

# Sprawl Developments: Measurement Indicator and Projections in Selected Nigerian Cities

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**Abstract**—Sprawl development is commonly attributed to the unprecedented rate of urbanization and city spatial growth. Large cities are not necessarily sprawling but are determined by characteristic compactness and connectedness of the metropolitan development and services including infrastructure and amenities. The understanding of the sprawl phenomenon is enhanced by some characteristic measurement of sprawl making use of certain development parameters. This paper therefore highlights an aspect of the measurement of sprawl utilizing the results from remote sensing data sourced from records of satellite images (from various Landsat and Nigerialsat) documented in research literatures. Also, the population census figures for each of the cities were sourced and projected as required for analysis and used in conjunction with their respective urban built-up land coverage. Results reveal varying pattern of relationship between progressions of urban spatial coverage changes and growth of population over a specified period of time. Intrinsic values from the computation such as urban population density and land consumption rate evolve as indicators for sprawl development and measurements.

**Keywords**—City Growth, Land Consumption Rate, Population Density, Urbanization, Urban Sprawl.

## I. INTRODUCTION

It is a common notion, at least within the threshold of understanding, that the human environment is not static in as much that humans themselves are dynamic organism. Specifically thus, a variety of activities and development takes place in the built environment, and the city at large. A phenomenon of development that has emerged as a dominant feature of spatial expansion of urban areas of the cities all around the world (Leichenko and Solecki, 2005) is generally referred to as urban sprawl but may be distinctive in pattern depending on the formative processes involved. It is usually characterized by sparse residential or commercial development at the outer regions or fringes of a relatively higher density urban core and also typically highly automobile dependent with respect to the urban core linkage (Hasse and Lathrop 2003). Wikipedia (2015) describes urban sprawl with respect to the expansion of the population of people

living within an urban center away from such center into low density surrounding communities with the car-oriented characteristic as mentioned earlier.

Urban sprawl is commonly perceived as a problem within the dynamics of city development. It is considered as a form of urbanization of the periphery of the urban areas (often described as peri-urbanization) and as such, comes along with the social and environmental consequences that are associated with it (Wikipedia, 2015).

From time past, debates and discussions on sprawl development had centered on what the phenomenon, as named, is actually all about. One of such relate to a book titled “The Death and Life of Great American Cities” in which the author, Jane Jacobs, in 1961 used ‘sprawl’ to describe the city expansion and peripheral development. In the book, the sprawling phenomenon of the cities was observed as an anomaly in the development of the cities (Sherman, n.d.). In the ensuing and apparent dispute in the literatures over what sprawl really is all about as it relates to urban setting, Bhatta et al. (2010) asserts that urban sprawl generally denotes an unplanned and uneven pattern of city growth caused by multitude of urban developmental processes.

However, much studies and attention had been given to the issue of sprawls in its different ramifications and has severally yielded urbanization as a strong indicator.

From contemporary studies, perhaps the root of the major world’s problem emanate from the several effects of urbanization, which cuts across issues such as adequate housing, effective transportation, food and potable water supply, climate change, etc. Urbanization can first be viewed as the migration of people from areas with ‘supposed lower standard of living’ to such better ones (within the context of urban or city development), and added with the natural increase in the population of settlements or cities, resulting in a continuous agglomeration of population within particular urban or city setting. Suffice it to say that urbanization around the world is increasing and the rate at which the population of cities are growing and the resulting urbanization rate in countries are indicative of the pace of social and economic change (Donk 2006).

Contemporary literatures places much emphasis on the rapid rate of urbanization and the measure of the relative composition of the world's population living in designated or classified urban areas. For example, as cited by Ajayi et al (2015), a UN (2014) estimate stated that the world's urban population will hit 4 billion by the year 2025, which constitute about 77 percent of the world's population.

While urbanization is a continuous process of population build up and increases, city growth grapples with the fundamentals of the cities' spatial expansion and density of population. Thus, urbanization becomes a direct function of the growth of the city.

