Quest Journals
Journal of Research in Environmental and Earth Sciences
Volume 7 ~ Issue 9 (2021) pp: 92-100
ISSN(Online) :2348-2532
www.questjournals.org

Research Paper

Land Cover Change and Flood Vulnerability of Obio/Akpor Local Government Area of Rivers State

Okocha, Sunny[1], Dr. V.E. Weli[2]
[1]*Centre for Disaster Risk Management and Developmental Studies, Faculty of Social Sciences, University of Port Harcourt, Nigeria or No 1 Allweather Road Owhipa Choba, Uniport Road, Rivers State, Nigeria. Sunny_okocha2000@yahoo.com*
[2]*Geography and Environmental Management Science, Faculty of Social Sciences, University of Port Harcourt, Rivers State, Nigeria.*

ABSTRACT
The current changes in the land cover of Obio/Akpor local government area as a result of anthropogenic alteration have made for the vulnerability assessment of the study area to flooding. The study employed land sat imageries of Tm of 30m x 30m in the year 1986 and 2010 to examine the changes in the Land cover characteristic of the study area. Geo spatial tools were used to examine vulnerability and tested using the paired samples correlation analysis while elementary statistic was used to differentiate the level of alteration in land cover as showed using geo spatial tools. Findings revealed that water bodies, swamp forest, and vegetal cover which are either primary or secondary were at the decline with a decline of 20,433,383m2, 41,986,199m^2, and 179,498,321m^2 as against 14,662,559m^2, 25,149,099m^2, and 133,936,276m^2 respectively and that land altered by human activities rose from 38,267,811m^2 to 106,394,556m^2 of land or surface area has been altered by the activities of human either as built up or other usages of relevance to the development of humans within the study period of 1986 through 2010. The study recommends regular research activities to find out the pattern land cover changes in the area. This would guide developmental activities from encroaching in to the swamp and wetland environment.

KEY WORDS: GIS, GPS, LANDSAT, IMAGERY, EVIRONMENT, VULNERABILITY.

Received 13 September, 2021; Revised: 26 September, 2021; Accepted 28 September, 2021 © The author(s) 2021. Published with open access at www.questjournals.org

I. INTRODUCTION

Land cover change and flood vulnerability are global and local problem. As man continue to pressure on land to tap its resources over the years, changes keep increasing on natural land despite several attempts routed internationally to improve the management of land cover. The changes in climate patterns, economic globalization, population growth across the world has increased the use of natural resources and not excluding rapid urbanization which are putting pressure on terrestrial ecosystems. Rockstrom*et al*, (2009) the limits to which man can utilize the available resources which is referred to as the bio physical limit is very close to its peak. The rate of environmental resource depletion is enormous, this has resulted in inferential utilization of these resources across the globe (lambin and meyfroidt 2010; Nepstad*etal*2009; Bai*etal*2008). The increase in demand for food and other man's need has increased the pressure on land resources. This situation is complicated by the growth in urbanization, and consumption (Lambin and Meyfroist, 2011). The cascade of outcomes resulting from these demands is complicated by urbanization and globalization which separates the production of goods from their consumption over vast distances (Barles 2010; Kissinger and Rees, 2010).The pertinent question is how these numerous demands can be met or managed in such a way that recognizes the human wellbeing and environmental sustainability. in order to address these demands its requires proper and careful examination on social relations and biophysical processes needed in managing terrestrial ecosystems, with consideration of priorities for policies, policy instruments, and approach to distribution of positive and negative implications.

It is however noted that land cover change is associated with some kind of environmental consequences which among others include Global Warming, Stratospheric ozone depletion caused by removal of earth vegetative cover, pollution of water resources due to the intensification in agricultural activities and Desertification caused by removal of vegetation, water depletion and climate change and many more. The above

impacts aggregate, environment security and human vulnerability are placed at high risk, in the broad view, it does not promote goals of sustainable development upon the policies articulated to address transition sustainability aimed towards controlling land cover change, directly or indirectly.

Flood hazard is one aspect of environmental challenges of natural event not isolated but occurs due to some deficiencies and weaknesses within human society, the deficiencies and weaknesses are human induced as a result of unplanned infrastructural development program which fail to consider water ways and its transportation medium either natural or anthropogenic in the wake of rainfall that result in much volume of runoff at a giving period. This has caused a varying and rapidly changing environmental condition. Hence the international community in 2004 noticed severity of loss of forest and its relation to flooding (Scot and Daniel, 2008). According to the Red Cross, during the time scale of 1971 and 1995, over 12, 700 humans were killed and 60 million affected rendering 3.2 million people homeless (Zbigniew and Lucas 2003).This is attributed to the degree of deforestation, other changes in land cover and population growth rate in the study area which is on the increase due to settlement of oil industries and other economy driving sectors, the urban growth by way of structural development is moving at fast rate without authorities responsible considering management measures to curtain run-off. According to the IPCC (2001) trend in precipitation has significantly increased globally over the 20th century. Rapid urbanization over the years in Obio/Akpor changes the communities green land cover or vegetation trees, forest, mangrove, river banks that would have served as "sponge" and buffer against flood has been taking over by buildings, streets, roads, flyovers thereby increasing run-off which eventually result to flooding and sometimes could trigger disaster to the uncommon man without adequate capacity to cope with flood exposure.

