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Using the Buffer Zone Method to Measure the Accessibility of the Green Areas in Tokat, Turkey

Mustafa Ergen

Abstract

This study measured the distance from its sample location to green areas in Tokat, Turkey, using the buffer zone method. This study evaluated the decisions of the Purposeful Tokat Conservation Framework Development Plan and the decisions outside of the Historical Urban Protected Areas Development Plan together as whole. Creating green areas that are at an accessible distance in urban planning projects is important. Accordingly, the accessibility of green areas was measured using the buffer zone method. This study also proposes a method in regard to accessibility to green areas in Turkey. The analysis performed in Tokat found that the green areas were not planned considering accessibility criteria. The results of this study indicate that settlements with houses and green areas should be planned proportionally and at a more accessible distance to each other.

Keywords: Tokat, urban planning, buffer zone method, accessibility, green areas

1. Introduction

Increased population is an important factor in the formation of urban areas within the human settlements for a very long time [1]. During the development of urban areas, settlements maintained some of their rural qualities until the industrial revolution. After that, the formation of urban areas transformed rural areas into industrial zones [1]. Urban areas had many problems in this period of development, which were joined by more problems with higher priority. Planning green areas to make them accessible has been an important issue since the beginning of urbanization, and suggestions and practices have been introduced along with legal regulations to ensure that green areas are planned, healthy, and sustainable.

As access to urban green areas has become a priority for the modern urban areas, increasing quality of life and creating open areas with proper airflow have also become important. Morar et al. indicated the contributions of green areas to urban quality of life [2]. Comber et al. helped measure the accessibility of green areas for different ethnic groups [3].

The term, green areas, covers many fields and meanings. Green areas may indicate recreational areas, playgrounds, or sports fields. The term refers to locations that increase quality of life and help people breathe fresh air and have space for leisure time and fun.

Urban planning refers to the approaches needed to organize and create healthy urban areas. Ergen explained that urban planning means making arrangements that help people to establish orderly relationships with their environments [4]. Accordingly, efforts have been made to conduct sustainable and healthy urbanization and green area arrangements through planned approaches.

Remarkable new approaches and arrangements have been performed within urban planning in accordance with the development of urban areas. Efforts have also been made to provide the best recommendations for resolving urban problems. With developments in dynamic urban structures, many predictable and unpredictable social issues have arisen. To create a more livable environment within the urban areas, 7 m² of green space per person was allocated for green areas in Turkey, and this was later updated to 10 m² per person. The new 2017 regulation on spatial planning raised this figure to 15 m² for actively used green areas in districts and provinces.

These regulations provide little guidance for arranging green areas. The first regulation on spatial planning (2014) indicated that green areas should be designed within 500 m from residences to ensure spatial quality and meaningful planning. However, the regulation contains no recommendations or methods on how to measure the 500 m in question. This study used the buffer method, which has often been used in the international literature, to measure accessibility in Turkey.

This method was used in the English cities, e.g., Norfolk, to measure distances to green areas [5]. In 2017, Kolitos and Papadopoulou measured the accessibility of green areas using the buffer method [6]. The accessibility of green areas is an important topic for everyone. For instance, green areas that are not accessible to the young, elderly, or disabled people do not adequately fulfill their function and indicate poor design and planning.

Enabling people to implement the buffer method, ArcGIS is a significant instrument. Many scientific studies are based on a scientific ground using ArcGIS. Its useful practices include land suitability maps and planning approaches and analyses [7–11].

The importance of understanding green areas' accessibility is clear. The active use of green areas requires them to be accessible, and since unused green areas are not meaningful, the active use of green areas, including open areas, recreational areas, and parks, is important.

Tokat is a city which has historical infrastructure with a conservation development plan. It is sure that the arrangements of green areas are difficult in conservation areas, because the land is valuable and the development is under control for keeping alive historical structures in the area. In this perspective, it is needed to construct green areas that should serve to the conservation areas within the entire city. It is sure that the buffer zone method appears as one of the most suitable techniques for the conservation areas in the cities.

