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Change Detection on Land Use/Land Cover and Its Environmental Consequences in Ikorodu Local Government Area, Lagos State, Nigeria.

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ABSTRACT: Ikorodu Local Government Area is one of the fastest growing municipalities in Lagos state and has experienced a rapid and intensive land modifications in recent decades because of various anthropogenic activities. The position of this research is to access the changes on land use/land cover in Ikorodu LGA of Lagos state between the year 1984 and 2016, and to predict the change in the land use/land cover for year 2032. The study made use of Landsat satellite imageriesto identify the land use/land cover classes. ArcGIS 10.2.2 and Idrisi selva software were used for thisresearch. Remote Sensing and GIS provide consistent and accurate base line information for such tasks. Factors responsible for the change and its consequences were identified.

Key words: Land use/Land cover, Change detection and prediction, Environmental consequences, Remote sensing and GIS.

I. CHAPTER ONE

Introduction

Land is definitely one of the most important natural resources, since life and developmental activities are based on it.Land use/land cover pattern of a region is an outcome of natural and socioeconomic factors and their utilization by man in time and space. Land use/land cover pattern reflects the interaction between man and environment as well as influence to the mankind basic economic activities. Agbor (2012) emphasized that man's activities on earth have had a deep effect on the natural environment thus resulting into an observable pattern in the land use/land cover over time. Human/natural modifications of land use/land cover have largely resulted in deforestation, biodiversity loss, global warming and increase in natural disaster such as flooding (Dwivedi et al. 2005). Awoniran (2012) observed that land use changesoccur at the periphery of large urban concentration where urbanization and industrialization pressures frequently result in loss of prime agricultural lands and tree cover. This pressure results into an unplanned and uncontrolled changes in land use/land cover (Seto et al. 2002). Vegetation cover on the surface of the earth likewise population has never in the history of mankind remained static, and as a result that, it is always and constantly changing from one type to another. Foley et al., (2005) stated that land use/land cover has generally been considered a local environmental issue, but it is becoming a force ofglobal importance.In situations of rapid and often unrecorded land use change, observations of the earth from space provide objective information of human utilization of the landscape.These changes are of significance in the field of environmental change (Turner, 2003; Lambin et al, 2001). Geographical Information System(GIS) provides the platform on which data on such images are stored, processed and analysed for decision making. Land use/land cover data are essential for planners, decision makers and those concerned with land resources management (Ndukwe, 1997). The evolution in technology of Remote Sensing and Geographical Information System (GIS) has caused it to become one of the most commonly used techniques in the world.

Statement of Problem

Several studies have addressed urban expansion dynamics in big cities in developing countries particularly Nigeria(Agbor., 2012, Joel Effiong, 2011, Innocent., 2013, Joel., 2011, Dami et

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al., 2014). Thus, the fast-growing medium size and small cities are being neglected despite the UN-HABITAT (2008) observation that African cities with less than 500,000 inhabitants are absorbing two-third of all urban population growth.

Aim and Objectives of the Study

The aim of this project is to access the nature and extent of land use/land cover change and its environmental consequences in Ikorodu LGA of Lagos state between the year 1984 and 2016 using remote sensing and GIS. The focus is on the change detection map which will depict and estimate the area extent for each land use/land cover change and to predict the change in the land use/land cover for 2032.

The specific objectives of the study are to;

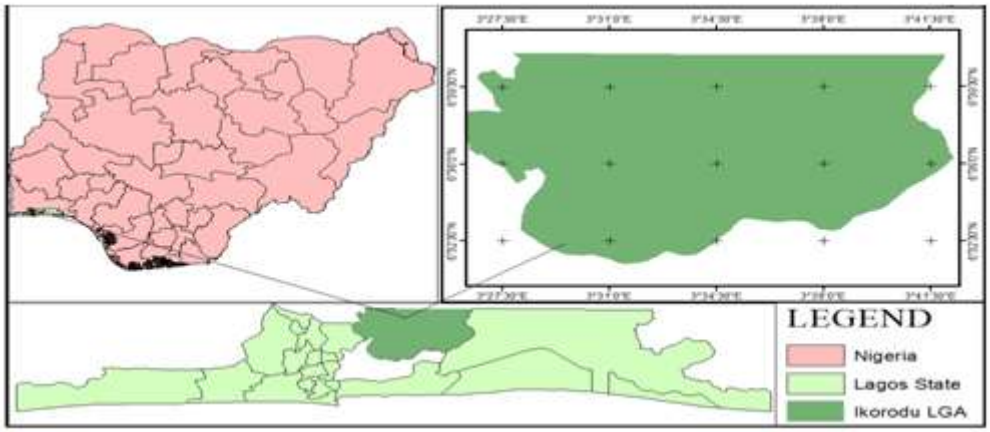
1. Assess the land use/land cover change of Ikorodu LGAbetween 1984 and 2016
2. Examine the factors responsible for the land use/land cover within the study period
3. Examine the environmental consequences of the land use/land cover in the study area
4. Predict land use/land coverchange in the study area for year 2032.