However, there are consequences directly associated with the rapid rate of urbanization. For example, the rate of population increase puts an ultimately very high demand on land resources for developments including housing, social amenities and services, infrastructures, etc. which gradually becomes increasingly inadequate, congested, overcrowded and resulting in an increasing demand for more land for development. Consequently, a rapid development at a pace usually unequalled by pragmatic and comprehensive town and city planning ensues, which highlights the inadequacies, the result and effect of un-coordinated land use, unplanned and sprawling city development. This paper therefore assesses urban sprawl in the cities' developmental process. It reviews the fundamental issues of sprawl development vis-à-vis urbanization, characteristic pattern and causes of the development, and suggests possible planning approaches towards the containment of urban sprawl. It thereafter makes highlights and discussions of spatial and demographic correlations (used as partial indicator for sprawl development) for ten cities in Nigeria.

## II. LITERATURE REVIEW

### 2.1 Sprawl and Urbanization

In an attempt for a definition, Omole F.K (2000) described Urban sprawl as a plan-less dispersal of high density, congested urban area without adequate consideration for the appropriate integration of working, living, commuting and other socio-economic and welfare systems in the expanded community spaces. Microsoft Encarta (2005) gives the definition of urban sprawl as the outward spread of built up areas caused by their expansion. That is, the expansion of the urban area towards the peri-urban areas surrounding it. The urban sprawl is usually one of the by-products of urbanization.

Urban sprawl is the growth of a planned urban center usually by the development of unplanned attachments of settlements at the fringes (at the outskirts of the urban areas or at the urban-rural divide). The unplanned attachments often violate several or all planning principles in that they are characterized by plan-less and disorderly development, uncontrolled rapid construction of new

building structures, chaotic mixture of incompatible land uses and inadequate social services and facilities. The developments are rapid and in most cases defeat timely intervention of planning authorities.

From another perspective, urban sprawl can be described as a geographical spread of city development characterized by 'loose-bound' neighborhoods and parcels of empty land between buildings sited on generous plots. It is directly associated with urban growth as cities expands around their peripheral boundaries (Batty, 2004). The fundamental characteristic features surrounding sprawl development have necessitated the variance in the use or description of the term. For example, Mohammadi et al (2012) described urban sprawl as a form of land use pattern characterized by low density and sparsely distributed residential developments and also, as a function of population increase usually strongly associated with the global phenomenon of urbanization.

The United Nations, Department of Economic and Social Affairs, Population Division (2014) asserts that more people live in the urban areas globally than rural in a proportion of about 54 percent of the world population and a figure of 3.9 billion in 2014. The rate of urbanization and consequent population growth are projected to increase the urban population figure by about 2.5 billion by year 2050. These figures and the increment rate are strong enough indicators for the spatial expansion of the urban areas and possibly, the development of sprawl which is dependent on other socio-economic and governance factors.

According to Knox and McCarthy (2005), the population of people determines the characteristic of a city with respect to composition, size and the rate of change of the population figures. This rate of change is directly associated with the cities' urbanization phenomenon with a variety of consequences in cities' and urban development. The growing population in the cities does respond to certain socio-economic changes based on some consequential effect of urbanization. Thus, a combination of effects such as increasing population density, overcrowding, the population subsets' (household) requirements through the respective lifecycle stages and a mixed blend of economic activities often bring about changes in the social, economic and spatial development of cities. The common denominator in the description of sprawl development is population growth which in turn is a function of urban spatial growth. It is therefore inevitable within the above stated circumstances to observe responses to inadequate housing, for example, tending towards the search and creation of more activity spaces and thus, the expansion of the cities.

The form of city expansion is captured as the development that takes place at the urban periphery. That is, urban peripheral (also often referred to as sub-urban) development simply expresses the spatial growth of cities.

This form of city growth, often described as peri-urbanization (Wikipedia, 2015), is perceived to be strongly tied to the urbanization phenomenon. However, it is strongly debated when used to describe urban sprawl. The common argument put up in many literatures including Ewing (1997) is that urban sprawl is not necessarily equitable to the urbanization of the periphery but that the term is relatively subject to the form in terms of the characteristic features and outcome of the development.

## 2.2 Patterns of sprawls

Urban sprawl has been described by UN-HABITAT (2010) as a pattern of development of a 'world class lifestyle' (embodied in housing development) by real estate developers in the North American cities.

The pattern of sprawl in many developing countries differs from those of the developed. According to UN-HABITAT (2010), the pattern in the developing countries exhibits two main types of development. These include the informal and the squatter settlement pattern of land use in the surrounding peri-urban areas of the cities which are usually characterized by lack of basic services, public facilities, infrastructure and inadequate access roads. The other pattern involves suburban automobile-dependent, residential developments mixed with commercial complexes which exclusively serves the middle and high income groups in the society.

