○ **Environmental Systems Research**

RESEARCH

Increasing the publicness of riversides as public space development on Kebena River, Addis Ababa, Ethiopia

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Abstract

Introduction: Public space development is important for the socio-economic and ecological conditions of cities. This study evaluated the publicness of riversides as public space development on the Kebena River in Addis Ababa, Ethiopia. The study identified the potentials and challenges of open spaces for public space development along the riversides of the Kebena River to increase the publicness of the riversides.

Methods: A comparative analysis of the publicness level of three selected open spaces along the riversides of Kebena River, namely, Wisdom Park, Minister Meda, and Agoza Meda, were done using the star model. Quantitative data were collected using site observations, document reviews, and questionnaire surveys with 169 interviewees. The land use and land cover (LULC) change detections were done for the years 2002 and 2020. Data were analyzed using SPSS, ArcGIS (Geographic Information Systems) software, and the Star model of the publicness analysis tool. Both qualitative and quantitative data were used to examine the riversides of the Kebena River.

Result: The results from the star model revealed that the riversides of the Kebena River could not be considered public spaces in their present conditions. This could be attributable to the abuse by the illegal settlers and urban agriculture activities.

Conclusion: The study depicted that the publicness of the Kebena riverside areas is very low and has a very poor public life. Publicness-oriented public spaces should be established and developed to improve and enhance the publicness level of the riversides of the Kebena River. The study contributes to scientific communities and policymakers to enhance the development of open green spaces, which may contribute towards climate change mitigation and adaptation strategies.

Keywords: Star-Model, Publicness Meta-themes, Public Open green Space, Land use and cover analysis, Kebena riversides

Introduction

Adequate provision of public spaces is necessary for the socio-economic well-being of a city (UN-Habitat 2013). The essence of the 'urban advantage' is found in public spaces. These spaces are pro-urban development (Saliez 2016). The study of public life is an ever-evolving field of research (Varna 2014; Gehl and Svarre, 2013). Public life and public spaces have traditionally been viewed as coherent entities (Gehl and Svarre 2013). Many scholars have tried to define, conceptualize and measure publicness, yet it is still a very complex and unexplored field of landscape architecture and urban planning (Wojnarowska 2016; Varna 2011; De Magalhaes 2010; Nemeth and Schmidt 2010; Madanipour 2010). Publicness is a multi-layered concept that describes how the public is a space, especially public spaces (Varna 2014; Carrone and

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Varna 2013; Varna and Tiesdell 2010; Madanipour 2010), and is the quality of being public (Zhang 2016; Varna 2011). Publicness can also be considered a tool to characterize public spaces (Turhan and Ayatac 2020; Varna 2014). Therefore, the classification and renovation of public spaces can be discussed using the publicness variables (Turhan and Ayatac 2020).

Although Addis Ababa has 46% of vacant spaces which can be used as a potential for public space, most of the public spaces in the city are being over-utilized (Alemayehu et al. 2015). According to the World Bank, however, the city center possesses a high population density (about 30,000 people per km^2), with around 30% of the population concentrated on 8% of the land (Alemayehu et al. 2015). The rate of urbanization in the city is increasing at the expense of public spaces resulting in the lessening of public spaces (Kassa 2008).

According to Admasu (2016), the Rivers and Riversides Development Project Office of the City Administration has selected six rivers for rehabilitation in Addis Ababa. However, most residents of the city do not consider the riversides as a recreational place (Aragaw 2011). The rivers of the city were providing various ecosystem services such as water for drinking, swimming, etc. (Weldegebriel et al. 2011; Alemayehu 2001). Currently, however, the riversides have not been developed as public spaces, and have been changing mainly to informal settlements (Abdullahi 2012). Yet, the street sides and joints, unplanned left-over pocket spaces, and few squares are the only available public spaces currently used in the city (Aragaw 2011).

The lack of public spaces is one of the critical problems existing in the city that requires proactive solutions (AACPPO 2017). Kebena Riverside flows through dense urban areas of Addis Ababa where there are intense construction and shanty housing due to urban densification (Salimi 2016; AA-ILIC 2014). This has caused environmental degradation, pollution, and flash floods in the areas posing danger to the communities living around and the river itself (Mohamed and Worku 2020; Worku and Giweta 2018; Yohannes and Elias 2017; Salimi 2016; Beyene et al. 2008). The severe deterioration of the water quality of the city's rivers, including the Kebena River, has prohibited some of the local communities not to using the river's water for domestic uses (Yohannes and Elias 2017; Salimi 2016). Yet, the great majority of poor local communities residing around the Kebena River still depend on this river for irrigation, bathing, washing, sanitation, and livestock watering (Worku and Giweta 2018). This calls for comprehensive actions to protect and ensure the sustainable use of the river's resources. Such actions require up-to-date information to understand the impacts on rivers' ecosystems and their services

(Muttitanon and Tripathi 2005) and to develop effective management strategies (Paudyal et al. 2019; Chowdhury et al. 2018). To achieve this goal, the objective of this study was therefore to evaluate the extent of potentials and challenges to the sustainability of open spaces along the riversides of the dense Kebena River areas in Addis Ababa generated by urbanization. The specific objective was to increase the publicness of the riversides of the Kebena River to enhance its socio-economic and ecological values through public space development.

Description of the study area

The study area is located in Addis Ababa (Fig. 1), the capital of the Federal Democratic Republic of Ethiopia, and the seat of the African Union. Addis Ababa is located in the horn of Africa at geographic coordinates 9° 2′ 0″ N and 38° 42′ 0″ E covering a total area of 540 km^2. Addis Ababa is currently among the fastest-growing urban centers and the commercial, and political center of the country. As of 2020, for administrative purposes, the city is subdivided into 11 sub-cities and 116 'Districts' (*District is the lowest official Administration unit in the city, locally named 'Woreda'*). The total population of the city for the year 2014 was projected to be 3,201,662 representing 19.8% of the country's urban population and 3% of the country's total population (CSA 2014). Six rivers are crossing the city from north to south, one of which is the Kebena River.

