Identification and Optimization Strategy of Urban Park Service Areas Based on Accessibility by Public Transport: Beijing as a Case Study

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Abstract: Parks are an important place for residents to relax. An equitable distribution of parks can promote social equity and enhance the residents’ welfare. The service areas of parks are affected by the mode of transport. As public transport is a green and economic travel mode with a wide range of applications, we identified the service area of parks based on the accessibility of public transport. On this basis, the problem of park layout was analyzed. The results show that: (1) the coverage rate for the park service areas decreased from the center of Beijing to the periphery. The subdistricts around employment districts have a high coverage of park services, whereas some suburban subdistricts lack services. (2) The spatial form of PSAs can be affected by factors such as railways, water courses, and the topography, so there are service gaps for some 48 parks, which are mainly located outside the Fourth Ring Road area. (3) A poor allocation of public transport resources has aggravated the uneven distribution of the park services. Areas with few parks also have poor public transportation conditions.

Keywords: urban parks; service area; accessibility; public transport; Beijing

1. Introduction

The urban park is a green space open to the public with recreation as the main function, and offers diverse leisure facilities, and ecological and scenic attractions [1]. The concept of modern urban parks originated from “Nature and Urban Planning in the 19th Century”. As an important green space in the city, parks have been called “a kind of return of nature to industrial cities” [2], and play an important role in climate and environment change adaptation and mitigation to the city [3,4]. At the same time, as an important element of urban public service facilities, they are public spaces for residents to enjoy as part of their daily lives. In modern society, as open spaces are gradually being replaced by buildings, the social, environmental, and economic benefits of parks are receiving more and more attention [5,6]. Parks can enhance the health and life of residents [7–11]. Accessibility to parks affects the quality of residents’ enjoyment of park services [12–14].

The service radius of a park is often used to define the service area of the park; parks with different functions have different service radii. Parks with rich functions, such as comprehensive parks and theme parks, can also be used as community parks to meet the daily activities of residents living in the neighborhood. In China’s “Urban Greenland Classification Standard CJJT85-2002”, the service radius of residential parks is typically 500–1000 m, and the service radius of community parks is 300–500 m. The Tokyo green planning agreement stipulates that the service radii of children’s parks, neighborhood parks, and regional parks in Japan are 250 m, 500 m, and 1000 m, respectively [15,16].
According to the actual situation, some cities have stipulated their preferred park service radius [17]. Researchers have determined a scientific service radius based mainly on the frequency of residents using the park based on living at different distances from the park. One study showed that 800 m was the maximum walking distance that residents would tolerate for traveling to the park [18]. Qiao Xin used the data calculation method and the empirical fixed-point method to test the suitability of the service area distribution of parks in big cities [19]. Research on parks in Tokyo, Japan using mobile phone data showed that park visitors often come from surrounding communities, and are concentrated within 2 km [20].

The method of delimiting the service area of a park via the service radius ignores the traffic conditions; a delineation based on accessibility was proposed as being more suitable for describing the actual situation [21]. The concept of park accessibility is derived from landscape accessibility [22]. Traditional methods mainly include the nearest neighbor method, the container method, the covering method, the gravitational model, and the two-step moving search method [23–27]. There are many assumptions made when using the traditional methods. In recent years, some improvements have been made to the traditional methods [21,28]. With the development of big data technology, map vendors introduced the path planning API, which provides support for destination accessibility calculations. Zhou was the first to use the Google Maps API to analyze the accessibility of parks in Illinois [29]. Thereafter, some studies on park accessibility based on electronic maps were published in China [30–32]. In addition, many researchers use mobile phone data, floating car data, bus swiping data, and other trajectory data to measure reachability [33,34]. In general, gravity models and the two-step mobile search methods take supply and demand into account; however, the research unit of these two methods is often large. The container method and the cover method provide simple means for calculation, but ignore the influence of distance, so they cannot reflect the effect of the layout of the facilities on accessibility in the buffer zone. With the development of cities, the demand for a better quality of life by residents has gradually increased, and the accessibility to open spaces is becoming more and more important for existing and planned future high-density housing. Cities need an ongoing refinement of the built environment, which places higher standards on the evaluation of the spatial characteristics of park services. The internal structure of cities has become more sophisticated and complex, and the traditional methods often ignore the influence of complex factors on travel time, such as the effects of overpasses, and prohibited or fenced-off areas. Therefore, it is necessary to adopt a more refined method to evaluate the spatial distribution of park services. As a special case of neighborhood analysis, accessibility analysis based on an electronic map API combines historical travel data, which are more suitable for complex urban environments and can provide a more realistic reference for the construction of parks in big cities.

