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Analysis of Influencing Factors of Urban Green Space Accessibility and Residents' Satisfaction

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Abstract. This study examines the factors influencing urban green space accessibility and resident satisfaction. Data were collected through a questionnaire survey to analyse residents' subjective evaluation of green space accessibility, frequency and quality of use. It was found that accessibility, spatial distribution of green space, improvement of facilities and management mechanism were the key factors affecting residents' satisfaction. Through quantitative and qualitative analyses, this study proposes suggestions for optimising urban green space planning, improving transportation and upgrading management mechanisms in order to increase residents' satisfaction with green space accessibility, and thus enhance the quality of urban life.

Keywords: Urban Green Space, Accessibility, Resident Satisfaction.

1. Introduction

With the rapid expansion of modern cities, the original natural buildings are gradually being replaced by modern structures, and the areas covered by vegetation are gradually decreasing. The urban ecological environment is being increasingly damaged, and significant changes have occurred in the living environment. Urban green spaces are an important component of the urban ecological environment. Improving the ecological quality of green spaces and rational layout and planning of land are key methods to enhance their ecological benefits. The quality of urban green spaces is an important indicator reflecting the ecological quality, quality of life, and civilization of a city. [1] The distribution of urban green spaces in China is unequal, with varying supplies from green spaces to meet the needs of surrounding residential areas, differing distances, quantities, and accessibility. Additionally, there are characteristics of single and lagging indicators for green space planning and service evaluation.[2] In 2012, the Ministry of Housing and Urban-Rural Development (MOHURD) put forward the “Guiding Opinions on Promoting the Healthy Development of Urban Landscaping and Greening Construction”, accelerating the construction of urban parks and green spaces according to the requirement that residents should be able to travel “300m to see the greenery and 500m to see the parks” and to continually improve the reach and efficiency of parks and green spaces. 2016 MOHURD named the “Ecological Garden” for the first time. In 2016, the Ministry of Housing and Construction named for the first time the “ecological garden city”, which is the upgraded version of the “garden city”, and will focus on promoting the construction of ecological garden cities and improving the quality of gardening and greening.

In the rapid development of urban industry after the industrial revolution, the degree of environmental damage gradually increased, the population has increased dramatically, traffic congestion

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and congestion, ecological degradation and other practical problems, urban green space to improve environmental quality and enhance the quality of life of the residents can play a huge role in this concept planners in the process of urban construction gradually consider the synchronization of green space and urban planning, urban parks and green spaces began to be dispersed by the man-made plaque Gradually developed into a network of urban park green space with connectivity and integration, and its layout is also rationalized.[3]With the continuous expansion of urbanization, residents' demand for urban green space continues to increase, the level of demand continues to improve, and thus in the level of service, spatial distribution, scale configuration and other aspects of the urban green space put forward a higher level of requirements, the influence of the urban green space is becoming more and more influential,[4]scholars around the world have been to the various aspects of urban green space to carry out explorations and research.

(1)Study on the accessibility of urban green spaces

Hansen[4]proposed the concept of accessibility for the first time, and combined the accessibility gravity model with the principle of gravity to analyze the relationship between the elements of space, describe the relationship between network nodes, and quantify the size and strength of this relationship. The first time the concept of accessibility appeared in China was proposed by academician Lu Da Dao[5]when exploring the role of regional economic development and its spatial structure. After the emergence of the concept of accessibility, scholars from various parties started to construct new models and related evaluation methods based on this concept, and explored a lot of issues in the field of urban green space planning combined with accessibility research and investigation.

