



# Urban Expansion in Nigeria

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## Question

*Based on available literature which cities/towns in Nigeria are expected to have the highest rates of urban expansion over the coming decades?*

## Contents

1. Summary
2. Urban expansion and its definitions
3. UN DESA World Population Prospects
4. Other data sets on urban expansion in Nigeria and its impacts
5. References

# 1. Summary

This rapid literature review, surveys the available literature on urban expansion in Nigerian cities/towns over the coming decades. It presents information on population growth, geographic expansion and urban density to illustrate that urban centres in Nigeria are expanding at different rates which are dependent on the aspect of urbanisation considered.

Rapid urbanisation is a global trend exerting an increasing impact on society. It is broadly accepted that for the first time, the majority of the world's population lives in what can loosely be classified as 'urban areas'. In 2014, an estimated 55% (around 3.8 billion people) lived in towns or cities (UNDESA, 2019: 1). The *2018 Revision of World Urbanization Prospects* estimates that this proportion is expected to increase to 68% by 2050. Furthermore, future increases in the size of the world's urban population are expected to be highly concentrated in just a few countries. Together, India, China and Nigeria will account for 35% of the projected growth of the world's urban population between 2018 and 2050. By 2050, it is projected that India will have added 416 million urban dwellers, China 255 million and Nigeria 189 million.

The identification of urban centres in Nigeria is based on population and legal or administrative criteria. As noted above, Nigeria adopts a threshold population of 20,000 people as a criterion for defining an urban centre. In addition to this, all states and local government area headquarters have historically, legally or administratively been regarded as urban centres (National Urban Development Policy, 2006).

At the national scale, the most extensive urban spatial expansion has been concentrated around four urban fields (Bloch et al., 2015):

- **A Northern conurbation** centred around Kano, which has a north-south axis running from Katsina to Zaria and an east-west axis running roughly from Funtua to Hadejia;
- **An emergent Central conurbation** running from Abuja in the southwest to Jos in the north-east;
- **A South-Western conurbation** stretching from Lagos in the south to Ilorin in the north to Akure in the east;
- **A South-Eastern conurbation** within a roughly square zone encompassing Benin City, Port Harcourt, Calabar and Enugu.

In terms of Nigeria, Bloch et al. (2015) and Farrell (2018) comment that the underlying cause of rapid urban population growth and urban expansion are population growth driven by declining mortality and persistently high fertility, as such urban natural increase plays a significant (and possibly dominant) role in driving urban population growth.

# 2. Urban expansion and its definitions

Rapid urbanisation is a global trend exerting an increasing impact on society. It is broadly accepted that for the first time, the majority of the world's population lives in what can loosely be classified as 'urban areas'. In 2014, an estimated 55% (around 3.8 billion people) lived in towns or cities (UNDESA, 2019: 1). The *2018 Revision of World Urbanization Prospects* estimates that this proportion is expected to increase to 68% by 2050. They continue that future increases in the size of the world's urban population are expected to be highly concentrated in just a few countries. Together, India, China and Nigeria will account for 35% of the projected growth of the

world's urban population between 2018 and 2050. By 2050, it is projected that India will have added 416 million urban dwellers, China 255 million and Nigeria 189 million.

With increasing numbers living in towns and cities, existing urban infrastructure in many contexts is struggling to cope with the increased demands of urban residents. Rapid expansion and growth has led to urban and suburban sprawl i.e. the unrestricted growth of housing, commercial development, and roads. Urban sprawl is a term that also relates to the social and environmental consequences associated with this form of development. Urban sprawl is often associated with longer commutes and contributes to traffic congestion and air pollution.

This report presents an overview of Nigerian urbanisation, drawing on available data. It presents information on population growth, geographic expansion and urban density to illustrate that urban centres are expanding at different rates dependent on the aspect of urbanisation considered. To contextualise data presented within this report, the below provide a series of definitions pertaining to urbanisation (UNICEF, 2012: 10).

- **Urban (area):** The definition of 'urban' varies from country to country, and, with periodic reclassification, can also vary within one country over time, making direct comparisons difficult. An urban area can be defined by one or more of the following: administrative criteria or political boundaries (e.g., area within the jurisdiction of a municipality or town committee), a threshold population size (where the minimum for an urban settlement is typically in the region of 2,000 people, although this varies globally between 200 and 50,000), population density, economic function (e.g., where a significant majority of the population is not primarily engaged in agriculture, or where there is surplus employment) or the presence of urban characteristics (e.g., paved streets, electric lighting, sewerage).
- **Urban growth:** The (relative or absolute) increase in the number of people who live in towns and cities. The pace of urban population growth depends on the natural increase of the urban population and the population gained by urban areas through both net rural-urban migration and the reclassification of rural settlements into cities and towns.
- **Urbanisation:** The proportion of a country that is urban.
- **Rate of urbanisation:** The increase in the proportion of urban population over time, calculated as the rate of growth of the urban population minus that of the total population. Positive rates of urbanisation result when the urban population grows at a faster rate than the total population.
- **Urban agglomeration:** The population of a built-up or densely populated area containing the city proper, suburbs and continuously settled commuter areas or adjoining territory inhabited at urban levels of residential density. Large urban agglomerations often include several administratively distinct but functionally linked cities.

