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GIS-Based Analysis to Identify the Distribution and Accessibility of Urban Green Space in Dhaka Metropolitan City, Bangladesh

Mohammad Wahidur Khan[1*#], Md. Sazzad Hossain[2*], Mahbubul Alam[1*]

[1]Chair of Ecosystem Services, Technische Universität Dresden, Dresden, Germany
[2]Chair of Tropical Forestry, Technische Universität Dresden, Dresden, Germany
Email: [#]mwrkhan.es@gmail.com, mdsazzadforestry13@gmail.com, mahbub36@gmail.com

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Abstract

Urban Green Space (UGS) plays an important role in minimizing the negative effects of urbanization on city dwellers, which is predominantly factored into the accessibility to UGS. This study elucidated the distribution and accessibility of UGS in Dhaka, Bangladesh considering the paucity of such important scientific studies in the given area. The methodological structure of this study employed a multispectral Landsat satellite image from 2020 for identifying the logically defined UGSs, as well as a minimum proxy distance being the parameter to estimate accessibility to the UGS through a primary survey scheme and literature review. Considering UGS as a public area, we adopted a hybrid (combination of supervised and unsupervised classification) method followed by post-classification for UGS distribution assessment. The unsupervised classification identified the overall distribution of green spaces, whereas the anomalies of generated classes were rectified during the post-classification. Following the study findings, UGS in Dhaka metropolitan city accounts for only 602 ha or 1.9% of the total geographical space, with Ramna thana ranked as the highest contributor of 111 ha. However, in terms of accessibility to the UGS by city residents, 19.9% of the buildings in Dhaka metropolitan city were computed to be within the determined proxy distance of 500 m around the UGS. Also, parallel to UGS distribution, green space in Ramna thana (111 ha) exhibited the highest accessibility rate (64%) to the UGS compared with other thanas in Dhaka metropolitan city. The baseline findings will contribute to the long-term sustainable urban planning and development of more accessible green spaces in the study area.

Keywords

Urbanization, Urban Green Space, Accessibility, Proxy Distance

*MSc. Student.
#Corresponding author.

1. Introduction

Urbanization lays the platform for the economic growth and progress of any nation [1] [2] [3]. According to prior studies, urbanization generates lucrative income opportunities and has a substantial impact on socioeconomic development [4] [5] [6] [7]. It is reported that urban area produces more than 90% of the global economy and significantly reduces the poverty level [8] [9] [10]. Yet, most urban-living people are psychologically stressed and lead busy lives [11]. UGS can contribute to mitigating the negative consequences of urbanization [12]. UGS provides a variety of ecosystem services, including, to name a few, air purification, microclimate regulation, water retention and infiltration, and food production [13]. In addition to maintaining the environmental balance, UGS promotes individual health by providing spaces for sociocultural activities [14] [15] [16]. Therefore, in populated cities, like Dhaka, UGS is critically important since a higher number of people can get benefited from green spaces [17] [18] [19]. However, accessibility, one of the three factors (also includes quality and quantity) to evaluate the impact of the UGS on human benefits, is found to be uneven across city residents [20] [21] [22].

Dhaka metropolitan city (hereafter Dhaka) is one of the fastest-growing megacities in the world with a population of over 21 million and an annual growth of 3.5% [23]. Dhaka city has also a very high population density of 1464/km^2 [24]. This rapid population explosion has created the demand for developing more and more residential, commercial, and road infrastructures. Historically, the ever-increasing requirement has been met through the conversion of UGS and/or open spaces. According to estimates, in the 1960s, almost 80% of Dhaka's land was reported to be non-urban (consisting of UGS, wetlands, and open spaces), but by 2005, that number had dropped to about 25% [25]. Besides, it was predicted that the geographic area of Dhaka would only have 2% of green space in 2020 [26]. The dramatic reduction of open and green areas has been attributed due to a lack of policy and knowledge, inadequate management, poor political commitment, and unplanned development [27] [28]. Although the causes of urbanization and their impacts on land use and green space have been thoroughly documented, accessibility to UGS received very little consideration in the context of Dhaka city.

For instance, [27] identified the dynamics of urbanization and green space in Greater Dhaka. [29] used a multicriteria evaluation to determine the level of quality of the city of Dhaka's parks. [30] described the pattern of urban green space in Dhaka. [26] illustrated the historical and current changes in the urban green space of Dhaka city. On the other hand, [29] proposed potential locations for green space development through multitype green space modeling. However, no study has yet been undertaken to assess UGS accessibility in Dhaka city. Hence, this study intends to remove the study gap in UGS distribution and accessibility estimation using the Geographic Information System (GIS).

