Using geographical information systems to measure accessibility of green areas in the urban center of Nevşehir, Turkey

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Abstract

The problem of how to ensure the accessibility of green areas is a significant issue for urban planners and leaders. Every segment of society should have access to green areas. The 2015 United Nations General Assembly Resolution indicated the necessity of ensuring that children, older adults, and disabled people have equal access to green areas.

The Accessible Natural Greenspace Standard (ANGSt) was implemented in England in response to the United Nations 2015 Resolution. ANGSt states that housing developments needed to have a green space within 300 m in order to be identified as having adequate access to green space. Almost at the same time, Turkey has also identified increasing access to urban green spaces as a priority, which can be seen most directly in the 2014

access to urban green spaces as a priority, which can be seen most directly in the 2014 Turkish Regulation on Spatial Planning. This document states that housing zones need to have a green space within 500 m to ensure that urban residents have sufficient access to green space. However, no specific suggestions or procedures have been provided on how to measure the accessibility of a city's green areas. To fill this gap, this study developed a method for measuring the accessibility of green areas according to the standards outlined in the 2014 Turkish Regulation on Spatial Planning as well as the standards described in England's ANGSt regulations. The accessibility of green areas in Nevşehir, Turkey was assessed using this method to demonstrate its utility.

The method of Comber et al. (2008) and the grid method used in the GEOSTAT procedure were adapted for this study to assess the accessibility of green areas in Nevşehir, Turkey. In order to conduct this study, ArcGIS was used and analyses were performed grid method. As a result, this study identified housing zones that do not have access to a green space, both according to Turkish standards as well as English standards. Furthermore, this study also identified many green spaces that are not within an accessible distance from residential areas, indicating that a significant proportion of Nevşehir's green spaces are being under-utilized.

This study reveals that thus far, the planning approaches used in Nevşehir have not taken access to green spaces into consideration, particularly along the city's borders. The center of the city has much more access to green areas, but it has the inverse problem of having green spaces that lack nearby residential areas, so they are not adequately utilized. This situation most likely arose due to reliance on the grid meter per capita standard for assessing green space rather than basing planning decisions on accessibility standards. Thus, this study provides important insights into Nevşehir's current land use distribution that can be used to shape the future of urban planning in Nevşehir, while also providing a method for assessing land use distribution that can be used in a wide range of contexts to evaluate access to green spaces.

Introduction

More than half of the global population lives in urban areas (United Nations, 2019). Many problems are associated with ever-expanding urban areas, but efforts have been made to overcome these issues through city planning strategies. Planning includes any activities that regulate the relationship between people and their environment, and any activities that positively sustain that relationship (Ergen, 1981). Construction and other activities that people engage in have been detrimental to the environment, and consequently green spaces have become even more important for urban areas. There are many challenging urban issues, such as unplanned settlements, insufficient urban infrastructures, increased demand for adequate housing, and problematic developments in the social infrastructure (Ergen and Ergen, 2018). Furthermore, the development of some urban areas has also resulted in reduced quality of life. Accordingly, one of the most significant problems for urban development is protecting green areas and ensuring their accessibility for urban dwellers. Additionally, when locations and designs for green spaces are being selected, urban planners should consider the needs of children, older adults, and disabled people to ensure that green spaces are accessible for all of those who live in urban areas.

As green areas in urban zones serve as outdoor places for relaxing and enjoying fresh air, adequate planning to ensure they are both usable and accessible is important. To help urban dwellers use urban green areas and ensure these areas increase their quality of life, accessibility should be planned appropriately. Urban green areas have been developed with different approaches to ensure their value to their local community. Recently, urban green areas have been developed with accessibility regulations, which has made them an integral element of urban planning.

Urban green areas include all open spaces within cities and along their borders, both those that exist by design and those that exist by default (Lo and Jim, 2012; Sathyakumar et al., 2020). It is defined green areas as parks, gardens, informal vegetated spaces, derelict public and private land, and historical place in their study (Anguluri &

Narayanan, 2017; Sathyakumar et al., 2020). Şahin et al. (2014) performed landscape character analyses to better define and use green areas and other landscape elements. Park and Guldmann, 2020 describe green areas as including trees, lawns, forests, parks, golf courses, and agricultural open fields. The literature provides a wide variety of definitions for green areas; however, because this study is focused on the accessibility of urban green areas, when this study uses the phrase "green areas," it is referring to woody areas (woody areas are under control of human arrangement), parks, forests (forests areas are natural areas without any human interactions), and recreational areas. These kinds of areas are generally considered "active" green areas because they are more often directly used by urban populations than some of the other green areas, such as derelict land or agricultural fields.

Forming and measuring green areas within urban zones is important for ensuring healthy urban development. However, the mere presence of these green areas is not enough—the accessibility of green areas within urban zones is just as important. When green areas are accessible, the quality of urban life increases.

The United Nations General Assembly (2015) set sustainable development objectives. Article 11 among these objectives states, "Make cities and human settlements inclusive, safe, resilient." Statement 11 says, "The UN has decided that green and public spaces should be accessible and provide a safe environment for women, children, older and disabled people until 2030" (The United Nations General Assembly, 2015). This statement indicates that equal social access to urban green areas is an important urban planning objective that should be considered by all countries.

