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Survey on Opportunities and Challenges of Urban Forestry in Purbachal Town, Dhaka

Md. Forhad Hossain[1]*, Md. Uzzal Husen[1], Farjana Hossain[2], Md. Emran Hossain[1], Mosfeca Sultana[3] and Akhi Aktar[1]

[1]*Department of Agroforestry and Environmental Science, Sher-e-Bangla Agricultural University, Dhaka*
[2]*Departyment of Agronomy, Sher-e-Bangla Agricultural University, Dhaka*
[3]*Soil Resources Development Institute, Ministry of Agriculture*

Abstract

A survey was conducted in Purbachal town, Dhaka, to assess the opportunities and challenges of urban forestry in addressing unplanned urbanization issues. A well-structured interview schedule and systematic random sampling method were used for the data collection during the household survey from June 15, 2023, to July 15, 2023. Main opportunities for urban forestry development in the study area included public willingness to participate in tree plantation activities, government plans, and community forestry expansion; on the other hand, the major constraints included a lack of public space, land fragmentation, and appropriate policy and awareness. The study revealed that urban forestry offered timber production, protection of soil and the environment, reduction of air temperature and pollution, support of biodiversity, and providing educational and research opportunities. In order to enhance urban forestry, the study recommended that the concerned authority organize social groups, build up institutional frameworks, and carry out long-term plantation and management strategies.

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Introduction

Dhaka, the capital city of Bangladesh being the sixth-most populous city across the globe with a population of 22.49 million (UN, 2022) has been facing numerous challenges due to rapid and unplanned urbanization. This unplanned growth has led to severe overcrowding and the proliferation of unhealthy living conditions throughout the city. To mitigate these pressures, an initiative of increasing urban area named Purbachal has been taken by the RAJUK (Rajdhani Unnayan Kartripakkha- a city development authority). Despite these efforts, Purbachal significantly lacks essential urban forestry and green spaces, with only 3.04% of its area dedicated to urban forest infrastructure. This is particularly concern to stakeholder's given the well-recognized importance of urban forestry in mitigating the adverse effects of urbanization (Miller, 1997; Konijnendijk and Randrup, 2004).

Urban green spaces are integrated components of a coherent whole, encompassing public and private green spaces, peri-urban and urban forests, parks, gardens, and undeveloped areas (Miller, 1997; Konijnendijk and Randrup, 2002). Despite its relatively recent development, urban forestry is a multidisciplinary approach that maximizes the benefits derived from green resources in urban settings. However, scientists continue to debate the precise definitions of what constitutes an urban forest and other related terms (Randrup *et al*., 2005). Numerous studies have highlighted the multifaceted benefits of urban forests, including improving aesthetics, maintaining ecological balance, promoting air purification, and regulating temperature extremes (Dwyer *et al.*, 1991; Keller,

*Corresponding author's e-mail: forhadsau@gmail.com

1979; Negi, 1998; Ulrich, 2001). Trees and plants capture particulate and gaseous contaminants, enhance microclimates, regulate runoff water, and contribute to urban cooling (McPherson *et al*., 1997). Additionally, urban forests provide habitats for wildlife, enhance the aesthetic appeal of urban areas, and improve mental well-being. They also help cool the air, reduce wind speeds, and protect soils, all while reflecting natural environments and supporting high biodiversity (Konijnendijk & Randrup, 2004).

In Dhaka, the development of urban forestry faces significant challenges, primarily due to a lack of awareness about the importance of tree cover. To effectively develop Purbachal Valley's urban greenery, it is crucial to gauge public knowledge, analyze institutional frameworks, participation rates, attitudes, and perceptions, and identify obstacles and opportunities for sustainable growth (Bista, 2009). As Purbachal evolves into a major urban centre, collaboration with RAJUK, construction companies, and other stakeholders will be essential in building a sustainable, greener, and healthier city. Despite the acknowledged benefits of urban forestry, there is a notable absence of studies specifically investigating the opportunities and challenges of implementing urban forestry in Purbachal. This research aims to fill this gap by exploring the potential for urban forestry in Purbachal, assessing public awareness, and identifying strategies for sustainable urban green space development. A systematic survey study was conducted to understand constraints and opportunities for tree plantations in Purbachal city, aiming to investigate the opportunities and challenges for enhancing urban forestry in newly developed Dhaka City. The specific objectives of the study were to (1) evaluate the opportunities of urban forestry in newly developed Purbachal city; and (2) evaluate the challenges of urban forestry in that area.

