OSUN GEOGRAPHICAL REVIEW

Journal of the Department of Geography,
Osun State University, State of Osun, Nigeria

Editor-in-Chief
Prof. Olusegun Ekanade

CONTENTS

IMPACTS OF INSURGENCY ON LAND USE CHANGES IN NORTH EASTERN NIGERIA

O. P. Mamudu, P. Yakubu and G. O. Enaruvbe

African Regional Institute for Geospatial Information Science and
Technology (AFRIGIST), Obafemi Awolowo University, Ile-Ife, Nigeria
Corresponding author email:mamudu@afrigist.org

Abstract

Insurgency is a threat to the social, political and economic stability of countries. Nigeria has been plagued by insecurities in recent years, especially due to insurgencies in the northern parts of the country. The use of geospatial technology by security planners provides a means for data analysis and presentations which can aid management decisions. This study harnessed geospatial technologies to ascertain land change dynamics in an insurgency affected local government area in Borno State, Nigeria between 2015 and 2020. Landsat 8 (OLI TIRS) imageries of 2015 and 2020 of Hawul Local Government Area were classified using the maximum likelihood classification algorithm to determine the land use changes in the area. Field visit to the local government area was done to determine affected and unaffected communities. Results show that total built up areas increased from 146.53km^2 in 2015 to 360.93km^2 in 2020. Farmlands decreased from 1544.61km^2 in 2015 to 1304.14 km^2 while vegetation also decreased from 261.54km^2 to 55.28km^2 in 2020. Insurgency affected communities in the local government increased from 8 in 2015 to 24 in 2020, with unaffected communities having built up expansions while growth was static in most of the affected communities. This indicates a migration pattern due to insurgency in the area. The findings of this study can help in managing the security challenges as well as provide information that may be useful in planning, resource distribution and security management.

Keywords: Insurgency, Insecurity, Land change dynamics, Geospatial technologies

Introduction

The management of land and land resources has played a key role in social and economic governance of societies because of the role of land in providing food, shelter, minerals and wealth. However, global population growth has led to increasing pressure on land and available land resources in recent decades (Stamp, 1958; Young, 2000; Lambin et al., 2003; Brink et al., 2014). This pressure has resulted in rapid land use changes in most parts of the world (Meyer and Turner, 1992; Ojima et al., 1994; Long et al., 2021). This trend is particularly evident in developing countries especially in Latin America, southeast Asia and sub-Saharan Africa (Mansour et al., 2020; Wang et al., 2020). The changes in land use is being aggravated by factors such as demand for land resources as a result of scarcity caused by population growth and the need for growth in economic wealth,

changing market systems, global and national policies and changing demographic structure of societies (O'Sullivan, 2020).

Many studies have analyzed how the quest for land resources have affected land use and land cover (Lin and Ho, 2003; Su et al., 2011; Liu, 2018; Enaruvbe and Atafo, 2019). This quest for the control of land resources has often been linked to social unrest and conflicts (Campbell et al., 2000; Eklund et al., 2017; Enaruvbe et al., 2019; Kweyu et al., 2020). This is mostly aggravated by globalization, as evident in the current spate of terrorism in many regions of the world. Horne (2002) observed that war, terrorism and other forms of transnational political violence are in many ways more threatening today than ever before and this is leading to increases in civilian casualties.

Terrorism, that is mostly fueled by Islamic fundamentalism and militancy, is becoming

widespread around the world(Helbling and Meierrieks, 2020; LaFree et al., 2020) and is enabled by politics, poverty and the clamor for control of resources (Blair et al., 2013). In Nigeria, issues linked to political, religious and widespread poverty have led to the emergence of various insurgency movement by local militants (Adenrele, 2012; Muzan, 2014). This is the case with the emergence of Boko Haram (which means 'western education is sin') sect and the Ansaru groups. These sects have unleashed a reign of terror on Nigerians and disrupted the social, economic and political structure in some parts of the country (Ering et al., 2013). . Weeraratne (2017) opined that the activities of the Boko Haram sect may be enabled by its strategic ties with Al Qaeda affiliates and the porosity of the Northern Nigerian border. The impact of the insurgency by the Boko Haram sect is evident in national security (Amalu, 2015; Shuaibu et al., 2015), economy and development (Awortu, 2015; Foyou et al., 2018), education and health(Omole *et al.,* 2015; Isokpan and Durojaye, 2016; Bilyaminu *et al.,* 2017), food production (Kah, 2017; Adelaja and George, 2019) and human migration and displacement (Eme *et al.,* 2018; Salleh *et al.,* 2018; Iacoella and Tirivayi, 2020)

The implications of terrorism on land-based resources is the threat to economic development and environmental sustainability. Security instability may lead to changes in land use patterns and may result in increasing rates of primary forest cover loss and land degradation in densely populated areas that are not affected by the activities of the insurgents (Adelaja and George, 2019; Enaruvbe et al., 2019). Moreover, displaced populations experiencing food and fuel shortages in regions characterized by anarchy exert tremendous toll on the environment (Formoli, 1995; Bashar, 2021). Areas occupied by refugees are often associated with severe forest degradation and accelerated removal of forest cover for fuel, construction materials and source of livelihood (Draulans and Van Krunkelsven, 2002; Dudley et al., 2002). Although some studies have suggested that the mass migration triggered by conflicts results in a reduction in wildfires and demand for agricultural land, which ultimately facilitates afforestation (Wilson and Wilson, 2013; Temudo and Cabral, 2017), the short-term respite of forest and other land-based resources may be overrun in the long term by increased demand for and exploitation of forest resources following a period of crisis and abandonment.

