

GIS AND REMOTE SENSING FOR URBAN PLANNING: A CASE OF FESTAC TOWN, LAGOS, NIGERIA

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Abstract

This study assesses the extent of encroachments into the original acquisitions of Festac town using SPOT XS satellite imagery and also investigates the extent of conversion of open spaces in the developed area of Festac town to other land uses using GIS techniques. Original Masterplans were digitally converted and integrated with remote sensing and field work data. The results show that encroachments into the original Festac acquisition have already been noted towards the west and north of the area. About 1.42 km² (142 ha) has already been affected. For the developed area of Festac, open green spaces reduced from about 0.2 km² (20 ha) to only 0.003 km² (0.3 ha). Residential houses and shops/shopping malls have virtually taken over the designated open spaces accounting for 35% and over 30% of the original areas allocated for open spaces. Only 1.6%, 4.9% and 1.4% respectively of the designated land area for open spaces still serve the purpose of functional open spaces, functional playground and open green spaces as opposed to their original allocations of 32.5%, 2.6% and 64.3% respectively. The implication of these on the liveability of Festac town, and city/urban planning is also examined.

INTRODUCTION

Urbanization is now a common feature of all third world countries. Primate cities and megacities are emerging in developing countries. In Asia, Africa and Latin America, the unprecedented population growth that characterised much of the 20th century has evolved into unparalleled urban growth (Brockerhoff, 2000). The growth in the population of cities in developing countries has been attributed to various factors which could be summarized in two: natural population increase and rural-urban migration. The cities of the third world have especially experienced population growth. For example, the population of the municipal boundary of Lagos rose from 230,256 in 1956 to 650,000 in 1963 (Oyeleye, 2001). The 1991 census put the population of Lagos State at about 5.7m and the projected figure using a highly conservative national growth rate of 2.83% (the growth rate of Lagos is actually about 6%) is about 7.5m. Lagos is expected to add nearly 10m people between 2000 and 2015 (Brockerhoff, 2000). This growth is going to be over a land mass of about 3,600 km² of which about 1,700 km² is water. Lagos has an average population density of 1,712 ppkm² in 1991. However the bulk of the population of Lagos is concentrated on the metropolitan area – an area less than 800 km² - where the industrial and commercial activities are concentrated. Metropolitan Lagos has 15 of the 20 local government areas (LGAs) in Lagos State and it is a fact that some of these LGAs have population density as high as 48,000 ppkm² (persons per square kilometre) in 1991 and 65,000 ppkm² by the year 2000 projections.

This increased population in the city of Lagos has in turn led to widespread environmental deterioration and pollution. Formerly planned residential areas are no longer liveable. The

limit of acceptable change can be used to identify indicative capacities and requirements of an area (Selman, 1996). For Lagos, evidence of development beyond the limit of acceptable change is manifested in slums and break-down of infrastructure and facilities in formerly planned residential estates. Lack of adequate tools and information for city and urban planning is also making planners in most developing countries to loose track and equally loose the battle for creating decent and liveable cities. The thrust of this study is divided into two: to assess the extent of encroachments into the original acquisitions of Festac town using SPOT XS satellite imagery; and to investigate the extent of conversion of open spaces in the developed area of Festac town to other land uses using GIS techniques.

STUDY AREA

The study area is roughly defined by UTM-31 coordinates 533409E, 713989N; 531727E, 718231N; 527512E, 718017N; and 528295E, 713512N. Located some 10 km southwest of central Lagos in-between Amuwo Odofin and Alimosho LGAs of metropolitan area (Figure 1), the original acquisition for Festac town covers approximately 19 km² (1,900ha) with a perimeter of about 220 km. Festac Town (also called Festival Town) was proposed to be a mini-town with its own facilities and employment opportunities. So, the proposed area layout design of Festac town has six major land use classes: Residential, Industrial, Commercial, Recreation, circulation and central function. Like any modern residential layouts the canals and drainage channels are well laid out to take care of flood and sewerage problems.

