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ASSESSMENT OF URBAN LANDUSE EXPANSION ON AGRICULTURAL LAND IN KWADON DISTRICT OF YAMALTU-DEBA LOCAL GOVERNMNT AREA, GOMBE STATE

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Abstract

The study sought to evaluate urban landuse expansion on agricultural landuse in Kwadon District. The information derived for this study was mainly through field survey, oral interview, questionnaire administration and imageries from Google earth from 1999 and 2015. The geo-referenced Google earth image of the area was digitized (on-screen) using ArcGIS 10.4.1 version. The GIS analysis result for change detection over landuses for the time period of 1999 to 2015 was a decrease in agricultural land from 49.31% to 34.22%, while built-up area increases from 9.04% to 25.58%. The study revealed the causes of the expansion which were population growth, migration and developmental project. It also revealed the dominant activities that took over farmlands in the area, included residential, commercial and semi-industrial uses among others. The study also revealed that reduction in crop production, loss of farmlands, changes in type of crops grown, which lead to food insecurity, are the effects of landuse expansion on crop production. Hence, farmers developed the following strategies; intensification of the use of remaining farmland, engaging in off-farm activities, changing crops grown and acquisition of new farm plots. The study recommended that an appropriate planning and zoning should be adopted with impact studies and scenarios, in order to protect agricultural lands from urban landuse encroachment.

Keywords: Landuse, Landcover, Kwadon, Encroachment, Satellite, Image

Introduction

Land is an important national resource for agricultural production and other developments. Despite the tremendous changes in socio-economic and technological development all over the world in recent decades, agriculture still remains a crucial sector in human endeavour. In Nigeria, over 80% of the populations were engaged in agriculture before the discovery of petroleum, either on part time or full basis (Baker, 2008). According to Adindu and Ogbonna (2003) and Ekpenyon, 2008), the conversion of agricultural land to urban landuse activities is a potential threat to agricultural production. Agriculture is in direct conflict with the process of urban expansion in the immediate hinterland (Josiah, 2003 and Simon, 2004). This has been as a result of population increase and migration into the hinterland in large numbers, as they require land for the provision of public utilities, services and residential activities. The implications include reduced farm plots size, reduced fallow period, changes in traditional farming system, changes in land tenure system, changes in crops grown, changes in value and culture, land speculation and increase land prices, conflict within the family, land degradation and loss of soil fertility, distances location of new farms from road and residences, trespass on land, farm fragmentation, increase in services costs and general disruption of rural communities (Dami, et al; 2011).

The population of Gombe town was estimated to be over 399,761 (National Population Commission, 2010). This change in population size implies pressure on agricultural land surrounding the state capital. Statistics from the state's Ministry of works show that from 2000 to 2010, a total of 290.8km of new roads have been constructed while over 302.60km has been planned for construction in the

next eight years. Housing development to accommodate the demands of increasing population is also taking large portion of agricultural lands. Available data on land use statistics from the Ministry of Land and Surveys, Department of Town planning Gombe indicate that urban landuse have changed dramatically in the last two decades. For instance from 1991-2010, over 4,772 hectares of peripheral agricultural lands have been approved for conversion to residential use by relevant authorities, 607 hectares was approved for commercial uses, over 90 hectares of agricultural land have given way to industrial use. These expansions into peripheral agricultural lands reduced the spatial extent of agricultural land and fragment them into smaller patch sizes of less than 1 hectare.

Kwadon district in historical perspectives was a rural community, with abundant agricultural land. Over the years, the area has experienced changes in its landuse type resulting to increasing competition for agricultural land and settlement. And the area is experiencing changes in its characteristics from rural settings to urban characteristics due to increasing expansion of Gombe town to the extent that one hardly differentiates the boundary between them. It is against this statement that the researcher seeks to assess urban landuse expansion on agricultural land in Kwadon district of Yamaltu – Deba LGA of Gombe State.

Aim and Objectives of study

This research aimed at assessing rate of urban landuse expansion on agricultural landuse in Kwadon district of Yamaltu-Deba Local Government Area of Gombe State.

