

Chapter 15

Nairobi Metropolitan Area

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Abstract This chapter examines the origin and brief history of Nairobi Metropolitan Area, which is Kenya's principal economic and cultural center and one of the largest and fastest growing cities in Africa. This chapter looks at the urban primacy, urban land use/cover change patterns, and the factors that have influenced the urbanization of Nairobi, as well as the potential implications of these factors to the future urban development of this Metropolitan. Nairobi is an example of an African colonial city, with colonial origins, which shaped its structure and management at the time of Kenya's transition to independence. Nairobi was born of the European colonial project and was first established as a transportation center, before it grew to become an administrative center. Like other African cities, after independence Nairobi was characterized by a rapid increase in rural to urban migration, accompanied by the proliferation of small-scale trade and commodity production. Nairobi has grown remarkably, with its urbanization driven by various interrelated factors. Land use/cover change analysis for Nairobi Metropolitan Area shows that the built-up areas would continue to increase at an average annual rate of change of 1.49 km²/year. The results of the landscape pattern analysis show that built-up land would be more aggregated but with disconnected, nonlinear, and complex patches of built-up land as Nairobi continues to expand. Nairobi's accessibility as the regional hub, its relative position as the gateway to eastern African region, its status as the country's capital, the adoption of various urban development strategies, and its population and economic growth, together, have combined to drive its urban development. Nairobi is, however, faced by a myriad of urban challenges that need to be taken into consideration in its future development including traffic congestion, inadequate urban housing, mushrooming slums, urban poor, unemployment, delinquency, crime, unavailability of clean water, inadequate drainage and sanitation, lack of adequate public transport, environmental degradation, and disaster unpreparedness. The Government of Kenya has embarked on an ambitious Nairobi Metro 2030 vision to spatially redefine the Nairobi

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Metropolitan Area and create a world-class city region which is envisaged to generate sustainable wealth and quality of life for its residents, investors, and visitors. It is hoped that this will be realized so that Nairobi can become a world-class metropolitan.

15.1 Origin and Brief History

Nairobi is the capital and largest city in Kenya (Fig. 15.1) and is main economic, administrative, and cultural center. It is the most populous city in eastern Africa and one of the most prominent and fastest growing cities in Africa (Rakodi 1995; Mundia and Murayama 2010). The city and its surrounding areas (Fig. 15.2) also form the Nairobi County, one of the 47 counties in Kenya under a new devolved system of governance. The area where Nairobi is currently located was an uninhabited swamp until a supply depot of the Kenya–Uganda railway was built around 1900 (Boedecker 1936). The site was chosen because it offered a number of favorable factors including a suitable stopping place via railway line enroute to Uganda, adequate water supply from nearby rivers, ample land for rail development, and elevated cooler ground to the west suitable for residential purposes (Foran 1950; Walmsley 1957). The supply depot soon became the railway headquarters and was named Nairobi, after the Masai name “Enkare Nairobi,” which means “a place of cool waters” (Hirst and Lamba 1994). The place was a grazing land and livestock watering point for the local Masai people and had no permanent African settlements.

Nairobi was totally rebuilt in the early 1900s after an outbreak of plague and the burning of the original town (White et al. 1948). Soon after, the spatial patterns

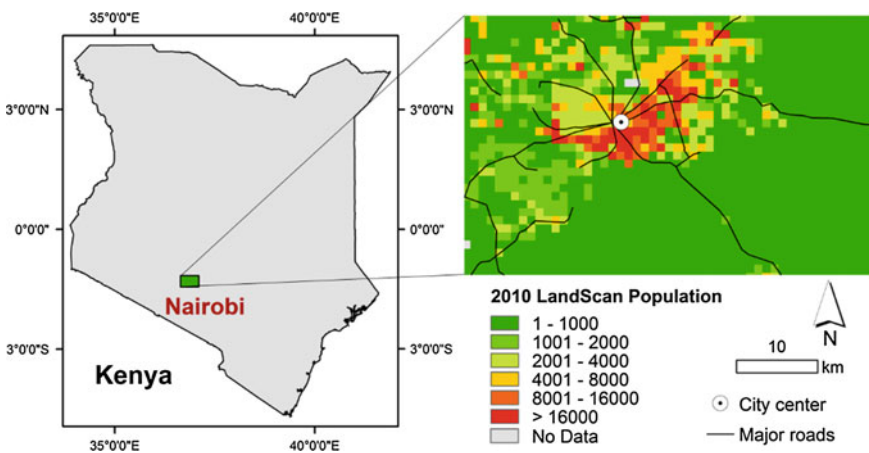


Fig. 15.1 Location and LandScan population of Nairobi Metropolitan Area, Kenya

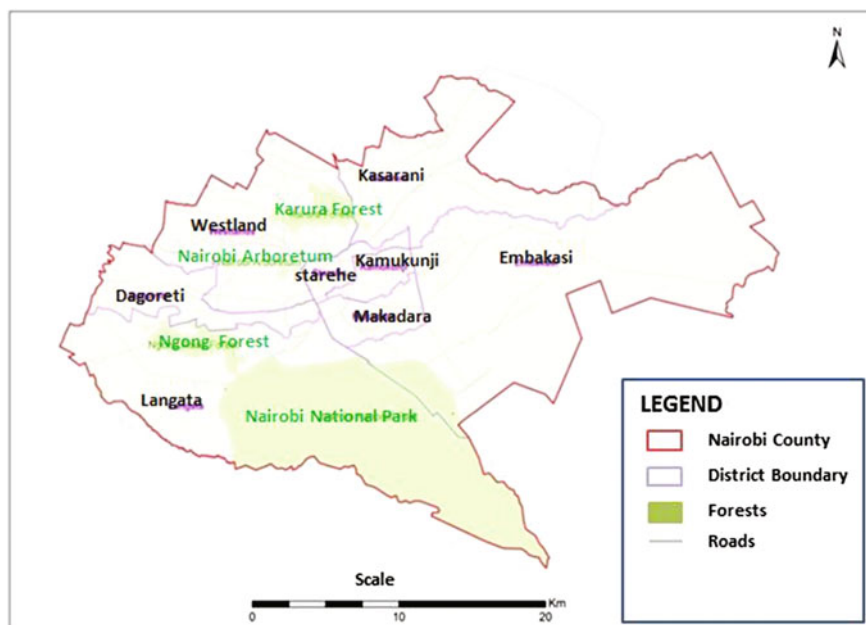


Fig. 15.2 Post-independence administrative boundary of Nairobi showing 8 constituencies

