

Evaluation of Recreational Facilities in Guandu section of Baoxiang River Basin Under the Background of Big Data: Based on POI

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Abstract. As the most important place for residents' daily leisure, the planning, layout and service level of urban recreational facilities are closely related to the quality of urban life. Taking national leisure as the benchmark and big data as the background, through the integration of POI data, vector building contour data and OSM road system data, combined with field survey, Tyson polygon is introduced to partition the urban recreational facilities in Guandu section of Baoxiang River Basin, build the urban recreational facilities system, and carry out the evaluation dimension from three aspects: quality, accessibility and coverage of urban recreational facilities, According to the main problems existing in this area, optimization suggestions are put forward, including improving the type of recreational facilities, adding the number of recreational facilities, paying attention to the fairness of recreational facilities and so on. This study has some limitations in the research scope, service scope and service population, but in view of the complex construction of the research scope, rich cultural types and certain representativeness, it can provide some reference for the evaluation and optimization of recreational facilities in similar regions.

Keywords: Big data, Recreational Facilities, POI, Tyson polygon, Baoxiang River Basin.

1. Introduction

A. Overview of Recreational Facilities

At present, the definition of urban recreation facilities has not been reached among schools, but it is generally defined as: it is located in the city or the outskirts of the city, and the recreational persons can freely enter and exit, and have open spaces, buildings and facilities with recreational, rest, shopping, sightseeing, communication, exercise and tourism functions. Meanwhile, the emphasis is placed on the recreational places. Also pay attention to recreational activities and behaviors in space [1].

With the continuous development of urban social civilization and the rising of urban living standards, the contradiction between urban recreation facilities and residents' demands for recreation has been constantly showing. The planning layout, facilities supply and experience activity design of traditional recreational facilities cannot adapt to the change of current recreational mode, and the urgency of planning and development, Rationality directly affects the convenience, comfort and high quality of residents' recreational experience, which is of great significance to effectively improve the livability and the happiness of urban residents [2].