Materials and Methods

Description of study area and duration of survey

The study was conducted in Purbachal, a recently developed city in the northeastern part of Dhaka, Bangladesh. Purbachal is geographically situated between the rivers of Balu and the Shitalakhya, encompassing areas within Rupganj and Kaliganj areas under the districts, Narayanganj and Gazipur, respectively. The research was carried out over a six-month period, from October 2022 to April 2023.

Sampling method and data collection

The target population for this study comprised residents from Purbachal who directly receive various services from the RAJUK. A systematic random sampling method was employed to select a representative sample of 100 respondents from the total population of 8,000 residential plot owners in the ten completed residential sectors (sectors 01, 02, 03, 09, 11, 13, 14, 23, 29, and 30). To ensure proportional representation, ten respondents were chosen from each sector. The RAJUK employees assisted in generating the list of potential respondents, ensuring a comprehensive and unbiased selection process. Data was collected through structured household surveys. The primary objective was to assess both the potentials and challenges associated with urban forestry in Purbachal. Respondents were interviewed to gather insights on their perceptions, attitudes, and experiences related to urban forestry. The survey included questions designed to evaluate the opportunities, challenges, and benefits of urban forestry as perceived by the respondents.

Likert scale assessment

To measure respondents' perceptions of urban forestry, the Likert scale method was utilized (Likert, 1932). This psychometric tool is widely used in perception and attitude assessments, allowing respondents to express their level of agreement or disagreement on a series of statements related to the topic of interest. For this study, the Likert scale ranged from 'High' to 'Not at all' (4 to 1) for opportunities and benefits, and from 'Severe' to 'Not at all' (4 to 1) for challenges.

Calculation of weighted mean

To quantify the survey data, the weighted mean was calculated using the following formula:

$$\text{Weighted mean} = \Sigma (wi.xi) / \Sigma wi$$

Where, wi = Respondents response in %, xi = Value assigned to Severe/High to not at all

Data analysis

The data collected from the surveys were systematically analyzed to derive meaningful insights. The weighted mean provided a quantitative measure of the respondents' perceptions, allowing for an assessment of the general sentiment towards urban forestry in Purbachal. The analysis aimed to identify key opportunities, challenges, and benefits as perceived by the residents, thereby providing a comprehensive understanding of the current state and potential future of urban forestry in the area.

Ethical considerations

In this study, participation of the respondents was voluntary and assured of the confidentiality and anonymity of their responses. Informed consent was obtained from all participants before the commencement of the surveys.

Results and Discussion

Knowledge of the respondents about urban forestry

The respondents were categorized into four groups based on their level of knowledge about urban forestry. The categorization criteria were: low knowledge (scoring up to 5), medium knowledge (scoring 6–10), high knowledge (scoring 11–15), and very high knowledge (scoring 16–20), as shown in Figure 2. Each respondent could earn two points for a correct answer, zero for an incorrect or unanswered question, and partial points for partially correct answers. The knowledge scores among respondents varied from 2 to 19, with a possible range of 0 to 20. The mean score was 15.35, and the standard deviation was 4.57. Figure 2 indicated that 39% of respondents had very high knowledge, 35% had high knowledge, 20% had medium knowledge, and 6% had low knowledge.

