Chapter 14
Bamako Metropolitan Area

Courage Kamusoko

Abstract The objective of this chapter was to analyze observed and projected land use/cover changes between 1990 and 2030 in Bamako Metropolitan Area. The land use/cover change analysis revealed significant built-up expansion for the “1990–2000” and “2010–2014” epochs, while built-up expansion slowed down during the “2000–2010” epoch. Built-up growth in Bamako Metropolitan Area was characterized by a low-density urban sprawl moving outward from the urban core into the surrounding rural areas. Generally, vacant lands in the surrounding rural areas were converted to residential and urban land uses. Future land use/cover simulations (up to 2030) indicated that the current land use/cover change trends, such as the increase in built-up areas and decrease in non-built-up areas as well as low-density urban sprawl, would continue to persist. The observed and simulated land use/cover changes provide an overview of built-up expansion as well as a simulated urban growth scenario for Bamako Metropolitan Area. This could potentially assist decision-makers with general built-up change information that can be used to guide sustainable urban development in Bamako Metropolitan Area.

14.1 Origin and Brief History

Bamako Metropolitan Area is located in the southwest of Mali (Fig. 14.1a). The metropolitan area is separated into the northern and southern parts by the Niger River. Bamako Metropolitan Area has a mean annual temperature of 28.2 °C and a mean annual precipitation of 82.6 mm. High temperatures are recorded in March, April, and May, while temperatures vary from 26.7 °C in November to 25.2 °C in February. The rainy season occurs in summer, with highest rainfall recorded in July, August, and September.

According to Dembele (2004), pre-colonial Bamako, which was located along the Niger River, was a secondary commercial center of West Africa. Pre-colonial
Bamako was inhabited by the Bambara, Bozo, Maure, and Arab ethnic groups (Dembele 2004). The French occupied Bamako—as a strategic point in order to invade West Sudan—at the end of the nineteenth century. In 1904, the former capital of West Sudan was relocated to Bamako (Vaa 2000). During the pre-independence era, the development of the city was moderate and gradual. In 1960, Bamako became the capital of Mali when the country gained independence. Although the original site of the city was located on the north bank, construction of the Martyrs Bridge and the King Fahd Bridge promoted the development of Bamako toward the south (Vaa 2000). Bamako has continued to sprawl particularly to the south, which does not have major physical constraints as the north (Fig. 14.1b). According to estimations, the population of Bamako grew from approximately 757,051 in 1987 to 2,156,177 in 2009 (World Bank 2015). While population estimates vary according to sources, Bamako was estimated to be increasing at an annual urban growth rate of 5.8% (Farvacque-Vitkovic et al. 2007).

The current spatial structure of Bamako is largely based on the French colonial era development model. The district of Bamako is divided into six communes (Fig. 14.1b). Each commune is administered by a municipal council and an elected mayor. Commune I is bordered to the north by the rural commune of Djalakorodji and Sangarebougou, to the northeast by Moribabougou, to the east by the rural commune of Gabakourou and Baguineda Camp, to the south by Commune VI, and to the west by Commune II. Commune II is limited to the north by the rural commune of Djalakorodji, to the east by Commune I, to the south by Commune V, and to the west by Commune III. The industrial sector of the city is located in Commune II. Commune III is bordered to the north by the rural commune of Dogodouman, to the east by Commune II, to the south by the portion of the Niger River and Commune V, and to the west by Commune IV. Commune III is the administrative and commercial center of Bamako. Commune IV is limited to the north and east by Commune III, to the west by Dogodouman, and to the south by Mande and the left bank of the Niger River. Commune V is bordered to the north by Communes II, III, and IV as well as parts of the Niger River, to the south by the rural commune of Kalaban Coro, and to the east by the Commune VI. Commune VI, where the airport is located, is the largest in Bamako District. This commune is bordered to the north by Commune I, to the east by Baguineda Camp, to the south and west by the rural commune of Kalaban Coro. Figure 14.1c–f shows selected sites in Bamako Metropolitan Area.
Fig. 14.1 (continued)

Fig. 14.2  Population distribution in major cities of Mali. *Source* World Bank (2015)
14.2 Primacy in the National Urban System

In Mali, urban population grew from 2,595,596 in 1998 to 4,766,170 in 2010 (World Bank 2007). To date, about 35% of the population in Mali is estimated to live in urban areas (World Bank 2007). Figure 14.2 summarizes the details of the four most populous cities and urban centers in Mali. Approximately 50% of the urban dwellers who live in urban areas in Mali are residents of Bamako. According to the World Bank report (2015), Bamako has a population of more than 2.1 million, representing 15% of the total population in Mali. Segou, Sikasso, and Kayes, the three largest cities after Bamako, have populations of 166,000, 143,000, and 127,000, respectively. Figure 14.2 shows that urban population is highly concentrated in Bamako.

