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Research on Accessibility Optimization of Emergency Shelters in Chengdu Ring Eco-zone from the Perspective of Resilient City

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Abstract: Frequent natural disasters have put forward higher requirements for the comprehensive ability of disaster prevention and resilience in urban areas with a large number of people, and green space, as the most commonly used land for disaster prevention and risk avoidance, plays a key role in disaster prevention and risk avoidance. As a new development area in Chengdu, the central area of Chengdu has a long history and extensive population density, but there are still problems such as insufficient per capita park green space, imperfect road network structure, "misalignment" between the layout of green space for disaster prevention and risk avoidance and urban population density, and the hot spots of residents' production and life. Based on ArcGIS network analysis, Open Street Map traffic network analysis and existing Gaussian theory, this paper analyzes the rationality of the spatial layout of the existing green space for disaster prevention and risk avoidance in the central urban area of Chengdu by combining the four indicators of population ratio served, service area ratio, per capita avoidable area and population allocation gap. Based on Chengdu's "14th Five-Year Plan" for disaster prevention and mitigation, this project will first summarize the evaluation system of resilient cities at home and abroad, try to build a resilient city evaluation system suitable for Chinese cities, and then conduct a comprehensive analysis through satellite cloud data and POI point of interest crawling to preliminarily determine the reasons for the failure to meet the standard, and then conduct field research on the field feelings of residents around a certain part of the green belt around the city. It can be summarized as follows: (1) Combined with literature review, the theoretical and practical results of the existing research and evaluation on the accessibility of disaster prevention green space at home and abroad were fitted. Through the theoretical and research results, the regional characteristics and geological hazards of the disaster-prevention green space in the Chengdu Ring Ecological Zone were determined, and the residents in the central area of Chengdu were questioned based on a questionnaire survey to understand their cognition of the disaster-prevention green space and the current status of disaster-prevention green space services. (2) Based on the theory of resilient city, for the research on the accessibility of special disaster prevention green space, the buffer zone analysis method, the kernel density analysis method, the two-step mobile search method, and the traffic resistance accessibility evaluation model were comprehensively used to evaluate the accessibility of emergency shelters from the aspects of service radius buffer zone analysis, per capita service analysis, and per capita accessibility road analysis of disaster prevention green space, and the relevant data of the overall disaster prevention accessibility evaluation of Chengdu Ring Ecological Zone were calculated. The scoring results of each ecological region were Qingyang District (0.2547), Jinjiang District (0.2507), Wuhou District (0.2336), Chenghua District (0.2119), and Jinniu District (0.2547). (3) Based on the evaluation results and data, combined with the research results, the accessibility optimization scheme of Chengdu Ring Ecological Zone was analyzed. There are common problems in all districts, such as the mismatch between refuge sites and human settlements, the lack of refuge sites in road sections with high accessibility, and the isolation of the utilization rate of refuge sites. In view of the above problems, it is proposed to fully integrate the living environment to set up a disaster prevention green space. Disaster prevention green space traffic optimization and priority measures; Raise awareness of the use of disaster-proof green space facilities and resource conservation. Under the theoretical system of disaster prevention green space accessibility evaluation system, this paper uses the perspective of resilient city to construct special research data and optimization measures for Chengdu Ring City Ecozone.

Keywords: Ring Eco-Zone; Emergency Shelters; Resilient Cities; Accessibility Evaluation.

1. Prolegomenon

1.1. Background

1.1.1. Requirements for the Construction of a Comprehensive Urban Disaster Prevention System

The contradiction between urban safety, the growing demand for emergency avoidance and the limited urban land is a problem that must be solved in China's urban planning today, and how to use the reasonable arrangement of limited urban land and provide disaster shelter and resettlement for the affected residents in the event of a disaster is a problem that must be solved in the construction of a comprehensive urban disaster prevention system. Urban green space is an important part of the urban disaster prevention and risk avoidance system due to its structural characteristics such as openness and openness, plant community, ecological function, restriction and guidance function, recreation function and landscape function.

