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Analysis of Sufficiency and Accessibility of Active Green Areas in Cukurova

Fatih Adıgüzel*¹, Mesut Doğan²

¹ Department of Geography, Institute of Social Sciences, Istanbul University, Istanbul, Turkey

e-mail: fadiguzel@nevsehir.edu.tr

ORCID ID: 0000-0002-5978-2495

² Department of Geography, Faculty of Arts and Sciences, Istanbul University, Istanbul, Turkey

e-mail: esutan@istanbul.edu.tr

ORCID ID: 0000-0002-4926-5769

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Corresponding Author:

*E-mail:

*fadiguzel@nevsehir.edu.tr

ABSTRACT

In this study, the adequacy and accessibility of active green areas in Adana Province Cukurova district were tried to be determined by using field study, GIS, and numerical data. For this purpose, active green areas in 10 urban neighborhoods of the Cukurova district were determined. These areas are neighborhood parks, playgrounds, and neighborhood parks. By comparing the neighborhood areas where these active green areas are located, population data, and the area of active green areas, their suitability, and adequacy with green space standards were determined. Only 1 neighborhood in the study area complies with the total green space standards. 9 neighborhoods are not sufficient in terms of active green areas. The fact that the per capita values of active green spaces are far below the 10 m² / person norm recommended by the Ministry of Environment and Urbanization in urban scale, clearly shows the effectiveness of the Development Plans on active green areas. It has been observed that accessibility to active green areas is not sufficient in the Cukurova district. This shows that the green areas in the district are not distributed regularly.

ÖZ

Anahtar Kelimeler:

Aktif Yeşil Alan,

Çukurova,

CBS,

Yeterlilik,

Ulaşılabilirlik .

Bu çalışmada, Adana ili Çukurova ilçesindeki aktif yeşil alanların yeterliliği ve ulaşılabilirliği arazi çalışması, CBS ve sayısal veriler kullanılarak tespit edilmeye çalışılmıştır. Bu amaç için, Çukurova ilçesinin şehir vasfındaki 10 mahallesindeki aktif yeşil alanlar belirlenmiştir. Bu alanlar mahalle parkı, çocuk parkı ve semt parklarıdır. Bu aktif yeşil alanların bulunduğu mahalle alanları, nüfus verileri ve aktif yeşil alanlarının yüzölçümleri kıyaslanarak, yeşil alan standartlarına uygunluğu ve yeterliliği belirlenmiştir. Çalışma alanında sadece 1 mahalle toplam yeşil alan standartlarına uymaktadır. 9 mahallede aktif yeşil alan açısından yeterli değildir. Aktif yeşil alanların kişi başına düşen değerlerin Çevre ve Şehircilik Bakanlığı'nın kent ölçeğinde önerdiği 10 m² /kişi normunun çok altında kalması, aslında İmar Planlarının aktif yeşil alan üzerindeki etkinliğini açık olarak göstermektedir. Çukurova ilçesinde aktif yeşil alanlara ulaşılabilirliğinin de yeterli olmadığı görülmüştür. Bu da ilçede yeşil alanların düzenli bir şekilde dağılmadığını göstermektedir.

1. Introduction

The green areas we see and use in our cities today have emerged as a solution to the problems caused by industrial cities. One of the solutions proposed to solve the multidimensional problems caused by the rapid urbanization that emerged with industrialization was to create more open and green spaces in cities [1-12]. However, the ever-increasing urban population prevents the production of open and green areas from being successful and the dimensions of the problem are increasing day by day. In most of the big cities that are the scene of industrialization and urbanization movements, the increasing building density and unplanned development of other needs with the population increase, the

disconnection with rural areas, the unconscious consumption of the existing open and green areas, and the mechanization of life negatively affect the people of the city psychologically and cause them to wear out. [13-27]. It is a fact that the possibilities of cities, which are getting more and more intense in terms of structure and people, in terms of green areas are becoming more and more inefficient. The proportion of open-green areas reserved for construction within the urban fabric emerges as an important factor in healthy urbanization. Active and passive green spaces are important in terms of the needs and life of the city, which is trying to survive in the deteriorating environmental conditions. Among different urban uses, green areas have the characteristics of improving the physical structure of the city, adding aesthetic value to the city, meeting recreational needs, increasing the air quality, and providing the ecological balance [19-23,28-35]. The need for green areas has been felt in every period of history. This need continues today. Green areas are one of the factors that determine the structure of a city. Coordination among those dealing with the physical layout, such as geographers, city and regional planners, landscape architects, is a must to obtain green space systems with a well-resolved connection to the city as a whole [36].

According to Öztan [36] (1968), the functions of green spaces are listed as follows;

- Green areas provide the physical balance of a city and act as a buffer between different areas that show disagreement in terms of the settlement, trade, and industrial characteristics.
- It is a balance element that reduces the density of buildings and people in the city or controls the settlement spread towards the peripheral belt.
- Green spaces have an important role in light, air, noise, and pedestrian safety. Green areas in the city provide safety in terms of traffic for people by separating vehicle traffic from pedestrian, recreation, and residential areas. Green areas also have a feature of absorbing or dispersing noise.
- Green areas add microclimatic properties to a city. In general terms, the temperature in green areas is 6.5°C warmer in winter and 10°C cooler in summer compared to urban areas.
- Green areas provide convenience for circulation. One of the most important functions of a city's green areas is to provide entry and easy movement for vehicle and pedestrian traffic. It provides convenience for people and vehicles to enter buildings and streets near green areas.
- While green areas provide an outdoor space organized for recreational purposes, they create a physically organized space for special activities at certain times of the year. These areas prepare all possibilities for active and passive recreation of people.
- Green spaces create an interest in the organic system in cities. These areas are among the geometric building patterns of the cities and eliminate monotony. It enables all elements of the city to be connected. It should ensure that one open area is connected to another by tree-lined paths, building greenery, and small open spaces.
- Green spaces establish a balance between a person in the city and his surroundings in terms of measure. The most important feature of the building and the open green areas around it is that it has brought the human-environment element relationship into an appropriate measure by alleviating the pressure of the building masses on people.
- Green areas serve the city aesthetically. Green areas are especially valuable as an aesthetic asset that removes the dryness of the city, gives it vitality and color with the voluminous greenery of the trees inside.