England measures the accessibility of its green areas by using the Accessible Natural Greenspace Standard (ANGSt). ANGSt designates that green areas should (England, 2010a):

- Be no more than 300 m (a walking distance of five minutes) from a house and at least two hectares in size

- Be within 2 km from a house and at least 20 ha
- Be within 5 km from a house and at least 100 ha
- Be within 10 km from a house and at least 500 ha
- Have a Natural Local Reserve of at least one-hectare corresponding to a population of 1000 people

ANGSt was used to perform zoning in cities such as Suffolk (England, 2010b). The reports generated by this project recorded the distances between housing areas and green areas, and then addressed the question of whether or not the green spaces met the ANGSt distance criteria. Pafi et al. (2016) conducted analyses of green areas in Amsterdam, Athens, Prague and Turin. They obtained their processed urban data from Urban Atlas, while their analysis borders were set using GEOSTAT (1 km x 1 km grid grids). They then used this data set to find the size of the cities' green areas, obtain the cities' population data, and perform transportation-related analyses with road network assessments. Although these studies analyzed access to green areas, other areas and urban housing locations were not specified to make more understandable where is needed more accessibility problems according to planning decisions, and they did not present recommendations for how urban planners could best arrange green areas. Koliotsis and Papadopoulou (2017) made an analysis green areas acessiblity by using the buffer zone method.

Comber et al. (2008) analyzed the level of access that various ethnic groups have to green areas by using network analysis. Using a method similar to the one used in this study, the study setting was divided into 1 km^2 areas and the ethnic population's access to green areas within these divided zones was assessed through network analysis. However, Combor et al. (2008) did not analyze the green areas' accessibility for other segments of the urban population. Not all of the residential areas in the city were measured for accessibility.

Comber et al. (2008) determined which ANGSt guidelines had been met. Equitable access to urban green spaces is an important issue for urban planners to consider as they develop plans that use environmental resources; having accessible green spaces may improve an urban population's well-being and support sustainable development (Ekkel and de Vries, 2017; James et al., 2016; Park and Guldmann, 2020). For the purposes of urban planning, it is important to understand which green spaces are not equally accessible for all populations and in which ways they are inaccessible (Park and Guldmann, 2020). The study of Park and Guldmann (2020) in United States of America focused on inequity in access to green spaces in terms of demographic, economic, infrastructure, and neighbourhood age factors. To accomplish this, Park and Guldmann (2020) used the gravity index to analyze access to green spaces. Similarly, Bruch (2006) analyzed the accessibility of green areas for minority and low socioeconomic status populations by using a master plan to define each green area's accessibility.

In contrast, our study directly analyzed the distance between housing areas and green spaces. By doing so, this study will identify whether each green space is accessible or not for every housing settlement within the study area in Nevşehir. All of the studies mentioned in the literature review used grids in their studies because they have generally used raster data to conduct their analysis. Raster data works with pixels, so grids are an important tool for processing the data. Our study also used grids as a method for analyzing the accessibility of green areas to facilitate urban planning and development.

One of the purposes of this study is to present an approach for how the accessibility of green areas in Turkey should be measured. This study drew grids rather than perform network analysis to analyze the distance between green areas and housing settlements. It is used 300 m and 500 m grids to find out minimum accesibility criteria of green areas for the cities. 300 m of grid is one of the nearest measurment distance and 500 m is the rule of measurement distance for Turkish cities. Because of this reasons, grids were formed based on the 500 m standard in Turkey (each grid was divided into 500m × 500m

formed based on the 500 m standard in Turkey (each grid was divided into 500m × 500m grids) and the 300 m standard in England (each grid was divided into 300m × 300m grids). Then the grids were analyzed according to the accessibility indicators which is 300 m and 500 m distances.

In 2014, Turkey determined that the maximum distance from a housing settlement to the closest green area should be no more than 500 m in order for the green area to be considered accessible to the settlement's residents. Consequently, in 2014 the Regulation on Spatial Planning in the Official Gazette number 29,030 was updated to indicate that all green areas in development plans should be within the 500 m accessibility distance. However, no strategy for how this distance could be measured was outlined.

To measure the accessibility of urban green areas, this study developed a method that aimed to determine whether or not urban green areas are within the recommended distance of the local housing zones. Moreover, efforts were made to identify any green areas located outside the accessible range for any nearby housing zones. Based on the results of this research, this study suggests arrangements and planning recommendations for how to increase the accessibility of urban green areas. The results of this study indicated that accessibility of green areas is one of the important indicator of enhancing the urban population's quality of life.

Section snippets

Study Area and Setting

The study was conducted in Nevşehir, located in the Central Anatolian region of Turkey. Nevşehir borders the Turkish cities of Kayseri, Aksaray, Niğde, Yozgat, and Kırşehir (see Fig. 1). The surface area of Nevşehir is 5386 km^2. The city is positioned on the south side of Kızılırmak valley at an altitude of 1150 m (Anonymous, 2016). Nevşehir has a

Nevşehir was selected as a case study because there is …

Results

The study's results indicated that proximity to housing locations was not regarded as a criterion in past approaches to planning green areas in Nevşehir. Although the ratio of green areas to housing zones was deemed sufficient, the number of locations where there were green areas but not many houses was higher than the adequate threshold, which is interesting because it shows that green areas in Nevşehir were not planned based accessibility standards.

The 500 m grid of Nevşehir contained totaly…

Conclusion and discussion

This study provides important results for planning the green areas in Nevşehir. Planning and arranging green areas based on the accessible distance standard ensures the development of a healthier and more livable urban space. Results indicate that developing plans for green areas based on the concept of accessibility is a necessity.

This study provides a model for how to assess for and develop plans to implement the 500 m accessibility standard specified in the Turkish Regulation on Spatial…

Declaration of Competing Interest

The authors report no declarations of interest….

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