



## **Evolution of Urban forms in Port Harcourt Metropolis**

**G. P. Bisco<sup>1</sup>, A. A. Obafemi<sup>2</sup>, O. D. Chukwudi<sup>3</sup> and M. Ogoro<sup>2\*</sup>**

<sup>1</sup>*Rivers State Ministry of Urban Development, Port Harcourt, Nigeria.*

<sup>2</sup>*Department of Geography and Environmental Management, University of Port Harcourt, Nigeria.*

<sup>3</sup>*Institute of Geosciences and Space Technology (IGST), Rivers State University, Nkpolu-Oroworukwo, Port Harcourt, Nigeria.*

### **Authors' contributions**

*This work was carried out in collaboration among all authors. Author GPB designed the study. Author MO performed the statistical analysis. Author AAO wrote the protocol. Author GPB wrote the first draft of the manuscript. Authors AAO and MO managed the analyses of the study. Author ODC managed the literature searches. All authors read and approved the final manuscript.*

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### **ABSTRACT**

The nature of urban development in Port Harcourt Metropolis makes for the study of urban evolution dynamics across the metropolis. Land-Sat Tm of 30m x 30m of 1986, 2000 and 2015 were employed to examine the changes in urban development across the study area. The direction of urban growth as revealed by the image analysis was digitized in the Arc GIS 10.4 environment. Findings revealed that, the morphology of the city is in the form of a non-regular polygon. The analysis also reveals that, there is an increase in the growth of the city from 1986 through 2000 and, then 2015. The growth direction of the city grew more north-ward rather than south-ward. The growth in the city population and the expansion of networks of roads, resulted in the transformation of the city form, and as development evolved, industrial locations were now focused in the Northern fringe of the city occupying extensive land areas which gave rise to other micro industrial and residential buildings extending northward hence, the visible level of anthropogenic activities or

\*Corresponding author: Email: [mark.ogoro@uniport.edu.ng](mailto:mark.ogoro@uniport.edu.ng);

alterations. The study therefore recommends that, geographical boundaries should be given great emphasis by planning authorities in plan preparation in order to accommodate developmental growth and expansions.

*Keywords: Morphology; urban; development; anthropogenic; fringe; evolution.*

## 1. INTRODUCTION

The study of urban morphology originates from the works of Schluter, Otto a German geographer [1]. This early period of urban morphology within geography had a marked influence on how the field developed in the course of the twentieth century. Urban morphology was from the beginning, in keeping with its origins in geography, inherently about distinguishing, characterizing and explaining urban landscapes which is characterized by a number of different perspectives one that has attracted increased interest since the early 1980s and is also arguably the oldest. Many parts of the towns and cities lack the regularity of plot dimensions which series of residential plots tend to have. This trend has resulted in the physical expansion of urban areas consisting largely of a pattern of low-density expansion in large urban areas. Informal housing development on the urban fringe lands which are mostly privately owned, sold in single small plots induced the outward growth of an urban area in an uneven form and progress. The growth of the city was made up of series of outward expansions in residential area separated by marked pauses. This gave rise to a fringe belts which are of great variety in shapes and sizes [2]. The changes over time in the number of buildings and its associated fluctuations in land values and cover, majorly influences the formation of urban fringe belts. Therefore, there is a stretch of uncontrolled outward spread of Urban (built-up area) areas as a result of urbanization processes. This phenomenon has attracted the attentions of researchers in various disciplines reflecting on the spatial context of various activities in city growth which explains the complexities of socio-economic, transportation, industrial and various environmental problems associated with activities on land development and city growth [1]. A glimpse into the historical sequence of development in the recent past suggests that, the diverse motives which have accelerated the phenomenal growth of urban cities are the availability of land to accommodate the growing population in the cities. A Nigerian city, typical of Port Harcourt metropolis, is one of such cities which show an example of physical expansion of