The entire study area is located in the administrative areas of Kirkos and Yeka Sub-cities in Addis Ababa. Three sites, namely Wisdom Park, Minister Meda, and Agoza Meda, have been selected for the study (Fig. 2). The selected sites stretch to three Districts—one in Kirkos sub-city, i.e., *District 08,* and two sites in Yeka sub-city, i.e., District 06 and District 07. The population density of District 08 of Kirkos Sub-city, and District 06 and 07 of Yeka Wub-city are 160–266, 96–128, and 68–160 persons per hectare respectively (AA-ILIC 2014).

The sloped profile has a diverse range that is from less than 2% to more than 30%. Some areas near the river have a greater slope value that is 15–30%. However, the majority of the area has a slope value ranging from 2 to 9% (AA-ILIC 2014).

Land use and land cover of the study area

The current land use land cover of the study area is predominantly featured with built-up, vegetation, and roads. Expansion of built-up areas is common in the city at the expense of agricultural lands. The built-up area was increased by the rate of 2.8km^2/year in the last two to three decades (Moisa and Gemeda 2021). This has increased the surface temperature of the city, thereby urban heat island (Warkaye et al. 2018). Most of the area
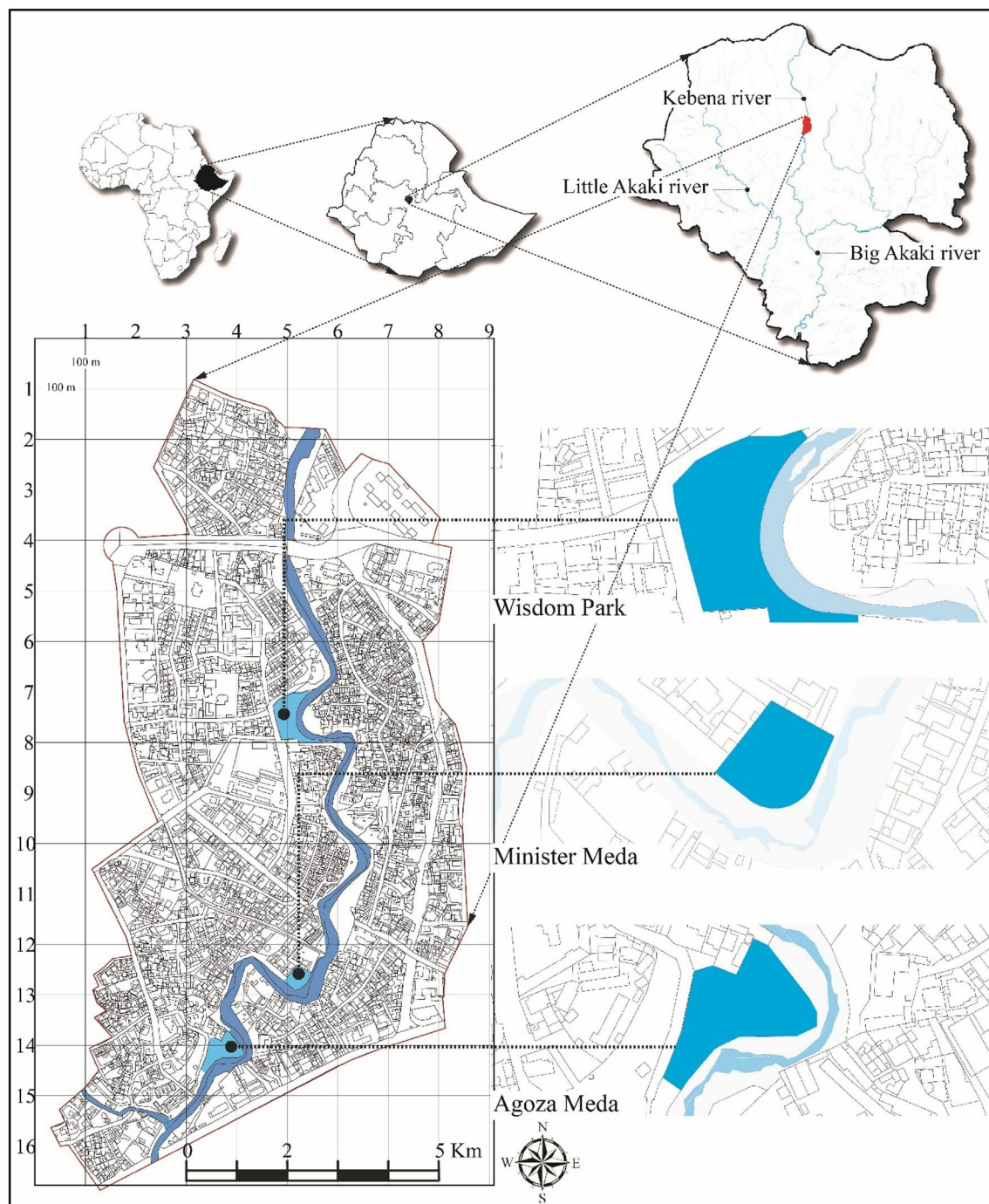
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Fig. 1 Map showing the study area and the three selected sites in Addis Ababa

is covered with residential shanty houses and mixed commercial buildings. The land use of the study area is medium-density mixed residence which is dominated by the residences (AACPPO 2017). The natural vegetation in and around the city is also converted into an impervious surface (Teferi and Abraha 2017). Roads, categorized

from the main street to sub arterial streets with different finishes, have also covered a significant amount of area.

Climate of the study area

The city is located in the central highland with an Afro-Alpine temperate and warm climate at an altitude range

Fig. 2 Photographs showing some segments of the three selected sites (*Top- Wisdom Park, Middle—Minister Meda, and Bottom -Agoza Meda*)

of 2200–3100 m above sea level. Addis Ababa has both dry and rainy/wet seasons. The rainy season extends from June to September while the dry season extends from December to April. The city receives a maximum amount of precipitation during the rainy season (June to September). The minimum and maximum mean annual temperatures are about 12 °C and 24 °C, respectively, while the night and day temperature of the city varies

between 10 and 15 °C and 20 and 24 °C, respectively. The average temperature of the city over the last 2 decades is 18.4 °C (Wubneh 2013).

