

Quantitative Assessment and Design Optimization of Spatial Vitality in Community Sports Parks: Challenges and Strategies for Mountainous Cities

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Abstract: In the context of intensive land use in mountainous cities, community sports parks have emerged as a new type of open public space. These parks are created by flexibly repurposing underutilized urban spaces, such as corner lots, primarily for physical exercise and leisure fitness activities while also serving general community park functions. This study aims to quantitatively evaluate the landscape Vitality of community sports parks in mountainous cities from the users' perspective, providing a reference basis for their planning, design, and optimization. Three newly constructed community sports parks of similar scale in Chongqing were selected as research samples. The Semantic Differential (SD) method was employed to establish 14 evaluation factors, and correlation analysis was used to analyze the data. The study reveals that the average scores for all evaluation factors of the sample parks were 2.00, 1.76, and 2.33 respectively, indicating overall satisfaction among evaluators. Accessibility, attraction, facility, and greenery were identified as key factors determining landscape Vitality and satisfaction. Shade and creativity generally received lower scores. Future planning and design should focus on improving ideal transportation accessibility, reasonable terrain management, affordance of environmental elements, and atmosphere of local historical and cultural. This landscape Vitality evaluation of community sports parks provides reference and optimization suggestions for landscape construction. It contributes to improving the quality and utilization efficiency of public spaces in mountainous cities, thereby promoting urban sustainable development and enhancing residents' health levels.

Keywords: Community Sports Park; SD Analysis; Landscape Vitality Evaluation; Optimal Design.

1. INTRODUCTION

Recent urban development strategies have emphasized enhancing the

quality and efficiency of green spaces, particularly in relation to existing infrastructure. The health benefits of urban green spaces, from a public health perspective, have gained increasing recognition and value. Urban areas, especially those in mountainous regions, face significant challenges in balancing limited available space with the growing demand for public health initiatives and outdoor recreational opportunities. Community sports parks have emerged as a solution to these challenges, offering enhanced amenities, diverse spaces, and a wide range of activities. These parks repurpose underutilized urban spaces, such as corners, interstitial areas, and street-side green spaces, prioritizing vegetation, physical exercise, and leisure activities to promote community health and fitness. This concept involves transforming unused urban land into public, welfare-oriented spaces that are accessible to all residents. Zhuhai, a city in Guangdong Province, pioneered the construction of community sports parks in 2012, catalyzing their rapid adoption across China. These parks are now recognized as comprehensive public sports facilities that provide opportunities for both physical fitness and recreation. Consequently, there has been a growing body of research focused on these parks and their impacts. The unique geographical features of mountainous cities significantly influence the benefits and design considerations of community sports parks (Liu & Lan, 2021). Designing convenient and suitable open spaces in densely populated urban areas presents substantial challenges. In response, government initiatives such as the *Chongqing Urban Enhancement Action Plan* have prioritized the creation of community sports parks on underutilized land as a key strategy to improve urban quality. By 2024, Chongqing aims to construct 134 community sports parks across all administrative districts in the metropolitan area. However, questions remain regarding the efficacy of these newly constructed parks in relation to their size and financial investment, as well as user satisfaction with their spatial vitality and utilization. This study focuses on three recently constructed community sports parks in Nan'an District, Chongqing. The research aims to evaluate these parks based on users' spatial perceptions using the Semantic Differential evaluation method (SD). Additionally, we employ mathematical analysis and behavioral observation techniques to determine specific values of spatial vitality for these parks and develop optimization strategies. The findings of this study seek to provide theoretical guidance for the renovation and design of similar parks, contributing to the broader understanding of effective urban green space utilization in densely populated areas.