around the depot and the railway station emerged. The Europeans established their homes on the elevated area to the west, away from Asians and Africans leading to exclusive European residential settlements. Asian employees, formerly working for the railway, established shops, later known as Indian Bazaars, not far from the railway station. African workers lived in employee housing and shanty villages to the east (White et al. 1948). By 1905, the original railway depot and camp had grown into an urban center of over 10,000 people and definite land use zones had appeared. The Europeans mainly occupied the cooler Westland, the Indians in the north, and the African workers were mainly concentrated on the periphery (White et al. 1948). In the same year, Nairobi replaced Mombasa as the capital of the British East Africa protectorate. It continued to grow under British rule, and many British people settled within the city's suburbs. With the influx of more non-African settlers, it expanded rapidly. By 1909, much of its internal structure, especially the roads, was already established (Boedecker 1936). The continuous expansion of the city began to anger the neighboring local Masai people because the city was taking up their grazing land to the south which they needed for their livestock. In the west, it also angered the Kikuyu people who wanted their land returned to them (Foran 1950). In 1919, Nairobi was declared a municipality under Nairobi city council, and at the same time, the boundary was extended to include the peri-urban settlements (Croix 1950). The boundary was extended again in 1927 to cover 30 miles² (White et al. 1948). From 1928 to the time of independence in 1963, the boundary remained the same with only minor additions and excisions taking place. Upon

independence, Nairobi became the capital of the new republic and the city was expanded further (Foran 1950; Walmsley 1957) (Fig. 15.2). It has grown rapidly since independence, and this growth has put pressure on the city's infrastructure (Karuga 1993; Mundia and Aniya 2005).

Nairobi is currently a characteristic blend of modernism and traditionalism. The city is a brawling, dynamic maelstrom of cultures and enterprises that reflects its diverse heritage (Nairobi City Commission 1985; Hirst and Lamba 1994). Its many contrasts are reflected in the variety of tribes, races, as well as the geographical juxtaposition of the city lying in close proximity to the African wilderness. Just outside the city is the Nairobi National Park which has a rich variety of wild animals and the only national park within a city anywhere in the world (Mundia and Aniya 2005). Nairobi has a diverse and multicultural composition with a number of prominent churches, mosques, and temples within the city serving the various cultures and religions (Nairobi City Commission 1985). Figures 15.3 and 15.4 provide views of the city of Nairobi.

15.2 Primacy in the National Urban System

15.2.1 *Kenya and Its National Urban System*

Kenya is located on the equator with the Indian Ocean lying to the southeast and is bordered by five East African countries of Tanzania to the south, Uganda to the west, South Sudan to the northwest, Ethiopia to the north, and Somalia to the north east. At 580,367 km², Kenya with a population of about 45 million people is the world's forty-seventh largest country by size and lies between latitudes 5°N and 5°S, and longitude 34° and 42°E (Stren and White 1989). From the coast on the Indian Ocean, the low plains rise to central highlands. The highlands are bisected by the Great Rift Valley, with a fertile plateau lying to the east (Walmsley 1957; Syagga et al. 2001).

Kenya adopted a new constitution in 2010 which marked a major milestone in the way the country is governed. Political power and economic resources were dispersed from a centralized government in Nairobi to the grassroots in a devolved form of governance. As a result, 47 counties were established (Fig. 15.5) based on cultural, ethnological, and geographical characteristics. Under a democratic-presidential form of government, Kenya is politically and administratively divided into these 47 counties which are the primary administrative and political divisions in the country (Omolo 2010).

Urbanization in Kenya has a long history, going back to as early as the ninth century when urban trading centers started along the Kenyan coast. Many urban centers, however, started during the pre-independence period, when they were used as centers for administrative and political control by the colonial government (Foran



Fig. 15.3 Nairobi Metropolitan Area as seen from upper hill and from the rooftop of KICC building. *Source* Author's fieldwork (2015)

1950). The urbanization patterns in Kenya have tended to reflect the development of British colonization rather than traditional African settlement patterns. The rate of urbanization in the country is one of the highest in the world with an estimated annual rate of growth of the urban population at 7.0% (Cohen 2004). The growth of urban population which has resulted from both natural population growth and rural–urban migration has led to an increased demand for resources needed to meet the demand for infrastructural services (Olima 1997). Population statistics show that the proportion of Kenyans living in urban centers increased from 5.4% in 1948 to 15.3% in 1979, to 21.4% in 1989, to 28.2% in 1999, and to 38.4% in 2009.



Fig. 15.4 Sections of Nairobi’s CBD taken along major city roads. *Lower left* Traffic congestion along Moi Avenue; *lower right* slum area, showing informal settlement in Kibera, Nairobi. *Source* Author’s fieldwork (2015)

There are currently about 230 urban centers in Kenya, with 45% of the urban population living in the capital city, Nairobi (Government of Kenya 2007). The Nairobi Metropolitan Area is the most populous in East and Central Africa with a

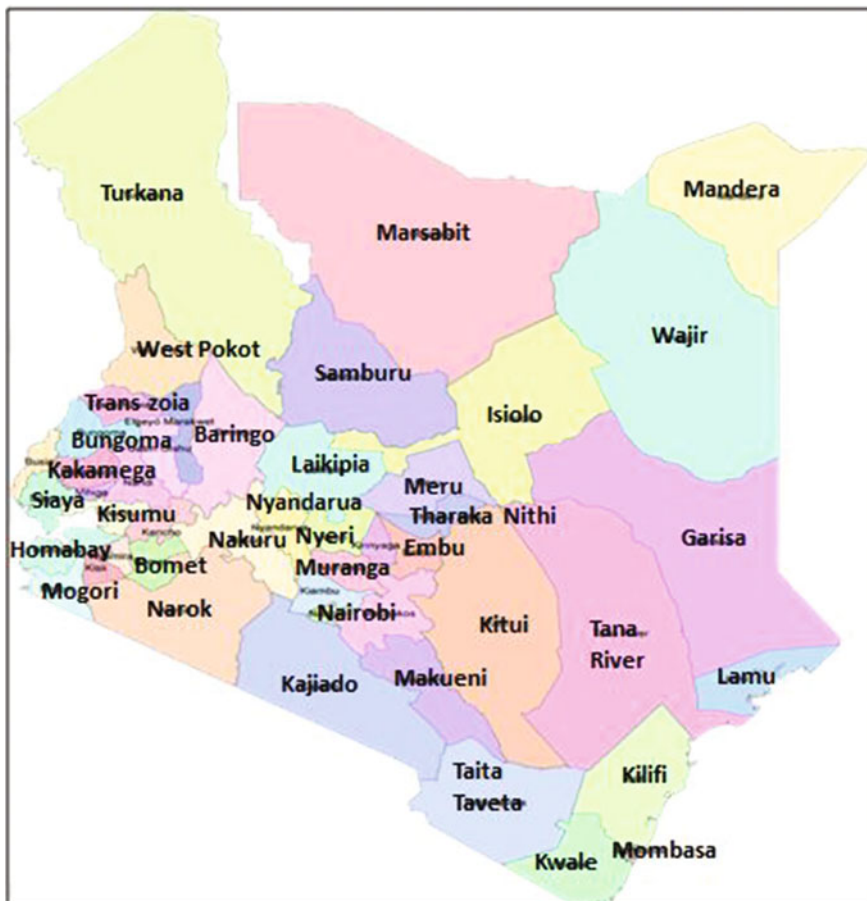


Fig. 15.5 Map of the 47 counties in Kenya. *Source* Survey of Kenya

population of 4 million people spread over 685 km². Kenya is the largest economy in East Africa and the ninth largest in Africa.