Justification

The rate at which Ikorodu Local Government Area is changing is the main reason for carrying out this project. No study on change detection on land use/Land cover in Ikorodu Local Government Area have been undertaken to determine the factors responsible and the environmental consequences being witnessed within the study area. This gap can be bridged by integrating Remote Sensing and GIS techniques to perform a change detection on multi-temporal remotely sensed data as a means of understanding landscape dynamics, identification, mapping, and to monitor differences in land use/land cover patterns over time.

Study Area

Ikorodu is a city and a local government area in Lagos State, southwestern Nigeria with an area of 390. 94km.sq. Ikorodu is located on the northern part of Lagos State with Coordinates 6°36′N 3°30′E and 6° 60'N 3° 50'E. The town is bounded on the South by the Lagos Lagoon, to the west by Kosofelocal government area, bounded in the north by Ogun State, while in the east, it has common boundary with Agbowa-Ikosi, a town in Epe Division of Lagos State.



II. CHAPTER TWO

Conceptual Framework

Land use refers to the type of utilization to which man has put the land. But land cover describes the vegetal attributes of land. Land use refers to how land is being used by humans while land cover is a measure of what is covering the surface of the earth (Jensen, 2000).Change detection is a process of identifying differences in the state of a geographic feature by observing it at different times (Singh, 1989). Change detection is the process of understanding a dynamic environment using a multi-date imagery. The purpose of the change detection process is to recognize land use/land cover on digital images. In this study, post-classification comparison technique was applied to the land use\land cover maps derived from satellite imagery.The three areas in which the environment suffers the most due to consequences of population growth and other factors are water, land and air. Such environmental consequences are flooding, land degradation, land deliration, climate change, temperature variation, wind erosion, disease outbreak, shortage of

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agricultural products, extinction of species and loss of biodiversity.

Literature Review

Studies have shown that there remain only few landscapes on the Earth that are still in their natural state. Man's activities on earth have had a deep effect on the natural environment thus resulting into an observable pattern in the land use/land cover over time. According to Hula (2010), vegetation covers on the surface of the earth likewise population has never in the history of humankind remained static. Thus, it is always and constantly changing from one type to another. Due to advancement in satellite sensors, their analysis techniques are making remote sensing systems fruitful, realistic and attractive for use in research and management of natural resources.

III. CHAPTER THREE

Data Acquisition

DATA	SOURCE	SPATIAL RESOLUTION	YEAR	PATH/ROW	ACQUSITION DATE
Landsat 5 TM	USGS	28.5m	1984	191/55	18/12/1984
Landsat 7 ETM+	USGS	30m	2000	191/55	06/02/2000
Landsat 8 OLI	USGS	30m	2016	191/55	10/02/2016
Administrative Map of Lagos	Other sources		2015		

SOFTWARE	OWNER	VERSION	PURPOSE
ArcGIS	ESRI	10.2.2.	Image pre-processing, image enhancement, band combination, supervised classification, reclassification, change detection, Accuracy assessment and map embellishment.
IDRISI Selva	Clark Laboratory	17	Land use/land cover change prediction
Microsoft Office Suite (Excel and Word)	Microsoft Corporation	2016	Microsoft Office Word was used to prepare reports while Microsoft Excel was used for statistical analysis which was used to generate graphs and charts

Methodology

Image pre-processing are processes performed on an imagery to reduce the likely error that have occurred during the process of acquisition such as image restoration, resampling, image enhancement. Image classification was performed using the Maximum Likelihoodwith respect to various false color composite, classification scheme under level 1 (Anderson et al. 1976). Accuracy assessment was carried using the error matrix, producer and the user accuracy(Campbell 2007;Congalton 1991; Jensen 2005) to determine the overall accuracy (Rogan et al. 2002) and the kappa coefficient (Congalton et al., 1983) of the classification. The reference data was derived from Google Earth™ by backdating to the required years. With respect to the criticism regarding the accuracy assessment, the context of satellite remote sensing requires 85% target accuracyfor mapping broad land use/land cover classes (Anderson level I, 9 broad classes) from Landsat sensor data (Anderson et al. 1976). Reclassification, change detection, post classification detection technique (Fan et al. 2007), population projection and change prediction were all carried out for the purpose of this research.

