

1 *Type of the Paper (Article)*

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3 **Title: Structure and Composition of Plant Vegetation in Urban Area of Dhaka**
4 **South City Corporation, Bangladesh**

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25 **Abstract:** Plants are an important feature of urban ecosystems which provide numerous
26 environmental and ecosystem benefits such as defenses against noise and air pollution and
27 conservation of biodiversity. The aim of this study was to investigate the structure and composition
28 of urban vegetation in different urban habitats like roadsides, parks, gardens and playgrounds in
29 Dhaka South City area. Stratified random sampling method was used in this study. A total of 221
30 plant species belonging to 63 families were identified and recorded. Among all plant species
31 *Swietenia macrophylla*, *Polyalthia longifolia*, *Cocos nucifera*, *Samanea saman*, and *Artocarpus heterophyllus*
32 are recorded as the most dominant. Most of the tree and shrub population were found between 6-9
33 m and 1-3m height classes whereas most of tree and shrub population were found in between 10-
34 15cm dbh classes. Highest IVI was found for *Swietenia macrophylla* (193.22%) followed by *Polyalthia*
35 *longifolia* (184.59%), *Samanea saman* (138.37%), *Cocos nucifera* (79.9%) and *Delonix regia* (68.27%)
36 respectively. Average frequency, density, dbh and basal area were found 46.82%, 138.28 tree ha⁻¹,
37 458.59 cm ha⁻¹ and 12.33 m² ha⁻¹ respectively. Findings of this study reveals that structural attributes
38 of plant represent quite young and still developing vegetation. This research will help to plan for
39 future green infrastructure which will maintain ecosystem function, therefore, providing longer
40 term benefits for the city dwellers.

41 **Keywords:** diameter at breast height; basal area; frequency; density; important value index

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44 **1. Introduction**

45 Urban forest is one of the most important component of urban ecosystem that provide multiple
46 service and environmental benefits to urban environment [1]. These environmental benefits may
47 include conservation of energy, reduction of urban heat island effect, improve air and water quality,
48 carbon sequestration and biodiversity conservation [2,3]. Urban forest also provide some social and
49 economic benefits such as reduce psychological stress, quick recovery from illness, reduce health cost,
50 improve the quality of microclimate and increase the property value [4,5,6]. Most of the city dwellers
51 think that urban forest has the significant contribution to make the urban environment safe for city
52 peoples and improve the better quality of life. The vegetation in urban area is a highly altered and
53 dominated ecosystem in which structure and composition of species is determined by human actions
54 [7,8,9]. The ecological processes and functions which enhance the environmental quality within urban
55 areas are highly influenced by urban forest structure and composition [10,11]. Variation in sizes and
56 species of trees in an urban forest ensures the diversity of structures which support the variety of
57 values the urban forest provides [12]. An urban forest can be characterized in terms of composition,
58 structure, and function [13] where structure means the spatial arrangement and characteristics of
59 vegetation in relation to other objects (e.g. buildings, parks, roadsides etc.) within urban areas [14].
60 Species composition can be characterized as the number of plant species found in a landscape,
61 including trees, shrubs, and herbs and it reflects different patterns of urban vegetation and modern
62 land use system [15,16]. Forest structure indicates the distribution of vegetation, both horizontally
63 and vertically, in a given area [17]. Basic information that is necessary to describe urban forest
64 structure includes tree numbers, species composition, density, basal area and growing conditions
65 [18]. Additionally, different urban sites such as private gardens, parks, green spaces or road networks
66 may have different types of species composition [19,10, 20,11, 21].

67 In Bangladesh, conservation of biodiversity and forest is very essential especially in urban areas as
68 they are suffering through extreme degradation because of high population growth, lack of
69 awareness, motivational activities, over exploitation and rapid loss of natural resources [22].
70 According to UN-World Health Organization, 9 m² per capita greenery area is required for
71 environmental and other adjuvant services but the present situation of urban greenery in Dhaka city
72 is so measurable and less than 2m² greenery space per capita is present [23]. So it is necessary to
73 increase the green space and forestation by using all available land including park, playground,
74 garden, alley and roadsides to minimize this critical situation. Many cities in the world especially
75 European and American cities have represented their success by increasing the planting rate of
76 different plant species in their urban city areas [1]. However, environmental biotic and abiotic factors
77 in urban area sometimes not suitable for planting trees. Furthermore, most of the urban streets and

78 footways are permanently construct with concrete which considered as one of the major barrier for
79 tree plantation. Consequently, many factors determine the structure, composition, distribution and
80 diversity of plant species in urban area [24]. Information on vegetative structure and floristic
81 composition is indispensable in understanding the urban ecosystem dynamics [25]. Therefore, this
82 research was attempted to evaluate the structure and composition of plant species which was helpful
83 to know the existing urban vegetation and also help to increase the greenery and establishment of
84 urban forest in Dhaka City because no systematic study has been performed yet to analyze the
85 structure and composition of vegetative covers of existing green spaces in Dhaka city.

86 **2. Materials and Methods**

87 **2.1 Study Area**

88 The study was carried out in the Dhaka South City corporation area located along the bank of
89 Buriganga river ($23^{\circ}72'39''$ N, $90^{\circ}40'85''$ S) covering an area of 109.19 square kilometer (Figure 1). The
90 city covering with a population of 7.56 million and the average density of 69,237 people km^{-2} . It has
91 27 parks, 10 playgrounds, 3 gardens and 2 Cemeteries respectively which has the major contribution
92 to cover the urban vegetation of this city [26]. Dhaka south city corporation area has 781.83 km roads
93 and 217.38 km footway which contribute to make an urban forest structure through street tree species
94 [27]. The whole city lies at the elevation of 6 to 8 m above sea level [28]. According to the geological
95 origin of soils; it situated under the category of Modhupur soil tract (AEZ 28) which consists mainly
96 of silt and clay [29]. Soil of the experimental site mainly belongs to the medium high land and its
97 texture contains silt loam, olive-gray with common fine to medium distinct dark yellowish brown
98 mottles and pH 5.6 [29]. The climatic condition is mostly tropical and humid. Cool and short winter
99 with hot and long summer season is one of the major climatic condition of Dhaka.