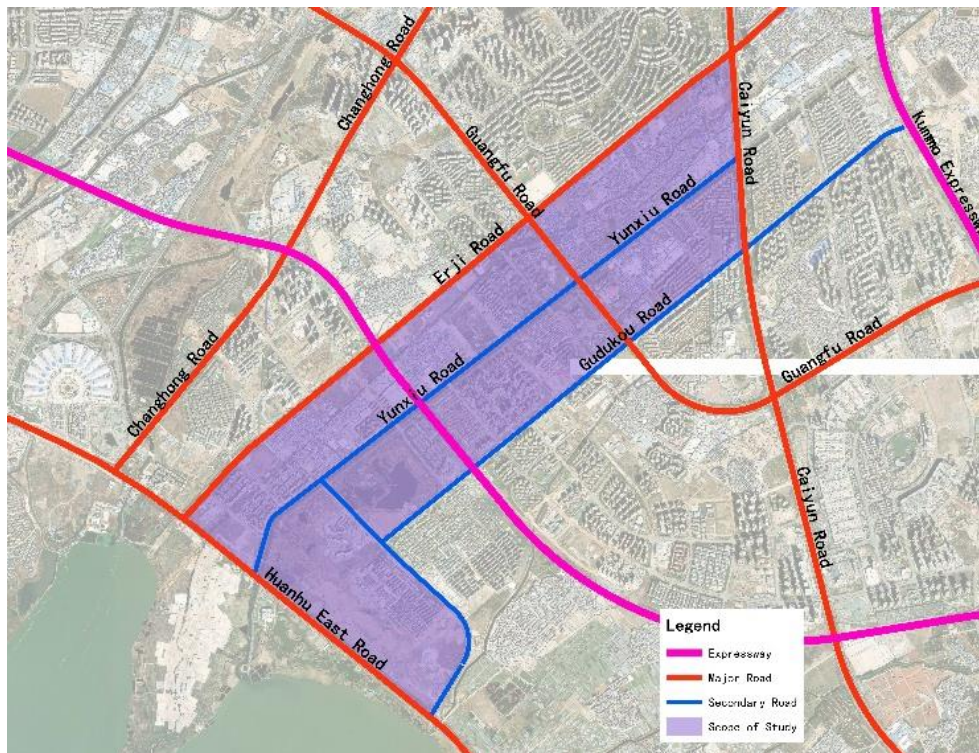


Figure 1. Scope of Study

B. Research Object and Scope

The research object of this study is Guandu section of Baoxiang River Basin, which is adjacent to Gudukou Road, Xilinji road in the East, Huanhu East Road in the south, Caiyun road in the north (Fig.1). As one of the important tributaries of Yunnan Province, the construction of the area and its surrounding areas is more complex:

- 1) from the perspective of spatial structure, the area mainly relies on Wujiaba city business district and builds a waterfront leisure landscape corridor combining with wetland park;
- 2) From the functional structure, the region is composed of business office, urban comprehensive service, financial industry, high-end education, cultural tourism and modern services;
- 3) From the construction situation of the region, there are not only new residential areas, but also traditional historical and cultural buildings in the area, and the urban villages to be reconstructed, which makes the construction more complex;
- 4) From the perspective of the deviation between planning and actual construction, most commercial and commercial land in the planning still bear the function of living. Many residential areas' central green space is occupied by other functions, and there are still a lot of idle land which causes waste of urban land resources.

In view of the complexity of the region, this paper takes this as an example to evaluate the urban recreation facilities, which is conducive to the comprehensive evaluation of the recreational needs of urban residents, and to provide optimization suggestions for the planning and construction of recreational facilities in Kunming and surrounding areas. The research objects must meet the following requirements: first, it must be along the river basin and not too far away; secondly, it should have strong continuity and clear indication; third, both sides of the basin should be included in the scope of urban planning area (excluding undeveloped or permanent village areas).

2. Assessment Method

2.1. Technical Route

This study evaluates the recreational facilities in the region. Combined with the POI of recreational facilities under big data, the evaluation is carried out from three aspects: type, quality and service pressure, as shown in Fig. 2.

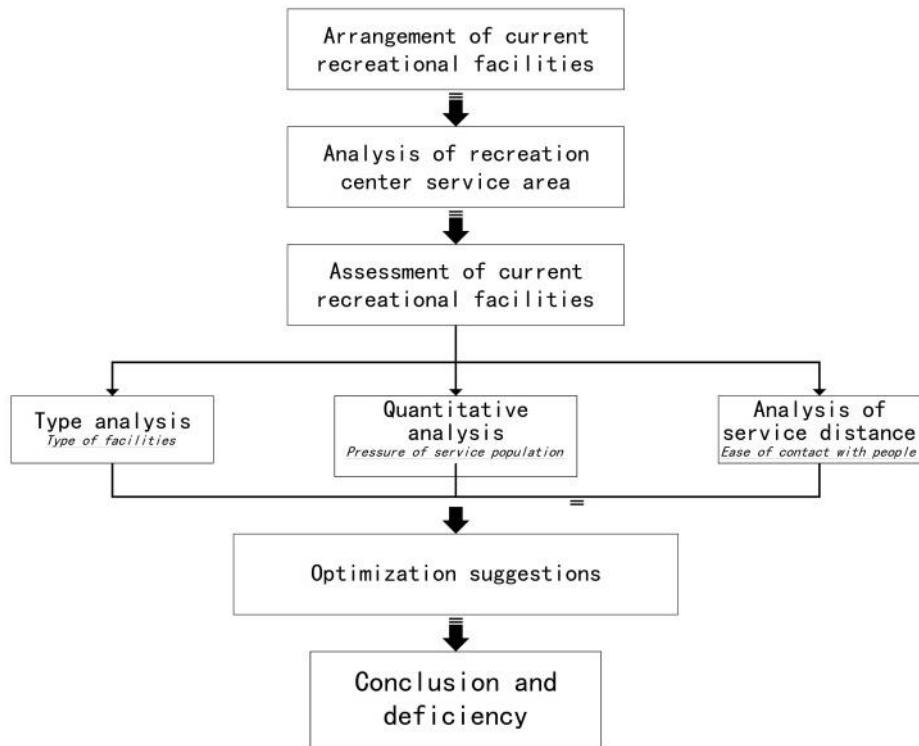


Figure 2. Technical Route

Based on POI, this paper evaluates the urban recreational facilities. The evaluation dimension is mainly from the quality, accessibility and coverage of urban recreational facilities, as shown in TABLE 1.

