A Bibliometric Analysis of Recreational Services in Park Green Spaces

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Abstract. With the accelerating process of global urbanization, the recreational services of park green spaces have become crucial for enhancing residents' quality of life and promoting urban sustainability. However, a comprehensive bibliometric review specifically focused on this field remains absent. This study employs bibliometric methods and CiteSpace software to analyze 165 relevant publications from the Web of Science core collection between 2005 and 2024, aiming to systematically review the research progress, hotspots, and frontiers of recreational services in park green spaces. The results indicate that research in this field has evolved through three distinct phases: initial (2005–2016), exploratory (2017–2020), and rapid development (2021–present). Geographically, publications are predominantly concentrated in Asia (45%) and Europe (40%), with China being the most productive country. Current research themes primarily encompass cultural ecosystem service valuation, health and well-being promotion, and supply-demand matching. Keyword burst detection reveals that research frontiers have shifted from "land use" to "demand" and recently to "digital mapping." The evaluation systems are categorized into process evaluation and supply-demand evaluation, influenced significantly by socioeconomic development levels and policy norms. Finally, this study discusses future challenges and directions, including enhancing social equity, achieving precise supply-demand matching, and leveraging multi-source data and intelligent models for evidence-based planning. The findings provide a systematic reference for future research and practical optimization of park green space systems.

Keywords: green space; urban park; recreation service; bibliometrics; research progress

1 Introduction

With the acceleration of global urbanization, parks and green spaces—as vital components of urban ecosystems—have become key vehicles for enhancing residents' quality of life, promoting social equity, and improving ecological environments through their recreation service functions. The core concept of recreation services originates from ecosystem services theory. Costanza et al. first described recreation as

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"opportunities for leisure activities" in Nature [1]. The United Nations Millennium Ecosystem Assessment further classified recreational activities and ecotourism as subcategories of cultural ecosystem services, defining them as "opportunities for spiritual fulfillment, aesthetic experiences, and leisure activities provided by natural landscapes, biodiversity, or cultural resources" [2]. Recreation services promote public physical and mental health, contributing to human well-being [3,4]. Numerous developed countries and regions safeguard recreation service provision through legislative and contractual mechanisms. Objective 2 Action 5 of the EU Biodiversity Strategy stipulates that member states should complete mapping and assessment of ecosystem and service conditions by 2020, while promoting the integration of these values into EU and national accounting and reporting systems [5]. The United States enacted the American Outdoors Act (2020), allocating substantial funds to assist states in improving park infrastructure and enhancing visitor recreation experiences [6]. In recent years, research on green space recreation services has garnered increased attention. Grounded in urban green spaces, these services provide the public with diverse offerings—including leisure, recreation, fitness, cultural education, and ecological healing—through scientific planning and effective management. They encompass three core characteristics: spatial accessibility, functional complexity, and social inclusivity [7]. Current research on recreation services primarily focuses on urban green spaces, particularly urban parks. The research scale ranges from micro to macro, covering individual parks, parks within urban areas, and parks in urban clusters. Through long-term research, a theoretical foundation and practical experience system regarding recreation services in park green spaces has emerged globally. Advancements in science and technology continue to broaden and deepen this research. However, most studies still primarily examine recreation services as a subset within ecosystem cultural services, with limited dedicated research on recreation services alone. Consequently, unified evaluation standards and assessments of influencing factors have yet to be established.

Bibliometrics is an interdisciplinary field that employs mathematical and statistical methods to conduct quantitative analysis of knowledge carriers [8]. As a crucial research methodology for revealing developmental patterns within specific domains [9,10], it has been widely applied in identifying research hotspots [11], analyzing collaboration networks [12], conducting co-citation analysis [13], and exploring the overall evolutionary patterns of disciplines [14]. In recent years, scholars worldwide have applied bibliometrics to quantitatively analyze the service functions of parks and green spaces from diverse perspectives, including biodiversity conservation [15], social equity [16], resident health benefits [17], climate change adaptation [18], and others. To date, no systematic bibliometric research has focused specifically on the field of recreation services in park green spaces. This paper employs bibliometric methods, utilizing Citespace software for data analysis and visualization, to conduct a quantitative analysis of the current state of research on recreation services in park green spaces. The objectives of this study are: (1) to systematically review publication trends, research status, hotspots, and themes in the field of park green space recreation services; (2) to analyze and summarize evaluation standards for park green space recreation services; (3) to deeply explore influencing factors of park green space rec-

reation services; (4) to discuss future development directions and challenges in this research field. The study aims to provide theoretical foundations and practical references for optimizing global urban green space systems and enhancing recreation service functions.

2 Materials and Methods

2.1 Data Sources

To comprehensively and intuitively reflect global research progress on recreation services in park green spaces, this study primarily utilized the SCI-E (Science Citation Index Expanded) database from Web of Science (WOS) as its core data source. Advanced search tools were employed with the query: (TS=(green space) OR TS=(urban park)) AND TS=(Recreation Service). The time span was 2005–2024, with article types limited to "Article" and "Review Article". Data retrieval was conducted on June 23, 2025, yielding 407 documents. To ensure the relevance of the retrieved literature, this study further screened the titles, abstracts, and keywords of each document, ultimately yielding 165 publications, 163 articles and 2 review articles (Fig. 1).

2.2 Research Methodology

This study employed the Citespace 6.3.R1 to conduct bibliometric analysis and thematic mining of literature on park green space recreation services. Combined with qualitative analysis, it systematically reviewed research progress, specifically:(1):Used Citespace software to statistically analyze annual publication volume, country-region distribution, publishing institutions, and author groups; (2) Keyword co-occurrence analysis, keyword clustering analysis, and timeline analysis were conducted using Citespace software, focusing on keyword co-occurrence frequency, centrality, and emergence intensity; (3) Qualitative analysis was employed to categorize and summarize evaluation criteria and influencing factors for park green space recreational services ; (4) Qualitative analysis summarized future development directions and challenges in park green space recreation services research.

