

Full Length Research Paper

Tragedy of urban green spaces depletion in selected sub-Saharan African major cities

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Urban green spaces (UGS) play important role in enhancing the socioeconomic and environmental health of cities around the world. For instance, UGS such as playgrounds, parks and residential greenery provide relief from mental and physical stress in densely populated areas. In spite of the significance of UGS in urban life and city development, their depletion rate in sub-Saharan countries seems alarming. Based on mixed methods approach including content analysis of relevant publications and spatiotemporal analyses, this paper discusses urban green spaces depletion in three randomly selected sub-Saharan African cities. The selected cities are Dar es Salaam, Accra, and Luanda. The study reveals a disturbing trajectory of UGS depletion in the selected cities. The causation factors include (a) pressure of rapid urbanization; (b) weak urban planning regulations; (c) socioeconomic challenges; and (d) weak institutions. Policy implications of these findings include the need to prepare and implement public park plans at regional and the local levels, and build institutional competence and capacity to address rapid depletion of urban green spaces (UGS) in sub-Saharan African cities.

Key words: Urban Green Spaces, Sub-Saharan Africa (SSA), Sustainable Development, Cityscape.

INTRODUCTION

The desire to create ecologically and economically vibrant cities has made green spaces an essential feature of city development. Green spaces are natural and multifunctional spaces that provide social, environmental, and economic benefits to cities (Smaniotto et al., 2008), as well as enhancing a city's aesthetic image (Hussain et al., 2010; Narh et al., 2020). Green spaces may be set aside for socialization and recreation or ecological conservation purposes (Hussain et al., 2010; Narh et al., 2020; King, 2010; Mensah, 2014a). Broadly defined, Urban Green Spaces (UGS) includes parks, community woodlands, street trees, wetlands, playgrounds and

residential greenery (Narh et al., 2020). They play an important role in enhancing the economic, health, and social way of life of cities, making them significant in achieving healthy and sustainable urban communities (King, 2010; Mensah, 2014a). In most developed countries, national and city authorities have put in place measures and policies to curb the depletion of urban green spaces (Girma et al., 2019; Schägner et al., 2016).

Despite the important contribution of urban green spaces, urbanization coupled with poor management practices and competing land uses have resulted in the rapid deterioration of green spaces in most sub-Saharan

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African cities (Mensah, 2014b; Loures et al., 2007; Mensah et al., 2020). For instance, most cities in the Republic of South Africa have less than 10% of public park coverage in their total land area (Mensah, 2014b). The total coverage of green spaces in Lagos, Nigeria is less than 3% of the city's landmass (Debrah et al., 2020; Lategan and Cilliers, 2014). In Kumasi, Ghana's fastest growing city and once the 'Garden city of West Africa', land cover data shows that the city has lost a huge percentage of its green spaces as only 10% of the entire cityscape constitutes urban parks (Amoako and Adom-Asamoah, 2017; Mensah, 2014a; Narh et al., 2020). The situation in Luanda and Dar es salaam is not different as rapid urban expansion has led to the destruction of green spaces (Mwageni and Kiunsi, 2021; Ngolo and Watanabe, 2022; Roy et al., 2018). This seems to be the trend in other sub-Saharan cities (Adjetey et al., 2023; Colding et al., 2020; Girma et al., 2019; Ngolo and Watanabe, 2022; Takyi et al., 2022).

Therein lies the motivation for the study to uncover the rate of green spaces depletion in selected sub-Saharan cities, identify key factors responsible for the depletion, and discuss the policy implications. The paper is structured in six sections. The next section discusses the significance or role of green spaces in the city development and the inherent tragedy of their depletion. The third section highlights the study setting, methods and materials, and how the land cover data was generated. The fourth section presents the results of the land cover analysis and discusses the findings of the study. The fifth section reviews the general factors responsible for green spaces depletion, and the final section concludes with policy implications or recommendations.

ROLE OF URBAN GREEN SPACES (UGS) IN CITY DEVELOPMENT

The literature on the significance of green spaces in urban resilience and sustainability abound (Amoako and Adom-Asamoah, 2017; Cilliers, 2017; Maghrabi et al., 2021; Xi-Zhang, 2009). The general consensus is that UGS increases the quality of urban settings and promote sustainability by improving the health and wellbeing of urban residents (WHO Regional Office Europe, 2019). Importantly, the value of green spaces transcends economics to include socio-cultural, environmental, and political characterizations. Generally, the value of urban green spaces (UGS) primarily manifests in three forms: (i) the social significance; (ii) the environmental significance; and (iii) the economic significance.

Social significance

The social importance of green spaces is usually

associated with leisure or recreation, and health promotion. Findings in the UK, Finland, Mexico, and China classified green spaces as a major urban resource for leisure and outdoor recreational activities such as relaxing, playing with kids, walking pets, exploring, and observing nature and wildlife (Haq, 2011; Mensah, 2017; Xi-Zhang, 2009). Cilliers (2017) and Jansson (2014) also found that green spaces serve as meeting centers for middle and low-income earners in both developed and developing countries, where they go to spend time relaxing, engaging in games, and having picnics. The measure of the benefits of green spaces is seen in terms of inherent aesthetic value, the living environment they create (Cilliers et al., 2013), the positive view of residents with regards to the value of the park (Guenat et al., 2021), and the deep sense of community and common interest (Narh et al., 2020). Additionally, Darkhani et al. (2019) indicate that green spaces with natural features play an important role in bringing people in the same community together.

Apart from recreation, studies suggest that green spaces play a crucial role in the physical and mental development and health of individuals. Contemporary urban life style is associated with chronic stress and anthropogenic environmental hazards that could be alleviated by the provision of urban green spaces (WHO Regional Office Europe, 2019). Kolimenakis et al. (2021) noted that walking to and within green spaces not only promotes socialization but also allows for physical exercises that eventually contribute to good health of users. Thus, physical activities such as walking, jogging, and other sporting activities that mostly characterize the use of green spaces are good ways to prevent obesity and other diseases such as cardiovascular disease, musculoskeletal diseases, stroke, and cancer (Cilliers, 2017; Jennings and Bamkole, 2019). In addition, green spaces are major stress relief sites for mostly children and young adults (Heikinheimo et al., 2020; Hussain et al., 2010). The sense of community created at green spaces improves social interaction and reduces fear and aggressiveness, which promotes quality neighbor relationships (Cilliers, 2017; Lategan and Cilliers, 2014; Nero, 2016).

Finally, Nero (2016) argues that green spaces not only enhance the knowledge of young people about nature but also helps them develop a sense of stewardship when they are frequently exposed to nature. Green spaces also transcend beyond helping locals and tourists understand the flora and fauna nature (Jennings and Bamkole, 2019) to serve as a useful resource for scientific research (Osei-mainoo, 2012) while sustaining cultural and national heritage (Mensah, 2016). To sum up, green spaces offer a wide range of social benefits, such as leisure and recreation, improved physical and mental wellbeing, improved children's development, social cohesion, and the preservation of cultural and national heritage. All these benefits contribute to the sustainable

development of nations.

Environmental significance

Green spaces with natural elements have been observed over the years as a local urban climate regulator (Maghrabi et al., 2021). Hard surfaces such as asphalt, pavements, and other concrete surfaces, urban areas absorb solar radiation, which produce heat waves in urban areas. On the contrary, evapotranspiration from urban green spaces and parks keeps urban temperatures cool and consequently alter the local climate (Browning and Rigolon, 2019; King, 2010; Maghrabi et al., 2021). Thus, urban green spaces and parks (UGSP) help to regulate urban high temperatures, lessen the effect of urban heat islands, and further promote the comfort of city dwellers (WHO, 2016). In addition, UGSP enhances the air quality in urban areas as studies conducted in Ottawa and Singapore, where a number of buildings have green vegetation roofs, revealed a significant reduction in Sulphur dioxide and nitrous oxide in those areas (Mensah, 2017). The existence of trees serves as a carbon sink and helps remove pollutants that improve the quality of air (Cilliers, 2017; Maghrabi et al., 2021). Moreover, natural elements available in green spaces help intercept the mobility of pollutants and consequently minimize air pollution in urban areas. Another significant benefit of UGSP is the protection of biodiversity and the conservation of the natural environment. Studies on the urban environment have revealed that different forms of urban green spaces have a significant amount of biodiversity (Cilliers, 2017; Maghrabi et al., 2021; Mensah, 2014b). Green spaces also mitigate some urban environmental problems; such as soil erosion. Studies show that urban trees, forests, golf courses, parks, and gardens, help to maintain urban soil and limit the effects of erosion (Adjei Mensah, 2016; Besada et al., 2019).

Finally, from an aesthetic point of view, green spaces and parks help to beautify the cityscape. Scott (2015) points out that gardens, urban trees, and green spaces help enrich urban architecture through their different styles and colors. This makes the urban setting more diverse and uniform. According to Cilliers (2017) and Mensah (2017), when planning towns and cities, green spaces should be at the forefront of our thoughts because they improve city identity and make urban areas more attractive to live, invest, work, and tour. Given the multiple environmental benefits of green spaces and parks, it is necessary to preserve them in sub-Saharan African cities.

