Africapolis (English version)

François Moriconi-Ebrard, Eric Denis, Dominique Harre-Roger, Catherine Chatel, Ousmane Thiam, Marion Séjourné

AFRICAPOLIS

Urbanization Trends 1950-2020:

A Geo-statistical Approach

West Africa

AGENCE FRANÇAISE DE DÉVELOPPEMENT

ANALYTICAL REPORT

Africapolis Team

Production Team

CHATEL Catherine	**Doctorant at SEDET (CNRS / Université Paris-Diderot)**
DENIS Eric	**Senior Research Fellow at SEDET (CNRS / Université Paris-Diderot)**
HARRE Dominique	**Doctor of Socio-Economics of Development**
MORICONI-EBRARD François	**Senior Research Fellow at SEDET (CNRS / Université Paris-Diderot)**
SÉJOURNÉ Marion	**Doctor of Geography**
THIAM Ousmane	**Doctor of Geography**

Technical and Documentation Team

GAZEL Hervé	**Doctor of Geography and Chairman of IRVGIS**
GUBRY Françoise	**Documentalist at CEPED**
MANDÉ Issiaka	**Associate Professor of History (University Paris-Diderot)**
TOLA Jacques	**Assistant-Engineer**

Scientific Editors

Eric DENIS a François MORICONI-EBRARD

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Introduction

Qualifying the concept of "explosive" urban growth

Seen through the eyes of history, urban growth has been taking place in West Africa for a very long time, but it is only in the last 50 years that this growth has been considered by most observers as truly "explosive."

However, the term "explosive," which conjures up images of a chaotic, disorganized, and dramatic process, deserves some qualification.

First, the phrase "through the eyes of history" itself needs to be qualified. Although it was separated from the development of urban cultures around the Mediterranean by some 8 million square kilometers of desert, this region of the world nonetheless developed its own urban culture in the past: Ghana, Nijmi (Bornu), and Gao (Songhai) from the 8th century; Kilwa, Oualata, Ife, Kano, Bussa, and Zagha from the 11th century; Mali, Gober, Oyo, Ikoso, Krenik, and Nupé in the 12th century; Timbuktu, Benin, and Ouagadougou from the 14th century, then Kazargamu, Agades, Sennar, Ngala, Ijebu, and Zaria in the 15th century, Masenya and Gbara in the 16th century, and Jima, Ogbomosho, and Kebbi in the 17th century. All are clear evidence of the continued presence of major cities across this region.

Qualification is also needed when comparing growth in West African urban areas with that in other developing countries that have undergone similar transformations in recent years. Compared to West Africa, urban growth has in fact been far more explosive in the Arab world, in Latin America, in India, in the rest of Africa, and in South-East Asia.

Further qualification is needed when taking into account the relative size of the major metropolitan areas of West Africa at the beginning of the 21st century. In 2005, there were just two agglomerations with more than 3 million inhabitants in the region – Lagos and Abidjan – which, when ranked according to the size of their urban population (following the *Geopolis* definition), come in 23rd and 83rd position, respectively, on a global scale. With 9.5 million inhabitants, the population of the agglomeration of Lagos is far smaller than that of Manila, Delhi, Saõ Paolo, or Mumbai, all of which have more than 18 million inhabitants, or that of Jakarta, Mexico City, or Seoul, which have more than 20 million inhabitants each, not to mention the mega-cities of the developed world, which, despite very low levels of demographic growth, are still at the top of the global rankings (Tokyo, with 31 million inhabitants, and New York, with 28 million).[1]

Finally, the term "explosive" needs to be qualified with regard to current levels of urbanization across the region. With some 32% of the population living in an agglomeration of more than 10,000 people in 2000, West Africa is one of the world's least-urbanized regions along with East Africa and the Indian sub-continent.[2]

[1] Source: *Geopolis*. Data collected using the same method as in this report can be downloaded from the website of INSEE, the French national statistical service: http://www.insee.fr/fr/ffc/chifcle_fiche.asp?ref_id=CMPTE01104&tab_id=19

[2] Ibid.

Urban markets of insignificant size on a global scale

If this region is one of the least urbanized in the world, this is partially because it is also one of the least industrialized and poorest in terms of economic resources. In developed countries, urban growth in the 19th century was an outcome of the Industrial Revolution: new agglomerations were created while existing agglomerations grew to a size unprecedented in the history of humanity. In China, current industrial growth is matched by equally spectacular urban development. Conversely, in Europe, the declining urbanization following deindustrialization is concealed only when the areas surrounding major agglomerations are statistically integrated into the metropolis.[3] For example, in France, the statistical partitioning in "Urban Areas" (which includes rural habitat called "peri-urban") was adopted in a period when the growth of "urban units" (as a continuum of built-up areas) started to decline.

Ranking the 230 countries of the world by GDP per capita shows that 15 of the 16 countries of West Africa are in the fourth quartile, among the poorest countries. The sole exception consists of the Cape Verde islands, which are in the third quartile, but which also have the lowest population. The poorest country in the region is Liberia, which is ranked 228th in the world, with GDP per capita of just $140 in 2006. The"richest" country, Côte d'Ivoire, is in 181st place with GDP per capita of $870. However, the local economy has suffered badly from financial, political, and social turmoil over the last few years.

Low levels of urbanization and high levels of poverty go hand in hand with low populations in many countries: Cape Verde, Guinea Bissau, Gambia, Liberia, Togo, and Sierra Leone all have fewer than 5 million inhabitants. Because of this combination of low levels of urbanization and wealth, the urban markets of West are insignificant when seen on a global scale.

[3] Ibid. See also: http://www.observation-urbaine.certu.equipement.gouv.fr/IMG/pdf/1.b_morphologie_MORICONI-EBRARD_cle716713.pdf, p.18

The populations of the capital cities that dominate the local urban hierarchies – cities such as Banjul, Bissau, Freetown, Monrovia, Lomé, or Conakry – have a purchasing power that is comparable to that of the inhabitants of a large regional capital in Europe. For example, although Monrovia (with 800,000 inhabitants in 2006) produces half the GDP of Liberia (some $230 million in 2006), this is the equivalent of the GDP produced by a regional French town of some 6,500 inhabitants.

Undoubtedly, this is the reason why the 31% of the population that is classified as urban seems larger than it is to most observers even though the level of urbanization is lower than the world average. This is also why the large size of some of the region's cities continues to come as a surprise to many observers. It is clear, therefore, that urban growth does not necessarily go hand in hand with industrial and economic growth. Although even those living in the poorest parts of the cities clearly have better access to services, health care, and education than their counterparts living in rural areas, it is fair to say that African cities do not necessarily guarantee improved living conditions or greater development.

As with the majority of the world's poorest countries, the cities of West Africa should not necessarily be seen as convergence points for a variety of endo-regulated flows. They can be concentration points, the product of exo-regulated movements, caused by the civil conflicts that have left their bloody mark on the majority of these countries in recent years: civil wars in Biafra (Nigeria), Guinea Bissau, Liberia, and Sierra Leone, recurring violence in Côte d'Ivoire and Togo, riots in Ghana, guerrilla warfare in the Sahara region, etc.

These crises have had an uneven impact on urban growth. The demographics of capital cities tend to increase during times of violence as the cities are seen essentially as places of refuge, as focal points for emergency food and humanitarian aid services, and as main departure points for prospective international migrants . Smaller towns and cities are less obviously affected by violence. Some are completely destroyed (as in northern Liberia or Sierra

Leone) while others experience changes akin to those seen in the capital city. In each case, the violence tends to lead to chaotic change, fuelled by a sharp increase in mortality rates and the sudden arrival or departure of large numbers of refugees.

Strong demographic pressure

Finally, the weak demographic position of West African cities on a global scale can be linked to the weak demographic position of the region as a whole.

In this vast region in terms of land area (more than 6 million km^2), the countries to the north of the region include part of the world's largest hot desert. This desert environment, classified as "absolute" by bio-geographers, covers a total of 2.7 million km^2 and its inhabitants number just 1.5 million, living either as nomads or in urban environments such as mining towns (Arlit, Zoueirat) or former caravan centers (Agadez).

In other words, if we concentrate solely on the part of West Africa that is not desert, or some 3.3 million km^2, the region does not appear under-populated. With a growth rate of 2.5% a year and a young population, the level of 100 inhabitants per km^2 is likely to be surpassed by 2015. As a result, the perception of the continent as under-populated needs to be qualified as well.

Demographic pressure plays a major role in urban growth because, whether or not rural exodus takes place, West Africa's urban population will continue to grow: while rural exodus leads to an increase in the population in existing cities, no exodus means that urbanization takes place *in situ* – the primary means of urbanization over several thousand years of human life and urban development. The largest villages become small towns, which in turn become agglomerations whose activity, density, and output becomes inexorably urban in nature.

Political leaders cannot ignore urban growth – they can only try to control it. Limiting the growth of major agglomerations simply leads to a proliferation of smaller ones, which in turn reduces the relative growth of medium-sized cities and towns. This in turn widens the gap between the metropolis – often the capital or former capital – and the network of medium-sized cities with only a limited capacity for polarization.

Growth through exo-regulated migrant flow: refugee camps north of the agglomeration of Monrovia (Liberia) in 2008

Urban statistics: the problem of unscientific data

The issue of urban growth remains a key element of any development strategy for West Africa. Yet the methodology used to calculate urban growth has barely progressed since the end of the 1990s. There have been a number of excellent studies on cities, administrative subdivisions, and a number of specific countries, but these alone cannot be used as the basis for constructing an overall picture of urbanization across the region.

First, this is because factors such as the size of cities, their hierarchy, their number, the speed at which they are growing, or the way in which they are spread out across the territory are not the key focus of most of these studies. Instead, they tend to focus on issues such as migration, economic activity, demographic change, management, or land development, and only occasionally offer data on urban populations to illustrate their main argument.

Furthermore, even when urban growth is the main subject, the tools and methodologies used can differ considerably from one study to another.

Whatever the approach, scale, methodology, or focus of the study, researchers need to posit their work within a wider context, either national or international. Phrases such as “urban growth in a given country has been phenomenal over the last 30 years” or “small towns, which account for half of the urban population in a given region” are widely used to place the study in a wider geographic, historical, or thematic context while stressing the significance of its results – i.e., that these can be extrapolated to a broader range of similar objects.

However, comparisons at the international level pose a particular problem. At the level of a city or administrative subdivision, it is possible to refer to national statistics. But West Africa is divided into 16 different countries whose statistical services have little concern for the compatibility of their data categories with those of their neighbors. Whether at the sub-regional or global level, statistical and spatial definitions of ”urban” differ considerably, and population censuses are not carried out on the same dates.

At the international level, there are several statistical publications by major institutions such as the UN or the World Bank, but these too present severe problems.

First, problems of compatibility arise because these institutions have no remit to decide which of the diverse national definitions is best, and therefore merely choose to standardize data collected using as many different approaches and definitions as there are national statistical services and which are as different as each country’s approach to the publication of such statistical data. For example, the agglomeration of Touba, the second largest in Senegal with 500,000 inhabitants in an urban area of 103.5 km^2 (or some 5% of the entire country’s population in 2008), continues to be classified as “rural” by the country’s statistical services.

Whenever a figure is cited, it is usually to emphasize the rationality and objectivity of a particular argument. As a matter of principle, national statistics on national “levels of urbanization” should not therefore be compared. Yet this is what thousands of journalists, teachers, stakeholders, and political leaders do on a daily basis when they refer to these sources.

These international publications also present problems of precision, as no existing database is sufficiently detailed to cover every aspect of the urban environment. Many publications list only cities over 500,000, 750,000, or even 1 million inhabitants (such as the *World Urbanization Chart*, for example) while even the most detailed cover only cities with100,000 inhabitants or more (such as the *UN Demographic Yearbook*).

Since there are only 104 agglomerations with more than 100,000 inhabitants in West Africa, this means that 90% of the cities of the region are not included in any database. We therefore have no information about the growth of medium-sized or small towns.

Are these getting larger? If so, what is the relative size of these emerging agglomerations, and what is the growth rate of existing agglomerations? Moreover, in an area of some 6 million km^2 where communication is often very difficult, how can we ignore where these agglomerations are located?

Establishing different levels of knowledge

Above all, the aim of the *Africapolis* project is to plug this gap in our geo-statistical knowledge – a gap that affects researchers, stakeholders, and planning and development organizations.

In order to assess the current state and future dynamics of urbanization in West Africa, *Africapolis* uses a number of techniques that are entirely innovative. These techniques are based on scientific hypotheses refined in the field of quantitative geography. They use state-of-the-art technology that combines satellite imaging with GIS (Geographic Information System) databases. They also make use of the largest collection of documentation on the region ever collated, including all geographical and historical data from population censuses and official publications (known as "village lists," "census gazetteers," or "village directories" depending on the country) at the lowest geographical level, that of towns and villages.

This two-pronged approach, which combines satellite imagery and census data – two totally different sources in origin and nature –, has allowed us to make a significant leap forward in our understanding of the urban phenomenon.

This leap forward in qualitative analysis has several implications.

First, the *Africapolis* approach offers a scientific guarantee that is shared by very few others – the ability to verify each methodological step. Thus when *Africapolis* gives the size of a city or town, a rate of growth, or a number of agglomerations, the researchers ensure that this information can be verified by the user.

The morphological data produced can easily be superimposed onto images from *GoogleEarth*, which are freely available. The demographic sources used are the property of the institutions that produced them (the national statistical services) and so cannot be reproduced in their entirety, but they will be placed in a public library – the CEPED[4] documentation center – where they can be consulted (via the online catalog).

Sharing knowledge

This possibility of verification, which ideally should accompany any statistical information that claims to be "scientific," presents new opportunities for knowledge sharing. This transparency means that the results of every analysis can be tested, although this critical approach is not so much about assessing the results themselves but rather the methods used to produce them. Despite every effort to ensure that the scanning, inputting, and verification of the data are carried out correctly, it is not possible to rule out human error entirely. However, if it is assumed that such errors are only marginal, then it can also be assumed that the scope and impact of the results are a true reflection of the hypotheses and methods used to generate them.

Since this critical approach focuses on the method used, the results can only show what the data used to generate them show. This means that the *Africapolis* study provides no information on migrations, the activities of populations, income levels, and so on. Entire swathes of what is traditionally considered part of the "urban studies" are not covered here in order to better concentrate on specific thematic areas such as the number of inhabitants, population density, and population growth.

However, this pioneering technique could also be used in with other datasets by future users, who could create their own information systems based on their own databases.

[4] CEPED: *Centre Population et Développement* (Center for the Study of Population and Development).

Establishing different levels of knowledge

Although the *Africapolis* project concentrates on one very specific dimension of urban growth, it offers an unprecedented opportunity to focus on different levels of investigation, from the global to the micro-local.

More than 2,558 agglomerations have been identified on the ground, down to the very last building, although only those with more than 10,000 inhabitants were classified as ”urban” to ensure that the definition was comparable across the region. On the other hand, using available statistical data, we identified 160,000 towns and villages.

This morphological database was cross-referenced with the results of the population censuses, starting with the present day and going as far back as possible given the sources available.

The results of work of this kind can be extrapolated to the global level, with users benefiting from the heuristic advantages of such scaling.

Since numbers have a tendency to grow to infinity, little by little and despite our best intentions, the figures become increasingly abstract. For example, once we know the rate of urbanization of the 1,017 agglomerations of more than 10,000 inhabitants in West Africa in 2000, we can calculate a “global” rate of urbanization. However, the information contained in such a single number masks a wide range of realities, which, when considered as a whole, make little sense. For example, what is the meaning of an average population size of 50,000 inhabitants when the size of agglomerations varies from 10,000 to several million inhabitants?

What we wanted to offer users was the possibility of finding a way past this fundamental contradiction between the “local” and the “global,” between the obvious reality of the city and the theoretical abstraction of the number. That is why this report contains not only a series of maps covering all of West Africa (in Part 3) and various statistical analyses at both national and global levels (in Part 2), but also a large number of high definition satellite images.

This opportunity to switch between different scales, an approach that is still not widely used in our cultures and by most researchers, will probably lead to many users changing the way they work.

As far as development is concerned, this approach offers even greater opportunities in that it is not limited to mere representations. Since the *Africapolis* database includes the coordinates of real places, which are compatible with any Global Positioning System (GPS), the data processed through the system can be clearly related to an actual position on the ground. As a result, the database is an effective research tool.

Africapolis is part of a wider project, called *e-Geopolis*, which is funded by a variety of institutions, including the French National Research Agency. Over the course of 2008-2009, an identical project will be carried out in India (*Indiapolis*), supported by the French Institute in Pondicherry, while another in Europe (*Europolis*), coordinated by Catherine Chatel, will run concurrently.

All these projects will help situate our knowledge of West Africa and better understand the specificities, strengths, and weaknesses of its urban growth.

In addition to this report, the data on each agglomeration will be gradually placed online as part of the e-*Geopolis* project (www.e-geopolis.eu), funded by the “Corpus and Database” program of the French National Research Agency.

Contents of Study

This final report, which covers some of the most striking findings of our work, consists of four parts:

- Part 1 sets out the documentary sources, definitions, and methodology used in the study, and makes comparisons with a range of earlier studies.
- Part 2 presents an analysis of the results. In parallel to the presentation of statistical data, the focus is on the processes and structures of urbanization. While urbanization in Africa is clearly evolving very rapidly, it is nonetheless important to understand that certain structures, put in place at different times or the result of simple, and often misunderstood, urban system's characteristics (for example, hierarchical distribution or the Law of Metropolization), can cause considerable inertia. Understanding the nature of this inertia allows us to better predict what will change, where it will change, and thus how we can attempt to control that change.
- Part 3 contains a statistical "atlas" of West Africa, consisting of a series of maps based on a number of key indicators of urbanization, all presented in the same format and on the same scale.
- Finally, Part 4 consists of 16 country fact-sheets, containing information about documentary sources and past and present administrative divisions used to present the population censuses' results. They also contain key statistical information on urbanization, including its development since 1950 and projections for 2020.

The diverse forms of urbanization in West Africa

An agglomeration in the Sahel: Aidu, Nigeria (25,000 inhabitants)

The center of a major national metropolis: Accra

The western part of the city of Kamsar (34,000 inhabitants), an agglomeration in Guinea that is officially classed as "rural."

Part One

Documentation status and review

1. HISTORICAL CONTEXT

"Explosive" urban growth

There have been high levels of urban growth in West Africa since the end of the Second World War. This growth resulted from a combination of two factors, as was the case in most "Third World" countries at the time. These consisted of a natural population growth rate that was particularly high, increasing by around 2 to 3% per year, and a continuously increasing "urbanization rate," i.e., the percentage of the population living in urban areas:

(a) The population of the region increased by a factor of 3.8 based on an average demographic growth rate of 2.7% over half a century (1950-2000);

(b) The urbanization rate increased by a factor of 4.2, from 7.5% in 1950 to 31.5% of the total population in 2000.

The combination of these two factors has led to a 16-fold increase in the total urban population.

	Factor increase between 1950 and 2000			
	of the total population	of the urbanization rate	of the urban population	of the number of urban areas
Benin	x 4.2	x 6.7	x 28.1	x 11.8
Burkina Faso	x 3.6	x 8.2	x 29.4	x 17.7
Cape Verde	x 2.9	x 5.9	x 17.0	x 3.0
Côte d'Ivoire	x 6.1	x 8.0	x 49.1	x 27.3
Gambia	x 5.2	x 4.1	x 21.0	x 7.0
Ghana	x 4.1	x 3.7	x 15.3	x 9.8
Guinea	x 2.9	x 8.2	x 23.4	x 5.2
Guinea-Bissau	x 2.3	x 3.1	x 7.2	x 3.0
Liberia	x 3.4	x 13.2	x 45.5	x 15.0
Mali	x 3.0	x 6.8	x 20.1	x 8.0
Mauritania*	x 5.4	-	-	-
Niger	x 4.6	x 9.1	x 41.9	x 11.3
Nigeria	x 3.7	x 3.4	x 12.7	x 5.8
Senegal	x 4.7	x 2.5	x 12.0	x 10.8
Sierra Leone	x 2.4	x 5.6	x 13.6	x 5.5
Togo	x 4.0	x 9.9	x 39.1	x 18.5
Overall	**x 3.8**	**x 4.2**	**x 15.9**	**x 8.1**

* No urban population in 1950

These factors have led observers to describe urban growth in West Africa as "explosive," a characterization that should, however, be put into perspective because,

a) urbanization in West Africa in the first half of the 20th century had fallen to extremely low levels, and:

b) a great deal of attention is focused on the major cities.

A level of urbanization that was initially very low

High levels of urban growth can firstly be explained by exceptionally low levels of urbanization at the beginning of the period. For example, it is not even possible to calculate the level of urbanization in Mauritania since there were no cities with a population of more than 10,000 until the end of the 1960s. The growth rate in the urban population is therefore likely to be infinite.

However, numerous historians have shown in fairly recent studies that despite these low levels of urbanization, West Africa is not deprived of urban history (Coquery-Vidrurbanovitch, 2005). Today, the low level of urbanization is attributed to the collapse of ancient political systems and the global population crisis that impacted African from the start of the 15th century (Diop-Maes, 1996).

There are numerous reasons for the crisis:

- The demographic decline is linked to the European slave trade and the looting raids carried out by the Arabs in the north and east;
- This demographic decline hastened the economic decline that was sparked off by the European discovery of the New World and the opening up of shipping routes that led to a gradual decline in trans-Saharan trade.

As a result, political systems were destabilized and inter-African wars multiplied. Traditional production and trade systems were gradually replaced by an export economy that served the colonial urban centers. Cities were physically destroyed or gradually abandoned to the benefit of new urban centers.

Some of today's cities are ancient cities, but most have gone through periods of decline from which they are only now recovering. Very few cities in West Africa have managed to maintain their importance over the last few centuries. Such cities can be found in the Middle East (Aleppo, Baghdad, Cairo, and Constantinople), India, and China. There was almost no continuity between pre-colonial geography and today's urban geography, with the result that West Africa now finds itself in a situation similar to that of Latin America relative to the Inca or Aztec empires.

- Kano, Kumasi, and Ibadan are the only major cities that were able to retain their importance as important urban centers. In other cities such as Ouagadougou, the ancient capital of the Mossi kingdom, there were periods of substantial decline, with the result that there was no real stability in the urban population;
- Abomey, Bauchi, Zinder, Agadès, Bida, Zaria, and, notably, about thirty Yoruba cities are the only secondary cities that managed to retain their urban importance despite periods of relative decline;
- More generally, dozens of small cities have disappeared to the extent that, in many cases, their populations still do not even spread beyond their ancient walls (northern Nigeria, Mali), despite the tremendous population boom that has occurred over the last half-century.

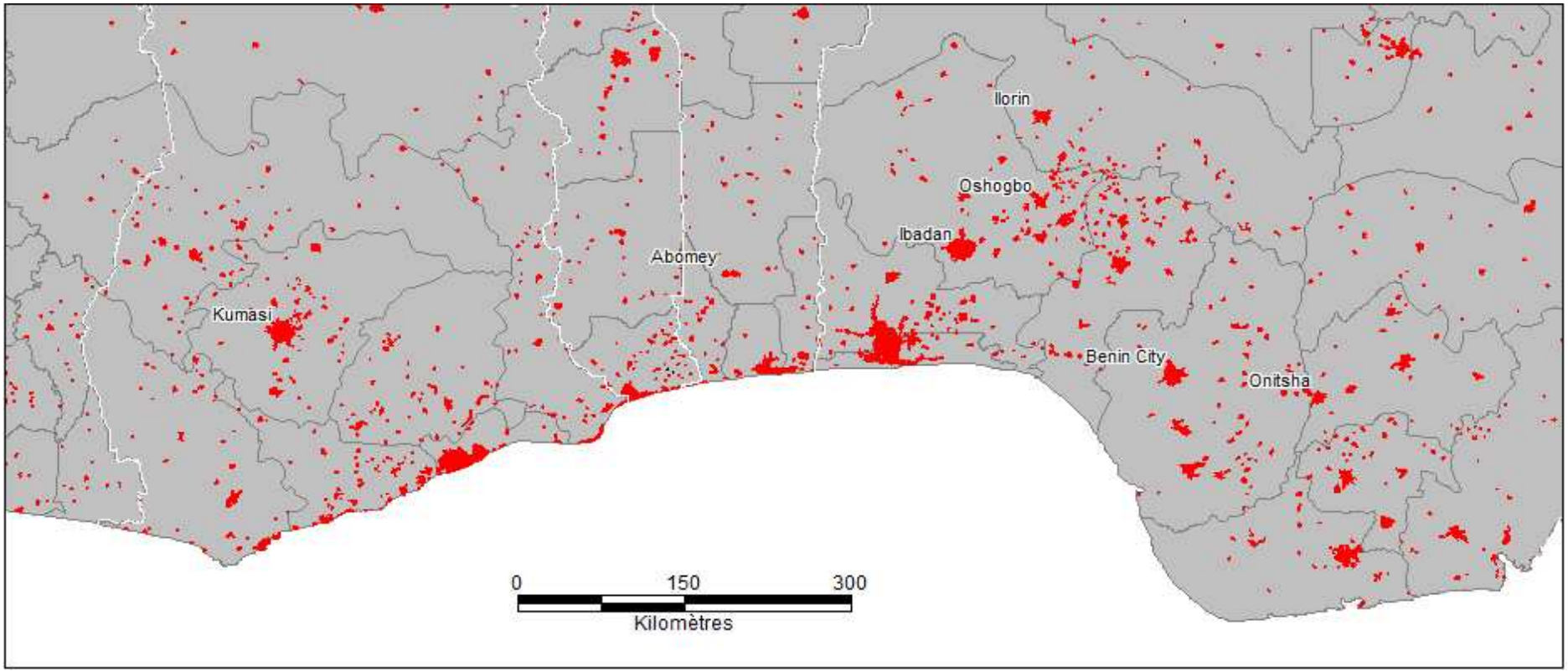
Some traces of ancient urban history can still be found in West Africa today, evident in:

a) the existence of an exceptionally dense network of cities in the Yoruba region;

b) the continued existence throughout the sub-continent of major communication networks;

c) a high population density within urban centers, with the existence of true medinas. However, the dilapidated building structures in these city centers now make urban renewal very difficult.

Physical extent of the urban centers in West Africa with populations of more than 5,000 inhabitants in 2005



Source: *Africapolis*

Ancient urban networks continue to exist through:

- the extremely high population density in urban centers in the south-east of the Plateau of Yorubaland;
- the reemergence or continued existence of a number of cities in the interior, such as Kumasi and Abomey, located within reach of the forest savanna areas favorable for trading agricultural products;
- the establishment or reestablishment of specific communication networks.

However, in contrast to today, no major cities developed along the coast until the colonial period. Moreover, many new urban centers were established after independence.

Representation crisis

Since the middle of the 1970s, the attention of the media and of international programs has been focused, among all the various aspects of urban growth, on major cities, with regard to both research and policies. At the time, new wordings with catastrophic connotations such as "urban explosion" were coined, with superlatives such as "megalopolis" and "gigapolis" abounding together with neologisms that were teratologically inspired, such as "urban monster," or pathology inspired, such as urban "cancer," "canker," or "gigantism."

Projection errors

In fact, the experts were taken by surprise by both the exceptional post-war urban growth and the population forecasts of the 1950s and 1960s, which systematically underestimated the populations of major cities in developing countries. Up until the 1970s, population census results were always higher, often much higher, than forecasts.

Forecasts for the next generation took these errors into account, but went to the opposite extreme and overestimated population levels. The most symbolic example of this trend was that of Mexico City. Experts at the first Habitat Conference in Vancouver predicted that the population of the city would reach 34.8 million in the year 2000 based on forecasts made in 1976, whereas census results gave a population of less than 19 million (Moriconi-Ebrard, 1996).

Once the metropolitan areas of developing countries became the largest urban centers in the world, all previous representations of the "City" were turned upside down. In the past, the term had represented "Progress" and "Civilization," but the city of the future became, like Babylon, synonymous with "den of iniquity."

The context of the 1970s

This catastrophic vision of the growth of the metropolis should, however, be put into the context of the mid-1970s.

The first World Population Conference was held in 1974, and the first Habitat Conference was held in 1976. At the same time (1973-1974), the White House drew up NSSM 200, a strategic resolution whose content was made public after the implementation of the Freedom Act.[5]

While the NSSM 200 resolution deemed overpopulation and population growth to be the main threats to the future of liberal democracies, it also outlined strategies and methods that the developed world should follow to counter these trends. These methods involved, in particular, orienting scientific programs through government resources and private foundations and using the media (movies, newspapers, news reports, etc.) to increase awareness and shape public opinion with regard to this issue.

The NSSM 200 resolution was clearly aimed at defending the interests of liberal democracies (i.e., US security and overseas interests). However, it should also be seen within the context of the Cold War. Thus, the emergence of the Third World "megalopolis," a pocket of misery filled with millions of poor people, served in particular to reinforce the fear of social revolt, which from the US standpoint, constituted a breeding ground for communism.

The media thus promoted hysterical images of the major cities of the future, as in Richard Fleischer's movie *Soylent Green*, which came out at the end of 1973.

[5] National Security Study Memorandum ("NSSM 200"): Implications of Worldwide Population Growth for US Security and Overseas Interests.

Meanwhile, the hygienist movement saw a revival. First introduced during another period of unprecedented urban growth in England in the 1840s, it had been later suppressed by the techno-scientific ideology of the post-war boom years.

The image, drawn from Malthusian ideology, of the megalopolis devouring agricultural land clearly shows the irrationality of the debate. For a given level of population, continuous growth of dense urban networks in metropolitan centers would in fact take up less agricultural land than dispersed and sprawling settlements.

