ASSESSMENT OF THE EFFECT OF URBAN RENEWAL ON VEGETATION IN KADUNA NORTH LOCAL GOVERNMENT AREA, KADUNA STATE

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ABSTRACT

The study assessed the effect of urban renewal on vegetation within Kaduna North. The study used Landsat imageries between the year 2016 and 2023. The characteristics of the Landsat images are; Landsat 7 (30m resolution), Landsat 7 ETM+ (30m resolution) and Landsat 8 Oli/TIRS (30m resolution). Landsat images of 2016 and 2023 was classified into two different categories/polygons viz: built-up and vegetation. The result revealed that the NDVI map (2016) lowest point to be 0.0528414 which according to the NDVI correspond to barren areas, sand and built-up. The highest point of the map revealed to be 0.34144. These represent the green-coloured areas on the map which according to NDVI such value of 0.2-0.3 represent shrubs, farmlands and grassland. Also, the 2023 NDVI map revealed the lowest point to be -0.177581 which according to the NDVI correspond to barren areas, sand and built-up. This indicate a clear distinction from figure 4.6 which the lowest value is -0.0528414. This indicates in increase in the built-up areas and decrease in vegetation within the study area. The highest point of the map revealed to be 0.432848. These represent the green-coloured areas on the map which according to NDVI such value of 0.2-0.3 represent shrubs, farmlands and grassland. Percentage change in area covered for vegetation in 2016 (10.23%) that is 7.18km^2 compared to the area covered by vegetation in 2023 which is 4.36% that is 3.06km^2. This implies that 4.12km^2 representing 5.87% of the total land loss to built-up areas for the urban renewal projects in the study area while the extent of

magnitude of land use land cover change in Kaduna North LGA revealed that farmlands and vegetation are both with negative values (Rate=-0.32km2 and -0.59km2) respectively to represent decrease in the total area covered. The study concludes that despites the loss in vegetation at the onset of the urban renewal, the NDVI map of 2023 of the study area revealed an increase in green areas (vegetation) within the study area. This is attributed to wide spread of horticulturist and consistent growth of plants along major roads such as Swimming pool road, Isa Kaita Road, Ali Akilu Road and Tafawa Balewa Way. The study recommends further spread of horticultures within the city to improve the urban beautification and in return increase the vegetation and modify the micro climate of the study area.
KEYWORDS: Assessment, Effect, Urban Renewal, Vegetation, Kaduna North

INTRODUCTION

Urban renewal is primarily the act of revitalizing a deteriorating urban area in order to restore economic vitality and improve livability and the safety of the inhabitants in the area. Although the urban renewal statute is flexible and can be used for development, as well as redevelopment (Brown and Barber, 2021). Understanding that redeveloping urban areas is much harder and more expensive than new development. Urban renewal, which is generally called urban regeneration in the United Kingdom, is a program of land redevelopment in areas of moderate to high density residential urban land use. This takes place when the physical social economic characteristics of a rundown urban area have been rebuilt as part of a strategic plan to improve an area. Housing, industrial locations and dock side developments are typical regeneration projects (Brown and Barber, 2021).

Every move made during the renewal process of an area brings about positive and negative impacts on the people, environment, economy and existing social linkage (Cinderby, 2020). The term Built Environment refers to the structures, and infrastructure, that are made by man. This can include everything from simple housing to entire cities, and even man-made outdoor environments. Built environments provide the basic necessities for human life as we know it, and therefore must be functional and healthy for all. Finding this balance is a complicated and challenging process, and one that is consistently being refined (Cinderby, 2020).

Urban renewal projects haves led to loss of vegetation which acts as both carbon sink, temperature regulating mechanism and habitat loss to a lot of birds, (for example the disappearance of vultures in northern town in Nigeria), and other animals(Qiao*et al.,* 2020), it has also led to forced migration, social distortion, internal displacement of citizens and has greatly affected the general livelihood of the inhabitants.

Vegetation is very useful in providing a conducive microclimate which mitigates urban heat islands (UHIs). Similarly, as the urban areas continue to develop through infrastructural development, replacement of old-fashioned houses to modern high-rise buildings, road dualization and expansions, the vegetation are gradually replaced by building and urban infrastructure which eventually aid urban heat islands (Yang *et al.*, 2017).

