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Valuation of Visitors' Perceptions on the Ecosystem Services of Urban Forest Park in Johor, Malaysia

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ABSTRACT

Urban forest parks deliver a wide spectrum of ecosystem services that support biodiversity, climate regulation, and public well-being; however, their perceived value among local visitors remains underexplored in Southeast Asia. This study investigates visitor perceptions and economic valuation of ecosystem services at Mount Pulai Forest Eco Park in Johor, Malaysia. Grounded in the Total Economic Value (TEV) framework and ecosystem service theory, the research employed a structured on-site survey of 392 visitors and applied the Contingent Valuation Method (CVM) to assess awareness, appreciation, and willingness-to-pay (WTP) for forest conservation. Findings revealed that visitors highly valued regulating services, such as air purification and flood mitigation (mean ≈ 4.3/5), and supporting services, like biodiversity (mean ≈ 4.2/5), while provisioning services were rated lower (mean ≈ 2.8/5). Despite limited familiarity with ecological terminology, only 33% understood the term "ecosystem services". In contrast, a substantial majority (79.1%) expressed WTP for conservation efforts, proposing an average annual contribution of MYR 51.32. Additionally, 65% of respondents supported an entry fee model, suggesting a mean payment of MYR 3.07 per visit. These results

underscore the economic and non-economic value that urban residents assign to forest benefits, offering new insights into conservation finance and public engagement. The study's innovation lies in its integration of ecosystem perception with economic valuation in an urban forest setting, providing a replicable framework for sustainable park management across Southeast Asia.

Keywords: Ecosystem Services; Urban Forest; Willingness-to-Pay; Contingent Valuation; Public Perception; Sustainable Management

1. Introduction

Urbanization and environmental degradation are among the most pressing challenges faced by societies today [1]. Rapid city expansion has led to increased land-use change, biodiversity loss, and climate-related issues such as the urban heat island effect, air pollution, and more frequent flooding [2]. In this context, urban green spaces, particularly urban forests, play a crucial role in mitigating environmental stressors and enhancing human well-being [3]. They provide essential ecosystem services, including carbon sequestration, temperature regulation, biodiversity conservation, recreational opportunities, and aesthetic experiences. However, the recognition and valuation of these services by the public remain uneven, especially in developing countries, where environmental education and policy integration are still in the process of evolving [4].

In Malaysia, urban forest parks, such as Mount Pulai Forest Eco Park, serve as critical ecological and recreational spaces within rapidly growing metropolitan areas, like Johor Bahru. While the country maintains relatively high forest cover (approximately 55% of total land area), much of this is concentrated in rural or protected areas [5]. Urban and peri-urban forests are increasingly important for their proximity to population centers, providing opportunities for education, ecotourism, and environmental restoration. Despite this, public awareness and appreciation of the full range of ecosystem services provided by urban forests remain under-investigated. Statements claiming that ecosystem awareness is universally low may no longer be valid; however, specific knowledge regarding complex ecosystem functions, such as nutrient cycling, climate regulation, and supporting services, remains limited among the general public [6].

Ecosystem services are broadly classified into four categories: provisioning services (e.g., raw materials and fresh water), regulating services (e.g., air purification and flood control), supporting services (e.g., habitat provision and biodiversity), and cultural services (e.g., recreation and aesthetic enjoyment) [7]. The Total Economic Value (TEV) framework further distinguishes between use values (direct and indirect) and non-use values (existence, option, and bequest), providing a theoretical foundation for understanding how individuals assign value to environmental goods and services. Based on this, we can hypothesize that visitors' perception and valuation of ecosystem services are influenced by their level of ecological knowledge, socio-demographic factors, and perceived benefits, both economic and non-economic, of interacting with natural environments.

