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Summary

Wetland conversion globally have resulted issues i.e. sea level rise, subsidence, imbalanced ecosystem etc. (Godstime et al, 2005; Pepple, 2011). The analyses of such conversion could be thematically extracted for spatial and temporal representation of urban encroachment into Ikorodu wetlands using the geo-information technology. The quest for the variation over years can be best represented in layers adopting the tri-stimulus color theory (Lui and Mason, 2009). Landsat datasets were used for change detection during the three (3) epochs using the supervised minimum distance image classification approach. The rate and trend of urbanization and wetland change over a period of 21 years (1990, 2000 & 2011). The study accounts for conversion wetland into other established that urbanization in Ikorodu Local Government Area, (Lagos, Nigeria) results from influx from the rural areas which had resulted in the quest for more spaces to provide accommodation or employment for the teaming population, which was evident in the growth of the built up area from 3.12 sq.km - 182.25 sq.km in year 1990 and 2011 representing a rapid growth of 5741.35 with an annual change rate of 1205.68 (Orji, 2014). This study focuses on the challenges faced by geo-informaticians to evaluate wetland loss and the benefits of wetland conservation. The study therefore recommends that human induced activities (both individuals and government) should be reduced while efforts should be amplified on those activities that encourage wetland conservation and preservation rather than the immediate benefits derived from wetland conversion (Orji, 2014).

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STATEMENT OF THE PROBLEM

- Rural-urban migration resulting to over
- This backed with the inadequate implementation of town and regional planning laws as well as lack of political will to address some pertinent planning issues has resulted in haphazard developmental planning. These developments cares less about ecologically fragile environments such as wetlands, coastal environment and flood plain of natural water course by encroaching on the regulatory setbacks for such natural features, thus reducing their retention capacity.

AIM AND OBJECTIVES

- The aim of this study is to evaluate the spatio-temporal wetland changes over time for the study area to achieve the aforesaid research aim and the following objectives are pursued.
- To map and generate a temporal data of the wetlands for the static years in Ikorodu LGA between a 21 years period (1990 - 2011).
- To evaluate the spatial extent of wetland loss and environmental impact within the selected period for the study.
- To identify major anthropogenic activities depleting wetlands in the area under study.

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DATA SOURCES AND CHARACTERISTICS

The research made use of both spatial and non-spatial (attribute) data. The spatial data include LANDSAT imageries and administrative maps, while the non-spatial data includes special names of wetland, population figures etc. Sources of the study data includes;

Table 1: The land use classification scheme

S/N	Data Type	Source	Extent/ Path & Row	Scale/ Resolution	Date Captured
1	LANDSAT Image (TM) 1990	www.glovis.usgs.gov	191/055	30m	27/12/1990
2	LANDSAT Image (ETM+) 2000	Lab 103 GCLME	191/055	30m	6/2/2000
3	LANDSAT image (ETM+)	Lab 103 GCLME	191/055	30m	3/1/2011
4	Administrative map of Lagos	OSGOS Lagos State	-	1:50000	-

The dates of the satellite images used were deliberately picked to maintain a minimum of at least 3,300 days spacing or intervals, so as to allow for enough change to take place. The band combination adopted (i.e. bands 3, 4 & 5) was chosen because the main features of interest were more pronounced in this combination (i.e. wetland and built-up).

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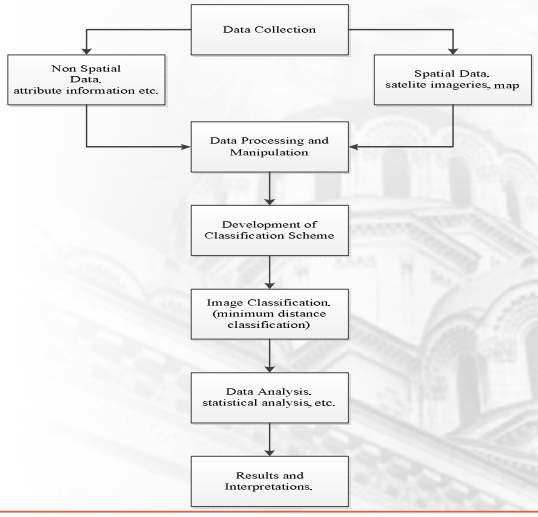
METHODOLOGY

To assess wetland changes in terms of rate, trend, direction and magnitude of change, to monitor the state of the remaining wetlands, the driving forces and health implications of the changes and to ensure their sustainable management. In wetlands, the task of collecting information by ground inventory is extremely difficult, time consuming, and therefore expensive. Remote sensing offers an attractive means of obtaining data for detecting wetland changes and updating management plans. This research involved the integration of remote sensing techniques with a Geographic Information System (GIS) framework to get information on the area under study using a PC-based image processing and analysis using ENVI 4.5 and ArcGIS 10.1 software. The following procedures depicted by the methodological framework were undertaken to carry out the work study.