Vegetal cover removal in the urban areas has contributed to environmental degradation, Aluko (2010), with floral conversion of most of the atmospheric carbon dioxide into oxygen, urban centres are believed to be contributing 80% of general anthropogenic carbon dioxide (United Nations, 2018; Ogutu*et al.,* 2021) globally, yet urban renewal as a drive to vegetal removal and replacement with infrastructure aid climate change and making our urban centres vulnerable in experiencing extreme weather conditions such as rise in temperature, and flooding (While & Whitehead, 2013).
Although, there are a number of studies on the implications of urban renewal projects, no specific study has been carried out in Kaduna North LGA especially on the aspect of vegetation. This study seeks to fill the gap by providing more empirical findings in the field of urban renewal and to complete the gap left by the study of Abdullahi (2021), where he assessed the effect of urban renewal on socioeconomic activities in Kaduna North LGA.

METHODOLOGY

Study Area

Kaduna North L.G.A lies between Latitudes 10^0 7'N and 10^0 6'N and between Longitudes 6^0 41'E and 8^0 5'E and it is one of the 23 Local Governments Areas in Kaduna State (See Figure 1.1). It is estimated to have a population of 620,747 (Kaduna State Ministry of Budget and Planning, 2016). Its headquarters is in the town of Doka. It consists of the following settlements: Kawo, Sabon Kawo, HayinBanki, RafinGuza, UnguwanDosa, Badarawa, Malali, Unguwan Rimi,

Unguwan Yero, Unguwan Kanawa, Kabala, Abakpa, Unguwan Shanu, central business district (CBD) and Kwaru. It is bordered by Kaduna South, Igabi, and Chikun local government areas. It has a mixed population with Muslims and Hausas being dominant (Yusuf, 2015).