2.3 Citespace Parameters

This study exported the "full record" of screened literature from the WOS database into a "RefWorks" file, then imported the data into Citespace software for analysis. Parameter settings were as follows: Time slice: 1 year; Cosine algorithm for calculating network average strength; g-index proportional factor (k) set to 25; keyword retention threshold (Top N) within each time slice set to 50; pruning mode set to "pathfinder" and "pruning the merged network"; all other settings defaulted to default values [19].

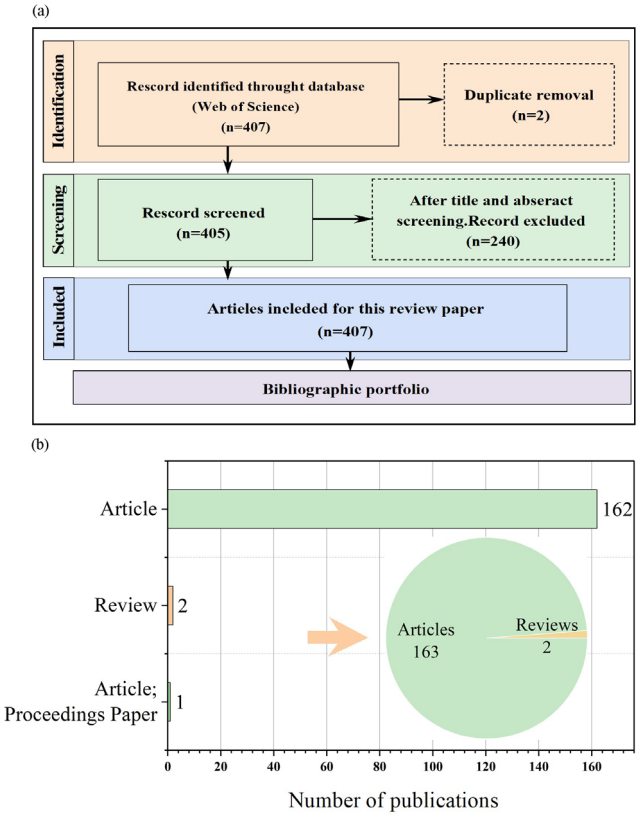

Fig. 1. Bibliometric analysis. (a) Flowchart for screening retrieved articles. (b) Number and type of articles. (figure caption)

3 Bibliometric Analysis

3.1 Annual Publication Trend

To grasp the full picture of development in a field, one must first examine its macro-level trajectory. The initial question posed by this study is: Over the past two decades, what developmental path has research on recreational services in parks and green spaces followed, and what are its levels of activity and phased characteristics? Based on an analysis of annual publication volume (Fig. 2), we can clearly divide the development of this field into three main phases.(1) Initial Phase (2005–2016): Research in this field remains relatively underdeveloped,with annual publications ≤5 articles. This phase is marked by the emergence of pioneering research, such as Jim et al.'s study on evaluating the recreational service value of urban green spaces in Guangzhou, which closely integrates methodology with decision-making practice [20]. Research during this period primarily focused on preliminary explorations of the recreational functions of natural parks, without yet establishing a systematic research framework. (2) Explo-

ration Phase (2017–2020): Annual publication volume showed a modest upward trend over a relatively short period. Research on ecosystem cultural services gained widespread attention, while foundational studies on recreation services in parks and green spaces gradually matured. Evaluation systems and applied research in this field experienced rapid development. (3) Rapid Development Phase (2021–2024): Annual publication volume surged dramatically during this period. The total number of articles (94) increased more than fivefold compared to the initial phase (17), accounting for 56.97% of the total. Research methodologies and evaluation systems matured significantly, with recreation services gaining greater attention as a subcategory of ecosystem cultural services (Fig. 2).

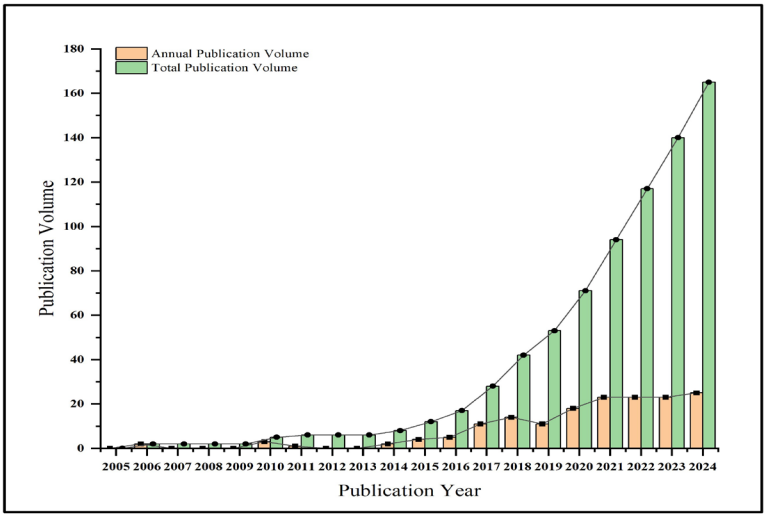

Fig. 2. Annual publications from 2005 to 2024.