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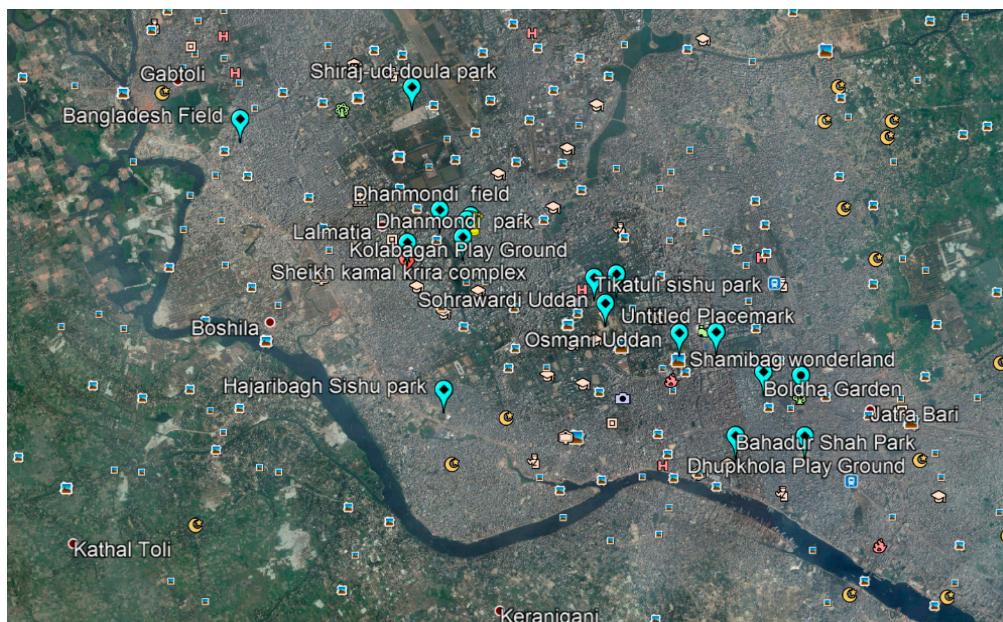


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(b)



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(c)

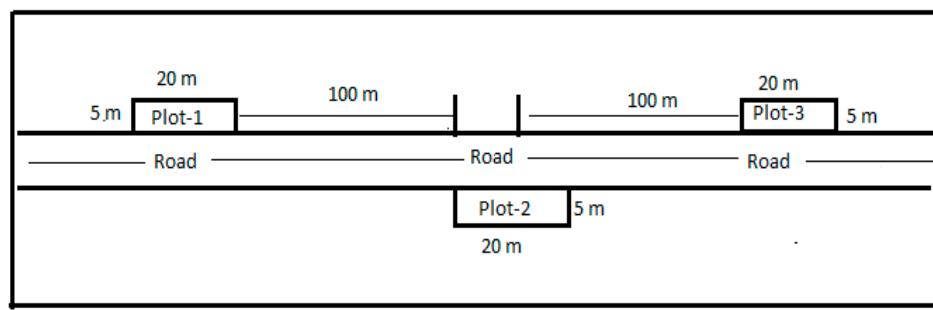
113
114 Figure 1. Location of the study area: (a) Bangladesh (b) Dhaka city and (c) Experimental plot
115 location in Dhaka south city area (Source: googlepro software).

116 **2.2 Sampling and data collection**

117 Reconnaissance study was made to the experimental areas from July 2016 to December 2016 in order
118 to get general information about the vegetation, accessibility to the parks, other green spaces and a
119 list of all tree species was prepared. According to vegetation characteristics the whole study sites
120 were divided into four categories (e.g. parks, playgrounds, gardens & roadsides). A total of 192
121 sample plots (parks-80, playgrounds-10, gardens-49 & roadsides-53) were taken and all plant

122 population except herb in each quadrat were recorded. At each habitat types, the quadrates were
123 divided into four specific sizes (park 15m×5m, garden 15m×5m, playground 10m×5m and roadside
124 20m×5m). The number of each tree species was also quantified. The sampling areas were selected
125 through random sampling method and quantitative assessment of structure and composition of tree
126 covers was done by stratified random sampling method.

127 In parks and gardens, 20 meter plot to plot distance was maintained whereas in play grounds 10
128 meter distance was adopted. In roadsides, plots were taken in a zigzag manner on both the sides of
129 road (Figure 2), in order to maintain variation and 100 meter plot to plot distance was maintained
130 [30].



131

132 Figure 2. Sampling method of roadside.

133 The diameters of all identified trees & shrubs were measured at breast height (1.3 m above ground)
134 using a diameter tape (5m length). Diameter of individual trees were recorded to calculate basal area
135 and relative basal area of plant species. Height of all sampling trees and shrubs were measured by
136 haga altimeter using the following percentage scale formula:

137
$$\text{Percentage scale: } \frac{(\text{TR}+\text{BR}) \times \text{H.D}}{100}$$

138 Where, TR= Top reading; BR= Bottom reading and HD= Horizontal
139 distance.

140 2.3 Data analysis

141 All the data was organized and analyzed by using MS Excel 2016, and statistical package for the social
142 science (SPSS-11.5 statistics). One way ANOVA and post hoc t test has been done to find out the
143 significant difference among different parameters.