## Urban expansion in Nigeria

The pattern, trend and characteristics of urbanisation in Nigeria has been particularly significant (Aliyu & Amadu, 2017). Nigeria's towns and cities have grown phenomenally with the rate of urban growth consistently above 2% per annum (UNDESA, 2019). Consequently, there has been a rapid expansion of Nigerian cities' area often in an unplanned and uncontrolled manner (Cities Alliance, 2007). Several studies have shown that inadequate planning of urban land uses in Nigeria and intensity of use has exacerbated urban problems such as congestion, air pollution and heat stress (Cities Alliance, 2007; Onibokun & Faniran, 2006).

Urban expansion typically concentrates on the periphery of cities and towns. As land cover expands, the urban edge undergoes a constant process of redefinition (Bloch et al., 2015). This frequently redefines urban boundaries, and what is categorised as 'urban' and 'rural', which creates complicated linkages between urban change, spatial expansion and urban governance. Bloch et al. (2015) comment that the emerging reality is that there is a mismatch between the extent of the land cover occupied by the built fabric, and the existing administrative and institutional boundaries of Nigerian municipalities. Urban expansion is frequently not constrained within municipal limits but often overlaps or spills over between various Local Government Areas (LGAs) or even federal states. Due to their constitutional roles and powers, state governments thus emerge as key actors in the strategic spatial planning processes required to address the dynamics of current Nigerian urbanisation and urban expansion (Bloch et al., 2015).

In Nigeria, a settlement is generally classified as urban if it comprises 20,000 people or more, a relatively high minimum population threshold compared to many other countries (Ofem, 2012). Nigeria's urban population has increased rapidly over the past 5 decades and is forecast to continue to grow in the foreseeable future, although how fast is a matter of some dispute. Projections developed by UNDESA (2019) suggest that Nigeria's urban population will likely double within the next 30 years. The growth of Nigeria's urban population in both absolute and relative terms has also been accompanied by the expansion of existing built-up areas and the emergence of new and identifiably 'urban' settlements (Bloch et al., 2015).

The identification of urban centres in Nigeria is based on population and legal or administrative criteria. As noted above, Nigeria adopts a threshold population of 20,000 people as a criterion for defining an urban centre. In addition to this, all states and local government area headquarters have historically legally or administratively regarded as urban centres (National Urban Development Policy, 2006).

At the national scale, the most extensive urban spatial expansion has been concentrated around four urban fields (Bloch et al., 2015):

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Bloch et al. (2015) continue that these do not necessarily represent continuously built up areas (although they can), but rather networks of cities, towns and rural settlements of varying sizes linked by transport corridors. Of these, the Northern conurbation around Kano is forecast to experience the most rapid physical expansion in coming decades and ranks among the top five most rapidly expanding settled regions in all of Africa (Seto, Güneralp & Hutyrá 2012).

## Drivers of urban expansion in Nigeria

Historically, cities have been compact areas with high population densities, with the physical extent of cities growing slowly (Seto et al., 2010). Contemporary reverses this trend with urban

expansion seeing urban areas expand, on average twice as fast as the populations that live within them (Angel et al., 2011). Seto et al., (2012) comment that although urban land cover is a small fraction of the total earth surface, urban areas are considered to drive environmental change with urban expansion influencing a host of issues including:

- Driving habitat loss.
- Threatening biodiversity.
- Resulting in the loss of terrestrial carbon stored in vegetation biomass.

Despite projections that world urban populations will increase to nearly 5 billion by 2030, little is known about future locations, magnitudes, and rates of urban expansion. Globally, a range of factors are seen to drive urban expansion and growth (Seto et al., (2012). These factors are often interpreted in a myriad of ways often leading to a range of forecasts: Factors or drivers include the below and collectively make up the urban increment:

- Urban and Natural Increase: the difference between the number of births and the number of deaths.
- Rural-Urban Migration: the movement of people into or out of the city.
- Reclassification of Rural Areas as Urban

Indeed the wide range in forecasts of urban expansion reflects the uncertainties in the underlying drivers. Commentators have highlighted that some past projections of population growth have proven to be inaccurate and there still remain large uncertainties around population-growth estimates (Cohen, 2004). Additionally, for many developing and emerging economies, population and economic growth may explain only a small fraction of urban land expansion. For example, GDP is a strong driver of urban land expansion in China but only moderately affects urban expansion in India and Africa, where urban population growth is a larger factor (Seto et al., 2012).

In terms of Nigeria, Bloch et al. (2015) comment that the underlying cause of rapid urban population growth and urban expansion are population growth driven by declining mortality and persistently high fertility, as such urban natural increase plays a significant (and possibly dominant) role in driving urban population growth.

Similar findings have been reported by Farrel (2018). He notes that drivers or components of urban growth involve a number of factors. He draws on a range of data sources to compute urban natural population increase and rural to urban migration taken from the United Nations (2014), and data to compute reclassification taken from the OECD (2017). Table 1 provides a disaggregated account of Nigeria's urbanisation with decadal estimates for each component between 1960 and 2010. This indicates that urban natural population increase, accounting for on average 50% of the urban increment between 1960 and 2010, is the dominant component underpinning Nigeria's urban transformation. As noted above, this has to do with the significant declines in mortality rates coupled with persistently high fertility rates.

