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ASSESSMENT OF THE IMPACT OF URBANIZATION ON AGRICULTURAL LAND USE IN BILLIRI LOCAL GOVERNMENT AREA, GOMBE STATE, NIGERIA

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Abstract

The aim of this research is to assess the impact of urbanization on agricultural land use in Billiri local government area of Gombe state. The study employed both primary and secondary data. A 17-item questionnaire was used to elicit information from 156 participants on issues relating to urban growth and housing. The Statistical Package for Social Science (SPSS) program was used to analyze the acquired data, which were presented using frequency tables, percentages, bar graphs and pie charts.Satellite imagery was classified using supervision classification Algorithim in the ArcGIS 10.6 environment and five classes of landuse considered using Andreson (2007) classification scheme. The classes considered are, Baresurface, vegetation area, Agricultural area, Water bodies and built up areas respectfully. Result of the analysis showed that Agricultural activities is the major occupation of the people of study are and build-up area accounted for 99.0% to the variance in changes of agricultural land use and displayed a strong negative contribution of -11.977 to variation in Agricultural land use over the years. The result also showed that Agricultural land use has a strong negative relationship of -0.995 at p=0.063 with build-up area. Hence, the study suggests the need to control urban encroaching into agriculture land as this will have serious repercussion on food production. Although urban expansion cannot be stopped, with proper management and planning it can be directed in a desirable and sustainable way. Further studies should explore the impact of urbanization on housing, health and sanitation.

Keywords: Assessment, Agriculture, Expansion, Impact, Landuse, Urbananisation,

1. Introduction

Urbanization is a reference to population shift from rural areas to urban areas. It also means the reduction in the percentage or proportion of people living in rural areas, and the ways in which societies adjust to this variation (Tacoli 2015). The term urbanization is also used for the expansion of urban land uses, a shift in settlement patterns from dispersed to denser settlement. Agricultural production on the other hand is a series of activities, production processes that result in agricultural product that will ultimately be sold to sustain or enhance human life (Chait 2019). Today, agriculture provides the livelihoods for around the world one-third of the world's lab our force and generates 2-3% of global value added although this is misleading in that a

significant proportion of industry and services are related to the production, processing, distribution and sale of food, and other agricultural products. In addition, the figure might be higher if the value of food produced by rural and urban dwellers for their own consumption (Satterthwaite 2007).

Past studies of the bioshpere estimate that about one-third to one-half of the earths land surface has been transformed by human activities (Malik and Ali, 2015). Recent studies have shown that urban development is taken place on the most fertile and productive lands. Several studies (Eduardo, Abrantes, Banos,Rocha and Buxton, 2018; Sabyasachi and Rani, 2018; Bandhu and Teufel, 2017; Iheke, Raphael and Ihuoma, 2015) have shown that there has been a decline on agricultural production in the rural area due to the growth of urbanization and high level of rural to urban migration.The food security and the loss in the agricultural products is the most distinct impact of the wide spread expansion of the activites in both rural and urban areas (Rabia and Maisam, 2015). However, the results of these studies seem to be over generalised and failed to address the direct effects of urbanisation on agricultural production especially interms of loss of agricultural land and food security. Moreover, from existing literature available to the researcher, no comprehensive study has been carried to examine the relationship between urbanisation and agricultural production in Billiri LGA. The aforemetioned motivated the need to examine the effects of urbanisation on agricultural land use in Billiri LGA of Gombe. Specifically, the study sought to:

i. examine the socio-economic characteristics of the respondents of the study area.
ii. assess the land use/land cover change in the area from 1988 to 2018
iii. identify the factors responsible for decrease in Agricultural land use.
iv. examine the effects of urbanisation on agricultural land use in the area.

2. Study Area

Billiri Local Government Area is situated in the present Gombe State of Nigeria. It lies south of Gombe. Between latitude 9^0 41'30''N to 9^0 57' 50"N and longitude 11^0 01'00''E to 11^0 15' 40"E. (GIS Analysis 2019).

