



Rapid Urbanization of Maiduguri Urban Environment: Trend, Causes, and Effects

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Abstract: Rapid urbanization has been considered one of the significant factors of urban studies in developing countries of the world since the emergence of population explosion in the 1960s and 1970s in larger cities (Barros, 2004). This study investigates the trend, causes, and effects of rapid urbanization in the Maiduguri urban environment between 1992 and 2022. The study was conducted using an integrated approach using Remote Sensing and GIS techniques. Key persons' interview was granted in five districts which include: Bolori, Dala Alamderi, Maisandari, Galtimari, and Mairi districts where 50 persons were interviewed as respondents. Data collected for the study were presented using maps, pictures, charts and analyzed using simple descriptive statistics. The study revealed that built-up area which constitutes residential, commercial and public facilities have recorded the highest change (22.34km²) in its area coverage between 1992 and 2022 and that natural population increase, rural-urban migration, commercialization, urban sprawl and city opportunities, were the most common causes of rapid urbanization in the study area. Rapid urbanization has given rise to several problems such as indiscriminate waste disposal, poor environmental hygiene and spread of diseases, slum and squatter sites development, generation of pollution, buildings along river banks, increased crime rate, high rate of unemployment, illegal hawking and begging on major roads, over stretching of public facilities, traffic congestion and shortage of portable water. Therefore, to achieve sustainable development and adhere to international best practice, the study recommends that the Borno State Government through the relevant stakeholders such as Borno State Urban Planning and Development Board, Borno Geographic Information Service, Borno State Environmental Protection Agency, Maiduguri Primary Health Care unit, Borno State Ministry of works and Transport, Borno State Traffic Management Agency and the Academia should be actively engaged to address problems associated with rapid urbanization in the study area.

Key words: Urbanization, Environment, Landuse/Landcover, Population.

INTRODUCTION

Rapid urbanization has been the main theme of urban studies in developing countries since the explosion of rates of growth in the 1960's and 1970's in very large cities (Barros, 2004). In spite of its small area coverage relative to the earth's surface, dynamic urban growth processes,

particularly the expansion of urban population in a larger extent and urbanized area, have a significant impact on natural and human environment at all geographic scales (Herold *et al*, 2005). Urban growth is a global phenomenon and one of the most important reforming processes affecting both natural and human environment through many ecological and socio-economic processes (Mandelas, *et al*, 2007). Currently, communities worldwide need spatial data to compensate for and adapt to current urban growth while planning for expected future change and its impacts on infrastructure, as well as the surrounding environment. Rapid rates of urban land use change and rate urbanization are now at the front of local political disputes (Goetz, *et al.*, 2003). In the last three decades, the technologies and methods of remote sensing have evolved dramatically to include a suite of sensors operating in a wide range of imaging scales with potential interest and importance to planners and land managers (Rogan & Chen, 2004).

The rapid urban growth, high population density and high consumption rate of residents in megacities has led to a wide range of local and global socioeconomic and environmental impacts which requires attention from the world community. Since it will significantly affect the global sustainability and future prosperity continuing urbanization or migration from rural to urban areas will expand the number of megacities, and it concedes that megacities are often plagued by environmental deterioration, inadequate housing, traffic congestion, slums, crime, and homelessness and so forth (Makinde, 2012). Although urbanization trend is global, according to the reports of the United Nations Centre for Human Settlements (Habitat, 2001), it has showed most remarked changes in developing countries associated with the migration of rural people to cities for better opportunities. Following this there had been estimated a rapid growth of population in urban areas at an average rate of 2.3% per year between the years 2000 and 2030 (Nations, 2001). Continuing population growth and urbanization are projected to add 2.5 billion people to the world's urban population by 2050, with nearly 90% of the increase are concentrated in Asia and Africa (UN, 2014). Rapid urbanization has been the key driving factor of Asia's development growth. Urbanization and rapid urban development in several Asian countries is marked by increasing physical growth which extends beyond metropolitan and city boundaries. Urbanization is predicted as a process that will continue in the coming years, so that sustainable development challenges will be increasingly concentrated in cities, particularly in the lower-middle-income countries where experiencing fastest urbanization (UN, 2014). Asian megacities have huge of population and rapid growth of economic so that they become magnets for people, investments, businesses, and organizations. Since they are facing urban expansion into their periphery areas, they bring both benefits and the problems of urbanization.