3.2 Study Countries

Having established that this field is in a transitional phase of development, a natural question arises: Which countries are primarily driving this growth? Where are the core forces behind this global research agenda concentrated?As shown in Fig. 3 & 4, the research landscape is characterized by a pronounced geographic imbalance. Analysis of 39 contributing countries and regions reveals that the vast majority of publications are concentrated in Asia (45%) and Europe (40%), which together account for 85% of the total research output. Within this core, China stands as the undisputed leading nation, contributing 37% of all publications globally. Other significant contributors include the United States and several European countries.Beyond these dominant regions, contributions from other continents are markedly limited. North America (excluding the U.S. data already incorporated in the continental tally), Africa, Oceania, and South America collectively account for the remaining 15% of publications. This distribution confirms the field's status as a subject of widespread global interest,

yet one that is currently propelled by a very distinct and concentrated geographic core of research activity.

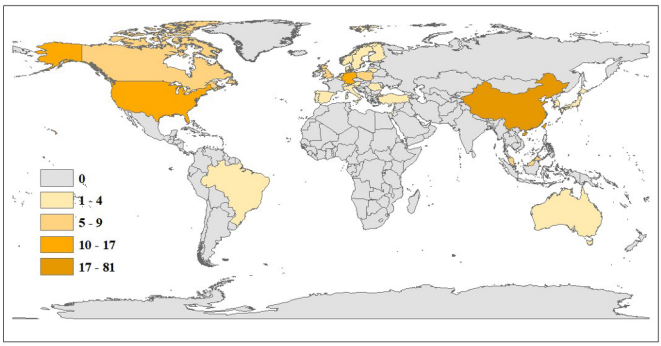

Fig. 3. Global distribution of the retrieved studies.

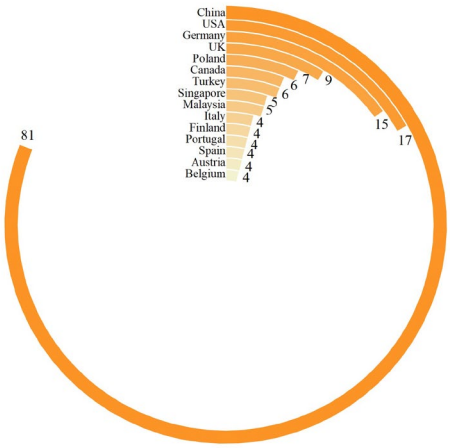

Fig. 4. Number of publications by country.

3.3 Analysis of Research Institution

The concentration of research output in specific nations raises a further question: which institutions constitute the core intellectual forces driving this field? An analysis of the most productive institutions (Fig. 5) reveals a landscape dominated by Chinese contributors. Seven of the top ten institutions are based in China. Their 29 collective publications account for 63% of the combined output of these ten leading institutions.Notably, Beijing Forestry University stands at the forefront, jointly leading the list with Germany's Helmholtz Center for Environmental Research (UFZ) and Helm-

holtz Association, each having published 6 papers. Germany is the only other nation with significant representation, claiming three institutions within the top ten. This distribution underscores that the scholarly foundation of this domain is not only geographically concentrated at the national level but is also propelled by a select few powerhouse institutions.

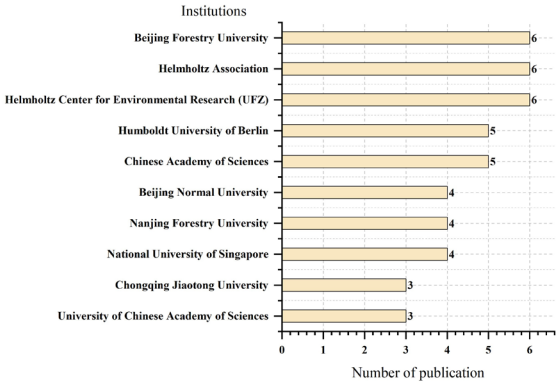

Fig. 5. Top 10 most productive institutions during 2005-2024.

3.4 Analysis of Research Hotspots

Subsubsection.

To identify the core research themes and their intellectual structure, we conducted a keyword co-occurrence analysis. This method visualizes the conceptual landscape of a field by mapping the strength and frequency with which keywords appear together in literature [21]. The resulting network (Fig. 6), comprising 272 nodes and 678 links (density = 0.0184), exhibits a distinct clustered structure. The network reveals a foundational thematic hierarchy. “Ecosystem services” as the largest node (appearing 47 times) indicates that research in this field remains grounded within the theoretical framework of ecosystem services. Meanwhile, ‘city’ possesses the highest centrality (0.41), playing a pivotal hub role. This signifies that most studies revolve around the core setting of “cities,” highlighting a strong application orientation and concern for urban issues. Through co-occurrence analysis of high-frequency keywords (Fig. 6, Table 1), this study identifies three core research themes: (1) Cultural Ecosystem Service Valuation: This theme, characterized by keywords such as “cultural ecosystem services” and “benefits,” is dedicated to quantifying the value of recreational services and establishing their significance within broader environmental and economic frameworks. (2) Health and Well-being Promotion: The frequent occurrence of the keywords “health” and “physical activity” reveals the direct and indirect pathways through which park recreation promotes public health. (3) Service Supply-Demand Matching: Keywords such as “demand” and “accessibility” exhibit significant centrality, indicating that service-demand matching has become a hot topic. Research focus

is shifting from supply-oriented approaches to demand-supply matching, emphasizing spatial equity and efficiency.