According to the rank-size rule, the largest city should only be twice as large as the second largest city, while the second largest city should be three times as the third largest city. Bamako is more than six times larger than Segou, the second largest city. This clearly demonstrates the status of Bamako as a primate city. In addition, the population Bamako is approximately two times larger than the total population of Segou, Sikasso, and Kayes. This clearly shows the spatial imbalance of the cities in Mali, which is largely attributed to the concentration of economic opportunities and political power in the capital city. The dominance of Bamako is also attributed to the long distances between cities, poor intercity transport, and communication network (World Bank 2015). According to the World Bank report (2015), most urban places are located along the major rivers in the south of Mali, where land is more suitable for agriculture, and the transport network is denser. Furthermore, the primacy of Bamako is exacerbated by refugees who come from northern parts of the country and from other neighboring countries (World Bank 2015). This concentration of inhabitants has led to increased poor living and sanitation conditions in the city.

14.3 Urban Land Use/Cover Change and Landscape Analysis (1990–2014)

14.3.1 Land Use/Cover Change Analysis (1990–2014)

Land use/cover maps and statistics of Bamako Metropolitan Area for 1990, 2000, 2010, and 2014 are shown in Fig. 14.3 and Table 14.1. The results indicate that built-up areas occupied 6.2 km², while non-built-up areas occupied 386.7 km² in 1990. Note that reference data were not available for the 1990 land use/cover map. Therefore, there is uncertainty associated with the 1990 land use/cover map, which is reflected by the low quantity of built-up areas. However, significant spatial expansion in built-up areas and subsequent decreases in non-built-up areas were observed in 2000. Built-up areas increased to 46.3 km², while non-built-up areas...
Fig. 14.3 Urban land-use/cover maps of Bamako Metropolitan Area classified from Landsat imagery
decreased to 347.3 km². Furthermore, analysis of the 2010 land use/cover map revealed additional increases in built-up areas which occupied 72.8 km², while non-built-up areas decreased to 317.4 km². For the 2014 land use/cover map, built-up and non-built-up areas occupied 103.9 and 289 km², respectively. In general, built-up areas increased substantially by 97.7 km² between 1990 and 2014, whereas non-built-up areas decreased. The water area varied slightly over the study period due to seasonal changes (Fig. 14.3).

Figure 14.4a shows that rates of land use/cover changes varied during the “1990–2000,” “2000–2010,” and “2010–2014” epochs. For example, “non-built-up to built-up” change was approximately 40.1 km² at annual rate of 4 km² between 1990 and 2000. We also performed a zonal analysis by overlaying land use/cover changes with the Bamako District boundary in order to understand areas where the major changes occurred. The major “non-built-up to built-up” changes occurred in communes V and VI in the south, and communes I and IV in the north of Niger River (Fig. 14.4a and b). However, during the “2000–2010” epoch, “non-built-up to built-up” changes slowed down to approximately 26.4 km² at an annual rate of 2.6 km². The major “non-built-up to built-up” changes also occurred in communes V and VI in the south and communes I and IV in the north (Fig. 14.4a and b). The “2010–2014” epoch saw a slight increase in “non-built-up to built-up” changes. The “non-built-up to built-up” changes increased to 31.1 km² at an annual rate of 7.8 km². The major “non-built-up to built-up” changes also occurred in the same communes as the previous epochs. Generally, the land use/cover change analysis revealed high rates of built-up expansion for the “1990–2000” and “2010–2014” epochs. However, built-up growth slowed down during the “2000–2010” epoch.

