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ARTICLE

PARK CITY PERSPECTIVE ACCESSIBILITY OF COUNTRY PARKS IN CHENGDU

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ARTICLE DETAILS

ABSTRACT

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Urban country parks are an important part of the urban park system and are important for the development and construction of the city. The accessibility of a country park can reflect the spatial distribution of the park and its services, and is an important indicator of whether a country park is accessible to citizens. The national parks in Chengdu were used as the study subjects, and three methods, namely kernel density analysis, standard deviation ellipse analysis and buffer zone analysis, were used to analyze the accessibility characteristics of the parks. The results show that rural parks in Chengdu are generally distributed in an east-west direction, with fewer parks in a north-south direction, and they are spread around major urban areas in a 'double ring'. Access to country parks is poor by bicycle, average by bus, and best by car. The conclusion is that the country parks in Chengdu are reasonably well distributed, well accessible overall, and suitable for self-drive tours. However, there are still some gaps in the service, there is scope for additional country parks in the north-south direction, and the issue of poor cycle access needs to be addressed.

KEYWORDS

Chengdu, Park Cities; Country Parks; Accessibility; GIS

1. INTRODUCTION

In recent years, the rapid development of China's cities and the expansion of urban space have put enormous pressure on the ecological environment around them. In Chengdu, for example, modern cities suffer from monoculture, ecological deterioration and lack of large open spaces. "to a city in a garden" [1]. The Chengdu Action Plan for Building a Park City Demonstration Zone that Practices the New Development Concept (2021-2025) stipulates that the Chengdu Park City Demonstration Zone should achieve significant results by 2025 and fully realize the goal of building a Park City Demonstration Zone by 2035.

Urban country parks have become an important part of optimising urban construction and development because of their role in protecting ecological infrastructure and natural landscape resources, providing suburban recreational areas for rural and urban residents, controlling the sprawl of urban construction and harmonising the relationship between urban and rural land use [2]. It has become an important part of optimizing urban construction and development. The accessibility of parkland is a powerful indicator of the park's capacity to serve. Studies on the accessibility of domestic and foreign parkland often use travel distance or cost methods, minimum distance methods, network analysis methods, statistical index methods, two-step moving search methods, and gravity model methods. In the context of Chengdu's aggressive efforts to build a park city, rural parks, as a category within the boundaries of urban parks, play a role of recreational services and ecological protection of suburban green spaces, and their study is of great significance. In this paper, we summarize the current characteristics of rural parks in Chengdu through the buffer zone analysis method, combined with a

comprehensive analysis of the kernel density and standard deviation ellipsoids, to provide a reference for the construction of rural parks in Chengdu in the context of park cities.

2. RELATED CONCEPTUAL STUDIES

2.1 Park city concept

The concept of "park city" was first proposed by General Secretary Xi Jinping during his visit to Chengdu's Tianfu New Area in 2018, and refers to the integrated planning of green space resources and the organic integration of park construction with urban construction to reduce the conflict between the conservation of natural resources in the suburbs and the rapid urbanisation process. The Park City is not simply a "park" + "city", building a park in the city, but turning the city into a big park, focusing more on the systematic, even and accessible layout of green space, and also emphasising the application of landscape gardening techniques to the overall construction of the city. This has resulted in a qualitative change from "park in the city" to "city in the park" [3]. Park City Concept and Rural Park Development The concept of a park city and the exploration of rural parks is a way to strike a balance between people and nature.

2.2 Country parks

Country parks are parks and green spaces on the outskirts of cities and outside built-up areas, where the grounds are dominated by native or secondary natural landscapes. China's national parks have not been under construction for a long time, and there are few indigenous cases,

