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The Provision and Accessibility to Parks in Ho Chi Minh City: Disparities along the Urban Core—Periphery Axis

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Abstract: In Ho Chi Minh City (HCMC, Vietnam), there is now an urgent need for evaluating access to parks in an effort to ensure better planning within the context of rapid and increasingly privatized urbanization. In this article, we analyze the provision and accessibility to parks in HCMC. To achieve this, the information gathered was then integrated into the geographical information systems (GISs). Based on an Ascending Hierarchical Classification, we were able to identify five different types ranging in their intrinsic characteristics. The accessibility measurements calculated in the GISs show that communities are located an average of at least 879 meters away from parks, which is a relatively short distance. Children have a level of accessibility comparable to that of the overall population. Accessibility also seems to vary greatly throughout the City—populations residing in central districts (planned before 1996) enjoy better accessibility compared to those in peripheral neighborhoods (planned after 1996). Parks located in areas planned between 1996 and 2002 are the least accessible, followed by parks in areas planned after 2003. Our findings suggest possible approaches that could be used to help ensure the quality of parks and their spatial accessibility.

Keywords: park access; urban park; park planning; Vietnam urban planning; Ho Chi Minh City; spatial analysis

1. Introduction

Urban parks have essential functions that make them a vital feature of any city. Regardless of a country's level of development or geographical context, research has shown that urban parks contribute to the population's wellbeing by reducing urban heat islands and noise, fostering physical activity among adults and children, and contributing to social interaction, which thereby strengthens the social cohesion of communities [1–5]. There are two key factors that influence park use and visitation—spatial accessibility to parks and characteristics of park space. Numerous studies have shown that the closer individuals live to a park, the more they use or visit parks [4,6]. Some authors have also demonstrated how certain characteristics (such as size, equipment, maintenance, etc.,) influence park visitation [2,7]. More specifically for children, previous studies show that green spaces—most notably, urban parks—provide children with many possibilities for enjoying physical and psychological activities that foster their physical, cognitive, environmental, and social growth. As such, the interactions that children experience in parks have a positive impact on their overall health and also help strengthen their creative skills, communication skills, and ability to participate in community life, explore nature, etc. [2,8,9].

In this article, we examine spatial accessibility to parks for children in Ho Chi Minh City (HCMC), Vietnam. We address only urban parks, one of the formally planned public spaces that exist in Vietnam. Parks with open and green spaces are scarce in large Vietnamese cities. In HCMC, as in other urban agglomerations in Vietnam, the lack of accessible open and green spaces is compensated by the use of the sidewalk and street spaces [10,11]. However, sidewalks in densely built and populated cities such as HCMC cannot replace safe and accessible open and green public spaces for multiple reasons mentioned above. Particularly, a study in Hanoi demonstrates intensive usages of parks throughout the day for physical exercises, relaxing, and socializing [12]. Furthermore, in HCMC, park provision and access have been changed rapidly and profoundly. Since its foundation 300 years ago, the City has evolved under many different political regimes and urban planning models [13]. Nowadays, the city, home to more than 8 million people, is characterized by a high population density (11,899 inhabitants/km^2 in urban areas) and rapid urbanization with the annual rate of urbanization and population growth of 3.8% and 4.1% [14]. Like in other cities in Vietnam, urban planning in HCMC is increasingly privatized [15,16]. Moreover, with spatial segregation on the rise, wealthy neighborhoods are often well supplied in terms of quality services in contrast to disadvantaged neighborhoods [15,17], which further contributes to the divide between the rich and the poor in urban Vietnam [18–20]. Combined with the lack of financial resources to provide facilities and infrastructure [13], such transformations in the City may undermine the provision and access of urban public amenities such as parks.

The provision of parks in HCMC remains very limited [21]. The park surface area per inhabitant is only 0.22 m^2—significantly lower when compared to other cities in Southeast Asia, such as Bangkok and Kuala Lumpur (1 m^2 and 1.25 m^2) [22], or Hanoi (1.48 m^2) [16]. And yet, public spaces—particularly parks—play a major role in the relaxation and recreational activities of the HCMC population [23]. Parks are constantly threatened by illegal construction, real estate development projects, and the parking and spatial encroachment resulting from the numerous commercial activities that take place in parks [24]. In this context, an empirical evaluation of park accessibility is urgently required if we are to help planners set priorities in park development plans and convince them to invest in parks as an essential public service. This study is a tentative response to this need.

We ask the three following questions: What are types of parks and how are they distributed across the city (space) and urbanization periods (time)? What is the extent of spatial accessibility of different park types and how does it vary across space and time? Are there discrepancies in the accessibility to parks for children across the city, compared to the overall population? We consider three periods of urbanization (1975–1996, 1997–2003, and from 2003), based on the city's history of urban development and official dates that urban districts in the city obtained their 'urban' status.

We hope to shed light on the distribution of parks while taking into consideration the population size and urbanization process. At the conceptual level, we also adapted concepts that were developed in Western cities (i.e., the very concept of 'park', types of parks, etc.,) in order to capture cultural, historical, and other place-based nuances of park provision in HCMC. As such, we contribute to the scant literature on urban parks in the Global South.

2. Contextualizing Parks in HCMC

2.1. Legislation and Place-Based Definition of Parks

Before pertaining on types of parks, it is worth examining different definitions of parks in the city. No definition of the word "park" can be found in legal documents in Vietnam [12,23], with the exception of a single reference in the 2005 Construction Standards (TCXDVN), No. 362.

This document includes the term "Green tree-park space" (*khu công viên cây xanh*, in Vietnamese) defined as "a type of green space, most of which is dedicated to outdoor activities, urban entertainment, cultural activities, connecting with nature, and improving the physical and psychological living conditions of the population" [25]. The document also contains a definition of another type of public park—the green garden space—which is defined as "a green space mainly intended for pedestrians; in other words, designed for those who are walking and wish to stop and rest for a short time. The size of the garden is at least three hectares. It consists mainly of flowers, shrubs, grass, trees, and relatively simple buildings" [25]. Based on these definitions, parks are therefore closely associated with public green spaces. When taking their name, size, shape, and function into consideration, we can distinguish three main groups of parks—parks and public gardens, public squares, and theme parks (Table 1).

Table 1. Different types of parks in Ho Chi Minh City (HCMC) by their name and their period of creation.