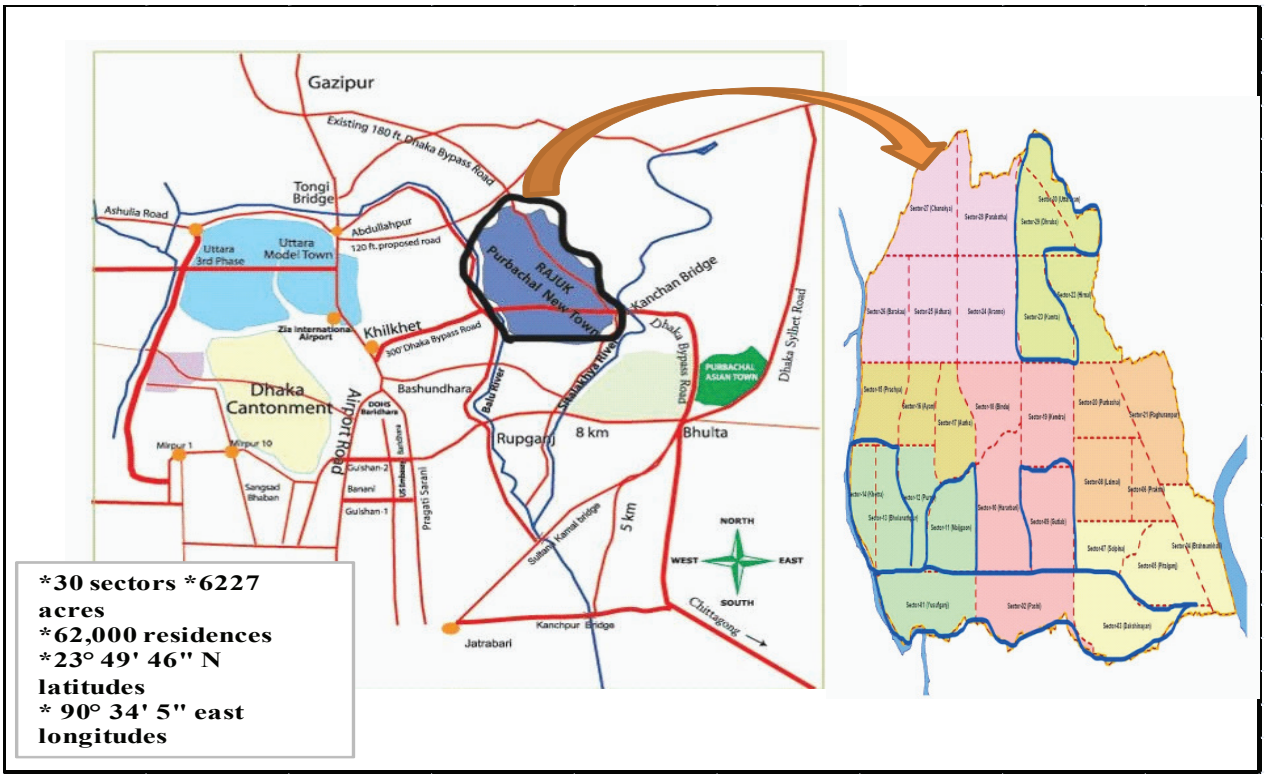

Figure 1. Map of the Study Area

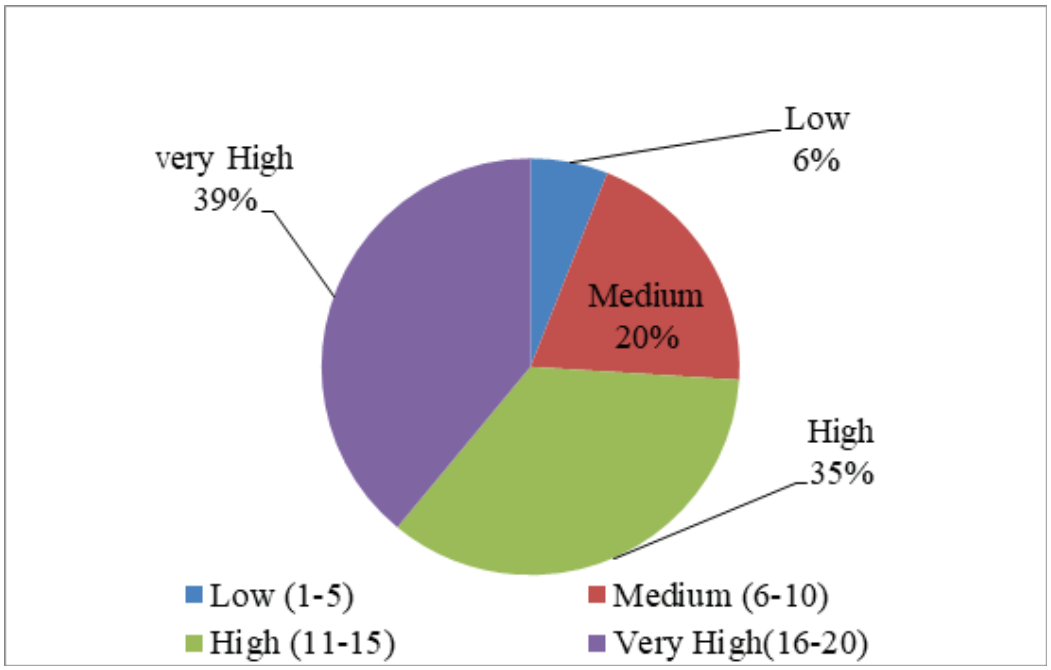

Figure 2. Knowledge of the respondents about urban forestry

These findings suggested a generally high level of knowledge about urban forestry among the majority of respondents, with 74% falling into the high or very high knowledge categories. However, the presence of 26% of respondents with medium to low knowledge highlights the needed for targeted educational efforts to enhance awareness and understanding across the entire community.

