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SPATIO-TEMPORAL CHANGES OF LAND USE LAND COVER DYNAMICS AND ITS IMPLICATION ON URBAN FLOOD VULNERABILITY IN MAKURDI, NIGERIA

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ABSTRACT

Makurdi as one of the major city located on the flood plain along river Benue in Nigeria is exposed to the recurring flooding events which results to loss of life and properties. Hence there is need to analysed the spatio-temporal Land use Land cover (LULC) Dynamics and its implication on Urban Flood Vulnerability in Makurdi, Nigeria. LULC change was determined using Remote Sensing techniques and Geographic Information System; the land use was classified into five classes from 1986 - 2016 to monitor the changes that have taken place over time and space. Digital Elevation Model (DEM) of the study area were created and classified into three classes; High, Moderate, and Low risk areas. Soil infiltration analyses were performed in some selected sample points across the study area. The result revealed that Wadata area have a high bulk density and moisture content of 1.46g and 89% respectively indicating low rate of infiltration thereby accelerating runoff and flood event. Similarly, from the interpretation of the different epoch of Landsat images it shows that built-up areas have been on increase from 4.82% in 1986 to 35.36% in 2016 which has resulted to encroachment into the flood plain. The classified DEM -slope shows that about 40016.09 hectares (48.43%) of the land mass is within the flood plain. Consequently, there is need to identify and developed strategies for sustainable urban flood plain development for the attainment of resilience urban flood.

Keywords: Spatio-temporal, LULC, Urban Flood, Bulk Density and encroachment

INTRODUCTION

Land use and Cover Dynamics (LUCD) and its implication on hydrological processes such as flooding have been prominent research topics in global environmental changes (Amini *et al.,* 2011; Chen et al., 2009; Fox et al., 2012).Globally, the landscape and hydrological cycle has been modified by anthropogenic activity which reflects the socio-economic conditions and pattern of land resource utilization.(Li et al., 2013).Therefore, changes in LULC can typically affect basin hydrology by altering the rate of interception, infiltration, percolation, overland flow and evapotranspiration that, in turn, can change time and volume of peak discharge (Baker and Miller, 2013). Biblically, the incidence of floods disaster also marked the beginning and the first practice of using water to collapse a flourishing civilization by God as a natural hazards disaster, which occurred to the Noah setting in such period Genesis 7Vs 1-24 Genesis 8:1-22.

There is no doubt that the world is under serious threat from the environment as seen From China to Mexico, Indonesia, United States of America, United Kingdom, Africa Nigeria and Makurdi in particular. Komolafe *et al*, (2015) argued that the environment was only responding to the abuses heaped on it by man's activities which lead to

increased flood events coupled with the lack of coping capacity and high levels of vulnerability of the people will continued to put many lives and properties at risk. The study seeks to Identify and classify land use/land cover dynamics of the study

area and Examine the infiltration characteristic of Soil within the study area

MATERIALS AND METHOD

The study area is Makurdi town, the Capital city of Benue state in north central Nigeria. It is the Headquarter of Makurdi Local Government Area and the capital of Benue state. The city is located between longitude 8º 24'E and 8º 38' E of the Greenwich Meridian and latitude 7º 38'N -7º 50'N, of the equator (Fig.1.1). It is situated in the Benue valley in the middle belt region of Nigeria. It is traversed by the second largest river in the country, the river Benue. The annual rainfall totals for the area ranges from 1200mm to 1500mm (Nyagba 1995).The Landsat imageries of 1986, 2006 &2016 serves as the primary data used in generating LULC distribution of the study area. (Fig.1.4). Based on prior knowledge of the area and field survey, a classification scheme on Anderson et al, (1976) level 1 classification was adopted and modified into five classes representing built up, vegetation, farmland sand bar, water body. The maximum Likelihood Method was used, The DEM was georeferenced and projected to UTM zone 32, then fill first to give the accurate values of the elevation and then inserted into the surface tool of ArcGIS to generate slope map of the area. The DEM (slope) was classify into three which are high, moderate and low risk areas.