In the national framework for spatial planning, the 47 county headquarters spread throughout the country have been identified as the country’s leading industrial, financial, and technological centers that serve as the main national growth hubs. The territorial spread of urban centers of different sizes across the whole country constitutes the national urban system. The spatial distribution of these urban centers provides an overview of Kenya’s national urban system and the regional social and economic agglomerations in the country (Government of Kenya 2008).

15.2.2 Primacy of Nairobi Metropolitan Area

Nairobi city and its surrounding area also form the Nairobi County. The total urban population in Kenya according to the 2009 population census was about 12.0 million with the population of Nairobi at 4.0 million representing over 30% of total urban population in Kenya. There are only three incorporated cities in Kenya, but there are other numerous municipalities and towns with significant urban populations (Syagga et al. 2001; Government of Kenya 2007). Table 15.1 summarizes the details of the five most populous cities and urban centers in Kenya according to the 2009 population census.

At the time of Kenya's first population census in 1948, there were 17 urban centers with an aggregate population of 285,000 people (Table 15.2). The urban population was proportionately small (5.0% of the total) but disproportionately concentrated in Nairobi and Mombasa (41.0 and 32.0% of the total urban population, respectively) with the majority of the urban dwellers being non-Africans (Government of Kenya 2007). By 1962, the number of urban centers had doubled to 34 and the urban population increased to 671,000 people, with Nairobi accounting for 34% of this population. While the overall urban growth rate stood at 6.3% per year, Nairobi's growth rate was 4.6%.

The growth of urban centers, both in numbers and population, accelerated after independence when Africans were allowed to migrate to the urban areas without any legal and administrative restrictions. The urban population grew to 1 million in 1969, at a rate of 7.1% per annum. This represented about 10% of the total population, with Nairobi and Mombasa accounting for about 67% of the total urban population: Nairobi (48%) and Mombasa (19%). This period also saw Nairobi recording the highest growth rate of 12.0%.

By 1979, the overall level of urbanization had risen to about 15.0% with over 90 urban centers and an urban population of 2.3 million (Obudho and Owuor 1991). Nairobi and Mombasa accounted for over 50% of the total urban population: Nairobi (36%) and Mombasa (15.2%). Although the urban population increased from 2.3 million in 1979 to close to 4.0 million in 1989, the growth rate was only

Table 15.1 List of the five populous cities and municipalities in Kenya

	City/town	Status	Population	County
1.	Nairobi	Metropolitan	3,375,000	Nairobi
2.	Mombasa	City	1,200,000	Mombasa
3.	Kisumu	City	409,928	Kisumu
4.	Nakuru	Municipality	307,990	Nakuru
5.	Eldoret	Municipality	289,380	Uasin Gishu

Source Kenya Bureau of Statistics, 2009 population census

Table 15.2 Distribution of urban population in Kenya by size of urban center, 1948–2009

Size of urban pop. ('000)	1948		1962		1969		1979		1989		1999		2009	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Over 100,000	1	6	2	6	2	6	4	3	6	4	20	10	19	8
20,000–99,999	1	6	2	6	2	6	4	13	21	15	82	42	90	39
10,000–19,999	2	12	3	9	7	15	15	11	19	14	18	9	28	12
5000–9999	3	18	11	32	11	24	24	22	32	23	23	12	30	13
2000–4999	10	58	16	47	25	53	42	42	61	44	51	27	64	28
Total no. of urban centers	17	100	34	100	47	100	91	100	139	100	194	100	230	100
Total urban pop. (millions)	0.28		0.75		1.06		2.31		3.88		5.4		12.0	
Total country pop. (millions)	5.4		8.6		10.9		15.3		21.4		28.2		38.4	
Urban pop. as % of country pop.	5.1		7.8		9.9		15.1		18.1		19.3		31.3	

Source Compiled from Kenya Population Censuses, 1948–2009

slightly above 5.0% compared to over 7.0% in the previous decade. With about 140 urban centers, the 1989 population results indicated that about 19% of the population resided in the urban areas. Nairobi and Mombasa accounted for about 45% of the total urban population (34 and 12%, respectively). In 2009, about 31.3% of the population lived in urban areas, of which more than half were in the five big urban centers in Kenya—Nairobi, Mombasa, Nakuru, Kisumu, and Eldoret. The urban growth rate reduced to about 3.5%, but the number of urban centers increased to 230 (Obudho and Owuor 1991; Kenya National Bureau of Statistics 2013).

As a consequence, the urban primacy index has shown an upward trend between 1979 and 2009 indicating that most of the Kenyan urban population lives in Nairobi. In other words, Nairobi continues to be a major urban center for socioeconomic and political activities in Kenya (Kenya National Bureau of Statistics 2013). Overall, based on population and GDP, the urban primacy of Nairobi Metropolitan Area relative to the other urban centers in Kenya is evident. The primacy of Nairobi City creates an imbalance in the urban hierarchy and development processes in the region. It is hoped that the new devolved system of governance in Kenya together with the current national framework for physical planning will promote country-side developments and a more balanced national urban system. At the moment, however, unlike Nairobi, there is no functional governing structure for the other urban areas which will be a great challenge in their respective landscape and urban development planning and implementation. There is, however, an ongoing national physical planning policy initiative that will ensure proper governance structure for the other urban areas to guide their growth and development. This is expected to ensure a more balanced national urban system that can spur nationwide development (Government of Kenya 2007).

15.3 Urban Land Use/Cover Patterns and Changes (1988–2030)

15.3.1 Observed Changes (1988–2014)

The results of the land use/cover mapping and change detection for Nairobi Metropolitan Area (Figs. 15.6 and 15.7) show that the built-up area increased from 43.32 km² in 1988 to 182.18 km² in 2014 (Table 15.3), a 320% increase in a period of 27 years, with an annual rate of change (increase) of 5.14 km²/year. The annual rate of change during 1988–2000 was 2.91 km²/year which increased during the 2000–2010 period to 4.15 km²/year (Table 15.4). During the period 2010–2014, however, the annual rate of change increased substantially to 15.63 km²/year.