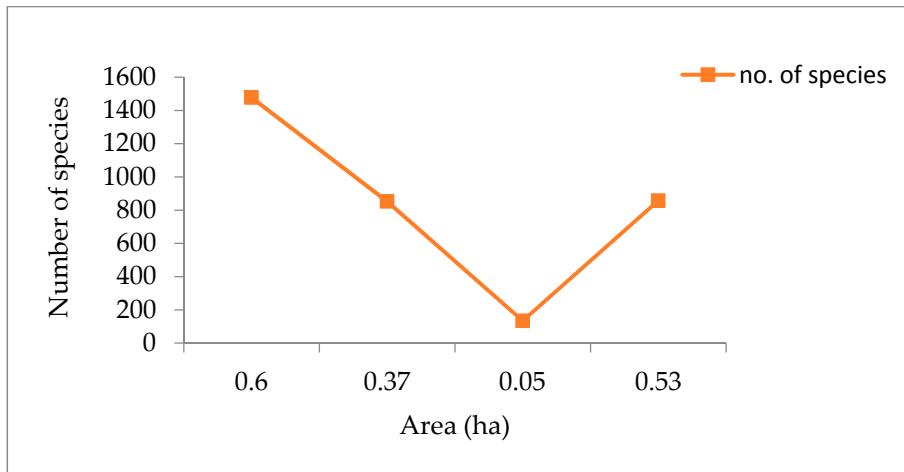
144 2.4 Vegetation Structure

145 The density (tree ha^{-1}), frequency (%), relative frequency (%), basal area ($\text{m}^2 \text{ha}^{-1}$), relative dominance
146 and Important Value Index (IVI) were calculated using the following formulas for quantitative
147 structure and composition of each trees and shrubs species [31,32,33].

186 **3. Results**187 **3.1 Number of plant population and size of the study area**

188 By comparing the number of species and the size of different study area indicates that with increase
 189 area size, the number of plant species increases as well. Park area (0.6 ha) showed the highest number
 190 of individual (n= 1478) followed by gardens (0.37ha; n=858), roadsides (0.53 ha; n= 856) and
 191 playgrounds (0.05 ha; n= 134) respectively (Figure 3).

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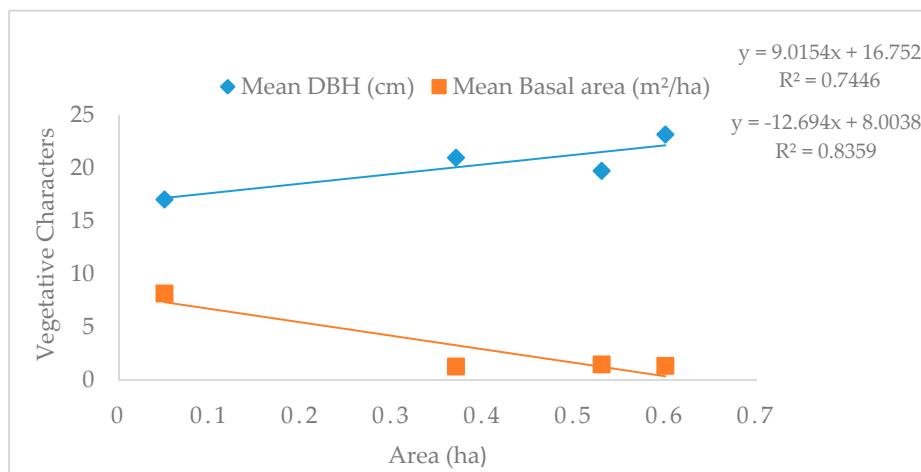


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194 Figure 3. Distribution of plant according to size of the study area.

195 **3.2 Relationship between study area and vegetative characteristics**

196 By comparing mean dbh (cm) and basal area ($m^2 ha^{-1}$) with four different type of study sites it is
 197 observed that mean dbh (cm) positively correlated with area size but slightly negative trend observed
 198 in case of basal area. Highest dbh was shown by parks (0.6ha) with the value of 20.99 cm and lowest
 199 value was found in playgrounds (0.05 ha, 17.05 cm). Similarly for basal area, the highest value was
 200 8.18 $m^2 ha^{-1}$ found in playgrounds and the lowest was 1.30 $m^2 ha^{-1}$ in gardens (Figure 4).



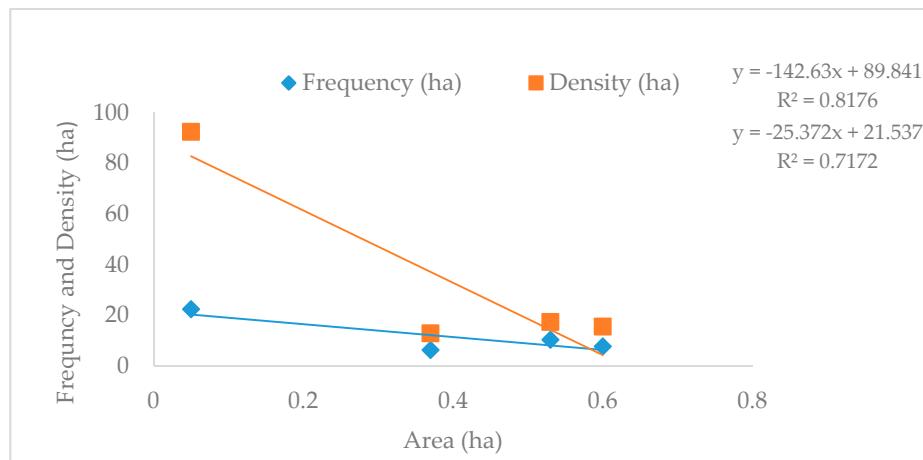
201

202 Figure 4. Relationship between area and vegetative characteristics among four different study sites.

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204 **3.3 Relationship between area with frequency and density**