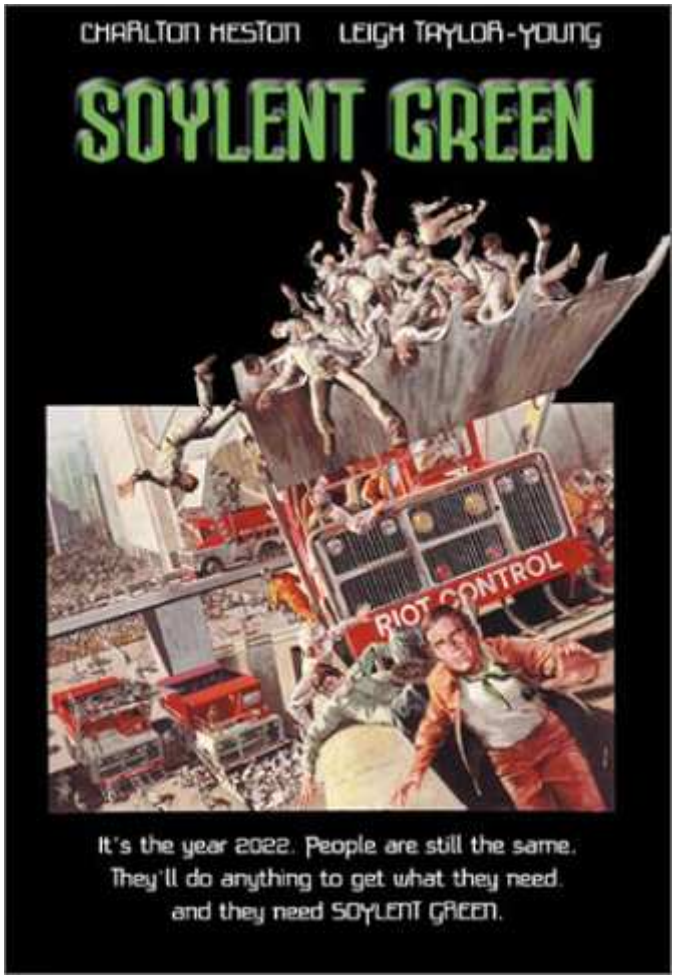
While most researchers were not taken in by this ideology, it is important to note the impact that these representations made:

a) on the perception by urban society as a whole of the urban condition;

b) on the choice and financing of research topics put forward by the most powerful institutions and foundations;

c) with regard to the approach taken by the major national and international assistance and development programs, which tended to focus on reducing the growth of metropolitan areas, sometimes to the benefit of small cities and at other times of rural development.

Ultimately, these representations have been partly successful since population growth in the major urban centers has leveled off since the 1990s.



Although the concept of an “urban explosion” in West Africa can be put into perspective, the rate of urban growth in the region has been very high since the middle of the 20th century. However, the tremendous changes that have taken place should not be reduced to catastrophic representations. Instead, appreciating the true nature of the change requires the rational observation of the facts through the development of measurement tools based on available statistical and mapping data.

2. DEFINITIONS OF URBAN GROWTH, SOURCES, AND METHODOLOGIES

Definitions: Three basic models in use worldwide

Although urban growth is a global phenomenon, it is hard to measure on an international scale because of the different ways in which urban spaces are defined. Each country uses its own definitions, as the basis for all its statistical information, and these definitions can be grouped into three basic categories: cities, urban agglomerations, and metropolitan areas (Moriconi-Ebrard, 2000).

Cities: **Political and administrative entities**	***Urban agglomerations:*** **A definition based on land occupation**	***Metropolitan areas:*** **A definition based on networks**
Historically, the word "city" has referred to a clearly defined territory whose inhabitants are not subject to land laws, but come under a separate legal regime. Although the boundaries of this territory are clearly established, they are not necessarily visible on the ground. They may, for example, cut through built-up areas – separating the city from its suburbs – or, conversely, encompass a city, its suburbs, fields, forests, or indeed several different cities of equal size and stature. This political and administrative definition of the city is used by most of the world's leading countries (the US, Germany, China, Japan, Russia, India, Pakistan, Iran, Indonesia, Egypt, etc.). In West Africa, it is the basis for the definition used in most Francophone countries: in Senegal, for example, urban municipalities are not defined in the same way as villages, which are grouped together in "rural communities".	Historically, the concept of urban agglomeration is based on the Roman definition of "urbs" (city) – and literally an urban space. The term appears for the first time in an official context in England in the 1841 population census. At that time, statisticians were preoccupied with establishing the true size of London, whose suburbs had grown beyond the traditional boundaries of the city. An agglomeration is defined by density – referring either to the number of inhabitants per unit of land or by a maximum distance between buildings. This definition is most widely used in countries where the development of municipalities has been widespread and where the legal status of each municipality is considered equal (France, Italy, Spain, the countries of Latin America, etc.). In order for an agglomeration to be considered "urban," it must meet several criteria: • It must be of a minimum size, although this varies greatly depending on the country (for example, 200 inhabitants in Denmark, 2,000 in France, and 10,000 in Switzerland); • It must house a minimum percentage of the population or of "non-rural" households, again with variation across countries; • It must offer a wide variety of services such as health, culture, education, transport, and security, among others. When one or all of these criteria are met, urban status can be granted to the city or cities included in the agglomeration. This approach is used by several West African countries, albeit with different thresholds (for example, 1,500 inhabitants in Guinea Bissau, 2,500 inhabitants in Sierra Leone and Liberia, or 5,000 in Nigeria and Ghana).	This approach to defining urban development is by far the most recent, appearing for the first time in the US census of 1950. At that time, there was a major debate about "counter-urbanization," and the main preoccupation of statisticians was to show that the sphere of influence of major cities did not end with their physical boundaries but often extended to nearby urban areas linked to them. Thus, even if the population of a city or agglomeration were to fall, as was occurring in the north east of the country, metropolitan areas could continue to grow. This approach is based on the movement of people (generally commuting time or distance) and of physical and intangible goods and sometimes on the density of networks. A metropolitan area is therefore neither a city nor an agglomeration but rather a grouping of various flows (of people and goods) linked to a greater or lesser extent to urban poles.

In order to measure urban development at the supranational level, a single definition is needed.

Toward a single definition of "urban"

To allow for urban development to be accurately assessed, a single definition must, by its very nature, transcend national boundaries since no single definition at the national level is comparable to any another. So how can this single definition be established?

In order to find a solution to this problem, two further questions must first be answered:

a) What are the common areas shared by all the definitions?

b) Are there any scientific sources that can be used to help establish this definition?

Urban "versus" rural

Most statistical definitions do not distinguish between 'urban' and 'rural' but rather between 'agricultural' and 'non-agricultural':

- Definitions based on cities as political entities tend to separate trades and crafts from landowners and farm workers.
- The agglomeration-based definition explicitly excludes all things agricultural from the urban area, which is defined as a continuum of built-up space whether it is used for residential, industrial, administrative, or commercial ends. However, public parks (where agricultural production is not allowed) are included in this definition.
- The definition of metropolitan areas is based on the concept of mobility, which means that, compared to commuters traveling to and from urban areas, farm workers are viewed essentially as "static" – even if they are highly mobile in their work in the fields.

This dichotomy can be clearly seen in various fields of the social and human sciences:

- In ethnology and history, in the classification of the three orders of society – clergy, soldiers, and peasants;
- In sociology and economics, in the classification of primary, secondary, and tertiary sectors of activity, where urban areas are defined as those excluding primary production;
- In geography, in the comparison between built-up and non-built-up land.

Building a definition

A standardized international approach to urbanization requires a methodology based on the availability of data.

There are two forms of data:

- Statistical data from censuses and population counts that are sufficiently detailed to show a clear separation between urban and rural areas;
- Cartographic data that clearly show land use.

The approach we are suggesting, based on the methodology used to build the *Geopolis* database, is defined as follows:

Are considered urban all local administrative units with more than 10,000 inhabitants and whose principal agglomeration accounts for more than half of that population.

An agglomeration is defined as a built-up area whose constituent buildings are no more than 200 meters apart. Residential and commercial buildings, government offices, and structures such as parking lots, highway interchanges, and airports are included in this definition.

Where an agglomeration is crossed by a lake or a river, the width of this body of water should be subtracted from the distance between buildings.

Seven stages methodology

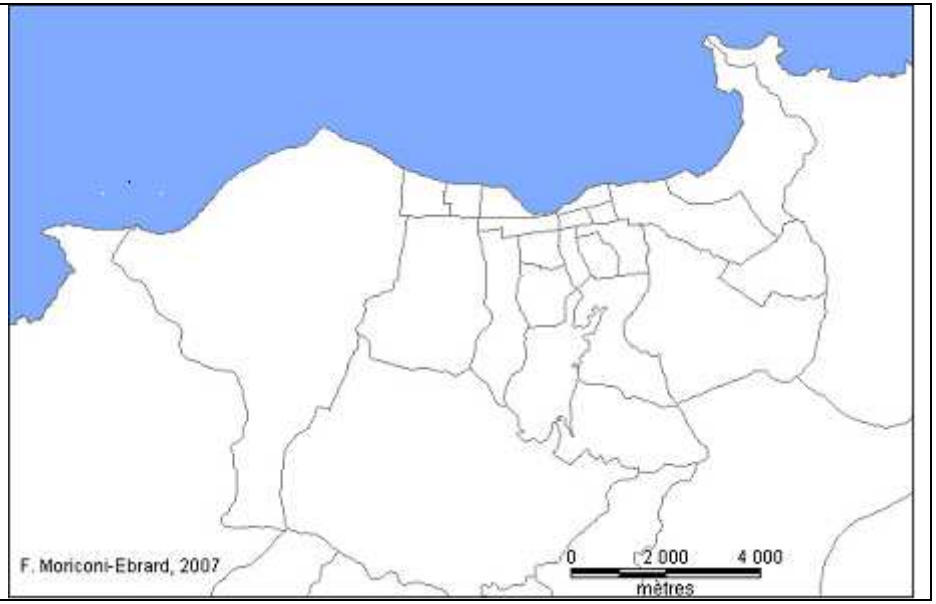
The standardized method for defining urban areas (the agglomerations) combines two different sources: statistical population data for each country and detailed images and geo-referenced maps, clearly showing the agglomerations' geographical boundaries.

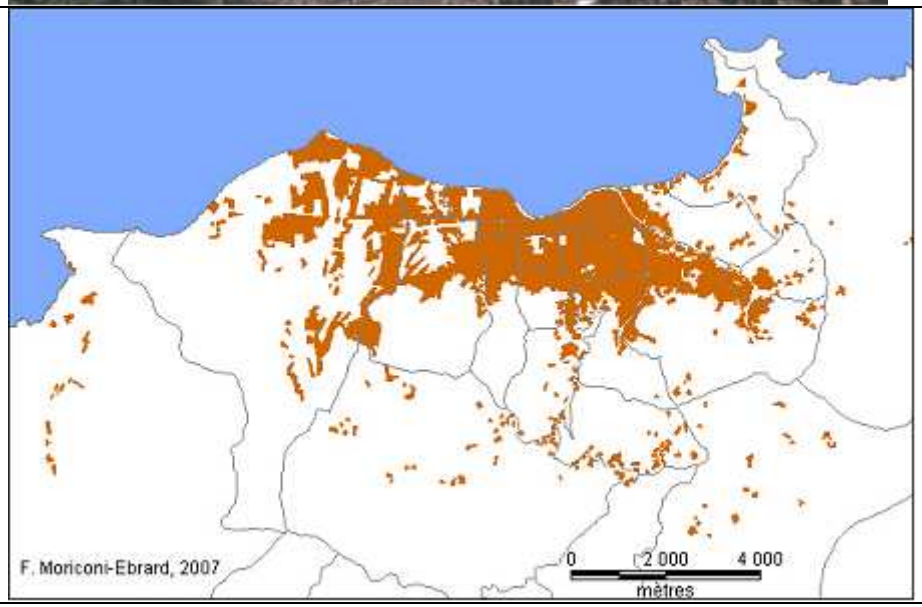
1. Population localization

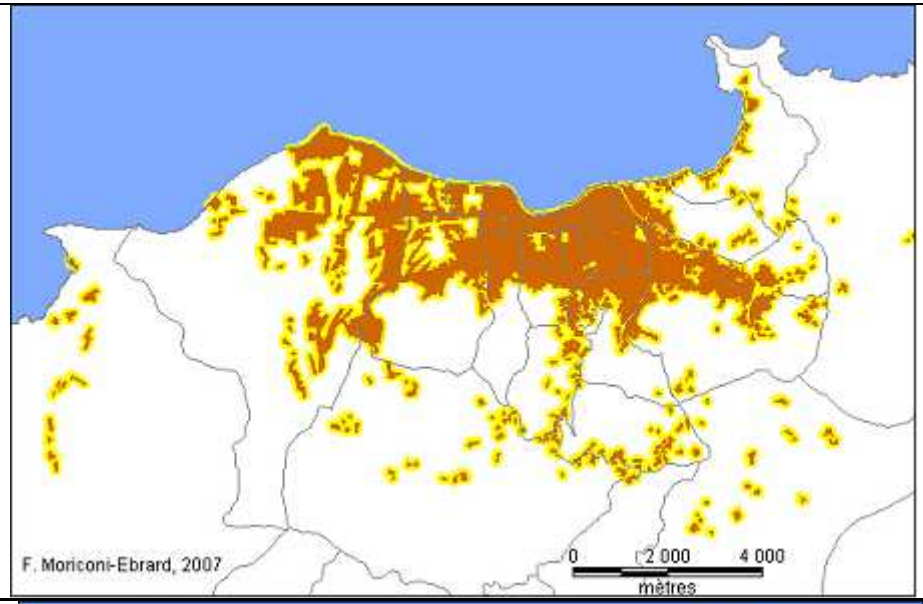
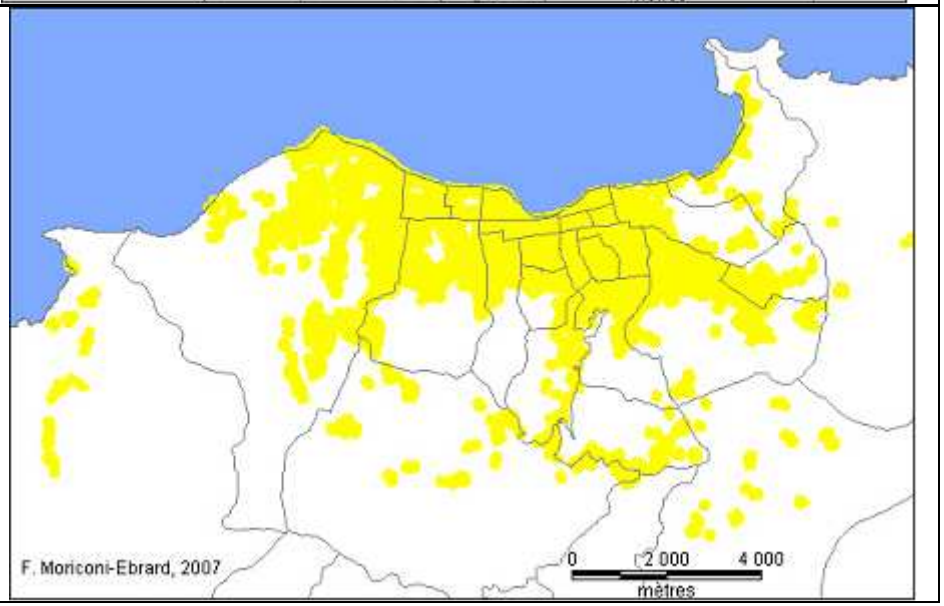
Juridical limits of the local units.

This stage makes use of statistics published by national statistical offices (population censuses, population counts, and official birth records).

When this data is not available as a map, the centroids are used as a mapping tool. A centroid is a point that represents the barycenter or center of a local community, such as a city hall, church, or major mosque.

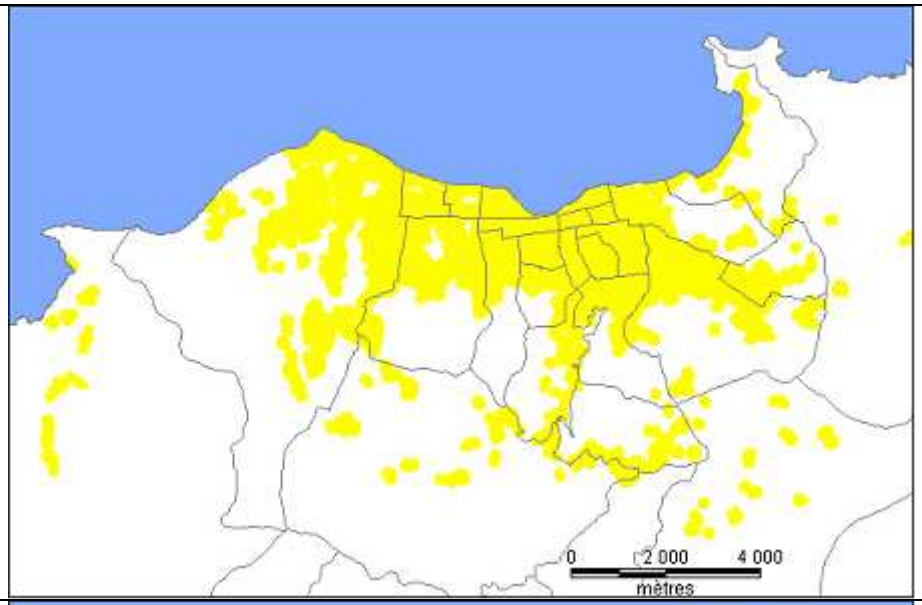


2. Accessing satellite images or topographical maps Most images can be downloaded from websites such as *Google Earth* (GE). However, there are many other complementary sources that can be particularly useful when the resolution of the image is of poor quality.		
3. Polygons representing built-up areas considered as urban In this case, the polygone shape files are superimposed on a map showing administrative boundaries.		

4. Creating buffer zones of 100 meters Buffer zones of 100 meters allow the extent of built-up areas to be assessed using the definition based on a figure of less than 200 meters between constituent buildings		
5. Merging blocks This removes any overlaps and creates contiguous zones of less than 2,500 meters.		

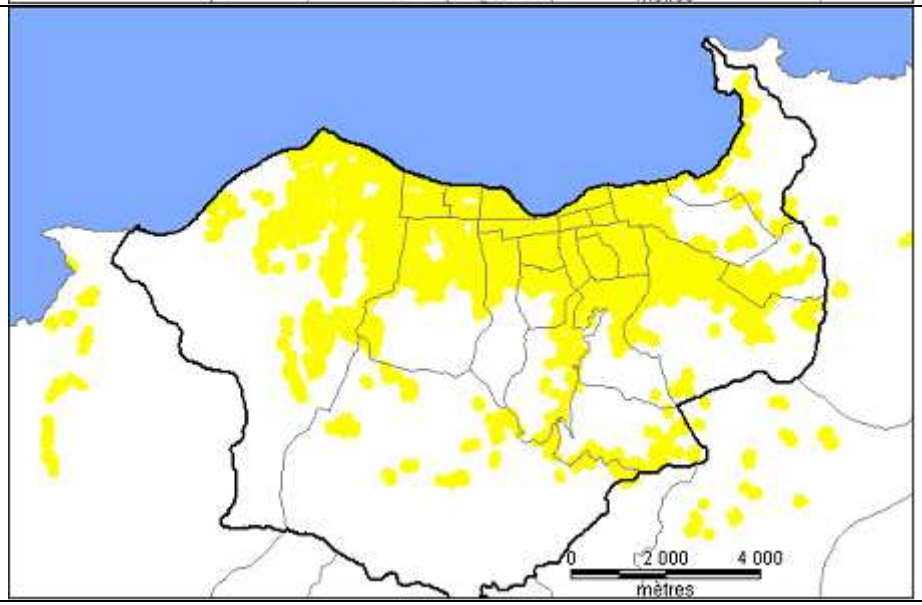
6. Cleaning up

The edges of the blocks are cleaned up to match the oecumene's boundaries (the area that is actually inhabited).



7. Statistical adjustment

The contours of the agglomeration are matched to local administrative units. At least 50% of the unit's built-up areas must be part of the main agglomeration. The resulting agglomeration therefore covers a number of different administrative units – municipalities, cities, villages, etc. In some cases, parts of specific administrative units located on the margins of surrounding units are included in the agglomeration while others are not – for example, to the east of the agglomeration shown on this map.
The margin of error created by this adjustment is minor for large agglomerations, but it can be more significant for smaller ones, especially those with a population of around 10,000 inhabitants.



Research sources

A detailed list of the demographic, geographic, and historical sources used in this report can be found in the following table. For further details, please refer to Annex 1.

Cartographic images of urban areas were created using primarily satellite images and aerial photos widely available on a number of websites. The most easily accessible website is *Google Earth*, but the quality of some images on this site can be poor. If necessary, additional images can be found in a variety of public sources, such as http://www.computamaps.com/en/catalog/index_2.html, http://glovis.usgs.gov, or http://edcsns17.cr.usgs.gov/EarthExplorer as well as several commercial sources.

Table summarizing the demographic sources used in the Africapolis database

Country	Population Census dates	Number of local units	Other sources (partial data)
Benin	1979, 1992, 2002	*3700*	d1961
Burkina Faso	1975, 1985, 1996, 2006	*7750*	
Cape Verde	1950, 1960,1970,1980,1990, 2000	*31*	
Côte d'Ivoire	1975, 1988, 1998	*8540*	
Gambia	1975, 1988, 1998, 1983, 1993, 2003	*1802*	
Ghana	1948, 1960, 1970, 1984, 2000	*52000*	
Guinea	1983, 1996	*14000*	a1958, est2001
Guinea-Bissau	1950, 1960, 1979, 1991	*?*	
Liberia	1962, 1974, 1984	*1750*	er2005
Mali	1976, 1987, 1998	*11525*	
Mauritania	1976, 1988, 2000	*7300*	a1965
Niger	1977, 1988, 2001	*23516*	a1938, a1956, d1962
Nigeria	1931, 1963, 1991, 2006	*24500*	
Senegal	1976, 1988, 2002	*13500*	a1955, a1965
Sierra Leone	1963, 1975, 1985, 2003	*1800*	a1947
Togo	1959, 1970, 1981	*2970*	er1992

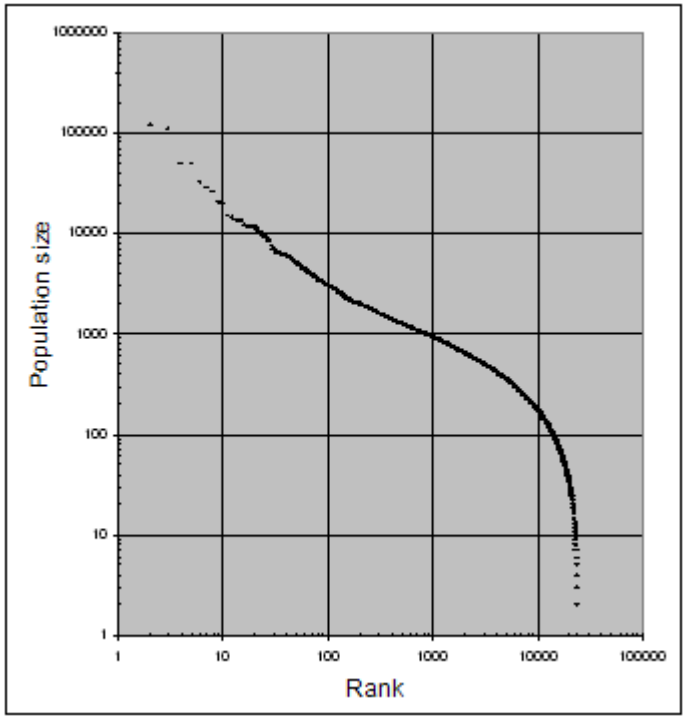
Notes: **d** – demographic surveys; a – administrative head count;
est. – estimation by national statistical service; **er** – electoral roll.

Setting a minimum statistical level for the definition of urban areas

Assessing the “urban” nature of any particular settlement is a classical issue in social sciences. Yet there is no consensus between the various disciplines on how to do this, especially when looking at the international, or indeed global, picture. The level that we have set in this study is therefore open to scientific discussion.

This level is based on both **theoretical hypotheses** of **quantitative geography** and on the **analysis of the most complete available lists of statistical information** on cities and villages in West Africa. This statistical dataset is used to correct and then validate the theoretical hypotheses.

Human settlements in Niger ranked by population size (Source: RGPH 1988, list of villages)



3. THEORETICAL REFERENCES

Hierarchical classification of cities and towns

As early as 1903, Auerbach noted that when cities in any given territory are classified in descending order of size, the distribution curve is lognormal. In other words, on the graph showing the logarithm of the cities' population against the logarithm of their ranking, the slope of the curve is roughly -1. This rule is related to the laws of probability governing the natural distribution of very large numbers (Pumain, 1982). It was formalized mathematically by Zipf (1941), and is known as the "rank-size" rule.

Another model, suggested by Davis (1970), suggests that the distribution of cities according to size follows a harmonic pattern. For example, if the largest city has *n* inhabitants, the population of the next two largest will be *n/2,* the population of the next four will be *n/4*, and so on. As is the case with sound frequencies, the distribution of the size of cities thus follows a harmonic sequence (1/2, 1/3, 1/4).

The graph on the previous page, which shows every human settlement in Niger in 1988, clearly shows the dichotomy between these two theories – a dichotomy which can be found in every country of the world despite vast differences in size, urban population, or number of cities.

Using the model put forward by Davis, the country's largest city, Niamey, clearly stands apart from the upper part of the distribution curve. It is followed by two agglomerations of similar size (Zinder and Maradi), whose combined populations are roughly the size of that of Niamey, and then by five more, whose combined populations are again roughly equivalent to that of the capital, and so on.

Using Zipf's model, it is also possible to show that the upper part of the distribution curve follows a line that is roughly equivalent to -1, the so-called "hierarchical curve," until it reaches cities of around 7,000 inhabitants (ranked in roughly 30th place in 1988).

Distribution of all human settlements

The problem with both these models is that they only apply to human settlements that are classified as cities or towns and not to all settlements (cities and towns, but also villages, hamlets, and isolated farms).

When taking into account the distribution of settlements of all sizes, a general rule of thumb appears. On the graph representing Niger, for example:

- A clear break can be seen in the hierarchical curve, which becomes shallower (-0.67) at around rank 30, representing settlements of 7,000 inhabitants or fewer. Some authors suggest that this break represents the threshold between urban and rural settlements.
- A concave "tail" in the distribution curve can also be seen, which corresponds to the fact that very small settlements become increasingly rare beyond a certain threshold, the smallest being just one inhabitant. This concave turn reflects the fact that smaller settlements become abnormally rare the further down the distribution curve they are.

This form of distribution is explained by the fact that, unlike urban settlements, rural communities have a very flat hierarchy. This is because cities are heavily dependent on external sources for key services such as food supplies, while villages tend to be more self-sufficient.

Notwithstanding empirical studies' results, the problem is that the theoretical threshold between urban and rural settlements varies across time and geographical areas.

The 10,000-inhabitant threshold

In order to test these hypotheses in West Africa, population census data was digitalized for as many settlements as possible down to the very smallest. This allowed us to create a dataset of around 160,000 local administrative units (classified as cities, towns, villages, hamlets, districts, camps, and localities or settlements, according to local usage) for which we have population data from one or more dates depending on the country.

The choice of threshold

Tests show that the theoretical threshold between rural and urban settlements varies according to time and geographical areas. It may also vary between regions in individual countries. In this region of the world, it is generally set at between 5,000 and 10,000 inhabitants, and most commonly around 7,000-8,000. These tests have allowed us to confirm the choice of 10,000 inhabitants as the threshold chosen in 1993 for the Geopolis database. As a result, the indicators and results shown in this report are comparable with those in the rest of the world.

As this report also includes a look ahead to 2020, the scope of the study was on this occasion extended to include agglomerations of 5,000 inhabitants. This threshold enables us to include all those settlements with a population of fewer than 10,000 in 2000, but whose population is likely to exceed that figure by 2020.

Relative sizes and comparisons

The threshold of 10,000 is considered by some to be too high while others consider it to be too low. It is therefore worth making some comparisons at this point.

In West Africa, households tend to be large, which means that an agglomeration of 10,000 inhabitants might consist of around 1,000 to 1,200 households, compared to 3,500 or 4,000 households in Europe. Fewer households also tends to mean fewer people in active work, and given the greater importance of primary industries, a high proportion of farmers is sometimes found in the smallest agglomerations. On this local scale, agricultural land is never very far away from workers' homes. While such agglomerations might be considered essentially agricultural, what marks them out as urban is the fact that they also contain non-agricultural activities. Furthermore, once a certain population threshold is crossed, the agglomeration reaches a "critical mass," beyond which new activities and services may start to develop. This threshold is not automatically set at 9,999 inhabitants, but it is roughly around that figure.

Conversely, it is important to remember that GDP per head in West Africa tends to be well below the average of that in developed countries: the total GDP of an agglomeration of 10,000 inhabitants in West Africa is roughly the same as that of a village of 200-250 people in Western Europe, the United States, or Japan. For example, the GDP of Bouaké, the second-largest agglomeration in Côte d'Ivoire, with 485,000 inhabitants in 2000, is roughly the same as that of the French towns of Mende (in the Lozère region), Granville (in the Manche region) or Langres (in the Haut-Marne region). This disparity is halved when calculated on the basis of purchasing power parity, even though Côte d'Ivoire is by no means the poorest country in the region. In the context of the global economy, these comparisons, although very rough, underline just how urban areas in West Africa really are.

Identification of agglomerations

In order to identify agglomerations of more than 5,000 inhabitants in 2000, we used two specific methods:

- Using census data, we estimated the population of local administrative units at a specific date (July 1, 1950, 1960, 1970, 1980, 1990, 2000, 2010, and 2020). We then selected all those with a population of more than 5,000 in 2000.
- Using satellite images, we identified all those agglomerations whose urban spread was greater than 500 meters on the ground.

The use of these two methods in parallel reduces the risk of omission.

Satellite imagery is also useful for eliminating areas that have a large population, but in fact are merely administrative units made up of a mixture of large villages and scattered housing. It also allowed us to identify several agglomerations which, unlike the previous examples, are made up of several local administrative units, each of which is smaller than 5,000 inhabitants.

Meanwhile, identifying agglomerations using statistical sources reduces the risk of overlooking certain agglomerations, which can occur if satellite imagery alone is used.

Results of the research

More than 2,600 agglomerations were identified using satellite images. These were then cross-referenced with the demographic data, which showed that only 1,526 of these agglomerations had, have, or will have a population in excess of 10,000 between 1950 and 2020.

The demographic data also allowed us to identify a list of nearly 2,800 local administrative units of more than 5,000 inhabitants in 2000 from our database of around 160,000.

This twin approach meant that we were able to show that some of these administrative units did not correspond to any agglomeration on the ground but rather to scattered housing or a group of villages. Conversely, we also discovered that some agglomerations consisted of a combination of local administrative units. Some of these units were very small villages with a few hundred inhabitants, whose buildings had effectively been swallowed up by far larger urban centers.

In the case of combinations of local administrative units, it is the unit that has traditionally had the biggest population that gives its name to the agglomeration as a whole.