2. RESEARCH THEORY AND METHODS

2.1 Community Sports Parks

The impact of community sports parks on users has emerged as a focal point of research in recent years. Several studies have explored various aspects of these parks, including their health promotion utility, spatial elements, and effects on different population groups. Liu and Fang evaluated the health promotion potential of 24 community sports parks in Chongqing, examining the correlation between land conditions and health promotion utility (Liu & Fang, 2022). In a pioneering study on health equity in community outdoor recreation spaces, Xu and Zhang investigated how three key spatial elements—accessibility, site sharing and configuration standards—influence health equity (Xu & Zhang, 2022). Wang et al. focused on the elderly population's use of community parks in winter, concluding that favorable outdoor thermal comfort promotes physical activity among older adults (Wang et al., 2023). Corroborating these findings, Barquilla et al. revealed that older adults living in proximity to community parks experienced higher levels of stress relief and increased physical activity, underscoring the crucial role of green spaces in promoting health and active lifestyles (Barquilla et al., 2023). A comprehensive review of 27 years of literature by Qin and Qin identified a general upward trend in globally published articles on sports parks (Qin & Qin, 2023). They noted that alongside traditional themes of "physical activity" and "sport," "tourism" and "urban parks" have emerged as research hotspots. The authors suggested that future research should focus on balancing urban green space with sports venues. Qin et al. examined sports park publications in China, proposing the organization of key areas, including sports parks, community sports, and ecological sports parks, to establish an international network (Qin et al., 2022). Their work aimed to form a multidisciplinary cross-research framework based on sports disciplines. Employing various methods such as literature review, logical analysis, and field research, Qi et al. explored the potential benefits of building community sports parks in China, both from theoretical and future-oriented perspectives (Qi et al., 2024). Practical research in this field has focused on applicability and optimization strategies. Liu and Lan (2021) summarized the general characteristics and enhancement strategies for community sports parks in Chongqing (Liu & Lan, 2021). Fang proposed two models of high-capacity and multi-activity spaces based on health promotion evaluations, outlining their appropriate applications and activity setups to enhance sports capacity and attractiveness (Fang, 2020). Zhong

and Sun constructed a "people-behavior-space" model using IPA analysis, observation, and research methods (Zhong & Sun, 2023). Their study yielded residents' importance-performance scores through categorization analysis, enabling the proposal of optimization and enhancement strategies for community sports parks. Chen et al. used community sports parks in Zhuhai City as a case study, conducting physiological and psychological analyses of elderly needs (Chen et al., 2023). They proposed aging-friendly landscape design strategies, including functional place and recreational activity design, walking path design, botanical landscape habitat creation, and integration of community culture and site texture. Wang and Zeng explored design paths for community sports parks aimed at promoting public health (Wang & Zeng, 2024). Li et al. proposed strategies for updating sports and fitness functions in urban parks, including community parks, addressing land use proportions and project content (Li et al., 2023).

2.2 User Needs

One of the key factors in determining the design of community sports parks is user satisfaction. The most basic need of users is outdoor fitness, and the scale of the sports ground, the type and number of sports facilities, the layout of sports space, and the planning of fitness paths are all factors that directly affect the satisfaction of users. Secondly, community sports parks integrate the features of general community parks, offering a conducive environment for outdoor activities. Only when the main body of the activity-users can really activate the venue by carrying out activities in the venue will the vibrant venue attract users to continue to create activities, so that the positive cycle makes the community sports park in the city really realize the utility of promoting public health.

Table 1(a): Three Types of Activities Based on User Needs




Types of Activities	Usage Behaviors	Space Requirements	Site Photos
Necessity Activities	Activities that are mandatory and functional include commuting, passing through, and waiting for someone, among others.	There is no absolute link between physical space and behavior.	 <p>Waiting for someone, passing through</p>

Table 1(b): Three Types of Activities Based on User Needs

Types of Activities	Usage Behaviors	Space Requirements	Site Photos
Spontaneous Activities	People independently select activities like strolling, strolling with a baby, and sunbathing.	Create a suitable spatial environment and supportive facilities to encourage people to participate in activities.	 Having a rest and visiting
Social Activities	Activities such as chatting, playing cards, and children's games rely on the participation of others. Certain circumstances and conditions transform necessity and spontaneity into social activities.	There are certain requirements for a spatial environment that can primarily support social interaction activities.	 Playing cards and chatting

