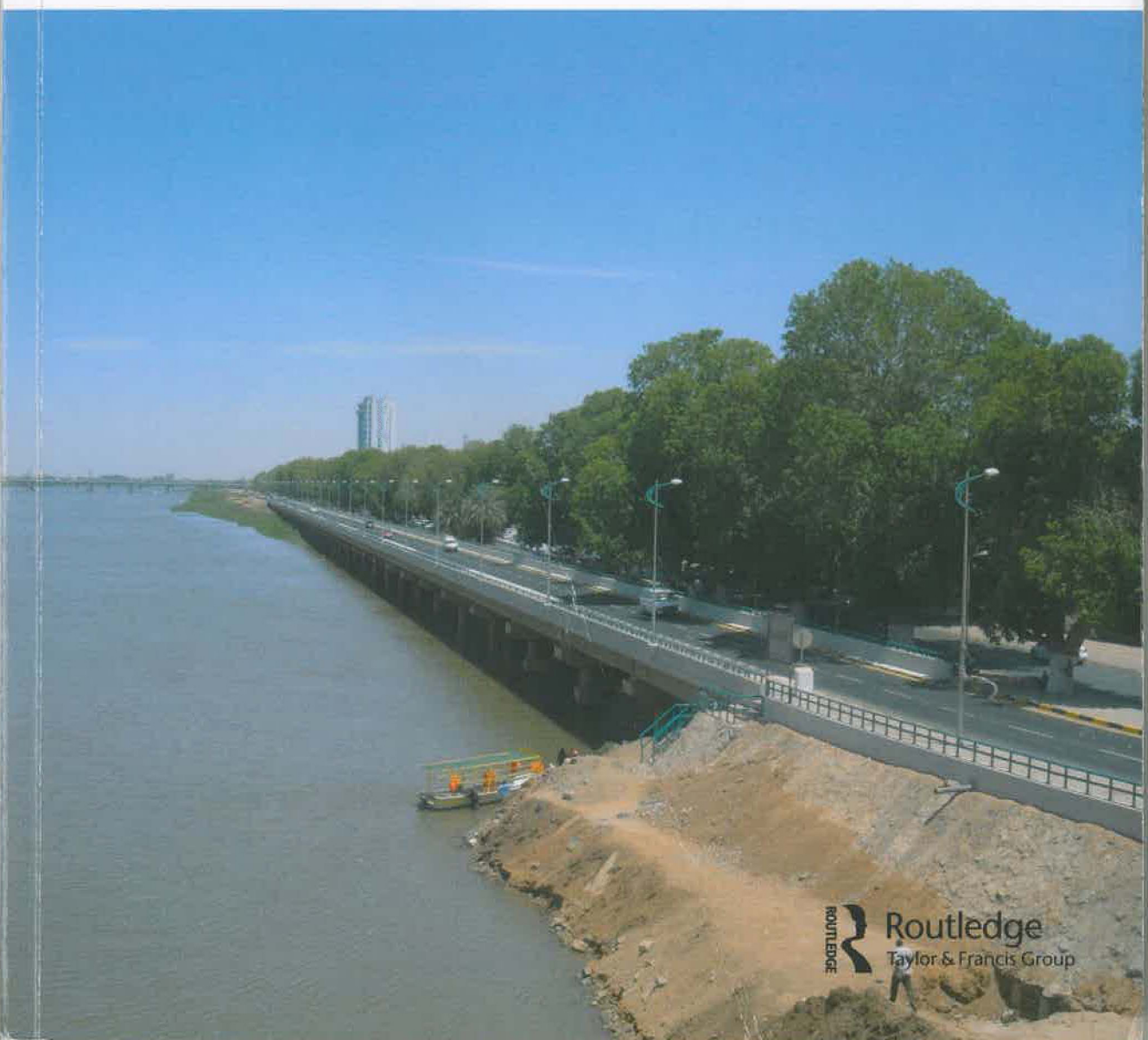


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# URBAN GEOGRAPHY



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**Cover photo:** New extension of the Nile Avenue in Khartoum. See Mohamed Babiker Ibrahim and Omer Abdalla Omer, "Evolution and changes in the morphologies of Sudanese cities", in this issue. (Photograph courtesy of Mohamed Babiker Ibrahim).

## Evolution and changes in the morphologies of Sudanese cities

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This article investigates the morphological evolution of Sudanese cities. The study of morphology or urban morphology involves consideration of town planning, building form, and the pattern of land and building utilization. Sudan has a long history of urbanization that contributed to the establishment of an early Sudanese civilization and European-style urban centers that have shaped the morphology of today's cities. We identify three broad morphologies: indigenous, African-Islamic, and European style (colonial). The ongoing, rapid urbanization of African cities in general and Sudanese cities in particular points to a need to understand the structure of this urbanization. The morphology of cities includes not only physical structure, but the cultural heritage, economic, and historical values on which it is based. Therefore, preservation, redevelopment, and urban policy underlying future urban expansion must be based on the nature of cities' morphologies and development.

**Keywords:** urban morphology; indigenous cities; African-Islamic cities; European-style cities; Sudan

### Introduction

The objective of this study is to investigate the evolving urban morphology of several Sudanese cities. Sudan has a long history of urbanization, beginning at the time of the Meroitic kingdom that flourished in the central part of the country from approximately 300 BCE to 350 CE (Adams, 1977; Shinnie, 1967). The country is now urbanizing rapidly, from 8% of the population living in urban areas in 1956 to 33.2% in 2011 (CIA, 2014; Krotki, 1958). Throughout Sudanese history, urbanization patterns have reflected the changing function and importance of cities as centers of politics, religion, commerce, administration, and education (Adams, 1977; El-Arifi, 1980; El-Bushra, 1971). In examining the urbanization of Sudan over a relatively lengthy historical period, we explore how cities evolve as dynamic entities, interacting with both local hinterlands and the national socioeconomic environment.

At present, Sudan's urban morphology is poorly documented, with little research into urban histories or efforts at preservation. For the last two decades, authorities in Khartoum have demolished many historical buildings and confiscated open spaces (Ahmad, 2000). These are sold to international companies that replace these historical buildings with multistory buildings. Our research provides important analysis of historical Sudanese urban morphologies and their connections to the contemporary forms and cultural heritage of these cities.

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## Background

Because many readers may not be familiar with Sudanese history, the following overview provides context for our study. The beginnings of the Sudanese nation date to around 3,500 BCE. Egyptian records document Nubia, which extended from Aswan in Upper Egypt to Sinnar in what is now Sudan (Figure 1) (Adams, 1967; Arkell, 1966; El Mahdi, 1965). The first indigenous Sudanese (Nubian) kingdom was the Kush, which was established by 750 BCE and survived until 350 CE. The Kush realm was divided into two kingdoms: the Napatan and Meroitic. From its capital Napata in northern Sudan, the former ruled from 750 BCE to 300 BCE (Figure 1). In 308 BCE, the capital of the Kush kingdom was moved southward to Meroe, which marked the beginning of the Meroitic kingdom (Figure 1). Around 350 CE, the Meroitic kingdom was attacked by an Axumite (Ethiopian) army, which destroyed the city of Meroe and ended the kingdom's rule (Adams, 1967, 1977; Crowfoot, 1927).