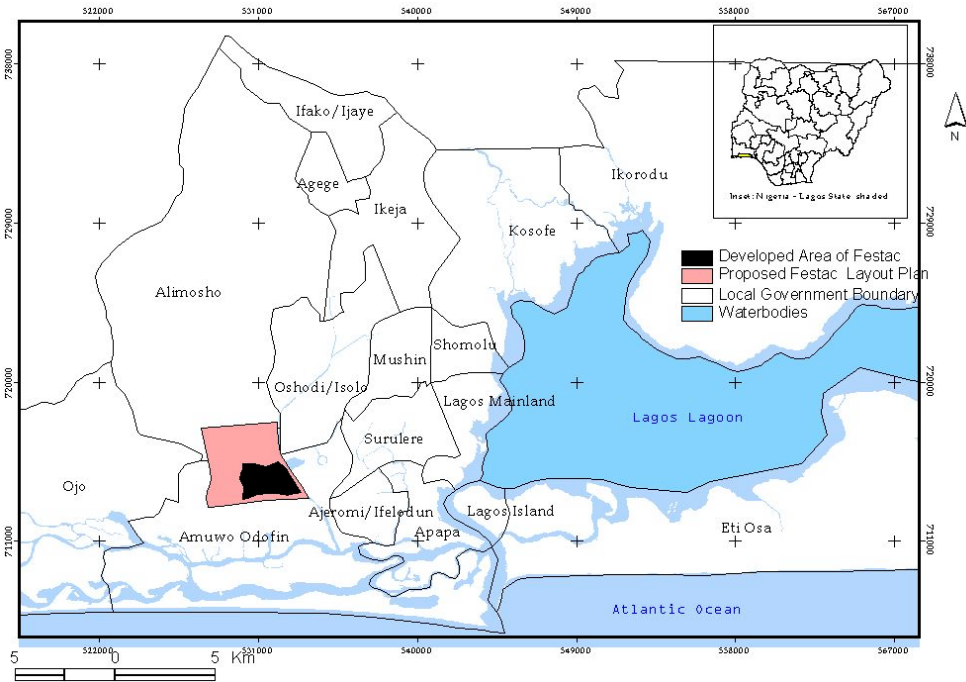


Figure 1: Metropolitan Lagos showing the Study Area.

Festac Town which is a Federal Government of Nigeria project through the Federal Housing Authority (FHA) was conceived around the same time that the government of Lagos State through the Lagos State Development and Property Corporation (LSDPC) hatched the idea of Planned Residential Estates to take care of the rapidly expanding population of Lagos. A portion of the residential zone covering about 5 km² (500ha) representing 26% of the entire planned layout area was built between 1975 and 1976 to accommodate foreign participants to the world's Festival of Black Arts and Culture – FESTAC - which was held in Lagos in 1977. Incidentally this event gave name to the new estate which was expanded in 1979-1980 and 1982. At completion, the estate was a model, the largest and first of its kind in the West Africa sub region. Up till now the remaining parts of the original layout plan including the industrial, much of the commercial, central function and much of the recreation and a larger part of the residential zones are yet to be developed due to the shift in emphasis to the development of Abuja (the new Federal Capital) and later, the downturn in the Nigerian economy.

RESEARCH METHODOLOGY

Data and data sources

This study integrates remote sensing data with geographic information system. To investigate the problem of encroachment on the original Festac town acquisition SPOT XS satellite Imagery acquired in year 2000 and original general Land Use Zoning Plan for the area at a scale of 1:10,000 prepared in 1977 were used (Table 1).

Table 1: Data and data sources.

S/n	Data	Scale	Year	Source
1	Landuse Zoning Plan	1:10,000	1976	Federal Housing Authority
2	SPOT XS satellite Imagery		2000	Geography Department, UNILAG
3	Revised Masterplan for Festival Town	1:2500	1982	Federal Housing Authority
4	Lagos State Administrative Map	1:100,000	2000	Geography Department, University of Lagos

To investigate the second problem of conversion of open spaces in the already developed parts of Festac town, the revised 1:2,500 Masterplan for the developed area produced in 1982 was used to generate the base data on the status of open spaces while field investigation was carried out in 2003 to see the situation on ground now. Digital file of Administrative map of Lagos State at a scale of 1:100,000 was accessed from the Department of Geography, University of Lagos.

Procedure

The Land Use Zoning Plan acquired from the archives of the Federal Housing Authority (FHA) was scanned and exported into Arcview GIS. This original plan has no geographic reference, hence six control points in UTM-31 coordinates was supplied by the FHA and four of these control points were used to georeference the scanned land use zoning plan using the Image Analysis tool of Arcview. The different feature classes – land use zones and roads were extracted from the scanned image using the head-up digitising within the Arcview GIS environment.

The SPOT XS satellite imagery covering western parts of Lagos, which had already been processed and georectified to UTM-31 coordinates was clipped with the vector layer of the land use zoning plan. Isodata classification was performed on the clipped area of the image using the Image Analyst tool of Arcview GIS. Five land use classes – Water, Built up area, Newly developing area, Forest, and Wetland were generated.