(2)Research related to the optimal allocation of urban green space

Initially the construction of urban green space for the purpose of improving the urban ecological environment,[7]thus with the developed countries for the ecological environment more and more attention, the emergence of a large number of concepts and theories about the construction of urban green space, and gradually reached a mature stage, such as the beginning of the idyllic city to the later ecological city, and then in the configuration of the urban green space to form a certain result.[8]Since then, scholars in various countries have carried out a lot of research on the optimal configuration of urban green space, and have given countermeasures and suggestions for the problems existing in urban functions, including the planning principles and planning objectives of urban green space, etc. Brown et al[9]explored the situation of people exercising in parks and green spaces in the study area, and concluded that different shapes of parks and green spaces can provide people with different services, providing a better solution for the rational layout of urban green space. It is concluded that different shapes of parks and green spaces can provide different services to people, which provides reference opinions for the rational layout of urban green spaces. Han Yinqi [10] took the planning and layout principles of urban green space as the starting point of the study, and the results proved that the structural attributes of urban green space need to be taken into account in the process of urban green space construction. With the increasing number of researches studying the optimal allocation of urban green space, the perspectives of research mainly include: landscape ecology, accessibility, and equity.

Maintaining the ecological environment and enhancing the quality of life for urban dwellers necessitates exploring the ease of access to urban green spaces. Providing methods and suggestions to improve resident satisfaction in this regard is crucial. As urbanization expands relentlessly and ecological standards rise continuously, the size and quality of urban green spaces must evolve accordingly. Consequently, the service standards and planning configurations of these green spaces confront significant challenges.In this scenario, exploring the subjective feelings and satisfaction of urban dwellers concerning In this scenario, exploring the subjective feelings and satisfaction of urban dwellers concerning the ease of access to urban green spaces is crucial. The aim of this research is to examine how urban residents perceive the accessibility of green spaces, delve into the correlation between accessibility and their satisfaction, furnish data to inform future urban green space planning, identify issues in current planning, and propose suitable countermeasures and recommendations.the ease of access to urban green spaces is crucial. The aim of this research is to examine how urban residents perceive the accessibility of green spaces, delve into the correlation between accessibility and their

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satisfaction, furnish data to inform future urban green space planning, identify issues in current planning, and propose suitable countermeasures and recommendations.

2. Methodology

2.1. Questionnaire method

This study first collects data by designing a structured questionnaire covering the subjective evaluation of urban residents' accessibility and satisfaction with green spaces. The questionnaire design contains the following key parts:

Green space accessibility: residents were surveyed on the walking time or driving time from their place of residence to the nearest green space to assess the physical accessibility of the green space. Data from this section can reflect the spatial distribution of green spaces and the ease of use for residents.

Frequency of green space use: assesses the actual use of green space and its relationship with accessibility by asking residents how often they use green space on a weekly or monthly basis.

Satisfaction with the quality of green space: This includes evaluations of the environment, the completeness of the facilities and the management of the green space, and aims to understand residents' subjective feelings about the quality of the green space.

Data on demographic characteristics: collect basic demographic information of respondents, including age, gender, income level, occupation, etc., in order to analyze the differentiated needs of different groups for green space accessibility.

2.2. Combination of qualitative and quantitative methods

Qualitative analysis method: statistical analysis of the collected data to analyze residents' average ratings of green space accessibility and green space quality, and to derive the problems of urban green space planning as well as residents' satisfaction with green space accessibility.

Quantitative analysis method: a binary logistic regression model was used to explore the influence of each factor on residents' satisfaction with green space accessibility. The reason for choosing the binary logistic regression model is that satisfaction is a categorical variable, which is suitable for binary data analysis. By quantitatively analyzing the independent variables (e.g., walking time, green space area, number of facilities, etc.) in the questionnaire data, we quantify the influence weights of each factor and clarify the key factors that affect residents' satisfaction.

