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Accessibility Analysis of Green Spaces in Two Neighborhoods with Diverse Socio-Economic Status (SES) in İstanbul[1]

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Abstract

Access to urban green spaces is an important issue that has been studied by different disciplines for a long time, especially in the fields of economy, environment, and urban studies. Urban green spaces contribute to the increase in the quality of urban life for individuals and have an important place in the relationship between space and healthy life. Access to urban green spaces, on the other hand, is not the same for all segments of society and may vary due to social and economic inequalities in neighborhoods. In addition, the distribution and accessibility of urban green spaces within the city may not be of the same standard for every neighborhood. This inequality has become more visible, especially during the COVID-19 pandemic. This article explores whether there is a relationship between socio-economic status (SES) level and accessibility to urban green spaces. Bakırköy and Bağcılar districts of İstanbul were chosen as sample areas because they are close to each other in terms of location, they are similar in terms of area and population, but their inhabitants' SES is different. Accessibility to green areas in these districts was evaluated according to the following indicators: a) the ratio of the amount of green area to the neighborhood area, b) the green area per capita, c) the average size of the green area and d) the ratio of the coverage of walking distance to the green space to the neighborhood. Scatter Plot Diagrams and GIS Buffer Analysis were used as analysis methods for the article. The findings reveal that there is a link between the SES index of the neighborhoods and the level of access to existing urban green spaces.

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1. Introduction

Urban green spaces are critical because they have a significant impact on the quality of life of urban residents in terms of social, environmental, and health factors. However, the size, adequacy, and efficiency of the use of green spaces are as critical as the existence of urban green spaces. In this way, the accessibility and geographical extent of urban green spaces are a common concern shared by multiple disciplines such as urban planning, landscape architecture, sociology, psychology, and health sciences. Common places such as open and green spaces, particularly during the pandemic period, have become increasingly essential in comparison to the pre-pandemic period since the worldwide pandemic periods restrictions (for example, coronavirus lockdown, time restrictions, and capacity reductions in public spaces) and the risk of virus transmission have made citizens' needs for urban open and green spaces more apparent. During the COVID-19 pandemic, people are focused on recovering urban green spaces in their surroundings. As a result, urban green areas in surrounding residential neighborhoods emerged as a topic that has to be reconsidered and reviewed.

In a study on the access of groups from different socio-economic levels to urban green spaces, it is easier for population groups with high SES to live in low-density residential areas in the city, while access to urban green spaces is limited for low socio-economic groups. For this reason, it has been observed that the green areas are more in the settlements where the income is high, and therefore the access to the green areas is higher (Wang,

[1] This study was presented as a paper at the 7th Urban Studies Congress

2019). Numerous quantitative and qualitative measures have been developed to assess the impact of parks and other green spaces on the quality of life of urban residents. It has been argued that the ratio of open space to city residents is a crucial factor in determining the success of cities across the globe (Ökde, 2022).

According to the provisions of the Spatial Plans Preparation Regulation published in the Official Gazette of the Republic of Turkey, the green area per capita in urban areas must be at least 10 m2 (Official Gazette dated 14.06.2014 and No: 29030) (MPYY, 2014). Given the fact that cities in Turkey do not even meet the 10 m2 per capita criterion, analyzing the socio-economic structure and the adequacy of access to green areas has become a greater priority. Furthermore, it is argued that these cities, which lack adequate green space, are unsatisfactory for the post-pandemic construction of healthy urban environments (Özdede et al., 2021).

Although some research has been conducted on the effectiveness of green spaces and how they are perceived by people from different socio-economic backgrounds (De la Barrera et al., 2016; Roe & Thompson, 2016; Sathyakumar, et al., 2019), studies examining the distribution of green space size in neighborhoods of varying SES, as well as studies investigating the relationship between access to green spaces and socio-economic status, are limited. A spatial planning policy, to increase urbanization and population concentration, also increases the likelihood that more people will live in a housing environment with less green space. In particular, lower socio-economic groups will have to live in housing areas with insufficient green space or with more limited green space than those in the peripheries of cities. In this case, it can lead to environmental injustice in the distribution of accessible public green spaces (Maas et al., 2006).

The purpose of this paper is to examine the relationship between SES and access to urban green spaces in two districts of İstanbul. Since İstanbul is the most populated city in Turkey, it hosts a large number of people with diverse socio-economic and cultural characteristics in a relatively small geographical area, and moreover, in areas that are very close to each other. To put it simply, groups with different socio-economic and cultural characteristics live at very close distances from each other. Such differentiation in socio-economic characteristics is also seen in the built environment and spatial characteristics of the city. For this reason, the city of İstanbul was chosen as the study area in terms of serving the purpose of the study. Bakırköy and Bağcılar were chosen as the sample areas in İstanbul because they are adjacent to each other (proximity), have completely different built environment characteristics (the former is a formally developed housing area and the latter is an informally developed housing area), and contain a mixture of socio-economic groups together.