In short, in our rapidly growing cities, the importance of green areas in terms of ecological and aesthetics, as well as socio-cultural and economic, is increasing day by day. Therefore, it is necessary to investigate the adequacy, accessibility, and usability of the existing green areas in the city. In this study, the current active green areas of Adana Cukurova district, one of the important tourism centers of our country, and the adequacy and accessibility of these areas according to the population density of Cukurova will be determined. It is aimed that the results obtained will guide local administrations, city planning, and development studies.

2. Material and Method

Study Area and Its Boundaries

Cukurova district is one of the central districts of Adana province. It is located between 37°09' North Latitudes and 35°14' East Longitudes. Cukurova; is located between the districts of Karaisalı in the north, Seyhan in the south, Sarıçam in the east, and Tarsus in the west (Figure 1). Since Çukurova district is located in the Mediterranean region, it is under the influence of the Mediterranean climate and for this reason, the summers are hot and dry, and the winters are rainy and warm. The southern part is lowland and flat, while the northern part is forested and hilly.



Figure 1: Location Map of Study Area

In the study, 1/5000 scaled digital Master Plan and True orthophoto images from the General Directorate of Geographical Information Systems of the Ministry of Environment and Urbanization were used as materials to examine the current active green areas of Cukurova district of Adana province in terms of their distribution and accessibility in the city. Fieldwork was carried out in the study area, observations and examinations were made, and various maps were produced using the relevant resources (book, article, report, thesis, etc.), TURKSTAT data, Rural services land inventory. To identify and plan active green areas; Map bases were prepared with ArcGIS 10.7 software to use 1/5000 digital Master Plan and True orthophoto images to evaluate the current active green texture. Active green area maps per capita were prepared for 10 neighborhoods (Table 1) in the Adana Cukurova district, showing the current active green space situation. The active green space maps per capita and showing the green space status prepared for each neighborhood were compared in terms of the standards and planning criteria used in previous studies. Taking into account the total area and population density of the Adana Cukurova district, maps were produced by analyzing the density and accessibility of active green areas using spatial analysis methods

Table 1: 10 Neighborhoods

Neighborhoods
Kurttepe
Karşılılar
Yüzüncüyıl
Belediye Evleri
Huzurevleri

Yurt
Toros
Güzelyalı
Mahfesiğmaz
Beyazevler

Results and Discussions

Distribution and Density of the Population

Cities are places where large masses of population gather. In urban settlements, the urban spatial distribution of the population is not homogeneous, but heterogeneous [37]. Although the Cukurova district was not a densely populated settlement before 2000, a significant population increase has been observed especially in the last 20 years. Parallel to this population increase, the area where the city expanded towards the north, northeast, and west, and as a result, the number of neighborhoods and population density of the neighborhoods increased [38].

There are 10 neighborhoods within the boundaries of the study area. There are differences in the population amounts of Cukurova district neighborhoods. The neighborhood with the least population is Karşılar District with a population of 4831, while the most populated neighborhood is Nursing Homes with a population of 62460. The area covered by the first established and determined according to the socio-economic conditions of that day was shaped according to the conditions of that day and this situation continues. However, most of the home-type houses in these neighborhoods have turned into shops and stores in the past historical processes. However, with the urban transformation, some house-type residences turned into multi-story buildings and the population density increased in those neighborhoods [38].

When the population numbers of Cukurova neighborhoods are examined, it is seen that two of the most populous neighborhoods were established on the edge of the Seyhan dam lake and they are scattered around. The areas of these areas are large and the number of building floors in most areas is low. For example; Karşılar, Kurttepe, and Beyazevler are the districts. The most populous ones are Nursing Homes, Toros, Municipalities, Yurt, and Güzelyalı neighborhoods. (Figure 2).