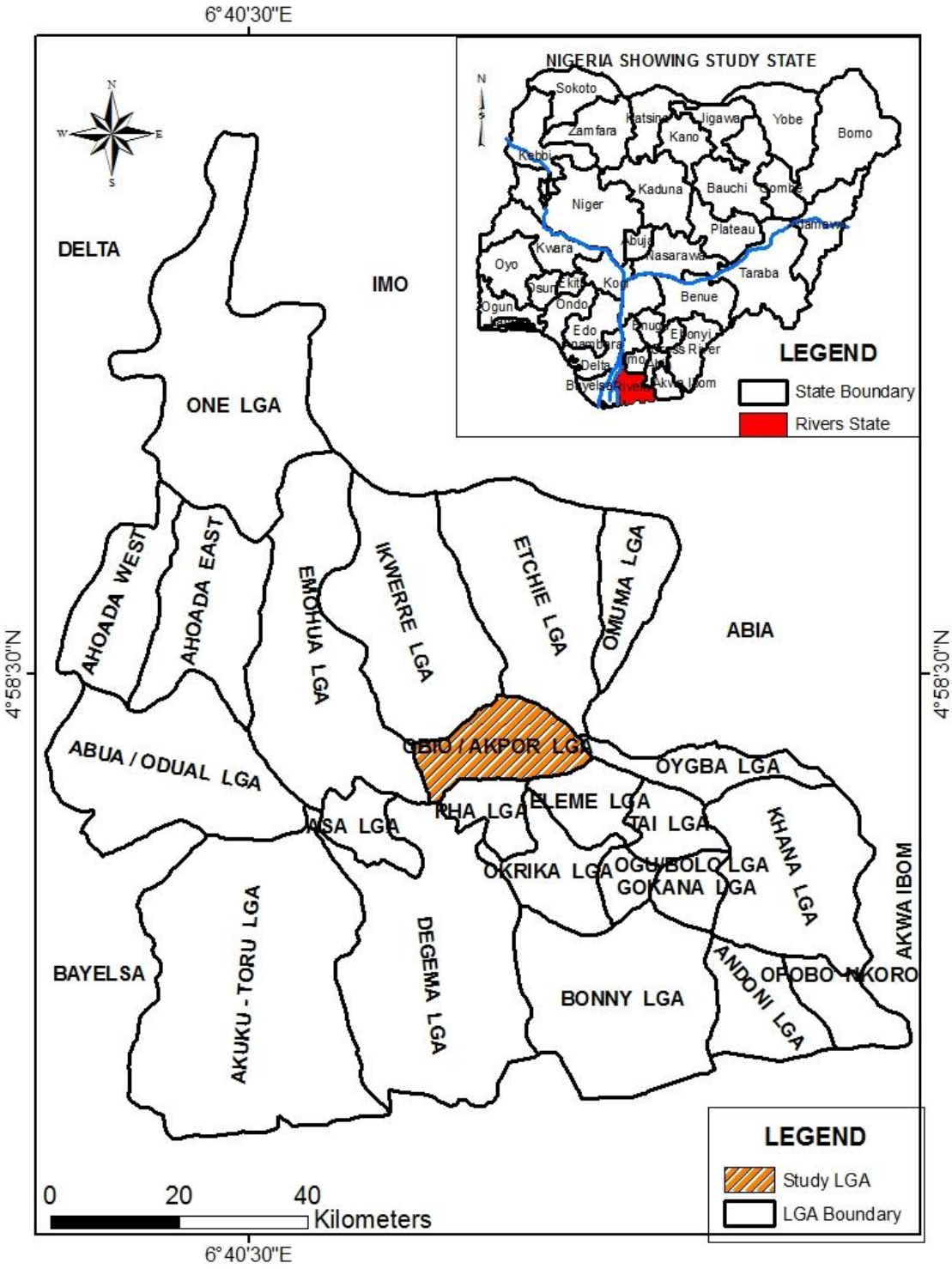
In view of the above, the study seeks to assess the changes in land cover within 1986 to 2010 to ascertain level of changes overtime, with leading question to what extent of change in surface water between 1986 to 2010, extent of changes in Swamp forest between 1986 to 2010, and look at how built up area changed the vulnerability levels in the study area. The aim is to determine the land use change to flood vulnerability of Communities between 1986 – 2010 in the study area while objectives is towards identifying the extent of change in surface water between 1986 to 2010, identifying the extent of change in swamp forest in the study area between 1986 to 2010 and quantify the land cover changes and their relationship to flood vulnerability in the study area. The null hypotheses of the research considered, there is no significance difference of land cover between 1986 and 2010 in the study area.

