

## PLANT SPECIES, PERCEPTION AND INTANGIBLE BENEFITS OF THE VEGETATION OF RAMNA PARK, DHAKA

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### Abstract

The study concerns with the evaluation of the current status of plant species composition and also perceptions and views of visitors on intangible vegetation benefits of Ramna Park, which focuses on determining the evaluation of the park in terms of physical/natural characters, accessibility, surroundings, motive for use, and the significance and quality of an urban green space in a megacity. A total of 384 people participated in a questionnaire composed of closed and open-ended questions. The study identified a total of 352 plant species under 96 families from the park area. The percentage of native and exotic species was found here at 49 and 51%, respectively. Based on people's perceptions, the study revealed that Ramna Park was more valued for its accessibility, green space characteristics, conservation, and importance of greenery in city dwellers daily lives. Among the participants, 41% visited the park for walking and relaxation, followed by 17% for physical exercise. In addition, regarding the participant's overall perceptions of intangible urban vegetation benefits, 48% of people were satisfied in terms of planning, 77% were satisfied with the current greenery, and 38% were satisfied with current security. Moreover, 52% of people were not able to identify the plants in the park area, and 84% of people could not distinguish the plants between native and exotic. Most of the participants (97%) mentioned the need for more parks and demanded parks having native plants with improved maintenance and proper administration throughout the city. Visitor's opinions revealed that the support was realized for the importance and management strategies of Ramna Park as it facilitates socialization, leisure, recreation, and physical activities. Recommendations include promoting the dominance of native species, replacing exotics gradually, increasing the number of wildlife supporting species, enhancing public awareness, and integrating expert opinion into urban plantation programs.

### Introduction

Urban vegetation is an essential element of urban ecosystem and environment. They are the main natural elements in cities and play an essential role in sustainable urban growth through the provision of ecological, economic, and social benefits (Xu *et al.* 2020). Currently, increased urbanization has led to a decline in the quality of the urban environment, particularly in larger towns and cities, affecting people's quality of life (Saldiva 2018). In Bangladesh, more than 35% of the population live in urban areas. According to Dewan *et al.* (2021), the country's urban population tripled between 1990 and 2019. Rapid urbanization is challenging for developing countries like Bangladesh (Rana 2011) because it causes pressure on social, environmental and economic well-being (Zinnia and Mcshane 2018) and a sharp decline in natural greenness (Dewan *et al.* 2021). According to Dewan *et al.* (2021), the country's urban population tripled between 1990 and 2019. Yet, inhabitant's needs for green space and its management are often ignored (Rahman and Zhang 2018). In light of competing land use needs, current trends indicate that green spaces in cities like Dhaka will continue to experience severe pressure. In a research by Nawar *et al.* (2022), it was found that the healthy green space of Dhaka city stands at only 2% in 2020. Whereas, in 1989, it was 17% of total land cover. So, the city lacks green space more than ever

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and the last remaining green covers are also in the threat of degradation. Regarding these green spaces of Dhaka city, several articles have been published in recent years including Uddin and Hassan (2016), Uddin *et al.* (2021) and Shila *et al.* (2024). However, these researches only enumerated plant species in different parts of Dhaka city and they didn't record the perception of people on intangible benefits that these green spaces provide. However, a single research on public perception done by Sultana and Selim (2021) was found that only focuses on the green spaces present randomly around the areas of South Dhaka. On the other hand, Pasha *et al.* (2021) worked on the ecosystem of Ramna park but did not work on its intangible benefits. To fill this void, the present study aims to know the composition of plant species within Ramna Park, characterize the physical, mental, and recreational values of the park, assess the accessibility of the park for various user groups, understand public perception and knowledge on plants and urban green spaces, particularly in relation to Ramna Park, and determine the statistical significance of these findings.

