Türk Tarım ve Doğa Bilimleri Dergisi 10(4): 1051–1063, 2023

https://doi.org/10.30910/turkjans.1354453

TÜRK
TARIM ve DOĞA BİLİMLERİ
DERGİSİ

TTDB

TURKISH
JOURNAL of AGRICULTURAL
and NATURAL SCIENCES

www.dergipark.gov.tr/turkjans

Araştırma Makalesi

Analysis of Çanakkale City Center Active Green Area Potential in GIS Platform

Melda AÇMAZ ÖZDEN[1*], Emre ÖZELKAN[1,2,3]

[1]Şehir ve Bölge Planlama Bölümü, Mimarlık ve Tasarım Fakültesi, Çanakkale Onsekiz Mart Üniversitesi, Çanakkale, Türkiye
[2]Doğal Afetlerin Risk Yönetimi Anabilim Dalı, Lisansüstü Eğitim Enstitüsü, Çanakkale Onsekiz Mart Üniversitesi, Çanakkale, Türkiye
[3]Uzaktan Algılama Araştırma ve Uygulama Merkezi, Çanakkale Onsekiz Mart Üniversitesi, Çanakkale, Türkiye
* Corresponding Author: meldaozden@comu.edu.tr

Received: 02.09.2023 Received in revised: 22.09.2023 Accepted: 22.09.2023

ABSTRACT

While cities are facing challenges such as uncontrolled growth, population growth, and climate change, environment and human-friendly solutions are sought to create more livable urban areas. Green areas in cities play an important role in improving the quality of life quality of life for residents and reducing the risks of the disasters. Urban green area planning is a holistic and strategic process in which qualitative and quantitative factors should be considered in detail. This study focuses on determining the qualities and potentials of urban green areas in the city center of Çanakkale province in western Turkey and determining the amount of green area per capita, which is one of the quantitative factors. In addition, the study also aims to draw conclusions about the distribution and accessibility of urban green areas. Determining the amount, accesibility and distribution of active green areas, which are intensively used by urban dwellers for recreational purposes and are the determinants of the presence of green area in the city, is important in terms of forming the basis for strategies that improve urban quality of life. In this study, the active green areas in various urban landscapes were determined by utilizing high spatial resolution satellite remote sensing images and the spatial distribution and accessibility analysis were performed in a geographic information systems (GIS) platform. The findings of this study provide a basis for the development of local green area strategies and contribute to the current discourse on livable and sustainable urban development.

Key words: Active green area, spatial analysis, GIS, Çanakkale

Çanakkale Kent Merkezi Aktif Yeşil Alan Potansiyelinin CBS Ortamında Analizi

ÖZ

Kentler kontrolsüz büyüme, nüfus artışı, iklim değişikliği gibi zorluklarla karşı karşıya iken, bir yandan da daha yaşanabilir kentsel alanlar oluşturmak için çevre ve insan dostu çözümler aranmaktadır. Kentlerdeki yeşil alanlar kent sakinlerinin yaşam kalitesini artırmada ve afet risklerini azaltmada önemli bir rol oynamaktadır. Kentsel yeşil alan planlaması niteliksel ve niceliksel faktörlerin detaylı düşünülerek yapılması gereken bütüncül ve stratejik bir süreçtir. Bu çalışma, Türkiyenin batısında bulunan Çanakkale ilinin kent merkezinde kentsel yeşil alanların niteliklerinin ve potansiyellerinin belirlenmesine ve niceliksel faktörlerden biri olan kişi başına düşen yeşil alan miktarının tespit edilmesine odaklanmıştır. Ek olarak, yeşil alanların kentsel mekândaki dağılımı ve erişilebilirliği ile ilgili çıkarımlar yapılması da çalışmanın hedeflerindendir. Kent sakinlerinin rekreatif amaçlarla yoğun olarak kullandığı ve kent içinde yeşil alan varlığının belirleyicisi olan aktif yeşil alanların miktarının,

erişilebilirliğinin ve dağılımının belirlenmesi kentsel yaşam kalitesini geliştiren stratejilere temel oluşturması açısından önemlidir. Bu çalışmada, çeşitli kentsel peyzajlarda aktif yeşil alanların miktarı, erişilebilirliği ve dağılımı uydu görüntüleri ile belirlenmiş ve mekânsal dağılım ve erişilebilirlik analizleri coğrafi bilgi sistemleri (CBS) ortamında gerçekleştirilmiştir. Bu çalışmanın bulguları, yerel yeşil alan stratejilerinin geliştirilmesi için bir altlık oluşturmakta ve ayrıca yaşanabilir ve sürdürülebilir kentsel gelişimin sağlanabilmesi konusunda mevcut söylemlere katkıda bulunmaktadır.

Anahtar kelimeler: Aktif yeşil alan, mekansal analiz, CBS, Çanakkale

INTRODUCTION

The concept of 'livability' can be considered as a concept that emerged with the development of modern life. It is also possible to consider this concept as the satisfaction of individuals with the place where they live and the evaluation of the measurable spatial, social and physical characteristics of the environment. For example, safety, health, education, climate conditions, air pollution, job opportunities are some of the criteria for determining the livability of cities. Urban open and green areas not only increase urban livability but also support the urban space quality (Lopes and Camanho, 2013; Yılmaz and Mumcu, 2016; Akkemik, et al., 2021; Finger-Stich, 2022). Green areas have many social, psychological, physical, ecological and economic benefits (Zhou and Parves Rana, 2012; Wolch, et al., 2014; Madureira, et al., 2015; Haq, 2016; Lee, et al., 2016; Yılmaz and Mumcu, 2016; Kothencz, et al., 2017; Semeraro, et al., 2021; Akkemik, et al., 2021; Finger-Stich, 2022). These benefits include creating ecological balance in cities, providing recreational activity areas for urban dwellers (Lopes and Camanho, 2013; Wolch, et al., 2014; Madureira, et al., 2015; Haq, 2016; Yılmaz and Mumcu, 2016; Kothencz, et al., 2017), stabilizing urban air quality (Zhou and Parves Rana, 2012; Madureira, et al., 2015; Haq, 2016; Yılmaz and Mumcu, 2016), reducing the effects of climate change (Madureira, et al., 2015; Semeraro, et al., 2021), reducing the risk of urban disasters (Lee, et al., 2016; Semeraro, et al., 2021), supporting the protection and enhancement of biodiversity in cities (Madureira, et al., 2015; Yılmaz and Mumcu, 2016; Haq, 2016; Semeraro, et al., 2021), benefiting people's psychological, mental and physical health (Zhou and Parves Rana, 2012; Wolch, et al., 2014; Madureira, et al., 2015; Haq, 2016; Yılmaz and Mumcu, 2016; Lee, et al., 2016) and increasing the economic value of the places (Haq, 2016; Yılmaz and Mumcu, 2016) where they are located.

