Valuing the invaluable: park visitors' perceived importance and willingness to pay for urban park trees in Pakistan

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Valuing the invaluable: park visitors' perceived importance and willingness to pay for urban park trees in Pakistan

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Abstract. In complex urban systems, urban parks are rare hot spots of nature, responsible for delivering a range of ecosystem services. Trees are critically important components of urban parks that provide many benefits, and, at the same time, face challenges such as lack of funds, mismanagement, climate change, pests, and diseases. There is a growing need to increase the urban tree cover to sustain urban ecosystems. Successful policymaking requires engagement with all stakeholders, especially park users. An understanding of how people's perceptions of the benefits and challenges faced by urban park trees is pivotal to making decisions that have long-standing support. We surveyed 521 park visitors in Multan, Pakistan, to assess their valuation of urban park trees, their understanding of the challenges faced by trees, and their willingness to pay (WTP) for increasing tree cover in urban parks. We found that people widely appreciated the ecosystem services provided by park trees. Provision of oxygen, shade, and clean air was considered the greatest benefits while cutting down, lack of space, and urbanization were perceived as the biggest challenges to trees. Respondents showed a WTP and believed in government–public cooperation for increasing tree cover. Income, age, and education were significant predictors of WTP. The study reflects findings in other development and geography contexts and highlights the need for broader dissemination of information on critical threats to park trees and underlines the potential for engaging locally to maximize effectively in the management of park trees.

Key words: ecosystem services; Multan; Pakistan; trees; urban park; willingness to pay.

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Introduction

The value of parks in the urban ecosystem

The 21st century is the urban century. Urban areas are home to more than half of the world's population and are predicted to expand by 2.5 billion people by 2050 (UN 2014). The pace and scale of urban expansion have caused environmental and health problems for urban dwellers, which are worsened by the lack of contact with nature (Manzoor et al. 2019). Urban parks, "the areas of land containing grass, shrubs, and trees, and are accessible to and managed for, the benefit of the public" (Collins et al. 2019), are rare hot spots of nature in complex urban centers (Filho et al. 2020) and contribute to environmental sustainability by providing a range of essential ecosystem services (ESs; Mexia et al. 2018).

Urban parks maintain many ecological functions in urban systems (Li et al. 2005). They help to mitigate urban heat island effects (Feyisa et al. 2014), remediate air (Ryswyk et al. 2019), and

water resources (Breuste and Artmann 2020), offer mental well-being (Shu and Ma 2020), aesthetics (Li et al. 2019), and health benefits (Collins et al. 2019). Urban parks also provide many social benefits (Hunter et al. 2019, A. Samad et al. 2020). Jogging tracks, sporting activities, and open spaces in urban parks contribute to the physical well-being of park visitors (Almeida et al. 2018). Urban parks offer many economic benefits; for example, the decision-making of potential buyers and property value is often affected by the presence of urban parks in the neighborhood of the property (Jensen et al. 2009).

Trees: a critical component of urban parks

In urban parks, trees are central to the provision of different ESs, especially climate regulation (Morakinyo et al. 2020). Globally, rapid urban expansion has caused an increase in urban temperatures (Tratalos et al. 2007), precipitating the need to plant more trees to regulate temperature (Vaz Monteiro et al. 2016). The temperature control by trees is an active energy saver in cities (Berry et al. 2013); urban park trees are, thus, often called "lungs of cities" (Collins et al. 2019). Moreover, urban park trees are efficient carbon sinks (Speak et al. 2020), provide shade (Collins et al. 2019), infrastructure (Berry et al. 2013), and reduce wind speed (Smithers et al. 2018). They prevent flooding by increasing the rate of water infiltration into the soil (Hümann et al. 2011) and mitigate pollution by absorbing and adsorbing atmospheric pollutants (Hewitt et al. 2020).

Urban park trees face many challenges. In addition to compacted soils, pests and diseases harm tree health, reduce aesthetics, and affect the provision of essential ESs (Ocasio-morales and Tsopelas 2007, Boyd et al. 2013). Diseases such as ash dieback and canker stain of plane have severely damaged trees in the urban parks of the UK (Hill et al. 2019). Climate change is another challenge for urban park trees. Many tree species might fail to adapt to the changing climate (Brandl et al. 2020), leading to a loss of tree species or a climate-induced increased susceptibility of trees to pests and diseases (Millar et al. 2007). Also, limited space (Hou and Grohmann 2018), lack of funds (Davies et al. 2019), increasing urbanization (Girma et al. 2019), and rising air pollution levels (Fenn et al. 2020) are critical challenges that urban park trees face, especially in the developing countries (Girma et al. 2019).

The value of understanding public perception

Public opinion matters more than ever now. Public opinion and engagement play a critical role in environmental projects as it instils a sense of participation in the community which results in decisions favored by the public and thus a higher chance of success (Cursșeu and Schruijer 2017). Appreciating and understanding the environmental importance of trees by the public is imperative for future planning, with all stakeholders having prior knowledge of possible risks that may incur in the future affecting the urban life quality (Rayner 2012). Understanding public perceptions can lead to better policymaking and, ultimately, better decisions for the urban environment.