### Materials and Methods

Ramna Park is one of the picturesque green spaces in Dhaka city with a lake in center whose history is as old as Dhaka itself. It is situated in Ramna area of Dhaka with a total area of 68.50 acres (2,77,200 m<sup>2</sup>), of which the lake covers 8.76 acres (35,500 m<sup>2</sup>). The park is easily accessible by walk, bus or any other modes of transportation because of its suitable location in the heart of Dhaka city. The area is geographically fenced, and the park is distinguished by a large, lush area with a variety of vegetation and a lake with fish, water fowl, ducks and different types of birds. The park features many beautiful and modern venues for relaxation which is maintained by the Public Works Department of the Government of Bangladesh.

The study area was visited several times in different seasons from July 2021 to June 2022. Random Meander method by Cropper (1993) was employed to record floral species, their habits and occurrence. Species identification was done by following different Floras including Siddiqui *et al.* 2007 and Ahmed *et al.* 2008-2009. Moreover, some exotic plant species have also been identified comparing with the reports of Hossain and Pasha (2001). Semi-structured close-ended questionnaire was used to gather data from people of different age groups and professions. A sidewalk interception, or street-intercept survey method was used to document people's opinion which is based on a non-selective recruitment of respondents from the streets indirect contact with their surroundings to gain quick access to their information (Lewis-Beck *et al.* 2003). This method can potentially provide high-quality data with reliable profiles of participants (Mulhall *et al.* 2008).

A total of 384 people were interviewed during the field visits in Ramna Park. The sample size was determined following Godden (2013). The Statistical Package for the Social Sciences (SPSS Statistics) and MS Excel were used to assess the participants' responses in the closed-ended questionnaire. After performing descriptive statistical analysis, an Independence test ( $\chi^2$  test) was conducted to find the significant relationship between responses of park visitors and various characters. A t test was used to determine the mean value of the responses based on the informants' age with its association with urban vegetation knowledge. All tests were done for 95% confidence limit.

### Results and Discussion

A total of 352 plant species belonging to 96 families were recorded during the survey. Families with the highest number of species include Asteraceae (6%) followed by Euphorbiaceae (5%), Fabaceae (4%), Poaceae (4%), Apocynaceae (4%), Rubiaceae (4%), Moraceae (3%), Arecaceae (3%), Solanaceae (3%) and Mimosaceae (3%). These 10 families with the highest

number of species collectively contain 39% of all species, whereas the remaining 86 families represent 61% of the total species (Fig. 1). All plant species were classified based on their habits into herbs, shrubs, trees, climber and parasites. It was noted that most of the plants were trees belonging to 132 species (38%) followed by 114 species of herbs (32%), 72 species of shrubs (21%), 31 species of climbers (8%) and 3 species of parasites (1%) (Fig. 2). Shila *et al.* (2024) documented 156 tree species in Ramna Park, exceeding the number found in this study. The observed difference in species counts can be explained by the distinct methodological approaches. Shila *et al.* (2024) adopted a stratified random sampling method, whereas the present study followed a random meander sampling technique.

According to the study, among the recorded species, about 30% are used for various medicinal purposes and 29% species are used as ornamental plants. Moreover, 9% species are timber-producing followed by 18% wildlife supportive and 14% consumed as foods (Fig. 3). The study found that majority of the native plant species in the park are in lower in number, while the exotics dominate nearly all of the parks' greenery. In terms of species number based on origin, most of the species were exotic (51%) and the rest were native (49%) (Fig. 4). Shila *et al.* (2024) documented a comparable pattern of purposeful species within the Ramna area, encompassing Ramna Park, the University of Dhaka campus, and Suhrawardy Udyan. Their research indicated similar proportions of exotic and native species as of this study, with ornamental and timber-producing species constituting the majority of the total species count. Moreover, Uddin and Hassan (2016) and Uddin *et al.* (2021) documented approximately 41% and 56% exotic species, respectively, in the University of Dhaka campus and road dividers of Dhaka city. These findings, in conjunction with the results of this study, present a grim picture of Dhaka's green landscape, which should ideally preserve the city's true green heritage.