Uncontrolled urbanization and population growth lead to increased structural density in urban areas (Haq, 2016; Gül, et al., 2020; Semeraro, et al., 2021; Buchavyi, et al., 2023). In some cities, this uncontrolled growth causes a negative pressure on open areas within the city and on the urban periphery (Haq, 2016; Gül, et al., 2020; Semeraro, et al., 2021). The process of structural sprawl, which we can characterize as urban sprawl towards the urban periphery, causes agricultural lands and olive groves to change their functions and turn into residential areas. In the inner-city areas, open and green areas that cannot grow in proportion to the building density cause an imbalance between urban occupancy and emptiness (urban solid-void), and the lack of sufficient green area and urban openness causes many negative effects (Yücesu, et al., 2017; Buchavyi, et al., 2023). Inadequate open and green areas, on the other hand, bring about many negative consequences such as dissatisfaction among the inhabitants of urban areas, lack of spatial quality, formation of urban heat islands, decrease in air quality, insufficiency of open social activity areas, and decrease in quality of life (Gül, et al., 2020; Buchavyi, et al., 2023). Therefore, it can be said that urban land use policies and urban growth have an impact on the availability and accessibility of open and green spaces. It should be emphasized that this is an important effect in terms of creating a basis for the construction of livable and sustainable urban areas.

Local, national and universal norms should be taken into consideration when planning urban green areas. In our country, "areas such as parks, playgrounds, recreation areas, squares" are defined as urban open and green areas in the legislation, and their standards are determined by the Zoning Legislation (Manavoğlu and Ortaçeşme, 2007; Gül, et al., 2020; Köşe and Kara, 2021). However, these standards only give an idea about the green area requirement for a settlement and determine the minimum conditions. The fact that there are deficiencies in the definitions of green areas in the national legislation and that the functions and functions of green areas are not included in the zoning plans are insufficient for sustainable landscape systems (Gül, et al., 2020; Yüksek and Esen, 2023). The lack of the necessary regulations to define green areas as a holistic system in the legal sense leads to fragmented landscapes with weak spatial relations with each other in the context of implementation (Manavoğlu and Ortaçeşme, 2007). In order to find solutions to spatially fragmented, non-

integrated and poorly connected landscapes, the relevant zoning legislation needs to be reconsidered and improved (Gül, et al., 2020).

Open and green areas are divided into two categories: active and passive. Active green areas are areas such as city parks, neighborhood parks, sports fields, children's playgrounds, picnic areas, botanical gardens, zoos, which are actively used by individuals for recreational purposes (Doygun, et al., 2015; Karafakı, 2016; Gül, et al., 2020; Akkemik, et al., 2021). Passive green areas are the ones that are not actively used but contribute to the green area potential, such as groves, refuges, cemeteries, military areas, nurseries (Gül, et al., 2020; Akkemik, et al., 2021). The Zoning Law No. 6785 dated 16.07.1956 in the Official Gazette did not set any standards for green areas (Çabuk, 2019; Yüksek and Esen, 2023). Interestingly, while the amount of green area per capita was expected to be 4 m^2 between 1933 and 1956, there was no legal standard between 1956 and 1972 (Çabuk, 2019; Yüksek and Esen, 2023). In 1972, Article 28 of Law No. 1605 defined the amount of active green area per capita as 7 m^2 (Karafakı, 2016; Çabuk, 2019; Gül, et al., 2020; Yüksek and Esen, 2023). On September 2, 1999, the amount of active green area per capita was increased to 10 m^2 (Karafakı, 2016; Çabuk, 2019; Gül, et al., 2020; Yüksek and Esen, 2023). According to the "Regulation on the Construction of Spatial Plans" published in the Official Gazette dated 14.06.2014 and numbered 29030, the amount of active green area per capita was determined as 10 m^2 (Osmanlı and Akdemir, 2011; Doygun, et al., 2015; Karafakı, 2016; Çabuk, 2019; Gül, et al., 2020; Köşe and Kara, 2021; Yüksek and Esen, 2023). In addition, based on accessibility, a service impact radius of approximately 500 m was determined for playgrounds, playgrounds and open neighborhood sports areas and it was decided to locate them in the zoning plans (Doygun, et al., 2015).

In the regulation, the green area standard is determined as the amount of green area per capita based on the ratio of the areal size of the city population (Karafakı, 2016; Akkemik, et al., 2021; Şenol, et al., 2023). Although there has been an increase in the standard of green area over time, the fact that this value (10 m^2) is not at international standards is an indication that we are still not at a sufficient level in terms of the amount of green area in our cities. On the other hand, apart from the per capita green area standard, there are no adequate legal regulations in relation to the planning and design of green areas (Şenol, et al., 2023). The World Health Organization (WHO) has stated that the minimum amount of green area per capita should be 9 m^2 (Benek and Şahağ, 2017; Russo and Cirella, 2018; Özgeriş, 2023). The United Nations emphasized that the amount of green area per capita should be 30 m^2, the European Union 26 m^2, and the USA 18 m^2 (Özgeriş, 2023). If the cities in the world are evaluated according to the amount of green area, Buenos Aires 1.9 m^2, Tokyo 3 m^2, Paris 14.5 m^2, New York 23.1 m^2, London 27 m^2, Berlin 27.1 m^2, Rome 45.3 m^2, Amsterdam 45.5 m^2, Singapore 66 m^2, Stockholm 87.5 m^2, Vienna 120 m^2 (Benek and Şahağ, 2017; Baharash Architecture, 2023). In Turkey, the amount of green area per capita is Balıkesir 3.1 m^2, Samsun 5.6 m^2, İzmir 5 m^2, İstanbul 6.4 m^2, Bursa 10 m^2 (Benek and Şahağ, 2017). When the amount of green area in our country is compared with the amount of green area abroad, it can be stated that many cities are far below the standards set universally. In fact, when we look at these numbers, it can be said that many cities in our country cannot even meet the amount of green area per capita, which the Spatial Plans Construction Regulation sets as a minimum of 10 m^2.

The accessibility of green areas is as important as the amount of green area in urban areas (Laan and Piersma, 2021). The fact that urban dwellers can access green areas both within walking distance and using public transportation is one of the desired criteria for livable cities as it will reduce car dependency (Atanur, et al., 2022). In the UK, an access distance of 300 m is envisaged as the impact area for access to green areas, while the European Environment Agency envisages an access distance of approximately 1000 m (Özgeriş, 2023). The proportion of green area in European cities has increased by 38% in the last 25 years, and 44% of the population living in European cities live close to a public park that is at least 300 meters away (Atanur, et al., 2022). Investigating the standard of green area per capita and accessibity of active green areas are important in terms of determining the current situation and the strategies envisaged for the future. For this reason, studies have been conducted in different cities and the existing green area potential of cities and the amount of green area per capita have been addressed.