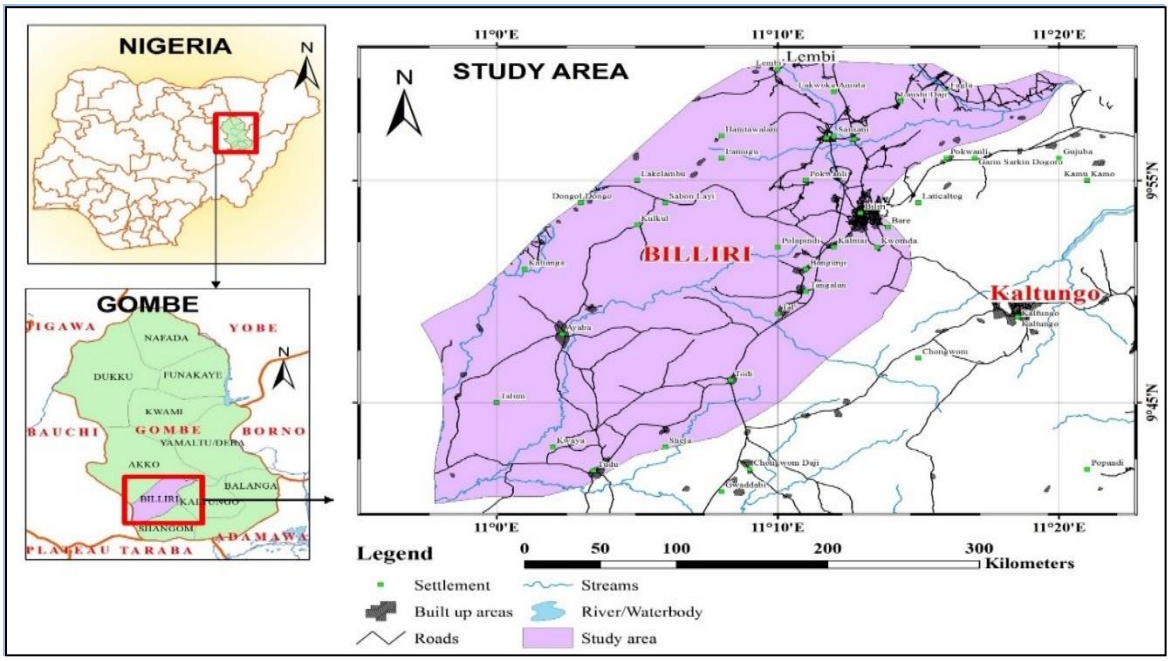

Figure 1: Study Area
Source: Modified from GIS and Remote Sensing Laboratory, Gombe State University, Gombe.

The major towns and villages in study area include Billiri (also known as lawisshi Biliri), the headquarters of the present Billiri Local Government Area council, Kalmai, Banganje, Tanglang, Tal, Todi, and Tudu Kwaya all in the above Local Government Area. Other notable settlements in the geographic location under reference include; Biliri-kufai, Komta, Pokwangli, Sikkirit, Lasale. Belfebe (Sansani), Kalindi, Lakwene, Lawisshi-lokorok, Pissi-ukko, Pagla, Pobdo, Lawilthew, Ladongor, Antawalam, Pobawure, Lawurkondo, Lamugu kulkul, Ayaba. Kolokk wannin. Lalaipitho, Pandi-kungu, kwi-bwa, Tangji. La-kwalak e.tc. Gwani (1999). The people of Billiri LGA speaks Tangale language. A sizable number of other language groups, which include, the Wurkun, Waja, Hausa, Fulani, Tula and Kanuri are found in the Local Government. (Ankruma, 2005). Billiri in terms of infrastructural facilities, most of the major villages or towns are link with a road (tarred). However, most villages do not have good road connection. They have hospitals, schools, commercial areas, Administrative areas, boreholes, roads etc.

3. Methodology

The data used for this study include; Data on socio-economic characteristics of the respondents, landuse/landcover change from 1988 to 2018 and factors responsible for decrease in Agricultural land use. All the primary data were collected through interview, personal observation and distribution of questionnaire, while secondary data were sourced from glovis.usgs.gov and National Population Commission Gombe, Gombe state, Journals and Satellite Images. The satelite data characteristics are presented in Table 1.