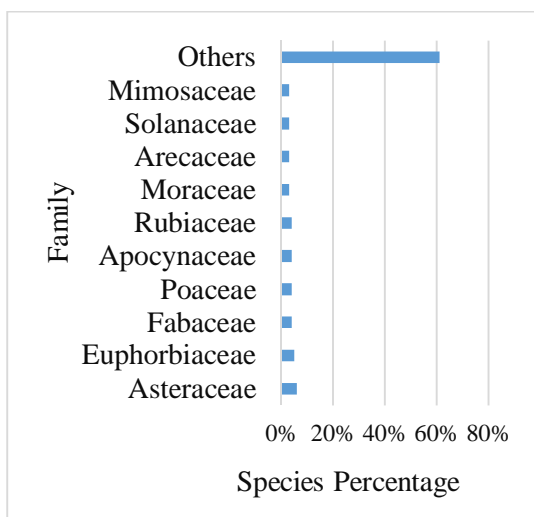


Fig. 1. Plant families with the percentages of species.

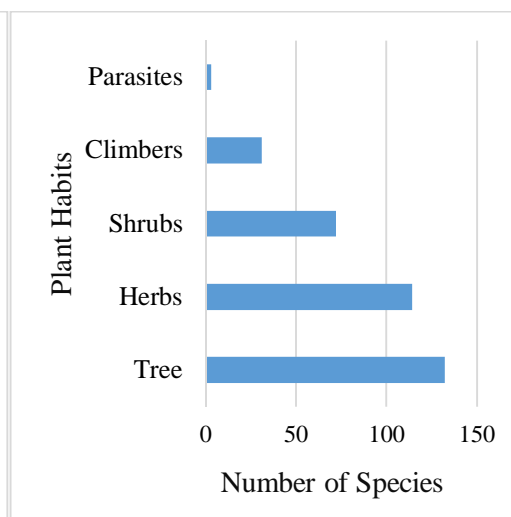


Fig. 2. Number of species of different habits.

The majority of respondents (74%) typically walk to the park, while a smaller percentage utilize other modes of transportation, including bus (9%), rickshaw (9%), bicycle (5%), and car (3%). This could be the result of the presence of several residential areas in the outskirts of Ramna Park including Eskaton, Segun Bagicha and Shahbag. Moreover, people from moderate or long

distant areas don't regularly visit the park considering Dhaka's high rate of traffic jam which consume long hours to travel. Regarding travel time, a significant portion of respondents (42%) can reach the park in less than 30 minutes. However, a considerable number take longer, with 30% requiring more than an hour and 28% taking between 30 minutes and an hour. In terms of preferred visiting times, the morning is the most popular choice for 50% of respondents, followed by the afternoon at 31%. The remaining 19% tend to visit the park in the evening. The lack of dedicated exercise spaces within Ramna areas, combined with the peaceful morning atmosphere, may contribute to the preference for morning and afternoon visits of the respondents. Moreover, the park's location amidst administrative, educational, commercial, recreational and residential building makes it a more tranquil option for nearby city dwellers during these times.

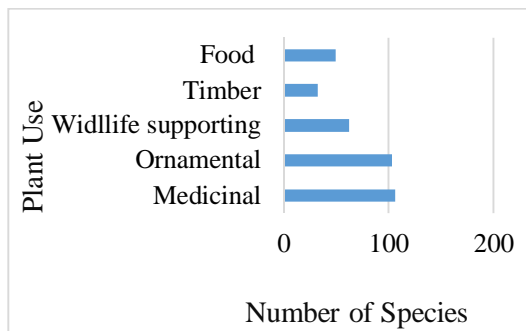


Fig. 3. Plant use for various purpose.