In a study conducted in Burdur, the adequacy and accessibility of neighborhood and district parks, playgrounds and sports facilities were analyzed and the amount of green area per capita was determined as 4.01 m^2 for Burdur (Yenice, 2012). In a study conducted for Konya Selçuklu region, the amount of green area per capita was determined as 4.5 m^2 and it was also observed that green areas did not have a homogeneous distribution in the study area. While the amount of green area per capita was higher in some parts of the study area, it was found to be less in some areas (Osmanlı and Akdemir, 2011). In another study, the amount of green area per capita in Kırklareli province was calculated as 4.01 m^2, while the amount of active green area was

found to be 1.6 m^2 (Yücesu, et al., 2017). In the current zoning plan of Kırklareli, the amount of green area per capita is determined as 11.88 m^2, which shows that the levels envisaged in the zoning plan have not yet been reached (Yücesu, et al., 2017). In a study conducted in Şanlıurfa, the amount of active green area in the city center was calculated using GIS. Accordingly, the amount of active green area per capita in Şanlıurfa is 3.82 m^2 (Benek and Şahağ, 2017). When the distribution of this amount, which is far below the standards, is examined, it can be said that the amount of green areas is less in poor neighborhoods, while a significant increase in the amount of green areas is observed in new settlement areas (Benek and Şahağ, 2017). In another study, the planning stages and the amount of green area in Kayseri city in the historical process were evaluated and it was stated that the amount of green area per capita was 2.97 m^2 in 2006 (Çabuk, 2019). In this article, it was emphasized that certain green area targets for Kayseri were set for the planning processes, but these targets did not coincide with the current needs and standards, as the projected population reached a much higher number (Çabuk, 2019). On the other hand, in a study conducted in Ordu city, the amount of green area per capita was calculated as 16 m^2, which is above the standards (Atabeyoğlu and Bulut, 2012). In addition, considering that there should be 4 m^2 of park area per capita in cities, there is 13 m^2 of park area per capita in Ordu city (Atabeyoğlu and Bulut, 2012). With these values, it can be said that green areas and parks in the city are sufficient. However, not only the amount of green area should be sufficient, but also basic criteria such as accessibility, usefulness and diversity should be evaluated.

In a study on the accessibility of green areas, a discussion was carried out especially on the concepts of environmental justice and being able to benefit from green areas fairly (Şenol, et al., 2023). This study focuses on the Buca district of Izmir city and evaluates the equitable allocation of greenspace and their accessibility within walking distance using a GIS-based algorithm (Şenol, et al., 2023). Another study aims to make an assessment by associating the concept of accessibility to green areas with population density through a mathematical formulation (Laan and Piersma, 2021). Following this formulation, where the size as well as the walking distance of green areas is included in the evaluation, it is concluded that densely populated areas have less green areas even if they are close to green areas (Laan and Piersma, 2021). In another study evaluating the accessibility of urban green areas were examined separately in four different functions as community park, district park, neighborhood park and mini park (Kemeç and Abdalkarim, 2023). In this study conducted in Erbil city, 300 m (5 minutes walking distance), 600 m (10 minutes walking distance), 900 m (15 minutes walking distance) were evaluated and maps were prepared with the help of GIS (Kemeç and Abdalkarim, 2023). In another study on the accessibility of green areas in 15 neighborhoods in Bursa Yıldırım District, walking distances of 250 m and 500 m were determined in the accessibility analysis of green areas (Atanur, et al., 2022). In this study, it was emphasized that the accessibility of open green areas is not the only criterion for the adequacy of green areas in urban areas, and that the size, quality and maintenance of open green areas are also important (Atanur, et al., 2022).

In a study conducted to assess Çanakkale's green areas, a questionnaire survey was conducted to determine the green area needs of the city's inhabitants, and the analysis of the surveys led to conclusions for each neighborhood (Ayaşlıgil, 1997). The legal green area standard valid at the time of the study was 7 m^2 and the study aimed to determine the need for green area by making an assessment based on this standard. As a result of this study, it was concluded that the participants found active green areas such as children's playgrounds, sports fields and neighborhood parks insufficient and that these areas should be developed in line with the needs (Ayaşlıgil, 1997). As seen in the studies above, the amount of green areas per capita in cities remains far below the standards or have accessibility problems. Failure to determine the population projection correctly during planning, the pressures of urbanization and density on open and green areas, and the differences between newly developed urban areas and the old urban fabric are factors that affect both the adequacy of green areas and accessibility to green areas. What has been discussed above shows that the issue of open green area is still an important research topic for urban planning that is worth studying. This study focused on determining the qualities and potentials of urban green areas and determining the amount of green area per capita and accessibility, which is one of the quantitative factors. The city center of Çanakkale, located in the west of Turkey, was chosen as the study area. The location and the amount of active urban green areas were determined by satellite images and the spatial distribution and the accessibility of them analyzed in geographic information systems (GIS). The aim of this study is to contribute to the development of local green area strategies and to ensure livable and sustainable urban development.

MATERIAL ve METHODS

The study area preferred in this research is between 26°21'38,566" - 26°27'31,891" east meridians and 40°4'59,385" - 40°12'4,104" north parallels. Although the region is under the influence of the subtropical Mediterranean climate (Altan and Türkeş, 2014), the climate experienced in the region in particular is defined as the temperate Marmara climate (Şensoy, et al., 2008). The wettest period is in December with 100.4 mm and the driest period is in August with 6.8 mm (MGM, 2023). July is the hottest month with 26°C and January is the coldest month with 6.5°C (MGM, 2023). In Çanakkale province, there are maquis, shrubs, olive, laurel, oak, red pine, black pine, beech, locust, fir and chestnut belonging to the Mediterranean vegetation and more than half of the province is covered with forests (Koca, 2005). Due to natural and artificial thresholds such as forest areas, military areas and airports, the city of Çanakkale has developed along the seashore. Today, this orientation continues more intensively in the direction of Karacaören in the north and Kepez (especially Hamidiye Neighborhood) in the south. The city of Çanakkale is divided by the İzmir-Çanakkale highway. This structural boundary disrupts spatial integrity in terms of ensuring the continuity of green areas in the city. Sarıçay, located in the center of the city, is a water element that starts from the sea and continues until the Atikhisar Dam. Although Sarıçay divides the city in two and has a lot of impervious surfaces around it, it is a natural element that can benefit the spatial richness of the city due to its potential as a green area and recreation area (Figure 1).