2. Materials and Method

2.1. Study Area

This study considers Dhaka, the capital of Bangladesh, as the study area (**Figure 1**). It is located between latitudes 23˚42'N and 23˚54'N and longitudes 90˚20'E and 90˚28'E [31] and covers approximately 306 km² [32]. Dhaka is further divided into 40 thanas (sub-district: local administrative unit), however, 21 of them fall under Dhaka metropolitan city [33], which were considered in this study. Dhaka is also Bangladesh's primary urban and economic hub, which houses approximately 9% of the total population and generates around 40% of the country's income [34]. People frequently relocate to Dhaka in search of economic advancement and an improved standard of living [35]. It should come as no surprise that Dhaka's yearly population growth rate, which is 4%, is far greater than the average national growth rate of 1% [27] [36]. Due to the high urbanization rate and high population influx, Dhaka is struggling to ensure a

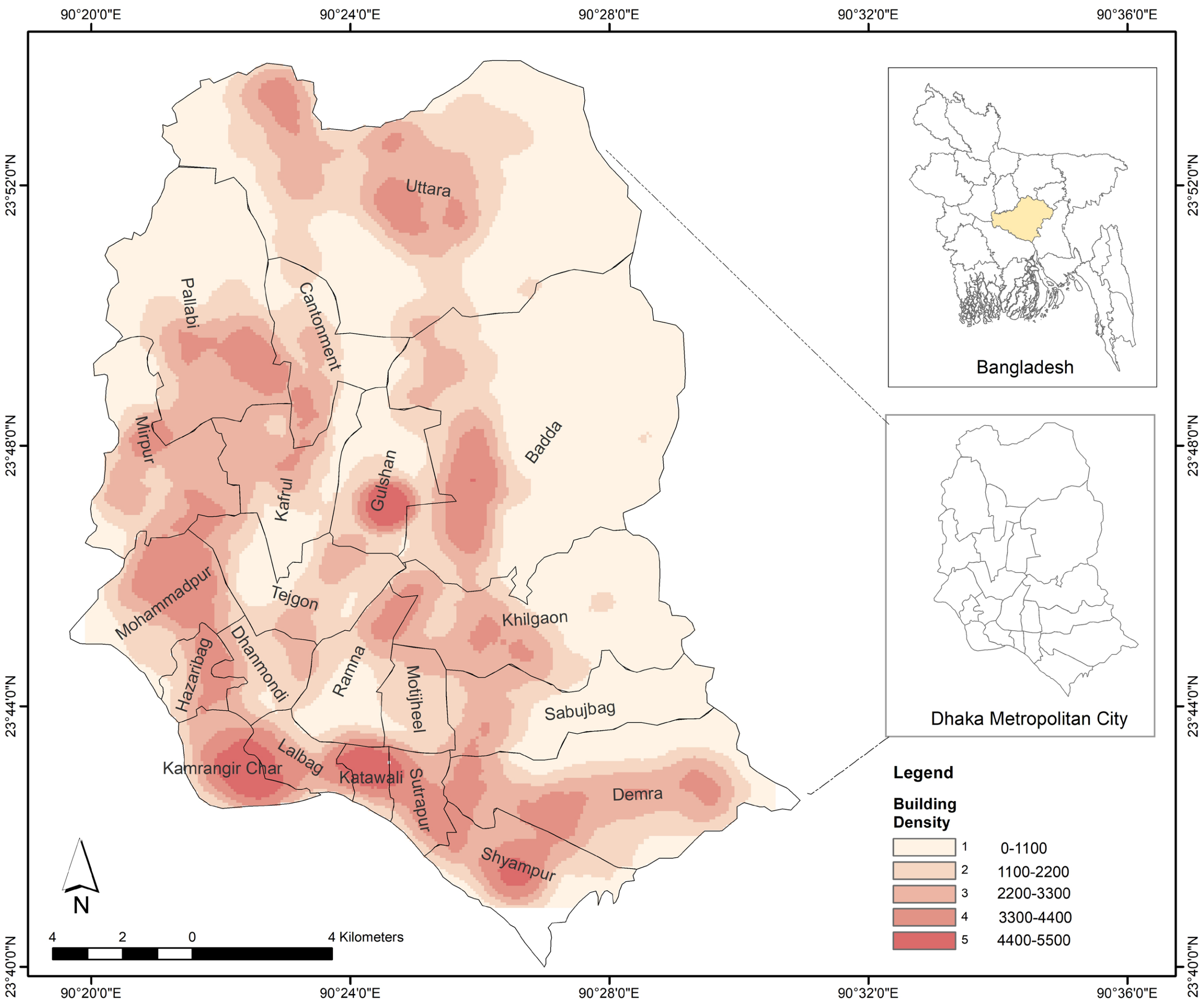

Figure 1. Location and building density of the study area.

sustainable urban environment including adequate UGS for city dwellers [37] [38].

2.2. Data Source and Collection Technique

This study made use of both primary and secondary data to assess UGS distribution and accessibility estimation. The UGS distribution was identified through satellite image analysis (using supervised, unsupervised, and post-classification techniques; detail provided in Section 2.3), whereas accessibility was calculated through the proxy distance between UGS and the living area (building) location. We carried out a scientific literature review, interviews, and discussion to determine the proxy distance that would best represent accessibility to UGS. Previous studies by [21] [22] [39] [40] also adopted the same technique for accessibility assessment.

Primary data related to computing optimal proxy distance was collected through personal interviews, Focus Group Discussions (FGDs), and Key Informant Interviews (KIIs). A total of eighty-four individual interviews (four from each thana) and twenty-one FGD (one from each thana) were carried out following several communities, users, and stakeholder groups. Respondents were chosen randomly and were well distributed by age, gender, and occupation. The respondents were asked about their perception of green spaces and modes of transportation used by them to go to UGS. The respondents also opined how far they think it is reasonable to walk in order to access UGS. Additionally, the key informants opined about the minimum distance that they considered optimal. Primary data was collected between May to August 2021. The response information was collected mostly on-site, however, participation over the internet (email or video call) was also encouraged considering the pandemic situation. Data from key informants, for example, government officials, urban planners, NGO personnel, and academicians were collected through face-to-face interviews solely.