2. Literature Review

Research demonstrates that urban green spaces, such as parks, woods, botanical gardens, and community gardens, provide important ecological services while also enhancing the physical activity, psychological health, and public health of their inhabitants (Wolch et al., 2014; Stigsdotter et al., 2010; Kothencz et al., 2017). Green spaces have positive effects in terms of supporting biodiversity as part of the natural ecosystem, creating habitat for flora and fauna, providing many other ecosystem services such as microclimate, air pollution, noise, urban heat island, and water drainage (MEA, 2005).

In addition to the environmental benefits of urban green spaces, they also contribute to health benefits. The findings in the report published by the World Health Organization (WHO, 2016) show that urban green space has health benefits, especially for economically deprived communities, children, pregnant women, and the elderly. For this reason, special priority should be given to the provision of adequate-sized and accessible urban green spaces in the residential areas where disadvantaged communities live. With the recent global pandemic, common areas in the immediate surrounding district of residence gained prominence, and the value of these locations in terms of supporting life began to emerge. During the pandemic process, the importance of the presence of green spaces in the neighborhoods was felt more strongly because it offered physical activity to individuals. It has been observed that spatial inequalities, in which socio-economic differences are also effective as a descriptive factor, negatively affect individuals' physical and mental health. As a result, this problem has arisen as a problematic one that necessitates collaboration across several disciplines on the subject of public health and space (Erdoğanaras et al., 2020).

In the global pandemic process, dense housing areas have suffered from not having enough open spaces, which negatively affects public health during the pandemic period since individuals would not be able to do physical activity within walking distance (Pehlivan, 2021). Especially in densely populated areas, the lack of adequate improvements in green space accessibility at the neighborhood level leads to a mismatch between green space allocation and population distribution (Shi et al., 2020). Considering that urban green spaces also help to reduce social problems in the city and makes living there more pleasant for its inhabitants (Ulrich et al., 1993; Cihangir-Çamur et al., 2021), providing balanced spatial distribution of urban park should be at the top of the agendas of local governments.

The spatial distribution of urban green spaces and thus their effects are not uniform and are intertwined with socio-economic conditions (Sathyakumar et al., 2019). In studies examining the health effects of green spaces (Stigsdotter et al., 2010; Kothencz et al., 2017), the psychological and physiological health status of individuals improves where access to urban green spaces is greater. It has been discovered that the negative effects of psychological and physiological factors are more severe for those living in urban areas where access to green areas is limited. According to a 2016 report by the World Health Organization (WHO), urban green spaces have numerous benefits for public health, including psychological relaxation, stress reduction, increased physical activity and less exposure to air pollution.

Urban green spaces in cities of developing countries remain more vulnerable to rapid transitions of land use patterns caused by population growth and economic development (Li & Liu, 2016; Jim 2013; Zhou et al., 2018; Zérah, 2007). Megacities in developing countries often have a complex socio-cultural structure. In these cities, access to urban facilities varies according to different social groups (Qureshi et al., 2007).

Urban green infrastructure, a concept that has been frequently encountered in the literature recently, is considered a key element in improving the quality of life and creating an appropriate framework for sustainable cities. The most widely used quantitative indicator to evaluate urban green infrastructure is urban green space per capita (Badiu et al., 2016). In addition to this, studies conducted on urban green space inequalities mostly discuss parameters such as green space per capita, percentage of green space and proximity to urban green space (Yenice, 2012; Olgun & Yılmaz, 2019; Gascon et al., 2016). However, it has been stressed in recent research that the quality and accessibility of green spaces are closely related to criteria such as the size diversity and spatial clustering of the green space (Jim, 2013; Zhou et al., 2018). In fact, the importance of healthy air, a quiet neighborhood, an attractive street view and green spaces within walking distance are emphasized in increasing urban livability (Herzele et al., 2003). Therefore, it is necessary to examine the quality and efficiency of urban green spaces in a multi-dimensional way.

3. Method

A quantitative research approach was employed in this study to reveal the relationship between socioeconomic level and accessibility of urban green spaces in İstanbul, as well as to associate the distribution of open green spaces in the urban space with SES level data. In İstanbul, two adjacent districts, Bakırköy and Bağcılar, were chosen because they present striking differences in terms of their built environment and are home to diverse socioeconomic groups. Bağcılar is characterized by its unplanned and informally developed residential areas, while Bakırköy is comprised of planned developed residential areas and hosts households with a relatively higher socio-economic profile.

In this study, neighborhood-level data were collected and then evaluated at the district level. This evaluation was based on two factors: (1) the SES of each district's neighborhood and (2) the existing urban green spaces in each district's neighborhood. SES scores were obtained from the 2016 "Mahallem İstanbul" project developed by İstanbul University, and urban green area data for the study area was obtained from the İstanbul Greater Municipality City Planning Department (2006). Using census data obtained from TUIK in 2022 and neighborhood area sizes calculated using geographic information systems (GIS), population and population density calculations were performed.