Although many studies have investigated the drivers of land use changes (Lambin et al., 2003; Enaruvbe and Atafo, 2019), the focus of these studies have mostly been on non-conflict scenarios. Similarly, research on the impacts of civil conflict mainly focuses on the sociopolitical and economic implications (Pelling and Dill, 2010; Hadzi-Vaskov et al., 2021). Few studies have examined the impacts of civil conflicts on the environment (Hendrix and Glaser, 2007), agriculture and food security (Adelaja and George, 2019) and migration (Eme et al., 2018). However, the relationship between civil conflict and land use change has remained largely elusive. The integration of land use assessment in areas that have been plagued by conflict may provide important insights that can aid in the planning and management of conflicts and conflict prone areas.This study, therefore seeks to analyze the impacts of insurgency on the land use/cover changes in Hawul Local Government Area of Borno State, Nigeria. This will be achieved through determining the land use changes over time and assessing the development of settlements in the area as a result of insurgency and displacements. This will provide useful information that is required by decision-makers and development experts for the planning of migrants camps and the management of internally displaced persons' settlements.

Material and Methods

Study area

Hawul (Latitude 10°10'59"N and 10°45'0"N and Longitude 11°50'48" E and 12°45'40" E) is surrounded by Local Governments of Biu to the North, Shani and KwayaKusar to the west, Askira/Uba to the east and Adamawa State to the south.It is one of the 27 Local Government Areas (LGAs) inBorno State, North Eastern Nigeria (Figure 1). The LGA is made up of 12 wards, with its administrative headquarters is in Azare town. With a total land area of 2,089 km^2, Hawul is one of the four LGAs that constitute the Biu Emirate in Nigeria.

Although the population of Hawul was 120,733 people according to the 2006 national population census(Nigeria Population Commission, 2006),, it is estimated that the population in 2021 is about 171,801 inhabitants (Okafor et al., 2007). A large proportion of the population of the area depends on agricultural activities as their major source of income, but many inhabitants also engage in other off-farm activities such as trade, pottery and hunting to enhance their income Crops grown in the area include maize, beans, groundnut, pepper, rice and

sorghum . In In addition, a range of animals such as donkeys, horses, goats and sheep are also reared and sold in the area.

The climate of the study area is within the Sudan Savanna climatic region of Nigeria. Vegetation in the area is characterized by grasslands with solitary trees widely spread. Common tree species include *Adonsonia digitata* (baobab), *Azadirachta indica* (Neem) and *Tamarindus indica* (Tamarind) (Yakubu et al., 2021). . Like most parts of Nigeria, it has predominantly 2 seasons with a wet season that starts in May and ends in October. The temperature of the study area is generally high. The mean monthly temperature ranges from 29.2°C in July and August to 37.6°C in March and April. Relative humidity in the area range from about 37% to 68% from the dry to wet seasons. The mean annual rainfall ranges from 650mm to 1000mm with the highest mean rainfall occurring between August and September.

Data collection and analysis

Landsat images of the study area were acquired from the archives of the United States Geological Survey. The images were collected for November 2015 (2015-11-03) and December 2020 (2020-12-18) from Landsat 8 OLI-TIRS as this period in the year is in the dry season and has the least cloud cover, thus minimizing errors resulting from atmospheric distortions and seasonal differences. To improve the images, they were corrected using radiometric calibration, atmospheric correction, dark object subtraction and conversion to spectral reflectance

(Song et al., 2001; Chang et al., 2008). Due to the volatility of the area, only few field based training sites could be established. Knowledge of the area as well as high resolution datasets available in Google Earth were used to determine more training sites for the classification. Using this technique, about 80 training sites were identified and used in this study. Recent studies have shown the effectiveness of the shortwave infrared bands in extracting built up area (Bouhennache et al., 2019; Feng and Li, 2019). Therefore, bands 3 (green), 4 (red) and 6 (SWIR) of the Landsat OLI imageries were used in this study. Supervised classification using Maximum Likelihood algorithm was used in extracting the land use types (Joseph et al., 2018; Dibs et al., 2020). The landuse classes were based on the Anderson (1976) level II classification scheme as used in Joseph et al. (2018) and Bello (2019). The classes include built-up, bare-land, agriculture land, water body and forest. To test for classification accuracy, the Kappa coefficient as used in Rwanga and Ndambuki (2017) was utilized.