cities aimed at containing her population increase. Urban growth as a complex process is as a result of combined factors such as geographical location, natural population growth, rural-urban migration, infrastructural development, national policies, corporate strategies, and other major political, social and economic forces, including globalization [3]. In Africa, urbanization has recently gained additional momentum due to climate change and armed riots in rural areas. According to investigations published by the UN in 2008, urban population increases much faster than that of the rural areas displaying the highest annual growth rate of 3.4% globally [4]. At the amalgamation of the Northern and Southern protectorates of Nigeria in 1914, the administration of Port Harcourt City under the British colonial masters took charge of the area known as the Port Harcourt Township and prepared an urban development plan comprising three distinct areas which are; European Quarters (GRA), the Port Railway Terminals Areas (Harbour Road) and the Native Residential and Commercial areas [5]. These areas formed the centre of the city as initially conceived and planned development was expected to proceed out of the Centre in a uniform dimension to the outer areas following the city's master plan carved out for the region [5]. In 1976, the Rivers State Government in an attempt to solve the problem of increasing population occasioned by migrations into the city, decided to reclaim lands for residential housing development and associated landuse within the metropolis. This however, did not give a directive or guide to the pattern of proposed city morphology or form neither did it govern the decision of urban habitants as to areas for residential and other developmental activities. This pattern of growth has some environmental consequences such as overcrowding, spread of infections, general filthy conditions and decaying environment. The continued growth of our urban centers, through the process of urbanization needs to be understood, and the direction of such growth determined so as to build a comprehensive plan that will accommodate future population and urbanization processes / dynamics.

### 1.1 Location and Extent

Port Harcourt metropolis is located between Latitude 4045'N through Latitude 4055'N, and Longitude 6°55'E through Longitude 7005'E as shown in Fig. 5. It is located at about 66 km from the Atlantic Ocean. Port Harcourt metropolis spans over two local government areas; Port Harcourt and Obio/Akpor LGAs.

Port Harcourt was founded in 1913 by the British colonial administration of Nigeria and started as a fishing settlement on which the colonial administration developed a coastal Port to facilitate the evacuation of goods from the region to the metropolitan country of England (Adeyemo and Ogbale, 1999). The city was established because its geographic settings met the locational requirement set by colonial surveyor for port-terminus deep water, near high ground which shall be connected to the mainland (Anyanwu, 1979 quoted by Obinna et al. [6]. From Igwuocha, Port Harcourt was renamed by Lord Fredrick Lugard after Vernon Harcourt, the then secretary of state for the colonies. The area that became Port Harcourt in 1913 was originally the farmlands of the Diobu village, a group of the Ikwerre, an Igbo sub-

group [7]. The colonial government caused the people of Diobu to cede their land and by 1913 the building of a Port Harcourt-town started (see Fig. 1 Port Harcourt Master Plan 1975).

The area had grown from 64km<sup>2</sup> to 360km<sup>2</sup> in the early 1990s and as at the year 2005 Port Harcourt had covered an area of over 500km<sup>2</sup> occupying local governments of Eleme, Okrika now Oyigbo (Ekpenyong, 1992; Umeudujii, 2006) see Figs. 2, 3 and 4.

The economic activities in Port Harcourt metropolis as in other urban areas are mostly trade, commerce and industrial development. Usually, the urban economy is known to be in the formal and informal sectors. The mile 1 market, mile 3 market, Oil Mill market, Port Harcourt New layout market and the Obio/Akpor International market are major centers for transactions of goods and services. The attractions of more population, informal businesses like: street Hawking petty hawking petty trading, are very common on street alleys which form the informal sections. Also there are supermarkets and warehouses stocking large volume of goods. The Residential hotel, La Meridian hotel, Somitel hotel etc. are few of the hotels that accommodate visitors in the city.