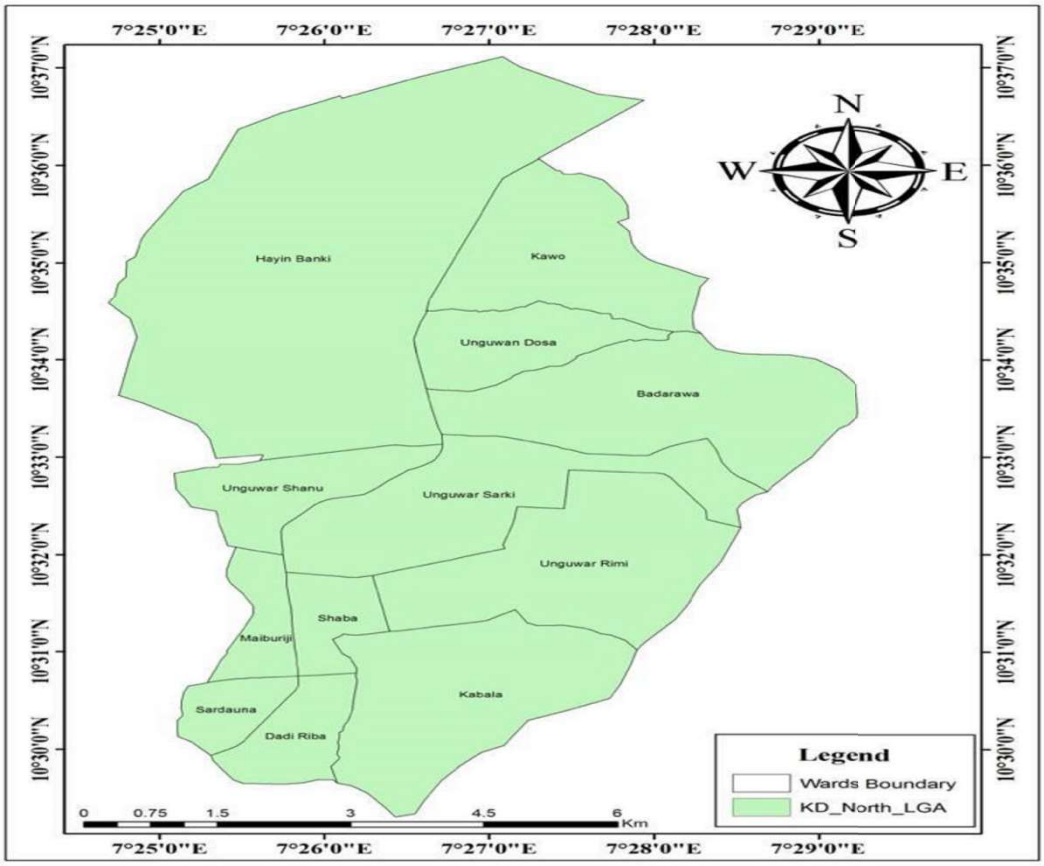

Figure 1.1: Kaduna North Local Government Area Showing the Twelve Wards

Source: Kaduna Geographical Information System, 2023

Types of Data and Sources

The study used two Landsat imageries between the year 2016 and 2023 and all the Landsat imageries have a resolution 30 metres, which we find adequate for this analysis. The characteristics of the Landsat images to be used are shown in Table 1.

Table 1: Characteristics of Landsat Imageries

S/N	Landsat	Bands	Resolution	Date
1.	Landsat 7 (ETM+)	8	30m	18-12-2016
2.	Landsat 8 (OLI/TIRS)	11	30m	18-12-2023

Source: NASA (2015)

Data processing

Pre-processing: The images was downloaded from United States Geological Survey Agency. The scenes containing the study area was individually imported into ERDAS Imagine 2014. In order for the satellite images to fit perfectly, the 2017 satellite image was geo-rectified to the baseline image of 2023. The study area was extracted by using Area of Interest (AOI) layer and masking the main satellite band.

DATA ANALYSIS

Landsat images of 2016 and 2023 was classified into two different categories/polygons viz: built up and vegetation.

Image Classification

The intent of the image classification process was to categorize all pixels in a digital image into one of several land cover classes, or "themes". This categorized data may then be used to produce thematic maps of the land cover present in an image. There are three common methods of land use land cover classification. However, this study made use of the supervised classification.

Supervised Classification

Supervised classification is the technique most often used for the quantitative analysis of remote sensing image data. At its core is the concept of segmenting the spectral domain into regions that can be associated with the ground cover classes of interest to a particular application. In supervised classification the user or image analyst “supervises” the pixel classification process. The user specifies the various pixels values or spectral signatures that should be associated with each class. This is done by selecting representative sample sites of a known cover type called Training Sites or Areas (Jensen & Joel, 1996).

Table 2: Change Detection Classification Scheme

Code	LULC categories	Definition
1	Vegetation	Natural Greenings, Scrub Lands and Flowers
2	Built-up land	Residential developments,

	Commercial developments, Tarred Roads, Rail lines, Pavements, and Concrete Floors

Source: Jensen, 2005

To establish the magnitude of change of land covers between 2016 and 2023 in Kaduna North LGA, the magnitude of change (MC), the percentage of change (PC), and the annual rate of change (ARC) for each LULC class during each period of time was computed based on the following equations.

$$MC\ (ha) = A_i - A_f \quad \text{.....i}$$

$$PC\ (\%) = \frac{A_i - A_f}{A_i}\ x\ 100 \quad \text{..... ii}$$

$$ARC\ (ha.year^{-1}) = \left(\frac{A_i\ -\ A_f}{n}\right)$$

$$ARC\ (\%) = \left(\frac{A_i - A_f}{A_i\ x\ n}\right)\ x\ 100$$

RESULTS AND INTERPRETATION

Land use Land cover Change of the Study Area 2016-2023

To assess the effect of urban renewal projects on vegetation in the study area, Landsat images of 2016 and 2023 were classified into two different categories/polygons namely, built-up and vegetation.