The trend towards urbanization is only accelerating and 96% of all urbanization by 2030 will occur in the developing world. Runde (2015) argue that this global shift towards a more global population has profound implications for a wide range of issues including food, water, and

energy consumption. Weisman (1980) mentioned there are two dominant trends pattern of urbanization in the world: (1) pattern of urbanization on the national scale; and (2) pattern of urbanization on the regional scale. On the national scale, there is an increasing concentration of people and production in one or a few places in the form of large metropolitan agglomerations. The ultimate form of this process is the megalopolis. Megapolitan development is occurring both in the highly industrialized and in the developing countries. However, the pace of transformation is dangerously rapid in the developing countries with limited capital, physical resources, as well as experience and skills. On the other hand, in the metropolitan regions themselves, the trend is inverted. The more affluent classes are moving into the surrounding country side to escape from the social and environmental consequences of excessive concentration, the physical congestion and the other negative externalities.

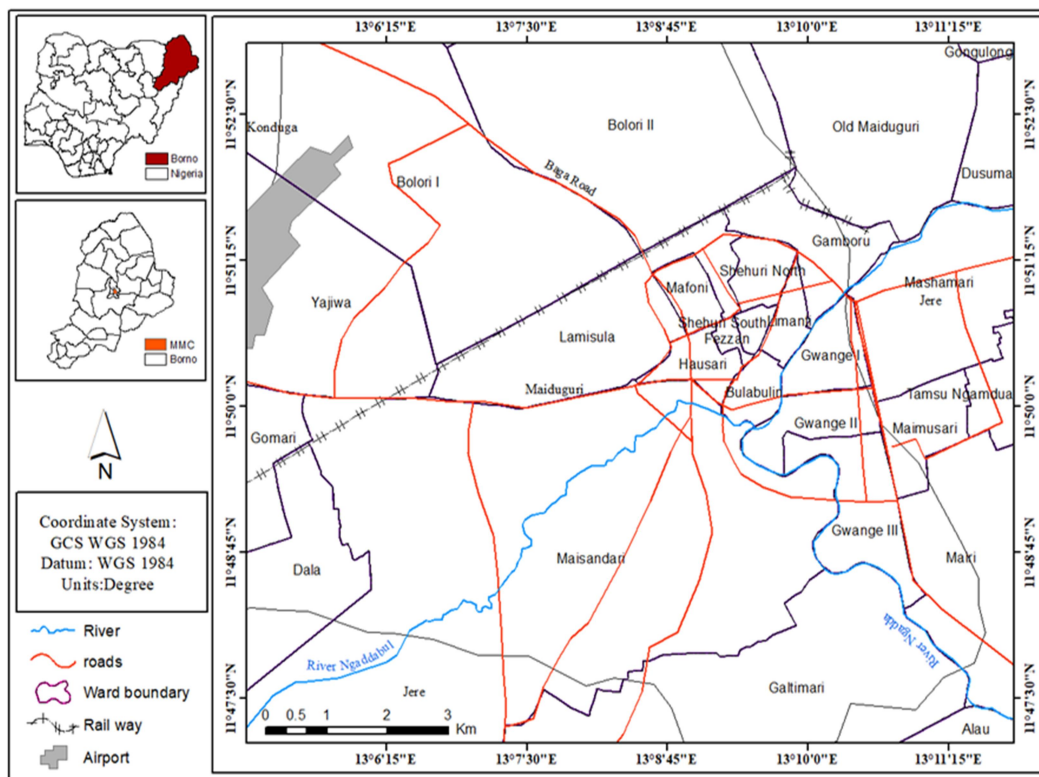
However, in both cases, the population and activities in the metropolitan regions continue to grow, although their central cities may be decaying and losing both. Darin-Drabkin, (1977) mentioned that the basic trends in world urbanization are: (1) An increasing percentage of world population is living in urban areas, the largest cities having the fastest growth; (2) Employment within these metropolitan areas is becoming concentrated in the city center; and (3) Population growth is mainly occurring in the outlying regions of the metropolitan area. Rapid population growth itself is a result of the diffusion of scientific- medical knowledge, and is the underlying cause of the growth of urban population. But the concentration of population in urban areas is also affected by economic growth, which is reducing the percentage of the population employed in agricultural (and rural) areas. Structural changes in employment, especially the raising of tertiary (service) sector have led to increased number of employment in the city center. Because most of the service firms need to be centrally located so they can obtain benefit from close interaction with each other. Industrial activities also continues to concentrate in the metropolitan area, which has a pool of skilled man-power, access to consumer markets, and a variety of auxiliary commercial services. These structural changes have also had an impact on the distribution of population in the urban areas. The increasing role of the city center for commercial purposes forces population shift to outlying districts. Developing new transportation systems has allowed it a degree of dispersal within the metropolitan region and facilitates outward spreading of urban areas.