2.3. Data sources

The object of this study is the satisfaction of urban residents of Urumqi, Xinjiang on the accessibility of green space, through the Internet questionnaires to obtain data, a total of 62 questionnaires, through the network IP, questionnaire fill in the logic of the screening exclusion of questionnaires, the recovery of valid questionnaires 58, the effective recovery rate of 93.54%.

descriptive analysis:

Table 1. User Personal Characteristics

Category	Options	Frequency	Weighting (%)
What is your gender?	Male	39	67.2
	Female	19	32.8
What is your age?	Under 20 years old	0	0
	20 to 40 years old	10	17.2
	Above 40 to 60 years old	35	60.3
	Above 60 years old	13	22.4
What is your monthly income?	Below 3000RMB	0	0
	3000-5000RMB	10	17.2
	5000-10000RMB	35	60.3
	Above 10000RMB	13	22.4

Source of data: Questionnaire survey

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As can be seen from the table, men account for 67.2% of the survey sample of residents, women account for 32.8%, men accounted for a larger proportion; age distribution in the middle-aged people aged 40 to 60 years old, accounting for 60.3%, followed by older people aged 60 years old or older, accounting for 22.4%, 20 to 40 years old accounted for 17.2%, and the number of people under the age of 20 years old is zero; the survey of the overall level of income is relatively high, mainly concentrated in the 5,000-10,000 yuan range, followed by more than 10,000 yuan at 22.4%, 3,000-5,000 yuan at 17.2%, and no one earning less than 3,000 yuan.

Table 2. Green Space Use Accessibility Survey

Category	Options	Frequency	Weighting (%)
What is the time it takes you to walk to the nearest green space?	Less than 10 minutes	24	41.4
	10-20 minutes	12	20.7
	20-30 minutes	12	20.7
	More than 30 minutes	10	17.2
Do you think the number of green spaces around you is reasonable?	Number of configurations is seriously low	10	17.2
	The number of configurations is small	21	36.2
	Reasonable number of configurations	17	29.3
	High number of configurations	10	17.2
How smooth is the traffic on your way to the green space?	Traffic is very congested	11	19
	Traffic is more congested	15	25.9
	Traffic is relatively smooth	22	37.9
	Traffic is very smooth	10	17.2

Source of data: Questionnaire survey

From the table, it can be seen that the time required for residents to reach the nearest green space on foot is within 10 minutes for 24 people, accounting for the largest proportion of 41.4%, followed by the same number of people in 10-20 minutes and 20-30 minutes, both accounting for 20.7%, and more than 30 minutes accounting for 17.2%. In the configuration of the number of green spaces, the vast majority of people responded to the configuration of the number of less, accounting for 36.2% of the most, responding to the configuration of the number of seriously low 10 people, accounting for 17.2%, reflecting the configuration of a reasonable number of people as well as the configuration of the number of more than accounting for 29.3% and 17.2%; in the investigation of the transportation to the green space, the vast majority of people responded to the smooth traffic, the traffic is more smooth with the traffic is very smooth respectively accounting for 37.3% and 17.2%. In the survey on the transportation to the green space, the majority of the people responded that the traffic was smooth, the traffic was smooth and the traffic was very smooth, accounting for 37.9% and 17.2% respectively, and a considerable part of the people responded that the traffic was very congested and more congested, accounting for 19% and 25.9% respectively. From these data, we can find some problems in the configuration of urban green space, from the number of people reacting to more than 20 minutes accounted for a relatively large part of the population, indicating that there is still a lack of urban green space from the residents of the distance planning; in the number of configurations on the majority of the people reacted to the configuration of the number of fewer, accounted for the largest number of people can be found in the number of urban green space configuration is unreasonable, the construction of the number of less; a considerable portion of the people reacted to the traffic is very blocked and more blocked, it can be concluded that green space is very blocked. more blocked, it can be concluded that the traffic planning layout of the green space still needs to be further optimized.

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Table 3. Green Space Frequency of Use Survey

Category	Options	Frequency	Weighting (%)
Average frequency of use is a few times a week?	0 times	5	8.6
	0-3 times	22	37.9
	3-6 times	21	36.2
	More than 6 times	10	17.2

Source of data: Questionnaire survey

From the table, it can be obtained that the residents' frequency of using the green space 0-3 times a week and 3-6 times a week are very high and close to each other, with 37.9% and 36.2%, followed by more than 6 times, with 17.2%, and the percentage of those who do not use the green space once is the smallest, with only 5 people, with 8.6%.