Table 15.5 summarizes the results of the landscape pattern analysis using spatial metrics for the built-up class. The percentage of landscape (PLAND) metric

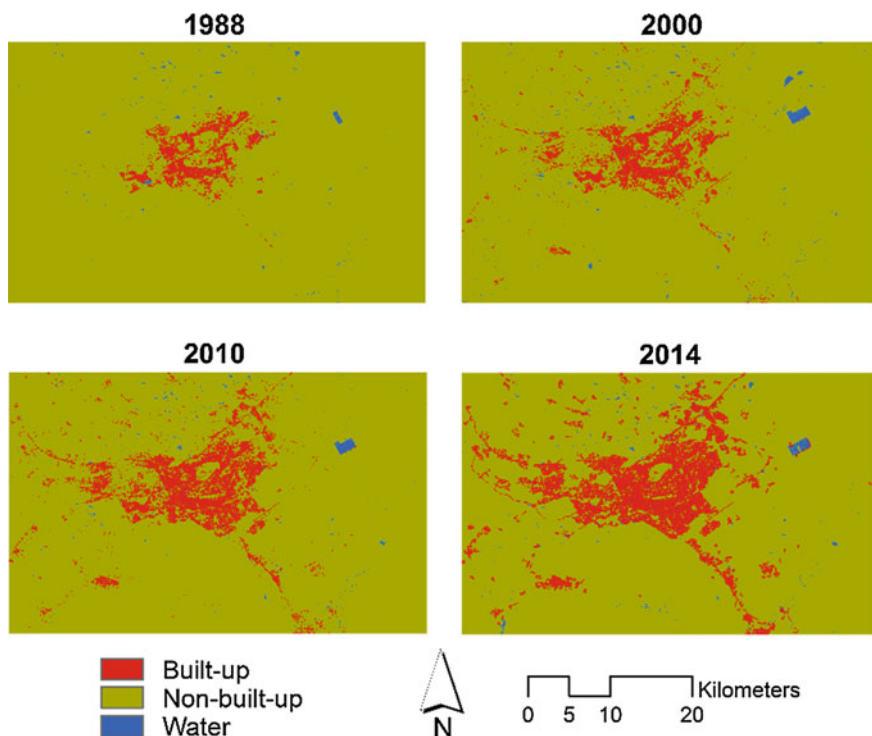


Fig. 15.6 Urban land use/cover maps of Nairobi Metropolitan Area classified from Landsat imagery

measures the proportion of a particular class at a certain time point relative to the whole landscape. In 1988, the PLAND of Nairobi Metropolitan Area's built-up land was 2.66%, and this increased to 4.82, 7.36, and 11.22% in 2000, 2010, and 2014, respectively (Table 15.5). The patch density (PD) metric measures fragmentation based on the number of patches per km^2 , in which a patch is based on an 8-cell neighbor rule. For Nairobi, the PD of its built-up land was 0.43 in 1988, which changed to 1.13 and 1.57 for 2000 and 2010, respectively. The PD for Nairobi then decreased to 0.12 in 2014 suggesting that the built-up land for Nairobi Metropolitan Area became less fragmented and more aggregated.

The Euclidean nearest-neighbor distance (ENN) metric is a measure of dispersion based on the average distance to the nearest neighboring patch of the same class. The mean ENN value of Nairobi's built-up land increased from 138.91 m in 1988 to 164.43 m in 2000 and then declined to 157.95 m in 2010. The mean ENN then increased to 353.50 in 2014. The increase during the 1988–2000 period could have been due to the aggregation of neighboring patches of built-up land, as also indicated by the increase in PLAND and decrease in PD during the same period (Table 15.5). The decrease of mean ENN from 2000 to 2010 could be due to the

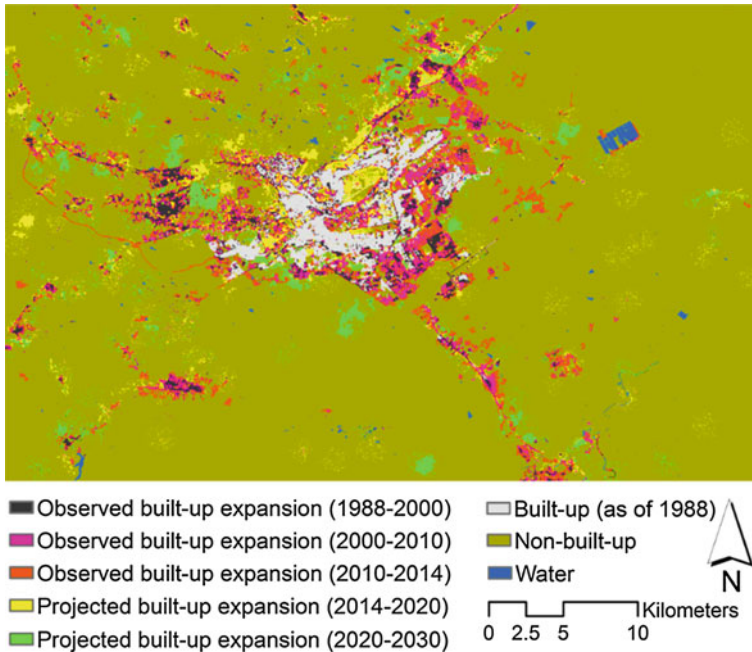


Fig. 15.7 Observed and projected urban land use/cover changes in Nairobi Metropolitan Area

Table 15.3 Observed urban land use/cover of Nairobi Metropolitan Area (km²)

	1988	2000	2010	2014
Built-up	43.32	78.19	119.67	182.18
Non-built-up	1583.56	1543.56	1505.23	1441.03
Water	4.28	9.41	6.26	7.94
Total	1631.16	1631.16	1631.16	1631.16

expansion of the old patches, as indicated by the increase in PLAND and PD during the same period.

The related circumscribing circle (CIRCLE) metric measures the circularity of patches. The CIRCLE value ranges from 0 for circular or one cell patches to 1 for elongated, linear patches one cell wide. The mean CIRCLE value of Nairobi Metropolitan Area’s built-up land generally showed an increasing trend during the 1988–2014 period (Table 15.5), indicating that substantial patches of built-up land became more elongated exhibiting a linear pattern. It is notable that Nairobi’s urban expansion seems to follow the road network (Figs. 15.6 and 15.7). The increasing trend could therefore be due to the aggregation of smaller, circular isolated patches.