Figure 1. Location of Çanakkale and the case study area

Active green areas within the borders of Cevatpaşa, Fevzipaşa, Kemalpaşa, Namık Kemal, İsmetpaşa, Esenler, Barbaros, Cumhuriyet, Boğazkent and Hamidiye neighborhoods are included in the study conducted in Çanakkale city center. The study aims to obtain information on the adequacy, location, distribution, accessibility and spatial relations of urban active green areas in Çanakkale by using high spatial resolution satellite remote sensing data in GIS platform. The reason for utilizing GIS method in this study is that it can provide a comprehensive and systematic approach to evaluate urban potential. Furthermore, understanding the spatial dynamics of active green areas can guide informed decision-making processes related to urban development, land use planning and development of recreational areas. Thus, it can contribute to the creation of livable and sustainable urban areas. In the study, high spatial resolution satellite and street images in Google Earth Pro program were used to determine the spatial distribution and potential of active green areas. Urban active green areas were drawn by digitizing the satellite images. Then, attribute tables of the vector data were created in the GIS platform and made suitable for spatial query and analysis. While creating the maps and attribute tables, active green areas were considered as neighborhood parks, city parks, children's playgrounds, picnic areas, urban groves, promenades and recreational sports areas actively used by city residents. Different spatial scales were considered during the analysis. First, active green areas were determined for each neighborhood based on neighborhoods and the distribution and adequacy of active green areas were evaluated. In addition, separate calculations were made for both Çanakkale center and Kepez town and active green areas were examined. In order to give a general idea, a quantitative assessment has been made in terms of green area adequacy in the whole urban area of Çanakkale, which is a medium-sized city.

RESEARCH FINDINGS AND DISCUSSION

Çanakkale central district consists of seven neighborhoods. These neighborhoods are Cevatpaşa, Fevzipaşa, Kemalpaşa, Namık Kemal, İsmetpaşa, Esenler and Barbaros. The town of Kepez consists of three neighborhoods, Cumhuriyet, Boğazkent and Hamidiye, which are located in the continuation of the central district of Çanakkale. The neighborhoods that have recently developed structurally and have a new housing texture are Eserler, İsmetpaşa and Hamidiye neighborhoods. The town of Kepez and the central district of Çanakkale are spatially integrated. The farthest distance of urban settlement, which comprises of ten neighborhoods of Çanakkale and Kepez, is approximately 10 km from a bird’s eye view. There are many urban dwellers who work in the center of Çanakkale and live in the town of Kepez and use the urban facilities in this area, or live in Kepez and live in the center of Çanakkale and use the urban facilities in this area. Consequently, these two regions are considered together in this study. According to 2022 data, the population of the central district of Çanakkale, which consists of seven neighborhoods, is 143675, while the population of Kepez town, which consists of three neighborhoods, is 35390.

As a result of the analysis, Table 1 shows the areal sizes of active green areas according to the functions of use according to the neighborhoods. According to children's playgrounds; the highest number of children's playgrounds is located in Esenler Neighborhood. Esenler Neighborhood is a newly built urban development area. The neighborhood is mostly composed of high-rise housing estates, but there are also single residential apartment buildings. While these apartment buildings constitute the older housing texture of the neighborhood, housing estates are the newer building types. In Fevzipaşa, Kemalpaşa, Namık Kemal and Hamidiye neighborhoods, according to the analysis made from the map, there are no areas allocated only as children's playgrounds. One reason for this is that children's playgrounds are located in parks in these neighborhoods. In Hamidiye Neighborhood, on the other hand, since there is an urban fabric consisting of closed housing estates, children's playgrounds are located within the gardens of the estates. Regarding the spatial distribution of playgrounds, it can be said that Esenler Neighborhood has a more homogeneous distribution of playgrounds. Although Cumhuriyet Neighborhood is less in terms of quantity, it is homogeneous in terms of spatial distribution. In Barbaros Neighborhood, it can be said that the distribution of playgrounds is homogeneous in some parts of the neighborhood, but not in the whole neighborhood.

When the park areas are analyzed, neighborhood parks, district parks and urban parks are considered together in the calculations. Barbaros Neighborhood has the highest number of parks in terms of surface area. Barbaros Neighborhood is the largest neighborhood in Çanakkale in terms of both population and surface area. The Hamidiye Bastions in the Barbaros Neighborhood can be described as an urban park. In addition, small parks along Sarıçay are also within the boundaries of Barbaros Neighborhood. Esenler Neighborhood ranks second in terms of the number of park areas. The Freedom Park, which is used extensively by Çanakkale residents, is located in the Esenler Neighborhood. Cevatpaşa Neighborhood ranks third in terms of park

density. The public park (Halk Bahçesi), a historical urban park, highly preferred by the citizens and with a unique microclimate, is located just behind the promenade in this neighborhood. Although there is a more homogeneous distribution in the Esenler Neighborhood, it can be said that there is not a homogeneous distribution in terms of the location of parks throughout Çanakkale and that a green network system between parks is not provided. In terms of groves and picnic areas within the city, Cumhuriyet Neighborhood ranks first, followed by Esenler, Cevatpaşa, Boğazkent, İsmetpaşa and Barbaros neighborhoods in terms of areal size. The promenade, which is of great importance for the city of Çanakkale, starts in Cevatpaşa Neighborhood and continues until Çimenlik Castle. The promenade, which is interrupted by Sarıçay, continues as a promenade along the coastline starting in Barbaros Neighborhood and extending to Kepez Harbor. When open sports areas are evaluated, it can be said that in some areas they are located in parks, but in some neighborhoods they are used only as sports areas. On the other hand, in Fevzipaşa, Kemalpaşa and Namık Kemal neighborhoods, sports areas could not be identified in the calculations made on the map.

When the green areas in Çanakkale are evaluated at the neighborhood scale on the map (Figure 2), it is possible to say that Esenler Neighborhood has a denser active green area texture in terms of the variety of functional uses and homogeneous distribution of green areas. Since part of Esenler Neighborhood, which mostly consists of gated communities, is within the new development area, it would be possible to say that urban open and green areas are more planned. On the other hand, the Hamidiye Neighborhood of Kepez, which develops with the same housing typology and can also be considered as an urban development area, has very few public green areas. Hamidiye Neighborhood, unlike Esenler Neighborhood, is dominated by completely closed housing estates and green areas, sports fields and children's playgrounds are located as private areas within these estates. On the other hand, Cumhuriyet Neighborhood and Boğazkent Neighborhood of Kepez are in better condition in terms of the amount of public green area compared to Hamidiye Neighborhood. The reasons for this increase are that these neighborhoods are located on the seashore, have a promenade, groves, picnic areas and parks of different sizes. On the other hand, the fact that active green areas are not homogeneously distributed cause to lack of homogeneous accessibility over the city.