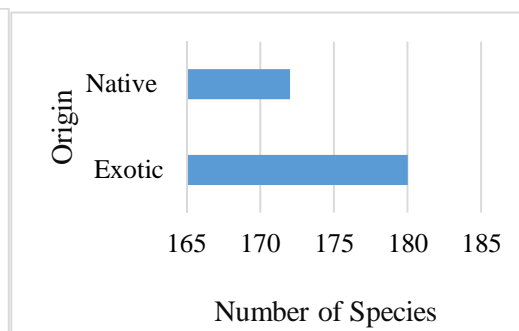


Fig. 4. Tree species according to origin.

The primary purpose for visiting the park, according to 41% of respondents, is for leisurely walks and relaxation. Physical exercise, particularly in the morning and evening, is another popular reason, accounting for 17% of responses. Socializing with friends is also a significant motivation, cited by 22% of respondents. Other reasons for visiting the park include spending leisure time and holidays (11%), attending social gatherings like Pahela Baishakh (Bangla New Year) and book fairs (2%), and enjoying special moments like dating or seeking mental refreshment (5%). A smaller percentage of respondents visit the park for their children to play (1%) or to appreciate nature (1%).

The study revealed a significant gap in public knowledge about urban plant species composition. A majority of respondents (52%) were unable to identify tree species within the park, while 84% lacked the ability to distinguish between native and exotic plants. Furthermore, in terms of awareness about the negative impacts of exotic species, 54% of respondents were unaware of any potential harm caused by these species to the park's biodiversity. This lack of awareness is particularly concerning given the prevalence of exotic species in Dhaka's urban landscape, as confirmed by previous studies of Uddin *et al.* 2021 and Shila *et al.* 2024. The limited knowledge of plant identification among respondents hinders their ability to differentiate between native and exotic species. This has serious implications for urban biodiversity conservation. Moreover, most nurseries in Dhaka city predominantly sell exotic species and the city dwellers are falling for that as they lack the knowledge about the harmful impacts of exotic species on the city's biodiversity, especially avifauna.

When asked about their preference for native or exotic plant species, a significant majority (73%) of respondents expressed a preference for native species, citing reasons such as aesthetics, environmental benefits, and a sense of cultural connection. The remaining 27% indicated a preference for exotic species that were planted in the park's landscape primarily due to their

variation. Over 80% of respondent demonstrated familiarity with the concept of urban vegetation. They attributed their knowledge to various media sources, including television and social media platforms like Facebook and YouTube. Regarding individual financial contribution for park improvements, the majority of respondents were unwilling to contribute (Fig. 5). A small number (110 respondents) indicated a willingness to contribute less than 100 Taka (Taka is the currency of Bangladesh). However, respondents expressed a willingness to contribute to specific improvement projects if the authorities set clear financial goals. The unwillingness among the people could be caused by perceived responsibility, lack of trust in the authorities, financial constraints and also the lack of awareness. However, their idea of setting up a fixed financial fee for the visitors express their deep concern for the park’s health and its sustainability.

Most respondents were satisfied with the park's current state of greenery and overall condition (Fig. 6). However, they were less pleased with the park's design and planning (Fig. 7), suggesting a need for a more structured approach to its development. Additionally, respondents expressed concern about the current security situation (Fig. 8), advocating for enhanced security measures utilizing modern technology.

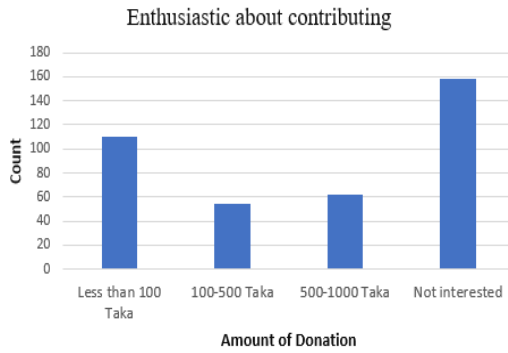


Fig. 5. Number of people enthusiastic about contributing for park improvement.