The specific objectives are:

i. to classify landuse/landcover of the study area from 1999-2015.
ii. to find out the causes and the major urban landuses encroaching on agricultural land in the study area.
iii. to find out the effects of landuse expansion on agricultural production in the study area.
iv. to determine the way farmers respond to the conversion of agricultural landuse to urban landuses in the study area.

The Study Area

Kwadon district is an area within Yamaltu-Deba local government area of Gombe State. It lies between latitude10^0 00^1N to 10^0 30^1N and longitudes11^0 11^1E to $11^0$45E respectively. The study area is located about 7km away from the state capital, along Gombe Biu-road. (See Fig.1)The area under study is part of extreme tropical continental type of climate. One of the basic characteristics of this climate zone is its relative short rainy season and a comparatively long dry season. The beginning and the end of the rainy season changes from year to year. It usually begins in late April to early May and ends in late September or early October. The area has a rainfall distribution ranging from 970.7mm to 1,142mm annually, with a mean of 850mm and a mean maximum and a mean minimum temperature of 32.8^0 c and 18.3^0 c respectively.

The relief of Yamaltu Deba L.G.A comprises part of the upper Benue trough of northern Nigeria. The plain has generally undulating characteristics especially towards the northern part of kwadom where the height of the area is estimated to be 274m above sea level. The area is drained by Wango stream through Kwadom, Zambuk down to Dadin-kowa which is a tributary to River Gongola. The soils are shallow to deep loamy, sandy, clay, vertisols and cracking clay that have weathered and are very fertile and support intensive agriculture. The soil of the study area is developed on the sand stone parent material (Gombe sandstone). The vegetation of the area is Sudan savannah, most of the forest cover in the area has been reduced to semi desert shrubs. The inhabitants of kwadom are predominantly farmers who depend on this activity for their livelihood inherited from their fore fathers.