STUDY AREA

The study area Obio/Akpor L.G.A and its selected communities in Rivers State is the economic base of Rivers State located between latitudes 4° 45'E and 4° 60'E and longitudes 6° 50'E and 8° 00'E within Niger Delta region of South-South, Nigeria as shown in figure 1 and 2. The study area is influenced by industrialization or urban sprawl where small communities have merged and formed megacity due to high influx of people resulting to rapid growth of population overtime. According to (National Bureau of Statistics, 2006) the census of 2006 records Obio/Akpor L.G.A with population size of 878, 890 compared to 1991 which is 263,017. The growth of the study area between 1991 to 2006 is about 70% increase on population. The area is l00sq mil (260Km^2), Head quarter is situated at Rumuodamaya. The industrial operations types that exist in the study area include: Seismic, Oil and Gas Exploration, Manufacturing, sales and marketing, Agriculture, Human Capital Development, Fishery.

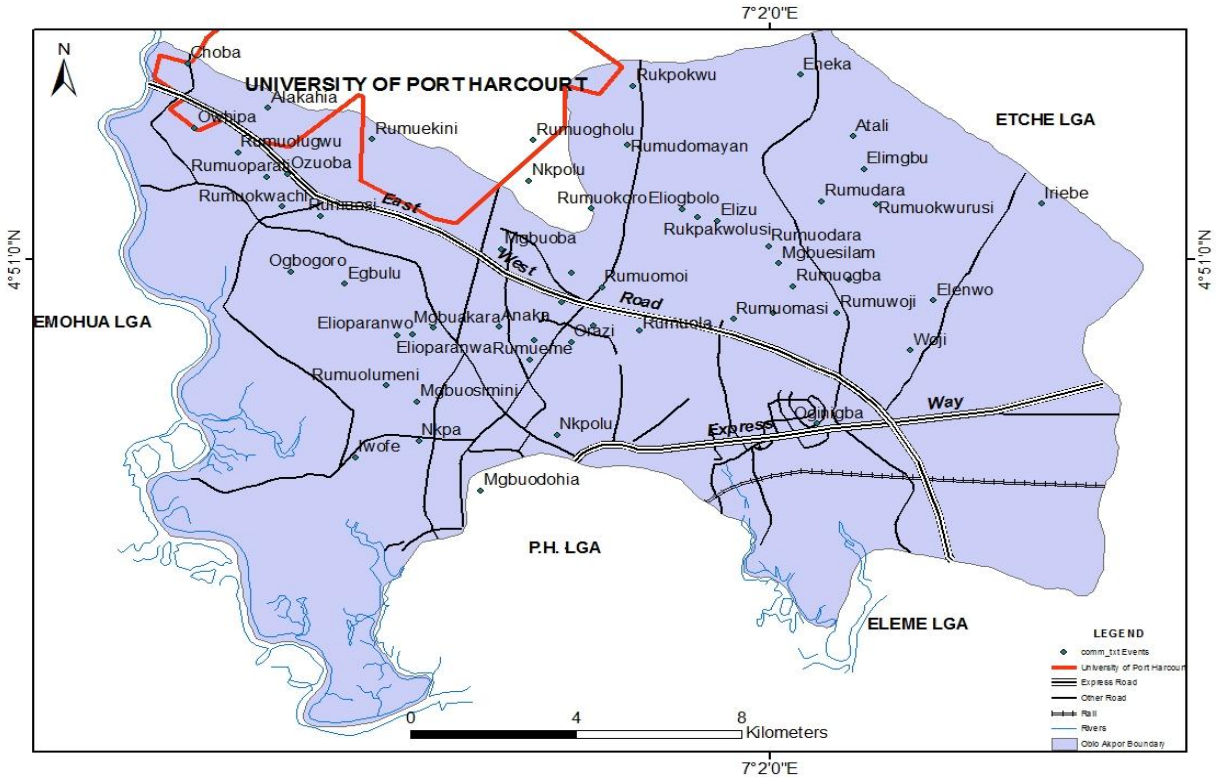
The study area is captured within 11,077Km^2 (4,277sq mil) of area and density of 468/Km^2 (1,210/sq mil) of Rivers State which has 23 local government area with overall population of 5,185,400 according to 2006 census and was created by 27 May, 1967, the rivers in the study area include Choba river, Ogbogoro river, Rumuolumini river, Rumu-Woji river among others. Historically,the inhabitants of the study area are known as farmers, the farming pattern 30 to 50 years ago are cultivated on seasonal farming of different species of agriculture ranging from yam, cassava, vegetables, corn, and others but rapid population growth and urbanization has taken over quantifiable land resorting to land use change.

