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RESEARCH ARTICLE

IMPACT OF URBAN LAND DEVELOPMENT ON AGRICULTURAL LAND USE IN BIRNIN KEBBI, KEBBI STATE, NIGERIA

[1] SALIHU KOKO MUSA, [2] ABDULFATAI ABIODUN BELLO

[1]Department of Urban and Regional Planning, University of Calabar, Nigeria
[2]Department of Geography and Environmental Science, University of Calabar, Nigeria

ABSTRACT

This study examines the impact of urban development on agricultural lands in Birnin Kebbi, Nigeria. Relatively little empirical research has been conducted on the actual effects of different spatial patterns of urban development on agricultural lands in the study area. This study aims to fill that gap with a focus on Birnin Kebbi, the Kebbi state capital. The objectives of the study were to obtain the land use and land cover (LULC) of Birnin Kebbi, determine the various loss of agricultural land types to urban development and to make viable recommendation based on the findings of this paper. Remote Sensing and Geographic Information System (RS/ GIS) was used in this study for achieving the objectives and data used was gotten from earthexplorer.usgs.gov. Landsat (TM) images of 1990, 2000 and 2016 were used. The study employed supervised digital image classification method using IDIRISI and ArcGIS 10.2 software. Result showed a major increase in built-up area of 9.2 percent in year 2000 to 48.7 percent in 2016. The cultivated area of 62.1 percent in 1990 reduced to 18.4 percent in 2016. Also, the main change observed for the period of 1990 to 2016 was the decrease in agricultural areas due to urbanization from 62 percent to 18 percent. Over 60 percent of the agricultural land types were loss as a result of development. It was recommended that land use zoning, and technological innovation be adopted by the government to manage and monitor land use cases in the study area.

Keywords: Agricultural land, Urbanization, land use, GIS, Remote sensing

Corresponding Author

Salihu Koko Musa
Email Addresses: Salihumkk@gmail.com & belloabdulfataia@yahoo.com[2]
Telephone Numbers: +2348038203193 & +2348054739073

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INTRODUCTION

Urbanization is transforming agricultural lands into urban areas, leading to changes in local farming practices and land loss. European nations like Norway and the Netherlands have experienced this, while the United States and Canada lose 4,800 square kilometers of ideal agriculture annually (Organization for Economic Co-operation and Development 2002; Travis, 2007). Puerto Rico's urban area has grown significantly, reducing its future production potential. This trend has led to the importation of food from Asian countries, as they lose their diversified food production capabilities (Jackson-Smith, Eric and Brian, 2006; Lopez, Mitchell and Thomlinson, 2001; Adeniyi & Omojola, 2009; Lu, Liang, Xiaoli, Duffy, Zhao, 2011; Enisan & Adeyemi, 2013).

One of the biggest dangers to Nigerian agricultural areas is urbanization (Atu, offiong, Eni, Eja and Esien, 2012; Azuma, Bianca, Thompson, 2014). Every expanding band around major cities experiences sprawl. Sprawl frequently results from disjointed construction projects and single-family houses that are built outside of cities, often within commuting distance of the city center (Atu et al, 2012). Even though sprawl is a problem in all Nigerian cities, Birnin Kebbi inclusive, the sustainability of this development is at risk since it is heavily influenced by shifting patterns of land use and land cover. As a result, built-up or urban land usage has altered substantial areas of agricultural terrain (Atu et al. 2012; Aliyu, 2015). According to Aliyu, (2015) unchecked urban expansion and land use change create a number of problems that could significantly affect agricultural land in Birnin Kebbi.

Land use decisions are converting 1.4 million acres of rural land into urban areas, causing loss of agricultural production, increased runoff, flooding, and habitat loss. Poor urban planning and insufficient integration of agriculture contribute to this issue (Danboyi, 2006). Rural population growth also results in the loss of prime farmland. As development competes with agriculture, farmers must intensify their operations within existing land areas. However, not all farm managers can implement this option (Danboyi, 2006).