In another new development area of Çanakkale, İsmetpaşa Neighborhood of the central district, while the new housing stock has increased rapidly, the green area stock has not increased to the same extent. While the neighborhood's border with Sarıçay is a great opportunity, the neighborhood's neglected Sarıçay border, and the lack of any kind of landscaping or rehabilitation work, creates problems. In addition to the lack of public green areas, another problem of this neighborhood is the insufficient level of private green areas in existing housing estates. İsmetpaşa Neighborhood is a risky area in terms of soil and susceptible to disasters (earthquakes, floods, etc.). For this reason, while planning the neighborhood, urban risks and disaster hazards should not be ignored, appropriate urban openings should be provided between buildings and impervious surfaces should be reduced to create a greener neighborhood. In addition, the lack of large green areas within walking distance due to the location of the neighborhood makes active green area planning that meets different user needs in this area mandatory in terms of ensuring user satisfaction.

Table 1. Amounts of active green areas by function according to neighborhoods

Neighborhoods	Children's Playground (m^2)	Parks (m^2)	Woodland Picnic Area (m^2)	Open Sports Area (m^2)	Promenade Area (m^2)	Total (m^2)
Cevatpaşa	8698	86486	14275	1647	18310	129417
Fevzipaşa	-	1451	-	-	3691	5142
Kemalpaşa	-	10237	-	-	6111	16348
Namık Kemal	-	22607	-	-	-	22607
İsmetpaşa	2364	24329	5582	24870	-	57146
Esenler	25626	116287	21857	21927	-	185696
Barbaros	14050	219014	2940	10904	47639	294547
Cumhuriyet	8729	7706	136048	12824	16083	181390
Boğazkent	12122	38030	13588	3691	18515	85946
Hamidiye	-	12335	-	1866	-	14201

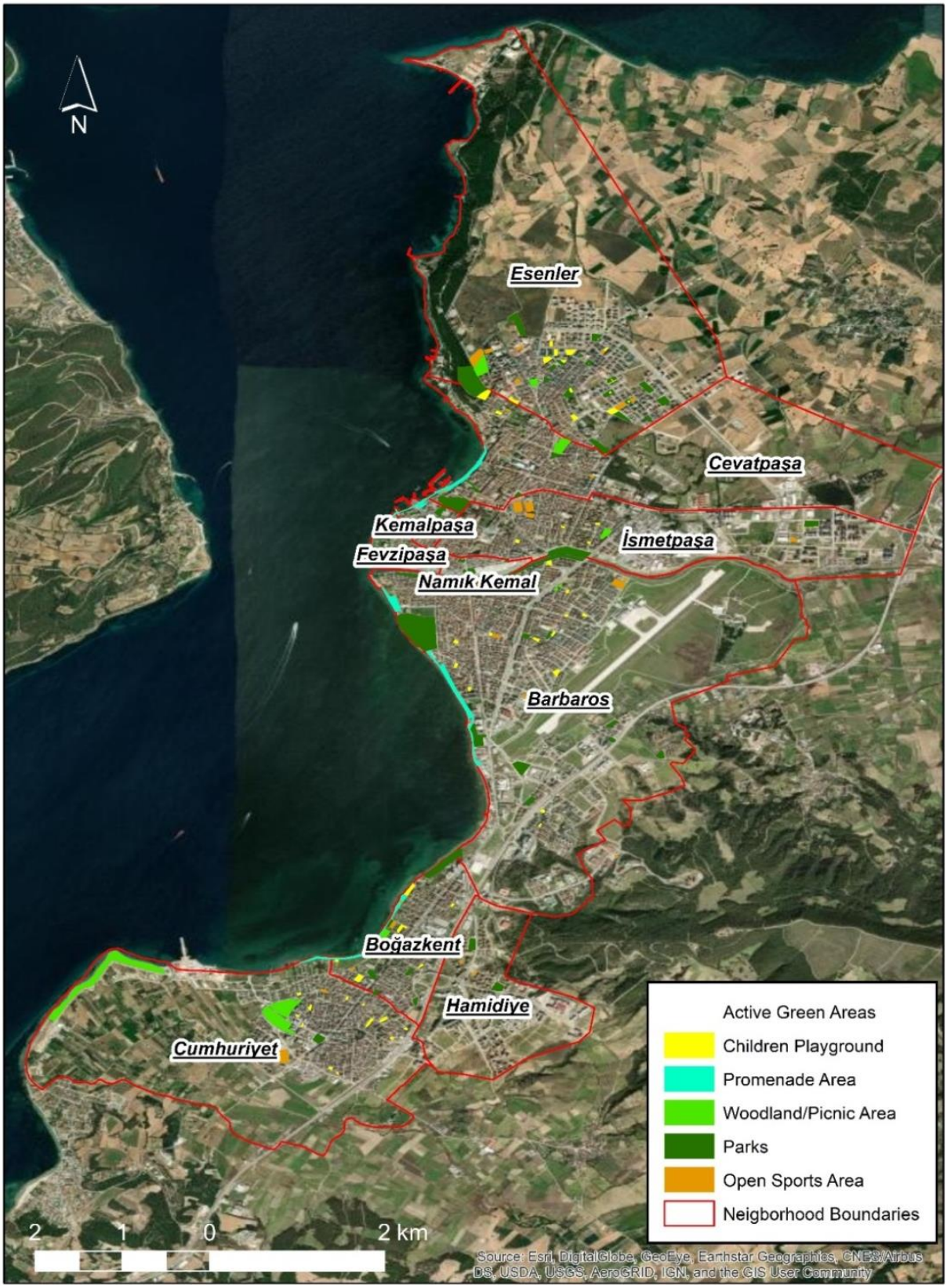
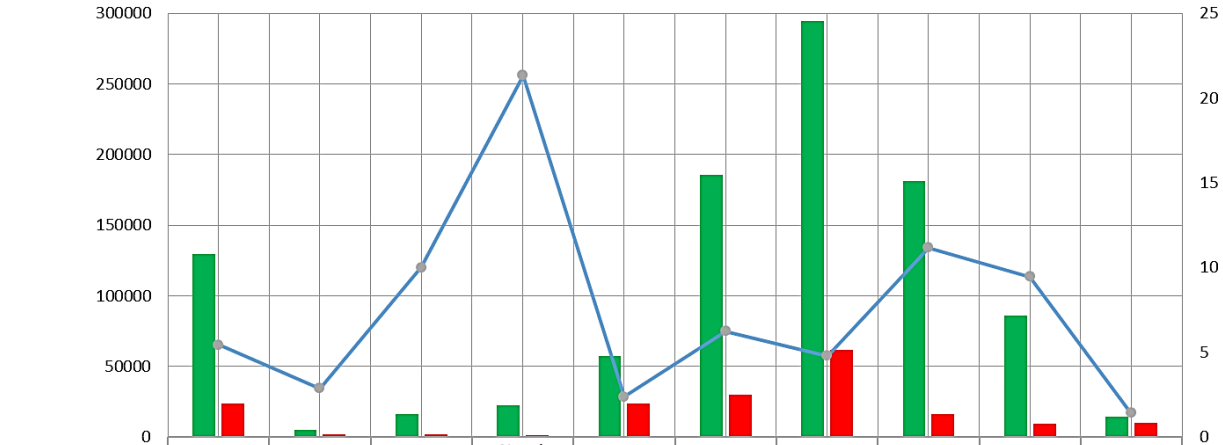