However, Obio/Akpor L.G.A was created by the then military administration of former Military President IbrahimBabangida on 3rd May, 1989 out of Port Harcourt City Local Government of Rivers State.



Source: Rivers State Ministry of Lands and Housing, Digitized by Author.

Figure 1. Rivers State Showing Study LGA



Source: Rivers State Ministry of Lands and Housing, Digitized by Author.

Fig 1.1 Map of Obio/Akpor L.G.A and Sampled Communities in Rivers State

II. MATERIAL AND METHODS

This research adopted the cross sectional where the researcher do not interfere with the subject of investigation rather observes the phenomena under consideration. Form the plan of study the researcher studied land cover change and flood vulnerability in the study area. In this study adopting the cross sectional research design enabled the researcher to conduct series of observation on the subject matter over a period of 1986 and 2010. This allowed for the easy detection of possible developmental changes in the characteristic of the question of study both collectively and individually. This is because this design allows for study that extends over and beyond a single time frame making for avenue to establishing sequence of events (Chava& David, 2009). In this study, observation is conducted on changes in the land cover of the study area over a period of 1986 and 2010 and adopting this design gives an insight to proper evaluation of the phenomena in question as the studies does not go within one study or time frame rather it goes beyond a period or single time frame. This enabled the researcher to predict the trend in development and alteration of land use in relation to vulnerability of the study area.

NATURE AND SOURCE OF DATA

The study utilized both the primary and secondary data. The primary data was derived from the field measurement using the Global Positioning System to acquire information on the absolute position of communities while Land cover analysis was carried out by utilizing the landsat imagery derived over the study area. This imagery helped in the computation and classification of the surface cover using the supervised classification method of image analysis.

METHODS OF DATA COLLECTION

The study land cover change was derived from land sat imageries of Tm of 30m x 30m in the year 1986 and 2010 to examine the changes in the Land cover characteristic of the study area. Geo spatial tools were used to examine vulnerability and tested using the paired samples correlation analysis while elementary statistic was used to differentiate the level of alteration in land cover as showed using geo spatial tools.

METHOD OF DATA ANALYSIS

Image Analysis

To determine the land use classification of the study area, supervised classification was carried out on the imageries acquired from landsat imagery data platform for the study area. Image of the study area for the year 1986 which served as the base and that of 2010 was derived from the shuttle radar topographic data. This was

imported in the GIS environment where the supervised classification was conducted on the images to derive the outcome presented.