Sprawl developments are seen as a type of land use pattern based primarily on residential uses in the form of low density development. The pattern and characteristic of sprawl differs broadly between regions or countries of developed and developing economy and especially amongst researchers who acknowledges that the term 'sprawl' lacks precision in its definition and characteristic (Wikipedia 2015).

The pattern of sprawl development can be easily deduced from the various definitions that are applicable and available in describing it. Thus the pattern of development is predominantly low density and primarily residential in occupation/usage. The development usually leapfrogs over urban boundaries, farmlands and development in another region and are in all cases established in the sub-urban or peri-urban areas where access to land is relatively unlimited (Ewing, 1997; Burchell and Mukherji, 2003; Polidoro et al. 2012).

Sprawl is generally regarded as an uncoordinated growth/expansion of the urban community without any consideration for the outcome of the development. It does not always necessarily portray the lack of the elements of planning input or basic sense of arrangement, but that such development often results in the unsustainability of the built environment so created (Batty and Besussi, 2003).

Arising from the contentions of the characterization of sprawl, Ewing (1997) and Batty (2004) attempted the differentiation of the suburban development to include

types of sprawl such as (i) Strip development - corridors of high accessibility along roads; (ii) Scattered development which are basically uncoordinated and usually exhibiting the organic growth pattern of cities; (iii) Development that leapfrogs existing barriers such as farmlands and natural features; (iv) Modern low density residential development that takes after some neighborhood planning concepts such as the radburn, cul-de-sacs, and others. These types of sprawl development are considered in contrast to the traditional urban or city structure with nucleated and compact spatial development (Batty, 2004).

## 2.3 Causes of sprawl

It has been argued however that all processes of urban growth do not necessarily lead to urban sprawl (Ewing, 1997; Bhatta, 2010). Based on certain distinctions in the pattern of urban sprawl between the different economic regions of the world, the causes of the development may differ according to the dictates of the socio-economic trends in such regions. From the fore-going, it can be put forward that the processes of urban growth is directly linked or similar to those of the development of urban sprawl. In Canada for example, the developmental changes in the cities expansion took to different directions one of which involves the expansion of city boundaries and the spatial matrix of extended house-neighborhood, -shopping and -workplace distances (Gurin et.al, 2003).

Taking population growth as a cause of urban sprawl is also indicative that urban growth is induced by the increase in population of the urban areas-the population increase that have arisen from natural increase within an urban area and the migration of people from other areas into the urban area.

From a broader perspective, the larger proportion of demographic growth on a global scale is concentrated in the developing countries giving rise to a strong indication of the development of urban sprawl in almost all the cities of the developing countries (Olujimi, 2009).

The fundamental leaning as regards population and urban growth is the rate of urbanization which ultimately presents an array of consequences. The increase in size of the basic unit (household) of a population set reflects household expansion, growing housing inadequacy and the quest for more space determined by some socio-economic factors such as affordability (Knox and McCarthy 2005).

Pressures of housing needs stemming from the seemingly inevitable increase in population and rate of urbanization brings about expansion of the urban areas beyond boundaries that are in themselves relatively dynamic as it progressively shifts outwards from the city center (Ade and Afolabi, 2013). The result is an overflow of development which, depending on the rate of urbanization, leads to urban sprawl.

Urban sprawl is aided also by the relatively cheaper landed property at sub-urban areas coupled with the push factors,

such as urban congestion and overcrowding, for household decision and action on housing upgrade. The decision constitutes the housing consumer preference determined by household size, socio-economic status and lifestyle (Knox and McCarthy, 2005; Bhatta, 2010) and additionally, embarking on capital investment in real estate development through the formal (usually private) housing sector (Muñiz, Calatayud and García 2007), as cited in Mohammadi et al. (2012).

Bhatta (2010) outlined several other causes of urban sprawl including lack of proper planning policies for urban growth and housing development. This is captured in a wider scope of the governance structure and urban management. Making reference to the developing countries, Agbola and Olurin (1998) as cited in Olujimi (2009) highlighted the factor and problem of governance in the management of the towns and cities. Pointers were made to circumstances whereby the rate at which the urban areas were growing far out-paces the control of planners and urban managers.