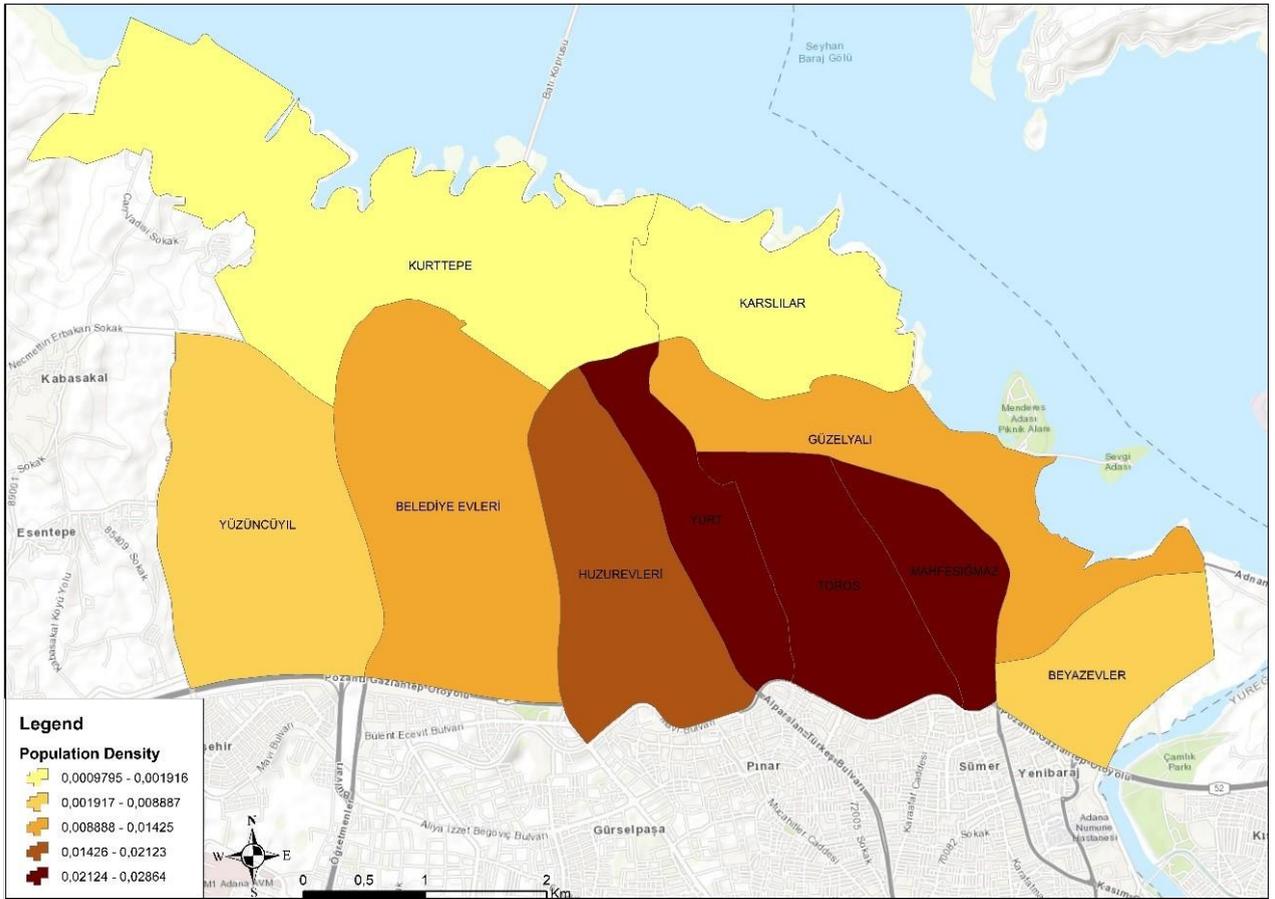


Figure 2: Population Density Map of Cukurova District

Green Areas: Areas covered with plants are called green areas. Recreation areas, picnic and resting places, park forests of various features, national parks, groves of large and small tree communities, and city parks, which are large in and around the city, and trees in clusters, groups, or rows of trees and ornamental shrubs. , roads, playgrounds, pools, etc. with flowers, grass areas, and compatible with them. Various types of garden areas including artificial facilities such as all are included in the concept of green areas [39].

Green areas that allow recreation can be classified according to their location in the city or their relationship with the city and their structural status. Green areas in the city are easy-to-access areas that can be used all day within a 5-15 minute walk. Neighborhood parks, children's gardens, sports and playgrounds, home gardens can be counted among these. Green areas in the city are areas that are mostly visited daily or used on weekends. It is among the regional parks and coastal parks [39].

The depressing effects of the monotonous life caused by the housing, population, and traffic density in Cukurova on the mental and physical structures of the people in the city make the people living in the city feel the necessity to participate in renewal and recreational activities [40-41]. However, when compared to western and developed country cities in terms of the number of active green areas found in the city and considering the minimum value (10 m²) of active green areas per person specified in the zoning plan regulation, it is very low in Cukurova district. As a result of the calculation made taking into account the amount of active green space available in Cukurova and the urban population of 2019, the active green area rate per person was determined as 2.53 m².

There are some active green areas in all of the sites in the study area. Kurttepe neighborhood has the least active green area with 3550.59 m² and the amount of green area per person is 0.54 m². With an area of 221 894.4 m², the neighborhood with the greenest areas is Belediye Evleri and its population is 57188 and the green area per person is 3.88 m². Although

Belediye Evleri quarter has the greenest areas, it is not the neighborhood with the highest green area per person. This is because its population is very large. Karşılılar is the quarter with the highest green area per capita at 4.45 m² and 16.93 m². (Figure 3).