Table 1. Evaluation dimension of urban recreational facilities

Evaluation Dimension	Main Contents of Evaluation	The Significance of Evaluation
Quality	Based on the relationship between supply and demand, considering the attraction of urban recreational facilities, the quantity and type of urban recreational facilities are evaluated	Feedback on the needs of users of urban recreational facilities
Accessibility	Based on the traffic mode and distance factors, the time accessibility of urban recreational facilities is considered;	Determine whether the urban recreation facilities are effectively allocated
Coverage	Calculation based on road and population distribution	Determine whether the spatial distribution of urban recreational facilities is uniform

2.2. Data Source

The data of this study mainly includes POI data, vector building contour data and OSM road system data. Among them, POI data was obtained from Gaode map open platform in September 2021, OSM

road system data was obtained from open street map platform in September 2021, and vector building contour data was obtained from Bigemap GIS office platform in April 2022 [3].

3. Evaluation of recreational facilities in Guandu section of Baoxiang River Basin Based on poi

3.1. Type Analysis

According to the existing literature, there are many classification methods of urban recreational facilities, and standard levels are often set according to different research objectives, such as service object attribute, recreational function, activity nature, material space form, behavior space form, tourism resource attribute, service scope, geographical location, etc. [1]. Under the general definition of urban recreational facilities in academic circles, this paper will provide supporting facilities for service guarantee (such as public toilets, bus stops and parking lots), which are also included in the scope of this study because they are closely related to the enthusiasm and frequency of recreational activities. This paper compares the advantages and disadvantages of different classification standards. Combined with the research object, this paper obtains the POI data of public service facilities in Kunming from Gaode map open platform in September 2021, and extracts the POI data closely related to recreational activities (including hotels, catering, shopping, transportation, tourist attractions, life services, leisure and entertainment, etc.). Based on the correlation between recreational facilities and recreational activities, after further cleaning the data and excluding the facilities that mainly provide services for residents' daily life (such as convenience stores), the recreational facilities in Baoxiang River Basin are divided into three categories and seven categories, with a total of 1293 facilities, as shown in TABLE 2.

Through the analysis, it is not difficult to find that the study area has carried out a variety of recreational activities around cultural relics, cultural exhibitions and cultural squares, and carried out secondary recreational activities including cultural activities, leisure and entertainment, health preservation, sports and fitness, shopping centers, etc. The corresponding supporting service type is relatively single, and it fails to build a richer upstream and downstream activity chain.

Table 2. Classification and statistics of recreational facilities in Guandu section of Baoxiang River Basin

General Category	Medium Class	Number of Facilities	Proportion (%)
Recreation Center	Scenic Spot	69	5.34
	Leisure Activity Point	243	18.79
Recreational Supporting Services	Restaurant	572	44.24
	Get Accommodation	275	21.27
	Comfort Station	6	0.46
Recreational Access Facilities	Bus Stop	49	3.79
	Parking Facilities	79	6.11

3.2. Service Populations Analysis

In this study, by capturing the vector building contour data with floors in Gaode map (September 2021), combined with the current residential construction land defined after field investigation, the corresponding service population is estimated by the total amount of residential buildings covered in the research scope / per capita residential construction area, so as to evaluate the service pressure. Referring to the data released at the awarding ceremony of real estate operation research and judgment in Kunming in 2021 (q1-q3), the per capita housing area in Kunming is 43.58 square meters, as show in Fig. 3 [4].