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Description of Land Use/ Classification Scheme

Based on observation and general information gained during the research process, it was decided to focus on the following major land use and land cover classes summarized below:

Table 1.1 : The land use classification scheme

S/No	Class	Description
1	Forested Wetlands	Forested Wetlands are wetlands dominated by woody vegetation. Forested Wetland includes seasonally flooded bottomland hardwoods, mangrove swamps, shrub swamps, and wooded swamps including those around bogs etc.
2	Non-Forested Wetland	Non-forested Wetlands are dominated by wetland herbaceous vegetation or are non-vegetated. These wetlands include tidal and non-tidal fresh, brackish, and salt marshes and non-vegetated flats and also freshwater meadows, wet prairies, and open bogs etc.
3	Built-Up Areas	Parcels of land developed for dwelling purposes (residential), commercial, markets, schools, banks, roads, rail roads etc. And other urban areas with human activities
4	Water body	Streams, rivers and inland waters
5	Bare Surface	Refers to those land surface features devoid of any type of vegetation cover or structures.
6	Vegetation	Agricultural lands, forests and other vegetation classes

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LAND-USE/ LAND COVER FOR 1990, 2000 AND 2011

Based on observation and general information gained during the research process, it was decided to focus on the following major land use and land cover classes summarized below:

Table 1. 2: The land use classification scheme

Classes	1990		2000		2011	
	Area (Sqkm)	Area (%)	Area (Sqkm)	Area (%)	Area (Sqkm)	Area (%)
Vegetation	218.01	32.81	250.24	37.66	185	27.84
Forested Wetland	157.44	23.69	46.22	6.96	42.56	6.41
Non Forested Wetland	21.63	3.26	19.01	2.86	14.42	2.17
Built up	3.12	0.47	62.62	9.42	182.25	27.43
Bare Surface	65.28	9.82	92.85	13.97	42.47	6.39
Water body	198.97	29.95	193.51	29.12	197.75	29.76
Total	664.45	100.00	664.45	100.00	664.45	100.00

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LAND-USE/ LAND COVER FOR 1990, 2000 AND 2011 CONT'D

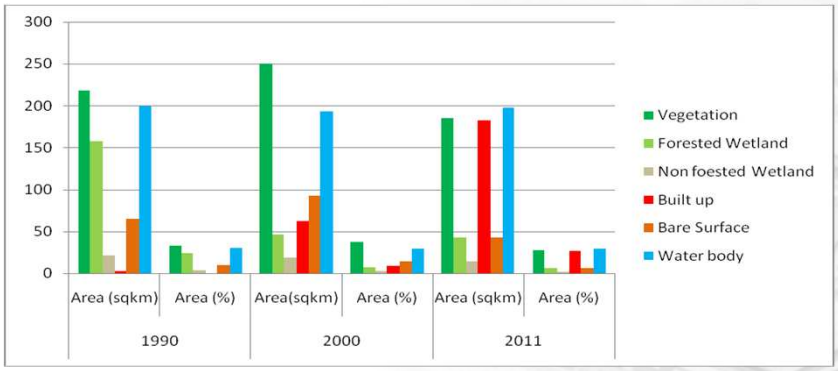

Figure 1. 0: Land-use and land-cover distribution for t_0, t_1 and t_2 (1990, 2000 and 2011)