Given the absence of historical data and/or official records, the use of multi-temporal satellite imagery has been found effective to assess different land use practices [27] [41]. Previous studies by [40] [41] [42] have successfully adopted the satellite image analysis technique to investigate the temporal distribution of green spaces in cities. Therefore, this study also used a cloud-free Landsat image (Landsat TM-30 m spatial resolution, acquisition date: 2020/12/27, row no 137 and path number 43) from https://earthexplorer.usgs.gov/ to determine the land use patterns and UGS distribution of the study area. On the other hand, building location was extracted from open street maps (https://www.openstreetmap.org). A schematic diagram of the methodology is illustrated in the following **Figure 2**.

2.3. Land Use Classification and UGS Distribution

For accessibility assessment and UGS distribution estimation, the first step is to define "UGS" and establish an explicit method for satellite image analysis. However, a globally accepted definition of green space has long been debated, and

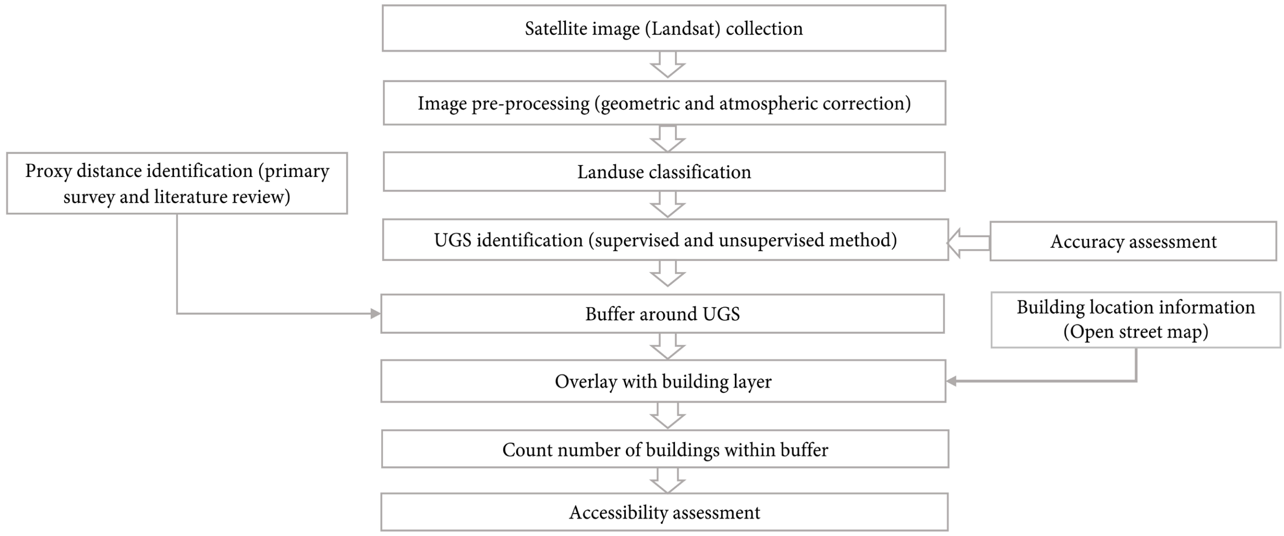

Figure 2. Methodology of the study.

Bangladesh is yet to develop one of its own [27]. Therefore, this study adopted the definition from [43] which outlined UGS as a public place that offers free access and provides a pocket of nature to all citizens. After defining UGS, we identified UGS distribution and accessibility, through satellite image analysis using a hybrid classification (supervised and unsupervised) method followed by a post-classification technique.

The outcome of land use classification from satellite image analysis depends on the quality (resolution, cloud cover) of the image and technique of landuse classification. However, free available satellite images often contain unsystematic errors [41] and thus require correction before analysis. Therefore, in the study, the geometric and atmospheric correction tool (Dark Subtraction and Radiometric Enhancement) of ENVI 5.2 (https://www.l3harrisgeospatial.com/) was used to remove those errors. As the size of the Landsat images was larger (170 km × 185 km) than the study area, the image sub-setting tool was used to clip the study area. Once the image is ready for classification, the major landuse of the study region were identified.

The research considered UGS (*i.e.*, parks, community gardens, continuously vegetated areas, etc.), urban fabrics (*i.e.*, roads, buildings, and bridges), water bodies (*i.e.*, canals, lakes, and rivers), and agricultural land (*i.e.*, croplands and pasture, and seasonal bare lands) as the major landuse types in the study area. It is worth mentioning, though the study is focused on UGS, other land use practices, for example, urban fabric, agricultural land, etc. which are closely related to UGS, were also identified. The reason for the identification of other land use classes is to separate each land use from others classes. For example, the adopted supervised classification technique can hardly distinguish UGS from agricultural land. Therefore, to separate UGS from agricultural land, it was necessary to create two classes. Moreover, the identification of all land use classes also contributed to the accuracy assessment of the landuse classification.