Mount Pulai Forest Eco Park, located in the Kulai district of Johor, exemplifies the challenges and opportunities in balancing conservation with increasing recreational demand. Despite being a designated forest reserve and recreational area with more than 139,000 visitors recorded in 2022 [8], there is a lack of empirical data on how visitors perceive and value the park's ecological functions. Previous studies in Malaysia have often emphasized biodiversity monitoring or ecotourism experiences in rural parks, such as Taman Negara or Endau-Rompin [9,10] However, studies explicitly focused on visitor-based valuation of ecosystem services in urban forest settings remain limited. One exception is the study by Jamean & Abas [11] in Kuala Lumpur, which explored ecosystem service perception without incorporating economic valuation components such as WTP.

The inclusion of WTP through the Contingent Valuation Method (CVM) allows researchers and policymakers

to assess the monetary value that individuals assign to environmental conservation [6]. Such methods are particularly useful in assessing non-market goods, such as clean air, biodiversity, and recreational services. Integrating visitor perception with WTP data offers a more holistic understanding of the public's valuation of urban forests, which can inform sustainable financing strategies such as entrance fees, donation schemes, or Payment for Ecosystem Services (PES) [11]. Furthermore, understanding how demographic and experiential variables such as age, education level, frequency of visits, or ecological knowledge influence WTP can support targeted awareness and engagement campaigns [12].

From a policy and planning perspective, cities aiming to become "eco-cities" or "garden cities" (concepts long embedded in sustainable urban planning) must align environmental conservation with public engagement. Urban forests offer a platform for achieving both goals [3]. However, to secure long-term ecological sustainability and financial viability, it is essential to recognize the public's perspective not just in terms of recreational enjoyment but also in their willingness to support conservation initiatives through behavior and financial contributions.

The primary aim of this study is to assess visitors' perceptions and the economic and non-economic value they assign to ecosystem services at Mount Pulai Forest Eco Park. The study is grounded in the TEV framework and seeks to link ecological awareness with valuation behavior. The specific objectives of this study are:

1. To identify and categorize the ecosystem services provided by Mount Pulai Forest Eco Park from the perspective of visitors.
2. To measure visitors' awareness, knowledge, and perceptions of these ecosystem services using structured questionnaires and descriptive analysis.
3. To assess the WTP for conservation and management of the forest using the CVM, and to examine factors influencing WTP behavior.

This study contributes to the growing body of literature on ecosystem service valuation in Southeast Asia by integrating perception analysis with economic valuation in the context of urban forests. It also offers a practical framework for urban forest managers and policymakers to incorporate public values into conservation strategies, enabling data-driven decision-making that supports both ecological integrity and visitor engagement.

2. Research Methodology

2.1. Research Area

Johor, located in southern Peninsular Malaysia, is undergoing rapid urbanization and industrial development. This transformation has contributed to increased environmental degradation, including forest loss, rising surface temperatures, and declining air quality. In this context, urban forests play a critical role in delivering ecosystem services, such as temperature regulation, carbon storage, and recreation [8].

Mount Pulai Forest Eco Park (TERGP1 and TERGP2), located within the Mount Pulai Permanent Forest Reserve (**Figure 1**), is strategically selected due to its accessibility to urban residents and its dual function as both a recreational area and a conservation site. TERGP1 is characterized by hiking trails, waterfalls, and an early warning system for hydrological risks, while TERGP2 features camping areas and riverside facilities. This variation offers a unique opportunity to assess visitor perceptions across different types of forest experiences.

These sites are representative of typical urban forest parks in Malaysia, situated on the urban fringe, accessible by road, popular for domestic tourism, and managed under a mixed mandate of conservation and recreation.