Theoretical background and research questions

Several researchers have quantified ESs provided by urban trees and identified socioeconomic factors that underpin the perceived importance of trees (Adekunle et al. 2013, Buchel and Frantzeskaki 2015, Sutton and Anderson 2016, Swapan et al. 2017, Livingstone et al. 2018, Collins et al. 2019, Sun et al. 2019). But most of these reports have come from developed countries such as the UK (Collins et al. 2019), USA (Sutton and Anderson 2016), Australia (Swapan et al. 2017), Canada (Livingstone et al. 2018), China (Sun et al. 2019), and Europe (Buchel and Frantzeskaki 2015). To the best of our knowledge, there has been no study on the perceived importance of ESs provided by urban park trees in Pakistan—the 5th most vulnerable country to climate change. In the context of Pakistan, this study aims to understand how park visitors perceive the ecological importance and challenges faced by urban park trees, identify socioeconomic determinants of park visitors' perception, and estimate their willingness to pay (WTP) for increasing park trees.

We considered Multan city as a case study in Pakistan. Multan is one of the largest cities in the country located in the south of Punjab province. This region has recently faced many ecological challenges, including floods, frequent heatwaves, and consistently high summer temperatures. Besides, the city has experienced an exponential urban expansion in the recent past, which has consumed most of the vegetation cover, leading

to environmental degradation (Manzoor et al. 2019). The role of urban parks is crucial in this ecologically challenged part of the country; understanding the determinants of public attitude toward the value and improvement of urban park trees in Multan could be pivotal to policymaking.

Socioeconomic determinants of public perception of urban park trees.—We used several socioeconomic variables based on knowledge of the study area, discussions with the local park managers, and a detailed review of the literature (Niemelä et al. 2010, Barrena et al. 2014, Buchel and Frantzeskaki 2015, Swapan et al. 2017, Kim and Jin 2018, Livingstone et al. 2018, Collins et al. 2019, Filho et al. 2020, Shu and Ma 2020). These variables include some classical socioeconomic variables such as gender, age, education, and income levels as well as three other variables named residential distance to urban parks, frequency of visiting urban parks, and connection to rural areas.

Residential distance to the urban park affects the mental health and well-being of the residents—people living near parks are more likely to understand the importance of urban parks (Confer and Mowen 2003, Sturm and Cohen 2014). The frequency of visiting urban parks also affects visitors' perception of urban park trees—frequent visitors are likely to be more appreciative of the ESs of parks (Breuste et al. 2013). Visits to nearby greener areas (e.g., mountainous areas) affect citizens' perception of the value of urban green spaces (Kothencz et al. 2017). In the case of Multan, there are no surrounding mountainous areas, but the nearby rural areas have natural greenery. We thus considered connection to the rural areas as a proxy of people's exposure to natural green spaces.

Willingness to pay for improving tree cover in urban parks.—Willingness to pay is a strong proxy to measure respondents' interest and involvement in the problem. The economic valuation of ESs makes explicit to society the scarcity of ESs and elaborates that the preservation of these services involves a cost that society must bear (Barrena et al. 2014). Any policymaking in which these costs are ignored will be ill-advised, and the society would be "worse-off due to miscalculation of resources" (Barrena et al. 2014). One of the aims of this study was to understand the public willingness to engage in improving tree cover in urban parks and to understand the factors behind WTP to assure the financial feasibility of policies regarding urban park tree management.

In this exploratory study, we aimed to examine public perception of urban park trees in Multan to answer the following questions:

1. How much do people value the ESs provided by urban park trees and understand the challenges faced by urban park trees?
2. How do socioeconomic variables affect people's perceived importance of the ESs provided by urban park trees?
3. To what extent are people willing to pay for urban park trees in Multan?
4. What are the socioeconomic determinants of people's WTP for increasing urban park trees in Multan?

Methodology

Selection of parks

In Multan, urban parks are primarily maintained by Parks and Horticultural Authority (PHA) Multan (https://phamultan.punjab.gov.pk/). This organization was established in 2014 and is responsible for making Multan Green, Clean, and Beautiful. PHA is responsible for maintaining existing parks and developing new parks in the city and currently maintains 59 parks in Multan, administratively divided into three zones: A, B, and C. The mean and median size of 59 parks are 3.36 and 1.58 acres, respectively. Only three parks exceed 10 acres, while the rest of the 56 parks range from 0.1 to 6 acres.

To sample representatively the range of parks, we sub-divided each zone into three classes based on park size: large (more than 5 acres), medium (1–5 acres), and small (<1 acre). We selected one of each class from each of the three administrative zones. Details of the parks chosen, and the number of respondents interviewed in each park is presented in Table 1.

Study design and data collection

We collected both qualitative and quantitative data from park users through a face-to-face paper-based interview using the technique of the mixed method. Respondents were randomly chosen in the selected parks and interviewed in late afternoon and evening (16:00–21:00 hours),

Table 1. Selected parks where the survey was conducted, and the number of respondents surveyed in each park ($n = 521$).