The pre-processed image was analyzed by ArcGIS 10.3 (https://www.esri.com/) to identify the aforementioned major land use classes. The image was classified using a supervised, maximum likelihood classification technique. However, this technique was unable to distinguish UGS from agricultural land (as both of them have an almost identical signature) with precise accuracy which could affect the outcome of the research. Therefore, to eliminate these abnormalities from the UGS classification, a post-classification technique was adopted. In that stage, the produced land use layer was overlapped over the Google Earth images to analyze areas of potential irregularities and classify them accordingly. However, due to cloud cover, it was not possible to compare the outcome of the generated landuse classification with the Google Earth image on the exact date. Still, the time difference between those two images (satellite image and Google earth image) was less than a month, which makes them appropriate for comparison. Areas, that appeared as different land use classes (either UGS in the produced land use class and agricultural field in Google Earth or vice versa), were categorized based on logical judgments. As such, the irregularities of land use classification were further amended.

According to the adopted definition, parks, community gardens, vegetated areas, and cemeteries are likely to be deemed as UGS. Having said that, the definition also specified areas, where access is restricted, and cannot be considered as UGS. This is why the green space of Dhaka Cantonment, Navy Headquarters, Bangladesh National Parliament, Army Golf Club, Dhaka International Airport, Old Airport, etc. had to be excluded from the UGS list. It is also worth mentioning that almost all agricultural lands of Bangladesh (no exception for the study area) are privately owned with no or very little public access. Consequently, agricultural land had also been left out of the UGS category. However, supervised land use classification cannot distinguish between places that offer access and that do not offer. Therefore, during post-classification, spaces that do not offer access have been excluded from the UGS layer.

Under the study, an attempt was made to collect a list of areas (park, community garden, etc.) from government sources (for example website, published governmental gazette, etc.). However, we did not find any information in this regard from any of the mentioned sources. Therefore, we had to rely on the data gathered during KII, FGD, and information available from non-governmental sources. We also used our understanding and knowledge to separate those places. Though large cemeteries meet the criteria (greenery and open access) to be considered as UGS, considering the spiritual values and religious beliefs those places were removed from the list as well. Post-classification also created the possibility to add green spaces (in reference to Google Earth images from 2020) that were not identified/classified during the supervised classification due to the use of medium-resolution images (30 × 30 m). During the post-classification, we scrutinized and rectified those anomalies as well.

After identifying the distribution of the UGS in the study area, the total geographical area (ha) covered by them was estimated. For a better understanding, we estimated thana-by-thana distribution as well as the percentage of each thana's area covered by UGS. The study also examined if there is any relationship between the area covered by UGS (thana wise) and the size of the thana through correlation analysis. The purpose of this investigation was to examine if the thana size influences the area of the UGS covering in the study area as well. In addition, the correlation between UGS and accessibility was investigated to see if a high UGS also led to high accessibility in the study area.

2.4. Accuracy Assessment

The land use classification should be treated cautiously because of the associated uncertainties [44]. Accuracy assessment can be a good approach to evaluating the outcome of the land use classification. In this study, the accuracy of the classification was estimated by the ground truthing survey. To collect real land use data, a set of 42 randomly generated sites (two locations from each thana) was chosen. The ground-truthing locations were widely distributed to cover as much of the study area as possible. The collected data was used to create a confusion matrix, which calculates the classification's accuracy as a proportion of classified land use to actual land use.

2.5. Accessibility Assessment

The standards and procedures for evaluating accessibility have been developed by several nations and city councils distinctively [45]. For example, American and British systems recommended that UGS should be accessible within 400 m and 300 m of one's living area, respectively [46] [47] [48]. Whereas, European Environment Agency (EEA) suggested 15 minutes (≈1000 m) of walking distance between the building and green space. [49] opined that accessibility to green space is optimal for vulnerable people when they are located within three to eight minutes of walking distance. Despite this, the existing policies of the Bangladesh and Dhaka structure plan 2016-2035 (draft) did not address any standard for accessibility to UGS [50]. In this situation, accessibility was estimated by adopting a straightforward buffering technique [45] [51]. The buffer zone is considered one of the techniques to measure accessibility to UGS. In this method, a polygon is created at a specific distance (for this study 500 m) from the green spaces and the number of a building located within this polygon is counted. The buildings that are located within the zone are considered to have accessibility. Through this method, the number of buildings located within a specific distance/buffer zone was identified.

In the study area, according to the respondents' perceptions, 10 minutes of walking distance best represent accessibility. According to findings of [52], the average walking trip is 15 minutes in Dhaka; and at an average speed of 1.11 m/s, one could travel approximately 1000 m (1.11 m/s × 60 × 15 = 999 m). However, in a more recent study, [33] claimed that the most preferable walking distance in

Dhaka is 500 m. This study also does not consider 15 minutes (1000 m) of walking distance, since it appeared to be a slightly long distance for the elderly and children. However, 10 minutes of walking distance from respondents' perceptions (≈600 m) is considerably close to the preferred walking (500 m) distance reported by [33]. Thus we adopted a 500 m distance as the threshold of accessibility assessment for this study. Through computer-aided programming: ArcGIS 10.3, a 500 m buffer around each UGS was developed. The buffer layer was then superimposed over the building layer and the number of buildings intersecting with the buffer layer was counted. Finally, the number of buildings that have accessibility was represented as a percentage of the total building number.