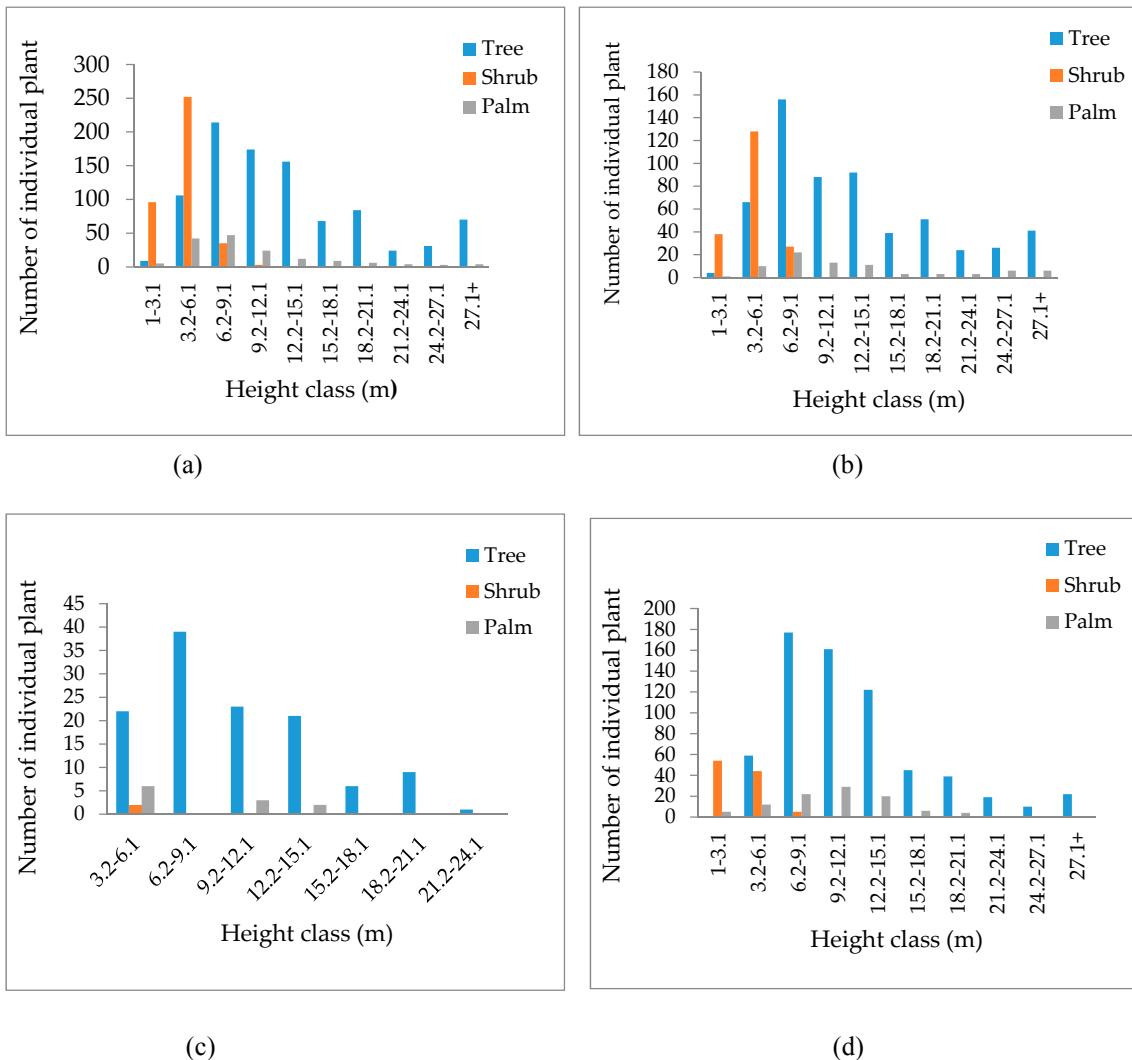
205 The graph shows a relationship between frequency and density with different study areas where both
206 of them show the negative trend. Highly negative relationship observed in case of frequency and
207 small negative relationship found in case of density. This figure also indicates that, playground (0.05
208 ha) shows relatively higher frequency (22.41) and density (92.4) rather than gardens (F=7.7, D=15.56),
209 parks (F=6.33, D=12.91) and roadsides (F=10.38, D=17.41) and the values are gradually decreased in
210 the order of playground >roadsides >gardens >parks (Figure 5).



211
212 Figure 5. Relationship between area size (ha) with frequency (%) and density (%) of four different
213 study area.

214 **3.4 Distribution of number of plant along with different plant height**

215 For the height structure, the classes were defined at regular intervals of 3m and the height classes are
216 categorized in comparison between areas. Differences in plant height among four categories of study
217 areas were not statistically significant. In parks, maximum numbers of trees and palms (n= 214 & n=
218 47) were enlisted in between 6.2-9.1m height class where maximum numbers of shrubs (n= 252) were
219 found in between 3.2-6.1m height class. Similarly, in gardens, maximum numbers of trees and palms
220 (n=156 & n= 22) were enlisted in 6.2-9.1m height class and shrubs (n=128) in between 3.2-6.1m height
221 class. Maximum numbers of trees (n=39), palms (n=6) and only 2 shrub species were found between
222 6.2-9.1m and 3.2-6.1m height classes in playground whereas roadsides contained maximum numbers
223 of trees (n=177) in 6.2-9.1m height and maximum numbers of palms (n=29) and shrubs (n=54) between
224 9.2-12.1m and 1-3.1m height class respectively (Figure 6). Trees and palms from almost all of the study
225 areas were found in between 6-9 m height class indicated that most of the trees are quite smaller in
226 height.