The buffer zone method was used in this study to measure the accessibility of green areas in Tokat, considering the 500-m requirement in Turkey. This method is an important procedure for assessing the accessibility of green areas. This study's results show the problems and advantages of green areas that were designed before the adoption of the 500-m rule, and what this rule will do for urban planning was demonstrated.

2. Methodology

2.1 Study area and settings

The province of Tokat has border with the provinces of Yozgat, Amasya, Samsun, Ordu, and Sivas. It is located in the Central Black Sea Region at northern latitude 39°

52° -40° 55' and eastern longitude 35° 27' -37° 39' [12]. According to data from the Turkish Statistical Institute (TSI), its address-based population is 166,136 [13] (**Figure 1**).

The development plans for Tokat were made using NetCAD and later transformed into ArcGIS data. This study uses its 1/5000 development plan and shows how its urban development emerged over the suggested fields. The development plans for Tokat were also put into the WGS 1984 Universal Transverse Mercator (UTM) Zone 35 North in ArcGIS to use the maps more effectively. Buffer zones were drawn using ArcGIS, and the distance of city's buildings to green areas was measured considering the 500-m rule.

The arrangements of green areas in the framework of Tokat conservation plan should bring to the fore structure of historical buildings. If this arrangement cannot be done, it is necessary to enrich green areas nearby to the conservation areas. It is important to reveal green areas with buffer zone in a way to provide integrity with conservation areas (**Figure 2**).

The data were classified. Housing zones and recommended housing zones were assessed together. The forest zones that were believed to host active green areas were grouped as parks, playgrounds, and woodlands (the recommended woodlands are also in these areas), and their accessibility was measured.

Although the term, buffer zone, has been used for a long time (occasionally for multiple use or transitional zones), its recent use as a concept date to the early 1970s [14]. Having been used to refer to the permitted vicinity of natural reserves, the term is now commonly used in many fields.

Buffer zones determine the limits of approaching and protecting natural reserves. The buffer zone method can be used to measure the usability and accessibility of urban open green areas. The importance of locations in buffer zones becomes clear based on usage purposes. The impact of use by people on natural reserves is measured to protect nature. The buffer zone method is an analytical method for understanding how green areas in urban buffer zones should have balanced usage and how deficiencies should be met (**Figure 3**).

The map of Tokat indicates that there are no housing zones on the west side of the city and that urban development has mainly occurred on the north, south, and