Figure 2. Distribution of active green areas in Çanakkale

Fevzipaşa, Namık Kemal and Kemalpaşa neighborhoods, which are the smallest neighborhoods of Çanakkale in terms of population and surface area, actually have a texture that is not only residential, but also commercial use, and even more intensive commercial use. In these areas, which can be described as the city center and its immediate surroundings, Namık Kemal Neighborhood borders Sarıçay, Kemalpaşa Neighborhood borders the promenade, and Fevzipaşa Neighborhood borders both Sarıçay and the promenade. Although the amount of green area per capita in Kemalpaşa and Namık Kemal neighborhoods seems high, this is because these neighborhoods are used for residential purposes and the number of people registered to the population is low. On the other hand, the fact that they are located in the city center and have a very intense usage potential (day and night) above the registered population due to their commercial&residential use makes these rates insufficient.

Cevatpaşa Neighborhood is one of the oldest and central neighborhoods of the city and is home to the urban park (Halk Bahçesi), a historic urban park. Being a central neighborhood and located on the seafront, it has public spaces that serve not only the residents of this neighborhood but also all Çanakkale residents. The promenade and the Public Garden (Halk Bahçesi) are among the most prominent of these public spaces. However, having the promenade in this neighborhood and having smaller parks next to the Public Garden (Halk Bahçesi) is not enough. In terms of landscape design, the promenade is an area where impervious surfaces are dense and shaded areas and seating units are inadequate. For this reason, individuals mostly use the promenade for walking and strolling. The neighborhood, which has a dense population and commercial-residential use, needs to increase the amount of green space to a sufficient level by considering all users, not only those registered in the population (Figure 3).

Accessibility maps were prepared using 250 m and 500 m walking distances (Figure 4). In terms of walkability, the 250 m walking distance was considered as a distance that the vulnerable segments of the society (elderly, disabled, children, etc.) can easily reach. İsmetpaşa and Hamidiye neighborhoods, which we can call residential development areas, consist of closed residential areas in terms of housing typology. Especially these two neighborhoods were found to be very inadequate in terms of the presence of public green spaces. When the accessibility maps are examined, it can be inferred that there are no parks within walking distance in these areas, especially due to the low adequacy of public parks in these newly developing residential areas. Especially since the city parks are located in the central areas of the city, their distances from the new residential development areas remain long. Hamidiye Neighborhood has wider uses than İsmetpaşa Neighborhood in terms of the presence of private site gardens. Although the city center does not seem to be problematic in terms of accessibility to green areas in terms of general uses, an evaluation of the usage functions of green areas in future studies will allow more detailed inferences to be made.



	Cevatpaşa	Fevzipaşa	Kemalpaşa	Namık Kemal	İsmetpaşa	Esenler	Barbaros	Cumhuriyet	Boğazkent	Hamidiye
A. G. Area (m2)	129417	5142	16348	22607	57146	185696	294547	181390	85946	14201
Population	23820	1790	1633	1059	23959	29767	61647	16251	9078	10061
pp (m2)	5,4	2,9	10,0	21,3	2,4	6,2	4,8	11,2	9,5	1,4

Figure 3. Amount of active green area per capita by neighborhoods in Çanakkale

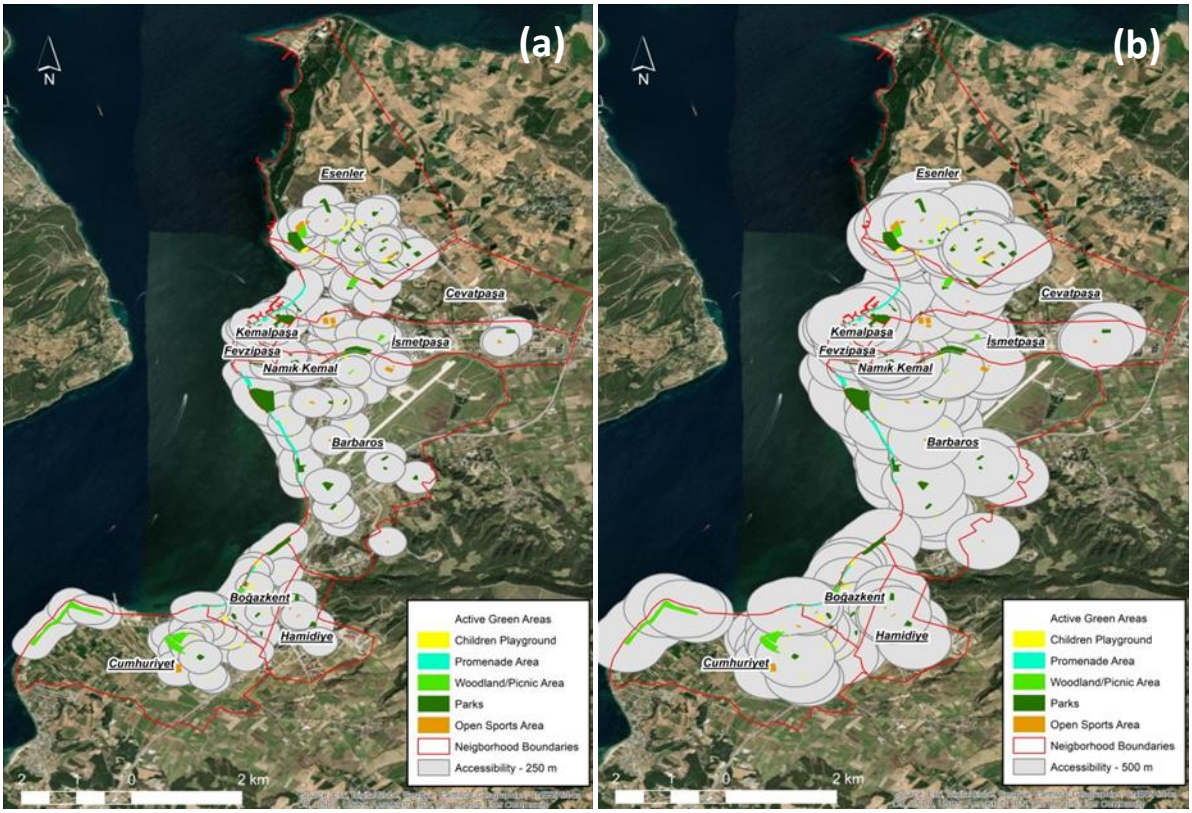


Figure 4. Accesibility of green areas: (a) 250 m and (b) 500 m walking distances

Barbaros Neighborhood is both the most populous neighborhood of Çanakkale in terms of population and the largest neighborhood in terms of area. When the graph is evaluated, it can be stated that although the amount of green area in Barbaros Neighborhood is higher than the other neighborhoods, the amount of green area is below the standards due to its large population. On the other hand, when the neighborhoods that are above the minimum standard of 10 m^2 are examined, although Namık Kemal and Kemalpaşa neighborhoods are seen to have a high amount of green area, this result should be considered with different criteria due to their very small area and very low population. Especially since these neighborhoods have a commercial rather than residential texture, they host a dense population from many parts of Çanakkale during the day. In short, these neighborhoods, which are intensely used during the daytime, are also densely populated during the day. The spatial relationship of Cumhuriyet and Boğazkent neighborhoods with the seashore and the recreational areas on the seashore have led to an increase in the amount of green area in these neighborhoods. This increase has also affected the amount of green area per capita.