Table 4. Green Space Quality Survey

Category	Options	Frequency	Weighting (%)
Please rate the quality of the city's green space environment (out of 4, with higher scores indicating higher quality)	1	14	24.1
	2	17	29.3
	3	18	31
	4	9	15.5
Please rate the completeness of the facilities in the urban green space.	1	17	29.3
	2	12	20.7
	3	15	25.9
	4	14	24.1
Do you think the management mechanism of urban green space is perfect?	Very deficient	13	22.4
	Somewhat deficient	17	29.3
	Comparatively perfect	18	31
	Very good	10	17.2

Source of data: Questionnaire survey

From the table can be derived from the residents of urban green space environmental quality evaluation of the comprehensive average score of about 2.38 points (out of 4 points), which can be seen that the environmental quality of urban green space is more moderate, but also has a great deal of room for improvement; the average score of the degree of perfection of the urban green space facilities is about 2.45 points, it can be seen that the degree of perfection of the situation is more general, a considerable portion of the people think that the facilities have not yet been perfected; the urban green space management mechanism, the vast majority of people think that the management mechanism is deficient, very deficient and somewhat deficient accounted for 22.4% and 29.3%, respectively, that is more perfect 18 people, accounting for 31%, that is very perfect accounted for 17.2%. To sum up, the quality of urban green space environment, the perfection of green space facilities and the management mechanism of green space are not yet perfect, and need to be reasonably optimized and improved.

Table 5. Green Space Accessibility Evaluation and Satisfaction Survey

Category	Options	Frequency	Weighting (%)
Please rate the accessibility of the city's green spaces (out of 4, the higher the score the higher the accessibility)	1	12	20.7
	2	17	29.3
	3	18	31
	4	11	19
Are you satisfied with the accessibility of the city's green spaces?	Satisfactory	32	55.2
	Unsatisfactory	26	44.8

Source of data: Questionnaire survey

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From the table, we can calculate that the average score of the residents' evaluation of the accessibility of urban green space is 2.48 points, in general, the accessibility of urban green space is in the middle and upper level, if we want to further improve the quality of life of the residents, we must optimize the factors related to the accessibility of the urban green space; for the satisfaction of the accessibility of the green space, 32 people chose to be satisfied with the accessibility of the green space, which accounted for 55.2%, and 26 people chose to be dissatisfied with it, which accounted for 44.8%. The government should actively seek opinions from the residents and continuously adjust and optimize the planning and configuration of urban green space to improve the quality of life and satisfaction of the residents.

Binary logistic regression model construction:

The dichotomous dependent variable selected for this survey is residents' satisfaction with the accessibility of urban green space, and the values assigned to the dichotomous variable are 0 and 1 corresponding to dissatisfaction and satisfaction, respectively.

Where P denotes the probability of residents' satisfaction with urban green space accessibility, Xik denotes the factors affecting residents' satisfaction with green space accessibility, βik refers to the regression coefficient, which represents the degree of Xik 's influence on P, β0 refers to the intercept, and μ denotes the perturbation coefficient.

3. Results

The following regression results were obtained by assigning the options of each factor of the questionnaire as independent variables and residents' satisfaction with the accessibility of urban green spaces as dependent variables through SPSS software, utilizing the Wald coefficient stepwise screening method. The result passed the Omnibus test with significance <0.001 indicating a good model fit.