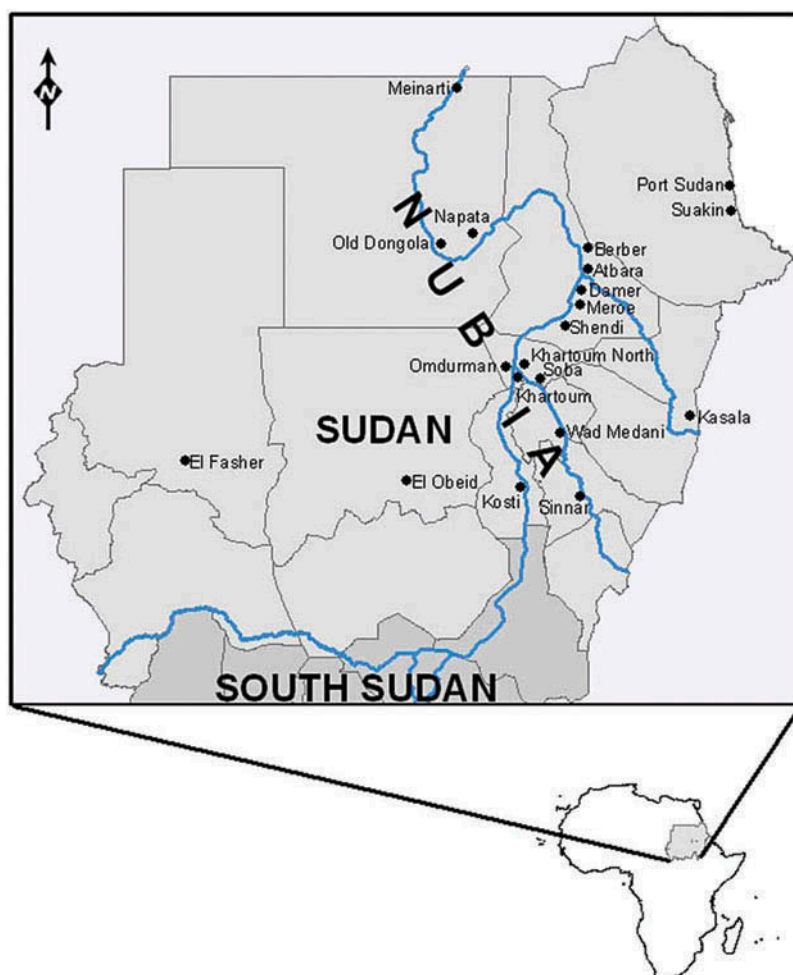


Figure 1. Sudan: study area.



After this period, little is known about Sudanese history between 350 CE and the Arab invasions of the seventh century (El Mahdi, 1965). Three separate and independent kingdoms existed between modern Aswan and the junction of the Blue and White Nile at Khartoum: Nobatia in the north, Makouria in the center, and Alodia/Alwa in the south (Adams, 1977; El Mahdi, 1965). In the seventh century, Nobatia and Makouria merged into one kingdom, which was dominated politically by Makouria (Adams, 1977; Arkell, 1966).

Muslim Arabs invaded Makouria and defeated it, forcing the Makourians to sign the *Baqt Treaty* in 651–652 CE (Adams, 1977; Hassan, 1967; Spaulding, 1995). The Makouria kingdom collapsed in the fourteen century and the throne passed into the hands of Muslims (Adams, 1977; Arkell, 1966). In 1504, a Funj army destroyed Soba, the capital of Christian Alwa, and ended Christianity as a religion of the native ruling class. Thereafter, the Funj Islamic kingdom was established, with Sinnar as its capital (Crowfoot, 1927).

The creation of the Funj kingdom is considered the formal Islamization of the Sudan (Adams, 1977; Fluehr-Lobban, 1981; Holt & Daly, 1979; Spaulding, 1977). The kingdom flourished for three centuries and was recognized as one of the most important states in northeastern Africa during that era (Spaulding, 1973). In 1820–1821, the kingdom was destroyed by a Turco-Egyptian army, nominally representing the Ottoman Empire (Adams, 1977; Spaulding, 1973). In the 1880s, a Sudanese national named Mohamed Ahmed ibn Abdalla, known as El Mahdi, revolted against the Turco-Egyptian rule in the name of a ‘simple and pure’ fundamental Islam (Holt & Daly, 1979). In January 1885, his troops defeated the Turco-Egyptian army at the battle of Khartoum. Five months later, he died and the Mahdia reign was assumed by his successor Khalifa Abdullahi Mohamed Turshain (El Mahdi, 1965; Holt & Daly, 1979). It should be noted that the periods of the Funj, the Turco-Egyptian, and the Mahdia are all considered as Islamic governments. In 1898, an Anglo-Egyptian army defeated the Mahdia troops at Omdurman, ending the Mahdia era. Thereafter, Britain, together with Egypt, began the rule of Anglo-Egyptian Sudan under the Condominium Agreement. Khartoum was chosen as the capital of the state which lasted until Sudan gained its independence in 1956 (Daly, 1986).

In sum, Sudanese history may be subdivided into four distinct yet interrelated periods: indigenous rule from 750 BCE to 1,504 CE, Islamic rule from 1504 to 1898, the colonial period from 1898 to 1955, and national rule from 1956 to present. It should be noted that Christianity and Islam coexisted for nearly 1,000 years. The time period generally thought of as contemporary Sudan began in the 1980s.

## Literature review

### *Studies of urban morphology*

The study of urban morphology involves observation of city planning, building form, and patterns of land and building use (Pacione, 1987; Whitehand, 1987a). In practice, urban morphology research informs the management of the urban landscape (Samuels, 2008; Whitehand, 2005). The majority of research in the geography of urban morphology has been undertaken in three areas: central Europe (Germany, the home of morphogenetic tradition), the United Kingdom, and North America (Pacione, 1987; Whitehand, 1987a). In German-speaking countries, the subject is closest to the ‘mainstream’ of urban geography research.

On the other hand, urban morphology in Great Britain and North America is poorly integrated into urban geography as a whole. Morphology belongs as much to historical geography as it does to urban geography. Urban morphology in the North American school is characterized by two themes. The first stems from cultural geography and is largely concerned with architectural styles, while the second deals with urban socio-economic analysis represented by classical ecological models of land use (Whitehand, 1987b). The origin of the British and North American schools of urban morphology is grounded in the work of M.R.G. Conzen between 1958 and 1962 (Whitehand, 1987a). It was Conzen who conceived of three divisions within the urban landscape: the town plan or ground plan (comprising streets, plots, and block plans of building), the 'building fabric,' and land and building utilization (Whitehand, 2001; see also Conzen, Gu & Whitehand, 2012). In the past 20 years, the field of urban morphology has expanded into the fields of architecture, planning, history, urban design, and urban history (Moudon, 1997; Whitehand, 1992). This transformation has yielded enhanced understanding of rapid physical and socioeconomic changes in urban development (Moudon, 1997; Whitehand, 1992). Much of the work of town plan analyses is undertaken in Europe using combined topographical, archaeological, and documentary evidence in an attempt to reveal the details of town plan development (Pacione, 1987; Whitehand, 1987a). This is the tradition in which we place our research.

Urban morphologies exist in a continuous state of transformation and replacement (Moudon, 1997; Whitehand, 1987b). To understand this transformation process, we incorporate into our analysis the economic, social, and cultural uses and meanings of the built environment. This allows us to highlight the cultural symbols that give cities a sense of continuity and identity (Whitehand, 1987b; Whitehand and Gu, 2010; Whitehand, Gu, Whitehand, & Zhang, 2011).