Four different metrics related to green space accessibility in each area were looked at: population density (1), SES index (2), green area per capita (3), green space accessibility within 500 meters buffer (4), and green space accessibility as a percentage of total green space in the district (5).

(1) For the population density analysis, the area of the neighborhoods in both districts and the neighborhood-level population data were utilized (TUIK, 2021). According to the population density, four classes were

determined as a result of the calculations. In the analysis, these classes are represented by colors. The neighborhoods with the highest population density are shown in the darkest color, and the neighborhoods with the lowest population density are shown in a light color.

(2) SES data is obtained from "Mahallem İstanbul SES Scores in 2016." According to the "Mahallem İstanbul SES Scores" data, four SES levels (A, B, C, and D) were identified. The scores for each SES level are as follows: A SES level is 75–100, B SES level 50–75, C SES level 25–50, and finally D SES level 0–25. Each neighborhood is colored according to its SES level. Neighborhoods with the highest SES levels are shown in dark blue, and those with low SES are shown in light blue.

(3) Using green space and population data, the amount of green space per capita in neighborhoods and districts was calculated (Table 1). Accordingly, four classes were established based on the amount of green space per capita. The neighborhoods with the greenest space per capita are depicted in the darkest green color, while the neighborhoods with the least amount of green space are depicted in the lightest green color.

(4) In the analysis of "the ratio of accessible green areas within 500 meters of walking distance" and "the total accessible green areas in the district," 500 meters of buffers were calculated from the border of the existing parks to their surroundings. Then, the ratio of urban green areas to the total green areas in the district area was calculated at 500-meter access distances (Figure 5).

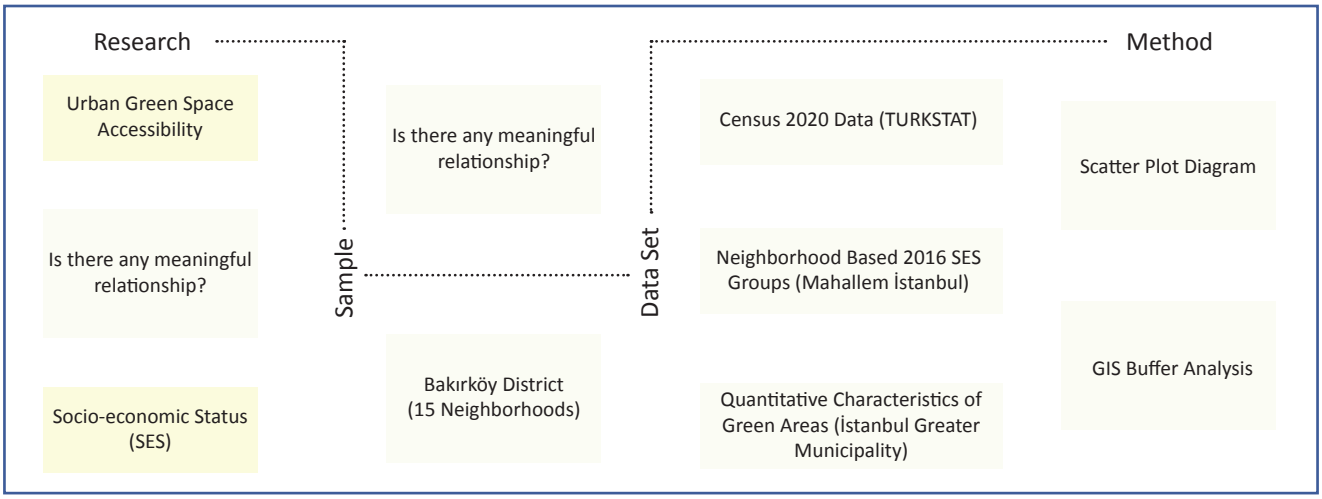

Figure 1. Methodological framework adopted for the study (Source:Authors)

3.1. SES (Socio-Economic Status) Index Indicator

In the study, data from the SES index, which were developed within the framework of İstanbul University's "Neighborhood İstanbul Project," which contains "2016 My Neighborhood İstanbul SES Scores," were gathered from the İstanbul Greater Municipality open data portal (data.ibb.gov.tr).

There is a multi-criterion scoring system in the SES index. Using official statistics from various institutions and organizations in the SES index, a SES score was calculated for each neighborhood. According to this index, two basic criteria were used to understand the socio-economic levels of individuals. These are education level and occupation variables. The Components of the SES Index are formulated as follows (Mahallem İstanbul Projesi, 2016):

SG= E + P
SG: SES Group (includes SES Score)
E: Education Variable
P: Profession Variable

By the SES index, eight groups were identified as A+, A, B+, B, C+, C, D, and E. According to the multi-criteria evaluation (Mahallem İstanbul Project, 2016), the neighborhoods with the highest SES index are at the A+ and A levels, while the neighborhoods with the lowest SES index are at the D and E levels.