The accessibility of parks is related to park layout. The latter is affected by urban population density, land use pattern, historical background, urban development policies, and other factors which have been quantitatively analyzed by many scholars [35]. Heynen’s research in Milwaukee showed that the urban park layout was affected by land development policies, and the construction of parks in downtown was insufficient, whereas it was sufficient in suburban areas [36]. Chen found that due to the rapid expansion of the city, the park space around the ancient city of Shaoxing was crowded-out by buildings [37]. Oh found that the accessibility of parks in Seoul are affected by urban development policies. The park accessibility was poor in the city center where there are dense buildings. As the development of the area south of the Han River was restricted, there are many ecological parks [35]. In addition to macro factors, traffic conditions, and the size and shape of parks can also affect their accessibility [38]. In general, current research on factors affecting park accessibility has focused on macro or meso-level factors, whereas the micro factors, such as park characteristics and surrounding traffic, are less studied.

A park service area (PSA) is defined as the zone of influence of individual parks [39]. Existing research on PSA mostly uses the service radius to delineate the area, and lacks con-
sideration of the impact of road structure, traffic mode, time consumption, and other factors. Research on park accessibility often focuses on evaluating its spatial distribution, without a clear binary definition being given regarding the accessibility of parks in combination with a scientific travel time threshold. The fuzzy boundary is not conducive to quantitative analysis of the defects of the park layout. To carefully evaluate in fine detail the problems pertaining to park construction in Beijing, this study used the electronic map API to obtain accessibility data. On this basis, the service area of the park was delimited according to an appropriate time threshold. The mode of transport will affect the park service area, and public transport is convenient, universal, and environmentally friendly. Therefore, this study analyzed the characteristics of park service areas based on the park accessibility under public transport, and analyzed the expansion strategy of the park service area from the perspective of micro-level and public transport conditions, in order to provide reference for the construction of urban parks.

2. Materials and Methods

2.1. Research Scope and Data

This study explores a method for identifying the park service areas and expanding strategies, including identifying service blind spots, analyzing the reasons for the formation of blind spots, and proposing optimization strategies. The following aspects are considered when selecting research scope and objects: (1) Beijing was selected as a case study. As the capital of China, Beijing is an international metropolis with a high density of buildings. There is a high demand for green park space by the residents. The evaluation method of Beijing's park configuration can be extended to other big cities. (2) The central urban area of Beijing has a concentric-circle-like structure composed of 5 ring roads [40], with 75.97% of the permanent population and 83.53% of the foreign residents living within the outer loop of the Sixth Ring Road [41]; therefore, this study examines the subdistricts within this perimeter as the research area. (3) The city parks are the research object. The main purpose of this paper is to explore the layout of parks that can meet residents' half-day-and-more activities, excluding smaller neighborhood parks, so the urban park in this study refers to a green space with high leisure value; the park has comprehensive facilities and recreational areas that are commensurate with that of a municipal park. The selection of the urban parks is based mainly on the “Beijing Municipal Parks Classification and Management Measures” issued by the Beijing Municipal Bureau of Landscaping. The selected parks include comprehensive parks, historical parks, ecological parks, community parks, and theme cultural parks, all with an area of more than 10 hm². Generally speaking, different types of parks have different functions and service scopes, and some important theme parks can serve inhabitants of the whole city. Since this study analyzes the service of parks for residents' basic leisure activities from half a day to a day on weekends, when the selected parks perform their basic leisure functions, the acceptable travel time for residents to travel to various parks is the same. (4) The data used in the research include park attributes, API data, and vector data. The name and type of parks were taken from the Beijing Municipal Bureau of Landscaping; the area, boundary, and entrance locations of parks were obtained according to the Baidu Map API; vector data, such as loop lines, administrative boundaries, water courses, and railways, were from the National Earth System Science Data Sharing Platform.

