Land Use Map from Nigeriasat 1 Imagery of 2006

Efforts to provide food security for the increasing population particularly through urban agriculture (Ifatimehin and Musa, 2008) may be responsible for the increase recorded for cultivated land in the area. It is common to see residents cultivating lands immediately around their residence with subsistence crops that can supplement their food needs.

Land Transformation and its Impact in Anyigba

Table 2 shows the various proportions of gains and losses amongst the various land uses. Vacant land which was 176 ha in 1995 increased to 215.34 ha in 2006 gaining from both cultivated land and vegetation. Built-up area increased from 167 ha in 1995 to 1255.07 ha in 2006 gaining from all land uses with the exception of the stream. It is logical that built-up area has not gained from the stream because the stream losses are mostly attributable to siltation and such areas are liable to flood which makes it risky for human habitation.

Cultivated land increased from 2056 ha in 1995 to 2334.75 ha in 2006 gaining from vegetation and stream. Vegetation recorded the greatest loss reducing from 1325 ha in 1995 to 7.16 ha in 2006 losing to virtually all the land uses except the stream. Finally, the stream reduced from 334 ha in 1995 to 99.69 in 2006 losing only to cultivated land.

Table 2: Land Transformation in Anyigba (1995 - 2006)

	Vacant Land	Built-up Area	Cultivated Land	Vegetation	Stream	2006
Vacant Land	176		189.23	17.11		215.34
Built-up Area	167	315	613.45	159.62		1255.07
Cultivated land			2056	847.12	234.31	2334.75
Vegetation				1325		301.15
Stream					334	99.69

Source: Laboratory and Field Analysis, 2008

Notes: Figures in Bold (diagonal) are area under that particular land use in 1995, while figures in the same column represent the shift in area to other land uses. Similarly, figures in the same row are increase in area captured from the land uses.

From the foregoing, the gains noticed in the built-up area may have emerged as an environmental force of a local proportion, whose growth is necessitating increase in cultivated land and decrease in vegetation cover and the stream which possibly contributes to the ecosystem services of the entire town. These will result in the build-up of carbon compounds, urban sprawl, infrastructure decay and others which may have both direct and indirect effects on the ecology and health of the town. A

further study of the town's physical and climatic environment revealed quantifiable indicators of change. Although on observation, traces of sheet of erosion, failure of boreholes to meet the population demand, indiscriminate erection of buildings, increase in refuse dump sites, pools of stagnant water and increase in runoff after any rain events and other environmental problems are noticed every other day. This may exacerbate certain negative environmental events such as flooding, micro climatic variation, infectious communicable diseases and pollution.

POLICY IMPLICATIONS

Undoubtedly, Anyigba is fast transforming from an agrarian community to an urban centre, and local environmental problems of various magnitude are becoming prominent. These problems are undoubtedly associated with the rapid rate of urbanization in Anyigba town, particularly since the establishment of the Kogi State University in the year 2000. Urgent steps need to be taken to address these problems to avert their negative implications on the environment.

Comprehensive land use planning and environmental policies should be strengthened and incorporated into the masterplan. Development control laws should be aggressively enforced by policy makers and their agents, albeit effective implementation to accentuate the correlation between a healthy ecosystem, a healthy human population and a healthy economy in Anyigba town. Therefore, we advocate a participatory approach in ensuring a controlled development. Stakeholders should be involved in order to attain that development that moves people toward sustainable patterns in both governance and environmental legislation. The early problem identification and solution proffering indicates a winning attitude towards achieving successes in the Millennium Development Goals by eradicating extreme hunger and urban poverty, combating infectious diseases as a result of landscape transformation and ensuring environmental sustainability.

CONCLUSION

This study has revealed that there is a tremendous transformation in the various land use in Anyigba town. The built-up area has shown the highest rate of expansion while vegetation suffered the greatest loss. The stream has also reduced drastically as a result of increase in siltation. The increasing urbanization has also been discovered to have negative implications on the environment particularly the weather and water supply. Finally, a review of the Anyigba masterplan and

enforcement of development control laws was recommended to avert the negative environmental implications of the increased rate of urbanization in Anyigba town.

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