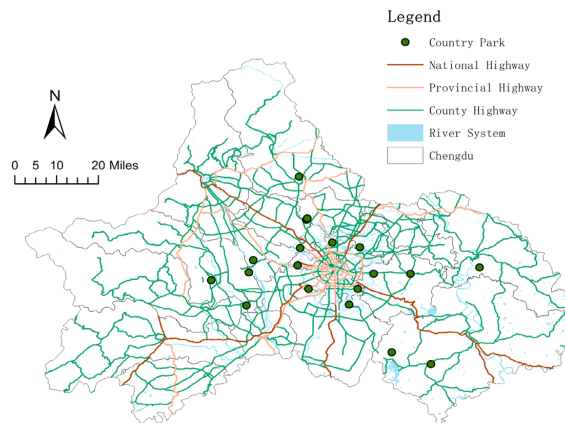


Figure 1: Schematic Diagram of Research Area (Redraw according to the Network)

mostly concentrated in coastal areas or large economically developed cities. The creation of country parks can limit the arbitrary expansion of urban development, increase the amount of urban green space and restore the ecological balance of cities [4]. The country parks can provide outdoor space for residents and visitors. Country parks can provide natural areas for outdoor activities for residents and visitors, as well as habitats for animals and plants, and are an important part of the ecological network of urban green spaces.

2.3 Accessibility

Accessibility is an important indicator of park service capacity. The concept of accessibility was first developed by Hansen [5]. The concept of accessibility was first introduced by Hansen and is often used to describe how easy it is to get from one place to another, or to reflect the use and accessibility of a place. Currently, there are many studies on the accessibility of urban green spaces, transportation and public facilities. Related studies in China started late, Lv and He studied the accessibility of 139 parks in Changchun through the buffer analysis method, and studied the influence of different modes of transportation on them [6]. Zhao et al. used buffer zone analysis to study the service and spatial carrying capacity of park green spaces in Changping District, Beijing, providing a theoretical basis for the design and development of park green spaces [7]. In this paper, we study the spatial distribution and services of rural parks in Chengdu by abstracting the city as a surface and treating the parks as coordinate points within it, using the buffer zone analysis method of ArcGIS 10.2, to derive the accessibility of rural parks under different modes of travel.

3. STUDY AREA

3.1 Overview of regional and country park development in Chengdu

Chengdu is located in southwest China, in the western part of the Sichuan Basin, between 102°54'~104°53' East and 30°05'~31°26' North, and is the capital city of Sichuan Province. Chengdu is one of China's top 10 ancient capitals, with a history of more than 2,300 years, and is also a hub for science and technology, trade and commerce, a financial center, and transportation and communication in the southwest. As a mega-city in the western region, Chengdu has a sound ecological foundation and strong development vitality, actively exploring the establishment of a park city and promoting the construction of rural parks to achieve initial results.

Back in 2004, the city of Chengdu planned and built ten rural parks in the city to meet the recreational and leisure needs of residents. As the city has developed, the nature of some of the country parks has changed [8]. The ten country parks. Six of the ten rural parks now exist, namely the Giant Panda Breeding Research Base, Happy Meilin Scenic Area, Qinglong Lake Wetland Park, Jiang'an River Ecological Park, Dafeng Riverfront Park and the International Intangible Cultural Heritage Fair Park. After the concept of "building a park city" was introduced, several new country parks have been built around the urban areas of Chengdu. Country parks have become the main places for outdoor tourism and leisure for people in urban areas of Chengdu.

4. DATA PROCESSING AND RESEARCH METHODS

4.1 Data processing

The study used vector map data from Chengdu 2020shp format, as well as water system and road data from RiverMap2.1 data server. Based on the ArcGIS10.2 software platform, the Baidu POI data was crawled from the Planning Cloud website (<http://guihuayun.com/>), and the basic data of Chengdu city parks was extracted with the help of Arcgis analysis tools. Then, based on literature, online data search, and actual studies, the objects belonging to the definition of rural park in Chengdu City Park were compared and screened. The results identified 19 existing country parks in Chengdu (Table 1).

4.2 Research methodology

4.2.1 Nuclear density analysis

By calculating the density of data points in the surrounding domain, kernel density analysis methods can find out where the data points are more concentrated and visually reflect the density and spatial influence range of the data points. In this paper, we use this method to analyze the distribution density of rural parks in Chengdu to determine the overall distribution of rural parks.

4.2.2 Standard deviation ellipse analysis

Standard deviation ellipses, which can be used to identify the spatial distribution characteristics of data points, reflecting the centre of gravity of the spatial distribution, the direction of the main trend and the direction of the secondary trend of the spatial distribution [9]. The standard deviation ellipse is used to identify the spatial distribution of the data points, reflecting the barycenter of the spatial distribution, the direction of the main trend, and the direction of the secondary trend. The standard deviation ellipse provides a better visualisation of the distribution of existing country parks and the direction of future development.