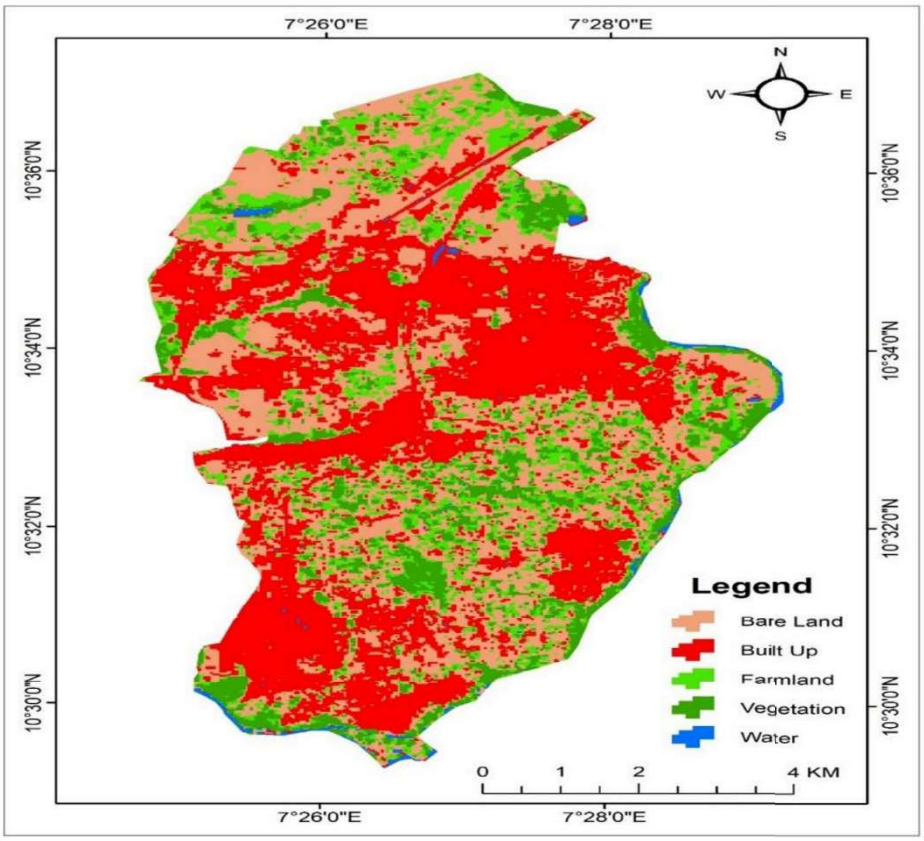

Figure 1.2: Kaduna North Showing the LULCC of 2016

Figure 1.3: Kaduna North Showing the LULCC of 2023

Source: Kaduna Geographic Information System (2023)

Figure 1.2 shows the LULCC of Kaduna North LGA of 2016. The spatial distribution of the greenery such as farmland and vegetation that spread spatially across the study area. The built-up areas represented by red colour and water bodyby blue. The urban renewal project started in the year 2016 which gives the reason for having more vegetation and farmlands in the study area prior the urban renewal in Kaduna State.