2.2. Methodology

This study used the Baidu Map Path Planning API to get the time from each unit to the nearest park. On this basis, PSAs were obtained according to the appropriate threshold. The distribution of PSAs under the public transport mode can be affected by the entrance-setting of the parks, the road network around the parks, and public transport resources. When the entrance layout or surrounding road are inefficient, the accessibility of the park from some directions is poor, and there will be gaps in the PSA, which will narrow the service range of the park for all modes of transport. Public transport resources include
bus lines, schedules, and stations; the more efficient the allocation of public transport resources, the faster residents can reach the park. Our methods flow chart for identifying PSA optimization strategies is shown in Figure 1.

![Methods Flow Chart](image)

**Figure 1.** The methods flow chart.

### 2.2.1. PSAs Defined according to Park Accessibility

The PSA in this study refers to the service scope of the park under the principle of proximity and suitable time constraints.

Existing studies have shown that a suitable time for residents to travel to a park is 15–30 min [17,29,42]. The public transport time in this article refers to the total transit time from the starting point to destination, and includes the walking time and waiting time. Considering the traffic characteristics of Beijing, this research uses the upper limit of the appropriate threshold in previous studies [17,29,42], which is 30 min, to delineate PSAs.

This study used the Baidu Map Path Planning API to obtain the transit time for each grid. The method can be expressed as:

$$T = \sum s_i / v_i + \sum u_j v_i = f(m,p)u_i = f(H,t_i)$$  \hspace{1cm} (1)

where $T$ is the total time, $s_i$ is the length of the $i$ section, $v_i$ is the speed of the $i$ section, $u_j$ is the time to pass through the $j$ intersection, $m$ is the mode of transportation, $p$ is the route choice preference, and $H$ is the historical data set for the time taken to pass the intersection. The transport mode selected in this study is public transport, and the route selection preference is travel by bus.

A grid is taken as the unit to analyze the spatial distribution of park accessibility. Using ArcGIS, the study area was divided into 208,905 grids, with an accuracy of 100 m. The shortest time between the grid center and the nearest park was obtained by calling the Baidu Map API. In order to eliminate the potential interference caused by road conditions as much as possible, the data were repeatedly crawled from 14:00 to 15:00 on different working days. The maximum time deviation of a point pair was 190 s, and 95% of the point pair deviations were within 1 min, which indicated that the data acquisition was stable. The traffic time data were correlated with the spatial grid, and grids of less than 30 min were picked out. Next, the grid was merged according to the corresponding park, and the PSA of each park was obtained. This process can be expressed as follows:

$$PSF_i = \{a : d(a,P_i) < d(a,P_j), t_d \cap 30|P_i, P_j \in P, i \neq j\}$$  \hspace{1cm} (2)

### 2.2.2. Identification of Parks Whose Entrance Layout and Surrounding Roads Need to Be Improved

Some parks have poor accessibility in specific directions, which are manifested by gaps in the PSA in these directions. These kinds of parks can be identified by the straight-line

[Diagram of entrance layout and roads around parks]
distance from the boundary of the park to the nearest service blind area. In this study, we took 100 m as the criterion. 100 m is not only the upper three digits of the distance between a blind area and the boundary of all parks, but is also a common length of a block in a metropolis. This part analyzed the impact of the park entrance layout and surrounding traffic barrier elements. In order to eliminate the influence of public transport resource allocation on the result, PSA here refers to the area within 3 km through the road to the nearest entrance of park.

According to the reasons for the formation of the PSA gap, parks can be divided into two categories: parks with inefficient entrances, and parks whose accessibility is affected by the surrounding traffic barriers. (1) Whether the entrance layout is appropriate or not can be judged by the maximum distance (along the park boundary) between the entrances of the park. If the distance is large, the park entrance layout is ineffective. (2) Traffic barrier factors include water courses, railways, highways, and so on.

2.2.3. Identification of Areas to Be Optimized for Public Transport

The allocation of public transport resources affects the distribution of PSA. In this study, the areas that can improve park accessibility by optimizing public transport configuration were divided into two categories.