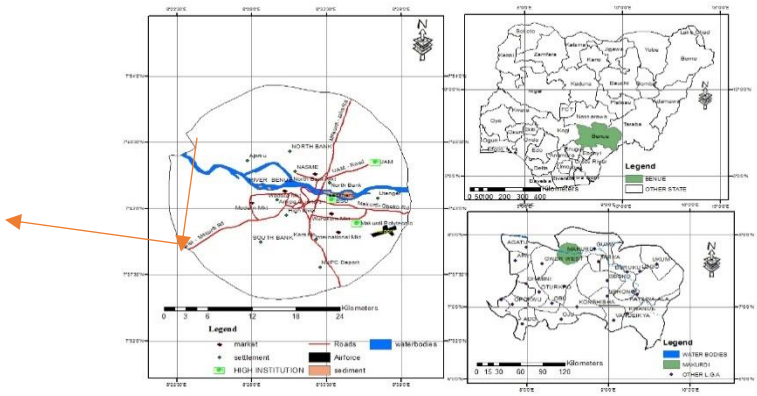

Figure 1: Map of the study area

RESULTS AND DISCUSSION

As revealed on table 4.1, the built-up (urban) has been progressively increasing throughout the study period occupying 39.8142 hectares (4.82%) in 1989, 779.805 (9.45%) in 2006 and 2921.715ha (35.36%) in 2016. This progressive increase in built-up area is in agreement with the work of Ade and Afolabi (2013).Agriculture, which occupied 349.8426ha (42.30%) in 1986 decreased to1737.54ha (21.06%) and 641.871ha (7.77%) in 2006 and 2016 respectively. The decrease in agricultural land throughout the study period must have been caused by the increase in built-up area which led to the conversion of agricultural lands to built-up land. This is in line with the work of Nwafor (2006) who also found that agricultural lands decreased as built-up area increased. Vegetation occupied 401.175ha (48.60%) in 1986 and increased to5398.2 (65.42%) in 2006 because of the afforestation programme of the state government and university of agriculture, Makurdi, and decreased to 4355.505 (52.72%) in 2016. Sand bar decreased progressively from11.0394 (1.33%) in 1986, to 45.585ha (0.55%) in 2006 and 100.566 (1.22%) in 2016. This could be due to constant excavation of sharp sand for construction purposes.

Figure. 2, 3, and 4 show the spatial extent of Land use/Landover classes (classification result).

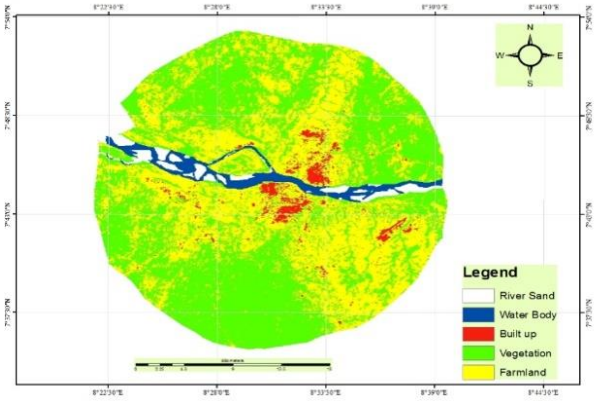

Fig.2: Classified 1986 LULC Map

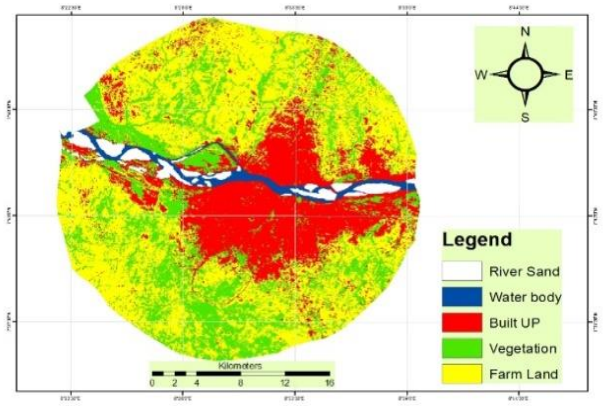

Fig.3: Classified 2006 LULC Ma

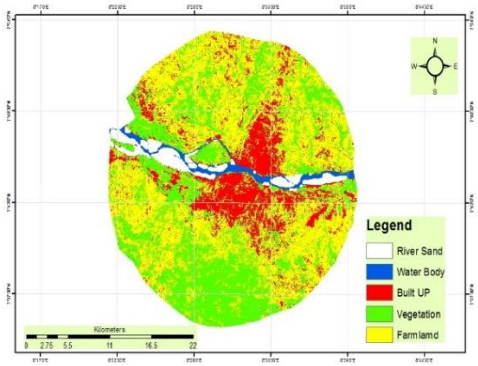

Fig.4: Classified 2016 LULC Map

Table 1: land use and land cover Distribution of Makurdi (1986, 2006, and 2016).

Classification category	**1986**		**2006**		**2016**	
	Area (Ha)	**Area covered (%)**	**Area (Ha)**	**Area covered (%)**	**Area (Ha)**	**Area covered (%)**
Vegetation	401.175	48.60%	5398.2	65.42%	4355.505	52.72%
Farmland	349.8426	42.30%	1737.54	21.06%	641.871	7.77%
Built up	39.8142	4.82%	779.805	9.45%	2921.715	35.36%
Water bodies	24.3864	2.95%	290.34	3.52%	242.604	2.93%
River Sand	11.0394	1.33%	45.585	0.55%	100.566	1.22%
Total	826.2576	100.00%	826.2576	100.00%	826.2576	100.00%

Source: Author's Analysis, 2017.