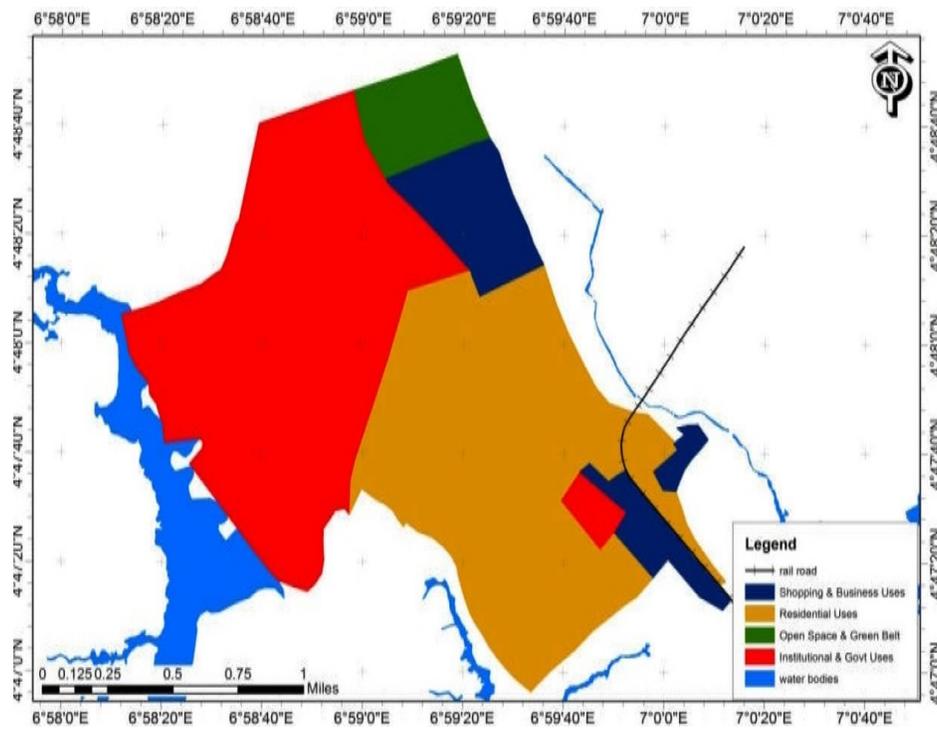


Fig. 1. Port Harcourt master plan 1975 [8]



