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Trend Analysis of Landcover/ Landuse Change in Patani L.G.A, Delta State Nigeria

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Abstract—*This study examines the use of GIS and Remote Sensing in trend analysis of landcover/landuse change in Patani L.G.A, Delta State Nigeria from 2005 to 2015. Thus the study is to carry out a multi-temporal analysis of development trends, thereby detecting the changes that have taken place between these periods. Two Landsat images, Landsat 7ETM+ (2005) and Landsat 8OLI (2015) were acquired, classified and change detection analysis was performed to determine the multi-temporal landcover/landuse changes between the years. The results showed that vegetation decreased from 16673.73 hectares in 2005 to 15973.9 hectares in 2015 covering 75.45% of landcover/landuse class in the study area, built up area gained from 3684.03 hectares in 2005 to 4346.37 hectares in 2015 covering 20.53 % in the study area, while water bodies also increased from 812.29 hectares in 2005 to 849.78 hectares in 2015 covering 4% of the study area. The study also indicated that the annual growth rate of Built up area has increased at 0.82% from 2005 to 2015, vegetation decreasing significantly at the rate of -0.21% from 2005 to 2015, and water bodies also increasing at a rate of 0.22% from 2005 to 2015. The results from this study can serve as a base for decision making and planning for urban planning and regional developments in Patani L.G.A.*

Keywords— Geographic Information System, Landcover/ Landuse, Remote Sensing, Change detection.

I. INTRODUCTION

Due to anthropogenic activities, the Earth surface is being significantly altered in some manner and man's presence on the Earth and his use of land has had a profound effect upon the natural environment thus resulting into an accelerated growth in settlement expansion (Zubair, 2008). Settlements are products of human activities. They are dynamic and constantly changing with man's changing social and economic needs. Settlements whether informal or formal, require constant monitoring. This is especially true in most developing countries including Nigeria where proper and periodic monitoring of formal settlements is not carried out; there is a very high tendency for informal settlements to develop (Opeyemi et al, 2015). Data on land use/land cover may not be easily obtained except with relevant remote sensing technologies and techniques (Ukor et al, 2016).

Remote sensing and Geographical Information Systems are powerful tools to derive accurate and timely information on the spatial distribution of landcover/landuse changes over large areas. GIS provides a flexible environment for collecting, storing, displaying and analyzing digital data necessary for change detection (Ukor et al, 2016).

Remote sensing imagery is the most important data resource of GIS. The satellite imagery can be used for recognition of synoptic data of earth's surface. The aim of change detection process is to recognize land use on digital images that change features of Interest between two or more dates. There are many change detection techniques such as post classification comparison, conventional image differentiation, using image ratio, image regression, and manual on-screen digitization of Change, principal components analysis and multi date image classification.

Therefore the main aim of this study is to analyze the trend of landcover/landuse changes in Patani Local Government using satellite imageries and GIS with a view to providing recommendations for sustainable development and decision making.

II. STUDY AREA

Patani is a Local Government Area in Delta State, Nigeria. Its headquarters are in the town of Patani. It has an area of 217 km² and a population of 67,707 at the 2006 census. It is located between latitudes $5^0$6' 0" N and $5^0$15'0"N and longitudes $6^0$0'0"E and $6^0$18'0"E see fig 1

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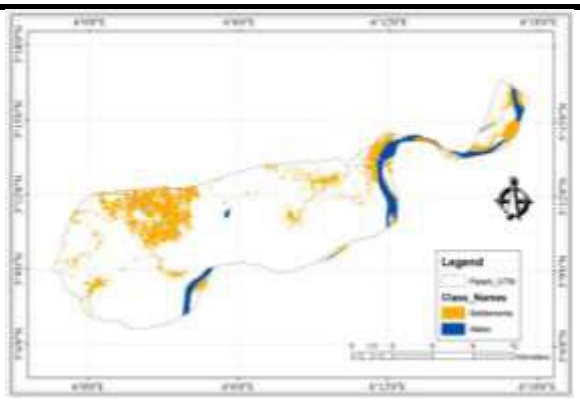

Fig.1: Map of Patani L.G.A

III. METHODOLOGY

For a proper and effective optimization, planning is very important. In this phase of the project, a user requirement analysis was done to focus on what information is presently being used, who is using it and how the source is being collected, stored and maintained. There is ideally a map of existing processes which was improved as well as being replicated by the GIS. The necessary information was obtained through interviews, documentations, reviews and workshops. This also involves the data requirement, hardware and software selections and method to be used.

