Year | Yıl 2019
Volume | Cilt 01
Number | Sayı 01
Pages | Sayfa 54-70

SKETCH

ARTICLE | MAKALE

Journal of City and Regional Planning

EVALUATING URBAN GREEN SPACE ACCESSIBILITY: COMPARING BEŞİKTAŞ AND ŞİŞLİ DISTRICTS

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Abstract

Acknowledgements:

This study was produced from the homework prepared in the master course called GIS in Urban Planning (supervised by Prof. Dr. Fatih TERZİ) in Urban Planning Master Program at Istanbul Technical University. We would like to thank Prof. Dr. Fatih TERZİ for his contributions. Besides, we would like to thank Ahmet Halil AVCI for helping to improve the language of our article.

Urban green areas are the physical features that provide important contributions to the city. The amount of green spaces and accessibility to green spaces are crucial for obtaining benefits from green spaces. The aim of this paper is to evaluate and compare the green space accessibility in two adjacent districts of İstanbul Beşiktaş and Şişli, both of which are located in the central business district (CBD) with different density characteristics. The paper starts with understanding the importance of green spaces and the standards that are used to determine the accessibility and sufficiency of green spaces. After that, sufficiency of green spaces according to Turkish legal standards was explored through calculating the area of green spaces per person at the neighborhood level in these two districts. Then, the accessibility of green space in Beşiktaş and Şişli was analyzed through mapping the service area of green spaces based on the walking distances that determined by the worldwide standards with network analysis. Geographical information system (GIS) is used to apply a network analysis of green space accessibility. Finally, these two districts were compared and evaluated with each other in terms of the accessibility results and the green space sufficiency.

Submitted | Gönderim: 29.06.2019
Accepted | Kabul: 25.09.2019

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doi: 10.5505/sjcrp.2019.98608

Keywords: Green Space, Accessibility, Network Analysis, Geographical Information System, İstanbul

INTRODUCTION

In this paper, the main objective is to measure and compare the green space accessibility in two different districts in İstanbul in order to evaluate the accessibility of people to the green space. In addition, the paper investigates the density effect on green space accessibility by choosing two districts with different population density in central area of Istanbul. The green space attributes to its broad meaning, however, in the case studies, it indicates the park and recreation areas while the graveyards, the woodlands, the forest areas, etc. are not included. In order to evaluate the green space accessibility of the districts, the distribution of population, the population density, the transportation and the land use pattern were taken into consideration as parameters that can have effect on it.

This paper addresses three main research questions in relation to the objective as identified below:

- How accessible are public parks and green spaces for people living in the chosen districts' neighborhoods borders?
- Which communities need increased access to public green spaces?
- Is density a factor affecting the accessibility of green space in districts?

In this paper, Şişli and Beşiktaş districts in the central area of Istanbul were chosen to compare the green space accessibility in . By investigating the literature about the international and Turkish standards of green space accessibility, sufficiency of and accessibility to green spaces were calculated with two-step analysis. In the first step, the sufficiency of green space based on the standards was explored through calculating green spaces area per person at the district level. Then, in the second step, green space accessibility in Beşiktaş and Şişli districts were analyzed through mapping service area of green spaces based on walking distances with network analysis.

LITERATURE REVIEW

Importance of Green Space

One of the many benefits of green spaces is the ability to increase urban ecological environment (Liu et al. 2008). Besides that, it can encourage the sustainable development by its specific ecologic, social, economic and natural functions (Liu et al. 2008). Green spaces reduce the negative effects of urbanization (De Ridder et al. 2004) and provide serious benefits to urban environment by reducing the heat island effect, filtering the air, reducing the noise, and evacuating the rainwater (Bolund and Hunhammar 1999; Liu, Li, and Li 2017). They have also significant contributions to urban social environment by increasing the quality of city life by preventing pollution, reducing the physical effects of urban heat, and preserving biodiversity (Kuta et al. 2014). Green spaces are places not just for recreation, entertainment and sport activities but also serve as a social participation and collaboration environment for its citizens (Abubakar and Aina 2006). In addition, green spaces contribute to economy as they increase willingness of the real estate market; therefore, the value of the nearby properties increases (Nature England 2010). Moreover, green spaces have a positive impact on the human health by increasing the air quality and decreasing the high heat concrete spaces temperature (So 2016). Besides, they improve human health by providing open area for increasing the amount of physical activity (Coutts, Horner, and Chapin 2010; Gerçek and Güven 2017). Consequently, as a result of positive impact of green spaces on physical and

mental health, they increase the quality of human life, and decrease the amount of mortality and morbidity (Bolund and Hunhammar 1999; Abubakar and Aina 2006; Maas et al. 2009; Coutts, Horner, and Chapin 2010; Gerçek and Güven 2017).

To conclude, in terms of urban planning, green spaces and parks provide ecological contributions to cities. They can protect urban populations' health and needs in both residential areas and business areas. In residential areas, it is important to have accessible and approachable green space to enhance the quality of life (Gupta et al. 2016). On the other hand, in the Central Business District (CBD), where daytime population is intense in a city, the presence of green space has importance, especially to meet the need for open space for working people in their break time and business visits. A CBD is the region where economic functionality is at its highest level, and it has a lot of high-rise building stock (Wang and Zacharias 2015). Therefore, green infrastructure plays a significant role in providing climate comfort by creating spaces among high-rise buildings. Green space and parks that create these gaps affect air temperature and air quality, in this way they can create shade and cooling areas by providing moderate temperatures in the CBD (Wolch et al. 2014).

Access to Green Space

Looking at the people-oriented perspective, access refers to the mobility of individuals. Accordingly, accessibility is used when explaining how to reach a location. As stated by Geurs and Van Wee (2004), accessibility can be defined as allowing passengers to reach a region depending on land use and transportation. In this context, as well as the amount of green spaces, their accessibility is an important matter as it demonstrates the efficiency of the green spaces. The accessibility is defined by So (2016) as the walking distance between the access points of green spaces and the communities. Similarly, Nature England (2010) defines accessible green spaces as the places that have free entrance and have not any time limits aside from some parks that could be closed after night or could require parking fees for vehicles. These significant points target especially people who live within walking distance to the green spaces. In addition, they should be available for all people that could prove by conforming the Disability Discrimination Act requirements (Nature England 2010). As emphasized by Kuta et al. (2014), green spaces benefits would not be valued if people could not access them. The level of accessibility could increase the amount of integration and social cohesion as more people could benefit from this service; hence, it increases the economic efficiency of these places and also help green spaces to meet up its value (Liu et al. 2008; Kuta et al. 2014). Also it is claimed that accessibility to green spaces has significant contributions to human health and decreases the amount of mortality (Coutts, Horner, and Chapin 2010). From authors' points of view, accessibility is defined as having at least one existing green space or park within walking distance without meeting any barrier which blocks pedestrian passage for the people who live or work in a region.