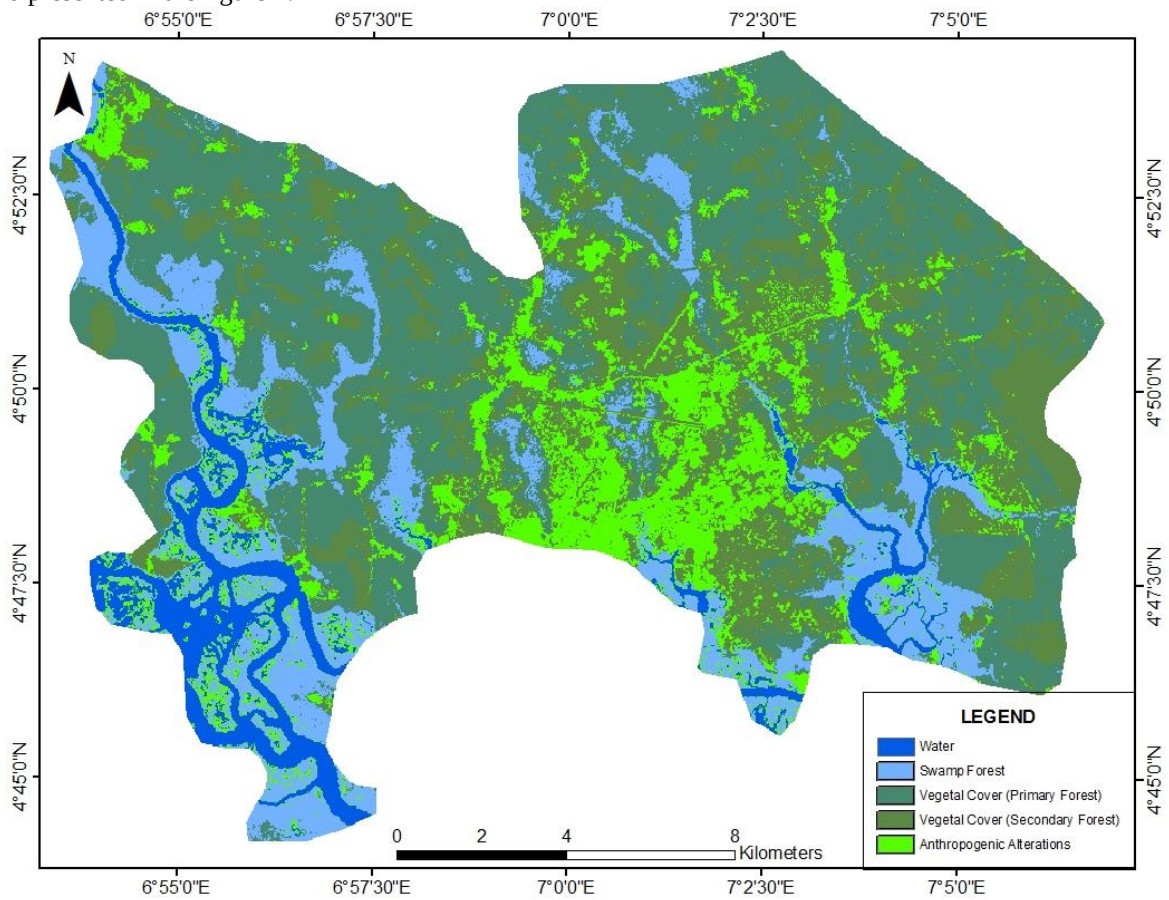
GIS technique and other geospatial and statistical tools were used in this study to analysis the relationship between the land cover and its dynamics in relation to the vulnerability of communities in the study area. The analysis was carried in line with community elevation, land cover and vulnerability classification utilizing base maps, google maps, srtm data of 30 meter digital terrain model, satellite imageries alongside secondary data from literatures.

III. RESULT

The presentation of data and analysis of result derived from this study. The result of land cover changes that had occurred in the study area between the periods of 1986 through 2010 is presented in this chapter. The attribute data calculated from the spatial features classes in terms of area in $m^2$and population growth changes in the study area will be tabulated for analysis alongside the result from testing the formulated hypothesis.

LAND COVER ANALYSIS

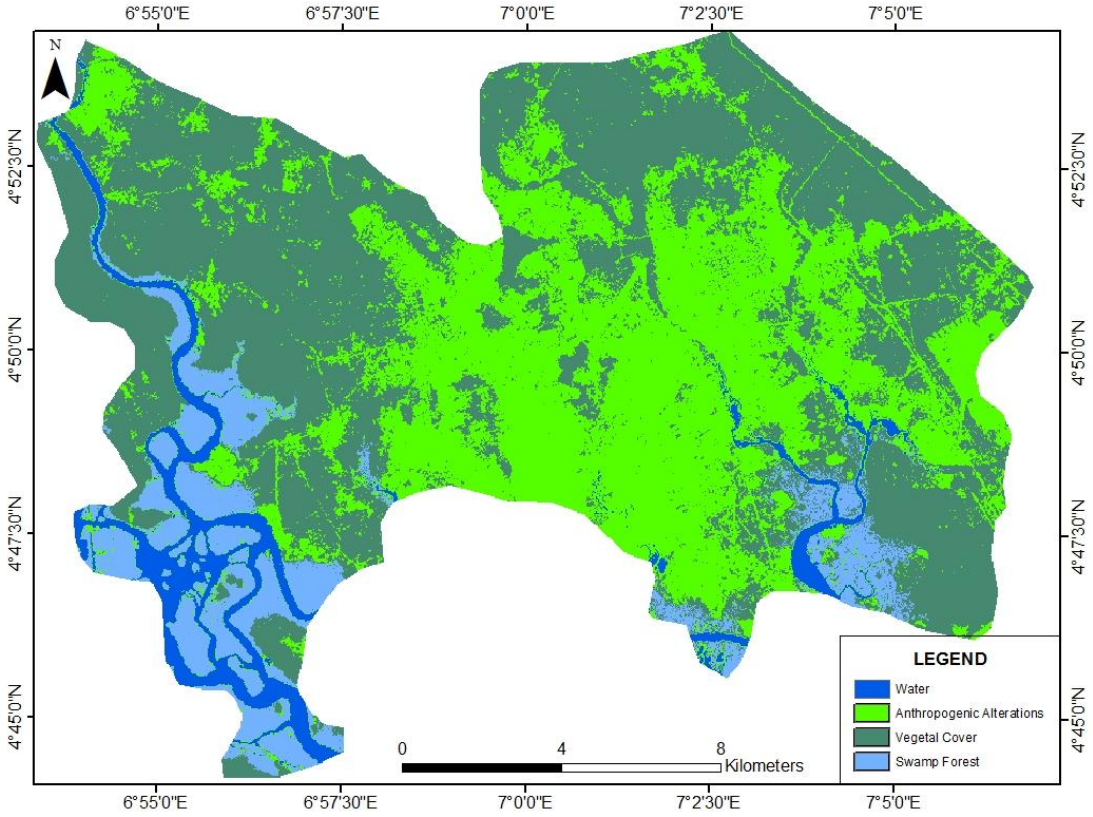
The findings from the land cover classification of the study area over the period of 1986 and 2010 was analyzed and presented in the figure 4.1