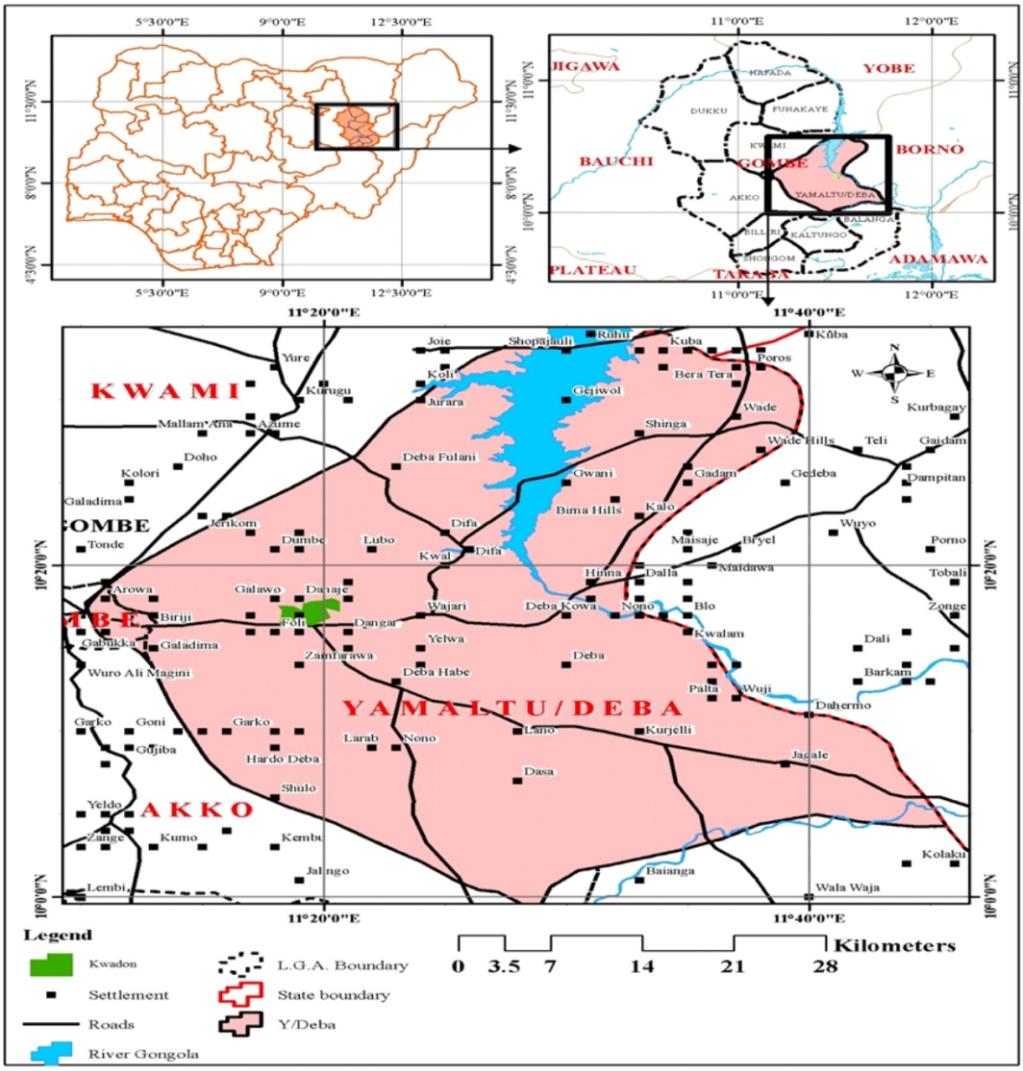

Figure: 1: Kwadon District the study Area in Yamaltu –Deba LGA
Sources: National Centre for Remote Sensing (NCRS) Jos, (2017)

Materials and Methods

Sources of Data

The sources of data used include both primary and secondary sources. The primary data used for this study included field observation, and administration of questionnaires to residents and farmers (farmers association of Kwadon). The secondary data was sourced NCRS, Jos where two sets of satellite imageries of kwadon (1999 and 2015) were obtained.

Tools and Equipment

i. Computer hardware and related accessories like mouse, printer etc

ii. ArcGIS 10.41 Software: This was used basically for digitizing the base map, development of Landuse landcover classes and subsequently for change detection analysis of the study.

iii. Hand held GPS (Germin): For taking coordinates of the study area.

iv. Topographic Map: This map was used to delineate the study area and extract settlements information in the study area. It was obtained from National Centre for Remote Sensing.

v. Satellite Images: Satellite images of 1999 and 2015 were obtained. These images were used to generate the land use and land cover information within the study area between1999-2015 was obtained from Google earth.

vi. Information obtained from farmers, farmers association in Kwadon was through a well-structured questionnaire and focus group discussion.

Sampling Technique

A purposive sampling technique was used. The reason for choosing purposive sampling is to avoid contact with non affected areas and non interest groups that lacked knowledge about the subject matter. Thus, the study only focuses on the areas and the farmers that are seriously being affected by the stated problem. A total of sixty (60) questionnaires were administered. The questionnaire has three sections. The first section seek for the Demographic, social and economic characteristics of the respondents; the second section seek for the characteristics of their previous and present farmlands, while the third section seek for the information on the effect, adjustment/ adaptation strategies employed by the farmers.

The data collected from were analyzed using descriptive method such as the use of tables, percentages, charts and graph. While satellite imageries of kwadon district were analyzed using ArcGIS 10.4.1 by screen digitization, editing of the various layers and colour composite to enhance major landuses change between 1999 and 2015 in GIS/Remote Sensing Laboratory Geography Department, Gombe State University.

Results and Discussion

Land use land covers classification map.

The spatial growth or expansion in other land cover types is directly taken place on the agricultural land as indicated by been the land cover type with significant decrease in area coverage for the period under study. The figures 2 and 3 are the Landuse/Landcover maps of kwadon derived from the satellite imageries of 1999 and 2015 respectively that showed different landuse classes of the study area as they appeared in these years.