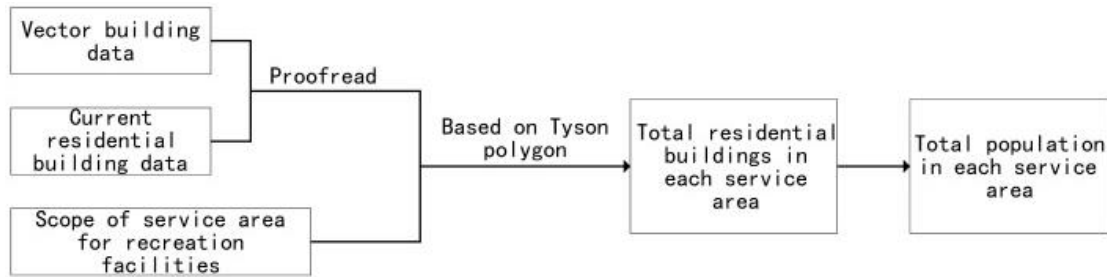


Figure 3. Estimated Path of population served by recreational facilities

According to the estimation results of the service population of each recreation center (TABLE 3.), there are three types of characteristics:

Table 3. Statistical table of service populations

Pressure Class	Name of Recreation Center	Service Population (person)
Greater pressure on serving the population	Guandu street Yunxiu community cultural activity square and Shuiyun nunnery	10000-20000
Great pressure on serving the population	Shanjing hall, Junfa xiliangtang Wetland Park, red culture collection exhibition hall, Fang's traditional Chinese medicine washing and moxibustion Hall, Kunming Dianchi Pan Asian International Urban Wetland	5000-10000
The pressure of serving the population is average	Bodhisattva hall, doumuge, Baoxiang square, Yunnan literature and Art Museum, Qingning temple, Swiss Garden Park, art home community legal culture theme park	1500-5000
Less pressure on serving the population	Sanyuan hometown, Lingyun Pavilion, Guandu Shaolin Temple, Guandu mosque, Kuixing Pavilion, Wenchang hall, Guanyin temple, Guandu ancient town Zhuangyuanfang, Dabei temple, Xianning temple, Nancheng guest hall of Jiguan community, Yunnan Grand Theater	500-1500
Low pressure on serving the population	Other recreation centers	0-500

1)As show in Fig. 4, although the recreation center is concentrated in the area of Guandu ancient town, this area is not the area with the largest service population within the scope of the study because it is dominated by villages in the city and the control of architectural style;

2) As show in Fig. 4, due to the large-scale development of the real estate in the south of the research scope, it has become the area with the greatest pressure on the service population of recreation points. The results further show that the supply of recreation points around new buildings is insufficient;

3) As show in Fig. 4, the area with the least population of recreational services is located in the middle of the study area, that is, around Yunnan Grand Theater and Yunnan Museum. Although these facilities are not positioned to provide services for the surrounding areas, it further indicates that such facilities need to further study how to improve their attractiveness to the surrounding residents.