PHA administrative zone	Size category	Park name	No. respondents
A	Large	Shah Shams Park	85
A	Medium	Ameerabad Park	52
A	Small	Ladies Park Rasheed Abad	38
B	Large	Qila Kohna Qasim Bagh	75
B	Medium	Arts Council Park	51
B	Small	Walayatabad Park	40
C	Large	Aam Khas Bagh	72
C	Medium	Shujabad Park	60
C	Small	BCG Chowk	48

on both weekdays and weekends in February 2020. Respondents were informed about the purpose of the survey and provided with anonymity. The questions were based on the visual analogue scale (VAS), multiple-choice, and open-ended responses. We adapted the questionnaire developed by Collins et al. (2019). We altered the questionnaire to cater to the specific objectives of our study. We rephrased many of the questions in the interest of clarity and removed and/or added questions based on a literature review, knowledge of the study area, and recommendation of the local park managers. The questionnaire was pre-tested to remove any ambiguity and ensure understanding of all questions.

The questionnaire was divided into the following four sections:

The first section recorded the socioeconomic profile of the respondents (age, gender, income, education [Appendix S1: Questions 1–4]). We asked their purpose in visiting a park, how frequently they visited, whether they had a park within walking distance of their home (i.e., within 1–2 km of their residence), and how often they visited a nearby village (Appendix S1: Questions 5–8).

The second section evaluated the respondents' opinion of the benefits of park trees. We asked if there should be more trees in parks, their understanding of the term ecosystem services, perceived benefits of urban park trees, and the main challenges faced by trees (Appendix S1: Questions 9–14).

The third section recorded the perceived importance of five key ESs of urban park trees (climate regulation, pollution mitigation, habitat for wildlife, dust control, and aesthetic value). These were chosen as the most relevant in the context of our study area, based on discussions with local park managers and horticulturists and review of the literature (Niemelä et al. 2010, Haase et al. 2014, Elmqvist et al. 2015, Collins et al. 2019). The response was recorded on a 0–10 VAS (not at all important to essential). We selected VAS over the Likert scale method as VAS provides proxy-continuous data that offer higher sensitivity and allow a more diverse data analysis (Grant et al. 1999, Reips and Funke 2008; Appendix S1: Questions 15–19).

The fourth section estimated respondents' familiarity with the name of the department that manages urban park trees in Multan. We asked if they thought tree cover should be increased by government efforts or by a government–public partnership, and finally, we asked whether they would be willing to pay for expanding the tree cover in their nearby parks (Appendix S1: Questions 20–23).

Statistical analysis

All statistical analyses were performed in SPSS (v 21, IBM Corp., Armonk, New York, USA) and R (v 3.3.2, R Foundation for Statistical Computing, Vienna, Austria). Shapiro–Wilk's test confirmed that the VAS data were negatively skewed (Ghasemi and Zahediasl 2012). Therefore, we used non-parametric Wilcoxon rank-sum test to compare the observations obtained between two groups, and Kruskal–Wallis H test to determine whether there were statistically significant differences between more than two groups of independent variables.

Perceptions of park trees, their ecosystem services, and challenges.—We recorded respondents' perception of park trees, the ecosystem service park trees provide, and the challenges faced by urban park trees in Multan as open-ended questions. We extracted the keywords from the recorded responses (survey questions 13 and 14), calculated their frequency, and visualized the frequency of the top ten words (Collins et al. 2019). We used the non-parametric Kruskal–Wallis *H* to estimate variation in public perception of the importance of each ES, followed by Dunn's post hoc test for pairwise multiple comparisons.

Willing to pay for increasing tree cover in urban parks.—Based on previous WTP studies (Alves et al. 2015, Enriquez-Acevedo et al. 2018), we asked the respondents if they were willing to pay for urban park trees and used a regression model to explain how independent socioeconomic variables predict the response. The question asked about WTP was the following: Would you be willing to pay for increasing the tree cover in urban parks of Multan? The response variable (WTP) has binary outcomes (0 = not willing to pay anything, 1 = willing to pay). To understand the influence of sociodemographic variables on respondents' WTP, we used a binary logistic regression. Binary logistic regression models the probability of an event occurring given a set of explanatory variables. The logistic regression model used to estimate the respondents' WTP for urban park trees is shown below:

$$Y_i = \alpha + \beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5 + \beta_6 + \beta_7 + \text{error}$$

where Y_i is the response variable (WTP, 1 = willing to pay, 0 = not willing to pay), α is a constant, and the βs are the explanatory variables; β_1 = gender (1 = female, 0 = male), β_2 = education (1 = university graduate, 2 = below university level), β_3 = income class (1 = low income [less than 20,000 PKR a month], 0 = high income [above 20,000 PKR a month]), β_4 = young (1 = aged below 20, 0 = otherwise), β_5 = middle-aged (1 = age between 20 and 30, 0 = otherwise), β_6 = old-aged (1 = age above 45, 0 = otherwise), and β_7 = park within walking distance of home (1 = yes, 0 = no). We converted all independent variables into binary predictors. For the sake of simplicity and ease of interpretation, we collapsed the levels of variables which were not statistically different. The estimates of intercept and coefficients are determined using a maximum-likelihood estimation subject to a log-likelihood function.