Land use land covers classification analysis

This characterizes the landuse and land cover class of Kwadon over sixteen years in Hectares and percentage. Table 1 shows the total area covered by each features in hectares and their respective proportions (in percentage). It also reveals the percentage of changes of land cover types that occurs in the area between the given periods. A negative percentage change indicates loss of land cover/landuse type. From the analysis, between 1999 and 2015, farm lands were decrease /lost by 15.09%, bare surface by 0.66%, Vegetation by 0.79%, while built up areas increased by 16.54%.The implication of this is that, it will lead to reduction of farmlands and farming activities which will also lead to food insecurity to the community, state and the entire country at large.

The areal extent of land cover in kwadon as illustrated in figure 4 below. In 1999, the area is covered mostly by farmland while in 2015, bare surface is the dominant land cover followed by buildup and vegetation.

The result in Figure 5 indicated that farmlands have a negative change between 1999 and 2015. That is, large proportion of farmlands was lost within the 16years period covered by the study. It was also observed that the areas covered by built up increased greatly which has implication on livelihood and food security.

Types of urban Landuse encroaching on agricultural land

Table 3, reveals that the majority of the landuse encroaching agricultural land are residential with 36.7% and commercial uses with 28.35% constituted the two dominant urban landuses encroaching on agricultural land in kwadon district while the rest being minor ones. This indicated that from now to 100years to come farmland will be continue reducing drastically which will lead to the shortage of food.

Farmers Affected by Encroachment

Information provided by sampled farmers on the number of farmers affected and non- affected by encroachment shows that about 68.3% of the sampled farmers were affected by the encroachment while only 31.7% were not affected (Table 4). The farmlands of some affected farmers are located close to the central market of the district, which will force them to go farther away to new farm plot which will require more time, energy and cost of transportation.

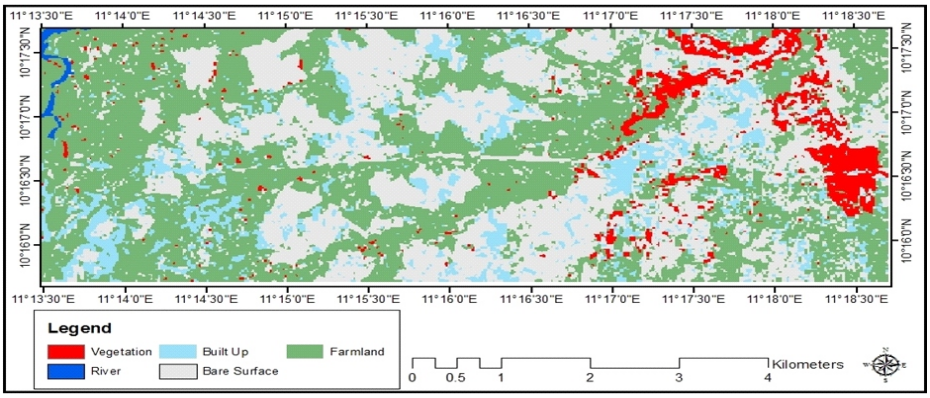

Figure 2a: Landuse/Land cover Classification of Kwadon district as at 1999 satellite imagery
Source: Field/GIS Lab. GSU (2017)

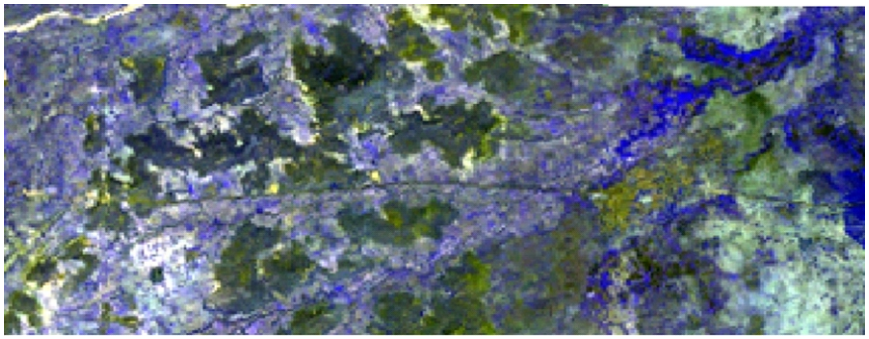

Figure 2b: Satellite image of Kwadon district as of 1999. *Sources: Google Earth 1999*

