

Recreational Attractiveness of Urban Parks and Implications for Their Management: A Case Study in Changchun, China

MAO Zhixia^{1,2}, WANG Wenjie¹, REN Zhibin¹, ZHANG Dan¹, HE Xingyuan^{1,2}

(1. Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences, Changchun 130102, China; 2. University of Chinese Academy of Sciences, Beijing 100049, China)

Abstract: Urban parks are an important part of urban ecosystems and also provide recreational services for urban residents. However, it is still unclear how the recreational attractiveness of urban parks can be evaluated. In this study, 12 typical parks in Changchun, China were selected for evaluation of their recreational attractiveness. We built a recreational attractiveness evaluation system based on the analytical hierarchy process (AHP) to produce a composite evaluation index. This method included : 1) the landscape quality of the parks; 2) the recreational facilities; 3) the conditions of the area; and 4) the accessibility of the parks. Our results showed that Nanhu Park, Children's Park, Shengli Park, and Jingyuetan Forest Park had high recreational attractiveness, whereas Linyuan Park had the lowest attractiveness among the 12 parks. These results agreed with the information obtained from a field survey of the actual recreational and revisit rates, which showed that the evaluation index is reliable. Correlation analysis showed that the landscape quality and recreational facilities of parks had a direct effect on their recreational attractiveness. A negative correlation was found between the accessibility of a park and its recreational attractiveness. We conclude that if the scenery and facilities are not as good as a visitor expects, then they may choose to visit a different park, even if it takes a longer time to reach.

Keywords: questionnaire survey; analytic hierarchy process; recreational attractiveness; management implications; perception of residents; urban parks

Citation: MAO Zhixia, WANG Wenjie, REN Zhibin, ZHANG Dan, HE Xingyuan, 2022. Recreational Attractiveness of Urban Parks and Implications for Their Management: A Case Study in Changchun, China. *Chinese Geographical Science*, 32(3): 456–466. <https://doi.org/10.1007/s11769-022-1273-5>

1 Introduction

Urban parks have an important role in promoting a harmonious coexistence between humans and nature (Endreny, 2018). Their ecological and recreational value mean that they are attracting increasing attention from people in all walks of life (Zhou et al., 2004; Georgi and Dimitriou, 2010; Fan, 2013). Parks are important places for urban residents to engage in leisure activities, such as exercise (Liu et al., 2017; Zhao, 2019). With the ac-

celeration of urbanization and rapid population growth, urban parks are being used more frequently and their recreational capacity is increasing (Chiesura 2004; Chang and Li, 2014; Ayala-Azcárraga et al., 2019). It is therefore important to study the attractiveness of urban parks to citizens and the key factors affecting the attractiveness should be considered in their construction. This has important theoretical and practical significance in the construction of a high-quality system of urban parks to meet the basic needs of urban residents, to promote urb-

Received date: 2021-01-03; accepted date: 2021-06-30

Foundation item: Under the auspices of the Youth Innovation Promotion Association of Chinese Academy of Sciences (No. 2020237); the National Natural Science Foundation of China (No. 42171109)

Corresponding author: HE Xingyuan. hexingyuan@iga.ac.cn

© Science Press, Northeast Institute of Geography and Agroecology, CAS and Springer-Verlag GmbH Germany, part of Springer Nature 2022

an humanistic care and to maintain the balance of urban energy (Kim and Jin, 2018). It is important to analyze the attractiveness of urban parks and to study their management strategies (Qiu et al., 2013).

Throughout history, most traditional urban parks and private gardens have provided services for the wealthy and few have served ordinary people (Li, 1987). Urban public parks first appeared in the 19th century after the industrial revolution in the western world and therefore their development only spans one or two hundred years. Their form, style, and management have evolved in parallel with the transformation of modern society and urbanization (Kienast et al., 2012; Sirina et al., 2017; Xiao et al., 2017). Olmsted (1870) popularly considered as the father of American landscape architecture, defined a city park as ‘a functional public green space in an urban area’.

The encyclopedia of China defines an urban park as ‘a type of urban public green space, a garden built and operated by the government or public organizations for public recreation, viewing, and entertainment’. After China’s reform and opening-up, the number of urban parks increased, and they developed into new forms, including wetland parks, theme parks, forest parks, and parks with ruins. Meng et al. (2003) noted that the phrase refers to a kind of city park that has a certain function for urban residents, the re-creation of the natural realm. Urban parks form the green infrastructure of a city and are often the main open space available to the public. Urban parks are spaces for both recreational activity and civic culture (Wolch et al., 2014).

Countries and researchers have differed in their definitions of urban parks over time. The concept of an urban park is dynamic and there is no unified definition of this concept in Chinese academic circles. Based on definitions from various countries, an urban park should have three characteristics. First, an urban park is a green, public open space in a city and is an important part of the urban ecosystem; second, urban parks mainly serve urban residents, so they need to accommodate a wide range of recreational needs and encourage physical activity; and, third, suggest changing to ‘urban parks should also reflect community identity, encourage local flora and wildlife, and be a place of refuge.

Global urbanization and deterioration of the urban environment have meant that more attention is being paid

to the recreational functions of the green spaces in urban parks (Voigt et al., 2014; Li et al., 2020). Studies of park recreation activities are also increasing in number (Dwivedi et al., 2009). Saunders et al. (1981) used a gravity model to survey and assess residents’ demand for waterfront recreational space in strip parks in US cities. They examined the factors (e.g., accessibility and forest coverage) that could influence the attractiveness of strip parks for recreation. The recreational attractiveness of urban parks for different population segments have also been studied, such as the differences in leisure and recreational behaviors of young and old people (Raitz and Dakhil, 1988; Lee, 2005). They found that older people were more influenced by the natural environment (e.g., tree coverage, water, and birds) in parks than younger people.