In the second step, we asked those who answered yes to the WTP question: How much would you be willing to pay per year? The options given were up to PKR 1000, PKR 1000–2000, PKR 2000–3500, PKR 3500–5000, above PKR 5000 (USD 1 = PKR 150 approximately). A descriptive statistical analysis was performed to identify the amount that visitors were willing to pay.

Results

Sample demographic and background information

We interviewed a total of 521 respondents from nine parks in Multan (Table 1). Men constituted 76.6% of the total sample size, whereas 23.4% of the respondents were women. 19.6% of the respondents were less than 20 yr old, and 50.7% were between 20 and 30 yr. Most (84%) earned less than 50,000 PKR a month, and most were literate; 29.4% attended a university followed by those who had attended high school (28%) and those who had college/vocational diplomas (29.4%). More than half of the respondents (64.3%) had a park within walking distance of their residence. 44.9% of the respondents visited parks at least once a week. Furthermore, 73.5% of the respondents owned a home in a nearby village where they would visit at least once in 2–3 yr. 32.1% of the respondents never visited any mountainous area, whereas 29% would visit a mountainous area at least once in a year. Demographic information is presented in Table 2.

Perception of urban park trees, the ecosystem services they offer and the challenges they face

The respondents largely agreed on the importance of urban park trees; 91.1% agreed that it is important to have trees in urban parks (Fig. 1a). The majority (91.9%) opined that it is important to have a variety of trees species in urban parks and most of them (84.2%) also supported an increase in tree cover in urban parks (Fig. 1b, c). Nearly half were unfamiliar with the term ecosystem services and of those who were aware of this term, only 13.2% were able to define it

Table 2. Demography of the respondents (percentage and the number of respondents in the parentheses).

Variables	% (*n*)
Gender	
Male	76.6 (399)
Female	23.4 (122)
Education	
Illiterate	15.5 (80)
High school	55.1 (287)
University	29.4 (154)
Age class	
20 yr	19.6 (102)
20–30 yr	50.7 (264)
30–45 yr	22.3 (116)
Above 45 yr	7.5 (39)
Income (PKR)	
Up to 20,000	51.6 (269)
20,000–50,000	32.4 (169)
Above 50,000	15.9 (83)
Frequency of visiting parks	
At least once a week	44.9 (234)
At least once a month	31.9 (166)
Few times a year	23.2 (121)
Visit to nearby village (at least once a year)	
No	26.5 (138)
Yes	73.5 (383)
Park within walking distance of residence	
No	35.6 (185)
Yes	64.4 (335)
Predominant reason for visiting park	
Walking/jogging	47.7 (249)
Relaxing/meditation	34.9 (182)
Socializing	17.2 (90)

correctly (Fig. 1d). Almost all the respondents (98.8%) knew which government departments are responsible for urban park tree management (Fig. 1e). Nearly all the respondents (98.8%) believed that urban park trees should be managed and increased with a public–government partnership approach (Fig. 1f).

The most popular key word responses to "What do urban park trees do for us?" were oxygen, shade, clean air, and recreation (Fig. 2a) and to "What challenges urban park trees face?" were cutting down, lack of space, and urbanization (Fig. 2b), respectively.

As shown in Fig. 3, trees were perceived to be important for the provision of all ESs included in this study, although the Kruskal–Wallis test suggested variation in the perceived importance of these ESs (Kruskal–Wallis test, $H = 58$, df = 4, $P < 0.001$). The Dunn's post hoc test of pairwise multiple comparisons suggests that the importance of urban park trees in providing aesthetic value and climate regulation was perceived as the highest whereas the perceived value of dust control was the lowest. Detailed pairwise multiple comparisons are presented in Appendix S2: Table S1.

Factors influencing perception

Gender.—The gender of the respondents affected the perception of urban park trees' importance to some of the ESs included in this study. Men perceived trees to be more important in providing pollution mitigation ($W = 29{,}289$, $Z = -1.885$, $P = 0.049$), habitat for wildlife ($W = 28{,}375$, $Z = -2.512$, $P = 0.012$), and aesthetic value ($W = 28{,}034$, $Z = -2.867$, $P = 0.004$). Conversely, women perceived temperature regulation ($W = 30{,}515$, $Z = -0.945$, $P = 0.345$) and dust control ($W = 29{,}936$, $Z = -1.356$, $P = 0.175$) to be more important ecosystem services provided by trees.

Residential distance to parks.—Living within a walking distance to a park increased perceived importance of urban parks to all of the ESs: pollution mitigation ($W = 43{,}645$, $Z = -3.198$, $P = 0.001$), temperature regulation ($W = 43{,}507$, $Z = -3.171$, $P = 0.002$), dust control ($W = 44{,}350$, $Z = -2.638$, $P = 0.008$), habitat for wildlife ($W = 43{,}560$, $Z = -3.194$, $P = 0.001$), and aesthetic value ($W = 44{,}241$, $Z = -2.85$, $P = 0.004$).