2.1.1. Research Design and Conceptual Framework

This study adopts a mixed-methods quantitative design, anchored in the TEV framework and the Millennium Ecosystem Assessment [7] classification of ecosystem services. The design captures both the non-monetary perception and the economic valuation (willingness-to-pay) of ecosystem services provided by urban forests. To structure the methodological flow, **Figure 2** outlines the research process.
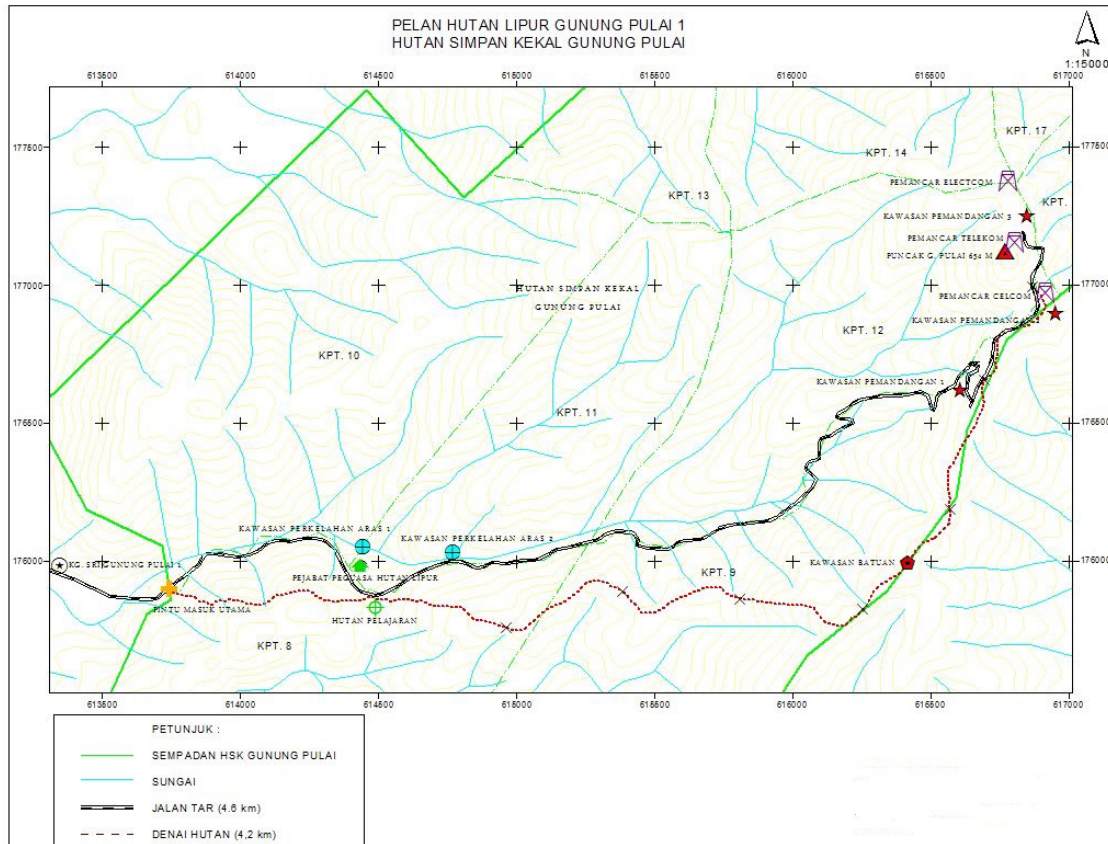
Figure 1. Mount Pulai Recreational Forest Plan.

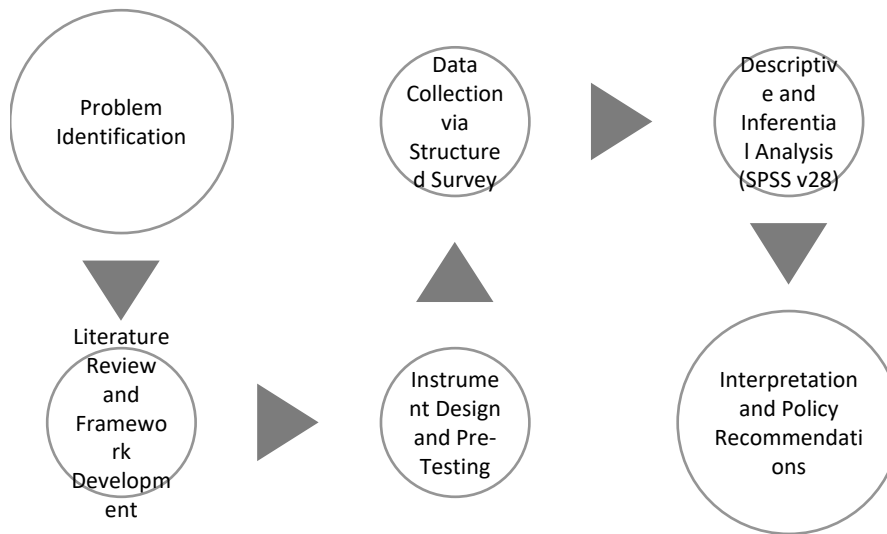Source: Johor Forest Department [8].