Krenichyn (2006) found that Americans attach great importance to their health; they exercise to keep fit and city parks are often the best places to take this exercise. Krenichyn (2006) also found that female participants in recreation were more likely to feel relaxed in urban parks and that park recreation has become an indispensable part of the daily life of many women. Aasetre et al. (2016) examined a mountain forest park in Netherlands and forest land in Norway and compared the different leisure preferences of people in these areas with very different population densities. They found that tourists in these areas had clear differences in terms of the leisure activities sought in these different, but accessible, natural areas. Different people have different leisure preferences in parks and it is therefore challenging to evaluate the recreational attractiveness of urban parks.

A search of the literature in international databases with the keyword of ‘recreational attraction’ found only 65 reports directly related to the attractiveness of urban parks (<https://www.sciencedirect.com/>, up to December 2019). A search in the China National Knowledge Infrastructure database (<http://www.cnki.net>, up to December 2019) using the keyword ‘leisure attraction’ with fuzzy retrieval produced 215 results, concentrated from 2018 onwards. These reports were mainly about leisure spaces, leisure behavior and landscape recreation. When ‘city park recreation attractions’ was used in the search, only 39 results were returned and these were not related to the topic of this paper. There has been little research into the attractiveness of urban parks in China. Most

studies have focused on recreational activities and attracting tourism. The attractiveness of parks for recreation is therefore a unique concept in the study of urban recreation; it is a vague concept leading to considerable controversy. There has been no in-depth and extensive discussion on the of park attractiveness, its influencing factors, the dynamic changes in these factors, or how to quantify attractiveness. Current theories and methods of study into the recreational attractiveness of urban parks are insufficient. In particular, there has been little research into the recreational attractiveness of forest cities in China, so it is necessary to strengthen quantitative empirical research to solve these existing theoretical and practical problems.

We used 12 typical parks in Changchun City, north-east China as an example. The goals of this study were: 1) to establish an evaluation framework for recreational attractiveness using an analytical hierarchy process composite index evaluation method based on four aspects (landscape quality, facility conditions, regional conditions and accessibility); 2) to evaluate the recreational attractiveness of urban parks in Changchun; and 3) to propose ways of maximizing the recreational attractiveness of urban parks. Our results will help urban planners to optimize the layout of urban parks and improve the quality of the living environment for sustain-

able development in urban areas.

2 Methods

2.1 Study area

Changchun is located at a mid-latitude in the Northern Hemisphere, in the hinterland of the Songliao Plain on the eastern coast of Eurasia. Our study was carried out within the fifth ring road of Changchun City, in an area of 524 km² (125°07' E–125°26' E, 43°44' N–44°02' N) (Fig. 1). The average annual winter and summer temperatures in Changchun are −14 and 24°C, respectively (Ren et al., 2021). Changchun is referred to as a ‘forest city’ because 45% of its urban area is covered by vegetation (Ren et al., 2018). The forest types mainly consist of coniferous and broadleaved trees. Common trees in Changchun include *Armeniaca mandshurica*, *Pinus sylvestris* var. *mongolica*, and *Pinus tabulaeformis* (Wang et al., 2018). The shrubs and grasses include *Swida alba*, *Spiraea salicifolia*, and *Amygdalus triloba*. We selected 12 parks in the main urban area of Changchun City as the research objects based on their size and location (Fig. 1).

2.2 Data collection

We used field investigations and a questionnaire survey,

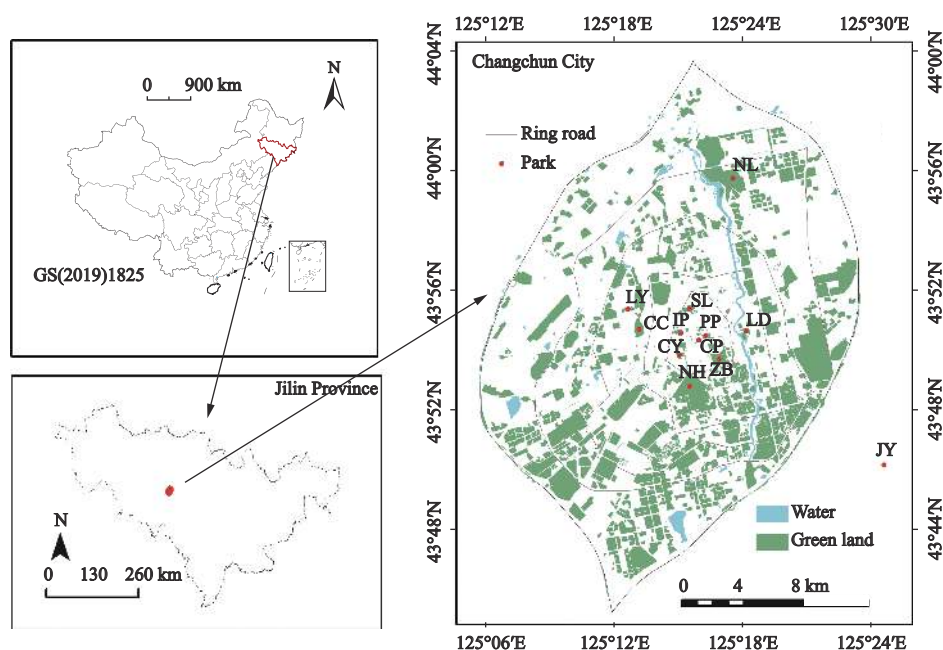


Fig. 1 Location of Changchun City, China, and the distribution of the 12 urban parks. SL: Shengli Park; IP: Imperial Park; CY: Chaoyang Park; CP: Children's Park; PP: Peony Park; ZB: Zoological and Botanical Park; LD: Laodong Park; NH: Nanhua Park; NL: North Lake Park; JY: Jingyuetan Forest Park; CC: Changchun Park; LY: Linyuan Park

