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Towards sustainable cities: Evaluating the distribution and functionality of green spaces in Atakum

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Abstract

The rapid increase in urbanization has led to a concentration of population and buildings, resulting in reduced green spaces and disrupted ecological balance. This trend negatively affects the well-being and quality of life in cities. Designing green spaces according to planning standards and protecting these areas is crucial for the sustainability of urban environments and the preservation of livable spaces for future generations. In light of these challenges, it is vital to preserve and expand green spaces for both environmental and social reasons. This study aims to evaluate the spatial distribution, size, and adequacy of existing green spaces in 16 neighborhoods of Atakum, a district in Samsun that has recently undergone intense urbanization. It also assesses the accessibility of these spaces using Geographic Information Systems (GIS). The analysis of urban green spaces in Atakum was conducted through spatial and buffer zone analyses using the Spatial Analyst tool in ARCGIS 10.7, revealing the current situation of these vital areas. The findings highlight the significance of green spaces in ensuring livable and sustainable urban development, especially in rapidly urbanizing areas. The research identifies substantial disparities in the distribution and accessibility of open and green spaces in Atakum, indicating an urgent need for improved urban planning. Using GIS analysis, the study compares the availability of green spaces against the World Health Organization's recommended standard of 10 m² per person. Results show that many neighborhoods fall short of this benchmark, a situation exacerbated by rapid urbanization and population growth. This deficit adversely impacts residents' physical and mental well-being, as adequate green space is essential for public health, social cohesion, and environmental sustainability. Additionally, the analysis reveals that existing green spaces primarily serve recreational purposes and lack multifunctionality, limiting their usability for diverse community needs. To address these deficiencies, the study recommends a multi-faceted urban planning approach, emphasizing the equitable distribution of green spaces, the design of multifunctional areas, and robust community engagement in the planning process. It also stresses the need for stronger legal frameworks to preserve and create green spaces, advocating for the integration of research and data analysis to inform evidence-based policies. In conclusion, this research contributes to understanding how urban green spaces can enhance livability, particularly in the context of climate resilience. The findings underscore the importance of strategic planning in fostering sustainable and inclusive urban environments in Atakum, offering valuable insights for future urban studies in similar contexts.

Keywords: equity in green space distribution, open and green spaces, urban planning, multifunctional areas, urbanization

1. Introduction

Open and green spaces not only enhance the quality of life in cities but also play a critical role in the ecological and environmental sustainability of urban areas. The size, accessibility, function, and spatial organization of these spaces are crucial elements in urban planning. The design and planning of open and green spaces vary in content, size, and function across countries and cities.

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These variations are influenced by natural features such as topography, soil capability, vegetation, climate conditions, the population served, and the characteristics of the settlement (Ersoy, 2015).

Urban open and green spaces include a range of areas such as parks, gardens, playgrounds, sports fields, forests, cemeteries, conservation zones, and medians along roads. Green spaces are designed for various purposes, including acting as buffer zones to protect natural resources and historical artifacts, and to prevent unplanned urban sprawl. On a neighborhood scale, one of the key benefits of green spaces is their contribution to human health. Their ecological functions significantly aid in air purification by balancing gases that cause air pollution and producing oxygen. Moreover, green spaces offer opportunities for residents to improve their mental and physical well-being through sports and recreational activities. Socially, they promote social relationships and enhance community solidarity (Ersoy, 2015). Green spaces serve a wide array of purposes, including nature conservation, recreation, ecology, land organization, aesthetics, and fostering social interactions (Bilgili, 2009). Given these benefits, the development of green spaces is integral to the healthy functioning of the urban ecosystem. However, for these areas to be truly effective, they must meet criteria of accessibility, sufficiency, and integration.

The primary factors determining the adequacy and accessibility of urban open and green spaces are their size and spatial distribution. Today, rising population densities and unplanned urban development are contributing to problems such as the reduction of green spaces, the loss of their functionality and productivity, and their insufficient proximity to residential areas. This situation has a significant impact on the quality of life for urban residents. This study aims to analyze the current status of open and green spaces in the Atakum district of Samsun, particularly regarding accessibility, sufficiency, and integration. Additionally, areas within the district that require improvement will be identified and discussed.

The intense urbanization in the Atakum district over the past 20 years has led to a rapid population increase, significantly raising the demand for infrastructure and urban amenities. This growing demand has placed immense pressure on existing green spaces, making sustainable planning and preservation of these areas a necessity. The protection of open and green spaces is not only crucial for improving urban life quality but also for maintaining ecological balance. Therefore, the planning and management of such areas should be regarded as essential components of urban development. This is the primary reason for selecting Atakum as the study area. The district consists of 57 neighborhoods, with this study focusing on 16 neighborhoods to assess urban life quality.

Open and green spaces are vital elements of urban life that enhance living standards by preserving the natural environment, improving environmental quality, and providing areas for recreation and social interaction. These spaces have been defined from various perspectives by experts across different disciplines. According to the Planned Areas Zoning Regulation, published in the Official Gazette (Resmi Gazete) on July 3, 2017 (issue no. 30113), green spaces are defined as "the total of playgrounds, children's parks, recreational areas, picnic and entertainment zones, as well as recreational and activity areas allocated for public use (including metropolitan-scale fairs, botanical and zoological gardens, and regional parks)." Keleş (1980) defined open spaces in the *Urban Sciences Dictionary of Terms* as "urban sections left in their natural state or allocated for agricultural or non-residential recreational purposes, outside of constructed areas where people conduct their daily lives." He further described green spaces as "parks, tree-lined roads, and similar public areas arranged by municipalities in cities and towns for activities such as resting, walking, and children's play, which help soften the city's concrete appearance." Although it is theoretically possible to distinguish between open and green spaces, in practice, the line between them is often blurred. Therefore, it may be more practical to evaluate these spaces collectively as "open and green spaces," which helps avoid confusion and fosters a more holistic understanding.