4. COMPARISON OF RESULTS WITH VARIOUS REFERENCE WORKS

The evaluation of urban morphologies: comparison of results with the Global Rural-Urban Mapping Project (GRUMP) of Columbia University

There are still very few systematic methods for the remote detection and assessment of urban areas, and those that do exist are very much still at the experimental stage. None of them has as yet been able to establish a definitive database of information about inhabited areas. Methods that involve the merging of geographical information provided by satellite imagery with census data are also still in the experimental stage. As a result, there is no standard corpus from these methods.

The most advanced program in terms of standardization across the globe is said to be the GRUMP (Global Rural-Urban Mapping Project) of Columbia University's Center for International Earth Science Information Network (CIESIN), in association with Leeds University, the International Food Policy Research Institute (IFPRI), the World Bank, and the Centro Internacional de Agricultura Tropical (CIAT). (2004; Global Urban-Rural Mapping Project (GRUMP), Alpha Version, http://sedac.ciesin.columbia.edu/gpw/aboutus.jps)

The GRUMP program grew out of the Gridded Population of the World (GPW) v3 program of the Socioeconomic Data and Applications Center (SEDAC) at Columbia University, which was supported by the Inter-American Development Bank and the National Aeronautic and Space Administration (NASA).

Critique of GRUMP

The GRUMP system works by placing urban populations into polygons that are automatically detected on satellite imagery provided by Landsat. The population data are available in a dedicated database containing the geographic coordinates of each administrative unit, its name, and its population in 2000 and 1990. The aim is to automatically generate maps of population density that distinguish between rural and urban populations, and to place them within the fine matrix that covers the entire country. By including additional data on principal highway transportation links, the system is able to produce relatively coherent maps showing the changing population dynamics of agglomerations on a global scale. However, the system is based on a definition of urban spread that is weak and largely incorrect.

For example, the resulting database is extremely inconsistent when it comes to issues such as the territorial scope of the urban area (often greatly exaggerated but sometimes also severely under-estimated, depending on the surroundings and the type of image used). Furthermore, the units classified as "Urban Extends" do not always correspond to a population center or even to facilities such as airports, factories, or ports. Instead, they sometimes refer to forests, irrigated areas, or even lakes. The "urban" population data contained in the database, meanwhile, merely consist of raw census data that do not correspond specifically to agglomerations and that are not collected on the basis of a common definition of "urban," even though this definition is known to vary from country to country.

Nonetheless, this database is used as a reference in many international publications, which not only use the maps it generates as illustrations but also as a means of measuring urban spread, designing growth models, and even assessing risks and modalities for development aid.

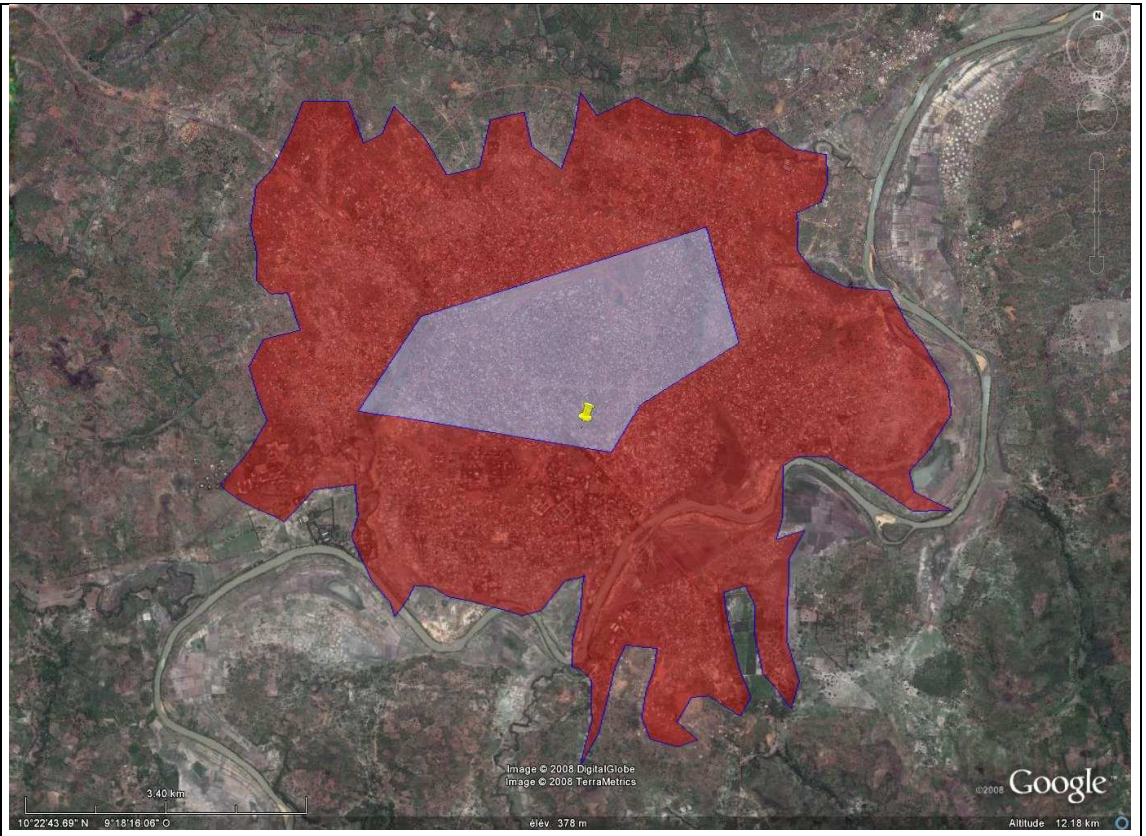
The combined GPW v3 and GRUMP databases are also the sources for the African Population Database developed for the United Nations Environment program (UNEP) by Columbia University and Leeds University (http://na.unep.net/globalpop/africa/Africa_index.html). It is also used by the UN for assessing the risks facing coastal populations, including tsunamis and global warming, and for assessing a variety of other environmental risks.

Examples of incorrect estimations of urban areas by GRUMP

GRUMP estimates that there are 780 inhabited areas of more than 5,000 people in West Africa. By contrast, *Africapolis* estimates that there are 2,558 inhabited areas of between four hectares and 1,030 km^2, of which 1,915 had a population of more than 5,000 in 2000 – in other words, 2.4 times the GRUMP figure. In addition, the units identified by *Africapolis* are named and accompanied by population figures for several dates. If data from *Africapolis* and the Urban Extends data from GRUMP are superimposed onto images from *GoogleEarth*, it is also clear that there are significant differences between the two in many cases. Some of these differences are highlighted in the following examples. (It should be remembered that the *GoogleEarth* images can be verified online free of charge.)

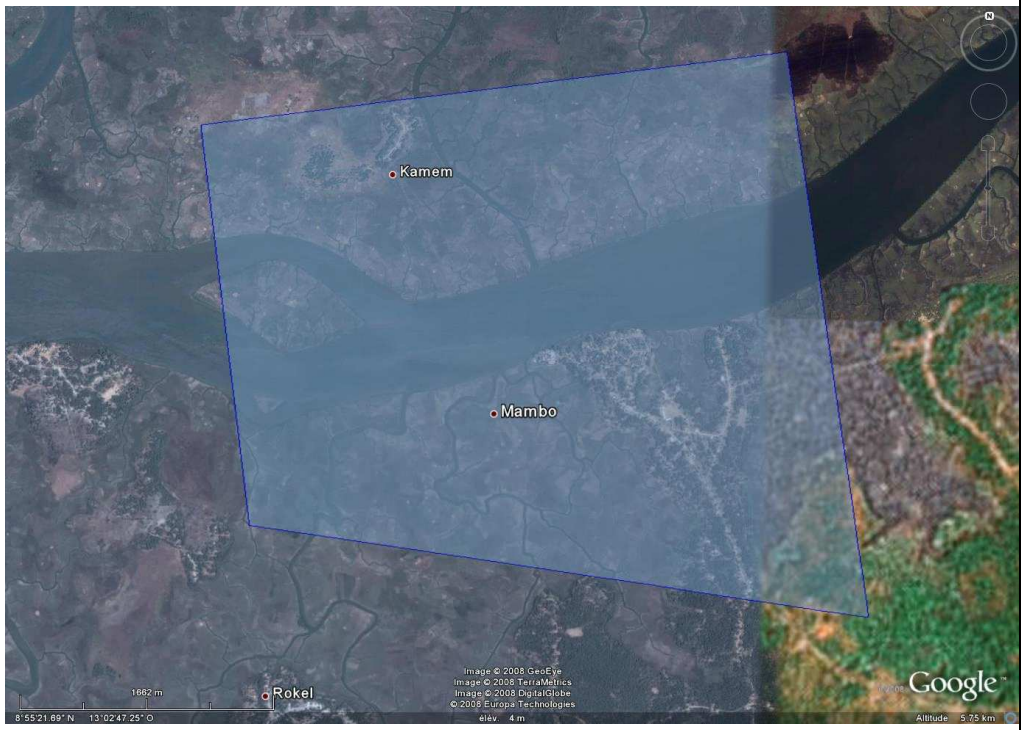
An example of clear under-estimation

Kankan, Guinea, 108,700 inhabitants in 2000.
The red area is urban sprawl as identified by *Africapolis.*
The blue area is the Urban Extends data from GRUMP.



A false agglomeration

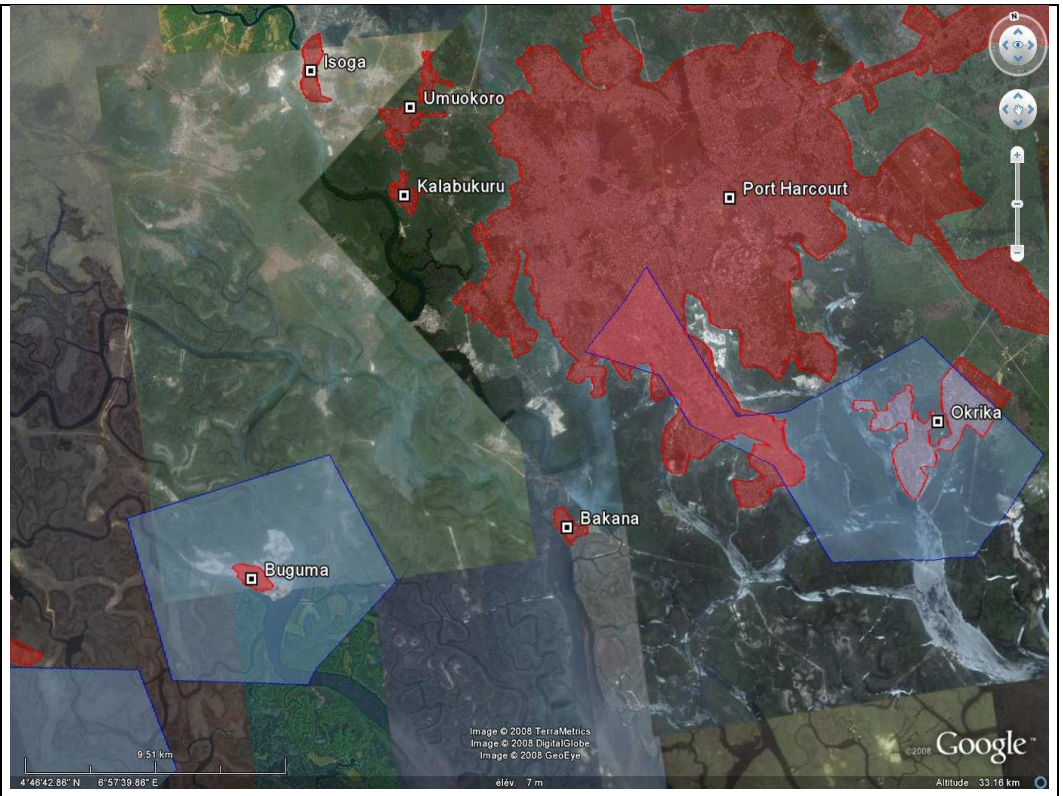
Identified by GRUMP in a marshy and virtually uninhabited area in the north of Sierra Leone.



Under-estimation, over-estimation, and incorrect location

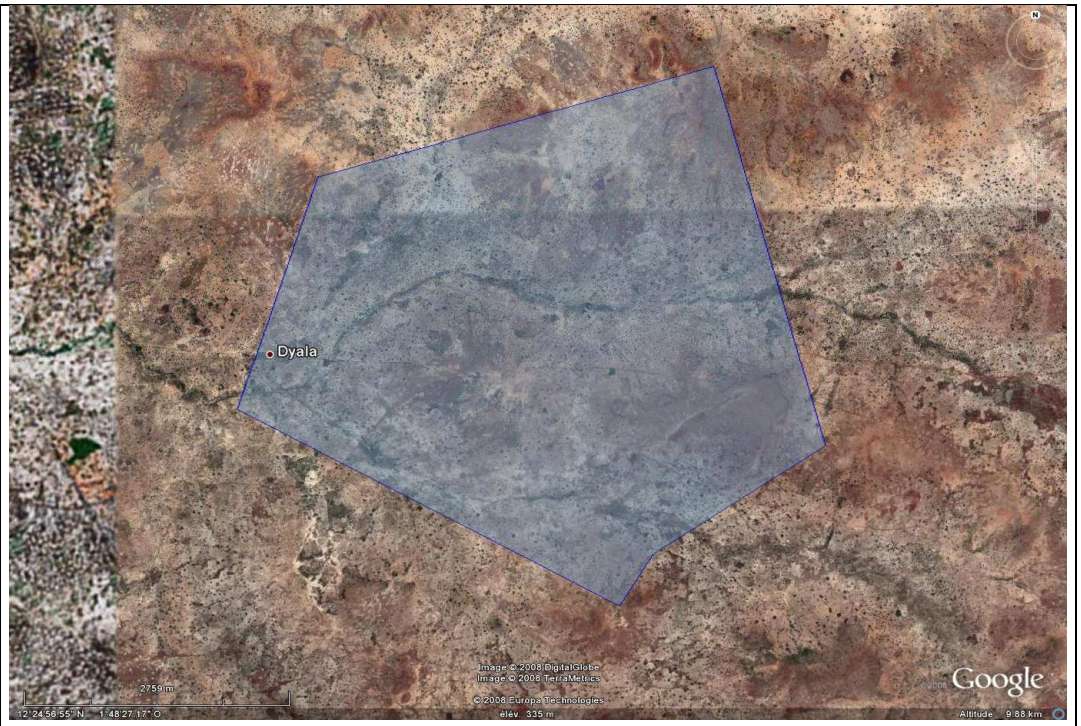
The agglomeration of Port-Harcourt (in red according to *Africapolis*). According to GRUMP, it is situated much further south (in blue, to the right of the image), and its size is clearly under-estimated.

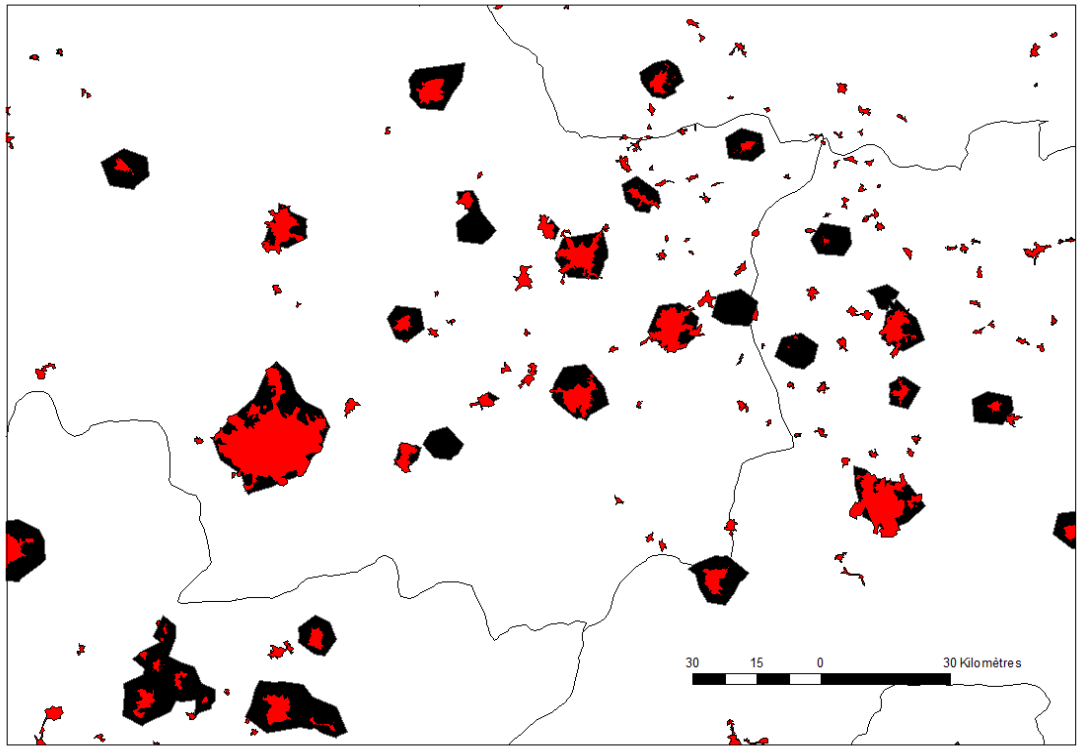
On the other hand, the area covered by the neighboring agglomeration of Buguma (to the left) is estimated by GRUMP to be 50 times larger than its actual size. Buguma is located in uninhabited marshland and its boundaries are very clear as a result.



Another false agglomeration

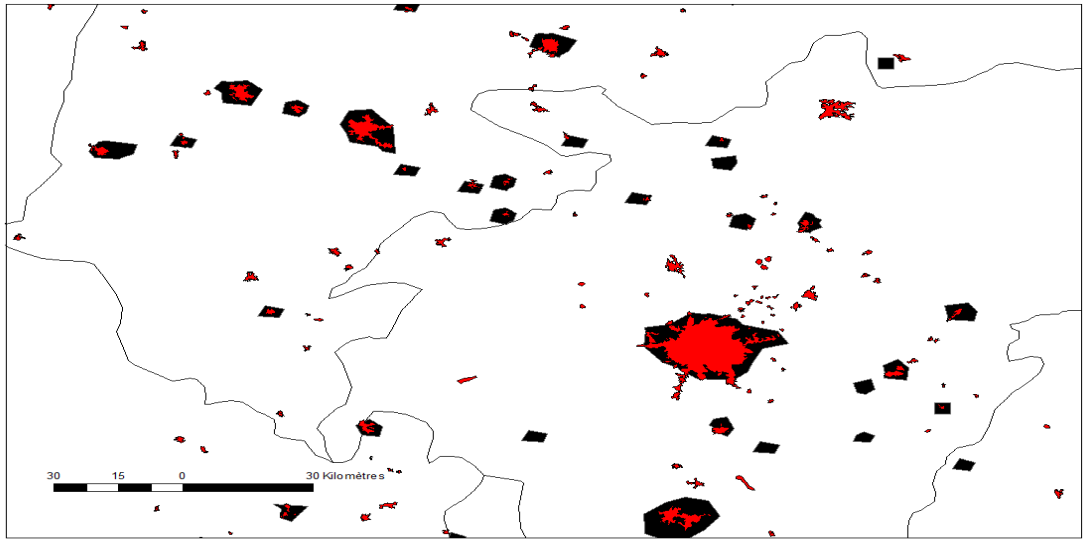
This time, to the west of Ouagadougou in Burkina Faso. There are many such false agglomerations identified by the GRUMP program in West Africa.





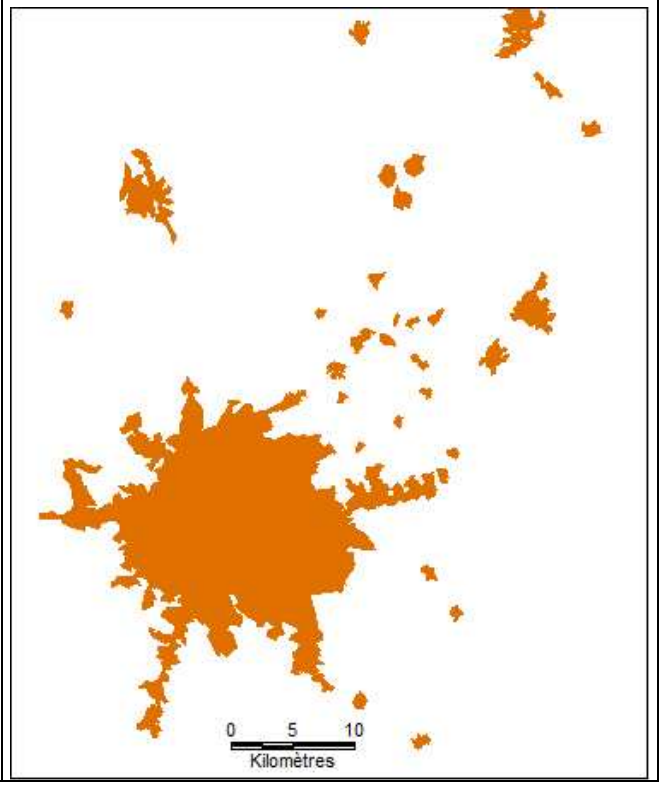
Incorrect identification of urban spread

In red, morphological units identified by *Africapolis*.
In black, those identified by GRUMP for the Oyo, Ondo, and Ekiti regions, to the northeast of Ibadan (Nigeria).



The same problem, this time around Kumasi in Ghana. The urban spread identified by GRUMP is both too regular and too large.

Opposite, a close up of the agglomeration of Kumasi according to *Africapolis*.



Size of cities and level of urbanization: comparison with UN data

Cities of more than 750,000 inhabitants in 2007

according to the UN

Cities of more than 750,000 inhabitants in 2007

(Number of inhabitants in thousands)

		1950	1960	1970	1980	1990	2000	2010	2020
Lagos	NGA	305	762	1 414	2 572	4 764	**7 233**	10 572	14 134
Abidjan	CIV	65	192	548	1 384	2 102	**3 032**	4 175	5 432
Kano	NGA	115	229	542	1 350	2 095	**2 658**	3 393	4 487
Ibadan	NGA	422	570	809	1 186	1 739	**2 236**	2 835	3 752
Dakar	SEN	211	359	610	957	1 405	**2 029**	2 856	3 726
Accra	GJA	177	393	631	863	1 197	**1 674**	2 332	3 041
Kaduna	NGA	33	99	266	628	961	**1 220**	1 560	2 083
Conakry	GIN	31	112	388	658	895	**1 219**	1 645	2 393
Kumasi	GHA	99	221	349	452	696	**1 187**	1 826	2 393
Bamako	MLI	89	130	222	489	746	**1 110**	1 708	2 633
Lomé	TGO	33	95	192	344	619	**1 023**	1 669	2 410
Benin City	NGA	46	83	163	335	689	**975**	1 302	1 755
Port Harcourt	NGA	56	135	266	482	680	**863**	1 104	1 479
Monrovia	LBR	15	75	164	325	1042	**836**	1 185	1 753
Abuja	NGA	18	23	48	125	330	**832**	1 994	2 971
Ouagadougou	BFA	33	59	111	257	537	**828**	1 324	2 111
Ogbomosho	NGA	124	247	378	485	622	**798**	1 031	1 386
Maiduguri	NGA	47	105	216	416	598	**758**	969	1 301
Zaria	NGA	47	117	241	423	592	**752**	963	1 293
Freetown	SLE	92	119	206	361	529	**688**	894	1 200
Niamey	NER	24	58	129	274	432	**680**	1 027	1 580
Ilorin	NGA	107	179	268	389	515	**653**	835	1 123
Cotonou	BEN	20	73	163	337	504	**642**	841	1 196

Total: 23 agglomerations
Source: UN/ESA - *http//esa.un.org/unup*

according to Africapolis

Cities of more than 750,000 inhabitants in 2007

(Number of inhabitants in thousands)

		1950	1960	1970	1980	1990	2000	2010	2020
Lagos	NGA	291	660	1 266	2 779	6 100	**8 053**	10 008	11 959
Abidjan	CIV	89	229	598	1 287	2 182	**3 147**	4 113	5 078
Accra	GHA	162	366	737	1 041	1 504	**2 516**	3 452	4 389
Ibadan	NGA	521	729	998	1 353	1 836	**2 490**	3 144	3 799
Dakar	SEN	253	404	731	1 265	1 768	**2 257**	2 747	3 237
Kano	NGA	92	459	882	1 130	1 448	**1 855**	2 262	2 670
Kumasi	GHA	93	185	372	483	745	**1 291**	1 838	2 385
Conakry	GIN	39	98	360	669	923	**1 249**	1 576	1 903
Bamako	MLI	57	99	231	479	755	**1 154**	1 551	1 948
Lomé	TGO	39	80	228	416	652	**1 030**	1 408	1 786
Kaduna	NGA	28	149	322	475	699	**1 030**	1 361	1 691
Cotonou	BEN	21	85	162	395	615	**911**	1 260	1 608
Ouagadougou	BFA	35	60	126	274	563	**906**	1 377	1 847
Port Harcourt	NGA	78	145	238	369	571	**884**	1 197	1 510
Benin City	NGA	49	78	137	251	461	**848**	1 235	1 622
Monrovia	LBR	23	65	150	315	529	**774**	1 261	1 586
Jos	NGA	102	193	293	404	557	**767**	977	1 187
Freetown	SLE	73	113	209	369	541	**717**	893	1 069
Ilorin	NGA	32	116	222	320	462	**666**	870	1 075
Niamey	NER	14	33	101	260	426	**647**	868	1 089

Total: 20 agglomerations, based on the *Geopolis* definition
Source: *Africapolis*

In general, the UN/ESA results are fairly close to those from *Africapolis*. However, this apparent similarity hides a number of significant differences at local scale.

The results are very similar for the population sizes of the two biggest agglomerations, Lagos and Abidjan. However, the UN data significantly over-estimates the size of Kano. The UN also lists four more large cities than does *Africapolis*: Abuja, Maiduguri, Zaria, and Ogbomosho.

The inclusion of Abuja can be explained by the difference in the definition of the urban boundaries used by the two sources. Abuja is clearly a city (in the political sense), but the huge area covered by this administrative constituency (7,315 km^2, or the size of an average French *département*) is in fact made up of several agglomerations and 260 villages. The city of Abuja is not an agglomeration in its own right, and even when its population reaches the three million mark in 2020, population density will still be little more than 400 inhabitants per km^2, far lower than for any truly urban population.

The under-estimation of the size of Accra by the UN is due to the same problem: only the ”city” of Accra is taken into account, not the 35 municipalities that form part of the agglomeration.

The inclusion of Ogbomosho in the UN list is due to a different reason. The city covers 28.5 km^2, which means that its population density in 2007 would be 33,400 inhabitants per km^2 according to the UN data. However, this is not representative of the situation on the ground. Even in the city center (pictured opposite), most of the buildings are low-rise, and there are many empty spaces as well as derelict buildings. This over-estimation cannot therefore result from the inclusion of people living within the administrative boundaries of the ”city,” - as with the case of Abuja - where the buildings are closely packed and the limits of the agglomeration are clearly defined by forests and intensive farming on the outskirts. For Maiduguri and Zaria, the population size given by the UN is even less credible.

For these three Nigerian cities, the errors can be explained by the fact that the UN is using unverified census data that are clearly exaggerated.

The population of West Africa

Urban population according to the UN (in thousands)

	West Africa		Benin		Burkina		Côte d'Ivoire		Ghana		Guinea		Guinea Bissau		Liberia		Mali		Mauritania		Niger		Nigeria		Senegal		Sierra Leone		Togo	
	pop	**urb**	**pop**	**urb**	**pop**	**urb**	**pop**	**urb**	**pop**	**urb**	**pop**	**urb**	**pop**	**urb**	**pop**	**urb**	**pop**	**urb**	**pop**	**urb**	**pop**	**urb**	**pop**	**urb**	**pop**	**urb**	**pop**	**urb**	**pop**	**urb**
1950	6 319	99	153	250		810	176	51	107	282	21	107	3 468	438	246	58														
1960	12 224	215	214	629		1 657	327	75	196	444	61	177	6 845	754	392	159														
1970	21 963	472	313	1 495		2 625	610	88	361	697	168	371	12 208	1 321	631	455														
1980	36 735	1 014	601	3 081		3 550	1 080	140	657	1 122	411	778	20 311	2 100	942	687														
1990	59 941	1 786	1 226	5 079		5 677	1 691	286	967	1 789	772	1 202	33 325	3 075	1 346	1 192														
2000	**93 004**	**2 770**	**1 971**	**7 423**		**8 856**	**2 547**	**407**	**1 666**	**2 787**	**1 026**	**1 801**	**53 048**	**4 200**	**1 605**	**1 974**														
2010	137 194	4 151	3 286	10 217		12 811	3 546	556	2 652	4 503	1 393	2 633	78 845	5 710	2 375	3 094														
2020	193 415	6 081	5 424	13 771		17 336	5 373	825	3 972	7 207	1 887	4 208	109 772	7 743	3 318	4 534														

Urban population according to Africapolis (in thousands)

	West Africa	Benin	Burkina	Côte d'Ivoire	Cape Verde	Ghana	Guinea	Gambia	Guinea Bissau	Liberia	Mali	Mauritania	Niger	Nigeria	Senegal	Sierra Leone	Togo
1950	4 661	89	82	142	10	470	97	26	46	23	107	0	40	3 032	358	91	49
1960	10 067	203	143	397	32	1 171	156	26	50	65	187	0	84	6610	655	158	130
1970	19 287	421	316	1 232	50	2 154	585	64	119	190	479	76	216	11 378	1 198	342	461
1980	32 081	1 120	705	2 762	75	2 993	1 068	159	129	484	977	306	519	17 235	2 176	630	748
1990	51 056	1 788	1 453	4 723	109	4 457	1 627	328	211	763	1 484	701	1 077	27 026	3 199	903	1 202
2000	**74 647**	**2 757**	**2 403**	**6 980**	**171**	**7 201**	**2 274**	**546**	**330**	**1 041**	**2 145**	**836**	**1 667**	**38 769**	**4 294**	**1 231**	**1 921**
2010	97 746	4 025	3 635	9 495	257	9 966	2 859	740	558	1 639	2 900	998	2 267	50 241	5 427	1 549	2 753
2020	124 830	5 217	4 801	12 064	343	12 997	3 465	969	760	2 016	3 713	1 166	2 827	61 823	6 568	1 912	3 568

In order to compare these two sets of data, it is important to look at how the projections have been calculated. The UN figures are based on official statistical definitions of urban areas used by each individual country. As pointed out earlier, these vary greatly. In contrast, the figures from *Africapolis* are directly comparable because they are all calculated from the same definition of "urban." This can sometimes lead to figures that are substantially different from official figures.