Fig. 2. Google image of Port Harcourt metropolis as at 1984



Fig. 3. Google image of Port Harcourt metropolis as at 2005

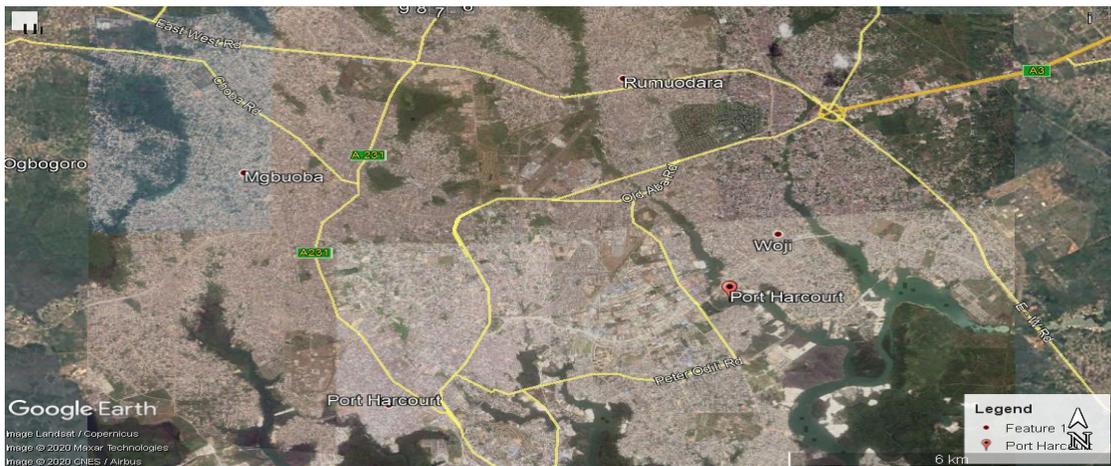


Fig. 4. Google image of Port Harcourt metropolis as at 2015

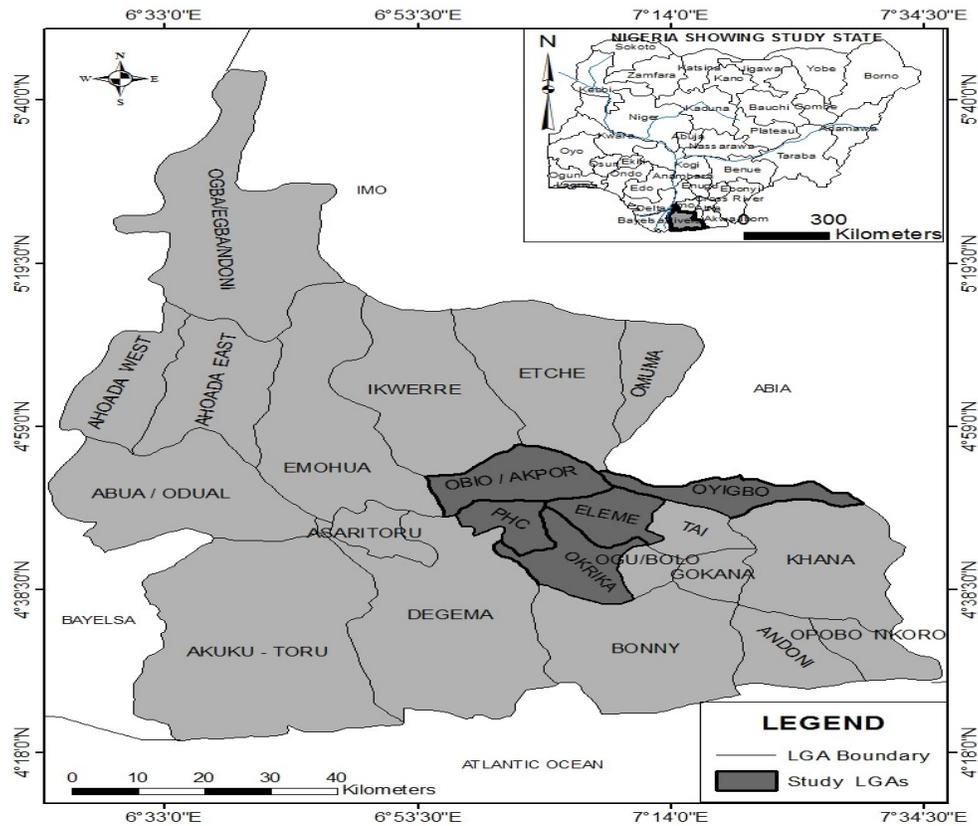


Fig. 5. Rivers state showing study local government areas

## 2. MATERIALS AND METHODS

The research design adopted for this work is the longitudinal research design which allows the researcher to observe phenomena for a time series and enable further analysis on the phenomena without interfering with the object being observed. This is very adequate, as the time series observation of land cover changes over time would enable the proper assessment of the growth in urbanization and development over time across the study area. The image of the study area was imported in to the ArcGIS 10.4 environment and this was spatially geo-processed to ascertain the degree of urban change in relation to the years under study. The sources of data for this study were primary and secondary; the primary data were acquired from Land sat imagery of the year 1986, 2000 and 2015. The land sat imagery was derived from the shuttle radar imageries from the global land cover facilities for the year 1986, 2000 and 2015. The data was processed and the band 1, 3, 5, and 7 were collapsed into the composite band in the ArcGIS 10.4 environment which was

classified using the supervised classification to differentiate the areas altered by the activities of man. Under supervised classification polygon for features were collated and named to represent the various features of the sampled population. The polygon was analyzed using the maximum likelihood analysis to collect data of features classes with similar reflection. Features with similar reflections as sampled were identified and attached to the attribute outlined for that phenomenon. Thereafter, all feature classes with same reflection were categorized as same and labeled within same context.

## 3. RESULTS AND DISCUSSION

The ever increasing changes in built-up area through the years 1986, 2000 and 2015 further highlighted the trend in land cover change across the metropolis.

### 3.1 Morphology of Port Harcourt

The Table 1 shows the extent of built up in the study area. This governs an understanding of the

morphology of the city across the period of 1986 through 2015 as presented. From the analysis over the decade, Port Harcourt city took the shape of an irregular polygon giving rise to new planning approach with an increase in city growth during the period of 1986 through 2000 and then 2015.