To generate data on the status of open spaces in the developed portion of the study area, the revised Masterplan was scanned and imported into Arcview GIS. Garmin 12XL Handheld GPS was used to collate control points for registering the scanned map using the Image Analyst tool of Arcview. Head-up digitizing method was used to digitize and code the status of open spaces as at inception. The map generated was used as the basis for field work to check what the status of these open spaces is in 2003.

ANALYSIS AND DISCUSSIONS

Land use zoning plan and encroachments of Festac

An analysis of land use zoning for the whole Festac is depicted on Figure 2 and Table 2. About 12 km² or 64% of the land was dedicated to proposed residential layouts. Other proposed land uses are 2.54 km² (13.42%) for recreational belts; 1.5 km² (7.95%) for light and cottage industries; and 1.44 km² (7.58%) for central function zone. Canals, circulation and others account for the rest.



Figure 2: The Land Use Zones of the Festac Acquisitions.

Table 2: Land Use Zones of the Festac Acquisitions

S/N	ZONE	SUM_AREA (km)	Percentage
1	Canal	1.00	5.25
2	Central Function Zone	1.44	7.58
3	Circulation	0.050	0.27
4	Commercial Zone	0.26	1.37
5	Industrial Belt	1.51	7.95
6	Recreation Belt	2.55	13.42
7	Residential Zone	12.14	63.93
8	Others	0.04	0.23
	TOTAL	18.99	100.00

From the SPOT XS satellite imagery, encroachments have already been recorded in some parts of the layout. About 1.42 km² (142 ha) has already been affected. Firstly, new developments have been noted around the already built up area (Figure 3). This suggests that individuals have been acquiring and developing lands on their own since the government has not carried out any development in Festac since the early 1980s. Whether these new developments are with the consent of the government through the FHA cannot be verified.

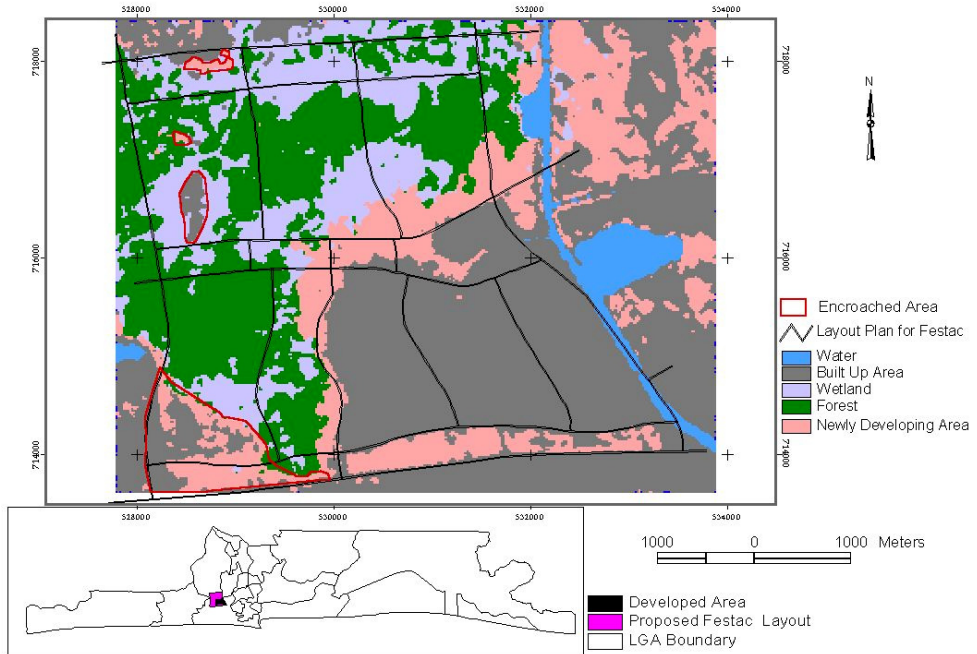


Figure 3: Classified SPOT XS Imagery Showing encroachments into the Acquisitions.

Secondly, at the western flank towards the boundary of the Festac acquisition with the International Trade Fair Complex along the Lagos-Badagry expressway, a fully developed area was noted. Field checks revealed that a Petrol Station has already been constructed here. The third area is the northern flank with other settlements such as Egbe, Igando and Eggan. New developments have already emerged in some parts of the area that is proposed for industrial development. These new developments are scattered and are connected by tracks and untarred roads which mean that the roads are probably constructed by the people themselves. These probably suggested that these developments are illegal and possibly not to the knowledge of the acquisition's supervisory authorities - the Federal Housing Authority.