The shape index (SHAPE) metric is a measure of complexity. This metric has a value of 1 when the patch is square and increases without limit as patch shape becomes more irregular. Nairobi’s built-up land had 1.25 mean SHAPE value for

Table 15.4 Observed urban land use/cover changes in Nairobi Metropolitan Area (km²)

	1988–2000	2000–2010	2010–2014
Built-up	34.87	41.48	62.51
<i>Annual rate of change (km²/year)</i>	<i>2.91</i>	<i>4.15</i>	<i>15.63</i>
Non-built-up	–40.00	–38.33	–64.20
<i>Annual rate of change (km²/year)</i>	<i>–3.33</i>	<i>–3.83</i>	<i>–16.05</i>
Water	5.13	–3.15	1.69
<i>Annual rate of change (km²/year)</i>	<i>0.43</i>	<i>–0.32</i>	<i>0.42</i>

Table 15.5 Observed landscape pattern of Nairobi Metropolitan Area

Class-level (built-up) spatial metrics	1988	2000	2010	2014
PLAND (%)	2.66	4.82	7.36	11.22
PD (number per km ²)	0.43	1.13	1.57	0.12
ENN (mean) (m)	138.91	164.43	157.95	353.50
CIRCLE (mean) ($0 \leq \text{CIRCLE} < 1$)	0.39	0.41	0.39	0.62
SHAPE (mean) ($1 \leq \text{SHAPE} \leq \infty$)	1.25	1.25	1.25	2.75

the period 1988–2010, which increased from 1.25 to 2.75 between 2010 and 2014 (Table 15.5), indicating complexity in the shape of the built-up patches. The observed landscape metrics correspond to the observed built-up expansion for Nairobi Metropolitan Area for the different time epochs as shown in Tables 15.3 and 15.4.

Analyses of the metrics for the built-up class of Nairobi Metropolitan Area along the gradient of the distance from the city center across all time periods from 1988 to 2014 (Fig. 15.8) show that PLAND decreases as the distance from the city center increases. This indicates that the proportion of built-up land near the city center is relatively higher. By contrast, PD increases first until it approaches 20 km distance from the city center and then starts to decrease.

This indicates that there were more patches of built-up land in middle distances. These were relatively more dispersed in farther distances, as indicated by the increasing trend of mean ENN across the distance from the city center. Analyses of the metrics also show a slight increase of the mean CIRCLE value along the gradient of the distance from the city center, indicating that the patches of built-up land were slightly more elongated or linear in farther distances. However, despite the variability of these metrics along the gradient of the distance from the city center, the complexity of the built-up land of Nairobi Metropolitan Area was much more uniform or stable as indicated by the mean SHAPE value.

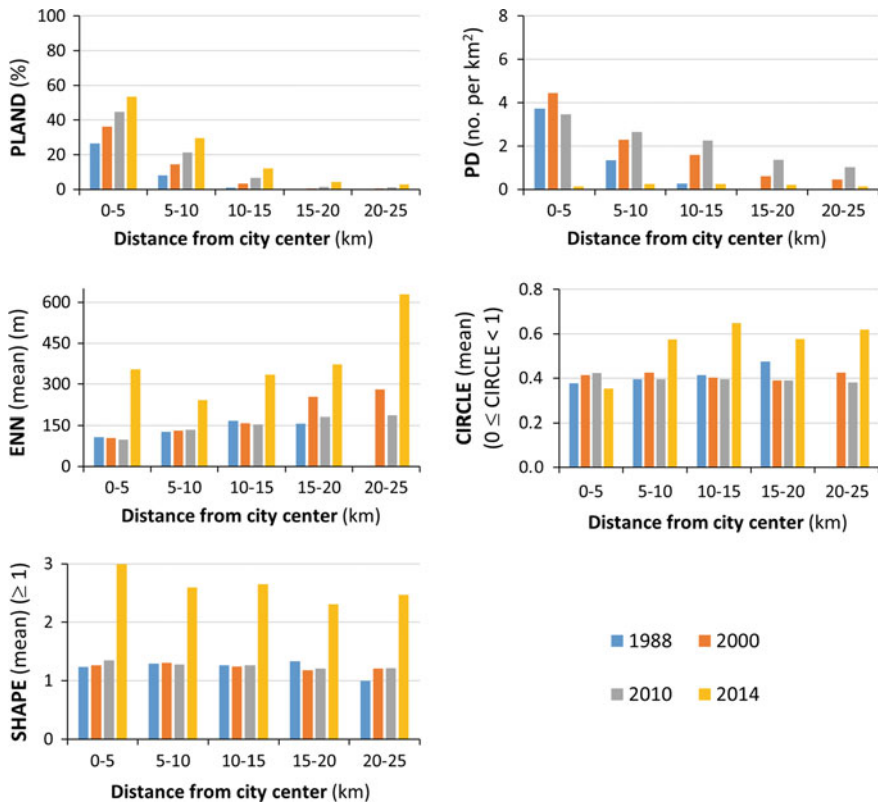


Fig. 15.8 Observed class-level spatial metrics for builtup along the gradient of the distance from city center of Nairobi Metropolitan Area. *Note* The y-axis values are plotted in the same range as those in Fig. 15.10

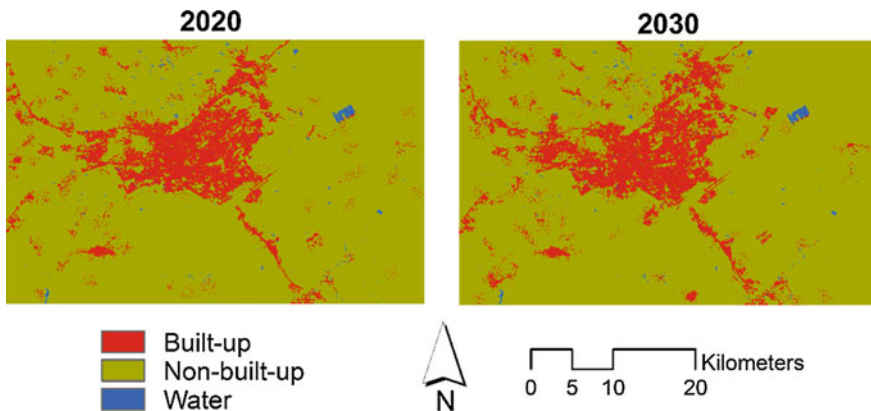


Fig. 15.9 Projected urban land use/cover maps of Nairobi Metropolitan Area

Table 15.6 Projected urban land use/cover of Nairobi Metropolitan Area (km²)

	2020	2030
Built-up	184.70	210.38
Non-built-up	1438.51	1412.83
Water	7.94	7.94
Total	1631.16	1631.16

Table 15.7 Projected urban land use/cover changes in Nairobi Metropolitan Area (km²)

	2014–2020	2020–2030
Built-up	2.52	25.68
<i>Annual rate of change (km²/year)</i>	<i>0.42</i>	<i>2.57</i>
Non-built-up	-2.52	-25.68
<i>Annual rate of change (km²/year)</i>	<i>-0.42</i>	<i>-2.57</i>
Water	0.00	0.00
<i>Annual rate of change (km²/year)</i>	<i>0.00</i>	<i>0.00</i>

Table 15.8 Projected landscape pattern of Nairobi Metropolitan Area

Class-level (built-up) spatial metrics	2020	2030
PLAND (%)	11.38	12.96
PD (number per km ²)	4.14	4.84
ENN (mean) (m)	78.25	78.44
CIRCLE (mean) ($0 \leq \text{CIRCLE} < 1$)	0.23	0.22
SHAPE (mean) ($1 \leq \text{SHAPE} \leq \infty$)	1.07	1.07

15.3.2 Projected Land Use/Cover Changes (2014–2030)

The projected results are shown in Fig. 15.9 (see also Fig. 15.7) and Tables 15.6, 15.7, and 15.8. The projected land use/cover for Nairobi Metropolitan Area shows that the built-up land would increase from 182.18 km² in 2014 to 184.70 km² by 2020 and 210.38 km² by 2030, with an average annual rate of change of 1.49 km²/year (Tables 15.6 and 15.7).