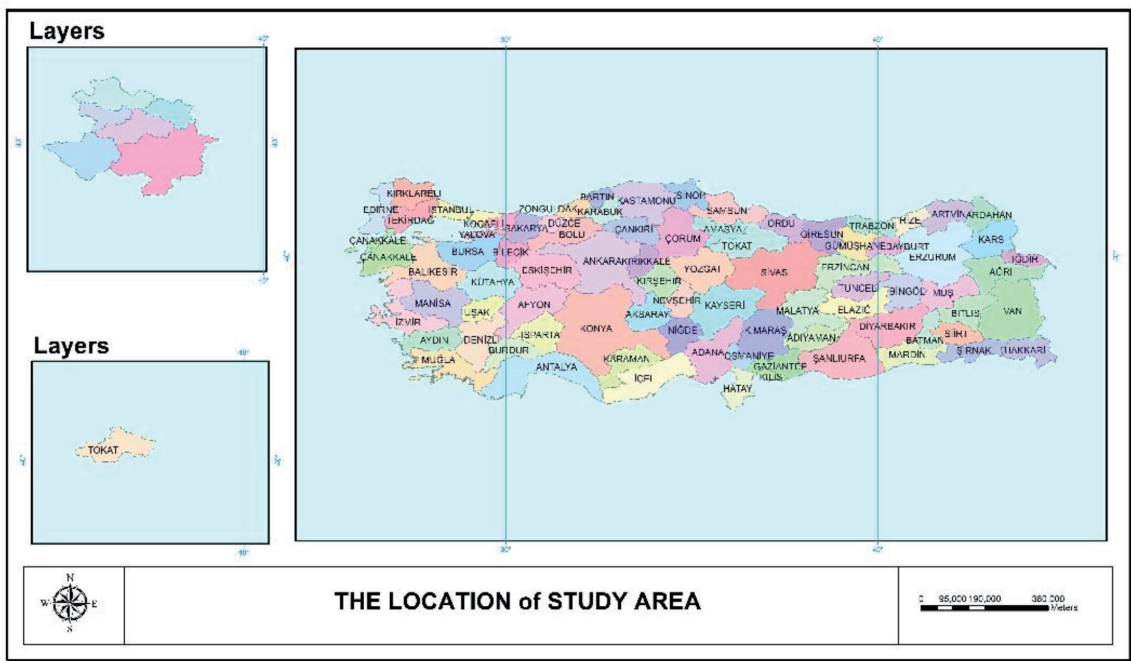


Figure 1.
The location of study area.

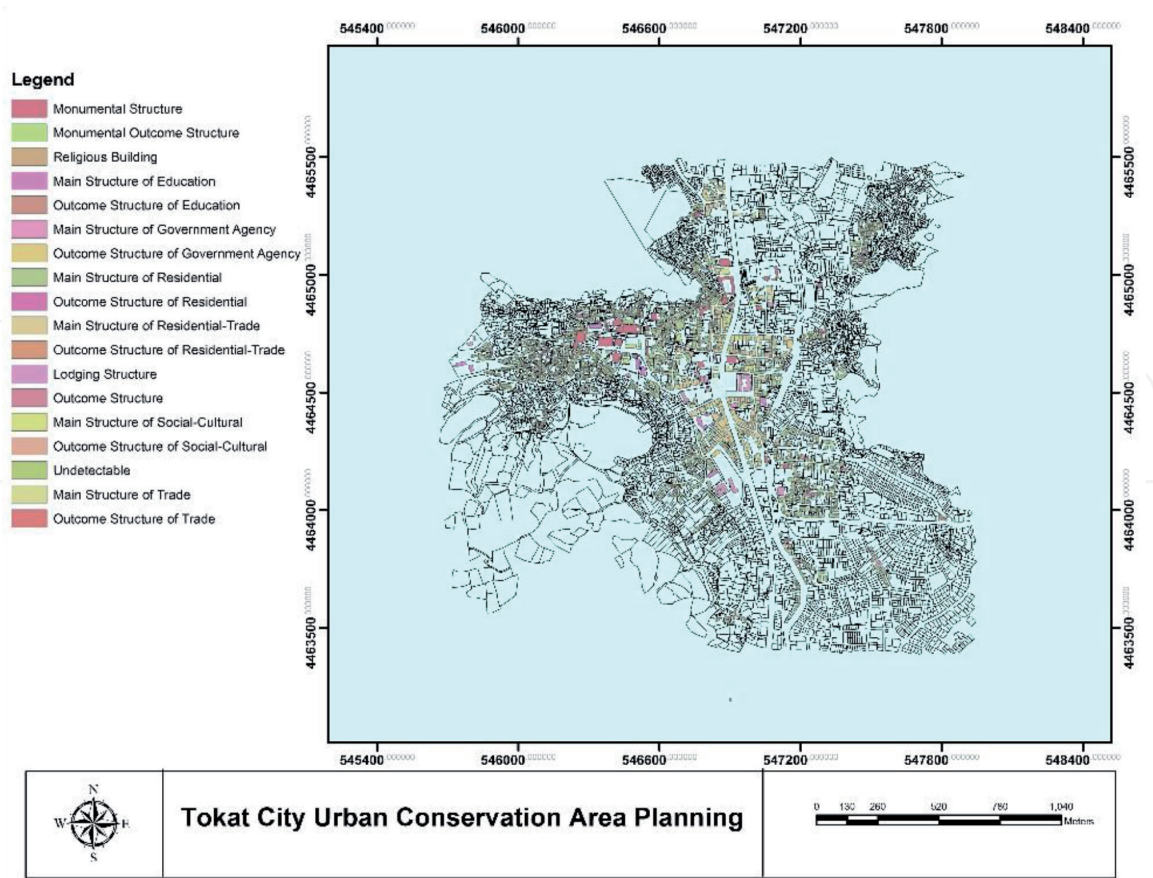


Figure 2.
Source: The map was obtained from Tokat municipality with ArcGIS program. The data is arranged by author for analyzing Tokat city.