taking 12 typical urban parks in Changchun City as the main investigation sites and recreational visitors to the parks as the main investigation objects. The surveys were conducted every weekend in July, August, and September, 2019, with 12 onsite surveys. The questionnaire included: 1) basic information about the respondent, such as gender, age, educational level, occupation, and income; 2) their reasons for using the city parks for recreational activities; 3) what attracted the respondent to the city park (e.g., the natural landscape, entertainment or a quiet environment); and 4) which factors influenced their visit to the park (e.g., ticket price, traffic, distance, traveled or landscape aesthetics). A total of 10 920 questionnaires were distributed, all of which were completed on the spot. We conformed to the range of sample sizes for simple random sampling without substitution and the number of questionnaires issued for each park was determined by the volume of the park. After excluding invalid questionnaires, 10 000 valid questionnaires were obtained.

Some data were obtained from the master plan for the construction of Changchun Forest City (Bureau of Forestry and Landscaping of Changchun, 2013–2025)

and the government website (<http://ccylj.changchun.gov.cn/>). The area of green space was extracted using the ArcGIS10.2 software package (Environmental Systems Research Institute, Redlands, USA) and manual interpretation. The remote sensing images were SPOT-5 (Système Probatoire d'Observation de la Terre) images with a resolution of 2.5 m.

References were made to relevant evaluation systems and criteria (Xie and Liu, 2003; Zheng and Zhou 2008), soliciting opinions from 5 experts in related fields such as Ecology, Landscape Science *etc.* and 16 evaluation indexes were selected considering four aspects: the landscape quality; entertainment facilities; regional conditions; and the accessibility of the urban parks (Table 1). The landscape quality indices were as follows: A1, park area (ha); A2, green area (ha); A3, wetland area (ha); A4, water quality; A5, scenic beauty; A6, park level (county, city or national); and A7, infrastructure improvement (bad, poor, average to good, and very good). The entertainment facilities indices were: B1, entertainment facilities; B2, frequency of entertainment events; and B3, fees (yuan RMB). The indices of the regional conditions were: C1, geographical location; C2, popula-

Table 1 Value ranges for each index in the recreational attractiveness scale

Index	Index scale				
	0–0.2	0.2–0.4	0.4–0.6	0.6–0.8	0.8–1.0
A1	< 50	50–100	100–300	300–500	> 500
A2	< 20	20–30	30–50	50–70	> 70
A3	< 20	20–30	30–50	50–70	> 70
A4	Bad	Poor	Average	Good	Very good
A5	Bad	Poor	Average	Good	Very good
A6	County	City	National 3A	National 4A	National 5A
A7	Bad	Poor	Average	Good	Very good
B1	Bad	Poor	Average	Good	Very good
B2	Very low	Moderately low	Average	Quite high	Very high
B3	0–20	20–40	40–60	60–80	80–100
C1	Suburbs	Fourth ring	Third ring	Second ring	First ring
C2	> 25 000	10 000–25 000	1000–10 000	200–1000	< 200
C3	1–2	2–3	3–5	5–10	> 10
D1	< 2	2–4	4–6	6–8	> 8
D2	> 50	50–30	30–10	10–0	0
D3	0	1–2	2–3	3–4	4–5

Notes: A1: park area (ha); A2: green area (ha); A3: wetland area (ha); A4: water quality; A5: scenic beauty; A6: park level; A7: infrastructure improvement degree; B1: entertainment facilities; B2: frequency of entertainment events; B3: fees (yuan); C1: geographical location; C2: population density (people/km²); C3: per-capita GDP (yuan); D1: length of visit (h); D2: ticket price (yuan); D3: mode of transportation

tion density (people/km²); and C3, per capita GDP (yuan RMB). The accessibility indices were: D1, length of visit to park (h); D2, ticket price (yuan); and D3, mode of transportation.

Indices A1–A3 and C1–C3 were obtained from field surveys and remote sensing images. The questionnaire data were used for indices A4–A7, B1–B3, and D1–D3 to quantify the results against the recreational attractiveness scale value for each indicator.

2.3 Evaluation system of recreational attractiveness

The system used to evaluate the recreational attractiveness of Changchun City parks needs to be scientific, hierarchical, systematic, dynamic, stable and to use accessible data (Xie and Liu, 2003; Zheng, 2013), combining both qualitative and quantitative measures and considering other basic principles. The analytic hierarchy process (AHP) in IDRISI geographical information system was used to determine the weighting of each index (Table 2).

2.4 Calculation of recreational attractiveness

Table 1 gives the quantitative and qualitative indicators,

including the quality of the infrastructure and the entertainment facilities. To compare different factors, these qualitative indicators need to be quantified into the same range before evaluation. We used normalization to standardize the original data. Set A_i ($i = 1, 2, \dots, 16$); B_j ($j = 1, 2, \dots, 12$) as the park dataset. The original data were processed according to Equ. (1) (Li et al., 2012):

$$P_{ij} = W_i \times S_{ij} \quad (1)$$

where P_{ij} is the standardized value of index i of j park, W_i is the weight of each indicator, and S_{ij} is its score.