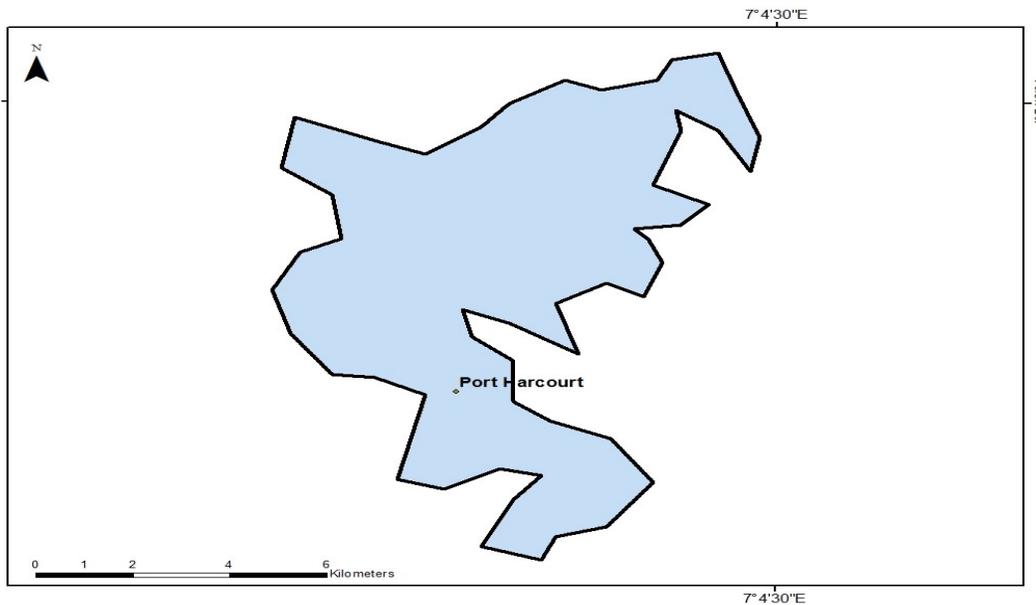
The Fig. 6 shows the growth direction and morphology of the city of Port Harcourt. From the analysis, the city grew more north-ward rather than south-ward. The growth pattern of the city was in an unplanned direction resulting in a shapeless polygon. The settlement as at that time of study is believed to have developed around the central business district which is referred to as Port Harcourt town today.

The image as shown in Fig. 7 reveals the level of urban alteration by man and is represented with the red colour, which is scattered across the study area. The concentration of urban development as at the time under study could be attributed to the availability of land in the northern fringe of the study area that can support developmental strive, Agricultural development and other developmental purposes enhancing the morphology of the region.

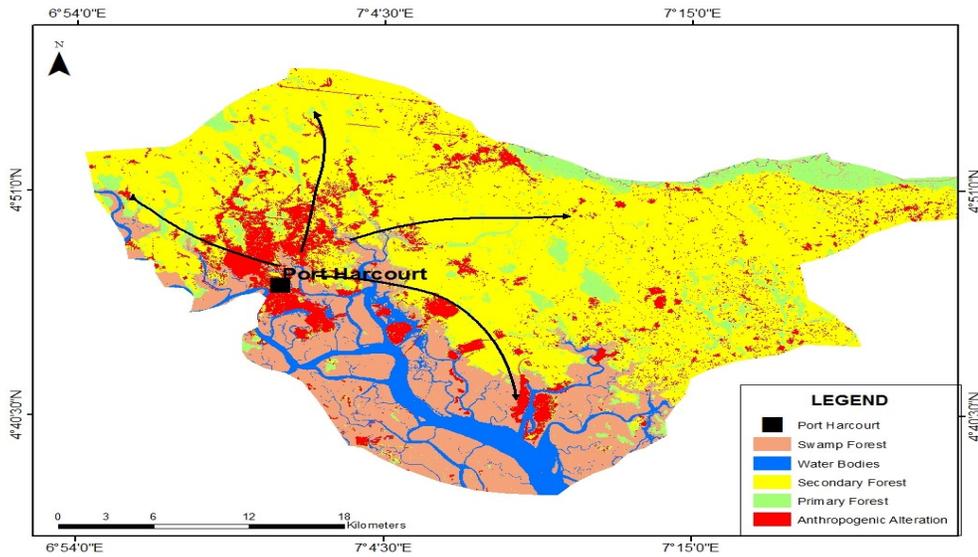
The agreement (Hargrove Agreement) reached with the colonial masters, the Ikwerre of the North and the Okrikas of the south resulted in the ceding of 30,000 acres of land to the Colonial Masters out of which only 13,000 acres were suitable for physical development and availability for agricultural practices [9]. This development triggered off the migration of several European trading firms, traders, businessmen and government establishment into the area from different parts of the country. The area gradually metamorphosed into a strong commercial and administrative centre south of the country. Its seaport became an export route for such commodities as groundnuts and palm oil. With the discovery of oil in commercial quantity in the region, the young city provided more economic opportunities for persons from all over the country. This was the beginning of rapid migration into the area and with the creation of Rivers State from the former Eastern Region; the city became the capital of the new State. Land filling of areas in the city not initially habitable became a trend in large scale increasing land acquisition by occupant of the city during the period of 1986 and 2000 altering the city morphologically [10-49].