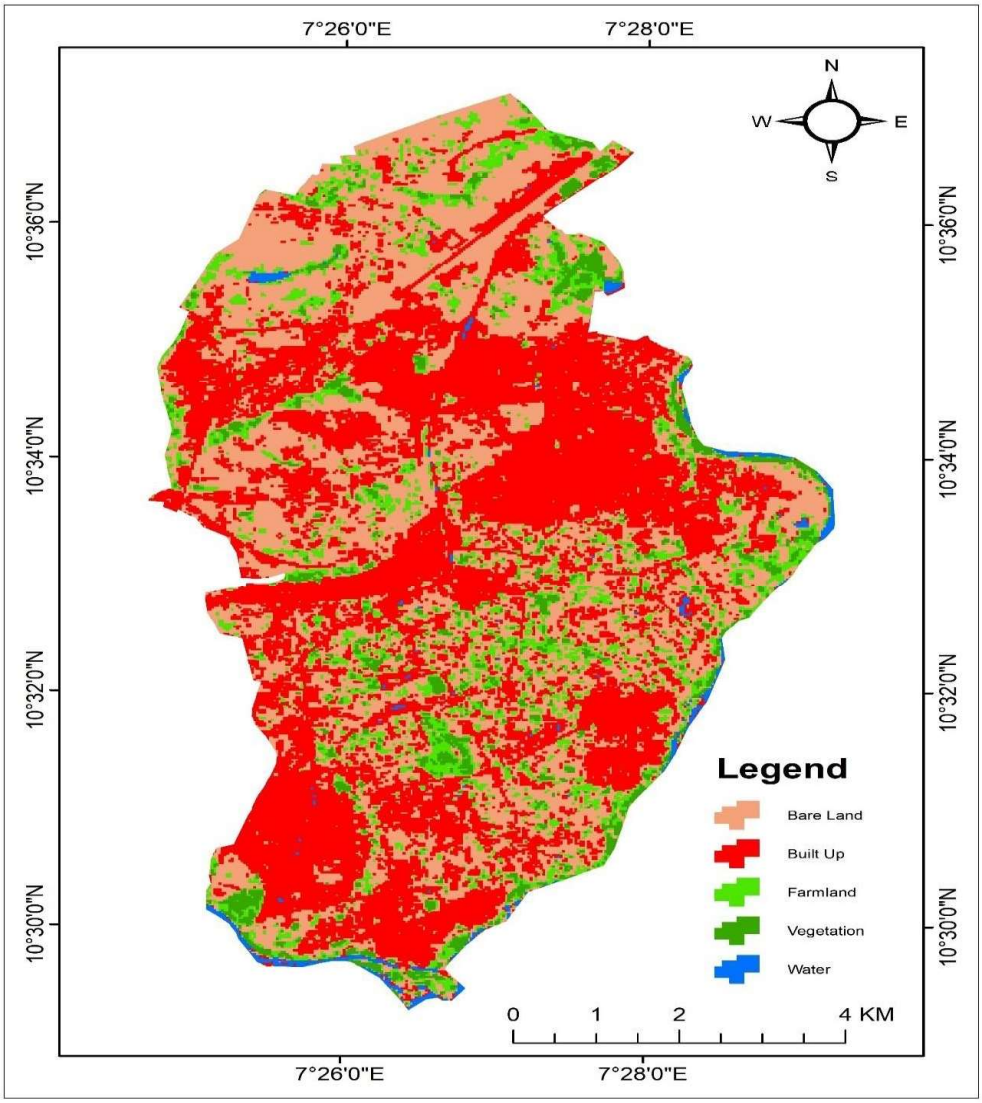

Figure 1.3 shows the LULCC of Kaduna North LGA of 2023. The figure revealed some changes when compared to figure 1.2 (LULLCC of 2016). The red colour representing the built-up areas spread wider across the study area reducing the greenery look of the study area from the 2016 LULCC of the study area. Vegetation and farmland loss in the study area is evidence of the impact of urban renewal project taking place in the study area. More infrastructures such as modern neighbourhood centers, shopping malls, modernization of markets, bridges and road constructions/rehabilitation are some of the urban renewal projects that has impacted on the urban vicinity which necessitated the removal/reduction of vegetation during the urban renewal project.

Source: Kaduna Geographic Information System (2016)