In recent years, the number and density of permanent residents in Chengdu have shown a trend of rapid growth year by year, while the construction rate of emergency shelters is slower than the growth rate of the population, and the per capita area of emergency shelters has decreased accordingly. From the perspective of accessibility, this paper studies the urban disaster prevention and risk avoidance green space, clarifies the spatial matching degree between the supply of disaster prevention and risk avoidance green space and the evacuation needs of permanent residents, and identifies the

areas that need more disaster prevention and risk avoidance green space the most, which is in line with the background of the continuous updating of the urban comprehensive disaster prevention system with the development of the city.

1.1.2. Requirements for the Construction of Resilient Cities

The International Council for Sustainable Development (ICLEI) defines a "resilient city" as one in which a city can withstand external disturbances, recover quickly and maintain relative stability. Many places in China have carried out the exploration of resilient cities, and megacities have put forward goals, methods and steps to achieve urban resilience according to local conditions when formulating urban master plans. Chengdu's overall land and space plan (2020-2035) also clearly points out that resilience should run through all aspects of urban development, so that resilience can be adapted to every node of the entire infrastructure network, and a system of emergency rescue and shelter places combining peacetime and wartime will be built. Cities are highly developed population clusters with high population density and building density, and in recent years, various disasters have become more and more frequent to bring security threats to urban residents. Urban green space is an outdoor activity place closely related to the life of urban residents, which has both social and ecological benefits, and has a strong ability to reduce disasters in space. In the case of land shortage, the construction of disaster prevention and risk avoidance green space is the first choice to consolidate the city's comprehensive disaster prevention system and safety system.

Compared with traditional urban safety planning, the concept of resilient cities emphasizes the resilience of cities and advocates the rational allocation of resources for rapid recovery from disasters. Urban disaster prevention and refuge green space is not only a part of urban green space, but also one of the main carriers of emergency shelters, which has a dual function. The combination of disaster prevention and risk avoidance green space is very consistent with the concept of resilient city and the background of resilient city construction.

1.2. Research Implications

1.2.1. Theoretical Implications

This paper comprehensively uses a variety of accessibility evaluation methods and multiple perspectives to analyze the accessibility of disaster prevention and risk avoidance green space in Chengdu Ring City Ecological Zone, extracts the evaluation index of disaster prevention and risk avoidance green space, and constructs a comprehensive evaluation system for the accessibility of disaster prevention and risk avoidance green space, which strengthens the rationality and pertinence of the layout of disaster prevention and risk avoidance green space, broadens the research methods and ideas of green space accessibility to a certain extent, and enriches the theory of planning and construction of disaster prevention and risk avoidance green space, which has certain theoretical expansion significance for enhancing the scientific nature of urban disaster prevention and risk avoidance green space planning theory.

1.2.2. Practical Implications

With the support of relevant theoretical research, this paper evaluates the rationality of the spatial distribution of disaster prevention and risk avoidance green space through the study of the accessibility of disaster prevention and risk avoidance green space in Chengdu Ring Ecological Zone, which is conducive to improving the disaster prevention and risk avoidance function of the existing urban green space according to local conditions, rationally arranging the disaster prevention and risk avoidance green space, saving urban land to the greatest extent, making better use of limited space resources, and maximizing the benefits of space resources, so as to improve the city's comprehensive disaster prevention ability and promote the safe development of the city. It has certain reference significance for the special planning of urban green space disaster prevention and risk avoidance function, and has practical significance for enhancing urban resilience.

1.3. Research Methods:

1.3.1. Gaussian Two-step Method

In the first step, for each piece of park green space j (i.e., the center of mass of the green space), the spatial distance threshold is set to d0 to form a spatial scope. For the population of each street k falling in the spatial scope (i.e., the centroid of the street), the Gaussian equation is used to assign a weight y, and these weighted populations are added to obtain the number of all potential users of green space j. The size of the green space is then divided by the number of all potential users to obtain the supply-demand ratio Rj.

$$R_j = \frac{S_j}{\sum_{k\in\{d_{kj}\le d_0\}} P_k} \tag{1}$$

In the formula: Pk is the population of street k in the spatial scope of green space j (dkj≤d0); dkj is the spatial distance from the center of street K to the center of green space J; SJ is the accommodating capacity of green space J, which is represented by the area of green space in this paper.