3.2. Case Area

This study specifically chose two districts on the European side of İstanbul (Figure 2). Bakırköy District is located to the north of the D-100 (former E-5) highway and is bordered by the Bahçelievler District to the north and the Marmara Sea to the south. It neighbors Zeytinburnu District in the east and Küçükçekmece District in the west and northwest. Bakırköy has an area of 29 km² and consists of 15 neighborhoods. Atatürk Airport is also located within the boundaries of the district (Bakırköy Municipality, 2022). Bağcılar District lies between the E-80 (TEM) highway (highway) in the north and the D-100 (former E-5) highway in the south. It is bounded on the west by Küçükçekmece, on the north and northeast by Esenler, on the southeast by Güngören, and on the south by Bahçelievler. has an area of 22 km² and consists of 22 neighborhoods (Bağcılar Municipality, 2022).

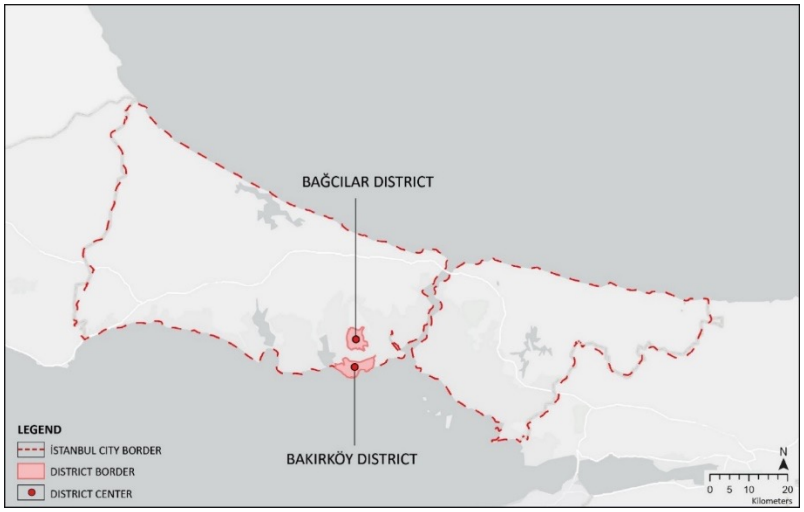

Figure 2. Location of the study areas in İstanbul

4. Research Findings

It has been observed that there are notably different population densities of Bağcılar and Bakırköy Districts, both at the district scale and at the neighborhood scale. In general, the population density of Bağcılar District is higher than Bakırköy District. Also, when the SES index is looked at on a neighborhood level, the socio-economic status of the two districts is very different (Figure 3). This preliminary comparison between the population density and SES groups of the study areas shows that there are considerable demographic and socio-economic status differences between the districts.

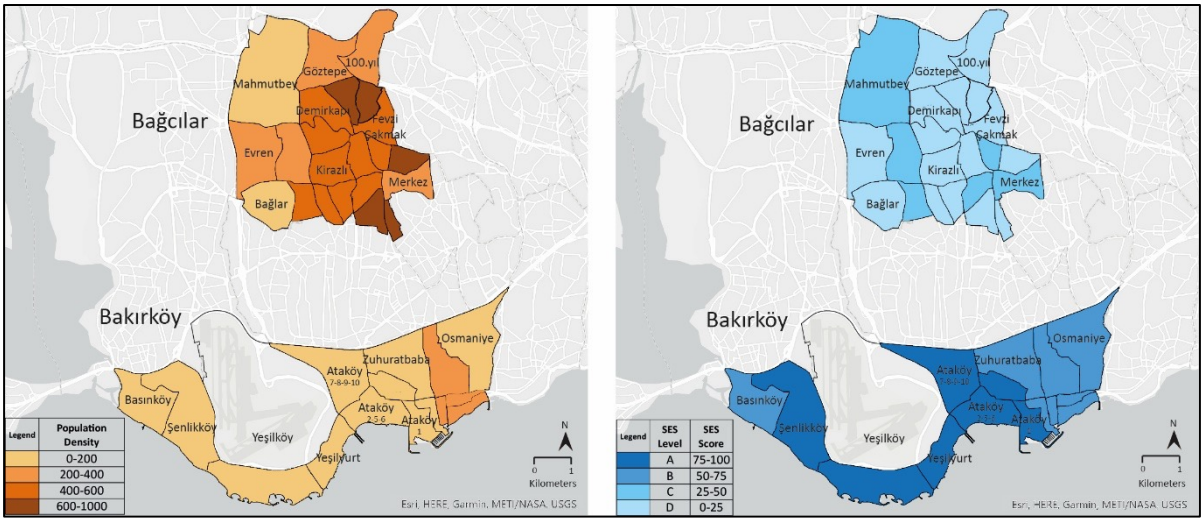

Figure 3. Population density (TURKSTAT, 2021) and SES Index Analysis (My Neighborhood İstanbul, 2016)
(Source: It was produced by the authors using ArcGIS Pro in line with the datasets.)