Accessible Green Space Standards

In the literature, there are various definitions of standards for assessing the provision of accessible green spaces. Accessible Natural Greenspace Standards (ANGSt) are the most common standards defined by the United Kingdom. As stated by Nature England (2010, 8) ANGSt is explained as "places where human control and activities are not intensive so that a feeling of naturalness is allowed

to predominate". ANGSt has three principles; access improvement, naturalness and connectivity (Nature England 2010).

According to ANGSt standards (Table 1), there should be at least 2 ha accessible green space per 1,000 population which is divided into four categories (Nature England 2010):

- Nobody should live 300 m from the nearest green space at least 2 ha in size.
- There should be at least one accessible 20 ha site within 2 km from dwelling area.
- There should be one accessible 100 ha site within 5 km.
- There should be one accessible 500 ha site within 10 km.

Area of Green Space	Distance
Under 2 ha	300 meter
2 ha - 20 ha	2 km
20 ha - 100 ha	5 km
100 ha - 500 ha	10 km

Table 1. ANGSt Standards

Besides ANGSt standards, the World Health Organization (WHO) also determines some standards indicating that there should be 9 square meters (sqm) green space per person and the green spaces should be 15 minutes of walking distance from residential areas (Pafi et al. 2016). On the other hand, in the United States, although each city has their own standards, a quarter mile that corresponds to 400 meter is defined as the distance that people eager to walk to achieve a park or a recreation area (So 2016). In Table 2, the walking distances responses in time and mile are shown.

Time (Minutes)	Miles	Meters
5	0.25	400
10	0.5	800
15	0.75	1,200
20	1	1,600
25	1.25	2,000
30	1.5	2,400

Table 2. The correspondence of walking distance (Manchester City Council 2017)

However, the norms for the planning units given above do not have any determinants in the Turkish Planning System. Instead, The Regulation for Spatial Planning Production[1] defines the amount of green space standard per person, and these standards are applied in planning studies as a binder. By the effect of Construction Zoning Law 3194[2] and supporting regulations, 10 sqm per person is accepted as the minimum urban green space requirement in Turkey. However, in this paper, rather than making reference to planning studies, it is desired to make an evaluation in terms of spatial quality and the level of access.

(1) Mekânsal Planlar Yapım Yönetmeliği

(2) 3194 sayılı İmar Kanunu

According to the Construction Zoning Law 3194, the settlement with a population of more than 5,000 is considered as primary school settlement unit; the settlement with a population of more than 15,000 is determined as neighborhood level; and, the settlement with a population of more than 45,000 is named as city

unit level. In respect to this, Table 3 is taken as reference based on the use of a norm connected to the planning units along with the field size per person. When the quantities listed below are sum up, 10 sqm per person green space legislation value is obtained.

Units	Primary School Settlement Unit (for 5,000 people)	Neighborhood Level (for 15,000 people)	City Unit Level (for 45,000 people)
Amount	1.5 sqm per person	4 sqm per person (2 sqm park + 2 sqm sport area)	4,5 sqm per person (3.5 sqm park + 1 sqm stadium)

Table 3. Green space standards in Turkey (Yıldızcı cited in Aksoy 2001)

CASE STUDY

İstanbul is one of the major cities in Turkey with a Central Business District (CBD), six sub-centers and two local centers (İstanbul Kalkınma Ajansı 2014). The CBD, as well as being important commercial center of the city, is a region that symbolizes İstanbul in terms of urban character by representing the daytime population. As the population of the day is concentrated in this region, it is necessary to meet the need for green space during work breaks or on business visits. Hence, the green space distribution and accessibility become much more significant in the core point and lively areas like CBD's. In this sense, study area context is determined as the central area of Istanbul that contains CBD in it (Figure 1).

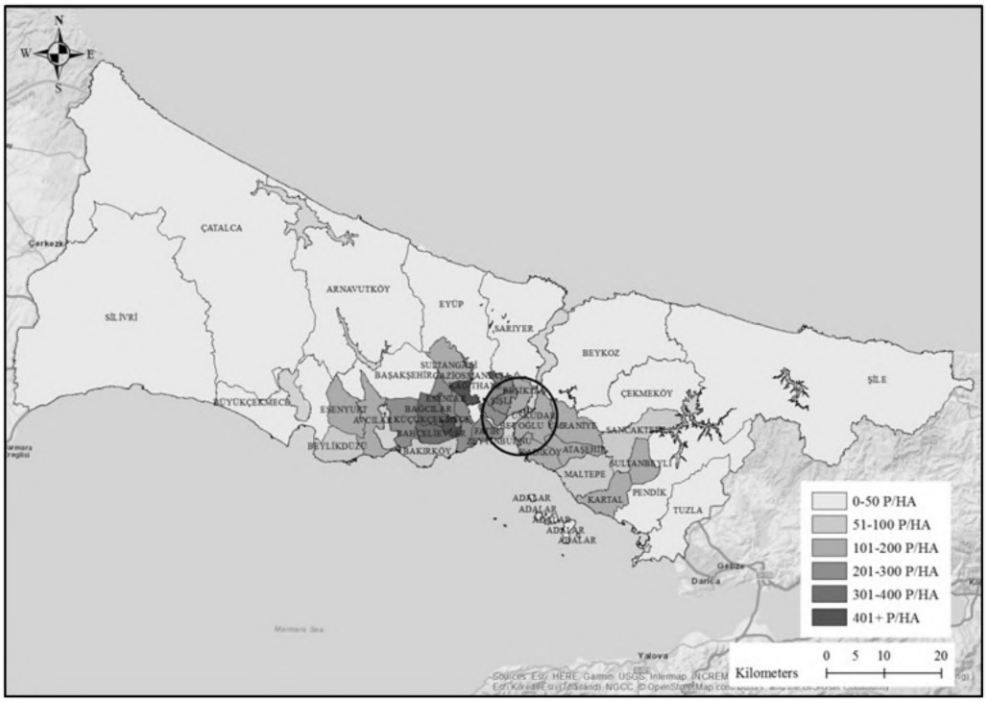

Figure 1. CBD in İstanbul

The CBD is comprised of four districts as Beyoğlu, Beşiktaş, Kağıthane and Şişli of which Beşiktaş and Şişli were selected to compare and evaluate the green space accessibility. The selection was made based on urban population density, being adjacent districts and having similar urban characteristics. Figure 2 demonstrates the variation of urban population density among these four districts.