2.3 Landscape Vitality

At present, the academic community has not made a clear definition of landscape vitality. Chen et al. proposed that landscape vitality refers to the ability of all types of landscapes in urban public space to produce attraction to people, to occur in diversity, and to continue to carry out activities over a long period of time (Chen et al., 2015). In community sports parks, landscape vitality influences not only the frequency and efficiency of park use, but also the quality of interaction between users and the environment, leading to user satisfaction. The analysis of relevant literature and cases, both domestically and internationally, reveals that the evaluation of landscape vitality typically encompasses multiple dimensions, including spatial characteristics, environmental aesthetics, social culture, and ecological benefits. A comprehensive and reasonable landscape vitality evaluation system usually covers the above dimensions and utilizes both quantitative and qualitative analysis methods in the evaluation process. We can realize quantitative analysis through indicator measurement and data analysis, such as spatial analysis using GIS technology; we can realize

qualitative analysis through interviews, questionnaires, and other methods to understand the subjective feelings of the residents (Zhong & Sun, 2023), and through the use of principal component analysis and hierarchical analysis for data analysis. Usually, the evaluation results serve as the basis for empirical research on design theory and feedback to construction management, guiding renovation and upgrading efforts.

3. THE EVALUATION PROCESS

3.1 Evaluation Method

American psychologist Charles Osgood proposed the Semantic Differential Method (SD Method) in 1957 as a psychometric tool and evaluation method to measure people's attitudes and perceptions of a concept or object. Evaluation indicators consist of "concepts" and a number of "scales". The "concepts" are symbols that point to the users' perceptions and have emotional significance, such as cleanliness. The "scales" refers to a pair of opposite adjectives that define the users' feelings, such as clean and dirty. The advantage of the SD method lies in its ability to convert subjective feelings into quantifiable data, thereby circumventing the challenges associated with subjective descriptions in traditional qualitative research, which can be difficult to quantify and often make it challenging for individuals to accurately express their own feelings. Urban planning and urban design now widely use the SD method. Urban planning and landscape design widely use it to evaluate the perceived quality of public space, environmental comfort, and user satisfaction, among other factors. The limitation of the SD method is that the design of the scale may affect the results. Therefore, this study introduces the Delphi method, which combines expert opinion and the results of user pre-survey to carefully design the evaluation items, thereby improving the reliability and validity of the study.

3.2 Evaluation Factors

Firstly, we reviewed domestic and international literature on the vitality of public space and the evaluation of sports facilities to identify the landscape vitality factors affecting users' activities in mountainous urban community sports parks. We then categorized factors such as "accessibility," "safety," "security," and "safety." We invited five experts from the fields of urban design, landscape design, and sports management to participate in the discussion. Using two rounds of the Delphi method,

we proposed special factors like "terrain adaptability," "shade," and others specific to Chongqing. We invited five experts from the fields of urban design, landscape design, and sports management to participate in the discussion. Using two rounds of the Delphi method, we proposed unique factors specific to Chongqing, like "terrain adaptability," "shade effect," and so on. We also analyzed the three dimensions of planning and design, spatial experience, management, and maintenance. Thirdly, we conducted a one-week field observation and semi-structured interviews at Dashuijing Community Sports Park, during which residents frequently mentioned key words such as "convenient," "bustling," "many facilities," and "greening." Based on these observations, we preliminary determined 17 evaluation factors, which are as follows: We preliminarily determined the following 17 evaluation factors: We then conducted a pre-survey, distributing a 7-point scale questionnaire containing these 10 pairs of adjectives to 30 users for scoring. Statistical exploratory factor analysis revealed a high correlation between "lively" and "number of facilities", which we combined as follows: We merged the "activity" factor into a final set of 14 evaluation factors (Table 2).