Economic significance

Economically, since public park projects are often labor-intensive and require enormous maintenance work, they

are sources of direct and indirect jobs for individuals in urban areas (Adjei Mensah, 2015). These job opportunities include landscape architects, contractors, laborers, and foremen, among others. In developing countries, the high rate of unemployment can be addressed with such job opportunities. According to Takyi and Seidel (2017), thousands of people are employed in different capacities to work on green spaces. Thus, urban green spaces and parks create employment opportunities for numerous people (Adjei Mensah, 2015; Cilliers, 2017; Mensah et al., 2020). A study by Heikinheimo et al. (2020) reveals that entertainment events and shows hosted in parks draw crowds and promote the economic viability of cities. Events such as “Ghana Party at the Park,” hosted in the UK, draw over ten thousand people who pay to watch artists perform, buy drinks and foods at these events, and sometimes buy souvenirs. According to Yagha (2015), these events provide income to thousands of people from event organizers to food vendors. Also, neighborhoods with green spaces have higher property value than areas without parks (Adjei Mensah, 2015; Monica, 2019; Verweij et al., 2009). This helps increase government revenue and aids in the implementation of other projects. In Canada, an assessment showed that the existence of parks in some neighborhoods helped the government to gain 8% more in property tax (Jennings and Bamkole, 2019). The overall economic impact of parks when analyzed in different forms shows that having green spaces in cities provides enormous economic benefits and should be promoted by city authorities. To sum up, it can be said that green spaces are useful city features that immensely contribute in diverse ways to enhancing the sustainable development of cities. Their benefits are widely expressed in social, economic, and environmental dimensions. Yet, in sub-Saharan African countries, the benefits of green spaces have largely not been accrued as city authorities disregard or are unaware of its significance (Abass et al., 2020; Adjetey et al., 2023; Cobbinah et al., 2020). On the other hand, developed countries have experienced the contributions due to their regard for the parks, and these experiences can serve as lessons for sub-Saharan countries (Hoover et al., 2023; Saavedra and Domingos, 2023; Takyi and Seidel, 2017).

MATERIALS AND METHODS

The study was based on a content analysis of secondary data and maps were generated to validate the key findings. The term secondary data is used in this study to refer to data that are used to address research questions different from the ones the original collector sought to answer (Vartanian, 2011). The search for the secondary data was guided by phrases such as: a) green spaces in sub-Saharan Africa; b) economic, social, and environmental benefits of green spaces; c) factors responsible for the deterioration of green spaces in SSA; and d) effective management of green spaces. A total of eighty articles/reports/books related to green spaces and park, its benefits, depletion, effects and management

Table 1. Cities of interest.

Country	City	Coordinates
Tanzania	Dar es Salaam	Lat: 06° 47' 32" S, Lon: 039° 12' 29" E
Ghana	Accra	Lat: 05° 35' 38.35" N, Lon: 0° 10' 47.02" W
Angola	Luanda	Lat: 8° 50' 17.99" S, Lon: 13° 14' 3.99" E

Source: Authors.

were used. All the relevant literature from different geographical locations on the indicators was screened to aid the analysis of the study. At the end of the search, three sub-Saharan cities stood out and land use-land cover data were attained to further make a strong case for the study, these are Dar es Salaam, Accra, and Luanda (Table 1 and Figure 1).

Image acquisition and processing

High-resolution images produced from sun-synchronous passive sensors on Landsat 5, 7, and 8 were used for this study and remotely acquired. The production of the outcome was carried out using Erdas Imagine 2015, ENVI 5.3, Google Earth Pro and ArcGIS 10.5. Specifically, multispectral Landsat 5, Landsat 7, Landsat 8, and Landsat 9 images were obtained from Earth Explorer for 2000, 2001, 2002, 2010, 2011, 2012, 2021, and 2022 (Table 2). Factors influencing the choice of images were the nature of the study, the focus and availability of data (cloud-free images) useful to the study. For both types of images, multispectral bands were layer stacked with the layer stacking tool in ENVI 5.3/ArcGIS 10.7 that makes it possible to combine multiple derivative image measures (texture, independent components, and so forth) into a single multiband image to improve the accuracy of the classification. Although some images had data gaps (due to the Scan Line Collector-SLC failure of all LANDSAT 7 images from 2003), they still maintain the same geometric corrections as images taken earlier and are still useful. The scan line gap was corrected using the gap mask tool (fill gap) in ENVI 5.3 and QGIS 3.162 (Hannover). Images with clouds were greatly avoided; a few portions with clouds were noticed and compared to ground controls and vital information from Google Earth Pro, which aided in the detection of land cover at those areas for accurate classification. Subsequently, autonomous atmospheric corrections, noise reduction on all images, and other radiometric corrections were carried out where necessary in Erdas Imagine 2015. Images were sub-setted with green areas as areas of interest. The metadata of images captured are depicted in Table 2.

Image classification

For the purpose of the study, two basic methods were used: Normalized Difference Built-up Index (NDBI) aided in the delineation of the built-up areas, and Normalized Difference Vegetation Index (NDVI) - false color combination (which highlights Infra-red) was used to identify areas with vegetative cover, hence non-built-up. The NDBI remains a good approach and an effective method for using LANDSAT images to automatically map out urban built-up areas (Chunyang et al., 2010). The Normalized Difference Vegetation Index (NDVI) is an indicator used to identify the presence of green vegetation (Mzava et al., 2019). This indicator for identifying the vegetation index is also used to quantify urban and infrastructure development and the growth of settlements by observing the decline in green vegetation over a period of time. The

robustness of the classification for each year was tested with 100 ground control points (GCP) using the accuracy assessment algorithm of Erdas Imagine. The overall classification accuracy was 95%, with the Kappa statistic being 0.886. These statistics indicate the accuracy of the classification and its usefulness for further analyses (Lillesand et al., 2004). Signature Separability was calculated for bands used for the classification so as to rule out bands that were not useful in the result classification. In the calculation between means of themes with Euclidean spectral distances, the normalized probability was found to be 0.6000. Outputs were color ramped and finalized in ArcGIS 10.5 and three thematic areas (that is, water, built-up, and green spaces) were identified for this work.

In order to determine the rate of increase or decrease in land cover, a change detection technique was used to determine the land surface changes that occurred from 2000 to 2022 (Lu et al., 2010). To better comprehend the rate of change over a 31-year period, the rate of change as applied in Mensah et al. (2020) was also determined for various cities.

RESULTS AND DISCUSSION

The land cover changes in the study areas were classified into built-up, water, and green spaces. The results of the classified satellite images over the period under consideration showed that there has been an increase in the built areas in the selected cities over the years, which in effect has resulted in a massive decline in green space cover.

Depletion of green spaces in Dar es Salaam, Tanzania

In Dar es Salaam, the change detection statistics indicated that in the year 2000, the green space cover stood at 86.6%, while the built-up area was 13%, with the water body in the city taking 0.4%. In 2010, however, the green space and water body declined from 86.6 and 0.4% in 2000 respectively, to 80.4 and 0.3% while the built-up area increased to 19.3%. As per the land cover data, the levels of encroachment on green spaces increased between 2010 and 2021 as there was a sharp decline in green spaces from 80.4% in 2010 to 40.1% in 2021, and the water bodies also lost 0.1% of coverage while the built-up areas increased from 19.3% in 2010 to 59.7% in 2021, as shown in Figures 2 and 3.

These changes could be linked to level of urbanization in Dar es Salaam. Tanzania National Bureau of Statistics

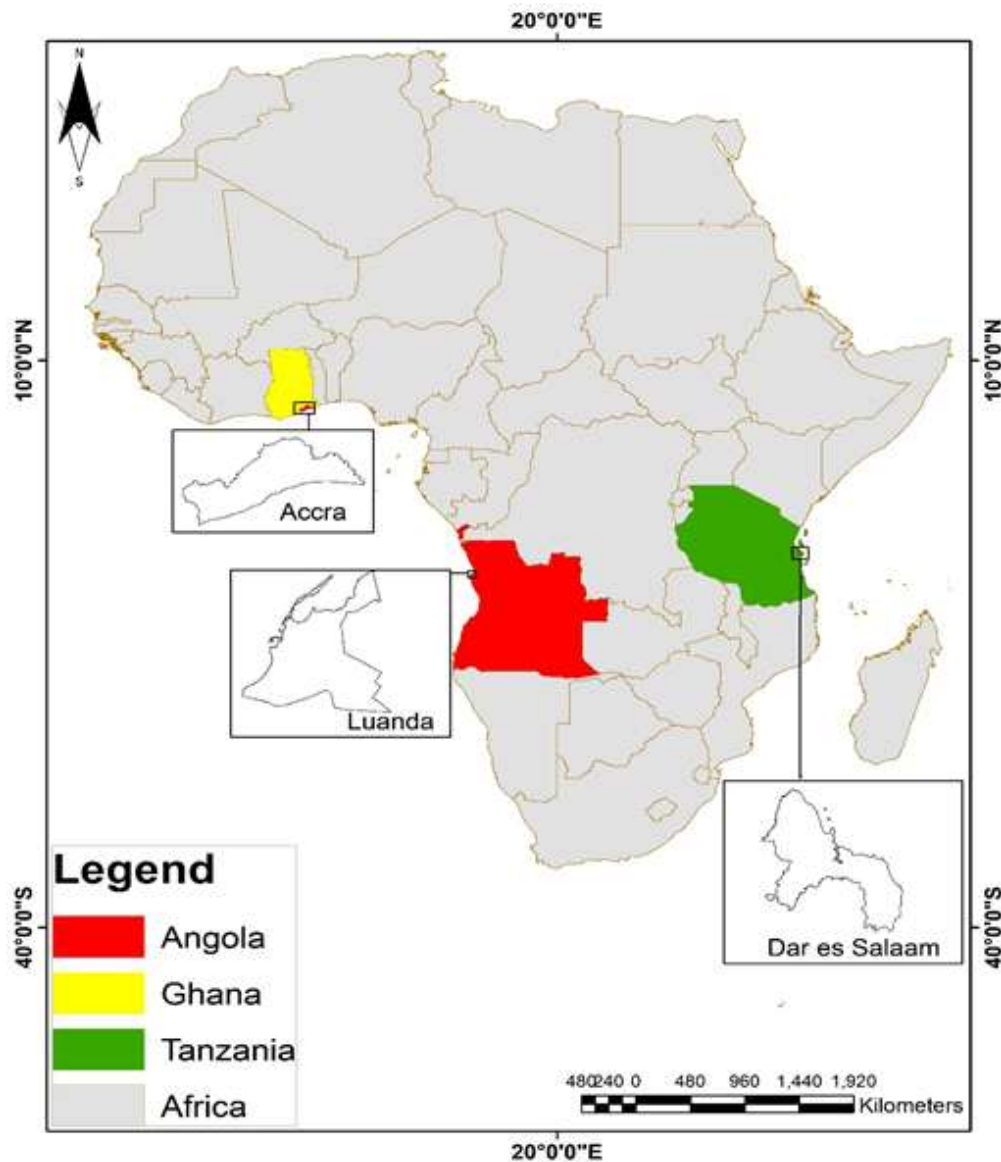


Figure 1. Map of Africa showing the case study cities.
Source: Authors.