**See: Table 1: Contribution of the components of urban growth, 1960–2010 (Thousands)**  
(Farrell, 2018: 292), <https://link.springer.com/content/pdf/10.1007%2Fs12132-018-9335-6.pdf>

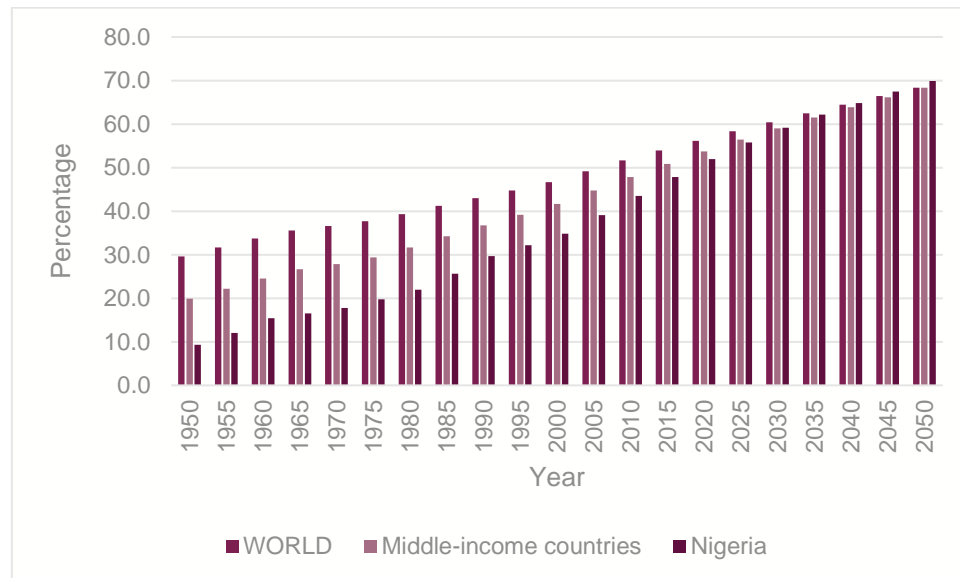
**Table 2: Contribution of the components of urban growth, 1960–2010 (Per Centage)**  
(Farrell, 2018: 292), <https://link.springer.com/content/pdf/10.1007%2Fs12132-018-9335-6.pdf>

The above suggests that urban and natural increase whilst dominant is balanced by a significant increase in rural-urban migration. An interesting feature of the above is the potential contribution that a reclassification ('rural' to 'urban') of settlements can have. Emerging towns and cities in Nigeria typically have lower building and population densities than older, established urban settlements with accumulated infrastructure, and may therefore contribute significantly to urban expansion, alongside the ongoing enlargement of existing urban boundaries. Bloch et al. (2015: 58-59) conclude

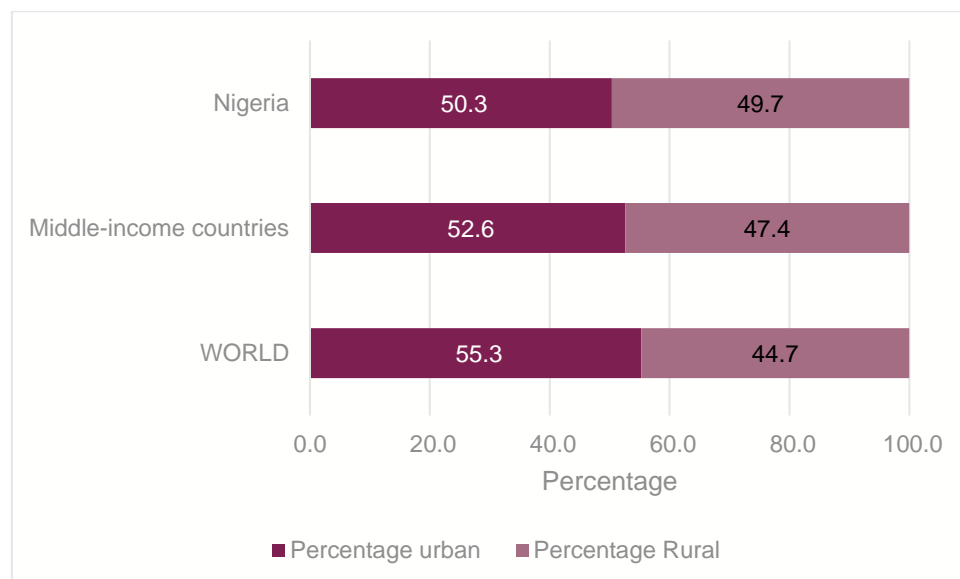
- While sources differ on its pace, it is expected that urbanisation and urban growth will increase rapidly in Nigeria in the decades to come. The underlying cause of rapid urban population growth (and spatial expansion) in Nigeria is rapid population growth driven by declining mortality and persistently high fertility: urban natural increase plays a significant (and possibly dominant) role in driving urban population growth. While rural-urban migration contributes to urban growth, the significance of urban natural increase and reclassification due to rural densification have been widely underappreciated while the role of rural-urban migration has likely been overstated in Nigeria.
- Fast-paced urban expansion has had a profound impact on the physical structure of Nigerian cities. Urban growth and expansion has transformed them into complex urban formations. Contemporary urban settlements in the country are dynamic entities marked by the – frequently unordered – assemblage of the traditional core city and its residential, commercial and industrial zones with a variety of new, typically suburban peripheral areas, which arise in an array of configurations and social realities, and which contain a diverse range of economic functions and social activities.
- Urban change concentrates in the periphery: with ongoing urban expansion, there is a constant redefinition of what is 'urban' and what is 'rural'. Urban expansion frequently occurs beyond municipal borders, and through a process of the deconcentration of both population and economic activity, polycentric urban structures, urban corridors and urban conurbations, are all emerging at different spatial scales. These processes of urban change are characterised by the dispersion of population and economic dynamism through a physical pattern of low density which typically links together various urban centres.
- Planning frameworks which strategically address spatial expansion are currently limited in Nigeria. The country also lacks appropriate population projections to accurately estimate urban land needs.
- Such planning should be informed by a thorough analysis of the way in which urban expansion is occurring in specific metropolitan areas, cities and towns. Given the characteristics of government structure in Nigeria (Federal states hold strong powers and functions compared to LGAs), and the observed trend in spatial expansion (urban areas spreading over several LGAs and even states), state governments – and purpose-built metropolitan-level agencies – could well play increasingly enhanced roles in strategic spatial planning.