**Table 1. Built up growth over time**

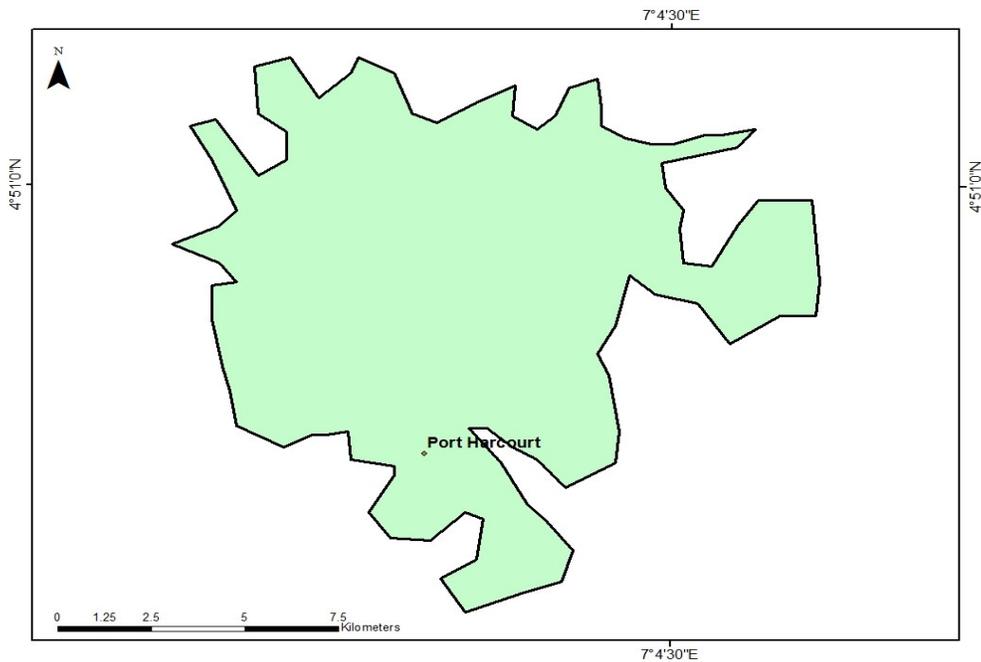
Evaluated Parameter	1986 Value (m <sup>2</sup> )	2000 Value (m <sup>2</sup> )	2015 Value (m <sup>2</sup> )
Anthropogenic Alterations	8,421,867	9,456,981	11,819,187



**Fig. 6. Shape of urban built extent as at 1986**



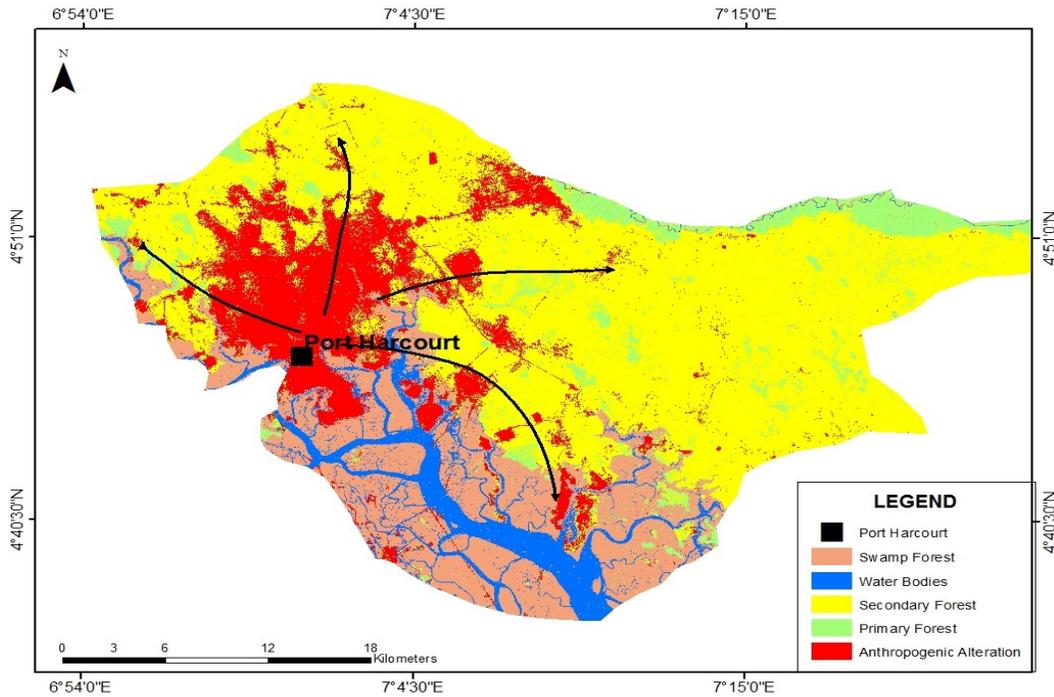
**Fig. 7. Image analyses of urban development and city morphology as at 1986**