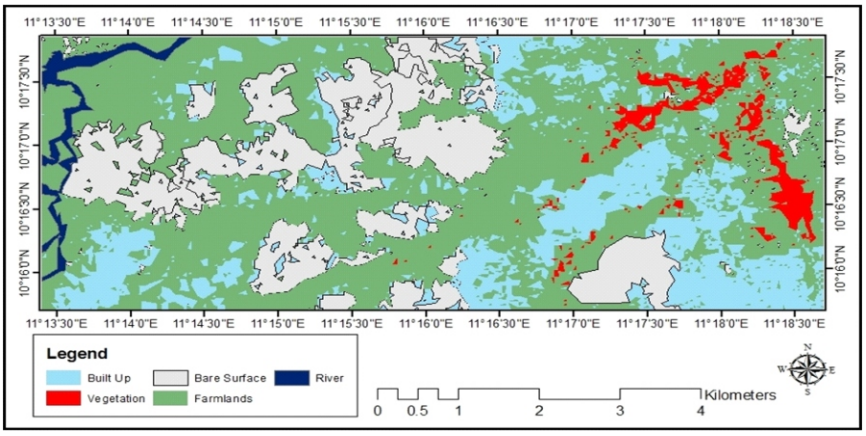

Figure 3a: Landuse/Land cover Classification of Kwadon district as at 2015 satellite imagery.
Source: Field/GIS Lab. GSU (2017)

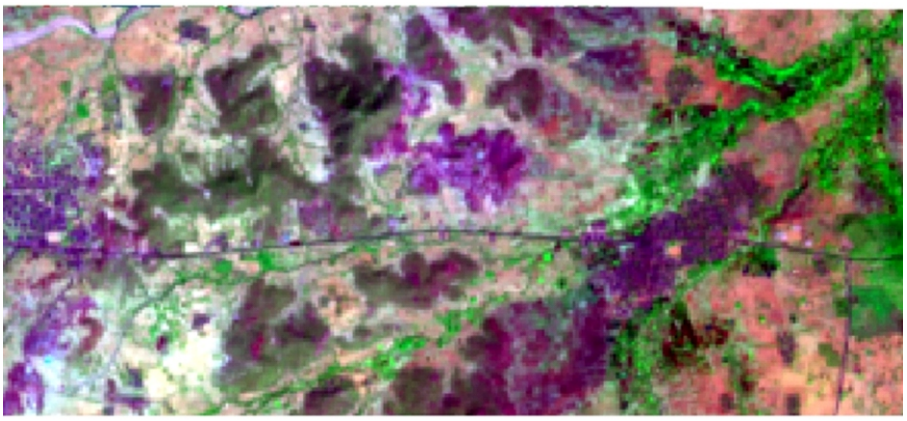

Figure 3b: Satellite image of Kwadon district as at 2015. *Sources: Google Earth 2015*

Table 1: Changes in land cover / landuse pattern between 1999 and 2015

Landuse/landcover	Total Area (Ha)		Total Area (%)		Change (%)	Years
	1999	2015	1999	2015		
Vegetation	513.82	408.75	3.84	3.05	- 0.79	16
Build up	1,210.23	3,424.23	9.04	25.58	16.54	16
Bare surface	5,062.16	4,974.36	37.81	37.15	- 0.66	16
Farmland	6,602.43	4,581.3	49.31	34.22	-15.09	16
Total	13,388.64	13,388.64	100	100		

Source: Field/GIS Lab. GSU (2017)

Table 2: Landuse classes description.

