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GEOSPATIAL TECHNIQUE IN ASSESSMENT OF WETLANDS IN ETCHE, SOUTH-SOUTH NIGERIA

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ABSTRACT

This study assesses wetlands in Etche Local Government Area between 1986 to 2016 and using lands at images of 1986 , 2006 and 2016 of 30mX 30m resolution where used for the study. The images were imported into Arc GIS 9.3 for band combinations using composite module. Supervised classification was used for image classification using Maximum Likelihood Algorithm namely in Erdas Imagine 9.1 whereby five major land use class were identify namely settlement, vegetation, water bodies and wetland. Areas in squared kilometers of each land use were calculated in ArcGIS 10.3 and simple arithmetic was used to complete the percentage change. Descriptive and inferential statistic were employed for data analysis finding shoes that wetland decreased from 394.826km^2 to 324.78km^2(-6.82263%) between 1986 to 2016. Similarly, vegetation and settlement increased by 2.568913% and 4.3875 39% while water bodies decreased from 4.673148km^2 to 3.299km^2 (-0.152632%). Findings also showed that within the period under review there were increase agricultural increase activities and urbanization. This work recommends that proper enlightenment and education to the people of Etche should be done on the importance of Biodiversity, Tourism, management, forest resources and needs for its conservation and management as wetland are importance to human existence.

Keywords: **Geospatial Technique, Wetlands, Etche, South-South, Nigeria.**

INTRODUCTION

Wetland loss is associated with loss of vital ecosystem services, and so has made places and people more vulnerable to environmental, economic socio-political perturbations with significant impacts on biodiversity and community livelihood (Odada, Ochola, Olagoal. 2009). Meyer, R. (2013). Ramsar convention on wetlands defined wetlands as: "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres". Ramsar convention Switzerland (2013). GIS, Remote Sensing and Global Positioning System (GPS), which are tools for geo-information techniques, play significant role in many extensive integrated researches related to space and time, and are valuable techniques and tools in obtaining, storing, managing, analyzing and visualizing ecological, water resource and socio-economic data for effective and efficient inventory and optimal policy and decision making. Adam, E. (2009) DahI, T.E., (2006).

Furthermore, with the proliferation of GIS in both industry and government for numerous applications, there has been a tremendous increase in demand for remote sensing as a data input source to spatial database development. Product derived from remote sensing are particularly attractive for GIS database development because they can provide cost-effective, large area coverage in a digital format that can be input directly into a GIS (United States Environmental Protection Agency Fonji, S. F., & Taff, G. N. (2014). (USEPA, 1991). Therefore, the purpose of study is to assess wetland loss in Etche Local Government.

Statement of the Problem

Wetlands are recognized as valuable ecosystems which provide water, food and raw materials, services such as flood attenuation and water purification, and intangible values such as cultural and religious value. In some areas, they can be particularly important for peoples' livelihoods. Despite this, and legislation to protect them, they are increasingly threatened, with more than half of the world's wetlands being lost already (Ajibola, 2012). For instance, Zabbey N., Erondu E.S, Hart A.L. (2010), (EPA), (2012) were of the view that a major reason for excessive depletion and conversion of wetland resources is often the failure to account adequately for their non-market environmental values in development decisions, poor understanding of economic values of wetlands is one of the contributory factors that makes people to see wetland as wastelands Accurate information is needed to measure the success of wetlands and their protection and restoration programs and to integrate wetlands into modern environmental management systems. There is little or no information on the condition of the wetlands and no baseline environmental data to determine if resources are allocated effectively and actions taken result in environmental improvement.

Geo-spatial techniques can provide information that will help to develop biological assessment methods to evaluate both the overall ecological condition of wetlands and nutrient enrichment (one of the primary stressors on many wetlands). Dauda A.B (2014).

Aim and Objectives

The aim of study is to assess ecosystem services and wetlands loss in Etche local government. The objectives are to:

i) Identify and map wetlands in Etche Local Government overtime.

ii) Determine the percentage change in wetlands size between 1986 – 2016.
iii) Suggest ways of sustaining the functionality of the wetland.
iv) Determine the periodic change of the wetland.
v) How has this ecosystem services been affected by wetland loss?

Research Hypothesis

There is significant variation in wetland between 1986 and 2016 in the study area.