The data used to identify the settlement affected in the year 2015 and 2020 was obtained through field visit, and supplemented with prior knowledge of the area, data from the Global Conflict Tracker (Campbell and Expert, 2020) as well as from Borno State Geographic Information Service (BSGIS) formally known as office of Land and surveying Biu zone. This was overlaid on the classified maps of Hawul in 2015 and 2020, to aid in understanding the changes in settlement pattern in the area.
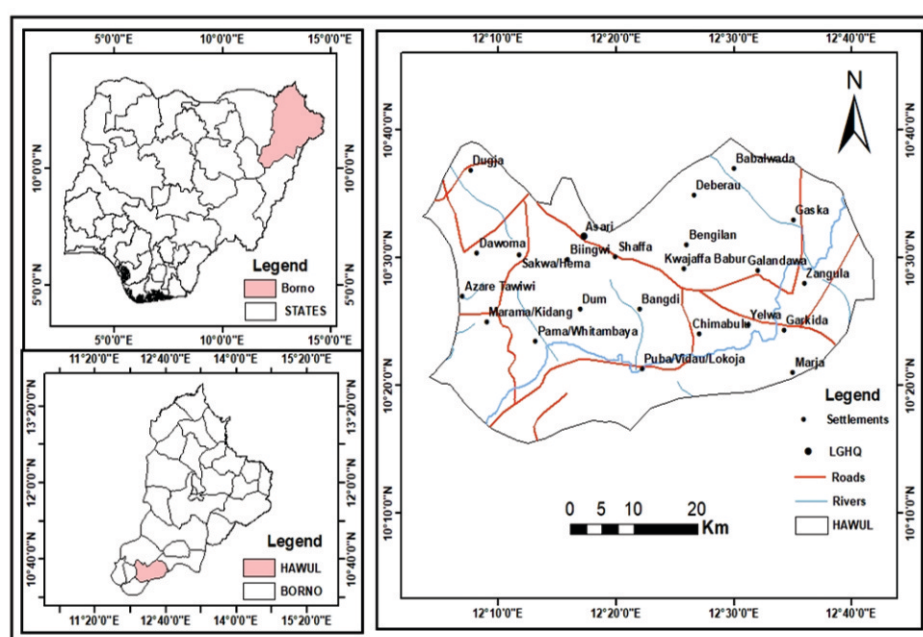

Figure 1: Hawul Local Government Area

Results and Discussion

Image classification is a process prone to errors due to various factors such as reflectance and training site selection. Testing for accuracy is important in verifying the usefulness of a classification for analysis (Foody, 2009). The overall accuracy in this study was 97.87% with an overall kappa coefficient of 0.97 (Table 1). Similar studies in land cover classification have accuracies of between 80% and 97% (Rwanga and Ndambuki, 2017; Fisher et al., 2018).

Land use of Hawul Local government area for 2015 and 2020 is presented in Figures 2 and 3 respectively. Analysis of the land use maps show that built up areas in 2015 covered 7.1% of Hawul Local government area but grew to 17.5% of the area in 2020, with an increase from 146.53km^2 in 2015 to 360.95km^2 in 2020 (table 2). Figure 2 show that settlements in the area in 2015 were mostly small, with larger settlements in Duku, Kudia, Ramta and Garkida. However, in 2020 (Figure 3) some of the prominent settlements observed in 2015 appear not to have increased. Analysis shows that those areas have more vegetation (grassland), indicating some levels of abandonment. Other areas like Jalingo, Wadiki and Kida show notable increase in the settlement area. Similarly, bare lands increased from 4.7% in 2015 to 13.7% in 2020, with the bare areas increasing from 97.47km^2 in 2015 to 282.43km^2 in 2020 especially in areas that were vegetated in 2015.

The increasing built-up areas and bare lands may have resulted in the decline in the extent of agricultural lands from 74.8% to 68.6% and Forested lands from 12.7% to 2.7% between 2015 and 2020. Agricultural lands reduced from 1544.62km^2 in 2015 to 1304.14km^2 in 2020, while vegetated lands reduced from 261.54km^2 in 2015 to 55.28km^2 in 2020. The image analysis showed that most of the forested areas have significantly dwindled. Forced migration as well as increasing population and demand for forest resources may be responsible for this decline. Agricultural lands are also affected in this regard as many farmers have left their properties to migrate to safer area, while agricultural lands in safer areas are been converted to built-up areas.

However, water bodies show increase from 15km^2 in 2015 to 62.4km^2 in 2020. Some of this increase may be attributed to classification errors, though some abandonment of settlements may also be responsible for the increase.

This growth in built-up areas is consistent with similar studies in urban growth in Nigeria (Abbas et al., 2010; Eze and Onokala, 2020; Fashae et al., 2020; Musa and Adamu, 2021), particularly in Borno State. Bello (2019) found that urban areas in Maiduguri grew from 51.8% in 2000 to 64.5% in 2018. The study also found a decrease in agricultural areas and grasslands. However, growing urban area is not peculiar with the state as other parts of Nigeria, like Lagos (Wang and Maduako, 2018), Kaduna (Dyachia et al., 2017) and Abeokuta (Olayiwola and Lawal, 2018) as well as other parts of the world like Ghana (Acheampong et al., 2017), China (Li et al., 2019) and Brazil (Daunt and Silva, 2019) have experienced growth.