	Types of Parks	Period of Creation (Approximate)
I. Parks and public gardens Public green spaces sometimes well designed with sports facilities, playgrounds for children, benches or maisonettes, etc.	Public garden, linear park	Several periods
	Large and medium parks that were created since colonial period (i.e., Tao Đàn)	Before 1975
	Cultural parks	1976–1996
	Neighborhood parks	1997–2002 and since 2003
	Botanical and Zoological Garden	Before 1975
II. Public squares Public squares and promenades with vegetation and equipment such as a park. These types of parks are also sometimes used as places of exhibitions or celebration.	Promenade	Since 2003
	Large place and square in the city center	Before 1975
	Small square and neighborhood squares	Several periods
III. Theme parks: paid parks	Amusement park	1976–1996
	Tourism complex	1997–2002

Sources: authors, synthesized from [21,26].

Our research focuses only on the first two types—"parks and public gardens" (with the exception of the Botanical and Zoological Garden) and "public squares" (Table 1, I and II). "Theme parks" and the Botanical and Zoological Garden are not considered since entrance is fee-based and not financially accessible to disadvantaged populations. In the remainder of the text, we use the term "park" to designate these two categories (Table 1, I and II).

2.2. How Has the Creation of Parks Evolved over Different Periods of Urbanization?

A. Before the reunification of 1975

Before the colonial era, Vietnam had no urban parks but traditional public spaces such as pagoda gardens or communal houses [27]. In the early 20th century, under colonial governments, Southeast Asian cities, including Saigon (HCMC's former name), were outfitted with their first urban parks. These particular parks were managed and developed based on the needs of the colonial governments for their workers' families, colonial citizens, royal families, and the indigenous bourgeoisie [28]. In HCMC, two large parks were created during this era—the Botanical and Zoological Garden (*Thảo Cầm Viên*) and the City Garden (*Tao Đàn* Park).

Vietnam's declaration of independence in 1945 was followed by a nine-year war and a 30-year conflict between northern and southern Vietnamese provinces which ended with the country's reunification in 1975. During this wartime, no major changes were made with relation to urban parks when compared with the previous period [29].

B. After the reunification (1975–1996): Soviet influence and economic reform

Following the reunification, the need for urban parks was on the rise and the city was experiencing rapid population growth (expanding from 3.4 million in 1979 to 3.9 million in 1989) [30]. This resulted in the emergence of new park concepts such as Soviet-type "cultural parks", which are often rather large in size [26].

Starting in the *Đổi Mới* era in 1986—the political-economic reform—and most notably since the 1990s, HCMC has experienced significant economic growth, marked by a rise in GDP of 5.5% to 8% per year [31] and incredibly rapid demographic growth (since 1999, the city's population has increased by more than 200,000 residents per year) (Ibid.). During this period, the city faced new urbanization challenges including high residential density (over 50,000 inhab./km^2 in central areas) and poor infrastructure (30% of urban neighborhoods lacked wastewater disposal systems and only 13% of roads were in good condition) [19]. No new parks, other than theme parks (fee-based), were built during this period.

C. 1997–2003: Peri-urbanization and new urban neighborhoods

In 1997, five new urban districts developed out of certain peri-urban and rural districts. One particularly remarkable phenomenon is the emergence of new urban neighborhoods (*khu đô thị mới*) [32] and the private sector's participation in the real estate development of these neighborhoods. A new type of parks was created for these particular neighborhoods through a partnership between the public and private sectors.

D. Since 2003: Increase in new urban areas and revitalization of the downtown area

In 2003, two rural districts were attributed the status of urban district; although neighborhood parks were established in these new urban areas, they were rather small in size and very poorly equipped, if at all [23,33]. In the downtown core, beautification programs were proposed in an effort to improve quality of life [23]. A number of urban parks were therefore equipped with safe and modern play structures for children, sports equipment for adults, etc. Many linear waterfront parks were also established along canal shores in central areas [23].

Based on this review, we consider three periods of urbanization, 1975–1996, 1997–2003, and from 2003. For each of urban districts in our study area, we used government's decrees to identify the years they obtained the 'urban' status. The years are used as a proxy of urbanization periods, since we do not have exact dates where the parks were built and renovated.

3. Conceptual Framework

3.1. The Intrinsic Characteristics and Typology of Parks

The visitation and use of parks depends heavily on the latter's characteristics [4,6,34]—specifically their size [7,8] and quality [2]. In many cities, typologies are instrumental in developing city-wide policies with measurable guidelines [35–37]. Although many typologies divide parks according to scale (catchment areas), size (in hectares), and function (types of activities and facilities), they often lack precision or ignore other dimensions. For instance, criteria related to sports and recreational facilities are generally defined in general terms as being related either to passive or active activities. In addition, the presence of vegetation (or absence thereof) is rarely addressed as a variable. This is an important caveat as parks constitute a considerable source of vegetation in urban neighborhoods.

We draw our typology on public documents from the aforementioned cities, empirical studies on the access to and use of parks [7,8,38,39], as well as conceptual models that define the quality of public spaces [40]. Our typology therefore includes six elements—size, physical configuration, services, nature, level of maintenance, and social factors.

Physical configuration generally refers to facilities, equipment, paths, and the separation of spaces [41]. Services, for their part, can be quite diverse, and can include restaurants, parking lots with surveillance, and restrooms with permanent on-site maintenance staff [42]. Nature takes into consideration several elements such as number of trees, grass, shade, fauna, arrangements landscaping, and the aesthetic quality of plants. Level of maintenance refers to the deterioration and cleanliness of park equipment [43]. Lastly, where social factors are concerned, the urban park is expected to foster such social interaction among individuals of every age group, socio-economic level, and provide the latter with a safe environment [44]. Several factors, such as the presence of park benches, pavilions, areas for collective activities, and the presence of security guards or officers, can have an impact on the level of interaction.

3.2. Accessibility to Parks

According to Rosa [45], accessibility is a broad and flexible concept that can be defined in different ways depending on the area of interest. Several authors define the concept of accessibility as being the ability to meet certain objectives such as obtaining services or enjoying the benefits of such services (ibid.). Penchansky and Thomas [46] refer to accessibility as including five dimensions—(1) geographic accessibility (spatial accessibility), (2) quality and availability of services (availability), (3) service organization (i.e., hours of operation), (4) service costs, and (5) social acceptability (perceptions of the administrative staff and service users). Most research on parks, which generally uses geographical information systems (GISs), aims to evaluate spatial accessibility [47,48] and the availability of services [7,8].