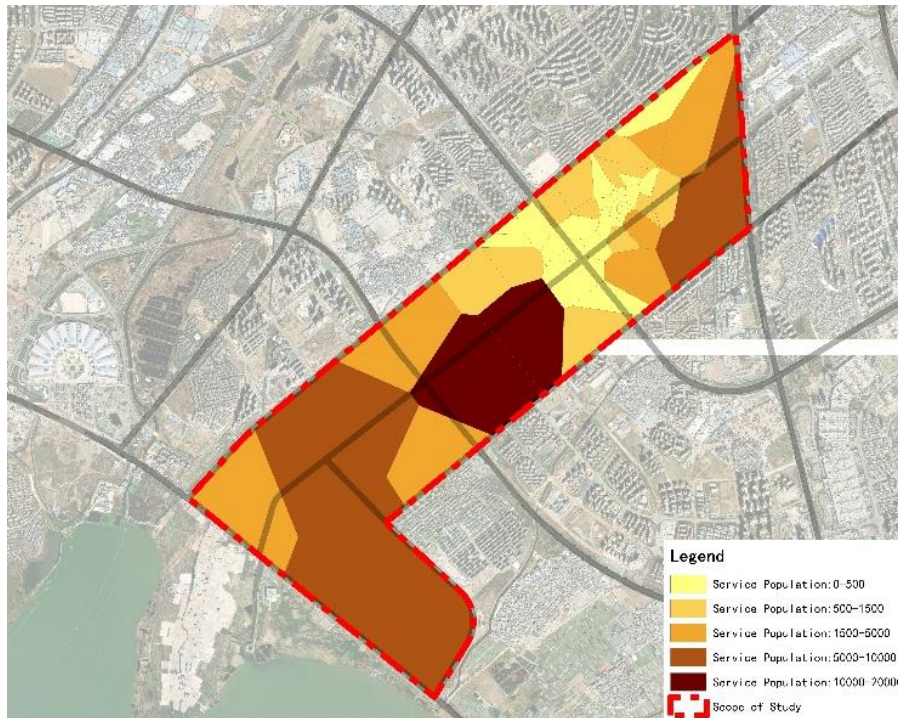


Figure 4. Estimation of Service Populations Based on Tyson Polygon

3.3. Service Distance Analysis

(1) As show in Fig. 5, this study is based on Tyson polygon to construct the service range of recreation center. According to the investigation and analysis results, there are many tourist attractions around Guandu ancient town, and the coverage area of Tyson polygon service area is small; However, the south of the research area is limited by the large-scale new residential areas, which can be used for recreation and selection of less scenic spots and insufficient coverage.

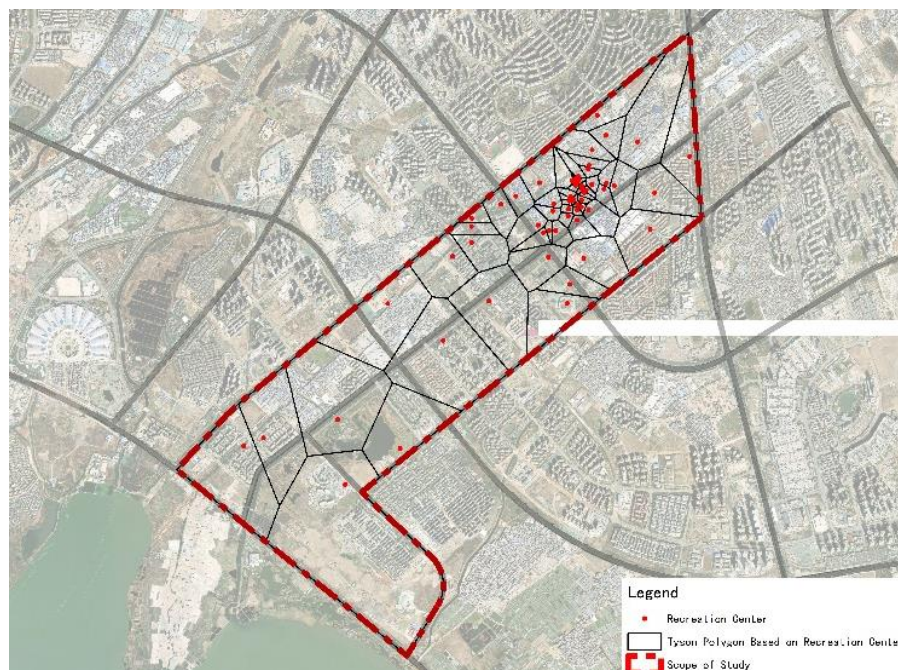


Figure 5. Tyson Polygon Based on Recreation Center

(2) Based on the priority of residents to choose the nearest recreational facilities in daily life, the paper analyzes the multi-loop buffer analysis of each recreational site, and analyzes the service distance of 300m, 500m, 1000m and 2000m based on the concept of current living circle(Fig. 6). From the analysis results, the distance between residents in the study scope and the nearest recreation point

is almost not more than 1000m, and the service distance of all residents north of Guangfu Road is within 500m, indicating that the accessibility of recreational facilities in this area is generally high, which can improve the enthusiasm of residents' recreation, and it is an effective supply for surrounding residents. The service distance of each recreation point near the East Road around Lake is generally larger, and even the service distance in the southeast corner is more than 1000m. Although the area belongs to high-end residential buildings, there are many recreational facilities in the area, but the fairness of urban public facilities needs to be improved.