Table 1: Image classification Confusion Matrix

Class	Built-up	Vegetation	Waterbody	Bare-land	Farmland	Total	Error of commission	Producer's Accuracy
Built-up	201	0	14	0	1	216	6.9%	97.10%
Vegetation	0	220	0	0	0	220	0%	0.00%
Waterbody	0	0	204	0	0	204	0%	92.73%
Bare land	0	0	2	220	0	222	0.9%	0.00%
Farmland	6	0	0	0	211	217	2.8%	99.53%
Total	207	220	220	220	212	1079		
Error of omission	2.9%	0%	7.3%	0%	0.5%		Overall Kappa	0.9734
User's accuracy	93.06%	0.00%	0.00%	99.09%	97.24%		Overall Accuracy	97.87%

Table 2: Land use/cover distribution (2015 and 2020)

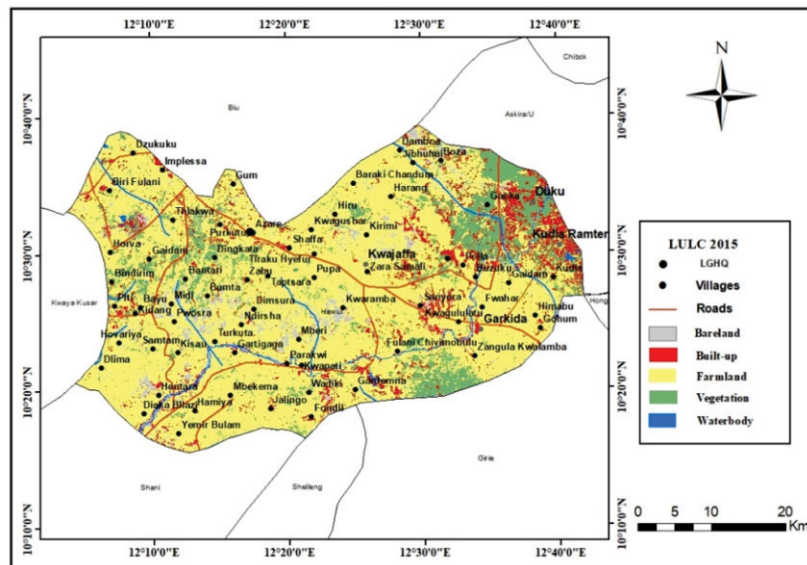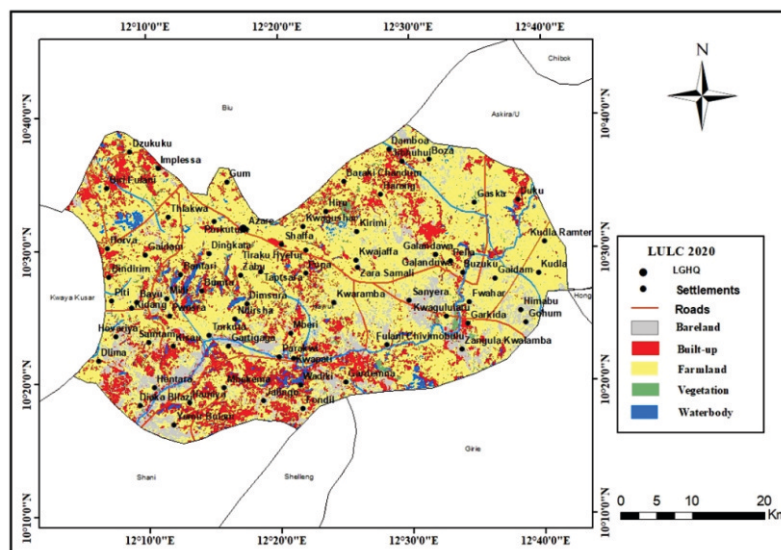| LULC	2015		2020	
	Area km^2	Area (%)	Area km^2	Area (%)
Bare land	97.64	4.73	282.43	13.68
Built-up	146.53	7.09	360.93	17.48
Farmland	1544.61	74.78	1304.14	63.15
Vegetation	261.54	12.66	55.28	2.68
Waterbody	15.13	0.73	62.44	3.02
Total	2065.46	100	2065.22	100

Figure 2: 2015 land use

Figure 3: 2020 land use

An eviden+t implication of the increase in the settlement areas in Hawul Local Government Area is the reduction in the forest and agricultural lands. The study by – Formoli (1995) highlighted the environmental devastation that can be brought on by war and terrorism. Enaruvbe et al. (2019) found that the extent of forest areas in Nimba County reduced during the period of conflict in Liberia. Forced migration in Hawul LGA, which is resulting in settlement growth in some part of the area puts pressure on surrounding forest areas; there is more demand for land for housing, fuel wood, food and other forest resources. This also affects agricultural lands as farms in some affected areas are being abandoned to fallow, while conversion to built up area is evident in areas that are unaffected. As agriculture is the main economic activity in the area,

losses in agricultural lands poses a threat to food security, not just in the area but in the country.

Population growth and migration are two major factors that affect the growth of settlements. While the growth in the population may be significant in Hawul, the activities of the Boko Haram sect may have an influence in the shift in settlement. Assessing the images show a shift in the growth of settlements. Most of the settlement growth is apparent in the western part of the study area. Hawul local government area has about 71 settlements (Table 3). In 2015, 8 of the settlements had been affected by insurgency activities (Baraki Chandum, Hareng, Kirimi, Kwajaffa, Pella, Buzuku, Garkida and Azara). These affected communities are more in the eastern parts of the study area (Figure 4). By 2020,

157

the number of affected communities increased to 24 settlements to include communities like Kudia, Ramta, Damboa, Shaffa, Turkuta and Kirimi. The map shows that most more affected settlement in the east with Turkuta being an outlying settlement affected in the western part of the area. It was apparent from visiting some of the affected settlements in the local government area that homes and businesses have been abandoned, with residents migrating to other settlements that have not been affected. The implication is that more people abandoning homes in the eastern part of the local government area and moving to the western part where most settlements have not been affected. The 2020 map of the area clearly show enlargements of many small settlements especially in the central and western parts of Hawul local government area.