Figure 2. Research Flowchart.

2.1.2. Sampling Procedure

The target population consisted of visitors to Mount Pulai Forest Eco Park. According to the Johor Forest Department [8], approximately 139,000 visitors were recorded in 2022. Using the Krejcie & Morgan [13] table, a

sample size of 392 respondents was determined to ensure statistical representativeness. A simple random sampling approach was employed to eliminate bias. Visitors were selected on-site, both on weekdays and weekends, to ensure demographic diversity. Each respondent was surveyed once only, and repeat entries were excluded through a visitor tracking log.

2.1.3. Research Instrument and Standard

The primary data collection tool was a structured questionnaire, adapted from Jamean & Abas [11] (2023), TEEB [14], and Samdin et al. [10], and aligned with elements from international guidelines, including ISO 14001 (Environmental Management Systems) and ASHRAE Standard 55 (for environmental comfort relevance). The questionnaire was validated via expert review and pilot-tested on 30 respondents prior to full deployment.

Section A gathers demographic details, such as gender, age, citizenship, education level, employment status, monthly income, place of residence, visit frequency, mode of transportation, and purpose of visit. These factors help identify visitor profiles and analyze how different backgrounds influence perceptions of ecosystem services.

Section B assesses visitors' knowledge of key ecological terms like "ecosystem," "forest ecosystem," and "ecosystem services." This section helps determine whether visitors understand the benefits of the park and highlights any gaps in environmental awareness that could inform future education and outreach efforts.

Sections C to F focus on visitor perceptions of the four main categories of ecosystem services:

- Provisioning services (e.g., water resources and raw materials)
- Regulating services (e.g., climate regulation and air purification)
- Cultural services (e.g., recreation, aesthetics and spiritual value)
- Supporting services (e.g., biodiversity and nutrient cycling)

These sections help identify which services visitors value most and how their awareness of these benefits may impact conservation efforts.

Section G evaluates visitor satisfaction with park facilities and management, including infrastructure, cleanliness, accessibility, and conservation measures. Understanding visitor feedback in this area can guide improvements that enhance both the visitor experience and environmental sustainability.

Section H examines visitors' WTP for conservation and park maintenance. WTP is an important indicator for developing sustainable funding models, such as entrance fees or donations, to support conservation efforts. This section also invites visitors to suggest improvements for the eco park, providing valuable insights for future management strategies.

2.2. Data Collection Procedure

Data were collected between May and June 2023, on-site at the entrance checkpoints of Mount Pulai. Research assistants were present to facilitate participation and clarify any doubts. To facilitate respondent participation, the questionnaire was developed using Google Forms and made accessible through a QR code displayed at the park's security lodge counter. Visitors were invited to scan the QR code upon registration in the visitor logbook and complete the survey on their mobile devices. To enhance response rates and minimize non-response bias, the researcher remained on-site to assist visitors with any inquiries related to the questionnaire [15].

Additionally, a hard copy version of the questionnaire was provided for visitors who experienced internet connectivity issues or preferred a paper-based format. This was particularly beneficial for elderly visitors who might not own smartphones, ensuring inclusivity and broader participation in the study [16].

Respondent consent was obtained verbally, and data collection adhered to ethical guidelines to ensure anonymity and voluntary participation. A pilot test was conducted with 30 participants to assess readability, question clarity, and response time, which led to minor refinements before the full-scale distribution.

This sampling procedure was designed to maximize response accuracy while maintaining methodological rigor and accessibility, thereby enhancing the reliability and validity of the data collected.