Respondents' plot ownership

Data collected from the respondents were categorized into two groups: "plot owner" and "not plot owner." Respondents' plot ownership was binary-coded as 1 (yes) and 2 (no), with a mean of 1.57 and a standard deviation of 0.50. As shown in Table 1, 43% of respondents were plot owners, whereas 57% were not.

The analysis indicated that less than half of the respondents (43%) were engaged in urban forestry through plot ownership in Purbachal. This data highlighted the potentials for increasing urban forestry participation among the remaining 57% who did not own plots, thereby promoting a more inclusive approach to urban greening initiatives in the study area.

Partitioning of plot area

The respondents' plot space was divided into four categories in the study area which were: house, road, tree planting, and total plot area (Figure 3). The total plot area ranged from 557 to 14,400 square feet with the average 5,071 square feet, and the standard deviation of 3481.2 (Figure 3). In Figure 3, area for house building and tree planting of the respondents were recorded an average 4914.63 square feet (SD 10.21 square feet) and 10.21 square feet (SD 38.69 square feet), respectively; and area for road was recorded with the average 146.86 square feet (SD

Table 1. Distribution of respondents based on plot ownership

Respondents	Frequency	Percentage	Weighted mean	Std. deviation
Plot owner	43	43%		
Not plot owner	57	57%	1.57	0.50
Total	100	100%		

74.54 square feet) which varied from 35 to 300 square feet, with a potential range of 300 to 500 square feet (RAJUK, 2020).

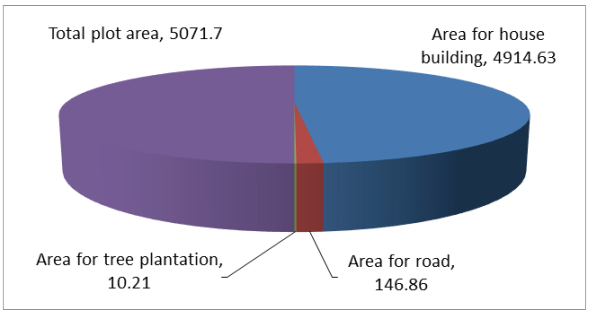

Figure 3. Partitioning of plot area

Opportunities of urban forestry

The findings indicated that the area offered a number of opportunities for urban forestry which were: willingness of people participants for increased tree planting; implementing government plan for urban forestry; community forestry; tree management, eco-clubs; identification of fallow and barren land; and local government plan. The study also involved 100 individuals to explore these potential opportunities. Following was the assignment of values between 1 and 4: Not at all is represented by 1 (not at all), 2 (low), 3 (medium), and 4 (high).