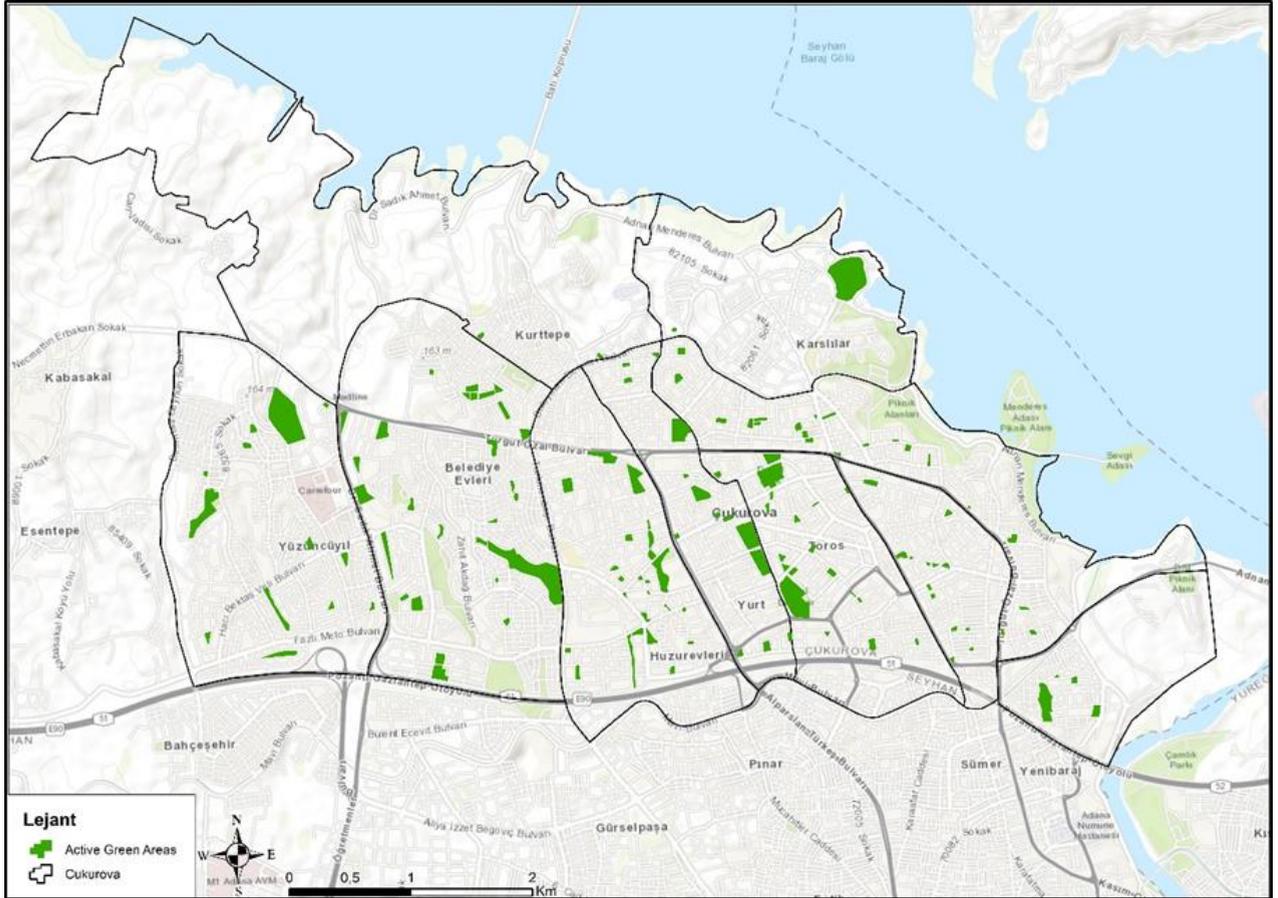


Figure 3: Distribution of Green Areas in Çukurova District

When we examine the green areas at the neighborhood level, neighborhood parks, which are one of the smallest green areas open to the public in urban areas, are mostly green areas that are used daily. The impact area of the neighborhood parks, which should be at least 8 decades in the area, does not exceed 800 m [42]. In addition to resting, sitting, and watching the scenery in the green area of the neighborhood park, table, and floor games such as mini chess, table tennis, in the appropriate places of the green area, these activities are function areas that encourage the public to the recreation culture. Facilities such as toilets, teahouses, and buffets should be included in the parks, and services that meet the eating and drinking needs of visitors [42,43]. In the neighborhood parks in the Cukurova district, there are generally children's playgrounds, sitting benches, and outdoor sports equipment. Also, in most of these parks, there are areas to meet the eating, drinking, and toilet needs of the people, recreational vehicles, and cafeterias that will attract visitors. When we examine the active green areas of the Cukurova district in terms of accessibility indicators, it is seen that there is a balanced distribution within the city. While the green areas in the Cukurova district are spread throughout the district except for the north-northeast, it draws attention that the periphery of the city is lacking in terms of accessibility. In the Cukurova district, Nursing Homes are located at a distance of 0-500 meters from the Municipal Houses Quarters in terms of accessibility. (Figure 4). Neighborhoods such as Kurttepe, Karşılılar, and Beyazevler lack accessibility.