(2012) official census in Dar es Salaam as of 1978 showed that the population of the city was 769,445; this figure increased astronomically to 2,272,483 in 2000. As such, the city started experiencing immense urbanization in 2000. Between 2000 and 2010, the population of Dar es Salaam increased to 3,870,000. As seen in the figure 2, that increase led to a corresponding increase in the built-up area from 13% in 2000 to 19.3% in 2010. The land cover change was mainly a result of rural-urban migration, as majority of the population were seeking jobs in the various sectors of the economy, wanted quality education for their children, and generally felt the need to improve their standard of living. In 2021, the population of Dar es Salaam jumped from 3,870,000

in 2010 to 7,047,000, which represents an 82.1% change over the 11 years. As such, it resulted in an increase in the built-up area from 19.3 in 2010 to 59.7 in 2021. Between 2000 and 2021, Dar es Salaam has seen almost 50.0% increases in population. Table 3 shows the crucial statistics of all the land cover changes that occurred between 2000 and 2021.

Depletion of green spaces in Accra, Ghana

The analysis for change detection in Accra revealed that in 2002, green space coverage accounted for 48.79%, while built-up areas constituted 47.95%, and the

Table 2. Metadata of images used.

Dar es Salaam- Years	Sensor	WRS_Path, WRS_Row	Resolution (m)	Projection
2000	LANDSAT 5 Thematic Mapper (TM)	166,065	30	UTM Zone 37
2010	LANDSAT 7 Enhanced Thematic Mapper (ETM)	166,065	30	UTM Zone 37
2021	LANDSAT 7 Enhanced Thematic Mapper (ETM)	166,065	30	UTM Zone 37
Accra- Years	Sensor	WRS_Path, WRS_Row	Resolution (m)	Projection
2002	LANDSAT 5 Thematic Mapper (TM)	193/056	30	UTM Zone 30
2011	LANDSAT 7 Enhanced Thematic Mapper (ETM)	193/056	30	UTM Zone 30
2021	LANDSAT 8 Enhanced Thematic Mapper (ETM)	193/056	30	UTM Zone 30
Luanda-Years	Sensor	WRS_Path, WRS_Row	Resolution (m)	Projection
2002	LANDSAT 4 Thematic Mapper (TM)	182/066	30	UTM Zone 33
2011	LANDSAT 7 Enhanced Thematic Mapper (ETM)	182/066	30	UTM Zone 33
2022	Landsat 9 Operational Land Imager (OLI) and Thermal Infrared Sensor (TIRS)	182/066	30	UTM Zone 33

Source: Authors.

remaining 3.26% was covered by water bodies. However, by 2011, the green space had declined to 31.94%, while the built-up areas increased to 64.6% and the area covered by water bodies increased slightly to 3.46%. Moreover, between 2011 and 2021, encroachment on green spaces intensified, resulting in a significant decrease in green space coverage from 31.94 to 27.2% and a loss of 1.18% of water resources. In contrast, the built-up area increased from 64.6% in 2011 to 71.16% in 2021, as depicted in Figures 4 and 5.

Ghana Statistical Service (2010), reports that in 2000 the population of Accra was 2,905,726. This number increased to 3,029,642 in 2002 (Ghana Statistical Service 2010). From 2002 to 2011, the population of Accra rose to 4,127,549 (Ghana Statistical Service, 2010) with a corresponding increase in the built-up area from 47.95 to 64.6%. Ten years later, the population of Accra further increased to 5,455,692 (Ghana Statistical Service, 2021), representing a 32.15% change which contributed to a rise in the built-up area from 64.6% in 2011 to 71.16% in 2021. Table 4 provides crucial statistics on the land cover changes in Accra between 2002 and 2021.

Depletion of green spaces in Luanda, Angola

The change detection statistics in Luanda reveal that in the year 2000, the city's green space cover accounted for 21.2%, while the built-up area accounted for 77.8%, and the water body occupied 1%. However, by 2012, the green space and water body declined significantly from 21.2 and 1%, respectively, to 7.93 and 0.07%, while the built-up area increased to 92%. The analysis of land cover data indicates that from 2012 to 2022, the level of encroachment on green spaces intensified, leading to a

sharp decline in green space coverage from 7.93% in 2012 to 5.4% in 2022. Additionally, the water resource lost 0.82% of its coverage, while the built-up area increased from 92% in 2012 to 94.6% in 2022, as illustrated in the Figures 6 and 7.

In Luanda, the 1990 official census revealed a population of 2,100,000, which significantly increased to 3,400,000 in 2000 (Instituto Nacional de Estatística, 2000), prompting a substantial surge in urbanization. By 2012, the population had grown to 6,945,386 (Instituto Nacional de Estatística, 2012), leading to a corresponding rise in the built-up area from 77.8% in 2000 to 92%. Rural-urban migration, driven by job opportunities, access to quality education, and a better standard of living, largely contributed to the increase in population and the consequent land cover changes. In 2022, the population of Luanda further increased to 9,700,000 (Brinkhoff, 2023), representing a significant 39.65% change over 10 years, leading to an increase in the built-up area from 92% in 2012 to 94.6% in 2022. Unfortunately, proper urban planning has not kept pace with population growth, leading to a disregard for the preservation of green spaces in many developing countries. Table 5 provides crucial statistics on all land cover changes between 2000 and 2022.

CAUSATION FACTORS

The foregoing analysis depicts the trend of green space depletion in three sub-Saharan African countries. Content analysis of the literature reveals several factors responsible for the state of green spaces in the region. The factors are discussed under the following themes: (a) Pressure of rapid urbanization; (b) Weak urban planning

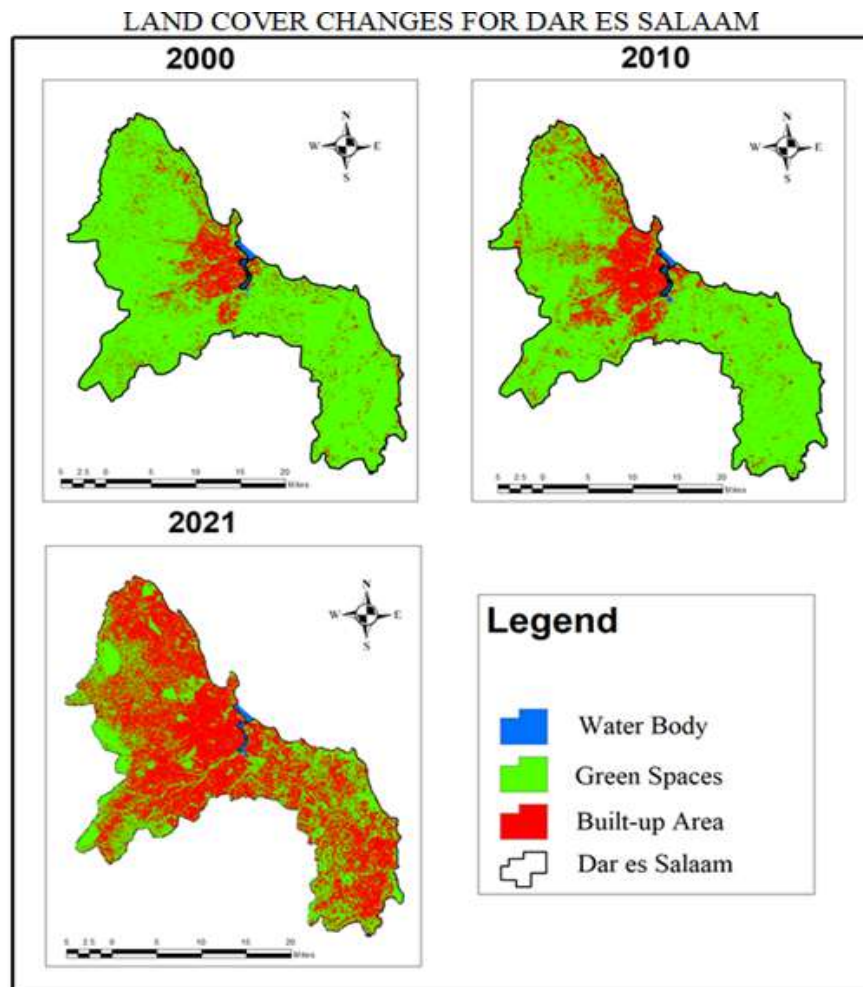


Figure 2. Map showing depletion of green space in Dar es Salaam, Tanzania in 2000, 2010 and 2021.
Source: Authors.