The basis of using remote sensing data for change detection is that changes in land cover result in changes in measurement values which can be remotely sensed. Techniques to perform change detection with satellite imagery have become numerous as a result of increasing adaptability in manipulating digital data and increasing computer power. Post-classification comparison and multi-date composite image change detection are the two most commonly used methods in change detection (Jensen, 1996). GIS and remote sensing based change detection studies have predominantly focused on providing the knowledge of how much, where, what type of land use and land cover change has occurred.

STUDY AREA AND METHODOLOGY

Study Area

Maiduguri is relatively a new settlement in view of the long history of the Kanem Borno Empire which has flourished for over a thousand years (Waziri, 2009). The town was a creation of the British colonialists to serve as a new capital for the relic of the Kanem Borno Empire that came under their influence in the late nineteenth century. The coming of Shehu Abubakar Garbai El Kanemi, on the advice of the British, to the present location on the 7th of January 1907 marked the beginning of the city. The colonialists preferred to call the new capital of Borno, Maiduguri. However it is also noted as an important centre of Kanuri culture, Islamic scholarship, commerce, industry and communication (Waziri, 2009). Maiduguri is the capital city of Borno state in the North-Eastern region of Nigeria. It is located on latitude $11^{\circ}50'N$ $11.83^{\circ}N$ and longitude $13^{\circ}09'E$ $13.15^{\circ}E$, lying on a relatively flat terrain of about 350m above sea level.



Source: Modified from UN Office for the Coordination of Humanitarian Affairs, (2022)

Figure 1: Study Area

The present climate of the area is known to be tropical dry climate, the temperature regime is warm to hot throughout the year, but slight cooler period exist between the months of