CONCLUSION AND RECOMMENDATIONS

When the active green areas of Çanakkale city are evaluated, the amount of active green area per capita in the city center, which has a population of 179065 people, is 5.5 m^2, while this ratio is 4.9 m^2 in Çanakkale district center and 8 m^2 in Kepez town. The amount of green area per capita is an important quantitative indicator for increasing the amount of green area in urban areas. According to the Spatial Plans Construction Regulation, this standard is set at a minimum of 10 m^2 and unfortunately, the active green areas in Çanakkale province are below this standard. Looking at the Çanakkale city center as a whole, it is possible to say that there is no planned green area system and that there are fragmented green area land uses that are generally disconnected from each other. On the other hand, note that the accuracy of the field values obtained in this study, which is digitized in GIS platform, depends on the spatial resolution and up-to-dateness of Google Earth satellite and Street images, which limits the research. Accessibility, another quantitative indicator, is a very important issue in terms of open and green areas and other urban facilities. Since Çanakkale is a medium-sized and linearly

growing city, no significant problems have been identified in terms of accessibility. Due to the presence of private housing estate gardens and insufficient public green areas in newly developing residential areas, it can be inferred that there are not enough public green areas within walking distance in these areas. In addition, the fact that the parks are scattered, small and fragmented caused no problems in the green areaaccessibility analysis. However, in order to create livable environments, this fragmented settlement form should not be preferred and the approach of providing connections between green areas should be adopted. For these reasons, it would be useful to evaluate the functions of green areas, population and the areal size of green areas while analyzing accessibility. On the other hand, existing urban parks and natural value add richness to Çanakkale's green area potential. At the same time, its relationship with the sea makes a positive contribution in terms of the promenade and the beach. Although Sarıçay, an important water feature in the city center, has not been planned and has not been given the quality of a promenade area, its existence is important for Çanakkale and with the right design, it can provide a great recreational potential for the city. Therefore, spatially homogeneous distribution of green areas and the creation of green connections between them are necessary for both urban ecology and livable cities. The amount of green area per capita and accessibility, which is a quantitative evaluation method, is not a sufficient parameter for livable and sustainable cities.

Evaluating green areas according to both qualitative and quantitative factors and developing legal standards would be a more rational approach in terms of increasing user satisfaction and thus ensuring quality of life. Community engagement and participatory planning have gained importance in shaping the spatial evolution of open and green areas. It is important to involve local communities in decision-making processes related to land use changes, foster a sense of ownership and ensure that open and green areas are compatible with the needs of residents. In addition, users' satisfaction with green area, usage characteristics, the well-maintained condition of parks, and the variety of functions that appeal to different users are indicators that are as important as the quantity and accessibility of parks. It is concluded that all these criteria must be met in order to develop a healthy and user-oriented green area system and to create livable cities. For this reason, while planning green areas, a guide should be created by taking into account the conditions and sociocultural structure of the cities, qualitative and quantitative norms should be evaluated in integrity, and the minimum standards determined by the Zoning Legislation should be re-evaluated and improved. A holistic approach where multiple criteria developed through participatory and consensual processes are evaluated together for design and planning criteria can create a new vision for our green areas. It is a great necessity to create interconnected open space networks that adapt to developing urban dynamics and to reconsider universal standards for livable cities and neighborhoods. In conclusion, assessing spatial changes in open and green area potential is a multidimensional endeavor that requires a comprehensive understanding of urban dynamics, planning strategies and community engagement. Going forward, addressing the challenges will contribute to a more holistic understanding of the evolving role of open and green areas in urban settings.

Acknowledgements: This study was prepared within the scope of the research project titled *"Evaluation of Urban Livability Criteria on Çanakkale Province"* numbered FBA-2023-4217 supported by Çanakkale Onsekiz Mart University Scientific Research Projects Commission.

Conflict of Interest Statement: The authors of the article declare that there is no conflict of interest.

Authors' Contribution Statements: The contribution of the authors is equal.

AUTHOR ORCID NUMBERS

Melda AÇMAZ ÖZDEN http://orcid.org/0000-0003-3872-4867

Emre ÖZELKAN http://orcid.org/0000-0002-2031-1610

REFERENCES

Akkemik, Ü., Alp, M. A., Sevgi, O. and Ekşi, M. 2021. Aktif yeşil alanların coğrafi bilgi sistemi platformunda irdelenmesi: Konya Selçuklu örneği. *Jeodezi, Jeoinformasyon ve Arazi Yönetimi Dergisi*, 3(Özel Sayı): 20-25.

Altan, G. and Türkeş, M. 2014. Çanakkale yöresinde oluşan orman yangınlarının hidroklimatolojik karakterleri ve iklim değişimleriyle ilişkisi. *Ege Coğrafya Dergisi*, 20(2): 1-24.

Atabeyoğlu, Ö. and Bulut, Y. 2012. Ordu kenti mevcut yeşil alanlarının değerlendirilmesi. *Akademik Ziraat Dergisi*, 1(2): 67-76.

Atanur, G. S., Mirici, M. E., Ersöz, N. D. and Han, K. 2022. A preliminary assessment on the accessibility of urban green spaces: the case of Bursa,. *GSI Journals Serie A: Advancements in Tourism, Recreation and Sports Sciences*, 5(1): 85-93.

Ayaşlıgil, T. 1997. Kent gelişim sürecinde açık ve yeşil mekan gereksiniminin Çanakkale örneğinde incelenmesi. İstanbul: İ.Ü. Fen Bilimleri Enstitüsü, Doktora Tezi.

Baharash Architecture. 2023. Livable cities: how much green space does your city have?. https://www.baharash.com/liveable-cities-how-much-green-space-does-your-city-have/ (Erişim Tarihi: 26.08.2023)

Benek, S. and Şahağ, A. 2017. Şanlıurfa şehrinde coğrafi bilgi sistemleri (CBS) ve uzaktan algılama (UA) kullanılarak yeşil alanların yeterliliğinin belirlenmesi. *Marmara Coğrafya Dergisi*, 36: 304-314.