2.3. Data Analysis

Quantitative data were analyzed using IBM SPSS Statistics Version 28. Descriptive statistics, including frequencies, means, standard deviations, and percentages, were used to profile respondents and summarize their perceptions of ecosystem services. Descriptive statistics reveal the common type of response distribution of all variables. Specifically, the mean and standard deviation were used to identify the characteristics of the sample in this study. According to Hair et al. [17], mean values can be categorized into four levels: low, moderately low, moderately high, and high, as shown in **Table 1**.

Table 1. Mean values.

Mean Score	Interpretation
1.00 - 2.00	Low
2.01 - 3.00	Moderately low
3.01 - 4.00	Moderately high
4.01 - 5.00	High

Source: Hair et al. [17].

Findings from this descriptive analysis allowed the researchers to describe the variables involved as factors that influenced the respondents' level of knowledge about the ecosystem and their perception of ecosystem services, the facilities provided, and issues regarding urban forests. To test for possible factors that contributed to the visitors' WTP attitude, multiple regression analysis was performed. The SPSS v.28 software package was used for all statistical analyses.

To ensure the data met assumptions for inferential analysis, normality was tested using skewness and kurtosis values, which all fell within acceptable thresholds (±2 for skewness and ≤10 for kurtosis). Multiple linear regression analysis was applied to identify predictors of WTP, including demographic factors, knowledge levels, and satisfaction with park amenities. Analysis of variance (ANOVA) and R-squared values were used to assess the explanatory power and significance of the models [10]. Results for WTP were reported in two parts: the mean annual contribution (MYR/year) and the mean proposed entrance fee (MYR/visit). These figures provide critical inputs for designing sustainable financing mechanisms for urban forest conservation.

2.4. Instrument Validity and Reliability

To ensure methodological rigor, the questionnaire was reviewed by environmental economics, forestry, and urban planning experts for face and content validity. A pilot test verified the clarity and comprehension of questions. Internal consistency reliability was assessed using Cronbach's alpha, with all major constructs yielding values above 0.70, indicating satisfactory reliability. Data integrity was ensured through quality control measures, including the exclusion of incomplete responses and triangulation of self-reported knowledge, perception levels, and WTP behavior. These procedures enhanced the trustworthiness of the findings and supported the study's objective of producing evidence-based recommendations for sustainable park management and conservation financing.

3. Results

3.1. Respondent Demographics

A total of 392 respondents participated in the survey (**Table 2**), with females (58.7%) outnumbering males (41.3%). The dominant age group was 21–30 years old, accounting for 77.6% of participants, followed by those under 20 years old (8.7%), and a small proportion aged 51 years and above (0.5%). The majority of visitors (98.5%) were Malaysian citizens, primarily Malay (84.2%), with smaller proportions of Chinese (5.1%), Indian (4.1%), and indigenous communities (6.6%). Educationally, more than half of the respondents held a bachelor's degree (56.1%), while others had diplomas (22.2%), secondary education (15.3%), and postgraduate degrees (4.6%). Most participants were students (37.0%) or employed in the private sector (42.1%), and nearly half (49.2%) earned less than RM1,500 monthly, reflecting a large student demographic.

The spatial distribution revealed that 67.3% of visitors came from outside the Kulai district. The park primarily attracted infrequent visitors, with 86.7% reporting fewer than four visits in the past year. Most traveled by private vehicle (76.8%), and were accompanied by friends (54.6%) or family (32.1%). Recreational bathing (35.2%) and hiking (29.6%) were the most common purposes for visitation, followed by seeking peace and quiet (21.7%).

Table 2. Demographics Profile.