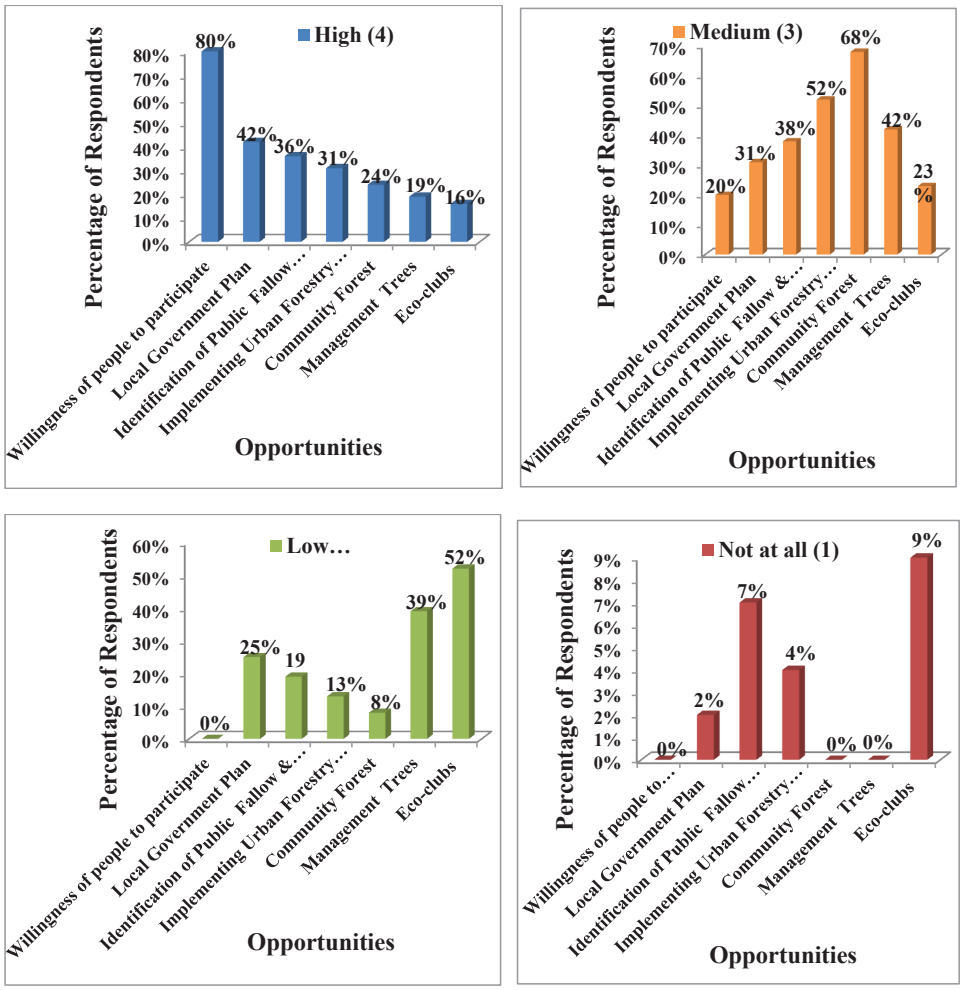

Figure 4. Opinions of the respondents about opportunities of the urban forestry

In Figure 4, the weighted mean for the first statement was 3.8, indicating a high value of 3.8, suggesting that 80% of respondents believed willingness participation in tree planting activities in urban forestry was the most significant opportunity for improvement, similarly, 42% agreed with a local government plan for urban forestry development. The study found that 68% of respondents perceived a medium-level opportunity for expanding community forestry, with a mean score of 3.16 (± SD 0.55). Additionally, 52% of respondents supported government plans for urban forestry activities, 42% emphasized the importance of proper tree management, and 38% believed utilizing public and barren land for green spaces presented a medium-level opportunity.

In contrast, only 52% of participants indicated a low-level opportunity for the growth of eco-clubs in the field of urban forestry (Figure 4). Among the above mentioned opportunities, willingness of people participation in tree plantation, inclusion of government plan, expanding community forestry seem to be the major opportunities behind the enhancement of urban forestry in Dhaka city. Building new parks, playgrounds, botanical gardens, and roadside plantations near residential and commercial districts can contribute to urban greening (Ansari 2008; IADB 1997).