Study Area

Etche lies between latitude 5°3' and 5°1'30" North and longitude 7°4'30" and 1°5'0" East. The study area is a part of the Niger Delta, occupying a geographical area of about 3,600 square kilometers, mainly used for farming and hunting (Nwogu Amaele, Nwodim, Nweke 2003). Etche lie in the North Eastern Part of Rivers State. It is bounded by Imo State to the North, Omuma Local Government Area of Rivers State to the East, Oyigbo Local Government Area of Rivers State to the South and Ikwerre Local Government Area of Rivers State to the West

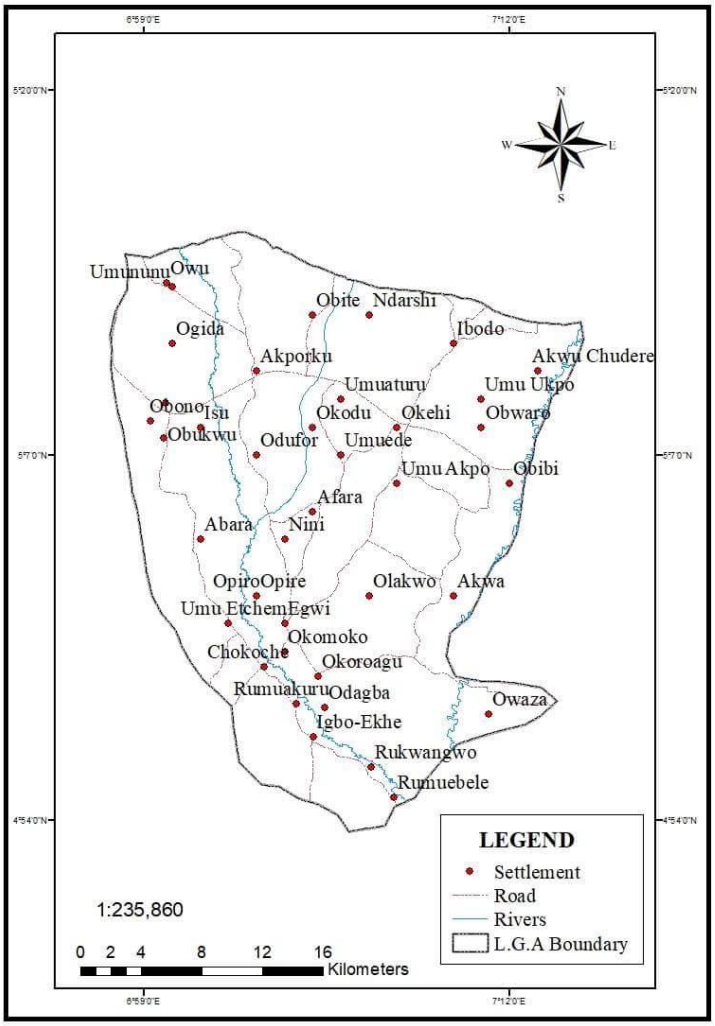

Figure 1: Map of Etche

METHODOLOGY

This study made use of both primary secondary data; include the landsat satellite imageries downloaded from the official website of United States Geological Survey 2016. In this study, three landsat images with a spatial resolution of 30x30 meters were use. The images were imported to ArcGIS 10.3 whereby the bands of the images were combined using COMPOSITE module. The shape file of Etche was then generated in ArcGIS 10.3 and was clip the false colour composite image of each year. The image 2016 was de-striped in ERDAS Imagine using Focal Analysis Module in Spatial Enhancement.

Inferential statistics was used to test the hypotheses. Hypothesis 1 was tested using analysis of variance (ANOVA) All these statistical analyses was computed using Statistical Package for Social Scientists (SPSS) Version 20 0 and Microsoft Excel 2007 Version.

RESULTS AND DISCUSSION

Spatial Distribution of Wetlands in Etche 1986, 1996 and 2016

From the classified satellite imagery obtained as it is seen that within the period, the year 1986 recorded 4.673148km for water body, 394.826km for wetland, vegetation occupied 108.5076km^2, 519km for settlement. Furthermore, the result for the year 1996 showed that water body had decreased to 4.77km^2, wetland size decreased to 390km^2, vegetation increased to 110.3km^2 and settlement also increased to 522km. Similarly the result presentation also showed at 2016 water body occupied 3.299km^2, wetland decreased 324.78km, vegetation increased to 134.0km and settlement increased to 564.1km^2.

Table 1: 1986 Spatial Distribution of Landcover in the study area

Landcover	Total Area Courage (Km^2)	Percentage Coverage	Geographical location of spread	Extent of distribution
Water body	4.673148km^2	0.455026%	South	Evenly distributed
Wetland	394.826km^2	38.44434%	South	Evenly distributed
Veg./Cultivation	108.5076 km^2	10.56542%	North	Fully distributed
Settlement	519km^2	50.53521%	North	
Total	**1027.007**	**100**		**Fully distributed**