Demographics		Number (n: 392)	Percent (%)
Gender	Men	162	41.3
	Female	**230**	**58.7**
Age	< 20 years old	53	8.7
	21-30 years old	**304**	**77.6**
	31-40 years old	20	5.1
	41-50 years old	13	3.3
	> 51 years old	2	0.5
Nationality	**Malaysian**	**386**	**98.5**
	Non-Malaysian	6	1.5
Race	**Malay**	**330**	**84.2**
	Chinese	20	5.1
	India	16	4.1
	Others	26	6.6
Level of Education	Secondary School	60	15.3
	Diploma	87	22.2
	Degree	**220**	**56.1**
	Masters	12	3.1
	PhD	6	1.5
	Others	7	1.8
Jobs	Government	30	7.7
	Private	**165**	**42.1**
	Self-employed	35	8.9
	Retired	2	0.5
	Student	145	37.0
	Not working	15	3.8
Monthly Income	**1500 and below**	**193**	**49.2**
	1501-3000	135	34.3
	3001-5000	46	11.7
	5001-10,000	12	3.1
	10,001 and above	6	1.5
Place of Living	In Kulai district	128	32.7
	Outside Kulai district	**264**	**67.3**
Frequency of Visits	**< 4 times**	**340**	**86.7**
	4-12 times	31	7.9
	> 12 times	21	5.4
Means of Transportation	Public transport	14	3.6
	Own vehicle	**301**	**76.8**
	Car pool	72	18.4
	Others	5	1.3
Company at park	Alone	35	8.9
	Family	126	32.1
	Friends	**214**	**54.6**
	Travel agency	12	3.1
	Colleague	5	1.3
Purpose	Picnic	32	8.2
	Climbing	116	29.6
	Recreational bathing	**138**	**35.2**
	Tranquility	85	21.7
	Others	21	5.4

3.2. Visitors' Perception on Urban Forest

3.2.1. Normality of the Data

The normality assessment for this study was made by evaluating the skewness and kurtosis for each variable. According to Hair et al. [17], the data distribution is considered normal if the tendency value is between ± 2. While the kurtosis index value must not exceed 10.0 . Based on **Table 3**, the value of skewness is in the range between -1.98 and 0.97 and kurtosis is in the range between -0.66 and 2.332, which is not more than 10.0. It shows that the data obtained for this study is a normal distribution.

Table 3. Data normality.

Variables	Skewness	Kurtosis
Level of knowledge on related terms	-0.330	-0.470
Perception on regulating services	-1.980	4.080
Perception on provisioning services	-0.380	-0.660
Perception on cultural services	-1.255	0.556
Perception on supporting services	-1.704	2.332
Perception on urban forest amenities	-0.698	0.323
Perception on issues created by urban forest	0.970	0.240
Perception on issues related to the urban forest management	-0.414	0.489
Perception on interest and trust in urban forest management	-0.062	-0.920

3.2.2. Knowledge on Terms

Descriptive analysis involving mean and standard deviation (SD) was conducted to determine the knowledge of respondents on the related terms. **Table 4** shows that the mean score level for visitors' knowledge of each term was at a low level. The mean score for the term "ecosystem" is 1.10 with SD of 0.303, the mean score for the term "forest ecosystem" is 1.19 with SD of 0.394, while the mean score for the term "ecosystem service" is 1.40 with SD of 0.491. Overall, the mean score for the level of visitors' knowledge of terms is at a low level, with a mean of 1.23 and a standard deviation of 0.39.

Table 4. Knowledge on term.

No.	Item	Mean	SD	Interpretation
1.	Term 'urban forest'	0.30	1.10	Low
2.	Term 'ecosystem'	0.39	1.19	Low
3.	Term 'ecosystem services'	0.49	1.40	Low
	Overall	0.39	1.23	Low

3.2.3. Provisioning Ecosystem Services

Table 5 shows that the mean score for each item for ecosystem service provision is at a moderately low level. "Forest resources as a source of nutrition" is the item with the highest mean of 2.95 (SD = 1.14) followed by the item "Water as a source of drinking" with a mean of 2.94 (SD = 1.11). Next, the item "Forest resources as forest products/ timber" has a mean of 2.77 (SD = 1.13), the item "Forest resources as a food supply" has a mean of 2.64 (SD = 1.06) and the last item is the "Forest resources as a daily oil source" with a mean of 2.57 (SD = 1.06). Overall, the mean score for visitors' perception of provision of ecosystem services is at a moderate level (mean = 2.77, SD = 1.10).

Table 5. Provisioning Ecosystem Services.