Spatial accessibility has been extensively used to examine environmental equity in access to urban parks. More specifically, studies in various North American cities have been raising concerns of inadequate access to parks in disadvantaged or ethnic neighborhoods [8,48–53]. Recent studies in China and Korea also show diverse spatial and temporal variations of park accessibility in rapidly urbanizing Asian cities [47,54,55]. In sum, the previous studies point to the importance of examining and explaining spatial inequality of park access between the intra-urban center and the periphery. Drawing on this corpus of literature, we examine spatial accessibility using by a variety of measures such as minimal distance to parks and the number of parks or park hectares within a 500- to 1000-m radius using the street network. Our analysis also takes into account demographic variables and urbanization periods.

4. Methodology

4.1. Study Area and Sociodemographic Data

The territory of study includes 19 urban and peri-urban districts (*quận*) within the HCMC metropolitan area and excludes the five rural districts (*huyện*) that have few parks. In 2009, the total surface area of the territory of study is 442.13 km^2 inhabited by 6 million people (83.2% of the city's population) [56]. The population density is very high—over 50,000 inhabitants per km^2—in central districts that obtained urban status before 1996 (Figure 1). There are 259 urban wards (*phường*) which is the smallest administrative unit in the Vietnamese (an average of 22,705 inhabitants). We have extracted three demographic variables from the 2009 Vietnamese census at the ward level—population density (inhabitants per km^2), and density and percentage of children under the age of 15 (Figure 1).

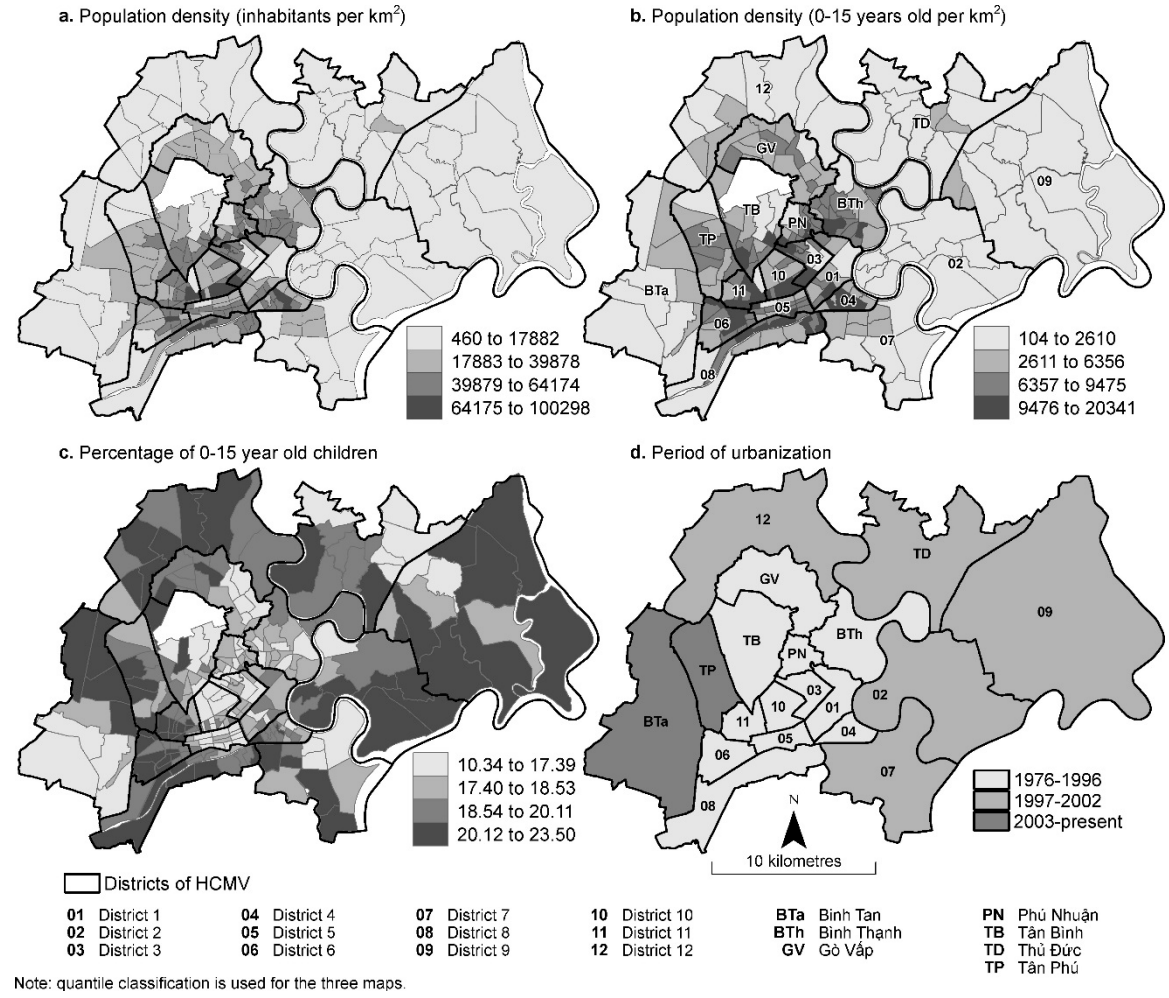


Figure 1. Population variables at the wards level and periods of urbanization in the city.

4.2. Data on Parks and Street Network

The park boundaries were extracted from the 2010 HCMC land-use plan and validated using satellite images in Google Earth as well as through field visits in 2016. This particular approach proved necessary since the official maps provided by the Vietnamese government are not always up to date [16].

The 108 parks were visited between July and September 2016 by the first author and a group of 10 research assistants (architects and students completing their third and fourth year of study at HCMC's University of Architecture). The assistants produced an inventory of the equipment in the parks and completed an evaluation grid that included the six previously outlined elements (Section 3.1).

More specifically, regarding the nature, indicators of the number of trees (collected when we visited 108 parks in 2016) were multiplied by 5 m^2 (using the government's construction standards guide [25]) to calculate the sum of the canopy surface area and then reported as the percentage of total surface area covered for each park. We recoded these vegetation indicators into six binary variables that indicate both the percentage of surface area covered in trees, classified into one of three categories (less than 10%, between 10% and 50%, over 50%) and the percentage of surface area covered by grass, again classified into one of three categories (less than 50%, between 50% and 75%, over 75%). Regarding the level of maintenance (i.e., deterioration and cleanliness), a series of photos featuring examples of deteriorated parks (Figure 2) was presented to the assistants who took photos of the parks they visited. Finally, we analyzed the photos and decided to revisit parks when needed.