Urban morphology research has in the past considered the cyclical character of land utilization and building form (Whitehand, 1987a). This is exemplified by the work on burgages (clearance of principal plots within medieval towns before redevelopment) in Britain, which has suggested the merits of plot measurement and reconstruction as a means of identifying an outline pattern of development. But the burgage cycle has received comparatively little attention (Pacione, 1987).

The cyclical theory of urban form was based on the interrelationship of land value, economic fluctuations, and innovation (Whitehand, 1992). The primary link between town plan analysis and the study of the cyclical character of land use and building form was provided by the *fringe-belt* concept (Conzen et al., 2012; Pacione, 1987; Whitehand & Morton, 2006). The fringe belt is an integral part of the historic-geographical development of cities but has received little attention from contemporary planners (Whitehand & Morton, 2003), despite the importance of the 'unprecedented pace' of changes in the morphology of urban landscapes (Conzen et al., 2012, p. 22).

Timing is also a significant element in the process of urban change, perhaps most visibly in the character of economic processes (Whitehand, 1992). The primary link between town plan analysis and the study of the cyclical character of land use and building form is provided by the fringe-belt concept, which focuses on the timing and agents of change. Agents directing changes in the urban landscape include property owners, architects, and developers (Whitehand, 1992). In this article, we follow Pacione's (1987) suggestion that historical analysis of town planning can be linked with a cyclical approach to analyzing land use. We use the concept of the fringe belt to understand the evolution of slums on the outskirts of large Sudanese cities such as Khartoum.

### ***Urban morphology research in the Sudan***

In sub-Saharan Africa, India, and the Middle East, the urban morphology of pre-colonial cities is often related to cultural meanings and uses (Hamouche, 2004; Kosambi & Brush, 1988; Winters, 1982). Pre-colonial morphology is characterized by narrow, winding, and congested streets (Hamouche, 2004; Karan, 1957). On the other hand, morphology of colonial cities—or those with heavy colonial influence—in Africa and Asia is often characterized by grid-patterned streets and the segregation of ethnic groups (Kosambi & Brush, 1988; Stock, 1995; Suret-Canale, 1971; Winters, 1982). Over time, the morphology of cities in the global South has changed as a result of colonial influences, rapid urbanization, neoliberal policies, and globalization (Hamouche, 2004; Sager, 2011).

The history of the morphology of Sudanese towns and cities is poorly documented because many towns were destroyed by invasions, abandoned, or submerged by the damming of the Nile River in Egypt (Ahmad, 2000; Born, 1980; Winters, 1977). Much of the scholarship on Sudanese cities has focused on the role and function of towns in various historical periods. As other authors have noted, the structure of towns and cities since the end of the nineteenth century is the basis for the present morphology of many Sudanese cities (Niblock, 1987; O'Fahey and Spaulding, 1974).

The urban morphology of these types of cities is a reflection of their historical development in association with their national socioeconomic function and physical and cultural environments. Cities that we categorize as indigenous and African-Islamic, which emerged and developed in the pre-colonial period, include historical features coupled with contemporary development. On the other hand, younger cities such as Khartoum, Port Sudan, Atbara, and Kosti were designed and planned in the European style (Hamdan, 1960; Oliver, 1966). The history, function, and growth of cities in different physical environments have resulted in differing morphological attributes and characteristics, some of which have become points of attraction for tourism and business. For example, some of the nation's largest cities have acquired illustrative nicknames including *Al Thuger* (the mouth) for Port Sudan and *Aroos Al Rimal* (bride of the sands) for El Obeid.

Studies of pre-1960 Sudanese urban morphology were often carried out by archaeologists, historians, and urban historians (e.g., Abu-Saleem, 1979; Adams, 1977; Crawford, 1951). In the 1960s, geographers conducted remarkable studies on the morphology and functions of the cities of Khartoum and Port Sudan (see Hamdan, 1960; Oliver, 1966). It is possible that the historical relationship between Sudan and Britain influenced the British school of urban morphology.

A few studies published by archeologists, urban historians, historians, and urban geographers during the 1970s and 1980s have dealt with urban morphology (Abu-Saleem, 1979; Adams, 1977; O'Fahey et al., 1974; Winters, 1977). During the 1990s, geographers carried out several studies of the fringe belts, slum settlements, and shanty towns of Greater Khartoum (Khartoum, Omdurman, and Khartoum North—Figure 1). These include Um Badda and Abu Siid in Omdurman (Hänsel, 1991; Ibrahim, 1990), and Mayo and Dar Al Salam and other slums in Khartoum (Abdalla, 2008; El-Bushra & Hijazi, 1995; Eltayeb, 2003) and Khartoum North (Ibrahim, 1991). However, few studies of Sudanese urban morphology have been published outside of Sudan itself, and one intent of this article is to expand the reach of this research.

### **Methods**

Data for this study were collected through field and archival work. Fieldwork on contemporary urban patterns was carried out in the cities of Khartoum and Omdurman in

August 2012 and March 2013. Morphological changes of contemporary cities were documented through pictures of buildings, streets, and neighborhoods. All pictures were taken by the principal author. One major problem encountered was the reluctance of Sudanese authorities to provide old maps of Khartoum and Omdurman.

Our understanding of urban morphology in the region is based largely on archaeological and historical cartographic sources dating to the 1860s. Archaeological excavations have provided information about the morphology of ancient Sudanese towns dating back to late Meroitic times, around 300 BCE (Adams, 1977). Information about Sudanese urban morphology for the period between the tenth and the nineteenth century was provided by historians and travelers. Maps from the 1860s exist for a few towns and villages, such as Berber, Kasala, Khartoum, Omdurman, Sinnar, and Suakin. These maps were provided in an atlas that lacks city descriptions (Crawford, 1951).

Historical research necessarily involves reliance on older sources of information. We relied heavily on Adams (1977) and Crawford (1951) as the best sources of information for the historical components of this study. Adams (1977) is the author of the most important book to provide comprehensive information on Sudanese archeology since the early recorded history of the country (Nubia) in the mid-twentieth century. The book written by Crawford (1951) is mainly a historical text that provides extensive information about the Sudanese towns between the seventh and nineteenth centuries. Particularly valuable is the inclusion of observations written by travelers about their visits to different Sudanese towns during this period.

Our research on contemporary Sudanese cities revolves around Khartoum and Omdurman. We focus on these locations due to their representativeness of contemporary Sudanese urbanization and because they provided the most comprehensive opportunities for data collection. Comparing the histories and morphologies of these two cities allows us to draw several, broader conclusions about contemporary urban morphology along the Nile and its tributaries, where the majority of Sudanese cities are located.

### **Historical evolution and morphology of Sudanese cities**

Based on historical maps, we observe that the morphological evolution of Sudanese cities is closely related to their historical development, the inhabitants' culture, and the dominant type of architecture. From these observations, we identify three types of cities in Sudan based on their origin and nature of governance: local or indigenous, African-Islamic, and European style (Moudon, 1997; Whitehand, 1987b; Winters, 1982). This typology is described in detail below.