Item/Question	SD	Mean	Mean Level
Water as a source of drinking	1.11	2.94	Moderately Low
Forest as a source of food supply	1.06	2.64	Moderately Low
Forest resources as forest/timber products	1.13	2.77	Moderately Low
Forest resources as a source of nutrition	1.14	2.95	Moderately Low
Forest resources as a source of daily oil	1.06	2.57	Moderately Low
Overall	1.10	2.77	Moderately Low

3.2.4. Regulating Ecosystem Services

Based on **Table 6**, it was found that there are two mean levels for visitors' perception of regulating ecosystem services, which are at a high level. Items that are at a high level are "Forests reduce landslides" with a mean of 4.33 (SD = 0.92), the item "Forests improve air quality" with a mean of 4.33 (SD = 0.88) and the item "Forests reduce the heat of the local area" with a mean of 4.35 (SD = 0.87). Additionally, "Forests reduce floods" has a mean of 4.29 (SD = 0.90), the item "Trees reduce air pollution" has a mean of 4.28 (SD = 0.92) and the item "Trees increase soil fertility" has a mean of 4.22 (SD = 0.89). Overall, the mean level of visitors' perception of regulating ecosystem services is high (mean = 4.30, SD = 0.89).

Table 6. Regulating Ecosystem Services.

Item/Question	SD	Mean	Mean Level
Forests reduce landslides	0.92	4.33	High
Forests reduce flooding	0.90	4.29	High
Trees reduce air pollution	0.92	4.28	High
Forests improve air quality	0.88	4.33	High
Forests reduce the heat of the local area	0.87	4.35	High
Trees increase soil fertility	0.89	4.22	High
Overall	0.89	4.30	High

3.2.5. Cultural Ecosystem Services

Table 7 shows the mean level of visitors' perception of cultural ecosystem services. There are two levels of perception, which are moderately high and high. The items that are at a moderately high level, with a mean of 3.23 (SD = 1.01), are the item "Forest as a place for research, learning and education" and the item "Forest as a place of tourism" with a mean of 3.97 (SD = 0.87). Other items that are at a high level are the item "Forest as a place for leisure and recreation" with a mean of 4.21 (SD = 0.80), the item "Forest as a place of calm and peace of mind" with a mean of 4.28 (SD = 0.78) and the item "Forest as an aesthetic place" with a mean of 4.27 (SD = 0.82). Overall, visitors' perception of this cultural ecosystem service is moderately high, with an average mean of 3.99 (SD = 0.85).

Table 7. Cultural Ecosystem Services.

Item/Question	SD	Mean	Mean Level
The forest as a place for leisure and recreation	0.80	4.21	High
Forest as a place of research, learning and education	1.01	3.23	Moderately high
The forest as a place of calm and peace of mind	0.78	4.28	High
The forest as an aesthetic place	0.82	4.27	High
Forest as a tourist destination	0.87	3.97	Moderately High
Overall	0.85	3.99	Moderately High

3.2.6. Supporting Ecosystem Services

The study's results showed that the mean score for visitors' perception of supporting ecosystem services was at a high level for each item (**Table 8**). The item "Forests provide indirect benefits to humans" showed a mean of 4.20 (SD = 0.82), the item "Forests main-tain biodiversity" with a mean of 4.22 (SD = 0.75), the item "Forests help ecosystem function" with a mean of 4.19 (SD = 0.75) and the item "Forests provide habitat for flora and fauna" with a mean of 4.24 (SD = 0.77). The overall mean score for supporting ecosystem services is 4.21 (SD = 0.77), which is a high mean level.

Table 8. Supporting Ecosystem Services.