### 3. UN DESA Word Population Prospects

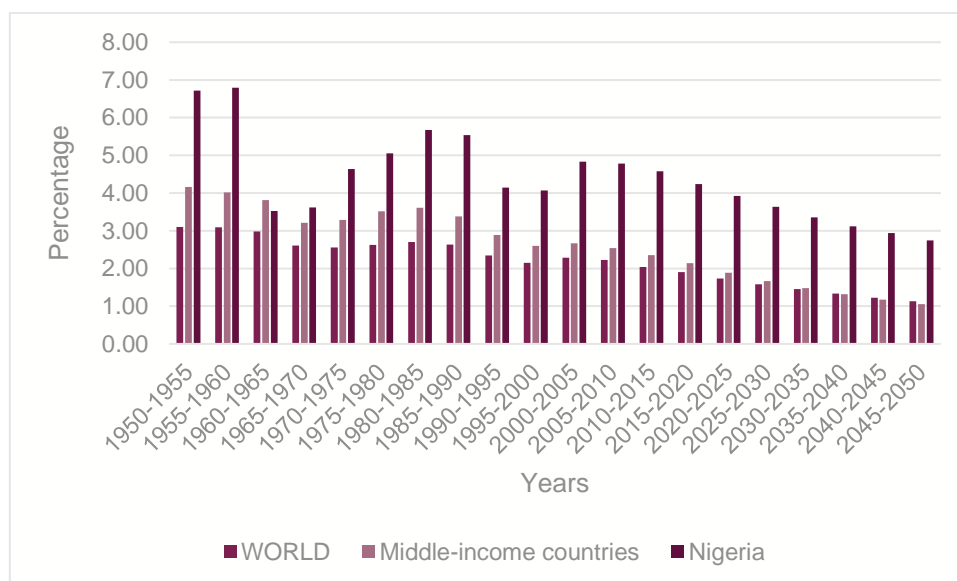
**Figure 1: Percentage of Population at Mid-Year Residing in Urban Areas 1950-2050 (World Urbanization Prospects 2018), licensed under a Creative Commons license (CC BY 3.0 IGO)**



**Figure 2: Population of Urban and Rural Areas at Mid-Year (thousands) and Percentage Urban, 2018 (World Urbanization Prospects 2018), licensed under a Creative Commons license (CC BY 3.0 IGO)**

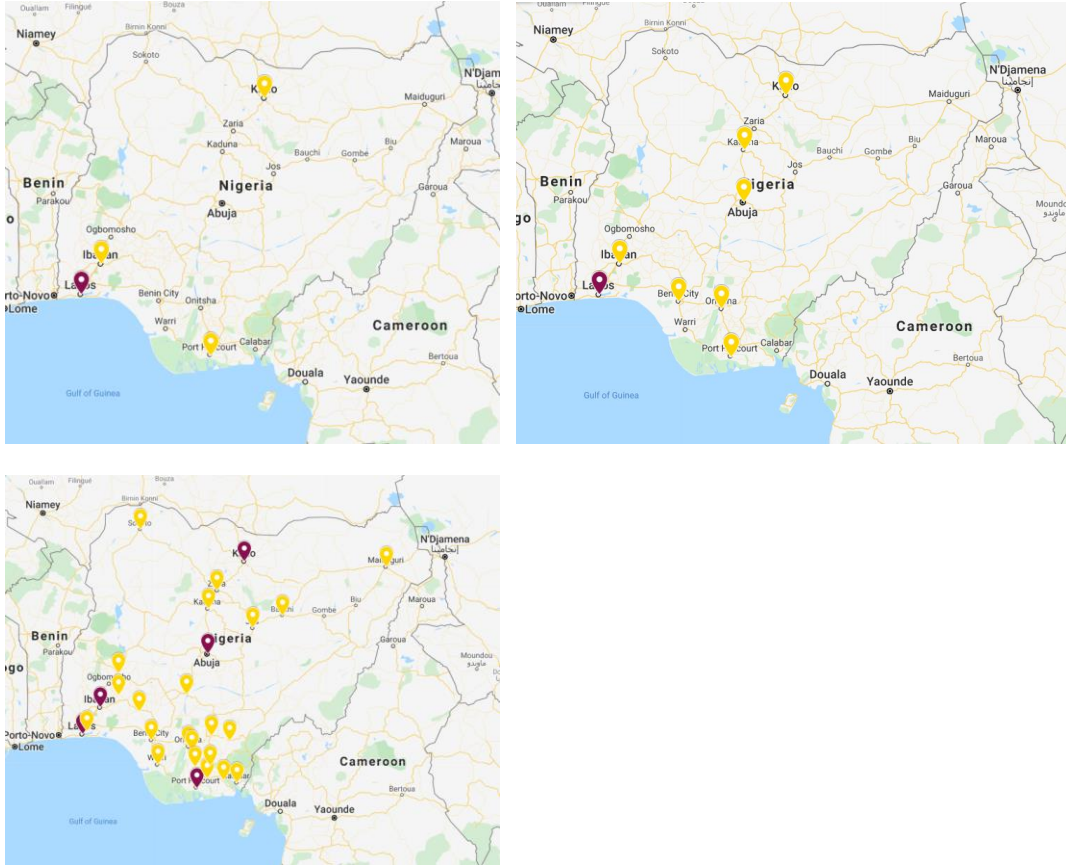


**Figure 3: Average Annual Rate of Change of the Urban Population, 1950-2050 (per cent)**  
**(World Urbanization Prospects 2018), licensed under a [Creative Commons license \(CC BY 3.0 IGO\)](#)**

