Research Paper

Suitable Site Selection for Urban Parks and Green Spaces Development

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ARTICLE INFO

ABSTRACT

The purpose of this research is to identify and select suitable sites for developing urban parks and green spaces. So that people in different areas of the city have suitable and convenient access to these areas. In this research, site selection was used to determine suitable areas for developing urban parks in Gorgan city in Golestan province through a multi-criteria evaluation method and AHP approach. At first, effective criteria in site selection for the development the urban parks were identified by reviewing the previous studies and experts' opinions. After that, the selected factors were weighed using the AHP method. Then, suitable zones for developing urban parks were identified using the ZLS command based on the area of zones and the value of the land area. The final zones were determined among these high-proportion zones in the next step, with field investigation and ownership review. The results of weighting showed slope, barren lands, and proximity to residential areas by gaining weights of 0.2515, 0.1929 and 0.0757, respectively, had the highest weight and have the highest importance for identifying new areas for developing urban parks in the next step, the criteria were evaluated through WLC method, and the suitability map were prepared for developing urban parks.

Results showed that 32.19 hectares of the study area are suitable for establishing urban parks. The results of the present study, identifying and presenting suitable areas for developing urban parks and green spaces in Gorgan city, could help managers and decision-makers in this sector in providing green space and improving the people's quality of life and welfare.

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Extended Abstract
Introduction
Urban parks, as a feature of the urban landscape, feature many functions such as improving the mental and spiritual state of People through restoring the power of intellectual concentration, reducing stress, improving social relations, providing recreational activities, and environmental benefits such as temperature adjustment, improving water and air quality, and also aesthetic values. So, nowadays, the demand for using urban parks and green spaces has increased. However, in most cities there is not enough green spaces for people. On the other hand, due to the rapid growth of cities, one of the main concerns of urban managers and designers is to meet the citizens' basic needs, such as identifying suitable areas for developing parks and urban green spaces. The selection of suitable sites for developing the intended land use should be based on a set of spatial criteria that determine the best land suitability for that use. In this regard, land suitability analysis is a process to determine the ability of land for specific uses and also to determine the level of ability or land suitability based on various spatial criteria such as land-use, slope, and roads which help with decision makers to choose the best place for developing the intended use, which in the present study is urban parks and green spaces. These features make this method one of the most essential and standard methods for determining and selecting areas for each land use, such as urban parks. Due to the low per capita urban green space in the city of Gorgan in Golestan province, in this research, site selection was exerted to determine suitable areas for development of urban parks in Gorgan city in Golestan province through a multi-criteria evaluation method and AHP approach.

Methodology
In this research, Suitability site selection for developing urban parks and green spaces in Gorgan city (Golestan province) was carried out based on Multi-Criteria Evaluation (MCE) method and Analytical Hierarchy Process (AHP). Before providing any plan for developing urban parks and green spaces, the effective criteria for these developments should be identified. In order to do this, a wide variety of researches in this field were investigate (such as Zucca, et al., 2008, P.759; Tahmasebi, et al., 2014, P.358; Ziyari, & Sattari, 2014, P.6; Ajza Shokouhi & Razzaghian,2016 & Hailmariam, 2021). Finally, 13 criteria were identified to determine Suitable places for urban parks and green spaces. These criteria include slope, distance to river, barren lands, distance to fault, distance to existing parks, distance to residential areas, distance to medical centers, distance to educational centers, distance to cultural centers, distance to roads, distance to Shopping malls, distance to industrial areas and distance to gas station. Then, the AHP approach, one of the most standard methods used for weighting the criteria, was exerted to weight them. This method is a powerful and flexible tool for quantitative and qualitative analysis of multi-criteria problems, and its main feature is based on pairwise comparisons. The criteria weighing scale was performed in a range of 1 to 9 points and the criteria were prioritized based on expert opinion. Then, the AHP matrix was performed in the Idrisi Selva program and the weight of the layers was calculated. Also, the Consistency Ratio coefficient (CR) was calculated to determine the accuracy of the weight assigned to the criteria, which values less than 0.1, indicating that the weighting performed by experts is approved. Then, the layers were fuzzified using fuzzy membership functions in the Idrisi Selva software. In the next stage, the criteria were integrated by the WLC method and the suitability map was obtained for developing urban parks and green spaces. Then, zones with high suitability for developing urban parks were extracted through the ZLS module based on the area of zones and zonal land suitability, so the final zones

were selected after a field survey and ownership review.

Results and discussion

In this research, Multi Criteria Evaluation (MCE) and the AHP approach where used to determine suitable areas for developing urban parks and green spaces in Gorgan city in Golestan province. According to the results of the AHP, the criteria of slope, barren lands, and proximity to residential areas had the highest weight with the weights of 0.2515, 0.1929, and 0.0757, respectively. This indicates the importance of these criteria in site selection for developing regional urban parks and green spaces. Other researchers such as Dashti et al. (2013), Abebe & Megento (2017), Hailemariam (2021), and Yang, et al. (2021) also use this method to weigh Criteria have been used to select suitable places for developing urban parks and green space and have achieved desired results. After weighing the criteria and preparing their layers, the multi-criteria evaluation process was performed using the WLC method. The WLC output map shows the land suitability for developing urban parks with values from 0 to 255, where 0 shows the lowest suitability and 255 is the highest land Suitability for the Purpose. This method has been used in many studies such as Ajza Shokouhi & Razzaghian (2016); Tabrizi & Zahedi Klaki (2017); Abebe & Megento (2017), and Hailmariam (2021) to select suitable zones for developing urban parks and green space. In the next step, in order to the ZLS (Zonal Land Suitability) module was used to extract areas that have high potential for urban parks development. In the present study, ZLS was achieved for determining the high suitable areas for developing urban parks and green spaces by considering the area of at least 0.5 hectares and the value of more than 220 for each zone. Thus, about 80 hectares of the area were high suitability for urban parks development. Then, the zones were surveyed by the ground conditions using field work and Google Earth software. Finally, according to the results, about 32.19 hectares of the study area have the potential for developing urban parks and green spaces.

Conclusion

The results of the present study, identifying and presenting suitable areas for developing urban parks and green spaces in Gorgan city, could help managers and decision-makers in this sector in providing green space and improving the people's quality of life and welfare. Easy access and use of urban green spaces are one of the main needs of today's societies because urban life has severed human connection with nature and the busyness of life does not allow people to spend much time in these areas. Proper distribution of space in urban parks in the city can allow people to spend their leisure time, however short, in these areas and enjoy its positive effects on health.