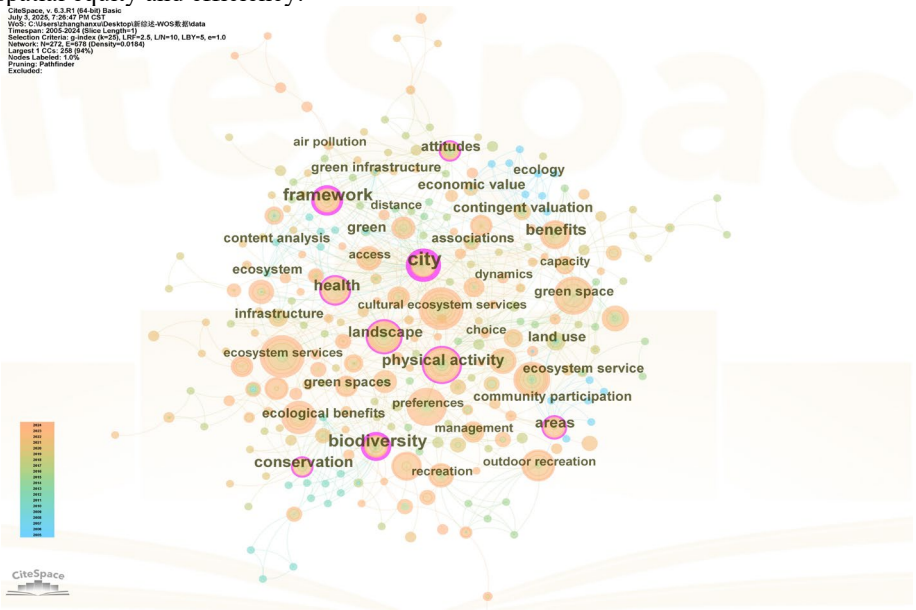

Fig. 6. Keyword co-occurrence analysis.

Table 1. Top 20 keywords ranked by the frequency

Keyword	Year	Count	Centrality
ecosystem services	2006	47	0.08
cultural ecosystem services	2016	39	0.04
green space	2015	35	0.09
city	2006	28	0.41
health	2010	27	0.15
preferences	2017	25	0.05
urban green space	2006	23	0.02
physical activity	2014	23	0.13
perceptions	2014	22	0
outdoor recreation	2006	21	0.05
landscape	2010	21	0.15
benefits	2006	19	0.08
accessibility	2017	19	0.02
demand	2018	16	0.05
biodiversity	2011	15	0.35
framework	2016	15	0.35
access	2019	15	0.09
parks	2006	15	0.02
values	2014	14	0.02
recreation	2015	14	0.09

Research Directions and Evolution Analysis.

To trace the intellectual evolution and thematic dynamics of the field, we employed cluster analysis and timeline visualization [22]. The clustering results (Modularity Q = 0.7046, Mean Silhouette S = 0.8649) confirm a highly significant and reliable cluster structure, from which 12 coherent research themes were identified. These themes were synthesized into five broader research directions (Fig. 7 & Table 2): (1) Theoretical frameworks: #1 cultural ecosystem services, #2 environmental justice; (2) Research subjects: #4 urban green space, #6 protected areas; (3) Methodology: #3 aesthetics, #9 pressure model, #11 assessment; (4) Problem-oriented: #0 demand, #5 recreation, #7 existing activities, #10 cultural diversity; (5) Group segmentation: #8 youth(Fig. 7 & Table 2).

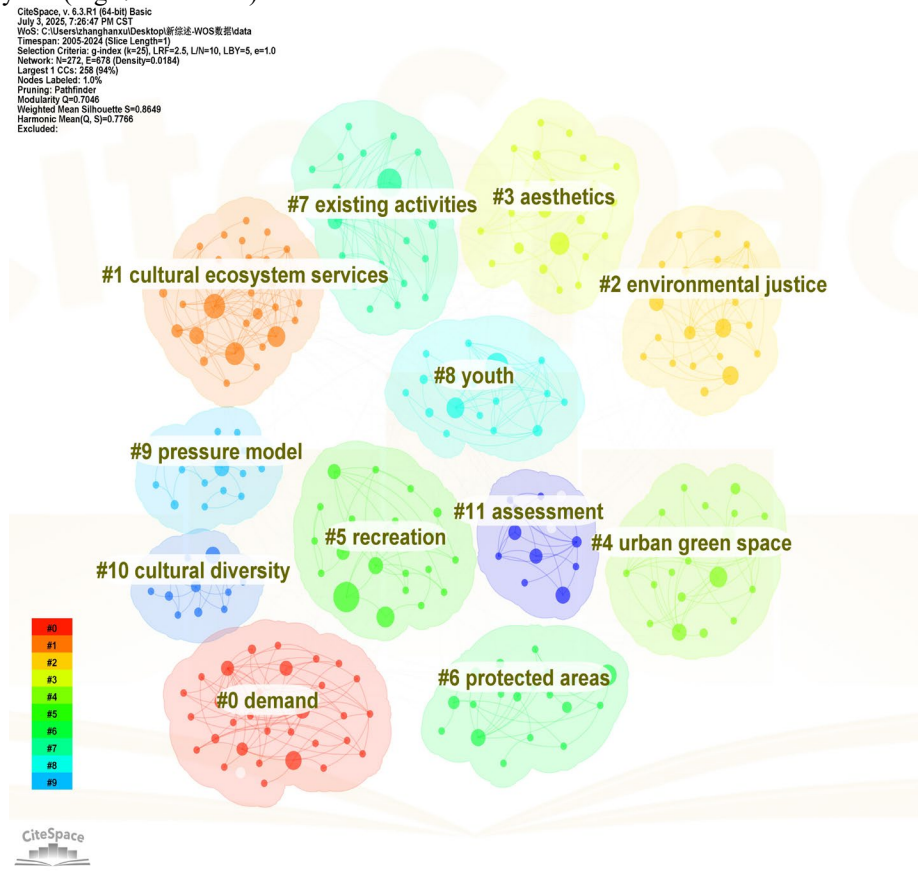

Fig. 7. Keyword cluster analysis.