Source: Researcher's Analysis, 2018

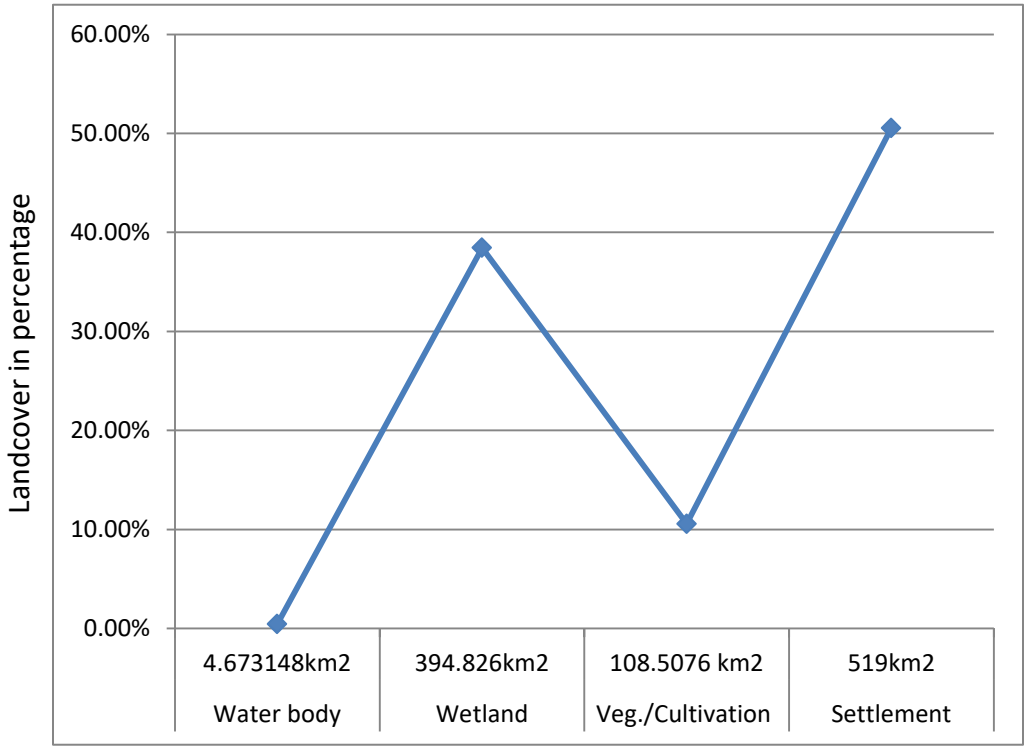

Figure 2: Chart showing 1986 Spatial Distribution of landcover in the study area

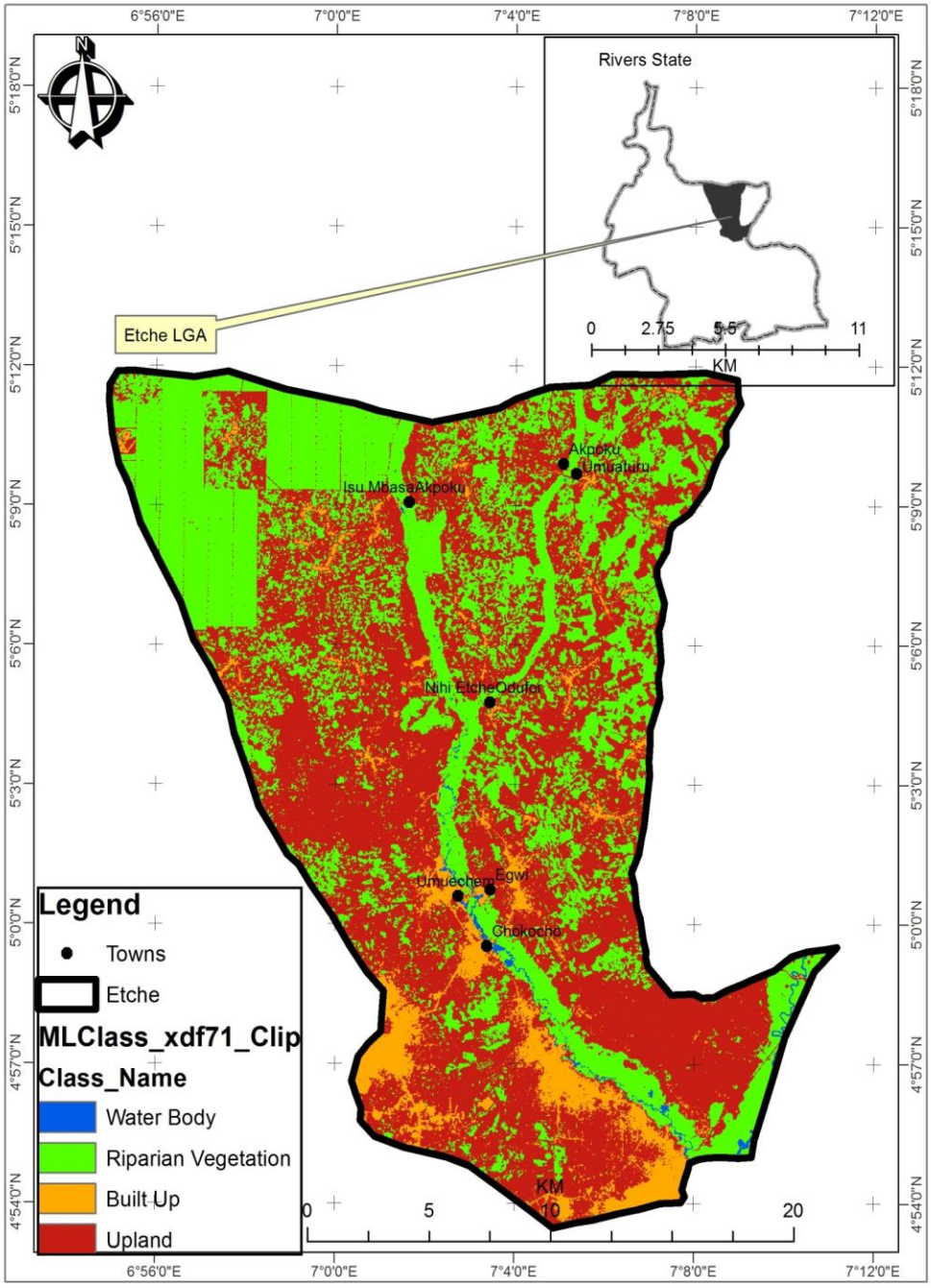

Figure 3: 1986 LandSatellite image of the study

Table 2: 1996 Spatial Distribution of landcove in the study area

Landcover	Total Area Courage (Km^2)	Percentage Coverage	Geographical location of spread	Extent of distribution
Waterbody	4.77km^2	0.464428%	South	Sparsely distributed
Wetland	390km^2	37.9721%	South	Sparsely distributed
Veg./Cultivation	110.3 km^2	10.73929%	North	Sparsely
Settlement	522 km^2	50.82419%	North	Sparsely
Total	**1027.007**	**100**		**Fairlydistributed**