Table 3: Settlements affected in 2015and 2020

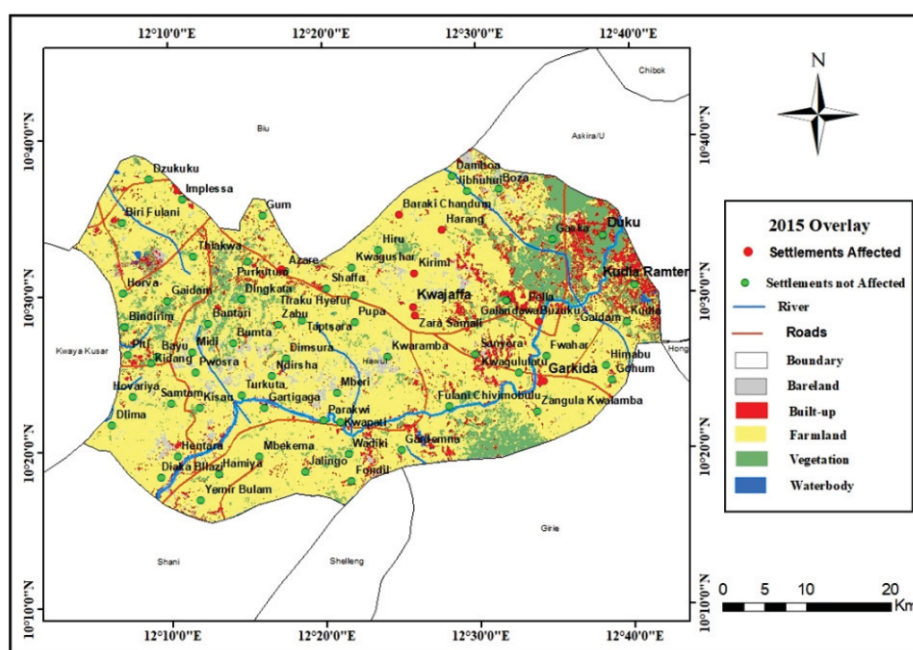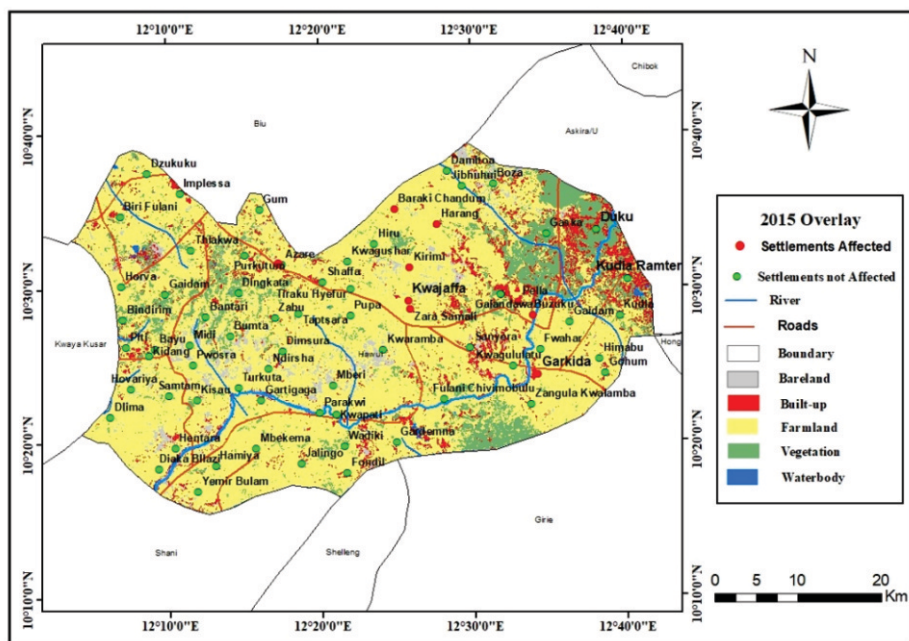| Year	2015	2020
Number of settlements	71	71
Number of settlements affected	8	24
Number of settlements not affected	63	47

Figure 4: LULC 2015 Overlay

Figure 5: LULC 2020 Overlay

Conclusion and Recommendation

Assessment of Land use and Land cover provide essential tools for monitoring drivers of environmental change. In areas affected by terrorism, it is important to examine the relationship between land use changes and civil conflicts, in order to provide insights that can aid in communities planning and management. This study investigated the impact of the terrorism activities of the Boko Haram sect on the changing land use in Hawul Local Government Area of Borno State, North Eastern Nigeria. The results show that built-up areas and bare-lands increased significantly, with notable decline in farmlands and vegetation in the five years of this study. Examining the insurgency affected and non-affected communities show a shift in the growth of built-up areas in Hawul LGA, with non-affected communities having more growth than affected communities. This implies that the many people have migrated from affected communities to relatively safer communities resulting in abandonment of homesteads, higher demand on land for housing and other land uses and reduction in arable land and forests especially around non-affected communities.