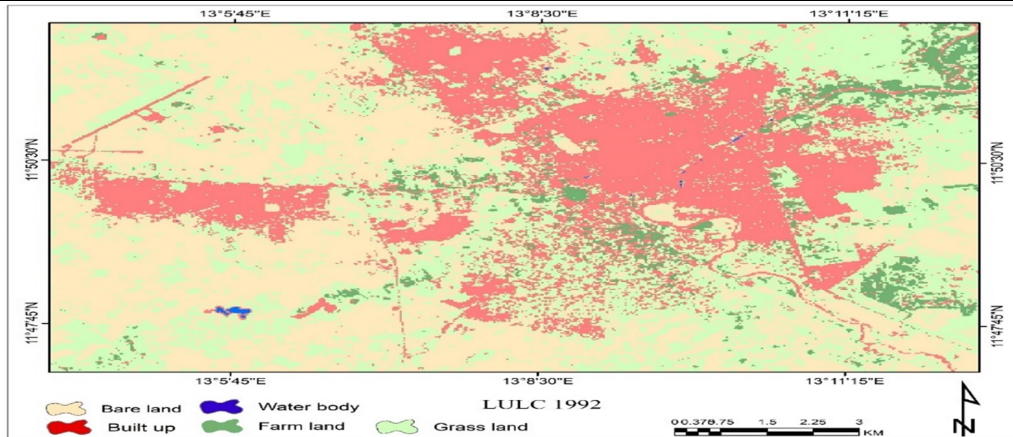
November and February. Mean annual temperature ranges between 30°C to 45°C, and mean monthly temperature values ranges between 28°C in the coldest months (December and February) and hottest months of April and May. Generally, rainfall in the area starts between May and June and ends around September and October. The mean annual rainfall is about 600mm with highest during the months of July to August (Ali, 2005). Maiduguri lies within Chad basin relief region which has an elevation of 300 meters above sea level. It is an extensive plain land with absence of prominent hills. This area was subjected to prolong sedimentation (Mega Chad) over a very long period. The Chad formation is separated from the southern highland by the Bama Ridge. River Ngadda has its source from the biu plateau which flows through Maiduguri and ended up within the jere bowl. (Nyanganji, 1994). Maiduguri is within the savanna zone. The vegetation types falls within the transition zones between the Sudan and Sahel ecological zones. The distribution and character of the vegetation like elsewhere, results from the interplay of climate, edaphic and biotic influence. The original vegetation of the area consists mainly of low- growing shrubs, mostly Acacia trees. Maiduguri was a commercial center serving a vast area and one of the major administrative centers in Northeast Nigeria. Trading includes major product like groundnut, hides and skin, Arabic gum and finished goods. There are five daily markets in Maiduguri with Monday market being the central one. The central business district along Babban layi and the Monday market area is the center of trade in all kinds of goods and services. Another main known market in Maiduguri is the Bolori stores.

Methodology

Data acquired for the study includes: Topographic map, Google earth images, GPS Coordinates, Landsat7 (ETM) 2001 Path/row 185/052, Landsat 8 (OLI) 2021 Path/row 185/052, Pictures of relevant situations in the study area and Relevant Socio-cultural information from key persons. Land use and Land cover of the study area had been classified using a supervised classification algorithm of CA Makov in Idrisi Terrset 2020 software. Shape files of extracted features were also exported to ArcGIS 10.8 environment to produce published maps. Anderson et al, (1976) classification scheme was adopted and images were clipped using the shape file of the study area after which interpretation was performed to identify available LULC classes. The LULC were classified as Built-up, Grass land, Water bodies, Farm land and bare land areas. Key person's interview was conducted in five districts which includes: Bolori, Dala Alamderi, Maisandari, Galtimari, and Mairi districts where 50 persons were interviewed as respondents. Data collected for the study were presented using maps, pictures charts and analyzed using simple descriptive statistics.

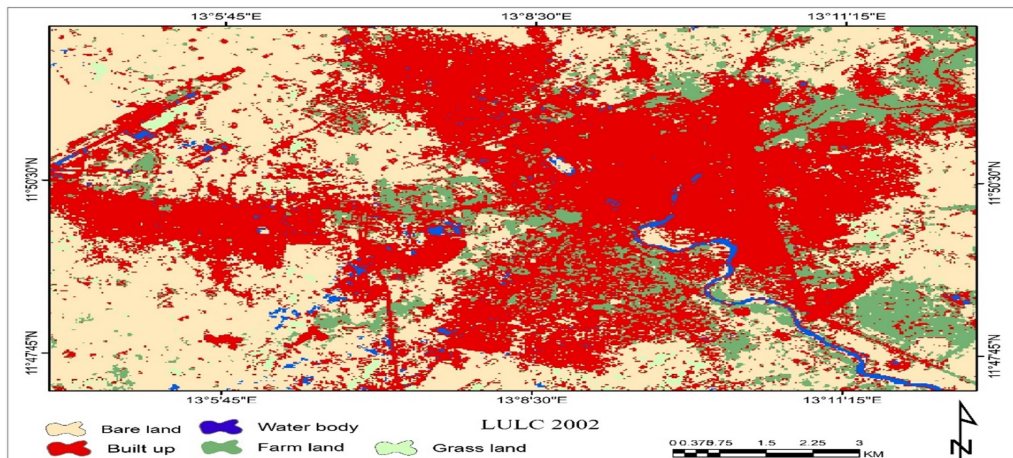
RESULTS AND DISCUSSION

Landuse/Landcover (LULC) Maps for 1992, 2002, 2012 and 2022 showing changes/trend