CODE	LANDUSE/LANDCOVER	DESCRIPTION
1	Farmlands	Agricultural Lands used for farming (plantation, cropland orchard)
2	Built-up land	Lands used for residential, industrial, commercial, etc.
3	Vegetation	Lands covered with natural and man made vegetation (any plant species)
4	Bare surfaces	Lands devoid of vegetation, exposed soil

Source: Field/GIS Lab. GSU (2017)

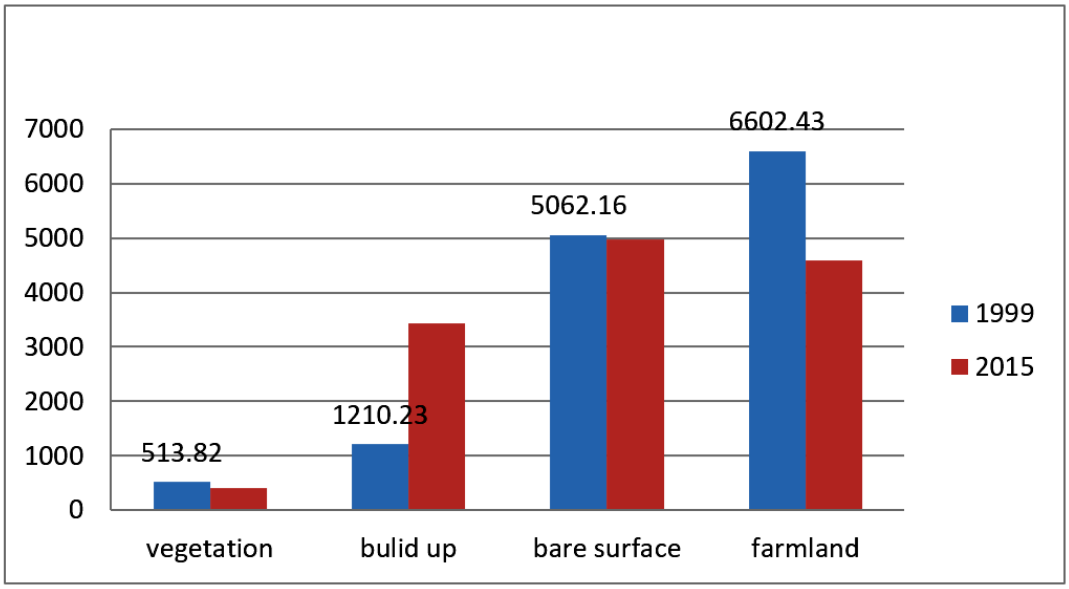

Figure 4: Areal extent of land cover in hectares
Source: Field work (2017)

Consequences of urban landuse expansion on agricultural production

Table 5, reveals the consequences of urban landuse expansion on agricultural production which include loss of farm land with 43.33%, reduction in crop produce with 40%, and changes in crop grown with 16%. This shows that agricultural lands are being threatened, as farm land size and crop production were drastically reduced thereby threatening food security of the people of kwadon and the state in general.

Adjustment/adaptation strategies employed by the farmers

Figure 6 reveals that farmers employed one or more response strategies. It also revealed that the most prominent response options adopted by the farmers are acquisition of new farm plots, intensification of the use of remaining farmland, engaging in off-farm activities and changing crops grown due to variation in soil fertility.

Acquisition of new farmland in farther rural areas

One of the forms of response adopted by the affected farmers is to acquire new farm plots in the outlaying rural areas. 35 respondents representing 58.3 % of those, whose farmlands suffered from encroachment, have acquired new farmland elsewhere. Information provided by them on locations and size of new farms is summarized in Table 6 and 7 respectively.

From Table 6, 34.3% of farmers acquired new farmlands within a distance of less than 2 kilometers; about 48.6% acquired new farmland within distance 3-5 kilometers while the rest acquired new farmlands were located above a distance of 5 kilometers. The implication of this is that the affected farmers require more energy, time, money and effort to reach their post-encroachment newly acquired farmlands.

Table 7 shows that more than 68.6% of the respondent had new farm size less than 2 hectares, 22.9% had new farms ranging from 2 -5 and only 8.6% had new farm plots whose sizes are above 5 hectares. This shows that urban expansion has displaced farmers of their farmland and acquired few hectares due to competition and high cost of acquiring new farmland.