In the second step, for each street i (i.e., the centroid of the street), the spatial distance threshold d0 is set to form another spatial scope, and the Gaussian equation is used to assign a weight y to the supply ratio (Rl) of each green space l falling in the spatial scope, and then the weighted supply ratio (Rl) is added to obtain the green space accessibility Ai of each street i. The size of the Ai value can be understood as the per capita occupancy of green space in the disaster prevention city, and the unit is m^2 per person.

$$A_i = y\sum_{l\in\{d_{il}\le d_0\}} R_l \tag{2}$$

In the formula: Rl is the ratio of supply of green space l (dil ≤d0) in the spatial scope of street i. The description of other indicators is the same as that of equation (1).

1.3.2. Traffic Resistance Accessibility Evaluation Model

Walking is the main mode of travel in the event of a disaster during an emergency evacuation, and people are walking faster than usual. Therefore, in this study, the walking accessibility of urban refuge green space was mainly investigated at the time of disaster, and the walking speed was set to 194 m/min. On the basis of obtaining urban refuge green space, the network analysis method was used to construct a digital model of the transportation network within the study area in GIS with the actual entrance of the urban refuge green space as the center point, the actual pedestrian road network as the connection, the road intersection points as the node, and the time required for travel as the resistance. In order to simplify the application of the accessibility evaluation system on the visualization platform and improve the accuracy, for example, the map path planning API of AutoNavi Map is a set of walking, bus, driving query and travel distance calculation

interfaces provided by HTTP. The visual information analysis of indicators needs to be more in line with the establishment of the system of the ecological zone around the city.

It is proposed to introduce traffic flow as the second resistance index of the refuge space, in which the theory of spatial friction is used to set Z to represent the directly related street between green space J and street K, and X is the indirect related street. In the survey data, it is shown that the resistance is the lowest when z is greater than ek.

$$G_{kd} = \begin{cases} \dfrac{\frac{1}{e^{\left(\frac{1}{2}\right)^{\left(\frac{dij}{ek}\right)^2}}} - e^{-\left(\frac{1}{2}\right)}}{1 - e^{-\left(\frac{1}{2}\right)}}, z > ek \\ e^{-\left(\frac{1}{2}\right)}, z \le ek \end{cases} \quad (3)$$

In the formula: Gkd is the resistance coefficient, when calculating the two-part moving method, the resistance coefficient is multiplied by Ai to obtain the accessibility data, and the other indicators are described in the same equation (1).

1.4. Scope and Content of the Study

1.4.1. Overview of the Study Area

In order to practice the construction of a park city with the new development concept of Chengdu, the 35th meeting of the Standing Committee of the 15th People's Congress of Chengdu in 2012 passed the "Regulations on the Protection of Chengdu Ring City Ecological Zone", which clarified the planning, construction, management and supervision activities of the ring city ecological zone, and ensured the large-scale and continuous ecological space resources in the core area of the city. It has created a major driving project around the high-quality new living space of the Ring Ecological Park, which can be implemented efficiently and steadily.

The Ring Ecological Park project is composed of 500 meters on both sides of the Ring Expressway in the central area of Chengdu and seven wedge-shaped plots (Jinsha Wedge, Anjing Wedge, Beihu Wedge, Longtan Wedge, Qinglong Lake Wedge, Sansheng Wedge, Jiang'an Wedge), spanning 12 districts with a total land area of 187.15 square kilometers. After the Ring Ecological Park is fully connected, there will be 121 characteristic parks including "eight wetlands and six lakes".

With the expansion of the central urban area to the "11+2" area, the ecological zone around the city has been endowed with a new connotation under the new economic geography, which will become an important support for leading the quality improvement and population evacuation of the middle and excellent regions and practicing the concept of "park city".

Figure 1. Scope of the study

1.4.2. Data Source

1) Park refuge data: The data of park green space with an area of >0.1 hectares and the surrounding residential land are extracted through satellite remote sensing data provided by the geospatial data cloud. The extracted green space data corresponded to the evacuation sites in each district provided by the Chengdu Emergency Management Bureau, and the vector data of the Chengdu Ring City Ecological Belt were obtained. Then, the residential land was searched around the obtained green space data to obtain the spatial data of demand points under different spatial domain values. According to statistics, a total of 121 parks in the Chengdu Ring City Ecological Zone were obtained, which matched with 35 evacuation sites in Chengdu City, and the emergency shelters in the Ring City Ecological Zone were obtained (Table 1).