#### ***Morphology of indigenous cities***

Our analysis of urban morphology during the era of Christianity and the early period of the Sinnar kingdom depends largely on the information provided by travelers, due to the limited number of cartographic sources that survive from this period. The earliest recorded history of urban centers in Sudan dates from the time of the Napatan and Meroitic kingdoms from 750 BCE to 350 CE (El Mahdi, 1965; Shinnie, 1967). Adams (1977) mentions that Nubian society in the Middle Ages was probably more densely urbanized than in any earlier period. The population of settlements that originated in the Nubian period, such as those now known as Qasr Ibrim, Gebel Adda, and Faras, may have reached several thousands and the inhabitants of villages reached hundreds.

The morphology of Nubian settlements in earlier times is exemplified by scattered dwellings built around monumental buildings. From among these settlements, Adams

(1977) identified Meinarti in the classical Christian period as a town, noting that the town was actually founded in the late Meroitic times.<sup>1</sup> Adams noted that houses in settlements such as Meinarti were tightly clustered into irregular blocks separated by narrow, winding alleys and were built of bricks in either a rectangular or square shape. The church is located at the edge of the settlement.

Structural and morphological characteristics of early cities like Napata and Soba were incorporated into the construction of later cities. These cities occupied large geographical areas and were therefore unlikely to be clusters or compact settlements. The primary economic base affected urban structure and morphology. Since both cities were located on the banks of the Nile River, the inhabitants were engaged in farming and the rearing of animals, as well as in nonprimary sector activities (Adams, 1977; Ibrahim, Abdel Ati & Abu Sin, 2001). Like Omdurman today, each town spread itself over a large area because there was ample room for such expansion. This phenomenon was also present in other African cities, such as Kampala and Gondar, in Ethiopia (Winters, 1977, 1982).

Soba was described by Ibn Salim al Aswani in the tenth century as a great city with luxurious buildings, gardens, and churches. One-quarter was the site of beautiful buildings, gardens, and hostels occupied by Muslims (Adams, 1977; Crawford, 1951). Soba and Dongola (Old Dongola) were capitals of Christian Nubia, described by Abu Salih in the early thirteenth century as wondrous places, with beautiful and wealthy churches (Adams, 1977; Crawford, 1951). During the time of the *Baqt Treaty*, Dongola was surrounded by a wall resembling those on other Christian sites. A unifying characteristic of these cities was the presence of defensive castles (Crawford, 1951).

By 1,200 CE, Dongola was a large city on the bank of the Nile containing many churches, large, flat-roofed houses, and wide streets (Crawford, 1951). From the north and south ends of the east side, stone walls ran down to the river. North of the city was a large Muslim cemetery (Crawford, 1951). In the period of Christian Nubia, churches (e.g., the great cathedrals of Faras and Qasr Ibrim and others) were located in the center of their towns. At Ikhmindi and Sheikh Daud, a church occupied a central position within the complex and was surrounded by a cemetery (Adams, 1977). The location of the church at the center of Sudanese Christian sites seems to be similar to other indigenous cities on the African continent (Stock, 1995).

### ***Morphology of the African-Islamic city***

The gradual merging of indigenous and Islamic characteristics has produced the form of the contemporary African-Islamic city, whose houses and building materials are different from their North African and Middle Eastern Islamic counterparts. Houses in African-Islamic cities are characterized by one-story clay buildings, while most Middle Eastern Islamic houses are built of stone and are more than two stories high. Differences in the buildings of African and Middle Eastern Islamic cities stem largely from the differences in the physical environment. However, both types share some architectural similarities, such as large arched doors.

Many Sudanese cities were established during the migration of Muslim Arabs to Sudan in the seventh century. An example of the Funj Islamic city is Sinnar, the capital of the Funj kingdom. Sinnar, from travelers' estimates, had 9,000 inhabitants occupying an area less than one square kilometer (Winters, 1977). It had irregular street patterns, much like other Muslim towns of the Middle East (Winters, 1977). Little information is available about the layout of Sinnar because it was severely damaged by heavy rains and fire during the civil wars of the late 1700s and early 1800s.



The development of most contemporary Sudanese African-Islamic cities likely began in the late Christian period (toward the end of the thirteenth century) when part of the city of Soba, the capital of the Christian kingdom of Alwa, was first inhabited by Muslim people (Adams, 1977; Crawford, 1951). The Christian city of Old Dongola was also inhabited by both Christians and Muslims during the time of the *Baqt Treaty*. Based on the fact that the northern part of the city was occupied by a large Muslim cemetery, Muslims may have been a large community (Crawford, 1951). Islamic waves of the late Middle Ages gradually transformed the Nubians, as well as some parts of sub-Saharan Africa, from Christianity to Islam (Adams, 1977). Today's African-Islamic cities have varying amounts of European features.

One important morphological feature that originated in indigenous Sudanese cities and has continued in the African-Islamic city is the location of the ruler's palace at the center of the city. This feature is clearly illustrated by the location of the palace of the sultan (king) in Sinnar and the house of the Khalifa in Omdurman, capital of the Mahdia (Holt & Daly, 1979; Winters, 1977). This is similar to the location of the palace in the pre-colonial African cities (Winters, 1982).

The morphology and the general structure of the Sudanese Islamic-African cities between the sixteenth and nineteenth centuries were largely affected by the socioeconomic and physical characteristics of different parts of the country. Thus, urban morphologies took one of three forms: linear or elongated, clustered or compact, or spatially distributed over a wide agriculturally productive area. Linear and elongated cities, such as Berber, Shendi, and Damer, are found along the Nile and have many open spaces (Winters, 1977) (Figure 1). For example, in 1814, Burckhardt described Berber as a city formed of four distinct quarters, with three lines of houses separated by two streets (Crawford, 1951). Despite the lack of maps for Shendi and Damer before the twentieth century, we posit that they also exhibited the linear morphology of cities located along the Nile.

Since the late eighteenth century, Shendi, located in central Sudan on the east bank of the Nile, has been one of the most important commercial cities on the river (Figure 1). In 1772, there were between 800 and 1,000 houses in Shendi and a population of about 6,000. By 1833, the number of homes had dropped to 600 or 700 houses and to 3,000–3,500 people (Crawford, 1951). The town was about two miles in circumference and was divided into several quarters, each separated by public places or markets, with irregular streets (Burckhardt, 1980). Ordinary houses were mostly small and made of clay and reeds (Crawford, 1951). A daily market, consisting of three rows of small shops, was held in an open space between the two principal quarters of the town (Burckhardt, 1980; Crawford, 1951). There was also a weekly market visited by the surrounding Arabs (Burckhardt, 1980).

Damer is another example of the Sudanese African-Islamic city founded toward the end of the fifteenth century (Figure 1). Since Damer was located on the bank of the river, it could be expected to exhibit a linear morphology. By 1814, it was a large town, containing about 500 houses.<sup>2</sup> The city was clean and had many new buildings. Houses were uniform in construction, in regular streets with shady trees (Burckhardt, 1980; Crawford, 1951).