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(a)

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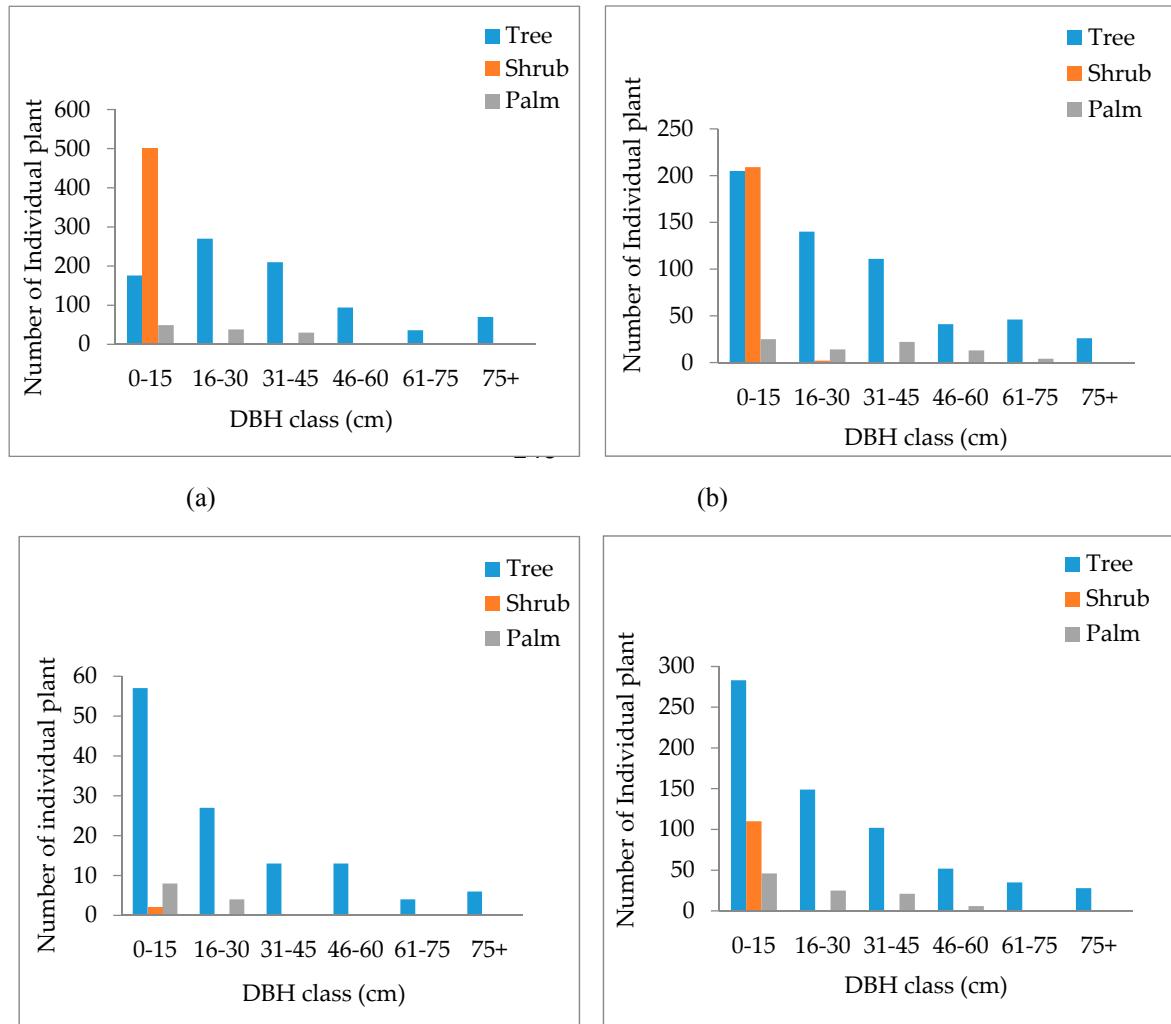
231 Figure 6. Distribution of number of individual along with different plant height classes among four
 232 different study areas (a) Park (b) Garden (c) Playground (d) Roadside.

233

234 3.5 Distribution of number of individual along with different dbh classes

235 In case of dbh, the classes were defined at regular intervals of 15 cm to improve the comparison
 236 between areas. It was observed that the differences in dbh among four categories of study areas were
 237 not statistically significant. In parks, maximum number of tree population (n= 270) were enlisted in
 238 between 16-30cm dbh class and maximum number of shrub and palm population (n=501 & n= 49)
 239 were found in between 0-15cm dbh class. Number of tree, shrub and palm in gardens (n= 205; n= 209;
 240 n= 25), playgrounds (n=57; n=2; n=8) and roadsides (n= 283; n=110; n=46) was found in same (0-15cm)
 241 dbh class (Figure 7).

242 However, maximum number of plant population belongs to the 0-15 cm dbh class in DSCC. Majority
 243 of plant population showed lower dbh and the number of individual plants decreased with the
 244 increase of diameter class in these study area. Significant variation observed in playground because
 245 shrubs and palm mostly absent in playground.