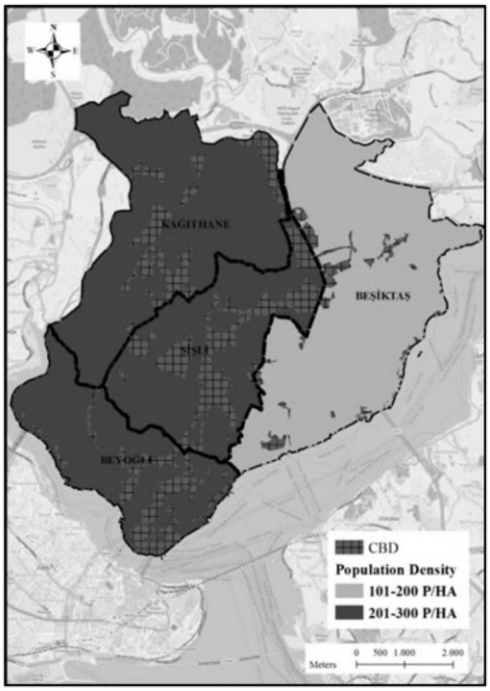

Figure 2. Population density of districts in CBD

Since the paper aims to understand the effect of the density on the green space accessibility, the districts with different population density in the CBD area were also tried to choose as the case districts. In the process of determination of the two districts, the population density of the four districts in the CBD was calculated. Table 4 summarizes the area of district, population and population density in the CBD districts.

Study Areas	Area of District (ha)	Population (2016)	Population Density (people/ha)
Beşiktaş	1,801	189,356	105
Beyoğlu	891	238,762	268
Kağıthane	1,487	439,685	296
Şişli	1,071	272,803	255

Table 4. Area, population and population density in CBD

The population density of Beyoğlu, Kağıthane and Şişli vary between 255 to 296 people/ha while Beşiktaş have a significantly low population density (105 people/ha) compared to the others. Therefore, to highlight the effect of population density, in addition to Beşiktaş, Şişli is selected due to its similar urban character with Beşiktaş. Beyoğlu and Kağıthane districts have intense slum settlements in the CBD and they can be considered as developing zone. On the other hand, Şişli has similar type of settlements with Beşiktaş. Consequently, by evaluating the population densities and taking into consideration the neighboring districts located in CBD with similar urban characteristics, Beşiktaş and Şişli districts were chosen as the study areas.

METHODOLOGY

Method of Assessment

The sufficiency of green space was evaluated in Beşiktaş and Şişli through calculating the green space distribution per person in case districts' neighborhoods. Following that, the results were compared with the Turkish

standards. Then, to calculate sufficiency of parks, the demographic information of two districts was obtained from census data. Although sufficient amount of green space is important , it is not a direct indication that this area is accessible to everyone in the community due to the inhomogeneous distribution of green spaces. For this reason, accessibility is examined by using Geographical Information System (GIS), as it is the most convenient system for representing the accessible zones graphically on a map (Handley et al. 2003).

To measure the accessibility, there are several methods; drawing buffers around the park boundaries, measuring distance to a site from access points, and network analysis which calculates the distance along the main access routes regarding the real speed and type of the roads (Handley et al. 2003; So 2016). In this paper, network analysis was chosen to calculate the green space accessibility, as it provides the most realistic results especially in a local level as also mentioned by Handley et al. (2003) and So (2016). So (2016) expresses that the usage of the actual road to public park or green space by inhabitants is much more possible and accurate than using a buffer circle to access the nearest green space. Figure 3 summarizes the flow of the methodology that is used in this paper.