Figure 1.4 shows the Normalized Difference Vegetation Index (NDVI) of the

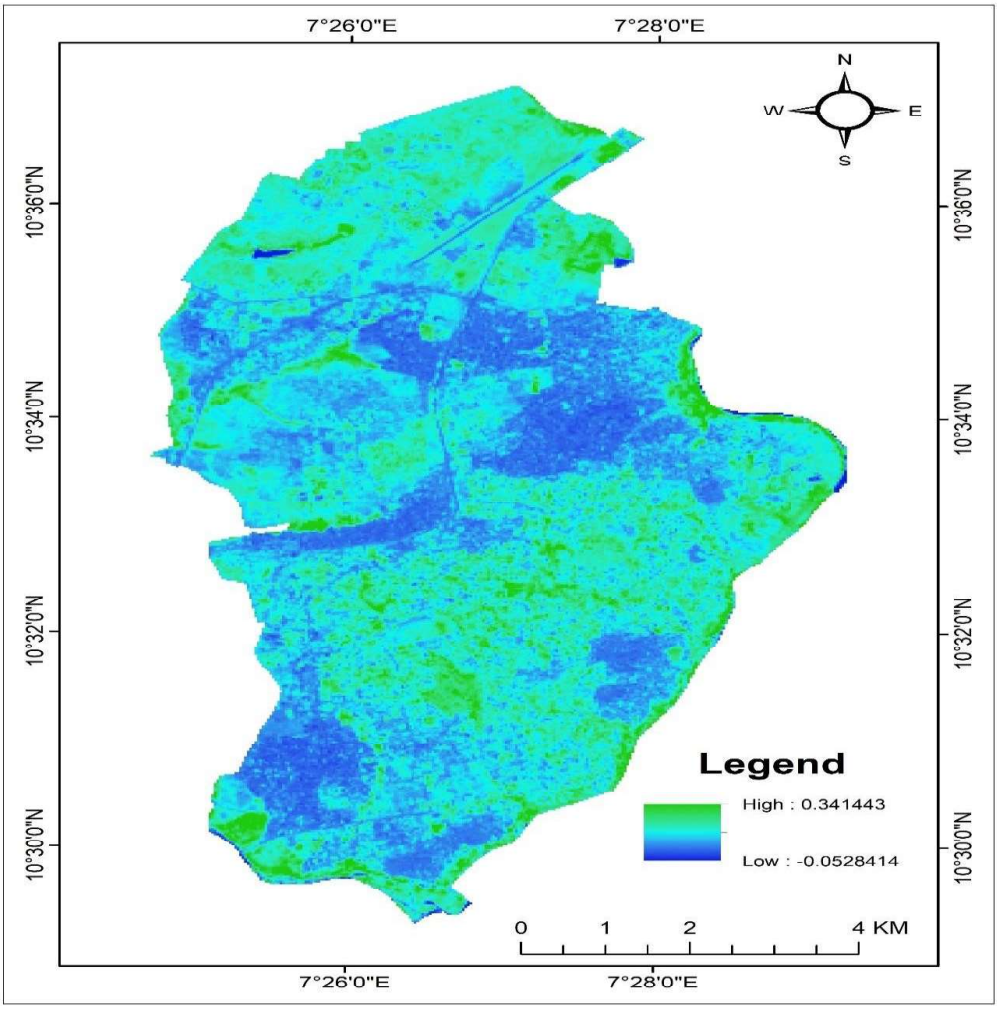

Figure 1.4: Kaduna North Showing the NDVI of 2016

study area in 2016 The map revealed the lowest point to be -0.0528414 which according to the NDVI correspond to barren areas, sand and built-up. The highest point of the map revealed to be 0.34144. These represent the green-coloured areas on the map which according to NDVI such value of 0.20.3 represent shrubs, farmlands and grassland. However, when NDVI result is within zero to less than

+1, it is likely to represent an urbanized area. That is the result confirmed to be a reduction in vegetation over the seven years period of urban renewal in the study area. The study connotes with the study of Nwanna (2012), on gentrification in Lagos State Nigeria, he was of the view that urban renewal is not only uneconomical but also damages the city's heritage and degrades various socioenvironmental qualities including vegetation loss.