4.2.3 Buffer analysis

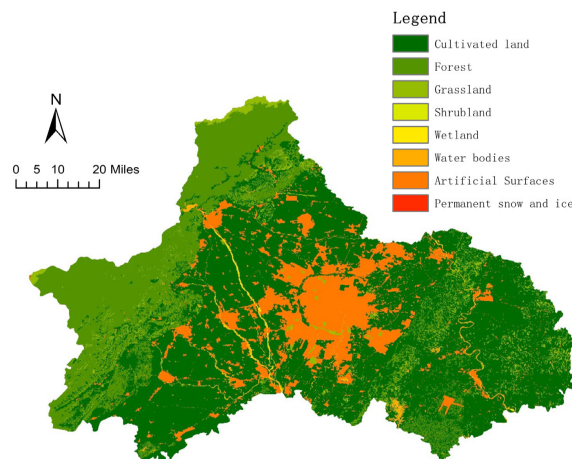
The city is abstracted into facets, with the country park as the center and the maximum service distance at different times as the radius. Residents within the buffer zone are considered to have easy access to the park and more convenient access to park services than those outside the zone. Country parks are located in the suburbs and outside the built-up areas of the city. Residents in urban areas generally use bicycles, self-driving cars and public transportation to reach the park. Considering the actual situation in Chengdu, we set a bicycle riding speed of 150 m/min, a self-drive speed of 500 m/min, and a bus traveling speed of 300 m/min, and selected 10, 20, and 30 min as the travel time for the rural park. An analysis of the buffer zone was performed.

4.2.4 Superposition analysis

Stacking analysis refers to the process of aggregating two different data under the same spatial reference frame to derive the desired data. The GLOBELAND30 (<http://globeland30.org/>) was used to obtain the 2020 version of the current land use map of Chengdu (Figure 2), and ArcGIS

Table 1: Chengdu Country Parks and Addresses (Drawing by the Author)

Title	address
Qinglonghu Wetland Park	Chengluo Avenue, Longquan Post Station, Chengdu
West Zhongshui Wetland Park	Intersection of Xiyuan Avenue and Furong Avenue, Gaoxin West District, Chengdu, Sichuan Province
Xinchuan Wetland Park	80 meters north of the intersection of Chonghe 3rd Street and Xintong North 3rd Road, Shuangliu District, Chengdu
Longquanshan Urban Forest Park	Longquanshan Urban Forest Park, Chengdu Second Ring Highway, Jianyang City, Chengdu City, Sichuan Province
Happy Merlin Scenic Spot	Intersection of Xingfu Road and Jinjiang Avenue, Sansheng Township, Jinjiang District, Chengdu City, Sichuan Province
Dafeng Riverside Park	Opposite Area A of Boya New City, Xindu District, Chengdu City, Sichuan Province
International Intangible Cultural Heritage Expo Park	601, Section 2, Guanghua Avenue, Qingyang District, Chengdu City
Chengdu Research Base of Giant Panda Breeding	1375 Panda Dadao, Chenghua District, Chengdu City, Sichuan Province
Jiang'an River Ecological Park	Section 3, Tuji Road, Majiahe Village, Wuhou District, Chengdu City, Sichuan Province
Lujiatan Wetland Park	About 70 meters southeast of the intersection of the third section of Beilin Green Road and Tianxiang Road, Wenjiang District, Chengdu City, Sichuan Province
Future science and technology suburban park	Along the east line of Future Science and Technology City, Jianyang City, Chengdu City, Sichuan Province
Kwun Kwon Country Park	100 meters southwest of the intersection of Binhe Road and Yutan Road, Pengzhou City, Chengdu City, Sichuan Province
Alder River Wetland Park	Wuxing Village, Baitou Town, Chongzhou City, Chengdu City, Sichuan Province
Jiayu Sheep Horse Wetland Park	366 Yonghe Avenue
Xiangcao Lake Wetland Park	Pi chengdu city, sichuan province are sand area 980 meters to the northeast corner of the west and new road intersection
Yangxi Valley Wetland Park	Jintang County, Chengdu City, Sichuan Province
Luoshui Wetland Park	Luoshui Wetland Park, intersection of SAN 'e Street and Mei Street, Luodai Town, Longquanyi Station District, Chengdu City
Fuheyuan Wetland Park	Chengdu city, sichuan province Pi district shu source road all three weir green tree scenic area
Sha Qu Wetland Park	Fangzheng Road, Dayi County, Chengdu City, Sichuan Province