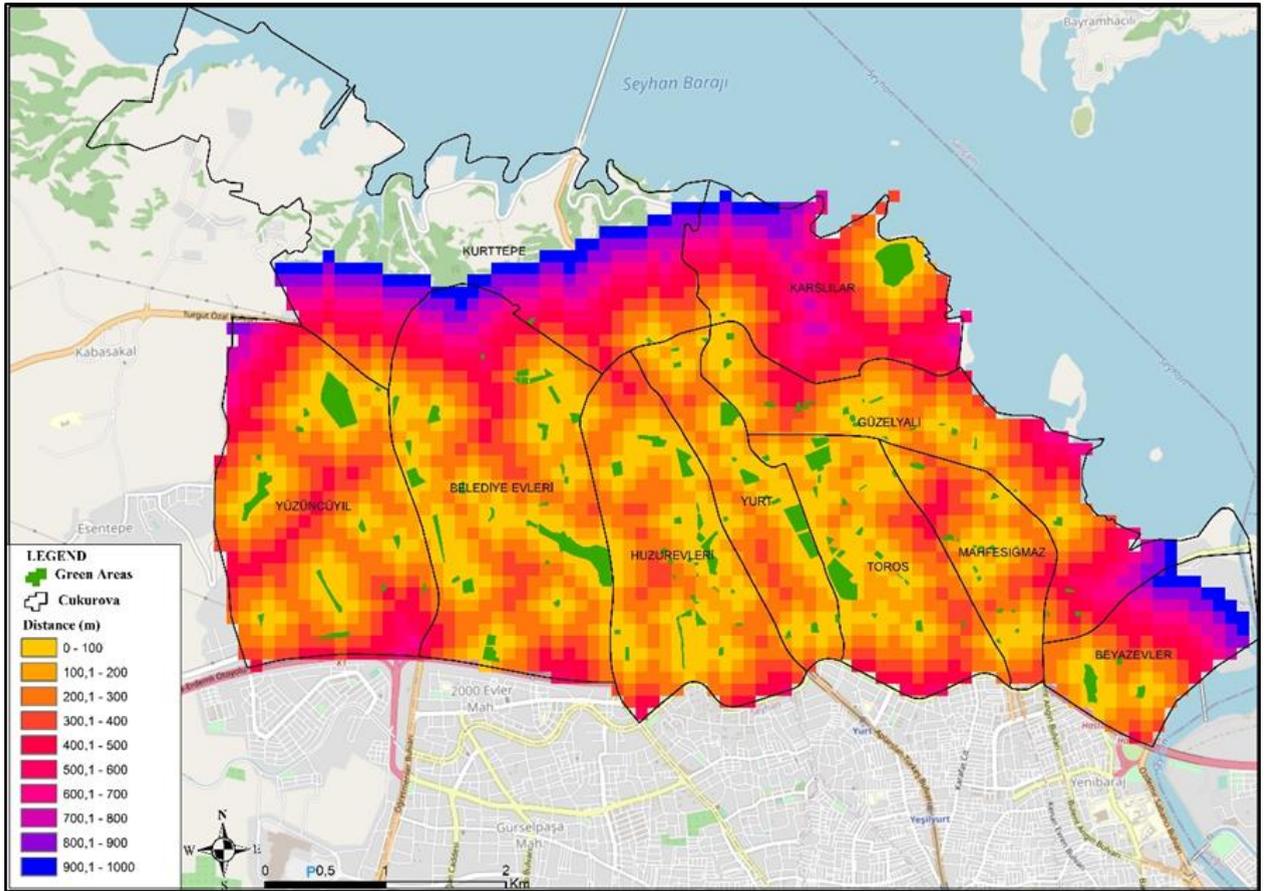


Figure 4: Accessibility of Green Areas in Cukurova District

When looking at the active green area density in the Cukurova district, the areas shown in dark green are the areas with the most active green areas. Especially in the area where the neighborhoods in the periphery of the district are located, the active green space density is very low. Looking at the densely populated neighborhoods, all of the neighborhood areas are concentrated in certain areas. These neighborhoods are Dormitory, Nursing Homes, Municipality Houses, and Yüzüncüyıl neighborhoods. The concentration of densities in certain regions leads to a deficiency in terms of competence and accessibility.

Green Area Inventory of Neighborhoods

Green area inventories in the neighborhoods are considered as active green areas under the title of green areas in the Cukurova Zoning plan. Evaluations made in 10 neighborhoods within the boundaries of the Cukurova district were made taking into account the norms that should be at the city scale.

Kurttepe Neighborhood: It is located in the northwest of the city, Karşılar neighborhood in the east, Belediye Evleri neighborhood in the south, Huzurevleri in the south and Yüzüncüyıl neighborhood in the southwest, Güzelyalı neighborhood in the southeast. In Kurttepe neighborhood, the population is 6,530, 666,502.65 m², and the active green area is 3550.58 m² compared to 2019. The active green area of 0.54 m² per person in the Kurttepe neighborhood is far below the 10 m² / person norm recommended by the Ministry of Environment and Urbanization on an urban scale.

Karşılar Neighborhood: Karşılar district is located in the northeast of the city, Kurttepe neighborhood in the west, Güzelyalı district in the south, and Yurt neighborhood in the southwest. In the Karşılar neighborhood, the population is 4831, the neighborhood area is 2520967.99 m² and the active green area is 81817.45 m² compared to 2019. The presence of active green areas of 16.93 m² per person in the Karşılar neighborhood is above the 10 m² / person norm recommended by the Ministry of Environment and Urbanization on an urban scale.

Yüzüncüyıl Neighborhood: Yüzüncüyıl district is located in the west of the city, Belediye Evleri quarter in the east, and Kurttepe district in the northeast. In the Yüzüncüyıl neighborhood, the population is 36037, the neighborhood area is 4054833.998 square meters and the active green area is 160474.86 square meters compared to 2019. The active green area per person falls to 4.45 m², in this case, it is below the 10 m² / person norm recommended by the Ministry of Environment and Urbanization on an urban scale.

Belediye Evleri Neighborhood: The Belediye Evleri neighborhood is located in the center of the city, Yüzüncüyıl neighborhood to the west, Huzurevleri neighborhood to the west, and Kurttepe neighborhood to the north. In the Municipal Houses neighborhood, the population is 57188, the neighborhood area is 4646716.817 m² and the active green area is 221 894.49 m² compared to 2019. The active green area per person falls to 3.88 m², in this case, it is below the 10 m² / person norm recommended by the Ministry of Environment and Urbanization on an urban scale.

Huzurevleri Neighborhood: Huzurevleri district is located in the center of the city, Yurt neighborhood in the east, Belediye Evleri quarter in the west, and Kurttepe district in the north. The population of the nursing homes is 62460, the neighborhood area is 2942079.94 m² and the active green area is 115062.16 m² compared to 2019. The active green area per person falls 1.84 m², in this case, it is below the 10 m² / person norm recommended by the Ministry of Environment and Urbanization on an urban scale.

Yurt Neighborhood: is located in the center of the city, Toros neighborhood in the east, Huzurevleri district in the west, Güzelyalı, and Karşlılar in the northwest. The population of the dormitory district is 45876, the neighborhood is 1601802,446 m² and the amount of active green areas is 105474.15 m² compared to 2019. The presence of active green areas of 2.29 m² per person in the dormitory neighborhood is below the 10 m² / person norm recommended by the Ministry of Environment and Urbanization on an urban scale.

Toros Neighborhood: Toros district is located in the east of the city, Mahfesiğmaz neighborhood in the east, Yurt neighborhoods in the west, and Güzelyalı district in the north. The population of the Toros neighborhood is 61851, the neighborhood area is 2275011.51 m² and the active green area is 124218.160 m² compared to 2019. The presence of active green areas of 2 m² per person in the Toros neighborhood is below the 10 m² / person norm recommended by the Ministry of Environment and Urbanization on an urban scale.