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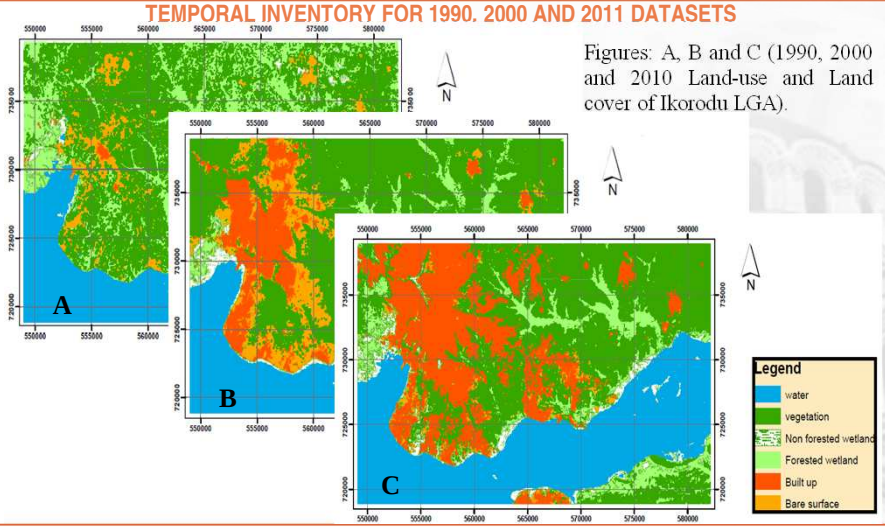
TEMPORAL INVENTORY FOR 1990, 2000 AND 2011 DATASETS



Figures: A, B and C (1990, 2000 and 2010 Land-use and Land cover of Ikorodu LGA).

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LULC INVENTORY FOR 1990, 2000 AND 2011 CONT'D.

Table 1. 3: Shows a 10 years annual rate of change between $t_0 - t_1$ (1990 - 2000).

Classes	1990 Area (Sq.km)	2000 Area (Sq.km)	Change (sq.km)	% Change	Annual Change Rate	Inference
Vegetation	218.01	250.24	32.23	14.78	1.48	Increased
Forested Wetland	157.44	46.22	-111.22	-70.64	-7.06	Decreased
Non Forested Wetland	21.63	19.01	-2.62	-12.11	-1.21	Decreased
Built up	3.12	62.62	59.50	1907.05	190.71	Increased
Bare Land	65.28	92.85	27.57	42.23	4.22	Increased
Water body	198.97	193.51	-5.46	-2.74	-0.27	Decreased
Total	664.45	664.45	0.00			

Table 1. 4: Shows an 11 years annual rate of change between $t_1 - t_2$ (2000 - 2011).

Classes	2000 Area (sq.km)	2011 Area (sq.km)	Change (sq.km)	% Change	Annual Change Rate	Inference
Vegetation	250.24	185.00	-65.24	-26.07	-2.87	Decreased
Forested Wetland	46.22	42.56	-3.66	-7.92	-0.87	Decreased
Non Forested Wetland	19.01	14.42	-4.59	-24.15	-2.66	Decreased
Built up	62.62	182.25	119.63	191.04	21.01	Increased
Bare Land	92.85	42.47	-50.38	-54.26	-5.97	Decreased
Water body	193.51	197.75	4.24	2.19	0.24	Increased
Total	664.45	664.45	0.00			

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TEMPORAL INVENTORY FOR 1990 AND 2011

Table 1. 5: Shows a 21 years annual rate of change between $t_0 - t_2$ (1990 - 2011).

Classes	1990	2011	Change (sq.km)	% Change	Annual Change Rate	Inference
	Area (Sq.km)	Area (sq.km)				
Vegetation	218.01	185.00	-33.01	-15.14	-3.18	Decreased
Forested Wetland	157.44	42.56	-114.88	-72.97	-15.32	Decreased
Non Forested Wetland	21.63	14.42	-7.21	-33.33	-7.00	Decreased
Built up	3.12	182.25	179.13	5741.35	1205.68	Increased
Bare Land	65.28	42.47	-22.81	-34.94	-7.34	Decreased
Water body	198.97	197.75	-1.22	-0.61	-0.13	Decreased
Total	664.45	664.45	0.00			

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SUMMARY, CONCLUSION AND RECOMMENDATION

- A general problem common to research and indeed researchers in social analysis is the inadequacy or sometimes the entire lack of relevant data. This research effort has not been an exception i.e. there was little or inadequate information on the wetland situations in Ikorodu LGA that could be accessed, and hence reflected in the pace at which this work was carried out.
- The completion of this study has demonstrated the relevance of spatial planning employing image processing analysis and geo-information in revealing wetland loss within the study area.
- Further study on this area is recommended to validate the results obtained from this study. Hence the data processing techniques to be used should be done taken account of the problems encountered in this study.
- The Geographic Information System, Remote Sensing approach and image processing approach should be employed for seasonal map updating as a means of monitoring construction activities on this endangered land forms.

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