Additionally, sprawl development in developing countries may have been greatly influenced by the informal housing sector development in response to the rapid rate of urbanization. The characteristic of informal developments, most often having no empirical validity renders the understanding of the sprawl development as unclear and less explored. This is implied by Mohammadi et al (2012) and Ojima (2009) as they make a case for the developing world.

In furtherance to the causes of sprawl, Polidoro et al. 2012 described specific instances of urban sprawl development in Brazil as to have been brought about by the acts of governance in the creation of new housing development lots by public municipal administration and private investors in the bid to increase the housing stock of a variety at distant periphery from the consolidated urban center. Also, the economic empowerment of households and even individuals often afford them to acquire housing for living in, or as second homes in the sub-urban (or peripheral) areas as future investments (Barnes et al. 2001), as cited by Bhatta (2010).

Other attributes of urban growth capable of promoting urban sprawl in one way or the other includes the relatively cheaper access to transportation (though depending on the type of sprawl) and the mode of transportation. The modern technological feats in telecommunications also add to the ease of long distance living (most often at city peripheral locations), working and transaction activities; a variety of which includes internet based work engagement (from home) and online transactions to mention a few.

#### 2.4 Effects of sprawl

Urban sprawl has often been put away as wasteful of land resources. The development resulting from urban growth

taking the characteristic features of scattered development, large expanse of low density and single use development constitute the basis for the criticisms (Ewing, 1997). Sprawl despoils the countryside from the aesthetics point of view and costly in infrastructure operations, commuting time, household expenditure on transportation, energy consumption and loss of agricultural land (Batty, 2004).

The predominant residential pattern of sprawl development and its peculiar occurrence at remote distance from the urban center exhibits the characteristic separation from the essential services, infrastructure and amenities including job availability, work places, schools, shopping, and the likes that are particularly oriented towards the urban centers (Polidoro et al. 2012).

Sprawl is considered as a problem of urban development dating back to the period of industrialization and the demand for workers' housing bundled up with the spate of urbanization. The rapid rate of urbanization has been consuming land and increasing the size of built-up areas in response to the spatial growth of the cities.

The consumption of land for developmental purposes has a marked effect on agricultural land and production and also critically affects the land-cover pattern. The land-cover changes from natural vegetative cover to larger expanse of sprawl developments of solid impervious built-up environments have terminal effects on the global environment. The effects are causatives of the dynamics of what is termed as urban heat islands. Rosenthal et al (2008) described an urban heat island (UHI) as an urban area whose surface and near-surface air temperatures are higher than its peripheral and rural areas. This is because buildings and man-made surfaces such as concrete and asphalt used variously in the built environment has greater heat retention capacity compared to the lesser heat retention and cooling properties of vegetation of the rural development pattern of land-cover. The built urban environment typically has fewer trees and other vegetation, thus temperature recordings are higher in urbanized land cover environment than natural land cover (Vose et al., 2005).

In line with the issues of urban heat generation, the criticality of sprawl development has become relatively more intense and proven costly over the centuries up to the present times. This is even more serious particularly when issues bordering on climate change had been incrementally consequential upon the sprawling of the cities, alongside associated features of heavy automobile-dependent transportation, air pollution and greenhouse gas emissions (Gurin et al, 2003; Batty, 2004).

#### 2.5 Control Measures for Urban Sprawl

The unprecedented rapid rate of urbanization leaves so much to question about population increase, urban growth and the development of sprawls and its effects. The many critics of urban sprawl often advocate that urban spatial

growth should rather take the form of compact development (Ewing, 1997). From the synthesis of the definitions, characteristics and patterns of the sprawl phenomenon, the aggregate effect of a sprawling community on an environment at large prompted solutions for urban expansion which generally requires the attention and application of planning concepts and principles. Models such as 'smart growth' were proffered as solutions for urban expansion (Gabriel, Faria and Moglen 2006, Litman 2007, Turner 2007) as cited by Mohammadi et al (2012).

Smart growth is an urban planning concept that advocates the development of compact urban areas with a view to eliminating urban sprawl. It is considered as focusing development at the urban centers with a higher mixed use proportion of housing, commercial and retail than the traditional development patterns and strictly discourages peripheral and suburban growth characterized as urban sprawl (Hevesi, 2004). The success of the implementation of smart growth concept is tied with the adoption of delimiting features at cities' spatial boundaries in order to effectively curtail boundlessness of the development area. These features could be natural (such as valleys, hills, rivers and the likes) or artificial (such as forest reserves, agricultural farmlands/settlements etc.) serving as urban growth boundaries (UGB), that is, the boundary within which an urban area is expected to develop without any spill beyond these features.