Open and green spaces play a crucial role in restoring the disrupted balance between nature and people in cities, improving urban living conditions. In addition to shaping the identity and

character of cities, these spaces offer high potential for recreational activities. They are open-air areas that provide urban residents with opportunities to enjoy their environment, rest, engage in sports, and socialize, all while contributing to the city's unique identity (Thompson, 2002). Moreover, these spaces contribute not only to the aesthetic and physical appeal of cities but also to the regulation of the microclimate and the organization of pedestrian and vehicle traffic. They positively influence social interactions, helping to strengthen social bonds, while also raising awareness of nature and the environment (Gül & Küçük, 2001).

In the literature, urban green spaces are generally classified based on their purpose, ownership, function, and location. According to ownership, they are grouped into three main categories: public spaces, semi-private spaces, and private spaces (Gezer et al., 2009). Public spaces include areas like city and neighborhood parks, urban forests, groves, cemeteries, botanical gardens, fairgrounds, exhibition areas, road medians, sports fields, zoos, picnic spots, and national parks. Semi-private spaces, which are not accessible to all residents and may be limited to specific groups or require a fee, include school grounds, military zones, public institution properties, factory sites, campuses, racetracks, and golf clubs. Private spaces, on the other hand, are for the exclusive use of their owners or residents and include residential gardens, terrace and rooftop gardens, facility gardens, and urban agricultural gardens (Gül et al., 2020).

Functionally, green spaces are divided into two categories: active and passive. Active green spaces, such as parks, children's playgrounds, and sports fields, are designed for public use and recreation (Official Gazette (Resmi Gazete), November 2, 1985, No. 29030). Passive green spaces, which include noise barriers, erosion-preventing buffer zones, and medians, play a significant role in improving environmental conditions and organizing urban spaces (Kaya, 2022). Both types of green spaces are essential for enhancing urban life and preserving the natural environment. In terms of hierarchical organization, green spaces are classified into five groups: residential area playgrounds, neighborhood parks, district parks, sector parks, and city parks (Ersoy, 2015). These classifications help cities meet green space needs and manage them effectively.

Green spaces significantly influence urban life quality and must adhere to certain standards in terms of quantity and accessibility. The process of organizing green spaces and setting quantitative standards began in England in the 1800s. Today, ensuring access to green spaces is essential for meeting social needs, particularly in densely populated cities (Gül et al., 2020). Green space planning and policies are central to sustainable urban life, contributing to both public well-being and environmental sustainability.

Urban green spaces have a profound impact on the health and quality of life of city residents. International organizations like the United Nations and the World Health Organization (WHO) have established guidelines for the ideal and minimum amount of green space per person (WHO, 2017). While these standards vary across countries, they serve as benchmarks for cities worldwide. The United Nations recommends 30 m^2 per person, the European Union suggests 26 m^2, and the United States recommends 18 m^2 (Şenik & Uzun, 2022). The WHO suggests an ideal of 50 m^2 of green space per person, with a minimum of 9 m^2 acceptable in urban areas (Badiu et al., 2016; WHO, 2017). Some cities have set even higher standards, such as 40 m^2 in London and 48.5 m^2 in Los Angeles (Gül et al., 2020). These benchmarks are considered essential for fostering a healthy urban environment. However, current regulations in Turkey fall short of these international standards and do not fully meet the green space needs of Turkish cities.

Legal regulations, zoning plans, and ordinances in Turkey dictate the allocation of green space to improve urban life and create sustainable environments (Önder & Polat, 2012). Historically, the amount of green space per person was first proposed at 4 m^2 in 1933 under the Law on Construction Roads (Official Gazette (Resmi Gazete), June 21, 1933, No. 2433). However, this was revised with the Zoning Law of 1956, which set a minimum of 7 m^2 per person. In 1975, the Metropolitan Area Master Plan proposed 9.25 m^2 per person. Further updates in 1999 increased the requirement to 10 m^2 per person in urban areas (Official Gazette (Resmi Gazete), September 1, 1999, No. 23804)

(Table 1). However, green space standards in Turkey have seen little improvement since 1999, and current standards still do not reflect population density variations (Özdede et. al., 2021). Considering the importance of green spaces, this issue warrants urgent review and updating.

Table 1 Legal Regulations Regarding Open and Green Spaces in Turkey

Law	Total (m²/person)
Green Spaces under the Law on Construction Roads, No. 2290	4.00
Zoning Law, No. 6875/1605 (July 6, 1956)	7.00
Metropolitan Area Master Plan (Dec. 22, 1975)	9.25
Zoning Law, No. 3194 (Nov. 2, 1985)	7.00
Zoning Law, No. 3194 Amendment (Sept. 1, 1999)	10.00

By comparing international best practices and green space standards, Turkish urban planners can identify areas for improvement, develop more sustainable policies, and address the shortcomings in green space accessibility. These international approaches can serve as valuable guides in overcoming the challenges faced by Turkish cities.