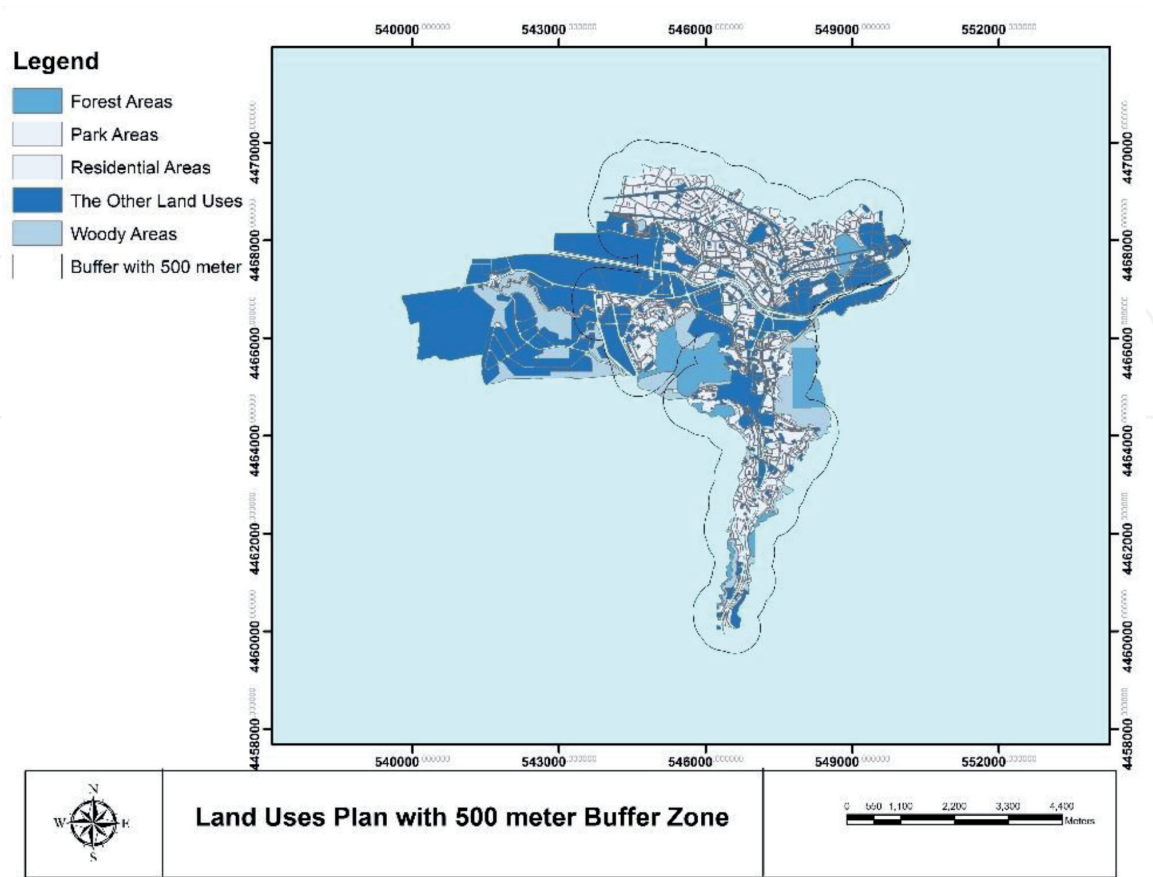


Figure 3.
Source: The map was obtained from Tokat municipality with NetCAD program. The map was converted to ArcGIS and prepared by the authors for description of analyzing areas in Tokat.