With the consideration of the above, other remarkable approaches towards ensuring city-spread control of urbanization problems such as the sprawl development include the establishment of new towns which would primarily serve as an extension of the saturated parent city. The new towns, also described as satellite towns are planned and located within short travel distance away from the parent city and accorded also with planning attributes at a scale commensurate to the size of the town. The concept of new town development is idealistic and at the same time practicable in the management and development control of an old city (Bennett, 2005).

New towns development is the core principle of the garden city movement of Ebenezer Howard to solve the contemporary problems of urban growth of his time, and even still, an inherent problem in cities of most countries manifesting as urban sprawl. Moreover, the values upon which Ebenezer Howard's Garden City model was based are still as relevant in application to today's communities as they were about a century ago (ACT, 2008).

The garden cities and new towns concepts primarily limits the spatial and population growth of large cities which were plagued by various problems and to provide alternatives to their overgrowth, congestion, decadence and sub-urban sprawl by creating newly planned and moderate-sized towns which provide healthy and pleasant

environments for living, working, recreation and circulation (Obateru, 2010). The new-town proposal included all the socio-economic functionalities of an urban center, such as well-ordered circulation, residential areas, public and institutional areas, industrial areas, commercial areas, recreation areas with a large area for garden as the central focus of the pattern of the model.

The central area of the garden city model was proposed to constitute just one sixth (about 17%) of the entire spatial coverage proposed for a new town development. This area serves as the functional city center which accommodates and facilitates all the activities involved in human daily living. The activity area is contained by agricultural land described as agricultural estates proposed as farm settlements only and are apparently, of very low population density. This agricultural estate constitutes the remaining five parts (about 83%) of the entire new town development and clearly represents the boundary of the town. The boundary characteristic is confirmed by the referencing, in the proposal, as a permanent belt open and agricultural land around the center. From the foregoing therefore, the feature of the permanent agricultural belt constitute the city growth boundary, commonly referred to as the urban growth boundary (UGB), and serves as containment or restraint from boundless or sprawling development of the town/city, thus also facilitating the smart growth approaches to city development.

### III. SPRAWL INCIDENCE IN NIGERIA

Most cities of the world including Africa and Nigeria in particular developed through diverse formative processes. The peculiarities of such formations are based on different fundamental activities prevalent at respective periods thus evolving cities as commercial, traditional, religious, colonial and administrative centers (Knox and McCarthy, 2005). Almost all cities in Nigeria evolved organically and had been subjected to modifications as influenced by the peculiarities mentioned earlier. For example colonial bases were developed as well planned and laid out administrative and living quarters as city adjoins usually well separated from the local settlements (Olujimi, 2009).

The increasing population and the unprecedented rate of urbanization in most of the Nigerian cities have progressively been yielding the outcome of pressure on the existing housing facilities and high demand for new housing markets and the exploits on urban and new sub- or peri-urban frontiers. The non- effectiveness of the Nigerian housing programmes coupled with the misappropriation of the public housing allocations in the past had posed serious threats on the right to meeting the basic housing need for most low income-earners inclusive of the vast proportion of the population constituted by the informal sectors. As a result of these, the proliferation of informal housing development comes to effect aided by

uncontrolled urbanization, and characterized by haphazard housing development in the peri-urban areas, where majority of the structures are without planning permit and mostly either in non-prepared or uncoordinated and unregistered layouts.

The improper coordination of the physical developments of informal housing usually brings about serious problems of accessibility into and within such areas. Additionally, these areas are prone to lack of essential social and welfare infrastructure like water, electricity, health care and educational facilities among others. Indications of slum development arising from unsanitary conditions in most informal development areas is one of the highly probable terminal effect of urban sprawl in most Nigerian cities. It worthy of note to state however that urban sprawl, by its definition and differential features do not always result into slum development most especially in the developed economies of the world.