Materials and methods

Site observation
Site observation as a method is logical and empirical for practical analysis and interpretation of data collected (Gehl and Svarre 2013). Using this method, different data collection techniques such as counting, mapping, tracing, tracking, photographing, and test walking were employed in the study (Gehl and Svarre 2013). Both qualitative and quantitative data were acquired from the site observation.

Document review
Document reviewing was conducted to acquire secondary data to assess the potential of the study for public space development. These were maps including digital ones, plans, strategies and policies, guidelines and frameworks, and reports. The documents were collected from government offices.

Questionnaire survey
The questionnaire surveys were also conducted using stratified random sampling targeting residents at the riverside with a sample size of 69. Respondents' background information with regard to gender, age, residence, and gender are presented in Table 1. Out of the 69 respondents, 46 are male and 23 are female. Regarding their age a diverse group of respondents has participated in the questionnaire including 3 respondents from age10-20, 33 are 20–30, 12 are 30–40, 9 are 40–50, and 12 are above the age of 50. The questionnaire was conducted within the boundary of the study area. 40 percent of the respondents happen to be living in the designated study area in which more than 50% of them have lived in the study area for more than 5 years. The rest of the respondents live around the study area but visit the site regularly and irregularly. The questionnaires consisting of open-ended, closed-ended, and mixed questions were made based on Kabir (2016). The questionnaires were administered by trained data collectors after conducting the pre-testing. Data regarding the need assessments and reflection of the society was then collected about the challenges of open spaces around Kebena Riversides, society's perception towards the riverside conditions, and attitude about the importance and availability of public spaces.

Land use and land cover (LULC) change detection
Environmental planning needs information on land use and land cover (LULC) analysis in terms of spatial composition and shifts in land use trends (Tadesse et al. 2001). The raster map used for GIS analysis is a google earth image. Thus, satellite images with a pixel size of 4800×3008 and resolution of 96 dpi obtained from google earth were used for the years 2002 and 2020. The year 2002 was picked as the starting point for the study as most of the land-use changes have been detected over the last 2 decades (Moisa and Gemeda 2021). ArcGIS version 10.8 was employed to geo-reference, digitize, and classify the satellite images using both unsupervised and supervised classification to produce vector maps that show the LULC of the two periods. The generated data is presented using maps and numerical values in a table to detect the 18 years of LULC changes in the study area. In the analysis, four LULC types, namely Bare land, Built-up, Road, and Vegetation were identified. The classification was verified using site observation by identifying the dominant features of the study area.

Data were analyzed using SPSS, and ArcGIS (Geographic Information Systems) software. The Star model analysis tool developed by Georgiana Varna was applied for the analysis of publicness, i.e., to compare and contrast the publicness of different public spaces (Varna 2014). Five criteria/dimensions were used as indicators as *Ownership* (ownership status), *Control* (Presence of blind spots, Presence of guards, police, etc.), *Physical configuration* (Connectivity, public walkways, walking opportunities, sitting opportunities, opportunities for active engagements, etc.), *Animation* (Diversity of activities, Diversity of users in terms of gender, age, etc.), *and Civility* (Physical maintenance and provision of greenery, provision of basic public facilities like public toilets,

Table 1 Respondents background information by gender, age group, residential Status, and Length of stay in the area

Gender	No. (%)	Age	No. (%)	Residential Status	No. (%)	Length of stay in years	No. (%)
Male	46 (66.7)	< 20	3 (4.3)	Resident	53 (76.3)	1–2	3
Female	23 (33.3)	20–30	33 (47.8)	Work	16 (23.2)	3–4	4
		30–40	12 (17.8)			4–5	4
		40–50	9 (13)			> 5	51
		> 50	12 (17.4)				
Total	69 (100)		69 (100)		69 (100)		69 (100)

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provision of public facilities like lighting, etc.) to assess the publicness using the star model (Varna 2014, 2011; Varna and Tiesdell 2010). Rating of the analyzed open spaces was used to identify the potential of the study area for public space development. The publicness level of the open spaces examined was rated based on Varna and Tiesdell (2010). Each indicator was rated out of five—from one to five. Under each meta-theme, the indicators have their descriptors that help evaluate the values of indicators with five being the highest and one being the lowest, in which five is more public and 1 is less public. The values of the five dimensions are determined by a complex calculation of the values of the sub-dimensions/indicators. Ratings of the values of the five meta-themes were computed by calculating the mean values/average score of their respective indicators. The final result was presented in a diagram showing the level of publicness of the open spaces. Three open spaces at the riverside were analyzed, namely, *Wisdom Park*, *Minister Meda*, and *Agoza Meda* (Fig. 1).

Result

Level of publicness of riverside

Minister Meda shows the lowest ranking open space in terms of publicness with an overall publicness level of 1.785 (Table 2). Similarly, Agoza Meda has a comparable degree of publicness of 1.852, which is a bit higher than Minister Meda. In terms of ownership, however, Minister Meda has a better status because of the claimed portion of land for private agriculture at Agoza Meda. Regarding control, both sites have the same but low rating of 2.25. The two areas have less than 2 points on each of the other three meta themes- physical configuration, civility, and animation. In comparison, the level of publicness of Minister Meda and Agoza Meda is lower than the Wisdom Park which has an overall publicness level of 3.08 (Table 2).

The level of publicness for the comparison of the three sites is shown in Figs. 3 and 4. Wisdom Park has the greatest rating of publicness, 3.08(Fig. 5).