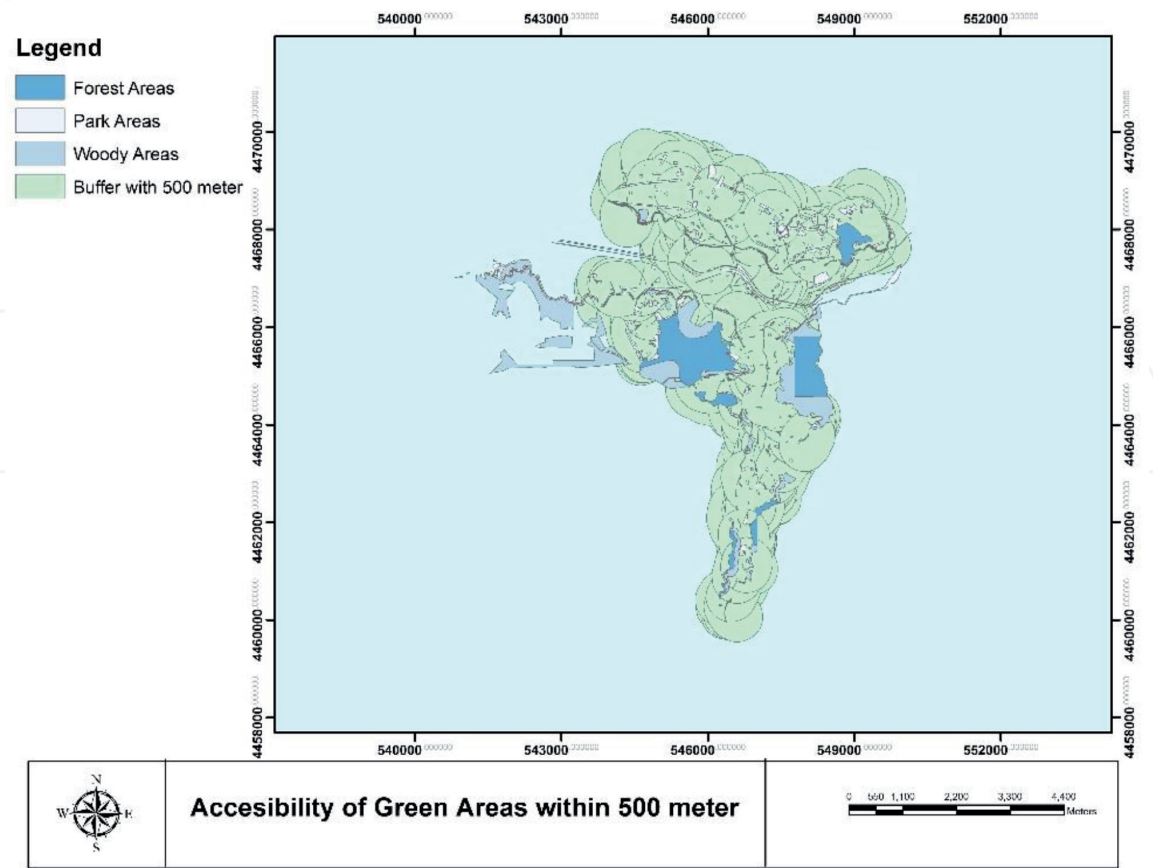


Figure 4.
Source: The map was obtained from Tokat municipality with NetCAD program. The map was converted to ArcGIS and prepared by the authors for description of analyzing areas in Tokat.

east sides. A green area planning activity on the west side where other terrestrial uses are common draws attention. The fact that these green areas do not serve any housing zones requires a reconsideration of the Tokat’s planning decisions (**Figure 4**).

The map shows that the green areas have been arranged without considering accessibility. The green areas outside the distance contribute to the number of green areas per capita, but they do not mean anything in terms of accessibility. The fact that no recommended housing zones are in this zone indicates that its green areas were not formed with a planning-based approach for accessibility. In addition, green areas were found to have been designed and planned without forming a unity. The map also shows that the green areas were designed inconsistently without considering planning principles.