Table 1. The basic situation of the emergency shelter in the ecological zone around the city

code	Emergency shelters	area /hm^2	category	Management mode	Type of evacuation site
1	Qinglong Lake Wetland Park	2000.00	Comprehensive park	Full openness	Class I
2	North Lake Wetland Park	79.87	Comprehensive park	Full openness	Class I
3	Sansheng Flower Township	1000	Specialized parks	Full openness	Class I
4	Shiling District	2740	Administrative	Full openness	Class I
5	New domain in the north	944.28	Administrative	Semi-enclosed	Class I
6	State-Guest Area	3.13	Administrative	Semi-enclosed	Class II
7	Jinsha Lake Wetland Park	1903	Comprehensive park	Full openness	Class I
8	Jiang'an Lake Wetland Park	12	Comprehensive park	Full openness	Class II

2) Population data: The annual permanent resident population of each region of Chengdu is obtained through the 2021 statistical yearbook published by the Chengdu Statistical Public Information Network. The population of each district and each street was obtained by means of field research and data inquiry, taking the street as the basic unit

(Table 2).

Table 2. The population of each street

DISTRICT	STREET	POPULATION
LONGQUANYI DISTRICT	SHILING STREET	160009
	DONG'AN STREET	59959
CHENGHUA DISTRICT	LONGTAN STREET	142057
	WHITE LOTUS POND STREET	28108
TAURUS DISTRICT	DAY BACK TO THE TOWN STREETS	82676
	XIHUA STREET	139188
JINJIANG DISTRICT	SANSHENG STREET	78840
QINGYANG DISTRICT	JINSHA STREET	75239
	SUPO STREET	131939

3) Passage time data the passage distance between the supply point and the demand point is taken as the shortest communication distance and passage time under different modes of passage provided by AutoNavi Map. According to the different management modes of emergency shelter carriers, they are divided into three categories: (1) fully open: the distance between the shelter and the demand point is the distance from the geometric center point of the shelter to the residential land. (2) Closed mode: the distance between the entrance of the refuge and the residential land. (3) Semi-enclosed and semi-open: the distance from the boundary of the refuge site and the intersection of urban roads to the residential land shall be followed.

1.4.3. Research Content

This paper takes disaster prevention and hedge green space in Chengdu Ring ecological area as the research object, comprehensively analyzes its accessibility from multiple perspectives by using a variety of methods, builds a comprehensive evaluation system for the accessibility of urban disaster prevention and hedge green space, and puts forward optimization suggestions for the layout of disaster prevention and hedge green space in Chengdu ring ecological area according to the evaluation results. It is mainly discussed from the following aspects:

(1) Basic theoretical research: The theoretical and practical significance of studying the accessibility of urban disaster prevention and hedge green space in the current era is analyzed, the research content and research method of this paper are determined based on the research status at home and abroad, the concepts of disaster prevention and hedge green space and accessibility are determined and their development trend is analyzed, and theories such as Gauss two-step moving method are studied.

(2) Research and analysis of basic data and data: Collect relevant basic data and data such as planning documents, statistical yearbook, street data of the seventh population census, and POI data of the research area, and conduct a preliminary analysis on the distribution status of disaster prevention and shelter green space and the location and spatial distribution relationship of related factors such as park green space in Chengdu Ring Ecological Area.

(3) Accessibility analysis of disaster prevention and hedge green space in eco-zone around the city: This paper analyzes the accessibility of disaster prevention and refuge green space in the ring ecological area from three main aspects: road traffic topology, the relationship between the supply of disaster prevention and refuge green space and the actual demand of residents, and the relationship between the distribution of disaster prevention and refuge green space and the distribution of POI data core density, and calculates the accessibility evaluation data of the surrounding residential areas.

(4) Construct an evaluation system for the accessibility of urban disaster prevention and hedge green space and summarize optimization suggestions: Determine evaluation indicators based on the results of previous studies on accessibility evaluation and the results of this paper's research and analysis, and build a comprehensive evaluation system for the accessibility of urban disaster prevention and hedge green space. According to the evaluation results, the layout of disaster prevention and hedge green space in the ecological district around the city is optimized, and the optimization suggestions of urban disaster prevention and hedge green space layout are summarized.