Connection to rural areas.—Our results suggest that respondents' connection to the nearby village also increases the perceived importance of urban park trees in providing all of the ESs included in the study: pollution mitigation ($W = 94{,}425$, $Z = -2.507$, $P = 0.012$), temperature regulation ($W = 95{,}513$, $Z = -3.041$, $P = 0.002$), dust control ($W = 97{,}333$, $Z = -1.795$, $P = 0.037$), habitat for wildlife ($W = 95{,}884$, $Z = -2.837$, $P = 0.005$), and aesthetic value ($W = 97{,}125$, $Z = -1.752$, $P = 0.008$).

Education.—We found that the perception of urban park trees in providing most of the ESs on our questionnaire is influenced by the levels of education with a university education leading to the highest rank score: pollution mitigation (Kruskal–Wallis test, $H = 10$, df = 3, $P = 0.01$), temperature regulation ($H = 16$, df = 3, $P = 0.001$), dust control ($H = 12$, df = 3, $P = 0.008$), habitat for wildlife ($H = 3$, df = 3, $P = 0.341$), and aesthetic value ($H = 2$, df = 3, $P = 0.56$).

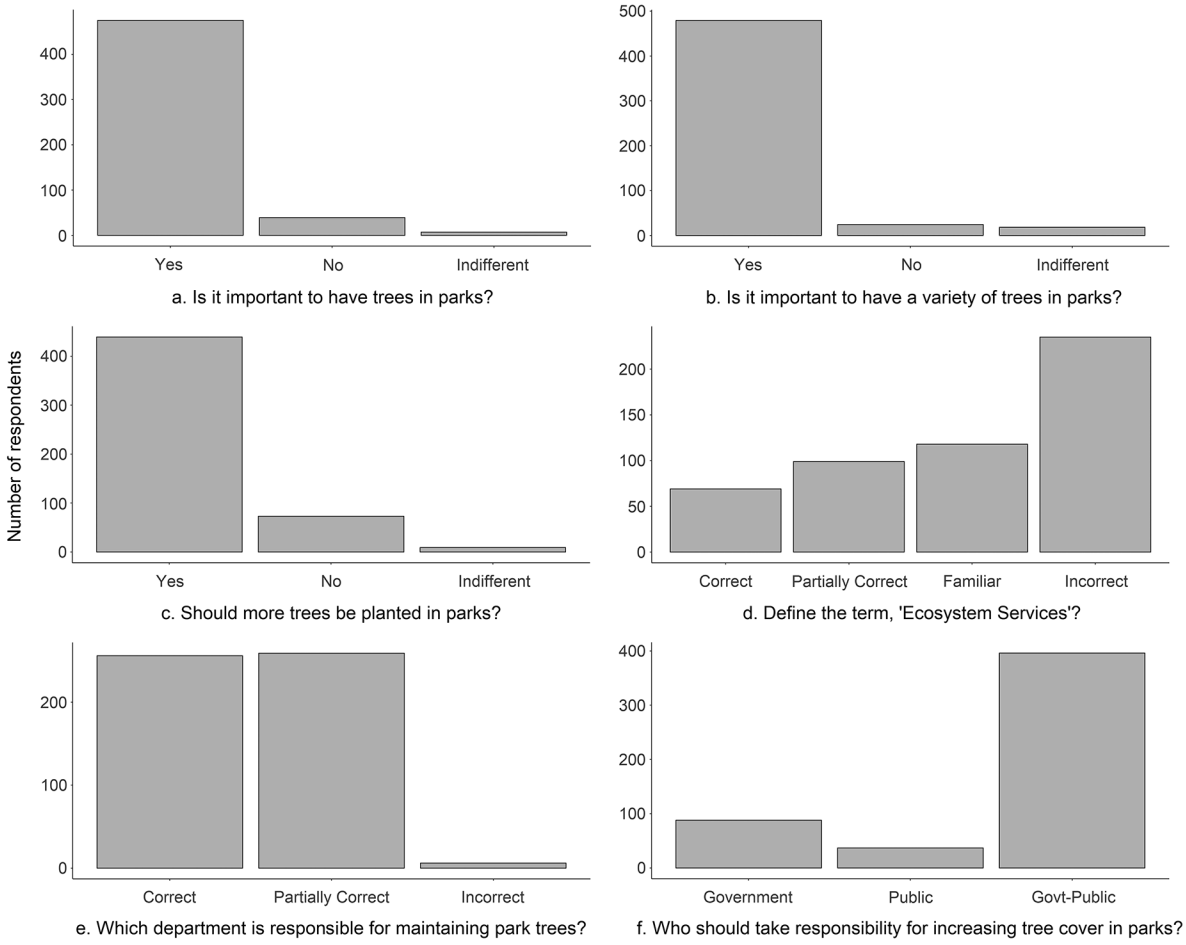

Fig. 1. Number of respondents choosing different options while answering questions (a–f). Total number of respondents was 521.

Results for the Dunn pairwise comparisons are presented in Appendix S2: Fig. S1a–c.