**Figure 2:** Land Use Map of Chengdu in 2020 (Drawing by the Author)

10.2 software was used to extract the area of built-up land in Chengdu, which was calculated to be approximately 1865.97km², in order to determine the size of the service area of the country park. An overlay analysis was performed on both rural park buffers and urban built-up land under multiple travel modes.

5. RESULTS AND ANALYSIS

5.1 Spatial distribution characteristics of country parks in Chengdu

The kernel density analysis (Figure 3) and the standard deviation ellipse analysis (Figure 4) were used to obtain the overall spatial distribution of the country parks in Chengdu. The country parks in Chengdu as a whole are distributed in an east-west direction, with the largest number of parks in the west and fewer parks in the north-south direction. As can be seen from the figure, the western part has the highest density of parks, concentrating on the West Zhongshui Wetland Park, the International Intangible Cultural Heritage Expo Park, the Jiang'an River Ecological Park, the Lujatan Wetland Park, the Jiayu Yama Wetland Park, the Herb Lake Wetland Park and the Fuheyuan Wetland Park. The western part of the city is used as a functional area for modern agriculture and ecological protection in Chengdu's urban master plan, focusing on the sustainable development of green industries and optimising the layout of ecological functions, and therefore more country parks have been built to maintain a modern idyllic urban form that is ecologically livable. The eastern part of the city is less densely populated, with only the Future Science and Technology City Country Park and the Longquanshan Urban Forest Park in the eastern part of the city, as the area to the east of Longquanshan is dominated by low and medium hills with great potential for development, and the soil quality is more suitable for urban construction and industrial layout than for the development of modern agriculture. The northern side of Chengdu has been developing at a slower pace than the other three sides, and there has been a comparative lack of planning for the construction of

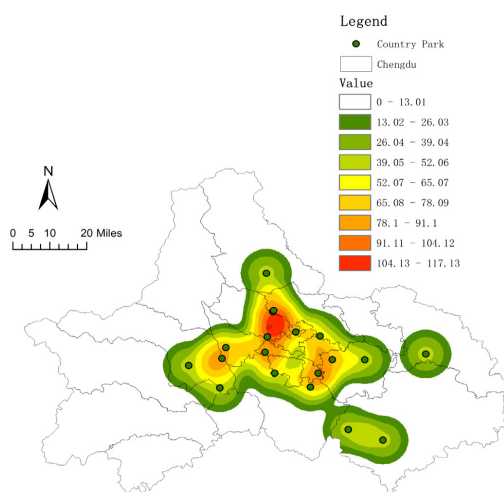


Figure 3: Nuclear Density Analysis of Chengdu Country Parks (Drawing by the Author)

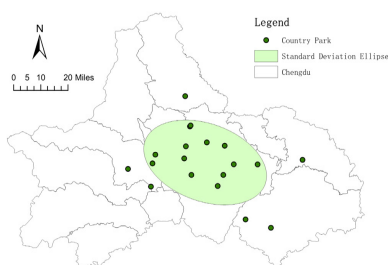


Figure 4: Standard Deviation Ellipse of Chengdu Country Park (Drawing by the Author)

country parks. Six of the ten existing country parks planned in the early years were concentrated in the outer circle of the main city, close to the first urban bypass, forming the 'ecological boundary' of the main city. The new park is still centred around the city centre, close to the Second Bypass. The "inner and outer ring" of Chengdu's country parks generally meets the needs of urban residents.