Figure 2. Figurations of damaged parks (in terms of deterioration and cleanliness).

4.3. Methods of Analysis

An ascending hierarchical classification (AHC) was created—using an Euclidean squared distance metric and Ward's aggregation criterion—in order to obtain a typology of parks based on their level of quality, as established by the five key elements and their size. To achieve this, 28 binary variables were used in relation to physical configuration (4), services (4), nature (8), level of maintenance (3), social factor (6), and size (3).

To measure spatial accessibility to parks, we established points with an equidistance of 10 meters along the perimeter of the parks. We calculated the centroid of the residential area for each ward by using the HCMC's 2010 land-use plan map. These allowed us to minimize aggregation errors [57,58] in the process of creating the network distance matrix between the 259 wards and the 108 parks since their size vary considerably.

The three following indicators of park accessibility were calculated for the 259 wards using the street network:

1. The distance from the centroid of the residential areas to the closest park (for parks overall and for each type in the typology).
2. The number of accessible parks within a 500- to 1000-m radius around the residential areas
3. The number of accessible park hectares within a 500- to 1000-m radius.

As mentioned in a recent literature review on the approaches to measuring the potential spatial access to urban services, it is then relevant to calculate several measures that enable potential geographic access to be described in all its complexity [57]. In this study, the three selected indicators refer to conceptualizations of potential geographic access, which are very different from one another—(1) the immediate proximity, (2) the availability of parks (number) provided by the immediate surroundings, and (3) the availability of park area (ha) provided by the immediate surroundings [57].

All the accessibility indicators were weighted using the population size of each ward. Once we had the park typology and accessibility indicators, we examined their relationships with socio-demographic variables and urbanization periods, using maps and bivariate statistical analysis. For example, in order to verify if there is a significant relationship between population density and the density of children and the accessibility to different types of parks, we calculated Spearman correlation coefficients between the variables of accessibility and the population density and the density of children per ward.

5. Results

5.1. Typology of Parks and Variations across Space and Time

The AHC allowed us to distinguish five types of parks (Table 2), which are illustrated in Figure 3. This optimal number of clusters was selected by using the Pseudo-F statistic [59] and the Cubic Clustering Criterion [60].

Table 2. Typology of urban parks in HCMC.

Type	A	B	C	D	E	Total
Number of Parks Per Type	**16**	**46**	**14**	**24**	**8**	**108**
Park Characteristics (Percentage of Parks with Equipment or Facility [a])						
Equipment						
Exercise equipment for adults	75.0	17.4	0.0	41.7	87.5	34.3
Path	75.0	78.3	35.7	100.0	100.0	78.7
Sliding play structure for children	31.3	2.2	7.1	4.2	75.0	13.0
Riding play structure for children	37.5	2.2	7.1	4.2	75.0	13.9
Services						
Public restrooms with maintenance staff	50.0	6.5	0.0	45.8	100.0	27.8
Parking lots for motorcycles with surveillance	31.3	2.2	7.1	41.7	100.0	23.1
Restaurant and café	75.0	13.0	14.3	29.2	100.0	32.4
Street vendors	50.0	13.0	7.1	54.2	62.5	30.6
Natural factor						
Decorative plants	100.0	95.7	50.0	95.8	100.0	90.7
Pond	25.0	26.1	14.3	62.5	75.0	36.1
Tree coverage of park's total surface area						
Less than 10%	0.0	8.7	50.0	66.7	0.0	25.0
10% to 49%	62.5	69.6	0.0	29.2	75.0	50.9
50% and more	37.5	21.7	50.0	4.2	25.0	24.1
Lawn coverage of park's total surface area						
Less than 50%	25.0	21.7	78.6	50.0	37.5	37.0
50% to 74%	6.3	34.8	7.1	16.7	25.0	22.2
75% and more	68.8	43.5	14.3	33.3	37.5	40.7
Level of maintenance						
Deterioration	50.0	43.5	100.0	20.8	0.0	43.5
Cleanliness	81.3	69.6	7.1	91.7	100.0	70.4
Garbage receptacles	75.0	39.1	57.1	91.7	100.0	63.0
Social factor						
Park keepers	31.3	15.2	14.3	75.0	87.5	36.1
Fixed and mobile security agent	18.8	8.7	0.0	70.8	100.0	29.6
Pavilions	6.3	0.0	0.0	25.0	37.5	9.3
Bancs	81.3	39.1	0.0	66.7	100.0	50.9
Fee-based games	6.3	2.2	7.1	4.2	87.5	10.2
Space for collective activities	31.3	4.3	0.0	37.5	100.0	22.2
Size of parks						
Less than one hectare	100.0	95.7	78.6	4.2	0.0	66.7
1 to 4.99 hectares	0.0	2.2	0.0	91.7	0.0	21.3
5 hectares and more	0.0	2.2	21.4	4.2	100.0	12.0

[a] For example, 75% of the 16 parks in Type A include an exercise equipment adult; A: small park (less than one hectare), well equipped, and of good quality; B: small park (less than one hectare), poorly equipped, and of average quality; C: poorly equipped and deteriorated parks; D: medium park (1 to 5 hectares), well equipped, and good quality; E: large park (over 5 hectares), very well equipped, and good quality.