The results of the landscape pattern analysis show that the predicted patches of built-up land in 2020 and 2030 would be more aggregated as indicated by the increase in PLAND (Table 15.8). The decrease in mean ENN also indicates that there would be more patches that would be disconnected as Nairobi expands. The increase in the mean CIRCLE and SHAPE values indicates more disconnected patches and nonlinear and complex patches of built-up land.

Along the gradient of the distance from the city center (Fig. 15.10), the PLAND of the predicted 2020 and 2030 patches of built-up land would also be higher at distances closer to the city center. The PD would still be relatively higher in middle distances. The mean ENN would increase at distances farther from the city center, especially for the 2020 predicted patches. The mean CIRCLE value would decrease

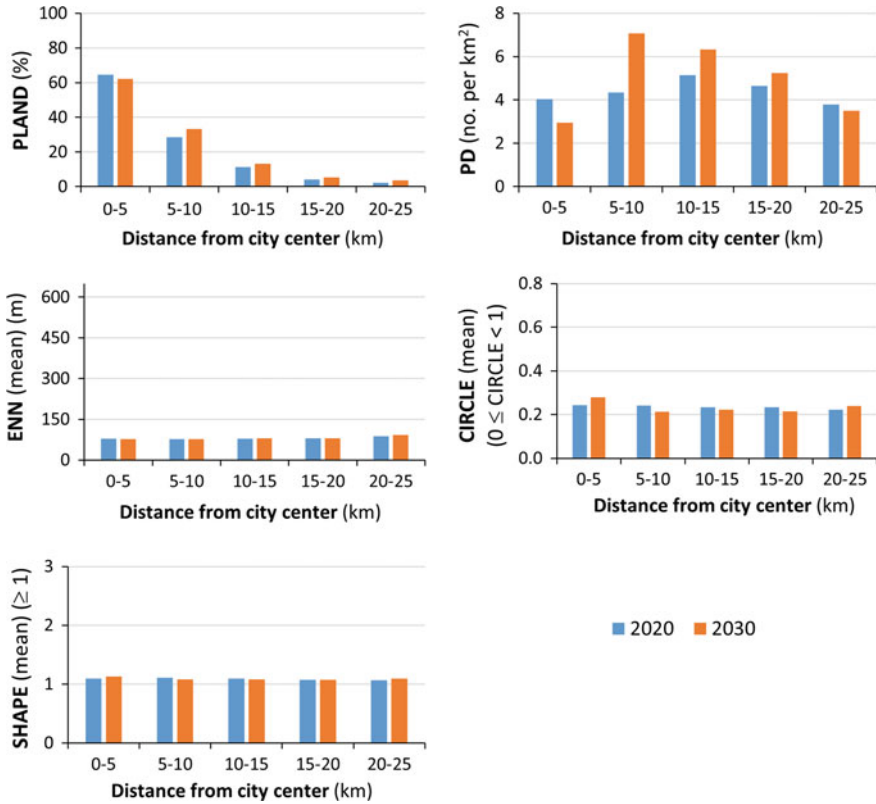


Fig. 15.10 Projected class-level spatial metrics for builtup along the gradient of the distance from city center of Nairobi Metropolitan Area. *Note* The y-axis values are plotted in the same range as those in Fig. 15.8

by 2020 and 2030, especially in distances 0–20 km. The mean SHAPE value would be relatively more uniform (Table 15.8).

15.4 Driving Forces of Urban Development

The land use/cover changes revealed for Nairobi City have occurred as a result of interactions of a number of environmental as well as demographic and socio-economic forces. Some factors that have influenced this urban expansion include the following.

15.4.1 Some Key Urban Development Initiatives for Nairobi Metropolitan Area

1. The 1898 Plan of Nairobi. This was the first plan for Nairobi which was a town layout for the railway depot, with the main feature being the Nairobi railway station and the railway line. The plan strikingly resembles the town layout of Nairobi CBD today.
2. The 1926 Plan for a Settler Capital. In this plan, the city area was expanded to 77 km² to accommodate the growing population.
3. The 1948 Master Plan for a Colonial Capital. This master plan introduced the neighborhood units and zoning scheme for different users in the city (White et al. 1948).
4. The 1973 Nairobi Metropolitan Growth Strategy. This strategy was a long-term structure planning policy guide with broad long-term policy directions, strategies, and possibilities for the development of Nairobi City (Nairobi Urban Study Group 1973). The plan was meant to guide the development of the city up to the year 2000. The 1973 Nairobi Metropolitan Growth Strategy recommended decentralization and development of alternative service centers; modification, upgrade, and extension of the road network; formulation of realistic housing programs; and extension of the city boundary to the west and northeast, as well as the growth of satellite towns surrounding the city (Nairobi Urban Study Group 1973). As much as the 1973 Nairobi Metropolitan Growth Strategy was a tool for state intervention, it supported the interests of a few (Emig and Ismail 1980; Anyamba 2004). The interests of the urban majority were neglected as segregation was enhanced based on economic and class lines as opposed to racial and class lines. In the process, the urban majority were marginalized further and informalization thrived (Anyamba 2004).
5. The 1984–1988 Nairobi City Commission Development Plan, which outlined the development needs of all sectors: housing, health and environment, sewerage, social services, transport and public works, manpower development, and financial management (Nairobi City Commission 1985). This plan remained only on paper, and nothing much was achieved as regards its implementation.
6. “The Nairobi we want convention of 1993.” The Nairobi City Convention was organized to map out strategies and practical actions toward a better Nairobi. The recommendations of this convention were broadly organized around four areas, namely (1) issues dealing with the use of space and the physical environment; (2) problems pertaining to the provision of services; (3) issues relating to the social sector; and (4) administrative, legal, and political issues (Karuga 1993). Unfortunately, much of these ideas were not taken into account in the planning of Nairobi.
7. The Kenya Local Government Reform Program (KLGRP) of 1999. This initiative embarked on policy and legal framework changes aimed at decentralization and local authority empowerment. This initiative introduced the Local Authorities Transfer Fund (LATF), a grant from the central government to equip

local authorities with means to provide their citizens with basic services. The key objectives of LATF were to (a) enable local authorities to improve and extend service delivery; (b) resolve municipal debts; and (c) improve local revenue mobilization, accountability, and financial management (Owuor et al. 2006). Within the same reform framework, the government in 2001 introduced the Local Authority Service Delivery Action Plan (LASDAP), which is a participatory planning and budgeting tool for identifying local priority needs in the local authorities.