3.1 Data Requirement

Data used in this research includes;

I. Landsat 7 ETM+ and Landsat 8 OLI Imagery of the study area
II. Co-ordinates of control points and other points of interest
III. Attribute Data of points of interest.
IV. Administrative map of Delta State showing Local Government boundaries
V. Materials available in Academic journals, conference papers, relevant texts, brochures, internet and statistical files of government offices.

3.2 Methods and Techniques

The method used in this study involves image subset, image classification techniques as well as multi-temporal image analysis. Image subset was done on the two multi-temporal sets of images obtained (Landsat7 ETM+, Landsat8 OLI) in order to cut out the study area from the image set, after which land cover maps of the study area were produced using the supervised maximum likelihood classification algorithm in ERDAS Imagine. Trend analysis was also performed to determine the trend of change in the time period between 2005 and 2015.

IV. RESULTS

The results of image analysis as obtained from the hard classification procedure of supervised classification, change detection and trend analysis are presented. Most of the discussions are supported by maps, tables and illustrative graphs.

4.1 Land cover / Land use Distribution of Patani L.G.A of 2005

In mapping landcover/land use, three different classes of interest were identified to include Built up area, Water, and Vegetation. The classified image of Patani L.G.A is shown in figure 4.1

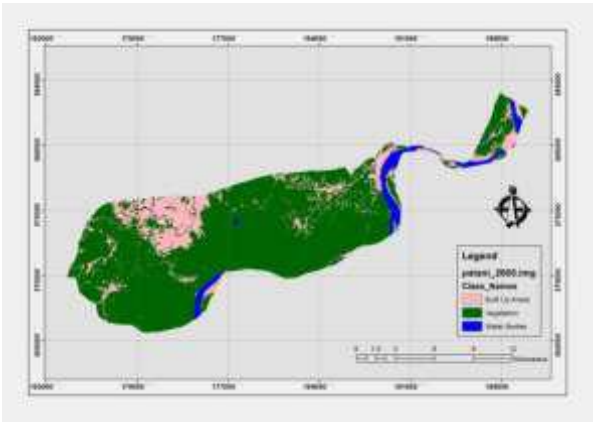

Fig.1: Landcover/Landuse of Patani L.G.A in 2005

The land cover/land use distribution of Patani in 2005 as shown in table 4.1 and fig 4.2 indicates that vegetation accounted for the largest land cover/use class in the study area with about 78.76% of the landcover/landuse class covering 16673.73 hectares in area, built up areas had 17.40% covering at total area of 3684.03 hectares while water body had 3.84% covering a total area of 812.29 hectares.

Table.4.1: 2 Landcover/Landuse distribution of Patani L.G.A in 2005

Class Type	2005	
	Area (Hectares)	Percentage %
Built Up Areas	3684.03	17.40
Vegetation	16673.73	78.76
Water Bodies	812.29	3.84
Total	21170.05	100

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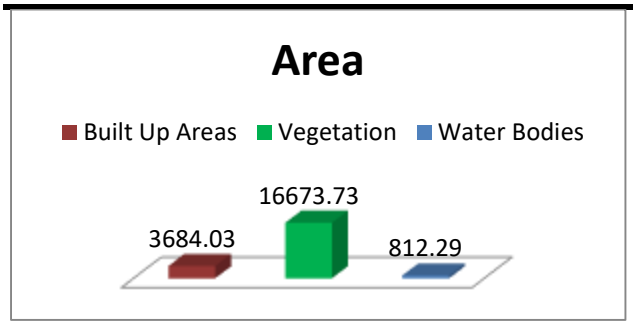

Fig.4.2: Histogram of Landcover/Landuse of Patani L.G.A in 2005

4.2 Land cover / Land use Distribution of Patani L.G.A in 2015

The land cover/land use distribution of Patani L.G.A in 2015 as shown in figure 4.3, 4.4 and table 4.2 indicate that vegetation decreased from 16673.73 hectares in 2005 to 15973.9 hectares in 2015 covering 75.45% of landcover/landuse class in the study area, built up area gained from 3684.03 hectares in 2005 to 4346.37 hectares in 2015 covering 20.53 % in the study area, while water bodies also increased from 812.29 hectares in 2005 to 849.78 hectares in 2015 covering 4% of the study area.