Green space standards in Turkey are generally determined through a quantitative approach based on the amount of green space per capita. However, a purely quantitative approach is not sufficient; it is equally important to consider the city's physical characteristics (such as climate, topography, location, etc.), socio-cultural factors, economic conditions, and usage frequency (Eminağaoğlu & Yavuz, 2010).

As stated in Appendix 2 of the Regulation on Spatial Plans (MEURT, 2014: Türkiye Cumhuriyeti Çevre ve Şehircilik Bakanlığı- Ministry of Environment and Urbanization of the Republic of Türkiye), open and green spaces are classified into various types, with specific standards set for the amount per capita (Table 2). This appendix serves as an important guide for the planning of open and green spaces in cities. By determining the size and types of these areas, it mandates the preservation and proper planning of such spaces to improve urban livability standards and ensure environmental sustainability.

Table 2 Green Spaces and Their Standards According to the MPYY (MPYY: Regulation on Spatial Plans) (Source: Resmi Gazete, 2014) (Appendix-2 Table)

Open green spaces	Standard (m²/person)
In district-level planning	Children's playground
Park	
Square	
Neighborhood sports field	
Botanical park	
Picnic area	
Recreation area	
In provincial-level planning	Zoo
City forest	
Areas to be afforested	
Fairgrounds, festivals, and carnival areas	
Hippodrome	

Accessibility is a key factor that determines the frequency of use of open and green spaces and enhances the well-being of users. To improve the quality of urban life, it is crucial for all residential areas to have accessible open and green spaces at different hierarchical levels. This context emphasizes the importance of planning where green spaces will be located in cities and highlights the critical significance of the concept of 'accessibility' (Schipperijn et al., 2010). Strategically planning green spaces allows city residents to be in closer contact with nature, thereby improving their quality of life. Therefore, prioritizing accessible and sustainable green spaces in urban planning is essential.

Standards for accessibility to open and green spaces vary from country to country, just as they do for quantitative standards. According to the European Commission's Urban Audit report, users should be within a maximum walking distance of 15 minutes from green spaces. These distances vary according to the types of green spaces: for example, it should take no more than 10 minutes to reach children's playgrounds, no more than 20 minutes to reach neighborhood parks, and no more than 30 minutes to reach city parks. As a general rule, all users should have access to green spaces within 300 meters (approximately a 5-minute walk) from their homes (Gül et al., 2020).

Access to open and green spaces in cities can be evaluated using various analyses conducted with Geographic Information Systems (GIS). GIS-based accessibility analyses include Buffer analysis, which creates a buffer around an area to assess accessibility; Network analysis, which evaluates the accessibility of services in a particular area; Kernel Density analysis, which shows the distribution of density; and New Closest Facility analysis, which identifies the nearest service point (Tango & Topçu, 2021).

Accessibility refers to the ease with which open and green spaces can be reached on foot, via public transport, or by other means of transportation (Ergin et al., 2020). Effective service radii encompass the areas served by these spaces and the population living in those areas. The effective service radii vary depending on the type, size, and location of the open green spaces within the urban fabric (Table 3).

Table 3 Standards for Open and Green Spaces (Source: Tülek & Mirici, 2019 ; Ersoy, 2015)

Parks	Effective Service Area Radius (m)	Population Served	Ideal Size (acres)
Children's Playground	200-600	Neighborhood	8-16
Sports Area	2000	Entire city	40-60
Neighborhood Park	500-1500	3,500-5,000 people	20-40
District Park	1000-2500	15,000-30,000 people	160-400
City Park	1000-10,000	Entire city	40-800
Regional Park	25,000-100,000	Region	2000-4000
National Park	Entire country	Country	Variable

Moreover, the MPYY in our country also contains provisions regarding walking distances. The Regulation on Spatial Plans, which was published in the Official Gazette (Resmi Gazete) on June 14, 2014, Issue No. 29030, and came into effect, specifies a walking distance of 500 meters for children's playgrounds, play areas, and open neighborhood sports fields. In the buffer analysis conducted for green spaces, the 500-meter radius circles defined in the regulation were used for analysis (Regulation on Spatial Plans, Article 12/2; MEURT, 2014).

2. Material and Method

As of the end of 2022, Samsun province, with a population of 1,368,488, ranks 16th in Turkey. The province has a total of 17 districts, with its central districts being Atakum, İlkadım, Canik, and Tekkeköy. Due to rapid development in recent years, Samsun has become a province where construction has increased, and its urban boundaries have expanded. This transformation has also brought attention to Atakum, which is part of the study area, as its urban structure has expanded (Atakum Municipality, 2023). Atakum, which gained district status in 2008, is one of the fastest-growing districts in terms of population in Samsun. While its population was 107,953 in 2008, it rose to 245,328 by 2023 (TÜİK, 2024). The district, which was primarily a coastal settlement with secondary residences in the early 2000s, has spread inland (southward) in recent years due to population growth, becoming a densely built area. The district, which consists of 56 neighborhoods, includes 16 neighborhoods within the study area (Figure 1).

Figure 1 Study area (Source: Prepared by the author using Google Earth Pro, 2024)

The populations and densities of the neighborhoods subject to the study are provided in Table 4. When examining the table, it is observed that the neighborhoods with the highest population densities are Cumhuriyet, Yenimahalle, Mimarsinan, and Mevlana.