Buchavyi, Y., Lovynska, V. and Samarska, A. 2023. A GIS assessment of the green space percentage in a big industrial city (Dnipro, Ukraine). *Ekológia (Bratislava) - Journal of the Institute of Landscape Ecology, Slovak Academy of Sciences*, 42(1): 89-100.

Çabuk, S. 2019. Modern türk şehir planlamasında aktif yeşil alan standardı: Kayseri şehir planlarında zamansal bir inceleme. *Bartın Orman Fakültesi Dergisi*, 21(2): 280-291.

Doygun, H., Atmaca, M. and Zengin, M. 2015. Kahramanmaraş'ta kentleşme ve yeşil alan varlığındaki zamansal değişimlerin incelenmesi. *KSÜ Doğa Bilimleri Dergisi*, 18(4): 55-61.

Finger-Stich, A. 2022. Well-connected urban green infrastructure for more livable and resilient urban systems. "Alınmıştır: *Urban Infrastructure Governance: Innovation, Concepts and Cases.* (ed) Finger, M. and Yanar, N., E. E. Publishing, 238-263.

Gül, A., Dinç, G., Akın, T. and Koçak, A. İ. 2020. Kentsel açık ve yeşil alanların mevcut yasal durumu ve uygulamadaki sorunlar. *İdealKent*, 11(3): 1281-1312.

Haq, S. M. A. 2016. Urban green spaces and an integrative approach to sustainable environment. "Alınmıştır: *Urban Ecology: Strategies for Green Infrastructure and Land Us*e (ed) Etingoff, K., Taylor ve Francis Group, Apple Academic Press, 147-164.

Karafakı, F. Ç. 2016. Niğde kent merkezindeki aktif yeşil alanların kentsel yaşam kalitesine etkileri. *Türk Tarım ve Doğa Bilimleri Dergisi*, 3(3): 184-191.

Kemeç, S. and Abdalkarim, S. H. 2023. Accessibility analysis of urban green space: the case of Erbil city. *ICONARP International Journal of Architecture and Planning*, 11(1): 24-44.

Koca, N. 2005. Environmental and economic effects of Atikhisar dam. *Eastern Geographical Review*, 10(4): 209-233.

Kothencz, G., Kolcsar, R., Cabrera-Barona and Szilassi, P., 2017. Urban green space perception and its contribution to well-being. *International Journal Environmnetal Reserach Public Health*, 14(7): 766.

Köşe, H. and Kara, B. 2021. Söke (Aydın) kenti aktif açık-yeşil alanlarının yeterliliğinin incelenmesi. *Kent Akademisi: Kent Kültürü ve Yönetimi Dergisi*, 14(2): 374-388.

Laan, C. M. and Piersma, N. 2021. Accessibility of green areas for local residents. *Environmental and Sustainability Indicators*, 10: 100-114.

Lee, A. C. K., Jordan, H. C. and Horsley, J.,2016. Value of urban green spaces in promoting healthy living and wellbeing: prospects for planning. *Risk Management and Healthcare Policy*, 8: 131-137.

Lopes, M. N. and Camanho, A. S. 2013. Public green space use and consequences on urban vitality: an assessment of European cities. *Social Indicators Reserach*, 113: 751-767.

Madureira, H. et al. 2015. Urban residents' beliefs concerning green space benefits in four cities in France and Portugal. *Urban Forestry & Urban Greening*, 14(1): 55-64.

Manavoğlu, E. and Ortaçeşme, V. 2007. Konyaaltı kentsel alanında bir yeşil alan sistem önerisi geliştirilmesi. *Akdeniz Üniversitesi Ziraat Fakültesi Dergisi,* 20(2): 261-271.

MGM, 2023. Meteoroloji Genel Müdürlüğü, İllere Ait Mevsim Normalleri. https://www.mgm.gov.tr/veridegerlendirme/il-ve-ilceler-istatistik.aspx?k=H&m=CANAKKALE (Erişim Tarihi: 26.08.2023)

Osmanlı, N. and Akdemir, G. 2011. Aktif yeşil alanların coğrafi bilgi sistemi platformunda irdelenmesi: Konya Selçuklu örneği. *Jeodezi, Jeoinformasyon ve Arazi Yönetimi Dergisi*, 3(Özel Sayı): 20-25.

Özgeriş, M. 2023. Aktif yeşil alanların niceliksel ve niteliksel analizi: Erzurum Adnan Menderes Mahallesi örneği. *Journal of Environmental and Natural Studies*, 5(1): 1-17.

Russo, A. and Cirella, G. T. 2018. Modern compact cities: how much greenery do we need? *International Journal of Environmental Research and Public Health,* 15: 1-15.

Semeraro, T. et al. 2021. Planning of urban green spaces: an ecological perspective on human benefits. Land, 10: 105.

Şenol, F., Öztürk, S. P. and Atay Kaya, İ. 2023. An urban plan evaluation for park accessibility: a case in Izmir (Türkiye). *Urban Design International*, 28: 220-233.

Şensoy, S., M., D. and Ulupınar, U. B. I. 2008. Climate of Turkey. Turkish State meteorological service report. https://www.mgm.gov. tr/FILES/genel/makale/13_turkiye_iklimi.pdf (Erişim Tarihi: 01.07.2023)

WHO, 2017. Urban Green Space: A Brief for Action. https://apps.who.int/iris/handle/10665/344116 (Erişim Tarihi: 27.08.2023)

Wolch, J. R., Byrne, J. and Newell, J. P. 2014. Urban green space, public health, and environmental justice: the challenge of making cities 'just green enough'. *Landscape and Urban Planning*, 125: 234-244.

Yenice, M. S. 2012. Kentsel yeşil alanlar için mekânsal yeterlilik ve erişebilirlik analizi; Burdur Örneği, Türkiye. *SDÜ Orman Fakültesi Dergisi*, 13: 41-47.

Yılmaz, S. and Mumcu, S. 2016. Urban green areas and design principles. "Alınmıştır: *Environmental Sustainability and Landscape Management.* (ed) Efe, R., Cürebal, İ., Gad, A. and Tóth, B., Sofia: St.Kliment Ohridski University Press Sofia, 100-119.

Yücesu, Ö., Korkut, A. and Kiper, T. 2017. Kırklareli kent merkezinin açık ve yeşil alanların analizi ve bir sistem önerisi. *ARTiUM*, 5(2): 22-37.

Yüksek, İ. and Esen, Y. 2023. İzmir İli, Çiğli İlçesi'nin mevcut ve imar uygulama planındaki açık yeşil alan yeterliliğinin irdelenmesi. *Düzce Bilim ve Teknoloji Üniversitesi,* 11: 264-275.

Zhou, X. and Parves Rana, M. 2012. Social benefits of urban green space: A conceptual framework of valuation and accessibility measurements. *Management of Environmental Quality*, 23(2): 173-189.