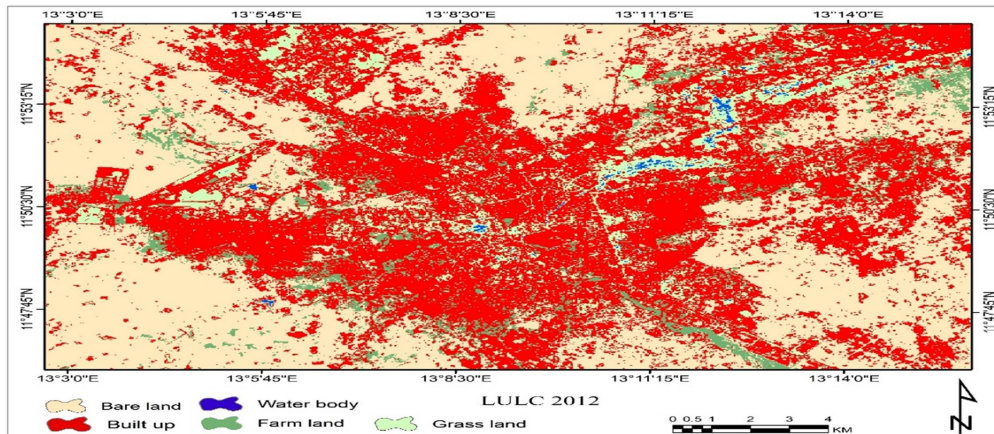
Source: LANDSAT IMAGE, 2022

Figure 2: LULC Map of the Study Area for 1992



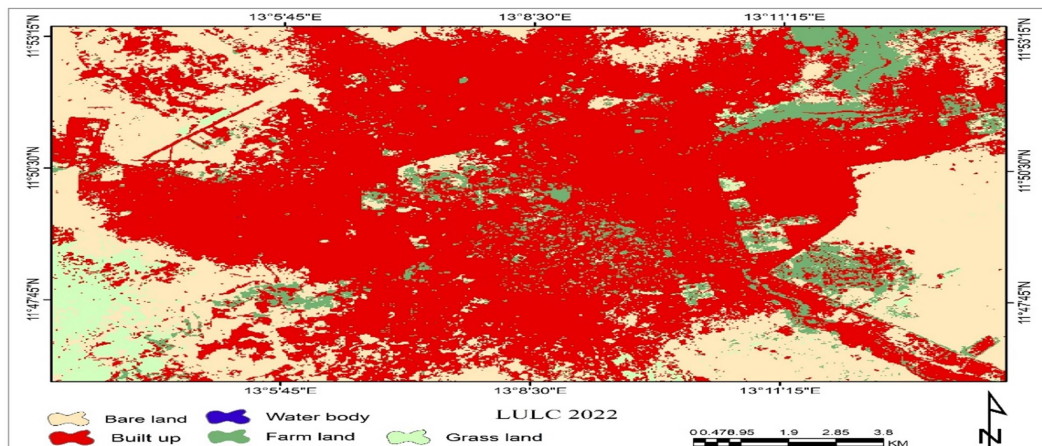
Source: LANDSAT IMAGE, 2022

Figure 3: LULC Map of the Study Area for 2000



Source: LANDSAT IMAGE, 2022

Figure 4: LULC Map of the Study Area for 2012

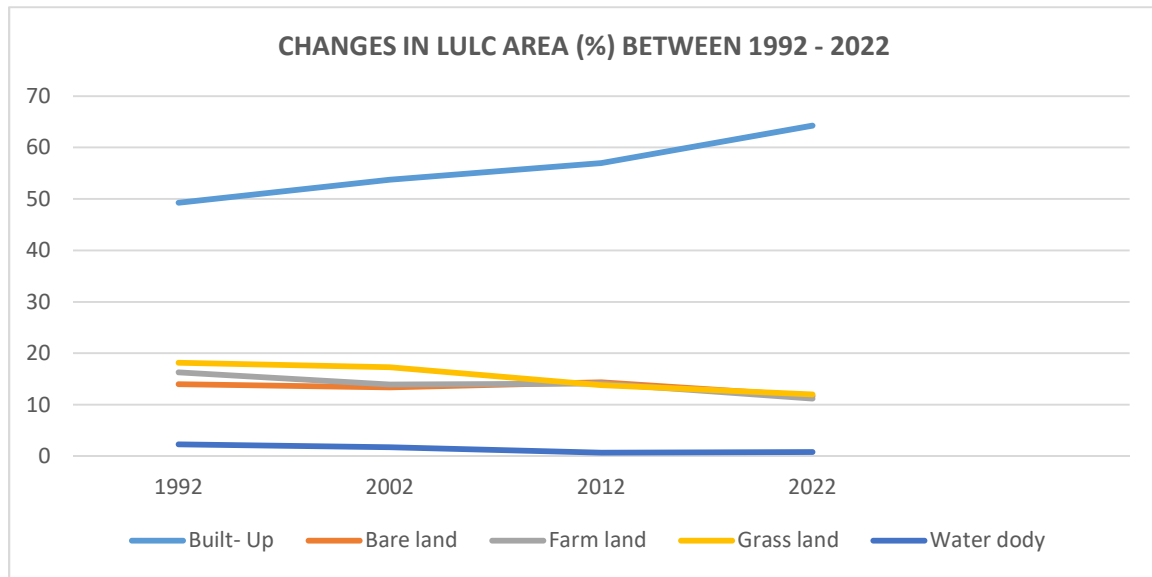


Source: LANDSAT IMAGE, 2022

Figure 5: LULC Map of the Study Area for 2022

The study revealed that Maiduguri urban area is about 149.15km² and that built-up area is the only class that witnessed a significant change between 1992 and 2022 in the study area. Built-up area occupied 73.49km² which is 49.27% of the total area in 1992; 80.18km² in 2002; 84.98 km² in 2012; and 95.83km² in 2022 which is 64.25%. This trend indicates a fast growth of the study area through these years. It has been observed that other classes of landuse other than built-up have declined between 1992 and 2022. Bare land recorded an area of 20.86km² (13.99%) in 1992 and finally declined to 17.45km² (11.70%), in 2022. Farm land recorded

24.28km² (16.28%) in 1992 and 16.71km² (11.20%) in 2022. Grass land and Water body recorded an area of 27.09 km² and 3.43 km² in 1992 and finally reduced to 17.91 km² and 1.25 km² in 2022. The above findings shows that built-up area which constitutes residential, commercial and public facilities and utilities have recorded the highest change of 22.34km² in its area coverage between 1992 and 2022.

