Article

An Assessment of Insecurity Impact on Settlements and Agricultural Landuse in Gwoza LGA, North-East, Nigeria

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Abstract: Gwoza Local Government Area (LGA) is one of the areas in North-Eastern Nigeria experiencing the debilitating insecurity challenges associated with the Boko Haram insurgence these last few years. The insecurity problem has affected local and regional food security through disruption of agricultural production, food trade, reduced investments, deterioration of land and infrastructure and displacement of large numbers of local dwellers as well as created a state of fear. This paper examines the impact of insecurity on settlements and agricultural land-use for a period of fifteen years using geospatial and participatory approach. Primary data was derived from the administration of well-structured questionnaire to Internal Displaced Persons (IDP's) in three IDP Camps, while secondary data combined Remote Sensing (RS) and Geographic Information System (GIS) to ascertain the rate of settlement and agricultural land-use change from 2002 to 2017 in Gwoza. Landsat ETM+ (2002) and Landsat OLI (2014 and 2017) images were acquired and resampled to 15m using the panchromatic band so as to identify agricultural lands more distinctly. Maximum likelihood classification algorithm in IDRISI was used to classify the image into six classes: agricultural land, built-up, rock outcrop, natural vegetation, bare ground and water body, based on Anderson classification scheme. Results reveal general decline in agricultural land and settlement areas with increasing vegetal

cover. Change detection analysis showed that, vegetated area increased by more than 30% and agricultural land reduced by 33%. Perception from administered questionnaire show that communities most affected by the crises are; Ngwoshe (38%), Gwoza (12.8%) and Gava (12.8%), with the individual loss from the conflict estimated to be between five hundred thousand to over a million naira by 63.4% of respondents. This paper reveal that Gwoza area is still dealing with loss as a result of insecurity.

Keywords: Agricultural land-use, Assessment, Gwoza LGA, Insecurity impact, Settlements

1. Introduction

Terrorism is globally becoming a household word as there is no nation that is completely absolved from its effect. Globalization has significantly influenced the spate of terrorism as the event in one part of the globe has a direct or an indirect effect on others. This explains why Horne (2002) in Rourke (2008) observed that war, terrorism and other forms of transnational political violence are in many ways more threatening today than ever before as civilian casualty has been on the increase. It is however difficult to evolve a single definition for the term "terrorism". The difficulty emanates from the lack of consensus or unified perspective among nations or scholars as to what could be regarded as terrorist act.

Today, no country or region of the world is spared as humanity is experiencing growing problems of insecurity. Worst still, in most emerging democracies in North Africa, the middle East and sub-Saharan Africa, there is a seeming combination of Insurgency and political violence and indeed poverty, with the later seriously fueling militancy and consequently insecurity across these regions and the world. Literature has re-emphasized the reality that conflicts and insecurity adversely affect agricultural production and investment through hinderance to supply of inputs and outputs, sharp change in price creating steep price margins and creating an absence of labor. In other words, there seem to be a curvilinear relationship between high level or widespread poverty and youth restiveness occasioned by terrorist groups. Militancy in North and West Africa exploded as a global issue after an international consortium of terrorists took hostage a number of gas workers in southern Algeria. In Nigeria**,** issues linked to politico-religion and widespread poverty has led to the emergence of a number of local militants that have embraced Al Qaeda type ideology. This is the case with the emergence of Boko Haram sect (which means Western Education is sin) and the Ansaru groups. These sects have unleashed a reign of terror that has rendered social, economic and political infrastructure irrelevant (Simon *et al.*, 2013). Literature reviewed by Kimenyi (2014) estimate that during periods of

conflict, agricultural production drops an average of 12.3 percent each year. Domestic agricultural production is a major source of food supplies in most low-income countries as stated by Olukayode (2015) he further narrated that armed conflict frequently has a disruptive effect on agricultural production and food availability, thus it has a direct impact on the nutritional status of children in many ways. Moreover, in some towns, water pumps were stolen by the rebels, making irrigated rice cultivation impossible (Kimenyi, 2014).

Landuse/Landcover (LULC) changes, play a major role in the study of global change. Land use/land cover and human/natural modifications have largely resulted in deforestation, biodiversity loss, global warming and increase of natural disaster-flooding. These environmental problems are often related to LULC changes. Therefore, available data on LULC changes can provide critical input to decision-making of environmental management and planning the future (Reis, 2008). Analyzing land use patterns using satellite images can provide a spatial dimension that census-based studies often lack (Gibson, 2012). Plus, freely available long-term image time series have proven effective for monitoring land cover changes caused by instability (de Beurs *et al.*, 2008). Changes to land systems over time can be caused by slow changes (e.g. urbanization or economic growth) or drastic shocks, such as sudden socio-economic, environmental and political changes or armed conflicts. Studies of armed conflicts have shown widespread land use changes through displacement and *land abandonment*, in some cases causing a reduction of cultivated land and increases in natural vegetation. For example, high farmland abandonment rates have been observed in the conflict areas of the 1991–1994 Nagorno-Karabakh conflict between Armenia and Azerbaijan (Eklund *et al.*, 2017).