Table 4 Neighborhood Populations and Densities (People/ha) (Source: Population data from index (2024), area data calculated by the author using vector data obtained from Atakum Municipality and GIS) (Atakum Municipality, 2023)

Neighborhood Name	Population (people)	Area (ha)	Gross Density (people/ha)
Atatepe	3659	131.5	27.8
Balaç	3041	174.2	17.4
Büyükkolpınar	3191	184.4	17.3
Cumhuriyet	27845	148.3	187.7
Çobanlı	2317	74.9	30.9
Denizevleri	3584	78.1	45.8
Esenevler	20315	148.4	136.8
Güzelyalı	4253	78.4	54.2
İstiklal	11237	154.5	72.7
Körfez	20672	639.6	32.3
Küçükkolpınar	8690	99.5	87.3
Mevlana	17111	153	111.8
Mimarsinan	23797	160.2	148.5
Yenimahalle**	57301	365	156.9
Yeşildere	3532	138.1	25.5
Total	**210545**	**2728.1**	**77.17**

Note: Due to the large size and high population of Yenimahalle neighborhood, it was divided by Samsun Governorship's approval (dated 05.10.2023, number 67651) under Article 9 of the Municipal Law No. 5393, and the area east of Ali Gaffar Okkan Street was named Atakent Neighborhood. Since demographic data for the study could not be found for these two neighborhoods separately, Yenimahalle's boundaries before the decision were used (Atakum Municipality, 2023).

The data for this study were collected from both primary and secondary sources. Primary data were gathered through informative interviews with officials from the Atakum Municipality's Urban Planning Department. The main sources of secondary data include books, articles, and theses.

The study focused on evaluating and analyzing the open and green spaces in the built-up areas of Atakum district, Samsun province, using geographic information systems (GIS) methods. Aerial photographs and maps of the area were used as materials.

The research conducted in the built-up region of Atakum district followed a method comprising four stages. The steps of the method used in the study are shown in Figure 2.

-Identifying the location of urban green spaces using satellite images and digital data obtained from relevant institutions.

-Conducting a literature review to establish the conceptual framework and determine appropriate standards in terms of accessibility and adequacy.

-Creating quantitative and spatial data on open and green spaces, calculating service areas, and mapping them (buffer zone analysis – spatial analyses) using ArcGIS 10.7 software.

-Evaluating the spatial adequacy and accessibility of open and green spaces.

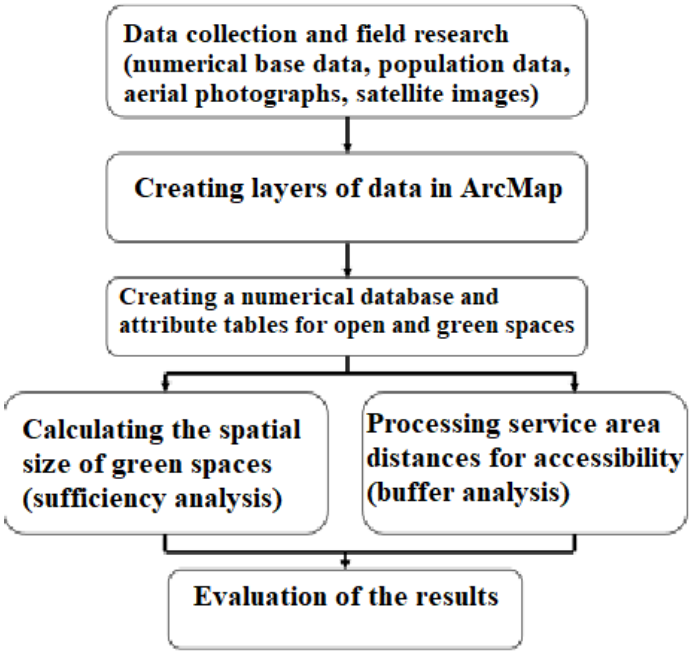

Figure 2 Methodology diagram

In the study, open and green spaces located in 16 neighborhoods were analyzed, focusing on the extent to which neighborhood parks meet population needs, the adequacy of recreational areas such as children's playgrounds and outdoor sports facilities, and the amount and accessibility of existing open and green spaces in consideration of neighborhood population sizes. Both parks serving all residents and children's playgrounds were included in the evaluation. The adequacy analysis was conducted by calculating the green space per capita based on the neighborhood populations, while the accessibility analysis was carried out using buffer zone analysis to map the

service area of green spaces based on walking distances. The processes carried out using the buffer analysis technique were performed in a simple and intuitive manner, as fewer data sets were used. In this technique, factors such as the topography of the region and road availability were not considered when determining distances.

Parks and children's playgrounds were digitized using GIS with satellite images and updated maps. Information on the size and type of green spaces was processed into the program as attribute tables. Demographic data, including the population of each neighborhood, were obtained from TÜİK to calculate the green space per capita. GIS (ArcGIS 10.7) was used to assess service areas through buffer zone analysis.