Land use/cover change analysis shows that built-up expansion between 1990 and 2000 was largely dominated by extension and infill developments (Fig. 14.4a). For example, the expansion of built-up areas in communes V and VI in the south and communes I and IV in the north shows infill and extension developments. This is because most of the growth of newly developed areas in 2000 occurred in areas that were already urbanized in 1990. Extension also occurred with the expansion of the existing built-up areas. However, the growth of built-up areas during the “2000–2010” period was dominated by the extension and leapfrog developments. Leapfrog development is characterized by the conversion of non-developed areas into newly developed areas outside of existing urban built-up areas. This development is conspicuous in the southern parts of the Niger River, especially in Commune VI and the rural commune of Kalaban Coro (Fig. 14.1b and Fig. 14.4a). The “non-built-up to built-up” change patterns between 2010 and 2014 also indicated the continuation of extension and leapfrog developments in Bamako Metropolitan Area.

<table>
<thead>
<tr>
<th>Table 14.1 Observed urban land use/cover of Bamako Metropolitan Area (km²)</th>
<th>1990</th>
<th>2000</th>
<th>2010</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Built-up</td>
<td>6.2</td>
<td>46.3</td>
<td>72.8</td>
<td>103.9</td>
</tr>
<tr>
<td>Non-built-up</td>
<td>386.7</td>
<td>347.3</td>
<td>317.4</td>
<td>289.0</td>
</tr>
<tr>
<td>Water</td>
<td>18.1</td>
<td>17.3</td>
<td>20.8</td>
<td>18.0</td>
</tr>
</tbody>
</table>
Fig. 14.4  a Observed and projected urban land use/cover changes in Bamako Metropolitan Area and b observed gains of built-up at the commune level for “1990–2000,” “2000–2010,” and “2010–2014” epochs
14.3.2 Landscape Change Analysis (1990–2014)

The percentage of landscape (PLAND), patch density (PD), Euclidean nearest-neighbor distance (ENN), related circumscribing circle (CIRCLE), and shape index (SHAPE) spatial metrics for the built-up class were computed using FRAGSTATS 4.2 (McGarigal et al. 2012). PLAND is a landscape composition metric, which measures the proportion of a particular class relative to the whole landscape (McGarigal et al. 2012). The PLAND metric is 0% when the corresponding class is rare in the landscape, while PLAND is 100% when the entire landscape is dominated by a single class (McGarigal et al. 2012). The PD metric is a measure of fragmentation based on the number of patches per unit area. Low PD signifies that patches are compact and less fragmented, while high PD implies high fragmentation. The ENN metric is a patch isolation metric that measures dispersion based on the average distance to the nearest neighboring patch of the same class (McGarigal et al. 2012). Generally, isolation measures the degree to which patches are spatially isolated. ENN approaches 0 as the distance to the nearest neighbor decreases. CIRCLE is a shape metric that focuses on geometric complexity (McGarigal et al. 2012). Note that CIRCLE provides a measure of overall patch elongation. For example, CIRCLE is equivalent to 0 for circular or one cell patches and approaches 1 for elongated and linear patches one cell wide. The SHAPE metric measures the complexity of patch shape compared to a standard shape (e.g., square or circle) of the same size (McGarigal et al. 2012).

The observed class-level spatial metrics for the built-up class between 1990 and 2014 are shown in Table 14.2. The PLAND metric increased from 1.6 to 26.4% over the study period, which indicates an increase in built-up class in the metropolitan area. However, the low PLAND metric shows that most of the study area is dominated by non-built-up areas. The PD increased slightly from 1.6 to 3.2 per km² during the “1990–2000” epoch, suggesting that built-up class became less compact due to rapid built-up expansion. The mean ENN decreased substantially from 125.6 to 112.3 m between 1990 and 2010. However, the mean ENN increased slightly between 2010 and 2014. While the mean ENN shows some variations, the values indicate low levels of dispersion between the built-up areas. The mean CIRCLE and SHAPE values did not change significantly over the study period.

<table>
<thead>
<tr>
<th>Class-level (built-up) spatial metrics</th>
<th>1990</th>
<th>2000</th>
<th>2010</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLAND (%)</td>
<td>1.6</td>
<td>11.8</td>
<td>18.7</td>
<td>26.4</td>
</tr>
<tr>
<td>PD (number per km²)</td>
<td>1.6</td>
<td>3.0</td>
<td>3.6</td>
<td>3.2</td>
</tr>
<tr>
<td>ENN (mean) (m)</td>
<td>125.6</td>
<td>122.0</td>
<td>112.3</td>
<td>117.6</td>
</tr>
<tr>
<td>CIRCLE (mean) (0 ≤ CIRCLE &lt; 1)</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
</tr>
<tr>
<td>SHAPE (mean) (1 ≤ SHAPE ≤ ∞)</td>
<td>1.2</td>
<td>1.3</td>
<td>1.3</td>
<td>1.3</td>
</tr>
</tbody>
</table>
suggesting that the built-up pattern is less complex and regular in most parts of the study area.