Güzelyalı Neighborhood: Güzelyalı district is located in the east of the city, Karşlılar neighborhood in the north, Mahfesiğmaz, Toros in the west, Beyazevler neighborhood in the south of Yurt districts. The population of Güzelyalı district is 41527, the area of the neighborhood is 2913674.104 m² and the amount of active green area is 68258.158 m² compared to 2019. The presence of active green areas of 1.64 m² per person in the Güzelyalı neighborhood is far below the 10 m² / person norm recommended by the Ministry of Environment and Urbanization on an urban scale.

Mahfesiğmaz District: The Mahfesiğmaz neighborhood is located in the east of the city, Güzelyalı district is in the east, and Toros district is in the west. In the Mahfesiğmaz neighborhood, the population is 34901, the neighborhood area is 1300559.45 m² and the active green area is 22616.44 m² compared to 2019. The presence of active green areas of 2 m² per person in the Mahfesiğmaz neighborhood is below the 10 m² / person norm recommended by the Ministry of Environment and Urbanization on an urban scale.

Beyazevler Neighborhood: is located in the southeast of the city, in the northwest is Güzelyalı district. In Beyazevler Neighborhood, the population is 9487, the neighborhood area is 162 1902.87 m² and the active green area is 35161.59 m² compared to 2019. The presence of active green areas of 3.70 m² per person in the Beyazevler neighborhood is below the 10 m² / person norm recommended by the Ministry of Environment and Urbanization on an urban scale.

Table 2. Showing of the active green area per person of the neighborhoods

Neighborhood	Area m ²	Total Population	Green Area m ²	Green Area Per Person m ²
Kurttepe	6666502,65	6530	3550,58	0,54
Karşlılar	2520967,99	4831	81817,45	16,93
Yüzüncüyıl	4054833,998	36037	160474,86	4,45
Belediye Evleri	4646716,817	57188	221894,49	3,88

Huzurevleri	2942079,94	62460	115062,16	1,84
Yurt	1601802,446	45876	105474,15	2,29
Toros	2275011,51	61851	124218,160	2
Güzelyalı	2913674,104	41527	68258,158	1,64
Mahfesiğmaz	1300559,45	34901	22616,44	2
Beyazevler	1621902,87	9487	35161,59	3,70
Total	30544051,801	360688	912808,975	2,53

Conclusions

Within the scope of this research, the Cukurova District; urban green areas, population density, and accessibility of the city were examined in terms of active green areas. According to the study, the spatial distribution, density, and adequacy of green areas were determined by calculating the amount of active green areas per capita in 10 neighborhoods that make up the city and discussed in terms of green space adequacy for the future. When the working area is examined as active green areas; As data of 2019, the active green area per person in Cukurova District is 2.53 m². According to the Zoning Law, the amount of green space in urban areas is 10 m² [44]. The total green area of Cukurova Active is 7.47 m².

10 neighborhoods in the study area were examined one by one and the area, population, active green area, and the number of green areas per person was determined. Accordingly, Kurttepe, Güzelyalı, Huzurevleri neighborhoods have been identified as places with the least active green space. It is known that city centers are the busiest and most active places in the city and these neighborhoods are located in the center of the Cukurova district. For this reason, green areas should be built in these neighborhoods urgently. When we look at the Karsilar neighborhood a little outside the district, the amount of active green areas (16.93 m²) is above 10 m², which is the measure of the zoning law.

Considering that the active green areas in the city are places to escape from the dense concrete structures of the city and the excess population and traffic situations, the excessive and dense structures of the district and the scarcity of green areas have negative effects on people. For this reason, we need to transform these areas into green areas by preserving existing green areas and realizing projects that revise the gaps in urban open and collapse areas. When urban active green areas are examined in the Cukurova district; It is seen that it is not in integrity within the areas of use and within the district, and it is insufficient when considering the ratio of the green area to the population.

Researches show that the insufficient amount of active green areas in the Cukurova District is not sufficient to explain the green area problem. If public areas in the city are used for different purposes, it is recommended that these areas be transformed into active green areas. Considering the active green areas in the Cukurova district, the active green areas should be distributed proportionally based on the neighborhoods and the quality of the existing green areas should be increased and put back into use. Applied in developed world cities in recent years; To take short breathing in the intense work tempo, rest and also to meet the children's need for play, their average size is 500 m² and the impact area is 500 m radius [45]. Another suggestion can be to meet the recreational needs of city residents by building Pocket Parks. By increasing the number of active green areas available; Neighborhood parks, pocket parks, neighborhood parks, and city parks are active green areas recommended for the Cukurova district.

Competing Interest / Conflict of Interest

The authors declare that they no conflict of interest. The none of the authors have any competing interests in the manuscript.