Agriculture in Nigeria is the most important sector of the economy from the standpoint of rural employment, sufficiency in food and fiber, and export earning prior to the discovery of oil in Nigeria (Okechukwu *et al.*, 2014). Reduction in the production of agricultural outputs in Nigeria began with the discovery of crude oil in 1956 while commercial exploitation commenced in the early '70s. The discovery of oil in Nigeria which was supposed to be a blessing and an additional source of income to the country has become a means of distorting our economy (Adebisi *et al.*, 2017). He observed that Agricultural products which were the main exports and major source of foreign exchange earnings for the country declined suddenly. Agriculture is not limited to crop production alone. The Northerners in Nigeria also involve in animal husbandry and they have been engaged in business even before the colonial era.

The manifestation of Boko Haram recently has been a great threat to the Nigerian business environment as farming and other business activities are being harmed. Nomadic cattle herdsmen who indulge in cattle grazing has abandoned their businesses, as the environment is no longer safe for them. The lives of those that are still involved in the business are also at stake, as a result of the crises. This

has led to decrease in milk production, meat production and by extension an increase in the price of cattle. Poultry farmers also do not find their business lucrative anymore, as the people purchasing the goods have been displaced. Adebisi *et al.*, (2017) attributed the present problem of low agricultural productivity to the violence in the Northern part of Nigeria.

Despite the fact that many African countries have been affected by civil conflict and also depend on agriculture for the livelihood of their citizens, few peer-reviewed studies have examined the effects of conflict on different actors across the agricultural value chain (Mwangi *et al.*, 2014). This study is aimed at assessing the impact of insecurity associated with Boko-Haram on settlement pattern and agricultural land-use in Gwoza LGA, Maiduguri, Nigeria; so as to provide relevant information for effective decision making and food security management.

1.1. Study Area

Gwoza LGA is located in Borno State, North-Eastern part of Nigeria (Figure 1). It lies between, longitudes 13º39′12″E and13º46′7″E and latitudes 11º23′38″N and 11º1′49″N. The land area is about 2,861 km^2. It has a population of about 276,312 inhabitants. Gwoza town is the Headquarters of Gwoza LGA. It is a border town about 135 kilometers South-East of Maiduguri. The terrain is rocky and hilly. The Gwoza Hills, with heights of about 1300m above sea level provides scenery and is made up of the Mandara Mountains, which form a natural barrier between Nigeria and Cameroon, starting from Pulka. They overlook the game reserves by meandering towards Mubi and beyond in Adamawa State. Gwoza LGA has been called "a notorious hide out for Boko Haram insurgents," who arrived in the area in 2009 from Maiduguri. Gwoza local government area is dominantly characterized by Agricultural activities and is known for its vast fertile soil which is suitable for cultivation of maize, rice, millet, groundnut and guinea corn. Irrigation farming is practiced and supported; Cattles and other livestock are also reared in the state. The area has abundant human and material resources and has great potential for economic development. Borno State is bordered by three countries namely: Niger, Chad and Cameroon. These countries constitute major trading partner to the State in particular and Nigeria in general. Substantial amount of the State's livestock requirement comes from Chad and Cameroon. Borno State also provides ready market for her neighboring countries in terms of agricultural produce. Thus, there is a buoyant cross-border trade between the State and her international neighbors. On the local front, the state is bordered by three states namely; Adamawa, Gombe and Yobe. Internally, the State is composed of 27 local government areas and each of these Local Government Areas (LGA) has peculiar market day's arrangement with distinct trade products. The relationship between the people of Borno and those of her foreign neighbors' pre-date Nigeria independence. The boundaries that separate the two countries are blurred due to the fact that families