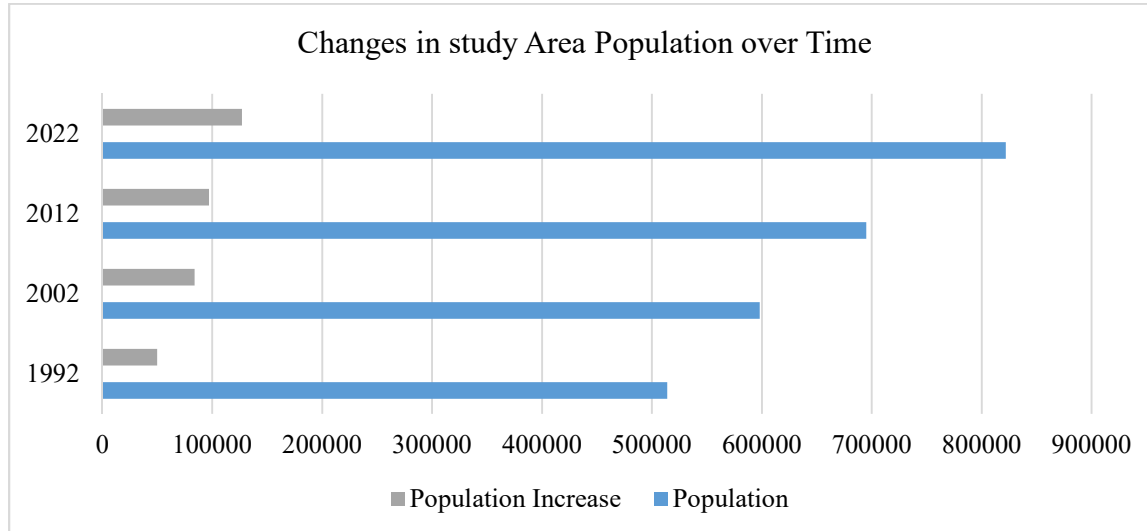


Source:
Author's
work
(2022)
Figure 6:
LULC
Change
between
1992

and 2022

Figure 6 above shows the trend between 1992 and 2022 where built-up area witnessed a steady and rapid growth. Bare land, Farm land, Grass land and water body all have their areas reduced basically due to urbanization which requires more land/space for housing and public facilities for the growing population in the study area. Rural-urban migration due to insurgency that ravaged most of the Local government areas of the State and natural population increase were observed to be the major factors that triggered the rapid urban growth in the study area.

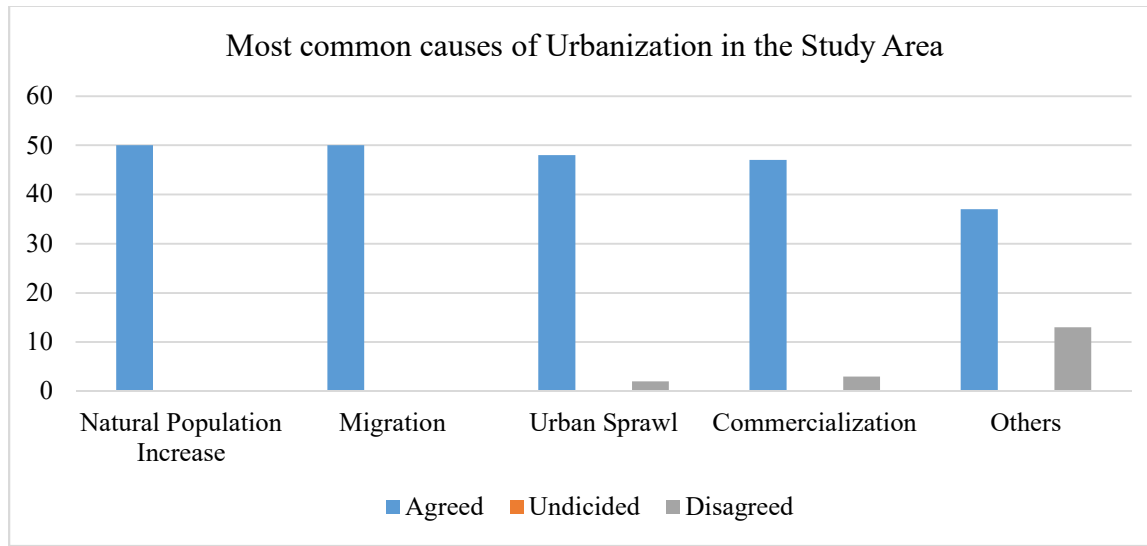
Causes of Rapid urbanization in Maiduguri Urban Area



Source: World statistical data (2022)

Figure 7: Changes in Study Area Population over time

The migration of the rural dwellers contributed greatly to population increase in the study area. The world statistical data says that Maiduguri urban area population in 1992 was 514,000, in 2002 was 598,000 and in 2012 and 2022 were 695,000 and 822,000 respectively. This high increase in population between 2012 and 2022 has tremendous influence on socio-economic activities as well as the physical environment development of the study area. Field investigation during the study pointed out the major issues of concern as regards rapid and uncontrolled urbanization in the study area such as: Indiscriminate waste disposal, poor environmental hygiene, slum development, generation of air pollution, buildings along river banks, urban sprawl development, illegal hawking and begging on major roads, over stretching of public facilities, traffic congestion, shortage of portable water among others.