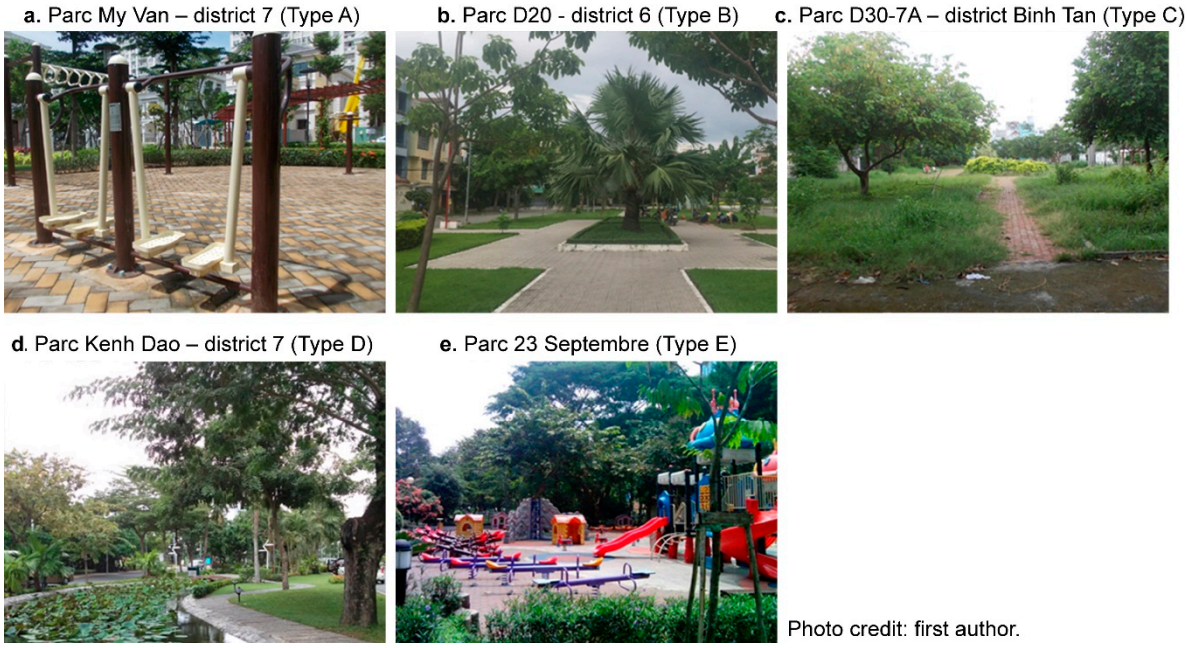


Figure 3. Examples of parks according to the typology obtained.

Nearly all of the Type A (16) and Type B (46) parks were very small in size (less than one hectare). These two types were distinguished by their level of equipment and services. Type A parks were better equipped—75% of them had at least one piece of exercise equipment for adults (compared to 17% for Type B parks) and over 31% of parks of this type were equipped with a play structure for sliding and a riding structure for children (compared to 17.4% and 2.2% of Type B parks). In terms of their services, 50% of Type A had public restrooms with maintenance staff (versus 6.5% for Type B) and 31.3% of Type A had parking for motorcycles with surveillance (versus 2.2% for Type B).

Type C parks (14) were characterized by a weak presence of equipment and services and, most importantly, a high level of deterioration (100%). They were quite variable in size—78.6% were smaller than 1 hectare and 21.4% were larger than 5 hectares. Type D parks were all of average size (1 to 5 hectares), of which 41.7% of these parks had exercise equipment but rarely had play structures for children (4.2%). Close to half of these parks included public restrooms with maintenance staff (45.8%) and parking for motorcycles with surveillance (41.7%). Street vendors were also present in these parks (54.2%). In terms of vegetation, practically all of the parks included decorative plants but the presence of trees was rather limited since. Most of the parks were clean (91.7%), equipped with garbage receptacles (91.7%), and showed few signs of deterioration (20.8%).

Lastly, the eight Type E parks had large sizes (over five hectares) and were often well outfitted in terms of equipment—87.5% had exercise equipment for adults, 100% had paths, and 75% had at least one play structure for children. 75% of these parks had tree coverage representing between 10% and 49% of their total surface area. Type E parks also featured several services such as public restrooms with maintenance staff (100%) and parking lots for motorcycles with surveillance (100%). Restaurants/cafés (100%) and street vendors (62.5%) were also highly present in these parks. All of these parks were clean (100%). Nonetheless, the majority still had fee-based games (87.5%).

The spatial distribution of park types is presented in Figure 4. To examine this spatial distribution along the three periods of urbanization, we created a contingency table (Table 3). Type E parks were located solely in central districts (planned before 1996). Types A, B, and D were more frequently found (75.0%, 47.8%, and 54.2%) in central districts than in peripheral neighborhoods planned after 1996 (with the exception of the Phu My Hung neighborhood in District 7). On the contrary, most Type C parks were located in peripheral neighborhoods (35.7% in areas planned between 1996 and 2002 and 50.0% in areas planned after 2003).

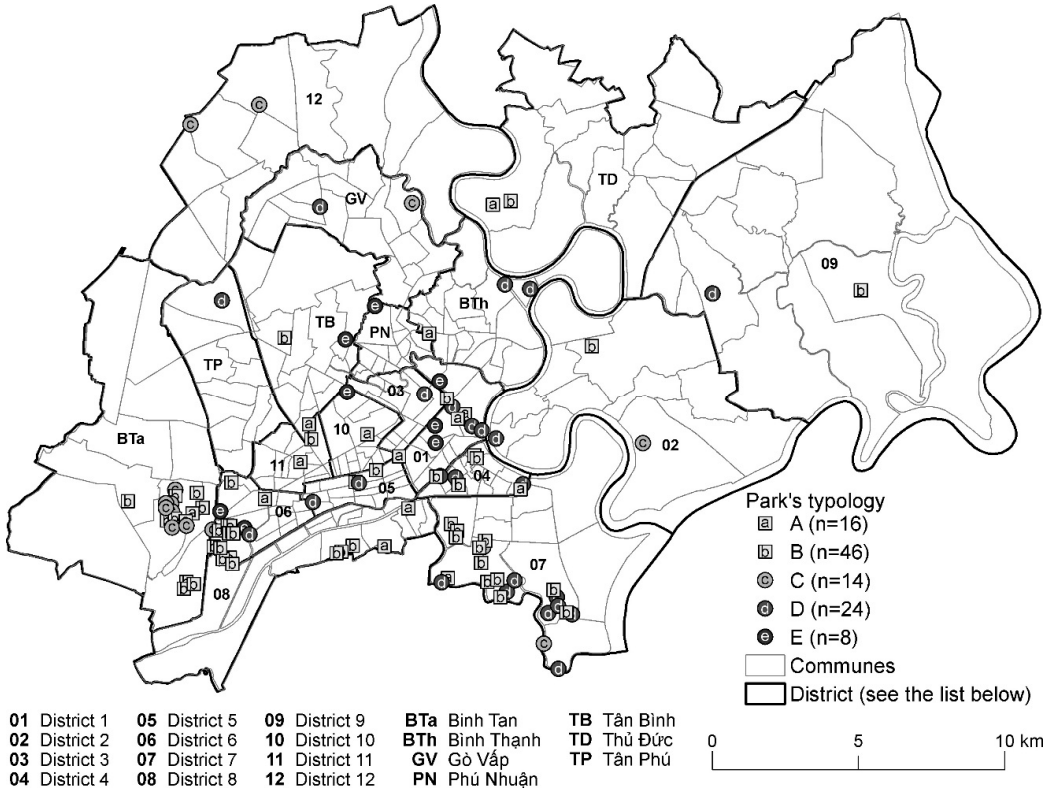


Figure 4. Spatial distribution of park types.