Urban green areas belonging to the neighborhoods of the districts included in the study are given in figure 4. Although the amount of green space per capita is estimated as 10 m² per capita in Turkey (MPYY, 2014), it has been observed that none of the neighborhoods in Bağcılar District meet this standard and even fall below this standard. In addition, after examining the existing green areas of the neighborhoods and the area qualifications per capita, it was calculated how much more green space is needed to reach the expected amount of green space (Table-1).

District	Neighborhoods	Population	Green space (m²)	Current amount of green space per capita (m²)	Deficiency of green space per capita (m²)	Green area ratio required to reach 10 m² (ratio of the existing green area)
Bağcılar	Bağlar	16635	6592	0.40	9.60	25.24
	Mahmutbey	24826	10056	0.41	9.59	24.69
	100. Yıl	47646	29837	0.63	9.37	15.97
	Evren /15 Temmuz	50518	13812	0.27	9.73	36.58
	Göztepe	39829	7223	0.18	9.82	55.14
	Güneşli	47326	24962	0.53	9.47	18.96
	Merkez	26643	5472	0.21	9.79	48.69
	Barbaros	21167	3204	0.15	9.85	66.06
	Demirkapı	54582	9012	0.17	9.83	60.57
	Fevzi Çakmak	33709	17184	0.51	9.49	19.62
	Hürriyet	26113	5981	0.23	9.77	43.66
	İnönü	23659	5429	0.23	9.77	43.58
	Kazım Karabekir	27966	4146	0.15	9.85	67.45
	Kirazlı	41934	12387	0.30	9.70	33.85
	Sancaktepe	19514	4866	0.25	9.75	40.10
	Yavuz Selim	28258	6451	0.23	9.77	43.80
	Yenimahalle	35143	17152	0.49	9.51	20.49
	Çınar	35043	5277	0.15	9.85	66.41
	Fatih	43119	3482	0.08	9.92	123.83
	Kemalpaşa	33658	1164	0.03	9.97	289.16
	Yenigün	21981	3845	0.17	9.83	57.17
	Yıldıztepe	37937	604	0.02	9.98	628.10
TOTAL		737206	198138	0.27	9.73	37.21
Bakırköy	Ataköy 1. Kısım	1693	17593	10.39	0	0.00
	Ataköy 2-5-6. Kısım	14255	28483	2.00	8.00	5.00
	Ataköy 3-4-11. Kısım	8312	24938	3.00	7.00	3.33
	Ataköy 7-8-9-10. Kısım	26406	95109	3.60	6.40	2.78
	Basınköy	5850	713172	121.91	0	0.00
	Osmaniye	23783	181714	7.64	2.36	1.31
	Şenlikköy	28517	36134	1.27	8.73	7.89
	Yeşilköy	24814	411299	16.58	0	0.00
	Yeşilyurt	8562	13903	1.62	8.38	6.16
	Zeytinlik	5189	6225	1.20	8.80	8.34
	Zuhurbaba	21518	9271	0.43	9.57	23.21
	Cevizlik	5177	3290	0.64	9.36	15.74
	Kartaltepe	37275	29115	0.78	9.22	12.80
	Sakızağacı	8260	103397	12.52	0	0.80
	Yenimahalle	6618	783	0.12	9.88	84.52
Total		226229	1674426	7.40	2.60	1.35

Table 1. Green space analysis table by neighborhoods

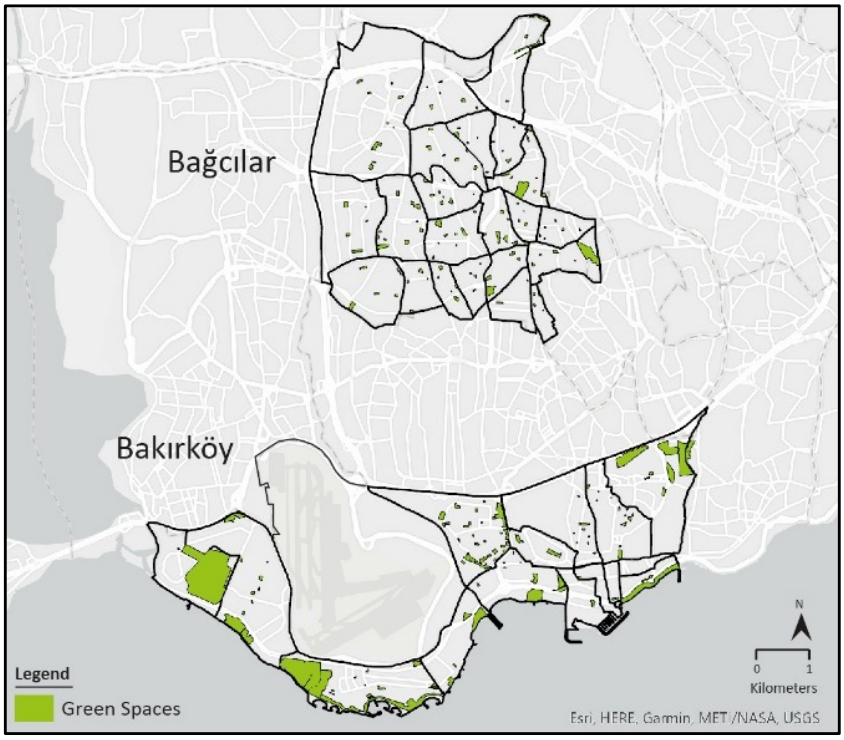

Figure 4. Urban green spaces
(Source: IMM, City Planning Department, 2006)