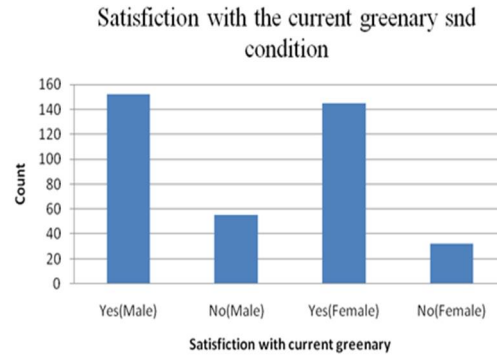


Fig. 6. People’s satisfaction with the current greenery and condition.

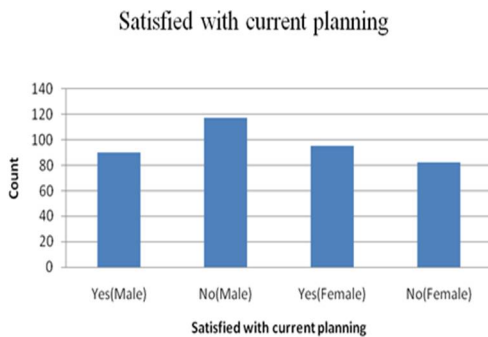


Fig. 7. People’s satisfaction with the current planning.

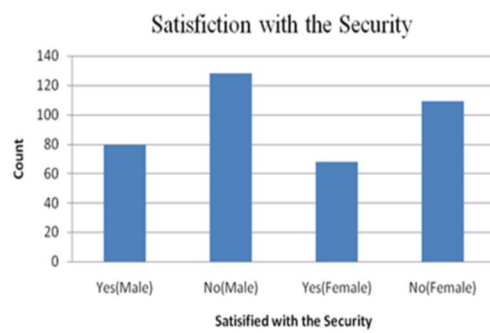


Fig. 8. People’s satisfaction with current security condition

The vast majority of respondents recognized Ramna Park's significant impact on their urban lives and lifestyles. They emphasized the urgent need for more green spaces in Dhaka to improve the city's quality of life and mitigate environmental pollution. Respondents stressed the importance of preserving Ramna Park, highlighting the potential negative consequences of its destruction, such as increased air pollution, environmental degradation, and the loss of recreational opportunities and exercise spaces. To enhance the park's value, respondents suggested various improvements, including enhanced security, improved infrastructure, a more aesthetically pleasing environment, better management of natural features, and expanded recreational facilities.

To assess the relationship between demographic factors and other elements of the questionnaire with public understanding of urban vegetation, a chi-square ( $\chi^2$ ) test was employed (Table 1). The results indicated that both education level and occupation significantly correlated with knowledge of urban vegetation ( $p < 0.05$ ), unlike in case of sexes of the people ( $p = 0.983$ ).

Furthermore, the  $\chi^2$  test explored the connection between visitors' perceptions and factors like mode of transportation ( $p = 0.154$ ) and arrival time ( $p = 0.525$ ). These factors have  $p$  higher than 0.05 which indicates that they did not influence public perception. Similarly, the purpose for visiting the park did not correlate with overall knowledge of urban vegetation ( $p = 0.141$ ).

**Table 1. Analysis of significance test ( $\chi^2$  test) of people's perception on urban vegetation and various characters.**

Characters	$\chi^2$ value	P value	Significance test
Sex	$\chi^2_{(1)} = 3.6 \times 10^4$	0.983	Non Significant
Occupation	$\chi^2_{(8)} = 30.799$	<0.001	Significant
Education	$\chi^2_{(4)} = 69.872$	<0.001	Significant
Mode of transportation	$\chi^2_{(4)} = 6.671$	0.154	Non Significant
Purpose of visiting	$\chi^2_{(8)} = 12.23$	0.141	Non Significant
Time of arrival	$\chi^2_{(2)} = 1.289$	0.525	Non Significant
Identifying trees of park	$\chi^2_{(1)} = 8.682$	0.003	Significant
Difference between exotic and native species	$\chi^2_{(1)} = 2.644$	0.104	Non Significant
Adverse effect of exotic species	$\chi^2_{(1)} = 15.433$	<0.001	Significant
Requirement of native species	$\chi^2_{(1)} = 1.284$	0.257	Non Significant
Satisfaction with the current planning	$\chi^2_{(1)} = 3.314$	0.069	Non Significant
Satisfaction with the security	$\chi^2_{(1)} = 3.41$	0.065	Non Significant
Impact on city life	$\chi^2_{(1)} = 3.692$	0.055	Non Significant
Need for new parks	$\chi^2_{(1)} = 6.706$	0.01	Significant