The clustered or compact morphology of other cities was related to the existence of city walls built between the sixteenth and the nineteenth centuries, when some towns were fortified (Holt & Daly, 1979). Khartoum and El Obeid were strongly fortified during the period of challenges from the Mahdist forces (Born, 1980). Walled cities like Kasala were confined within small areas (Born, 1980). In these cases, houses were built closer to each other, and the number and size of open spaces in the city were reduced, with irregular

street patterns. Empty lands were found outside the walled area, and contemporary expansion has taken place outside the walled section. In the mid-nineteenth century, Kasala was a small town situated on the eastern bank of the Gash stream. Today, it is a large city of nearly 300,000 (Sudan Census, 2008). Morphologically, the city has expanded to the north and the west across the Gash stream, because of the availability of farms or unused land. Mount Taka, to the east of the city, has limited the expansion of the city in that direction. Suakin, another compact city, was built on an island for security purposes. Narrow irregular streets radiate from the city center to the coastal areas. Once Port Sudan was established in 1904, Suakin was deserted for a time. Today, however, the city has grown to become the second most important port in the country. New neighborhoods have developed off the island to the south and southwest of the city.

The third morphological type of African-Islamic city is found on the plains of central Sudan. These cities are not bound by physical or human-constructed barriers. Many cities emerged in the open, flat lands of central Sudan. El Obeid was established as six small villages around wells, separated by large open spaces (Pallme & Petherick, 1980). Houses were mostly huts of straw, while some were built of clay. During the Turco-Egyptian era, El Obeid was described by Pallme and Petherick (1980) and Born (1980) as a city consisting of two sections—a core occupied by a military camp, administrative offices, the market, and residences of the wealthier merchants and a series of separate out-villages constructed mainly of straw huts and accommodating various Sudanese ethnic communities (Pons, 1980). Cities located in the plains of the Sudan have and will expand in all directions as the physical environment permits.

There are several morphological similarities between indigenous and African-Islamic cities. First, public spaces separate different parts of the city from one another. This is illustrated by the morphologies of towns such as Soba and Napata during the early history of the Sudan, and Shendi, Damer, and Sinnar during the Islamic and contemporary periods. Second, the market and holy buildings (i.e., the church and mosque) are found in the central parts of these cities. The location of markets and houses of worship at the center of cities was adopted and applied by the British to the layout of European-style cities such as Khartoum, Port Sudan, and many African cities (Stock, 1995; Winters, 1982).

### *Morphology of European-style cities*

After 1899, new cities, including Khartoum, Port Sudan, Atbara, and Kosti, were developed and designed in a European-style grid system with regular, straight streets, and many public spaces (Daly, 1986; Hamdan, 1960; Oliver, 1966). Unlike pre-colonial cities, older and contemporary neighborhoods of European-style cities tend to have the same general morphology. We consider these cities to be European style based simply on their construction dates. The British gave special attention to the building of Khartoum and Port Sudan, with Khartoum as the administrative and political center and Port Sudan as the main seaport of the country. The streets and public spaces of these cities were laid out following the European style, with markets and the main mosques sited at the center, in the Sudanese African-Islamic style.

European-style Khartoum was chosen by Governor Kitchener in 1898 to become an administrative center and the capital of Anglo-Egyptian Sudan (Daly, 1986). It was laid out, for military purposes, in the form of a series of convergent avenues similar to the pattern of the Union Jack at the end of the southern bank of the Blue Nile (Figure 2) (Hamdan, 1960). Open spaces were created both inside and outside the buildings to cope with the hot climate of the city (Hamdan, 1960). With its administrative functions,

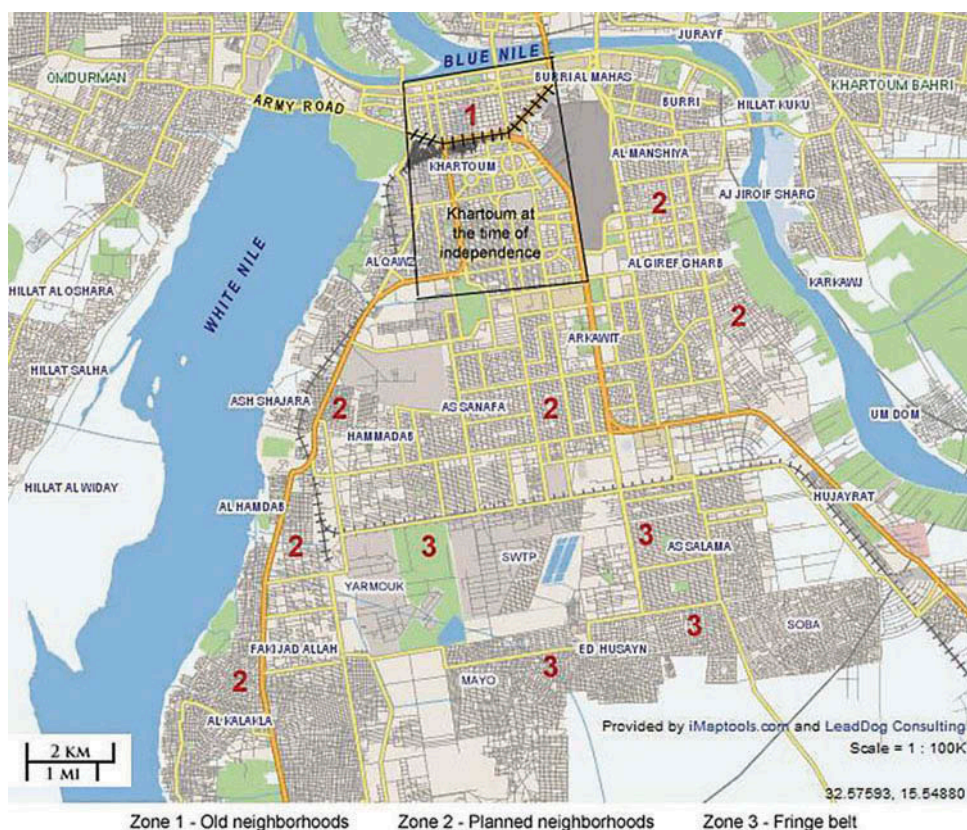


Figure 2. Khartoum: a European-style city.

modern services, and status as a business center, Khartoum became an important colonial city.

Planning and layout of Khartoum after Sudanese independence in 1956 continued in a similar manner. A grid system was applied in new neighborhoods, which were divided into first, second, and third class, based on the size and type of buildings; the larger structures were given first- and second-class designation (Hafazalla, 2006; Hamdan, 1960). Before independence, first- and second-class residential areas were confined within three square miles of the Blue Nile and coexisted with administrative areas. These districts were inhabited by the British in the eastern part of the city and by other foreign groups and Copts in the west (Hamdan, 1960). Since independence, the city has expanded horizontally, and the administrative area has also expanded to include the residential areas previously occupied by foreign groups. Today, this area forms the central business district (CBD) of Khartoum located at the southern bank of the Blue Nile in a half circle bounded by the railway line (Figure 2). Outside this area are the first- and second-class residential areas of Al Amarat, which are composed mostly of two-story buildings, and the third-class residential area located to the south of Al Amarat. Hafazalla (2006) noted that houses in the third-class residential area are smaller and are one-story buildings made of mud and bricks (Figure 3). In contrast to many other capitals of the world, Khartoum expands horizontally and remains dominated by one-story structures (Figure 1).



Figure 3. A view from Ajjiraif Sharg that shows traditional one-story buildings which represent the majority of houses in Sudanese cities. (Photograph by the principal author.)