When the accessibility of urban green spaces at a distance of 500 meters is examined, although the percentage of green space accessibility in both districts seems high, 94.1% of all neighborhoods have access to urban green spaces in Bakırköy, this rate is 88.6% in Bağcılar. Namely, there is a difference of 5.5%, and the qualities of accessible urban green spaces (area size, population in the catchment) are not the same (Figure 5).

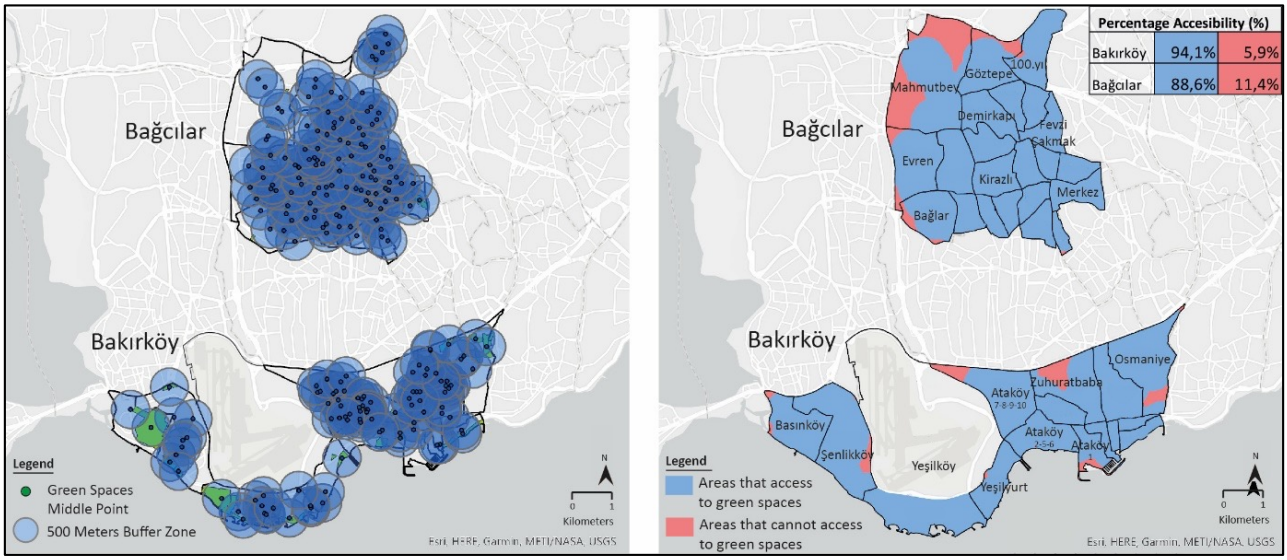

Figure 5. 500 meters buffer zone analysis and accessibility rates
(Source: It was produced by the authors using ArcGIS Pro in line with the datasets.)

Therefore, when analyzing the accessibility and efficiency of green spaces, it is not sufficient to examine the accessibility status of a district according to its surface area. For this purpose, green space per capita and the arithmetic average of green space were also evaluated. Each of the round dots in the figures below represents neighborhoods within the district boundary. The fact that green space data per capita of neighborhoods and the percentage of existing green spaces in neighborhoods within the neighborhood boundary area are evaluated together gives us main information about areas (1), per capita standards (2), and most importantly, the distribution of green space characteristics throughout the city (3). (Figure 6) (Source:Authors).