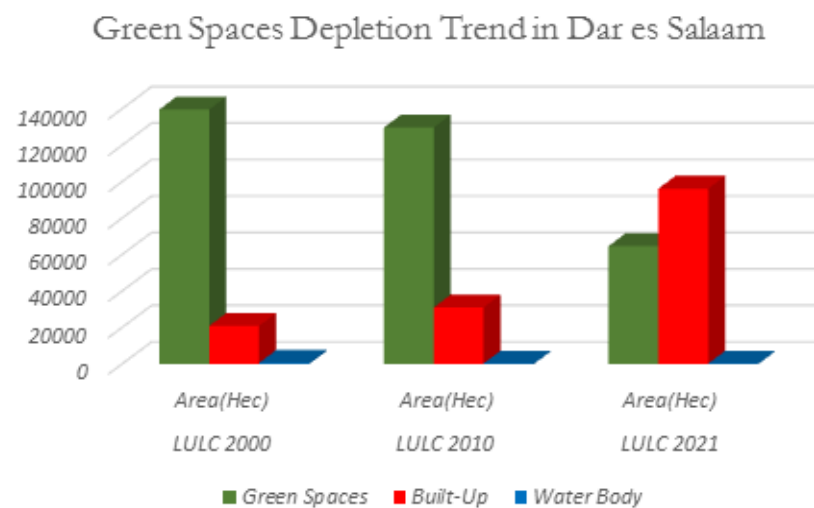


Figure 3. Land cover analysis of Dar es Salaam, Tanzania.
Source: Authors.

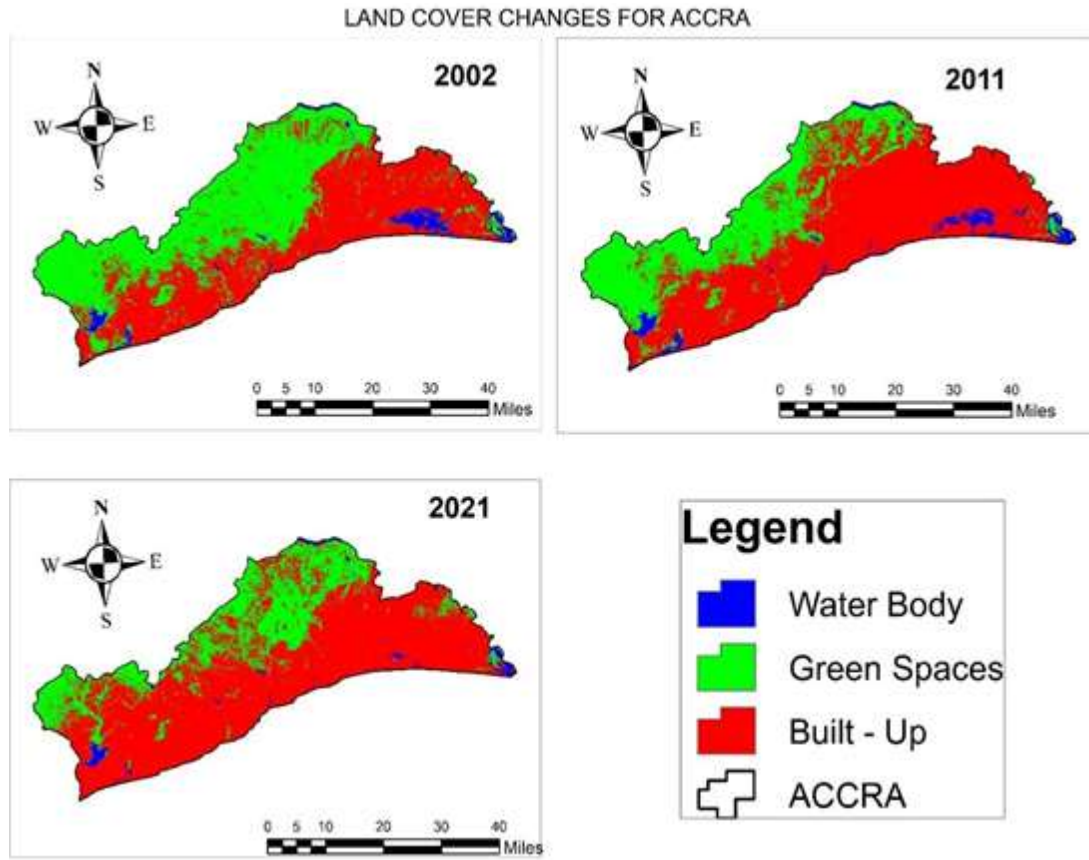


Figure 4. Map showing green spaces depletion in Accra, Ghana, in 2002, 2011 and 2021. Source: Authors.

Table 3. Table showing the land cover changes in Dar es Salaam, Tanzania.

Land Use	LULC 2000		LULC 2010		LULC 2021		Coefficient of variation	
	Area (Hec)	Area (%)	Area (Hec)	Area (%)	Area (Hec)	Area (%)	Coefficient	%
Green Spaces	139714	86.6	129852	80.4	64768	40.1	0.365408	36.5408
Built-Up	21000.84	13	31136.08	19.3	96318.27	59.7	0.825989	82.5989
Water Body	692.91	0.4	419.67	0.3	321.48	0.2	0.402634	40.2634
Total	161407.8	100	161407.8	100	161407.8	100		

Source: Authors.

regulations; (c). Socioeconomic challenges; and (d) Political challenges.

Pressure of rapid urbanization

In Sub-Saharan Africa, one of the predominant causes of the depletion of green spaces is rapid urbanization (Nero, 2016; Tibesigwa et al., 2020). Some of the world’s most populous cities, such as Lagos (Nigeria) and Kinshasa (D.R. Congo) are found in the region. The 2018 State of

African Cities Report put together by UN Habitat indicated that over 900 million people live in the Sub-Saharan Region, and 50% of these people live in urban centers (UN Habitat, 2018). Frightening statistics that revealed the intensity of the region’s urbanization and its effects were presented in the report. For instance, in Southern Africa, the zone where nations such as Zambia, Zimbabwe, and the Republic of South Africa are found has 60% of its population living in urban areas. The urban population of West Africa, as of 2010 had 137.2 million people living in urban areas, and it is also projected to

Green Spaces Depletion Trend in Accra, Ghana

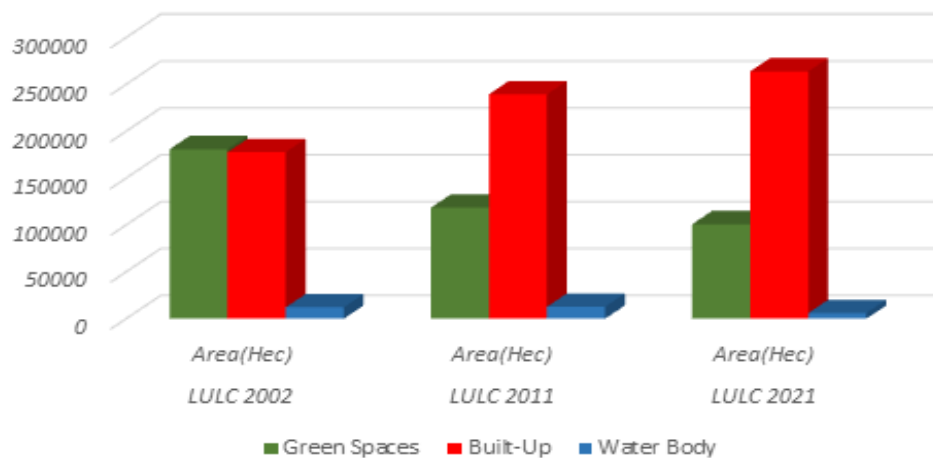


Figure 5. Land cover analysis of Accra, Ghana.
Source: Authors.

Table 4. Table showing the land cover changes in Accra, Ghana.

Land Use	LULC 2002		LULC 2011		LULC 2021		Coefficient of Variation	
	Area (Hec)	Area (%)	Area (Hec)	Area (%)	Area (Hec)	Area (%)	Coefficient	%
Green Spaces	180864.1	48.79	118416.33	31.94	100814.58	27.2	0.315423	31.5423
Built-Up	177734.6	47.95	239469.93	64.6	263798.91	71.16	0.195445	19.5445
Water Body	12090.24	3.26	12802.68	3.46	6075.45	1.64	0.357996	35.7996
Total	370688.9	100	370688.9	100	370688.9			

Source: Authors.

reach 427.7 million by 2050. The depletion of urban green spaces in African cities is directly associated with the region's rapid urbanization (Besada et al., 2019; Emife, 2020). A manifestation of this phenomenon is the massive emergence of several slums across the region's cities.

Urban sprawl settlers take up environmentally sensitive zones and lands reserved for urban green spaces. The Sub-Saharan region has over 200 million slum dwellers, the world's highest slum population (UN Habitat, 2020). The rapid rate of urbanization in Nigeria, with its corresponding increase in informal settlements and the depletion of urban green spaces, cannot be overemphasized. Lagos, the financial capital of Nigeria, has witnessed a tremendous increase in its population from 1.4 million in 1970 to 14.8 million in 2021 (National Population Commission Nigeria, 2021). The drastic increase in population has resulted in the creation of many shanty towns, causing the worrying depletion of several urban green spaces (Dekolo et al., 2015). The phenomenon is worrying in Lagos, as slum dwellers in Makoko have extended their settlement from the land to settle on the Makoko water (BidCreates, 2020). This goes

to show the levels of sprawl in the city. In Dar es Salaam, Tanzania, the consequences of rapid urbanization on the depletion of green spaces are alarming. Studies conducted on the proliferation of informal settlement indicate that there is evidence of both planned and informal residential settlements in the city, that dates back to as far as 1992, and is a major contributor to the sale of environmentally sensitive zones and urban green spaces in the informal land market (Bhanjee and Zhang, 2018; Tibesigwa et al., 2020). Also, the urban trees that were planted to enhance the aesthetics of the city and protect the urban environment have all been destroyed to a large extent (Tibesigwa et al., 2020).