Income.—Income levels of the respondents also affected the perception score of all ESs except for aesthetic value: pollution mitigation ($H = 11$, df = 2, $P = 0.003$), temperature regulation ($H = 19$, df = 2, $P = 0.001$), dust control ($H = 9$, df = 2, $P = 0.008$), habitat for wildlife ($H = 6$, df = 2, $P = 0.045$), and aesthetic value ($H = 2$, df = 2, $P = 0.28$). In all cases, respondents earning less than 20,000 PKR a month had the lowest rank score. There was no significant difference between rank scored of mid-range (20,000–50,000 PKR) and high income (above 50,000 PKR) respondents (Appendix S2: Fig. S1d–g).

Age.—We found no evidence that the perception of urban park trees' importance varied among the different age groups: pollution mitigation ($H = 3$, df = 4, $P = 0.416$), temperature regulation ($H = 5$, df = 4, $P = 0.222$), dust control ($H = 2$, df = 4, $P = 0.720$), habitat for wildlife ($H = 4$, df = 4, $P = 0.307$), and aesthetic value ($H = 7$, df = 4, $P = 0.126$).

Park visit frequency.—Respondents' perception of urban parks tree importance to provide ESs varied with their frequency of visits to parks: pollution mitigation ($H = 8$, df = 2, $P = 0.016$), temperature regulation ($H = 5$, df = 2, $P = 0.067$), dust control ($H = 10$, df = 2, $P = 0.006$), habitat for wildlife ($H = 9$, df = 2, $P = 0.009$), and aesthetic value ($H = 19$, df = 2, $P < 0.001$). The respondents who visited the park only few times a year had the least score for all ESs while respondents who visited parks weekly had the

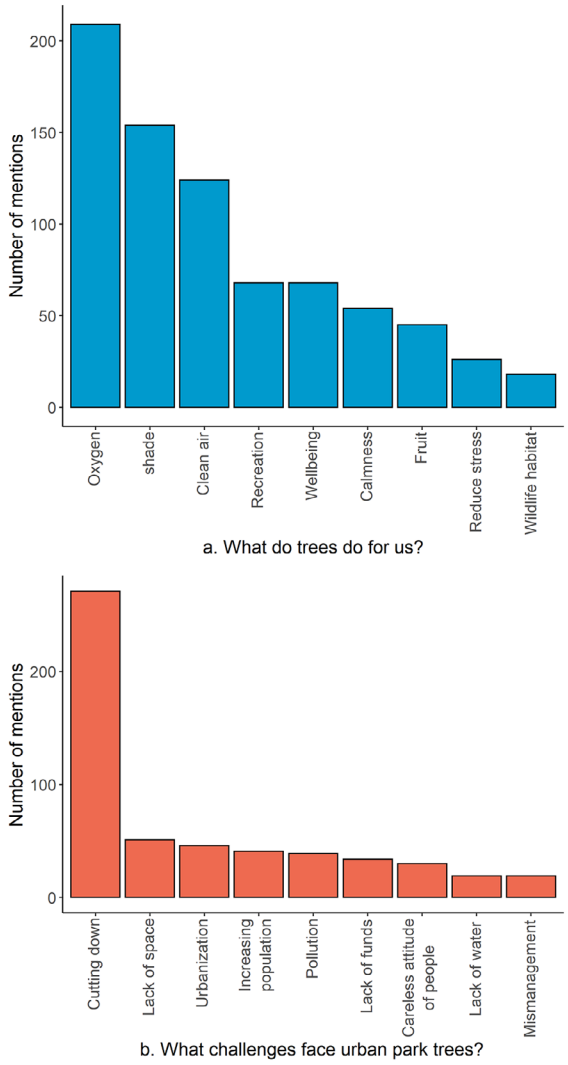

Fig. 2. Popularity of the top 10 terms given in response to questions: (a) What do urban park trees do for us? and (b) What are the greatest challenges they face?.

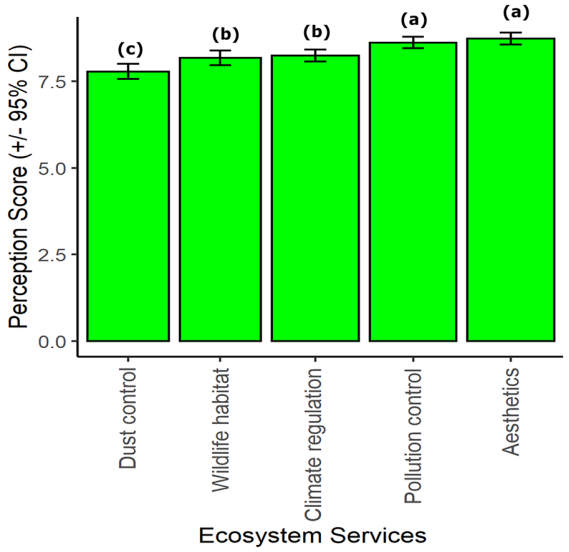

Fig. 3. Public perception of ecosystem services provided by urban park trees. Mean visual analogue score (0–10) values (n = 521). Groups followed by the same letter are not significantly different (α = 0.05).

highest rank score. Moreover, there was no significant difference between the perception scores of weekly and monthly visitors (Appendix S2: Fig. S1h–k).