1.5. Present Situation of Urban Green Space Construction in Chengdu

1.5.1. Green Space Construction in Chengdu Eco-zone

According to the data released by the Chengdu Park City Construction Administration Bureau, the planning index of the urban green space system of Chengdu (2011-2020) will be 15 square meters per person in 2020, but due to the rapid growth of the permanent population, this planning index has not been achieved as scheduled.

According to the Classification Standard of Urban Green Space (CJJ/T85-2017), park green space is divided into four categories: comprehensive park, community park, special park and recreation park. The distribution range of park green space in Chengdu is wide, but the scale of park green space varies greatly. The main urban area is mostly small green space, and the large area of park green space is mainly distributed in the ecological circle around the city.

1.5.2. Basic Situation of Disaster Prevention and Hedge Green Space in Chengdu Eco-zone

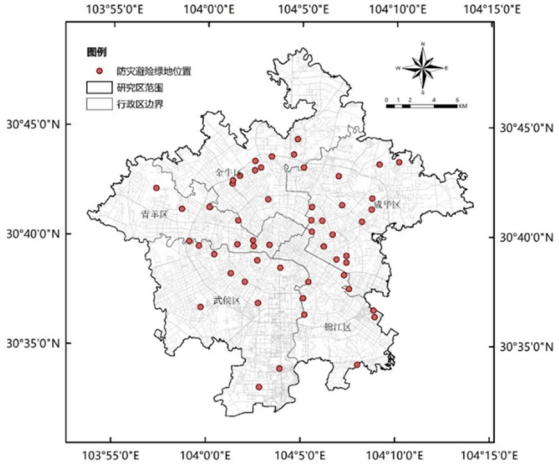

Figure 2. Distribution of disaster prevention and hedge green space in Chengdu eco-zone

The location data of disaster prevention and hedge green Spaces were imported into ArcGIS to obtain the distribution

map of disaster prevention and hedge green Spaces in Chengdu Ring City Ecological Zone (Figure 2). It can be seen that the distribution of disaster prevention and hedge green Spaces in Chengdu Ring City ecological Zone is relatively uniform.

2. Definition and Theoretical Basis of Disaster Prevention Green Space

2.1. Emergency Shelter

Emergency shelter is based on the city's refuge development planning and other relevant laws and regulations, through overall planning, design, construction, peacetime implementation of scientific management, emergency events for residents to safely take refuge, support the disaster area of the personnel camp and set up disaster relief command agencies, according to different indicators can be divided into a variety of types.

2.1.1. Divided by the Length of Refuge

In the "Earthquake emergency Site Selection and Supporting Facilities", the refuge places are divided into three categories according to the refuge time:

Table 3. Classification of emergency shelters (Source: Earthquake Emergency Site Selection and Supporting Facilities GB21734-2008)

Emergency shelter level	Facility configuration	Number of days to place assisted personnel
Class I	Complete comprehensive facilities	More than 30 days
Class II	Generally well-equipped	10 to 30 days
Class III	Complete basic facilities	Within 10 days

2.1.2. Divided by Service Object

The service objects of emergency refuge places can be mainly divided into two categories: supporting disaster personnel and disaster personnel, and according to this, they are divided into refuge places that provide refuge services for disaster personnel, command camp refuge places that serve to support disaster personnel and command agencies, and mixed refuge places that serve both types of service objects.

2.1.3. Divided by Type of Facility

The site type mainly includes disaster prevention and shelter green space, city square, stadium and playground, open parking lot, etc., which mainly uses the open space as an emergency shelter area to build tents, simple houses or transitional housing for the disaster victims to shelter. Place type mainly includes museums, exhibition halls, gymnasiums and other types of houses with large indoor independent space, using the existing closed space for disaster victims to escape.

2.2. Accessibility Concept and Research Method of Disaster Prevention Green Space

2.2.1. Accessibility Concept of Disaster Prevention Green Space

In 1959, Hansen Explained The concept of Accessibility for the first time in his book How Accessibility Shapes Land Use, which defined accessibility as the size of the role opportunities of each space node in the entire road traffic network. In the study on landscape accessibility of Zhongshan City, Yu Kongjian et al. (1999) first mentioned that landscape accessibility refers to the difficulty of reaching the target landscape point from any geographical location in the urban space. This is the first study on the concept of accessibility in China.