Source: Author's Analysis

Figure 3. Land Cover Analysis of the study area in 1986

The land cover classes and its features in the study area analyzed are water bodies, swamp forest, primary forest, secondary forest, and anthropogenic alterations. From the analysis, water bodies was represented with the colour blue as at the year 1986 image analysis. This category represents / covers 20,433,383m^2 of the entire surface area of Obio/Akpor LGA. Swamp forest which is represented with the colour light blue covers a total area of 41,986,199m^2 of the entire surface of the study area. Vegetal cover which could be either primary or secondary in nature covers a total area of 179,498,321m^2 in the study LGA. A total of 38,267,811m^2 of land or surface area has been altered by the activities of human either as built up or other usages of relevance to the development of humans.



Source: Author's Analysis

Figure 3.1 Land Cover Analysis of the study area in 2010

The land cover classes and its features analyzed for the study area water bodies, swamp forest, primary forest, secondary forest, and anthropogenic alterations were considered. From the analysis, water bodies was represented with the colour blue as at the year 2010 image analysis. This category represents / covers 14,662,559m^2 of the entire surface area of Obio/Akpor LGA. Swamp forest which is represented with the colour light blue covers a total area of 25,149,099m^2 of the entire surface of the study area. Vegetal cover which could be either primary or secondary in nature covers a total area of 133,936,276m^2 in the study LGA. A total of 106,394,556m^2 of land or surface area has been altered by the activities of human either as built up or other usages of relevance to the development of humans.The analysis reveals a change in the negative direction in the area coverage of the study area by water. Therefore from the analysis shown in table 4.1, water coverage or presence in the study area at the surface has drastically reduced at about 28 percent. Also in the reducing trend is swamp forest which has reduced in the tune of 40 percent revealing that the area covered by water and swamp has being converted to alternative purpose or factors that favours the present of water at the surface level and development of swamp or wetland region is not much favour. For the forest region, it is noticed from the analysis that forest cover in the region has being tampered with making for a reduction in forest cover between the period of study to a tune of 25 percent revealing that areas covered by forest in the year 1986 has being converted from forest to other purposes as deem necessary for the survival of mankind by mankind. Finally there was a huge reversal in the trend of land cover changes in the study area as the area alteration by human activities as revealed from the analysis shows a positive growth for over 3 times the base status as at 1986. Hence for the period of study (1986 to 2010) there was a growth in anthropogenic alteration in the tune of 64 percent over the study area. This revealed the reason for the changes in declining manner over the study period for land cover changes analysis as carried out over the period of 1986 through 2010.

Table 3.2 summary of land use change analysis between 1986 and 2010 in the study.

S/N	LAND USE CLASSES	AREA IN m^2 FOR 1986	AREA IN m^2 FOR 2010	AREA DIFFERENCE IN m^2	% DIFFERENCE	REMARK
1	Water	20,433,382 m^2	14,662,559 m^2	5,770,823 m^2	28%	Decreased observed
2	Swamp forest	41,986,199 m^2	25,149,099 m^2	16,837,100 m^2	40%	Decreased observed
3	Forest	179,498,321 m^2	133,936,276 m^2	45,562,045 m^2	25%	Decreased observed
4	Built up	38,267,811 m^2	106,394,556 m^2	68,126,745 m^2	64%	Increased observed

Source: Author's Analysis

HYPOTHESIS TESTING

The hypotheses of this research stated as follows:

Hypotheses 1

1. There is no relative difference of land cover between 1986 and 2010 in the study area was tested using the chi square analytical tools to see the level of fitness between the expected and observed data. The analysis examined if the area covered by water, forest, built-up and swamp has remained the same or changed over the period of 1986 and 2010. The result of the analysis is shown in table 4.2,4.3,4.4 and 4.5