(1) The first category is areas with efficient bus routes, and low bus operation efficiency. In this category, we defined the area that improves the accessibility of the park by optimizing the public transport organizational structure as an efficiency optimization area (EOA). According to the accessibility data, the average speed of public transport is about 6 km/h when considering the time consumption of walking, waiting for the bus, and stopping at bus stops. This calculation shows that an average distance of 3 km can be completed by public transport within 30 min. In areas where the bus line to the nearest park is less than 3 km and the time consumption exceeds 30 min, convenient park services can be obtained by optimizing the efficiency of bus operation. (2) The second category is areas where the park cannot be reached quickly due to underdeveloped bus lines. We defined this kind of area as the route optimization area (ROA). In this paper, ROA refers to the area where the road network distance to the nearest park is less than 3 km, and the bus line distance is greater than 3 km.

3. Results
3.1. Spatial Distribution Characteristics of PSA
3.1.1. Morphological Characteristics of PSA

The design of transport routes needs to consider the issues of efficiency and fairness, and the bus routes are often not the shortest routes. Therefore, in addition to park distribution and road structure, the distribution of bus stops and the structure of public transport will also affect accessibility of parks. As shown in Figure 2, the PSA, based on the accessibility of public transport, presented the following morphological characteristics: (1) the PSA appeared as broken plaques, which had poor spatial continuity and many gaps. (2) The accessibility of the park is anisotropic, so the extension of the PSA in different directions of the park varies greatly. (3) Most of roads in Beijing are north-south and east-west, so PSAs in these directions are larger than those in other directions. (4) The parks in the Fifth Ring Road Area are dense, and the PSAs are widely distributed. For example, the PSAs of Beihai, Yuyuantan, and Taoranting overlap each other, with few gaps. The parks outside the Fifth Ring Road are scattered, and the PSAs are relatively independent of each other. (5) The spatial form of PSAs can be affected by factors such as railways, water courses, and the topography.
3.1.2. Spatial Coverage Characteristics of PSA

Using public transport, residents need time to walk and wait for buses, and buses need time to stop at stops. Therefore, the areas in which parks can be reached within 30 min are limited. The results show that the PSA in the study area is 64,500 hectares, which accounts for 29% of the total area, that is, most of the area is not covered by park services. On the whole, the spatial coverage rate of the PSA decreases from the city center to the periphery by 79% (2nd), 72% (3rd), 50% (4th), 47% (5th), and 23% (6th), respectively.

A subdistrict is the smallest administrative unit of a city, and the basic unit for residents to perceive the city. Figure 3a,b reflect the PSA area and proportion of streets in the study area, respectively. From a spatial perspective, we found that: (1) most of the subdistricts with a PSA area greater than 600 hectares are distributed outside the Fourth Ring Road, and their PSA coverage rate is small. (2) Subdistricts with a PSA area of less than 200 hectares are mainly distributed within the Third Ring Road and in the Sixth Ring Road Area. The PSA coverage rate of the subdistricts within the Third Ring Road is relatively high. The PSA coverage rate of subdistricts in the Sixth Ring Road Area is low. The PSA area of the subdistricts in the Fifth Ring Road is large, whereas the coverage rate is at a middle level, mostly between 30% and 50%. (3) The subdistricts with a high PSA coverage rate (more than 80%) are mainly distributed in the employment centers, where the population densities are high. Moreover, almost all the subdistricts with a low PSA coverage rate (less than 20%) are located outside the Fourth Ring Road; there are many large residential areas distributed in some of these subdistricts, and a great number of residents in these areas cannot reach the parks easily.

3.2. PSA Expansion Strategy

3.2.1. Optimization of Traffic Access around the Park

According to the relationship between the PSA and the park service blind area, based on the analysis of the layout of the park entrances and the surrounding traffic blocking elements, the parks that need to optimize these two kinds of facilities are identified. The park optimization types were determined according to Table 1, and the distribution of these types of parks was shown in Figure 4. The results were as follows:
out and road should be optimized.