Source: Researcher's Analysis, 2018

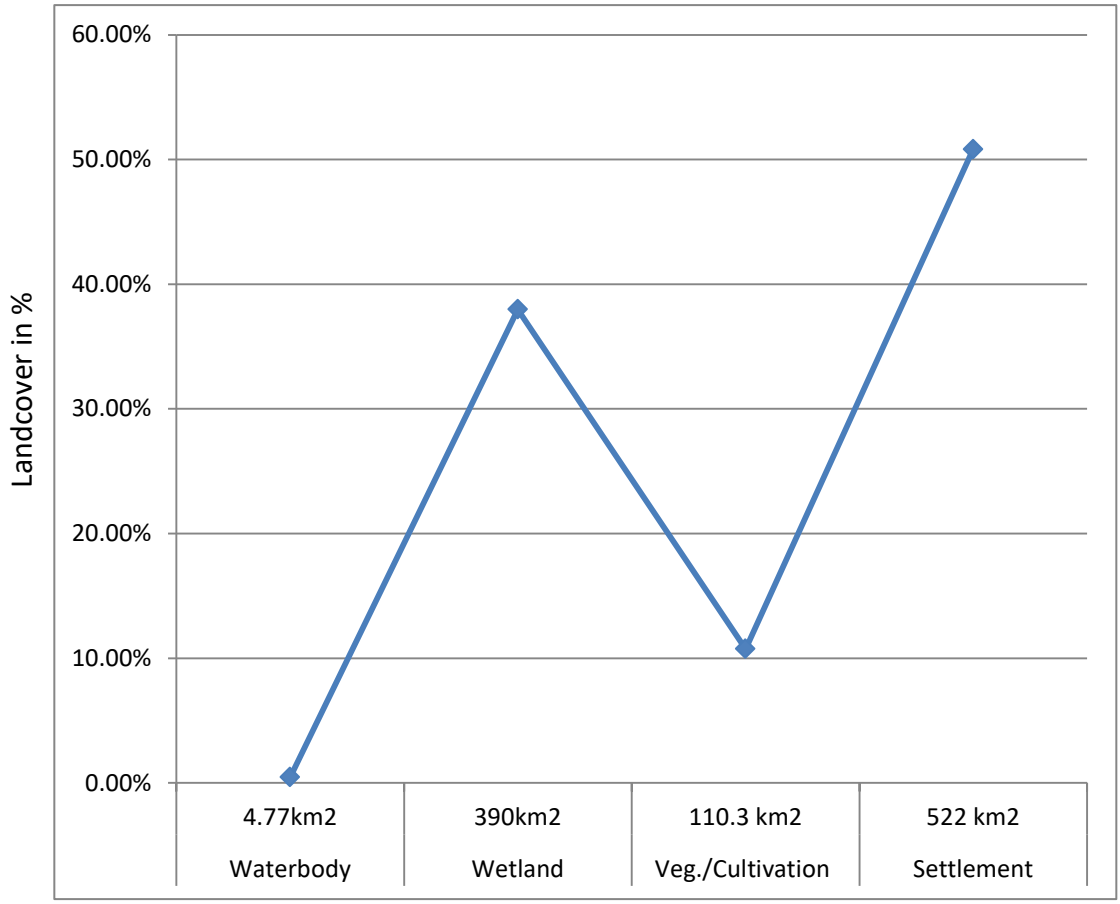

Figure 4: Chart showing 1996 Spatial Distribution of landcover in the study area

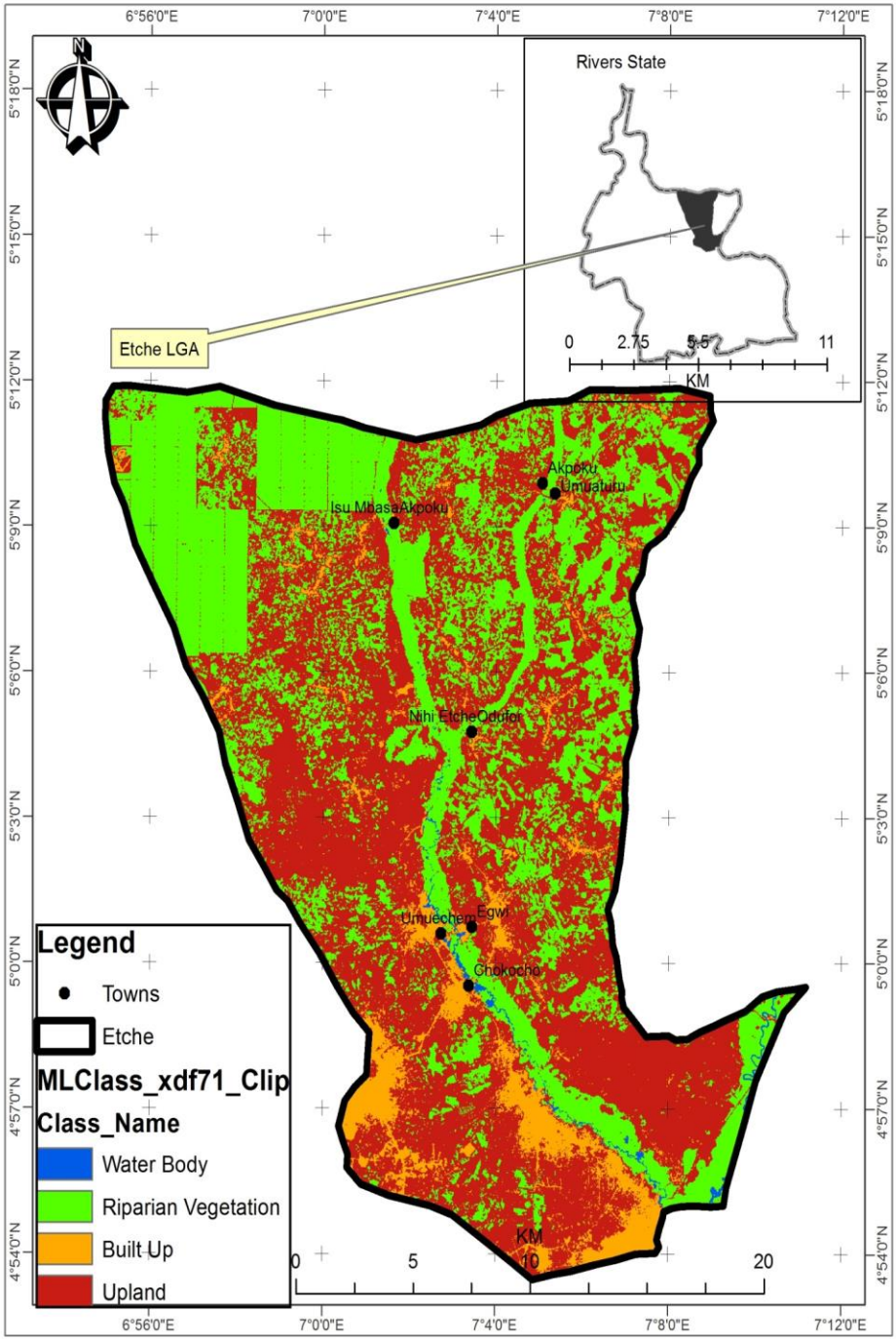

Figure 5: 1996 Land Satellite image of the study

Table 3: 2016 Spatial Distribution of landcover in the study area

Landcover	Total Area Courage (Km^2)	Percentage Coverage	Geographical location of spread	Extent of distribution
Waterbody	3.299km^2	0.321202	South	Evenly
Wetland	324.78km^2	31.62172%	South	Evenly
Veg./Cultivation	134.9km^2	13.13434	North	Sparsely distributed
Settlement	564.1km	54.92275	North	Sparsely distributed
Total	**1027.007**	**100**		**Fully distributed**