3. Results

3.1. UGS Distribution and Accessibility Estimation

The findings of this study show that around 602 ha area is covered by UGS which is approximately 2% of the geographic area of Dhaka. For further understanding, the study also identified the distribution of the UGS according to the administrative unit (thana). The analysis also indicates that Ramna thana holds maximum UGS coverage (111 ha), whereas Katawali thana has the least UGS distribution (1.7 ha). In terms of UGS distribution, Ramna thana has 14% of the topographic area being covered by UGS which is the highest within the study area. On the other hand, nearly 0.2% of the geographic area of Shyampur thana is covered by UGS which is the lowest. The distribution of UGS is enlisted in the following **Table 1** and is illustrated in **Figure 3**. This study adopted a 500 m distance between UGS and the living area/building as a proxy for accessibility assessment and buildings located within a 500 m buffer of the UGS and have accessibility to green spaces are illustrated in **Figure 4**. According to this study data interpretation, around 19.9% of the buildings of Dhaka is located within a 500 m buffer zone from green space, *i.e.*, have accessibility to UGS. It is worth mentioning that, around 2% of the geographic area of Dhaka is covered by UGS providing accessibility to around 20% of the buildings. Urban green space covers around 14.1% area of Ramna thana and provides accessibility to 64.4% of the buildings which is the highest in the study area (**Table 1**). On the other hand, Shyampur thana has 3.7% of the building access to UGS, seats at the bottom of the list.

3.2. Accuracy Assessment

For the accuracy assessment of the UGS distribution, a set of 42 randomly generated ground truthing points were selected. Those points were well distributed to represent the entire study area. The identified UGS distribution was compared with the real land use to develop the confusion matrix for accuracy assessment. The overall accuracy of the produced classification is around 94% (**Table 2**). The accuracy level is higher than the minimum accuracy standard of 85% [53].

Table 1. Distribution of UGS, building density, and accessibility to UGS of the study area.

	Urban green space area (ha)	Thana area (ha)	Green space (%)	No of UGS within Thana border	Total building number	Selected building number (located within 500 buffer)	Accessibility (%)	Building density
Ramna	111.2	788	14.1	15	8809.0	5670.0	64.4	1117.5
Motijheel	57.8	481	12.0	7	5684.0	1635.0	28.8	1181.8
Tejgaon	84.8	1079	7.9	9	12636.0	3135.0	24.8	1170.6
Dhanmondi	35.7	509	7.0	10	7147.0	3312.0	46.3	1404.9
Hazaribag	20.2	341	5.9	1	8055.0	1309.0	16.3	2362.1
Gulshan	53.6	939	5.7	22	15802.0	5809.0	36.8	1682.9
Sutrapur	15.3	386	4.0	4	11678.0	4752.0	40.7	3029.2
Mohammadpur	31.2	1070	2.9	6	23002.0	6173.0	26.8	2150.5
Kafrul	26.8	1075	2.5	7	13935.0	2233.0	16.0	1296.2
Lalbag	7.3	419	1.7	2	11768.0	1503.0	12.8	2806.3
Cantonment	13.5	942	1.4	7	11149.0	3015.0	27.0	1183.2
Pallabi	33.8	2425	1.4	15	27970.0	9230.0	33.0	1153.6
Sabujbag	12.2	1300	0.9	5	11715.0	3088.0	26.4	901.5
Katawali	1.7	201	0.8	3	10516.0	2624.0	25.0	5227.6
Uttara	40.0	6126	0.7	18	61992.0	10682.0	17.2	1012.0
Mirpur	8.5	1314	0.6	5	20274.0	2135.0	10.5	1543.0
Badda	30.2	4952	0.6	11	38154.0	4297.0	11.3	770.4
Demra	10.6	2362	0.5	3	36403.0	3326.0	9.1	1541.0
Kamrangir char	2.1	551	0.4	4	20916.0	3292.0	15.7	3796.0
Shyampur	2.0	1092	0.2	1	20610.0	756.0	3.7	1887.5
Khilgaon	4.3	2196	0.2	1	23192.0	1940.0	8.4	1056.1
Total	602.4	30548	2.0	156	401407.0	79916.0	19.9	

Table 2. Accuracy assessment of the UGS distribution.

Land use category	UGS	Urban fabric	Waterbody	Agriculture	Classification overall	Overall accuracy (%)
UGS	57	2	0	1	60	93.5
Urban fabric	1	9	0	0	10	
Waterbody	0	0	5	0	5	
Agriculture	0	1	0	8	9	
Overall truth	58	12	5	9	84	
User's accuracy	98.2%	75%	100%	88.9%	76%	
Kappa coffiecient (%)				0.87		