Table 2. Summary of 11 clusters.

No.	Name of cluster	Size of cluster	Average year of citation	Co-occurring keywords ranked 1-5 in frequency of each keyword cluste
#0	demand	31	2014	ecosystem services; forest management; forest recreation; multi-source data; blue space accessibility
#1	cultural ecosystem services	31	2014	landscape; perceptions; heat island; energy; microclimates
#2	environmental justice	23	2013	cultural ecosystem services; green space; private green infrastructure; provisioning ecosystem services; protected areas
#3	aesthetics	22	2018	ecosystem services; discrete choice experiment; human benefits; blue spaces; visitor management
#4	urban green space	21	2012	urban green space; landscape planning; geographic information system analysis; environmental function; ecosystem service
#5	recreation	21	2018	ecosystem services; ecosystem service; guangzhou city; areas; urban planning
#6	protected areas	20	2017	social media; protected areas; national park; salience index; demand assessment
#7	existing activities	20	2018	cultural ecosystem services; transfer error rate; evaluation method; spatial value transfer; public perception
#8	youth	17	2016	urban parks; ecosystem service; ecosystem characteristics; ecosystem service capacity; multi-criteria analysis
#9	pressure model	15	2021	urban green space; central europe; public health; social survey; congestion risk model
#10	cultural diversity	12	2018	cultural ecosystem services; evaluation method; spatial value transfer; transfer error rate; public attitudes
#11	assessment	11	2014	cultural ecosystem services; healthy aging; network analysis; urban green space accessibility; public perception

The timeline view of these clusters (Fig. 8) reveals a clear evolutionary pathway. Early research (clusters #4, #6, #8, #11) established urban green spaces and protected

areas as the primary physical settings, with a focus on quantifying their objective ecological and health benefits. This foundational work was largely descriptive and supply-oriented. A significant shift occurred as the field matured, intersecting with sociology and economics. Research emphasis broadened from single functions to multidimensional values, with growing attention to subjective well-being, social equity, and diverse user demands (e.g., #0 demand, #10 cultural diversity). This period marked a transition toward a more human-centered perspective. In recent years, the field has entered a methodologically innovative phase. The emergence of clusters such as #9 pressure model and the sustained relevance of #11 assessment reflect the adoption of advanced tools like multi-source data integration, GIS, and sophisticated modeling techniques. These developments are enabling a more nuanced and dynamic evaluation of recreational service levels, moving the field toward predictive and precision-oriented research.

Analysis of Research Frontiers.

To explore the evolving research frontiers in this field, we conducted an outbreak detection analysis of keywords—a method that captures terms experiencing sudden spikes in citation frequency, thereby revealing emerging research interests [23]. Analysis of the 25 keywords with the highest citation outbreak intensity revealed three overlapping phases in the evolution of research frontiers (Fig. 9). The early phase (2006–2019) centered on “land use,” emphasizing the physical spatial foundations of recreational services. This confirmed that land use patterns constitute the fundamental spatial framework influencing the recreational service functions of park green spaces. The intermediate phase (2017–2020) shifted toward prioritizing “residents' needs,” with keywords like ‘demand’ and “benefits” showing a significant increase in frequency. This marked a profound shift in research perspective from supply-oriented to demand-oriented approaches, aiming to enhance social benefits and resident well-being. The recent phase (2020–present) has entered the “digital mapping” stage, exemplified by “recreational activity visualization.” This signals the digital transformation of international park recreational service research in the post-pandemic era and drives ongoing methodological innovation. Subsequently emerging keywords like “tourism,” “accessibility,” “landscape,” “perception,” and “outdoor recreation” indicate future research will focus on: 1) Quantifying experiences and perceptions by measuring and modeling sensory experiences and subjective perceptions to analyze visitor behavior patterns and recreational preferences; 2) Research on spatial equity and accessibility, emphasizing the refinement of multimodal, multidimensional accessibility models to precisely identify service gaps and inequalities in recreational opportunity provision for diverse groups, particularly vulnerable populations; 3) Functional landscape design and optimization, exploring the impact of different functional landscapes and specific landscape elements on recreational experiences and resident well-being; 4) Synergistic effects with tourism, investigating the mutual influences and collaborative mechanisms between park recreational services and broader urban tourism (Fig. 9).

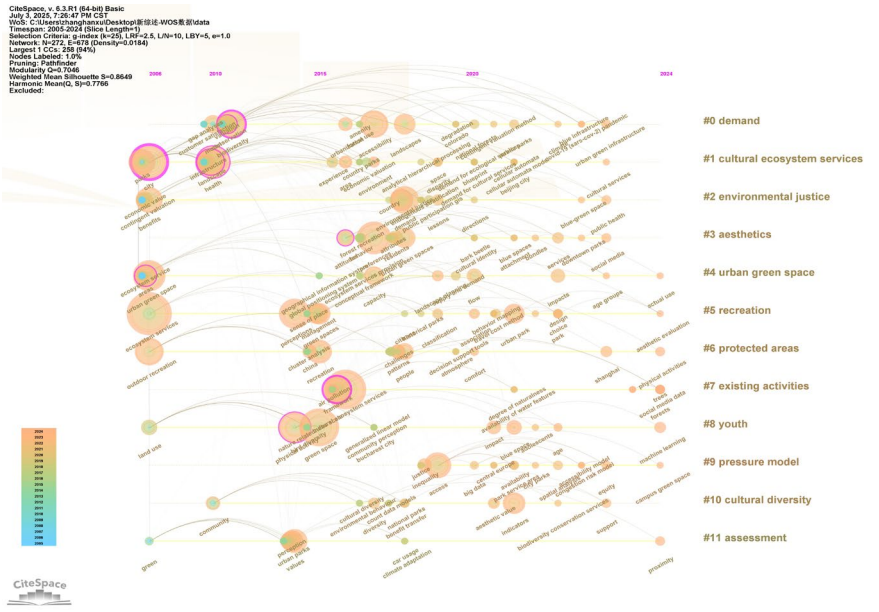

Fig. 8. Keyword co-occurrence clustering timeline map.