from both sides of the frontier interact as if there were no international demarcation. From the Cameroon side there is Fotokol, Kolofata, Amchide and Achigachia that can easily be accessed through Ngala LGA. From Bama (Nigeria), traders/households can easily access Banki. There is Banki town in both sides popularly known as Banki Nigeria and Banki Cameroon, hence the movement of people is unhindered, which is a favorable condition for international trade (Danladi *et al.*, 2015).
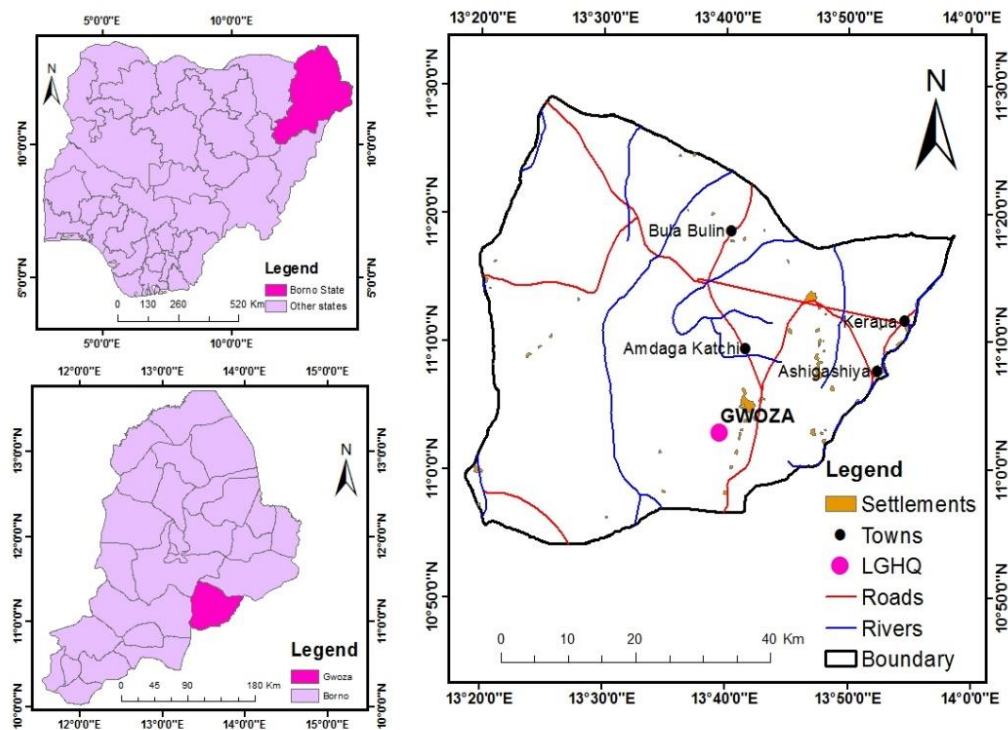

Figure 1: Study area map

2. Materials and Methods

2.1. Methodology

The methodology adopted have two aspects. First is land-use and landcover mapping to assess changes in settlements and agricultural areas resulting from the insecurity in the study area. The second is the social aspect, which was executed using participatory approach. This was achieved through questionnaire administration to Internal Displaced Persons (IDP's) and officials in the camps.

2.2. Landuse and Landcover Mapping

Landsat ETM+ for 2002 (before the crises) and Landsat OLI (2014 and 2017) images of 30m resolution were obtained from USGS official web-site and utilized to analyze LULC change pattern and dynamic in settlements and agricultural land use. The data were resampled to 15m using the

panchromatic band (8 for ETM+ and 9 for OLI) so as to identify agricultural lands more distinctly. False color composites were created using bands 234 for Landsat ETM and bands 345 for Landsat OLI images respectively. GPS point data for each land cover type in the area was collected using hand held Garmin CSX. Training sites were then selected for all classes using 30 samples per class. Maximum likelihood classification algorithm in IDRISI was used to classify the image into six classes (agricultural land, settlement, rock outcrop, natural vegetation, bare ground and water body) based on Anderson *et al*. (1976) classification scheme. Change detection method was used in detecting changes in Land-Use/Land-Cover (LULC) before and during the conflict (2002-2017).

Validation of the result was also carried out via confusion Matrix using the GPS data collected in the field. Transition matrix was computed to estimate the variation and change in LULC for the area with particular focus on agricultural (farm) land and settlement in Gwoza area. Confusion matrix was also done to validate the accuracy of the work. In doing this, a sample of pixels were selected and a confusion matrix was built using the samples (IDRISI module CONFUSE). This was used to determine the nature and frequency of errors.

2.2. Questionnaire Administration: Data Collection and Sampling Technique

The instrument that was used for data collection was a self-structured questionnaire. The questionnaire was made of two section, section A and Section B. Section A contained personal information of the respondents such as gender, age, level etc., while section B was used to gather information on the impact variables of the study. The face and content validation of the instrument was conducted by two experts in the field of impact assessment as a quality control measure. A total of one hundred and seven (107) sample size respondents was used from three (3) IDP's and officials in the Internal Displaced Persons Camps (Spread across the area). A multi-staged sampling technique was used. Respondents were sourced randomly from population in each of the camps using simple random sampling techniques to select respondents, a total of 40 respondents was pulled from Camp A, 32 respondents from camp B and 35 respondents from Camp C. In analyzing the data gathered from the returned questionnaire, descriptive statistical tools of frequency counts and percentage was used in MS Excel software environment to assess socio-economic and demographic impact of Boko Haram crises in Gwoza LGA based on local perception.