Table 2 Rating of the five meta-themes for the level of publicness of the studied sites

Publicness Meta-themes	Wisdom Park	Minister Meda	Agoza Meda
Ownership	5	3	2
Control	3.5	2.25	2.25
Physical configuration	2.158	1.5	1.66
Civility	2	1	1.75
Animation	1.98	1.75	1.6
Overall publicness level	3.08	1.785	1.852

Fig. 3 Level of publicness of the three sites: Wisdom Park, Minister Meda, and Agoza Meda
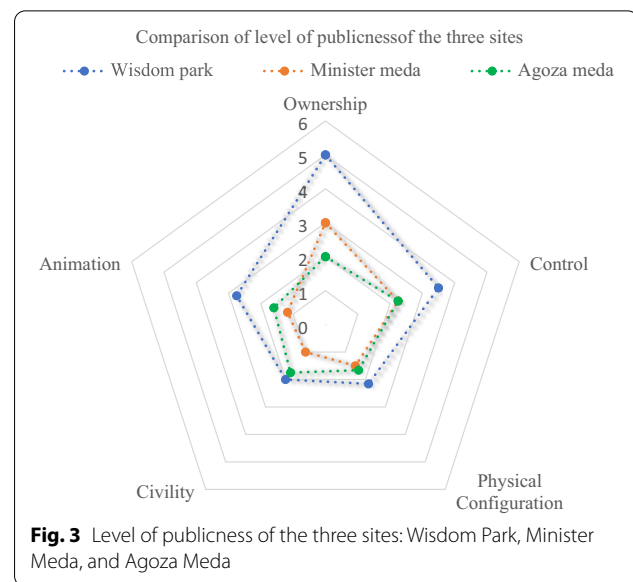
Potential of the riverside for public space development

Public interest

The information acquired from the analysis of the questionnaire reveals that less than 50% of the respondents visit regularly the riverside while the rest don't at all. About 39% of the respondents visit the riverside daily whereas about 24% visit the area twice a week and 14.7% once a week and about 22% once a month. And more than 50% of the visitors in the area are residents that live in and around the riverside. The information gathered from the data shows that more than 90% of the users visit the site. Living and working in the study area are the frequent reasons (Fig. 6). The stratified random sampling statistical analysis result for sample size is presented in Table 3.

Available open spaces

Open spaces that are classified as available for this study are those that are more than 1000 m² (Table 4). Two open spaces are present at the riverside. These spaces don't include areas that are under the park, recreational and urban agriculture uses. Wisdom Park has been claimed as an urban agriculture area.

Challenges of open spaces at the riverside

Concerning the challenges of open spaces on the riversides, lack of accessibility, absence of public spaces, and safety factors were the core motives constituting 36%, 22.7%, and 24% of the total responses, respectively (Fig. 7).

63.3% of the respondents confirmed that illegal land invasion is the major cause of the loss of open space at
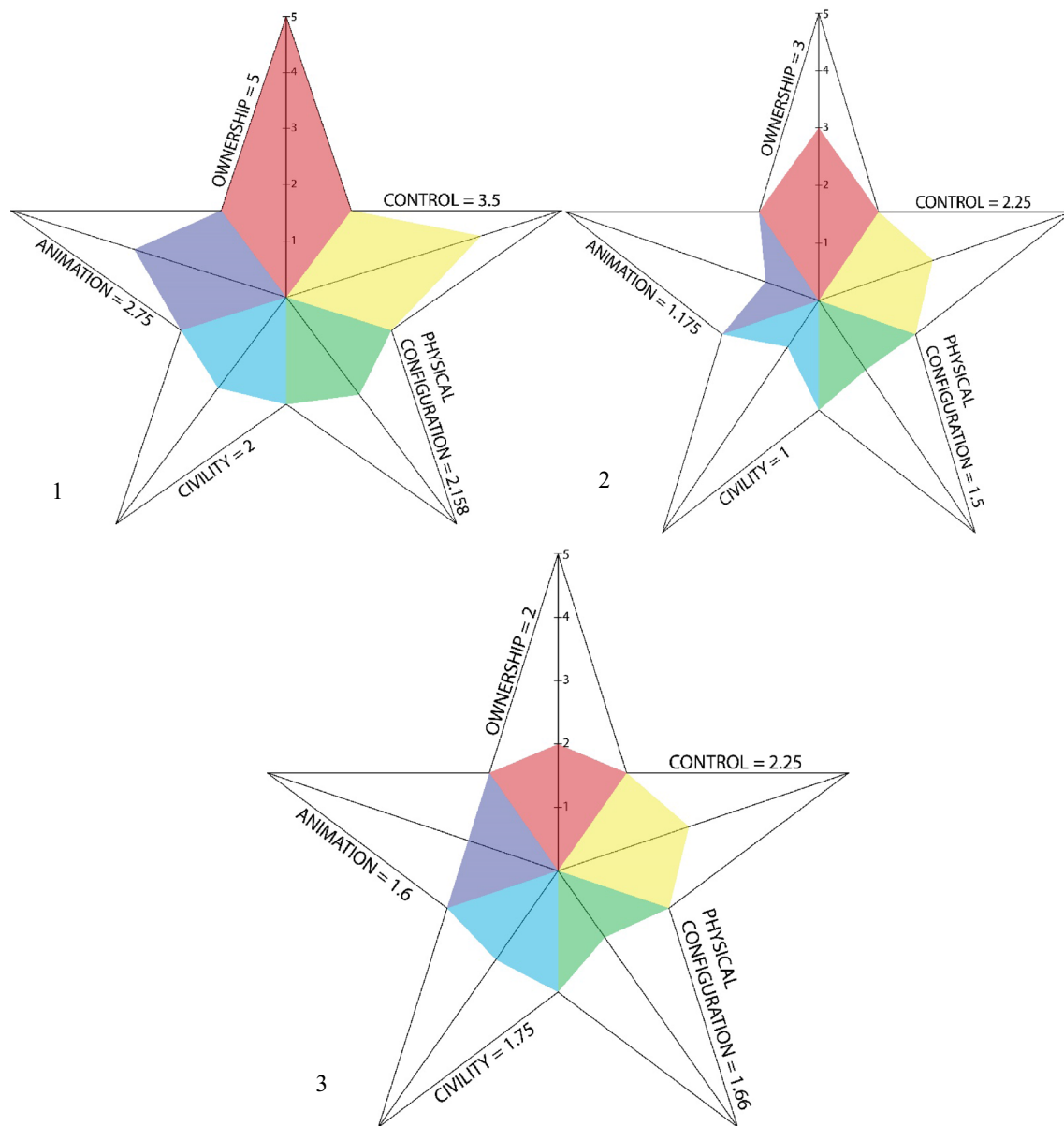
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Fig. 4 Star model representation of the level of publicness (*1—Wisdom Park, 2—Minister Meda, and 3—Agoza Meda*)
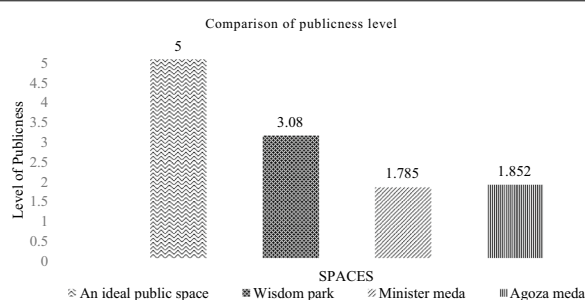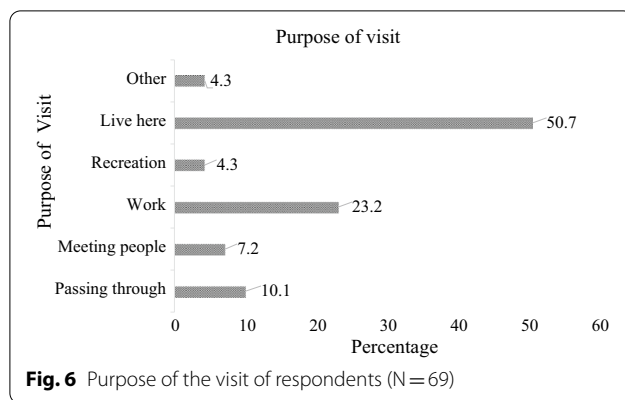