Conversion of open spaces in the developed portions of Festac

Situation as of Masterplan (1982)

The second thrust of this study is to investigate the extent of conversion of designated open places in the developed/inhabited parts of Festac. From the scanned and georeferenced revised Festival Town Masterplan prepared in 1982, the designated open spaces were

digitized and coded within GIS (Figure 4). The designation and extent of these open spaces are shown on Table 3.

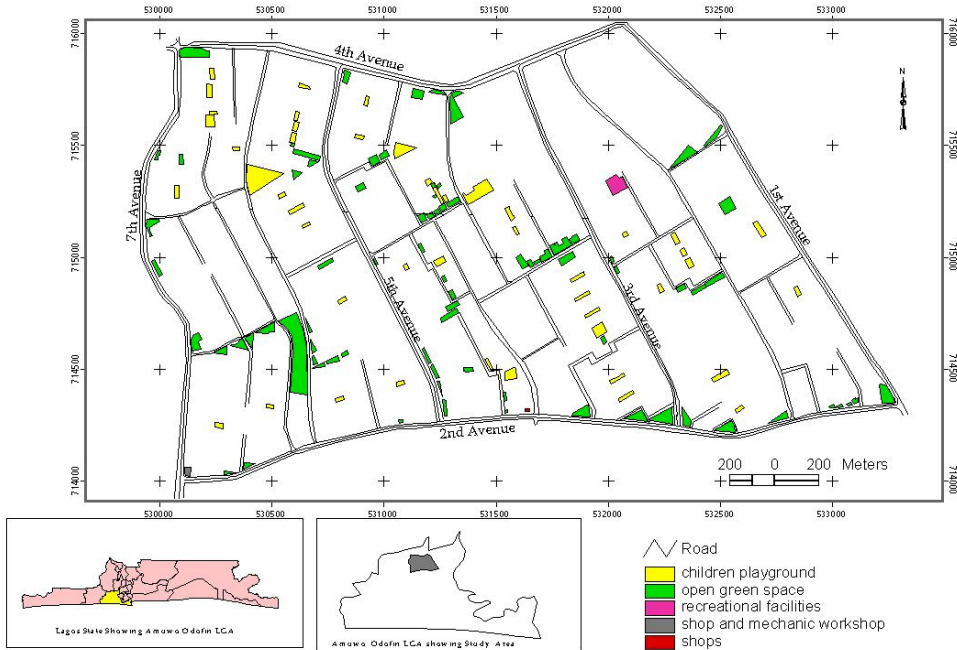


Figure 4: Open spaces in developed part of Festac Town (Masterplan 1982).

Table 3: Designated Use and extent of Open spaces in Festac Town (1982).

S/n	Designated Use	Count	Total Area (acres)	Total Area (m ²)	Percent
1	Children playground	47	16.07	65048.33	32.45
2	Open Green Space	92	31.85	128880.73	64.30
3	Recreational Facilities	1	1.28	5175.74	2.58
4	Shop And Mechanic Workshop	1	0.26	1043.93	0.52
5	Shops	1	0.07	293.32	0.15
TOTAL		142	49.53	200442.05	100.00

From Table 3, a total of 142 spaces covering about 0.2 km² (20 ha) were designated as open spaces. Ninety-two of these, covering and area extent of about 0.13 km² (13 ha) or 64% of the entire open areas were allocated for open Green Spaces. This is followed by children playground covering 0.06 km² (6 ha) or 33 %. Other minor designated use of open spaces includes recreation facilities, shopping complex, and automobile workshops.

Situation as of 2003

The map in Figure 4 was taken to the field in June 2003 to investigate the scenario as at year 2003. The results of the field work are shown on Figure 5 and Table 4.

The breakdown on Table 4 clearly shows the conversion of designated open lands into other uses different from the original intended uses. Open green spaces reduced from about 0.2 km² (20 ha) to only 0.003 km² (0.3 ha). Of serious concern is that residential houses and shops/shopping malls have gradually taken over the designated open spaces accounting respectively for 35% and over 30% of the total area of conversion. It is also sad to note that