WTP—binary logistic regression model

The results of binary logistic model suggest that the respondents in the low-income category (i.e., less than 20,000 PKR a month) are least likely to consider paying for the increased tree cover in urban parks (β = −0.669, Wald = 8, P = 0.004). Also, the respondents with a university degree are statistically significantly more likely to pay for increasing tree plantation in Multan parks (β = 0.505, Wald = 4, P = 0.04). Furthermore, we found evidence (significance level 0.1) that the female respondents are more likely to consider paying for increased trees in urban parks of Multan (β = 0.483, Wald = 3, P = 0.06). Detailed results of the binary logistic model are presented in Table 3. Furthermore, the descriptive statistical analysis of those who were willing to pay is shown in Table 4. Results suggest that more than two-third of the respondents showed willingness to pay for increasing tree cover in the urban parks of Multan.

Discussion

The role of urban parks in providing valuable ecosystem services is widely acknowledged (Buchel and Frantzeskaki 2015, Elmqvist et al. 2015, Kothencz et al. 2017); however, the ecosystem services offered by urban parks are not always explicit (Buchel and Frantzeskaki 2015). To evaluate the quality and value of

Table 3. Results of binary logistic regression model modeling respondents' willingness to pay to increase tree cover in urban parks of Multan, Pakistan.

Variables	β	SE	Wald	df	Sig.	Exp(*B*)
Female	0.483	0.261	3.427	1	0.06*	1.620
Park within walking distance of home	−0.133	0.236	0.319	1	0.570	0.875
Frequent park visitor	−0.120	0.092	1.688	1	0.190	0.887
Low monthly income	−0.669	0.230	8.478	1	0.004**	0.512
University graduate	0.505	0.250	4.084	1	0.04**	1.657
Young aged	0.160	0.334	0.229	1	0.632	1.173
Old aged	0.395	0.479	0.681	1	0.409	1.484
Middle aged	0.166	0.275	0.364	1	0.546	1.181
Constant	1.310	0.268	23.883	1	0.000	3.706
Log-likelihood	562.98					
Number of observations	521					

Notes: β, beta; SE, standard error; Wald, Wald chi-square; df, degrees of freedom; Sig, significant levels *10% and **5%.

Table 4. Number of responses to each option in response to the question, "How much would you be willing to pay to increase tree cover in urban parks of Multan?" (n = 521).

Willingness to pay†	No. respondents
Not willing to pay	130 (24.9%)
Up to 1000	224 (42.9%)
1000–2000	85 (16.3%)
2000–3500	43 (8.2%)
3500–5000	23 (4.4%)
Above 5000	16 (3.07%)

† Values are in Pakistan rupee.

urban parks, it is imperative to explore which ecosystem services are recognized by citizens (Li et al. 2019). Public perception of urban parks not only helps to prioritize the delivery of ecosystem services but also helps to gauge the quality of parks through social metrics (Buchel and Frantzeskaki 2015). In this paper, we sought to understand what people know of the benefits and challenges faced by urban parks in Multan, Pakistan, and to identify socioeconomic determinants of citizens' willingness to contribute to the sustainable management of urban park trees.

The perceived benefit of and challenges to urban park trees

Most respondents were aware of the importance of trees and opined that the number and variety of trees in the urban parks of Multan should be increased (Fig. 1a–d). This agrees with several reports from around the world where citizens are concerned about the low tree density in cities and seek an increase in the number and variety of trees in urban green spaces (Camacho-Cervantes et al. 2014, Collins et al. 2019, Suchocka et al. 2019). These results reiterate the growing concern that cities—globally—are suffering from lack of nature as citizens urge for greener neighborhoods (Duinker et al. 2015).

Here, oxygen, shade, clean air, and recreation were perceived to be the greatest benefits of urban park trees (Fig. 2a) and should be interpreted in the context of two important facts. First, the recent exponential expansion of Multan city has had adverse impacts on air quality (Manzoor et al. 2019), and, second, the region has experienced prolonged and harsh summers and unprecedented heatwaves in recent years. These could have made services such as shade and fresh air more obvious to the residents of Multan as has been reported in other parts of the world (Camacho-Cervantes et al. 2014, Collins et al. 2019, Manzoor et al. 2019).

The most frequently perceived challenges to urban park trees were cutting down, lack of space, and urbanization (Fig. 2b). Similar responses were recorded for a survey in London, UK, where park visitors also did not identify climate change, pests, and diseases as potential challenges to urban park trees (Collins et al. 2019). For example, in the recent past, Shisham Dieback has nearly wiped out the Shisham tree (*Dalbergia sissoo* (L.)), one of the key tree species of the region. Thus, park visitors were aware of some of the threats to urban park trees but were unaware of other important challenges such as pests, diseases, and changing climate.

Perceived importance of ecosystem services from urban park trees

In line with other studies, few respondents defined the term "ecosystem service" correctly (Collins et al. 2019). This is probably because the term is still very academic—and not widely propagated on mainstream media. Despite

unfamiliarity with this term, the respondents were aware of what trees do for them. Trees were perceived as essential for all ESs included in this study (Fig. 3), again in agreement with many other studies (Camacho-Cervantes et al. 2014, Collins et al. 2019).