3. Results and Discussion

3.1. Change Detection Analysis

In this study, Land imagery covering Gwoza for three dates spanning from 2002 to 2017 were subjected to change detection analysis to assess changes in Land use and land cover for the purpose of

understanding the impact the current insecurity problem in the area on settlements and agricultural land use. The distribution of LULC for the study period is presented in Table 1.

Table 1: LULC before (2002) and during Boko-Haram Conflict (2014 and 2017)

Classes	Years					
	2002		**2014**		**2017**	
	Area(km^2)	**%**	**Area(km^2)**	**%**	**Area(km^2)**	**%**
Agricultural Land	241.18	8.43	12.49	0.45	20.39	0.71
Build-up	12.96	0.45	12.27	0.43	10.09	0.35
Rock out Crop	279.27	9.76	516.57	18.05	675.56	23.61
Natural Vegetation	889.99	31.10	1232.33	43.07	663.74	23.20
Bare Ground	1437.61	50.24	1087.65	38.01	1488.31	52.01
Water Body	0.30735	0.01	0.0056	1.97	3.22	0.11
Total	2861.31	100	2861.31	100	2861.31	100

Table 1 shows the transition of changes in Land-use/Land-cover for Agricultural land, Built-up, Rock Outcrop, Natural Vegetation, Bare Ground and Water body. For 2002, the built-up area occupies 0.45%, agricultural land (8.43%), and natural vegetation accounted for 31.10% of the total area. In 2014, the results show built-up accounting for 0.43% at 12.27km^2 in area size, while agricultural land had reduced to 0.45% from 8.43% as at 2002, with an area size of 12.49km^2, natural vegetation increased to 43.07% occupying a total land area of 1232.33km^2. In 2017, built-up was seen to reduce to 0.35% (10.09km^2) from 0.45% (12.96km^2) in 2002, while agricultural land remained 0.71% even though it increased in area size to 20.39km^2. Maps showing the LULC pattern for the different years under study are presented in Figures 2 to 4.
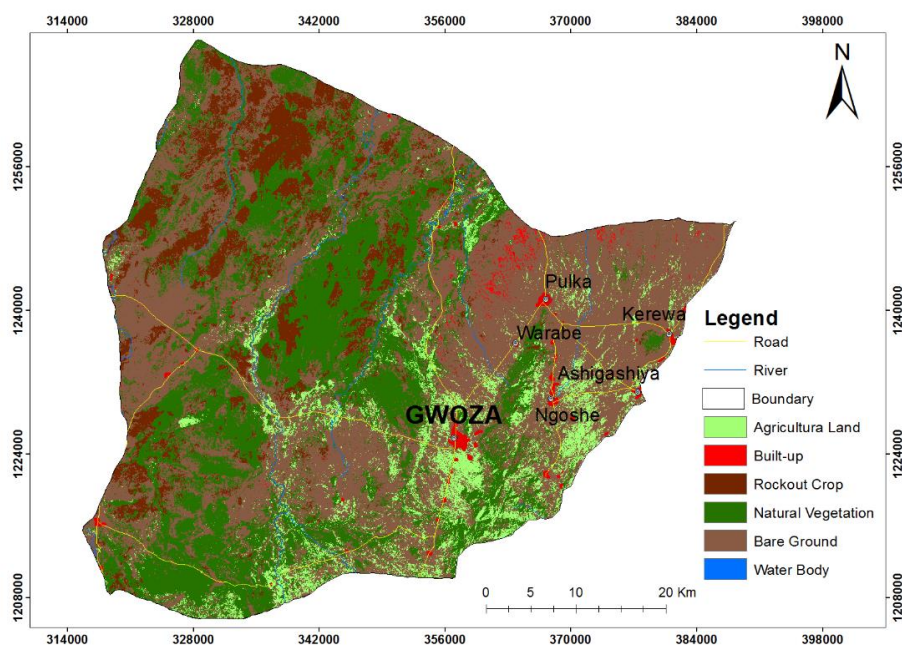
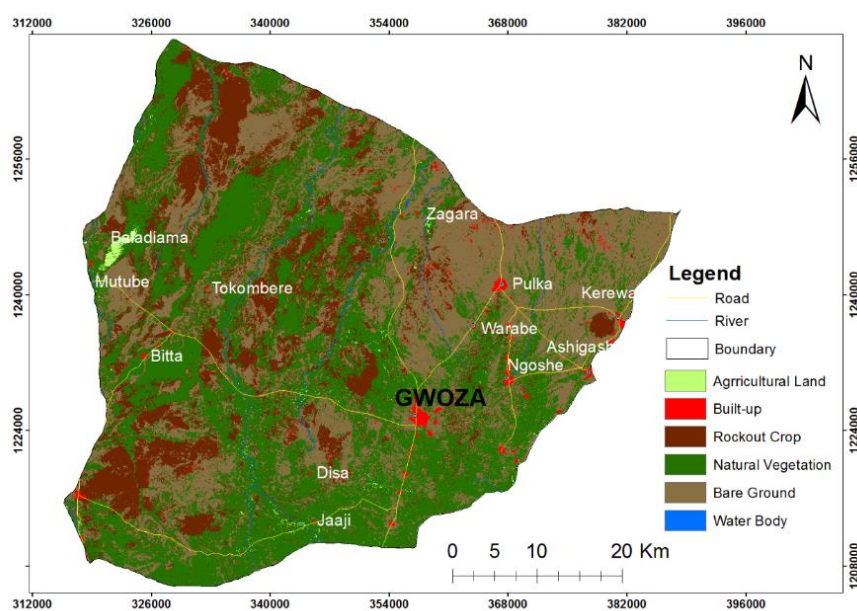**Figure 2:** Land Use Land Cover, Gwoza LGA (2002)