Projected growth figures are also based on hypotheses that vary according to who is compiling the figures. Differences between the figures, therefore, especially when added to those already created by the vagaries of the definition of ”urban,” can often be considerable. For the purpose of this comparison, therefore, it is appropriate to focus on ”verified” data – that is, up to the year 2000.

The population figures for Nigeria given by the UN are higher than those of *Africapolis* (+40% in 2000). This is all the more surprising given that the UN’s minimum definition of ”urban” is 20,000 inhabitants whereas the *Africapolis* threshold is 10,000. Thus the *Africapolis* database would normally be expected to generate higher figures than the UN database. There are two reasons for this difference. First, it is clear that the census data from Nigeria are over-estimated (see Part 2 and the Country Sheet in Annex 1). Second, the UN also tends to over-estimate the size of the largest cities – except that of Lagos. Since cities by definition have large populations, the combination of the two distortions leads to a very large over-estimate of the urban population.

The UN also gives population figures that are higher than those given by *Africapolis* for Liberia (+60%) as well as Sierra Leone and Guinea Bissau (+33% each), three countries that have seen bloody civil wars that the UN data appear not to have taken into consideration. The urban populations of Niger, Mali, Ghana, and Mauritania are less severely over-estimated (+20%) by the UN as these countries have broader definitions of ”urban”. The populations of Côte d’Ivoire and Guinea are also over-estimated (+10% and +15%, respectively), for the same reason.

In contrast, the *Africapolis* estimates of urban populations are higher than those of the UN for Burkina Faso (+20%) and Benin (+10%). Only Togo and Senegal show comparable population figures.

In short, the UN figures tend to over-estimate both the size of the ‘large cities’ and the ‘urban population’.

West Africa: comparison with the WALTPS' results

The West Africa Long-Term Perspective Study (WALTPS[6]) was published in 1998 along with a set of working papers relating to work carried out during the 1990s. Its geographical coverage is a little broader than that of this study, covering also Cameroon, Chad, and the Central African Republic.

Following on from work carried out in the early 1990s on regional integration in Africa, this prospective study set out to analyze trends in land organization as well as the economic performance of African nations between 1960 and 1990 by looking primarily at population dynamics – and in particular at the high level of mobility within the sub-region.

This study was the first to show demographic growth and urbanization at a trans-national level (covering 19 countries) and to create a population database in a standard format covering the entire region during the period 1960-1990, using:

- Data from within each country (regions, departments, counties, etc.) standardized across the entire period;
- A database of cities and towns using a standard threshold of 5,000 inhabitants.

Data used by WALTPS

It is unfortunate that the various documents produced by WALTPS (including the annexed methodology) only give a limited idea of the level of analysis of the data. While it is clearly explained that the research was carried out at the lowest possible administrative level and that 1,935 pieces of data were gathered from national censuses, the full data set has not been published.

Moreover, the study does not explain in the extent to which the data were standardized with regard to spatial units nor how agglomerations of more than 5,000 inhabitants were defined, even though this threshold is used as the definition of "urban."[7]

As for the study of urban spaces, the cartographic approach (such as the *Geopolis* method), new information tools such as *GoogleEarth*, and the development of state-of-the-art GIS technologies that allow to combine both the morphological and demographic approaches have given researchers at the dawn of the 21st century a far broader range of options.

Using demographic data only – as opposed to a method based on the cross-referencing of demographic and geo-referenced data – has meant that the WALTPS analysts were not able to base their study on the core concept of a clearly defined morphological agglomeration.

The extent of this problem is particularly acute in the case of Nigeria, which accounts for half of the region's population and 60% of its urban population. The WALTPS study had no data for Nigeria: data from the 1963 census were 35 years old, and the *Gazetteer* for 1991 was never published, apart from a list of cities and towns of more than 30,000 inhabitants, which was published in 1995, but in incomplete form and based on population figures that bore little or no relation to reality.

[6] Club du Sahel/OECD, 1998. Preparing for the Future – A Vision of West Africa in the Year 2020: West Africa Long-Term Perspective Study (WALTPS). Club du Sahel, OECD, Paris (France), 157 pp.

[7] Kalasa B. (1993). Settlement Patterns in West Africa: Commentary on the Database. Working Paper No.1 SAH/D (93) 415, 124 pp.

WALTPS results

The results of the WALTPS study are not directly comparable to those in this report because they cover a different set of countries. Nonetheless, the two studies share many of their conclusions regarding major trends toward urbanization in West Africa. Both note a steady rise in the proportion of the population living in urban agglomerations, the creation of a high density urban belt along the coast of the Gulf of Guinea by 2020, the current development of urban networks, and the recent trend toward secondary cities and smaller urban centers.

However, the *Geopolis* method offers further opportunities to explore the mechanism of urbanization as well as to formalize and/or identify the various types of population patterns in West Africa. For example, the typology based on four major eco-demographical zones considered homogenous from the point of view of population dynamics, which the WALTPS researchers created in answer to the question: "Where will the population of West Africa live in 2020?", ignores key types of population patterns and urbanization such as the 'axialization effect' –the concentration of settlements along north-south major roads - or the diversity of population development within specific zones, which the *Africapolis* database highlights through rank-size analyses.

The insufficient level of precision offered by the cartographic analysis meant that the WALTPS researchers were not in a position to appreciate and describe the variety and diversity of population development in West Africa. Similarly, because they tended to ignore resources such as lists of villages, gazetteers, and other *village directories*, the WALTPS team had no way of predicting one of the most significant developments in the region over the period covered by the study, namely, the proliferation of small agglomerations.

Finally, the use of satellite imagery has allowed us to highlight the specific role of different forms of population, and in particular the varied possibilities for future development created by oppositions such as high and low population areas or high density rural areas.

CONCLUSION: SCOPE AND LIMITATIONS OF THE *AFRICAPOLIS* DATABASE

The obvious discrepancies between previous studies and *Africapolis* should be seen in the context of the specific objectives of each of these studies. *Africapolis* is part of a global project that aims to make data and reference indicators on the growth of urban agglomerations available to the public. The project will be as long-term as possible and will aim to provide observations on the cycles and trends relating to global settlement patterns. In contrast with the data provided by the UN and the majority of other international organizations, the approach preferred by *Africapolis* starts at the bottom (local) level and finishes at the top (global) level. This process has a number of consequences with regard to the scope and limitations in use of the project.

WALTPS vs Africapolis: Two different generations

Of the three large reference works to be compared with *Africapolis*, WALTPS is the best in terms of the reliability of the results. However, a generational gap separates these two programs. Even though the two studies were only carried out ten years apart, there was a significant technological revolution during those ten years.

The general dissemination of freely accessible satellite images, technological progress with regard to the interfacing of geographical information systems (GIS), and the increased speed and capacity of computers to process and recognize patterns all ushered in a new generation of research, whose cutting-edge quality is well illustrated by *Africapolis*.

GRUMPS and UN/ESA:

Disadvantages of global models

The disadvantage of the large databases that are available to the public, such as GRUMPS (morphology) and UN/ESA (demographic statistics), is that they provide only approximate information.

The apparent reliability of their global results is based on a statistical attribute, or the “law of large numbers.” The larger the group of countries being studied, the greater the number of cities, the higher the urban population, and the more likely that the natural law of probabilities will play the game of “chance.” In the case of a region such as West Africa, overestimation errors will be compensated by underestimations or omissions so that at the global level, the order of magnitude will be maintained.

Consequently, on such a scale, the statisticians are able to adjust the key elements of the model and provide, with a small margin of error, a theoretical and abstract forecast of future urbanization in Africa.

When the error is true ….

This facetious remark serves to underline the real and operational consequences of the problems associated with the validity scale of the forecast models. The global approach of the models is, without doubt, relevant to fundamental research and scientific debate in an epistemological, heuristic, and theoretical sense, but for the development stakeholders, the situation is very different.

The stochastic trap

Using global theoretical models makes it possible to estimate the urbanization rate in West Africa in 2020 with a small margin of error. However, while this forecast may be accurate on a global scale, there may be significant errors that cancel each other out and are therefore invisible at the global level.

For example, overestimating the population in a handful of major cities in Nigeria would make up for omitting hundreds of small towns. On a global scale the population and the urbanization rate will remain unchanged, but overestimating the population of a major conurbation by 2 million people is the same as omitting 200 towns with a population of 10,000 each.

While, from the general perspective of these statistical models, the error may appears ‘true’, it, nevertheless, give a false view of reality. So what are the consequences of these errors from the point of view of the African stakeholders and populations concerned?

Validating the global model and a specific example

Firstly, we have to recognize that the development of an urban area of more than 2 million people presents completely different problems on a global scale than those presented by the development of 200 towns with a population of 10,000 each. These problems are diverse in nature and relate to governance, society, economy, transport, access to facilities, education, and health.

Having opened up a Pandora’s Box with regard to the limitations of global statistics, we should also consider the issue of physical location. In the previous example, the 200 agglomerations that were hidden as a result of the statistical approach may not necessarily be located on the outskirts of the major city for which the population has been overestimated.

For example, overestimations of the populations of Ogbomosho and Kano are ‘statistically’ canceled out over an area of several million square kilometers by small towns that could well be located in Mauritania’s or Mali’s Sahel, along the coast of Liberia, in the forested region of Guinea, or in the Volta valley. These may be towns that are scattered over millions of square kilometers and do not necessarily trade with each other or even belong to the same country, and thus may not share the same political constraints or the same natural or social environments. How do such results help local and international stakeholders with regard to their diverse operations in the political, technical, epidemiological, economic, and financial domains?

Finally how do global results answer the needs of the African populations concerned? Predicting that the urban population of Côte d’Ivoire will increase by a certain percentage is one thing, but knowing which towns or which types of as yet rural areas may be affected is quite another.

Despite the intellectual satisfaction derived from providing results accurate from the perspective of a modeling system, the sponsors of the study should bear in mind the objectives they assigned to the project. This classic problem has for some time led researchers to discuss the operational consequences of models that may be relevant at one level but may be completely inappropriate at other levels.

Conversely, there is no certainty that a model based on a specific zone such as the Sahel, the Gulf of Guinea plains, or a single country such as Liberia or Niger will provide successful results when extrapolated for the whole of West Africa.

The operational definition of "local"

The data is essentially made up of the morphologies of land use patterns (continuum of built-up areas) and also based on surveys (population censuses in particular):

- The "Local" level is documented at a very high resolution, as land use morphologies are identified almost down to individual houses;
- Similarly, results from population censuses that are too general or are broken down into large administrative areas cannot be used. The research material is based on the finest breakdown of the local units available, without, however, going down to the level of the individual (data protection based on privacy protection provisions) or census mapping for enumeration areas for which the archives have largely disappeared and which cannot be used to compare one census with another due to inconsistencies in their areas of application. Population settlements in West Africa can thus be recreated based on the mapping of 160,000 local units.

This breakdown remains inadequate from the point of view of the morphologies' homogeneity. This is due to the fact that, as shown in previous chapters, many local units in the population censuses associate the surrounding hamlets and isolated dwellings to a main rural agglomeration. The list of 24,500 local units seemed a relatively large group of entities for the 660,000 enumeration areas in Nigeria (2006 Population Census). However, relative to the total area of the country (910,000 km^2), these local units are comparable to the number of municipalities in France (36,600 over 550,000 km^2).

Like INSEE (the French National Statistical Institute), which calculates the population of "urban units" based on entire municipalities, the *Geopolis* method also introduces errors with regard to the total population that actually lives in the agglomeration (see supra-methodology) when the population is not perfectly grouped. However, if there is a comparable pattern with regard to the local units, then the error will be applied to the same extent everywhere.

The advantage of this method is that it links social discretization with discretization related to the geographical morphology. In Africa, as in most parts of the world, the village, municipality, or town is still the fundamental reference unit for the population.

It is also an operational unit led by a chief, a mayor, a committee with a discernible leader, or a group of decision makers. However, this is not the case for enumeration areas because their perimeter is defined based on the short-term requirements of carrying out a population census.

Lastly, for all of these reasons, each land use pattern previously identified as an urban pattern can be linked to an identified and classified place name: the toponym.

Africapolis does not provide purely morphological data but rather a compromise between two clearly distinct types of information sources: **morphological** data and **social** data, which is itself a quantitative demographic compromise (size of the community) and a qualitative political-administrative compromise (consistency and status of the community).

Morphology and toponymy

Linking satellite images with toponyms was a significant component of the *Africapolis* project.

Despite recent progress in remote sensing, a satellite cannot provide information on the names of places. Thus the names given on *GoogleEarth* come from heterogeneous sources that have not always been verified, such as the US Army Gazetteers, which are based on topographic maps at various scales and are sometimes out of date.

In addition, censuses are rarely produced in map form, at least they have not been until the last few years. The most precise information on locations is provided by administrative centers at regional level (province, department, district, or canton).

The example below illustrates the problem of linking morphological data to demographic data.

Entering, understanding and associating the data

The "*Africapolis*" database provides information based on three specific variables: the physical location of urban agglomerations, their land area, and the number of residents estimated at a common date. Some additional information is also given, such as the administrative status of the local units, their rank in the hierarchy of the administrative sub-divisions, and the administrative function of the urban agglomeration (main town). Other indicators can be calculated directly from this information, for example, the population density of the agglomeration, its growth rate, or its rank.

Many other indicators can be obtained by linking this data with other categories of information: altitude, distance from the coast, natural environment, etc. It is, however, important to ensure the quality of the data entered for this purpose. In this study, it was not possible, for example, to link the collected data with reliable information on the road network. Although many vector-based GIS programs are available to the public via the internet, none of the programs we evaluated were of sufficient quality (or at least as good as the *Geopolis* morphology database) to be included in the analysis. However, it is clear that roads play a key role in development.

Moreover, the main database contains no information beyond total population. This means that demographic, socio-economic, and socio-demographic variables (such as age, natural population change, marital status, employment, etc.) that are traditionally used in urbanization studies have not been used here. This information is rarely provided at the local unit level in West Africa, and the categories of variables published on a national level are in any case too dissimilar to those at international level.

Similarly, the database does not include data on migration, although this clearly plays a key role in urban growth.

Conclusion

The initial phase of the *Africapolis* project was aimed at updating the informational tools that are crucial to understand urban conditions in West Africa.

The key priority during this phase was to finalize the database. Though it can clearly be improved upon, it has broken new ground in the field. It is a compromise between the demands of varying levels (scientific quality, usefulness to development, and capacity for comparison with other regions in the world). It also provides a creative response to a combination of issues as well as an innovative approach to urban growth in this part of the continent. Nevertheless, as with previous studies, it cannot provide a solution to all questions relating to urbanization in Africa.

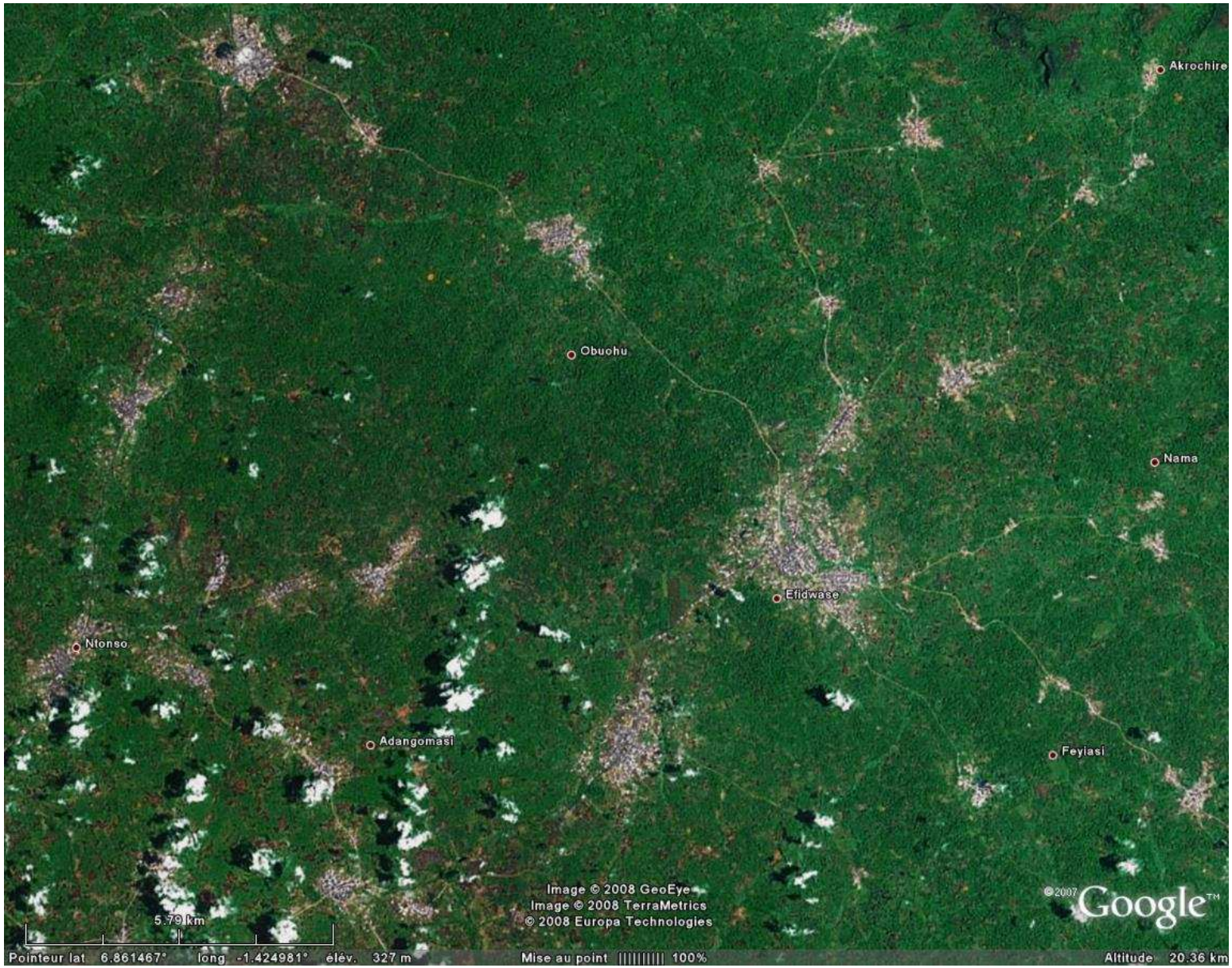
Morphology and toponymy: Ashanti region (Ghana, north-east Kumasi)

The precision involved in mapping land-use patterns contrasts with the failings of toponymy.

In this image taken from *GoogleEarth*, most of the major agglomerations in the area are not identified by name. Some names are not in the correct position or have been placed in rural areas.

Spellings are approximate.

Some toponyms are not recognized in the Gazetteers of Ghana while others have numerous homonyms at the national and even regional level.



Part Two

Analysis of Urbanization Processes

1. SPATIAL PROCESSES OF URBANIZATION

The three prototypical types of urban growth

In West Africa as well as in other parts of the world, recent urban growth has taken three forms:

1. Densification of existing agglomerations;
2. Expansion of existing agglomerations;
3. Development of new agglomerations from: existing village cores (in situ urbanization), newly and specifically created cities and towns (*ex-nihilo* urbanization), and unplanned concentration of groups of inhabitants giving birth to urban centers.

This distinction is crucial to understand the role of rural exodus, which has long been considered to be the main cause of urban growth, both in developed countries during the Industrial Revolution or the post-war boom and in developing countries.

Yet, while the first two urbanization processes listed above (densification and expansion of existing urban areas) are based on the massive migration of populations from outside cities and especially from rural areas (i.e., rural exodus), the third process does not necessarily imply a rural exodus or a migratory flow.

Despite the fact that rural-urban migration remains one of the major historic causes of urban growth, this phenomenon must nowadays be analyzed separately. Indeed, the recent growth of a number of cities appears to be the result of inverted flows caused by an urban exodus, consisting mainly of young couples who are moving out of the family home and are searching for the type of housing that they are unable to find in larger metropolitan areas.

Several factors may help us understand this issue:

- A rural exodus only represents part of the incoming flow of population, which might have originated from other cities but not from rural areas;
- The incoming flow may be counterbalanced by an outflow toward other cities or rural areas, superimposing itself onto the natural growth of the stable local population and creating strong demographic pressure in those areas.

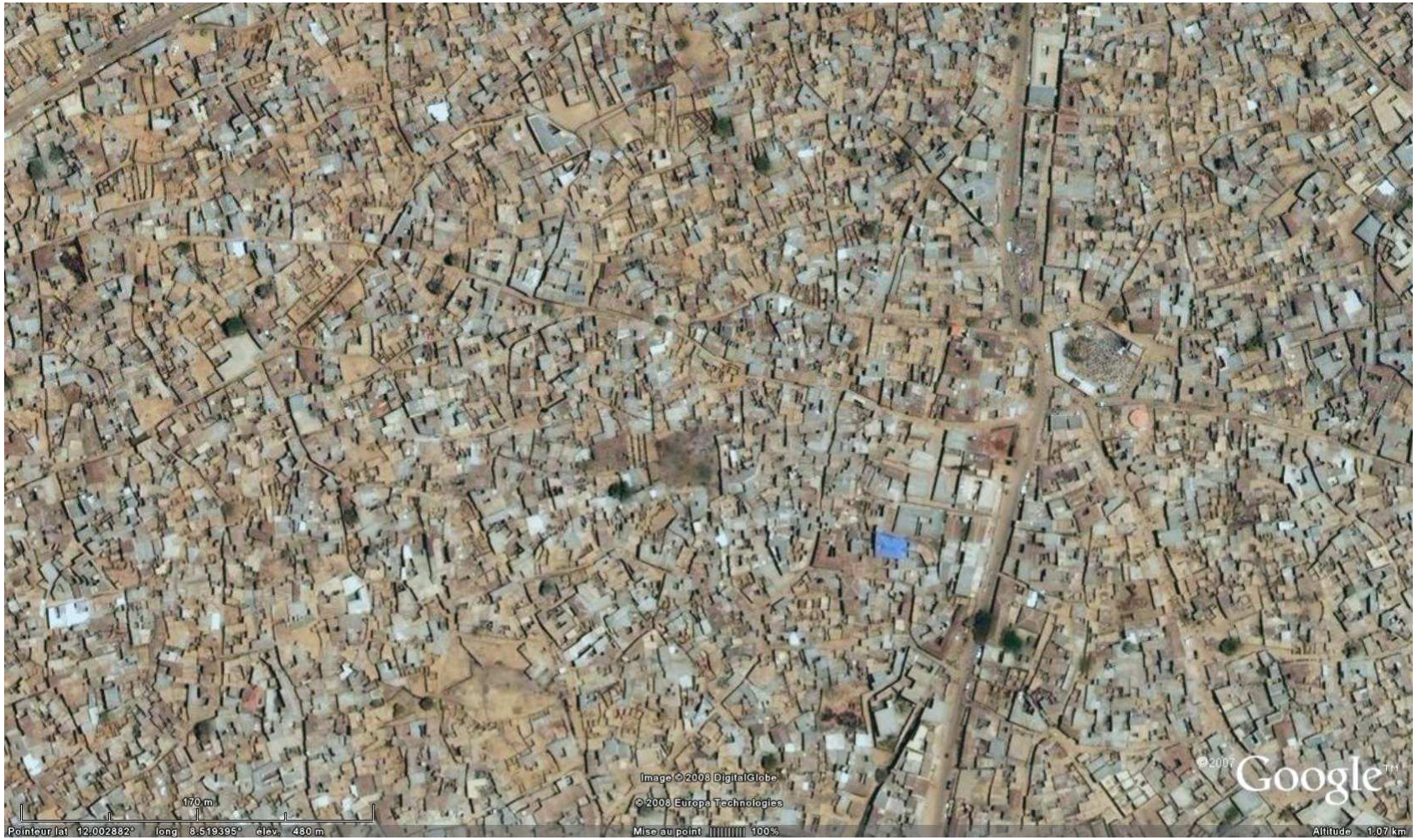
The second situation has seldom been taken into account in studies of African urbanization. One reason is that urban growth is often limited to the study of large cities. Another reason is that this phenomenon tends to place urbanization at the very threshold of the urban-rural dichotomy. Consequently, it is difficult to assess this dichotomy on the basis of national statistics. It is also impossible to study it internationally because of a lack of documentation.

Urban growth may not always result from a rural exodus: indeed, in a context of high birth rates, it is the absence of a rural exodus that may explain urbanization, which in this case translates into a proliferation of small and medium-sized cities and towns.

Densification

Rural-urban migration has contributed to making existing urban fabric increasingly dense, particularly in large urban centers. In Africa, however, densification has more often resulted in space filling rather than high-rise building construction.

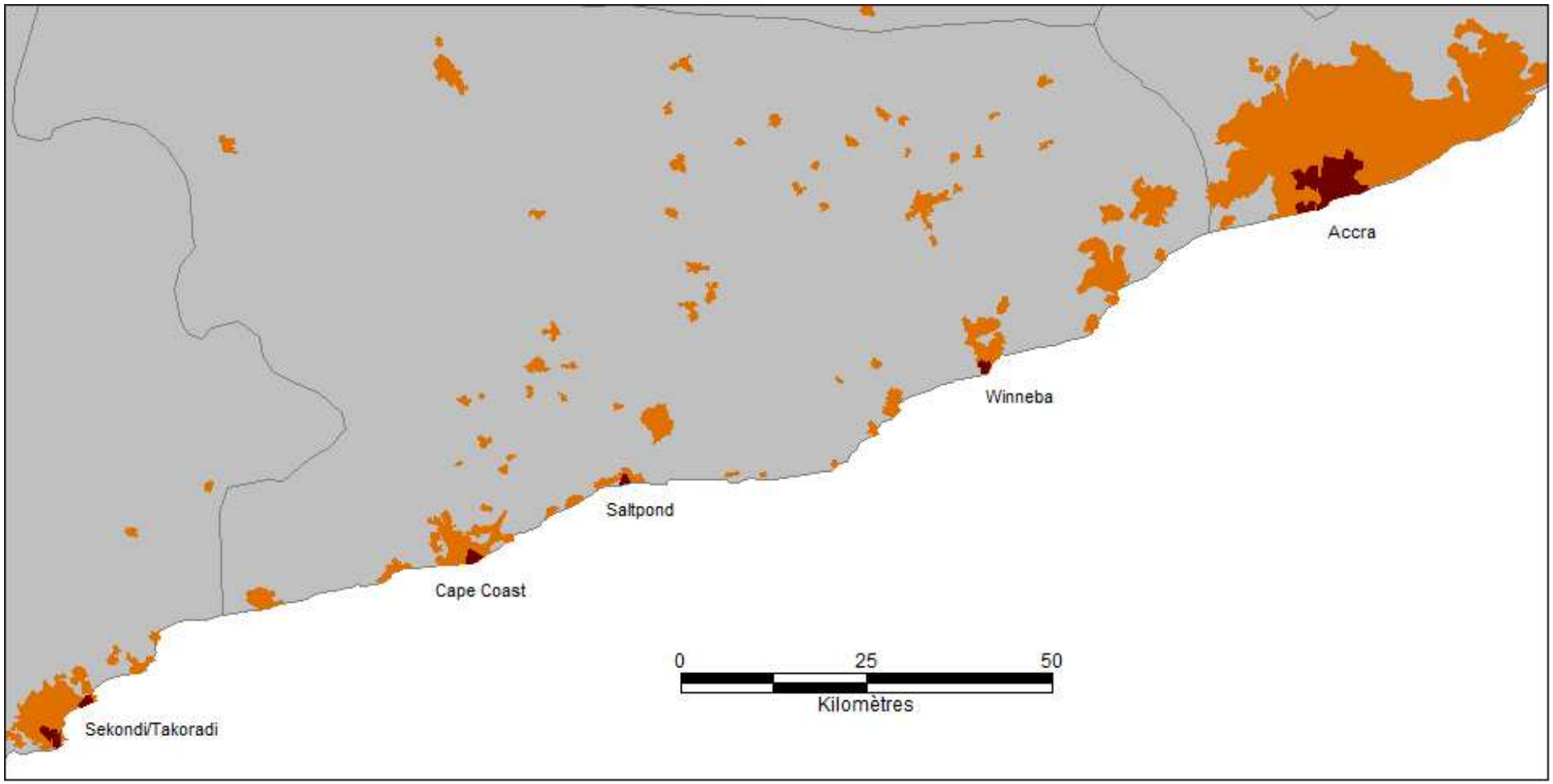
Space filling and densification in built-up areas: Kano city center



Expansion of built-up areas

Urban areas receiving an incoming population and saturated by densification have extended beyond the city limits. While these city fringes are sometimes administratively incorporated into the urban center, some remain independent “cities” or "towns" in terms of their administrative status. For example, the city of Accra extends over 36 different municipalities and Cape Coast over three, while Sekondi and Takoradi currently form a conurbation.