Source: Researcher's Analysis, 2018

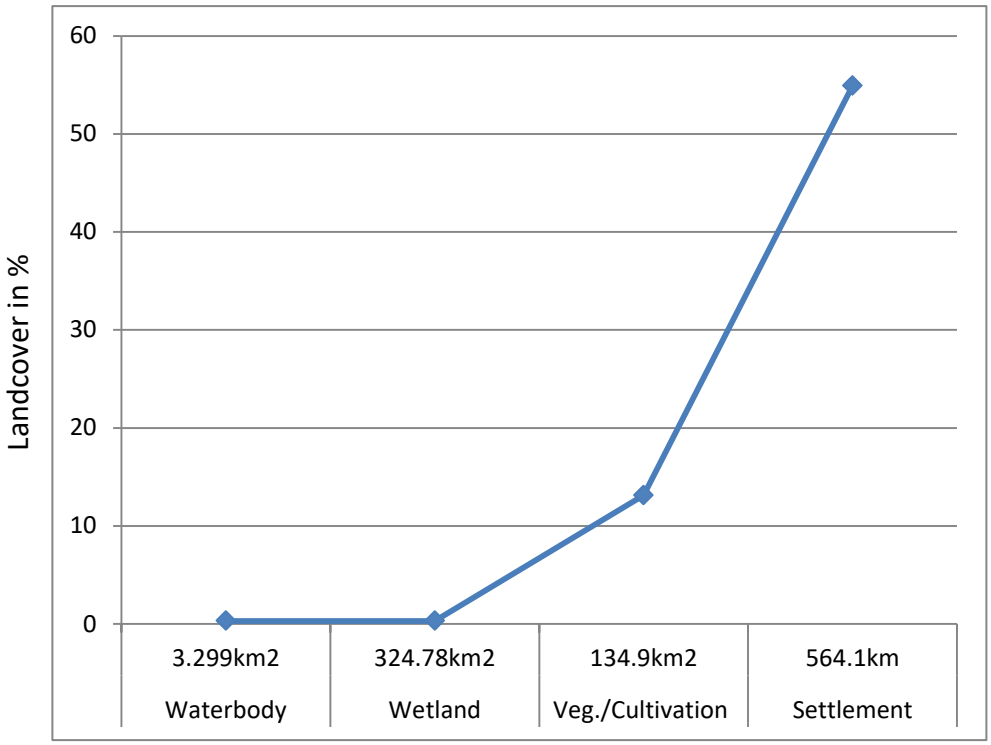

Figure 6: Chart showing 2016 Spatial Distribution of Wetland in the study area

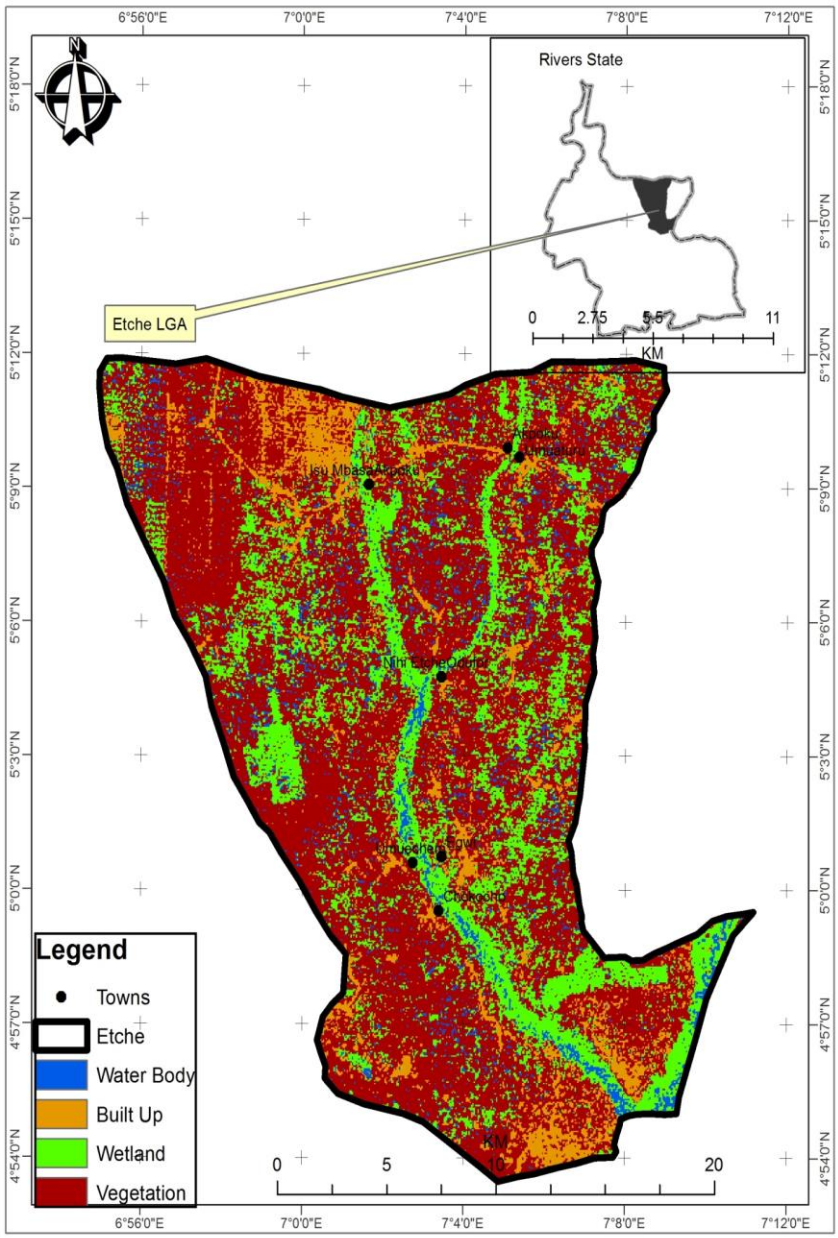

Figure 7: 2016 Land Satellite image of the study

Parentage Changes in Landcover

The statistics for percentage landover changes between 1986 – 1996 the result revealed that the water bodies lost 0.455026 about 0.009402% change, between and 1996 to 2016, The wetland decreased in 0.47225% change. The surface area occupied by vegetation (cultivated area) in the study area also increased by 0.173865. Consequently the settlement landuse area gained an extensive area of about 0.288981 between 1986 and 1996 in the study area.

Table 4: Change and loss within 1986- 2016

	(Change and loss within 1986 – 2016									