3. Results

In the study, open and green spaces were identified in 16 neighborhoods of Atakum district. In this context, open and green spaces in the 16 neighborhoods within the sample area were digitized using ArcGIS 10.7 software and processed as current status data. According to the findings, the total amount of open and green space is 958,361 m², and the amount of active green space is 563,568 m². As for passive green spaces, the area contains 296,041 m² of medians, and 9,700 m² of open squares (Figure 3). Semi-private (schoolyards, military zones, areas belonging to public institutions, factory sites, campuses, racetracks, and golf-tennis clubs) and private green spaces (residential and site gardens, agricultural lands) were not included in the study.

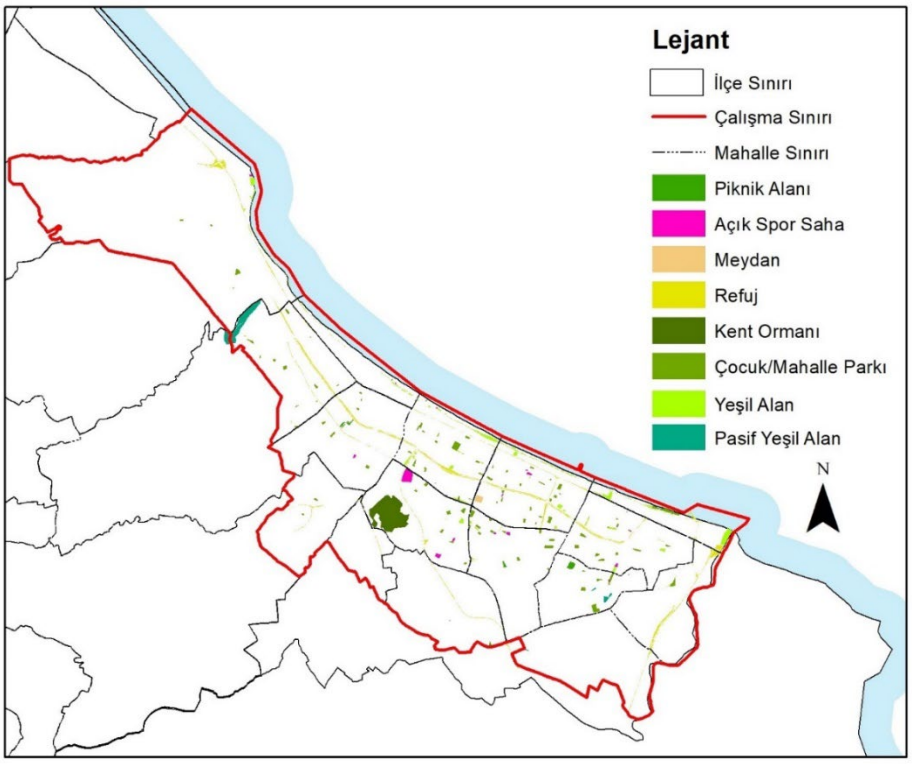

Figure 3 Analysis of the current open and green spaces in the study area (Source: Prepared by the author using ArcGIS 10.7)

As a result of the examination, it was found that İstiklal neighborhood has the highest amount of open and green space. The reason for this is the presence of a 195,345 m² urban forest within the neighborhood boundaries. On the other hand, there are no active green spaces in Büyükkolpınar and Çobanlı neighborhoods. The green spaces in these neighborhoods consist only of road medians. These areas are still in the development phase, with existing structures primarily consisting of detached houses or residential complexes. While there are children's playgrounds within the residential complexes, there are no public active green spaces.

The amount of green space per capita was calculated by dividing the total amount of green space in each neighborhood by the population of that neighborhood. In this way, the compliance of open and green spaces with the standards outlined in the regulations and their spatial adequacy was determined. If this ratio does not fall below 10 m² per capita according to the relevant legal regulations, the area is considered sufficient. Figure 4 is a thematic map showing the neighborhoods where the ratio of open and green space per capita is above and below 10 m². It was determined that all neighborhoods, except for Denizevleri, İstiklal, and Yeşildere, fall below the open and green space standard (Table 5).

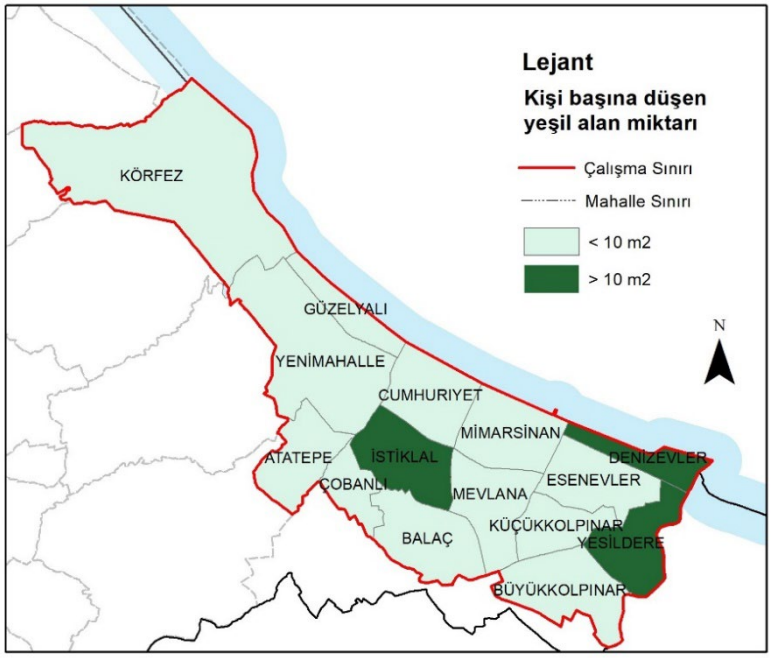

Figure 4 Per capita green space by neighborhood (Source: Prepared by the author using ArcGIS 10.7)

It is observed that İstiklal Neighborhood has the highest amount of open and green space per capita, with 22.10 m². This high ratio is largely due to the urban forest within the neighborhood boundaries, making its green space ratio significantly higher than other neighborhoods. Additionally, Denizevleri (20.09 m²/person) and Yeşildere (11.85 m²/person) are among the other neighborhoods where the amount of green space per capita is above the standard. All remaining neighborhoods fall below 5 m² per person, far below the standard.