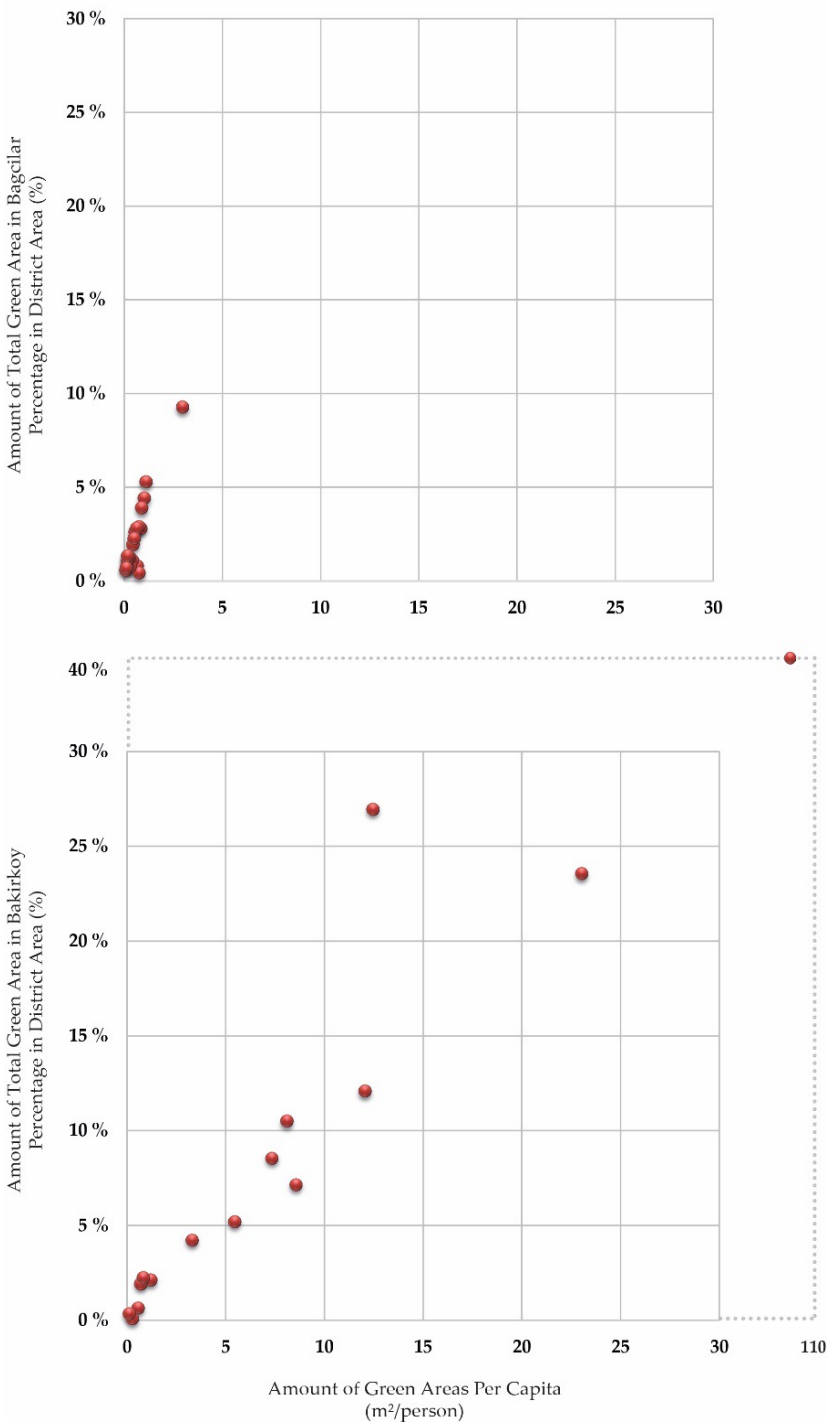

Figure 6. Green space per capita based neighborhood - Proportion of total green spaces (Source:Authors)

When the figures are examined, it is seen that the neighborhoods in Bağcılar District fit only within 1x2 borders within the 6x6 grid system, while the neighborhoods in Bakırköy District have a more hierarchical structure and overflow the 6x6 grid system. This overflow indicates that there is a neighborhood in Bakırköy that is considerably higher than the green space standards. The amount of open green space per capita and the accessibility of these green spaces are higher in the neighborhoods of Bakırköy District with a high SES index. On the contrary, it has been observed that the size of green spaces is low in neighborhoods of Bağcılar District, which have a low SES index, and therefore the amount of green space per capita is also lower.

As a second evaluation method, the arithmetic average of green spaces in neighborhoods was considered (Figure 7).