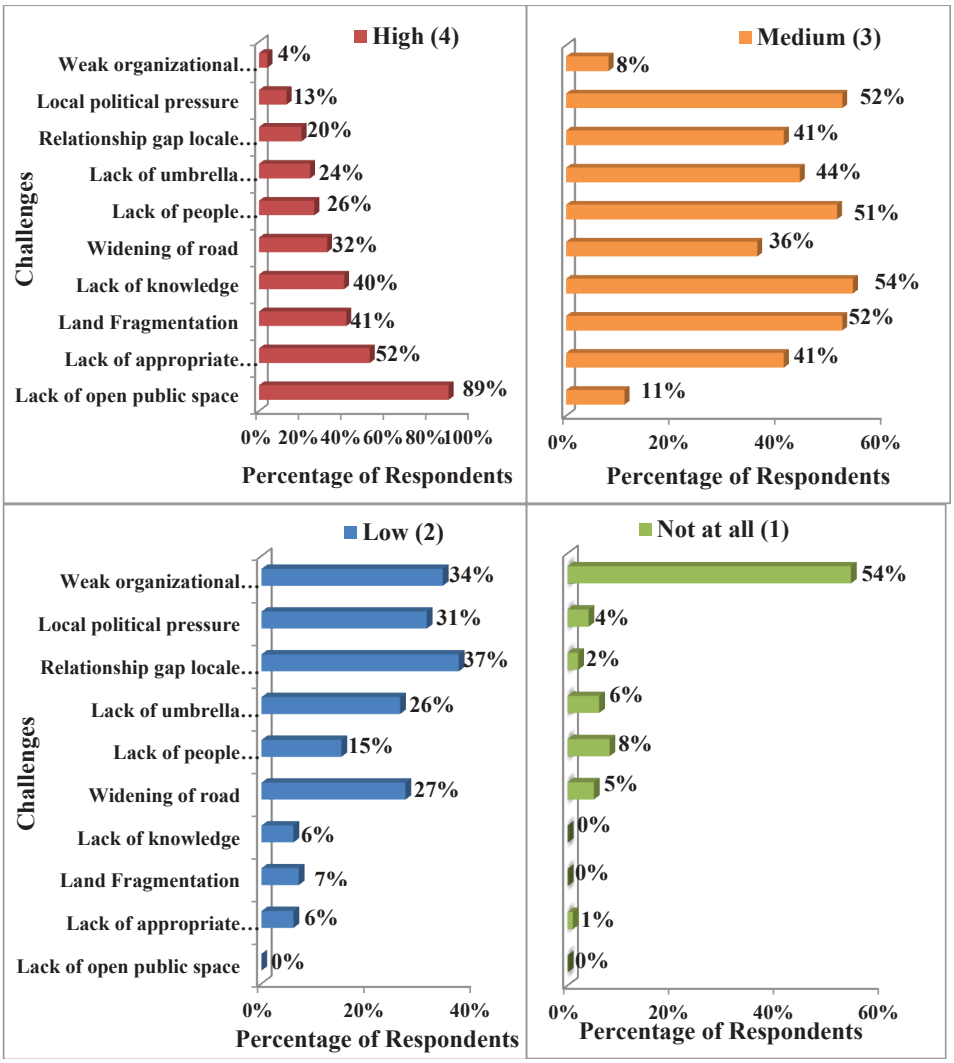

Figure 5. Opinions of the respondents about challenges of the urban forestry

Challenges of urban forestry

The study revealed numerous challenges to urban forestry development in the study area, including lack of open public space, land fragmentation, road widening, public ignorance of species selection, lack of appropriate policies, lack of an umbrella organization, weak organizational framework, public participation, local political pressure, and mismatch between local populace and urban forestry organizations. The study also involved 100 individuals to explore these potential challenges of the urban forestry. The assignment of values ranging from 1 to 4 was as follows: The numbers 1 (not at all), 2 (low), 3 (medium), and 4 (high). The results were listed in the Figure 5. In the first statement, the weighted mean was 3.89, which was near the assigned value 1, i.e., high level of challenges. Hence, majority of the respondents (89%) seemed that the lack of accessible open spaces was significant barriers to the reduction of urban forestry, similarly, 52% of respondents agreeing that lack of appropriate policies and strategies was highly significant barrier for declining urban forestry, respectively (Figure 5).

Conversely, the study found that 54% of the respondents seemed that public ignorance of species selection (mean 3.34± SD 0.59) were medium level challenges for declining urban forestry, similarly, land fragmentation (52%), and local political pressure (52%), respectively. Other factors included that 51, 44, 41 and 36 percent of the respondents claimed that lack of public participation, lack of an umbrella organization, mismatch between local population and urban forestry organizations, and road widening as a development barrier, respectively, these issues hinder the progress of urban forestry.

Urban forestry faced challenges due to a weak organizational framework, with 54% disagreeing and 46% agreeing (mean 1.62±SD 0.80, from low to high range). Among the above mentioned challenges, lack of open public space, lack of appropriate plan and policy, land fragmentation, lack of knowledge seem to be the major challenges for decreasing urban forestry in Dhaka city. Due to various activities including housing, Urbanization, driven by housing, commercial, and industrial construction, places significant pressure on existing green spaces. Compact urban environments lack interstitial spaces for vegetation, leading to population growth and the conversion of green spaces into built-up areas, making urban greening difficult for planners (Jim 2004; Ansari 2008). The Dhaka City Corporation planted 29,000 trees in 2002, falling short of the goal of 40,000 due to lack of open spaces (Byomkesh *et al.,* 2012). However, poor decision-making, road widening, and lack of people participation contribute to the deterioration of urban green resources. The National Environmental Management Action Plan aimed to improve people's quality of life, but poor practices and regulations continue (Ansari 2008).