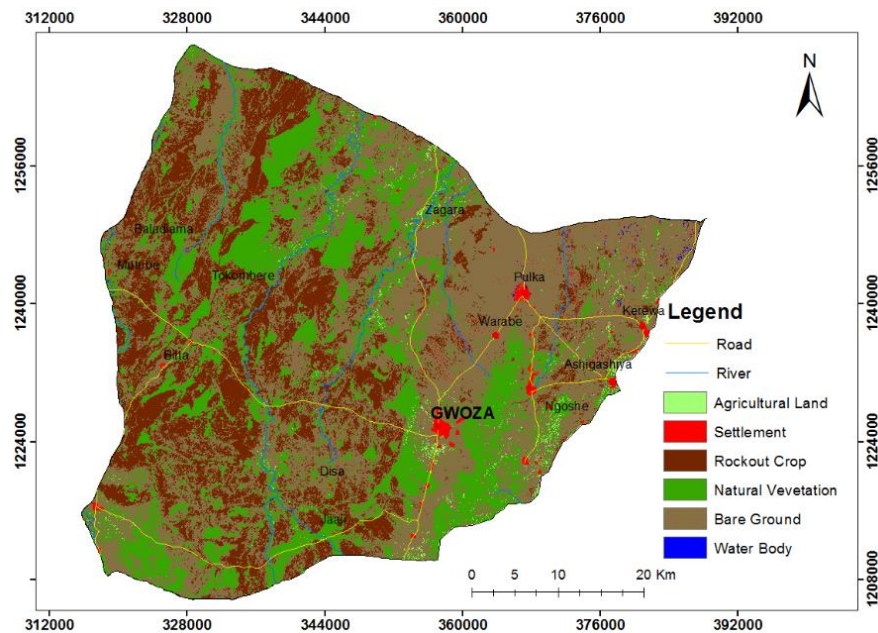**Figure 3:** Land Use Land Cover, Gwoza LGA (2014)

Figure 4: Land Use Land Cover, Gwoza LGA (2017)

Histogram capturing the LULC trend and chart displaying rate of change in LULC over a period of fifteen years are depicted in Figures 5 and 6 respectively. Results from the accuracy assessment computed with confusion matrix revealed an overall accuracy 0f 81.29% with a Kappa coefficient of 0.86 in 2002, 90.72% with a kappa coefficient of 0.95 for 2014 and an overall accuracy of 97.69 and a kappa coefficient 0.99 for 2017.
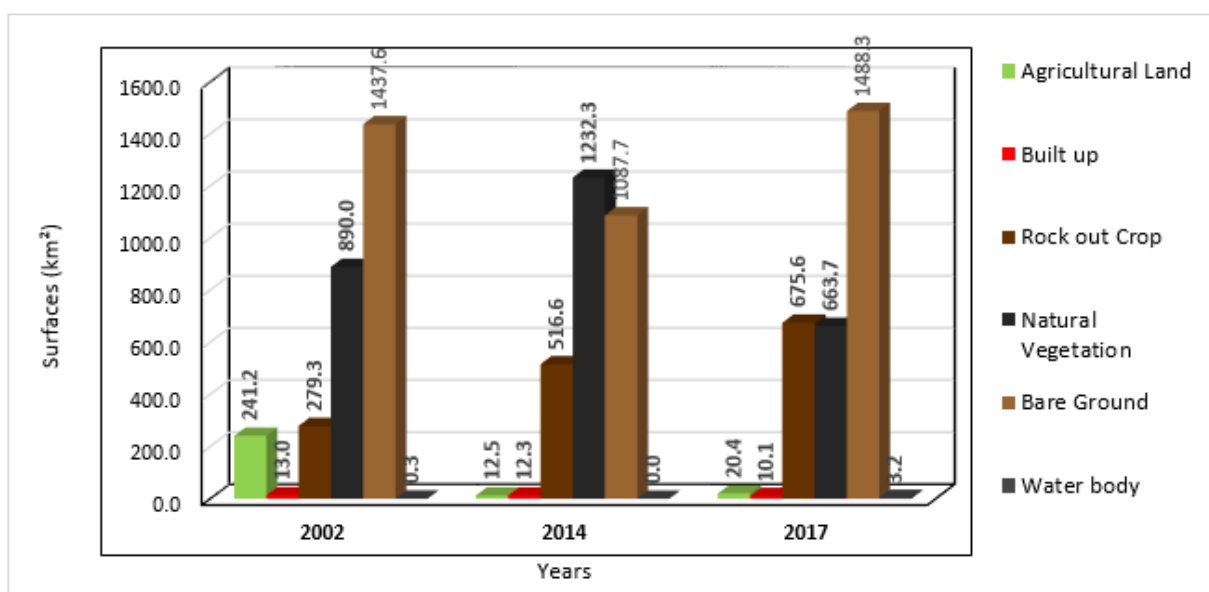