Birnin Kebbi, the capital city of Kebbi State, has experienced rapid growth and development since the creation of the state in 1991. Despite being largely rural, Birnin Kebbi is expected to experience rapid urbanization due to its administrative and commercial functions (Aliyu, 2015). This growth has led to increased concentration, congestion, extension of settlements to flood-prone areas, emergence of satellite settlements, and incorporation of rural lands which led to loss of agricultural land in Birnin Kebbi local government area of Kebbi State (Aliyu, 2015). Thus, this study examines how urban land development has engulfed Agricultural land in Birnin Kebbi local government area of Kebbi State. Specifically, objectives of this study are to: (i) generate the landuse and landcover (LULC) of Birnin kebbi; (ii) determine the various loss of agricultural land types to urban development, and; (iii) make viable recommendation based on the findings of this paper.

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LOCATION OF THE STUDY AREA

The study area is located on the North West axis of Kebbi State, further downstream along the extensive valley of the Rima River. The city is located between latitude 12º 15'N to 12º 35'N of the equator and longitudes 4º 01'E to 4º 38'E of the Greenwich meridian. It has a total landmass area of 86.5 sqkm. It is bounded by Argungu in the north-east, Kalgo, Jega and Aliero to the west, Gwandu to the east and Arewa/Dandi Local Government to the north-west. Birnin Kebbi has 15 political wards. (Figure 1)

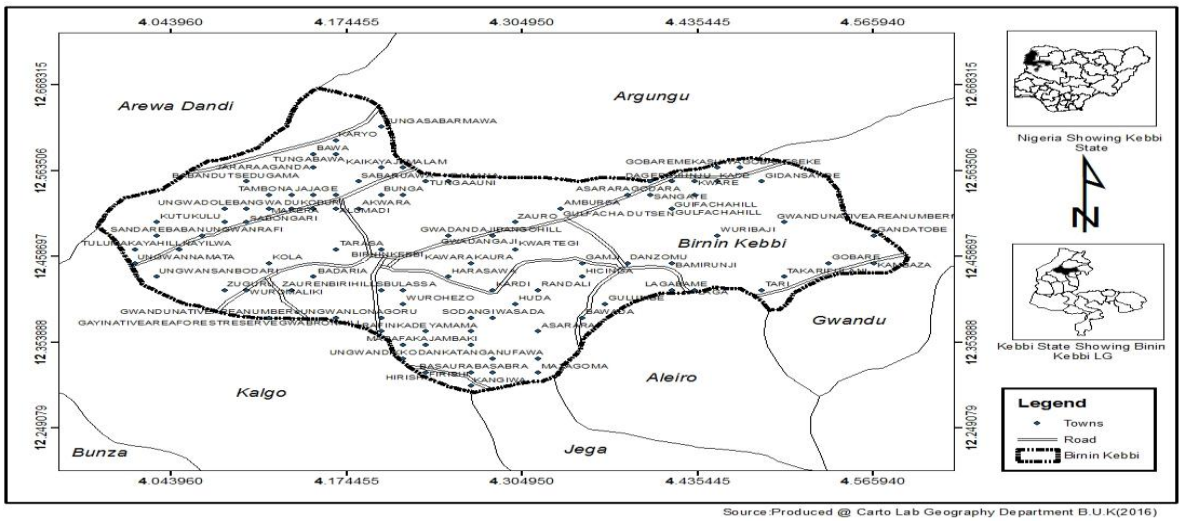

Figure 1: Birnin Kebbi LGA, Kebbi State.

MATERIALS AND METHODS

Research design

Reconnaissance survey was carried out in Gesse phase 1&2 and Bayan Kara in the study area in order to have knowledge of expansion and development in the area. This was to help the researcher to get familiarized with the study area.

Quantitative data were used for the study. The quantitative data are satellite data of Birnin Kebbi for period of (1990-2016). Source of primary data (Remote Sensing) for the study is Land Sat images on Global Land Cover Facility (GLCF).

Data analysis

Remote sensing data was analyzed particularly relating to the rate of loss of agricultural land as a result of urban development for period of 1990-2016. Idirisi and ArcGIS 10.2 software were used for mapping and analysis of the remote sensing data. Supervised classification technique using maximum likelihood algorithm is the most commonly and widely used method for land cover classification (Jia and Richards, 2006). This classifier is based on Bayesian probability theory.