Expansion of built-up areas in 1960 and in 2005: the Accra-Sekondi sector (Ghana)

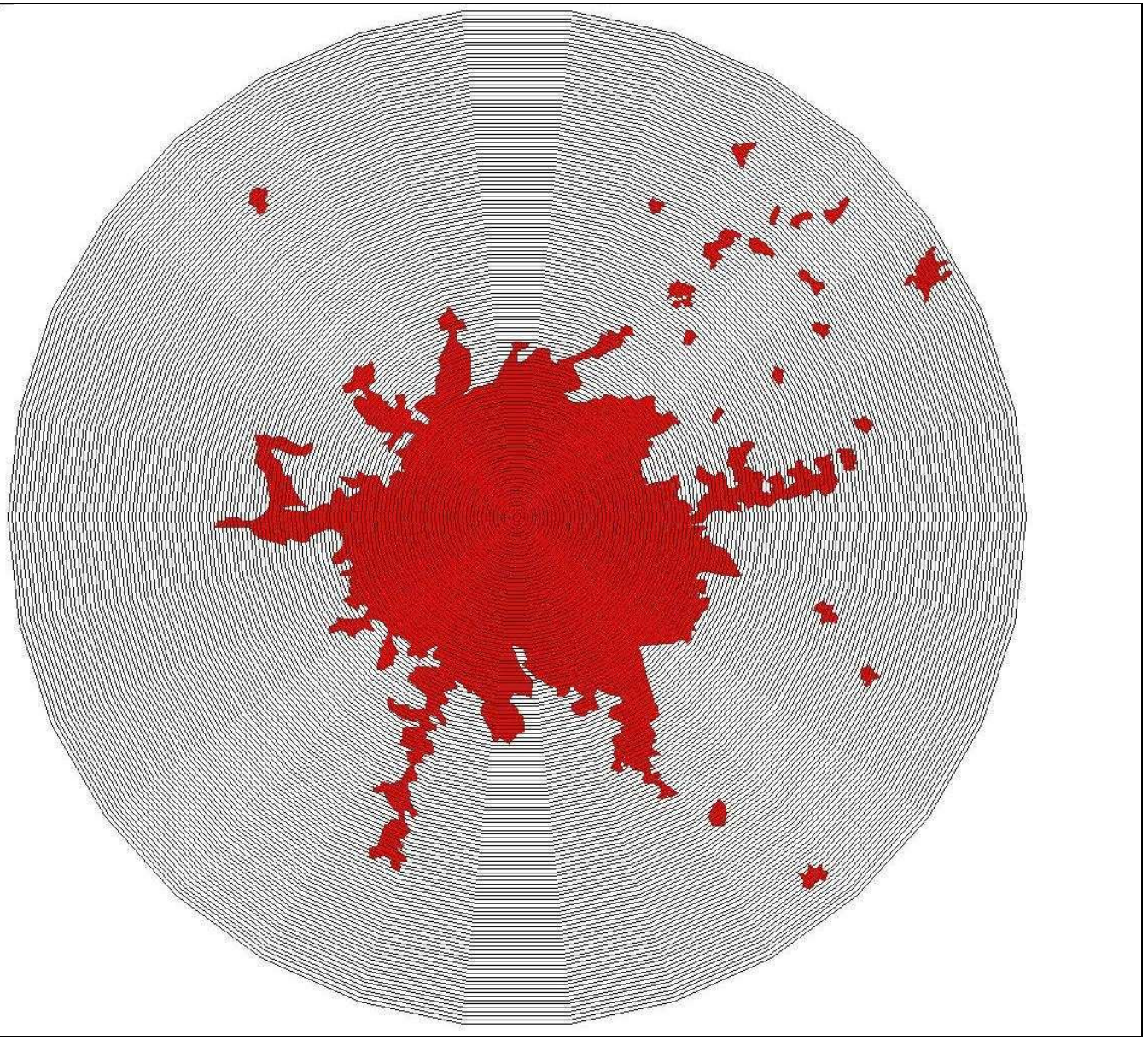


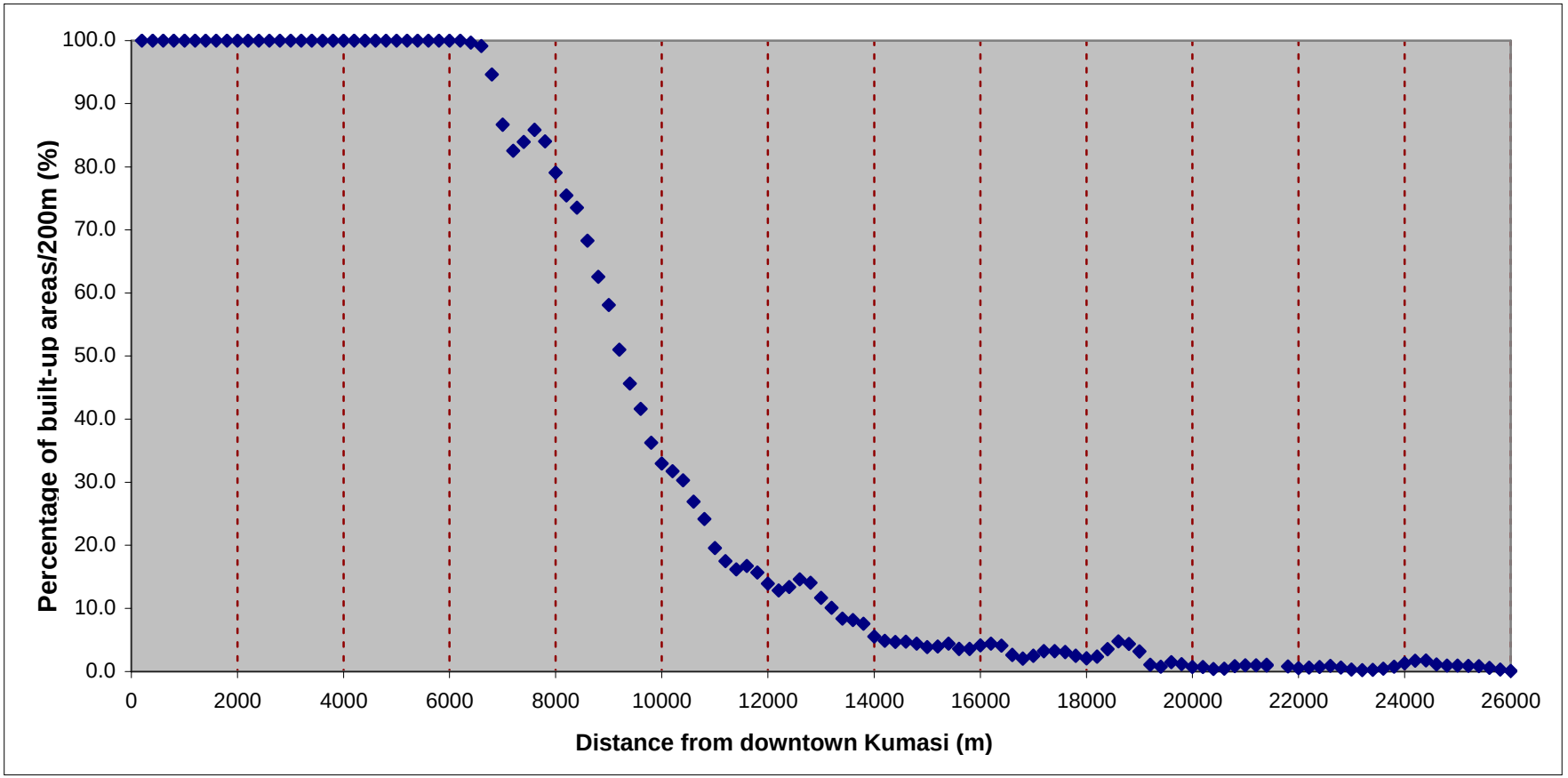
Clark's law and the expansion of built-up areas: the Kumasi case

The case of Kumasi clearly demonstrates the relationship between the density of the Kumasi built-up area and distance from the city center.
The built-up area is divided as follows:

- From 0 km to 6.2 km, density reaches 100% of the land area in each ring;
- From 6.2 km to 14 km, density varies between 99% and 5.5% of the land area in each ring;
- Density is lower than 5% of the land area in each ring if it located further than 14 km from the city center.

This type of structure is typical of most African cities that have undergone urban sprawl because of the absence of obstacles that might channel urban development, thus allowing the indiscriminate spread of built-up areas in all directions.





Clark's law states that density at a given distance from the center of a city Dd is a function of the distance d and of the density at the centre of the city Do. It is expressed mathematically as: $Dd=Do.e^{-ad}$

This law is linked to the economic theory of rent, and states that rent tends to decrease as distance increases in order to compensate for higher transportation costs. Households thus tend to settle around the center and the surrounding areas based on the decongestion gradient, thus causing a fall in density.

Emergence of new cities and towns

During the past 50 years, new urban agglomerations have developed. Their status, location, and size vary widely, and some are barely taken into consideration by official statistical definitions of urban areas. These agglomerations may be divided into three broad types:

(a) New cities created ex nihilo

These new cities that have been the object of previous urban planning, along with their residential districts, industrial activities, and provision of services (as in Nouakchott and Yamoussoukro as well as Abuja and New Bussa in Nigeria). However, programs that aim to develop new cities, especially when poorly monitored, cannot prevent new districts or suburbs from appearing on the fringes of the original urban plan. Some of these new cities are currently home to more than 100,000 inhabitants.

(b) Relatively well equipped and well structured secondary cities

These cities usually consist of the main urban center at each tier of the territorial administrative division (regions, provinces, *départements*, *préfectures*, etc.). The importance of these urban areas is largely related to the importance of their administrative hinterland. The development of an administrative center tends to be higher if its hinterland is in a strong position relative to other territorial divisions. The more territory, population, and resources a hinterland holds, the more its administrative center tends to develop. Most of these agglomerations are considered to be “cities” from a political and statistical point of view. Thus, in Guinea, the administrative center of each *préfecture* is automatically considered an urban agglomeration. This status ensures that cities will benefit from the direct provision of public infrastructure that leads to new, local public employment opportunities while also indirectly generating economic activity in related sectors (law firms, medical practices, services, repair businesses, etc.). Finally, these agglomerations tend to benefit from their privileged status as the administrative center for their hinterland in the form of the convergence and modernization of communication networks but also the provision of electricity, telephone, and water services, etc. Even if not all of the administrative centers are immediately and automatically supplied with all of this typical and essential infrastructure, these agglomerations function as power centers for decentralized government agencies, serving as anchor points for the implementation of decentralization policies. They are also seen as promising areas in terms of development, especially in comparison with the conditions of utter destitution that mark other regions.

(c) Small towns: in situ urbanization

Most of these small towns were initially villages that grew, gained density, and expanded without proper urban planning. This is due to the fact that these areas are not considered ”urban” in terms of their administrative or statistical status. Some of these towns have now become true urban agglomerations. They are the seat of a wide range of activities related to the processing of local products and of trade.

Despite its numerical and demographic importance and despite a multiplicity of cases as well as their very rapid growth, this last category remains by far the most misunderstood.

2. SMALL AGGLOMERATIONS: EXPLORING THE URBAN THRESHOLD

The emergence of small agglomerations raises an issue that was until recently almost unheard of, namely, the respective domains of "urban" and "rural" in terms of statistics, the economy, society, and governance. These agglomerations are the focus of Part 1 of this study, enabling us to tackle the urbanization issue from the bottom up.

Small agglomerations have recently multiplied within three types of geographical areas:

- In rural areas with the highest density;
- Around the periphery of large cities;
- Along highways.

In situ urbanization: transforming the rural environment

Mainstream mechanisms

In rural regions with the highest density, the increase in the size of settlements is a mechanical result of demographic growth. This is especially true in cases where no migration flows have been observed. One example is Benin, where the population grew five-fold between 1950 and 2005. Assuming no future residential migration, all of the villages that had 2,000 inhabitants in 1950 will reach a population of 10,000 in 2005, 14,000 in 2020, etc.

This quantitative increase usually generates a series of qualitative changes. Beyond a certain threshold, a city's population can no longer depend exclusively on its agricultural activities because growth of the local market tends to increase the volume and intensity of trade activities while also generating a need for additional services and infrastructure.

Thus rural settlements gradually become urban due to dynamic internal activity. This phenomenon has been observed throughout history and is called *in situ* urbanization.

In West Africa, two elements have caused *in situ* urbanization to gather strength: a rapid natural increase in demography, and the weakly hierarchical distribution of populations in rural areas.

In cases in which a natural and steady increase in demographic growth is observed, rural-urban migration alone is not always rapid enough to counterbalance an on-going trend of urbanization in-situ. During the second half of the 20th century, Africa's population almost reached a 3% annual growth rate, or approximately twice the rate observed in European countries during the second half of the 19th century. This rate is also half a point higher than the rates observed in Japan or the United States during the 20th century, when ongoing urbanization in these countries was particularly intense.

To stop the *in situ* urbanization process from escalating, migration rates must reach at least 3% per annum. However, given the very low urbanization rates in the region at the beginning of the reference period, rural areas have become a demographic reservoir. Because there were initially few cities and towns, the number of migration destinations was extremely limited. As a result, urbanization in situ continued to progress despite the rapid growth of national capitals and the creation of new cities.

The hierarchical distribution of rural settlements

The proliferation of *in situ* agglomerations is a structural consequence of the statistical distribution of populations in human settlements. As we saw previously, the number of agglomerations that may be classified as "urban" tends to rise the lower we look on the hierarchy of human settlements. There is a clear discontinuity in the distribution curve modeling the increase in the number of urban units. This discontinuity threshold may be empirically located by observing the distribution curve, or it may be mathematically calculated by minimizing the residuals in a least squares-fit rank-size distribution.

Below this threshold, the number of similarly sized settlements suddenly tends to rise. Thus, in the case of Niger (1988 census), 8 settlements had a population ranging between 7,000 and 10,000 inhabitants in 1988 whereas 35 settlements had a population ranging between 4,000 and 7,000.

Consequences of the average size of human settlements

There are many ways for equally dense populations to spread within a given territory. One of these is through dispersed habitat, with each household living on an isolated farm. This contrasts with concentrated habitat, where the population is massed within dense urban areas while areas beyond it are not built, while concentrated dispersion is one in-between possibility among others. A concentrated habitat may display a large number of scattered small communities (as in Niger) or, conversely, into a small number of larger cities and towns (as in the Yoruba region).

There is a wide diversity in types of settlement not only at a regional level (West Africa) but often also at a national level, and within small distances. The following map, which features the areas of Burkina Faso surrounding Ouagadougou, shows a dense spread of small towns that contrasts with areas that are loosely settled, with the larger towns reaching a population of 2,000-4,000 inhabitants.

Concentrated habitat and high demographic density

The combination of high demographic density and concentrated habitat optimizes the *in situ* urbanization process.

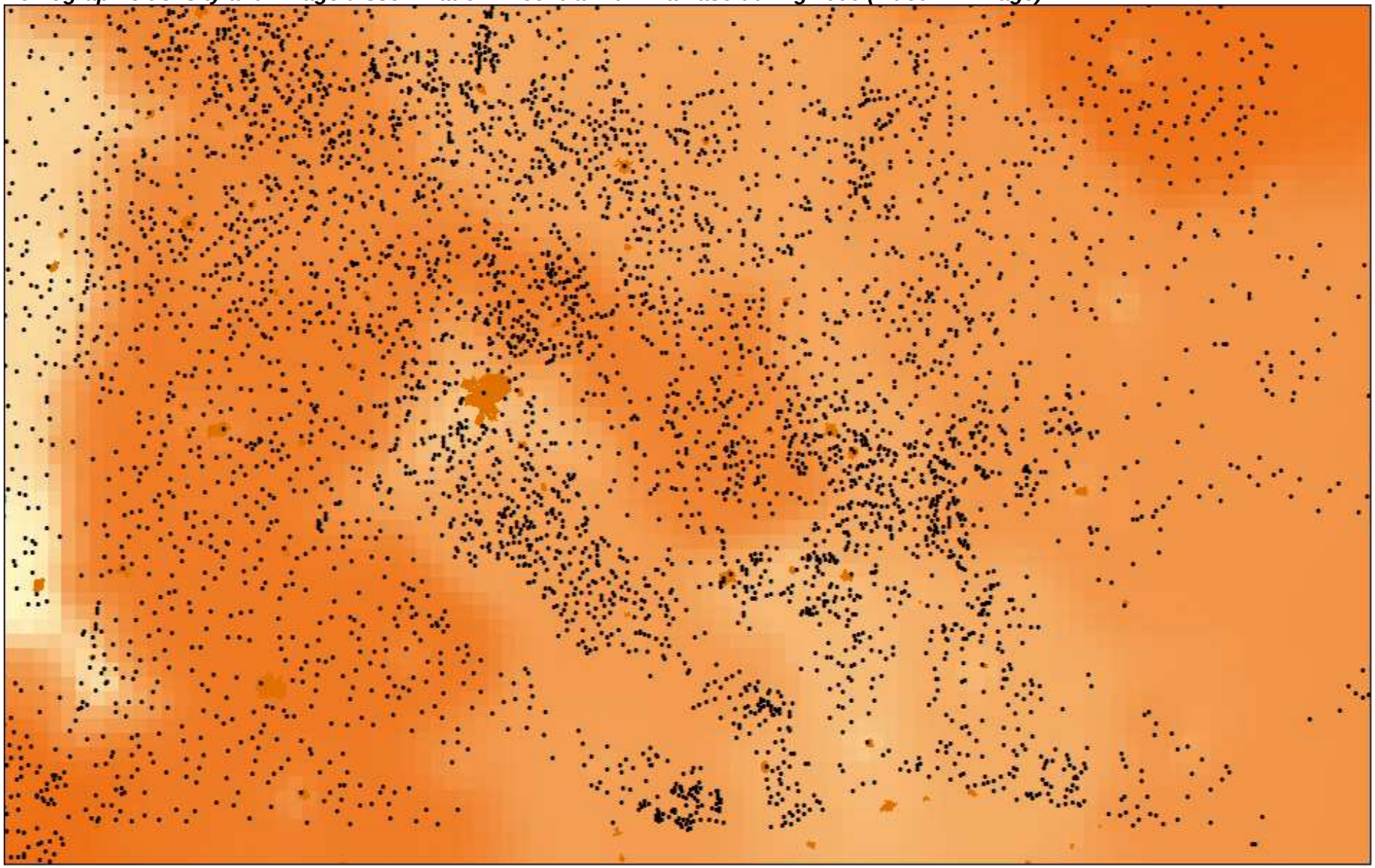
This combination is observed in approximately 800 new agglomerations in Egypt (2006) and 3,600 in India (2001). In West Africa, this combination has had limited impact due to the fact that demographic density in the region is of a much lower order than in the deltas and plains of Asia and Egypt: the demographic density in the Niger Delta is only half that of the Nile Delta. Similarly, the rural density of the plains of the Gulf of Guinea are far below that of the plains in the Philippines, Indonesia, Bangladesh, and Vietnam.

Dispersed habitat and high demographic density

The combination of high demographic density and a dispersed habitat results in the opposite effect, causing the emergence of extremely large agglomerations, between ‘urban’ and ‘rural’. Examples of this type of conurbation may be observed, for example, in northern Belgium, where the demographic density of these agglomerations remains quite low compared to the general urban density criteria, though it is high by rural standards.

The Anambra hills (located north of the Niger Delta) are currently developing this type of habitat.

Demographic density and village dissemination in central Burkina Faso during 1996 (1 dot = 1 village)



Concentrated habitat and high density in the Anambra Hills (Nigeria): Nsukka region

This form of habitat is dispersed within a given area. It becomes increasingly linear as its density increases, leading to a type of settlement that may be classified as “intermediate” due to its combination of rural and urban characteristics (approximately 700 inhabitants per square kilometer in 2006). A conurbation of nearly 2 million inhabitants looks set to develop north of Enugu in the coming years, a development that may mean rethinking the concepts and analytical methods currently in use.

Summary: Conditions for optimizing the in situ urbanization process

General conditions	Situation in West Africa
o Natural increase	o One of the highest in the world: 2.8% per annum
o Rural exodus	o High potential at the beginning of the reference period due to a low urbanization rate. Low number of migration destinations due to a lack of existing cities.
o Return migration	o Unknown parameter. o There is no systematic study available at a sub-continental level.
o Urban exodus	o This phenomenon has recently been maximized along highways and in the periphery of large cities.
o High demographic density in a rural environment	o Even within the Niger Delta, density is noticeably lower in West Africa than in the deltas of monsoon Asia or Egypt. o However, the density is relatively high in the plains of the Gulf of Guinea (Ghana, Togo, Benin), in the Yoruba region, and in the Niger Delta and its surrounding areas (north and east).
o Average size of human settlements (type of habitat)	o Varies greatly across regions. o Small-size settlements in the Sahel belt and in most of the savannah areas. Large-size settlements in southern Togo, Benin, central Burkina Faso, and the Yoruba region.

Proliferation of small agglomerations located within the orbit of large capital cities

A second important type of new agglomerations is proliferating on the outskirts of large cities. In developed nations, this process is called "peri-urbanization." However, the use of this denomination remains controversial in developing countries.

These agglomerations differ from the previously mentioned category (*in situ* urbanization). They are not necessarily considered suburbs of a large city. Suburbs tend to develop as urbanized networks that are the extension of a large urban center's morphology. By contrast, agglomerations located within the orbit of large capital cities are clearly distinct in terms of morphological boundaries. Most are located along the main radial highways, 60 to 100 kilometers from the city center.

New agglomerations tend to form corridors linking large, adjoining cities. These corridors carry an intense flow of goods and people. Large cities, their suburbs, and other disseminated new agglomerations link into vast zones marked by internal or cross-zone flows. These zones are similar to what official statistics in some developed countries designate as a "metropolitan area" (particularly in the United States).

The growth of these small agglomerations does not only result in a natural increase in the population but also generates a positive migratory balance that may be simultaneously caused by rural exodus and by urban exodus that originates in large cities. These new small agglomerations tend to attract a rural-urban migrating population that previously gravitated toward large cities but is currently concentrating in some of the cities' more affordable outskirts, where housing is less expensive. For the same reasons, new agglomerations also receive migrants leaving the large cities. This trend mainly affects young couples who are moving out of the family home and are having difficulty finding affordable housing in the heart of the metropolitan area. The flow caused by a looser urban network could therefore be linked to a process of "de-urbanization" rather than "peri-urbanization." Indeed, we must remember that urbanization is basically the result of centrifugal rather than centripetal flows. If this were not the case, cities would simply not exist. Jean-Paul Hubert suggested using the term "orbis" (hence, "orbanization"), which has same origin as the word "orbit," to describe this phenomenon. This term would designate all areas located outside the city center yet remaining under its influence.

Small agglomerations have emerged within the orbis of larger cities due to a recent change in the population's residential strategy as couples or families give priority to daily mobility over residential mobility, which had previously stimulated the growth of large cities. In developed countries, this type of evolution typically generates an increase in the use of private vehicles. In developing countries, where fewer households own a motor vehicle, the population's mobility is mostly provided by urban transportation services, which are often operated by the private sector: minibuses, microbuses, shared taxis, bush taxis, etc.

However, this phenomenon normally only develops under conditions of high traffic density that tends to reach its optimal level when road density is low and demographic density is high. In fact, a low density of major roads raises traffic density by a channeling effect, whereas high demographic density is often caused by initially high rural density.

High rural density levels are often linked to the emergence of large agglomerations, and the "orbanization" of large cities thus tends to overlap with the phenomenon of *in situ* urbanization.

Corridorization of urban networks

Role of major communication corridors

The "orbanization" of large agglomerations reveals the important role played by a territory's corridor network, which is not limited to the periphery of large cities. The development of small towns along major transportation and communication corridors affects Africa just as it affects other countries throughout the world. However, in West Africa, this phenomenon has two major characteristics:

- The fact that the population tends to spread and settle along these corridors may be due to the low density of the area's transportation networks. The importance of railways in the urbanization process in West Africa has been described in numerous historical studies (of the cacao growing area of the Gold Coast at the beginning of the 19th century or in Bobo Dioulasso in Upper Volta). Today, the highways have replaced he railways.
- There have generally been no communication corridors along the African coast in the past. The area has often limited itself to hosting a series of urban clusters that are connected to each other by sea, except for rare cases such as the corridor running from the south of Dakar to Mbour or the corridor running through part of the Gulf of Guinea between Sekondi-Takoradi (Ghana) and Lagos (Nigeria).

Role of the coastline

The coastal area was populated following a "tooth comb" pattern, which is reminiscent of the colonial settlement structure. Thus a large majority of the urban population lives near the coast large metropolitan areas have emerged in coastal countries (Nouakchott, Dakar, Banjul, Kanifing, Bissau, Conakry, Freetown, Monrovia, Abidjan, Accra, Lome, Cotonou, Lagos). A large proportion of national urban population lives in these large metropolitan areas; however, interaction between them is relatively weak due to the subcontinent's political segmentation.

Moreover, because the coastline does not constitute a major regional corridor, few small towns have emerged along the coast.

Small towns tend to proliferate along corridors that are perpendicular to the coastline: Dakar-Touba (Thiam, 2008), Abidjan-Bouaké, Accra-Kumasi, Lome-Kara, Cotonou/Porto Novo-Abomey, Lagos- Ibadan. Since the 'corridorization' process is associated with major highways, the point of origin of these highways is of great interest (Giraut et Moriconi-Ebrard, 1991).

North-South corridors

One of the key factors in urbanization is trade. In West Africa, two types of networks can be contrasted in terms of climate: the North-South exchange networks and the East-West exchange networks.

Very different climatic zones such as forests, savannas, deserts, and the Sahel belt are linked by North-South networks ~~corridors~~. At a sub-continental level, they allow the flow of food and export crops as well as other products, sometimes leaving production to be dictated by climatic comparative advantages.

Over relatively short distances, North-South networks also allow the marketing of seasonal agricultural produce within similar climatic zones by staggering the timing of exchanges. Thus, mangos ripen several weeks earlier in the Ouagadougou region than in the south of Burkina Faso, which allows some northern growers to sell their fruit for a higher price in the south at the beginning of the season.

Further north, the seasonal migration of livestock farmers has generated multiple trails that are not always suitable for motor vehicles. However, these corridors generate considerable trade activity, especially where they cross East-West corridors.

East-West corridors

East-West corridors in West Africa have a different function from North-South corridors because they generally do not connect different climatic zones. However, these corridors play an important strategic role.

East-West corridors are dominated in the north by the “Arabian Holy Land” highway, the historical route followed by Islam as it penetrated the region. Linking the Red Sea to Touba (Senegal) via Lake Chad, the highway is not truly a road but a bundle of dirt roads and tracks that did not need to cater for motor vehicles until modern times. The corridor’s importance may be partly due to the fact that the Islamization of Africa developed hand in hand with itinerant trade. Moreover, the main ‘highways’ in this corridor follow the boundaries of the vast Sahara desert and crosses the Sahel belt. The intensely arid climate and the high variation in the annual precipitation rate in the area force livestock farmers to migrate back and forth between north and south according to the season. In doing so, these migrants meet the international East-West corridor, which links the Red Sea to Senegal, thus maximizing the possibility of interaction between populations that lack density and are scattered throughout vast territories.

Another consequence of the variety across West African climatic zones is a second series of corridors that run roughly from east to west and are located toward the south of the region, connecting several sets of towns that tend to correspond to the former urban centers of the precolonial era (Yoruba region, Abomey, Kumasi, etc.). These ancient cities initially developed in areas where different climatic environments met. Today, they have recovered some importance as their number has increased with the newly emerging “colonial centers,” such as the agglomerations of the Baoulé “V” area in Côte d'Ivoire or those of the Kara region in Togo. These corridors have generated the emergence of small towns in areas located between major cities.

The climatic contact zones have shifted from north to south due to fluctuations in the global climate as well as the introduction of new exports crops. This has in turn shifted the location of the region’s trade centers, causing the decline of some cities to the benefit of new ones further south. A detailed analysis reveals that these urban trade corridors follow the region’s orography, dominated by a line of steep hills that run from the southwest to the northeast.

Finally, if we look at the political map of West Africa, we notice that East-West corridors cross several national borders. Borderlands often witness vigorous trade due to differences in exchange rates, agricultural subsidies, and tax policies across countries. However, this is not always the case, especially when borderlands, in addition of being remote, are ill-serviced and ill-equipped, thus thwarting the development of urban markets.

In the end, despite modernized infrastructure, highway networks do not always encourage territorial innovation. Highway networks that connect existing agglomerations tend to enhance the concentrated and centralized character of large cities, following the principle of "descending innovation" (Lepetit, 1988), which is similar to the situation observed in France during the 19th century.

This strategy explains why small towns ~~to~~ proliferate along corridors, generating multiple activities that can appear to be linked to transient populations (mechanics, gas stations, tire replacement services, food and drink providers, small grocery stores, makeshift stalls, etc.), to which a local population congregates from no further than surrounding villages.

Lack of documentation regarding the African highway network

Intuitively, urban growth seems to be closely related to the development of communication networks, most particularly, nowadays, road networks. It would, therefore, be interesting to measure the real impact of highway development on African urban

growth. However, creating a reliable, updated, and realistic database of conditions on African roads would require gathering specific documentation, which would go beyond the scope of this study. Like the process of defining the African “urban,” matching the African road classification system (national highways, provincial or district roads, etc.) with other systems at an international level is not easily achieved. Classifying these highways as “paved/non paved” would seem an appropriate approach. However, experienced travelers know that throughout Africa, poorly maintained paved roads tend to be less drivable than well maintained dirt roads. Finally, a road’s drivability may change according to the season. During the dry season, some non-paved roads in the Sahel belt are in excellent condition while during the rainy season, it may be impossible to cross the region’s rivers. In this case, the lack of bridges and embankments along the course of the region’s waterways is a more important factor than poor road conditions.

Agglomerations must remain easily accessible regardless of the season if their development is to be unhindered. However, given the current lack of documentation regarding highway networks, a global study of the relationship between urban activity and road networks must restrain itself to use high quality data on urban morphologies together with unverified data on road conditions. We therefore provide only one example, that of Senegal, where information regarding the highway network was digitized by Ousmane Thiam as part of his doctoral thesis in geography (Thiam, 2008). Thiam's analysis confirms the unsurprisingly close link that exists between road networks – in Senegal, paved "national” highways – and urban networks.

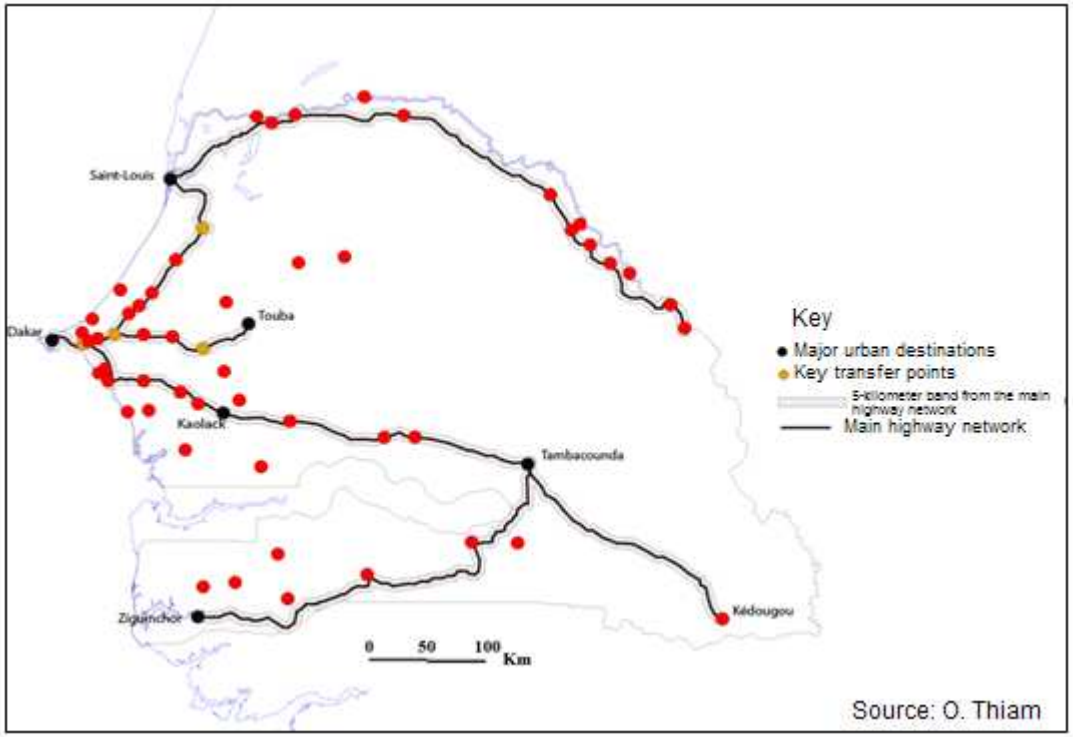
However, these conclusions should be interpreted with caution because throughout history the cause and effect relationship between agglomerations and highways has tended to be bi-directional, as roads stimulate a city’s growth while cities may also generate the construction of new roads.