Figure 5: Histogram showing the change in LULC area in Km^2 (2002-2017)
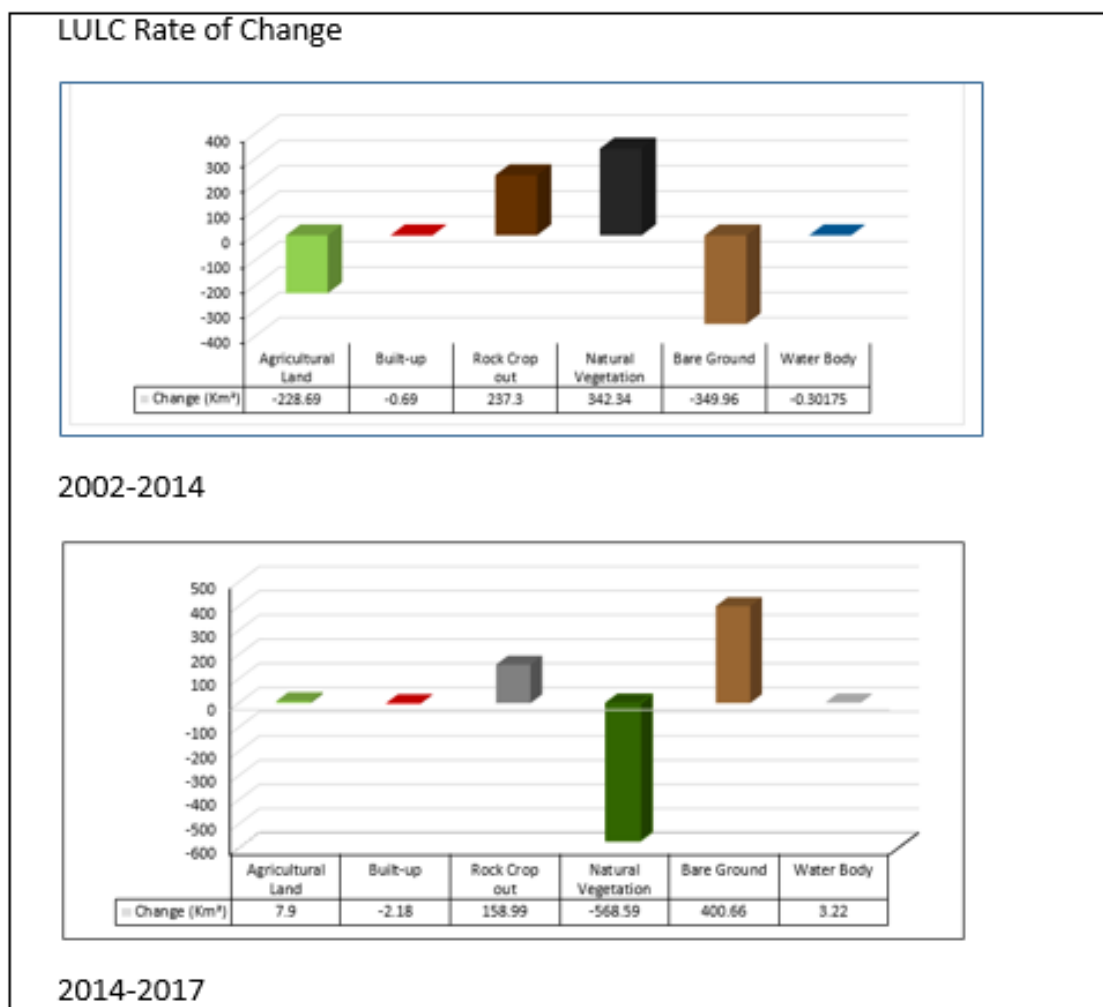
Figure 6: Rate of Change for LULC in the area over a period of fifteen years

The chart above describes the rate of change for two different periods (2002-2014 and 2014-2017). There was a decline of -228.69km^2 in agricultural activities, built up area also declined by -0.69km^2 from 2002 to 2014 and natural vegetation increased by 7.9km^2 as shown in Figure 6 above. The second period (2014-2017); agricultural land increased slightly by 7.9 km^2 while built-up area decreased by -2.18km^2.