Table 5 Green Space Amount and Per Capita Green Space by Neighborhood (Source: Prepared by the author using ArcGIS 10.7 based on index population data)

Neighborhood	Population (people)	Open and Green Space (m²)	Green Space Per Capita (m²)
Atatepe	3659	6785	1.85
Balaç	3041	9967	3.27
Büyükkolpınar	3191	13085	4.10
Cumhuriyet	27845	96915	3.48
Çobanlı	2317	5621	2.42
Denizevleri	3584	72023	20.09
Esenevler	20315	47168	2.32
Güzelyalı	4253	22935	5.39
İstiklal	11237	248342	22.10
Körfez	20672	54025	2.61
Küçükkolpınar	8690	37810	4.35
Mevlana	17111	41424	2.42
Mimarsinan	23797	95295	4.00
Yenimahalle	57301	165084	2.88
Yeşildere	3532	41882	11.85
TOTAL	**210545**	**958361**	**4.55**

When evaluating the adequacy of open and green spaces, several key factors must be considered. First, the size and distribution of the area should be examined. While the total amount of green space in a city may be sufficient, if these areas are not evenly distributed, access to green spaces may be limited for city residents. Therefore, the adequacy of green spaces is not only about quantity but also accessibility. Furthermore, it is important that open and green spaces serve different purposes. Spaces catering to various users are positively evaluated in terms of adequacy. In the study area, children's playgrounds are the most common, and these areas also include open sports areas and rest areas.

To assess the accessibility of open and green spaces, a buffer zone analysis based on distance was applied. A metric radius distance was used to measure the distance, determining how accessible green spaces are for users. The service areas consist of publicly accessible areas serving the local population. Accessibility to open and green spaces in the study area was evaluated using the buffer analysis in ArcGIS 10.7. The distance standards were applied according to the radius distances defined in the regulations. According to the regulations, a walking distance of 500 meters was used to determine the service areas for children's parks, playgrounds, and open neighborhood sports areas. Since the urban forest and picnic areas have an impact beyond the neighborhood scale, the multiple buffer option was used for these areas, selecting distances of 1000m, 1500m, 2000m, and 2500m for the urban forest, and 1000m, 2000m, and 3000m for the picnic area service area. The results of the analysis are presented in Figures 5a, 5b, 5c, and 5d.