Figure 14.5 shows spatial metrics for the built-up areas of Bamako Metropolitan Area (from 1990 to 2014) along the gradient of the distance from the city center. Generally, PLAND increased between 1990 and 2014 within all the distance buffer zones. However, the magnitude of change was greater within the 0–15-km buffer zone. This indicates that the proportion of the built-up class near the city center is relatively high. The PD metric varied within the different buffer zones over the study period. For instance, PD increased within the 0–5 and 5–10-km buffer zones between 1990 and 2000, which suggests that the built-up patches were fragmented. Nevertheless, PD decreased within the 0–5-km and 5–10-km buffer zone between 2010 and 2014, suggesting that built-up patches were becoming less fragmented. Yet, PD increased substantially within the 10–15 km distance buffer zone over the
study period, indicating that built-up patches became less compact with distance. This is mainly attributed to outward and leapfrog developments. The mean ENN metric was relatively constant within the 0–5 and 5–10-km buffer zones over the study period. However, the mean ENN substantially decreased within the 10–15-km buffer zones, which indicates low dispersion level. This implies that built-up patches within the 10–15-km zones were more connected. Generally, the mean CIRCLE and SHAPE values did not show a clear trend over the study period. Nevertheless, the relatively low mean CIRCLE and SHAPE values suggest that the built-up class is less complex and more regular. In general, the analysis of the spatial metrics with distance buffer zones indicates that 1990 built-up areas were scattered given that the initial built-up area in 1990 was substantially small. Built-up expansion between 2000 and 2014 suggests that the built-up patches were coalescing. On the other hand, the built-up areas became discontinuous and scattered further away from the city center, which is partly attributed to outward and leapfrog developments.

14.3.3 Driving Forces of Urban Development

Urban development is influenced by many complex underlying and proximate driving forces, which vary over space and time (Turner et al. 1995; Geist and Lambin 2001). Qualitative analysis of the driving forces of urban development for the “1990–2000,” “2000–2010,” and “2010–2014” epochs was based on the literature review. Generally, the land use/cover changes and the subsequent built-up expansion in Bamako Metropolitan Area were driven by a number of socioeconomic, political, and natural driving factors.

According to the UN-Habitat (2012), Bamako Metropolitan Area is one of the ten fastest growing cities in the world. The metropolitan area (i.e., Bamako District and the surrounding rural communes) has experienced high population growth due to rural–urban migration and high natural population growth. The UN-Habitat (2012) estimated that approximately 2,350,000 people were living in Bamako Metropolitan Area in 2011. While the population in Bamako District was reported to be increasing at approximately 5.8% per year, the annual growth rate of the population in the surrounding rural communes was higher—ranging from 6.2 to 17.2%. As a result, the demand for land for housing in Bamako Metropolitan Area has increased due to massive population increase.

Economic growth and availability of economic opportunities in Bamako also increased urban development. According to Durand-Lasserve et al. (2013), the income of urban households as well as the emergence of an urban middle class, albeit fairly small combined with remittances from Malians living in the diaspora, also resulted in housing developments in Bamako Metropolitan Area. In addition, land in the city and the surrounding rural communes were also acquired for speculative investments given lack of other investment opportunities in Mali.
This led to a high demand for land since investors speculated that property prices would increase in the future if the area became urbanized (Durand-Lasserve et al. 2013). Equally important is the influence of political factors. For instance, land was usually allocated before elections as part of the election campaign strategy and patronage (Durand-Lasserve et al. 2013). However, after elections, some of the land was sold in order to develop residential areas (Durand-Lasserve et al. 2013).

While the proportion of urban population living in slums has decreased from 94.2 to 65.9% in Bamako, unplanned settlement is one of the key drivers of urban development (UN-Habitat 2012). This is partly attributed to complex land tenure system whereby land in urban and peri-urban areas is governed by a combination of state and customary laws (Durand-Lasserve et al. 2013). As a result, land in Bamako Metropolitan Area is generally expensive. This forces the majority of urban dwellers to illegally squat on public land or to enter into informal land use agreements with traditional authorities on the urban periphery. Furthermore, as in most sub-Saharan African countries, poor local governance combined with corruption in land allocation as well as expensive land registration processes has fueled the growth of informal settlements in the outskirts, which led to increased built-up expansion (Durand-Lasserve et al. 2013). According to Feracque-Vitkovic et al. (2007), the growth of Bamako is uncontrolled since traditional land owners, local government, and national authorities have the right to sell or distribute land. Last but not least, people have been forced to migrate to urban areas during periods of recurring droughts (Diallo and Zhengyue 2010). For example, the farmers and nomads have migrated to urban areas in search of better economic opportunities.