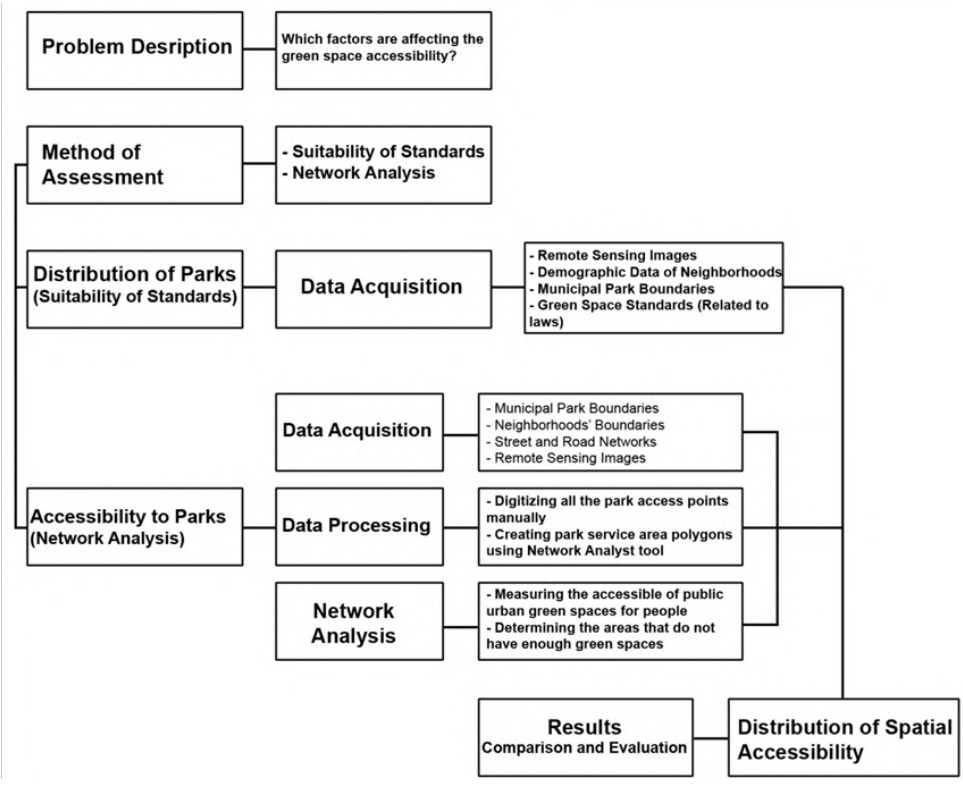

Figure 3. Flow of the methodology

Sufficiency of Green Space

The sufficiency of the green space of these two districts is evaluated by calculating the green space distribution of the neighborhood units per person. The sufficiency of the green space amount is identified through the Turkish standards as mentioned in the previous section (see Table 3). As stated in the Turkish standards, there should be 4 sqm green space per person in the neighborhood units; 2 sqm park and 2 sqm sport areas. Within the scope of this study, only parks were taken into consideration, as these areas are active and always accessible for dwellers.

GIS and Network Analysis

GIS allows carrying out analysis of spatial data available with its dynamic set of tools. For example, network analysis tool helps to answer a series of questions about linear networks such as roads, railways, facilities and utilities (Comber et al. 2008). Common applications of network analysis can be listed as route planning or finding, identifying the nearest facility depending on distance and time, and identifying the service areas (i.e. detecting parks within 500 meters) (ArcGIS Network Analyst 2019). In general, service areas method helps to indicate the degree of accessibility to green space in urban areas. It is based on the idea of reaching a location from another one within accurate walking distances, walking durations or travel times (ArcGIS Network Analyst 2019). After the creation of the service area in a region, it is possible to identify the population who use the service or determine the regions where the service is unavailable (Birkin et al. 1999).

There are a number of studies which analyze the green space in terms of the location, the distribution and the accessibility to parks by using GIS and network analysis. Ahn and friends (1991) study the accessibility between open spaces which consist of parks, green space, green belts and wetlands such as lakes, and settlements in Seoul. Jim and Chen (2003) use GIS to study the interconnection, the development and the enhancement of existing green space in Nanjing. Zhang and Wang (2006) suggest a GIS-based network analyses to study the accessibility of recommended green space enhancement in Xiamen Island. Comber and friends (2008) analyze and compare the accessibility of different ethnic and religious groups to green space in Leicester. They use network analysis with benchmark standards of UK. Gerçek and Güven (2017) map inadequate and low accessibility areas in terms of green space in İzmit city with using network analysis in geographical information systems. In brief, the method was used by a series scholars as a method to analyze accessibility of green spaces. In this paper, network analysis was chosen as the method to calculate the green space accessibility by considering that network analysis obtains the most realistic results through using real distances and places.

The network data which is mostly generated from linear features, i.e. roads, footpaths, was used to measure the distance between points and nodes in the network analyses (Comber et al. 2008). In this paper, the network data set was created by utilizing the data from Istanbul Metropolitan Municipality. The data set contains following information:

- Municipal park boundaries
- Neighborhoods boundaries
- Street and road networks
- Demographic data of neighborhoods
- Basemap Imagery

In the implementation of accessibility determination process, network analysis needs to digitize the parks access points. The access points of the parks were identified by using the ArcMap World Imagery Basemap. The access points are the intersections of the park roads and main road points. In this study, only the park and recreation areas were considered as green space, because these areas are the most accessible and active green spaces. Different from ANGSt, the cemeteries, the woodlands, the forest areas were not included to analysis due to having limited access and being inactive. After digitizing, 174 and 42 park access points were identified in Beşiktaş and Şişli districts, respectively (Figure 4).

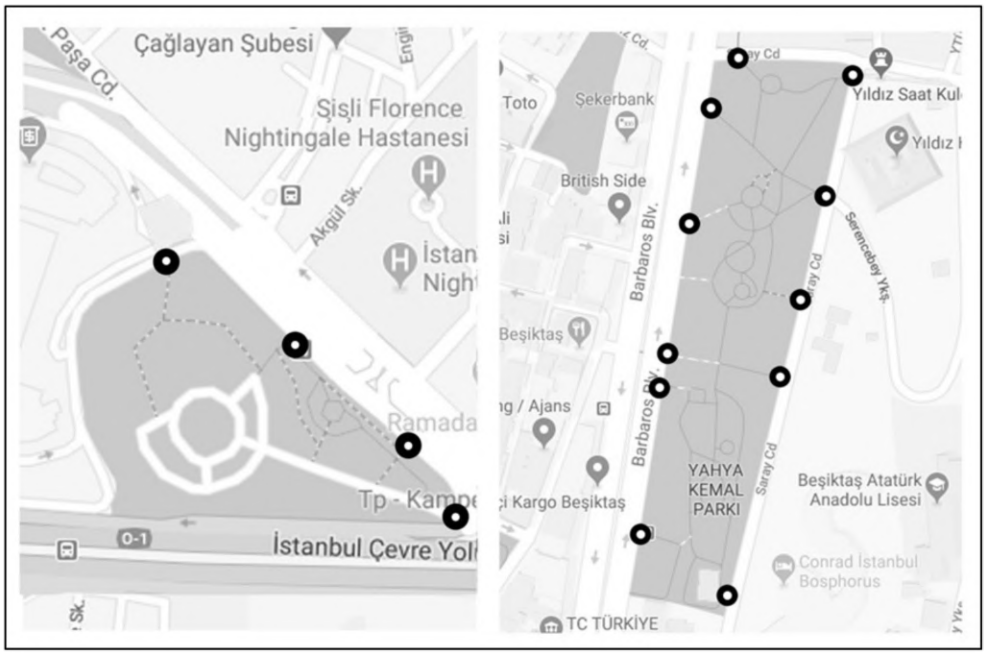

Figure 4. Sample of digitizing park access points (İBB Abide-i Hürriyet Park in Şişli on the left and Yahya Kemal Park in Beşiktaş on the right)

After digitizing the spatial data, the network analysis was conducted. The road data that includes all streets and pedestrian paths processed to create a network data set. After that, park service area polygons were created by loading the park access points to facilities category in Network Analyst Tool which were created by taking into consideration the world standards, especially ANGSt standards (see Table 1 and Table 2).