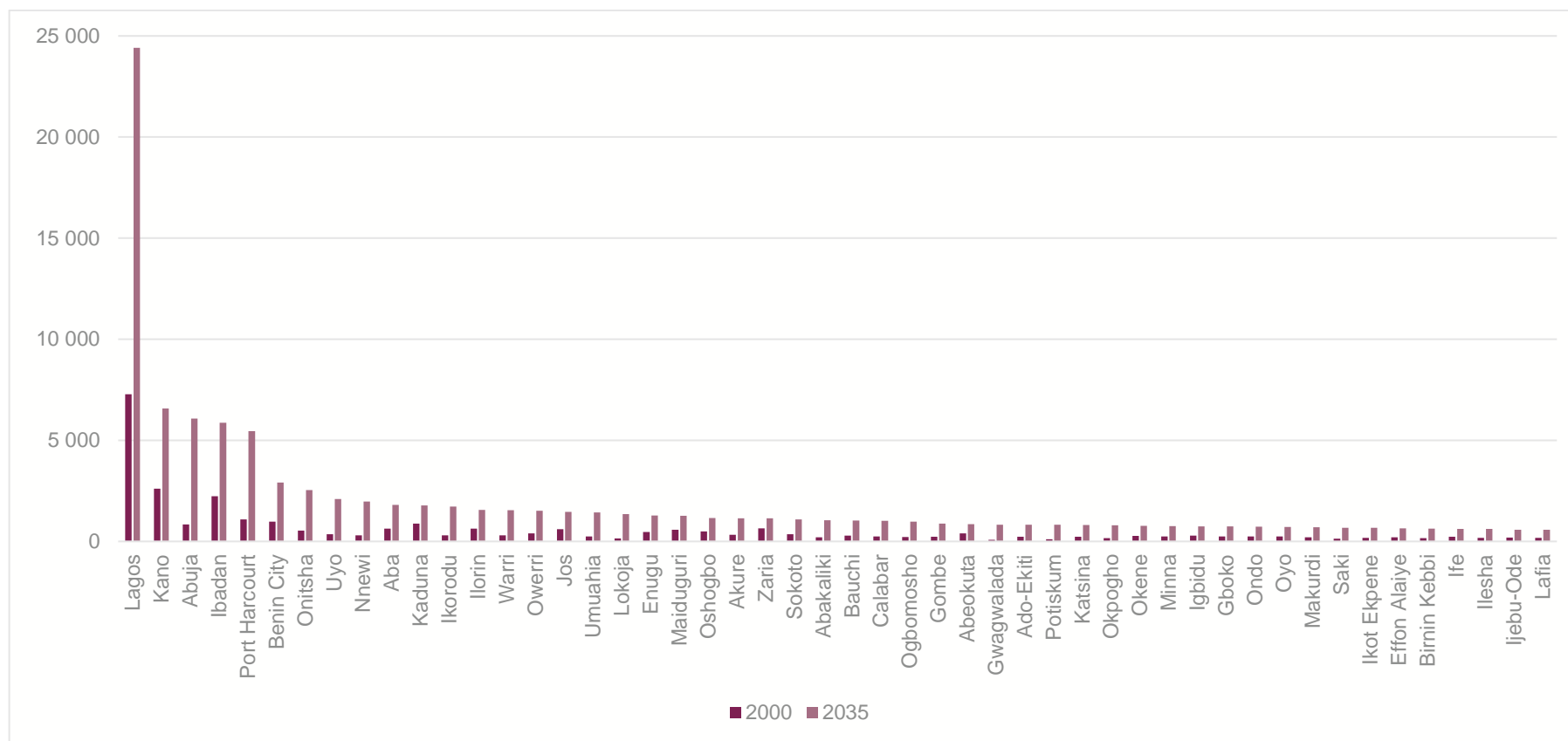




**Map 1: Nigerian cities according to size in 2000 (top left), 2015 (top right) and 2035 (bottom left) (Purple = cities of 5 million or more, Yellow = cities of 1-5 million) (World Urbanization Prospects 2018), licensed under a [Creative Commons license \(CC BY 3.0 IGO\)](#)**



**Figure 4: Population of Urban Agglomerations with 300,000 Inhabitants or More in 2018 - 1950-2035 (thousands) (World Urbanization Prospects 2018), licensed under a [Creative Commons license \(CC BY 3.0 IGO\)](#)**



**Table 3: Nigerian cities of varying sizes (2000, 2015, 2035) (World Urbanization Prospects 2018), licensed under a [Creative Commons license \(CC BY 3.0 IGO\)](#)**