### 14.4 Projected Future Land Use/Cover Changes

#### 14.4.1 Projected Land Use/Cover Changes

Future land use/cover changes for 2020 and 2030 (Fig. 14.6) were simulated based on the calibration scenarios between 1990 and 2010 (see Chap. 2). Based on the 1990 land use/cover base map, the multiple transition probabilities, and the “1990–2010” transition potential maps, the land change model projected that built-up areas would increase substantially from 103.9 km² in 2014 to 151.8 km² in 2030, while non-built-up areas would decrease from 289.6 to 241.2 km² over the same study period (Fig. 14.7). The annual rate of built-up change was projected to be 3.8 km² for the “2014–2020” epoch and 2.5 km² for the “2020–2030” epoch.

The simulated built-up areas in 2020 and 2030, and the observed built-up areas in 1990 indicated that urban expansion will continue with infill and leapfrog developments particularly to the north and south of Niger River (Fig. 14.4a). For
Fig. 14.6  Projected urban land use/cover maps of Bamako Metropolitan Area

Fig. 14.7  Simulated future urban land use/cover trend under the current scenario
example, built-up areas to the south of the airport in Commune VI (Fig. 14.1c) and parts of the rural communes of Kalaban Coro are expected to grow substantially in the future. The spatial metric results (Table 14.3) for the built-up class indicate that PLAND would likely increase from 32.2 to 38.6% between 2020 and 2030. This implies an increase in built-up areas in the future. However, PD would decrease slightly from 3.1 to 2.9 per km² in the future, which implies that most of the built-up class will be less fragmented and more compact. The mean ENN would increase slightly from 96.8 to 100 m between 2020 and 2030, which implies low levels of dispersion for the built-up areas. The mean CIRCLE and SHAPE values would likely remain constant over the study period (Table 14.3), indicating that built-up would become more regular in the future.

Figure 14.8 shows spatial metrics for the built-up areas of Bamako Metropolitan Area (2020 and 2030) within the distance buffer zones from the city center. Results show that PLAND would decrease with distance in 2020 and 2030, which implies that built-up patches would be continuous near the city center, and scattered further away from the city center. The PD metric would remain constant within the 0–5-km and 5–10-km buffer zones and then increase over the 5–10-km buffer zone. Therefore, built-up expansion will be more compact near the city center and more fragmented further from the city center. This implies that extension and infill developments would continue near the city center, and leapfrog development further from the city center. The results show that the mean ENN would likely decrease with distance for 2020, which indicates low dispersion levels near the city center. However, for 2030, the mean ENN would likely decrease within the 0–5-km and 5–10-km buffer zones and then increase further away from the city center. This implies that built-up patches would likely become scattered within the 10–15-km buffer zones. The mean CIRCLE value shows slight variations with distance over the study period, which suggests that the built-up patch would be more stable. Nonetheless, the mean SHAPE value would vary in 2020 and 2030, implying that the built-up patches will be more irregular with distance. In summary, the results indicate that built-up areas would likely be continuous near the city center in the future, which implies continuation of infill and extension developments. However, the built-up would likely be discontinuous and scattered with further distance from the city center in 2020 and 2030.

<table>
<thead>
<tr>
<th>Class-level (built-up) spatial metrics</th>
<th>2020</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLAND (%)</td>
<td>32.2</td>
<td>38.6</td>
</tr>
<tr>
<td>PD (number per km²)</td>
<td>3.1</td>
<td>2.9</td>
</tr>
<tr>
<td>ENN (mean) (m)</td>
<td>96.8</td>
<td>100.0</td>
</tr>
<tr>
<td>CIRCLE (mean) (0 ≤ CIRCLE &lt; 1)</td>
<td>0.4</td>
<td>0.4</td>
</tr>
<tr>
<td>SHAPE (mean) (1 ≤ SHAPE ≤ ∞)</td>
<td>1.2</td>
<td>1.3</td>
</tr>
</tbody>
</table>
14.4.2 Implications for Future Sustainable Urban Development