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Maximum Likelihood Classification is a statistical decision criterion to assist in the classification of overlapping signatures; pixels are assigned to the class of highest probability. The Maximum Likelihood classifier is considered to give more accurate results than Minimum distant classification. However it is much slower due to extra computations. It was found that the Maximum likelihood method gave the best results and both Minimum distance and Mahalanobis distance methods overestimated agricultural land and suburban areas (Ahmadi and Hames, 2009). A supervised classification was performed on false colour composites (bands 4, 3 and 2) into the following land use and land cover classes; Cultivated/Vegetation, Built-up area, Water body and Bare surfaces.

RESULTS AND DISCUSSION

The objective of this study forms the basis of all the analysis carried out in this chapter. The result is presented in form of maps and statistical table.

Rate of Loss of Agricultural Land

Change in Land Cover

The land use land cover distribution for each year derived from the imageries as presented in table 1. This is characterized of land use land cover of Birnin Kebbi in hectares and percentage. The figures presented in table 1 represent the statistic area of each land use land cover category for each study year. Built-up in 1990 occupies the least class with just 9.2 percent of the total land area. This may not be unconnected to the fact that the town was made the state capital in 1991, the image was acquired 1990 a year before the creation of the state. The agricultural/ vegetated land occupies the highest portion with 62.1 percent in 1990 and decreased to 58.2 percent and 18.4 percent in 2000 and 2016 respectively. Bare surface occupied 25.3 percent of the total area in 1990 but increased to 30.5 percent in 2000 and 31.9 percent in 2016.

The study further reveals that water body has the lowest proportion occupied 1.6 percent in 1990, and drastically reduce to 0.1 percent in 2000 and increase to 1.1 percent in 2016. This is in contrast to the work of Zubair (2006) where he analyzed land use/land cover change in Ilorin between 1972 and 2001, The result of the work shows a rapid growth in built-up land between 1972 and 1986 while the periods between 1986 and 2001 witnessed a reduction in this class. Apart from this, the time of the year in which the area was imaged which happens to fall within the onset of harmattan could also be a major contributing factor to the observed classification, contributing to the high percentage of bare surface and low percentage of water body. The spatial growth or expansion in other land cover types is directly taken place on the agricultural land as indicated by been the only land cover type with decrease in area coverage for the period under study.

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The research design for this research is similar to that of (Aliyu, 2015) whose target was on land use/ land cover dynamics using remote sensing and GIS, land consumption rate and land absorption. The results showed that over the few decades, Kaduna town had been transforming due to population increase, thereby causing vegetation loss including expansion in built up area. The work is in contrast to my findings as they only considered population increase to be the only factor causing vegetation loss and expansion in built up area. Figure 2, 3 and 4 are Landcover maps derived from the satellite imageries of 1990, 2000 and 2016 respectively that showed different landcover classes of the study area as they appeared in these years.

Table 1: Land Cover Classes of Birnin Kebbi (1990, 2000 and 2016)

Land Cover	**1990**		**2000**		**2016**	
	F	**Percent**	**F**	**Percent**	**F**	**Percent**
Bareland	F	%	382.6	30.5	398.2	31.9
Builtup	317.5	25.3	135.4	11.2	607.9	48.7
Cultivated/Vegetation	787.7	62.1	729.9	58.2	229.3	18.4
Water Body	20.0	1.6	0.9	0.1	13.3	1.1
Total	**1248.8**	**100.0**	**1248.8**	**100.0**	**1248.8**	**100.0**

Source: Field work (2016)