The case of Senegal

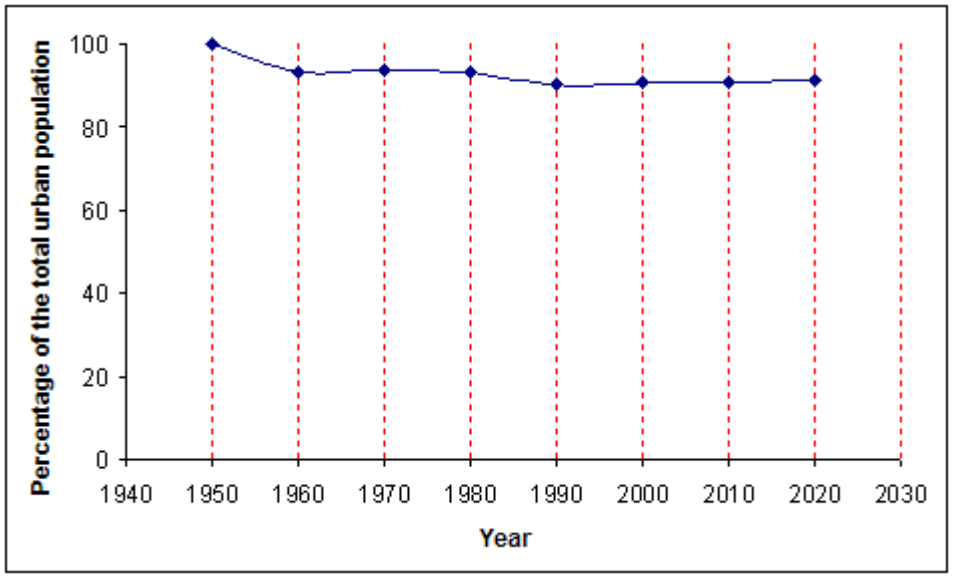
As it did during the colonial era, the highway network plays a decisive role in the distribution of urban centers within Senegal today. According to *Africapolis* data shown in the maps below, 38 towns out of 60 with a population of more than 10,000 inhabitants are located less than 5 kilometers from the main highway network, representing 63% of this urban category.[8] These agglomerations gathered 100% of the total urban population in 1950 and 91% in 2000. The current percentage is likely to remain stable until 2020. However, this may depend on urban growth as well as on the construction of new highways. There is therefore an obvious link between the spatial distribution of urban centers and the highway network. In Senegal as well as in other countries, the link between these two elements is based upon gradual change in the area's economic systems, which currently rely on mobility and which are essentially sustained by the country’s cities and towns.

[8] Highway appear on the map depending on two criteria: the road’s classification as a “national highway” and the highway’s importance in terms of traffic. Some segments of the main network (Diourbel-Kaolack, Louga-Darou Mousty-Touba, Kaolack- Karang-Bignona, Touba-Linguère, and Tambacouda-Kidira) are therefore not shown on the map shown below because they do not meet the second criterion in that they do not carry substantial traffic and therefore do not generate substantial urbanization activity.

Location of urban centers in relation to the main highway network, Senegal (2002)



Evolution of the population living in agglomerations located less than 5 kilometers from the main highway as a proportion of the total urban population, Senegal (1950-2020)



General model and conclusions

The three global factors identified above may combine locally, thus optimizing the proliferation of new agglomerations due to the following factors:

Initially high rural density
+ Location within the proximity of a large agglomeration
+ 'Corridorization' of the population

However, a key issue consists of evaluating the weight of these new agglomerations relative to the total and urban populations in order to select suitable strategies for development.

The threshold between "urban" and "rural" is reached through the proliferation of new agglomerations. This constitutes the most problematic aspect of population dynamics from an economic, social, and political point of view.

If we persist in classifying these new agglomerations as rural settlements, many will continue to proliferate and spread because no statistical approach allows us to estimate the impact of their number, size, and influence upon the urbanization process. Though these settlements may not be correctly classified as "cities," they remain likely to proliferate without falling within the scope of laws governing dense population concentrations. This will contribute to their marginalization. Thus the development programs and initiatives being carried out in these urbanized areas will likely prove inadequate.

The demographic and morphological data gathered on a transnational scale for the first time in West Africa has helped establish several methods aimed at solving the issues discussed above. This study has demonstrated intuitively the importance of these new agglomerations However, the modern urbanization phenomenon in West Africa should not be reduced to a single dimension. Rather, it should be seen in relation to other aspects of the process, especially the growth of metropolitan areas.

3. URBANIZATION AND METROPOLIZATION

In recent years, numerous studies have shown that although the "megapolitan" areas of developing countries are continuing to grow, there are many signs that this growth is slowing. In fact, early in the 21st century, growth rates are far lower than the record rates of the 1950-1970s, when yearly growth frequently reached 7% or 8%, which meant that the population of these urban areas was doubling every 10 to 12 years.

While this "urban explosion" in large metropolitan areas is much less of a hot topic today, it is still important to note that the slowdown is observed when urbanization is approached purely through its morphological dimension i.e. the key notion of "agglomeration". In effect, over the past few years, the economic and political stakes for growth are no longer confined to the built-up areas of the agglomeration. Instead, as was previously discussed, agglomerations now encompass vast urbanized areas, which can no longer be seen through criteria such as residential density or the extent of urban infrastructure but in terms of the connexity and connectivity of networks.

Connexity : In the developed world, new metropolitan areas are measured according to the intensity of traffic, the diversity of material and immaterial communication systems, the intensity of human flows, and the power of specific urban centers to polarize these flows**.** It has long been believed that this approach – which first appeared in the official statistical zoning in the United States during the 1950 census – could only be applied to developed countries. However, we are now seeing this phenomenon spreading into some parts of the developing world such as Brazil, China, India, and Indonesia, and perhaps in some African agglomerations such as the coastal area between Accra and Lagos.

Even though the metropolization process by definition touches upon a question that goes far beyond urban agglomeration, it cannot be applied to all territories. In developed countries, for example, some agglomerations are in deep crisis, especially in regions formally engaged in heavy industry, whereas rural areas, once victims of rural exodus, are undergoing intense growth. With rural exodus slowing, we can now speak of "extra-metropolitan exodus," that is, migrations out of an urban agglomeration in crisis into surrounding villages or towns. In these cases, the difference between "metropolitan" and "non-metropolitan" lies in the region's degree of connectivity with the rest of the world. Will this process also spread into West Africa?

Connectivity : In large African capitals, it is often much easier to interact with cities such as Paris, London, or New York (either by traveling there physically or by making telephone calls, send mail, or making money transfers) than it is in most villages or small provincial towns within the country. Metropolization is therefore defined by the privileged position some power centers hold as interfaces between the seat of economic and political control and the network of global cities. This attribute of connectivity is directly expressed through the geography of foreign investments, which hardly ever extend into areas located more than one traveling hour from an international airport (Denis and Vignal, 2002). Accordingly, many neighborhoods in the large metropolitan areas have become small islands of wealth and relative overdevelopment compared to their hinterland, and this does nothing to narrow development gaps on the regional level.

Primacy and macrocephaly

Defining the notion of “megapolis” does not necessarily imply a need to set a fixed size threshold since the term can also be defined relatively as referring to a set of institutionally integrated cities (cities within a single country, for example). For instance, Lomé (the capital of Togo), which had 442,121 inhabitants in 1981, now looks like a modestly sized agglomeration on the African landscape. On the national level, however, the capital accounts for an especially high concentration of the country’s population.

To make sense of this phenomenon, this study uses two relatively simple indicators, which are independent from the overall urbanization rate of a territory as well as from the absolute size of its largest agglomeration.

Primacy index

This classic indicator is calculated by dividing the population of the largest agglomeration by the population of the second largest agglomeration. So, one merely needs to know the total population of the two largest agglomerations to calculate it.

One shortcoming of this method, however, is that it is highly dependent on the size of the second city, which in some countries can be relatively large. This is the case, for example, in Burkina Faso, where Bobo Dioulasso is really a second metropolis, just behind Ouagadougou. The result is that the major discontinuity in the hierarchical distribution of cities does not fall between the two largest agglomerations but between the second and third largest.

Thanks to the rail connection with Abidjan, Bobo Dioulasso has become a genuine “port” in a territory without maritime access. In 1950 and 1961, its population even surpassed that of Ouagadougou, the future capital of the country. It was only after independence that Ouagadougou reasserted its supremacy, thus widening the population gap with Bobo Dioulasso at each census (Figure 3).

In the case of bipolarization (with two cities dominating the rest of the urban hierarchy) or even multipolarization (with multiple cities of similar size and influence) of urban systems, as in Nigeria, the primacy index therefore conceals the real imbalances that exist between metropolitan agglomerations and others.

Macrocephaly index

This more synthetic indicator expresses the relationship between the population of the most populated agglomeration and the agglomeration ranked R_m such that the sum of the populations of agglomerations ranked 2 at m matches the population of the agglomeration ranked 1.

For instance, in Togo in 1981, it was necessary to add the population of the 31 most populated secondary agglomerations to reach that of Lomé, or $R_m = 32$, which corresponds to the sum of all agglomerations with more than 7,536 inhabitants. If we divide the total population of Lomé by the population of one of these agglomerations, we obtain a score of 58.7.

This indicator thus highlights the macrocephaly of Togo's urban system.

Its heuristic advantage is that it is much more stable than the primacy index since, as we have seen, the distribution of agglomerations tends to level out as we go down in the hierarchy.

Comparing the two indicators

The macrocephaly indicator is less frequently used because it requires data that are not available for all countries. It does, however, better describe the imbalance between metropolitan populations and urban populations in multipolarized urban systems.

In Burkina Faso in 2006, for instance, the primacy index was very moderate: 2.71 versus 9.19 for Togo and 5.3 for the worldwide average. However, the macrocephaly index is almost as high in both countries (52.3 in Burkina versus 58.7 in Togo, and for comparative purposes, 24 in France). This illustrates how this index expresses the weakness of secondary urban networks, which goes undetected by the primacy index. In both of these countries, no agglomeration likely to challenge the size supremacy of the metropolis has emerged.

Primacy and macrocephaly indexes for Togo

Census	Population of first-ranked agglomeration (metropolis)	Population of second-ranked agglomeration	Primacy index	Number of agglomerations required to match the population of the metropolis	Population of agglomeration ranked R_m	Macrocephaly index
1981	442 121	48 098	9.19	31 (R_m = 32)	7 536	58.7
1970	228 179	32 356	7.05	15 (R_m = 16)	10 134	20.6
1959	73 646	14 687	5.01	7 (R_m = 8)	8 403	6.0

Source: CPH

Primacy and macrocephaly indexes for Burkina Faso

Census	Population of first-ranked agglomeration (metropolis)	Population of second-ranked agglomeration	Primacy index	Number of agglomerations required to match the population of the metropolis	Population of agglomeration ranked R_m	Macrocephaly index
2006	1 181 702	435 543	2.71	20 (R_m = 21)	22 585	52.3
1996	745 462	309 771	2.42	14 (R_m = 15)	20 080	37.1
1985	441 514	228 668	1.93	8 (R_m = 9)	21 049	21.0
1975	172 661	115 063	1,50	3 (R_m = 4)	25 690	6.7

Source: CPH

The countries of West Africa are no exception to the phenomenon of urban macrocephaly and primacy. For comparative purposes, the primacy index for France (7) in 1982 was the same as Togo's in 1981. By contrast, the macrocephaly indexes for Burkina and Togo are lower than those of wealthy countries such as Ireland or Denmark.

The Law of Metropolization: a universal rule

The alarmist rhetoric in the 1970s regarding the “urban explosion of the megapolis” masked one geographic fact: the population of modern metropolitan areas does not grow haphazardly but rather according to rules that have been verified on a global level and for all historical periods for which we have data.

Statistical approach to defining a metropolis

A “metropolis” differs from other cities not only through quantitative discontinuity but also through qualitative discontinuity. Just as we can distinguish “rural” from “urban” in the statistical distributions of human settlements, we can distinguish a “metropolis” from a “normal” city based on probabilistic laws governing the distribution of large numbers.

This qualitative difference derives from the connexity of metropolitan areas. It can be explained by the fact that a metropolis controls the interface of two areas, the national and the international, as well as, on the national level, the interior and the exterior. Given that the entropy of the distribution of these two systems is combined and that the advantages of a given position tend to accumulate, control over the interface explains the “abnormal” size of the metropolis in terms of the laws of probability.

The quantitative discontinuity in the distribution reflects numerous qualitative discontinuities. The demographic size of the metropolis also constitutes a change of scale in the physical dimensions of the city, which brings about an increase in travel time and distances as well as in the density of flows. This is accompanied by a diversification of activities, a change in the lifestyles of societies, widening income gaps, and the implementation of administrative and governmental systems adapted to the size of the agglomeration.

Scope of the Law of Metropolization

This law has been verified on a global scale and is applicable to urban systems as different as those of Lesotho, Ethiopia, Sweden, or the United States. It also holds when applied to a single country on different dates even if growth in the urban population underwent a rapid boom.

The law also adequately describes urbanization patterns on the level of inter-state territories such as regions or *départements* so long as they are sufficiently stable and have real territorial and economic cohesion.

Scale invariance, therefore, is one of the properties of the law, which refers back to the relativity of the metropolis concept. Thus we can observe that:

- There are several levels of metropolitan areas (national, regional, départemental);
- An agglomeration considered a metropolis on a lower level is not necessarily a metropolis on a higher level.
- , any agglomeration of a substantial size can be considered a metropolis on a local scale. Since we assign a strict relationship in a given territory between metropolitan population and urban population (Pm = Pu), this hypothetical number comes into being when the metropolis has at least 25,000 inhabitants, in other words, whenever an urban system only has a single agglomeration, which, by definition, is its metropolis.

Mathematical formalization

The Law of Metropolization (Moriconi-Ebrard, 1993) states that the size of a megapolis varies according to the total urban population, as follows:

$P_m = 6.55 \, . \, P_u 0.815$

where P_m represents the metropolitan population and P_u the urban population, or the sum of all the territory's urban agglomerations controlled by the metropolis.

Diachronic application

The Law of Metropolization is rooted in a dynamic model (Moriconi-Ebrard, 1998) of the allometric type, in which the terms of the relationship formally link a whole (the urban population) to a specific part of this whole (the metropolitan population), as in the following mathematical formalization:

$A = B^n$

This allometric principle of growth is well known to biologists. When the part grows more slowly than the whole, the allometry is labeled "lower bound" (exponent lower than 1). In the opposite case, it is labeled "upper bound" (exponent higher than 1).

Given that the *n* exponent is equal to 0.815, we are dealing here with lower-bound allometry: that is, the metropolitan population grows more slowly than the urban population. Inversely, when the urban population decreases, the metropolitan population decreases more slowly. Metropolitan areas are thus more resistant to crises.[9]

[9] http://cyberato.pu-pm.univ-fcomte.fr/collgeo/files/8_GeoPonts_Moriconi.pdf

A counterintuitive relationship

The fact that the Law of Metropolization is based in an allometry seems counterintuitive. How, for instance, could the population of a metropolis gain and maintain a numerical advantage over all of the other agglomerations if its growth is below that of the entire urban population?

Although superficially logical, this question stems from an error analogous to the well-known paradox of Zenon of Enea.[10] The error lies in including the "part" (the metropolitan population) not in the "whole" of which it is a part, but in the remaining population, that it, the population of one or several other agglomerations.

The analogy with the principle of "lower-bound" allometry drawn from biology helps illustrate this error in reasoning through a comparison with the human body. In the human species, the weight of a newborn's brain represents a higher proportion of the entire body than is the case of adults. This means that during growth the weight of the brain increases proportionally more slowly than the rest of the body. However, this relationship makes no direct statement about the growth of other body parts taken separately, like the femur or the heart.

Lastly, unlike classical quantitative geography, the Law of Metropolization encourages an approach that sees urban growth as a morphogenic process and not as the product of stochastic evolution governed by chance (Pumain, 1982). In effect, the origin of each "urban system" is a "metropolis," a mother city in the etymological sense of the word, which then gives rise to other cities.

[10] This paradox is mentioned in La Fontaine's fable of The Hare and the Tortoise. It "proves" through faulty mathematical reasoning that it is impossible for Achilles to catch the tortoise. This reasoning fails because it compares the distance separating Achilles from the tortoise (the part) instead of comparing it to the total distance left to run (the whole).

Verifying the Law of Metropolization: the case of Togo

Urbanization in Togo started with the Lomé agglomeration. The city was made the capital of German Togoland in 1897, but its population did not exceed 10,000 until 1930, reaching 27,900 in 1947. As the only agglomeration with more than 10,000 inhabitants at that time, Lomé included 100% of Togo's urban population.

In the 1981 census, the agglomeration reached 442,000 inhabitants, although this still only represented 57.2% of Togo's urban population because this population had spread throughout 19 other agglomerations with more than 10,000 inhabitants.

For 1981, the Law of Metropolization predicted a population of 412,000 inhabitants for Lomé, a number only 6.7% lower than the population reported in the census. This difference can be attributed to the minimum threshold for defining a given urban area (10,000 inhabitants) in order to calculate the size of the urban population.

We note that:

- Proportions generated by the Law of Metropolization hold true despite the fact that the urban population increased by 3,000% in 36 years;
- The weight of the metropolis continued to fall while primacy greatly increased. This is due to the fact that outside the metropolis, urban growth was more rooted in growth in the number of agglomerations than in the population of individual secondary agglomerations.

Verification of the Law of Metropolization in Togo

Year	1945	1959	1981
Urban population	25 800	110 665	773 445
Number of agglomerations	1	4	19
Predicted population for Lomé	25 800	84 549	412 393
Observed population for Lomé	25 800	73 646	442 121
Lomé population in total urban population	100.0	66.5	57.2

Conclusions: West Africa's urban systems are evolving at different rates

We have shown that any urban system evolve in stages. Four broad stages can be identified:

- During the initial phase, urbanization is based on a small number of agglomerations. This is the case in West Africa, where modern urbanization is a recent phenomenon (except in Nigeria).

These patterns characterized West African cities early in the colonial period, except in Nigeria, where the precolonial urban network of the Yoruba region survived the arrival of the British.

- During the next phase, secondary agglomerations appear. At this stage, the urban network is composed of one metropolis and a few small cities. Although this phenomenon does not challenge primacy, the weight of the metropolis in the total urban population automatically goes down due to the emergence of new agglomerations.

This is the case of the smallest or least populated countries of the region: Gambia, Guinea Bissau, and Togo today, Côte d'Ivoire in the 1950-1960s, and most of the West African countries at independence.

- In the third phase of this evolution, the urban system expands while secondary cities became structured hierarchically. Amongst these cities, several generations of agglomerations can be identified. The oldest and the most favored have had a chance to blossom into large cities. The urbanization rate goes up, which means that the reservoirs feeding the rural exodus begin to dry up.

This is how the current urban system looks in Côte d'Ivoire, Ghana, and Nigeria today.

- The fourth phase is characterized by old urban systems, comparable to those in European countries. At this stage, urban hierarchies have stabilized. The demographic growth of cities has slowed. Some even decline and are replaced by others. The urbanization rate is high (60% to 90%) depending on continent and environment. However, the overall total urban population and the population of many other agglomerations have become almost completely stable.

No country in West Africa has yet reached this stage, which crucially implies that demographic equilibrium has been achieved.

4. INTERMEDIATE-TIER CITIES: THE "CHEF-LIEU" EFFECT

The so-called "intermediate" tier of agglomerations poses no major problems for urban classification. With the notable exception of Touba in Senegal and several large urban centers such as Kamsar and Sangaredi in Guinea, these urban areas are officially classified as "cities" (as opposed to "villages") or "municipalities" from the administrative and political point of view, and their population is classified as "urban" in national statistics.

In West Africa, the major part of this tier is composed of the cities and towns at the center of administrative divisions. Thus:

- The administrative functions of these regional centers generate urban concentration;
- Consequently, the number, hierarchy, and size of the territorial divisions have an influence on the shape of the urban distribution as well as the number and size of agglomerations.

The effect of the entropy of territorial grids has been measured successfully in a large number of countries.[11] In France, it has been shown that over the long term (1794-1999), the size of the capital city grew multiplied by 8.4, that of cities and towns functioning as upper-tier urban administrative centers (*préfectures*) by 4.3, that of second-tier centers (*sous-préfectures*) by 2.2, and that of third-tier centers (*cantons*) by 1.2. Meanwhile, the share of the national population living in agglomerations with no such function multiplied by only 0.6. This staged growth geometrically matches the entropy of territorial grids almost perfectly.

Although the entropy in territorial grids conforms to these general rules, it remains difficult to measure. To do so, it is necessary to have longitudinal data over relatively long periods, which assumes that the grid remains stable. In West Africa, not only do population data not go back very far into the past, but the administrative divisions change over time. Thus, this measurement cannot be carried out in Burkina Faso, Nigeria, Togo, or Ghana.

Additionally, there is a variety of grid systems in play. In some countries such as Ghana, the administrative hierarchy has been downplayed because intermediate tiers found between central government and localities are only at the region and district levels. By contrast, other countries have a large number of territorial tiers, as in Senegal, divided into regions, departments, districts, and rural and urban municipalities.

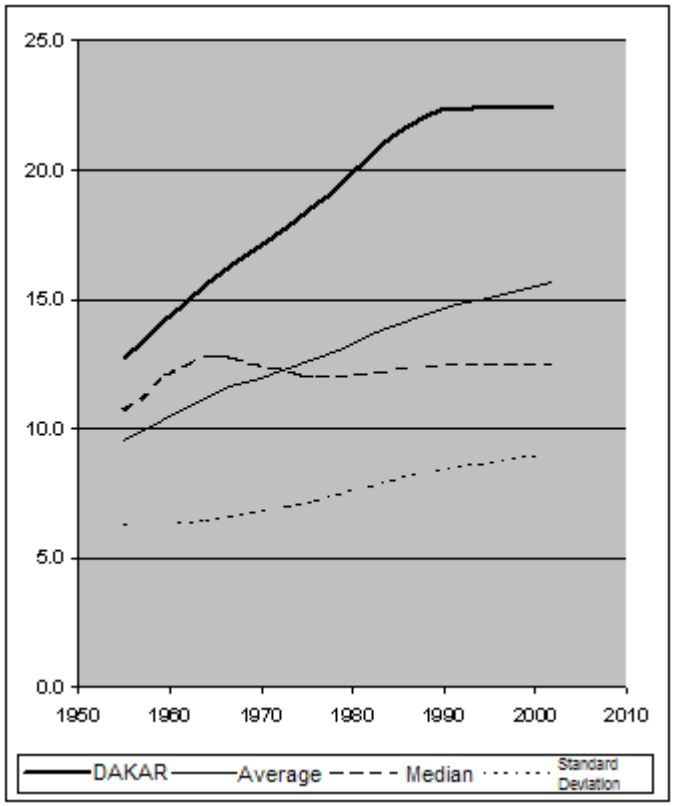
However, in the sense that these divisions still bear the influence of the colonial era territorial partitioning, two types of approaches determine their architecture: the French approach and the British approach.

[11] See for example: http://www.observation-urbaine.certu.equipement.gouv.fr/IMG/pdf/annexes_cle27247c.pdf

Polarization of population in regional administrative centers ('chefs-lieux')

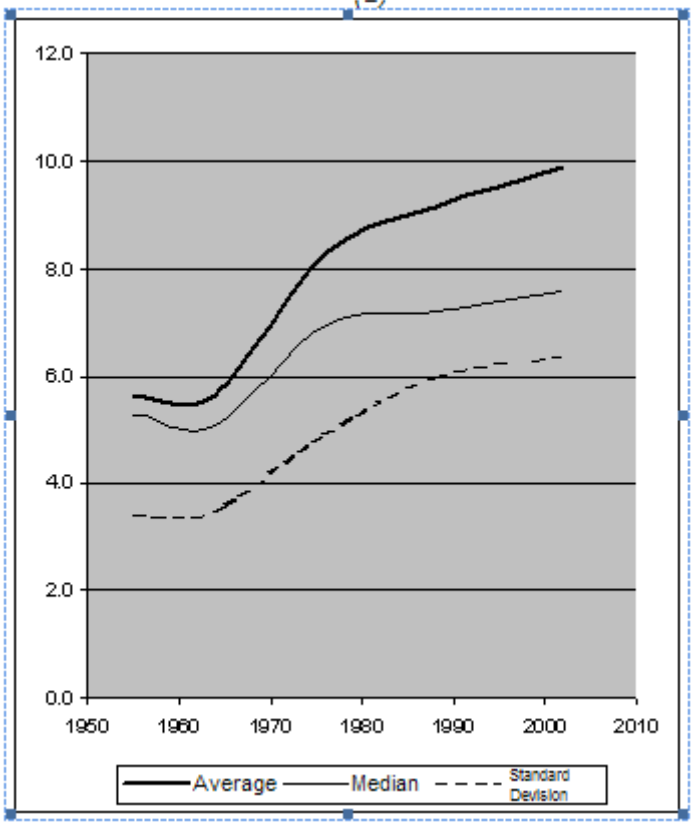
Change in the capital city's share of the national population; of the main town's share of the population of its region (1) ; of the administrative regional centres share of the population of its district (2)

(1)



Sample: 9 main towns of regions (excluding Dakar).

(2)



Sample: 18 districts (the 9 main towns of regions excluded).]

The legacies of two opposing colonial legal traditions

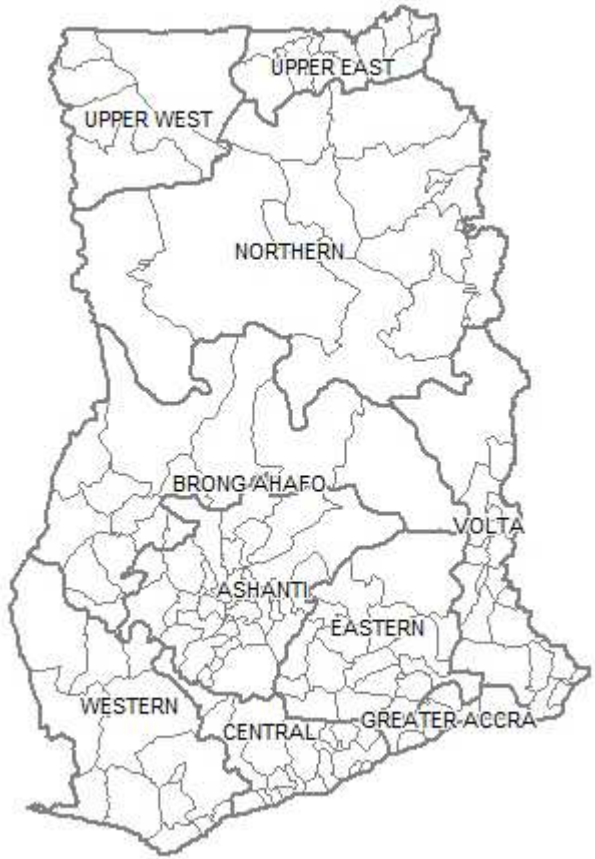
Though they originate in a common "Romano-Christian" theological-legal tradition, the British and French legal traditions went their separate ways and were even opposed to each other quite early on. This legal opposition was carefully cultivated as the foundation of a national identity in order to buttress the sovereignty of each of the two kingdoms. These legal traditions were then exported to the colonies, and each generated a specific approach to territorial division.

The British tradition

Firstly, the British tradition is concerned with the lot of vulnerable groups. It starts from exceptionalism, in the sense that it envisions the possibility of granting unequal status to territories within the same state. This logic can be expressed through the metaphor of sheep and wolves sharing the same territory: while the wolves want to abolish fences, the sheep favor them. Thus, the first concern of the British system is to protect the sheep and then allow the wolves to use the rest of the territory. Thus, the territories Britain came to control were divided into colonies administered directly as part of the British Empire or indirectly as protectorates, with a heterogeneous mix of local common laws prevailing in both.

From the 'French' point of view, this tradition leads to unbalanced administrative divisions. The United Kingdom itself provides an example, combining powerful England (50 million inhabitants) with such minnows as Man, Jersey, or Guernsey (each with fewer than 100,000 inhabitants sharing a few dozen square kilometers). At Ghana's independence, this mode of division left vast, densely populated regions with abundant resources (Central, Ashanti) bordering small, sparsely populated regions such as the Upper East Region.