### Development and morphological changes in contemporary Sudanese cities

The morphology of contemporary Sudanese cities resembles both African-Islamic and European-style cities. In our study, Omdurman is representative of the former and Khartoum of the latter. The two cities, together with Khartoum Bahri (North), form Greater Khartoum (Figure 1). Our examination of this urban morphology involves consideration of the town plan, architecture, and the pattern of land and building utilization, all of which are subject to change over time. The morphology of contemporary African-Islamic and European-style cities is characterized by three distinct zones: old neighborhoods (the core), planned neighborhoods, and the fringe belt (Figure 4). Unlike the fringe belt of European cities, which is generally occupied by public institutions such as hospitals, public parks, and utilities (Whitehand, 1994), the fringe belt of contemporary

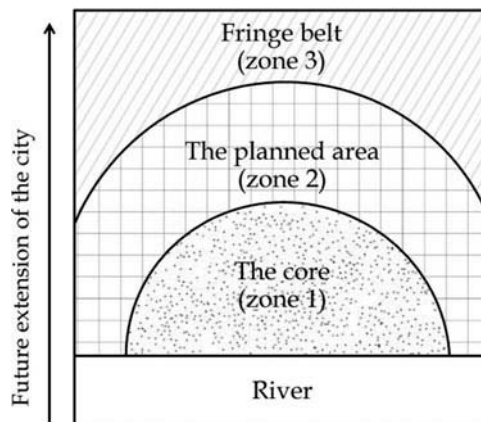


Figure 4. A model of the morphology of contemporary Sudanese cities.



Table 1. Population of Omdurman and Khartoum for the period 1907–2008.

Year	Omdurman	Khartoum
1907	No information	69,349
1909	42,779	No information
1956	113,600	93,100
1973	299,399	333,906
1983	526,284	476,218
1993	1,271,403	947,483
2008	2,395,159	1,410,858

Sources: Encyclopedia Britannica (2011) and Sudan Census (2008).

Sudanese cities (with the exception of Khartoum) is occupied by slum or squatter settlements. Within the city, contemporary urban development has resulted in a pattern of mixed towns that exhibit both Islamic and European characteristics.

The population of Greater Khartoum has increased dramatically since the 1970s (Table 1). This unprecedented increase stems chiefly from rural–urban migration brought on by drought in western Sudan in the 1970s and 1980s, displacement from the South because of the civil war fought there between the 1960s and 2005, and internal migrants from the conflict in Darfur from 2003 to the present. Migration to Khartoum from other parts of the country has occurred against the background of government policies that curtailed the irrigated and mechanized agriculture that had formed the backbone of the Sudanese economy. In all, two million migrants are living in the fringe belt of Greater Khartoum in slums or squatter settlements, some with relatives and others on small pieces of land (El-Bushra & Hijazi, 1995; United Nations Environment Program, 2007; United Nations Human Settlement Program, 2009). Most drought victims returned to their homes in western Sudan after good rains in 1988, and almost half of the internally displaced people (IDP)<sup>3</sup> from the South returned home after the Comprehensive Peace Agreement in 2005 (United Nations Environment Program, 2007). The remaining displaced people strain the planning and administrative capacity of the authorities (Post, 1996; United Nations Environment Program, 2007; United Nations Human Settlements Program, 2009).

Squatter settlements are distributed haphazardly in available space in low-density areas and old villages near Greater Khartoum. At the peak, there were approximately 100 settlements, all of which lacked services such as water, sewage, roads, and solid waste management (El-Bushra & Hijazi, 1995; United Nations Environment Program, 2007; United Nations Human Settlements Program, 2009). By the end of 2012, 50 of these were demolished (Sudacon, 2013), with 53 more awaiting that fate (Ibrahim, 2013).

Previous policies of Khartoum urban development were designed by Dioxides in 1960, the Italian company MEFFIT in 1975, and MEFFIT again in 2007 (Post, 1996; El Sammani, Abu Sin, Talha, El Hassan, & Haywood, 1989; United Nations Human Settlements Program, 2009). All of these were constrained by the lack of qualified administrative personnel, lack of financial resources, and inability of the authorities to handle the massive number of migrants displaced from rural areas (De Geoffroy, 2011; Post, 1996; El Sammani et al., 1989; United Nations Environment Program, 2007; United Nations Human Settlements Program, 2009). The planners took different approaches, including the replanning of old neighborhoods, ‘upgrading’ and replanning of urban villages, demolishing of squatter settlements, relocation of people affected by demolishing and replanning, establishment of new neighborhoods, and the redevelopment of business areas.



### *Morphological changes and development of Omdurman*

Morphological changes from development are taking place in all these three zones of the city (Figure 5). Zone 1 is the core of the city, occupied by the old neighborhoods. It has a village-like structure, characterized by short irregular, narrow, and winding streets, with few open public spaces (Figure 5). In the 1970s, this section had been replanned to widen some of its streets, and affected households were relocated in *Intidad Bait Al Mal*, a wide space between the planned section (Zone 2) and Um Badda slum in the western part of the city. The planned section is by far the largest section of the city, with a grid system and