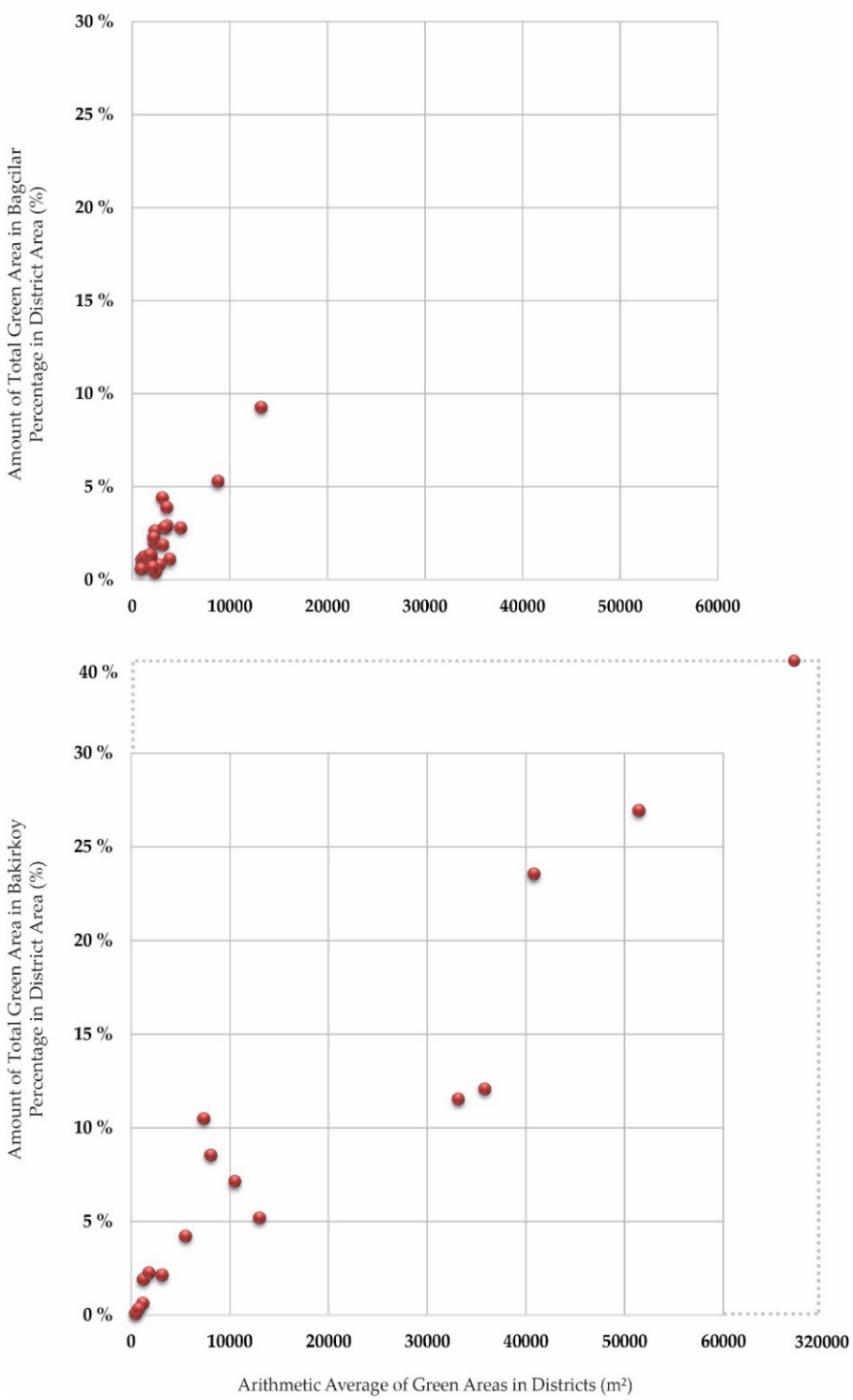

Figure 7. Arithmetic Average of Neighborhood Based Green Spaces - Proportion of Total Green Spaces (Source:Authors)

When the figures are examined, we see that the number of accessible green spaces in Bağcılar District is very low and consists of green spaces of similar size and that there is no diversity or hierarchy. On the other hand, in the Bakırköy District, green spaces of different sizes, which are not uniform, are scattered throughout the space by forming a hierarchy, and therefore accessibility is higher. However, since Bağcılar is a district with a lower socio-economic development level compared to Bakırköy, there is no problem with access, but there is a problem with the quality of the accessible green space.

Finally, the SES levels of the two districts, which are in close geographical locations but have different SES indices, are compared with different variables, such as the size of the green areas, the amount of green per capita, and the green areas accessible within a 500-meter walking distance. It has been observed that there is a connection between the amount of open green areas, their spatial distribution, and their accessibility.

5. Evaluation and Conclusion

Urban green spaces are an essential issue for healthy and livable cities. In particular, the efficiency of urban green spaces should be considered both qualitatively and quantitatively. With the COVID-19 pandemic process lately experienced on a worldwide scale, the amount and quality of urban green spaces have become increasingly essential. Green spaces in cities have become increasingly important as a part of the 'healthy life and space' interaction. Despite the risk of viral transmission, people are increasingly attracted to urban parks and other outdoor gathering places. This trend has led to an increase in the demand for urban parks and other green areas that are easily accessible by walking.

The fact that green areas are not distributed fairly in cities is an important problem. While all individuals want to reach urban green spaces within walking distance to meet their physiological and psychological needs, this may not be the case for many urban residents. In addition to the 10 m2 standard in spatial plans, the parks should be distributed in a balanced and proportional manner in the city. Accessibility analysis based on walking distance alone is not sufficient. In addition to the accessibility distance in spatial plans, the size of the green area and the size of the population it serves should also be taken into account.

As for the relationship between the accessibility of existing urban green spaces and SES, it is discovered that there is a connection between the SES levels of the neighborhoods, and thus the districts, and the amount of open green spaces and their accessibility to urban parks. People in Bakırköy, which has a high SES index, are in better condition than those in Bağcılar, which has a lower SES index. Indeed, all the analyses carried out within the scope of the study highlight the importance of studies such as SES and accessibility, and thus strategic planning, in ensuring the spatial and social sustainability of cities. Furthermore, creating healthy living circumstances in cities is an important aspect of determining the quality of urban life.

Finally, the findings of this study are expected to make an impact on fields such as urban planning and design, and public administration in terms of creating more livable urban space and following implications from perspectives of accessibility and fairness to all.

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