Regarding the standards for the park and recreation areas that is smaller than 2 ha, the first degree accessible green space boundary was identified as 400 meters. In this context, the first degree corresponds to 5 minutes walk from the park units to the settlements as also defined in ANGSt and US standards. For the parks smaller than 2 ha, 800 meters was identified as the second degree accessible green space boundary that people can reach in 10 minutes to the park units is seen suitable in the world standards defined by WHO (15 minute walking distance in total).

Regarding the standards for the park and recreation areas that is greater than 2 ha, as their impact scope is much more higher than the small-scale parks, the first degree accessible green space boundary is identified as 800 meters that means 10 minutes walking distance from the residential units. With respect to ANGSt standards, for the parks between 2 ha and 20 ha, walking distance is identified as 2,000 meters (2 km). Therefore, 2 km accessible distance is specified as the second degree accessible green space boundary for parks greater than 2 ha (Table 5).

Accessibility Degree	Parks less than 2 ha	Parks larger than 2 ha
First Degree Accessible	400 m (5 min. walking distance)	800 m (10 min. walking distance)
Second Degree Accessible	800 m (10 min. walking distance)	2 km (25 min. walking distance)

Table 5. Identified network analysis standards

FINDINGS AND DISCUSSION

According to sufficiency of green space analysis, the data of Beşiktaş and Şişli Districts were mapped in Figure 5. The sufficiency of green space in a neighborhood was determined as minimum 2 sqm per person. For this reason, in this study, neighborhood which has green space between 0 and 2 sqm per person was identified as insufficient; neighborhood which has green space between 2 and 5 sqm per person was determined as sufficient; and neighborhood which has green space higher than 5 sqm per person was identified as highly sufficient in terms of green space (Figure 5). Examining the green space distribution of these two districts per person in neighborhood scale reveals that the sufficient amount of green space occurred at nine neighborhoods in Beşiktaş, which are Akat, Bebek, Cihannuma, Dikilitaş, Kuruçeşme, Kültür, Levent, Vişnezade, Yıldız neighborhoods, as these are the neighborhoods that have green space per person higher than 2 sqm. On the other hand, only three neighborhoods have a sufficient amount of green space per person in Şişli, which are Merkez, Halil Rıfat Paşa and Harbiye neighborhoods. In Şişli, there are 18 out of 25 neighborhood units that have not got any green space area, which equals to almost 70% of the neighborhoods. However, in Beşiktaş, the green space per person is distributed more properly. The amount of districts with no green space is 6 out of 23 neighborhoods, which is much more less than Şişli. Moreover, having 8.28 sqm green space per person, the sufficiency of the total green space in Beşiktaş is significantly higher than Şişli, and this amount is also higher than the city unit standards, which is 3.5 sqm per person for parks. On the other hand, Şişli, having 0.75 sqm of green space per person, is resulted below the standards.

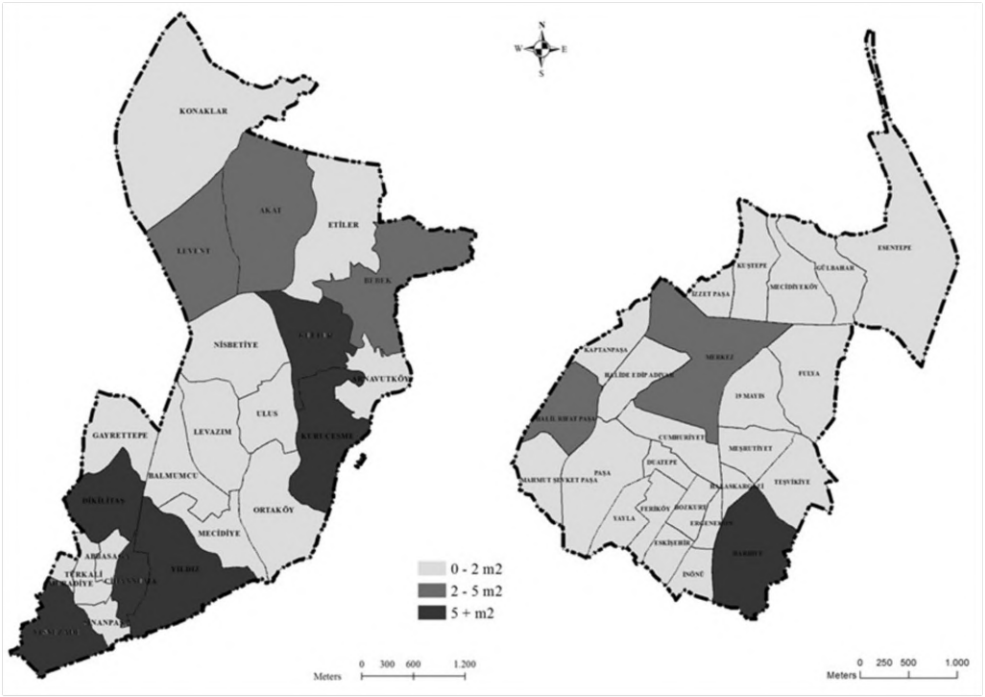

Figure 5. Green space distribution (per person) in Beşiktaş and Şişli

According to accessibility of green space analysis, the data of Beşiktaş and Şişli Districts were mapped through network analysis as demonstrated in Figure 6. Although Şişli has not a sufficient green space in its neighborhoods, according to accessibility analyses, 82.8% of its territories has an access to green space. On the other hand, although Beşiktaş has a much higher green space sufficiency than Şişli, there is no notable difference among the accessibility to green space in these two districts.

Table 6 tabulates the comparison of accessibility to parks in Beşiktaş and Şişli. In Beşiktaş, 55.8% of the area is accessible to green space in first degree (400 meter for parks less than 2 ha, 800 meter for parks larger than 2 ha); whereas in Şişli, 36% of the area is accessible to green space in first degree.