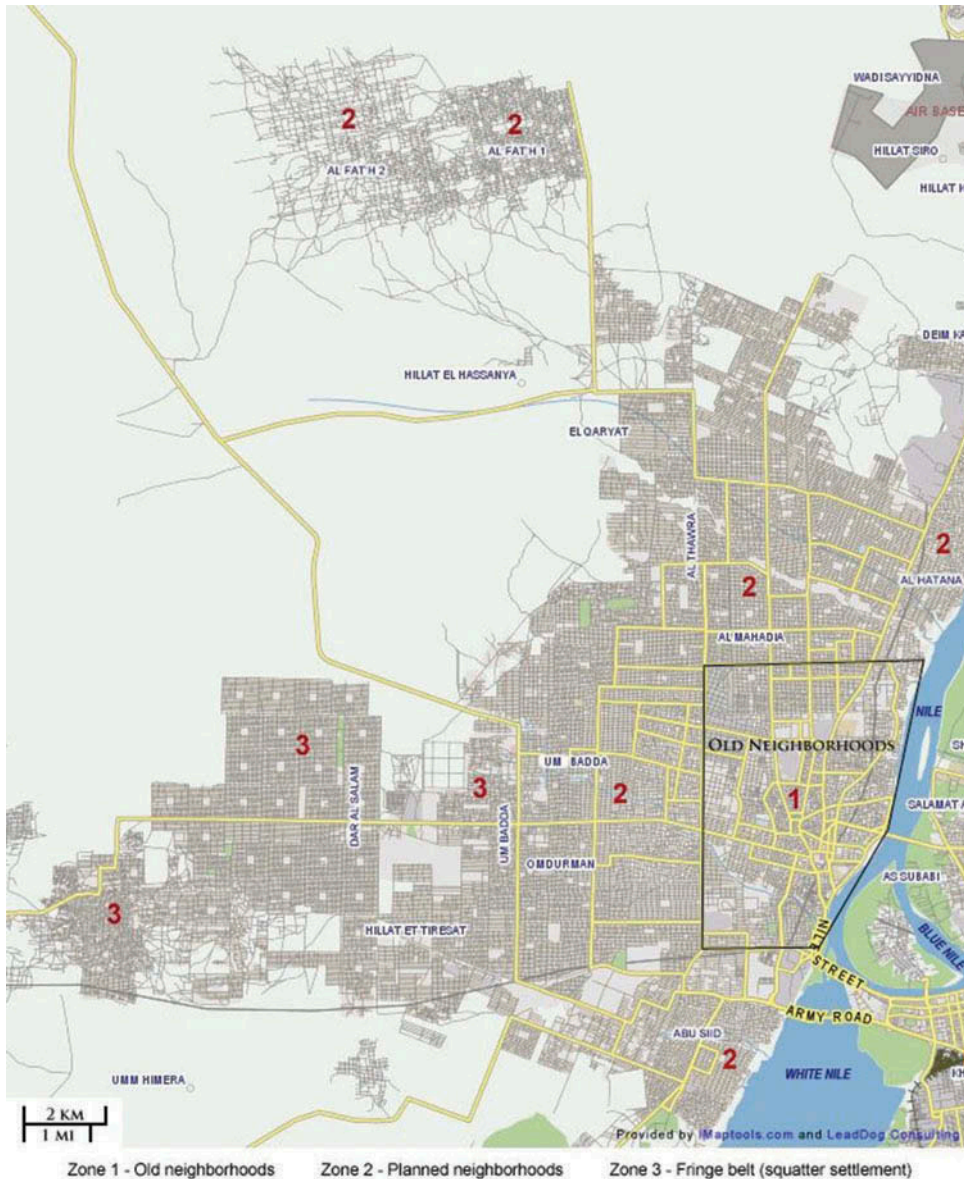


Figure 5. Omdurman: an example of African-Islamic city.



Figure 6. Multistory buildings along Al Arbaeen street leading to the CBD of Omdurman. (Photograph by the principal author.)

long straight streets (Figure 5). It also includes upgraded urban villages, such as Al Gamayir and Al Hatana, outside the core zone and along the bank of the White Nile (Figure 5). Until the 1980s, most of the buildings were one-story construction, made of mud and sun-dried bricks. Since the 1990s, the majority of these older buildings were demolished by owners and rebuilt with fired bricks and cement.

Another significant change has occurred along streets leading to the CBD of Omdurman, where three- to five-story buildings have been constructed. Those off the main thoroughfare remain mostly one-story buildings, occasionally interrupted by two- to four-story structures (Figure 6). Examples of these streets are Al Arda, Al Arbaeen, and Banat of the planned neighborhoods of Al Arda, Ab Kadok, and Banat (Figures 6 and 7). These changes occurred near the CBD as a result of high land value in the area.



Figure 7. Multistory buildings on Banat street in the Banat old neighborhood of Omdurman. (Photograph by the principal author.)

In addition, Zone 2 includes the development of new neighborhoods formed out of many adjacent blocks, such as Al Thawra and Al Fat'h 1 and 2. This was intended to relocate the squatters who have been affected by demolition and eviction in other parts of Greater Khartoum (Figure 5). These new neighborhoods transformed a rainfed agricultural and grazing zone into a residential area. Because the city has experienced low amounts of rainfall throughout the last three decades, no agricultural activity is now being practiced. The new neighborhoods suffer from the lack of services such as water, electricity, sewage, roads, rainwater drainage, and solid waste management (United Nations Environment Program, 2007; United Nations Human Settlements Program, 2009). The heavy rains of August 2013, followed by flash flooding, have destroyed many of the mud houses in the new neighborhoods and squatter settlements. Many of these homes had been built in water courses, and the lack of rainwater drainage system proved disastrous. Such destruction of a large number of buildings reflects a failure of urban planning and poor management of urban landscape.

The third zone of the city is the fringe belt, occupied by the squatter settlements of Um Badda and Dar Al Salam in a large part of the western end of the city. In addition, there are 12 small groups of displaced people settled around the city (Sudan Tribune Newspaper, 2013) (Figure 5). Substantial parts of squatter settlements have been replanned, and their inhabitants have been given legal right to the land, with other sections waiting to be replanned (Sudan Tribune Newspaper, 2013). About 70% of the population of Dar Al Salam now has legal right to their premises (Abdalla, 2008). Um Badda and Dar Al Salam are classified as a third-class residential area to accommodate the poor of the city. Both settlements suffer from the lack of services, especially potable water supply and electricity. People buy water from water vendors (United Nations Environment Program, 2007; United Nations Human Settlements Program, 2009) and use powered electric generators (Abdalla, 2008). In addition, because of its remoteness, inhabitants of Dar Al Salam suffer from a transportation problem. On the other hand, some of the demolished squatter settlements were found around urban villages at the bank of the Nile. Urban villages such as Al Gamayir and Al Hatana, north of the core area, have been upgraded and provided with services. Some of the squatters there have been relocated in Al Thawra neighborhood (Block 48) and Dar Al Salam squatter settlement (Figure 5).

### ***Morphological changes and development of Khartoum***

Similar to Omdurman, Khartoum is divided into three zones: the core, the planned section, and the fringe belt (Figure 2). The core (Zone 1) is the oldest part of the city and was designed and built by the British at the beginning of the twentieth century. The administrative section runs along the bank of the Blue Nile, while commercial and business areas are located at the center, and residential areas lie in the eastern and western parts of the zone (Hamdan, 1960). When the city was built, residents of this zone were exclusively British, Copts, and other international groups. The native Sudanese lived south of the railway lines (Hamdan, 1960). This reflects a typical distribution of population in European-style and colonial cities in the rest of the African continent, which was based on ethnic segregation (Stock, 1995). This was the situation until independence—before this, the city was small and its development was managed through British laws and planning, which discouraged rural–urban migration.

Throughout the last four decades, the function and morphology of this section of the city have undergone various changes. Functionally, the entire zone has become administrative, and the CBD of the city no longer contains any residential areas. After independence, the

British and other non-Sudanese groups either left Sudan or moved to the first and second residential areas, such as Al Amarat, Al Riyadh, and Al Taif. Now, the core is occupied by government buildings and the offices of large companies and corporations. Morphologically, Khartoum's core has witnessed a gradual change in the structure and type of buildings. It has been redeveloped, and the CBD is now dominated by multistory buildings (Figure 8). Until the 1960s, with the exception of a few two-story commercial buildings, the majority of houses were one-story buildings (Hamdan, 1960). Zone 2 is occupied by planned neighborhoods, as well as upgraded and replanned urban villages, which were incorporated into the city along the banks of the Blue and White Niles. These include Burri and Al Giref Gharb along the Blue Nile bank and Al Gowz, Ash Shajara, Al Hamadab, and Al Kalakla at the White Nile (Figure 2). With the exception of a few areas classified as first- and second-class residential areas near the core of the city, this section is a third-class residential area. Similar to Omdurman, all of the new neighborhoods of this section were built in a rainfed agricultural area that transformed into a residential area. As with the majority of Sudanese houses, buildings in this section are mostly one-story buildings (Figure 3). Development of new neighborhoods has transformed more and more agricultural land into residential areas. The open space between the urban villages of Burri and Al Giref Gharb, which was previously occupied by irrigated agriculture, has been transformed into a first-class Al Manshiya residential area (Figure 2). Similarly, Al Hijjayrat agricultural land, south of Al Giref Gharb, has been transformed into a first-class residential area (Figure 2). Because of the high value of land, owners of these farms were encouraged to sell their lands. Some invested their payouts into commercial and retail businesses.

Another change to Khartoum's morphology, similar to that seen in Omdurman, is that all streets leading to the CBD are now occupied by three- to five-story buildings. They were built to be rented as business offices. The buildings behind them, which are part of the old neighborhoods, are mostly one-story buildings, occasionally interrupted by two- to four-story structures. These include the neighborhoods of Al Shagara, Khartoum 2, Burri Extension, and Al Sahafa East streets (Figures 9 and 10).