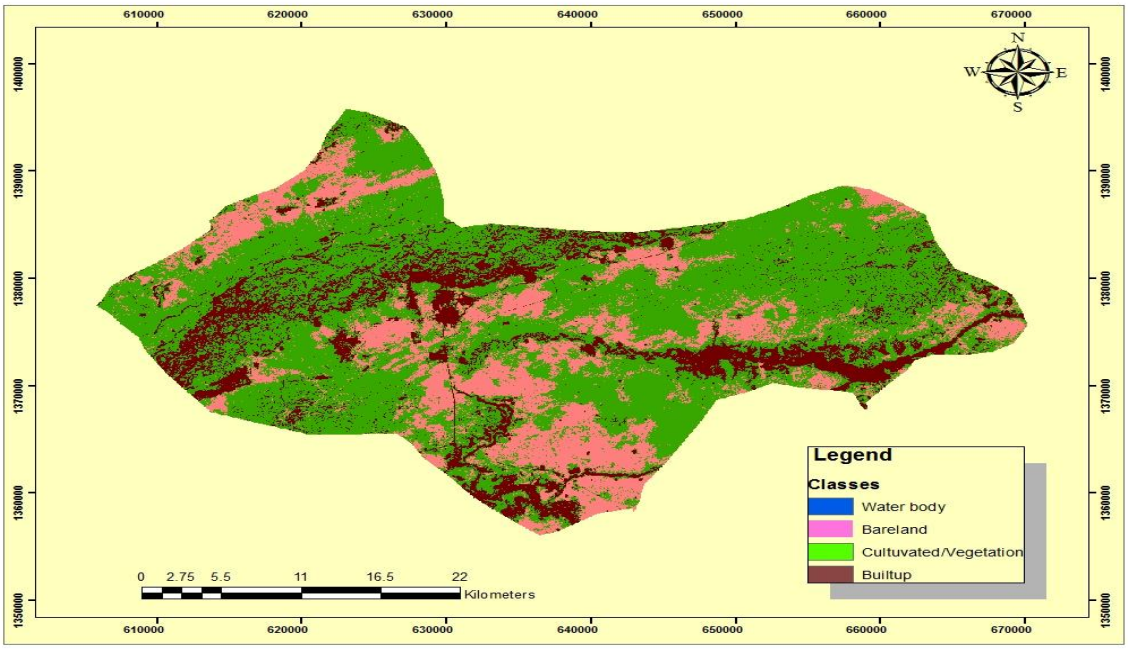

Fig 2: Landcover Map of Birnin Kebbi in 1990.

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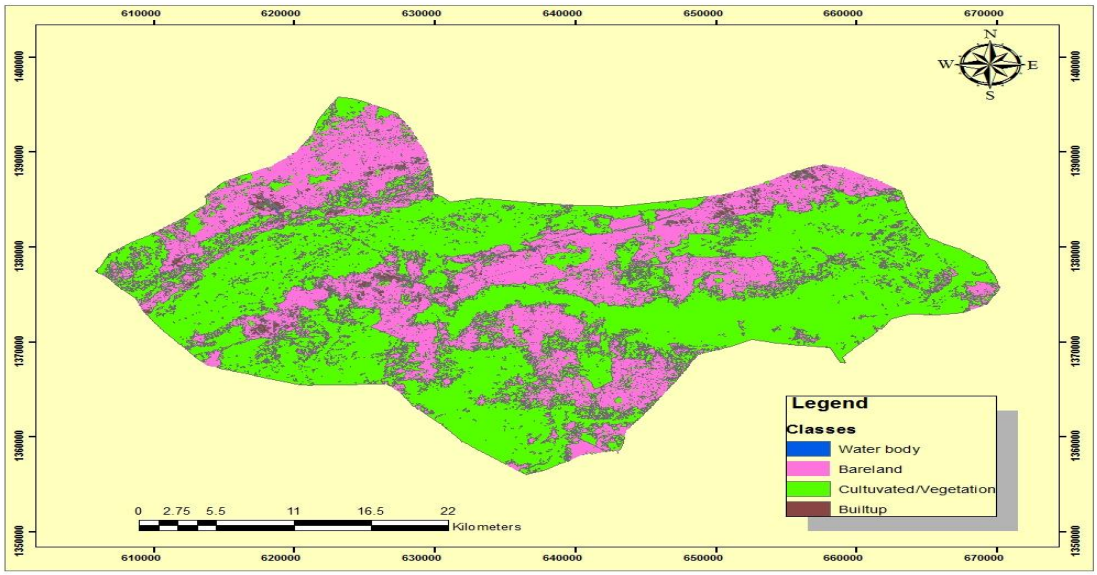