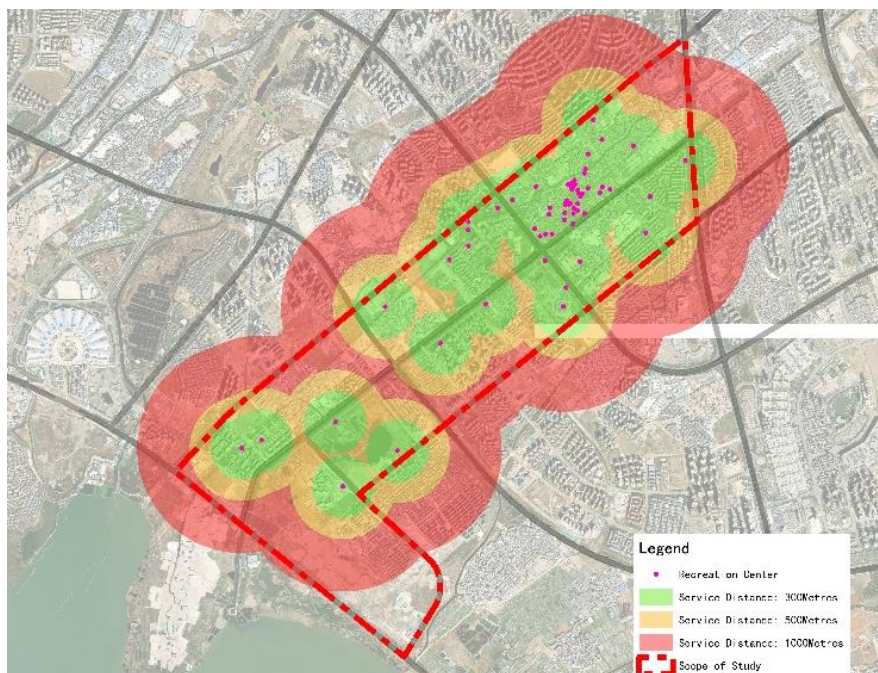


Figure 6. Analysis of Service Distance Based on Multi-ring Buffer

4. Optimization suggestions and deficiencies

Based on the premise that residents choose the nearest recreational facilities in daily life as the premise, the Taisen polygon method is introduced, and the system of the recreational facilities in Guandu section of Baoxiang river basin is constructed based on the evaluation of the quality, accessibility and coverage of urban recreational facilities. According to the main problems in various dimensions, the optimization suggestions proposed in this study are as follows:

- 1) to improve the types of recreational facilities to improve the vitality of recreational sites and the enthusiasm of residents' recreation;
- 2) The number of recreational facilities in the South should be added, especially the supplement of supporting services, such as the increase of public toilets and public transport stations;
- 3) Pay attention to the fairness of recreational facilities and the development of facilities[5].

The shortcomings of this study are:

- 1) Due to the limitation of the research scope, there are some limitations in the selection and research of recreational facilities. Some facilities should also provide services for residents within the research scope, but they are not listed in this study due to the distance;
- 2) Some facilities within the research scope actually serve a wider range, so the service pressure is far from the deficiencies described in this paper;
- 3) In the estimation of the service population, due to the complexity of the research area, the population is simply estimated by the residential construction area.

Although it reflects the spatial distribution of the population to a certain extent, there are great limitations on the change of population flow in urban villages. In the next research, the emerging technology and method of mobile signaling will be used to make up for the deficiency of this research.

Acknowledgment

This work was financially supported by Scientific research fund of Yunnan Provincial Department of Education in 2020, which named< Parametric analysis and reconstruction of recreation space in Guandu section of Baoxiang River Basin>, NO. 2020J1312.

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