Furthermore, high rates of urbanization have caused many cities in South and West Africa, such as Johannesburg, Cape Town, Pretoria (South Africa), Luanda (Angola), Harare (Zimbabwe), Kano, Kaduna, Ibadan (Nigeria), Accra, Tema, Kumasi (Ghana), Freetown (Sierra Leone), and Dakar (Senegal) to lose major portions of their public green spaces to infrastructural development and urban sprawl (Abass et

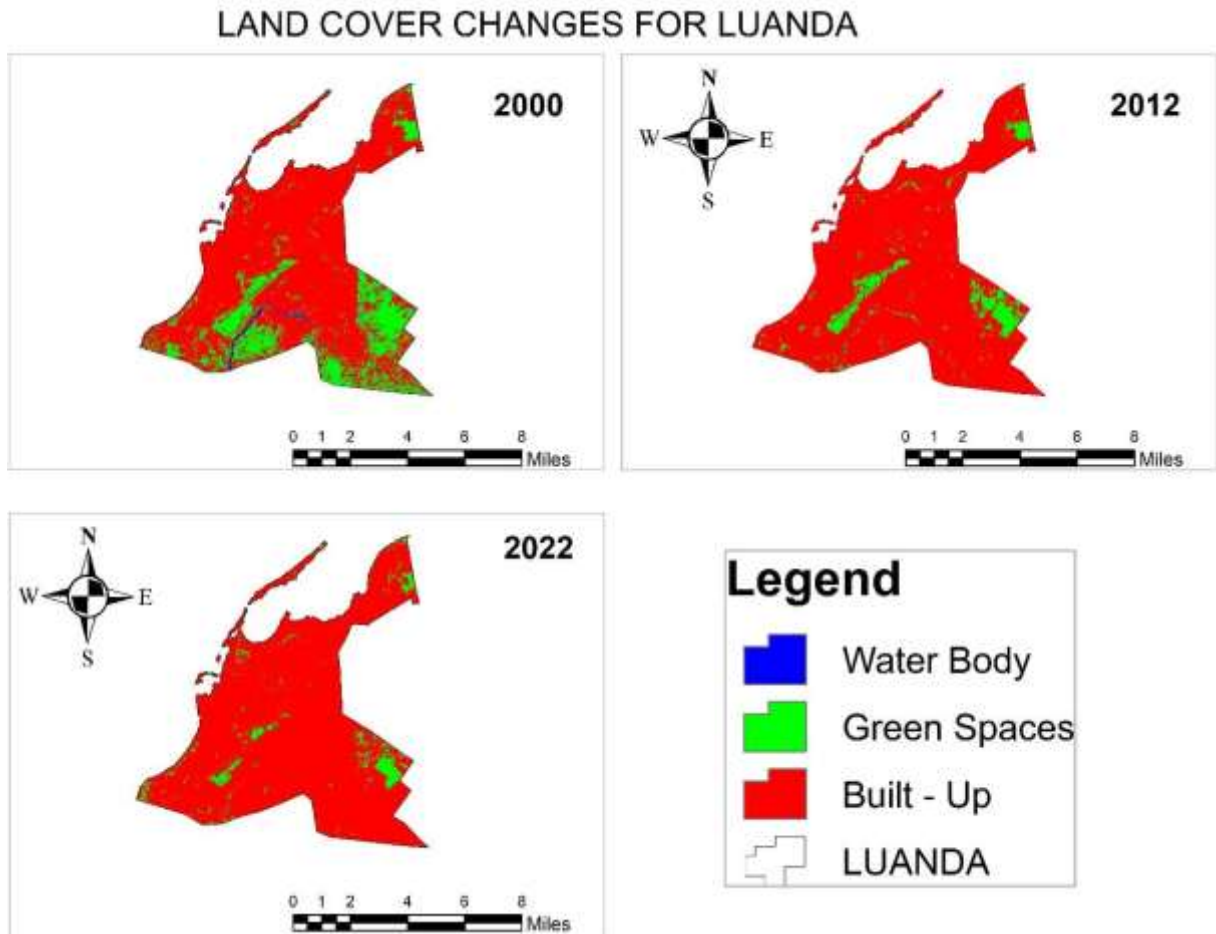


Figure 6. Map showing degree of land cover change in Luanda, Angola 2000, 2012 and 2022.
Source: Authors.

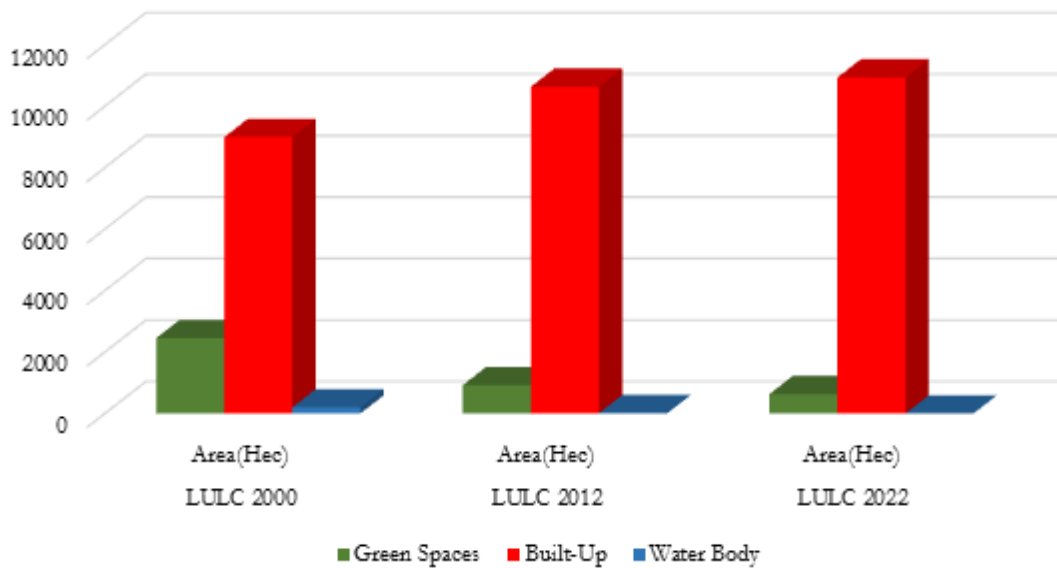


Figure 7. Land cover analysis of Luanda, Angola.
Source: Authors.

Table 5. Table showing the land cover changes in Luanda, Angola.

Land Use	LULC 2000		LULC 2012		LULC 2022		Coefficient of Variation	
	Area (Hec)	Area (%)	Area (Hec)	Area (%)	Area (Hec)	Area (%)	Coefficient	%
Green Spaces	2448.45	21.2	917.19	7.93	624.6	5.4	0.736439	73.6439
Built-Up	8984.25	77.8	10625.58	92	10927.08	94.6	0.10272	10.272
Water Body	199.16	1	9.09	0.07	0.18	0	1.617772	161.7772
Total	115551.86	100	11551.86	100	11551.86	100		

Source: Authors.

al., 2020; Dekolo et al., 2015; Nero, 2016).

In a related development, a study on informal settlement and urban sprawl in Dar es Salaam and its effects on green spaces showed a considerable loss of urban greenspace coverage due to built-up area expansion (Bhanjee and Zhang, 2018). Specifically, the study showed that from 1982 to 2002, informal settlement grew by 120% at the expense of the natural environment (Bhanjee and Zhang, 2018).

Weak urban planning system and regulations

Town planning in Sub-Saharan Africa is governed by regulations issued by the legislative assembly and approved by the executive. Inasmuch as there are several land regulations on green spaces in Sub-Saharan Africa, their implementation has been a major problem. The following issues are identified as the major factors causing the weak urban planning regulations on green spaces: The nature of urban planning systems in the region, the lengthy and bureaucratic nature of acquiring development permits in the region, and less regard for green spaces by city authorities in Sub-Saharan Africa.

The outmoded and archaic nature of urban planning systems in the region fails to address the current challenges associated with development and urbanization in cities. Although urban planning regulations exist in Sub-Saharan Africa, most of the fundamental regulations and plans were made several years ago by the colonial authorities (Auwah et al., 2010). For instance, the 1946 and 1956 town planning ordinances of Nigeria and Tanzania were prepared by colonial masters and does not have the muscles needed to curb urban sprawl and protect urban greenery; this situation is similar for countries like Ghana and Malawi (Josse, 2020). These regulations, prepared almost 65 years ago, are still in operation. Little and in some instances, no changes have been made to the regulations, which makes it difficult to address the current urban environmental challenges in most Sub-Saharan African cities. Furthermore, Sub-Saharan African cities over rely on master plans that were prepared by colonial masters to manage development urban areas. Master plans are maps that display the long-term desired urban form in broad land

use (JICA, 2020). These master plans are not meant to deal with detailed land use challenges such as depletion of urban green spaces, due to the fact that they are outmoded and proper stakeholder engagements were not conducted during the drafting of the plans in the colonial era (Boamah and Amoako, 2013). Cities like Accra (Ghana) have a master plan that was drawn in 1944 and revised in 1957 and is still in operation; the master plan of Abuja (Nigeria) was drawn in 1970, and physical development is still based on this plan. Current development patterns and challenges in the cities in Sub-Saharan Africa makes it practically impossible for worn-out regulations and plans to guide the growth and developments of these cities, resulting in the massive encroachment of environmentally sensitive zones and green spaces.

The lengthy and bureaucratic nature of acquiring development permits in the region was identified as a contributor to the weak urban planning system. Across the region, attaining land development permits takes quite a long time, and the process is mostly bureaucratic. In Nigeria, it was noticed that for an individual to get the right documentation for land acquisition, they would have to go through thirty-two processes and it sometimes takes over a year to get it done (Adjei Mensah, 2015; Josse, 2020). In Tanzania, the process for building permits and plans being approved could take up to four years. Moreover, for countries like Ghana and DR Congo, securing development permits from state planning agencies could take up to two years (Adjei Mensah, 2015). The bureaucratic processes influence urban developers and private citizens to evade the processes required for land development projects and sometimes resort to bribing their way through the process. As a result, environmentally sensitive areas such as wetlands and urban green spaces are encroached upon by these developers, with no one able to hold them accountable (Adjei Mensah, 2015).