8. Creation of the Ministry of Nairobi Metropolitan Development in 2008. This ministry was charged with the development issues of the Nairobi Metropolitan Area, aiming at area-wide governance interventions. Specifically, the ministry was in charge of roads, bus, and rail infrastructure—creating an efficient transport system; replacing slums with affordable low-cost and rental housing; enforcing planning and zoning regulations; facilitating efficient water supply and waste management infrastructures; and promoting, developing, and investing in sufficient public utilities, public services, and infrastructure (Government of Kenya 2008).
9. Nairobi Metro 2030 vision of 2010. Responding to urban growth projections and in an attempt to address current and future Nairobi Metropolitan Area challenges, the Government of Kenya embarked in an ambitious Nairobi Metro 2030 vision to spatially redefine the Nairobi Metropolitan Area and create a world-class city region expected to generate sustainable wealth and quality of life for its residents, investors, and visitors. The plan's elaboration and implementation fell under the responsibilities of the then Ministry of Nairobi Metropolitan Development. The vision of the Nairobi Metropolitan Area was to create a best managed metropolis in Africa, providing a dynamic and internationally competitive and inclusive economy supported by world-class infrastructure and a skilled labor force (Government of Kenya 2008). Based on the core values of innovation, enterprise, sustainability, coresponsibility, self-help, and excellence, the strategy was to optimize the role of the Nairobi Metropolitan Area in national development by building on existing strengths, including Nairobi's hub function in air transportation, the large number of regional and international bodies already present in the city, and its educational and research institutions. Nairobi Metro 2030 sought to brand and promote Nairobi as East Africa's key gateway city by creating a framework for comprehensively addressing a broad range of policy areas, including the economy, trunk and social infrastructures, transportation, slums and housing, safety and security, and financing. The Nairobi Metropolitan Area covers the 3000 km² that depend on Nairobi's regional core functions for employment and social facilities. Planning would initially involve a 40 km radius, despite Nairobi's functional outreach covering about 100 km. Apart from Nairobi Municipality itself, the Nairobi Metropolitan Area vision affected 14 other adjacent independent local authorities (Government of Kenya 2008). The implementation of this strategy started in 2010, and some progress has been noted.

15.4.2 Rapid Development

The economic development has been one of the dominant driving forces. Nairobi's gross domestic product (GDP) was about US \$254 million in 1975, \$970 million in 1985, and \$1.65 billion in 1995 (Republic of Kenya 2002). The national economic survey of the year 2000 put Nairobi's GDP at \$2.25 billion (Republic of Kenya 2002). The economic development has led to the establishment of more industries, the boom of real estate and subsequently to the expansion of the built-up areas. The unregulated small-scale businesses have expanded rapidly, and the employment in this sector is estimated at 500,000 people (Republic of Kenya 2002). The increase in economic development as measured by the changes in the GDP values reflects the change in urban expansion. The economic development which grew much faster in the period 1975–1985 (153% growth) led to a higher rate of urban expansion. The period 1988–2000 had a lower rate of urban expansion, which can be explained by the slow economic development (70% growth) during the period 1985–1995.

15.4.3 Urban Population Growth

The 1969 population census put Nairobi's population at slightly over half a million. The population rose to 1.35 million by 1989 against a national total population of 23 million (Development Solutions for Africa 1992). The current population is estimated at 4.2 million. This rapid urban population growth reflects a natural population increase among the urban residents (52%) as well as migration of people from rural areas to the city (48%). As a consequence, Nairobi's urban primacy index has shown an upward trend between 1979 and 2010 indicating that most of the Kenyan urban population lives in Nairobi (Mundia and Aniya 2005). The substantial population growth in Nairobi is responsible for the land use/cover changes shown in Fig. 15.6. Nairobi's economy, public services, and infrastructure have not managed to keep up with the increasing population. The city management has been unable to cope with the increasing demand for efficient city services since the rapid urban growth has outpaced the capacity of local authorities to provide and maintain infrastructure and basic services (Stren and White 1989; Mundia and Murayama 2010). The population, which has been growing at a rate of 4% annually, has contributed to the urban sprawl as well as the mushrooming slums, and the increased land use/cover changes. Poor planning in addition to the population increase has made worse the already existing physical, social, economic, and environmental problems (Mundia and Murayama 2010).

15.4.4 Physical Factors

The physical setting of Nairobi City has also influenced the expansion directions. From Figs. 15.6 and 15.7, the northeast and westward expansions have tended to follow the flat areas. In the areas to the east, where flat land and the general topography offer lower land and residential building costs, the poor road network, the greater prevalence of clay soils, and the drainage problems have reduced these advantages. In the western part of Nairobi, where the ground is higher with rugged topography, expansion is constrained by the existence of steep slopes. Major constraints to the expansion of Nairobi City include the national park to the south of the built-up area, and the safety zone and noise corridor around the Nairobi international airport. The national park, a protected area within the city right next to the built-up area, makes it a unique and valuable resource, not only as a tourist attraction, but also as an ecological counterpoint to noise, traffic, pollution, and stress of the urban environment, with all the inherent benefits that an unspoiled natural environment provides to its surrounding area. It is therefore a resource that must be preserved, and this has checked the southward expansion of the city (Mundia and Aniya 2005).

15.5 Implications for Future Sustainable Urban Development

Urbanization is one of the many human activities that have a serious impact on the natural environment, both locally and globally (Grimm et al. 2008; Wu 2010; Seto et al. 2011; Dahiya 2012; Estoque and Murayama 2014). It is also “the most drastic form of land transformation that result in irreversible landscape changes” (Estoque and Murayama 2014, p. 943). Sustainable urban development, characterized by a well-balanced relationship between environmental, social, and economic aspects of society, is an important component and an indispensable part of the sustainability goal of human kind (Estoque and Murayama 2014). For the case of Nairobi Metropolitan Area, though its socioeconomic conditions improved over the years, its overall sustainability remains a critical issue. This section examines the potential implications of its population growth and built-up expansion pattern to its future sustainable urban development.