Ghana's Territorial Division in 1998: regions and districts



The French Tradition

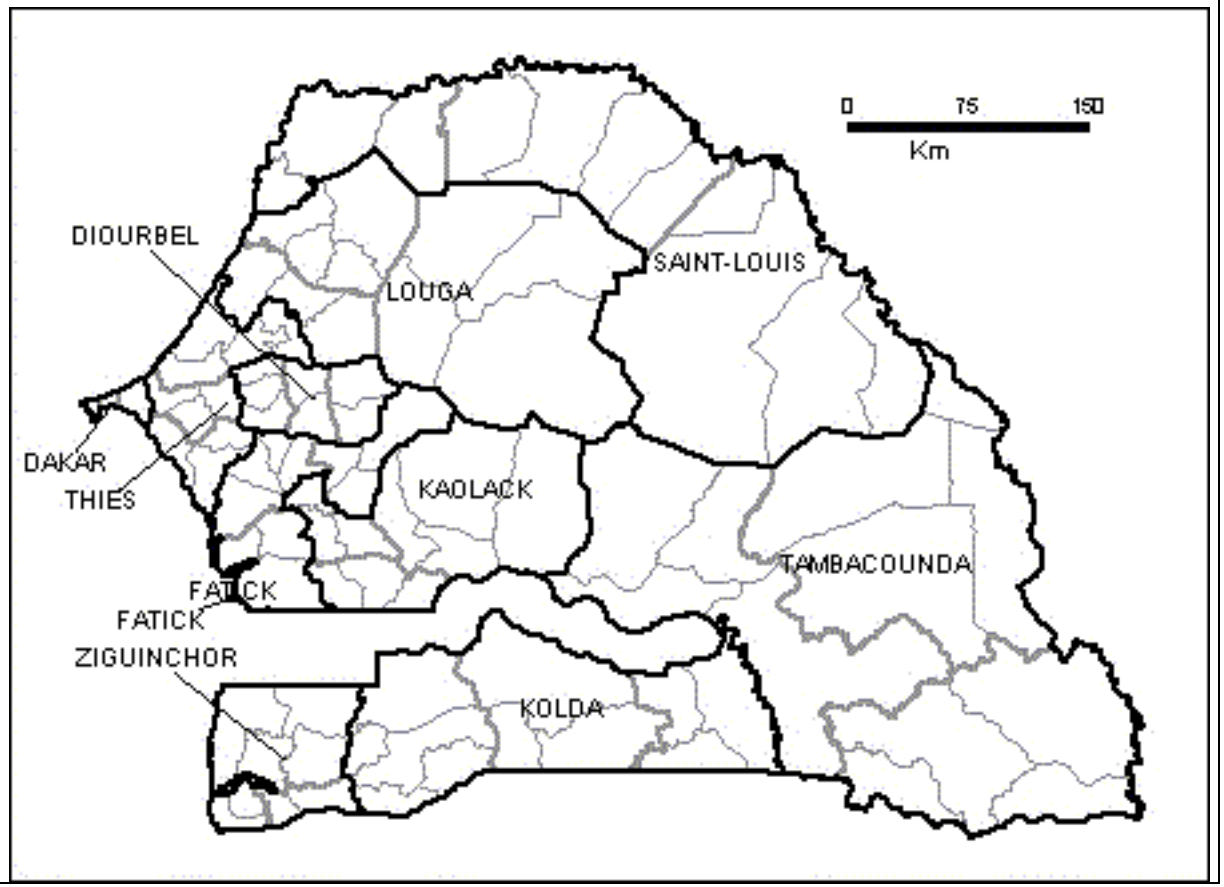
By contrast, the French tradition starts from a Platonic approach in which central government attempts to create vast territories where density is low (meaning that, in an agricultural economy, the soil is marginally fertile) and small territories where density is higher.

Senegal's divisions provide a good example of this, as the map of the territorial grid is the negative of the density map. At all levels of the hierarchy, the largest entities are the least dense while the smallest are the densest.

The same is true in Benin, where the dense south is divided into small districts while the less dense north is divided into large districts.

From the 'British' point of view, this division is unbalanced when seen through the metaphor of the "large" having greater appetite than the "small." Thus, the principle of compensation for a low population with a large area pointlessly grants vast territory to the "weak" while it limits that of the "strong," who need of more space.

Senegal's Territorial Division in 1998: regions, districts (départements), and counties (cantons)



Consequences for urban hierarchies

The consequences of these different philosophies of territorial division for the shape of urban hierarchies are considerable if we consider that in the context of limited infrastructure and under-industrialization, the main cities (’chef-lieux') and towns pick up a disproportionate share of urban growth.

- The British tradition, by granting large hinterlands to the most important urban centers, leaves the urban network to freely develop a hierarchy according to “natural” laws. Thus, in the former British colonies, the urban network of secondary cities is more hierarchical than in the former French colonies. For example, in Ghana and Nigeria, large urban areas have emerged outside of the national capital.
- By contrast, the French tradition, by dividing the richest spaces, which are best adapted for the development of large urban areas, favors the multiplication of small, competing centers, in other words, of secondary cities of an equivalent stature. Thus in the former French colonies, the secondary cities struggle to develop a hierarchy among themselves. Over time, just as happened in France, this system ensures the supremacy of the national capital. However, a negative effect of this process is that it consolidates the primacy of the national capital over the secondary cities. For this reason, this primacy is much greater in the former French colonies than in the former British colonies (see tables in the “Country Sheets” section). This process can be seen on a global scale and not just in West Africa.

Thus, if we compare the distribution of agglomerations in Ghana with those of Senegal or Côte d'Ivoire, it is clear that:

- The distribution of Ghana is not tiered and has more in common with Zipf’s model than with Davis’s classes (see above);
- By contrast, the distributions of Senegal and Côte d'Ivoire show the strong primacy of the capital followed by a much less substantial secondary metropolis than in Ghana: Touba and Bouaké had 366,000 and 486,000 inhabitants respectively in 2000, compared with 1.3 million in Kumasi, in a country that also has a number of well tiered secondary urban areas with between 100,000 and 200,000 inhabitants.

These differences can be compared with upper-tier administrative divisions, which is unequal in Anglophone countries but equal in the Francophone countries.

To summarize:

(a)The main towns of administrative divisions ('chef-lieux’) have a strong tendency to influence the polarization process of urban growth;

(b) In a manner similar to the “Law of Metropolization,” they tend to attain a size proportional to their hinterland over time.

From which (a) + (b): the shape of the distribution of agglomerations is thus closely linked to that of the architecture of territorial divisions.

Implications

Strategies

To counteract the tendency toward concentration linked with entropy in the administrative division of a territory, various strategies can be envisaged:

▪The first consists of favoring the instability of divisions. According to this strategy, the territorial divisions are frequently brought into question. Their boundaries, number, and size are adjusted and the main urban administrative centers relocated. The risk here is of creating a severe decline in the 'chef-lieux' when they lose their administrative function. An extreme case was Abomey, when the capital of Dahomey (now Benin) was moved to Porto-Novo;

▪The second strategy consists of subdividing the existing grids. Current administrative centers will thus lose a part of their hinterland in favor of new centers, which are often former main towns for smaller administrative divisions. This strategy, adopted by most countries, is justified by demographic growth.

▪The third strategy consists of multiplying levels within the hierarchy of the administrative divisions so as to produce a diversified fabric of cities in terms of function and size.

Decentralizing reforms

The decentralization programs of the 1980s, which were supported by international donors, did not always consider the factors discussed above. Although it is still too early to observe their consequences for the evolution of urban hierarchies in Africa, conclusions could be drawn on from similar experiments conducted in other parts of the world. For instance, in Bangladesh, at the request of international financial institutions, the government promoted more than 400 localities to the status of "city" between 1974 and 1981.While these saw remarkable development, the brutal atomization of urbanization patterns led to a relative decline of the only two secondary metropolitan areas (Chittagong, Khulna) that could have counterbalanced the extreme primacy of the capital (Dacca). The consequence was a spectacular widening in primacy at the national level.

Similarly, in Sweden, the Hagerstrand reform (1966), which created 289 large municipalities, had the effect of accentuating the metropolization process and led to the relative decline of the urban regional administrative centers.

Looking forward, two options are available:

Favoring the multiplication of small urban areas

Widely distributed over the entire territory, urbanization moves closer to rural populations. However, the gap between the metropolis and the secondary cities is accentuated.

Favoring or protecting the fabric of existing agglomerations

Urban services remain more distant from rural areas, although some cities can hope to develop into regional metropolitan areas, with the infrastructure, services and functions of truly large cities (universities, airports, etc.), thus reducing primacy.

If a balance between these two policies is hard to maintain, changes in the territorial grid have been shown to be an effective tool. It is important that, as part of the decision making process, national and international actors consider the negative effects of each strategy. If the aim is to reduce primacy, this objective will not be achieved by multiplying small urban centers, but by helping the most successful secondary urban areas to develop.

5. MEASURING URBANIZATION IN NIGERIA

A unique case in West Africa

Nigeria is worth looking at separately for several reasons. Firstly, because this country alone contains more than half of the population of West Africa, half of its urban population, and nearly half of the agglomerations identified by the *Africapolis* project, the urban indicators from this single country weigh heavily on all other results. Secondly, as we pointed out above, Nigeria is the only country where real networks of old cities remain. Not only did several of these Nigerian cities already have more than 20,000 inhabitants in the 8th-10th centuries, but they are the only cities in West Africa to have continuously remained in the "urban" category throughout history. In fact, Yorubaland is the only region in West Africa to have a dense urban network comparable to Rhineland in Europe or Punjab in India.

A final and altogether different factor is that Nigeria has an especially poor statistical gathering system despite the fact that it is one of only two African countries, along with Ghana, where population censuses date back to the late 19th century, or more than 100 years before these were carried out in Francophone Africa. Although specialist opinion is divided over the quality of these old censuses, all agree that the last usable one was taken in 1952.

In effect, it is becoming clear that the 1963 census data are sometimes greatly overestimated. Moreover, the degree of overestimation varies considerably from one region or city to the next. The cumulative effect of these overestimates can be seen on a national level through the extraordinary population growth rate projected on the basis of that census: + 82% in the 11 years between 1952 and 1963. While it may be argued that this was due to underestimates in the 1952 census, when the data from the 1931 census are examined, it becomes apparent that the 1952 census had in fact already made overestimates. There seems to be a long-running tradition of inflating the numbers from Nigeria's censuses.

The second method for evaluating the extent of the overestimates is to examine the age pyramids from the 1963 census. Cheating is one thing, but discreetly manipulating the figures is something else. For example, in 1963, the fictitious population was curiously homogenous, namely, young men between 20 and 45 years of age. In addition, the over-representation of this population category in almost all regions reached such unrealistic proportions that the population figures were ultimately rejected by the scientific community.

The 1973 census was officially annulled and no results were published. Starting in 1975, Nigeria's statistical services sent a list of cities with over 100,000 inhabitants to the UN's *Demographic Yearbook*. The method used for making estimates was highly simplified: one common annual growth rate – the supposed annual growth rate for Nigeria – was applied to all cities. To make matters worse, the growth rate in question was based on faulty census results.

Given the distortions in the age pyramid, we reanalyzed the 1963 figures in an attempt to make them more realistic. The method consisted of removing from the age pyramid of each census district the number of fictitious men who had been added, and then to use this coefficient to weigh the cities in the census district. Although the method is clearly quite crude, at least the results obtained are less inaccurate than the official data.

Population figures from various sources are presented in the following table, which compares the tentative data and the final data (1952d) from the 1952 census (1952p column), figures from the 1962 pre-census (1962p), and the final results from 1963 (1963d) with the estimates adjusted using the method described above (1963c).

Nigeria's largest cities in 1952 and 1963

	1952p	1952d	1962p	1963d	1963c
Lagos	267.5	272.0	450.4	665.3	542.1
Ibadan	459.2	459.2	555.9	627.4	426.8
Ogbomosho	139.6	139.6	225.5	319.9	268.3
Kano	111.4	127.3	224.3	295.5	255.3
Iwo	119.6	119.6	168.7	239.3	200.7
Oshogbo	122.8	122.8	147.3	208.9	175.2
Ilorin	41.0	41.0	179.1	208.6	171.6
Abeokuta	84.5	84.5	166.3	187.3	167.5
Port-Harcourt	65.0	71.7	158.7	179.6	152.0
Ilesha	72.1	72.1	110.8	165.9	145.5
Onitsha	80.5	77.0	165.0	163.1	152.6
Iwo	100.1	100.1	111.8	158.6	133.0
Ado-Ekiti	24.7	24.7	111.6	157.6	142.7
Mushin	32.1	32.1	94.0	150.1	114.7
Kaduna	42.2	38.8	115.3	150.0	114.3
Maiduguri	56.8	56.8	100.3	140.0	110.2
Enugu	53.1	62.8	111.0	138.5	122.6
Ede	44.9	44.9	94.9	134.6	112.9
Aba	56.1	57.8	132.5	131.1	117.7
Ife	110.8	110.8	96.7	130.1	103.0
Ila	25.8	25.8	85.3	114.7	90.8
Oyo	72.2	72.2	89.7	112.4	95.4
Ikere	35.6	35.6	76.0	107.3	97.1
Zaria	47.9	54.0	82.0	103.7	90.4
Benin City	53.8	53.8	108.8	100.7	89.1

Nigeria's statistical services and the UN both continued to overstate Nigeria's population growth, estimating an average rate of 3% per year, which is the "normal" rate for developing countries.

In this context, results from the 1991 census sparked a heated debate when population figures more than 30% below what was expected were announced. Once again, the results were annulled and only a few tables were published, with population per state and per Local Government Area (LGA) – the rough equivalent of an *arrondissement* of France's *départements* or of a US *county* – followed by a list of cities whose population figures were incoherent. For example, some cities had a higher population than the LGA in which they were located. The announcement of the provisional results of the 2006 census took place in much the same way. Before they were even published, most media had already declared them invalid.

Federal Nigeria thus developed a structural problem as ethnic groups found themselves competing over the redistribution of oil profits and political representation, with each group, city, community, or state having something to gain from artificially inflating its population because this translated to a higher number of political representatives.

The morphological method of analysis we applied to identify urban agglomerations (discussed in the next paragraph) confirms these cases of overestimates and leads us to greatly revise estimates of the size of cities. Superimposing the map of LGAs with satellite images shows that the 2006 census also contains some serious cases of fictitious populations, especially in the far north, in the Yoruba region, and in some areas of the Niger river delta. However, data on Lagos and some other regions appears to be accurate.

For close to half of the smaller cities, the estimates we were able to reach in 2006 do not match the supposed population size in 1963. According to the 2006 census, the country contained 140 million inhabitants. In reality, it probably does not even contain 100 million. Even so, this country easily keeps its position as Africa's demographic giant.

Using morphology as an approach

The absence of a recent and coherent corpus on the basic units of Nigeria's population led us to develop a systematic approach rooted in morphology. This approach was later applied to the entire region under study.

Available data

- 2006: Only the number of inhabitants per LGA in 2006 – or 774 units ranging from 12 km² to more than 10,000 km² – was published at the time of this study. No data on local units (cities or villages) were available. We managed to obtain from Nigerian secondary sources local data for 440 units with more than 5,000 inhabitants, but these are tentative and have not been verified or validated.
- 1991: In the 1991 census, only data on LGA populations were published. However, because LGA boundaries were revised between 1991 and 2006, these results are incoherent and offer nothing more than statistical noise, and were therefore excluded.
- 1973: The 1973 census was invalidated and remained unpublished.
- 1963: We have population figures for 2,113 local units with more than 5,000 inhabitants in 1963 (with both agglomerated and dispersed populations). Moreover, 1,164 of these units contain precise geographic coordinates. This information was supported by the Gazetteer of 22,000 villages. However, these reference populations have been adjusted (see above).
- Lastly, we had population data for 288 units of more than 5,000 inhabitants in 1952 as well as population data for all cities and villages in 1911 (excluding the Northern protectorates). By combining[12] these data, we produced series on three dates for 99 units (2006, 1963, 1952) and on two dates each for 184 units (1952 and 2006) and 265 units (1963 and 2006).

The morphological approach and taking density into account

In order to complement these highly incomplete data, we used satellite images from *GoogleEarth*. We did a systematic search for agglomerations with more than 5,000 inhabitants in 1953. The purpose was to verify the existence and location of these agglomerations and to determine their current perimeters. This enabled us to build a digital cartographic base of 833 agglomerations, in full confidence that their agglomerated nature is real.

These agglomerated areas were then compared to local units for which we had 2006 population data as well as more or less complete time series. Thus we were able to develop a density model adjusted by region that enabled us to compose a series of 833 agglomerations with their populations in 2006, 1963, and 1952.

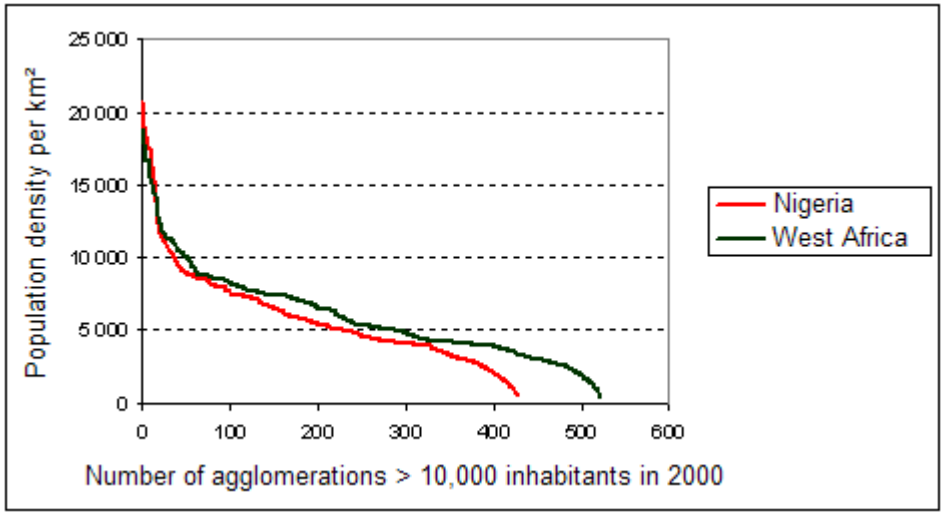
The density approach reveals the discrepancies in the census figures detailed above. These figures clearly demonstrate the logic behind the over-evaluation of populations, which can occur on two levels, either by simply manipulating data with upward revisions or by tallying on the level of local units populations dispersed across areas much larger than the actual agglomerations. Crossing these two types of information – the physical extent of cities and the available population data – clearly therefore verifies the reliability of the source.

[12] The *Africapolis* database shows standardized regionalization for the 1950-2000 period. This was needed for comparisons over time given changes in administrative divisions over this period.

The density model was subject to regional comparisons, which were carried out by considering urban extensions throughout the area under study. Given the observed morphologies, it is no longer possible to claim that Nigerian cities are more than twice as dense as the other cities under study in West Africa.

The distribution of Nigerian agglomerations with over 10,000 inhabitants thus obtained (see the diagram below) can be compared to that of other agglomerations in West Africa about which we have more reliable population data as well as up-to-date data on agglomerated areas. Put differently, while these estimates could be disconfirmed by specific data from surveys or a valid census, all the population figures on Nigeria's agglomerations proposed here and arrived up via a clearly explained method are generally reliable. Certainly, they are vastly more reliable than the official numbers obtained from censuses.

Distribution of agglomerations with over 10,000 inhabitants in Nigeria and West Africa in 2000



The morphological approach and high-resolution densities

High-resolution images are available for numerous cities. These can be used to make close density estimates as they enable us to count with precision the number of inhabited units and the number of habitations per square kilometer. In this study, these calculations took into account the dwelling types identified in our survey of field data and in studies of specific cities. In sum, this approach made it possible to determine the number of inhabitants in the largest cities as well as the margin of error in the adopted method.

Warri (Niger River Delta)

Dense habitat without high-density zone in the center. Image showing 9,000 inhabitants/km².
Average agglomeration density: 5,100 inhabitants/km².

Kaduna (Kaduna State)

Highly dense habitat. Image showing 30,000 inhabitants/km². Average agglomeration density: 8,720 inhabitants/km².

Abuja (capital of Nigeria)

Planned multi-level habitat. Image showing 10,000 inhabitants/km². Average agglomeration density: 5,030 inhabitants/km².

Enugu-Ezike

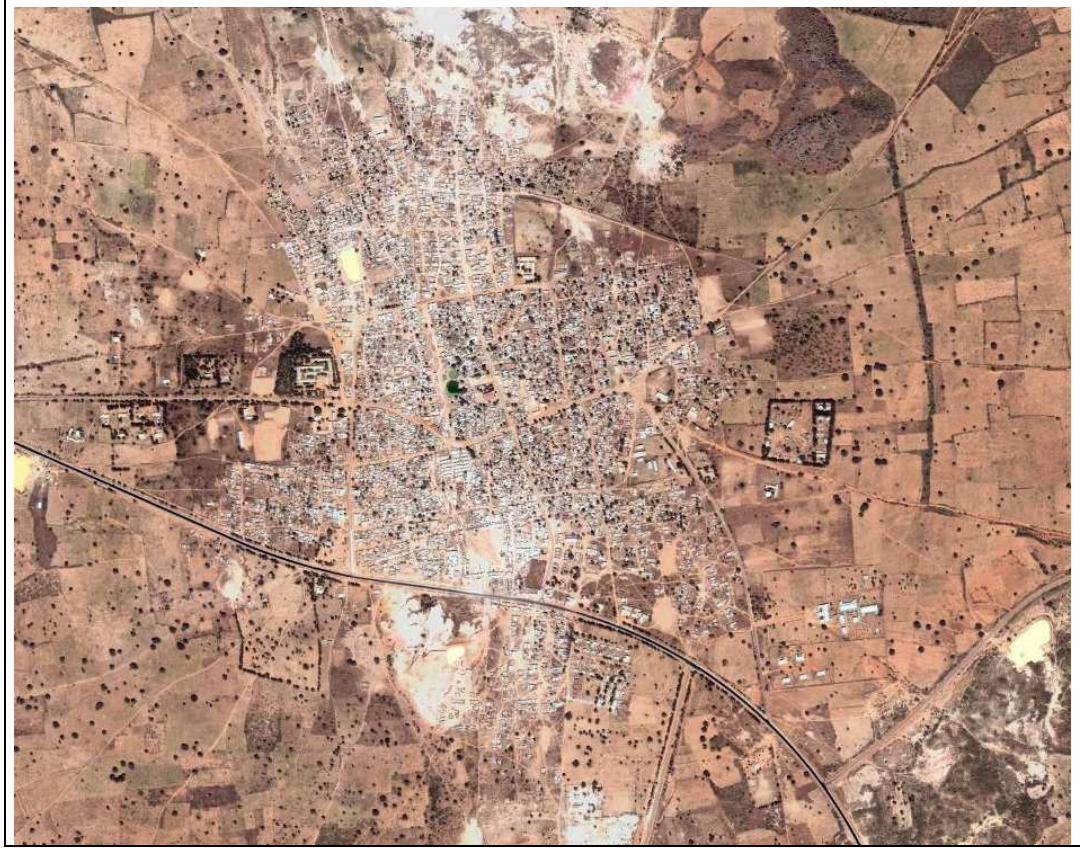
Rural agglomeration in an area with multilinear habitat in the Anambra region, Enugu and Ebonyi.
Average agglomeration density: 5,000 inhabitants/km².

Dutse (administrative center of Kano-Jigawa LGA)

Average agglomeration density: 7,200 inhabitants/km².

Reconciling data and adjusting overestimates using density

Comparing different census data has already revealed several discrepancies that explain the successive overestimates as well as the variable size of tallying areas. For example, some cities had only marginally more and sometimes far fewer inhabitants in 2006 than in 1963. These cases of inaccuracies are systematically confirmed by morphological examination. A few examples of discrepancies between the number of inhabitants in 2006 and/or population variation between 1963-2006 and the size of the agglomerated area obtained through satellite images between 2002 and 2008 are presented below to illustrate our case.



Dukku (Gombe region -- Administrative center of LGA)

29,100 inhabitants according to 1963 census.

26,500 inhabitants after adjustment (see above)

16,961 only in 2006.

According to an image taken in November, 2002, the Dukku agglomeration covers an area of 3.5 km². A population of 16,961 inhabitants translates into a density of 4,860 inhabitants per km². This entirely coherent result was retained and the historical population of the area was adjusted, which means there were only 2,880 inhabitants in 1963.

It is probable that the 1963 figures were not only overestimated, but also that the population number included an administrative perimeter that went beyond the “city” and took in nearby villages, hamlets, and other diverse outlying habitats.

Song

Song is the administrative center of an LGA. The earliest population figures are from 1963 (8,400 inhabitants according to the census, lowered to 7,910 after adjustment). Today, the city covers an area of 3 km².

Given the type of habitat and the urban densities observed in the Adamawa and Taraba region, there can be no more than 6,000 inhabitants per km². The population must therefore be around 18,000.

Given the urban growth observed in the region, this also means that the 1963 population was greatly overestimated and should have been closer to 3,600 inhabitants rather than 7,900.

As in the previous example, this overestimate appears to be due to the fact that these census figures refer to administrative perimeters listed under the “city” category, but that go well beyond the actual agglomeration itself.

Kalgo

Kalgo is the administrative center of the LGA that combines the regions of Sokoto, Kebbi, and Zamfara. The land size of the agglomeration is extremely tiny: 1.4 km² in 2000.

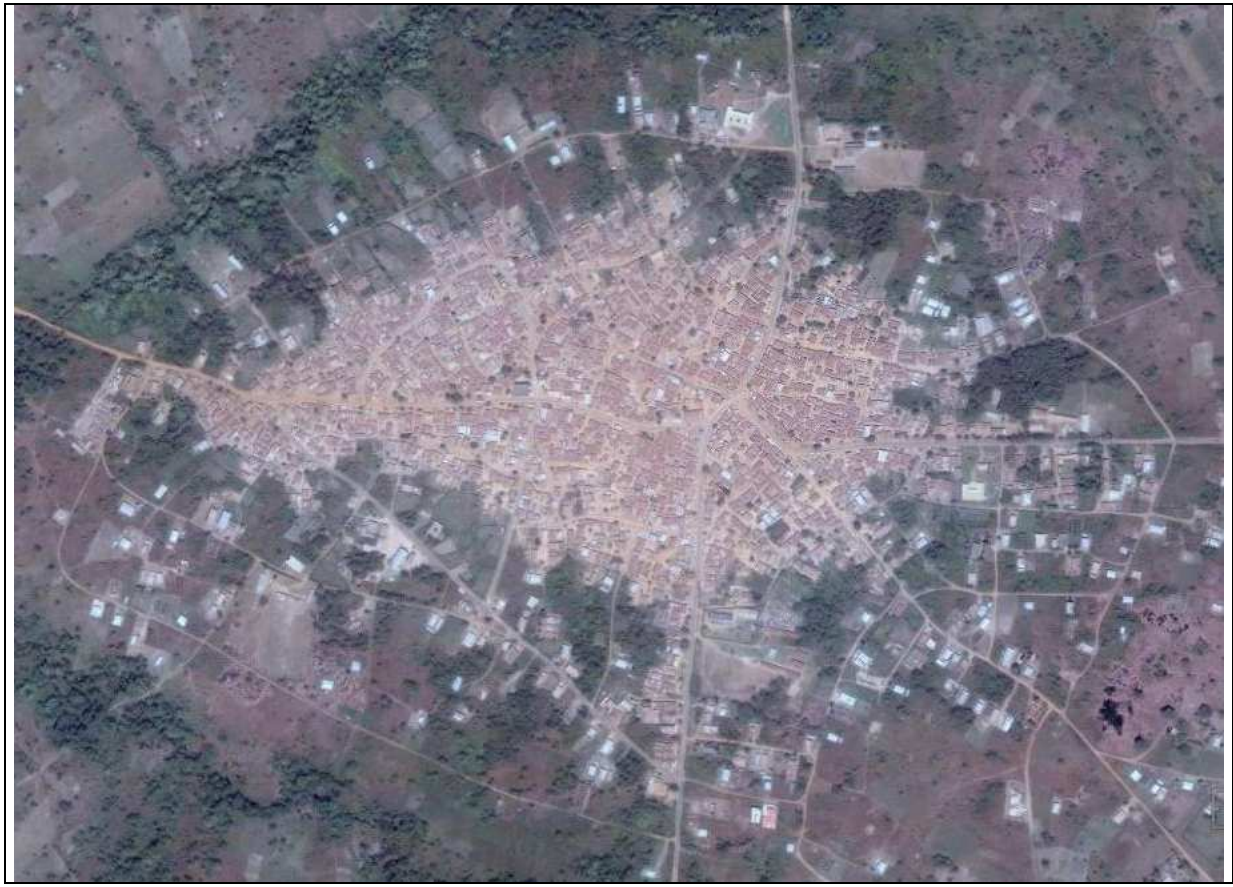
However, Kalgo was reported to have 9,500 inhabitants, which was reduced to 9,480 after adjustment. There are two explanations for what occurred: either fictitious populations were added to all categories and not only to men between 20 and 45 years of age (see above), or, more probably, the 1963 figures cover an extended administrative perimeter.

Given regional trends, we assigned a population of 12,150 inhabitants and reduced the 1963 population of the agglomeration to 4,500.

The historical center of Kalgo

The image depicts an area 150 meters wide.

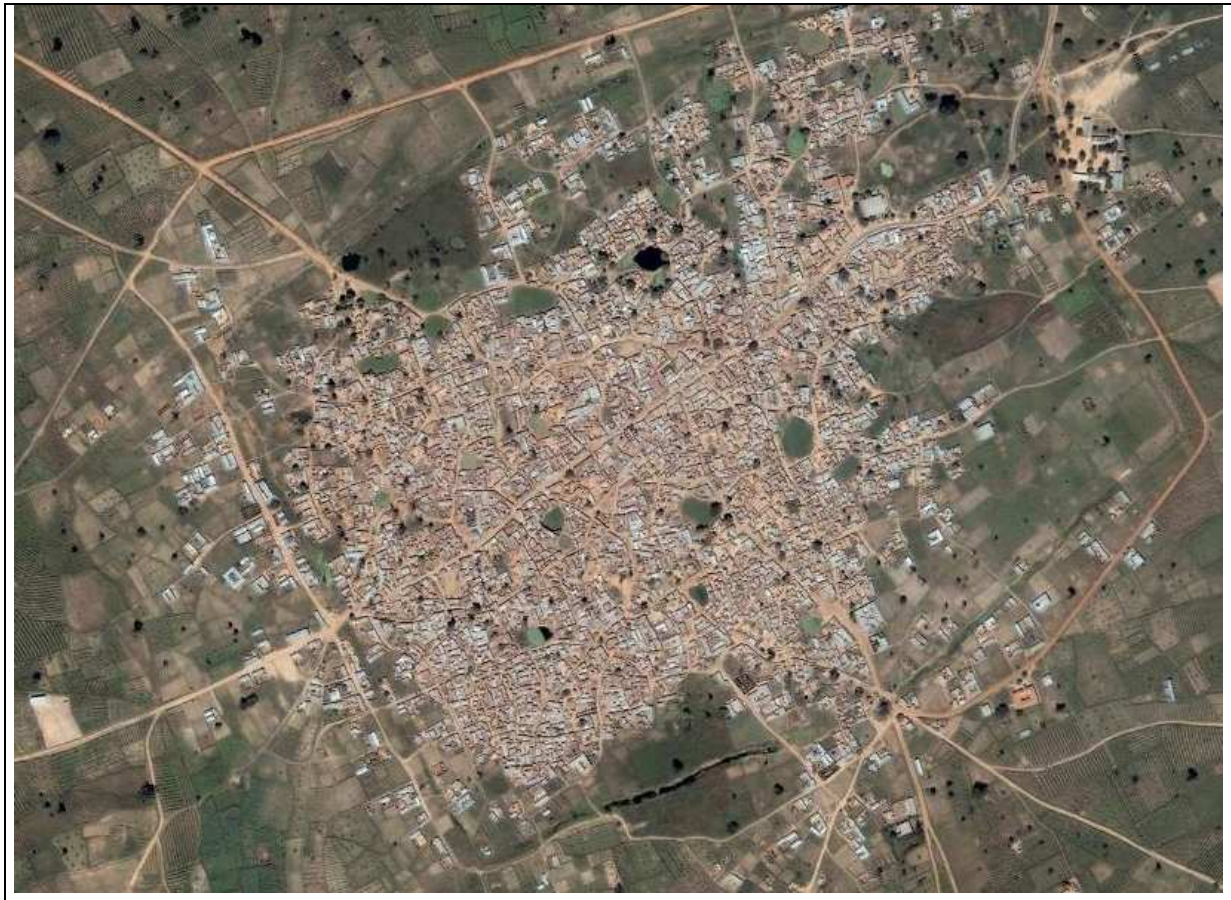
Kalgo is the archetype of agglomerations where there is no ambiguity regarding current land area or urban dynamics. Detailed observation clearly reveals an old center, a historical nucleus from which the population has extended very little since 1963, as well as more recent extensions..