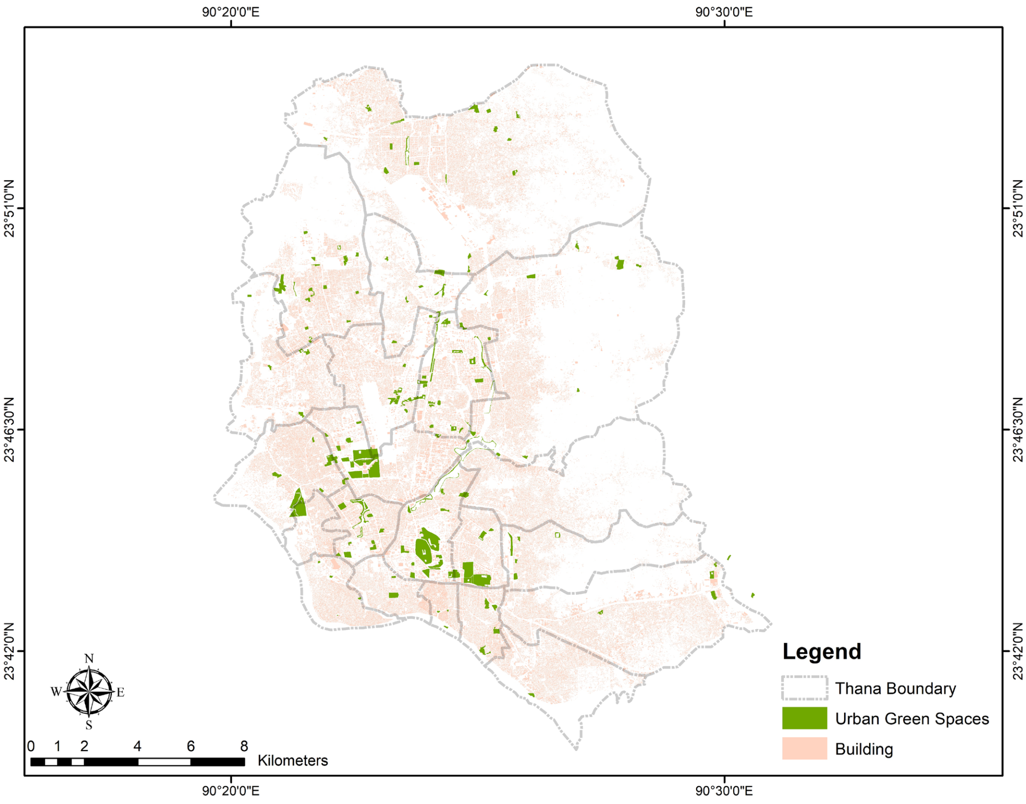

Figure 3. Distribution of UGS in the study area.

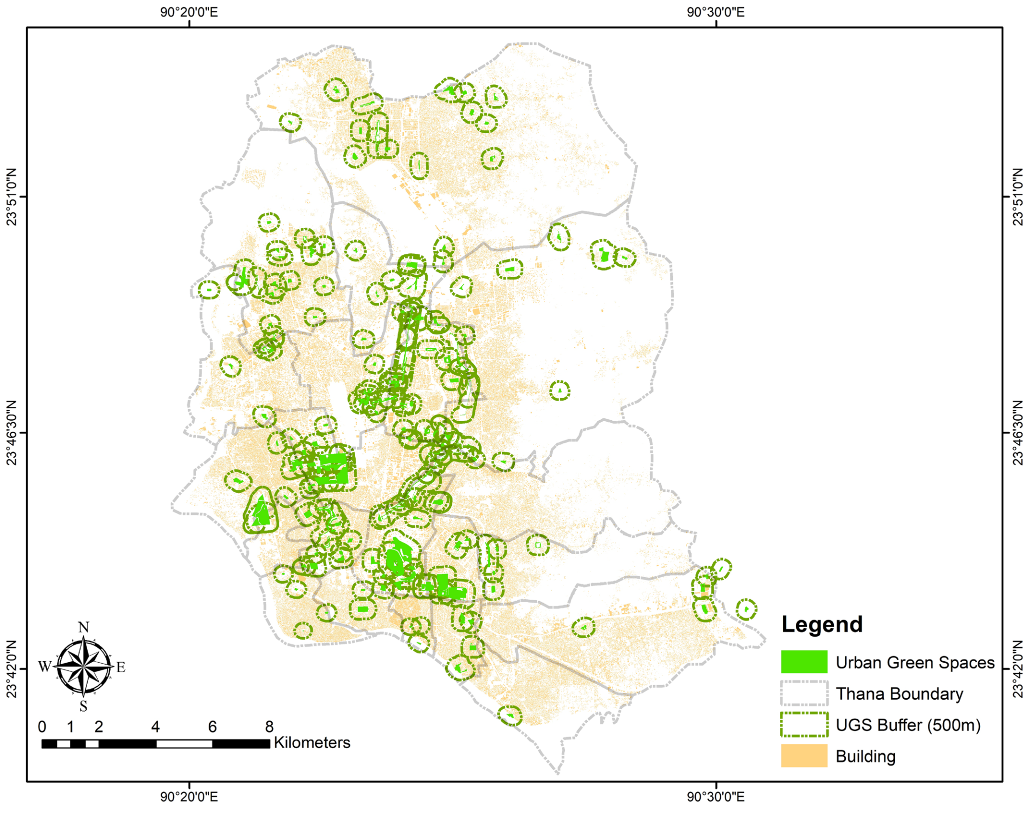

Figure 4. UGS accessibility map of the study area.

4. Discussion

Dhaka, with a population of over 20 million and an annual growth rate of 3.2%, is one of the fastest-growing megacities [32]. It is the main economic center of Bangladesh as well. Over the past years, the open and urban green spaces of Dhaka have been sacrificed to accommodate the need for residential and commercial infrastructures [33] [54]. Between 1989 and 2020, Dhaka lost nearly 56% of its green space [26]. According to this study, about 1.97% of Dhaka city's land area was covered by UGS in 2020, which is quite similar to the estimate of 2% made by [26].