Table 3.3 Land Cover analysis over the study period

S/N	LAND USE CLASSES	AREA IN m^2 FOR 1986	AREA IN m^2 FOR 2010
1	Water	20,433,382 m^2	14,662,559 m^2
2	Swamp forest	41,986,199 m^2	25,149,099 m^2
3	Forest	179,498,321 m^2	133,936,276 m^2
4	Built up	38,267,811 m^2	106,394,556 m^2

Source: Author's Analysis

From the analysis of landsat images of the study area the result as shown in the table 4.2 reveal that there is a trend of decline in land cover types over the study period with an exception in the land cover alteration by man over the same study period. Hence from the analysis as presented in the table, human alteration of the study area is at the increase over the study period result in almost three times increase in human modification of the surface.

From the analysis of hypothesis 1 using Geo-spatial tools and elementary statistics (frequency table as shown in table 4.2, it is revealed that land cover change in the study area is significant over the period of study. It hence means that the land use cover at the base line or time of study which is 1986 does not represent what is obtainable today.

IV. DISCUSSION OF FINDINGS

The analysis of land cover changes in the study area over a period of 1986 through 2010 revealed that water bodies, swamp forest, and vegetal cover which are either primary or secondary were at the decline with a decline of 20,433,383m2, 41,986,199m^2, and 179,498,321m^2 as against 14,662,559m^2, 25,149,099m^2, and 133,936,276m^2 respectively. While the area of land altered by human activities rose from 38,267,811$m^2$to 106,394,556$m^2$of land or surface area has been altered by the activities of human either as built up or other usages of relevance to the development of humans within the study period of 1986 through 2010.

Hence for the period of study (1986 to 2010) there was a growth in anthropogenic alteration in the tune of 64 percent over the study area. This revealed the reason for the changes in declining manner over the study period for land cover changes analysis as carried out over the period of 1986 through 2010.

The results of the tested hypotheses shows that there is a trend of decline in land cover types over the study period with an exception in the land cover alteration by man over the same study period. Hence from the analysis human alteration of the study area is at the increase over the study period result in almost three times increase in human modification of the surface.It hence means that the land use cover at the base line or time of study which is 1986 does not represent what is obtainable today.

V. CONCLUSTION

The pressure man puts on the environment via exploitation; globalization and so on has resulted in an undue effect on the global environment. Biophysical limits on what is available for human use are real and there are strong signals that these limits are close to being reached or have already been exceeded. This has resulted in growing demand for food, feed, fuel, fiber and raw materials creates local and distant pressures for land cover change. Unplanned or planned urban areas without adequate protection of water ways like proper drainages, sand filling of water ways, buildings without layout to contain water due to rainfall are potential cause to flooding. The analysis of land cover change and its vulnerability of the study area to flooding within the period of 1986 and 2010 was observed that water bodies, swamp forest, and vegetal cover which are either primary or secondary were at the decline with a decline of 20,433,383m2, 41,986,199m^2, and 179,498,321m^2 as against 14,662,559m^2, 25,149,099m^2, and 133,936,276m^2 respectively and that land altered by human activities rose from 38,267,811m^2 to 106,394,556m^2 of land or surface area has been altered by the activities of human either as built up or other usages of relevance to the development of humans within the study period of 1986 through 2010. Finally, there is a trend of decline in land cover types over the study period with an exception in the land cover alteration by man over the same study period. On the above premise its suggest that the hierarchy of attention required by habitats of these areas with regards to the blue and sky blue needs most attention in the event of flooding. This is because in line with the onions framework, the people natural base of survival will be impacted which include both the social and economic platform of their survival. There is also the need for regular research activities to find out the pattern land cover changes in the area to also guide for developmental activities from encroaching into the swamp and wetland environment.

REFERENCES

[1]. Bariweni, P.A, Tawari, C.C and Abowei, J.F.N.(2012). Some Enviromental effects of flooding in the Niger Delta Region of Nigeria.International Journal of Fisheries and Aquatics Sciences 2. ISSN: 2049-8417, elssn:

[2]. Barles, S. (2010), society, energy and materials: the contribution of urban metabolism studies in sustainable urban development issues. Journal of environmental and planning management 53(4), 439-455.

[3]. Birkmann J (2006) Measuring vulnerability to natural Hazard, United Nations Press, New York.

[4]. Blaikie, p., Cannon, T., Davis, I. and Wisner, B., 1994. At Risk Natural Hazards, people's vulnerability and Disasters, Routledge, London.

[5]. Bogardi J and H. G. Brauch (2005) Global Environmental Change: A challenge for Human Security in measuring vulnerability to Natural Hazard Towards Disaster Resilience Society. United Nations Press, New York.