5.2 Comparison of differences in country park accessibility by different modes of Transport

5.2.1 Park accessibility in cycling mode

As shown in Figure 5, the buffer zone analysis yields a total park service area of approximately 46.45km² for a 10min ride, 198.49km² for a 20min ride, and 441.54km² for the total park service area radiated by a 30min ride. These account for 2.49 percent, 10.64 percent and 23.66 percent of the total land area under construction in Chengdu, respectively. The Happy Meilin Scenic Area, Dafeng Binhe Park, West District Zhongshui Wetland Park, Xinchuan Wetland Park, International Intangible Cultural Heritage Expo Park, Chengdu Giant Panda Breeding Research Base, Jiang'an River Ecological Park and Qinglong Lake Wetland Park near the main urban area are relatively well accessible, while other parks are difficult to reach by cycling. An analysis of the data showed that it takes residents in most areas of Chengdu more than 30 minutes to reach the country park by bicycle, and the country park is not very accessible by bicycle.

5.2.2 Park accessibility by self-drive

As shown in Figure 6, the total area of park services accessible by car in 10 minutes is about 544.03km², in 20 minutes by car is about 1245.98km² and in 30 minutes by car is about 1503.73km². The service area of the park within 30 minutes can cover almost the entire urban area of Chengdu, indicating good accessibility under the driving mode. More than half of residents can travel within 20 minutes and only a small percentage of residents cannot reach the park within 30 minutes, while residents in the Southeast, South and North areas spend a relatively longer time traveling. The time it takes to travel is relatively long for residents in the South, South East and North Districts.

5.2.3 Park accessibility by bus mode

As shown in Figure 7, the total service area of the park that can be reached by bus travel for 10min is calculated to be about 198.49km², the total service area of the park that can be reached by bus travel for 20min is about 746.57km², and the service area of the park that can be reached by bus travel for 30min is about 1167.31km². They account for 10.64 percent, 40.01 percent and 62.56 percent of the total land area under construction in Chengdu, respectively. Verdict: The accessibility of country parks under the bus tour mode is average. More than half of the residents need to travel more than 20 minutes by bus to reach the park. Most of them can reach the park within half an hour, but with the time taken to get to the bus stop and wait for the bus, most trips still take more than 30 minutes.

5.3 Comprehensive accessibility assessment

The above statistics show that cycling takes longer to reach country parks, the travel experience decreases after 30min, and accessibility is worst for cycling. Access to the park by bus is average, with most residents traveling 20-30 min, while access by car is the best, covering nearly the entire length of Chengdu's main city in 30 min. Chengdu's road network is extensive, with a large number of private cars, and most country parks are located along major highways such as the bypass, making them easily accessible by car. Overall, Chengdu's rural parks are generally accessible and reasonably well distributed, especially for self-drive tours. However, there are still a number of service gaps and poor cycling accessibility needs to be addressed.

6. CONCLUDING REMARKS

In this paper, we analyze the distribution and accessibility of rural parks in Chengdu using three analysis tools: kernel density analysis, standard deviation ellipse and buffer analysis in ArcGIS, and three travel modes: cycling, autonomous driving and public transportation. The following conclusions were drawn: Chengdu's rural parks, located far from urban

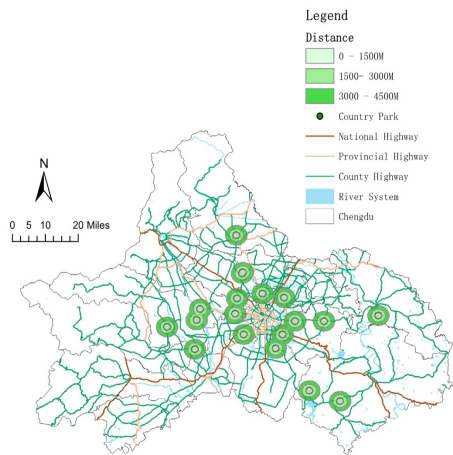


Figure 5: Buffer Zone Analysis Diagram under Bicycle Riding Mode (Drawing by the Author)

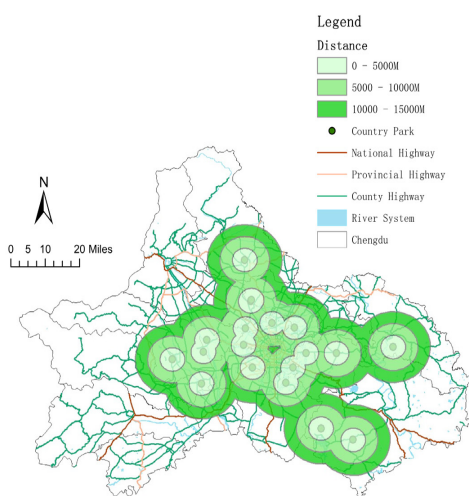


Figure 6: Analysis Diagram of Buffer Zone in Self-Driving Mode (Drawing by the Author)