3.2. Participatory Impact Assessment Results

Respondent's views were sampled from three IDP's camps in the investigated area using questionnaire. According to the respondents (70.4%) Boko Haram activities began in the area in 2013, while 14.1% indicated 2012 as the beginning of the crises. On the communities mostly affected by Boko Haram activities, the respondents revealed that twelve (12) communities in Gwoza were affected by crises. Ngoshe community was worst hit as reported from the questionnaire with a percentage of 38% followed by Gwoza (12.8%) and Gava (12.8). Based on their response on communities mostly

affected by Boko Haram, Figure 7 was produced in ArcGIS software environment to show the spatial distribution of the communities.
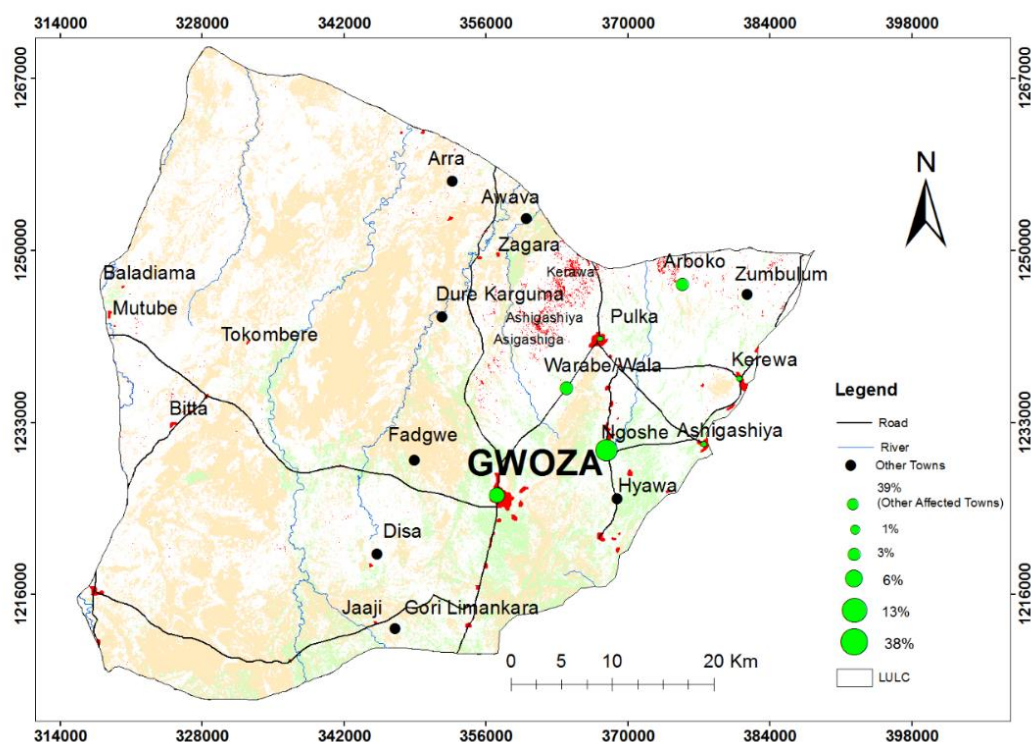

Figure 7: Communities most affected by Boko-haram in Gwoza area

Other communities impacted by the crises were Wala 7%, Kerewa 2.8%, Cikede2.8%, Chenene 1.4%, Barawa 2.8%, Arboko 5.6%, Amuda 2.8% and Ashigashiya 1.4%, while all other communities accounted for 9.9% impact. Before the crises began the number of communities was twelve (12) as listed above, but after the boko-haram insurgence the number of settlements reduced to five, four of which are Internal Displaced Persons Camps (IDP's) within and outside the states were population affected by the crises had to relocate to (Pulka IDP, Gwoza IDP, Abuja IDP, Maiduguri IDP and Mubi). The level of damage inflicted on people by the insurgence as assessed from retrieved questionnaire revealed 43.7% of respondents estimated their loss as greater than one million, while 19.7% claimed that their loss ranged between five hundred thousand to a million naira (500,000-1,000,000). 15.5% estimated their loss to be between a hundred thousand to five hundred thousand naira (100,000-500,000). The remaining 21.3% estimated their loss as ranging between ten thousand to a hundred thousand naira (10,000-100,000). 90.1% of the population agreed that the crises are still on going, while the remaining 9.9% indicated 2017 as the end of the crises. 97.2% of respondents stated that they escaped from their communities by themselves with no assistance from the government, while the respondents all agreed that there was no help from the government as it concerned escape