Table 6. Table logistic regression results

	Variables in the equation	B	Standard error	Wald	Degrees of freedom	Significance	Exp(B)
Step 1a	Please rate the quality of the urban green space environment (out of 4, with higher scores indicating higher quality)	2.955	0.757	15.222	1	0	0.052
	Constant	-6.477	1.709	14.363	1	0	650.317
Step 2b	How was the traffic on your way to the green space?	1.849	0.707	6.836	1	0.009	0.157
	Please rate the quality of the city's green spaces (out of 4, with higher scores indicating higher quality).	2.959	0.947	9.759	1	0.002	0.052
	Constant	-10.795	3.076	12.315	1	0	48756.589
Step 3c	Is transportation on your way to the green space smooth?	2.167	0.975	4.943	1	0.026	0.115
	Please rate the quality of the urban green space environment (4 out of 4, with higher scores indicating higher quality)	3.044	1.14	7.128	1	0.008	0.048
	Do you think the management mechanism of urban green space is perfect?	1.169	0.546	4.578	1	0.032	0.311
	Constant	-14.303	4.745	9.087	1	0.003	1628203.1

Source of data: SPSS

As obtained from the above table, whether the transportation on the way to the green space is smooth or not, the evaluation score of the environmental quality of the urban green space, and whether the management mechanism of the urban green space is perfect or not passed the significance test.

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(1) Analysis of the influence of the smoothness of transportation on the accessibility of urban green space on the satisfaction of the accessibility of urban green space

By logistic regression analysis results can be obtained on the way to the green space of the traffic on the urban green space accessibility satisfaction of the impact of the significance of 0.026 < 0.005, passed the test of significance, it can be obtained on the way to the green space of the traffic on the residents of the urban green space of the accessibility of the satisfaction of a greater impact. The regression coefficient is 2.167, with a positive sign, indicating that the smoothness of transportation to the urban green space is positively correlated with the residents' satisfaction with the accessibility of the green space, and the smoother the transportation is, the higher the residents' satisfaction is. Therefore, traffic management needs to optimize and adjust the traffic section to the green space, so as to improve the smoothness of traffic to improve the accessibility of residents to the green space, and further improve the satisfaction of residents.

(2) Analysis of the impact of the quality of urban green space environment on the satisfaction of urban green space accessibility

From the results of logistic regression analysis, it can be concluded that the quality of the urban green space environment has a significant impact on the satisfaction of the accessibility of urban green space of 0.08 < 0.005, which passes the test of significance, and it can be concluded that the quality of the urban green space environment has a greater impact on the satisfaction of the residents with the accessibility of urban green space. The regression coefficient is 3.044 with a positive sign, indicating that the quality of the urban green space environment is positively related to the residents' satisfaction with the accessibility of green space, and the higher the quality of the green space environment is, the higher the residents' satisfaction is. In order to better enhance the quality of vegetation, relevant management and planning departments can increase the variety of planted greenery, and appropriately use fertilizers, nutrient soil, and other methods to improve the growth of vegetation.

(3) Analysis of the influence of the perfection of the management mechanism of urban green space on the satisfaction of the accessibility of urban green space

From the results of logistic regression analysis, we can get the significance of the influence of the improvement of the management mechanism of the urban green space on the satisfaction of the accessibility of the urban green space is 0.032 < 0.005, which passes the significance test, and it can be concluded that the improvement of the management mechanism of the urban green space has a greater influence on the satisfaction of the accessibility of the urban green space. The regression coefficient is 1.169, with a positive sign, indicating that the improvement of the management mechanism of urban green space is positively correlated with the satisfaction of the accessibility of urban green space, and the more perfect the management mechanism of urban green space is, the higher the satisfaction of the residents will be. The government can strengthen the monitoring and management of urban green space, enhance the planning and implementation of urban green space, and increase the investment in green space construction so as to build a more perfect management mechanism of urban green space and improve the residents' satisfaction with urban green space.

4. Conclusion

This study provides an in-depth analysis of the multiple factors affecting urban green space accessibility and resident satisfaction. First, the physical accessibility of green spaces was assessed by investigating green space walking time, frequency of use, and residents' subjective evaluation of green space quality. It was found that transportation accessibility, spatial distribution of green space, facility improvement, and management mechanism were the main factors affecting residents' satisfaction. Through a combination of quantitative and qualitative analyses, the study suggests that optimizing urban green space planning, improving transportation, and upgrading green space management can significantly increase residents' satisfaction with green space accessibility, and ultimately enhance the quality of urban life.

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