However, a strong link was found between knowledge of urban greenery and specific abilities, including tree identification ( $p = 0.003$ ) and understanding the negative impacts of exotic species ( $p < 0.001$ ). Interestingly, the ability to distinguish between native and invasive species, and the requirement of native species did not correlate with perception of people on urban vegetation.

Regarding satisfaction with Ramna Park's planning, its security and impact on city life, the  $\chi^2$  test revealed no significant association with the public understanding of urban vegetation. Nevertheless, significant associations were observed in demand for new parks ( $p = 0.01$ ).

Using a t test, it was determined whether participants' ages on average and their level of perception of urban vegetation were related (Table 2). At 5% level of significance, there is a difference in the mean age of informants depending on whether they are familiar with urban vegetation or not.

**Table 2. Analysis of t test between age and responses on perception.**

Urban vegetation	Age of the respondent		
	Mean	N=Number	Std. Deviation
No	36.81	100	14.217
Yes	40.24	284	13.255
Total	39.34	384	13.577
Characters	t value	df	P value
Age of the respondent	-2.181	382	.030

The p value of 0.030 indicates that there's a significant relationship between individual's age and their perception of urban vegetation. This means that older individuals perceive urban vegetation differently than younger individuals. This could be the cause of the fact that with growing old, individuals become more nature-centric and environmentally conscious. Moreover, the younger individuals mostly prioritize recreational activities, such as sports and social gatherings, which Ramna Park provides less, and older individuals may prefer quieter, more contemplative activities, such as walking, bird watching, or simply enjoying the peaceful atmosphere.

Based on the present research results, visitor's perception and field observations a number of measures have been suggested for the better management of the plant diversity of the study area. Initially, a long-term master plan should be developed for Ramna Park's beautification by using native plant species with the involvement of local stakeholders including city corporations, Public Works Department (PWD), parks and gardens authorities, RAJUK, vegetation department, the environment department and experts from universities. Secondly, immediate management measures for those exotic species that have already been planted are required. *Acacia auriculiformis* A.Cunn. ex Benth., *Albizia niopoides* (Benth.) Burkart var. *niopoides*, *Caryota urens* L., *Swietenia macrophylla* King, *Dalbergia sissoo* Roxb., *Delonix regia* Rafin., *Dypsis lutescens* (H.Wendl.) Beentje & J.Dransf., *Eucalyptus camaldulensis* Dehnhardt, *Leucaena leucocephala* (Lamk.) de Wit, *Samanea saman* (Jacq.) Merr. and *Terminalia catappa* L. are a few examples of current exotic plants that need to be included in a management plan. Cutting, trimming, and dressing can be done as required. Third, wildlife supporting native tree species such as *Albizia procera* (Roxb.) Benth., *Alstonia scholaris* (L.) R. Br., *Azadirachta indica* A. Juss., *Barringtonia acutangula* (L.) Gaerth., *Bombax ceiba* L., *Butea monosperma* (Lamk.) Taub., *Crateva magna* (Lour.) DC., *Diospyros malabarica* (Desr.) Kostel., *Litsea glutinosa* (Lour.) Robinson, *Ficus racemosa* L., *Neolamarckia cadamba* (Roxb.) Bosser, *Shorea robusta* C.F.Gaertn., *Sterculia villosa* Roxb. ex Sm., *Syzygium cumini* (L.) Skeels, *Tamarindus indica* L.,