15.5.1 Population Growth

The Population of Nairobi Metropolitan Area has increased from 500,000 in 1970 to the current 4.2 million. Nairobi has experienced rapid growth in terms of population compared to other major cities in Africa. The large population of Nairobi

has been a key factor to its primacy over all urban centers in Kenya. However, its increasing population density and the rate of urbanization have overstretched the capacity of infrastructure and services and have caused various socioeconomic problems including uncontrolled growth and spreading of slum settlements, unemployment, delinquency, crime, unavailability of clean water, inadequate drainage and sanitation, lack of adequate public transport and environmental degradation, and urban poverty among other urban challenges. Much of Nairobi's urban footprint is unplanned settlement driven by rapid population growth and urban poverty, among other things. Population increase coupled with the acute shortage of urban housing and the problem of inadequate shelter have manifested themselves in the rapid formation and growth of informal settlements and tenement structures matched by deficiencies in the supply of the most basic infrastructure and public facilities required for human habitation. The sprawling informal settlements handicap the city's delivery of social services and negatively impact the quality of life. There is an urgent need for the Government of Kenya to ensure that there is corresponding increase in delivery of urban services to cater for the expanding population of its primate city.

As noted earlier, Nairobi's gross domestic product has been on the increase. The economic development has led to the establishment of more industries, boom in real estate development and subsequently to the expansion of the built-up areas. The increase in economic development as measured by the changes in the GDP values reflects in the change in urban expansion. Nairobi's gross domestic product, however, requires to consistently grow at a much higher level, if the identified urban challenges are to be managed. The national and county governments have indicated their intention to ensure continued economic growth and per capita socioeconomic development in addition to sorting out Nairobi's urban growth challenges to ensure sustainable growth trajectory.

15.5.2 Built-Up Expansion Pattern

Built-up expansion pattern of Nairobi Metropolitan Area exhibits aspects of concentric and sector urban growth models. Urban expansion has not taken place evenly in all directions but more along certain directions. Expansion has taken place around the periphery and also through infilling and sprawl development. Nairobi shows a star-shaped urban sprawl emanating from the city center and centered on the main roads. Some of the challenges that have been noted and which are related to this growth pattern include traffic congestion, inadequate urban housing, mushrooming slums, urban poor, unemployment, delinquency, crime, unavailability of clean water, inadequate drainage and sanitation, lack of adequate public transport, environmental degradation, and disaster unpreparedness (Mundia and Aniya 2005, 2006, 2007; Mundia and Murayama 2010; Kamusoko et al. 2011).

The sprawling pattern of Nairobi Metropolitan Area also has an important implication to urban planning. Analysis of urban expansion indicates that deliberate

planning is lacking in Nairobi's built-up expansion pattern and that the principles of urban planning and regulations have not been adhered to. Some key urban development strategies initiated previously have not been followed through. Comprehensive planning is therefore needed to help Nairobi manage its resources better and deal with various challenges. The main challenge at present is learning how to cope with rapid urban growth which requires concerted effort by all stakeholders to redirect their collective energies and available resources in devising viable urban management strategies.

15.5.3 Current Major Development Plans

Two key urban development strategies are notable. The first is the Nairobi Metropolitan Development Plan of 2008. Under this development plan, the boundaries of the metropolitan were expanded to include adjoining towns and municipalities.

The plan's goal included the following:

1. Developing integrated road, bus, and rail infrastructure for the metropolitan area to provide an efficient mass transport system;
2. Replacing informal settlements with affordable low-cost housing;
3. Developing and enforcing planning and zoning regulations;
4. Preparing a spatial plan for the metropolitan area;
5. Developing efficient water supply and waste management infrastructure;
6. Promoting, developing, and investing in sufficient public utilities, public services, and world-class infrastructure for transforming Nairobi into a global competitive city for investment and tourism;
7. Identifying and implementing strategic projects and programs requiring support by the government;
8. Promoting the Nairobi Metropolitan Area as a regional and global services center for financial, information, and communication technology, health, education, business, tourism and other services; and
9. Developing a sustainable funding framework for the development of identified urban and metropolitan areas.

The implementation of this development plan started in 2010, but the results are yet to be seen. Given the many challenges facing Nairobi and the effects these have on a large number of people as well as on the country's economy and its international reputation, Kenya needs to move quickly and fully to implement this development strategy.

The second and the newly launched key development plan for Nairobi is the integrated urban development master plan for the city of Nairobi. The purpose of this integrated plan is to provide a guiding framework to manage urban development in Nairobi City County from 2014 to 2030, integrate all urban development

sectors, and realize the goals of Kenya Vision 2030 for the city county of Nairobi. This master plan has integrated all the existing master plans of various infrastructures within the city of Nairobi and its surrounding. Infrastructures integrated in this plan include urban transport, railway, airport, power, water supply, sewerage, telecommunication, and solid waste management. The plan's goals include the following:

1. To provide spatial order of physical investments;
2. To enhance quality of life for inhabitants;
3. To guide investments by providing location criteria; and
4. To embrace the evolving urban policy regime in integrating social, economic, environmental, and political issues under one unitary framework.

It is hoped that with the new devolved system of governance, this integrated urban development master plan for the city of Nairobi will be implemented as envisaged.

15.6 Concluding Remarks

Nairobi Metropolitan Area has experienced rapid urban expansion driven by various factors including its position as the regional hub and gateway to the East African region, status as Kenya's capital city, its population and economic growth, and the adoption of a number of urban development strategies to guide its urban development. Land use change analysis for Nairobi Metropolitan Area shows that the built-up land would continue to increase at an average annual rate of change of 1.49 km²/year. The results of the landscape pattern analysis show that built-up land would be more aggregated but with more disconnected, nonlinear, and complex patches of built-up land. Key drivers of urban expansion include environmental, demographic, and socioeconomic forces as well as some urban development policy initiatives that have been adopted.

Though Nairobi's growth has been phenomenal, there are a number of key urban challenges that need to be taken into consideration in its future development. The key challenges include traffic congestion, inadequate urban housing, mushrooming slums, urban poor, unemployment, delinquency, crime, shortage of clean water, inadequate drainage and sanitation, lack of adequate public transport, environmental degradation, and disaster unpreparedness.

The county government of Nairobi and the National Government of Kenya have embarked on an ambitious Nairobi Metro 2030 vision to spatially redefine the Nairobi Metropolitan Area and create a world-class city region which is envisaged to generate sustainable wealth and quality of life for its residents, investors, and visitors. The county government of Nairobi has also unveiled a new integrated master plan for Nairobi to provide a guiding framework to manage urban development in Nairobi Metropolitan Area and Nairobi County for the period

2014–2030, integrate all urban development sectors, and realize the goals of Kenya Vision 2030 for the city county of Nairobi. It is hoped that these initiatives will finally be realized so that Nairobi can grow into a world-class metropolitan.

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