Source: Field investigation 2022

Figure 8: Causes of Urbanization in the Study Area

The study further revealed that Natural population increase; Migration due to insurgency and city opportunities; Sprawl development at the city outskirts to accommodate the growing population; commercialization and other factors were considered causes of rapid urbanization in the study area. The findings show that 100% of the respondents agreed that natural population increase and rural-urban migration due to insurgency and city opportunities were among the major causes of rapid urbanization in Maiduguri urban area. Whereas, sprawl development recorded 96%, commercialization 94% and other factors such as living standard, reclassification of settlement, rural-urban change and social benefits recorded 74% of the respondents to have agreed as most common causes of rapid urbanization in the study area.

Problems of Rapid urbanization in Maiduguri Urban Area

As evidently portrayed in the pictures below, rapid urbanization has various negative effects on the physical environment in the study area. These effects are: Indiscriminate waste disposal, poor environmental hygiene and spread of diseases, slum and squatter sites development, generation of pollution, buildings along river banks, urban sprawl development, high crime rate, high cost of housing, high rate of unemployment especially among youth, illegal hawking and begging on major roads, over stretching of public facilities, traffic congestion and shortage of portable water among others.



Source: Field Investigation, 2022

Plate 1: Open latrine in a slum Connected to PVC pipe discharging waste to a pedestrian way



Source: Field Investigation, 2022

Plate 2: Urban Sprawl at the outskirts of the study area



Source: Field Investigation, 2022

Plate 3: Air pollution and Scavenging activities by Gwange Slum dwellers behind Gidan Madara



Source: Field Investigation, 2022

Plate 4: School aged children playing near Ephemeral stream behind Badamsi Filling Station along Biu Road



Source: Field Investigation, 2022

Plate 5: Buildings along river bank in Gwange Sobon Gari Area, Behind Gidan Madara



Source: Field Investigation, 2022

Plate 6: Population overcrowd in the State owned General Hospital Maiduguri



Source: Field Investigation, 2022

Plate 7: Traffic Congestion and Street Beggers along Polo by Circular Road Junction



Source: Field Investigation, 2022

Plate 8: Overcrowded classroom in a Public School



Source: Field Investigation, 2022

Plate 9: Street baggers along Polo by Circular Road Junction



Source: Field Investigation, 2022

Plate 10: Residents queuing for water



Source: Field Investigation, 2022

Plate 11: Bad housing condition in Jiddari Polo slum



Source: Field Investigation, 2022

Plate 12: BOSEPA machines evacuating refuse during environmental sanitation exercise



Source: Field Investigation, 2022

Plate 13: Scavenging activity and Indiscriminate waste disposal in 122 Layout



Source: Field Investigation, 2022

Plate 14: The ongoing Dualization and Expansion of the Monday Market – Gidan Madara Road as an effort to reduce traffic congestion

CONCLUSION AND RECOMMENDATION

The study concluded that Maiduguri urban area is fast growing basically because built-up area is the only landuse class that witnessed a significant change or increase between 1992 and 2022. Natural population increase, Rural-Urban Migration, and commercialization were considered major causes of rapid urbanization in the study area. Rapid urbanization has given rise to several problems such as indiscriminate waste disposal, poor environmental hygiene and

spread of diseases, slum and squatter settlement development, generation of pollution, buildings along river banks, urban sprawl development, high crime rate, high rate of unemployment especially among youth, illegal hawking and begging on major roads, over stretching of public facilities, traffic congestion and shortage of portable water. Therefore, to ensure urbanization contributes to both physical and socio-economic sustainable development in the study area, the global best practice should be adhered to. Hence, the study recommends that the Borno State Government through the relevant stakeholders such as Borno State Urban Planning and Development Board, Borno Geographic Information Service, Borno State Environmental Protection Agency, Maiduguri Primary Health Care unit, Ministry of works and Transport, Borno State Traffic Management Agency and the Academia should be engaged actively to address major problems associated with rapid urbanization in the study area as in the case of Monday Market – Gidan Madara Road (see plate 14)

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