Table 3. Spatial distribution of parks by five types [a] and three periods of urbanization.

Count Row Percent Column Percent	A	B	C	D	E	Row Total
1976–1996	12	22	2	13	8	57
	21.05%	38.60%	3.51%	22.81%	14.04%	
	75.00%	47.83%	14.29%	54.17%	100.00%	52.78%
1997–2002	2	14	5	10	0	31
	6.45%	45.16%	16.13%	32.26%	0.00%	
	12.50%	30.44%	35.71%	41.67%	0.00%	28.70%
2003–present	2	10	7	1	0	20
	10.00%	50.00%	35.00%	5.00%	0.00%	
	12.50%	21.74%	50.00%	4.17%	0.00%	18.52%
Column Total	16	46	14	24	8	108
	14.82%	45.59%	12.96%	22.22%	7.41%	

[a] See name and descriptions of each park type in Table 2.

5.2. Spatial Accessibility of Parks and Variations across Space and Time

We calculated univariate statistics for the different accessibility measurements obtained for the 259 wards weighted by the total population and the children under the age of 15 (Table 4). The average and median values show that, in HCMC, both of these populations were located relatively far away from parks—an average of 1879 and 1890 m, respectively (median = 1304 and 1313). Furthermore, one quarter of the city's inhabitants and children under the age of 15 reside more than 2500 m away from the closest park (Q3 = 2533 and 2570).

The number of parks and number of park hectares located within a 500- and 1000-m radius—considered an acceptable walking distance—was relatively low. For example, within a radius of 1000 m, the average number of accessible park hectares was 2.49 and 2.36 when weighted by the total population and the population of children under the age of 15, respectively.

When breaking down the accessibility to park types, Type D parks (well-equipped and good-quality parks of medium size) were the closest at 3030 m away from residential areas. Type C parks (poorly equipped and deteriorated parks) were the furthest, at over 5000 m away. It is also worth noting that Type E parks (very well-equipped and good-quality parks of a large size) were also characterized by poor accessibility, being located an average of over 4500 m away.

Table 4. Univariate statistics of accessibility measures at ward level.

Accessibility Measure	Statistics Weighted by the Total Population						Statistics Weighted by the Population under 15 Years Old					
	Moy.	Min.	Q1	Q2	Q3	Max.	Moy.	Min.	Q1	Q2	Q3	Max.
Minimum distance according to type of park [a] (in meters)												
All	1879	2	713	1304	2533	9953	1890	2	737	1313	2570	9953
A	4097	2	1400	2742	5830	22,325	4192	2	1414	2768	6373	22,325
B	3381	96	1337	2494	4476	12,411	3418	96	1361	2498	4592	12,411
C	5139	32	3050	4918	6532	18,261	5101	32	3050	4768	6467	18,261
D	3030	8	1516	2568	3964	15,541	3029	8	1510	2568	3952	15,541
E	4548	226	1745	3263	6042	22,683	4613	226	1819	3296	6042	22,683
Number of parks												
500 m	0.24	0.00	0.00	0.00	0.00	6.00	0.23	0.00	0.00	0.00	0.00	6.00
1000 m	0.75	0.00	0.00	0.00	1.00	12.00	0.72	0.00	0.00	0.00	1.00	12.00
Number of hectares of parks												
500 m	1.05	0.00	0.00	0.00	0.00	41.61	0.99	0.00	0.00	0.00	0.00	41.61
1000 m	2.49	0.00	0.00	0.00	0.75	41.61	2.36	0.00	0.00	0.00	0.63	41.61

[a] See name and descriptions of each park type in Table 2.

Only three indicators of accessibility are presented in Figure 5. Accessibility to parks was better in central districts and more limited in peripheral neighborhoods which were generally urbanized in 1997–2002. However, accessibility in the periphery was slightly better during the last period (after 2003). For example, when weighted by total population, the average distance to the closest park was 1034 m for wards in the first period, 3642 m for the second, and 2134 m for the last. But when looking at park quality, central and older wards were closer to Type D parks (well-equipped medium-sized parks of good quality) while peripheral and newest wards were closer to Type B parks (small, poorly equipped parks of average quality).

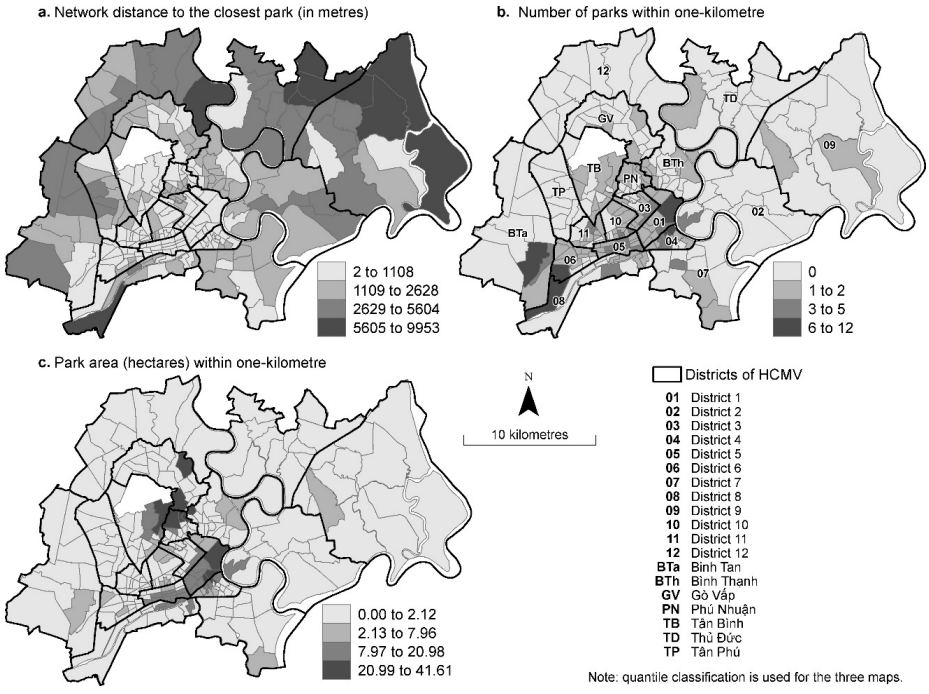


Figure 5. Accessibility to parks by wards in HCMC.

