



Study on the availability of urban parks of Ulaanbaatar, Mongolia

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Abstract: Urban parks are crucial for the good quality of life in cities. Ulaanbaatar's first urban park was built in the 1930s, and the city has since expanded significantly. However, the availability of its parks is still understudied. The aim of this study is to map and analyse urban parks larger than one hectare. The map of Ulaanbaatar was studied in QGIS. Results show that less than 2% of the city has park availability, and 25.37% of the residents live within a walking distance of them. Spatial analysis reveals a concentration of parks near the city centre, highlighting uneven park distribution in Ulaanbaatar.

Keywords: spatial analysis, population analysis, remote sensing, park distribution, urban planning

1. Introduction

In 2018, an estimated 55.3 per cent of the world's population lived in urban settlements. By 2030, urban areas are projected to house 60 per cent of people globally [1]. The capital and the biggest city of Mongolia, Ulaanbaatar (*Fig. 1*) is home to more than 40% of the country's population. In the past 20 years, Ulaanbaatar has been facing rapid urbanization with its population growing by 70%, due to land-obtaining laws and migration from the countryside to cities [2], and the projection shows that the population will reach 1.9 million by 2035 [3]. The city of Ulaanbaatar has a history of more than 300 years as a settlement, and the first street structure and urban planning started at the beginning of the 20th century. In the book by Dugersuren L. titled *Ulaanbaatar City 1921–1940*, the author mentions that the first municipal office of the city was established in 1925, the first urban planning engineering committee was set up in 1936, and the first urban plan of the

city was completed by 1938. The first ever public park of Ulaanbaatar was built by voluntary workers on a former meat market around the 1920s [4]. From then on, the area of urban green space of Ulaanbaatar increased, as well as the total area of the city, and by 1980 the total size of urban green space and the area dedicated to sports activities amounted to 204 hectares [5]. After 1990, the former Soviet building complexes have become denser with new high-rise buildings, changing the initial planning of the city without regard to future expansions [6]. After the transition to market economy, the initial planning of the city of Ulaanbaatar that was created by Soviet engineers changed and unplanned urban sprawl increased, resulting in inequality in access to amenities such as engineering structure, social and health benefits, as well as urban green spaces [7].

Currently, Ulaanbaatar is a metropolitan city with 1.5 million inhabitants living in its 9 districts, with an area size of 4,074 km². The size and the green infrastructure distribution of districts vary greatly due to the rapid urbanization and fast expansion. The aim of this study is to map and analyse the urban parks of Ulaanbaatar and evaluate the distribution across the districts.

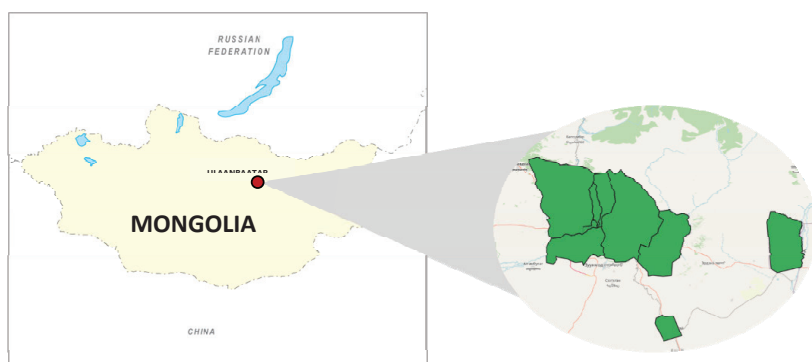


Figure 1. Ulaanbaatar, Mongolia

The city of Ulaanbaatar is aiming to increase the green space per person to 25-30 m² by 2030 in its Master Plan 2020 and Development Approaches for 2030. In 2018, the green space area per person in the city was 3.17 m² (General Agency for Land Administration and Management, Geodesy and Cartography, 2018). When comparing the 1984 percentage of UGS area with that of 2018, it becomes visible that the expansion of the city's administrative area and the population growth have outpaced the development of green space, resulting in a declining proportion of UGS within the urban area. The findings of this study could be useful in the future planning of new urban green spaces in the city to reach the goal of Master Plan 2020 and Development Approaches for 2030 while addressing any gap in their distribution.

2. Materials and methods

To study the state of urban parks of Ulaanbaatar, the term “urban park” needed to be determined first. The description of urban green space often refers to parks, urban forests, gardens, and street trees, based on the ecosystem service they provide [9]. In these areas, urban parks are usually well maintained, well managed, equipped, and they form recognizable green spaces in the city [10]. In Mongolia, the Construction Norms of Mongolia [11] regulate the required area size of urban parks in the city.