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References

- [1] Adıgüzel, F., Cetin, M., Kaya, E. Simsek M., Gungor S., Bozdogan Sert E (2020) Defining suitable areas for bioclimatic comfort for landscape planning and landscape management in Hatay, Turkey. *Theoretical and Applied Climatology (Theor Appl Climatol)* (2020) 139(3): 1493-1503 doi:10.1007/s00704-019-03065-7, <https://link.springer.com/article/10.1007/s00704-019-03065-7>
- [2] Cetin, M. (2020) Climate comfort depending on different altitudes and land use in the urban areas in Kahramanmaraş City. *Air Qual Atmos Health* 13, 991–999 (2020). <https://doi.org/10.1007/s11869-020-00858-y>; <https://link.springer.com/article/10.1007/s11869-020-00858-y>
- [3] Cetin, M., Sevik, H. & Cobanoğlu, O. (2020) Ca, Cu, and Li in washed and unwashed specimens of needles, bark, and branches of the blue spruce (*Picea pungens*) in the city of Ankara. *Environ Sci Pollut Res* (2020). DOI: 10.1007/s11356-020-08687-3; <https://doi.org/10.1007/s11356-020-08687-3>; <https://link.springer.com/article/10.1007/s11356-020-08687-3>
- [4] Bozdogan Sert E, Turkmen M, Cetin M (2019) Heavy metal accumulation in rosemary leaves and stems exposed to traffic-related pollution near Adana-İskenderun Highway (Hatay, Turkey), *Environmental Monitoring and Assessment*, 191:553, <https://doi.org/10.1007/s10661-019-7714-7>, <https://rd.springer.com/article/10.1007/s10661-019-7714-7>
- [5] Cetin M., Cobanoğlu O. (2019) The Possibilities of Using Blue Spruce (*Picea pungens* Engelm) as a Biomonitor by Measuring the Recent Accumulation of Mn in Its Leaves. *Kastamonu University Journal of Engineering and Science*. 5(1): 43-50. <https://dergipark.org.tr/download/article-file/745562>
- [6] Altera A.Z.A., Bayraktar O.Y., Cetin M. (2019) Advanced Road Materials in Highway Infrastructure and Features. *Kastamonu University Journal of Engineering and Science*. 5(1): 36-42. <https://dergipark.org.tr/download/article-file/745527>
- [7] Cetin Mehmet (2017). Change in Amount of Chlorophyll in Some Interior Ornamental Plants (Bazı İç Mekan Süs Bitkilerinde Klorofil Miktarının Değişimi) *Kastamonu University Journal of Engineering and Sciences* 3(1):11-19, 2017. <http://dergipark.gov.tr/download/issue-file/5600>
- [8] Sandal, E., & Adıgüzel, F. (2014). Spatial development of Tarsus and the changes in land use. *Urban and Urbanization*, 1, 570-579.
- [9] Alkan, A., Adıgüzel, F., & Kaya, E. (2017). Batman Kentinde Kentsel Isınmanın Azaltılmasında Yeşil Alanların Önemi. *Coğrafya Dergisi*, (34), 62-76.
- [10] Sancar, M. C., & Güngör, Ş. (2020). A Review of Bioclimatic Comfort Areas Determined by the New Summer Index in Terms of Tourism in Antalya. *Acta Biologica Turcica*, 33(1), 53-63.
- [11] Cetin M., Zeren I., Sevik H., Cakir C., Akpınar H. (2018). A study on the determination of the natural park's sustainable tourism potential. *Environmental Monitoring and Assessment*. 190(3): 167.<https://doi.org/10.1007/s10661-018-6534-5>
- [12] Cetin, M.; Sevik H. (2016). Evaluating the recreation potential of Ilgaz Mountain National Park in Turkey. *Environmental Monitoring and Assessment*, 188(1):52, <http://link.springer.com/article/10.1007%2Fs10661-015-5064-7>
- [13] Bayraktar, A. (1973). İzmir Şehri'nin İmarında Peyzaj Mimarlığı ile İlgili Problemler ve Prensiplerin Tesbiti". Ege Üniversitesi Ziraat Fakültesi Yayınları, Yayın, (33).
- [14] Cetin, M.; Sevik, H. (2016). Assessing Potential Areas of Ecotourism through a Case Study in Ilgaz Mountain National Park, InTech, Chapter 5, Eds:Leszek Butowski, 190, ISBN:978-953-51-2281-4, 81-110, <http://www.intechopen.com/books/tourism-from-empirical-research-towards-practical-application/assessing-potential-areas-of-ecotourism-through-a-case-study-in-ilgaz-mountain-national-park>