5.3. Spatial Accessibility, Population, and Children

The correlations between the three demographic variables and the distance to the closest park are all significant, ranging from weak to moderate (between ± 0.10 and 0.62 in Table 5). Negative correlations show the greater the population density and the density of children, the better the proximity to parks (the shorter the distance to the closest park), regardless of the type of parks. This is because in central wards where the population density and the children density are higher, the distance to parks is shorter (as shown above). However, there were positive correlations between the percentage of children and the distance to parks. The higher the percentage, the lower the accessibility, which is due to the fact that the percentage of children was higher in peripheral wards where accessibility is worst. Overall, Type A parks (small and well-equipped parks, located in central wards) tended to be the most accessible, having the highest correlations with the densities. Type C parks (bad quality) were the less accessible, having the lowest correlations; however, what is worrying is that most of them were found in the periphery.

Table 5. Spearman's correlations between network distance to nearest park and demographic variables, by ward.

Demographic Variable	Reticular Distance to the Nearest Park by Type [a]					
	A	**B**	**C**	**D**	**E**	**All**
Population density	**−0.63**	**−0.45**	−0.08	**−0.45**	**−0.53**	**−0.39**
Percentage of children under 15 years old	**0.23**	**0.14**	**−0.18**	0.08	**0.38**	**0.22**
Density of children under 15 years old	**−0.62**	**−0.45**	**−0.11**	**−0.45**	**−0.49**	**−0.38**

[a] See name and descriptions of each park type in Table 2. Values in bold—significant at the threshold 0.01%, N = 259.

Correlations in Table 6 corroborate the preceding findings. Within a 1000-m radius, the higher the number of parks and park hectares were, the greater the density was, but the lower the percentage of children under 15 years old was. However, the coefficients were weaker and almost all correlations were not significant at the 500-m threshold.

Table 6. Spearman correlations between number of parks and number of hectares (in proximity areas of 500 m and 1000 m) and demographic variables, by ward.

Demographic Variable	Park Area (Hectares)		Number of Parks	
	Within 500 m	**Within 1000 m**	**Within 500 m**	**Within 1000 m**
Population density	0.04	**0.28**	0.04	**0.25**
Percentage of children under 15 years old	−0.12	**−0.21**	**−0.14**	**−0.25**
Density of children under 15 years old	0.03	**0.26**	0.03	**0.23**

Values in bold—significant at the threshold 0.01%.

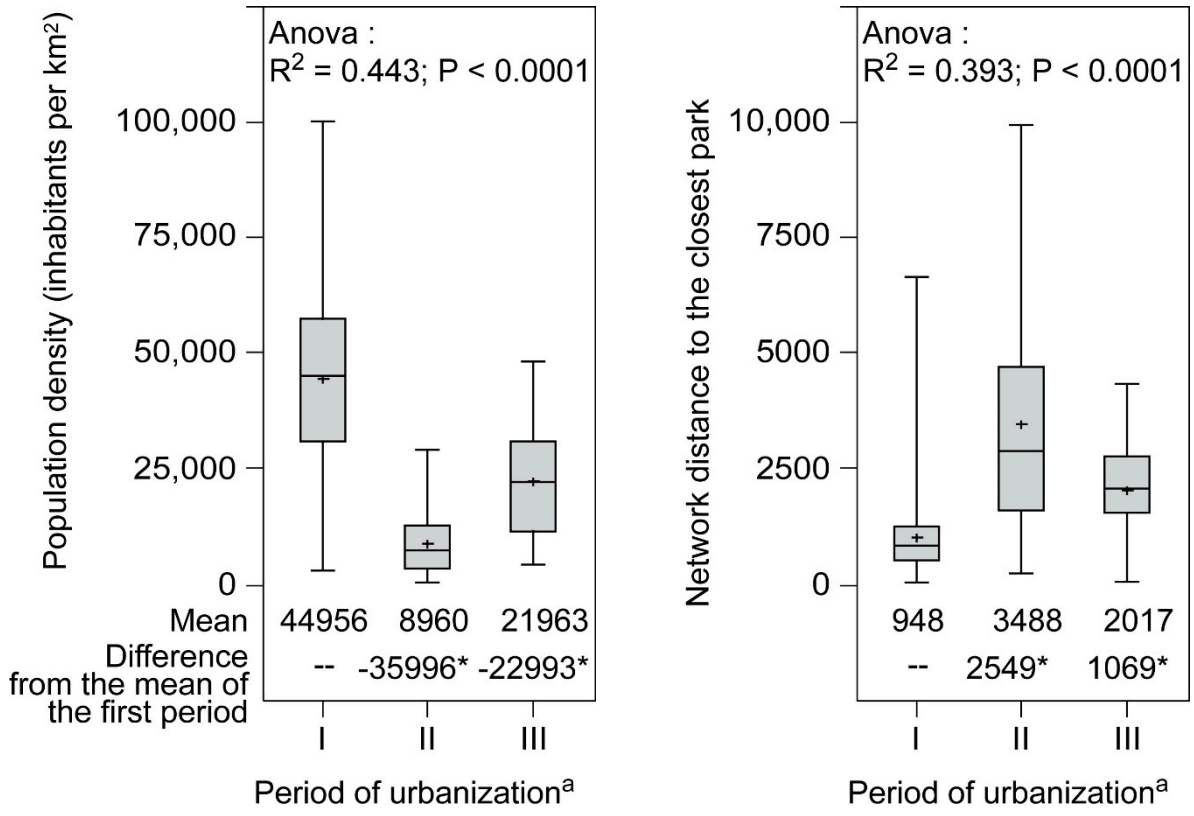
When combining these indicators with urbanization periods, whether these accessibility measurements are weighted by total population or population of children under the age of 15, accessibility was much better in wards during the period between 1976 and 1996 (Table 7).