Fig. 5 Comparison between an ideal public space and open spaces at Kebena riverside

the riversides. Change in land use has been labeled as a second cause (18.2%) and government projects as the third cause (13.6%) as per the views of the respondents (Table 5).

The views of the respondents about the existing challenges in the open spaces at the riverside were examined. About 37%, 21%, and 20% of the respondents stated that pollution, lack of public service/infrastructure, and security problems, respectively, are the challenges of open spaces at the riverside (Table 6).

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Fig. 6 Purpose of the visit of respondents (N = 69)

Table 3 Stratified random sampling calculation for sample size

Factors/variables	Values	Remarks
The population size of the sample area *(total population size of Kirkos and Yeka sub-cities)*	896,001	Estimated for 2020
Margin of error	10%	
Confidence level	90%	
Z-score	1.65	*The z-score/ z-value for 90% confidence*
Sample size	69	

Stratified random sampling was implemented to identify the sample size for the questionnaire with a 10% margin of error and 90% confidence level

Table 4 Available open spaces that are not claimed by other functions at the riverside

The local name of the open space	Location		Area (m²)	Average slope (%)
	Sub-city	District		
Agoza Meda	Kirkos	08	3223	19%
Minister Meda	Kirkos	08	1612	9.8%

About 75% of the respondents rated the open spaces at the riverside as the poorest in their condition. About 15% rated the open spaces poor and about 10% as fair. The final calculated rating shows no excellent or good conditions at all, especially for cleanliness, comfort, and safety (Fig. 8).

LULC changes

LULC maps of the study area were prepared and presented for 2002 and 2020 as shown in Fig. 9. Areas for each of the four categories of LULC types and the number of changes were derived for the three-time period 2002–2020 (Table 7). The changes in LULC are described below for each category (built-up, vegetation, road, and bare land).

The LULC analysis result indicated that the area covered by bare land present during 2002 was greater than that of the period 2020. According to the result, the total area covered by bare land LULC class showed a considerable decrease of 44.36% between 2002 and 2020. However, the other three classes showed an increase for the period between 2002 and 2020. The vegetation class increased by 53.59%., and the most change for this LULC class took place along the Kebena River.

Discussion

Level of publicness

The overall level of publicness of Wisdom Park is a moderate score according to Varna (2014), Carrone and Varna (2013), and Varna and Tiesdell (2010). Public open spaces offer opportunities for leisure activities and contact with nature (McCormack et al. 2010). However, the result obtained from *Minister Meda* and *Agoza Meda* sites supports the claim that the publicness of space at the riverside is degraded due to pollution and insufficient infrastructure *(*Salimi 2016). This is because the site is an underdeveloped space. The results revealed the analyzed open spaces are found below the standard which is the ideal publicness level (Varna 2014). This implies that the riverside might not have many visitors for recreational purposes. But it can be enhanced by public space development by providing properly designed public open spaces at the riverside to encourage physical activity and walking (Giles-Corti et al. 2005; Kaczynski and Henderson 2007) and provide a meeting place for users to develop and maintain social ties and sense of community (Larson et al. 2016).

Accordingly, Wisdom Park was found more public than Minister Meda and Agoza Meda. The result indicated how landscape planning, design, and management are important to public space development. This is because open spaces have been recognized as important tools for planning healthy livable cities (Frumkin 2003; Shanaha et al. 2015).