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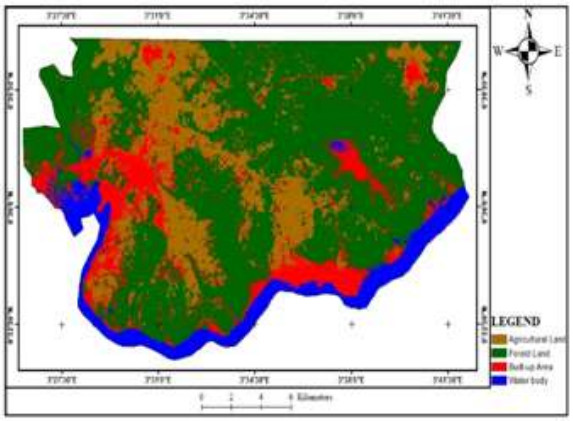
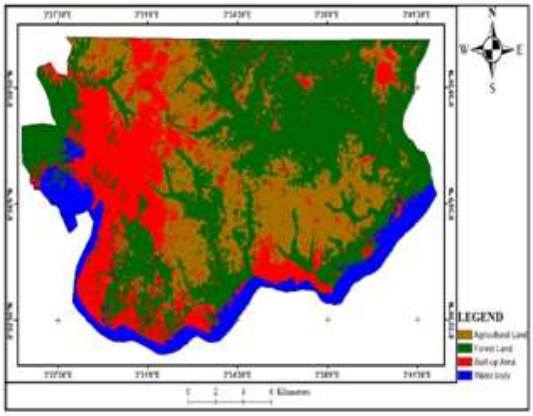
IV. CHAPTER FOUR

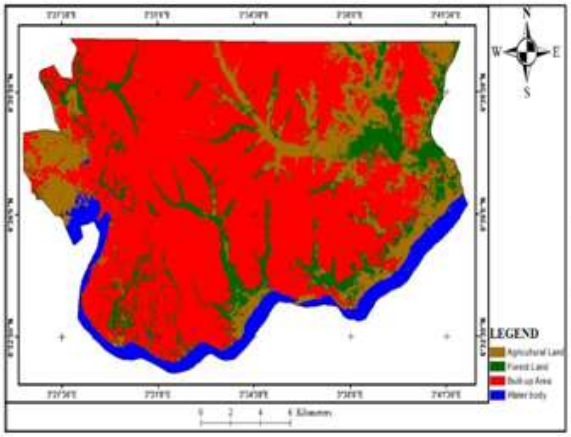
Results

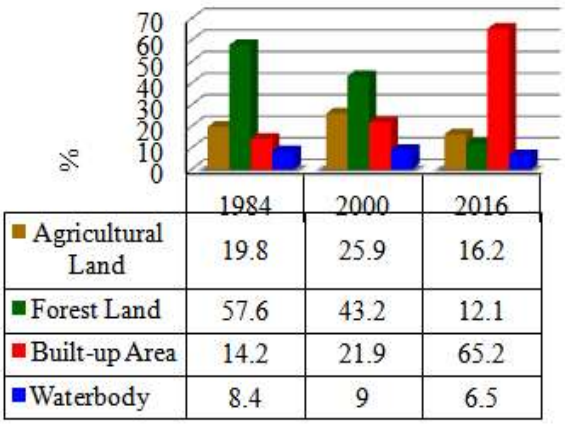
ACCURACY ASSESSMENT						
Land use/land cover	**1984**		**2000**		**2016**	
	Producer	**User**	**Producer**	**User**	**Producer**	**User**
Agricultural Land	85	100	100	100	96.77419	100
Forest Land	95	97.3	100	100	96.66667	96.66667
Built-up Area	100	85.1	95	100	100	100
Waterbody	100	100	100	95.2	98	98
Overall Accuracy	**0.95**		**0.988**		**0.9875**	
Kappa	**0.93**		**0.979**		**0.9829**	

From the table above, the accuracy assessment provides the producer, user, overall accuracy and the kappa coefficient of the classified images. With 1984, 2000 and 2016 having an overall accuracy of 95%, 98.8% and 98.7% while the kappa for the three years indicates a strong agreement.