By combining the relevant national standards and the results of previous research (Zheng and Zhou, 2008) with our data, we obtained the Equ. (2) for recreational attractiveness:

$$RA = \sum_{i=1}^{16} P_i \quad (2)$$

where is the recreational attractiveness value of each park and is the standardized value of each index.

Based on the values of recreational attractiveness, we classified these 12 urban parks with the aim of guiding the planning and management of urban parks to improve their recreational attractiveness. We used the in-

Table 2 System used to evaluate the recreational attractiveness of urban parks in Changchun, China

Target decision layer (weight)	Middle element layer (weight)	Index layer (weight)
Recreational attractiveness evaluation (1.00)	Landscape quality (0.42)	A1 (0.03)
		A2 (0.10)
		A3 (0.04)
		A4 (0.07)
		A5 (0.11)
		A6 (0.03)
		A7 (0.04)
	Recreation facilities (0.24)	B1 (0.07)
		B2 (0.11)
		B3 (0.06)
	Regional conditions (0.15)	C1 (0.09)
		C2 (0.02)
		C3 (0.04)
	Park accessibility (0.19)	D1 (0.04)
		D2 (0.07)
		D3 (0.08)

Notes: A1: park area (ha); A2: green area (ha); A3: wetland area (ha); A4: water quality; A5: scenic beauty; A6: park level; A7: infrastructure improvement degree; B1: entertainment facilities; B2: frequency of entertainment events; B3: fees (yuan); C1: geographical location; C2: population density (people/km²); C3: per-capita GDP (yuan); D1: length of visit (h); D2: ticket price (yuan); D3: mode of transportation

intermediate factor layer and recreational attractiveness value as the clustering variables and the SPSS software package (version 19.0) (IBM Corporation, New York, USA) for hierarchical classification to obtain the system cluster genealogy.

2.5 Field verification

To evaluate the reliability of the system for the evaluation of recreational attractiveness, we conducted a field survey to determine the actual recreational rate, the revisit rate, and the potential recreation rate for 12 typical urban parks in Changchun. Questionnaire data were used to verify the recreational attractiveness of the urban parks. Based on previous research, the actual recreational rate, the revisit rate, and the potential recreation rate are highly relevant to recreational attractiveness (Aasetre et al., 2016; Liu et al., 2017). We therefore selected the actual recreational rate, the revisit rate, and the potential recreation rate as the verification indicators in the questionnaire. The revisit rate is the ratio of the number of people who have taken more than two recreational trips to a park to the total number of visitors. The potential recreation rate is the percentage of people who have heard of a park and are interested in future recreation. If urban parks have a higher recreational attractiveness, then the actual recreational rate, the revisit

rate, and the potential recreation rate will be higher. The actual recreational rate, the revisit rate, and the potential recreation rate were collected via field surveys for 12 typical urban parks on every weekend in the summer of 2019.

3 Results

3.1 Recreational attractiveness of different urban parks in Changchun

We calculated the recreational attractiveness index for 12 typical parks in Changchun, China (Table 3). The recreational attractiveness results are presented in Table 4. The ranking order of the parks from high to low was Nanhu Park (NH), Children's Park (CP), Shengli Park (SL), Jingyuetan Forest Park (JY), Imperial Park (IP), Laodong Park (LD), Zoological and Botanical Park (ZB), North Lake Park (NL), Changchun Park (CC), Peony Park (PP), Chaoyang Park (CY), and Linyuan Park (LY). The attractiveness of Nanhu Park was more than twice that of Linyuan Park. bility values of these two parks were similar (0.1420 and 0.1496, respectively). However, the landscape quality, recreational facilities, and regional conditions of South Lake Park were 0.3372, 0.1870, and 0.1236, respectively, significantly higher than those of Linyuan Park, (0.0988, 0.0321, and

Table 3 Recreational attractiveness index of 12 typical parks in Changchun, China

Park name	A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	C1	C2	C3	D1	D2	D3
NH	0.52	1.00	1.00	0.28	1	0.40	1.00	1.00	0.90	0.60	1.00	0.42	0.63	0.20	1.00	0.80
CC	0.22	0.56	0.16	0.45	1	0.30	0.30	0.20	0.10	0.05	0.50	0.46	0.33	0.10	1.00	0.80
ZB	0.31	0.61	0.09	0.42	0.63	0.40	0.50	0.35	0.46	0.33	0.78	0.80	0.41	0.42	0.40	0.80
JY	1.00	1.00	0.05	0.37	1.00	1.00	0.60	0.43	0.32	0.76	0.10	0.79	0.23	0.57	0.40	1.00
NL	0.91	0.98	0.23	0.45	0.40	0.80	0.10	0.40	0.17	0.30	0.20	0.88	0.61	0.44	1.00	0.40
SL	0.12	0.21	0.02	0.43	0.61	0.40	0.63	0.80	0.79	0.77	1.00	0.42	0.52	0.20	1.00	0.80
IP	0.11	0.18	0.01	0.50	0.81	0.20	0.92	0.53	0.68	0.01	0.66	0.45	0.69	0.19	1.00	0.80
LD	0.05	0.11	0	0.50	0.47	0.19	0.49	0.85	0.69	0.33	0.75	0.41	0.45	0.20	1.00	0.82
CP	0.08	0.15	0.03	0.61	0.61	0.40	0.68	0.85	1	0.89	0.95	0.44	0.51	0.40	1.00	0.81
LY	0.02	0.21	0.00	0.00	0.49	0.19	0.44	0.27	0.12	0.00	0.52	0.48	0.43	0.39	1.00	0.80
CY	0.21	0.24	0.05	0.42	0.42	0.20	0.38	0.13	0.11	0.00	0.92	0.47	0.68	0.38	1.00	0.80
PP	0.01	0.07	0.00	0.00	0.88	0.20	0.83	0.15	0.10	0.00	1.00	0.48	0.43	0.39	1.00	0.80