Multi-stage sampling technique was used for the study. Firstly, cluster sampling was used to divide Billiri LGA into three based on geographical zones of North, Central and South respectively. Secondly, purposive sampling was used to select six wards already identified as having predominant farming activities (two wards per zone). Thirdly, systematic sampling technique was used to select actual settlements from which respondents were drawn.

To obtain the sample size, population of the communities was projected to 2018 using exponential formula;

Population= (P_{t+n}= $P_t e^{r*n}$) - - Equation 1

Were; P_{t+n} = Population at the future date (2018), P_t = Base year population (1991), e = exponential, r = Growth rate (3.2%), n = interval between the base year and the future year (2018-1991= 27).

Yamane (1967) formula was used to calculate the sample size.

$$SS = \frac{N}{1+N(e^2)} \quad - \quad - \quad \text{-Equation 2}$$

Where, SS= sample size, N= Population size, e = sampling error of 0.08 significant level). The above formula was used to obtain 156 as sample size for the study.

To determine the proportion of respondents per unit area (community), Yamane (1967) was also used; $\frac{n\ X\ SS}{N}$ - - -Equation 3

Where n = population of each community, ss = sample size, N= Total population of selected the communities.

Satelite data characteristics and sources are shown in Table 1.

Table 1: Satelite data Characteristics and Source

Data type	Year	Number of Scene	Path & Row	Resolution	Source
Landsat 4 (TM)	1988	1	p186, r053	30m	USGS
Landsat 7 (ETM)	2003	1	p186, r053	30m	USGS
Landsat 8 OLI	2018	1	p186, r053	30m	USGS

Source: Fieldwork, 2019.

Descriptive statististics such as the mean, tables and graphs were used to present data on socio economic characteristics of the respondents and factors of ubanisation. In addition, supervision classification was used to classified the area into five classes of landuse/landcover as also considered by Andreson (2007). The classes considered were baresurface, Forest, Grassland, water bodies and built-up area. In other to determine the effect of urbansation on Agricultural landuse, forest and grassland were considered to be agricultural land area based on the fact that the areas support the growth of plants, while built up areas were used to measure the rate of urbanization. Correlation and Regression analysis was used to examine the effects of Urbanisation on agricultural land area with the help of Statistical Package for Social Science (SPSS).

$$r = \frac{\sum xn/n - \overline{xy}}{\sqrt{(\sum x^2/n - \overline{x^2})(y^2/n - \overline{y^2})}} \quad - \quad - \quad - \quad \text{Equation 4}$$

Where: r = Correlation coefficient, X = Build-up Area, and Y = Agricultural land Area.

$Y= a+b_1x_1$ - - - Equation 5

Where: Y = Agricultural Land Area, X_1 = Built-up Area, and a and b are constant.

4. Results and Discussion

4.1 Socio-economic characteristics of respondents

Regarding the sex distribution of respondents Table 3 shows that 70% of the respondents are males while 30% are females. This is based on the fact that in urban areas males tends to outnumber females because of factors such as internal migration of males from rural areas in search of job opportunities as validated by UNESCO (2008); Agesa (2003). In reference to age of the respondents, the results revealed that, majority of the respondents are youths. This is explainable by the high rate of migration of youths from rural to urban areas owing to pull factors such as better job opportunities, further education and access to improved medical facilities. Information on the educational qualification of respondents on the other hand indicates that literacy level of the respondents in the study area is relatively high based on the facts that, majority of the respondents (49%) have secondary school qualification. Result on the occupation of the respondents revealed that, most of the respondents (41%) were farmers, which clearly showed that farming is the major occupation in the study area. Following the result obtained, it is clear that majority of the respondents are male and are mostly engage farming activities which clearly implies that, any activity that can affect agricultural land either directly or indirectly will also affect the inhabitant of the area.

Table 2: Socio Economic and Demographic Profile of Respondents.