Out

Otu is a small agglomeration in the Oyo region. It covered 3.3 km² in 2006. It had 10,400 inhabitants according to the 1963 census, and 8,825 after adjustment.

This result seems plausible and corresponds to a town of roughly 16,450 inhabitants in 2006, with a density that matches that of other cities in the region.



Maska

Maska is the administrative center of an LGA in the Katsina area. It barely measures 600 meters across, and covers .08 km². Note the presence of numerous empty spaces as well as living areas structured around dominant courtyards.

An agglomeration of this size cannot possibly have contained 9,600 inhabitants in 1963 (9,295 after adjustment).

We looked at the average, already quite high urban densities in the Katsina-Sokoto region (9,000 inhabitants per km²), and calculated that this area had a population of 6,840 in 2006 and 1,300 in 1963.

This is one of the regions, along with Kano, where we see the most glaring population overestimates in 1963. This overestimates are certainly not unrelated to the extreme politicization of Nigerian census data since independence and the political hegemony of the North. Aberrant cases abound here.

The number of inhabitants in these units has been continuously inflated due to early overestimates.

Miga

Miga is the administrative center of an LGA in the Kano area. This city is not one of the agglomerations of more than 5,000 inhabitants we included in the final Africapolis database.

The agglomeration is barely 450 meters across and covers an area of .5 km².
It most likely contains no more than 3,000 inhabitants.

Summary of results

In total, the dataset of morphological agglomerations in Nigeria includes 833 units, identified using recent satellite images (2000-2008). The largest is Lagos (9,650,000 inhabitants over an area of 1,030 km²) and the smallest is Bornu Yessu (1,260 inhabitants over .28 km²). Overall, 136 agglomerations have at least 5,000 inhabitants, 216 have between 5,000 and 10,000, and 480 have more than 10,000. This dataset includes a near-exhaustive list of agglomerations with over 10,000 inhabitants, but not of agglomerations with smaller populations because we lack recent census data on all inhabited areas (such as lists or village records) that would enable us to identify smaller morphological agglomerations.

Comparison between UN estimates and the Africapolis base for 1963 and 2006

In considering agglomerations with over 20,000 inhabitants, the UN Department for Economic and Social Affairs suggested an urbanization rate of 49% in 2006 compared to the *Africapolis* estimate of 30%.

The main difference between the *Africapolis* data and the United Nations estimate (http://esa.un.org/wup) is that the latter takes into account all population units with at least 20,000 inhabitants (*Towns with 20,000 inhabitants or more whose occupations are not mainly agrarian)* and uses the 1952, 1963, and 1991 censuses as references. Thus the UN data set, based solely and uncritically on old data that, as we have seen, is incoherent, over-represents the lower tiers of the urban hierarchy (cities with between 20,000 and 40,000 inhabitants).

The UN projections and adjustments are not backed by any reference other than census data, unlike the *Africapolis* base, which is rooted in verifying the material existence of these agglomerations in 2000-2006. In effect, the UN approach is purely statistical.

This approach consists of analyzing local units indiscriminately without attempting to compare the data across censuses. Had this type of analysis been carried out unit by unit, it would have revealed numerous discrepancies. In fact, the gap between the UN and the *Africapolis* data widens over time. For instance, the gap between the two indicators of total urban population increases from 20% to 39% between 1963 and 2006. In practice, 75% of the gap identified for this indicator in 2006 can be explained by the increasing weight of populations in units with fewer than 500,000 inhabitants, whose number t is not given in the UN database.

By contrast, we present a verified agglomerated population tally for 2006. This is supported by data on morphological agglomerations and reverse projections according to the earlier, plausible data available to us. While a few small agglomerations may have escaped our attention, the *Africapolis* database contains an exhaustive list of agglomerations with more than 20,000 inhabitants. Simple omissions cannot explain a gap of 20,000,000 people. Thus it seems evident that the UN data set groups scattered, rural populations under the “urban” category.

In fact, the model used by UN economists aims principally at adjusting the urbanization rate to fit trends in global population for any given urban population. Projections thus iron out any discrepancies. Perhaps the overall figure for the Nigerian population should be called into question since it has obviously been overestimated. This, however, goes beyond the framework of this study.

Comparison of urbanization indicators for Nigeria: UN versus Africapolis estimates

Indicators of urbanization in Nigeria: UN estimates

Unit size (in inhabitants)	1963			2006			Annual rate
	Population	Number of agglomerations	% urban	Populations	Number of agglomerations	% urban	
5 à 10 millions	0	0	0.0	9 091 379	1	13.2	
1 à 5 millions	1 060 418	1	11.2	9 864 585	6	14.3	
500 000 à 1 million	668 000	1	7.0	8 901 954	14	12.9	
500 000 à 20 000	7 770 000	not specified	81.8	41 070 138	not precised	59.6	
TOTAL URBAIN	9 498 418		100.0	68 928 056		100.0	4.7
TOTAL POPULATION	55 660 000		17.1	140 000 000		49.2	2.2

Indicators of urbanization in Nigeria: Africapolis data

Unit size (in inhabitants)	1963			2006			Annual rate
	Population	Number of agglomerations	% urban	Population	Number of agglomerations	% urban	
5 à 10 millions	0	0	0.0	9 650 000	1	22.9	
1 à 5 millions	0	0	0.0	8 500 000	5	20.2	
500 000 à 1 million	2 391 177	3	31.7	3 030 000	5	7.2	
500 000 à 20 000	5 143 957	93	68.3	20 921 255	262	49.7	
TOTAL URBAIN	7 535 133	96	100.0	42 101 255	273	100.0	4.1
TOTAL POPULATION	50 598 830		14.9	140 000 000		30.1	2.2

The weight of Nigeria in West African urbanization

The *Africapolis* data not only enable us to revise the figures to a more realistic level, but also to compare Nigeria with other countries in the region.

The evolution in the ranking of West African agglomerations between 1950 and 2000 is indicative of increasing urbanization outside Nigeria. In other words, it shows the relative decline of this historical bastion of urbanization.

While Lagos maintains its supremacy in size over all other agglomerations on the sub-continent, the national capitals of other countries have come to be viewed as major hubs in the West African urban landscape.

Their growth has been faster than that of the old network of Nigerian cities. For instance, Lagos has grown to the detriment of Ibadan, whereas Conakry, Lomé, Cotonou, Monrovia, Ouagadougou, Niamey, Nouakchott, and to a lesser degree Bamako and Abidjan have consolidated their position among the 20 largest agglomerations in West Africa. In all locations, the building of nation states has been accompanied by a metropolization dynamic marked by the primacy of capital cities, with the exception, due to civil war, of Sierra Leone.

Evolution in the rankings of 20 of West Africa's largest agglomerations (as of 2000) between 1950 and 2000

Name of agglomeration	ISO	Population 1950	Population 2000	Rank 1950	Rank 2000	Change
Lagos	NGA	290 539	8 052 958	2	1	1
Abidjan	CIV	89 423	3 147 499	8	2	6
Accra	GHA	162 401	2 515 556	4	3	1
Ibadan	NGA	521 342	2 489 974	1	4	-3
Dakar	SEN	253 306	2 257 317	3	5	-2
Kano	NGA	92 394	1 855 340	7	6	1
Kumasi	GHA	93 413	1 291 472	6	7	-1
Conakry	GIN	38 500	1 249 209	30	8	22
Bamako	MLI	56 525	1 153 522	16	9	7
Lomé	TGO	38 904	1 030 000	29	10	19
Kaduna	NGA	27 739	1 029 918	47	11	36
Cotonou	BEN	21 000	911 319	61	12	49
Ouagadougou	BFA	35 481	906 089	35	13	22
Port Harcourt	NGA	78 061	883 919	9	14	-5
Benin City	NGA	49 081	848 162	20	15	5
Monrovia	LBR	22 900	774 215	54	16	38
Freetown	SLE	73 428	717 044	11	17	-6
Ilorin	NGA	31 604	666 031	40	18	22
Niamey	NER	13 830	647 341	85	19	66
Nouakchott	MRT		558 195	n.d.	20	

Name of agglomeration	ISO	Population 1950	Population 2000	Rank 1950	Rank 2000	Change
Ibadan	NGA	521 342	2 489 974	1	4	-3
Lagos	NGA	290 539	8 052 958	2	1	1
Dakar	SEN	253 306	2 257 317	3	5	-2
Accra	GHA	162 401	2 515 556	4	3	1
Oshogbo	NGA	115 112	306 047	5	33	-28
Kumasi	GHA	93 413	1 291 472	6	7	-1
Kano	NGA	92 394	1 855 340	7	6	1
Abidjan	CIV	89 423	3 147 499	8	2	6
Port Harcourt	NGA	78 061	883 919	9	14	-5
Abeokuta	NGA	74 612	312 528	10	32	-22
Freetown	SLE	73 428	717 044	11	17	-6
Ife	NGA	72 197	332 845	12	30	-18
Oyo	NGA	68 636	261 743	13	38	-25
Onitsha	NGA	67 999	325 022	14	31	-17
Ilesha	NGA	63 461	238 519	15	40	-25
Bamako	MLI	56 525	1 153 522	16	9	7
Enugu	NGA	55 607	377 911	17	27	-10
Owerri	NGA	54 559	371 537	18	28	-10
Aba	NGA	50 793	413 464	19	24	-5
Benin City	NGA	49 081	848 162	20	15	5

Evolution in the rankings of 20 of West Africa's largest agglomerations (as of 1950) between 1950 and 2000

The rise in the ranking by large cities in the interior of Nigeria such as Kaduna reflects the relative demographic strength of the highly-ranked northern urban areas, which appear to have withstood better than other regions the growing pull of the South, which is sustained by a deliberate policy of industrialization. Relatively speaking, it is the old, dense network of Yoruba towns that is the most affected negatively by the development of Lagos.

In 1950, the urban network of Nigeria consisted of 72 agglomerations with over 10,000 inhabitants (60% of the total) and accounted for 64% of West Africa's urban population. By 2000, it included no more than half of the urban population, with 474 agglomerations (46% of the total). In 2020, it should still contain 49.5% of the urban population, with 565 agglomerations (39% of the total). Thus Nigeria will most likely keep its place atop the urban hierarchy whereas elsewhere we should see the more rapid growth of new agglomerations of more than 10,000 inhabitants.

The weight of the Nigerian urban system is thus keeping the country firmly anchored atop the urban hierarchy of West Africa. In 1950, 40 of the 100 largest agglomerations in West Africa were Nigerian compared to 56 in 2000. Beside the consolidation of national metropolitan areas, the phenomenon that has most counterbalanced the supremacy of the Nigerian urban network has been the proliferation of small and mid-sized cities throughout West Africa.

Summing Up and Looking Forward

Validity of the Projections

Unlike the data and urban indicators presented in this study for the period 1950- 2000, projections for 2010 and 2020 are by their very nature unverifiable. Empirically speaking, they will not be verifiable for another 20 years or so. A few remarks are therefore necessary for the data to be properly interpreted.

First, compared to earlier studies – especially the *WALTPS* study, which can be considered the most comparable to the *Africapolis* study in terms of methodology and approach – the *Africapolis* projections are much shorter since the *WALTPS* study antedates the *Africapolis* study by 15 years. Moreover, as regards Nigeria, the *WALTPS* study is based on figures from the 1963 census that were overestimated and obsolete by the 1990s due to rapid demographic growth in the country. Yet the population of Nigeria makes up more than half the population of West Africa, so much so that in the calculation of regional indicators, it is weighted as much as all the other countries in the region combined.

The *Africapolis* projections can therefore be considered more reliable because:

- Most of the data for the year 2000 calculated by Africapolis are not the result of projections, but rather of interpolation and are therefore already verifiable. When the data do result from projections, these projections are short and therefore relatively reliable. For example, the latest censuses from Côte d'Ivoire and Mali date back to 1998 only.
- Similarly, for 2010, the projection is sometimes quite short, as in Burkina and Nigeria, where the latest censuses were conducted in 2006.
- For longer projections, the second parameter to take into account is the slow contraction of global demographic growth. Barely noticeable when it began by 1990, the trend has since become more apparent, so much so that demographic growth should gradually fall from 2.95 in 1985-1990 to 2.11 in 2015-2020 (http://esa.un.org/unup/p2k0data.asp).

Based on the census figures used for this study, we believe that these growth rates are still overestimated by the global statistical models used by the UN. What we do know is that this contraction is mainly due to a decrease in birth rates, specifically in large and medium-sized agglomerations, which represent a considerable proportion of the urban population. To offset this contraction in population growth in the largest cities, rural exodus would have to accelerate. Instead, it is in the process of petering out, and in some areas, of reversing. As we have shown, this has caused the proliferation of small agglomerations *in situ*.

A modest increase in the urbanization rate but high urban growth

In absolute terms, the projections made by the *Africapolis* project are markedly lower than those presented in other sources. This difference is evident in the urbanization rates in West Africa, which according to *Africapolis* should reach 33.6% in 2010 and 34.6% in 2020 compared to 44.6% and 50.5%, respectively, according to UN/ESA (http://esa.un.org/unup/p2k0data.asp).

The modest increase in the urbanization rate predicted by the present study by no means implies weak urban growth. In fact, according to the *Geopolis* definition of urban agglomeration, 481 new agglomerations will cross the threshold of urban between 2000 and 2020. By then, West Africa will have as many agglomerations as North America. In 2020, the urban population of the 16 countries of the region will thus reach 124 million inhabitants compared to 74 million in 2000. **Thus 50 million additional urbanites are excepted, a number equivalent to the entire urban population of West Africa in 1990.** In other words, in only 20 years, the urban population increase alone will be comparable to the level of urban population reached in 1990, following several centuries of growth. Although the urban population growth rate is slowing, this is offset by the increase in population stocks, and around 2.5 million additional urban people per year must therefore be expected.

Even if the projections based on the *Africapolis* database provides lower urbanization rates than those generated by the UN database, it does not follow that urban growth in Africa will be weak. **On the contrary, its rate will remain one of the strongest, perhaps t*he* strongest growth rate in the world.** West Africa surpasses its own historical record every day in the number of agglomerations as well as its urban population stocks. Similarly, every day, the size of large agglomerations radically alters the urban dimension of local societies in terms of demographic scale and agglomeration's footprint.

Contradictions among standard reference sources

In considering whether the predictions made by the *Geopolis* method are more or less realistic than those of other studies, it is useful to note one of the major contradictions among the global models used by international institutions. We saw in Chapter 3 that these models have a tendency to overestimate the population of large agglomerations at the expense of small ones. Since the birth rate is falling fastest in large agglomerations, this overestimation should lead to predictions of a deceleration in the urbanization rate, in part as a result of population growth in rural areas, where the birth rate is falling more slowly. Yet, the UN forecast suggests precisely the opposite scenario, a prediction that defies logic.

Whether a comprehensive prediction is likely to prove realistic can also be evaluated on the basis of disaggregated statistics for statistical units. In the case of the urban population, these units are the urban agglomerations scattered across a territory, and these can be seen to be increasing in number. Thus a correct prediction must not simply show that the population figures and percentages will rise. They must also indicate where the new individual agglomerations responsible for the increase will emerge. Let us assume that the urban population increase of 70 million predicted by the UN models in 2020 is evenly distributed across agglomerations' size categories. This would lead to almost 20 million inhabitants living in new small agglomerations, or the equivalent of some 2,000 agglomerations of 10,000 inhabitants. Moreover, once these figures are accepted, this new urban population must still be located correctly on the map.

The morphological approach: is the accepted definition of "urban" too strict?

Unlike the *WALTPS* study and the UN/ESA database, the *Africapolis* results depend on a standardized definition of "urban."[13]

The debatable point is therefore the definition itself, that is to say, the minimum threshold to classify an agglomeration as "urban" and the morphological criteria defining the boundaries of "built-up" areas. Although both of these aspects were discussed above, we still need to assess the extent to which this definition could minimize the number of individuals in the urban population as well as the urbanization rate.

First, the urbanization rate obviously increases as the minimum urban threshold is lowered. By virtue of the Paretian character of the hierarchical distribution of human settlements, the number of agglomerations increases geometrically. Thus, since there were 571 agglomerations with between 10,000 and 20,000 inhabitants in 2000, there should be as many with between 5,000 and 10,000 inhabitants. In fact, there are many more because the distribution curve flattens considerably below 7 000-8,000 inhabitants, so that below this threshold, more and more rural populations are incorporated. *Africapolis* counted 899 agglomerations with between 5,000 and 10,000 inhabitants.

By lowering the urban threshold to 5,000 inhabitants, 6,300,000 million additional inhabitants are at a stroke introduced into the urban population, bringing the urbanization rate to 34.5%, up from 31.5%. Although this threshold clearly appears too low for the majority of agglomerations in West Africa, it would lead to an urbanization rate of the order of 38% in 2020, still far from the 50.5% predicted by the UN.

Second, the morphological definition of "urban" based on a distance of 200 meters between buildings may be too restrictive. It would certainly be useful to test for different distances (50 meters, 500 meters, etc.) and to apply these to all of West Africa. With a higher distance threshold, the urban areas would be vaster and they would integrate larger populations. Others would merge (for example Bamako and Kati), which from an urbanization rate perspective, would lead to a zero sum game. However, it is important to note that the expansion of an urban area does not substantially increase the size of the agglomeration except in very densely populated areas and where the habitat is dispersed. This potential change in the definition criteria significantly alters the data in the Asian deltas or, in Africa, in the Nile Valley. However, in West Africa, very few regions follow this pattern outside the Niger Delta and its eastern hills.

Finally, if the tendency in developed countries is to replace the morphological approach with one based on daily mobility (see Definitions, Part 1, Chapter 2), can the same approach be considered in Africa? From a technical perspective, this must be ruled out because no country in the region offers *ad hoc* sources. Even if it is likely that research on work-to-home mobility (commuting) will be carried out in the coming years, this will not permit the study of current or past phenomena. Moreover, this approach is still disputed by many researchers on the grounds that, in most countries where it was adopted, it helped mask a historic change in population dynamics, namely, the crisis of the city to the benefit of the suburban areas.

Although the urban mobility approach completes the morphological approach, it does not substitute for it. In fact, on the scale of human history, urbanization remains fundamentally a process of concentration. It therefore results in centripetal movements: if this were not the case,

[13] The UN is a multilateral organization that reproduces the official data provided by the statistical services of each member country based on definitions that are not standardized across countries. By taking into account agglomerations with more than 5,000 inhabitants, the *WALTPS* database is more uniform, but it does not account for morphological agglomeration phenomena.

there would be no agglomerations on the surface of the earth. In developed countries, peri-urbanization is still fundamentally regarded as the result of centrifugal movements. There is therefore, if not an urbanization crisis, a crisis in representations of the urban. Thus, if peri-urbanization must be considered a form of urbanization, it follows that at some point in recent history, a profound transformation took place in western societies to the point of reversing the process of urbanization.

Even if these hypotheses are validated in the rich countries of the West, it remains to be proved that the process is – or will be – identical in West Africa. In addition to the absence of data, which makes delimitations of peri-urban zones in West Africa improbable, the integration of peripheral populations in the "urban" category, which would increase both the population in this category as well as the urbanization rate, remains highly controversial. Overall, the approach seems a largely fanciful transposition to Africa of a Western model.

Global comparisons

Unlike developed countries (Part 1, Metropolization chapter), urban systems in West African countries are still in the process of forming: growth rates are low, the number of agglomerations is stable, and permutations in the hierarchical ranking are not very noticeable. Even when the urban system is developed and organized into a hierarchy as in Ghana and Nigeria, the growth rate is high enough for new large cities to come into existence very rapidly. Thus, the new capital of Nigeria, Abuja, like Brasilia or Ankara, is set to become a real metropolis, outranking numerous older cities. Such phenomena do not occur anymore in developed economies, and are less probable in the intermediate countries of Latin America or the Gulf, where local urbanization rates are now very high (between 705 and 805 in Brazil, Argentina, Saudi Arabia, Venezuela, Uruguay, etc.)

To fully grasp the challenges of urban change in Africa, it is useful to remember that while the urban population of West Africa will increase by 25 million per decade that of European countries and Japan will stagnate or even decrease during the same period. In all, 25 million additional people will have to be fed and provided for during periods of crisis linked to speculation affecting agricultural commodities and the patenting and privatization of non-reproducible seeds (Moriconi-Ebrard, 2001).

To estimate the West African urbanization rate in 2020, it would be useful to compare it to the rate in other regions of the world, remembering that the level of urbanization of a country is not uniquely correlated to its level of wealth (Moriconi-Ebrard, 1993, Chapter 1.3). Rather, it also depends on factors such as population density, agricultural structures, and population levels. Thus Ireland and Denmark, the two richest countries in the European Union after Luxembourg, have an urbanization rate barely above 50%, while other, less wealthy countries surpass 75% (Spain, Belgium, United Kingdom, etc.).

Thus, the urbanization rate does not increase automatically with development. Culture and local traditions also exert a considerable influence on lifestyles. Just as Ireland or western France are sparsely populated and have low urbanization rates compared to Mediterranean regions, the populations of West Africa may be less "urbanizing" than their South American or Arab counterparts.

Among possible explanations are: attachment to the land and the community of origin, the importance of nomadism, the influence of social and economic structures based on small population units, as well as linear population models that do not necessarily lead to models of intense

urbanization. This has also been reinforced by political forces, as in Sekou Toure's Guinea, or nostalgic western writers cultivating representations of a rural African identity.

The main challenge of urbanization is not based on urbanization rates but on the ability to encourage a layer of intermediate cities between large metropolitan areas and small agglomerations caught between urban and rural. While the spectacular proliferation of small agglomerations in West Africa will have the effect of bringing the city closer to rural enclaves, the sustained growth of primatial agglomerations will bring major African metropolitan areas up to international standards in infrastructure and trade. As regards small agglomerations, this proliferation could put the brakes on development, especially if infrastructure does not keep up and there is a delay in recognizing the “urban” status of these agglomerations in administration, services, education, health, and accessibility.

By contrast, primatial agglomerations run the opposite risk of relative over-development: in most countries of the region, they remain the only agglomerations with universities, large specialized hospitals, international hotels, an airport, conference centers, expressways, modern public transportation, even a few neighborhoods offering standards close to those of major cities worldwide. Moreover, they capture the lion's share of foreign investment. Between the two extremes, the development of intermediate cities is essential for the spread of urbanization on a national level.

Glossary

Agglomeration

Literally, “agglomeration” means the process of gathering into a mass.

In the field of geography, it refers to a concentrated and continuous group of buildings.

In the *Geopolis* database, continuity is defined as a built-up area with no more than 200 meters between buildings. Exceptions are made for areas with waterways crossed by bridges, parks, and major road infrastructures (interchanges, parking lots, airports, etc.).

An agglomeration can be rural or urban. In the *Geopolis* database it is considered urban if the sum of the population of the local units that make up the agglomeration is over 10,000 inhabitants.

Central city (Eponymous city)

Local unit that gives its name to the whole agglomeration. In the *Geopolis* database the central city (or eponymous city) of an agglomeration,

a) occupies the highest level in the administrative hierarchy of regional institutions, or if not,

b) had the highest population at the time the agglomeration emerged, or if not,

c) currently has the highest population.

City/Town (status of)

A city or town is a political and administrative unit defined as such by government and precisely defined in terms of its geographical boundaries.

Some countries make a distinction between “cities/towns” and “villages.” The status of “city/town” is based on the presence of a city/town council, relative autonomy, or a particular function (main urban center of an administrative subdivision).

Some countries define the “urban” category of their population based on “cities/towns.”

For example, Burkina Faso defines “urban” population as the population living in “cities and towns.”

Some cities can be vast. For example, the largest city in the world, Chongqing in China, spreads over 82,000 km^2 and has a population of 32 million, but its main agglomeration has barely 4 million.

In contrast, some cities are much smaller than their agglomerations. Examples include Paris (2.1 million in an agglomeration of more than 10 million) and Accra (Ghana).

Megalopolis

Like “megapolis”, “megalopolis” is formed by using the prefix “mega” (of which *megalou* is a declension). However, unlike “megapolis”, it has scientific origins, as the term was used in Jean Gottmann’s book “Megalopolis, Urbanized Northeastern Seaboard of the US,” MIT Press, 1964.

Gottmann’s book described and explained the origins of an immense urban area, from Boston to Washington, made up of distinct but neighboring agglomerations that complemented each other in terms of activities.

The author demonstrated that the emergence of a megalopolis is associated with the development of a globally dominant financial, industrial, military, and agricultural position. West Africa does not occupy such a position in any of these sectors, and here the concept of “megalopolis” is paradoxical or even fictional.

Megapolis

Common term that simply means “very large city.”

The word comes from the Greek superlative “mega” (large). The Greek form is often affixed to slang words used by young people to mean “very.”

Megapolis has many definitions that are somewhat contradictory.

a) At the global level there is a perfect continuum of demographic size ranging from the largest to the smallest city. Establish a quantitative threshold between “large” and “very large” cities is, therefore, arbitrary. However, the UN (Habitat) defines a “very large” city (or “megacity”) as having more than 8 million inhabitants.

In West Africa, only Lagos could thus be classified as a “very large” city at the beginning of the 21st century.

b) On the long term, a less arbitrary approach is based on the fact that, for millennia, no agglomeration exceeded a population of 1-1.2 million. During the Industrial Revolution, this threshold became meaningless, with hundreds of agglomerations reaching and then surpassed it.

The population of London reached 2 million for the first time in 1842, a threshold that other cities such as Paris, Vienna, Berlin, New York, and Chicago later reached and exceeded. This threshold has thus a historical meaning, and demonstrates that urbanization is linked to modern industrial concentration or to the concentration of capital in a highly industrialized global economy.

Beside Lagos, West African cities such as Abidjan, Accra, Dakar, Ibadan, and Kano currently fall within this category.

c) At a global level there is no absolute threshold size that can be used to define a “very large city.” However, most countries have an urban structure that is excessively dominated by one major city. The demographic size of the largest agglomeration does not fall within the size continuum of the other agglomerations.

Some authors have therefore used a relative approach to define the “megapolis.” according to which an agglomeration the size of Bissau (46,000 inhabitants in 1950) would be defined as a “very large city.”

All the economic capitals of West African countries fall within this category, whether they are located on the coast or, as in the case of Niamey, Bamako, and Ouagadougou, inland.

Metropolis

In terms of etymology, “metropolis” means “mother city.”

In political terms, it is associated with the presence of an empire. “Metropolis” was a title given to a city by an emperor, and, by extension, by a structured institution or centralized power. For example, the Church of Rome designated a number of cities where a “metropolitan” bishop would have jurisdiction. France now has the concept of “counterweight metropolis” as the focus of its decentralization policies.

In the same way that metropolis and empire are related, modern global metropolitan areas are central to the world’s transnational industrial and financial empires.

If the label “metropolis” is associated with a centralized political structure, then the capital city of any country is a self-designated metropolis, where the state’s command functions are concentrated. Such a metropolis is also an interface between the domestic hinterland and the global economy.

This vital interface between the regional and international systems is the feature retained in this study to provide an operational usage of the word “metropolis.”

In a geographic context, the label “metropolis” can be applied to a city, an agglomeration, or even a region (metropolitan or metropolized area) made up of different cities and agglomerations that are closely interconnected.

Orbit

From “orb” (a word that has fallen into disuse and designated a circle or area situated within the circle).

Pertains to the area outside of the agglomeration but within its sphere of influence.

Peri-urban

Refers to entities located “around the urban area.”

Peri-urban areas are situated outside of the agglomeration, but their populations interact closely with the agglomeration, commuting back and forth on a daily basis.

Primacy index

Indicator calculated by dividing the size of the population of the first-ranked agglomeration by that of the second-ranked agglomeration.

Rural

Category of area or population living outside of the urban agglomeration.

“Rural” should not be confused with “agricultural.”

Suburb

Part of the agglomeration located outside of the eponymous city.

Urban

From “urbis,” meaning “within the city walls”.

“Urbs” gave us the word “urban”, which refers to the densely populated areas of a city or village.

“Urbi” is the opposite of “orbi” (see Orbit).

Some rules relating to the distribution of cities

Rank-size rule

The rank-size rule (Zipf, 1941 and 1949) describes the regularity observed between the size of agglomerations and their rank in a hierarchical distribution:

Log(P) = a.Log(R) + b where P is the population, R the rank, and a and b are constants.

This rule applies the Pareto principle to urban geography.

Davis rule

Taking into account the distribution by size classification of cities, Davis (1970) introduced a harmonic frequency hypothesis based on geometric distribution.

The population of the first-ranked city is equal to the sum of the following two cities (second- and third-ranked cities), which is equal to that of the following four cities (forth- to seventh-ranked cities), and so on.

Law of Metropolization

The Law of Metropolization (Moriconi-Ebrard, 1993, 1998) holds that the size of metropolitan areas varies according to the total urban population following the formula:

$P_m = 6.55. P_u^{0.815}$ where P_m represents the metropolitan population and P_u the urban population, that is, the sum of all urban agglomerations in the region controlled by the metropolis.

Based on Pareto's distribution assumptions, metropolitan areas differ from the total urban population distribution based on their "excessive" size and correspond to the discontinuity presented in Pareto's distribution assumptions.

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Pictures and Maps

Figures and Tables

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