People's perception towards urban forestry

In order to learn about the opinions of 100 respondents on urban forestry, values ranging from 1 to 4 were assigned: not at all (1), low (2), medium (3), and high (4). The value obtained by computing the weighted mean, and the value that was closest to the assigned value was used as the outcome. The study found that 97% of respondents seemed that urban forest trees were highly beneficial (mean 3.97±SD 0.17) to human health, similarly, 74% and 54% of the respondents agreed that it enhances landscape beauty, and reduces pollution and bad smell, respectively. Additionally, 54% and 54% agreed that people should be involved in urban forestry management and development activities in the future, respectively (Table 2). On the other hand, 63% of respondents moderately agreed that inadequate tree management in urban areas poses an obstacle to the development of urban forestry (Mean 3.29 ± SD 0.5). Similarly, the majority of respondents (54%) believed that there was a pressing need for urban forestry development in Dhaka city, and 52% believed that institutional involvement was necessary. Conversely, 48% of respondents expressed low agreement (mean 2.42 ± SD 0.88) with the statement that there were enough trees planted on urban roads. Similarly, 48% expressed low agreement that people felt ownership in these plantations. The study revealed findings from Sharma and Ghimire (2019) and Blazevska *et al.* (2012), indicating that 80% of urban residents believed trees were beneficial, but 50% lacked

tree management, and 60% called for urgent urban forestry development. Additionally, 74% associated urban forests with parks, greenery, and beautiful spaces, with primary motivations being aesthetics, relaxation, and walking. Furthermore, 73.8% of municipalities were satisfied with their urban woods, but 80% believed more was needed, including maintaining, planting, building more, and avoiding new buildings near urban forests.

Benefits derived from different ecosystem services from urban forestry

The study area (Purbachal) benefited from urban forestry offered numerous ecosystem services which was mentioned in Figure 6. These were: timber, soil protection, air pollution reduction, biodiversity promotion, educational spaces, scenic beauty, and recreational activities. A survey of 100 people assessed these benefits, with the most similar outcome chosen. The assignment of values ranging from 1 to 4 was as follows: The numbers 1 (not at all), 2 (low), 3 (medium), and 4 (high) stand for not at all.

In Figure 6, the study found that the majority of respondents (99%) believed that the main benefit of urban forestry is the provision of timber or wooden products (Mean 3.99±SD 0.10), similarly, 67 and 66% of respondents highly seemed that urban forestry protects soil and environment, reduces air temperature, protects the environment from

Table 2. People's perception towards urban forestry in the Purbachal town of the greater Dhaka metropolis.

Statements	Response %				Weighted mean	Std. deviation
	High (4)	Medium (3)	Low (2)	Not at all (1)		
Trees in urban forestry are beneficial to human health	97 (97%)	3 (3%)	0	0	3.97	0.17
Trees in urban area increase the landscape beauty of that area	74 (74%)	26 (26%)	0	0	3.74	0.44
Trees in urban area decreasing the pollution & reduce the bad smell are good for environment	54 (54%)	46 (46%)	0	0	3.54	0.50
There is lack in management of trees in urban area to obstacle for developing urban forestry	33 (33%)	63 (63%)	4 (4%)	0	3.29	0.54
There is an urgent need of starting urban forestry development activities in Dhaka city	46 (46%)	54 (54%)	0	0	3.46	0.50
People's involvement in urban forestry management of roadside trees is necessary	54 (54%)	45 (45%)	1 (1%)	0	3.53	0.52
People's involvement in urban forestry development activities in future is necessary	54 (54%)	43 (43%	3 (3%)	0	3.51	0.56
The number of trees planted in road side of urban area are enough	14 (14%)	26 (26%)	48 (48%)	12 (12%)	2.42	0.88
People feel ownership in roadside plantation	11 (11%)	20 (20%)	48 (48%)	21 (21%)	2.21	0.90
Role of institutional involvement in the urban forestry development are necessary	28 (28%)	52 (52%)	15 (15%)	5 (5%)	3.03	0.80

climate change, respectively, additionally, 56% of respondents highly seemed that urban forestry acts as a habitat for biodiversity and important for educational and research purposes.

Figure 6 showed that 62% of respondents perceived the creation of scenic beauty as the medium level important benefits derived from urban forestry (mean 3.34±SD 0.52, 59), similarly, 59 and 54% of the respondents believed that public running spaces and high-quality public spaces were as medium level of benefits, respectively.

Conversely, 61% and 47% of those interviewed thought that public hiking and bicycling spaces were among the low level significant benefits derived from urban forestry (Mean 2.24±SD 0.74; Mean 2.23±SD 0.84,) (Figure 6). Among the benefits derived from urban forestry in the study area, providing timber, protecting soil and the environment, reducing air pollution, promoting biodiversity, and offering educational and research spaces stand out as major advantages resulting from various ecosystem services. Similar types of benefits were mentioned in some studies on urban forestry, aiming to improve mental and physical health by reducing stress, encouraging physical activity, and providing fresh air, particularly for impoverished residents (Roy *et al.,* 2016; Wolch *et al.,* 2014; Konijnendijk *et al.,* 2006).