Table 1. Construction Norms of Mongolia – Urban park norms

Type of green infrastructure	Location	Area, ha	Radius, km	Maximum time to reach
Urban park	Residential zone	15	5	With transport 20 min
Special use park	Residential zone	3		No norm
Neighbourhood park	District area	10	2	With transport 10 min
Apartment complex park	Inside apartment complex	3	1	15-20 min walk
Mini apartment complex park	Inside apartment complex	1	0.5	5-7 min walk
Park square	Between buildings	0.5		
Park street	Between 2-lane streets	10-50m wide		

According to these norms (*Table 1*), the smallest required area size of an urban park in Mongolia is 1 ha. Therefore, urban parks that have equal to or more than one hectare have been mapped and analysed for this study.

3. Methodology

The mapping of the urban parks of Ulaanbaatar was done with QGIS software with OpenStreetMap, and, additionally, Google Satellite map was used for accuracy (*Fig. 2*). Separate shapefile layers (*Fig. 3*) were created for each district and urban park bigger than 1 ha, which were mapped with a polygon tool. Local projected coordinate reference system EPSG:32648 - WGS 84 / UTM zone 48N (Universal Transverse Mercator for Mongolia) was used to minimize distortions. Riverside vegetation, wild forests, and summer resident areas were not included.

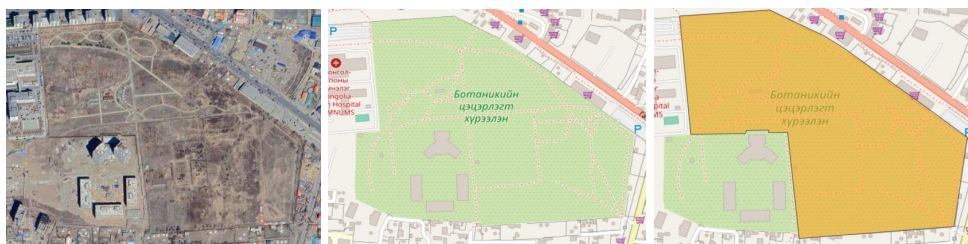


Figure 2. Botanical garden on Google Satellite images using OpenStreetMap and QGIS

The district border data (green lines on the map) was extracted from the open data portal of General Agency for Land Administration and Management, Geodesy and Cartography (<https://opendata.gov.mn/dataview/355>, accessed on 10.29.2024).

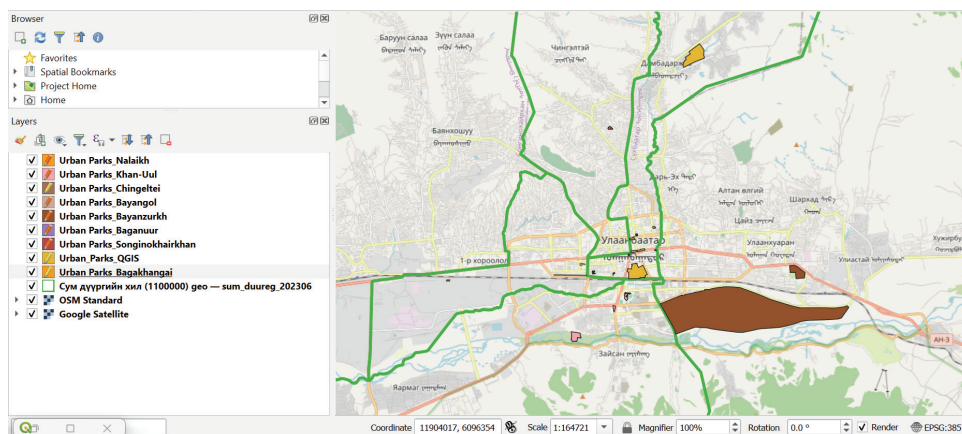


Figure 3. District shapefiles in QGIS

After assessing the area of each district and comparing the OpenStreetMap with Google Earth images, a total of 15 urban parks larger than 1 hectare were mapped in 7 out of the 9 districts. The remaining two districts lack any urban parks of such area size.

Whilst mapping the urban parks, there was a noticeable concentration of them in close proximity to the central part of the city. Therefore, to see the spatial distribution of the urban parks, a buffer circle from the centre of the city was added. The distance from the buffer was adjusted several times to find the correct distance that would represent the concentration, and a radius of 8 kilometres was selected. As the centre point of Ulaanbaatar, a mosaic point on the Sukhbaatar Square (0 point) was selected (Fig. 4).