3. Result

Of all the entire green areas, 53% were in the buffer zone, including 44% of park areas, 61% of forests, and 54% of woodlands. Although the accessibility of the green areas seemed to be ensured in this zone, 56% of the parks were not designed for accessible distances in a planned manner. The green areas were proposed to the region of the centers of the city in the old development plan. This planning decision exposed insufficient green areas and increased to predict 15,200 m² green areas in the solution approach [15] (**Table 1**).

The results indicate that the green areas in the city were distributed without planning criteria. The fact that most of the green areas are not within accessible distance indicates that Tokat’s planning decisions should be reconsidered. The presence

Unit of green spaces	Percentage of areas in 500 m
Park areas	44%
Forest areas	61%
Woody areas	54%

Table 1.
The percentage of green areas in buffer zone.

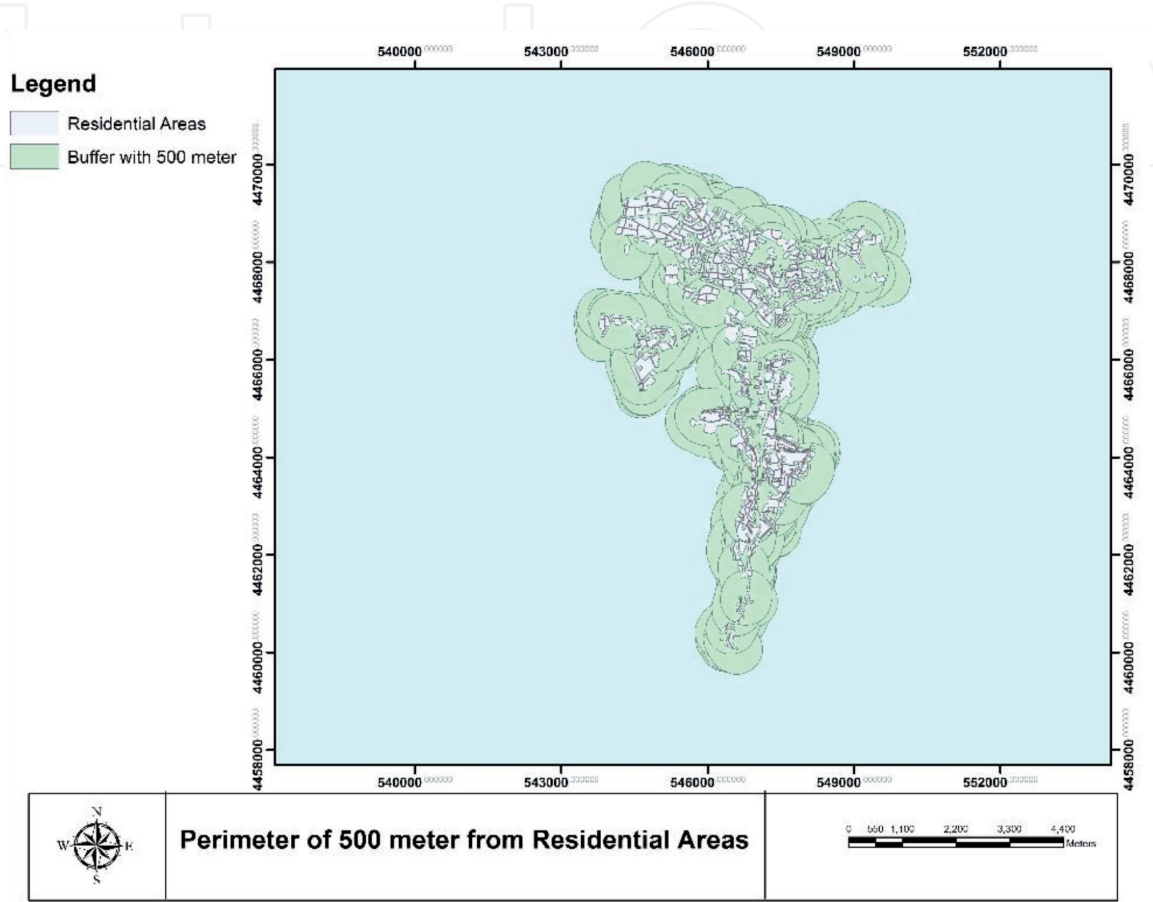


Figure 5.
Source: The map was obtained from Tokat municipality with NetCAD program. The map was converted to ArcGIS and prepared by the authors for description of analyzing areas in Tokat.