<table>
<thead>
<tr>
<th>Type Leading Factor Description</th>
<th>Park Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entrance layout, railroad, ways, and rivers.</td>
<td>Beihai Park and Zizhuyuan Park</td>
</tr>
<tr>
<td>Entrance layout of parks within the Fourth Ring Road are efficient.</td>
<td>In the Fifth Ring Road Area, the maximum distance between adjacent entrances of 14 parks is greater than 2000 m.</td>
</tr>
<tr>
<td>Entrance layout is well planned. However, due to the influence of the urban river, railway, and other factors, there are still gaps in their PSAs.</td>
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</table>

(1) The average distance between a park and the nearest blind area is 500 m. There are some 48 parks with a distance less than 100 m from the blind area. Most of these parks are located outside the Fourth Ring Road, especially in the Sixth Ring Road area. Except for Beihai Park and Zizhuyuan Park, all parks within the Third Ring Road are more than 1000 m away from the blind area, and the parks may be fully utilized. (2) A defective setting of park entrances will cause gaps in the PSA. The entrance layouts of parks within the Fourth Ring Road are efficient. In the Fifth Ring Road Area, the maximum distance between adjacent entrances of 14 parks is greater than 2000 m. In the Sixth Ring Road Area, 32 parks have a maximum entrance distance of more than 2000 m, accounting for 44% of the number of Sixth Ring Area parks, and many these parks have service area gaps. (3) The entrance layouts of some parks are well planned. However, due to the influence of the urban river, railway, and other factors, there are still gaps in their PSAs. These kinds of

Figure 3. Spatial distribution of PSA on subdistrict scale. (a) Area of PSA in each subdistrict. (b) PSA coverage of subdistricts.

Figure 4. Spatial distribution for types of park optimization.
parks are mainly distributed in the south of the South Fourth Ring Road, and the west of the West Fifth Ring Road. For example, Changping New Town Binhe Forest Park is surrounded by river on three sides, and the traffic flow is blocked by the Shahe River. The traffic on the east side of Beigong National Forest Park and the south side of Qingyuan Park are blocked by the presence of railways, so there is a service blind area around these parks.

3.2.2. Identification of Areas to Be Optimized for Public Transport Based on PSA

Affected by functional zoning and unbalanced economic development, the distribution of public transport resources in Beijing is uneven. General speaking, the distribution of bus stations and road networks is dense in inner rings and sparse in outer rings, and the density in the north is higher than in the south. In this context, we found that the total areas for EOA and ROA in the study area were 18,765 hectares and 18,207 hectares, respectively, accounting for 8.45% and 8.20% of the total area. The spatial patterns presented the following characteristics:

As shown in Figure 5a, the area of EOA increased from the 2nd to the 6th Ring Road Areas. The EOA ratios for the regions in the 2nd Ring Road Area, the 3rd Ring Road Area, and the 4th Ring Road Area are approximate. These areas have a dense distribution of bus stops, and the formation of EOAs is mainly due to the frequent stops of buses at the stations. The EOA ratios for the regions in the Fifth Ring Road Area are the largest, and there are many large EOAs near the south Fifth Ring Road. The parks in the Fifth Ring Road Area are densely distributed, but the density of stops is low, so the accessibility improvement potential of these parks is large. The EOA ratios for the regions in the Sixth Ring Road Area are smallest, and the low PSA coverage is mainly due to the defective park layout. Low bus operation efficiency is often caused by the sparse layout of bus stops, low bus schedules, or frequent stops, and the efficiency should be improved by optimizing the public transport organization structure.

According to Figure 5b, it can be found that the distribution characteristics for the ROA are similar as that for the EOA. The ROA area in the 2nd Ring Road is smallest, and that in the 6th ring is the largest. The proportion of the ROA in the 4th Ring Road is small, where the public transport network is comprehensive and the bus stop density is high; as a result, buses take shorter detour rides. The ROA outside the 4th Ring Road accounts for a large proportion, of which the 5th Ring Road area has the largest proportion of ROA at 11%. The 5th Ring Road area has a comprehensive road network, but the stations and bus lines are sparse, so there is great potential for route optimization.
## Table 1. Optimization types.