City size class	City	2000 Population (Millions)	City size class	City	2015 Population (Millions)	City size class	City	2035 Population (thousands)
5 Million >	Lagos	7.2	5 Million >	Lagos	12.2	5 Million >	Lagos	24.4
							Kano	6.5
							Abuja	6
							Ibadan	5.8
							Port Harcourt	5.4
1 - 5 Million	Kano	2.6	1 - 5 Million	Kano	3.5	1 - 5 Million	Benin City	2.9
	Ibadan	2.2		Ibadan	3.1		Onitsha	2.5
	Port Harcourt	1.0		Abuja	2.4		Uyo	2.1
				Port Harcourt	2.3		Nnewi	1.96
				Benin City	1.4		Aba	1.81
				Onitsha	1.1		Kaduna	1.77
				Kaduna	1.0		Ikorodu	1.72
500,000 - 1 Million	Benin City	0.97	500,000 - 1 Million	Aba	0.94		Ilorin	1.55
	Kaduna	0.88		Ilorin	0.85		Warri	1.54
	Abuja	0.83		Uyo	0.84		Owerri	1.52
	Zaria	0.64		Jos	0.80		Jos	1.46
	Ilorin	0.63		Nnewi	0.77		Umuahia	1.42
	Aba	0.63		Maiduguri	0.72		Lokoja	1.35
	Jos	0.60		Owerri	0.71		Enugu	1.28
	Maiduguri	0.58		Ikorodu	0.70		Maiduguri	1.26
	Onitsha	0.53		Zaria	0.70		Oshogbo	1.16
				Enugu	0.68		Akure	1.14
				Warri	0.66		Zaria	1.13
				Oshogbo	0.64		Sokoto	1.08
				Umuahia	0.58		Abakaliki	1.04
				Akure	0.55		Bauchi	1.03
				Sokoto	0.55		Calabar	1.02
						500,000 - 1 Million	Ogbomosho	0.97
							Gombe	0.88
							Abeokuta	0.85
							Gwagwalada	0.82
							Ado-Ekiti	0.82
							Potiskum	0.82
							Katsina	0.80

							Okpogho	0.79
							Okene	0.77
							Minna	0.75
							Igbidu	0.74
							Gboko	0.74
							Ondo	0.72
							Oyo	0.71
							Makurdi	0.69
							Saki	0.67
							Ikot Ekpene	0.66
							Effon Alaiye	0.65
							Birnin Kebbi	0.63
							Ife	0.62
							Ilesha	0.61
							Ijebu-Ode	0.58
							Lafia	0.57

## 4. Other data sets on urban expansion in Nigeria and its impacts

A common critique of UN figures is that they are useful at the macro (i.e. national) level, margins of error increase significantly when it comes to estimates of individual settlements, where urban boundary definitions and the quality of underlying census data make a significant difference.

The most recent innovation in monitoring urban change, which may help resolve such disputes, has come in the form of geospatial datasets comprised of satellite imagery and census data. Proponents claim that satellite imagery of built-up areas “is a more precise, consistent and comparable definition of an urban area than notions such as population thresholds or administrative boundaries” (Linard, Tatem & Gilbert, 2013, 23). Leading data sets include

- Global Rural-Urban Mapping Project (GRUMP),
- The Atlas of Urban Expansion,
- The WorldPop project
- Africapolis.

Apart from illustrating the extent of urban settlement in Nigeria, these data sets show that Nigeria has a fairly ‘balanced’ urban system. In other words, despite the widely held perception that Lagos is an overbearing mega-city, Nigeria’s urban population is spread across four large conurbations (Bloch et al., 2015). Indeed, Nigeria has historically exhibited a relatively balanced urban system in contrast to many African countries.

### The Global Rural-Urban Mapping Project (GRUMP)

GRUMPv1 consists of eight global data sets: population count grids, population density grids, urban settlement points, urban-extents grids, land/geographic unit area grids, national boundaries, national identifier grids, and coastlines. All grids are provided at a resolution of 30 arc-seconds (~1km), with population estimates normalised to the years 2000, 1995, and 1990. All eight data sets are available for download as global products, and the first five data sets are also available as continental, regional, and national subsets.

#### **Map 2: Global grid of probabilities of urban expansion to 2030 (GRUMP),**

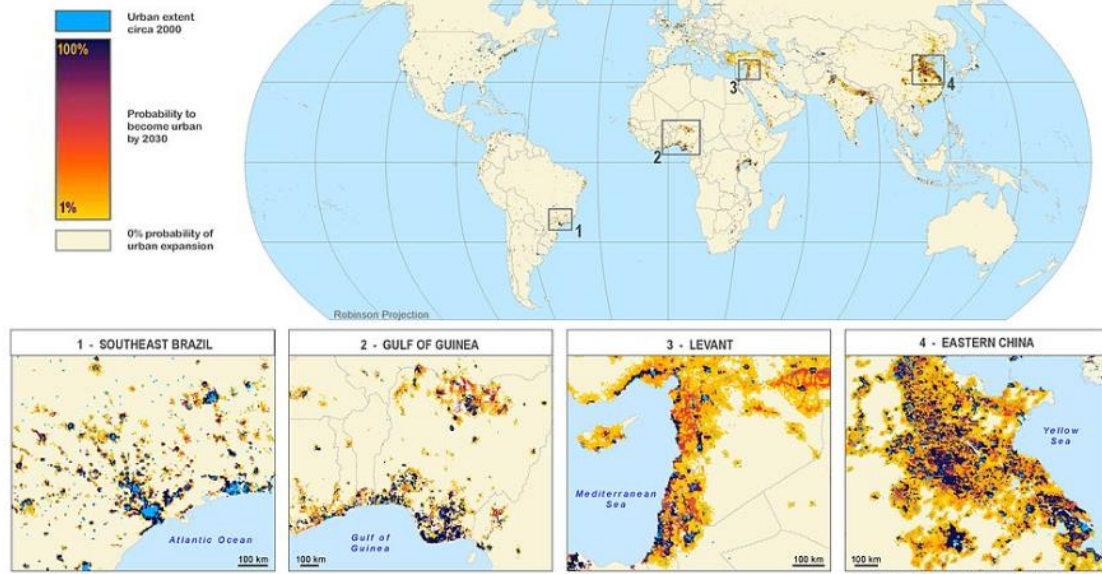
<https://sedac.ciesin.columbia.edu/data/set/lulc-global-grid-prob-urban-expansion-2030/maps>,  
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## Global Grid of Probabilities of Urban Expansion to 2030