Notes: NH: Nanhu Park; CC: Changchun Park; ZB: Zoological and Botanical Park; JY: Jingyuetan Forest Park; NL: North Lake Park; SL: Shengli Park; IP: Imperial Park; LD: Laodong Park; CP: Children's Park; LY: Linyuan Park; CY: Chaoyang Park; PP: Peony Park. A1: park area (ha); A2: green area (ha); A3: wetland area (ha); A4: water quality; A5: scenic beauty; A6: park level; A7: infrastructure improvement degree; B1: entertainment facilities; B2: frequency of entertainment events; B3: fees (yuan); C1: geographical location; C2: population density (people/km²); C3: per-capita GDP (yuan); D1: length of visit (h); D2: ticket price (yuan); D3: mode of transportation

Table 4 Recreational attractiveness of different parks in Changchun, China

Park name	Value of landscape quality	Re-order	Recreational value	Re-order	Regional condition value	Re-order	Park accessibility	Re-order	Recreational attractiveness value	Re-order
NH	0.3372	1	0.1870	2	0.1236	1	0.1420	6	0.7898	1
CC	0.2315	4	0.0265	10	0.0674	10	0.1380	9	0.4634	9
ZB	0.2046	5	0.0850	7	0.1026	6	0.1088	12	0.5010	7
JY	0.3219	2	0.0881	6	0.0340	12	0.1308	10	0.5748	4
NL	0.2380	3	0.0557	8	0.0600	11	0.1196	11	0.4733	8
SL	0.1598	8	0.1660	3	0.1192	3	0.1420	6	0.5870	3
IP	0.1886	6	0.1122	5	0.0960	7	0.1416	8	0.5384	5
LD	0.1245	11	0.1453	4	0.0937	8	0.1436	5	0.5071	6
CP	0.1676	7	0.1962	1	0.1147	5	0.1508	1	0.6293	2
LY	0.0988	12	0.0321	9	0.0736	9	0.1496	2	0.3541	12
CY	0.1291	10	0.0212	12	0.1194	2	0.1492	4	0.4189	11
PP	0.1433	9	0.0215	11	0.1168	4	0.1496	2	0.4312	10

Notes: NH: Nanhu Park; CC: Changchun Park; ZB: Zoological and Botanical Park; JY: Jingyuetan Forest Park; NL: North Lake Park; SL: Shengli Park; IP: Imperial Park; LD: Laodong Park; CP: Children's Park; LY: Linyuan park; CY: Chaoyang Park; PP: Peony Park

0.0736, respectively).

3.2 Verification of recreational attractiveness of urban parks

Table 5 shows that the recreational attractiveness of the urban parks had a significant positive correlation with the actual recreation rate, revisiting rate, and potential recreation rate. There was a significant positive correlation between the recreational attractiveness of the urban parks and their landscape quality and recreational facilities ($P < 0.01$). This indicates that the landscape quality and recreational facilities of a park directly affect its attractiveness to visitors. However, there was a negat-

ive correlation between recreational attractiveness and park accessibility ($P < 0.01$).

3.3 Classification of urban parks

We took the intermediate factor layer and the recreational attractiveness value as clustering variables and used the SPSS software package for hierarchical classification to obtain the system cluster genealogy (Fig. 2). The recreational attractiveness of the 12 typical urban parks in Changchun was classified into five categories according to the cluster analysis tree. The first category consisted of four parks: Shengli Park (SL), Imperial Park (IP), Laodong Park (LD), and Children's Park

Table 5 Correlation analysis of recreation rate and attractiveness of different parks in Changchun, China

Variables	Value of landscape quality	Recreational value	Regional condition value	Park accessibility	Recreational attractiveness value	Actual recreation rate	Revisit rate	Potential recreation rate
Value of landscape quality	1							
Recreational value	0.250	1						
Regional condition value	-0.339	0.377	1					
Park accessibility	-0.441	0.100	0.392	1				
Recreational attractiveness value	0.669*	0.847**	0.289	-0.021	1			
Actual recreation rate	0.804**	0.221	-0.077	-0.357	0.599*	1		
Revisit rate	0.566	0.518	0.344	0.194	0.780**	0.776**	1	
Potential recreation rate	-0.804**	-0.221	0.077	0.357	-0.599*	-1.000**	-0.776**	1

Notes: * Correlation is significant at the 0.05 level ; ** Correlation is significant at the 0.01 level (two-tailed)

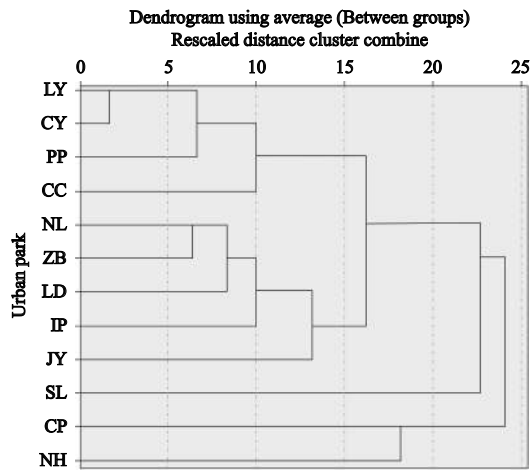


Fig. 2 System clustering tree for the urban park's recreational attractiveness in Changchun, China; NH: Nanhu Park; CC: Changchun Park; ZB: Zoological and Botanical Park; JY: Jingyuetan Forest Park; NL: North Lake Park; SL: Shengli Park; IP: Imperial Park; LD: Laodong Park; CP: Children's Park; LY: Linyuan park; CY: Chaoyang Park; PP: Peony Park