The implications of these land use changes may impact the environment in the long term, considering the abandoned impervious surfaces and the loss of forest vegetation. Food production and security may be threatened in the long term, as farmers who are forced to abandon their farmlands and produce not only reduces the food available for supply but also add pressure to existing resources based on the need for sustenance. It is therefore recommended that more attention be paid to security and curbing insurgency in the region to reduce the rates of migration. This may help reduce the rate of changes in the land use while preserving agricultural and forested lands. Though other factors, including population growth impacts land use change, insecurity is accelerating this process in the area.

This study provides information that may be required by decision-makers and development experts for the planning of migrants camps and the management of internally displaced persons' settlements. Future studies on the impact of civil conflict on land use change may investigate the pattern of change in growing settlements due to migration, as well as its implication on forest ecosystem and biodiversity. Assessing its impact on ecosystem services may prove useful in environmental planning and management.

References

Abbas, I., Muazu, K. and Ukoje, J. (2010). Mapping land use-land cover and change detection in kafur local government, katsina, nigeria (1995-2008) using remote sensing and gis. *Research journal of environmental and Earth Sciences,* 2(1), 6-12.

Acheampong, R. A., Agyemang, F. S. and Abdul-Fatawu, M. (2017). Quantifying the spatio-temporal patterns of settlement growth in a metropolitan region of ghana. *GeoJournal,* 82(4), 823-840.

Adelaja, A. and George, J. (2019). Effects of conflict on agriculture: Evidence from the boko haram insurgency. World Development, 117, 184-195.

Adenrele, A. R. (2012). Boko haram insurgency in nigeria as a symptom of poverty and political alienation. *IOSR Journal of Humanities and Social Science,* 3(5), 21-26.

Amalu, N. S. (2015). Impact of boko haram insurgency on human security in Nigeria. *Global Journal of Social Sciences,* 14(1), 35-42.

Anderson, J. R. (1976). A land use and land cover classification system for use with remote sensor data (Vol. 964): *US Government Printing Office.*

Awortu, B. E. (2015). Boko haram insurgency and the underdevelopment of nigeria. *Research on Humanities and Social Sciences,* 5(6), 213-220.

Bashar, S. (2021). The rohingya refugee crisis in bangladesh: Environmental impacts, policies, and practices.

Bello, S. A. (2019). Changes in land use/land cover of maiduguri urban, borno state Nigeria. *International Journal of Scientific and Research Publications,* 9(3).

Bila, Y., Mshelia, B. S. and Landi, J. H. (2015). Off farm activities and its contribution to household income in hawul local government area, Borno state, Nigeria. *Journal of Agriculture and Veterinary Science,* 8, 9-13.

Bilyaminu, M., Iya, I. B. and Purokayo, S. G. (2017). Analysis of the impact of boko haram insurgency on education in Adamawa state, Nigeria. *International Journal of Academic Research and Reflection,* 5(6), 45-56.

Blair, G., Christine Fair, C., Malhotra, N. and Shapiro, J. N. (2013). Poverty and support for militant politics: Evidence from pakistan. *American Journal of Political Science,* 57(1), 30-48.

Bouhennache, R., Bouden, T., Taleb-Ahmed, A. and Cheddad, A. (2019). A new spectral index for the extraction of built-up land features from landsat 8 satellite imagery. *Geocarto International,* 34(14),

1531-1551.

Brink, A. B., Bodart, C., Brodsky, L., Defourney, P., Ernst, C., Donney, F., Lupi, A. and Tuckova, K. (2014). Anthropogenic pressure in east africa—monitoring 20 years of land cover changes by means of medium resolution satellite data. *International Journal of Applied Earth Observation and Geoinformation,* 28, 60-69.

Campbell, D. J., Gichohi, H., Mwangi, A. and Chege, L. (2000). Land use conflict in kajiado district, kenya. *Land Use Policy,* 17(4), 337-348.

Campbell, J. and Expert, C. (2020). Beyond the pandemic, boko haram looms large in Nigeria. *Council on Foreign Relations,* 11.

Chang, J., Clay, D. E., Leigh, L., Aaron, D., Dalsted, K. and Volz, M. (2008). Evaluating modified atmospheric correction methods for landsat imagery: Image-based and model-based calibration methods. Communications in soil science and plant analysis, 39(9-10), 1532-1545.

Commission, N. P. (2006). Population census of the federal republic of nigeria. Census Report. National Population Commission, Abuja.

Daunt, A. B. P. and Silva, T. S. F. (2019). Beyond the park and city dichotomy: Land use and land cover change in the northern coast of sao paulo (brazil). *Landscape and Urban Planning,* 189, 352-361.

Dibs, H., Hasab, H. A., Al-Rifaie, J. K. and Al-Ansari, N. (2020). An optimal approach for land-use/land-cover mapping by integration and fusion of multispectral landsat oli images: Case study in baghdad, iraq. *Water, Air, & Soil Pollution,* 231(9), 1-15.