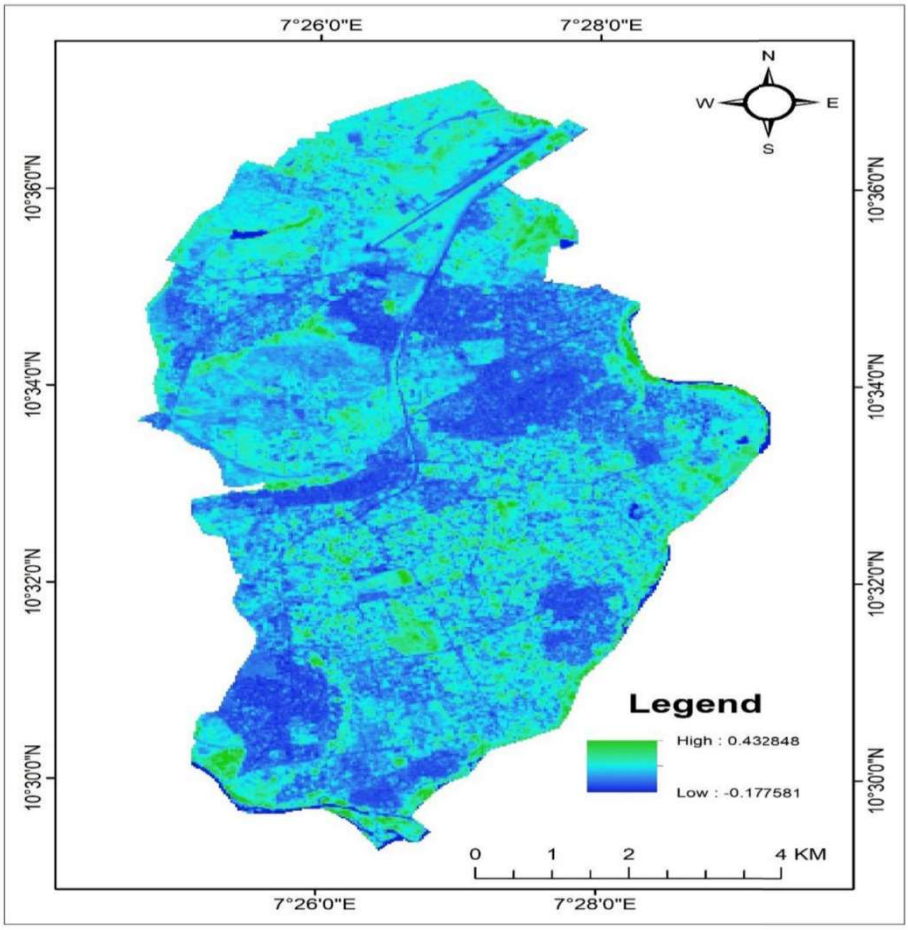

Figure 1.5: Kaduna North Showing the NDVI of 2023
Source: Kaduna Geographic Information System (2023)

Figure 1.5 shows the Normalized Difference Vegetation Index (NDVI) of the study area for the year 2023. The map revealed the lowest point to be -0.177581 which according to the NDVI correspond to barren areas, sand and built-up. This indicate a clear distinction from figure 4.6 which the lowest value is -0.0528414. This indicates an increase in the built-up areas and decrease in vegetation cover

within the study area. The highest point of the map revealed to be 0.432848. These represent the green-coloured areas on the map which according to NDVI such value of 0.2-0.3 represent shrubs, farmlands and grassland. However, when NDVI result is within zero to less than +1, it is likely to represent an urbanized area. The planting of more trees, flowers on the streets, presence of horticultures (florist) in the study area and rehabilitation of some green areas/parks leads to the possible increase of the green areas in the study area in the year 2023.

Magnitude of Land Use Land Cover

The Tables (3 and 4) show the extent of change of the land use from the period of 2016 to 2023 and the magnitude of change of these land use that is built up areas, vegetation, water body, farmland and bare ground. It is clear that the percentage change shows a high variation or changes between vegetation and built-up areas over the years.

Table 3: Magnitude of Land Use Land Cover Change Kaduna North LGA

Class Name	**2016**		**2023**	
LULC Class	**Area KM^2**	**Percentage %**	**Area KM^2**	**Percentage %**
Bare Land	27.83	39.64	30.28	43.13
Built Up	26.40	37.60	30.17	42.97
Farmland	8.30	11.82	6.05	8.62
Vegetation	7.18	10.23	3.06	4.36
Water	0.49	0.70	0.65	0.92
Total	**70.21**	**100**	**70.21**	**100**

Extent (Magnitude) = Reference Year - Base year (i.e. 2016-2023)

Table 4: Extent of Magnitude of Land Use Land Cover Change Kaduna North LGA

Class Name	**Magnitude**	**Rate**
LULC Class	**Area KM^2**	**Area KM^2**
Bare Land	2.45	0.35
Built Up	3.77	0.54
Farmland	-2.25	-0.32
Vegetation	-4.12	-0.59
Water	0.16	0.02

Table 3 show a percentage change in area covered for vegetation in 2016 (10.23%) that is 7.18km^2 compared to the area covered by vegetation in 2023 which is 4.36% that is 3.06km^2. This implies that 4.12km^2 representing 5.87% of the total land loss to built-up areas for the urban renewal projects in the study area.

Table 4 show the extent of magnitude of land use land cover change in Kaduna North LGA. The table revealed that farmlands and vegetation are both with negative values (Rate= -0.32km2 and 0.59km2) respectively to represent decrease in the total area covered.

Magnitude of difference. The area was obtained by divide the Magnitude by the total number of years covered which is 7. The variable bare land has a total magnitude of 2.45km^2 given an area difference of 0.35km^2. The positive values show an increase while the negative values show a decrease of area covered. Over the span of 7 years (2016-2023), the table revealed that bare land has increased with 0.35km^2, built up areas increased with 0.54km^2 and water also increased with 0.02km^2.

CONCLUSION

The study concludes that despites the loss in vegetation at the onset of the urban renewal, the NDVI map of 2023 of the study area revealed an increase in green areas (vegetation) within the study area. This is attributed to wide spread of horticulturist and consistent growth the plants along major roads such as Swimming pool road, Isa Kaita Road, Ali Akilu Road and Tafawa Balewa Way. The study recommends further spread of horticultures within the city, improves the urban beautification and in return increase the vegetation and modify the micro climate of the study area.

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