Districts	Accessibility to Parks (less than 2 ha)		Accessibility to Parks (larger than 2 ha)		Total Accessibility	
	400 m distance	800m distance	800 m distance	2,000 m distance	Accessible Places	No Access
Beşiktaş (1,800 ha)	21.9 % (394.9 ha)	47.7 % (859.6 ha)	33.9 % (610.5 ha)	78.5 % (1414.8 ha)	**84.2 % (1516.2 ha)**	**15.8 % (284.8 ha)**
Şişli (1,070 ha)	18.6 % (198.7 ha)	53.7 % (575.4 ha)	17.4 % (185.8 ha)	68.1 % (729.1 ha)	**82.8 % (887.6 ha)**	**17.2 % (183.4 ha)**

Table 6. Comparison of accessibility to parks between Beşiktaş and Şişli

In this paper, besides sufficiency, the accessibility of green space in Beşiktaş and Şişli examined because the amount of green space per person in neighborhoods is not the only parameter. Although a district has a sufficient green space, it does not mean that all people in the district can access to green space. For instance in Beşiktaş, although Bebek neighborhood has a sufficient amount of green space per person (2.5 sqm), accessibility to green space has not been provided in all of the neighborhood borders, and it is mostly accessible in 2 km. On the other hand, for example, the amount of green space per person in Gayrettepe neighborhood (0.31 sqm) is lower than Bebek; however, the network analysis indicates that it is more accessible than Bebek (see Figure 6). Therefore, it is possible to conclude that even though a neighborhood does not have sufficient green space in its border, it could access to green space if it is in influence area of a large-scale park in the adjacent neighborhoods.

In Beşiktaş, there are 6 neighborhoods (Balmumcu, Etiler, Levazım, Mecidiye, Muradiye and Ulus) that have no green space within their boundaries. However, they are mostly accessible to the green space at least in 2 km, since they are in the boundaries of green space in the adjacent neighborhoods, except most parts of Levazım neighborhood. On the other hand, in Şişli, there are 18 neighborhood units (Ondokuz Mayıs, Bozkurt, Cumhuriyet, Duatepe, Ergenekon, Eskişehir, Feriköy, Gülbahar, Halaskargazi, Halide Edip Adıvar, İnönü, İzzet Paşa, Kaptan Paşa, Kuştepe, Meşrutiyet, Paşa, Teşvikiye and Yayla) that have not any park and recreation area within their boundaries. However, all the neighborhood units has the accessibility to green space at least in 2 km, except the general parts of Paşa and Yayla neighborhoods (Figure 6).

In addition, in this paper, the effect of density on the amount and accessibility of green space was identified for district and neighborhood level. Beşiktaş is a less dense district then Şişli. As a result, the sufficiency of green space amount per person is much higher than Şişli. So, it could be said that in dense communities the amount of green space could generally be in low level and could affect the green space sufficiency of the districts. Also the effect of the density to accessibility is identified by evaluating the accessibility of high density neighborhoods in network analysis (Figure 6). In Şişli, neighborhoods with highest density generally reach the green space in 2,000 meters under the effect of the large-scale parks, except the north districts of Şişli. However in Beşiktaş, the densest districts can reach green space generally in 800 meter by the effects of the large-scale parks. So, it could be claimed that density especially in neighborhood level does not show the accessibility level in neighborhoods, but it affects the total amount of accessibility to green space of the districts.

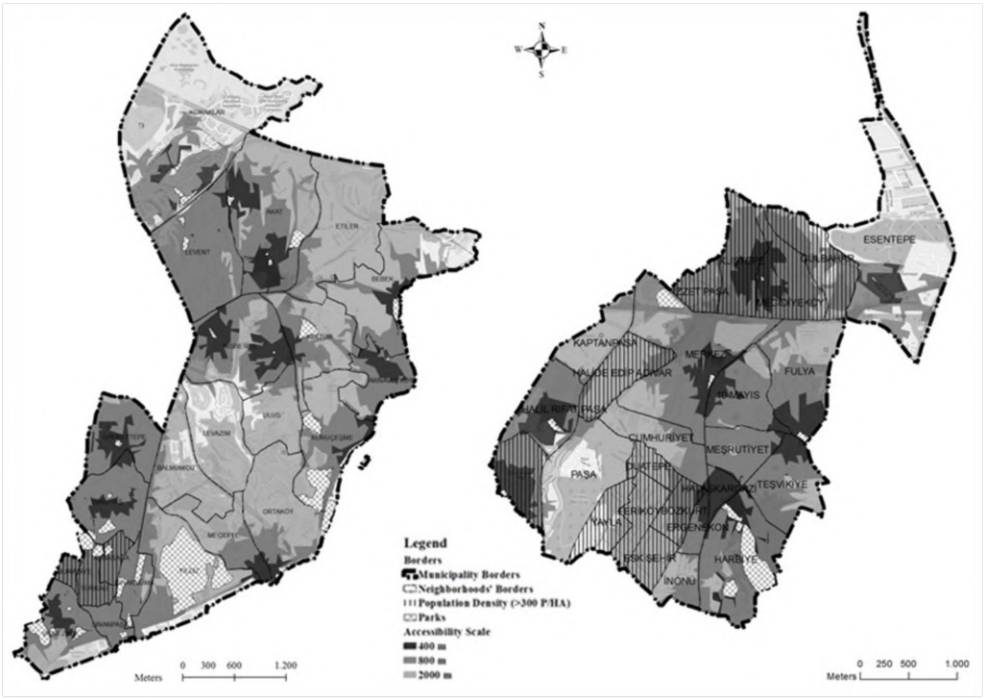

Figure 6. Green space accessibility by network analysis in Beşiktaş and Şişli

After obtaining information about sufficiency and accessibility of green space to make an evaluation, based on the merge of districts that have sufficient amount of green space per person and the accessible areas, an evolution chart generated to show the most sufficient and accessible areas in these two districts (Figure 7).