Of the five ESs included in this study, the majority of our respondents rated aesthetics and pollution control as the most important ESs provided by urban park trees (Fig. 3). This may be attributed to unawareness of the less-visible ESs such as the provision of habitat for wildlife and the contribution to urban park trees in controlling dust (Collins et al. 2019). Aesthetics and Pollution control are often the most highly rated ESs, partly because these are widely discussed in the mainstream media and our results accord broadly with other studies on this subject (Swapan et al. 2017, Raum 2018, Collins et al. 2019). Subtly, in Chengdu, China, climate regulation was perceived as the most important ES, while in London, UK, habitat for wildlife was most highly ranked, these variations suggest that cultural differences may influence perception (Swapan et al. 2017).

In Multan, there are many influences on the perceived importance of ESs: gender, residential distance to parks, connections to rural areas, income levels, education, and frequency of visiting parks all accounted for some variation, as was found elsewhere (Swapan et al. 2017, Raum 2018, Collins et al. 2019, Suchocka et al. 2019, Drillet et al. 2020).

Willingness to pay for increasing urban park trees

The ES theory is fundamentally anthropocentric in focus; it explains how ecosystems offer economic and cultural value to human beings (Ruhl and Chapin 2013). Here, using WTP as a metric, we show citizens' willingness to increase urban park trees in Multan. Female respondents are more willing to pay than males, aligning with other literature suggesting that women are often more sensitive to environmental causes (Marbuah 2019). A greater female-WTP can also be attributed to differences in social roles of women and men (Franzen and Vogl 2013). Women being nurturers from a social and cultural perspective may be more concerned about the preservation of life and conservation of the environment (Torgler and Garcia-Valiñas 2007). The university graduates show greater WTP for urban park trees. Several studies pointed out that WTP for environmental causes is positively correlated with education (Marbuah 2019). Better education often results in more information on environmental issues which, in turn, increases an individual's WTP for environmental protection (Torgler and Garcia-Valiñas 2007, Franzen and Vogl 2013, Marbuah 2019). The more affluent individuals are often more willing to spend for environmental causes, relative to the poor. Our income finding is consistent with the affluence hypothesis: "given a constrained budget and same preferences, more wealthy individuals will be able to expend more for environmental goods than less wealthy individuals" (Marbuah 2019).

The Multan respondents were mostly (completely or partially) familiar with the department that manages urban park trees, and an overwhelming majority believed that sustainable management or urban park trees here should be a public–government effort rather than completely a government responsibility. This suggests an opportunity to develop further trust and public participation in campaigns for increasing tree cover. Volunteering for a cause or contributing to a fundraising is often more successful when people show personal interest in the issue and have faith in the responsible authorities (Bennett 2003).

We show that citizens of Multan understand and acknowledge the significance of urban park trees and have shown WTP to increase tree cover in the parks of Multan. Citizens are likely to welcome a government–public partnership for sustainable management of urban park trees. Future policies to involve the public in park management and in raising funds for park trees could target the educated, the young and the affluent sectors of Multan society. For this, local colleges and universities could be excellent hot spots for fundraising and finding potential volunteers. Media and information campaigns should highlight the less known but critical problems of urban park trees such as pests and diseases and should provide information on how the public and contribute to sustainable park tree management.

A comparison of public perceptions about urban park trees suggests that the ecological value of trees is recognized globally, irrespective of the

socioeconomic, geographic, or climatic features of the countries. Exploratory studies in the UK (Özgüner and Kendle 2006, Collins et al. 2019), Australia (Rossi et al. 2016), Hungary (Kothencz and Blaschke 2017), China (Jim and Chen 2006), and Turkey (Özgüner 2011) reported broadly similar understanding of public toward the importance of trees in urban areas. Even though the term, ecosystem services are not widely understood, people around the world understand the role of trees in maintaining urban environment and are willing to pay for increasing tree cover.

Conclusion

We conclude that, although Multan park visitors have low familiarity with the term, ecosystem service, they understand the benefits of urban park trees and appreciate ESs provided by urban park trees, especially aesthetics and pollution control. Park visitors were less aware of some of the critical challenges to urban park trees, such as pests, disease, and climate change. The majority of the park visitors believed that the number and variety of tree species in urban parks should be increased through government–public cooperation. Two-third of the respondents showed a willingness to pay for increasing tree cover in urban parks of Multan. Income, age, and education of the respondents were significant predictors of WTP for urban park trees. We show that there is a potential for stakeholder engagement by policymakers and park managers to involve the public in the sustainable management of urban park trees in Multan.

Our work indicates that the importance and understanding of trees in urban areas is broadly similar the world over, whether the context is a rapidly expanding city in a developing nation or an established city in a developed nation. Urban parks and their trees have a substantial role to play in the health and economies of city residents in all urban contexts.

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Supporting Information

Additional Supporting Information may be found online at: http://onlinelibrary.wiley.com/doi/10.1002/ecs2.3348/full