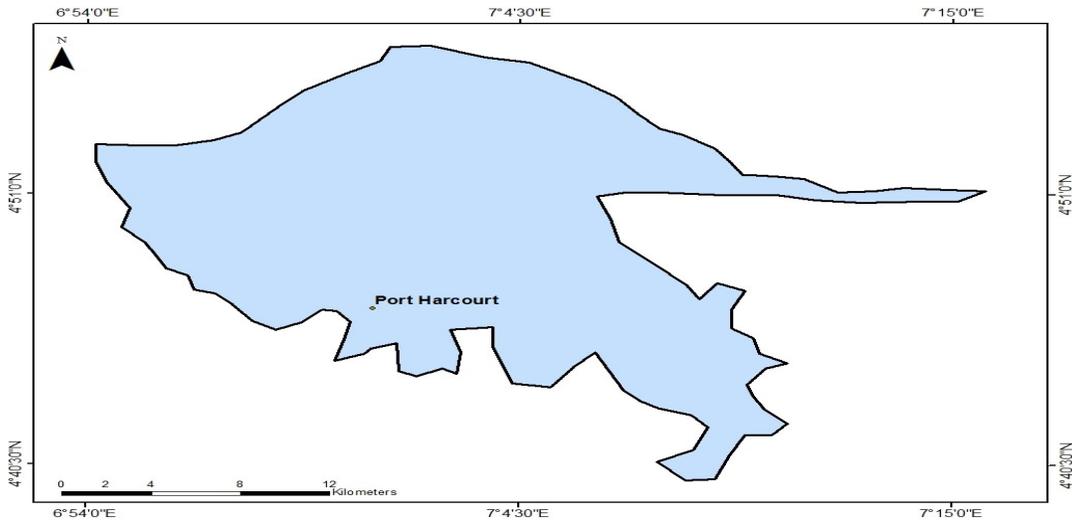
**Fig. 8. Shape of urban built-up extent as at 2000**

From the image shown in Fig. 9, it is obvious that, there is a shift of developmental activities in a continuous form and direction in the Northern fridge of the old city. The development of the city from the analysis of the image of 2000 revealed via the arrow that the growth direction of the city was majorly northern ward showing no visible growth in the southern direction after 1986 as shown in Fig. 6.

Fig. 10 reveals the extent of urban development and morphology of the Port Harcourt city in the year 2015. From the outcome of the analysis, it was observed that, the city growth direction took a known shape and direction rather than the initial shapeless form recorded in the year 2000. Therefore, the city of Port Harcourt can be said to have expanded beyond the marked city center altering the city form or morphology.