Moreover, authorities in cities are less concerned about protecting urban green spaces. A study by the UN Habitat on the state of planning in Africa revealed that rapid urbanization has drifted the attention of city authorities to the provision of transport infrastructure, schools, public housing, and other social infrastructure, while issues regarding public park management and

protection have been neglected (Addo-Fordwuor, 2014; UN-Habitat and Africa Planning Association, 2013). In Tanzania, Olaleye et al. (2013) also observed that city authorities hardly regard urban green spaces due to the enormous socioeconomic benefits associated with urbanization. Also in Kenya, city authorities have less regard for the management and development of green spaces, which has resulted in a lack of basic facilities such as washrooms, chairs, and notice boards on public parks (Adjei Mensah, 2015).

Socioeconomic challenges

A major social challenge associated with the loss of urban green spaces is the low enthusiasm of city dwellers towards the preservation of green spaces. Due to the limited stakeholder engagement in making decisions about green spaces and low education of city residents on the benefits of green spaces, individuals tend to ignore the depletion of green spaces. For instance, in Ghana, decisions on green spaces are left to city authorities; this approach lacks public consensus and support (Addo-Fordwuor, 2014). This challenge is similar in many countries across the Sub-Saharan Africa region, where city residents are not consulted or involved in the management of green spaces (Narh et al., 2020). The lack of involvement of city residents and their inadequate knowledge of the benefits of green spaces have influenced their perception of leaving green spaces to the sole management of city authorities and the neglect of green spaces in their neighborhoods. This has resulted in the depletion of green spaces by city dwellers and the conversion of these spaces into dumpsites in cities such as Accra and Kumasi (Ghana), Lagos and Kaduna (Nigeria), Luanda (Angola), and Dar es Salaam (Tanzania) (Mensah, 2014b; Tibesigwa et al., 2020).

Economic challenges associated with the depletion of green spaces are the misappropriation and embezzlement of state funds and poverty among urban dwellers. Socio-economic developments such as green space development, even with their little budgetary allocation, often have their funds misappropriated and embezzled by state officials (Mensah, 2014b; Narh et al., 2020). Misuse of funds allocated for the development of green spaces in most Sub-Saharan African countries often finds its way into the pockets of corrupt officials (Mensah, 2017). For instance, in Harare (Zimbabwe), funds donated by donor agencies to fund projects that will protect environmentally sensitive sites were found to have been diverted and misused, rendering the projects to a halt (Adjei Mensah, 2015; Tibesigwa et al., 2020). In Accra (Ghana), as of 2016, the forestry commission set out to redevelop the Achimota Forest, an urban forest, into an ultra-modern ecotourism park, but till date the project has not been commenced (Dasmani, 2016). The fund for the project, which was initially \$1.2bn as stated by the Deputy Chief

Executive of the Forestry Commission, Mr. John Allotey, was slashed to \$320m (Anstey, 2016). The project has since been abandoned, and conversations about the ecotourism park have been dropped due to the diversion of funds initially allocated for the project.

Poverty in the path of urban dwellers was also identified as an economic challenge that poses an existential threat to green spaces. The studies on urban poverty in Sub-Saharan Africa indicate that the region's rate of urban poverty is dire (Emife, 2020). Currently, the international poverty line stands at \$1.90 per person per day, and the Sub-Saharan Africa region holds the largest number of poor people in the world after it overtook Asia in 2019 (Emife, 2020). In 2020, the Nigerian National Bureau of Statistics indicated that 40% of Nigerians live below the poverty line (Onyeiwu, 2021). As of 2019, the World Bank reported that 38.5% of the people in Benin also live below the poverty line (Emife, 2020). The rate of poverty in the region is linked to the depletion of green spaces, as poor people rely on these for survival. In African cities, poor people take over environmentally sensitive areas and make such areas their homes, such as Makoko (Lagos) and Old Fadama (Accra). The consequence of these acts is the excess depletion of green spaces in the cities of Sub-Saharan Africa by the urban poor.

Political issues

On the path of African leaders, the political will to embark on greenspace initiatives is weak. In many cities in Sub-Saharan Africa, it was found that there was a lack of enthusiasm when it came to initiating measures to promote the development and management of green spaces. A study conducted by Amoako and Adom-Asamoah (2017) indicated that instead of preserving green spaces in Kumasi (Ghana), political actors in some cases change their use. A typical example is the Kumasi Race Course, which has now been converted into a commercial space. Also, the Achimota Eco-tourism Park in Accra (Ghana) which was to commence in 2016, has still not seen the light of day due to lack of political will (Dasmani, 2016). In the wake of calls for action to tackle climate change, several leaders in Sub-Saharan Africa pledged to plant trees in their major cities in countries such as Nigeria, Kenya, and DR Congo, but the implementation of these projects have all been abysmal due to the lack of political will (Agency Report, 2020; Alfa Shaban, 2019; Kimani and Schreckenberger, 2020). The issue of Sub-Saharan African politicians unwilling to take the bull by the horn and work to protect and preserve the public parks is a major cause of the extinction of the parks.

Again, political instability in the region was identified as the last and major challenge to the preservation of green spaces. The last three decades have been challenging

for many Sub-Saharan African states, with civil wars and coups in Angola, Cote d'Ivoire, Mali, Guinea, DR Congo, and Liberia. The disturbing effects of these wars on sustainable development and the preservation of green spaces cannot be downplayed. For instance, in Liberia and Cote d'Ivoire, long years of war destroyed a substantial part of the urban natural environment in Monrovia and Abidjan (Adjei Mensah, 2015). Civil wars in Angola and Mali also led to the loss of trees and the destruction of parks. Coup d'états in countries like Mali and, recently, Guinea also impede the urban development of the country. Usually, when coups occur, activities the government was carrying out get halted; these activities could include the development of urban parks or even large-scale tree planting agendas.

POLICY IMPLICATIONS AND RECOMMENDATIONS

The advancement of sustainable development ensures all facets of urban development, including urban parks, stand the test of time, one that should see green spaces devoid of conversion (Elliot, 2017). Conserving urban parks has enormous benefits, such as promoting greenery and protecting the climate. However, there are several problems associated with urban parks in sub-Saharan Africa. For SSA, one of the problems has been that the appropriate institutions do not have the power to perform activities fully without governments intervening. There have also been issues with encroachment on lands purposely set aside for urban parks. This kind of encroachment is mostly due to rapid population growth and urban sprawl (Yeshitela, 2019). These problems associated with urban parks are to be remedied intentionally. There should be a conscious effort made to conserve these parks by curtailing, if not eliminating, all problems or potential ones. In this regard, the subsequent paragraphs will highlight effective and efficient ways of sustaining the management of green spaces in sub-Saharan Africa.

Preparation of Public Park plans

With the growing population of sub-Saharan Africa, there has been an urgent need for commercial, agriculture, and residential land uses (Kimengsi and Fogwe, 2017). More and more farmers are seeking farmlands in order to grow food to feed their families. Others are also illegally taking urban lands to build structures and inadvertently destroying urban green spaces (Guenat et al., 2019; Tibesigwa et al., 2020). This has been made worse by rapid and inappropriate urban sprawl and rural-urban migration (Guenat et al., 2021). To resolve this situation, there is the need to prepare and implement public parks or greenspace plans at regional and the local levels, and build institutional competence and capacity to arrest the tragedy (Yeshitela, 2020; Yeshitela, 2019). With this, all

urban parks must be properly planned and strictly protected. These green space plans are to ensure that certain spaces set aside as urban parks are protected by the law and that anyone who flouts it is adequately punished. There is the tendency that recalcitrant inhabitants may opt to flout the plan and disobey city authorities, and that is where the law is expected to take its course.

Building institutional competence and capacity

Institutions in charge of managing urban parks in sub-Saharan Africa have neither the power to enforce any law made towards the protection of these green spaces nor the financial muscle to maintain these spaces due to their high maintenance costs (Lindholst et al., 2015). These institutions are not able to ensure that people do not encroach on lands allocated for such purposes, and for that matter, they are not able to sue individuals that go against the law (Guenat et al., 2019). Again, they are poorly resourced, primarily in terms of finance. Despite the fact that some of these urban parks charge entry fees, they are still unable to accrue the funds necessary for routine maintenance and to sustain them. This has led to many urban parks failing despite being developed with huge sums of money. Institutions in charge of managing these urban parks can make it an institutional vision to sue any individual that trespasses on their space and also, innovative in raising or generating funds internally to do its routine maintenance. Innovative in a manner that some special, attractive offers and programmes can be introduced in the urban parks to attract people and encourage them to patronize these special offers, and with that, monies for maintenance costs can be raised. In the event that the above-mentioned are not sufficient, these institutions can collaborate with other companies and corporations to render services that would increase their funds.

Despite the fact they structure all these, the onus lies on these institutions to sensitize the people on the essence of urban parks, the penalties associated with trespassing on the property or lands or pollution of the parks, and also the various social activities, offers, and collaborations that the public can take advantage of (Guenat et al., 2019, 2021; Yeshitela, 2020). These institutions can ensure a participatory approach where the views of the people are fully sought after and taken into consideration in the management of these parks. This will encourage active participation of residents around the park, appreciable patronage of the parks, and general cooperation towards fundraising and management of the parks (Guenat et al., 2019).

Institutional independence

Political succession, almost as fleeting as it comes,

poses a great disservice to state institutions in sub-Saharan Africa (Yeshitela, 2019). More often than not, should there be a framework concerning urban parks being worked on by a government or a newly sworn-in government, these newly sworn-in governments prefer to start projects as designated by their political parties, thereby abandoning projects commenced by the outgoing governments. On the other hand, there is political interference. Institutions are not able to undertake certain activities if the ruling government does not support them. The interference comes in two forms: a situation where governments are to append to some legal frameworks concerning these urban parks or provide some fund allocation and simply because it does not serve in the party's interest or part of its priorities, the funds or framework are delayed for years. The other interference is such that the institutions in charge of these urban parks may decide to take action against some citizens for going against the activities of the parks and the area. These two instances render the institution powerless in every sense.