(CP). These four parks are all located in the first ring of Changchun City, an area with a large population flow and high per capita GDP. Of these, only the Imperial Park had a relatively high landscape quality value; the other three parks had average landscape quality values. The second category included Changchun Park (CC), the Zoological and Botanical Park (ZB), Jingyuetan Forest Park (JY), Chaoyang Park (CY), and Peony Park (PP). The third category contained Nanhu Park (NH), which had the highest recreational attractiveness because of its good regional location, high landscape quality, and sound infrastructure. The fourth category included Jingyuetan Forest Park, a suburban park far away from downtown noise. It has convenient transportation links and the landscape makes it valuable for viewing wildlife and for scientific research. However, there is an entrance fee and the regional conditions and accessibility are very low. The fifth category included North Lake Park. This is a newly built park constructed within the last two years. Afforestation in the park is not yet on a large scale and the allocation of various resources is not perfect.

4 Discussion

4.1 Differences in the recreational attractiveness of urban parks and main influencing factors

This survey showed that Nanhu Park had the highest re-

creational attractiveness, followed by the Children's Park (CC) and Shengli Park (SL). Jingyuetan Forest Park (JY) had the lowest score (Table 4). For the landscape quality value for each park, the most attractive (0.3372) and the least attractive (0.0988) were found in Nanhu Park (NH) and Linyuan Park (LY), respectively. A park's landscape quality has a significant positive correlation (correlation coefficient: 0.669; $P < 0.05$) with its recreational attractiveness. However, the attractiveness of a park is not entirely determined by the quality of its landscape. Although Jingyuetan Forest Park (JY) had a high landscape quality value of 0.3219, its recreational attractiveness was not very high because of its low regional condition score of 0.0340 and low accessibility score of 0.1308. Therefore, even if the landscape quality is high, the overall value of a park's recreational attractiveness will be affected if the entertainment facilities, regional conditions, and accessibility scores are low.

Nanhu Park had the highest recreational attractiveness and its landscape quality and regional condition values were the highest of these 12 urban parks. Nanhu Park is adjacent to the business district in Changchun; the lake water is clear, with green willows on the banks of the lake, and there are winding bridges and many birds and flowers.

The Children's Park was the second most attractive place for recreation, with the highest scores for recreational facilities and accessibility. The Children's Park mainly attracts children and teenagers. The attractiveness of Shengli Park was also high, but its landscape quality and accessibility were poor. The attractiveness of Shengli Park derives from its location on a busy street near the railway station, so tourists can rest and play there after traveling. Jingyuetan Forest Park is located in a suburb of Changchun City and had a high attractiveness index because it is a high-profile national 5A grade forest park. It has a combination of wetlands and forest landscapes and its landscape quality value is very high. However, because it is located in a suburb, far from the city, it takes a long time to travel there, despite the choice of several modes of transportation, meaning that it has poor accessibility and the revisit rate is low. The recreational attractiveness of Imperial Park, Labor Park, and the Zoological and Botanical Garden were very high and it is possible to appreciate the flowers and animals in these parks. North Lake Park,

Changchun Park, Peony Park, Chaoyang Park, and Wooden Land Park were less attractive. North Lake Park is a national 4A level park, but has a remote location and is newly built. The internal facilities are not yet perfect, the trees are not yet mature, and the landscape quality is poor. Changchun and Linyuan are not well known, so their recreational attractiveness is poor.

This analysis shows that the recreational attractiveness of urban parks depends on many factors, including the scenery, accessibility, popularity, and recreational facilities. This conclusion is similar to that of Li et al. (2012), who evaluated the recreational attractiveness of various urban parks in Beijing. They concluded that Beihai Park, located within the Third Ring Road, had a high recreational attractiveness and the best location, but low accessibility. Yuyuantan Park had a good location, but the wetland landscape quality and the accessibility of the park were average, meaning that its attractiveness was lower than that of Beihai Park. Taoranting Park had a good location and high accessibility, but the quality of the wetland landscape was average and it therefore had the lowest attractiveness among the three parks. We can therefore conclude the level of attractiveness of an urban park is not determined by one single factor, but by the combined effects of many factors. The urban parks with the highest recreational attractiveness all have a good location, good accessibility, and a high landscape quality.

It is important when planning, constructing and managing modern urban parks to select appropriate and effective scientific indicators to evaluate the recreational attractiveness of urban parks. Our study shows that the recreational attractiveness of urban parks has a significant positive correlation with the actual recreation rate, the revisiting rate, and the potential recreation rate, indicating that the recreational attractiveness values were in line with the actual situation. Table 5 shows that the recreational attractiveness of these urban parks was significantly positively correlated with their landscape quality and recreational facilities. This shows that the landscape quality and recreational facilities of a park directly affect its attractiveness to visitors. However, there was a negative correlation between recreational attractiveness and park accessibility, which indicates that a park with high accessibility is not necessarily attractive. If the scenery and facilities of a park are not good, then tourists will prefer a place with lower accessibility

for recreation. When evaluating the recreational attractiveness of Beijing city parks, Li et al. (2012) also found that the accessibility of Daoxiang Lake Park was high, but its recreational attractiveness was low. This is closely related to the improvement in the living standards of the current citizens. A few years ago, the transport links were not convenient, so people could only choose local parks for recreation. However, with the increasing popularity of family cars, people are pursuing a higher quality of life and are less limited by the accessibility of parks.