### 3.1 Measurement of Urban Sprawl

Development in the research studies of urban sprawl have associated sprawl with several attributes of quality of life such as long distances and time commuting of private vehicles, obesity, traffic fatalities, poor air quality and several others (Ewing and Hamidi, 2014). A recent research study carried out measurement of sprawl in metropolitan statistical areas (MSA), in the United States, based on population census of at least 200,000 people in each of the census-defined areas and divisions (ibid.). The analysis of development in the areas were based on four evaluation factors which include the development density, land use mix, activity centering and street accessibility. These factors are equally rated and used to calculate the sprawl index score for each MSA which are the read relative to an average value of 100, with higher scores tending towards less sprawling, compact and connected metropolitan development and lower scores than the average indicating sprawling development (ibid.).

### 3.2 Methodology

The method employed in this study only highlights the characteristic urban population density and the rate of land

consumption for urban use. This falls short of the comprehensive approach to sprawl measurement as described above, however, the attributes of density and consumption rates are used here as indicators for sprawl tendencies. Measurements of urban built-up land areas in square kilometers were retrieved for ten cities in Nigeria from results of remote sensing data sourced from records of satellite images (from various Landsat and Nigersat) documented in research literatures. The figures were plotted for respective years and projected accordingly using rate of change as trend parameters for respective year's projections. A base year 2006 was referenced using exact appropriation and/or projections as required, and for year 2015 and 2020 respectively. The cities were randomly selected and include Abuja, Ibadan, Karu, Minna, Benin, Kano, Akure, Enugu, Sokoto and Lagos. Additionally, the population figures for each of the cities were projected as required for analysis and used in conjunction with their respective urban built-up land coverage.

### 3.3 Results and Discussions

The following tables indicate the spatial and population dynamics for each of the selected cities. The measurement of land coverage vis-à-vis population census figures and projections, including the computations of respective population densities and land consumption rates are used as part parameters to deduce characteristic sprawl projections in the cities from a base year 2006 through 2015 up to year 2020.

Table 1 shows the measurement pattern and projections for Abuja in terms of land coverage and population census. While the spatial coverage and population increases over the period 2006 to projected 2020, the population density of the city decreases and an increasing land consumption rate. The population density trend is an indication of decreasing compactness and sprawling tendency but subject to other land use parameters. This can also be justified by the rising rate of land consumption through the projected period.

*Table 1: Abuja Urban Land Coverage and Population Dynamics*

Abuja						
Year	Land Coverage (Sq.km)	% Increase in Land Area	Population (urban)	Population Density (urban)	Land Consumption Rate (Ha/Pop.)	% Increase in Land Consumption Rate
2006	*382.60		**1,405,201	3,673	0.027	
2015	*685.22	79.10	1,817,510	2,652	0.038	38.47
2020	*853.35	24.54	2,096,784	2,457	0.041	7.95

Source: Author's Projection work 2016: \*Adapted from Ade and Afolabi (2013); \*\*National Population Commission (2006)

The characteristic land consumption rate in the city of Ibadan indicates a reverse tendency from that of Abuja city (Table 2). The trend of population density indicates increasing compactness of the city and a corresponding decrease in land consumption rate. Thus Ibadan city can be described as a compact city with less sprawling tendencies.

Table 3 shows a relatively stable urban population density despite increases in land coverage and population figures in Karu urban area (in Nasarawa state). This is indicated also by the small margin of changes the land consumption rate between year 2006 and 2015 (positive), and between year 2015 and 2020 (negative).

The urban population density of Minna decreases through the projection period with corresponding increase in the rate of land consumption. This is indicative of urban

sprawling tendency (Table 4). Similar trend of development is revealed in Table 5 for city of Benin though land coverage and population figures are higher in Benin than Minna. Conversely, the urban population density figures in Minna are higher than in Benin.

In Tables 6, 7, 8, 9 and 10 showing properties for Kano, Akure, Enugu, Sokoto and respectively, the urban population densities shows incremental values through the projection periods and indicative of more compactness within the cities' urban areas. The rate of land consumption is quite significant particularly in Lagos

Table 2: Ibadan Urban Land Coverage and Population Dynamics

Ibadan						
Year	Land Coverage (Sq.km)	% Increase in Land Area	Population (urban)	Population Density (urban)	Land Consumption Rate (Ha/Pop.)	% Increase in Land Consumption Rate
2006	*101.41		**2,560,853	25,252	0.00396	
2015	*119.71	18.05	3,312,249	27,669	0.00361	-8.73
2020	*129.89	8.50	3,821,201	29,419	0.00340	-5.95

Source: Author's Projection work 2016: \*Adapted from Oladele and Oladimeji (2011); \*\*National Population Commission (2006)