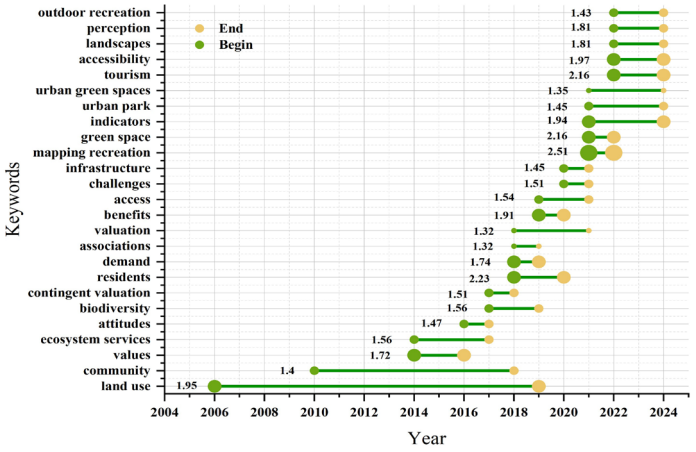

Fig. 9. Keywords with strong frequency bursts

4 Evaluation of Park and Green Space Recreational Services

The evaluation of recreational service levels has gained increasing scholarly attention globally in recent years. Such research provides a theoretical foundation for optimiz-

ing land use patterns, rationally developing recreational resources, and enhancing the cultural service functions of ecosystems [24,25]. As a subcategory of cultural ecosystem services, recreational services are inherently intangible and non-material in nature compared to other ecosystem service categories, posing particular challenges for their assessment [26]. Currently, the evaluation of cultural ecosystem services has become a prominent focus in international academic discourse. Among these, recreational services in parks and green spaces represent a key area of interest, with evaluation approaches primarily falling into two categories: process evaluation and supply–demand evaluation [27].

4.1 Process Evaluation of Recreational Services

To systematically evaluate the recreational service level of park green spaces, it is first necessary to understand their service effectiveness. Process evaluation aims to address the following core questions: What is the recreational experience of park users? What is the environmental quality of park green spaces? Is park management and operation efficient? This is the core question that process evaluation aims to address. To address these questions, process evaluation commonly employs public participation methods such as questionnaires and in-depth interviews, typically relying on users' cognitive preferences and willingness to pay [28]. This approach targets park and green space users to survey satisfaction levels, usage behaviors, perceptions, and evaluations. For instance, Muderrisoglu et al. employed questionnaires to assess pre-visit importance ratings and post-visit satisfaction evaluations for green space recreation areas, thereby evaluating recreation service quality [29]. Concurrently, process evaluation employs methods such as field observation, management and operational data analysis, and emerging technology applications to analyze data on user behavior, environmental facilities, and budget expenditures. For instance, Donahue et al. utilized social media data to analyze urban park usage patterns and visitation trends, thereby assessing the public benefits of recreational services [30]. Although process evaluation can deeply capture user emotions and behavioral preferences, it is susceptible to subjective biases and is not suitable for large-scale spatial comparisons.

4.2 Evaluation of Recreation Service Supply and Demand

Against the backdrop of rapid urbanization, the supply of park green spaces is increasingly constrained, disrupting the human-land relationship and giving rise to a series of practical challenges. These include a fundamental mismatch between service supply and resident demand, an uneven spatial distribution of recreational resources, and inequitable access opportunities among different social groups [31]. These pressing issues compel us to address a more macro-level and critical question: at the urban scale, to what extent is the supply of park recreation services spatially aligned with the actual needs of the population? Answering this question—and thereby diagnosing the rationality, equity, and efficiency of the current spatial distribution—requires a robust framework for evaluating the supply and demand of recreation services Such an assessment system must encompass both supply-side and demand-side dimensions.

The selection of specific indicators and the determination of an appropriate analytical scale are, in turn, contingent upon the characteristics of the study area and the specific objectives of the evaluation.

Among these, the most common indicators on the supply side are park area and per capita park area, which explicitly represent the capacity of park green spaces [32]. Second, indicators such as Normalized Difference Vegetation Index (NDVI), Landscape Aesthetic Quality (LAQ), Naturalness Index, water area ratio, infrastructure completeness, path density, and average slope reflect the quality of recreational supply in park green spaces. These factors determine users' direct perception of recreational services. It is worth emphasizing that accessibility is one of the key indicators for evaluating the supply capacity of recreational services in park green spaces [33]. Its value lies in transforming the recreational resources of park green spaces into services that residents can actually enjoy.

Table 3. Summary of 11 clusters.