Landcover	**1986(km$^{2)}$**	**1996(km^2)**	**Change(km^2)**	**Change %**	**1996(km^2)**	**2016(km^2)**	**Change km^2**	**Change %**	**Total lost km^2**	**Total area lost%**
Water body	4.673148km^2	4.77km^2	0.096852km^2	0.009402%	4.77km^2	3.299km^2	-1.471km^2	- 0.14323	-1.33448	0.152632
Wetland	394.826 km^2	390km^2	- 4.8226km^2	- 0.47225%	390km^2	324.78km^2	- 65.2 km^2	- 6.35038	-70.226	-6.82263
Vegetation (Cultivated area)	108.5076km^2	110.3km^2	1.7924km^2	0.173865%	110.3km^2	134.9km^2	24.6km^2	2.395048	26.3924	2.568913
Settlement	519km^2	522km^2	3 km^2	0.288981%	522km^2	564.1km^2	42.1km^2	4.098558	45.1	4.387539

Source: Researcher's Analysis, 2018

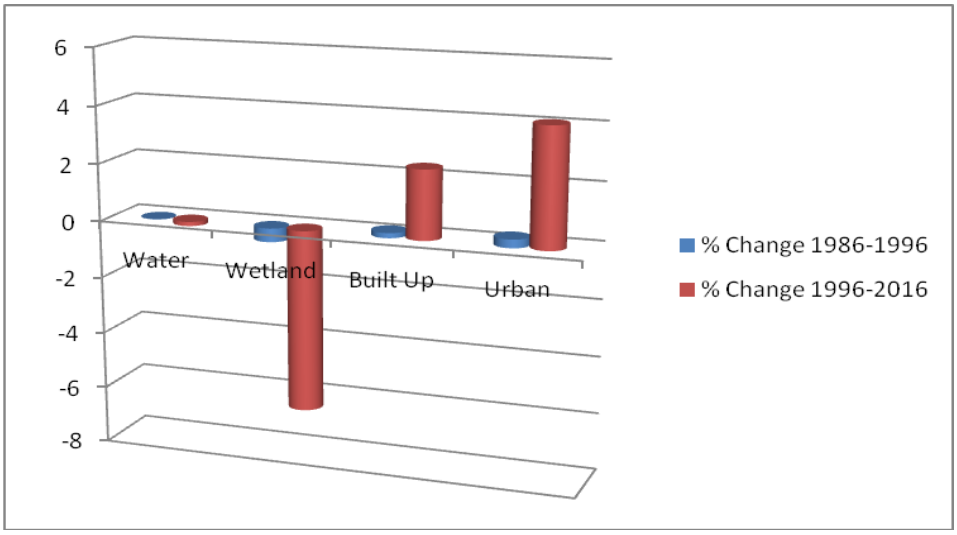

Figure 8: Trends of landuse change between 1986 and 2016

Hypothesis Testing

Hypothesis 1

H_o: There is no significant variation in wetland size between 1986 – 2016 in the study area.

H_i: There is a significant variation in wetland size between 1986 – 2016 in the study area.