[6]. Bradshaw, C.J Shodni, N.S., Peh, S.H and Brook, B.W (2007) Global evidence that deforestation amplifies flood risk and severity in developing countries.World Global change Bio J.13, 2379-2395

[7]. IPCC (1996) The Science of Climate Change in Oyegun C U. Climate Change and Nigeria Coastal Resources, UPPL, 2007.

[8]. IPCC (Intergovernmental Panel on Climate Change) (2001) Climate change: the Scientific Basis Contribution of the working Group I to the third Assessment Report on the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge.

[9]. IPCC(2001) "Climate Change 2001: Impacts adaptation and vulnerability" Contribution of work group 11 to the third assessment report of the intergovernmental panel on Climate change (IpCC), Cambridge University Press, New York.

[10]. IPCC, 1996 Intergovernmental Panel on Climate Change, second assessment climate change.

[11]. IPCC, 2001 Intergovernmental Panel on Climate Change, Climate Change 2001: The scientific basis Cambridge, Cambridge University press

[12]. IPCC, 2007, Intergovernmental Panel on Climate Change, AR4, fourth Assessment Report: Climate change 2007

[13]. IPCC,(2001), Climate Change 2001: the scientific basis Cambridge, Cambridge University PressiSDR (2004). Living with flood, UN guidelines offer decision- makers hope to reduce flood losses World Water Day (22 March) the publication Guidelines for reducing flood losses was launched in Geneva, New York, Bangkok and Harare.

[14]. Kissinger, M. and Rees, W. (2010). An interregional ecological approach for modeling sustainability in a globalizing world: reviewing existing approaches and emerging directions. Ecological modeling 221, 2615-2632.

[15]. Lambina, E. and Meyfrold, P. (2011) Global land use change, economic globalization, and the looming land scarcity. Proceedings of the national Academy of sciences of the United States of American 108 (9), 3465-3472.

[16]. Lambnia, E. and Meyfrold, P. (2011), land uses transition: Socio- Ecological feedback versus socio economics change. Land use policy 27, 108-118.

[17]. Lambnia, E.F, Turner, B.L, Geist, H.J Agbola, S.E, Angelem, A. Bruce, J. W. Coonmes, O.T., Dirzo, R., Fichers, G. Folke, C., George, P.S., Homewood, K., Imbermon, J.,Leemans, R., Li X., Moran E.F, Mortimore, M., Rumakrishman, P.S Richards, I.F, Skanes, H, Stffen, W. Stone, G.D,. syedin, U. velukcamp, T.A. Vugel, C and Xu, I (2001). The causes of land use and land- cover change moving beyond the myths. Global environment change 11(4), 261-269.

[18]. Nepstad, D., Soares- fiiho, B.S Merry, F.Lima, A., Carter, I. Bowman, M. Cattanes, A, Rodrigues, H. Schwartamons, S. McGroth, D.G., Sticker, C.M, Lumowski, R. PirisCabezas, P., Rivelo, S. Akencan, A. Almelda, O. and stella, O. (2009). The end of deforestation in the Brazilian Amazon.Sciences 326-1351.

[19]. Rockstrom, J. Stellen, W. Noone, K. Persson, A. Chapiri, F.S Ill, Lambiri, E. Lenton, T.M Scheffer, M. Floke, C. Schellnhuber, H. I., Hykvist, B., de Wit. C.A Hughes, F., Van Der Leeliw S., Snyder, P.K., Custanza, R., Syediri, U., Falkedilark, M., Kanberg, L., Corell, R.W Fabry, V.J Hansen. J., Walker, B., Liverman, D., Richardson, K., Crutzen,

[20]. Scot E. S. and Daniel.H. (2008) Analysis of Watershed Vulnerability to Flooding in Haiti. World Applied Sciences Journal 4 (6) University of Florida, Gainesville

[21]. Senaranthne, P.C., Ekanayake E. and Perera, S.J (2012).Learning to live with floods, Natural hazard and disaster. German development Cooperation Sir Lanka

[22]. Thieler, E. R., & Hammer-Klose, E. S. (1999). National Assessment of Coastal Vulnerability to Future Sea Level Rise:Preliminary Result for the U. S. Atlantic Coast (G. S. O.-F. Report, Trans.). U.S.

[23]. Thieler, E.R. and Hammer-Klose, E.S 2000. National Assessment of Coastal Vulnerability to sea- level Rise: Preliminary Results for the US pacific Cost. Woods Hole, MA. United State Geological Survey (USGS), Open File Report 00-178,1p
[24]. Zbigniew W K and Lucas M. 2003 Flood risk and vulnerability in the changing world International Conference Towards natural flood reduction strategies Warsaw