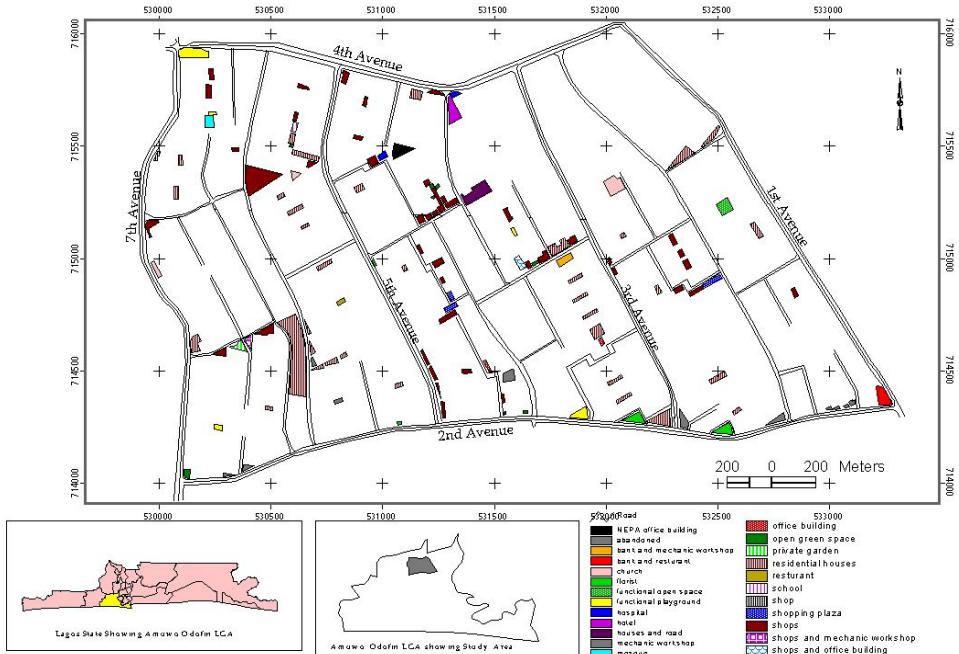


Figure 5: Appropriated Use and extent of Open Spaces in Festac Town (2003).

Table 4: Appropriated Use and extent of Open Spaces in Festac Town (2003).

S/n	Appropriated Use	Count	Total Area (acres)	Total Area (m2)	Percentage
1	NEPA office building	1	0.9630	3,896.45	1.94
2	Abandoned	10	1.8770	7,600.48	3.79
3	Bank and mechanic workshop	1	0.5440	2,202.39	1.10
4	Bank and restaurant	1	0.9370	3,792.42	1.89
5	Church	3	1.8680	7,559.96	3.77
6	Florist	4	1.4840	6,001.96	2.99
7	Functional open space	1	0.7730	3,128.24	1.56
8	Functional playground	5	2.4370	9,865.16	4.92
9	Hospital	2	0.4660	1,886.02	0.94
10	Hotel	1	1.0050	4,068.14	2.03
11	Houses and road	1	1.6780	6,792.45	3.39
12	Mechanic workshop	1	0.4650	1,880.79	0.94
13	Mosque	1	0.5140	2,081.16	1.04
14	Office building	2	0.3130	1,267.52	0.63
15	Open green space	18	0.7090	2,876.60	1.44
16	Private garden	1	0.3840	1,554.94	0.78
17	Residential houses	35	17.4270	70,530.09	35.19
18	Restaurant	1	0.1670	675.65	0.34
19	School	1	0.2290	926.07	0.46
20	Shop	1	0.1330	537.65	0.27
21	Shopping plaza	3	1.0010	4,048.31	2.02
22	Shops	46	13.4420	54,395.86	27.14
23	Shops and mechanic workshop	1	0.3150	1,273.78	0.64
24	Shops and office building	1	0.3950	1,599.96	0.80
TOTAL		142	49.5260	200,442.05	100.00

only 1.6%, 4.9% and 1.4% respectively of the designated land area still serve the purpose of functional open spaces, functional playground and open green spaces as opposed to their original allocated spaces of 32.5%, 2.6% and 64.3% respectively.

This trend may likely have resulted from increased migration of people to Festac town, but it however portends dangers for aesthetics, beauty and liveability of Festac town. It shows neglect of the city and lack of monitoring on part of city administrators and planners. This is true more so since planners in our own part of the world still lack adequate application knowledge of the necessary tools of GIS and remote sensing to carry out their jobs of development control and urban monitoring.

CONCLUSION

The data and information generated in this study using GIS and remote sensing techniques has demonstrated the deterioration of the study area. While encroachments into the original acquisitions have been discovered, there is widespread conversion of open spaces in the already developed area. The implications of this on the liveability of Festac town cannot be over-emphasised. A major problem now is that city planners and administrators in Nigeria still lack the required knowledge of the tools of GIS and remote sensing to enhance their efficiency at work. Thus, the more developed world has a duty to assist in training our city and urban planners and administrators so that we can indeed ensure liveable cities and sustainable developments on both side of the Atlantic. Only then can we go further to bridge the Pacific and Atlantic in Geospatial information research.

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