of woodlands and forests also affected the city’s planning decisions. The important point here is how much of the forests and woodlands are in active use (**Figure 5**).

Considering the distance from the housing zones to green areas, the 500-m rule was generally implemented. However, the green areas in the city do not have any unity, and not all of them are within 500 m from housing, which shows a case of unpracticality for young, elderly, and disabled people and raises the problem of their accessibility. Although there are numerous green areas around the housing zones, most of them are more than 500 m from houses. Two approaches will help to make Tokat’s green areas more planned and sustainable. The first suggestion is that the recommended housing zones should be relocated outside the buffer zone of current green areas, and the second is that a balance can be achieved by providing more green areas for the recommended housing zones.

Another approach is that recommended green areas should also complement one another and be unified. Green areas will thus be sustainable and form a climate that will help the urban ecology more. This will lead to more sustainable planning that will better reflect the city’s urban structure.

4. Discussion

If green areas are not planned carefully in urban planning zones, they will have problems with accessibility and distribution. This problem of the planning means that the result of decision for increasing density of structure in the Tokat city center area is the reason of new additional structuring decisions made by changing relationship of the parcel and structure to attract and bring revenue to the area, which makes decreasing rate of open areas [16]. Plenty of green areas may not be an accurate reflection of realistic planning data. To plan green areas properly and healthily, it is clear that making decisions by considering the green areas will provide a great contribution to the planning approach. Green areas should be considered in planning not only from the necessity-based perspective but also from the perspective regarding the quality of providing ecological benefits, forming healthy living conditions and serving as the places of gathering and sheltering during disasters.

The first priority of the conservation planning is to protect historical buildings, and the second priority is the green area arrangement. However, it is well-known that green areas are so important in both improving the quality of life and increasing the visual quality. It is necessary to make mandatory planning arrangements for green areas with the regulations and laws. If it is not possible to do any planning action for green areas to serve conservation areas, at least the green areas should be created within 500-m distance rule as required by laws and regulation. This condition reveals the importance of green areas arrangements.

The analyses clearly showed that Tokat's green areas lacked connections and that their ecological aspects were not considered. Regarding the urban distribution of green areas which could be regarded as planned zones, 56% were outside the buffer zone, indicating that they have planning-related problems. This study shows the necessity to approach to green areas with a more planned and usable method.

5. Conclusion

This paper serves as an analysis guiding the efforts to study the accessibility of green areas in Turkey. Its results, which should interest Turkey, indicate that the green areas were designed without considering their accessibility, as the new regulation stipulates. Bringing green areas to within 500 m is important for the public and young, elderly, and disabled people, and this makes the ability to measure their accessibility important.

The results show that green areas are not designed in accessibility distance of 500 m. In addition, the buffer zone method gives us the opportunity to measure the accessibility of green areas. Green areas per person were taken into account for the urban planning in Tokat city. Among the obtained results, buffer zone has forest areas (61%) and woody areas (51%) which compensates the planning of the amount of green areas for the residential areas.

This study is intended to guide papers about the accessibility of urban green areas in Turkey. It proposes a method for measuring accessibility. The planning approaches seen in Tokat indicate the need for housing zones and green areas to be proportional and accessible, which is also the case for many other cities in Turkey. This study proves that ArcGIS is an effective program and an important tool for buffer zone measurement. This method is important in order to guide many future studies and to be used in new studies, for example, in urban fringe to create green zones, the efforts to create zones of approaching conservation areas in urban development, etc.

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