The ideal public space in terms of publicness is the kind of public space that gets a maximum rating for each of the five meta-themes making the overall publicness level 5 (Varna 2011). Ideal public space describes the space that has the overall maximum five-point rating. Thus, the finding of this study found that the three open spaces were not found fit to be entitled as ideal public spaces regarding publicness as accessibility and quality influence open space uses (Berg et al. 2015). Even the "well-planned" public space, Wisdom Park, is not yet in the standard of an ideal public space, which requires improvements. Likewise, the result reveals that Minister Meda and Agoza Meda, both under the average threshold, need a thorough improvement through landscape
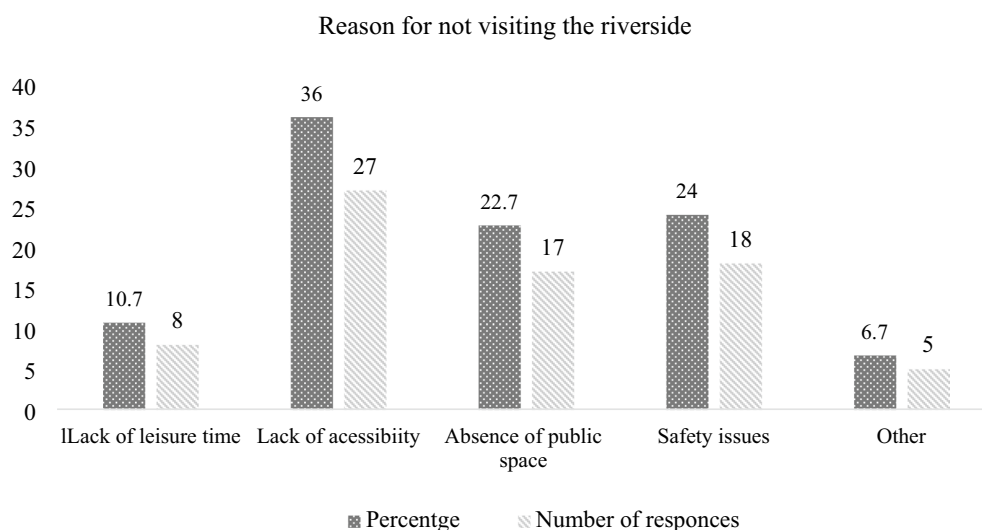
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Fig. 7 Reason (multiple responses) for not visiting the riverside (N = 69)

Table 5 Cause for the loss of open spaces at Kebena riverside (N = 69)

Cause for loss of open spaces	Percent
Land consumption of government projects	13.6
Illegal land invasion	63.6
Privatization of open	4.5
Change of land use through urban designs	18.2
Total	100

Table 6 Respondent's response to the challenges of open spaces at the riverside (N = 69)

Challenges	Percentage
Pollution	36.9
Security problem/Crime	19.6
Flood	7.7
Privatization of public spaces	13.7
Lack of public service/ infrastructure	20.8
Other	1.2
Total	100

planning as it benefits the development and implementation of management plans (Terrado et al. 2016).

Therefore, it is fair to make a sweeping statement that Wisdom Park can have a better level of publicness if the physical configuration, civility, and animation dimensions have been improved. Also, the control dimension needs a little intervention to fulfill the needs for publicness.

Minister Meda and Agoza Meda require improvement in all five dimensions for a better degree of publicness. Such improvement requires the incorporation of local values, knowledge, and perspectives to account for their benefits (Gundersen et al. 2016; Smith et al. 2014; Fliervoet, et al. 2013).

Potentials of the riverside

It is customary that public spaces designed in areas where the users don't appreciate and need public spaces as an important entity are likely to be left abandoned. Deprived of the need from the public abandoned or vacant spaces can't be converted into parks and public spaces (Banerjee 2007). The finding discovered that all of the respondents in the study area recommend the development of public space at the riverside as it is important and supports the ideals of public space development at the Kebena riverside. Based on the result acquired, 100% of the users responded that they need public spaces. This confirms that the development of an effective and functioning public space is an essential component of public life. River buffers should be furnished with greenery and vegetation to control pollution and untidiness (Yohannes and Elias 2017).

Addis Ababa Structural Plan states that river buffers should be 10–30 m wide on both sides. These spaces are for green areas and recreational parks based on the slope gradient of the terrain. It further states that as circumstances permit, up to 50 m wide buffer zones should be provided for a networked multifunctional green space (AACPPO 2016). The structure plan spatial framework implementation guidelines and standards clearly state

Fig. 8 Overall rating of condition of open spaces at Kebena riverside
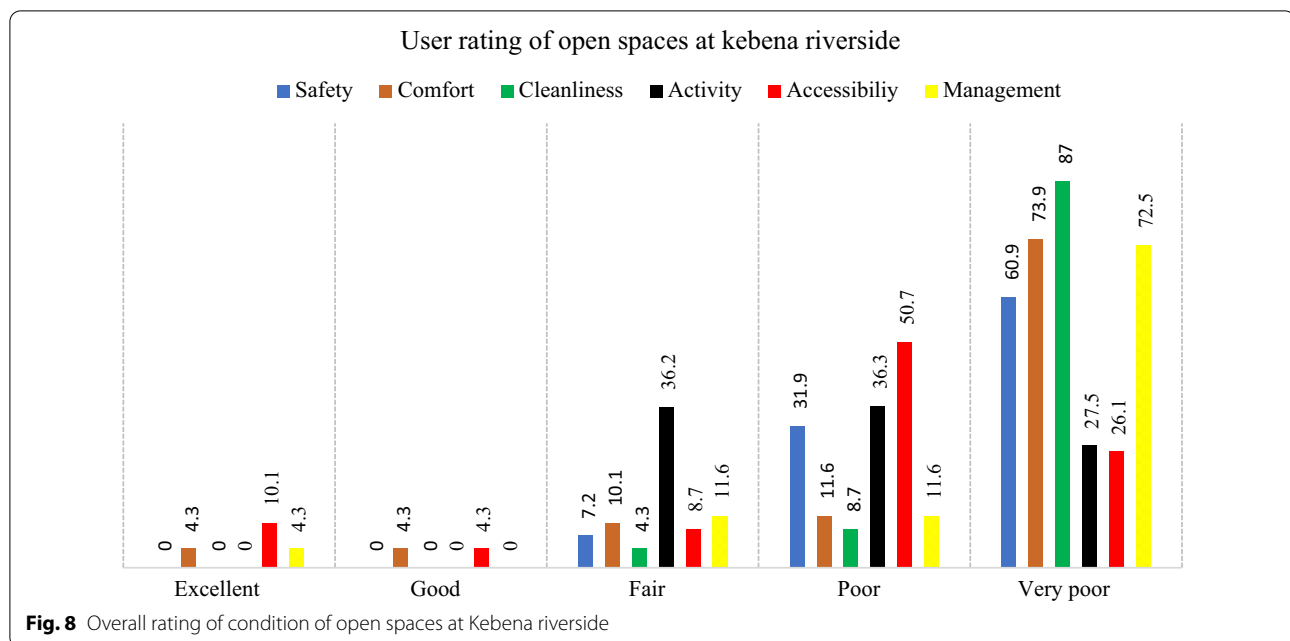
that 30% of the area should be open space and developed for green areas and parking (AACPPO 2015). The structural plan of the city documents that only about 114 ha of the land is covered by public parks achieving only less than 1 m^2 per capita of provision of green space which is one of the lowest values worldwide (AACPPO 2016).