<table>
<thead>
<tr>
<th>Type</th>
<th>Leading Factor</th>
<th>Description</th>
<th>Park Name</th>
</tr>
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<tbody>
<tr>
<td>Entrance layout optimization</td>
<td>PSA is affected by entrance layout of the park.</td>
<td>The maximum distance between adjacent entrances of the park exceeds 2000 m</td>
<td>Olympic Forest Park, Badachu Park, Baiwangshan Forest Park, Beijing Botanical Garden, Haidian Xishan Forest Park, Beijing Huaiyuan, Nanhaizi Park, Xiangshan Park, Old Summer Palace</td>
</tr>
<tr>
<td>Road optimization</td>
<td>PSA is affected by railways.</td>
<td>The distance from the park to the nearest railway is less than 500 m, and the service area gap overlaps with the railway.</td>
<td>Gaoxin Park, Jingyi Park, Xiaoyue Country Park, Yukang Park, Zhenhai Temple Country Park, Purple Valley Eden</td>
</tr>
<tr>
<td></td>
<td>PSA is affected by rivers.</td>
<td>The distance between the park and the nearest river is less than 100 m, and the service area gap and the river overlap.</td>
<td>Changping New City Binhe Forest Park, Dawangjing Park, Fahai Temple Park, Guta Park, Red Army Park, World Flower Grand View Park, Xihui Park, Qinglong Lake Park, Changying Park</td>
</tr>
<tr>
<td></td>
<td>PSA is affected by the overpass of the high-speed ring road.</td>
<td>The boundary of the park coincides with the ring road highway and is close to the overpass.</td>
<td>Haidian Park (Wanquan River Bridge), Beijing Sports and Leisure Park (Pingfang Bridge), Wanghu Park (Laiguangying Bridge), Xihongmen Xingguan Ecological and Cultural Leisure Park (Xihongmen South Bridge)</td>
</tr>
<tr>
<td>Both entrance layout and road should be optimized</td>
<td>PSA is affected by entrance layout and railways.</td>
<td>Meet the conditions affected by entrance layout and the railways.</td>
<td>Beijing Garden Expo Park, Dongfeng Park, Qingyuan Park, Yungang Forest Park, Zhongguancun Forest Park</td>
</tr>
<tr>
<td></td>
<td>PSA is affected by entrance configuration and rivers.</td>
<td>Meet the judgment conditions affected by the park entrance layout, railroad, and rivers.</td>
<td>Dongba Country Park, Dongjiao Wetland Park, Taihu Wetland Park, Wangdong Country Park</td>
</tr>
<tr>
<td></td>
<td>PSA is affected by entrance layout, railways, and rivers.</td>
<td></td>
<td>Bajiadi Country Park, Beigong National Forest Park, Beijing Cuihu Wetland Park, Dongxiaokou Forest Park, Fangshan New City Waterfront Forest Park, Lianshihu Wetland Park, Century Forest Park, Yunmeng Mountain National Forest Park, Pingzhuang Country Parks</td>
</tr>
</tbody>
</table>
4. Discussion

The distribution pattern of parks in Beijing will be affected by many factors, such as history, major events, natural elements, and urban function partition. Many parks in the 2nd Ring Road Area and the Xishan Cultural Belt were built in history. The hosting of the Olympic Games, the Garden Expo, and the World Horticultural Exposition promoted the construction of parks in the host area. Most of the parks in the Sixth Ring Road Area are ecological parks built based on natural conditions.

As a public service facility, parks should serve all classes. However, since house prices near parks are often higher [43,44], high-income groups are more likely to obtain park resources under the influence of the market, whereas low-income groups are often distributed in areas with poor environments due to their economic level. Many foreign studies show that rich groups have more parks than low-income vulnerable groups [45,46]. At present, the park service coverage in Beijing needs to be improved, and the uneven distribution of public transport resources further aggravates this problem. For example, in the southern part of Beijing, due to insufficient public transport resources, the service efficiency of the parks is low. The subdistricts in the south of the study area are populated by a great number of migrants and blue-collar workers [47], and the proportion of EOAs and ROAs here is large. Among these subdistricts, the floating population in the Jiugong subdistrict and the surrounding areas exceeds the permanent population, and there is a large proportion of low-income and low-education residents [48]. Changying, Guanzhuang, and Beiyuan subdistricts are mainly composed of urban–rural integration; there are many urban fringe areas in these subdistricts, and the density of the elderly and poor is great [9]. Public transport is a lower-threshold and efficient way to travel for disadvantaged groups [49]. Public transport is faster than walking, and more friendly to low-income people than driving. Cycling is environmentally friendly and convenient, but it requires good physical condition and riding ability, which is difficult for the elderly. The residents of the subdistricts mentioned above are heavily dependent on public transport. Insufficient public transportation has made the problem of insufficient park services more serious and hampered social equity.