Table 3: Karu Urban Land Coverage and Population Dynamics

Karu						
Year	Land Coverage (Sq.km)	% Increase in Land Area	Population (urban)	Population Density (urban)	Land Consumption Rate (Ha/Pop.)	% Increase in Land Consumption Rate
2006	*53.80		**216,230	4,019	0.02488	
2015	*69.94	29.99	279,675	3,999	0.02501	0.50
2020	*78.90	12.82	322,650	4,089	0.02445	-2.21

Source: Author's Projection work 2016: \*Adapted from Rikko and Laka (2013); \*\*National Population Commission (2006)

Table 4: Minna Urban Land Coverage and Population Dynamics

Minna						
Year	Land Coverage (Sq.km)	% Increase in Land Area	Population (urban)	Population Density (urban)	Land Consumption Rate (Ha/Pop.)	% Increase in Land Consumption Rate
2006	*21.95		**202,151	9,210	0.011	
2015	*36.44	66.01	261,465	7,175	0.014	28.35
2020	*44.49	22.09	301,642	6,780	0.015	5.83

Source: Author's Projection work 2016: \*Adapted from Morenikeji et.al. (2015); \*\*National Population Commission (2006)

where it is known that land is limited for urban development.

Kano city has a higher population density and significant rate of increase of land coverage (17.86% and 8.42%)

with lower rate of land consumption, a characteristic feature of inverse properties to that of Lagos. All of these cities indicate characteristic reverse tendency for sprawl development.

Table 5: Benin Urban Land Coverage and Population Dynamics

Benin						
Year	Land Coverage (Sq.km)	% Increase in Land Area	Population (urban)	Population Density (urban)	Land Consumption Rate (Ha/Pop.)	% Increase in Land Consumption Rate
2006	*1,029.87		**1,086,882	1,055	0.095	
2015	*1,774.72	72.32	1,405,791	792	0.126	33.23
2020	*2,188.53	23.32	1,621,801	741	0.135	6.89

Source: Author's Projection work 2016: \*Adapted from Olayiwola and Igbavboa (2014); \*\*National Population Commission (2006)

Table 6: Kano Urban Land Coverage and Population Dynamics

Kano						
Year	Land Coverage (Sq.km)	% Increase in Land Area	Population (urban)	Population Density (urban)	Land Consumption Rate (Ha/Pop.)	% Increase in Land Consumption Rate
2006	*92.01		**2,826,307	30,717	0.00326	
2015	*108.44	17.86	3,655,592	33,711	0.00297	-8.88
2020	*117.57	8.42	4,217,301	35,871	0.00279	-6.02

Source: Author's Projection work 2016: \*Adapted from Adzandeh, et.al. (2014); \*\*National Population Commission (2006)

Table 7: Akure Urban Land Coverage and Population Dynamics

Akure						
Year	Land Coverage (Sq.km)	% Increase in Land Area	Population (urban)	Population Density (urban)	Land Consumption Rate (Ha/Pop.)	% Increase in Land Consumption Rate
2006	*80.76		**491,033	6,080	0.01645	
2015	*103.66	28.36	635,110	6,127	0.01632	-0.76
2020	*116.38	12.27	732,700	6,296	0.01588	-2.68

Source: Author's Projection work 2016: \*Adapted from Oyinloye (2013); \*\*National Population Commission (2006)

Table 8: Enugu Urban Land Coverage and Population Dynamics

Enugu						
Year	Land Coverage (Sq.km)	% Increase in Land Area	Population (urban)	Population Density (urban)	Land Consumption Rate (Ha/Pop.)	% Increase in Land Consumption Rate
2006	*80.89		**717,291	8,867	0.01128	
2015	*101.46	25.43	927,756	9,144	0.01094	-3.02
2020	*112.89	11.27	1,070,313	9,481	0.01055	-3.55

Source: Author's Projection work 2016: \*Adapted from Nnan, et.al. (2014); \*\*National Population Commission (2006)

Table 9: Sokoto Urban Land Coverage and Population Dynamics

Sokoto						
Year	Land Coverage (Sq.km)	% Increase in Land Area	Population (urban)	Population Density (urban)	Land Consumption Rate (Ha/Pop.)	% Increase in Land Consumption Rate
2006	*86.02		**430,698	5,007	0.020	
2015	*105.96	23.18	557,072	5,257	0.019	-4.76
2020	*117.04	10.46	642,670	5,491	0.018	-4.26