The development trend of Bangladesh follows a sectoral rather than a spatial pattern [55]. Here, the developments are often unplanned and a bit rushed. A report from the planning commission acknowledged considerable discrepancies in development activities and budget allocation among different sectors in Bangladesh [55]. Thus, areas that are falling behind in development have fewer infrastructural facilities, and limited gas/power supply, and often receive smaller development allocations. As a result, over time, developments, administration, and trades have become more and more Dhaka-centric.

This study found that the headquarters of nationally important institutions, for example, Bangladesh Navy, Bangladesh Army, National Parliament, etc. are located in Dhaka. These institutions' premises own green spaces, however, accessibility to those areas is limited. The same also applies to green spaces under the ownership of the Roads and Highways Department (RHD), Rapid Action Batallion (RAB), and Bangladesh Airforce. It can be anticipated that access to UGS has been made limited considering the sensitivity of those areas. Therefore, the "presence of" those green spaces has no impact on the "accessibility to" UGS. This study further observed that green space in educational institutions like schools and colleges is also not accessible to common people. The accessibility is restricted in order to maintain the grounds' cleanliness and provide a private learning atmosphere. However, those UGS should be made more accessible to people, especially to children and youths. In a highly populated city like Dhaka where UGS is scarce, permitting people to visit those places, could increase overall accessibility. [56] also emphasized the importance to make educational institutions' green spaces more accessible.

The analysis indicates that only 1.97% of the geographic area of Dhaka is covered by UGS. Moreover, the distribution of UGS is uneven among the administrative units as well. Data analysis also identifies that accessibility is positively correlated with UGS ($r = 0.72$) (**Figure 5(a)**), whereas UGS is negatively correlated ($r = 0.36$) with thana area (**Figure 5(b)**).

The analysis implies that green space has not been developed keeping in mind the size of the thana or considering the number of inhabitants in the locality. For instance, Ramna thana has the highest UGS in the study area because of Ramna Park, which is one of Dhaka's biggest and oldest parks. The same also applies to Dhanmondi area, as Dhanmondi lake is located there. Among the recently