There is a significant positive correlation (Correlation coefficient: 0.804; $P < 0.05$) between the actual recreation rate and the landscape quality value, which indicated that the higher the landscape quality and recreational attractiveness, the higher the probability that people will actually visit.

4.2 Management implications

The cluster analysis showed that urban parks can be categorized to examine their advantages and disadvantages and to find ways to further improve their recreational attractiveness. The first category includes parks that need to improve their landscape quality. Among these, Labor Park and Children's Park could increase their proportion of ornamental plants and introduce a rotation of plants throughout the year to give different flowering periods in the four seasons. By strengthening the ecological connection between their forest and wetland areas, Imperial Garden and Victory Park could create an ecological corridor and improve the ecological connection between different landscapes. In the second category, five parks had a high landscape quality, but needed to increase their attractiveness, which requires park managers to highlight the value of science, culture, and education, and to extend the recreation time of residents. The third category included South Lake Park, which was ranked as the most attractive for recreation. The managers of this park should consider the capacity of the park and protect the green space from damage and the environment from pollution. In the fourth category, Jingyuetan Forest Park should receive government funding to reduce the ticket price and increase accessibility. This could be adjusted seasonally to alleviate capacity problems, with lower prices in the low season to avoid wasting resources. In the fifth category, North Lake Park was only recently built, which means that lessons

could be learned from the construction of previous parks, such as improving the allocation of resources, using planting schemes with a high landscape quality, paying attention to water quality, promoting visibility, and improving accessibility via local transport policies.

5 Conclusions

We developed an evaluation index system to calculate the recreational attractiveness of 12 typical urban parks in Changchun City, China. The field survey and statistical analysis of the questionnaire showed that the recreational attractiveness results were consistent with the actual situation, which indicates that the evaluation index system and the model established here are feasible. Recreational attractiveness was very different among these 12 parks. Based on the correlation analysis between the recreation rate and recreational attractiveness, we found that the recreational attractiveness of the urban parks was significantly positively correlated with their landscape quality and recreational facilities. The recreational attractiveness of the parks was negatively correlated with their accessibility. The potential recreation rate was negatively correlated with the landscape quality value, recreational attractiveness, and actual recreation rate. Classifying the recreational attraction of urban parks can guide planning and management decisions and improve their recreational attractiveness.

References

- Aasetre J, Gundersen V, Vistad O I et al., 2016. Recreational preferences along a naturalness-development continuum: results from surveys in two unequal urban forests in Europe. *Journal of Outdoor Recreation and Tourism*, 16: 58–68. doi: [10.1016/j.jort.2016.09.006](https://doi.org/10.1016/j.jort.2016.09.006)
- Ayala-Azcárraga C, Diaz D, Zambrano L, 2019. Characteristics of urban parks and their relation to user well-being. *Landscape and Urban Planning*, 189: 27–35. doi: [10.1016/j.landurbplan.2019.04.005](https://doi.org/10.1016/j.landurbplan.2019.04.005)
- Chang C R, Li M H, 2014. Effects of urban parks on the local urban thermal environment. *Urban Forestry & Urban Greening*, 13(4): 672–681. doi: [10.1016/j.ufug.2014.08.001](https://doi.org/10.1016/j.ufug.2014.08.001)
- Chiesura A, 2004. The role of urban parks for the sustainable city. *Landscape and Urban Planning*, 68(1): 129–138. doi: [10.1016/j.landurbplan.2003.08.003](https://doi.org/10.1016/j.landurbplan.2003.08.003)
- Dwivedi P, Rathore C S, Dubey Y, 2009. Ecological benefits of urban forestry: the case of Kerwa Forest Area (KFA), Bhopal, India. *Applied Geography*, 29(2): 194–200. doi: [10.1016/j.ap-geog.2008.08.008](https://doi.org/10.1016/j.ap-geog.2008.08.008)
- Endreny T A, 2018. Strategically growing the urban forest will improve our world. *Nature Communications*, 9(1): 1160. doi: [10.1038/s41467-018-03622-0](https://doi.org/10.1038/s41467-018-03622-0)
- Fan Xin, 2013. Thinking of urban forest development and building beautiful China. *Forestry Economics*, (7): 69–72. (in Chinese)
- Georgi J N, Dimitriou D, 2010. The contribution of urban green spaces to the improvement of environment in cities: case study of Chania, Greece. *Building and Environment*, 45(6): 1401–1414. doi: [10.1016/j.buildenv.2009.12.003](https://doi.org/10.1016/j.buildenv.2009.12.003)
- Kienast F, Degenhardt B, Weilenmann B et al., 2012. GIS-assisted mapping of landscape suitability for nearby recreation. *Landscape and Urban Planning*, 105(4): 385–399. doi: [10.1016/j.landurbplan.2012.01.015](https://doi.org/10.1016/j.landurbplan.2012.01.015)
- Kim D, Jin J, 2018. Does happiness data say urban parks are worth it. *Landscape and Urban Planning*, 178: 1–11. doi: [10.1016/j.landurbplan.2018.05.010](https://doi.org/10.1016/j.landurbplan.2018.05.010)
- Krenichyn K, 2006. ‘The only place to go and be in the city’: women talk about exercise, being outdoors, and the meanings of a large urban park. *Health & Place*, 12(4): 631–643. doi: [10.1016/j.healthplace.2005.08.015](https://doi.org/10.1016/j.healthplace.2005.08.015)
- Lee B D, 2005. *Motives, Behaviors, and Attachments: A Comparative Study Between Older Travelers and Younger Travelers in A National Scenic Area*. Pennsylvania: The Pennsylvania State University, 137.
- Li Min, 1987. *Modern Parks in China—Development and Evaluation*. Beijing: Beijing Science and Technology Press. (in Chinese)
- Li Fen, Sun Ranhao, Chen Liding, 2012. Recreational attraction of urban park wetlands in Beijing. *Chinese Journal of Applied Ecology*, 23(8): 2093–2099. (in Chinese)
- Liu H X, Li F, Xu L F et al., 2017. The impact of socio-demographic, environmental, and individual factors on urban park visitation in Beijing, China. *Journal of Cleaner Production*, 163 Suppl: S181–S188. doi: [10.1016/j.jclepro.2015.09.012](https://doi.org/10.1016/j.jclepro.2015.09.012)
- Li F Z, Li F Y, Li S J et al., 2020. Deciphering the recreational use of urban parks: experiments using multi-source big data for all Chinese cities. *Science of the Total Environment*, 701: 134896. doi: [10.1016/j.scitotenv.2019.134896](https://doi.org/10.1016/j.scitotenv.2019.134896)
- Meng Gang, Li Lan, Li Ruidong et al., 2003. *Urban Park Design*. Shanghai: Tongji University Press. (in Chinese)
- Olmsted F L, 1870. *Public Parks and the Enlargement of Towns*. Cambridge, MA: American Social Science Association.
- Qiu L, Lindberg S, Nielsen A B, 2013. Is biodiversity attractive?—On-site perception of recreational and biodiversity values in urban green space. *Landscape and Urban Planning*, 119: 136–146. doi: [10.1016/j.landurbplan.2013.07.007](https://doi.org/10.1016/j.landurbplan.2013.07.007)
- Raitz K, Dakhil M, 1988. Recreational choices and environmental preference. *Annals of Tourism Research*, 15(3): 357–370. doi: [10.1016/0160-7383\(88\)90027-8](https://doi.org/10.1016/0160-7383(88)90027-8)
- Ren Z B, He X Y, Pu R L et al., 2018. The impact of urban forest structure and its spatial location on urban cool island intensity.