Table 2(a): Indicators of Assessing Landscape Vitality in Community Sports Parks

Indicators	Evaluation Factors	Adjectives	Questionnaire Questions
Planning And Design	Orderliness	Disorganized - Clear	Is the tour route clear and smooth?
	Landscape appearance	Conflicted - Harmonized	Is the landscape of the park harmonized?
	Compatibility	Contrary - Adapted	Does the terrain design respond to the mountainous terrain?
	Creativity	Monotonous - Innovative	Is the park's landscape design creative?
	Accessibility	Hard - Easy	Is the park easily accessible?
Spatial Experience	Attraction	Uninteresting - Interesting	Is the park attractive?
	Shade	Sunny - Shady	Is the venue well shaded?
	Bustle	Cold - Lively	Is the park crowded?
Atmosphere	Local Characteristics	Absent - Distinct	Does the park have distinctive local characteristics?
	Visual effects	Boring - Outstanding	Is the park visually appealing?
	Cultural atmosphere	Inadequate - Intense	Is there a strong cultural atmosphere?

Table 2(b): Indicators of Assessing Landscape Vitality in Community Sports Parks

Indicators	Evaluation Factors	Adjectives	Questionnaire Questions
Facilities and Maintenance	Facilities	Reasonable - Unreasonable	What is the number, location and accessibility of facilities for sports, recreation, etc.?
	Greenery	Less effective - More effective	Effectiveness of plant configuration and maintenance of trees, shrubs and grasses
	Cleanliness	Dirty - clean	What is the level of cleanliness and hygiene in the park?

3.3 Evaluation Scale

We designed the questionnaire using the Likert scale method to enable respondents to assess the park's landscape vitality with relative clarity, speed, and precision. The questionnaire asked about the respondents' demographics and the types of activities they like to do. It also asked them to rate 14 sets of adjectives that describe the evaluation factors of landscape vitality based on how much each evaluation factor affected their choice of space and how they did their activities. We set up the questionnaire with an 7-point evaluation scale, which ranges from -3 to 3, where a higher absolute value indicates a higher degree of agreement with the evaluating factor, while a score of 0 indicates average or neutral.

4. RESULTS

4.1 Research Sites

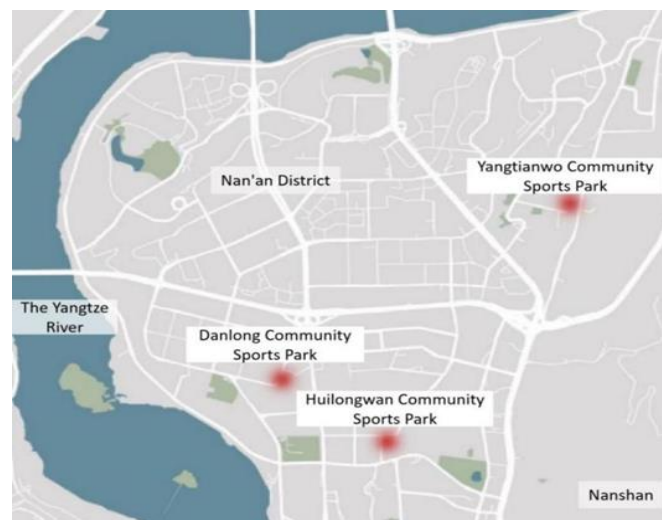


Figure 1 : Geographic Location of the Research Site on the Map

The three research sites (Fig. 1) are situated in the main urban area of Chongqing, a city that was among the first in China to construct community sports parks. Given its mountainous terrain and land constraints, these sites hold significant research value and demonstrate the importance of creating small and micro-spaces. The author visited 30 community sports parks that were completed and put into use in 2019 during the pre-survey session and finally selected three research sites in Nan'an District (Table 3), taking into account various factors such as utilization rate, land scale, terrain changes, the surrounding environment, and transportation.