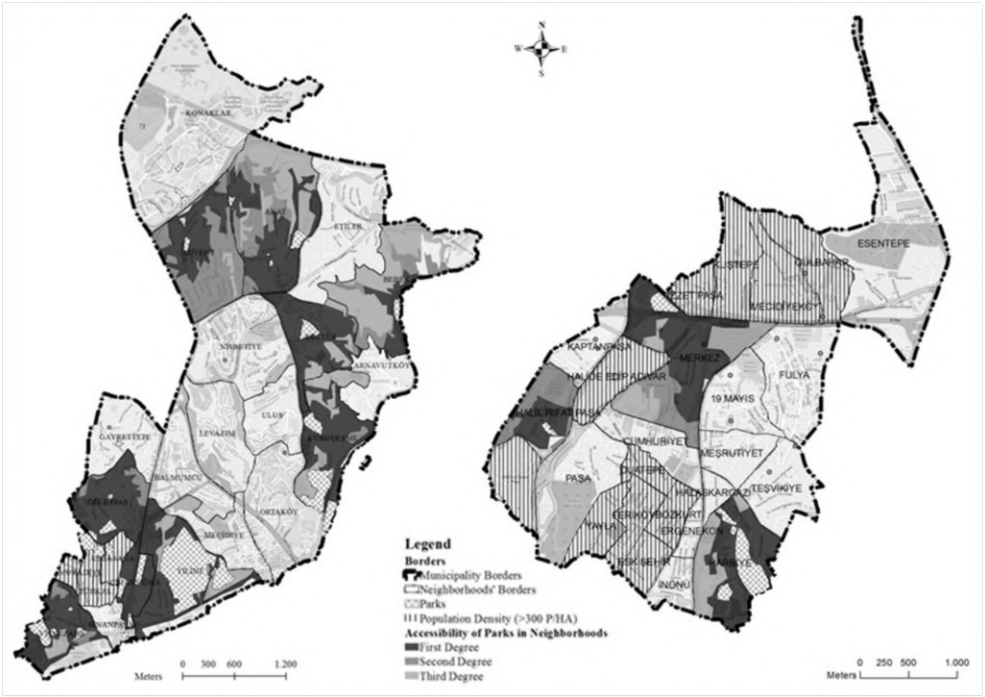

Figure 7. Evaluation of accessible areas in Beşiktaş and Şişli

Firstly, the sufficient neighborhoods in terms of green space were identified. In Beşiktaş there are 9 neighborhoods that have sufficient amount of green space. In Şişli, Halil Rıfat Paşa, Harbiye and Merkez districts are the districts that have sufficient amount of green space (higher than 2 sqm green space per person). After that the degrees of accessibilities in these sufficient neighborhoods

identified as seen in Table 6. In Şişli, the total amount of first degree accessible and sufficient areas are calculated as 13.2%, however in Beşiktaş it is calculated as 25% (Table 7).

Evaluation Criteria	First Degree Accessible	Second Degree Accessible	Third Degree Accessible
Neighborhoods have enough parks (According to Turkish Standards)	**400 m for parks < 2 ha, 800 m for parks > 2 ha**	**800 m for parks < 2 ha**	**2,000 m for parks > 2 ha**
Akat	44 % (66.5 ha)	21.4 % (32.3 ha)	34.6 % (52.2 ha)
Bebek	15.1 % (18.3 ha)	16.1 % (19.5 ha)	46.7 % (56.5 ha)
Cihannüma	100 % (28 ha)	-	-
Dikilitaş	89 % (56.9 ha)	11 % (6.9 ha)	-
Kuruçeşme	60.3 % (54.8 ha)	2.8 % (2.6 ha)	36.9 % (33.6 ha)
Kültür	83 % (59.8 ha)	2.1 % (1.5 ha)	11.9 % (8.60 ha)
Levent	40.4 % (42.8 ha)	56.2 % (59.6 ha)	2.6 % (2.8 ha)
Vişnezade	64.1 % (42.3 ha)	7.7 % (5.1 ha)	7.6 % (5 ha)
Yıldız	73 % (81.8 ha)	-	16.5 % (18.5 ha)
Total (in Beşiktaş District)	**%25 (451.2 ha)**	**%7.1 (127.5 ha)**	**%9.8 (177.2 ha)**
Halil Rıfat Paşa	43.02 % (18.50 ha)	50.3 % (21.63 ha)	-
Harbiye	74.03 % (57 ha)	-	25.97 % (20 ha)
Merkez	58.5 % (66.10 ha)	16.1 % (18.15 ha)	25.4 % (28.70 ha)
Total (in Şişli District)	**13.2 % (141.6 ha)**	**3.7 % (39.78 ha)**	**4.5 % (48.7 ha)**

Table 7. Evaluation of accessible neighborhoods

Afterwards, the reasons why these neighborhoods do not have accessibility to green space were questioned, and the barriers that affect the neighborhoods' accessibility to green space were analyzed. Although some neighborhoods have lower densities, some factors cause these neighborhoods to have less amount of green space and less accessible. Examining the neighborhoods both Beşiktaş and Şişli reveals the factors mostly act as barriers that prevent the neighborhoods' accessibility to green space:

- Private property areas (gated communities)
- Main roads
- Limited access areas (universities, commercial complexes, cemeteries etc.)

In these two districts' borders, main barriers that prevent to access parks are identified as cemeteries, museums, university areas, military space, private property areas like residence and office areas, limited access areas like commercial complexes and areas that people must pay money to enter it. For instance, Bogazici University Campus, the shopping mall and residence structure which is called as Zorlu, Dolmabahçe Palace in Beşiktaş district cause interruption of pedestrian access to green space. On the other hand, shopping mall structure which is called as Cevahir AVM and Profilo AVM, Okmeydanı SSK Hospital, office areas which cover almost the neighborhood border and cemetery walls limits the pedestrian access to the parks in Şişli district.

According to analysis results, there are no conditions restricting access to the green space in sixteen neighborhoods (Abbasağa, Akat, Arnavutköy, Cihannüma, Dikilitaş, Etiler, Gayrettepe, Kuruçeşme, Kültür, Levent, Muradiye, Nisbetiye, Ortaköy, Sinanpaşa, Türkali and Ulus) located in Beşiktaş region. On the other hand, six neighborhoods have restrictions to access to the green space. These neighborhoods are Balmumcu (due to the gated communities with their own gardens), Bebek (due to the museum that people must pay to enter it and restricted area as Bogazici University), Konaklar (due to the gated communities with their own gardens, Bosphorus Bridge and military space), Levazım (due to the shopping mall and residence structure which is called as Zorlu and gated communities with their own gardens), Vişnezade (due to Dolmabahçe Palace that people must pay to enter it) and Yıldız (due to private properties).