The structural plan of Addis Ababa endorses the development of recreational spaces at river buffers to increase the per capita green space (AACPPO 2017) to meet the standard set by WHO which is 9 m^2 per capita (Maryanti et al. 2016). In addition, the finding reveals that the master plan guide instructs at least 10% of the area should be dedicated to neighborhood parks (lower-level parks) in a mixed-use residential urban area (AACPPO 2015). The study area is located in the zone of mixed-use residences as classified in the structural plan (AACPPO 2017). Based on this study, out of the 90 hectares of the study area, only 1.9 hectares are developed as a park composing only 0.41% of the area.

Available land is one of the essential ingredients for public space development (Kassa 2008). However, the open spaces are facing an existential threat in the study area. Illegal land invasion, change in land use, government projects, and privatization of open spaces are among the root causes identified. Although there are numerous pocket spaces at the riverside that can be converted into usable green areas, the areas have been identified for the development of public parks that can be used as District parks (0.3–1 ha) or neighborhood parks (< 0.3 ha) (AACPPO 2015). Minister Meda (1.6 ha) and Agoza Meda (3.2 ha) are potential open

spaces in terms of availability meeting the requirements of the structural plans set by AACPPO. Also, the open spaces are located along the Kebena River where they share a border with the river channel. Nevertheless, water is an element that gives a crucial ecological dimension to a public space (Andini 2011) but it is being missed from most of the public spaces in the inner city. This is a good opportunity to integrate the benefits of water in a public space considering that rivers are parts of people's or communities' identity, are places for recreation that is beneficial for the body and mind, are resources/ sustenance, and are places for nature (Davenport and Anderson 2005).

The vegetation cover has also increased because urban agriculture and riverine vegetation have flourished immensely. Urban agricultural activities and inaccessibility of the river due to pollution might also increase the vegetation cover along the Kebena River over the last 2 decades. The river being inaccessible and abandoned played a key role in supporting the riverine vegetation. The increase in vegetation cover should be considered a potential for public space development at the sensitive landscape features like riversides as they provide cultural ecosystem services such as esthetics, recreation, and ecotourism which play an important role in the physical and psychological health of urban populations and the improvement of life (Chang et al. 2017; Dickinson and Hobbs 2017; Kim and Jin 2018) and regulating ecosystem services such as carbon sequestration, and microclimate regulation (Lonsdorf et al. 2021).
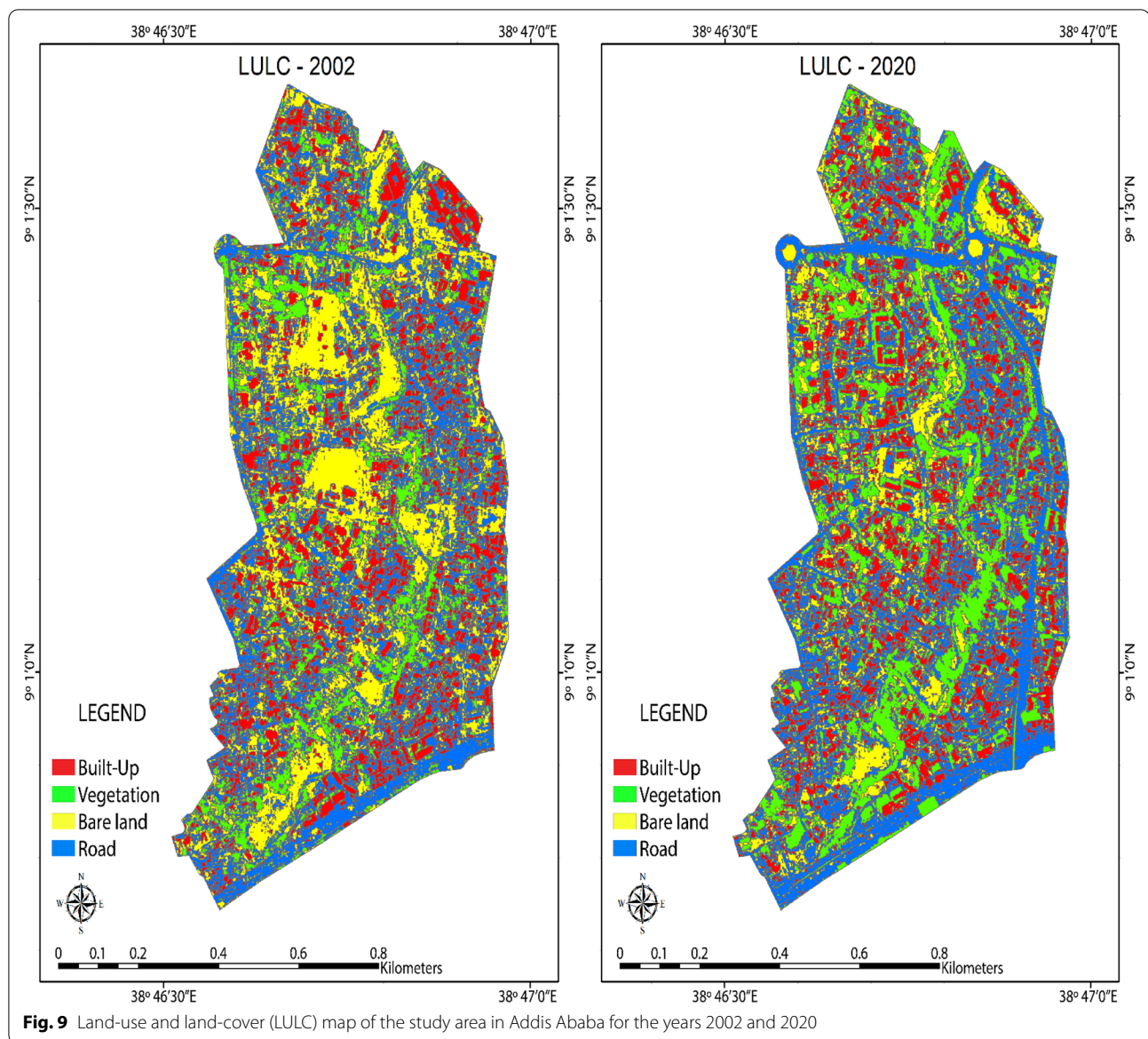
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Fig. 9 Land-use and land-cover (LULC) map of the study area in Addis Ababa for the years 2002 and 2020