Table 3 : Basic Information About the Research Site

Name	Yangtianwo Community Sports Park	Danlong Community Sports Park	Huilongwan Community Sports Park
Location	Fuxiang Road, Nan'an District	Danlong Road, Nan'an District	Nanhu Road, Nan'an District
Area (m ²)	5200	3796	8199
Main Service Recipients	Elderly and children within a 500-meter radius	Residents of Yunfeng Residential Area	Residents of Huilongwan Community
Activity Facilities	Fun swings, children's activity areas, sports and fitness zones	Common facilities like basketball courts, badminton courts, running tracks; themed areas include youth fitness spaces, activity areas for seniors and children	Basketball courts, badminton courts, table tennis courts, multi-purpose fitness areas, children's playgrounds
Site Photograph			

4.2 Data Collection

The survey was conducted over 8 days in May and October 2023, covering weekdays, weekends, sunny days, cloudy days, etc. We randomly selected users over 18 years of age from 7:30 to 20:30 on the survey days, collecting their perceptions of the park's landscape vitality through questionnaires. Meanwhile, we took photographs and made behavioral annotations to document the main activities and spatial aggregation characteristics of people in the park. Simultaneously, we recorded people's

main activities and spatial gathering characteristics in the park using photo records and behavioral notes. A total of 332 questionnaires were distributed, and 314 were returned, of which 296 were valid questionnaires, with a validity rate of 94.3%. The validity and reliability of the 296 questionnaires were tested by SPSS 20. The reliability and validity tests manifest that the Cronbach's alpha coefficient of the designed questionnaire content is $0.776 > 0.7$. Therefore, the questionnaire has good reliability and validity. In order to further explore the degree of influence of the above 14 evaluation factors on the spatial vitality of community parks, a second questionnaire survey was conducted in November 2023, with a total of 90 questionnaires distributed in the three parks and 83 returned, for a validity rate of 92.2%. The main purpose of distributing the questionnaires was to allow park users to rank the importance of these factors and to classify the degree of vitality based on the ranked result factors.

4.3 Statistical Analysis of Results

Following data collation, we derived vitality evaluation scores for the three community sports parks (Table 4). The results indicate that most factor scores exceeded 1.00, with the exception of the "Shade" in Danlong Community Sports Park, suggesting generally high satisfaction of users.

Table 4 : Table of SD Factor Scores For Three Community Sports Parks

Evaluation Dimensions	Evaluation Factors	Park Name		
		Danlong Community Sports Park	Huilongwan Community Sports Park	Yangtianwo Community Sports Park
Planning and Design	Orderliness	1.24	2.19	2.58
	Landscape appearance	2.10	1.67	1.95
	Compatibility	2.08	2.19	2.53
	Creativity	1.19	1.57	1.47
Spatial Experience	Accessibility	2.67	2.14	2.84
	Attraction	2.57	2.05	2.89
	Shade	-1.43	0.81	1.79
	Bustle	1.95	2.10	2.05
Atmosphere	Local Characteristics	1.52	2.00	2.95
	Visual effects	1.62	2.86	1.84
	Cultural atmosphere	1.81	2.43	2.58
	Facilities	2.38	2.62	2.79
Facilities and Maintenance	Greenery	2.76	1.52	1.68
	Cleanliness	2.14	1.90	2.68
Average score		2.00	1.76	2.33

Horizontally, the three parks scored closely in the category of 'Planning and design,' indicating that, as a group of recently constructed parks, their design concepts and approaches have generally met the public's needs and demonstrated a high degree of 'design-use' compatibility (Fig. 2). Regarding 'Spatial experience,' the ratings of the three parks varied significantly, with Huilongwan Community Sports Park showing the most pronounced fluctuation, highlighting its distinctiveness among the study subjects. The generally low scores for 'shade' confirm the strong demand from residents for shade, cooling, and other microclimatic amenities, especially under the hot and humid summer conditions. The negative scores for Huilongwan Community Sports Park are attributed to its location on elevated terrain, surrounded by few high-rise buildings, and its low internal vegetation cover. The scores for 'Atmosphere' and 'Facilities and maintenance' show considerable variation, and the scores for the same park across different factors also exhibit noticeable highs and lows. This suggests that the three parks have distinct design focuses and struggle to balance the relationship between physical space and spiritual atmosphere. Furthermore, compared to intangible design elements like ambience, users show a greater interest in 'visible' and 'perceivable' conditions, such as greenery and cleanliness.