from crises affected areas, 2.8% indicated that they escaped via a different means than by themselves. 85.9% stated that no support was provided for them by the Government all through the period of the crises while 14.1% indicated that the government assisted them during the period of the crises. 81.7% indicated that all occupants of their community had to relocate away from their community, while 18.3% indicated that some people still remained in their community after the crises. 78.9% of respondents said their farming activities was halted by the crises as they could no longer go to their farms, while 21.1% of respondents stated that boko-haram crises did not affect their farming activities. A high percentage of respondents (57.7%) indicated that they last saw their farms in 2013 when the crises officially began, while 21% of respondents said they last saw their farms in 2014 and the remaining 21.2% stated that they last saw their farms in 2011 and 2012 respectively, as revealed from questionnaire assessed.
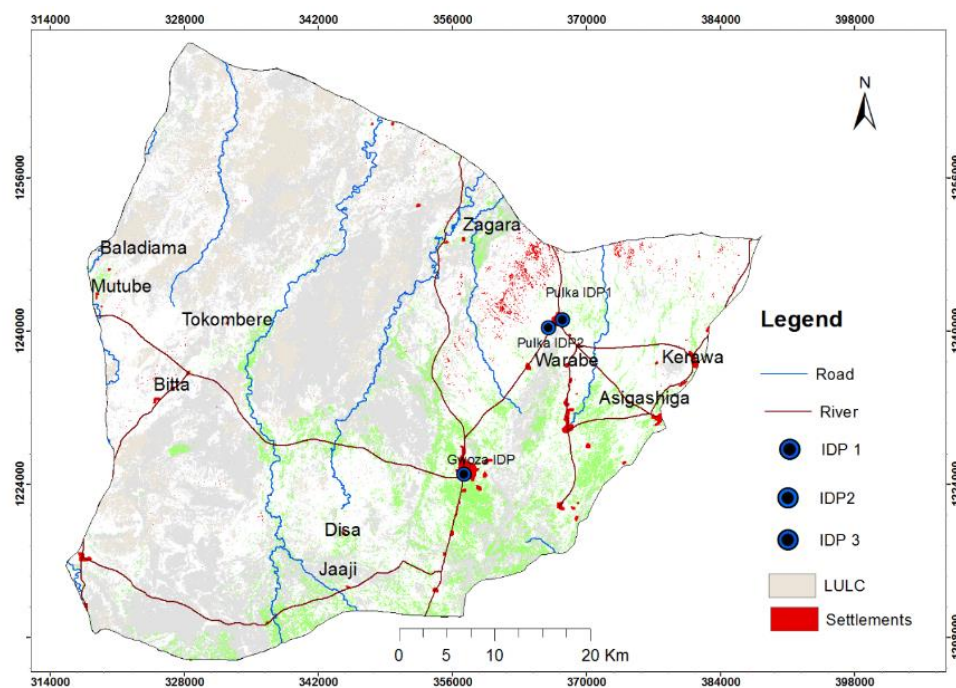

Figure 8: IDP Camps (where questionnaire was distributed); Gwoza, Borno State
Main text paragraph.

4. Conclusion

The impact of insecurity associated with Boko Haram activities on settlements and agricultural landscape of Gwoza LGA, North-eastern Nigeria have been examined in this study. Insecurity challenge in the area have injected fear in the hearts of local dwellers and displaced large percentage of people in the area. The main concern is the impact on local and regional food security through

disruption of agricultural production, food trade, reduced investments and deterioration of land and infrastructure. A major decrease in agricultural land was observed. It was also discovered that areas where agricultural activities were active in 2002 were no more active/possessed less intensive agricultural activity in 2014. This means that the emergence of Boko Haram and its related violence reshaped the agricultural landscape of Gwoza in some areas. This research highlights the fact that the effects of armed conflict on land use are not unidirectional, but that changes are heterogeneous and dependent on local contexts. Over two hundred and seventy-six thousand, three hundred and twelve (276,312) people have been forced to leave their homes in Gwoza due to the conflict. Abandonment of land and destroyed houses now characterize the area. The study found signs of land abandonment in the area were 8% of what had been agricultural land during the study period (2002–2017) changed to fallow/ bare soil and natural vegetation. In another development, it was observed that built-up area experienced a slight decline from 12.96km² in 2002 to 12.27km² (0.43%) in 2014, it further dropped to 0.35% in the year 2017. Gwoza area experienced the killing of hundreds of civilians, the abduction of women and girls, the destruction of towns, and large-scale forced displacement of population as a result of Boko-Haram terrorist activities which is still on within the area.

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