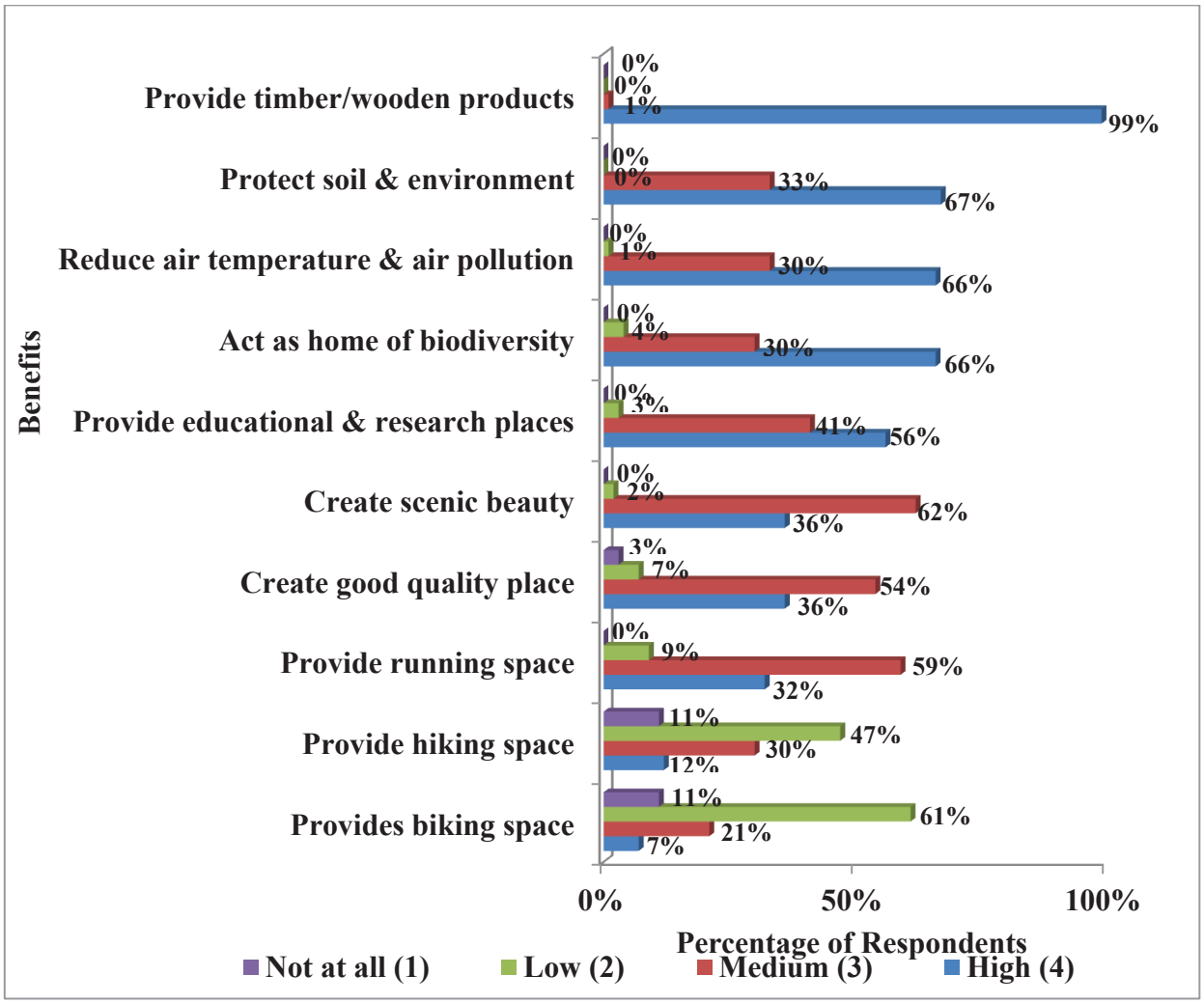

Figure 6. Benefits derived from different ecosystem services from urban forestry

Conclusions

The urban forestry in Purbachal town is undervalued due to all-size-fits-all policies, hindering development. From the results of the study it can be concluded that urban forestry development in the study area offers opportunities like participation in tree plantation activities, local government plans, and community forestry expansion. Challenges include high population density, lack of public space, policy, land fragmentation, and lack of awareness. Benefits include timber production, soil protection, air pollution reduction, biodiversity, and educational opportunities.

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Conflict of Interest

There is no conflict of interest to declare.

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