Limited by data and time constraints, this research still has some areas for improvement, which will be addressed in follow-up research. (1) Cycling and driving are also important ways for residents to travel to the park on weekends. Considering the research purpose of evaluating the layout of parks, public transport which is suitable for a wider range of groups was selected to divide the service scope. Research on other modes of transportation is insufficient. The characteristics of park accessibility under different transportation modes will be further studied and compared. (2) When theme parks, famous historical and cultural parks, and other types of parks play their special tourist functions, the service scope is different from that of daily recreational functions. Considering the purpose of the research, this study only calculates the service area of various parks that perform the basic leisure function. In the future, we will study the differences in the service scope of parks in different scenarios. (3) This study mainly analyzes the coverage level of park services, but does not take the quality of park services and the attractiveness of parks into account, which is also important for the leisure experience of residents. Future research will analyze the spatial pattern of park service quality in combination with park attractiveness. (4) This research analyzes the spatial characteristics of PSAs based on the road network, public transport resources, and park layout, but does not consider the impact of traffic conditions. Follow-up research should take account of road traffic conditions to analyze the changing laws of PSA spatial characteristics at different times.

5. Conclusions

Urban parks are important to ensure a pleasant urban environment and a good quality of life for the residents. Taking Beijing as an example, this study explored an approach applicable to large cities for identifying park service areas and improving strategies. The study found: (1) the distribution of parks in Beijing is uneven. There are many parks within
the Third Ring Road and in the Fifth Ring Road Area, and the parks are evenly distributed. There are few parks in the Fourth Ring Road Area, and many parks in the Sixth Ring Road Area; however, the parks within the Sixth Ring Road Area are clustered near the Fifth Ring Road. Influenced by the layout of parks, the subdistricts with a large proportion of PSAs are mainly clustered around the larger employment centers, such as Financial Street, Asian Games Village, and Zhongguancun subdistricts. In addition to the subdistricts close to the Fifth Ring Road, the proportion of PSAs in most subdistricts of the Sixth Ring Road Area is low, including the subdistricts with dense populations. Therefore, it is necessary to strengthen the park construction around the large residential areas in the Sixth Ring Road Area. (2) The factors affecting PSAs vary from park to park. Optimizing according to specific conditions can effectively expand the scope of the PSA and better develop the service capacity of the park. The entrance layouts of the parks within the Fourth Ring Road are well planned, and the PSA is less affected by the surrounding traffic barrier elements, whereas the accessibility of parks outside the Fourth Ring Road is greatly affected by entrance layout and traffic barrier elements, and the PSAs are strongly anisotropic. (3) The expansion of PSAs in the southern part of Beijing was restricted by the efficiency of public transport and the route layout. These regions are populated by low-income migrants who travel mainly by public transport. The allocation of public transport resources in these regions should be strengthened to expand PSAs and promote social justice.

Author Contributions: Conceived and designed the research: C.W., Y.D.; contributed reagents/materials/data/analysis tools: Y.D., P.C.; wrote the initial draft of the manuscript: Y.D., C.W., P.C. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by grants National Natural Science Foundation of China, No. 42071151; Strategic Priority Research Program of the Chinese Academy of Sciences, No. XDA20010101; Post-doctor Science Foundation No.68, grant number 264578.

Data Availability Statement: The data that support the findings of this study are available on reasonable request from the author at dangy.17s@igsnrr.ac.cn. Proposals requesting data access will need to specify how it is planned to use the data.

Conflicts of Interest: The authors declare no conflict of interest.

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