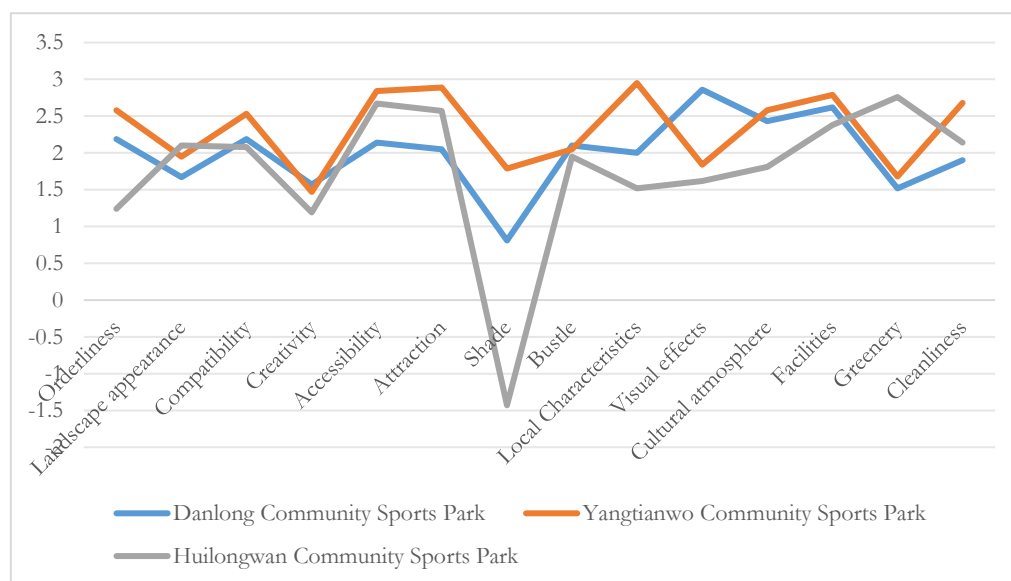


Figure 2 : Community Sports Park Landscape Vitality Evaluation Foldout.

4.4 Correlation Analysis of Landscape Vitality Factors

In the second round of the questionnaire survey, a ranking method was employed to assess the landscape vitality factors. The average ranking positions and standard deviations for each factor were calculated from the survey responses. Based on these calculations, the factors were categorized

into three distinct classes: strongly relevant, moderately relevant, and weakly relevant. The findings are presented as follows:

Strongly correlated vitality factors: accessibility, attraction, facilities, greenery.

Medium correlation vitality factors: orderliness, compatibility, shade, visual effects, cleanliness.

Weakly correlated vitality factors: landscape, creativity, bustle, local characteristics, cultural atmosphere.

The grading outcomes not only delineate the extent of influence exerted by each factor on the park's landscape vitality but also furnish a prioritized reference for the subsequent optimization strategies.

Accessibility: Accessibility pertains to the ease with which residents can reach and utilize a community sports park, impacts the efficiency and emotions of park users, and is associated with factors such as walking distance, public transportation routes and numbers, and the placement of parking facilities. A community sports park that is easily accessible can attract more people, resulting in greater landscape vitality. For example, Yangtianwo Sports Park is well-located and surrounded by residential areas, with a large base of people using the park. Neighborhood residents prefer Yangtianwo Sports Park's convenient transportation in the periphery for walks and relaxation, earning it the high scores of 2.84 and 2.05, respectively, for both accessibility and liveliness. In contrast, Hui Long Wan Sports Park, situated in the downtown area, suffers from a complex and congested road network in its periphery, which limits residents' accessibility and willingness to visit the park. Consequently, the park's liveliness suffers, scoring only 0.57.