- Urban Ecosystems*, 21(5): 863–874. doi: [10.1007/s11252-018-0776-4](https://doi.org/10.1007/s11252-018-0776-4)
- Ren Z B, Zhao H B, Fu Y et al., 2021. Effects of urban street trees on human thermal comfort and physiological indices: a case study in Changchun city, China. *Journal of Forestry Research*, 3: 1–12. doi: [10.1007/s11676-021-01361-5](https://doi.org/10.1007/s11676-021-01361-5)
- Saunders P R, Senter H F, Jarvis J P, 1981. Forecasting recreation demand in the upper Savannah River Basin. *Annals of Tourism Research*, 8(2): 236–256. doi: [10.1016/0160-7383\(81\)90084-0](https://doi.org/10.1016/0160-7383(81)90084-0)
- Sirina N, Hua A, Gobert J, 2017. What factors influence the value of an urban park within a medium-sized French conurbation. *Urban Forestry & Urban Greening*, 24: 45–54. doi: [10.1016/j.ufug.2017.03.021](https://doi.org/10.1016/j.ufug.2017.03.021)
- Voigt A, Kabisch N, Wurster D et al., 2014. Structural diversity: a multi-dimensional approach to assess recreational services in urban parks. *AMBIO*, 43(4): 480–491. doi: [10.1007/s13280-014-0508-9](https://doi.org/10.1007/s13280-014-0508-9)
- Wang Peijiang, Zheng Haifeng, Ren Zhibin et al., 2018. Effects of urbanization, soil property and vegetation configuration on soil infiltration of urban forest in Changchun, Northeast China. *Chinese Geographical Science*, 28(3): 482–494. doi: [10.1007/s11769-018-0953-7](https://doi.org/10.1007/s11769-018-0953-7)
- Wolch J R, Byrne J, Newell J P, 2014. Urban green space, public health, and environmental justice: the challenge of making cities ‘just green enough’. *Landscape and Urban Planning*, 125: 234–244. doi: [10.1016/j.landurbplan.2014.01.017](https://doi.org/10.1016/j.landurbplan.2014.01.017)
- Xiao Y, Wang Z, Li Z G et al., 2017. An assessment of urban park access in Shanghai—implications for the social equity in urban China. *Landscape and Urban Planning*, 157: 383–393. doi: [10.1016/j.landurbplan.2016.08.007](https://doi.org/10.1016/j.landurbplan.2016.08.007)
- Xie Hualin, Liu Liming, 2003. Research advance and index system of rural landscape evaluation. *Chinese Journal of Ecology*, 22(6): 97–101. (in Chinese)
- Zhao Ying, 2019. *Study on Improvement of Urban Park Circle Function and Planning Optimization Based on Recreation Demand in Beijing*. Beijing: Beijing Forestry University. (in Chinese)
- Zheng Wenjun, Zhou Zhixiang, 2008. Research on the attraction of rural landscape and assessment system based on tourism view. *Acta Agriculturae Jiangxi*, 20(10): 146–148, 153. (in Chinese)
- Zheng Wenjun, 2013. The value cognition and function reconstruction of rural landscape on tourism perspective: based on the literatures analysis. *Areal Research and Development*, 32(1): 102–106. (in Chinese)
- Zhou Zhixiang, Shao Tianyi, Tang Wanpeng et al., 2004. The different urban green-land spatial patterns and their environmental effects: a case of the central district of Yichang city, Hubei Province. *Acta Ecologica Sinica*, 24(2): 186–192. (in Chinese)