Figure 4. Centre point of Ulaanbaatar City

4. Urban park availability in terms of area size

After analysing the concentration, the park availability within the city area was measured. Since the preferred distance from a park to one's residence for purposes of walking is usually 1,000 m [12], a buffer layer of 1,000 meters was added to the park polygons. The area percentage with the urban park availability was calculated by merging all the buffered zones together with the Dissolve tool in QGIS (*Fig. 5*), and we subsequently calculated its proportion to the total urban park availability within the city's boundaries.

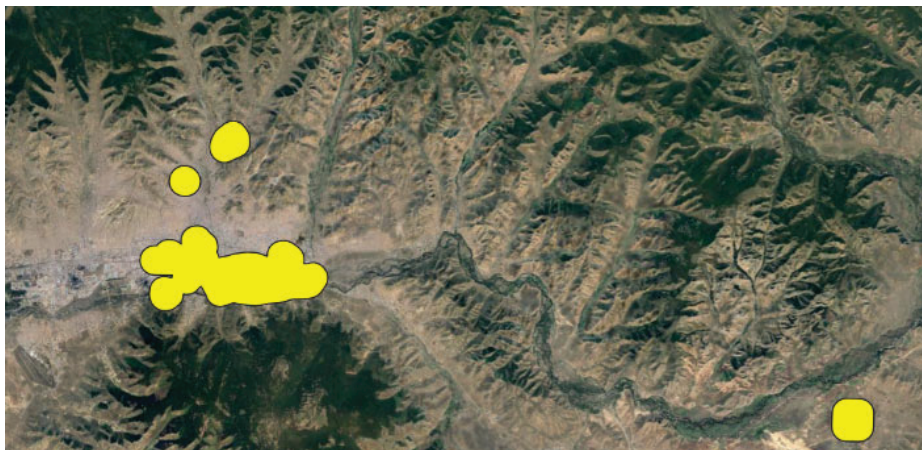


Figure 5. Urban park buffer zones merged together in QGIS

5. Urban park availability in terms of population

To calculate the population of the city living in areas with urban park accessibility, smaller subunits of the districts were used. The geographical boundary data along with their population in each subdistrict (*khoroо*) was sourced from opendata.gov.mn. With the population data of subdistricts, the access of urban parks was estimated more precisely. In QGIS, population data was integrated (Fig. 6) and estimated to be proportionally distributed within the *khoroо*, allowing for the calculation of the projected population of each district part inside the buffered zone.

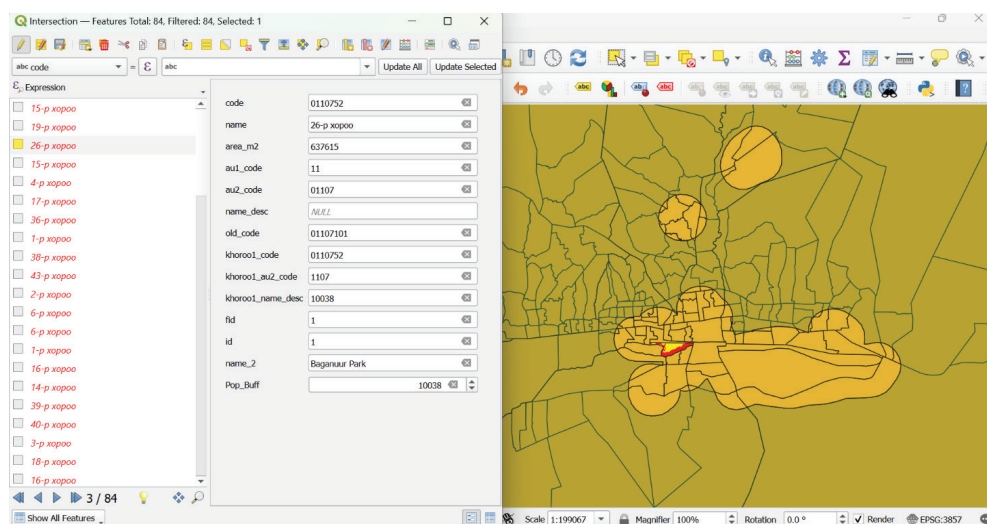


Figure 6. *Khoroо* boundaries intersected with buffered urban park areas in QGIS

6. Results and discussions

A total of 15 urban parks larger than 1 hectare were mapped in 7 out of 9 districts of the city of Ulaanbaatar. The remaining districts, Songinokhairkhan and Bagakhangai, have no urban parks larger than 1 hectare. The total number of parks with data on their size and names are shown in *Table 2*.