Fig 3: Landcover Map of Birnin Kebbi in 2000

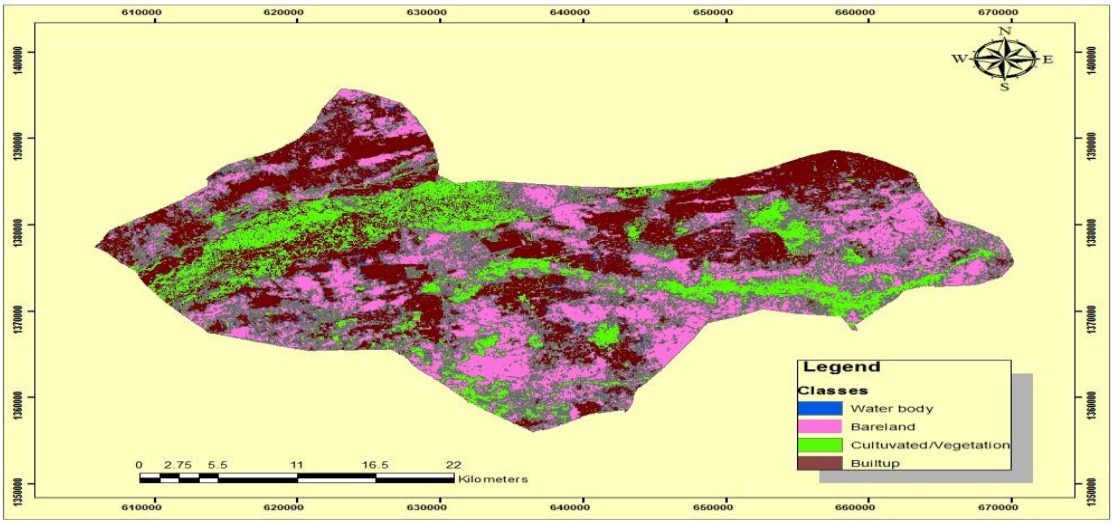

Figure 4: Land use/ Landcover Map of Birnin Kebbi in 2016

3.2. Loss of Agricultural Land

The creation of Kebbi State in 1991 and Birnin Kebbi as the state capital results to rapid loss of agricultural lands ranging from rainfed, irrigated, grasslands and forest areas as a result of development. Over 60% of the agricultural lands were loss as a result of development. In 1990 both the rainfed and irrigated lands occupies 30% where it reduces to 20% and 15% respectively in 2000 and 2016. The grassland area occupies about 10% in 1990 and reduced to 7% and 5% in 2000 and 2016, while the forest areas occupy about 7% in 1990, 4% and 2% in 2000 and 2016 respectively.

Table 2: Loss of types of Agricultural Land Use

Agricultural land use	1990 %	2000 %	2016 %	Total %
Rain-fed/ Irrigated land	30	20	15	65
Grasslands	10	7	5	22
Forest Areas	7	4	2	13
Total	**47**	**31**	**22**	**100**

Source: Field work (2016)

CONCLUSION AND RECOMMENDATIONS

Conclusion

In conclusion, the findings in this study indicate that urban development has impacted negatively on agricultural lands in Birnin Kebbi, Nigeria by reducing their spatial extent and density and fragmenting them into smaller sizes. Hence, the challenge in the sustainability of agricultural activities lies in the conservation and management of existing fragments in the face of very rapid urbanization. This feat can be achieved via the integration of agricultural landscapes into urban land use planning systems and agricultural lands must also be taken into consideration as crucial part of urban development. The objective of the farmland preservation movement is to limit exurban development and ensure that farming can continue to operate in close proximity to urban centers.

The primary argument of the farmland preservation movement is the maintenance of the food supply. This includes arguments that land in close proximity to urban areas is typically more productive than any land that might be brought into production to offset land conversion in the fringe, the opportunity for local food production, and the amenity benefit of having farms as green space. In addition, there is often a recognition that limits on the conversion of farmland force urban development to stay within the growth boundary.