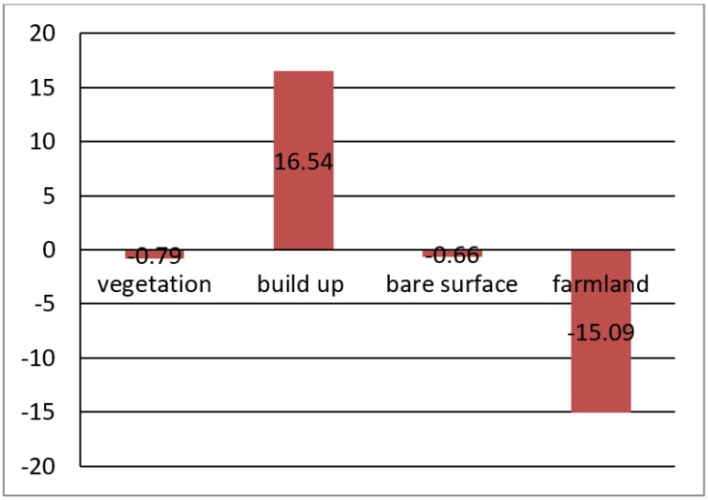

Figure 5: Percentage Change in landuse/landcover
Source: Field work (2017)

Table 3: Types of urban Landuse encroaching on agricultural land

Type of urban landuse	Frequency	Percentage (%)
Residential	22	36.7
Commercial	17	28.3
Educational	6	10
Medical	4	6.7
Religious	3	5
Industrial	8	13.3
Constructional	0	0
Recreation	0	0
Total	60	100

Sources: Field survey, June, 2017

Table 4: Distribution of Affected Farmers by Urban Encroachment

Category of farmers	Frequency	Percentage (%)
Affected farmers	49	68.3
Non-affected farmers	11	31.7
Total	60	100

Source: Field work 2017

Table 5: Consequences of urban landuse expansion on agricultural production

Effects	Frequency	Percentage (%)
Reduction in crop production	24	40
Loss of farmland	26	43.33
Changes in crop grown	10	16.66
Total	60	100

Source: field survey, June, 2017

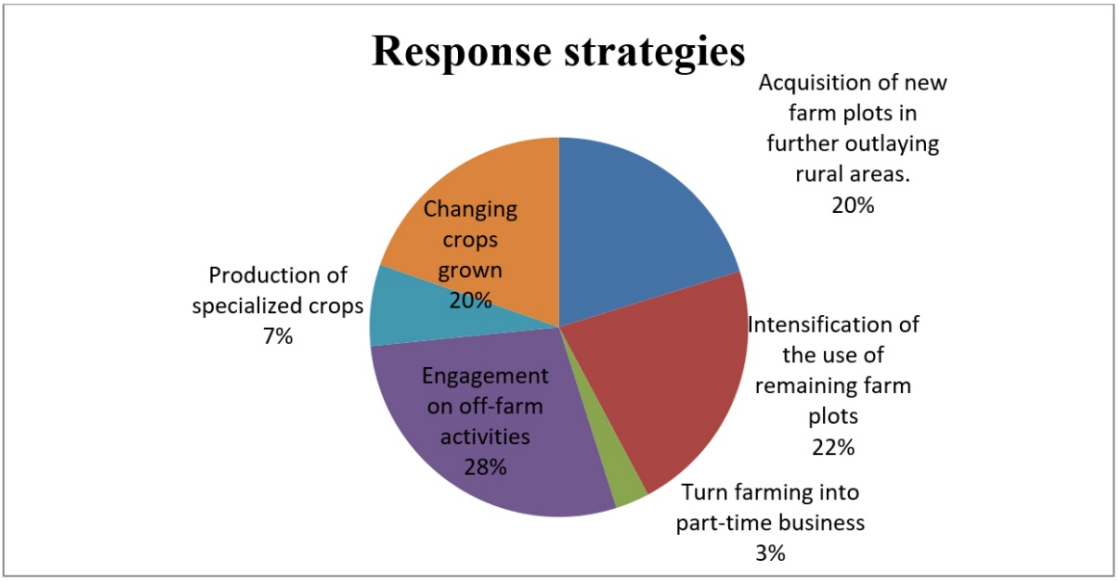

Figure 6: Adjustment/ Adaptation Strategies Employed by the Farmers
Source: Field Survey, June, 2017.