**Fig. 9. Image analyses of urban development and city morphology as at 2000**

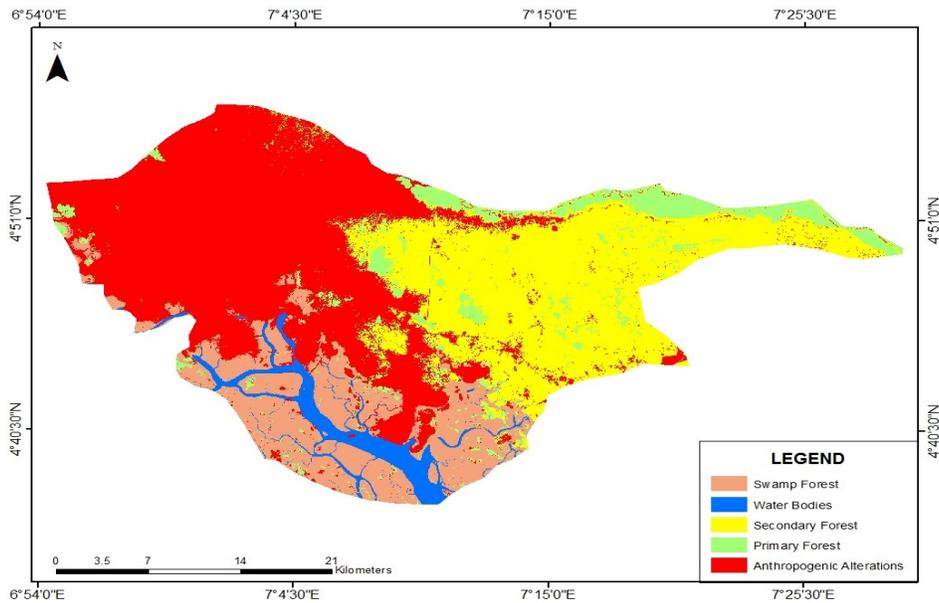


**Fig. 10. Shape of urban built-up extent as at 2015**

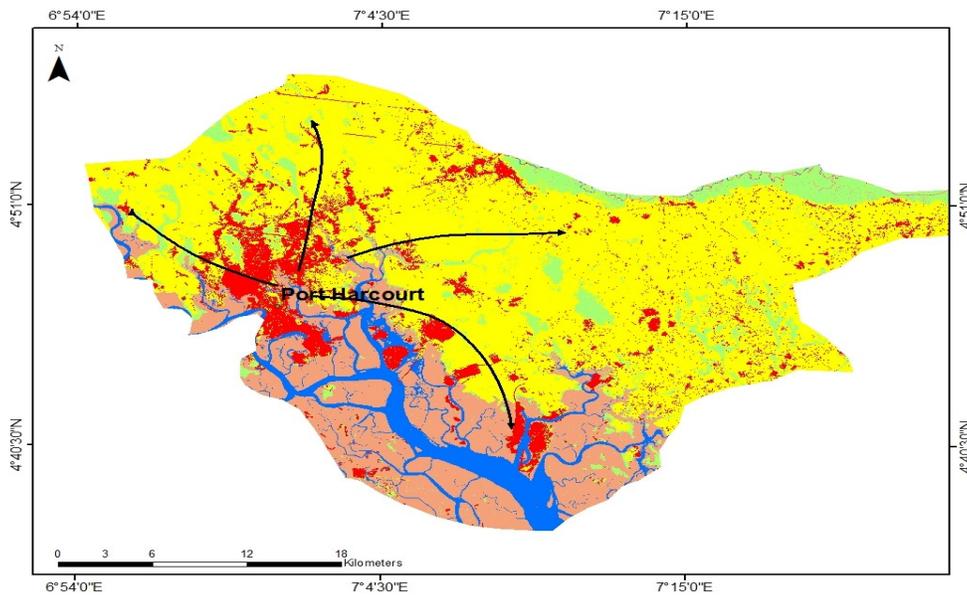
From the Fig. 11, key city infrastructures tend to have developed northward subjecting the city to grow in the direction favoured by land availability. The location of the old city center creates an avenue for the survival of the traditional housing design which kept on transforming as residential areas departs from the centre. This level of degradation resulted in a wide stretch of built-up

environment owing to the transformation of the traditional fabric in to high density apartment.

From the analysis shown in Fig. 12, city growth technically avoided areas that have difficult terrain and drainage system. This created a northward city growth and developmental direction pointed by the arrows indicating a far



**Fig. 11. Image analyses of urban development and city morphology as at 2015**



**Fig. 12. Urban expansions and development of port harcourt city**

northern, north western, north eastern and little in the south eastern growth directions.

#### 4. CONCLUSION AND RECOMMENDATIONS

In conclusion, the study of urban morphology in Port Harcourt city took the shape of a non-regular polygon giving rise to new planning approach. From the analysis, there is an

increase in the growth of the city from 1986 to 2000 and then 2015.

The city grew northward rather than southward creating an unplanned growth pattern as developmental activities depart from the Central Business District (CBD). The growth in the city population and the expansion of networks of roads resulted in the transformation of the city form as development evolved. Human activities

such as industrial locations were now focused in the Northern fringe of the city occupying extensive land areas which gave rise to other micro industrial and residential buildings extending northward. The study recommends that; Geographical boundaries should be given great emphasis by planning authorities in plan preparation in other to accommodate developmental growth expansions. There is also need to evaluate the urban fabric in the temporal and local context of development, in which constant changes are natural. This could prevent possible splits, and facilitate achieving balance in urban open spaces, so as to restore and induce the regeneration of cities.

### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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