- [15] Zeren Cetin I, Ozel HB, Varol T (2020) Integrating of settlement area in urban and forest area of Bartın with climatic condition decision for managements. *Air Quality, Atmosphere & Health*, 13(8), 1013-1022.. <https://doi.org/10.1007/s11869-020-00871-1>
- [16] Zeren Cetin, I. & Sevik, H. (2020). Investigation of the relationship between bioclimatic comfort and land use by using GIS and RS techniques in Trabzon. *Environmental Monitoring and Assessment*, 192(2), 71.
- [17] Zeren Çetin, İ. (2019). Trabzon ekoturizm potansiyelinin GIS kullanımı ile biyoklimatik konfor açısından değerlendirilmesi. Yüksek Lisans Tezi. Kastamonu Üniversitesi Fen Bilimleri Enstitüsü. Kastamonu.
- [18] Cetin, M. (2015). Evaluation of the sustainable tourism potential of a protected area for landscape planning: a case study of the ancient city of Pompeipolis in Kastamonu. *International Journal of Sustainable Development & World Ecology*, 22(6), 490-495
- [19] Cetin, M. (2016). Determination of bioclimatic comfort areas in landscape planning: A case study of Cide Coastline, *Turkish Journal of Agriculture-Food Science and Technology* 4 (9), 800-804
- [20] Bekçi, B. ve Taşkan, G. (2012). Açık Yeşil Alanlardaki Kent Donatılarının Kişisel Mekan Uzaklığına Etkisi: Bartın Kenti Örneği. *Bartın Orman Fakültesi Dergisi*, 14(22), 61–71.
- [21] Cetin, M., Adıgüzel, F., Gungor, S., Kaya, E. and Sancar, M. C. (2019). Evaluation of thermal climatic region areas in terms of building density in urban management and planning for Burdur, Turkey. *Air Quality, Atmosphere and Health*, 12(9): 1103-1112. <https://link.springer.com/article/10.1007/s11869-019-00727-3>
- [22] Çetin, M., Güngör, Ş., & Adıgüzel, F. (2020). Bulanık Mantık Ve Cbs İle Kentsel Dokudaki Bozulma Miktarını Ölçmek İçin Mekânsal Model Geliştirme. Ş. Güngör, & F. Adıgüzel içinde, *Kapadokya Araştırmaları İnsan Ve Mekân* (s. 55). Nevşehir: Literatürk Academia.
- [23] Doygun, H. (2007). Büyüyen Kentlerde Yeşil Alanların Konumu ve Geleceği: Kahramanmaraş Örneği. *Bartın Orman Fakültesi Dergisi*, 9(12), 48–53.
- [24] Cetin, M. (2015). Determining the bioclimatic comfort in Kastamonu City. *Environmental Monitoring and Assessment*, 187(10), 640, <http://link.springer.com/article/10.1007%2Fs10661-015-4861-3>
- [25] Kaya, E., Agca, M., Adıgüzel F., Cetin, M. (2019). Spatial data analysis with R programming for environment. *Human and Ecological Risk Assessment: An International Journal* 25 (6): 1521-1530. <https://www.tandfonline.com/doi/full/10.1080/10807039.2018.1470896>
- [26] Cetin M., Adıgüzel F., Kaya O., & Sahap, A. (2018) Mapping of bioclimatic comfort for potential planning using GIS in Aydin. *Environment, Development and Sustainability*, (2018) 20 (1): 361-375. <https://doi.org/10.1007/s10668-016-9885-5>
- [27] Cetin M, Sevik H, Canturk U, Cakir C (2018) Evaluation of the recreational potential of Kutahya Urban Forest. *Fresenius Environmental Bulletin*, 27(5):2629-2634.
- [28] Gungor, S., Cetin, M. & Adıgüzel, F. (2020) Calculation of comfortable thermal conditions for Mersin urban city planning in Turkey. *Air Quality, Atmosphere & Health (Air Qual Atmos Health)* (2020). DOI: 10.1007/s11869-020-00955-y; <https://doi.org/10.1007/s11869-020-00955-y>; <https://link.springer.com/article/10.1007/s11869-020-00955-y>
- [29] Karataş, A. ve Kılıç, S. (2017). Sürdürülebilir Kentsel Gelişme ve Yeşil Alanlar. *Journal of Faculty of Political Science*, (56).
- [30] Güngör, Ş., & Adıgüzel, F. (2019). Kentsel Yeşil Alanlar İçin Mekânsal Yeterlilik Ve ulaşılabilirlik Analizi: Nevşehir Örneği. A. Uysal, & H. İçen içinde, *Kapadokya Araştırmaları* (s. 90). Nevşehir: Pegem Akademi.
- [31] Cetin, M. (2015). Using GIS analysis to assess urban green space in terms of accessibility: case study in Kutahya. *International Journal of Sustainable Development & World Ecology*, 22(5), 420-424, DOI: 10.1080/13504509.2015.1061066
- [32] Deniz, A , Güngör, Ş . (2020). Mapping With Unmanned Aerial Vehicles Systems: A Case Study Of Nevşehir Hacı Bektas Veli University Campus . *Kastamonu University Journal of Engineering and Sciences* , 6 (1) , 27-32
- [33] Manavoğlu, E. ve Ortaçşme, V. (2007). Konyaaltı kentsel alanında bir yeşil alan sistem önerisi geliştirilmesi. *Akdeniz Üniversitesi Ziraat Fakültesi Dergisi*, 20(2), 261–271.
- [34] Cetin M (2019). The effect of urban planning on urban formations determining bioclimatic comfort area's effect using satellitia imagines on air quality: a case study of Bursa city. *Air Quality, Atmosphere & Health, (Air Qual Atmos Health)*. 12(10):1237-1249. <https://doi.org/10.1007/s11869-019-00742-4>

- [35] Sandal, E , Adıgüzel, F , Karademir, N . (2020). Changes In Land Use Between The Years Of 1990-2018 In Mersin Province Based On CORINE (Coordination Of Information On The Environment) System . Kastamonu University Journal of Engineering and Sciences , 6 (1) , 8-18.
- [36] Öztan, Y. (1968). Ankara şehri ve çevresi yeşil saha sisteminin peyzaj mimarisi prensipleri yönünden etüd ve tayini. Ankara Üniversitesi Basımevi.
- [37] Aliğaoglu, A. (2003). Afyon'da Şehir Morfolojisinin İki Unsuru: Cadde-Sokak Sistemi ve Konutlar. Coğrafi Bilimler Dergisi, 1(2), 63–83.
- [38] Sandal, E. K. (2009). Kahramanmaraş'ta ulaşım problemleri ve halkın ulaşım sistemine ve problemlerine bakışı. Doğu Coğrafya Dergisi, 14(21), 137–158.
- [39] Bozdoğan, E. ve Gültekin, E. (2001). Karaisalı İlçesi nin Kentsel Gelişim Potansiyeli İçinde Yeşil Alan Gereksinimleri. Çukurova Üniversitesi Fen Bilimleri Enstitüsü Fen ve Mühendislik Bilimleri Dergisi.
- [40] Karagüzel, O., Ortaçşme, V. ve Atik, M. (2000). Planlama ve Uygulama Yönünden Antalya Kenti Yeşil Alanları Üzerinde Bir Araştırma. Akdeniz Üniversitesi Ziraat Fakültesi Peyzaj Mimarlığı Bölümü, Antalya.
- [41] Sandal, E. K. ve Karademir, N. (2013). Kahramanmaraş'ta Yeşil Alanların Yeterliliği İle Halkın Beklentilerinin ve Bilinç Düzeyinin Belirlenmesi. Doğu Coğrafya Dergisi, 18(29), 155–176.
- [42] Simonds, J. O. (1997). Landscape architecture: a manual of site planning and design.
- [43] Demir, Z. (2004). Düzce'nin Yeni Kentleşme Sürecinde Açık ve Yeşil Alanlara Yeni Fonksiyonlar Kazandırılması.
- [44] Aksoy, Y. (2014). Türkiye'de yeşil alanlarla ilgili yasal düzenlemeler.
- [45] Kısar, E. (2004). Yeşil Alan Kullanım Özellikleri ve Tercihleri (Ataköy, Beşiktaş, Zeytinburnu Örneği).