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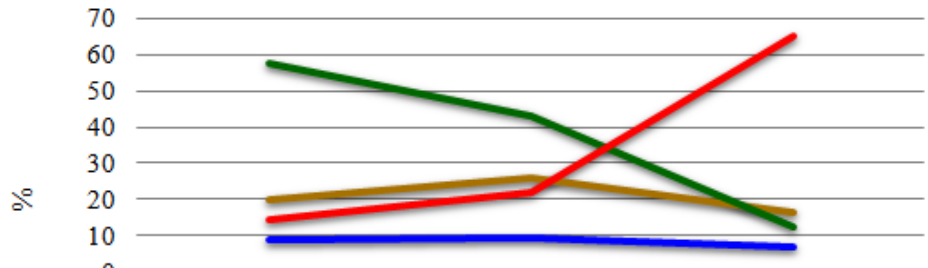

	1984	2000	2016
Agricultural Land	19.8	25.9	16.2
Forest Land	57.6	43.2	12.1
Built-up Area	14.2	21.9	65.2
Waterbody	8.4	9	6.5

From the above table, between 1984 and 2000, the was a negative change in the forest land while agricultural land, built-up area and waterbody witnessed a positive change (increased). The period between 2000 and 2016 showed that only the built-up area witnessed a positive change (increase) while forest land, agricultural land and waterbody witnessed a negative change(decrease) within the study area.

Change Matrix (1984-2000)

Land use/land cover	Agricultural Land	Forest Land	Built-up Area	Waterbody
Agricultural Land	**45148**	8178	32538	7
Forest Land	58020	**161972**	26010	3505
Built-up Area	9399	15697	**33973**	2962
Waterbody	1	1719	2386	**32307**

Change Matrix (2000-2016)

Land use/land cover	Agricultural Land	Forest Land	Built-up Area	Waterbody
Agricultural Land	**1966**	2570	107994	0
Forest Land	55337	**44840**	87399	4
Built-up Area	3401	4497	**86903**	85
Waterbody	9674	649	725	**28016**

The diagonal are the areas the remained unchanged while the others changed over time.

Change Prediction (2032)

Land use/land cover	**Sq.km**	**%**
Agricultural Land	30.4209	7.79
Forest Land	25.2504	6.40
Built-up Area	316.5984	81.30
Waterbody	18.3825	4.60
Total	**390.65**	**100**

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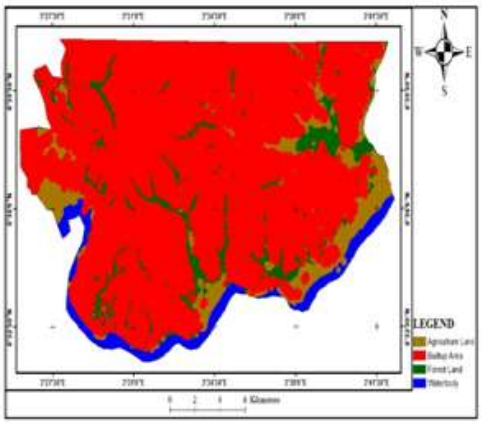
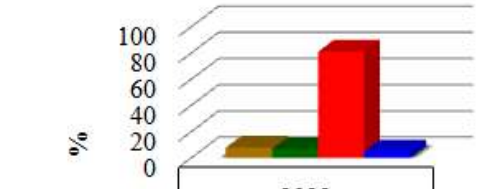
From the above table of projected land use/land cover for the year 2032, it indicates that the forest land, agricultural land, waterbody will cover 7.79%, 6.64% and 4.71% of the study area respectively, while built-up area would occupy 81.04% of the total study area.





	2032
Agricultural Land	7.79
Forest Land	6.46
Built-up Area	81.04
Waterbody	4.71

V. CHAPTER FIVE

Conclusion

This research has successfully demonstrated the importance and usefulness of satellite data for the preparation of accurate and up-to-date land use/land cover maps depicting existing land use/land cover classes, analyzing their change pattern from 1984 to 2016, factors responsible for the change, the environmental consequence and change prediction for year 2032 in Ikorodu Local Government Area of Lagos State by utilizing digital image processing techniques. Furthermore, the significant change within the study area is as a result of increase in population. The result of the classification clearly shows constant positive increase in built-up area and decline in the agricultural and forest land. If such rate of change (decline) continues, there would be small area of agricultural and forest land within the study area in the next 16 years, that is, year 2032 based on the prediction. This is against the concept of sustainable development and may trigger off more environmental consequences.In conclusion, remote sensing of the earth and digital image processing using geographic information system techniques are very effective and vast in change detection studies of land use/land cover. Therefore, the adoption of both techniques will go a long way in assisting students, researchers, private and government agencies to make worthwhile decisions.

Recommendation

The current land use/land cover pattern of the study area is not sustainable for the development because biodiversity is lost at an increasing rate due to human activities. This can be controlled based on;

1. Government should make policy that can help manage the ecosystem
2. Rules and regulation should be enacted against illegal activities
3. Policy on urban and town planning should be revived in other to avoid unapproved construction which would increase environmental issues.
4. As a result of constant increase in population, government should provide modern infrastructure that will meet the demand of the rising population.

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