Draulans, D. and Van Krunkelsven, E. (2002). The impact of war on forest areas in the democratic republic of congo. *Oryx,* 36(1), 35-40.

Dudley, J. P., Ginsberg, J. R., Plumptre, A. J., Hart, J. A. and Campos, L. C. (2002). Effects of war and civil strife on wildlife and wildlife habitats. *Conservation Biology,* 16(2), 319-329.

Dyachia, Z. S., Permana, A. S., Ho, C. S., Baba, A. N. and Agboola, O. P. (2017). Implications of present land use plan on urban growth and environmental sustainability in a sub saharan africa city. International Journal of Built Environment and Sustainability, 4(2).

Eklund, L., Degerald, M., Brandt, M., Prishchepov, A. V. and Pilesjö, P. (2017). How conflict affects land use: Agricultural activity in areas seized by the islamic state. *Environmental Research Letters,* 12(5), 054004.

Eme, O. I., Azuakor, P. O. and Mba, C. (2018). Boko haram and population displacement in nigeria: A case for psychological input. Practicum Psychologia, 8(1).

Enaruvbe, G. O. and Atafo, O. (2019). Land cover transition and fragmentation of river ogba catchment in Benin City, Nigeria. *Sustainable cities and society,* 45, 70-78.

Enaruvbe, G. O., Keculah, K., Atedhor, G. and Osewole, A. (2019). Armed conflict and mining induced land-use transition in Northern Nimba County, Liberia. *Global Ecology and Conservation,* 17, e00597.

Ering, S. O., Omono, C. E. and Oketa, C. M. (2013). Islamic militancy and global insecurity: An analysis of boko-haram crisis in northern nigeria. *Canadian Social Science,* 9(5), 31-36.

Eze, J. N. and Onokala, P. C. (2020). Analysis of land use and land cover change in the sahel: A case study of yobe state, nigeria. *Climate Change,* 6(21), 120-128.

Fashae, O. A., Adagbasa, E. G., Olusola, A. O. and Obateru, R. O. (2020). Land use/land cover change and land surface temperature of ibadan and environs, Nigeria. *Environ Monit Assess,* 192(2), 1-18.

Feng, X. and Li, P. (2019). Urban built-up area change detection using multi-band temporal texture and one-class random forest. Paper presented at the 2019 10th International Workshop on the Analysis of Multitemporal Remote Sensing Images (MultiTemp).

Fisher, J. R., Acosta, E. A., Dennedy-Frank, P. J., Kroeger, T. and Boucher, T. M. (2018). Impact of satellite imagery spatial resolution on land use classification accuracy and modeled water quality. *Remote Sensing in Ecology and Conservation,* 4(2), 137-149.

Foody, G. M. (2009). Sample size determination for image classification accuracy assessment and comparison. *International Journal of Remote Sensing,* 30(20), 5273-5291.

Formoli, T. A. (1995). Impacts of the afghan–soviet war on afghanistan's environment. *Environmental Conservation,* 22(1), 66-69.

Foyou, V. E., Ngwafu, P., Santoyo, M. and Ortiz, A. (2018). The boko haram insurgency and its impact on border security, trade and economic collaboration between nigeria and cameroon: An exploratory study. *African Social Science Review,* 9(1), 7.

Hadzi-Vaskov, M., Pienknagura, S. and Ricci, L. A. (2021). The macroeconomic impact of social unrest.

Helbling, M. and Meierrieks, D. (2020). Transnational terrorism and restrictive immigration policies. Journal of peace research, 57(4), 564-580.

Hendrix, C. S. and Glaser, S. M. (2007). Trends and triggers: Climate, climate change and civil conflict in sub-saharan africa. *Political geography,* 26(6), 695-715.

Horne, J. (2002). Civilian populations and wartime violence: Towards an historical analysis. *International Social Science Journal,* 54(174), 483-490.

Iacoella, F. and Tirivayi, N. (2020). Child nutrition during

conflict and displacement: Evidence from areas affected by the boko haram insurgency in nigeria. Public Health, 183, 132-137.

Isokpan, A. J. and Durojaye, E. (2016). Impact of the boko haram insurgency on the child's right to education in nigeria. *Potchefstroom Electronic Law Journal/Potchefstroomse Elektroniese Regsblad,* 19(1).

Joseph, O., Gbenga, A. E. and Langyit, D. G. (2018). Desertification risk analysis and assessment in northern nigeria. Remote Sensing Applications: Society and Environment, 11, 70-82.

Kah, H. K. (2017). 'Boko haram is losing, but so is food production': Conflict and food insecurity in nigeria and cameroon. *Africa Development,* 42(3), 177-196.

Kweyu, R., Thenya, T., Kiemo, K. and Emborg, J. (2020). The nexus between land cover changes, politics and conflict in eastern mau forest complex, kenya. *Applied Geography,* 114, 102115.