According to the results of the analysis of Şişli region, there are no conditions restricting access to the green space in ten neighborhoods (Bozkurt, Ergenekon, Halaskargazi, Halil Rıfat Paşa, Harbiye, Kuştepe, Mahmut Şevket Paşa, Mecidiyeköy, Meşrutiyet and Teşvikiye). On the other hand, fifteen neighborhoods have restrictions to access to the green space. These neighborhoods are Ondokuz Mayıs (due to the shopping mall structure which is called as Cevahir AVM), Cumhuriyet (due to Dolmabahçe-Bomonti Tunnel which blocks pedestrian passage), Duatepe (due to the lack of green space), Esentepe (due to Zincirlikuyu cemetery walls), Eskişehir (due to the lack of green space), Feriköy (due to the lack of green space), Fulya (due to the shopping mall and residence structure which is called as Torun Center), Gülbahar (due to the shopping mall structure which is called Profilo AVM), Halide Edip Adıvar (due to the lack of green space), İnönü (due to the lack of green space), İzzet Paşa (due to the lack of green space), Kaptanpaşa (due to Okmeydanı SSK Hospital and office areas which cover almost the neighborhood border), Merkez (due to the Italian Jewish Cemetery walls which blocks pedestrian passage), Paşa (due to the cemetery walls) and Yayla (due to the lack of green space).

EVALUATION AND CONCLUSION

The main aim of this paper was to find and compare the green space accessibility of pedestrians, and to understand the effect of density on green space accessibility in two different districts in İstanbul. To be able to detect it, three research questions were tried to be answered:

- How accessible public parks and green space are for people living in the chosen district's neighborhoods borders?
- Which communities need increased access to public green space?
- Is density a factor for the accessibility of green space in districts?

Some notable results were obtained in this paper. Comparing the sufficiency of green space in Beşiktaş and Şişli districts, it is determined that the green area is 0.75 sqm per person in Şişli, while green area per person is 8.28 sqm in Beşiktaş. This indicates that Beşiktaş has a sufficient amount of green space, and it is significantly higher than Turkey standards (2 sqm per person), whilst green space per person in Şişli is under the standards. On the other hand, 15.8% of Beşiktaş and 17.2% of Şişli could not access to any green space. It means that although the amount of green space differs from each other, the accessibility to green space in each district has not shown extreme difference from each other. This situation shows that low level of accessibility to a green space not only derived from the lack of green space, but also from the blocking of access to green space. It was also identified that even though road is an important data to evaluate accessibility, cemetery walls, museums, university areas, military

space and private properties could prevent pedestrian crossings. So, it was recognized that having sufficient green space in a district does not mean that all people in the district could have access to green space. On the other hand, it was also identified that although a neighborhood does not have sufficient green space in its border, it could access to green space if it is in influence area of a large-scale park in the adjacent neighborhoods. According to analysis results, in sixteen neighborhoods in Beşiktaş district and in ten neighborhoods in Şişli district, there are no conditions restricting access to the green space. On the other hand, there are six neighborhoods in Beşiktaş district (Balmumcu, Bebek, Konaklar, Levazım, Vişnezade and Yıldız) and fifteen neighborhoods in Şişli district (Ondokuz Mayıs, Cumhuriyet, Duatepe, Esentepe, Eskişehir, Feriköy, Fulya, Gülbahar, Halide Edip, İnönü, İzzet Paşa, Kaptanpaşa, Merkez, Paşa and Yayla) need increased access to public green space. In Şişli, the total amount of first degree accessible and sufficient areas are calculated as 13.2%, however in Beşiktaş it is calculated as 25%. In addition, the paper provided some inferences about the effect of density on the accessibility by evaluating two districts with different densities . Based on the findings of the study, it could be argued that density, especially in neighborhood level, does not indicate the accessibility level in neighborhoods, but it affects the total amount of accessibility to green space of the districts.

While conducting the analysis, there were limitations that might affect the results. There was a problem in terms of finding the current data. In the data evaluation phase, the boundary data in 2010 and the green space data in 2015 were evaluated. Therefore, the results may not reflect the current status. In addition, the methodology was mainly based on the road network in the ArcMap software, and all calculations were made automatically. Therefore, errors may have been caused by dataset.

To conclude, the paper was conducted only within the boundaries of two districts in the Central Business District of Istanbul. The neighborhoods which are sufficient and accessible in terms of green space were identified. As further studies, proposals for new green space in the neighborhoods where lack of access to green space could be developed. Besides, by using the methodology of this study, accessibility to green space can be evaluated for other districts of Istanbul or other cities.

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Year | Yıl 2019
Volume | Cilt 01
Number | Sayı 01
Pages | Sayfa 54-70

SKETCH

ARTICLE | MAKALE

Journal of City and Regional Planning

Kentsel Yeşil Alanlara Erişimin Değerlendirilmesi: Beşiktaş ve Şişli İlçelerinin Karşılaştırılması

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Özet

Kentsel yeşil alanların şehirlere önemli katkıları vardır. Yeşil alan miktarı ve yeşil alanlara olan erişim bu alanlardan fayda sağlanması noktasında oldukça önemlidir. Yapılan bu çalışma İstanbul'un Merkezi İş Alanı (MİA) bölgesinde yer alan; fakat farklı nüfus yoğunluğuna sahip birbirine komşu iki ilçe olan Beşiktaş ve Şişli İlçelerindeki yeşil alan erişilebilirliğini değerlendirmeyi ve karşılaştırmayı amaçlamaktadır. Çalışmada ilk olarak yeşil alanların öneminden ve yeşil alanların yeterliliği ve erişilebilirliğini belirlemek için kullanılan standartlardan bahsedilmiştir. Daha sonra, Türkiye standartlarına göre belirlenen yeşil alan yeterlilik düzeyi her iki ilçenin mahalleleri bazında kişi başına düşen yeşil alan miktarı ölçülerek incelenmiştir. Ardından, her iki ilçedeki yeşil alan erişilebilirliği, dünya standartları temel alınarak belirlenen yürüme mesafelerine göre, network (ağ) analizi yapılarak oluşturulan yeşil alan hizmet alanları üzerinden tespit edilmiştir. Çalışmada network analizini uygulama noktasında Coğrafi Bilgi Sistemlerinden (CBS) yararlanılmıştır. Sonuç olarak yapılan bu çalışmada çıkan sonuçlara göre her iki ilçedeki yeşil alan yeterliliği ve erişilebilirliği karşılaştırılmış ve değerlendirilmiştir.

Anahtar Kelimeler: Yeşil Alanlar, Erişilebilirlik, Network (Ağ) Analizi, Coğrafi Bilgi Sistemleri, İstanbul

Submitted | Gönderim: 29.06.2019
Accepted | Kabul: 25.09.2019

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doi: 10.5505/sjcrp.2019.98608