### Land Use and Land Cover (LULC)



The Global Grid of Probabilities of Urban Expansion to 2030, v1 (2000-2030) data set presents spatially explicit probabilistic forecasts of global urban land-cover change from 2000 to 2030 and is part of the Land Use and Land Cover (LULC) collection. For each grid cell that is non-urban in 2000, a Monte-Carlo model assigned a probability of becoming urban by the year 2030. The authors first extracted urban extent circa 2000 from the NASA MODIS Land Cover Type Product v5, then used population densities from SEDAC's Global Rural-Urban Mapping Project (GRUMPv1) to create a population density driver map. Next, using the present empirical distribution of regional urban population densities along with the probability density functions of projected regional population and GDP values for 2030, new urban land in each region by 2030 was estimated in a Monte-Carlo fashion.

Center for International Earth Science Information Network Applications Center (SEDAC), <http://dx.doi.org/10.7927/H4Z899CG>.  
Data Source: Seto, K., B. Güneralp, and L.R. Hutrya, 2015, Global Grid of Probabilities of Urban Expansion to 2030. Palisades, NY: NASA Socioeconomic Data and Applications Center (SEDAC).

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## The Atlas of Urban Expansion

The Atlas of Urban Expansion collects and analyses data on the quantity and quality of urban expansion in a stratified global sample of 200 cities. The Atlas presents the output of the first two phases of the Monitoring Global Urban Expansion Program, an initiative that gathers data and evidence on cities worldwide.

**Table 4: Atlas of urban expansion annual rate of Hectares - Lagos and Ibadan (1984, 2000, 2013)**

	1984		2000		2013	
	Hectares	Annual Rate of Increase %	Hectares	Annual Rate of Increase %	Hectares	Annual Rate of Increase %
<b>Lagos</b>	29,738	n/a	58,060	4.4	82,684	2.6
<b>Ibadan</b>	24,264		33,429	2.1	49,121	2.8

Source data: Atlas of Urban Expansion, <http://atlasofurbanexpansion.org/>

**Table 5: Atlas of urban expansion annual rate of Hectares – Gombe and Oyo (1990, 2000, 2013)**

	1990		2000		2013	
	Hectares	Annual Rate of Increase %	Hectares	Annual Rate of Increase %	Hectares	Annual Rate of Increase %
<b>Gombe</b>	1,471		1,871	2.6	5,262	7.9
<b>Oyo</b>	1,986		3,089	4.8	5,933	4.7

Source data: Atlas of Urban Expansion, <http://atlasofurbanexpansion.org/>

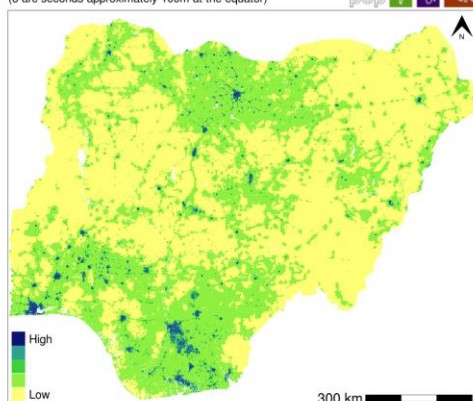
## WorldPop Project

The WorldPop project was initiated in October 2013. It aims to provide an open access archive of spatial demographic datasets to support development disaster response and health applications.

**Map 3: Nigerian population 2000 (Left), <https://www.worldpop.org/geodata/summary?id=1437> and 2019 (right), <https://www.worldpop.org/geodata/summary?id=6160>, licensed under Creative Commons Attribution 4.0 International (CC BY 4.0)**

**Nigeria population 2000**

Estimated total number of people per grid-cell at a resolution of (3 arc seconds approximately 100m at the equator)

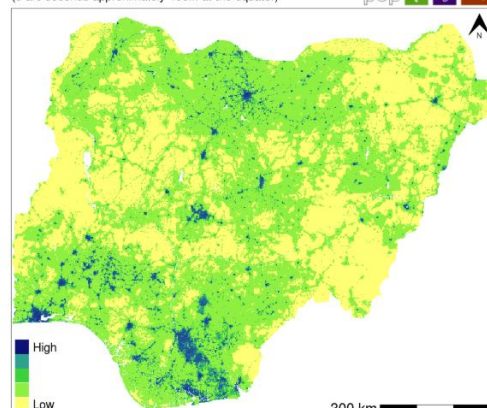


WorldPop (www.worldpop.org – School of Geography and Environmental Science, University of Southampton; Department of Geography and Geosciences, University of Louisville; Département de Géographie, Université de Namur) and Center for International Earth Science Information Network (CIESIN), Columbia University (2018). Global High Resolution Population Denominators Project – Funded by the Bill and Melinda Gates Foundation (OPP1134076).