	Variables	Percentage
Sex	Male	70.00
	Female	30.00
Age	Less than 20	7.00
	20 – 30	32.00
	31 – 41	29.00
	42 – 52	21.00
	Greater than 52	12.00
Education	Primary	7.00
	Secondary	41.03
	Tertiary	49.00
	Informal	3.03
	None	0.00
Occupation	Civil Servant	33.00
	Farming	41.00
	Trading	19.03
	Others	7.03

Source: 2019 Fieldwork.

4.2 Land use/land cover changes

Table 3 and figure 2 present the land use/land cover areas in the LGA, following the result obtained from the field, it is clear that vegetation cover area (Forest and Grassland) decreased with increase in years. In 1988, the total land area for agricultural activities covered about 90% of the study area, which clearly suggested that agricultural land area was large in that year. Contrariwise, agricultural land area in 2018 reduced to about 53%, which clearly showed that almost one-fourth of agricultural land area (26%) was converted into another different land use type. Another land cover that showed a similar pattern with agricultural land area was rock outcrop, which covered a total land area of 28.46km^2 in 1988 but was reduced to 23.16km^2 in 2018. This implies that some parts of rock outcrop was also converted to another land use such as built-up. Results of the built-up area showed a different pattern where the total land area increased with respect to time. The total land area decreased by 2.34%, which clearly revealed that, built-up areas have overtaken other land uses.

Table 3: Land Use/Land Cover 1988 to 2018

Classes	1988		2003		2018	
	Area	%	Area	%	Area	%
Forest	389.87	50.37	304.86	39.39	190.15	24.57
Grassland	307.93	39.79	368.54	47.62	297.72	38.47
Built up	15.12	1.95	19.01	2.46	33.24	4.29
Bare surface	32.59	4.21	55.67	7.19	229.72	29.68
Rock outcrop	28.46	3.68	25.9	3.35	23.16	2.99
Total	773.97	100	773.98	100.00	773.98	100.00

Source: Author's Analysis (2019)

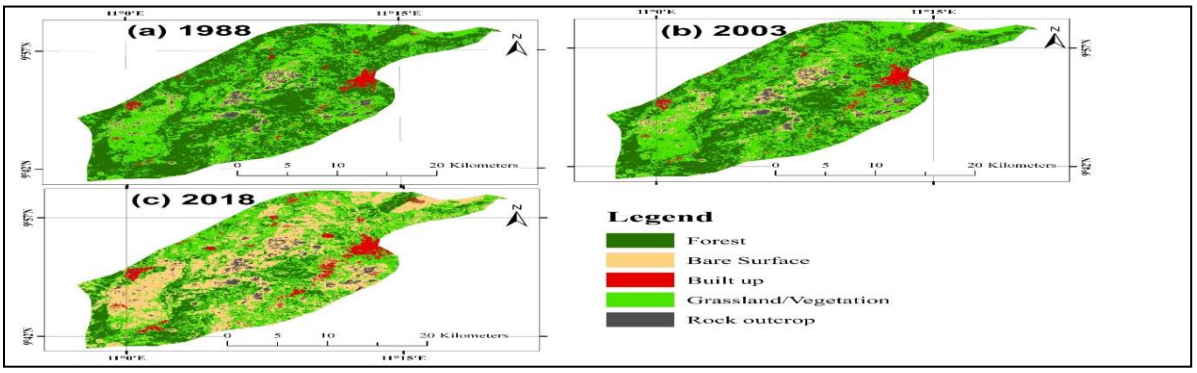

Figure 2: Land use/land cover map from 1988 to 2018
Source: Author's Analysis

4.3 Factors responsible for reduction in agricultural land use

Table 4 present the view of the respondents on the factors accountable for the reduction in agricultural land use in the study area. Result of the analysis revealed that majority of the respondents (83%) believed that population increase is the factor that contributed to reduction in agricultural land use while 10% believed that migration is the factor for agricultural land reduction. Following the result presented in Table4, it is clear that population increase by either birth or migration is the major factor responsible for reduction in agricultural land area; it also implies that increase in population leads to increase in urbanization.