	Indicator Conten	**References**
Recreational service supply-side indicators	Park area	Gou et al. (2024) Luo et al. (2024)
	Per capita park area	Luo et al. (2024)
	Normalized difference vegetation index (NDVI)	Luo et al. (2024)
	Landscape aesthetic quality (LAQ)	Hou et al. (2020)
	Naturalness index	Liu et al. (2021)
	Water area ratio	Gou et al. (2024) Liu et al. (2021)
	Path density	Luo et al. (2024)
	Average slope	Luo et al. (2024)
	Infrastructure development	Wei et al. (2024)
	Accessibility index	Wu et al. (2022)
Recreational service demand-side indicators	Population density	Fang et al. (2022)
	Population density of 0-14 year old and population density of those aged 60 and above	Wei et al. (2024)
	City points of interest (POI) density	Liu et al. (2021)
	Land use intensity (LUI)	Yang et al. (2025)
	GDP	Xia et al. (2024)

Demand-side indicators are selected based on dimensions including population characteristics, social equity, and economic development. Regarding population characteristics, the most common demand-side indicator is population density [34], which directly quantifies the recreational pressure exerted by human activities on park green spaces. Additionally, characteristics such as population age structure and gender ratio also influence the overall demand for recreation services in park green spaces. Regarding social equity, vulnerable groups often occupy marginalized positions in resource competition and are susceptible to inequitable distribution of recreational resources [35]. Fairness in recreational services primarily involves meeting the diverse recreational needs of different social groups, including variations in age, gender, in-

come, and ethnicity [36]. In terms of economic development, open data networks such as urban POIs have found extensive application in urban research. Evidence indicates that robust urban infrastructure services reflect stronger recreational demand among residents and stimulate increased leisure activities [37,38]. Additionally, demand indicators such as land use intensity and GDP quantify the level of urban economic development, thereby reflecting residents' recreational service needs. Research on evaluating the supply and demand of recreation services in parks and green spaces often combines methods such as geographic information system analysis and big data analysis to address the practical problem of mismatches between supply and demand for recreational services in parks and green spaces (Table 3). Compared to process evaluation, supply-demand assessment excels at identifying spatial mismatches and equity issues, providing direct basis for planning, but falls short in capturing service quality.

5 Factors Influencing Recreational Services in Park Green Spaces

Key factors influencing the evaluation of recreation services in parks and green spaces primarily include socioeconomic development levels and policy planning. The former determines the capacity for investment in social service resources and the level of demand, while the latter guides the allocation and innovation of service resources through institutional frameworks.

5.1 Socioeconomic Development Level

Among the myriad influencing factors, socioeconomic status constitutes the most fundamental and decisive backdrop. We must first dissect how socioeconomic status profoundly shapes the structure and quality of park recreation services from both the supply and demand sides. Analysis indicates that its influence operates through dual pathways.

On the supply side, economically developed regions typically possess greater financial resources, enabling local governments to provide more recreational resources in parks and green spaces, thereby ensuring adequate service supply [39]. Areas with higher socioeconomic development often feature larger urban built-up areas. As the size of the urban built-up area increases, so do the green coverage rate of urban parks and the per capita park area, leading to higher park visitation frequency. Second, economically advanced regions typically invest more in technological support for recreational services. Research indicates that modern technology integration continuously enhances the quality and efficiency of park green space services [40]. From demand forecasting and recreational experiences to optimized management, smart technology applications have become indispensable enablers within park green space systems. Conversely, in low-income areas, limited local fiscal revenues often result in lower priority for green space construction and maintenance compared to essential public services like education, healthcare, and transportation. Insufficient local fiscal capaci-

ty is a key factor constraining both the quality and quantity of public spaces, including parks and green spaces. This also traps existing green spaces in a "build-heavy, maintain-light" cycle, leading to the degradation of recreational service functions [41]. Globally, low-income communities often face the risk of "green gentrification," resulting in inequitable distribution of green space recreational resources [40].

At the demand level, increased socioeconomic security shifts public values from emphasizing material welfare and physical safety toward prioritizing self-expression, quality of life, aesthetic needs, and environmental protection [42]. A national survey in Denmark revealed that residents with higher per capita GDP exhibit more diverse motivations for green space use compared to lower-income areas, thereby driving the development of more comprehensive recreation services in parks and green spaces [43]. Simultaneously, high-income, highly educated community groups place greater value on the ecological environment of green spaces and demonstrate stronger critical awareness and willingness to participate [44]. This directly demonstrates the influence of socioeconomic development levels on residents' demand hierarchy and evaluation criteria for park and green space recreation services.

5.2 Policy Norms

Policy norms continuously shape the logic, content, and value orientation of recreation services research in parks and green spaces. International experience indicates that a robust recreation services system relies on a multi-level, multi-perspective policy framework. For a long time, policy provisions enacted by various countries and regions have provided legitimacy and authority to recreation services systems in parks and green spaces, promoting standardization of recreation services. These policies influence the quality of recreational services through means such as enforcement, guidance, incentives, and constraints.

However, due to standardized metrics overlooking local variations and unequal distribution of fiscal resources, policy regulations can also negatively impact research on park and green space recreation services under certain circumstances, leading to issues such as social inequity [45], resource misallocation [46], lack of innovation [47], and inefficient management [48].

6 Prospects and Challenges

Based on the aforementioned bibliometric analysis, this study systematically traces the developmental trajectory, research hotspots, and influencing factors within the field of recreational services in park green spaces. To further advance this field, the discussion centers on three core issues: the linkage mechanisms between recreational services and human well-being, challenges to social equity in service provision, and insights from methodological innovations for future research.

6.1 Deepening the Mechanisms Linking Recreational Services to Human Well-being

Keyword analysis indicates that "ecosystem services" and "health" remain long-standing core concerns in this field (Fig. 6), confirming that research on recreational services in parks and green spaces is grounded in the theoretical framework of "cultural ecosystem services" [2]. However, the research focus has gradually shifted from early efforts to identify and quantify service functions toward in-depth exploration of the intrinsic mechanisms through which these services enhance human well-being.