While mapping the parks, a noticeable concentration of urban parks was observed in the centre area of the city. The distribution of urban parks was not consistent, with Sukhbaatar District having 5 parks, whereas Songinokhairkhan District had none at all despite having more than twice the population of the former.

Table 2. Urban parks in Ulaanbaatar

District	Name	Area size (ha)
Bayangol	Railway Garden	4.1
	Railway Directorate Garden	1.1
Bayanzurkh	National Park	727.7
	Botanical Garden	17.7
Baganuur	Baganuur Park	1.7
Nalaikh	Chinggis Khaan Monument Park	90.3
	Misheel Garden	9.6
Khan-Uul	Tsengeldekh Garden	3.0
	Bogd Museum Garden	1.4
	National Green Infrastructure Park	35.5
Sukhbaatar	National Amusement Park	30.0
	Central Tower Garden	1.8
	Sukhbaatar Square Garden	1.4
	Parliament Garden	1.2
Chingeltei	Chingeltei Park	1.4

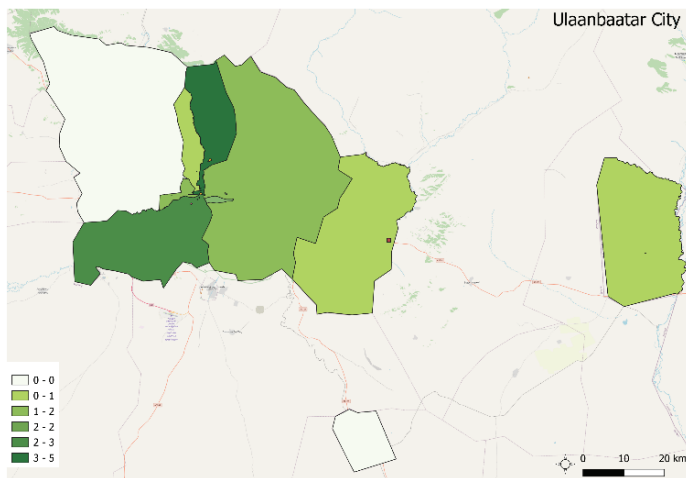


Figure 7. Number of urban parks in each district

As construction norms require, each district needs to have at least one urban park larger than 1 hectare; however, two districts out of the 9 have no such green areas. Urban parks were distributed inconsistently, regardless of the district's land size and population. The inconsistency of urban parks in each district is illustrated in *Fig. 7*.

To examine the spatial distribution of urban parks in relation to the proximity to the city centre, a buffer zone from the city centre was applied. This analysis reveals that out of 15 identified urban parks, 12 were located within an 8-km buffer zone (*Fig. 8*), indicating a concentration of parks close to the centre.

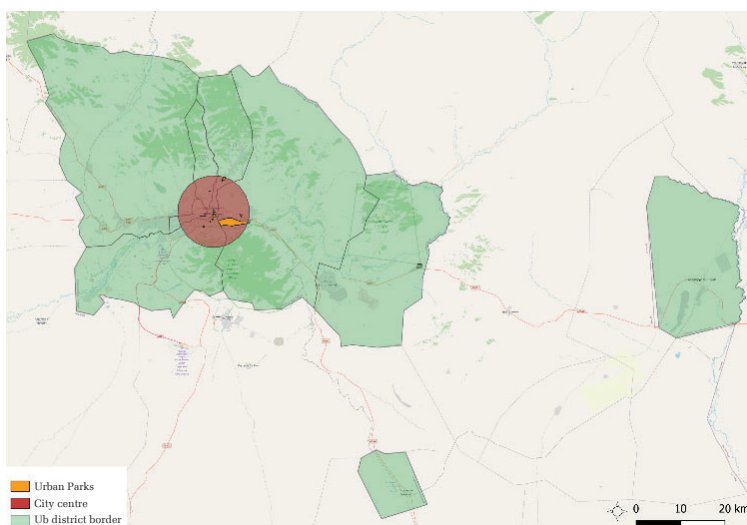


Figure 8. The 8-km buffer zone from the centre of the city

To calculate urban park availability in the city, area sizes and the number of residents living in that area were calculated. With the preferred walking distance from one's residence to a park being buffered, the area within walking distance of an urban park was calculated to be 6,893 hectares, which amounts to 1.47% of the total area of Ulaanbaatar. This result shows that less than 2% of the city's area has park availability. Out of the 9 districts of the city, 7 have urban parks, and from the 204 subdistricts only 84 have access to an urban park within walking distance.