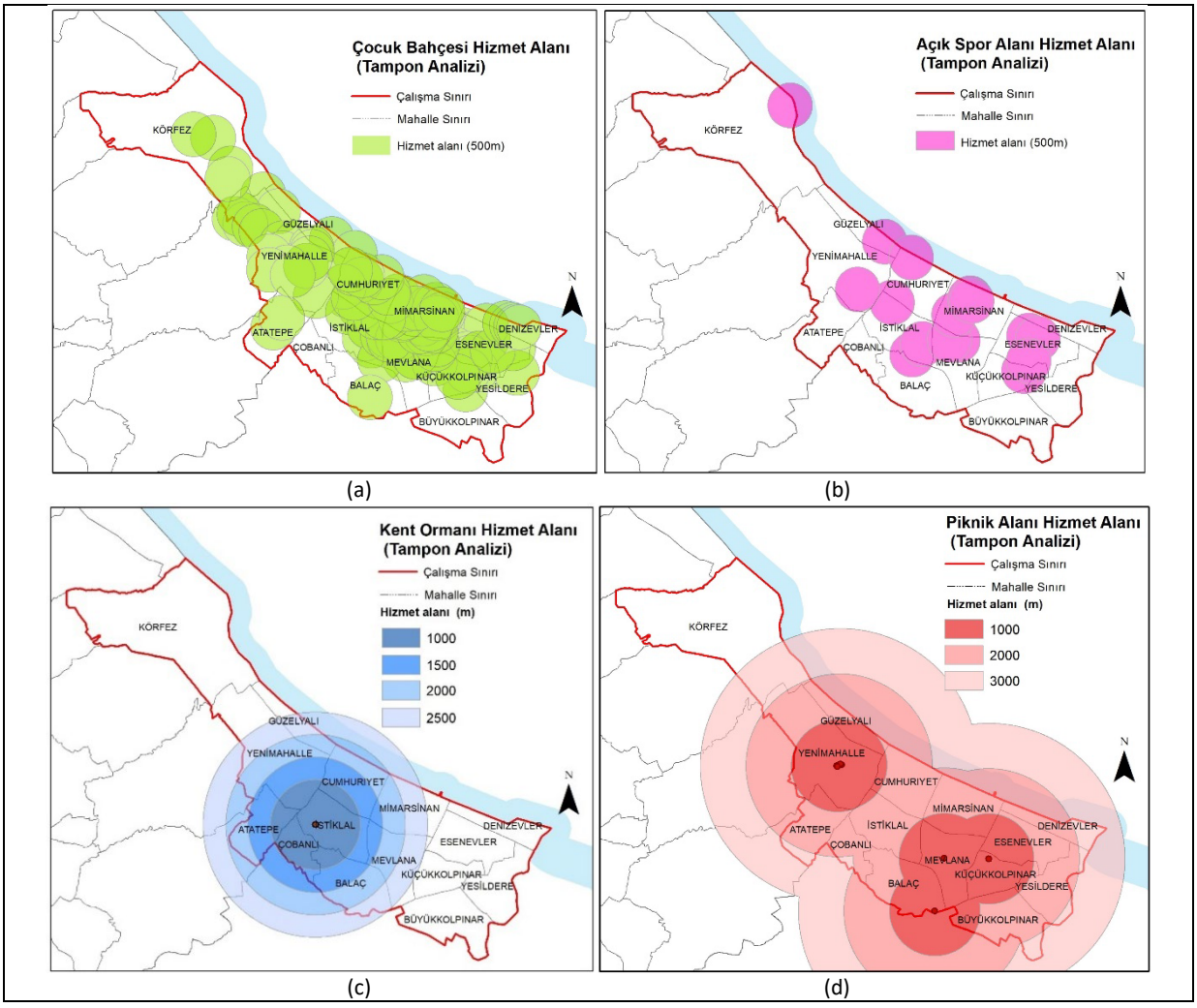

Figure (5a) Children's park service area; **(5b)** Open sports area service area; **(5c)** urban forest service area; **(5d)** Picnic area service area (Source: Prepared by the author using ArcGIS 10.7)

In our country, when calculating per capita green space in adequacy analyses, areas that are not actively used by urban residents, such as road medians (refüj) and passive green spaces, are typically included. However, in this study, the adequacy analysis within the scope of the accessibility analysis was conducted solely based on actively used green spaces. The accessibility criteria also encompass aspects such as access for individuals with disabilities, safety—particularly for women and children—proximity to public transportation, and usability by people from various demographic groups. These issues were not included in the study as the study area is large and the scope is at a higher scale.

According to the analysis results, while children's parks remain within the accessible service areas at the neighborhood scale, open sports areas are found to be inaccessible in Körfez, Yenimahalle, Atatepe, Çobanlı, Balaç, Büyükkolpınar, and Yeşildere neighborhoods.

4. Discussion

In this study, the current situation of open and green spaces in the Atakum district was examined in terms of accessibility and adequacy, and their services to urban residents were evaluated. The research findings provide important insights, both positive and negative.

When examining the accessibility of open and green spaces by neighborhoods, it was determined that these areas are not adequately distributed in surrounding neighborhoods, and significant challenges in access may arise. The per capita ratios of open and green spaces are below both the standards recommended by the World Health Organization and those specified in our country's relevant regulations. The research results indicate that, due to rapid urbanization and population growth in the region, the existing green spaces are insufficient, and the local population cannot fully benefit from these areas. The lack of adequate open and green spaces negatively impacts both physical and mental health. It is necessary to increase legal and economic incentives for the protection of existing open and green spaces in the study area and to create new ones.

This study investigates the current state of open and green spaces in the Atakum district, focusing on their accessibility and adequacy, as well as the services they provide to urban residents. The findings reveal significant insights regarding the spatial distribution and availability of these essential resources.

Access to green spaces has been linked to numerous health benefits, including reduced stress levels, increased physical activity, and improved overall quality of life (Kuo, 2015). Furthermore, these spaces are crucial for biodiversity, providing habitats for various species and contributing to ecological resilience (Gómez-Baggethun & Barton, 2013). However, the analysis conducted in this study indicates that many neighborhoods in Atakum fall short of the recommended standard of 10 m^2 of green space per person, which is a guideline set forth by both the World Health Organization and local regulations. This shortfall not only limits residents' access to essential recreational and restorative environments but also reflects the broader challenges posed by rapid urbanization.

The analysis indicates that open and green spaces are not uniformly distributed across neighborhoods, leading to accessibility challenges for residents. Urban green spaces are crucial for enhancing the quality of life, promoting physical activity, and ensuring social interaction among community members (Wolch et. al., 2014). However, in Atakum, many neighborhoods experience a lack of accessible green areas, particularly in densely populated zones.

Research shows that neighborhoods with poor access to green spaces can contribute to social inequality and adverse health outcomes (Beyer et al., 2014). The results of this study align with these findings, revealing that many residents, especially in areas like Körfez and Yenimahalle, face significant barriers to accessing recreational spaces. Addressing these disparities is essential for fostering equitable health benefits across diverse socio-demographic groups.

Moreover, the per capita ratios of open and green spaces in Atakum fall below both the World Health Organization (WHO) recommendations and national regulations. The WHO suggests a

minimum of 9 m² of green space per person to promote physical and mental well-being (WHO, 2017). However, our findings indicate that most neighborhoods have significantly lower ratios, underscoring the insufficiency of existing green areas.