Intensification of the use of land

Another strategy employed by the farmer to cope with the encroachment was using the remaining farmland intensively through application of fertilizer/ manure, pesticide, herbicide and adoption of crop rotation and mixed cropping system and planting of improved seed varieties.

Figure 7 indicated that application of fertilizer and adoption of mixed cropping system constituted two commonest measure employed by farmers in intensification use of the remaining farmland. While more than 50% of the 49 respondents used at least one of the following measures of manure, herbicides, improved seed and crop rotation.

Off-Farm activities of affected farmers

Another important measure adopted by affected farmers is to engage on off-farm activities. This group of farmers combined farming and off-farm work in order to supplement their farm incomes as indicated in Table 8. However, the three most important activities of those respondents are petty trading, labour work and motorcycle riding.

Table 6: Location of new farms plots.

Distance from residence (km)	Frequency	Percentage (%)
<2	12	34.3
3-5	17	48.6
>5	6	17.1
Total	35	100

Source: field survey, June, 2017

Table 7: Size of newly acquired farmland

Farm size (Ha)	Frequency	Percentage (%)
<2	24	68.6
2-5	8	22.9
>5	3	8.6
Total	35	100

Source: field survey, June, 2017

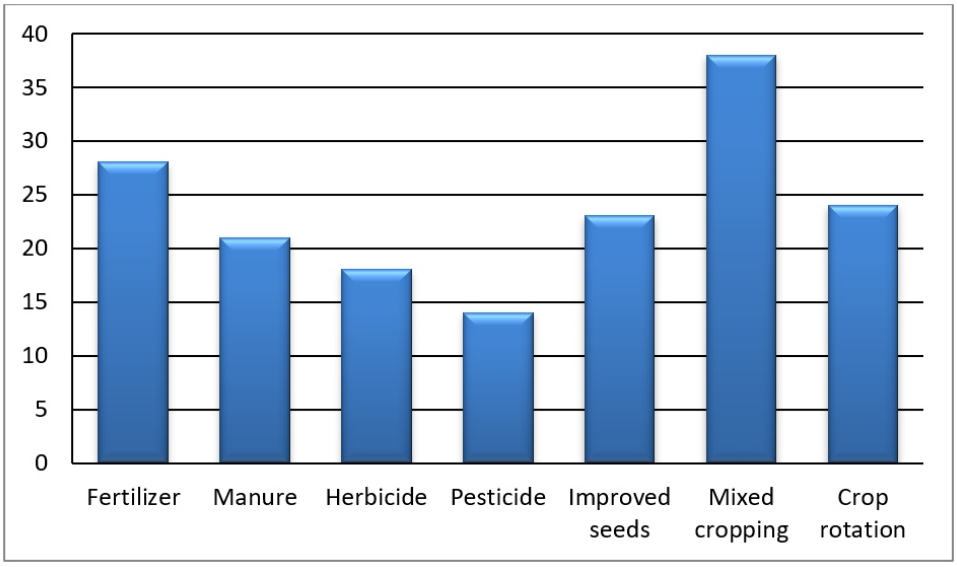

Figure 7: Measures of intensification use
Source: Field survey, June, 2017

Table 8: Off-farm activities of farmers in the study area

Type of off-farm activities	Frequency	Percentage (%)
Petty trading	11	22.4
Labour work	19	38.8
Blacksmith	4	8.2
Okada	9	18.4
Bicycle mechanic	2	4.1
Barbing	1	2.0
Tailoring	3	6.1
Total	49	100

Source: field survey, June, 2017

Conclusion and Recommendations

Expansion of urban landuse into farmlands is at an alarming rate, changing large productive farmlands into builds up by displacing farming activities. Consequently, farmers are exposed to joblessness and increase food insecurity. Therefore, a lot needed to be done in adoption of an appropriate planning in order to protect agricultural lands from urban landuse encroachment. On the basis of the planning implications and findings, there should be:

1. Agricultural intensification in a sustainable manner should be encouraged as farmland is reduced and there is market for the produce.
2. Proper and adequate land capability assessment study in identifying areas that are suitable for agricultural production, residential development, commercial use, and agricultural unproductive areas suitable for other uses.

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