The research of accessibility involves a wide range of fields and many research directions, and there are obvious differences in the definition of accessibility among various scholars. This paper holds that the meaning of accessibility can be elaborated from two levels: on the objective level, it mainly refers to the degree of connection between the two Spaces of urban transportation network, which is between the supply point and the demand point; At the subjective level, people's psychological feelings and thoughts are included in the research category to analyze people's subjective will to choose space. At this level, accessibility includes the analysis of the attraction of the supply point, that is, the analysis of the service supply ability of the supply point.

2.2.2. Research Methods on Accessibility of Disaster Prevention Green Space

The accessibility of urban park green space disaster prevention and avoidance function refers to whether residents can enter the park in time after a disaster occurs. High accessibility indicates that people are easy to reach the park, and vice versa. The commonly used methods to measure the accessibility of urban refuge green space include statistical index method, neighborhood method, buffer analysis method, multi-factor resistance analysis method, gravitational potential energy model method, cost weighted distance method, two-step mobile search method, network analysis method and so on.

This paper mainly uses network analysis method to study accessibility

1. Data collection and processing

Download and interpret the satellite image of Chengdu City Ecological Park to extract green space information in the study area. With reference to the Overall Plan of Chengdu City 2016-2030 and the 14th Five-Year Plan for Comprehensive Disaster Prevention and Reduction of Chengdu City, the road information was downloaded based on the Chengdu Statistical Yearbook 2021 and related maps, and the data was integrated by Arcgis.

2. Build a digital traffic network model within the study area

Studies have shown that in emergency evacuation, walking is the main way to travel when disasters occur, and people walk faster than usual. Therefore, in this study, the walking accessibility of residents in urban refuge green Spaces during disasters was mainly investigated, and the walking speed was set at 194 m/min (the average walking speed of healthy residents during disasters). On the basis of obtaining urban refuge green space, network analysis method is adopted to build a digital traffic network model within the study area in GIS, taking the actual entrance of urban refuge green space as the central point, the actual walking road network as the connection, the road intersection points as the node, and the travel time as the resistance. The differences of the accessible area and the serving population of the urban refuge green space in 0-3, 3-5, 5-10, 10-15 min under the walking mode were calculated.

3. Statistics of service efficiency indicators

The service efficiency of parks under the requirement of disaster prevention and risk aversion is to superposition the population data of the park green space that can carry out

disaster prevention and risk aversion activities, obtain the service population of the park green space, and then analyze the service efficiency of urban parks and evaluate the disaster prevention and risk aversion service level of urban park green space.

2.3. Influencing Factors of Disaster Prevention Green Space Accessibility

There are three factors affecting the accessibility of green space: one is road traffic, which is calculated by the traffic time or distance from point to point; The second is the distribution of community settlements, calculating the distance between the residents' starting place and the target green space; The third is the supply capacity and location demand level of endpoint services, which refers to the ability to provide accessibility services and the need for accessibility services.

3. Data Processing

3.1. Evaluation Visualization

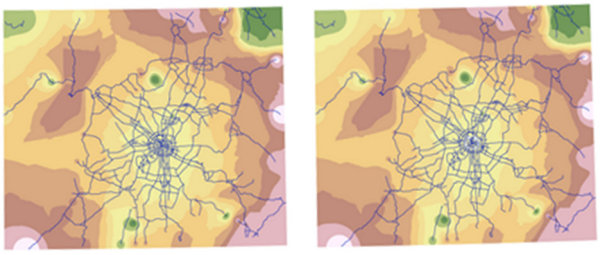

Figure 3. Accessibility of Chengdu traffic network and accessibility of green belt around the city

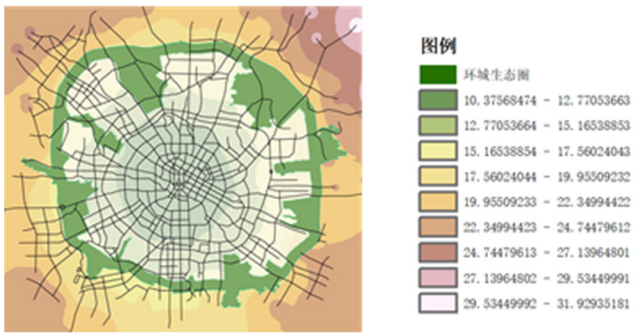

Figure 4. Traffic accessibility analysis of green belt around Chengdu City

Build a visualization platform, refer to the rating index system, and plan to establish a disaster prevention guide application guided by the map form. With simplicity, convenience and high efficiency as the main purpose, intelligent guidance is used to evaluate and construct the platform visual map.