Table 4: Factors Responsible for Reduction on Agricultural Land use

	Percentage (%)
Population	83.00
Commerce	7.00
Migration	10.00

Source: 2019 Fieldwork

4.4 Effects of Urbanisation on Agricultural land use

Table 5 presents the effect of built-up areas on agricultural land use and the result showed a statistically F-value of 101.632 at p=0.063 and built-up area accounted for 99.0% of the variance or changes in agricultural land use (R^2= 0.990, Adjusted R^2 = 0.981). Build-up areas showed a strong negative contribution of -11.977 variation in Agricultural land use over the years. This negative contribution suggested that a unit increase in build-up area would lead to a decrease in agricultural land use with 11.977. In addition, the 99% contribution of the built-up areas to Agricultural land use signifies that availability of Agricultural land use is strongly determined by the size of built-up areas in the LGA. In the same vein, result of the relationship between built up areas and agricultural land area presented in Table 6 showed a strong negative relationship of -0.995 at p=0.063 which clearly suggested that as built areas increased, the agricultural land area decreased and vice versa . This analysis agreed with the leading view of the respondents (73%) presented in Table 7 that urbanization is the cause of the reduction in agricultural land area. This by implication suggests that majority of the respondents in the study area attributed the decrease in agricultural land area to population increase. The preceding analysis is validated by Eduardo et al., 2018; Sabyasachi and Rani, 2018; Bandhu and Teufel, 2017; Iheke, Raphael and Ihuoma, 2015 who affirmed that urbanization played a very significant role in reducing agricultural land area.

Table 5: Regression result between Agricultural Land use and Build-up Area

Model	Un-standardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
(Constant)	888.653	28.240		31.468	.020
Build-up land	-11.977	1.188	-.995	-10.081	.063

Source: Author's Data Analysis

Table 6: Correlation between Agricultural Land use and Build-up Area

		Agricultural Land Area	Build-up Area
Agricultural Land Area	Pearson Correlation	1	-0.995
	Sig. level		0.063
Build-up Area	Pearson Correlation	-0.995	1
	Sig. level	0.063	

Source: Author's Data Analysis

Table 7: Respondents' view on the effect of Urbanization on Agricultural land use

	Percentage (%)
Strongly Agreed	50.00
Agreed	23.00
Undecided	10.00
Not Agreed	17.00

Source: Fieldwork 2019.

5. Conclusion

With regards to the result of this study, it was concluded that agricultural activities is the major occupation of the people of the area and the land area for agricultural practices is reducing while built-up area is increasing with respect to time. It was also concluded that population increase either by birth or migration is the major factor responsible for reduction in agricultural land area implying that increase in population leads to increase in urbanization. The study also concluded that built-up areas contributed significantly to the reduction in Agricultural land use and displayed strong negative relationship with the agricultural land use.

6. Recommendations.

In view of the rate of development that is going on at present and the likely ones in the future, the following are therefore, recommended:

i. Population influx has been attributed to urban expansion in the study area especially from the surrounding rural areas. Hence, adequate social amenities should be incorporated into rural planning framework to improve living conditions in the rural areas so that the rate of emigration will be reduced and thereby checking the expansion of the city on agricultural land.

ii. There is need to control urban sprawl on agricultural land, as this will have serious repercussion on food production. Although urban expansion cannot be stopped, with proper management and planning it can be directed in a desirable and sustainable way.

iii. Remote Sensing and GIS techniques should be incorporated as a monitoring system, which will enable planners and decision makers to adequately plan and control urban expansion effectively in a spatiotemporal dimension.

iv. All stakeholders in the study area should take proactive measure towards a better understanding of the changing pattern of land use of the area to be better equipped in order to manage various environmental challenges that might be associated with urban expansion.

v. Impact of population growth and urban expansion on agricultural land is a continual phenomenon; this research is therefore not an end to the issue of loss of agricultural land to urban expansion. Further studies into spatiotemporal pattern of urban expansion and the resultant environmental effects are recommended

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