Table 5 shows the result of the analysis. It revealed that the p value is less than 0.05 significant level. The null hypothesis was rejected while the alternative hypothesis. Hi was accepted which state that there is a significant variation in wetland size between 1986 – 2016 in the study area.

Table 5: Analysis of variance (ANOVA) computed for wetland size between 1986-2016 in the study area

Landuses compared	Sum of Square	Degree of Freedom	Mean Square	F ratio	P value	F crit
Between Groups	519822.5	3	173274.2	217.9887	1.64-06	4.757063
Within Groups	0.000848	2	0.000424	5.33-07	0.999999	5.143253
Error	4767.261	6	7948768			
Total	5245918	11				

Source: Researchers' Field Analysis, 2018

Discussion of Findings

Finding showed that wetlands reduced from 394.825km^2 in 1986 to 4.77km^2 in 1996 and further reduced to 3.299km^2 in 2016. Furthermore the total wetland loss in the area sum up to a total of 70.226km^2 which is - 6822.63%. This shows that wetlands decreased in terms of spatial extent between 1986 and 2016. This may be due to the fact that wetland is being converted to other landuse types which ranges from agricultural farmland and dredging activities and urbanization.

Wetland Service Rendered

Endemic plant and animal species

Table 6 showing endemic plant and animal species distributed in wetland in Etche, Rivers State

Animal species found in wetland	Plant species found in wetland	Most animal species at risk	Most plant species at risk
Grass cutter	Whistling pine	Hyena	African bamboo
Antelope	Iroko	Bush dog	Iroko
Squirrel	Obeche	Grey duikier	Hard leaf
Tortoise	Mango	Mona monkey	Aframonumdaulii (oseoji)
Snakes	African Bamboo	Bush crocodile	Scam week
Birds	Melina	Bush buck	Ginger
Porcupine	Plantain	Tortoise	Scent leaf
Bush pig	Rephia palm tree	Kob	Dogwuyaro tree
Chameleon	Hard leaf	Python	Bitter leave
Hare	Oil bean tree	Cobra	Lemon grass

Source: Researchers' Field Analysis, 2018

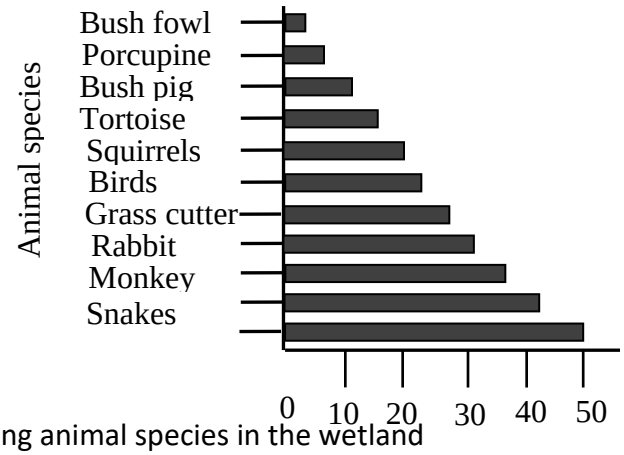

Figure 9: Chart showing animal species in the wetland
Source: Researchers' Field Analysis, 2018

Summary

Findings showed that the size of wetlands in Etche decreased overtime resulting into wetland loss between 1986 and 2016, the land use/landcover area varied significantly in 1986, with vegetation (forest cover and cultivated area) occupying total land area of 108.5076km^2, water bodies occupied 4.673148km^2, wetland occupied 394.826km2, settlement occupied 519lkm^2. However the results of the hypotheses tested revealed that the size of wetland between 1986 and 2016 varied significantly.

Conclusion

The study has revealed the extent of changes in land cover from 1986-2016 with emphasis on wetlands. Wetland as observed have both spatial and temporal variations but it is of much importance to mention that wetlands in Etche are diminishing at a fast rate. The study has also shown that within the period under review there is concrete evidence of wetland loss and change.

Recommendations

The wetlands in Etche is gradually losing its spatial extent, in order to prevent further degradation and loss of wetlands size, it is therefore recommended that:

1. Human activities (both individuals and government) diminishing wetlands size should be reduced.
2. Increased effort should be directed on those that encourage wetland conversation.
3. Focus should be shifted from the immediate benefits derived from conversation of wetlands areas to agricultural or for other purposes to future/sustainable benefits from proper wetlands management.
4. A well-coordinated and concise research should be conducted regularly on wetlands from time to time, in a bid to promoting adequate wetlands assessment and management.
5. Any developmental activity that will not consider the topography and landscape characteristics should not be practiced. Because this will only contribute to an unbalance distribution of water in the study area.
6. To properly educate and enlighten the people on the importance of biodiversity/forest resources and wetlands functions and the need for its conservation.
7. Rivers State Government should establish a centre for remote sensing and Geographic Information System (GIS) in all the state university in other to monitor land use and landcover change in Rivers State.

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