4. Comprehensive Optimization Analysis

4.1. Service Optimization Suggestions

According to the "14th Five-Year Plan for Comprehensive Disaster Prevention and Reduction of Chengdu" and the "14th Five-Year Plan for National Economic and Social Development of Chengdu and the Outline of the Long-term Goals for 2005" and other policy documents, the planning service is based on the three time points when there is no disaster, and the occurrence of disasters and major disasters. On the basis of accessibility evaluation, some suggestions are put forward for disaster prevention and life index serviceability of the ecological district around the city. Taking walking for 5min and 15min as two indexes, the service scope of the park green space was analyzed. Considering traffic flow lines and disaster prevention needs, suggestions are made for park green area, service radiation and ecological environment indicators. Taking the per capita effective park green space (m2 / person) = the area of the fastest reached park green space/the number of permanent residents within the service area of the park, it can be concluded that the per capita refuge green space is about 1.5 square meters, which is less than the expected index of 2 square meters. In the construction of green space, it is still necessary to implement the construction as soon as possible, prevent disasters and accurately control disasters.

4.2. Accessibility Optimization Recommendations

According to the Classification Standard of Urban Green Space (GJJ/T 85-2002), the classification of urban park green space can be analyzed from the perspective of accessibility, with reference to the traffic accessibility evaluation model under the Gaussian two-step model and the network analysis model. In view of the impact of urban main roads and branch roads on the accessibility of the eco-zone around the city, cities that require per capita construction land of more than 100m2 in the standard of "National Garden City" should be taken, the per capita park green area of the city is not less than 9 m2/ person, and the per capita park green area of each city is not less than 5m2/ person. In the construction of urban network, the relationship between branch roads and main roads should be studied with accessibility as the system, the requirements of streamline and disaster prevention accessibility should be carefully considered, the spatial conflicts should be reduced, and the per capita green area and per capita traffic area should be increased.

5. Peroration

Based on the field survey data as shown in Figure 5, the evaluation of street residents and residents of Chengdu and its surrounding areas on the eco-zone around the city is summarized. It is for reference to study the plan of optimizing the suitability of green space system and disaster prevention system, and optimize the green space park in the ecological district under the accessibility suggestion, so as to meet the resilience indicators of "sponge city" and "ecological sustainability".

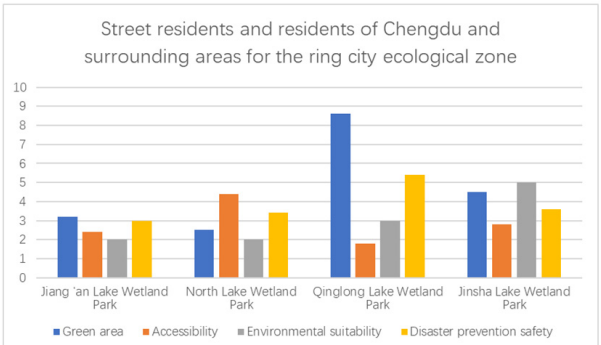

Figure 5. Street residents and residents of Chengdu and surrounding areas for the ring city ecological zone

In this paper, eight representative wedges of Qinglong Lake Wetland Park, North Lake Wetland Park, Sansheng Flower Township, Shiling District, New domain in the north, State Guest area, Jinsha Lake Wetland Park and Jiang 'an Lake Wetland Park are taken as the research objects. After summarizing its geographical characteristics and environmental profiles, the spatial friction deviation coefficient was fitted into the accessibility evaluation model, and its accessibility value was calculated to guide the optimization of disaster prevention green space in ecological areas. Based on the actual situation of Chengdu city and the preliminary concept of the construction of the eco-zone around the city, the disaster prevention performance and the coordination of the surrounding environment are made overall suggestions, and the traffic rationality and spatial accessibility of the eco-zone around the city are optimized and improved with the main purpose of jointly enjoying green space services, jointly guaranteeing disaster prevention and safety and jointly coordinating urban development.

Acknowledgments

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