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(a)

(b)

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(c)

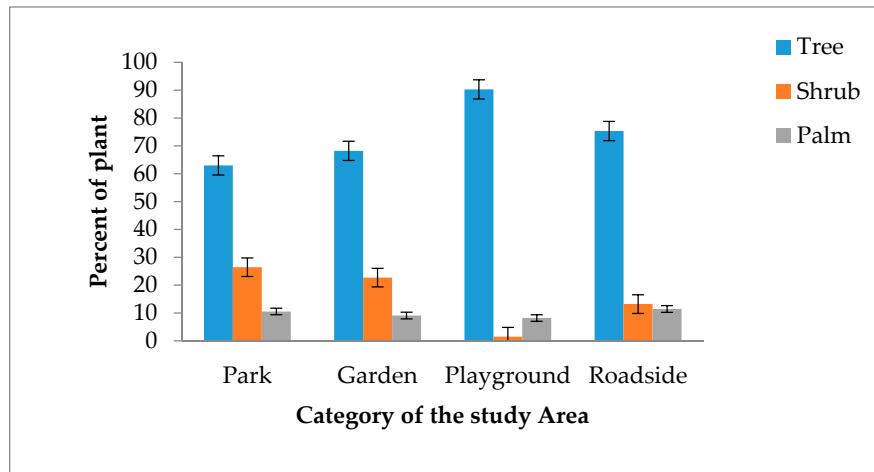
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250 Figure 7. Distribution of number of individual along with different dbh (cm) classes among four
 251 different study area (a) Park (b) Garden (c) Playground (d) Roadside.

252

253 3.6 Distribution of plant species according to the category of the study area

254 The bar graph shows the percent of plant species in four different types of study area (Figure 8).
 255 Significant variation among tree, shrubs and palm observed in Playground and it contained higher
 256 percent of tree species (90.29%) but lower percent of shrubs (1.49%) and palm (6.2%) species. Little
 257 variation has found in parks (trees=62.99%, shrubs=26.45%, palms=10.55%) and gardens
 258 (trees=68.18%, shrubs=22.72%, palms=9.09%) whereas in roadsides shrub (13.20%) and palm (11.42%)
 259 species shown no significant variation (Figure 8).



260

261 Figure 8. Distribution of plant species according to the category of the study area.

262 **3.7 Vegetation Structure**

263 Plant vegetation structure and composition represent the overall structural features of park, roadside,
 264 garden and playground in DSCC. Ranges of frequency (%), density (trees ha^{-1}), and basal area (m^2ha^{-1})
 265 ¹⁾ in four different study sites varied from 1.25-80.00, 1.67-600.00 and 0.01-113.91 respectively, where
 266 highest mean frequency, density and basal area observed after total 10 plot studied in playground
 267 ($F= 22.41\pm4.38$, $D= 92.41\pm11.87$, $BA= 8.18\pm4.67$) and lowest frequency and density found in park ($F=$
 268 6.33 ± 2.80 and $D= 12.91\pm4.30$) in total 80 plot studied. Only different is basal area which was lowest
 269 in garden (1.29 ± 1.56) (Table 1).

270

Table 1. Frequency, density and Basal area of four different study area.

Area	Frequency (%)	Range		Density ha^{-1}		Basal area(m^2ha^{-1})		Range	
		Min	Max	Min	Max	Min	Max	Min	Max
Park	6.33 ± 2.80	1.25-43.75		12.91 ± 4.30	1.67-138.33	1.36 ± 1.71		0.02-25.46	
Roadside	10.38 ± 3.23	1.89-54.72		17.40 ± 4.71	1.89-145.28	1.50 ± 1.78		0.01-21.51	
Garden	7.70 ± 2.70	2.04-36.73		15.56 ± 4.18	2.72-84.35	1.29 ± 1.56		0.02-17.27	
Playground	22.41 ± 4.38	10.0-80.0		92.41 ± 11.87	20.0-600.0	8.18 ± 4.67		0.02-113.91	

271

272 **3.8 Species Diversity and Structure of Twenty Most Dominant Species.**

273 A total of 221 plant species belonging to 63 families were identified and recorded from 192 sampling
 274 plot in four different study areas. Considering the relative density (RD), relative frequency (RF) and
 275 relative dominance (RD), *Swietenia macrophylla*, *Polyalthia longifolia*, *Samanea saman*, and *Cocos nucifera*
 276 were found most important plant species (Table 2).

277 Distribution of plant according to their family represented that Fabaceae and Arecaceae were most
 278 important and dominated family among the other families found in the study sites in respect of their
 279 number of species (28, 14), number of genera (22, 13) and also total number of individual (542, 337)
 280 (Table 3).