On the other hand, building construction in the new first-class neighborhoods, such as Al Manshiya in Khartoum and Madinat Al Nil in Omdurman, is accompanied by signs of



Figure 8. Multistory buildings in downtown Khartoum. (Photograph by the principal author.)





Figure 9. Multistory buildings in the new extension of the Burri neighborhood of Khartoum. (Photograph by the principal author.)



Figure 10. Multistory buildings on Al Sahafa East street in Al Sahafa old neighborhood in Khartoum. (Photograph by the principal author.)

modernization. Buildings in these neighborhoods are mostly villas composed of three- to four-story buildings (Figure 11). Most owners of villas are expatriates who migrated to oil-rich countries two to three decades ago. Thus, a major feature of the recent change in the morphology of Sudanese cities is a change in the traditional housing from one-story buildings to buildings of three or more floors, constructed of concrete. Concrete does not suit the hot climate of the country, so it becomes possible to live and use these houses only with a continuous supply of electricity and the use of air conditioning. In structure, height, and environmental relationship, Khartoum and Omdurman have become similar to an American-style CBD—where the CBD is made up of multistory, multifunctional structures, surrounded by a sector of one and two stories, mainly residential buildings.



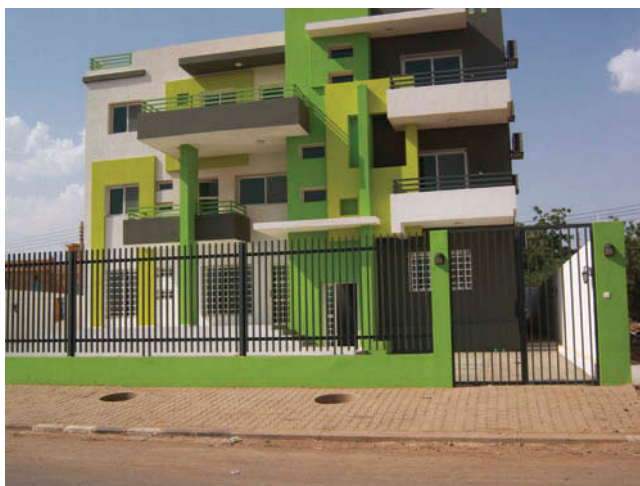


Figure 11. Residential villas in the new first-class neighborhood of Al Manshiya in Khartoum. (Photograph by the principal author.)

The fringe belt of Khartoum (Zone 3) is occupied by five distinctive features: the sewage water treatment plant (SWTP), a green belt, upgraded and replanned urban villages, Yarmouk military and industrial areas, and squatter settlements. This is more similar to the fringe belts of European cities, which are generally occupied by public institutions, green parks, and public utilities. In the early 1960s, Khartoum's SWTP was built 10 km south of the core of the city to treat wastewater. A green belt irrigated by the treated sewage water was planted west of the SWTP to protect the city from dust storms (Zaroog, 2006). West of the green belt, the Yarmouk military and industrial area is located.

Before the construction of the SWTP and the green belt, the fringe belt, which is a poor savanna, was occupied by a few groups of herders who lived in three small villages—Soba, As Salama, and Ed Husayn. Their main function was to provide the city with fresh milk throughout the year and to practice rainfed cultivation during the rainy season from July to September. Recently, these villages have been 'upgraded' and formally incorporated into the city. Replanning of As Salama started in 1996; Ed Husayn at the beginning of the Millennium; and Soba in 2004, continuing to the present day. The majority of the inhabitants have been given legal land rights, while others were relocated to new neighborhoods such as Al Fat'h 1 and 2 in Omdurman and Al Rasheed in Jabal Awliya south of Khartoum. Residents of the three villages suffer from the lack of services such as water access, electricity, schools, and paved roads (Abdalla, 2008). Groundwater, which is the main source of water, is salty to the extent that in some places it is not suitable for human use (Abdalla, 2008).

Since the early 1970s, migrants from different ethnic background have moved to the city and wound up in the squatter settlement of Mayo (Abdalla, 2008). Mayo is one of the largest squatter settlements, occupying an area of 40 square kilometers (Abdalla, 2008). All vegetation was removed and replaced by squatter settlements. Replanning of Mayo began in 1992 and continues to the present. Inhabitants satisfy their needs for water by buying water from vendors even though they are poor and work in marginal jobs. Similar to other squatter settlements in Greater Khartoum, Mayo's houses are built of mud.

## Conclusion

The morphology of Sudanese cities is largely governed by the surrounding physical environment, with a linear pattern along the Nile, and clustered structures found in places originally bounded by walls or by water. Internally, old African-Islamic neighborhoods are characterized by short, narrow, winding streets; European-style and contemporary Sudanese cities are dominated by wide, long, straight streets. Buildings in new, first-class residential areas show clear signs of modernization. These are mostly villas built by wealthy people in contrast to the traditional style of one- or two-story buildings. Such change has resulted in a transformation in the profile of Sudanese cities, inscribing a pattern of higher structures in the urban core and decreasing heights as one moves outward from the center. The development of contemporary Sudanese cities has resulted in a pattern of mixed towns that exhibit both Islamic and European characteristics.

In recent years, contemporary Sudanese cities have expanded dramatically beyond the designated boundaries of the city plan because of unprecedented rural to urban migration. These cities develop across what we have divided into three zones. Zone 1 (the core) is the oldest part of the city, Zone 2 is the planned and the largest section, and Zone 3 is the fringe belt. The population of many cities has increased dramatically in the last three decades because of migration from rural areas in response to drought, civil wars in south Sudan and Darfur, and government policies that neglect rural development. As a result, past and present city plans have failed to control city sprawl. Contemporary Sudanese cities suffer from a lack of services and infrastructure, far beyond the government's ability to provide them. We predict that rapid growth of Sudanese cities will continue unless policies of rural development are given strong consideration. Future expansion of Sudanese cities will likely occur along the core–fringe belt axis. Some new neighborhoods are expected to expand beyond the fringe belt, which may replicate the cycling model of the morphology of European cities (Whitehand & Morton, 2003).

The morphology of cities should be understood not only in economic, historical, and physical terms, but also in cultural heritage terms. Therefore, we suggest that the preservation, redevelopment, urban policy, and future expansion of cities should incorporate analyses of the cities' historical and contemporary morphological development. Since most large Sudanese cities are located along the Nile, the cities' morphology and future extension will likely follow the model of the three zones of Khartoum and Omdurman (Figure 4). Migration from rural areas continues to increase, as climate change forces more people to migrate to the banks of the Nile. In sum, our study documents the form and growth of Sudanese cities, focusing on how contemporary morphological characteristics relate to cities' historical identities. These histories inform the contemporary morphology of Sudanese cities and should, in turn, inform contemporary urban planning as social and environmental transformation continues to propel rapid urban growth in Sudan.

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## Notes

1. However, in his description of the town, he also referred to it as a village. We assume that he referred to these settlements as villages based on their population (200–400 people), while at the

same time he called them urban centers based on the function and the services that they provided to the hinterland.

2. Burckhardt (1980) mentions that there was no distinction made between villages and towns in this part of Sudan.
3. The terms 'migrants,' 'IDP,' and 'squatters' are used interchangeably in this article to denote all of the people who moved from rural areas and settled in Greater Khartoum.

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