Attraction: The attraction of a community sports park significantly impacts its landscape vitality, directly influencing the users' subjective willingness to visit. The more appealing the park is to people, the more they will go there. Enhancing the park's attraction involves creating a rich functional form and internal facilities, among other things, to highlight its unique characteristics and attract more people. Rich attraction enhances user retention and freshness in community sports parks. Yangtianwo Sports Park has a 2.89 attraction score, and it performs better than the other two parks in terms of facilities, colors, and creativity. Better facilities and richer colors are all attractive elements of community sports parks.

Facilities: The number, location and accessibility of facilities for sports and recreation are of general concern to users and have a direct impact on the landscape vitality of the park. Since community sports parks combine the functions of exercise and fitness, and most of the weekday users are

the elderly and children, improper use of the facilities can easily lead to safety hazards. During the study, users indicated that the availability of safe and secure fitness facilities was an important factor in traveling to and staying in the parks. For instance, in community sports parks primarily frequented by the elderly, the provision of fitness equipment and seats is deemed necessary due to the elderly's age, weakened muscle strength, and preference for leisure, static, and low-exercise activities. As for community sports parks mainly used by young people, due consideration should be given to the fact that young people like challenging and intense sports, and the setting up of places for extreme sports such as skateboarding and rock climbing should be encouraged.

Greenery is a fundamental component of community sports parks, which are urban public spaces primarily composed of green spaces. The plant landscape effectively separates the park from the city's hardscape areas. The judicious combination of different types of plants, such as trees, shrubs, and grasses, not only attracts and encourages the use by residents but also creates a favorable living environment for plants and animals, exerting positive ecological benefits in the local area. The scores for Huilongwan Community Sports Park and Yangtianwo Community Sports Park were relatively low, at 1.52 and 1.68, respectively, while the greening at Danlong Community Sports Park received user approval, with a score of 2.76. Comparatively, the latter has a more reasonable mix of plant colors, types, and heights, and has demonstrated better management and maintenance in the subsequent stages. Furthermore, the hierarchy's findings indicate that the majority of moderate and weak vitality factors are associated with the park's facilities and environment. The landscape vitality of community sports parks is significantly influenced by a good environment and robust facilities. For example, the three parks surveyed by the author performed better in terms of facilities and environment, with overall scores of 1 or higher, which improved the parks' landscape vitality to a certain extent. Even the factors categorized as "weakly relevant" are not unimportant, but less influential than other factors. In the actual planning and design, it is still necessary to consider all the factors comprehensively in order to realize the overall optimization of the efficiency and quality of park services.

5. CONCLUSION

This study investigated the utilization of three community sports parks in Chongqing after their construction, focusing on the users' viewpoint.

We constructed an index system to assess the landscape vitality of community sports parks in the region, utilizing questionnaire surveys and behavioral observations. The study also analyzed the relationship between user perception and spatial vitality. This criterion categorizes the vitality variables into three groups based on their scoring and ranking. Therefore, we can summarize the optimization design method for the parks by focusing on the strongly connected vitality elements. The main findings were as follows:

(1) Ideal transportation accessibility. Community sports parks are not only an important type of green space in the "15-minute community living circle," but also the most accessible green open space for residents in mountainous cities with limited land use. The questionnaire reveals that 93.1% of users either walk or use a battery-powered car or bicycle to access the park. Good accessibility is a prerequisite for users to visit the park, and the polarised data reveals that users' responses to accessibility are sensitive and vary significantly. The design should organize the traffic flow lines both inside and outside the site, create a road classification and linear layout for the park, and establish a connection between the entrances and the city roads on the outside. For example, the height difference between Huilongwan Community Sports Park and the neighbouring main roads is large, and it is necessary to go up a flight of stairs to reach it. The urban interface should be within the visible range of good sight guidance, with landscape signs that align with the park's image guiding users to enter. Simultaneously, the land use situation should dictate the placement of ramps, elevators, etc. to ensure barrier-free access.