281 Table 2. RF, RD, RBA & IVI of twenty most dominant species in Dhaka south city area.

SL No	Species name	Relative frequency	Relative density	Relative dominance	IVI
1.	<i>Swietenia macrophylla</i>	240.61	304.7	34.35	193.22
2.	<i>Polyalthia longifolia</i>	308.8	231.39	13.58	184.59
3.	<i>Samanea saman</i>	67.84	166.13	182.64	138.87
4.	<i>Cocos nucifera</i>	198.8	143.45	5.73	115.99
5.	<i>Artocarpus heterophyllus</i>	28.49	145.09	4.41	59.33
6.	<i>Mimusops elengi</i>	27.53	162.7	7.83	66.02
7.	<i>Delonix regia</i>	47.72	140.71	16.38	68.27
8.	<i>Mangifera indica</i>	28.81	142.83	9.35	60.33
9.	<i>Ficus bengalensis</i>	106.6	81.42	8.72	65.58
10.	<i>Albizia richardiana</i>	8.88	94.43	35.92	46.41
11.	<i>Lagerstroemia speciosa</i>	14.4	103.73	5.5	41.21
12.	<i>Dypsis lutescens</i>	2.9	81.14	0.17	28.07
13.	<i>Tectona grandis</i>	25.53	88.96	4.76	39.75
14.	<i>Eucalyptus camaldulensis</i>	3.65	77.93	12.53	31.37
15.	<i>Terminalia arjuna</i>	24.01	75.23	9.72	36.32
16.	<i>Anthocephalus sinensis</i>	64.63	68.94	10.79	48.12
17.	<i>Dalbergia sissoo</i>	63.87	74.28	1.8	46.65
18.	<i>Acacia auriculiformis</i>	13.4	64.52	6.32	28.08
19.	<i>Mesua ferrea</i>	12.78	61.77	1.74	25.43
20.	<i>Syzygium cumini</i>	4.16	59.61	3.25	22.34

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Table 3. Number of species, genera and individual plant population according to the family.

SL No.	Family	No of species	No. of genera	No. of individuals
1.	Fabaceae	28	22	542
2.	Arecaceae	14	13	337
3.	Moraceae	13	5	211
4.	Malvaceae	11	11	74
5.	Apocynaceae	9	8	135
6.	Euphorbiaceae	8	7	86
7.	Rutaceae	8	4	47
8.	Bignoniaceae	7	7	23
9.	Rubiaceae	7	7	110
10.	Myrtaceae	7	5	143
11.	Combretaceae	7	4	154
12.	Lythraceae	7	4	114
13.	Solanaceae	5	5	42
14.	Meliaceae	5	5	276
15.	Annonaceae	4	4	176
16.	Anacardiaceae	4	4	92
17.	Sapotaceae	4	3	107
18.	Oleaceae	4	2	38
19.	Magnoliaceae	4	2	10
20.	Lecythidaceae	3	3	45

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289 **4. Discussion**290 **4.1 No of plant species**

291 A total of 221 plant species belonging to 63 families were identified and recorded from the study
292 areas in Dhaka south city area. The number of species is quite lower compared to the 376 species (140
293 trees, 162 shrubs and 74 herbs) found in an urban forest, Lore lindu park of Indonesia [34] and 267
294 species (113 trees, 89 shrubs, 65 herbs) found in the eastern Terai of India [35]. However, 116 species
295 (27 trees and 89 shrubs) in the urban forest of Fortaleza, Brazil [36] is quite lower than the present
296 findings followed by 126 species (87 trees and 39 shrubs) found in the Shenyang city of China [37].

297 **4.2 Height class distribution**

298 Almost all of the study areas of Dhaka south city, trees were found in 6-9 m height class indicates
299 most of the trees are quite smaller in height. In case of shrub species, most of them are 1-3.1m height
300 class which means the shrub species represents adequate height because of regular pruning and other
301 management practices. The findings of this study is lower than the research conducted in the
302 metropolitan areas of Sylhet city, Bangladesh where 48 percent of trees were found in 9-12m height
303 class [38]. In the deforested area of Chittagong, the maximum tree and shrub population was found
304 in 3- 4.9 m height which comparatively lower than present study value [39]. In urban parks of Sydney,
305 majority of vegetation including trees and shrubs found between 5-20 m height [40]. In the Shenyang
306 city of China, about 65% trees represent less than 10 m height [37].

307 **4.3 Dbh class distribution**

308 Trees and shrubs which has a placed with the urban living space are poor in diameter on account of
309 various ecological elements like polluted sources, chemicals, dirt into the surrounding air, soil, and
310 water. These factors are specifically impact on vegetation mortality and makes obstructions to
311 wildlife life development.

312 Maximum number of tree and shrub species in present study areas belongs to the 0-15 cm dbh class.
313 Maximum number of plant population showed lower dbh and the number of individual plants
314 decreased with the increase of diameter class (Figure 7). This result represented lower dbh class value
315 compared to the urban areas of Sao Paulo, Brazil where maximum native trees (>25%) were found in
316 the 22.5-27.5cm dbh class [41] but quite higher in comparison to the urban parks and recreation places
317 of Chicago, USA where maximum number of plant population including trees and shrubs are found
318 in the 1-3 cm dbh [42]. Most of the trees (about 76%) in the Shenyang city, China, represent less than
319 20 cm in diameter which are almost similar with the present study [37]. Another study was conducted
320 in vacant and commercial land at the Roanoke city of Virginia, USA found maximum number of trees
321 and shrubs in 7.1-15.2 cm dbh class [43] which near similar to the findings of this study. In this
322 research fewer number of individual tree were found with larger dbh values greater than 60 cm (dbh
323 > 60 cm) because of their growth form which can go up to this diameters [44].

325 **4.4 Distribution of plant species according to the category of the study area**
326 Playgrounds and streets of Dhaka south city have a scarcity of plant species compared to the garden
327 and parks. Park contains highest percentage of plant population (44%) whereas gardens and
328 roadsides represent 26% of plants. Playgrounds represent the lowest plant population (4%). Number
329 of plant population are greatly related to the area size and the number of plot studied. A study was
330 conducted in Barcelona city, Spain where parks have 43.10% and streets have 17.5% tree cover
331 whereas in case of shrub, parks and streets contain 35% and 3.2% shrub population respectively [45].
332 Similar study was conducted in Shahiwal city, Pakistan found 74% tree species present in Public Park
333 whereas 55% exotic and 45% local tree species in different institutions [46].