RECOMMENDATIONS

Environmental policy makers concerned with restoration and ecological sustainability in the area must recognize that development forces in the space economy are not likely to provide them the luxury of a stationary target. Research should be directed at specifying the relative importance of these many factors in order to develop a policy-focused model of land use demand in the area. It was revealed that mixed land use is being practice (especially residential and agriculture), this implies that there is need for an organ of government that is vested with the responsibility of determining how land is to be used for such purpose that may be detrimental to the environment.

Secondly it should be a policy any land collected from a farmer, he should be given another land and be compensated financially so as to encourage him/her continues production. A body should exist to plan the land use in Birnin Kebbi; zoning laws should be operated in order to determine the use certain land should be put.

Given the scenario in Birnin Kebbi, it is the specific recommendation of this paper that the government should reform it regulatory system to bring it more into line with practices in most other states and countries. This can be done by granting local authorities more policing powers to control and regulate all the development within their areas of jurisdiction.

Competing Interest

The authors have declared that no conflicting interest exist in this manuscript.

REFERENCES

Adeniyi, P.O. and Omojola, A. (2009). Landuse/Landcover change evaluation in Sokoto Rima basin of N.W. Nigeria based on archival remote sensing and GIS techniques. In Adeniyi, P.O. (Ed.) *Geoinformation Technology and Development: A Compendium of Selected Papers,* 81 - 111. Lagos: Wura-Kay Prints

Al-Ahmadi, F.S and Hames, A.S. (2009). *Comparison of four classification methods to land use and land cover from raw satellite images for some remote arid areas, Kingdom of Saudi Arabia* JKAU; Earth Science, 20(1) 167 – 191.

Aliyu, Z.A. (2015). Effects of urbanization on landuse/landcover changes in Birnin Kebbi. An unpublished M. Sc. Thesis, Department of Geography, ABU Zaria.

Atu, J.E., Offiong R. A., Eni, D.I., Eja, E.I., Esien, O.E. (2012). The Effects of Urban Sprawl on Peripheral Agricultural Lands in Calabar, Nigeria. *International Review of Social Sciences and Humanities*, 2(2), 68 – 76.

Azuma, D.I., Bianca, N.I., Thompson, J.L. (2014). *Effects of rural residential development on forest communities in Oregon and Washington, USA*. Department of Forest Resources and Management. The University of British Columbia, USA.

Danboyi, A.J. (2006). Reclamation of Derelict ponds of Birnin Kebbi. An Unpublished M. Sc. Dissertation, Department of Geography F.U.T. Minna, Nigeria.

Enisan, G. and Adeyemi, A.G.(2013) Effects of Agricultural Practices on Residential Land Use in Ipinsa Town, Akure, Nigeria. *International journal of Education and Research*, 1(7).

Jackson-Smith, D., Eric, J. and Brian, J. (2006). "Changing land use in the rural intermountain west." Pp. 253-276 in *Population Change and Rural Society*. W.A. Kandel and D.L. Brown Dordrecht (Editors). The Netherlands: Springer.

Jia, X. and Richards, J.A. (2006). *Remote Sensing digital image analysis, an introduction*. Taylor and Industrial Arts.

Lopez, T. D. Mitchell, A. and Thomlinson, J. R. (2001), Urban expansion and the loss of prime Agricultural lands in Puerto Rico, Ambio. *A Journal of the Human Environment, 30*(1) 49-54.

Lu, Q., Liang, F., Xiaoli B., Duffy F., Zhao, Z. (2011). *Effects of urbanization and industrialization on agricultural land use in Shandong Peninsula of China. Yantai Institute of Coastal Zone Researches*. Chinese Academy of Sciences, Yantai City, Shandong Province, China Western Illinois University, Macomb.

Organisation for Economic Co-operation and Development, OECD (2000), Agriculture and Biodiversity, Developing Indicators for Policy Analysis.

Travis, W.R. (2007). *New geographies of the American West: Land use and the changing patterns of a place*. Washington, DC, Covelo, London: Island Press.

Zubair, O. (2006). *Change detection in landuse and landcover of Ilorin and its environs using remote sensing and GIS, 1972-2005*. An Unpublished M.Sc Dissertation, Department of Geography, University of Ibadan.