LaFree, G., Dugan, L. and Fahey, S. (2020). Global terrorism and failed states Peace and conflict 2008 (pp. 39-54): *Routledge.*

Lambin, E. F., Geist, H. J. and Lepers, E. (2003). Dynamics of land-use and land-cover change in tropical regions. Annual review of environment and resources, 28(1), 205-241. doi: 10.1146/annurev. energy.28.050302.105459

Li, M., van Vliet, J., Ke, X. and Verburg, P. H. (2019). Mapping settlement systems in china and their change trajectories between 1990 and 2010. *Habitat International,* 94, 102069.

Lin, G. C. and Ho, S. P. (2003). China's land resources and land-use change: Insights from the 1996 land survey. *Land Use Policy,* 20(2), 87-107.

Liu, Y. (2018). Introduction to land use and rural sustainability in china. *Land Use Policy,* 74, 1-4.

Long, H., Kong, X., Hu, S. and Li, Y. (2021). Land use transitions under rapid urbanization: A perspective from developing china: Multidisciplinary Digital Publishing Institute.

Mansour, S., Al-Belushi, M. and Al-Awadhi, T. (2020). Monitoring land use and land cover changes in the mountainous cities of oman using gis and ca-markov modelling techniques. *Land Use Policy,* 91, 104414.

Meyer, W. B. and Turner, B. L. (1992). Human population growth and global land-use/cover change. *Annual review of ecology and systematics,* 23(1), 39-61.

MUSA, I. G. and ADAMU, S. (2021). An analysis of land use and land cover change in southern part of kaduna metropolis, kaduna state, Nigeria.

Muzan, A. O. (2014). Insurgency in nigeria: Addressing the causes as part of the solution. *African Human Rights Law Journal,* 14(1), 217-243.

O'Sullivan, J. N. (2020). The social and environmental influences of population growth rate and demographic pressure deserve greater attention in ecological economics. *Ecological Economics,* 172, 106648.

Ojima, D., Galvin, K. and Turner, B. (1994). The global impact of land-use change. *Bioscience,* 44(5), 300-304.

Okafor, R., Adeleke, I. and Oparac, A. (2007). An appraisal of the conduct and provisional results of the nigerian population and housing census of 2006. Paper presented at the Proceedings of American Statistical Association: Survey Research Methods Section.

Olayiwola, A. M. and Lawal, M. O. (2018). Mapping urban growth and its impact on agricultural lands in abeokuta, nigeria: 1966-2016. *Interdisciplinary Environmental Review,* 19(3-4), 289-305.

Omole, O., Welye, H. and Abimbola, S. (2015). Boko haram insurgency: Implications for public health. *The Lancet,* 385(9972), 941.

Pelling, M. and Dill, K. (2010). Disaster politics: Tipping points for change in the adaptation of sociopolitical regimes. Progress in human geography, 34(1), 21-37.

Rwanga, S. S. and Ndambuki, J. M. (2017). Accuracy assessment of land use/land cover classification using remote sensing and gis. *International Journal of Geosciences,* 8(04), 611.

Salleh, M. A., Ahmad, A. A. and Jamil, S. (2018). Forced displacement and the plight of internally displaced persons in northeast Nigeria. *Humanities and Social Science Research,* 1(1), p46-p46.

Shuaibu, S. S., Salleh, M. A. and Shehu, A. Y. (2015). The impact of boko haram insurgency on Nigerian national security. *International Journal of Academic Research in Business and Social Sciences,* 5(6), 254-266.

Song, C., Woodcock, C. E., Seto, K. C., Lenney, M. P. and Macomber, S. A. (2001). Classification and change detection using landsat tm data: When and how to correct atmospheric effects? *Remote Sensing of Environment,* 75(2), 230-244.

Stamp, L. D. (1958). The measurement of land resources. *Geographical Review,* 48(1), 1-15.

Su, C., Fu, B., Lu, Y., Lu, N., Zeng, Y., He, A. and Lamparski, H. (2011). Land use change and anthropogenic driving forces: A case study in yanhe river basin. *Chinese Geographical Science,* 21(5), 587.

Temudo, M. P. and Cabral, A. I. (2017). The social dynamics of mangrove forests in guinea-bissau, west africa. *Human Ecology,* 45(3), 307-320.

Wang, J. and Maduako, I. N. (2018). Spatio-temporal urban growth dynamics of lagos metropolitan region of nigeria based on hybrid methods for lulc modeling and prediction. *European Journal of Remote Sensing,* 51(1), 251-265.

Wang, S. W., Gebru, B. M., Lamchin, M., Kayastha, R. B. and Lee, W.-K. (2020). Land use and land cover

change detection and prediction in the kathmandu district of nepal using remote sensing and gis. *Sustainability,* 12(9), 3925.

Weeraratne, S. (2017). Theorizing the expansion of the boko haram insurgency in Nigeria. *Terrorism and Political Violence,* 29(4), 610-634.

Wilson, S. A. and Wilson, C. O. (2013). Modelling the impacts of civil war on land use and land cover change within kono district, sierra leone: A socio-geospatial approach. *Geocarto International,* 28(6),

476-501.

Yakubu, A., Baba, B. A., Thlawu, P. and Gadzama, A. A. (2021). Assessment of the effect of boko haram insurgency on crop production in hawul local government area, borno state, nigeria. *Journal of Agricultural Economics, Environment and Social Sciences,* 7(1), 266-277.

Young, A. (2000). Land resources: Now and for the future: Cambridge University Press.