Sustaining these would mean that institutions in charge of urban parks are allowed full autonomy to operate, maintain, and also punish culprits that flout rules. Consequently, institutions are empowered to do more to protect these parks with the full backing of the government. In the event that full autonomy makes way for corruption, then the government, having granted this autonomy, should also make room for a very effective audit system that can ensure that accountability is observed. This autonomy is expected to be made effective through the preparation of new legislative or executive instruments entrenched in the highest laws of various countries in sub-Saharan Africa or the strengthening of an existing legal framework (Nelson and Agrawal, 2008). It is to be entrenched to avoid governments making changes to the laws to suit their priorities. It will also give credibility to the institutions managing the parks and help them exercise the power they wield over the effective management of urban parks.

CONCLUSION

Creating ecologically and economically vibrant cities has made green spaces an essential feature of city development. Green spaces are natural and multifunctional spaces that provide social, environmental, and economic benefits to cities as well as enhancing a city's aesthetic image. Around the world, green space plays an important role in enhancing the economic, health, and social way of life of cities, making them significant in achieving healthy and sustainable urban communities. They contribute significantly to the sustainability of cities. In the discourse of sustainable development, green spaces play a very crucial role due to their contributions to the social, economic, and

environmental facets of society. In spite of the numerous benefits they provide, there is evidence of the rapid depletion of green spaces in many sub-Saharan African cities. Based on a comprehensive review of relevant literature, this paper contributes to the discourse on the trajectory of urban green space depletion in three cities within the Sub-Saharan Africa region.

The findings show that in spite of the many benefits green spaces provide there is significant decline in green space cover in SSA, with spatial evidence from selected cities. This is tragic. In Accra, Ghana, evidence shows significant decline in the city's green infrastructure between 2002 and 2021. Approximately 48.8, 48 and 3.2% of the land area was made up of greeneries, built-up area and water bodies, respectively, in the year 2002. In 2011 however, there was a 16.8% decline in the green areas between 2002 and 2011 (48.8% in 2002 and 32% in 2011), but an increase in the built up area to 65%. There was further decline in the green areas of the city to 27% in 2021, compared to a 71.2% in the built up area. Secondly, in Dar es Salaam, financial capital of Tanzania, evidence shows significant decline in its urban green spaces over time – 21 years. Approximately 86, 13 and 1% of the city's land comprised green space, built-up area and water body, respectively, in the year 2000. There was however a decline in the green area to 80%, representing a 6% reduction in 2010, with a corresponding increases in the built-up area. There was a further rapid decline in green area to 40% in 2021 largely to increased population and corresponding demand for land for physical development. Similar to evidence in Accra, and Dar es Salaam, Luanda has experienced decline in its green infrastructure over time. Land cover analysis shows that Luanda's green areas covered 21% of its total land area (1,155.52 sq. km.) in 2000, compared to 78% making up the built-up area. In 2012 and 2022 however, its greeneries decline to 7.9 and 5.4% respectively. Its built-up area however increased from 78% in 2000 to 92% in 2012 and 94% in 2022.

It was revealed that the several factors have accounted for the decline in green space cover in the cities. Despite the growing recognition of the benefits of urban green spaces, the review identifies several factors that hinder their development, performance, and management in SSA. The primary obstacle is the rapid urban population growth in the region, leading to uncontrolled urban development and urban sprawl. The high population growth has resulted in informal urbanization, leading to encroachment on urban green spaces and areas designated for greenery. Additionally, weak urban planning regimes and poor enforcement of development control measures exacerbate the decline of urban green spaces, forests, nature reserves, and parks. This research calls for the preparation of public park plans, building institutional competence and capacity as well as institutional independence based on these findings. These are measures to address the many challenges

resulting in the decline of green spaces in the cities.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

REFERENCES

- Abass K, Buor D, Afriyie K, Dumedah G, Segbefi AY, Guodaar L, Garsonu EK., Adu-Gyamfi S, Forkuor D, Ofosu A, Mohammed A, Gyasi RM (2020). Urban sprawl and green space depletion: Implications for flood incidence in Kumasi, Ghana. *International Journal of Disaster Risk Reduction* 51:101915.
- Addo-fordwuor D (2014). Green space depletion in Ghana's urban settlements: A case of Kumasi.
- Adjei Mensah C (2015). Sustaining Urban Green Spaces in Africa: A Case Study of Kumasi Metropolis, Ghana. A Thesis Submitted to the University of Birmingham for the Degree of Doctor of Philosophy.
- Adjei Mensah C (2016). The state of green spaces in Kumasi city (Ghana): Lessons for other African cities. *Journal of Urban and Regional Analysis* 8(2):159-178.
- Adjetei LD, Takyi SA, Asibey MO, Amponsah O (2023). The fate of urban green spaces: Assessment of the ownership, availability and conditions of parks in Accra, Ghana. *Urban Forestry and Urban Greening* 82(January).
- Agency Report (2020). Afforestation: Nigeria to plant 300 million trees in 2020-Official. Premium Times.
- Alfa Shaban RA (2019). Fayulu launches tree-planting drive to combat DR Congo's forest fires. *Africanews*.
- Amoako C, Adom-Asamoah G (2017). The Politics of Managing Green Areas in Kumasi, Ghana. *Icida* pp. 395-406.
- Anstey T (2016). Ghana developing \$320m world-class eco-tourism destination. *CLADnews*.
- Awuah KGB, Hammond FN, Block R, Proverbs D, Booth C (2010). Sub-Saharan Africa urban land use planning systems: The need for an economic appraisal. A Paper Presented at the Construction, Building and Real Estate Research Conference of the Royal Institution of Chartered Surveyors.
- Besada H, Sewankambo N, Lisk F, Sage I, Kabasa JD, Willms DG, Dybenko E (2019). Climate change in Africa: adaptation, mitigation and governance challenges. *CIGI Special report*. [cigionline.org/sites/default/files/climate_change_in_africa_3.pdf](https://www.cigionline.org/sites/default/files/climate_change_in_africa_3.pdf)
- Bhanjee S, Zhang CH (2018). Mapping Latest Patterns of Urban Sprawl in Dar es Salaam, Tanzania. *Papers in Applied Geography* 4(3):292-304.
- BidCreates (2020). Inside Makoko: The Floating Slum. Inside Makoko: The Floating Slum of Lagos, Nigeria: https://youtu.be/ZRB_JGwLpKU
- Boamah EF, Amoako C (2013). Regionalism and Urban Development Planning in Africa: Towards A Collaborative Framework for Decentralized Planning in Ghana. *Developing Country Studies* 3(9):142-155.
- Brinkhoff T (2023). City Population. <https://www.citypopulation.de/>
- Browning M, Rigolon A (2019). School Green Space and Its Impact on Academic Performance: A Systematic Literature Review. *International Journal of Environmental Research and Public Health* 16(3):429.
- Chunyang H, Peijun S, Dingyong X, Yuanyuan Z (2010). Improving the Normalized Difference built-up Index to Map Urban Built-up areas Using a Semiautomatic Segmentation Approach. *Remote Sensing Letters* 1(4):213-221.
- Cilliers EJ (2017). The Importance of Planning for Green Spaces The Importance of Planning for Green Spaces. January 2015.
- Cilliers S, Cilliers J, Lubbe R, Siebert S (2013). Ecosystem services of urban green spaces in African countries-perspectives and challenges. *Urban Ecosystems* 16(4):681-702.
- Cobbinah PB, Gaisie E, Oppong-Yeboah NY, Anim DO (2020). Kumasi: Towards a sustainable and resilient cityscape. *Cities* 97.
- Colding J, Gren Å, Barthel S (2020). The incremental demise of urban green spaces. *Land* 9(5).
- Darkhani F, Tahir OM, Ibrahim R (2019). Sustainable urban landscape management: An insight into urban green space management practices in three different countries. *Journal of Landscape Ecology* 12(1):37-48.
- Dasmani L (2016). Ghana to get \$1.2bn ultra-modern ecotourism park in its capital city. *The Africa Report*.
- Debrah C, Owusu-Manu DG, Kissi E, Oduro-Ofori E, Edwards DJ (2020). Barriers to green cities development in developing countries: evidence from Ghana. *Smart and Sustainable Built Environment*.
- Dekolo S, Oduwaye L, Nwokoro I (2015). Urban sprawl and loss of agricultural land in peri-urban areas of Iagos*. *Regional Statistics* 5(2):20-33.
- Elliot AJ (2017). An introduction to sustainable development. In: *Choice Reviews Online* 37(8).
- Emife S (2020). Poverty in Sub-Saharan Africa: The Dynamics of Population, Energy Consumption and Misery Index.
- Ghana Statistical Service (2010). Population and Housing Census. https://statsghana.gov.gh/gssmain/fileUpload/pressrelease/2010_PH_C_National_Analytical_Report.pdf
- Ghana Statistical Service (2021). Ghana 2021 Population and Housing Census. POPULATION OF REGIONS AND DISTRICTS REPORT (statsghana.gov.gh)
- Girma Y, Terefe H, Pauleit S (2019). Urban green spaces use and management in rapidly urbanizing countries:-The case of emerging towns of Oromia special zone surrounding Finfinne, Ethiopia. *Urban Forestry and Urban Greening* 43 p.
- Guenat S, Dougill AJ, Kunin WE, Dallimer M (2019). Untangling the motivations of different stakeholders for urban greenspace conservation in sub-Saharan Africa. *Ecosystem Services* 36:100904.
- Guenat S, Lopez GP, Mkwambisi DD, Dallimer M (2021). Unpacking Stakeholder Perceptions of the Benefits and Challenges Associated With Urban Green spaces in Sub-Saharan Africa 9:1-12.
- Haq SMA (2011). Urban Green Spaces and an Integrative Approach to Sustainable Environment. *Journal of Environmental Protection* 2(5):601-608.
- Heikinheimo V, Tenkanen H, Bergroth C, Järv O, Hiipala T, Toivonen T (2020). Understanding the use of urban green spaces from user-generated geographic information. *Landscape and Urban Planning* 201:103845.
- Hoover F, Meerow S, Coleman E, Grabowski Z, McPhearson T (2023). Landscape and Urban Planning Why go green? Comparing rationales and planning criteria for green infrastructure in US city plans. *Landscape and Urban Planning* 237:104781.
- Hussain G, Nadeem M, Younis A, Riaz A, Khan MA, Naveed S (2010). Impact of public parks on human life: A case study. *Pakistan Journal of Agricultural Sciences* 47(3):225-230.
- Instituto Nacional de Estadística (2000). Population Statistics of Angola 2000. <https://ghdx.healthdata.org/organizations/national-institute-statistics-angola>
- Instituto Nacional de Estadística (2012). Population Statistics of Angola 2012. <https://ghdx.healthdata.org/organizations/national-institute-statistics-angola>
- Jansson M (2014). Green Space in Compact Cities: The Benefits and Values of Urban Ecosystem Services in Planning. *Nordic Journal of Architectural Research* 26(2):139-159.
- Jennings V, Bamkole O (2019). The relationship between social cohesion and urban green space: An avenue for health promotion. *International Journal of Environmental Research and Public Health* 16(3).
- JICA (2020). Project, The Development, Urban Plan, Master Capital, Vientiane Report, Final Simulation, Urbanization.
- Josse G (2020). Planning and managing Africa's cities: What place for technology innovations? *Field Actions Science Report* 22:52-57.
- Kimani J, Schreckenber PK (2020). International Tree Foundation Annual Report. https://issuu.com/internationaltreefoundation/docs/impact_report_issue
- Kimengsi JN, Fogwe ZN (2017). Urban Green Development Planning Opportunities and Challenges in Sub-Saharan Africa: Lessons from Bamenda City, Cameroon. *International Journal of Global Sustainability* 1(1):1.
- King B (2010). Conservation Geographies in Sub-Saharan Africa: The