*Terminalia arjuna* (Roxb. ex DC.) Wight & Arn., *Terminalia bellirica* (Gaertn.) Roxb., and *Terminalia chebula* Retz. could be selected for the urban plantation (Datta and Mitra 1953). Fourth, small, native, showy tree species of different flowering seasons should be included on the plantation list for aesthetic purposes such as *Bombax ceiba*, *Butea monosperma*, *Cassia fistula* L., *Cycas pectinata* Buch.-Ham., *Holarrhena pubescens* Wall. ex G. Don, *Ixora coccinea* L., *Lagerstromia indica* L., *Tabernaemontana divaricata* (L.) R. Br. ex Roem. & Schult. and *Vitex negundo* L. (Datta and Mitra 1953). Fifth, for overcoming the difficulty of locating seedlings of native plant species, nurseries can be built under the supervision of the vegetation department.

Considering on the current study findings, people's opinion on how to improve the conditions of Ramna Park, various initiatives have been considered for better improvement. At first, The park can be properly planned in terms of infrastructure, vegetation, maintenance and aesthetics. A genuine urban park can be built in the midst of Dhaka if the government, experts from the civil engineering department, and plant taxonomists are all involved in this initiative. Secondly, expanding the area if at all possible can benefit people by giving them more walking space and a higher level of biodiversity. Third, tree plantation may be done in a planned and systematic way with the help and proper guidelines from plant taxonomists which will contribute in protecting the ecosystem. Fourth, the interview findings revealed that installing drinking water stations throughout the park is essential by which visitors can relieve their thirst. Fifth, for security purposes, security can be strengthened and effectively maintained by installing CCTV throughout the park area, along with trained security personal and a command center. Moreover, for the appearance and clean environment, the study area can be cleaned and maintained properly by placing more recycle bin throughout the park so that people don't face any difficulties. Likewise, the lake of the park might be properly cleaned and managed because many species of fish, water fowl, and birds depend on it. According to Pasha *et al.* (2021), it was revealed that eight (08) fish species and forty-two (42) bird species were found from the park. Furthermore, people should be made aware of the importance and values of the park area by providing knowledge about urban vegetation into schools, colleges, and universities programs. Finally, mass and social media also could play a crucial role in informing and concerning individuals about various plant species, their significance and impacts on the ecosystem.

The outcomes of this assessment of plant species composition recorded from Ramna Park provides a basis for future urban park management. The record of 352 plant species under 96 families is evidence of species richness of the study area. Unfortunately, exotic species contributed the most in terms of proportion which is a serious threat to Dhaka's ability to maintain its biodiversity in the future. The majority of the Ramna Park's vegetation is made up of exotic species which is not at all favorable to the environment, biodiversity, or the development. Present data of plant species diversity in Ramna Park may assist concerned departments and stakeholders in their aims to increase native species and reduce exotic plant species.

Based on the findings, some recommendations were made for the better management of plant diversity for the study area to meet the requirements of aesthetics and biodiversity preservation. Some recommended native plant species for plantation are *Alstonia scholaris*, *Bombax ceiba*, *Butea monosperma*, *Cassia fistula*, *Holarrhena pubescens*, *Ixora coccinea*, *Shorea robusta*, *Syzygium cumini*, *Tabernaemontana divaricata*, *Terminalia arjuna*, *Terminalia bellirica* and *Toona ciliata* M. Roem. and also other local seasonal flowers.

This study also contributes to a better understanding of how people perceive Ramna Park, a particular urban green place in the core of Dhaka. By implementing the recommendations, the native biodiversity of Ramna Park will be increased, the intangible benefits it provides will be improved, natural heritage will be saved, and the prevalence of exotics will be reduced. Based on current findings, to ensure the long-term preservation of Ramna Park's



plants and intangible values, the authority can take pragmatic policies and measures, planning, and programs for urban green management, biodiversity conservation, and ecosystem services.

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