This mechanism relies on two key dimensions: First, physiological and psychological promotion pathways. The high frequency of the keyword "physical activity" confirms that parks, as venues for promoting physical activity, serve as vital conduits for enhancing public health levels [3]. Current research has moved beyond simple linear relationships to examine complex pathways through which green spaces influence mental health, social interaction, and cognitive restoration. Second, the shift from universal provision to demand responsiveness. The emergence of keywords like "demand" and "preferences" indicates growing recognition that the effectiveness of recreational services heavily depends on users' sociocultural backgrounds and individual preferences [49]. Future research should prioritize understanding the differentiated needs of diverse age groups, income levels, and cultural backgrounds, driving a shift from standardized supply to refined, adaptive allocation of recreational services.

6.2 Challenges to Social Equity in Recreational Service Provision

Although "environmental justice" has formed an independent cluster (#2), discussions on equity have permeated multiple research directions, reflecting that spatial distribution justice for parks and green spaces as public resources is an unavoidable core issue. The intensification of social stratification and spatial heterogeneity has increasingly highlighted inequalities in access to park recreational services among disadvantaged groups [49]. This study supports Rigolon's [50] observation that the spatial distribution of parks and green spaces exhibits significant socioeconomic gradients, with low-income and minority communities often facing a "triple deprivation": insufficient green space, poor environmental quality, and limited spatial accessibility.

A deeper paradox lies in the fact that new green space development or renovation projects intended to bridge service gaps can sometimes trigger a process of "green gentrification" [40]. As environmental quality improves, rising land values and rents may force original disadvantaged groups to relocate, creating a planning dilemma where "greening leads to social exclusion." Future planning practices should therefore transcend the conventional mindset of merely increasing green space area. Instead, they should adopt the "Just Green Enough" strategy [40], which involves small-scale, decentralized green space renewal embedded within social structures. This approach improves ecological environments while maximizing the stability of community networks. Concurrently, future research should focus on constructing a multidimensional spectrum of needs for vulnerable groups, establishing a tiered and categorized recreational service system, and promoting their participation throughout the entire plan-

ning, design, and management process to ensure they gain substantive service rights [51,52].

6.3 Innovation in Research Methods and Future Research Trends

Keyword emergence analysis clearly reveals significant evolution in research methodologies within this field. “Mapping recreation” emerges as the most prominent keyword, signifying that the research frontier has advanced into a phase of deepening spatial quantification and model simulation.

This trend manifests in three key dimensions: First, diversification of data sources. Traditional questionnaire data is increasingly integrated with mobile phone signaling data [53], social media data [54], and IoT monitoring data [55], enabling the capture of recreational behavior from “static characteristics” to “dynamic processes.” Second, increased complexity of analytical methods. Research has shifted from early descriptive statistics and buffer zone analysis toward advanced models such as pressure models (Cluster #9) and discrete choice experiments (Cluster #3) to simulate user behavioral decisions and spatial choices under varying scenarios. Finally, precision in planning support. By integrating multi-source data with intelligent algorithms, simulation systems serving planning decisions can dynamically evaluate park recreation services, diagnose supply-demand mismatches, and predict planning scenario outcomes. This drives a shift from “experience-driven” to “evidence-driven” planning decisions.

6.4 Limitations of the Study

This study has the following limitations: All literature data were sourced from the SCI-E (Science Citation Index Expanded) database within the Web of Science (WOS) core database. Excluding other databases may have resulted in the omission of relevant research literature. Future studies should consider expanding the scope of databases to access more relevant data sources in this field. Additionally, the text analysis capabilities of the Citespace software are relatively weak, lacking in-depth semantic analysis of literature, which may overlook potential research themes.

7 Conclusion

To systematically reveal the research focus, development trends, and cutting-edge dynamics in the field of recreational services in park green spaces, this study employed CiteSpace software to conduct a bibliometric analysis of research outputs from 2005 to 2024. Key findings are as follows:

Research Development Trajectory and Regional Characteristics: Research on recreational services in park green spaces has garnered increasing attention, with its development divided into three phases: the initial phase (2005–2016), the exploratory phase (2017–2020), and the rapid development phase (2021–present). Geographically, research output is concentrated in Asia (45%) and Europe (40%). China leads globally

in publication volume, accounting for 37% of total articles, indicating uneven global attention and dominance by a few nations.

Research Themes and Frontier Evolution: Current research themes primarily revolve around three core directions: theoretical frameworks for ecosystem services, studies on human health-related benefits, and evaluations of recreational services. Research frontiers have evolved from early focus on material spatial foundations like "land use," through a mid-phase shift toward "resident needs" and benefit assessment, to the recent stage of "digital mapping" and activity visualization. Future research will increasingly concentrate on quantifying human-centered experiential perceptions, spatial equity and accessibility, functional landscape optimization, and synergistic effects with tourism ecosystems.

Service Evaluation Systems and Influencing Factors: Park and green space recreation service evaluations primarily employ two methodologies: process evaluation and supply-demand assessment. Key factors influencing service effectiveness encompass socioeconomic development levels and policy regulations. The former jointly shapes service patterns through resource supply capacity and public demand tiers; the latter provides institutional safeguards for service system standardization and sustainability, though conflicts between standardization and local variations may raise equity and efficiency concerns.

Future Challenges and Development Directions: Looking ahead, research in this field faces three core challenges and development directions: First, deepen differentiated research on the recreational needs of vulnerable groups to build a service system that precisely responds to their demands, addressing social equity challenges; Second, research should enhance dynamic assessment and optimization of supply-demand matching for recreational services in parks and green spaces to improve spatial resource allocation efficiency. Third, efforts should continue to advance optimization research based on multi-source data and intelligent models, shifting research methodologies from empirical judgment to evidence-driven paradigms.

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