- Politics of National Parks, Community Conservation and Peace Parks. *Geography Compass* 4(1):14-27.
- Kolimenakis A, Solomou AD, Proutsos N, Avramidou EV, Korakaki E, Karetos G, Maroulis G, Papagiannis E, Tsagkari K (2021). The socioeconomic welfare of urban green areas and parks; a literature review of available evidence. *Sustainability (Switzerland)* 13(14):1-26.
- Lategan LG, Cilliers EJ (2014). The value of public green spaces and the effects of South Africa's informal backyard rental sector. *WIT Transactions on Ecology and the Environment* 191:427-438.
- Lillesand MS, Keifer RW, Chipman JW (2004). *Remote Sensing Image Interpretation*. John Wiley and Sons.
- Lindholst AC, Sullivan SG, van den Bosch CCK, Fors H (2015). The Inherent Politics of Managing the Quality of Urban Green Spaces. In *Planning Practice and Research*. Taylor and Francis 30(4):376-392.
- Loures L, Santos R, Panagopoulos T (2007). Urban parks and sustainable city planning-The case of Portimão, Portugal. *population*, 15(10):171-180.
- Lu D, Hetrick S, Moran E (2010). Land cover classification in a complex urban-rural landscape with quick bird imagery. *Photogrammetric Engineering and Remote Sensing* 76(10):1159-1168.
- Maghrabi A, Alyamani A, Addas A (2021). Exploring pattern of green spaces (Gss) and their impact on climatic change mitigation and adaptation strategies: Evidence from a Saudi Arabian city. *Forests* 12(5).
- Mensah CA (2014a). Is Kumasi Still a Garden City? *Land Use Analysis between 1980-2010*. *Journal of Environment and Ecology* 5(2):89.
- Mensah CA (2014b). Urban Green Spaces in Africa: Nature and Challenges. *International Journal of Ecosystem*, 2014(1):1-11.
- Mensah CA (2017). Towards sustainability: Overcoming the physical barriers to urban green spaces in Kumasi, Ghana. *Ghana Journal of Geography* 9(2):125-150.
- Mensah C, Atayi J, Kobo-Bah AT, Švik M, Acheampong D, Kyere-Boateng R, Prempeh NA, Marek MV (2020). Impact of urban land cover change on the garden city status and land surface temperature of Kumasi. *Cogent Environmental Science* 6(1).
- Monica V (2019). Green spaces in cities. *Papers from the Department of Human Geography, Stockholm University, May*.
- Mwageni N, Kiunsi R (2021). Green Spaces in Residential Areas of Dar es Salaam City: Types, Coverage and Uses. *Journal of Sustainable Development* 14(3):121.
- Mzava P, Nobert J, Valimba P (2019). Land Cover Change Detection in the Urban Catchments of Dar es Salaam, Tanzania using Remote Sensing and GIS Techniques 45(3):315-329.
- Narh SN, Takyi SA, Asibey MO, Amponsah O (2020). Garden city without parks: an assessment of the availability and conditions of parks in Kumasi. *Urban Forestry and Urban Greening* 55:126819.
- National Bureau of Statistics (2012). *The United Republic of Tanzania Basic Demographic and Socio-Economic Profile Key Findings 2014 2012 Population and Housing Census*.
- National Population Commission Nigeria (2021). *Nigeria Population Census Report. Population Statistics*. <https://nigerianstat.gov.ng/elibrary/read/1241207>
- Nelson F, Agrawal A (2008). Patronage or participation? Community-based natural resource management reform in Sub-Saharan Africa. *Development and Change* 39(4):557-585.
- Nero B (2016). Urban green space dynamics and distributional equity in Kumasi, Ghana. *European Space Agency, (Special Publication) ESA SP, SP-740(May)*.
- Ngolo AME, Watanabe T (2022). Integrating geographical information systems, remote sensing, and machine learning techniques to monitor urban expansion: an application to Luanda, Angola. *Geo-Spatial Information Science*.
- Olaleye DO, Ayoade OJ, Omisoro EO (2013). A multivariate analysis of factors influencing green space provision in residential neighbourhood of Sub-Saharan Africa. *Journal of Environment and Earth Science* 3(5):138-146.
- Onyeiwu S (2021). Nigeria's poverty profile is grim. Its time to move beyond handouts. *The Conversation* 27p.
- Roy M, Shemdoe R, Hulme D, Mwageni N, Gough A (2018). Climate change and declining levels of green structures: Life in informal settlements of Dar es Salaam, Tanzania. *Landscape and Urban Planning* 180:282-293.
- Saavedra A, Domingos T (2023). Integrating food provisioning ecosystem services and foodshed relocalisation targets with edible green infrastructure planning. A case study from Lisbon city region. *Sustainable Cities and Society* 96 p.
- Scott C (2015). *UBoC UNITED BANK of CARBON*. https://issuu.com/groenesteden/docs/leaf_benefits_of_urban_green_space_
- Schägner JP, Brander L, Maes J, Paracchini ML, Hartje V (2016). Mapping recreational visits and values of European National Parks by combining statistical modelling and unit value transfer. *Journal for Nature Conservation* 31:71-84.
- Smaniotto CC, Mathey J, Šuklje EI (2008). Green spaces – a key resources for urban sustainability. *The GreenKeys approach for developing green spaces*. *Urbani Izziv* 19(2):199-211.
- Takyi E, Mensah H, Aazore FK, Nalumu DJ, Abu JJ (2022). Understanding the Urban Planning-Green Space Depletion Nexus: Insights from the Kwabre East Municipality, Ghana. *Urban Forum*.
- Takyi SA, Seidel AD (2017). Adaptive management in sustainable park planning and management: Case study of the city of Vancouver parks. *Journal of Urban Ecology* 3(1):1-15.
- Tibesigwa B, Ntuli H, Lokina R (2020). Valuing recreational ecosystem services in developing cities: The case of urban parks in Dar es Salaam, Tanzania. *Cities* 106:102853.
- UN-Habitat, Africa Planning Association (2013). *The State of Planning in Africa: An Overview* 36 p. <https://unhabitat.org/the-state-of-planning-in-africa-an-overview>
- UN Habitat (2018). *The State of African Cities 2018*. <https://unhabitat.org/the-state-of-african-cities-2018-the-geography-of-african-investment>
- UN Habitat (2020). *World Cities Report*. https://unhabitat.org/sites/default/files/2020/10/wcr_2020_report.pdf
- Vartanian TP (2011). *Secondary Data Analysis*. Oxford University Press.
- Verweij P, Schouten M, Beukering P van, Triana J, Hess K. van der LS (2009). Keeping the Amazon Forest Standing: A Matter of Values.
- WHO (2016). Urban green space interventions and health: A review of impacts and effectiveness. *WHO Regional Office for Europe* 80 p.
- WHO Regional Office Europe (2019). Urban green spaces: a brief for action. <https://apps.who.int/iris/handle/10665/344116>
- Xi-Zhang S (2009). Urban green spaces in Guangzhou (China): Attitude, preference, use pattern and assessment. A PhD Thesis Submitted at University of Hong Kong.
- Yagha J (2015). Economic Impact of urbanization on forest resource in Texas. *Southern Illinois University Carbondale* pp. 14-15.
- Yeshitela K (2020). Attitude and perception of residents towards the benefits, challenges and quality of neighborhood Parks in a sub-Saharan Africa City. *Land* 9(11):450.
- Yeshitela K (2019). Urban Green Space Development and Management in a Rapidly Urbanizing Sub-Saharan African City: the Case of Addis Ababa, Ethiopia. *Ethiopian Journal of Environmental Studies and Management* 12(1):96-111.