Table 7. Means of accessibility measures for wards according to the three periods of urbanization.

		Network Distance to the Nearest Park by Type [a]						Park	
Urbanization [b]	**Weight**	**All**	**A**	**B**	**C**	**D**	**E**	**N**	**ha**
1976–1996	Total population	1034	2483	2551	4833	2029	2521	1.01	4.15
1997–2002	Total population	3642	8001	5794	6737	4772	9581	0.12	0.17
2003–present	Total population	2134	3764	2587	3749	3868	3925	0.79	0.21
1976–1996	0–14 years old	1048	2522	2554	4804	2022	2586	1.00	3.97
1997–2002	0–14 years old	3569	8132	5817	6554	4744	9541	0.13	0.18
2003–present	0–14 years old	2218	3898	2712	3891	3867	4035	0.63	0.17

[a] See name and descriptions of each park type in Table 2. [b] number of wards per period: 1976–1996 (n = 181); 1997–2002 (n = 57), 2003–present (n = 21).

Lastly, the boxplots in Figure 6 show that the population density of wards was higher in the wards developed during the 1976–1996 period than in the last two periods. In addition, the network distance to the closest park in the wards of this period was shorter. This is explained by the fact that those wards are located in central neighborhoods and they have more parks than in the periphery (as shown in Tables 5–7).



[a] I: 1976-1996; II: 1997-2002; III: after 2003

Note: Tukey test for comparison of the mean values. * Significant difference at P=0.01.

Figure 6. The link between the period of urbanization and population density in HCMC (**left**) and park accessibility (**right**).

6. Discussions and Conclusions

Our results show that there are considerable variations in the accessibility to different types of parks along the urban–peripheral axis and, hence, periods of urbanization. The minimum distances to parks become greater as we move away from the downtown core (with the exception of the wealthiest Phu My Hung neighborhood in District 7). Moreover, park types differ by period of urbanization. In fact, wards in the 1976–1996 period had large proportions of Type D and E parks (medium- and large-sized, well-equipped, and of good quality) while the latest periods of urbanization featured more Type A and B parks (small parks). Type C parks (poorly equipped and deteriorated), for their part, are mostly located in wards of the last period.

Spatial variations of park accessibility in HCMC corroborate what was documented in other cities. For example, in Hanoi, Pham and Labbé [16] have shown that newly established parks on the outskirts of the city are often far from residential areas. In Seoul, Oh and Jeong [47] highlighted that most of the parks are situated on the periphery, far from dense residential neighborhoods, thus limiting their use. In Hangzhou, Wei [54] showed complex changes of park accessibility between 2000 and 2010, in 41 subdistricts. While half of the subdistricts benefited from an increase of park accessibility,

the other half suffered from inaccessibility to parks (within the 400-m radius) and they were mainly located in the outer city.

Such spatial patterns are explained by urban planning models and social–political transformations in Vietnamese cities. Recall that green spaces and parks are public facilities that were not always considered a high priority in planning before 2000 [16]. Between 1975 and 2000, under the influence of the Soviet urban-planning style, some large cultural parks were set up on lots previously used for other purposes (cemeteries, train stations) and often on abandoned sites (former dump sites, quarries, etc.,) in central areas of the city. The creation of such large parks in the center accentuated the big difference between the center and the periphery.

After 1997, and notably since 2003, urban planning and the creation of parks has been influenced by two main factors, explaining the disparities between the center and the periphery of HCMC. The first factor is the recognition of the importance of parks in planning documents. Parks as open and green public spaces have become a mandatory element in certain urban-planning principles in Vietnam [61,62]—for example, as part of the obligation to create services (parks, schools, cultural centers) for everyday use located within a reasonable walking distance. Although the recognition is supposed to improve the provision of parks, it has been undermined by other broader socio-political processes which constitutes the second factor. The most important process in the second factor is privatization and the growing involvement of the private sector and foreign companies in the construction of new urban areas [63], which have been causing negative impacts on the provision and the quality of parks in the periphery. More specifically, the private sector's role in urban production is fostered by the socialization policy (*xã hội hóa*, in Vietnamese) that aims at increasing private investments in the construction of urban projects, including new urban areas (Ibid.). Numerous new urban areas on the outskirts of HCMC were developed by private or semi-public companies during this period, which is also common in other Vietnamese large cities, such as Hanoi [64,65]. The major problem with privatization, as also documented in other Southeastern Asian cities, is that the profit objectives of private investors, are, for the most part, at odds with benefits for the public [64]. Services in new neighborhoods are created with the objective of making as much profit as possible. It is also common that investors are not able to carry out the projects [13]. These result in the fact that neighborhood parks are often small, poorly equipped, of moderate quality, and sometimes poorly maintained. This explains the important presence of Type B and C parks in peripheral areas and their overall poor accessibility.

It is important to note some limitations of our study. Several recent studies, mostly carried out in the U.S. [66–68], showed that the potential saturation of parks is an important factor to consider. In other words, these parks may have a large number of users, which may lead to a more rapid deterioration of equipment and cleanliness. Hence, given the high population density and lack of parks in HCMC, it would be a clear research area in the future.

As is the case in Hanoi, Vietnam's capital [16], there is a desperate need for parks in HCMC. However, given the city's high population density and compactly built form, the strategies used for creating new parks in the city, especially in central areas, must remain flexible. For example, any vacant lot, yard, or playground in public buildings could be redesigned by the government and managed by the local community. According to Pham and Labbé [16], such an approach would require consideration of the property's status and the management of park facilities to ensure that these are in keeping with local regulatory frameworks. In new districts located in peripheral areas, where spatial accessibility to parks is poor, parks should be quickly added, before built-up density becomes too high. In addition, the quality of existing parks should also be improved, as the latter are generally deteriorated or poorly equipped. In new planned urban areas, we can imagine new ways of creating open and green spaces, for example land reserved for parks can be designed into vegetable gardens and managed by local residents, as urban food growing is increasingly popular in Vietnamese cities because of food safety concerns [69].

HCMC could also use the canals and rivers, which are evenly distributed throughout the city, to compensate for its lack of parks. Applying this particular strategy, however, would require active measures to stop the filling of canals and other forms of encroachment upon these spaces. Although public spatial policies in Vietnam have experienced positive change over the last few years [16], it is clear that there are many lessons to learn from the existing urban park system in HCMC.

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