Source: Author's Projection work 2016: \*Adapted from Eniolorunda, et.al. (2012); \*\*National Population Commission (2006)

Table 10: Lagos Urban Land Coverage and Population Dynamics

Lagos						
Year	Land Coverage (Sq.km)	% Increase in Land Area	Population (urban)	Population Density (urban)	Land Consumption Rate (Ha/Pop.)	% Increase in Land Consumption Rate
2006	*982.70		**9,113,605	9,274	0.011	
2015	*1,054.41	7.30	11,787,686	11,179	0.009	-17.04
2020	*1,094.24	3.78	13,598,952	12,428	0.008	-10.04

Source: Author's Projection work 2016: \*Adapted from Abiodun et.al. (2011); \*\*National Population Commission (2006)

In summary, the relative compactness and looseness of urban development in the case cities are revealed as indicated by their respective values of population densities. A very high density value irrespective of the size of urban land coverage and population has direct implication on the tendency for a city to be described as sprawling or not. Interestingly also, the rate of land consumption is inversely proportional to the population densities and signifies city outstretch that is likely to culminate into a sprawl.

#### IV. RECOMMENDATIONS

Sprawling development of cities need not be regarded as mere urban growth process. Rather, researches and their findings on the effect of such development should be appraised as the dire consequence is hidden in a long term outcome determined by the rate of urbanization. Big cities are attracting population and the developing countries, especially in Africa are urbanizing at a rate with declining population densities at the urban centers and rampant sprawling at the periphery (Freire, 2013). It is therefore expedient to set in motion the mechanisms for effective control of the 'anomalies' in urban growth as growth cannot be put on hold but can be managed (Batty, 2004). Urban planners and managers need to capture the inherent problem of urban growth and spatial expansion early from the drawing table and curtail the cancerous nature of the sprawl before it develops.

Planning tools and concepts such as urban growth boundaries (UGB), Smart Growth and New-town approach to city development can be explored and implemented.

The properties of the garden city, most especially the permanent farm lands forming the urban growth boundaries greatly control the loss of agricultural farm lands that is required to effectively serve and meet the city's demand for fresh farm produce at lower transportation cost and convenience (Howard, 1902). It eliminates urban sprawls and also reduces the continuous accumulation of urban heat islands which are indicators for global warming and possibly on the long run, climatic changes. In essence, the issues of urbanization and associated problems are being addressed and thus, sustainability in city development can be achieved.

In a current scenario common to most Nigerian cities, the inevitable spatial growth of the cities requires prompt action. Necessary interventions such as the creation of large expanse of green reserves at un-plundered peri-urban or absolute rural abutment to cities would constitute a first step towards setting a growth boundary. At this juncture, effective acts of governance need be put in place to enforce restrictions of development and the activities of land speculators in marked areas. Thus, development areas could grow independently to assume urban status exhibiting compactness in demographics distribution alongside the provision of services and amenities for

living, working, recreation including other socio-economic aspects of life.

## V. CONCLUSION

From the foregoing, urban sprawl can be definitely described as a phenomenon of urban expansion without any distinct spatial boundaries. It is a boundless and continuous outstretch of non-static urban periphery and exhibits to a large extent a monotypic landuse of residential development. The generally unplanned and uncoordinated growth characteristic of the sprawling urban area is rather spatial in essence. That is, a continuous abutment of development which is devoid of urban and peri-urban spatial management and integration strategy of amenities and services.

The recommendations put forward would presumably have far reaching effect as evidences of the implementation of aforementioned planning features such as the UGB in conjunction with smart growth principles, green-belt and new-town developments (popularly known as garden cities) are recording successes in cities in the United Kingdom and the United States of America.

Besides all of the above, the contemporary city development exhibits very high pressures in the demand for urban, peri-urban and even rural spaces in the dynamics of city expansion, and aggravated by the fundamentals of urbanization. Transition zones doubling as urban boundaries have been heavily craved for the need for development in today's cities and have resulted in the metropolitan status of cities with very large spatial coverage areas. Interestingly, these cities exhibit a multi-nuclei model (set out by Harris and Ullman in 1945-Knox and McCarthy, 2005) type of city development that does not necessarily portray urban sprawl judging with the parameters of analysis for sprawl development.

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