334 **4.5 Vegetation Structure**
335 Frequency, density and basal area were found 46.82%, 138.28 tree ha^{-1} and 12.33 $m^2 ha^{-1}$ respectively.
336 Stem density 418 ha^{-1} found in Kamalachori natural forest of Chittagong city, Bangladesh [47], 279
337 ha^{-1} in urban forest of Shenyang, China [48], 705 ha^{-1} in urban roadsides of Taiwan [49], 369 ha^{-1} in
338 Bamu reserve forest of Cox's Bazar, Bangladesh [50], 376 ha^{-1} in woodland of Metema area of
339 northeastern Ethiopia [51] and 484 ha^{-1} in forested landscape of central Himalayas [52]. These result
340 are quite higher than the stem density of present study (parks, playground, gardens and roadside).
341 Basal area 15.3 $m^2 ha^{-1}$ found in Kuandisha forest of northeastern Ethiopia, 102 $m^2 ha^{-1}$ in Wof-Washa
342 forest of Shewa, Ethiopia, 50 $m^2 ha^{-1}$ in Jibat forest, 45 $m^2 ha^{-1}$ in Denkoro forest, 115.4 $m^2 ha^{-1}$ in Tara
343 Gedam forest of northwestern Ethiopia [53,54,55], 16.88 $m^2 ha^{-1}$ found in Chunati Wildlife Sanctuary
344 Chittagong, Bangladesh [56], 27.07 $m^2 ha^{-1}$ in Dudpukuria Dhopachori Wildlife Sanctuaries of
345 Chittagong South Forest Division [57], 53.5 $m^2 ha^{-1}$ in Chittagong hill tracts [58], 21.10 $m^2 ha^{-1}$ in
346 Kamalachori natural forest of Chittagong city, Bangladesh, [47], 16.88 $m^2 ha^{-1}$ in Bamu reserve forest
347 of Cox's Bazar, Bangladesh [50] and 47.02 $m^2 ha^{-1}$ in Tankawati natural forest of Chittagong,
348 Bangladesh [59]. All of these result are also quite higher than the basal area of present study.

349 **4.6 Important Value Index (IVI)**
350 The importance value index (IVI) is an aggregate index that summarizes the density, abundance, and
351 distribution of plant species [60]. IVI reflects the degree of dominance and abundance of a given
352 species in relation to other species in an area [61,62]. Similarly, ecological significance of species can
353 be identified in the study area through important value index [63].
354 Findings of this study showed the highest IVI for *Swietenia macrophylla* (193.22) followed by *Polyalthia*
355 *longifolia* (184.59) and *Samanea saman* (138.87) (Table 2). Similar study was conducted in the urban
356 parks of Bangalore, India where IVI value found for *Polyalthia longifolia* 34.9 [64], 28.37 for *Swietenia*
357 *macrophylla* in the metropolitan area of Chittagong [65], 77.1 for *Swietenia macrophylla* in the urban
358 forest of Sri Lanka [66] and 21.41 for *Samanea saman*, and 2.01 for *Swietenia macrophylla* in the roadsides
359 of Southwestern Bangladesh [30]. The high Importance Value Index (IVI) of these species in green

360 areas of Dhaka south city indicates their dominance, good power of regeneration, their growth habits
361 and potential to tolerate diverse environmental condition of urban settlement.

362

363 **4.7 Composition of tree and shrub species according to family, genera and number of individuals**
364 A total of 221 species distributed into 63 families and 135 genera identified in the study area of Dhaka
365 south city (Table 3). The number of species, families and genera was higher in comparison to 72
366 species, 30 families and 65 genera found in the urban forest of Nigeria [67]. Another study conducted
367 in the public land of Melbourne city, Australia found 399 species and 52 families [68]. Fabaceae was
368 found as a richest family being represented by 28 species, 22 genera and 542 individuals followed by
369 Arecaceae (14 species, 13 genera and 337 individuals), Meliaceae (5 species, 5 genera and 276
370 individuals) and Moraceae (13 species, 5 genera and 113 individuals). Fabaceae family also
371 represented as the richest family with 18 species found in the urban forest of Brazil [36] and urban
372 area of Congo with 188 species [69].

373 **5. Conclusion**

374 Urban tree plantation is desirable from both aesthetic and environmental perspectives. At present,
375 Dhaka city has very small amount of green structure. Species composition and abundance decreasing
376 continuously as areas are covered by different infrastructure. Existing very little vegetation also not
377 under well managed. During this study it was found that out of 27 registered park of DSCC, more
378 than 10 parks have gone extinct due to illegal possession by rickshaw and car garage, restaurant,
379 official club, kitchen market etc. which gradually shrinks the urban vegetative areas. Moreover,
380 species composition in playground and garden are also not satisfactory. Roadside vegetation still in
381 early stage. Fostering people's awareness, proper management by particular authority with strict
382 government policy and law regarding urban vegetation could be a potential steps to establish and
383 conserve vegetation spots. Considering the present situation of the urban vegetation of Dhaka south
384 city corporation, it is need to suggest that appropriate planning and management technique like
385 afforestation by different plant species, restoration of vegetation area are the effective modes to
386 conserve biodiversity, functioning the natural ecosystem and improve urban tree coverage.

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389 Shahriar Jaman, Ishrat Jahan and Md. Forhad Hossain designed the study, analyzed the data, wrote
390 the main protocol, and wrote the first and final draft. Author Mahbuba Jamil and Md. Javed Azad
391 checked and evaluate the first and final draft. Author Md. Shariful Islam and Md. Golam Jilani Helal
392 directly helped in field experiment. All authors read and approved the final manuscript.

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394

395

396 **References**

397

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