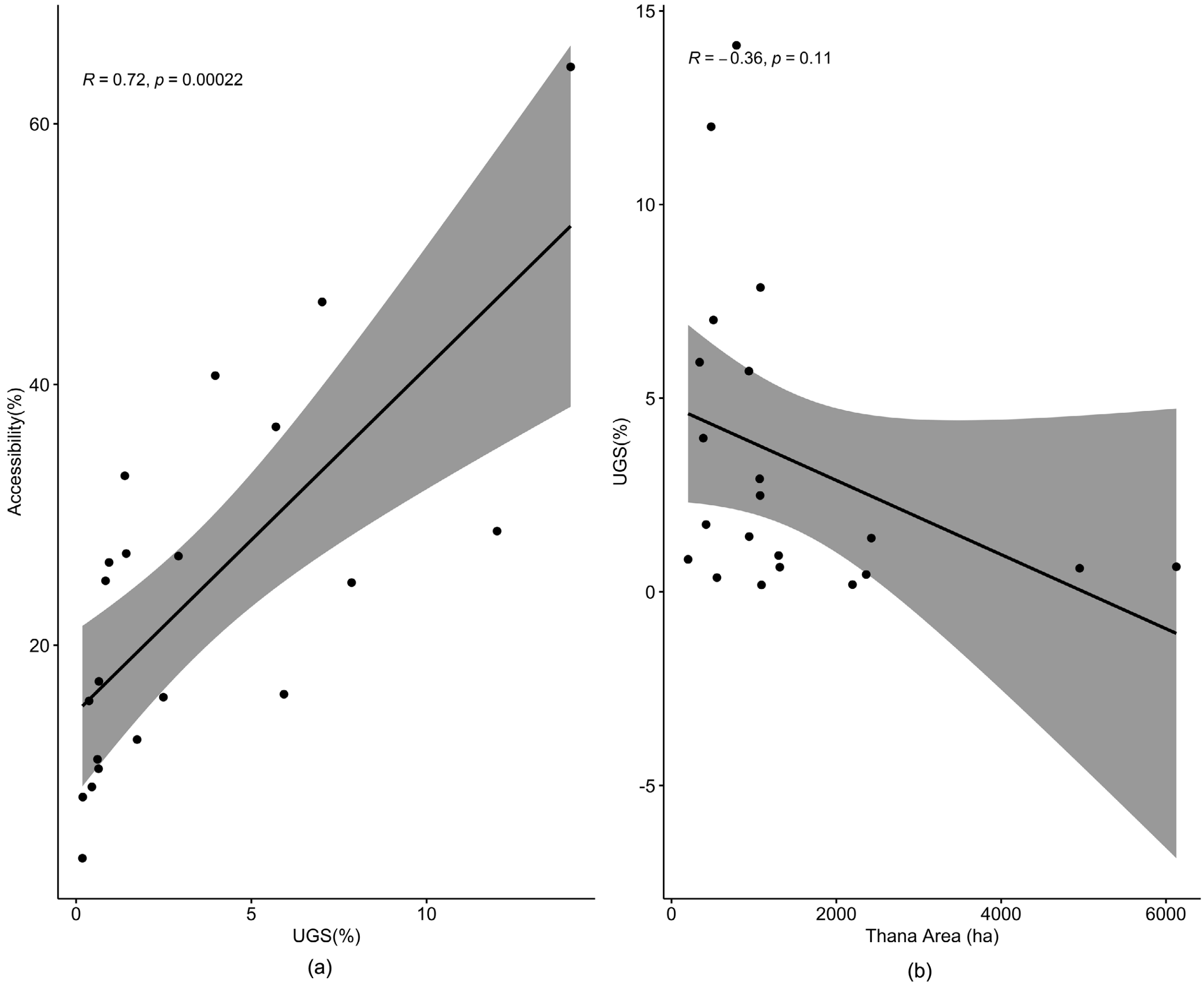

Figure 5. UGS distribution and accessibility correlation.

developed areas, for example, Uttara, Gulshan, Banani, etc., which are architecturally designed to be greener, this study disagrees with the perception. Gulshan which is considered the core of modern development has 5.7% of the area being covered by UGS, whereas in Uttara the amount is around 0.65% only. Therefore, this study argues that the initiatives to develop new UGS are quite insufficient.

Dhaka City Corporation (DCC) took an initiative in 2002 to plant 45,000 trees in Dhaka. However, due to the lack of open spaces, just 29,000 trees were planted [28]. In 2003, DCC planned to replace 6000 trees that were damaged from the previous plantation and further aimed to plant 60,000 trees more based on the availability of lands in Mirpur and Uttara. Nonetheless, the number of trees that were actually planted remained undocumented. There are 46 small parks and open places owned by DCC which could have been used for tree planting across Dhaka. Unfortunately, some of the parks have already been occupied by hawkers and the homeless, and others have been transformed into slums, bus stations, temporary marketplaces, etc. [28]. Additionally, government agencies have encroached on parks and open spaces in Dhaka due to the construction of community centers, government buildings, and residential areas [51]. Despite straightforward planning directives in the Detailed Area Plan (DAP) for recreational usage, different large-scale open areas in Dhaka are being forcibly occupied by government and semi-government groups. Among these, the Old Airport area, Border Guard Bangladesh (BGB) area, and central prison area are notable areas that are occupied by the corresponding ministries. Those places could be potentially utilized for further UGS development.

It was proposed that the ideal guideline for neighborhood-level parks should be 0.32 acres/1000 people [51]. Considering that guideline and the total population of Dhaka, there should be at least 6700 acres of green space, whereas currently there are only 1488 acres (602.4 ha) of UGS. Therefore to meet the standard, it is necessary to create new green spaces in the study area. According to the analysis, establishing smaller but many green spaces would be a better choice in the study region than developing a few large-size green spaces.

5. Limitations of the Study

There is no universal or globally accepted definition of the UGS and for the sake to make an assessment we adopted a definition from another study. However, depending on the definition of the UGS, the distribution assessment could vary. For example, in this study area, like the Navy headquarters, National Parliament, etc. were removed from UGS as they do not offer access. Due to religious beliefs and the use of the Cemetery, these places were also excluded from the UGS list, even though they permit open access. One could argue about the justification of the definition and criteria adopted in the study. Moreover, the study also argues the necessity to introduce the UGS definition in the study area.

The method that we adopted to evaluate accessibility is a buffering technique around green spaces and counting the number of buildings located within this area. We considered 500 m distance as a proxy for estimation to represent accessibility. The distance that we adopted is an approximate illustration based on the primary survey, literature review, and discussion. However, the distance that best exemplifies accessibility in the study area requires further research and argument.

The study utilized 30 m resolution satellite imagery to identify green space distribution. The use of higher-resolution satellite images might have identified more green spaces. However, to overcome the issue the outcome of the landuse classification was compared with the Google Earth imagery.

The attempt to prepare a list of green spaces that offer free access based on information from governmental sources did not succeed. Therefore, the study relied on information collected from the KII, FGD, and personal interviews. Any information available from governmental sources could have added more credibility to the study.

6. Conclusion

Dhaka plays an enormous role in the economy of Bangladesh. In order to meet the demand of a very high population size, the city has become a victim of unplanned development and has been reported as one of the least liveable cities in the world. To improve the living standard of the city, green spaces could play an important role. This study identified the distribution of UGS and reports that only around 2% of the geographical area of Dhaka is covered by UGS. Due to the high building density in the study area, comparatively a lower percentage of green space (2% of the geographic area) provides accessibility to a large number (20%) of buildings. However, according to our findings, the green spaces are not evenly distributed. For policy recommendations, it could be suggested to create new green spaces to make the UGS distribution consistent across the study area and also set the standard of the UGS (ha or percentage) that each thana should cover. This study could be considered as a baseline for future policy development for UGS distribution and accessibility assessment. Unfortunately, national and municipal policies are lacking in the study area which might be the operative tools to overcome this situation. Additionally, rather than developing ambitious plans, it is inescapable to prepare realistic and achievable goals. At the same time, it is also very important to ensure that the existing UGSs are being protected.

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Conflicts of Interest

The authors express no conflict of interest.

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