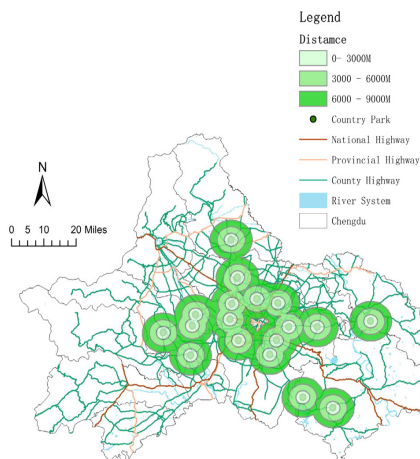


Figure 7: Buffer Analysis Diagram under Bus Mode (Drawing by the Author)

areas and mostly dotted, have a reasonable overall layout and form the city's 'ecological boundaries'. The number of country parks in the north-south direction is less dense than in the east-west direction and needs to increase. The parks are scattered and not well connected, and the interaction needs to be improved. Access to the park is directly influenced by the mode of travel. Cycling is not yet a major mode of access to country parks due to the long journey times. The next step is to improve the distribution of rural parks in the north and south, to close gaps in park services and to improve park accessibility.

According to Chengdu's urban master plan, the western part of the city is a key area for ecological protection. Based on the good foundation for the development of rural parks, we can continue to strengthen this area in the future and make the western part an idyllic city with pleasant surroundings. In the east, north and south, while promoting economic development, more rural parks can be created to protect the regional ecological environment and strengthen ecological management, so that urban ecology and economy can develop in tandem. The city of Chengdu is building a park city to promote green and low-carbon travel, and has built many park greenways to encourage cycling, so the accessibility of parkland can be improved by strengthening the network of greenways in areas surrounding rural parks, which will also facilitate travel for residents. With the Chengdu Metro under construction, additional stations near rural parks could shorten the public travel time for city residents to reach suburban parks. Improving accessibility is a key step in improving the service level of Chengdu's rural parks.

REFERENCES

[1] Xu, H. Exploring the site selection and development of Zhengzhou country parks from the perspective of park cities. *Modern Horticulture*. 2020, 43(24):131-132.

[2] Yokohari, M., Takeuchi, K., Watanabe, T., et al. Beyond greenbelts and zoning: a new planning concept for the environment of Asian megacities. *Landscape & Urban Planning*. 2000, 47(3/4): 159-171.

[3] Shi, Z.B., Lu, Y.Q. Reflections and explorations on the concept of park city in the practice of urban repair: an example of green space landscape construction in Changqing Garden, Xining. *China Garden*. 2022, 38(z1):81-85.

[4] Luo, Y., Jiak, J., Zhao, Z., et al. Exploring the construction of urban country parks in China. *Journal of Southwest Forestry University (Social Science)*. 2017(6):88-93.

[5] Hansen, W. G. How accessibility shapes landuse. *Journal of the American Planning Association*. 1959, 25(2): 73-76.

[6] Lv, J., He, X. Research on the layout and accessibility of parks in Changchun based on different travel modes. *Sichuan Building Materials*. 2021, 47(11):62-63.

[7] Zhao, S., Liu, X., Li, X. Analysis of service capacity of urban parks based on service radius and spatial carrying capacity - taking Changping District of Beijing as an example. *Anhui Agronomy Bulletin*. 2019, 25(22):158-161.

[8] LU, L., ZHAO, G., WANG, Y. Exploring the construction and application value of recreation opportunity spectrum in Chengdu country parks. *Shanghai Journal of Agriculture*. 2019, 35(4):63-69.

[9] Sun, Z., Zhang, Y. Spatial and temporal evolution characteristics of the agglomeration level of high-tech manufacturing industry in China--an empirical study based on the spatial statistical standard deviation ellipsoid method. *Science and Technology Progress and Countermeasures*. 2018, 35(9):54-58.