For the population analysis, from the subdistrict population data, the calculation shows that 25.37% (415,864) of the total population lives within walking distance of an urban park. With the noticeable concentration of urban parks in the city centre, mostly the residents who live in close proximity to the central area can access the urban parks on foot in Ulaanbaatar. A comparison of the data on available and unavailable urban parks is shown in *Fig. 9*.



Figure 9. Urban park availability in Ulaanbaatar

Table 3. Integrated district information

Districts	Population (person)	Area of the districts (km ²)	District population density (person/ km ²)	Number of urban parks	Area of urban parks (ha)	Total population with urban park access
Bagakhangai	4,422	140.0	31.5	-	-	-
Baganuur	29,342	620.2	47.3	1	1.7	313
Bayangol	252,979	29.5	8575.5	2	5.2	96,581
Bayanzurkh	436,822	1,244.1	351.1	2	745.4	122,805
Chingeltei	136,280	89.3	1526.0	1	1.4	53,971
Khan-Uul	258,187	484.7	532.6	3	14.0	68,423
Nalaikh	38,690	687.6	56.3	1	90.3	156
Songinokhairkhan	341,390	1,200.6	284.3	-	-	-
Sukhbaatar	141,537	208.4	679.16	5	69.9	73,615
Total	1,639,649	4,704.4	12,083.7	15	927.9	415,864

The number and area size of the urban parks in their respective district together with their population and population density are illustrated in *Table 3*. This information shows there is no correlation between the area size of the district and the urban parks they have, and despite the high population, some districts have no urban parks at all. In addition to the table, *Fig. 8* concludes that the location and size of the urban parks in Ulaanbaatar are based on the proximity to the

city centre more than any other factors. This finding suggests an environmental injustice present in the city of Ulaanbaatar, where not even a quarter of the total population lives within walking distance to an urban park. It is important to note that the city of Ulaanbaatar, despite having 1.6 million residents, has only one form of public transportation, and it experiences significant traffic congestions on a daily basis, further complicating access to urban parks for residents living further away from the city centre.

7. Conclusions

The city of Ulaanbaatar has a history of over 300 years, and its urban planning started actively in the early 20th century, when the first urban parks were built. Currently, Ulaanbaatar is the capital city of Mongolia, with a population of over 1.6 million. The urban parks in the city have evolved and expanded over the past century; however, their distribution and availability has not been studied yet. The aim of this study was to map every urban park larger than 1 hectare in size, register them, and analyse their spatial distribution and availability within the districts as well as to the population.

The spatial analysis reveals that the distribution of urban parks in Ulaanbaatar is based more on the proximity to the city centre, regardless of other indicators such as population or land area size. There is a noticeable lack of urban parks in the outer areas of the city in contrast to their concentration in the central circle. Ger districts (enclosed residential areas consisting of traditional yurts) are deprived of green space availability in addition to the already concerning lack of engineering systems such as water and heating. Less than 2% of the total area of the city has urban park availability, and due to the limited transport options, it is difficult for the residents living in more remote locations to access urban parks and benefit from them. Using data on the population and the subdistrict (*khoroо*) borders, the population living within walking distance of the parks has been calculated. This analysis shows that only around one fourth of the population is living within walking distance of urban parks, indicating the evident environmental injustice in Ulaanbaatar.

The results from this study contribute to filling the gap in research on green space availability and distribution in Ulaanbaatar, creating a list of urban parks of the city of Ulaanbaatar regarding their size and location. In this study, only urban parks larger in than 1 hectare in land area were studied, and therefore further research including other forms of green spaces, such as smaller parks, informal green infrastructure, urban forests, and riverside green areas that could also provide environmental benefits should be conducted to assess environmental injustice in Ulaanbaatar more thoroughly. The registration of urban parks and the analysis of

their availability and distribution could be useful for developing further research as well as urban planning initiations as a foundational knowledge.

The urban plan of a city handles the preferences that different people, groups, businesses, and the government have for the city, along with their various needs of ecosystem services [13]. To address the gaps in urban green area distribution and availability, future urban planning initiations should focus on the development of new parks on the fringe areas of the city while improving public transport to the existing ones. Investing in green spaces in such areas would help all residents of the city, regardless of their location, to have equal availability to urban green spaces and would furthermore reduce the disparity of urban park availability in Ulaanbaatar.

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