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**Nigeria population 2019**

Estimated total number of people per grid-cell at a resolution of (3 arc seconds approximately 100m at the equator)



WorldPop (www.worldpop.org – School of Geography and Environmental Science, University of Southampton; Department of Geography and Geosciences, University of Louisville; Département de Géographie, Université de Namur) and Center for International Earth Science Information Network (CIESIN), Columbia University (2018). Global High Resolution Population Denominators Project – Funded by the Bill and Melinda Gates Foundation (OPP1134076). <https://dx.doi.org/10.5258/SOTON/WP00645>

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## Africapolis

Africapolis.org and the 2018 Update is produced by the Sahel and West Africa Club (SWAC) in collaboration with e-geopolis.org. This project is made possible by regular funding from SWAC members and by additional funding from USAID. The Africapolis project started in 2008 with support from the French Development Agency (AFD).



**Table 6: Top 10 Nigerian Agglomerations (Africapolis)**

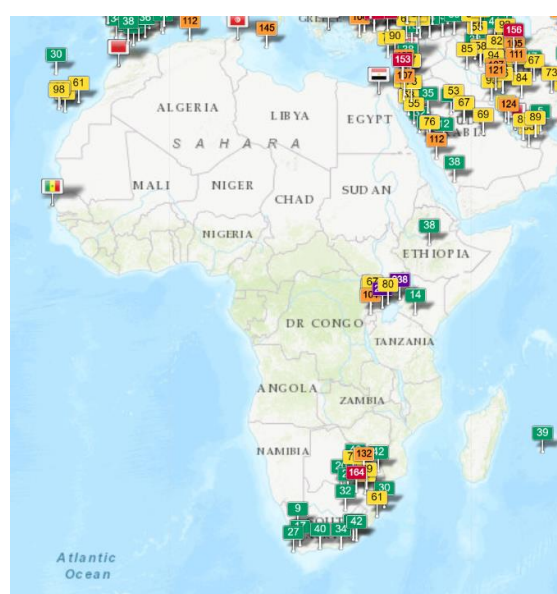
Population in 2015		Density in 2015		By Growth in Population (2000-2010)		by % Growth in Population (2000-2010)	
Lagos	11,847,635	Kano	13790	Onitsha	4,901,000	Nsukka	418.2246
Onitsha	8,530,514	Hadejia	13125	Lagos	3,537,000	Uyo	359.8286
Kano	3,888,582	Mayo-Moskota/Ashi gashiya (NGA)	12183	Uyo	1,259,400	Onitsha	338
Ibadan	3,088,477	Dutse	11695	Kano	1,159,000	Bwari	319.2547
Uyo	2,271,025	Kwali	11200	Nsukka	1,154,300	Abuja	227.7778
Abuja	1,998,816	Bwari	11015	Abuja	820,000	Suleja/Madalla/Kwamba	187.1901
Port Harcourt	1,845,232	Lagos	10839	Port Harcourt	490,000	Kwali	170
Aba	1,687,158	Gudumbali	10245	Ibadan	481,000	Anagada	168
Benin City	1,569,977	Gubio	10085	Aba	331,000	Gwagwa	166.3438
Kaduna	1,447,250	Rafin Pa	10000	Ikorodu	237,000	Burum	161.9048

Source: Sahel and West Africa Club (SWAC/OECD) (2019), Africapolis Agglomeration 2015, <https://www.africapolis.org/data> [Accessed on 28.10.2019]

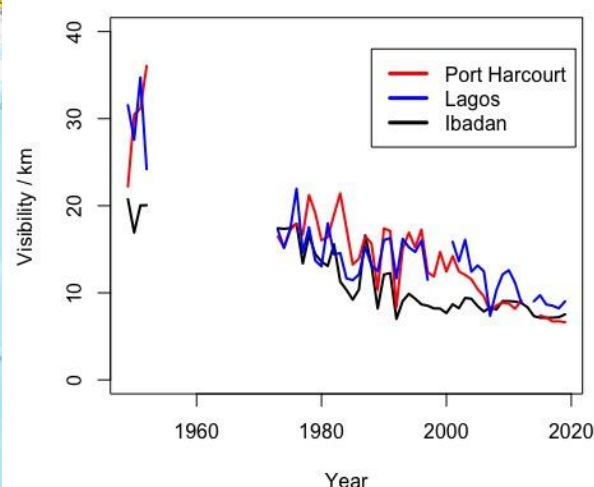
## Urbanisation and its impacts (air pollution)

Available data suggests that accelerating urbanisation has been accompanied by declining air quality across globally. Whilst there exists a paucity of air quality data across Nigeria (the country currently lacks any air quality monitoring stations see map 4), available information illustrates that air quality is an issue of particular concern with poor air quality threatening to undermine the development of inclusive, safe, resilient and sustainable cities. Long term visibility measurements can be used for a proxy for air pollution (see figure 6). Visibility data is routinely collected at airports throughout the country (in some cases from the 1950s to present day). Historic visibility in cities is inversely proportional to the amount of particulate matter present in the air.

**Map 4 & Figure 6 (left) & 7 (right): Active air quality monitoring stations in Africa and visibility data collected by air ports (Lagos, Ibadan, Port Harcourt)**



Source: Worldwide EPA (Environmental Protection Agencies), made available by The Open Data Framework, (<https://waqi.info/>)



Source: authors own analysis



## 5. References

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## Useful Websites

- World Urbanisation Prospects: <https://population.un.org/wup/>
- Global Rural-Urban Mapping Project (GRUMP): <https://sedac.ciesin.columbia.edu/data/collection/grump-v1>
- The Atlas of Urban Expansion: <http://atlasofurbanexpansion.org/>
- The WorldPop project: <https://www.worldpop.org/>
- Africapolis: <https://www.oecd.org/swac/topics/africapolis/>
- World's Air Pollution – Real time air quality index: <https://waqi.info/>

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## About this report

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