The scarcity of adequate open and green spaces has been linked to a decline in residents' physical and mental health. Research has consistently shown that access to green spaces can reduce stress, enhance mood, and encourage physical activity (Mitchell & Popham, 2008; Niemelä et al., 2010; Jennings et al., 2012; Hartig et al., 2014). The lack of sufficient green spaces in Atakum may therefore contribute to higher rates of chronic diseases and mental health issues among residents.

The rapid urbanization and population growth in Atakum have exacerbated the issue of inadequate green spaces. As cities expand, green areas often face encroachment from development, leading to their degradation or disappearance. This phenomenon is evident in Atakum, where urban sprawl has resulted in the loss of accessible open spaces. The findings indicate that existing green spaces are underutilized, primarily due to their insufficient quantity and accessibility, limiting their potential benefits for the community.

Recommendations for Improvement; To address these challenges, it is imperative to enhance the protection of existing open and green spaces while simultaneously investing in the creation of new ones. Urban planning policies should prioritize the integration of green infrastructure into development projects, ensuring that new housing and commercial areas include accessible green spaces (Tzoulas et al., 2007). Additionally, the implementation of legal and economic incentives to preserve existing green areas is crucial. Initiatives such as public-private partnerships could facilitate the development of community parks and recreational facilities, improving overall accessibility and fostering community engagement.

In conclusion, the study highlights the critical need for strategic planning and policy interventions to ensure adequate and equitable access to open and green spaces in Atakum. By prioritizing green space development and protection, urban planners and policymakers can significantly enhance the quality of life for residents, promote public health, and contribute to sustainable urban development.

5. Conclusion

One of the greatest needs of cities is effective planning to ensure the balanced distribution of open and green spaces throughout the urban area. It should not be forgotten that these areas not only add aesthetic value but also support the physical and mental health of all segments of society, strengthen social ties, and promote environmental sustainability.

It is crucial to have green spaces that individuals from different age groups and socio-economic levels can easily access. Additionally, these areas should be planned to serve multiple purposes, such as sports activities, recreation, cultural events, and education, rather than just functioning as parks. Open and green spaces of varying hierarchies (such as neighborhood parks, community parks, city parks, and regional parks) provide various user groups with opportunities for physical activity as well as socialization.

This study highlights the current state of open and green spaces in the urban settlement of Atakum and the importance of these areas in urban life. The analyses show that most neighborhoods are inadequate in terms of active green spaces and that the standard of 10 m² of green space per person, as specified in legal regulations, has not been met. Although the accessibility of existing green spaces may seem sufficient, an examination of their sizes reveals that their capacity to serve the surrounding population is quite limited.

Numerous studies in the literature exist on the importance of urban open and green spaces for cities. However, there is currently no study focused on this issue specifically in the province of

Samsun or the district of Atakum. Therefore, this study stands out as one of the first to evaluate the adequacy of open and green spaces in Atakum, serving as an important reference.

The findings of this study hold significant importance for urban planning and management. To create sustainable cities, the existence of urban open and green spaces and their spatially appropriate planning and design are critical elements that must be considered.

6. Recommendations

The findings of this study underscore the pressing need for effective urban planning that ensures the balanced distribution of open and green spaces throughout Atakum. Such spaces are not merely aesthetic enhancements; they play a pivotal role in promoting the physical and mental health of the community, enhancing social cohesion, and fostering environmental sustainability. As urban areas continue to grow, the importance of accessible green spaces becomes even more critical in addressing various public health concerns, such as urban heat islands, air pollution, and mental well-being.

In light of these findings, it is recommended that urban planners and policymakers take a multi-faceted approach to address the deficiencies in green space provision:

Prioritize Equitable Distribution: Planning efforts should focus on ensuring equitable access to green spaces across all neighborhoods, particularly those that are currently underserved. Implementing policies that prioritize the development of parks and green corridors in high-density areas can alleviate accessibility issues.

Multifunctional Spaces: Green spaces should be designed to serve multiple purposes, catering to various community needs, such as recreation, sports, cultural events, and education. For instance, integrating community gardens, playgrounds, and open-air classrooms can enhance the utility of these areas, making them more inclusive and beneficial for diverse demographics.

Community Engagement: Involve local residents in the planning and design processes of green spaces to ensure that these areas meet the specific needs and preferences of the community. Participatory approaches can enhance community ownership and stewardship of green spaces, leading to better maintenance and utilization.

Strengthen Legal Frameworks: The establishment and enforcement of regulations that promote the preservation and creation of green spaces is vital. Local governments should consider implementing green space preservation ordinances and providing incentives for developers to include public green spaces in new developments.

Integrate Research and Data Analysis: Future studies should continue to explore the relationship between urban green spaces and public health outcomes, as well as their socio-economic impacts. This research can inform evidence-based policies and contribute to the growing body of literature that underscores the importance of urban greenery in enhancing livability (Gianfredi et al., 2021).

Climate Resilience: As cities face the challenges of climate change, urban green spaces can serve as critical components of climate adaptation strategies. Green areas can mitigate urban heat effects, manage stormwater, and enhance urban biodiversity, contributing to the overall resilience of urban ecosystems (Van Doorn & McPherson, 2018).

In conclusion, this study highlights the current inadequacies in open and green space provision in Atakum and emphasizes the need for strategic urban planning to foster sustainable, healthy, and inclusive urban environments. By prioritizing the development and equitable distribution of green spaces, city planners can significantly enhance the quality of life for residents and contribute to the overall resilience and sustainability of urban areas.

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