The rapid pace of urban expansion in Bamako Metropolitan Area has major implications on sustainable development given that the spatial expansion of built-up areas is being driven by informal access to land for housing. For example, over 65.9% of the urban population in Bamako currently lives in slums and informal settlements (UN-Habitat 2012). As a result, rapid expansion of built-up areas creates major difficulties for urban planning, particularly the provision of basic services and infrastructure development. As mentioned before, poor governance within local authorities coupled with a complex land tenure system and a malfunctioning land sector also pose major obstacles for sustainable development (Farvacque-Vitkovic et al. 2007). Consequently, vacant land available for housing in the metropolitan area is costly. Within this context, an in-depth understanding of spatial patterns and

Fig. 14.8 Projected class-level spatial metrics for built-up along the gradient of the distance from city center of Bamako Metropolitan Area. Note The y-axis values are plotted in the same range as those in Fig. 14.5
underlying processes of built-up expansion in Bamako Metropolitan Area is required. Therefore, the land use/cover change analysis and simulations in this chapter provide an analytical framework in order to assess urban growth as well as to analyze its underlying driving forces.

The simulated land use/cover changes have several implications for sustainable urban development for Bamako Metropolitan Area. For example, the results indicated that simulated future built-up expansion under the current scenario would be dense near the city center, and discontinuous and scattered with farther distance from the city center. According to Farvacque-Vitkovic et al. (2007), urban sprawl in the surrounding areas has resulted in high infrastructure and commuting distance costs. As a result, local authorities need to focus attention on reducing discontinuous and scattered built-up expansion. This can be accomplished by integrating mixed land use patterns, which would minimize transport and service delivery costs. In addition, open land would be used in a cost-effective manner, which will improve sustainable urban development in the long term.

While the local authorities in Bamako have intensified efforts to improve sustainable urban development (Farvacque-Vitkovic et al. 2007), urban sprawl will likely continue unless proper urban policies based on clear scientific evidence are formulated. The local authorities and central government have prioritized the integration of population in the surrounding areas as a cornerstone of sustainable urban development in Bamako Metropolitan Area (Farvacque-Vitkovic et al. 2007). This study produced simulated land use/cover maps that provide a visual and quantitative representation of built-up expansion in Bamako Metropolitan Area. For example, the observed and simulated land use/cover changes under the current scenario provide built-up change information, which can be used as an initial scientific or diagnostic tool for guiding sustainable urban development. This can possibly assist researchers, policy makers, and other stakeholders in assessing the implications of future built-up expansion and urban development policy alternatives.

14.5 Summary and Conclusions

The land use/cover maps for 1990, 2000, 2010, and 2014 along with change analyses and spatial metrics revealed that significant built-up expansion occurred during the study period. Built-up growth in Bamako Metropolitan Area was characterized by low-density urban sprawl moving outward from the urban core into the surrounding rural areas. The built-up expansion was dominated by infill, extension, and leapfrog developments, which are attributed to socioeconomic, political, and natural driving factors. The analysis of the spatial metrics with distance buffer zones revealed that built-up areas were expanding in a continuous and high-density form near the city center. In contrast, the built-up expansion was discontinuous and scattered as housing developments occurred further from the city center due to outward and leapfrog developments. While urban growth dynamics
are too complex to capture in a short period, this chapter provided an overview of built-up expansion in Bamako Metropolitan Area.

Future land use/cover simulations (up to 2030) indicated that the land use/cover change trends, such as the increase in built-up areas and decrease in non-built-up areas, would continue under the current growth scenario. The spatial metric results indicated that future built-up areas would likely expand in a continuous and homogenous form near the city center. However, built-up areas would likely be discontinuous and scattered with farther distance from the city center in 2020 and 2030. Since built-up expansion affects open and agriculture land, the current land use/cover changes will have impact on the environment in Bamako Metropolitan Area. This chapter has demonstrated that an integrated approach incorporating remote sensing, spatial metrics, and simulation tools help to understand land use/cover changes in Bamako Metropolitan Area. Therefore, land use/cover products could potentially assist decision-makers and other stakeholders with built-up extent in the metropolitan area. This can be used to guide sustainable urban land use planning and development in Bamako Metropolitan Area, in particular, and West Africa in general.

References