Furthermore, from the analysis of the steady state infiltration conducted in the study area, it has been identified that most of the soil in the study area exhibit low infiltration as evidence in 2017 flooding in the area. Plate 1-3 affirms that more built -up areas has been on the increase on flood ways making more community vulnerable.

Plate 1: Radio Benue area of Makurdi

Plate 2: Welfare Quarters extension

Plate 3: Wadata area of Makurdi

Overall, the present study shows that soil in the study area have low to moderate infiltration except for location1(Bawu collage farm) which exceptionally exhibits very high permeability, whereas the lowest permeability capacity was recorded in location 3 (built-up).

In addition, the classified DEM and Slope reveals that 40016.08604 hectares (48.43%) of the area is on lower elevation which is a fundamental aggravating recurring flood events in the study area.30716.94976 (Ha) (37.17%) are moderate risk areas and 11898.78526 (ha) (14.40%) are low risk aMeas.it is therefore conclude that generally the study area is a flood plain area.

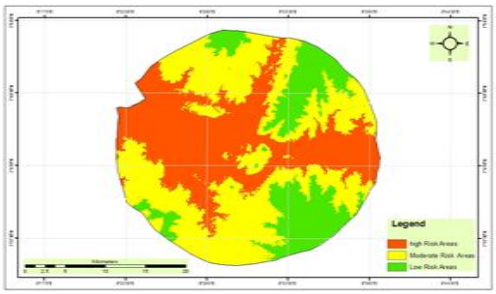

Fig. 5. Classified DEM Map of the study area

CONCLUSION

The spatio- temporal LULC maps affirmed higher changes in LULC in recent times. It is also paramount to note the fact that human settlement is on the increase towards the floodplain/river area and along water ways. By implication increase the vulnerability of built-up areas.

It is apparent that from the analysis that fundamental factors such as land use pattern, low relief, increased in built-up and human activities will continue to intensify flooding in the area. The study therefore recommends the need to identify and developed strategies for sustainable urban flood plain development for the attainment of resilience urban flood. The master plan of the area should be review to integrate peri-urban development and this should take cognizance of building along the water ways so as to reduce flood problems, as many rural land uses will transit to urban which were not included in the earlier plan.

Government should adopt, enhance and promote the development of a resilient city in the study area so as to reduce the impact of flood

There is also the need for all stakeholders like Ministry of Land and Survey, Ministry of Environment, State Development Board and NGOs in urban land use management to ensure strict adherence to urban land use legislations.

REFERENCES

Amini, A., Ali, T., Ghazali, A., Aziz, A., Akib, S., (2011). Impacts of land-use change on streamflows in the Damansara Watershed, Malaysia. *Arab. J. Sci. Eng.* 36 (5), 713–720.

Baker, T.J. and Miller, S.N., 2013. Using the Soil and Water Assessment Tool (SWAT) to assess land use impact on water resources in an East African watershed. *Journal of Hydrology*, 486, pp. 100– 111.

Chen, Y., Xu, Y., Yin, Y., (2009). Impacts of land use change scenarios on storm-runoff generation in Xitiaoxi basin, China. Quat. Int. 208, 121–128

Fox, D.M., Witz, E., Blanc, V., Soulié, C., Penalver-Navarro, M., Dervieux, A., (2012). A case study of land-cover change (1950–2003) and runoff in a Mediterranean catchment. Appl. Geogr. 32 (2), 810–821.

Komolafe A.A., Adegboyega S.A. and Akinluyi F.O. (2015). A review of flood risk analysis in Nigeria. *American Journal of Environmental Sciences* ,11(3):157–166.

Ade, M. A., Afolabi, Y. D., (2013). Monitoring Urban Sprawl in the Federal Capital Teritory of Nigeria Using Remote Sensing and GIS Techniques. *Ethiopian Journal of Environmental Studies and Management*. 4 (13): 82-95.

L, Q., Cai, T., Yu, M., Lu, G., Xie, W. and Bai, X., (2013). Investigation into the Impacts of Land-Use Change on Runoff Generation Characteristics in the Upper Huaihe River Basin, China. *J. Hydrol. Eng.*, (18) 1464-1470.

Nyagba, J. L. (1995). The Geography of Benue State. In Denga D. J. (ed.) Benue State the Land of Great Potentials: A Compendium. Calabar: Rapid Educational Publisher Limited, Nigeria.