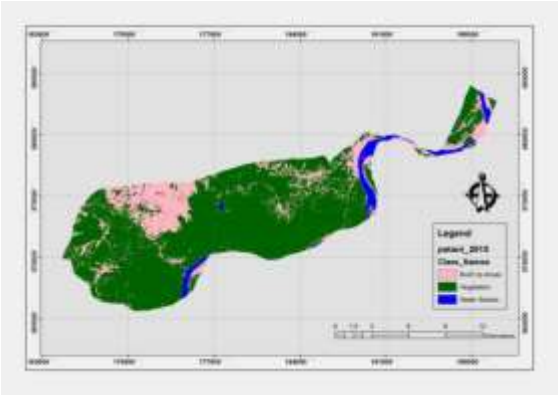

Fig.4.3: Landcover/Landuse of Patani L.G.A in 2015

Table.4.2: Landcover/Landuse distribution of Patani L.G.A in 2015

Class Type	2015	
	Area (Hectares)	Percentage %
Built Up Areas	4346.37	20.53
Vegetation	15973.9	75.45
Water Bodies	849.78	4.014
Total	21170.05	100

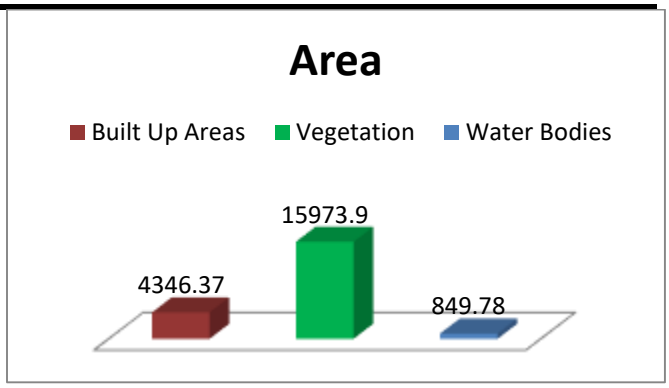

Fig.4.4: Histogram of Landcover/Landuse of Patani L.G.A in 2015

4.3 Trend Analysis

The results of the trend analysis are presented in table 4.3 and figure 4.5. A trend percentage with a value greater than zero means that the land use type has increased over the period of years while a value less than zero shows a decrease in the land cover/land use type over a period of time (long et al, 2007) .

The results indicate that the annual growth rate of Built up area increased at at 0.82% from 2005 to 2015, this is significant as this indicates a trend of urban expansion in the study area from 2005 to 2015. Vegetation decreased significantly at the rate of -0.21% from 2005 to 2015, this is by far the most significant decrease in the study area, and this loss is attributed to urban expansion and flooding events in the study area, due to rapid urbanization and anthropogenic activities in the study area. This activity gives rise to vegetation encroachment thereby resulting in the decrease of vegetation from 2005 to 2015. Water bodies also increased at a rate of 0.22% from 2005 to 2015.

Table.4.3: Trend of change of landcover/landuse of Patani L.G.A from 2005 to 2015

Class Type	Annual Rate (%)
	2005-2015
Built Up Areas	0.82
Vegetation	-0.21
Water Bodies	0.22

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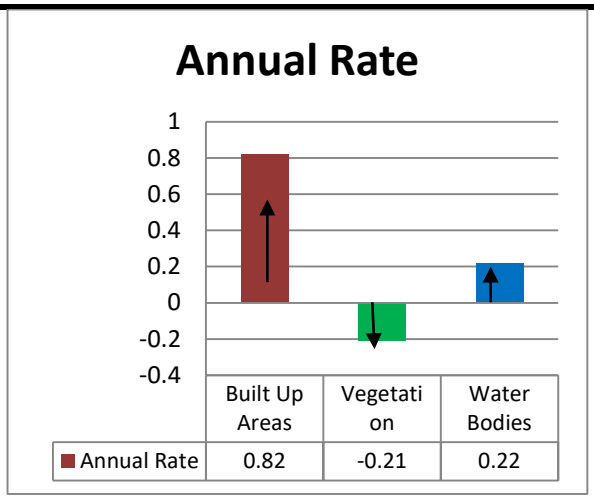

Fig.4.5: Trend of change of landcover/landuse of Patani L.G.A between 2005 and 2015

V. CONCLUSION

This study demonstrates the ability of Remote Sensing and GIS in capturing spatial-temporal data. Attempt was made to capture as accurate as possible the three land use land cover classes as they change through time.

The study indicated that the annual growth rate of Built up area has increased at 0.82% from 2005 to 2015, vegetation decreasing significantly at the rate of -0.21% from 2005 to 2015, and water bodies also increasing at a rate of 0.22% from 2005 to 2015.

This result is significant as it indicates a trend of urban expansion in the study area from 2005 to 2015, this trend can also be said to be responsible for vegetation reduction from 2005 to 2015 due to vegetation encroachment from urbanization.

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