Challenges of the riverside

Rivers play key ecological, economic, and social roles in the sustainability of human society (Sander and Zhao 2015; Wang et al. 2014). However, rivers and riversides are among the most threatened worldwide due to a broad range of human activities (Reid et al. 2019; IPBES 2018). The result indicates that nearly half of the respondents did not visit the riverside regularly. This might be due to the lack of certain attributes such as amenities, maintenance, or safety that play important roles in encouraging the use of public open spaces (Frumkin 2003). This study confirms that the lack of accessibility, the absence of public spaces, and safety issues were the reasons forwarded as the major repellant factors of the riverside, and yet can be appropriated by public space development (Terrado et al. 2016). This requires interventions through restoration or rehabilitation measures aimed at decreasing human

Table 7 LULC change for the Kebena riverside between 2002 and 2020

Class name	2002 (ha)	2020 (ha)	Changes (ha)	%
Built-up	18.40	20.21	1.81	+9.84
Vegetation	14.63	22.47	7.84	+53.59
Road	30.91	32.91	1.99	+6.47
Bare land	26.26	14.61	−11.64	−44.36

influence and increasing natural values (Verbrugge and Born 2018). In urban areas, such river restoration has constituted an integral element of sustainable urban development (Vollmer 2009; Findlay and Taylor 2006).

Lack of public service and infrastructures like walkways, access routes, crossings, and seats are other challenges identified by the respondents. These also discourage the users from visiting the site regularly. 19.6% of the visitors were threatened by the security problems like theft, assaults, sexual abuse, and crimes. This challenge was caused by the absence of security systems and the visual inaccessibility of some sections of the riverside, the argument has also been supported by Abdullahi (2012). Privatization of open spaces is another challenge perceived by the respondents. Portions and whole open spaces are subject to private entities in Addis Ababa for different purposes (Abdullahi 2012), mainly the privatization act (Kassa 2008), which is government-backed and disregards society's need for public space. Thus, it is necessary to take supportive measures to achieve good ecological status and benefits by investing in river restoration and nature conservation (Feld et al. 2018; Grizzetti et al. 2016). Such landscapes transformation is used to enable sustainable use of the river resources for economic, ecological, and human well-being benefits (Rijke et al. 2012).

LULC changes

In 2002 there was 26 ha of bare land (open space) but decreased to 14 ha in 2020. More than 11 ha of bare land was transformed into other LULC types. The finding alleges the available bare land LULC was lessened by 44%. This could aggravate the pressing challenges of the lack of public spaces (AACPPO 2017). The decrease in the amount of bare land may suggest that the available open spaces for public space development might get lost. Therefore, developing public spaces might be more difficult because it requires more finance, time, legal work, and resources. If the bare land keeps on diminishing at this rate, there will be a chance that there might not be a potential bare land (open space) for public space development in near future.

Almost all of the users at the riverside categorized the open spaces as below the average condition. The overall condition of the open spaces at the riverside has been characterized as a very poor condition. The finding revealed that the majority of the respondents (75%) rated the riverside as a very poor condition. This calls for the significance of an immediate and robust improvement at the riverside as quickly as possible. Otherwise, the result aggravates the impacts of the global challenges of climate change in cities.

Changes in land-cover patterns are one way in which the effects of climate change are expressed (Virginia 1997). The effects include both implications of land-use change on the atmospheric flux of $CO2$ and its subsequent impact on climate and the alteration of climate change impacts through land management (Dickinson 1991). The finding identified a lack of green infrastructures, lack of social connectivity, and well-being as the challenges caused by rapid urbanization and poor development scheme in the study area. Similar challenges are posed in different cities. Addressing the above issues in the study area will help in the process of creating a climate change resilient city.

Conclusion

The study evidenced that the publicness of the Kebena riversides is very low and has a very poor public life. The open spaces at the riversides are decreasing over the past 2 decades. The study also showed that there are multiple causes for the loss of public spaces. The lack of urban planning, landscape design, government commitment, social willingness, and infrastructure requires multilayered solutions to tackle the problems. Generally, the development approach has not converged with the requirements of public life to achieve a picture-perfect public space.

Open spaces at the riverside should be protected from privatization, illegal settlement, and pollution to protect the environment and social well-being by establishing public space development. The development should then be managed and maintained properly to sustain its ecological and socio-economic values, complying with the best interest of the public to boost public life. This should be harmonized with the current structural plan and policy of riversides.

Author contributions
AG was responsible for all activities of the research process such as the research method selection, data collections, data compilation, entry, data and Google Earth image analysis and interpretation, and writing up of the draft manuscript. KA and HD were involved in improving the quality of the manuscript by providing constructive guidance, critical comments and suggestions on the data and image analysis, data interpretation and editing the manuscript. Both KA and HD read and approved the final manuscript. All authors have read and approved the final manuscript.

Availability of data and materials
The data that support the findings of this study are available from the corresponding author upon request.

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Declarations

Ethics approval and consent to participate
This article does not contain any studies with participants performed by any of the authors.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

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