(2) Reasonable terrain management. The unique geographical features of cities located in mountainous areas present a difficulty when it comes to building parks, but they also offer the opportunity to create intricate and diverse spatial structures. Community sports parks should prioritise overcoming site limitations and effectively utilising variations in terrain height to optimise space utilisation, given their extensive reach, diverse activity requirements, and high land usage. Strategic planting of native plant communities with high biodiversity creates a lush backdrop in areas characterised by dense contour lines and significant elevation variations. This not only serves the purpose of soil protection and slope stabilisation but also provides an aesthetically pleasing environment. Recreational facilities like slides, climbing walls, and fitness trails enhance the overall enjoyment of mountain sports by incorporating the slopes. Organize the flat terrain to accommodate various activities like table tennis, badminton, square dancing, relaxation, and landscape appreciation. Under certain

circumstances, we can design the site as an irregular sports pitch, leveraging its unique shape to serve as a community sports park and enhance the aesthetic appeal of the landscape (Fig. 3) .



Figure 3: The Form of Terrain Management ((a) is a Fitness Trail and Ramp, and (b) is a Children's Playground with Slide).

(3) Affordance of environmental elements. The questionnaire results indicate that a luxurious and enjoyable setting is a crucial element in enticing nearby residents to visit the location. Facility systems, such as sports facilities, cultural facilities, and supporting facilities that are suitable for the size of the site, offer opportunities and assistance for a wide range of activities on the site. They are also crucial for increasing the liveliness of the landscape. Users are more likely to prefer a complex environment that combines multiple functions and activities. Therefore, the planning and design should carefully consider the needs of the elderly, children, and the disabled. It is important to create functions that support staying and to carefully manage the relationship between facilities and green spaces. While avoiding excessive hardening of the site, we should also consider the quality of the greenery and the overall environment (Fig. 4) . Furthermore, the proper functioning and upkeep of the site, including tasks such as cleaning, maintenance, safety, and security, are crucial for ensuring its affordance. Effective maintenance is critical for the site's long-term utilization and significantly influences the perception of its use and the vitality of its landscape.



Figure 4: The Form of Environmental Elements ((a) is a Rainbow Runway, and (b) is a Plastic Fitness Ground, and (c) is a Corridor).

(4) Atmosphere of local historical and cultural. The integration of local culture and parks fosters a sense of closeness and integration among users, thereby fulfilling the goal of fostering a people-oriented environment. Chongqing not only has prominent mountainous features, but it is also a city with rich history, culture, and deep humanistic deposits. Integration of recognizable cultural features into landscape design avoids homogeneous design of the same type of parks and enhances the residents' sense of identity and belonging to the community and even the city. Two common types of landscape design are performing arts and cultural facilities, which combine pavilions and fitness plazas to create performance and viewing areas for the exhibition and dissemination of local cultural events. Other cultural facilities, such as cultural landscape walls, landscape vignettes, and cultural corridors, serve as display areas for cultural creation and exchange.

Generally speaking, The SD method perception study analyzes the genuine psychological feelings of users from their perspective, identifying the type of park space they truly require. This knowledge aids in promoting a shift in the design and construction of community sports parks towards a more user-oriented approach. The study investigated the types of people, activities, and age groups in the community sports parks in order to propose targeted programs through the landscape approach. The study draws important design characteristics like availability and attractiveness, which impact the landscape's vitality, from the SD perception data from three different community sports parks. The study proposes an optimization strategy for the design and construction of community sports parks in Chongqing. This strategy aims to enhance the experience, identity, and iconicity of these parks by utilizing comprehensive methods such as good transportation accessibility, reasonable topographic treatment, availability of environmental elements, and local historical and cultural atmosphere. This approach enhances the landscape vitality and service quality of the parks. The introduction of the SD method to evaluate community sports parks represents a novel approach that leverages group landscape preferences and implements people-oriented ideas. This approach offers theoretical support and methodological exploration for enhancing the landscape vitality of community sports parks and promoting the construction of green open spaces in mountainous cities.

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