Item/Question	SD	Mean	Mean Level
Forests provide indirect benefits to humans	0.82	4.20	High
Forests maintain biodiversity	0.75	4.22	High
Forests help ecosystem's function	0.75	4.19	High
Forests provide habitat for flora and fauna	0.77	4.24	High
Overall	0.77	4.21	High

3.3. Urban Forest Amenities

Table 9 shows the mean score level for the facilities provided at Mount Pulai Forest Eco Park. Respondents' opinions have been identified as to whether the facilities provided are in good condition. There are two mean score levels, which are medium and high. Items at a moderate level include "Toilet" with a mean of 3.48 (SD = 1.03) and the item "Clothing room" with a mean of 3.48 (SD = 1.03). The items with a high mean score consist of "Parking place" (mean = 3.68, SD = 0.98), "Visitor information counter" (mean = 3.54, SD = 1.04), "Pedestrians" (mean = 3.85, SD = 0.88), "Cleanliness" (mean = 3.73, SD = 0.95), "Safety" (mean = 3.67, SD = 0.92) and the item "Management and maintenance" (mean = 3.67, SD = 0.95). Overall, the mean score for the facilities provided at Mount Pulai Forest Eco Park is at a high level of 3.63.

Table 9. Forest Eco Park Facilities.

Item/Question	SD	Mean	Mean Level
Parking lot	0.98	3.68	Moderately High
Toilet	1.03	3.48	Moderately Low
Changing room	1.03	3.48	Moderately Low
Visitor information counter	1.04	3.54	Moderately High
Pedestrian	0.88	3.85	Moderately High
Cleanliness	0.95	3.73	Moderately High
Safety	0.92	3.67	Moderately High
Management and maintenance	0.95	3.67	Moderately High
Overall	0.97	3.63	Moderately High

3.4. Urban Forest Disservices

The results in **Figure 3** show that most of the respondents had average and negative perceptions of the disservices of urban forests (total low-level mean scores of 2.19, ±0.95). The highest mean was that of urban trees causing brown waste, at 2.48, and the lowest mean was that of urban trees causing an unpleasant view, at 1.78, indicating that urban forests did not cause a big issue for visitors.
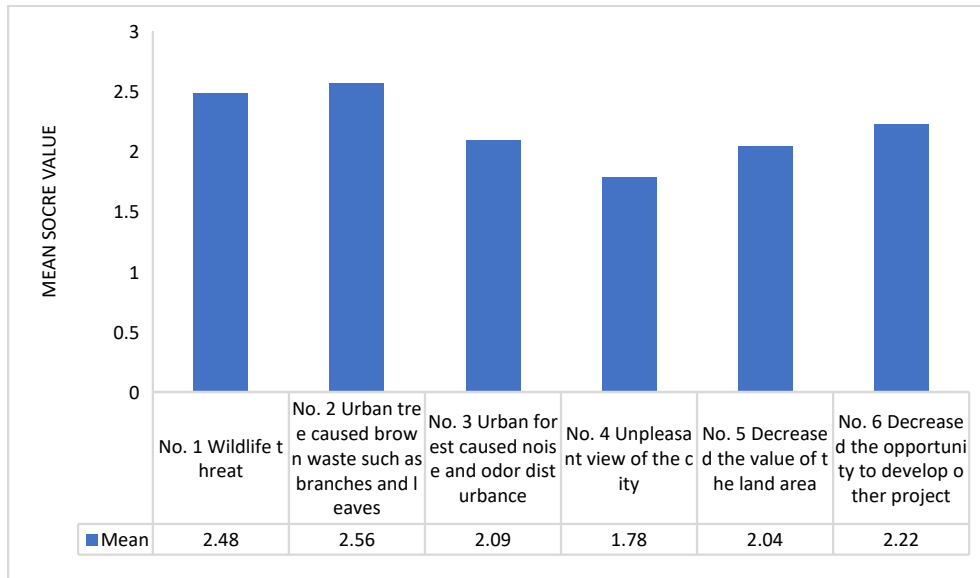
Figure 3. Issues caused by urban forests.

3.5. Urban Forest Management

The results show that the mean score of each item was moderately high or high. Items that had high scores were 'Lack of awareness among the public regarding urban forest ecosystem services' (4.23, ±1.11) and 'Lack of attention given by policy makers and decision makers in considering the importance of urban forests' (4.38, ±0.88), while the items that had moderately high scores were 'Lack of allocation for the purpose of preserving and conserving urban forests' (3.66, ±0.97), 'High management and maintenance costs' (3.14, ±1.09), and 'Less studies are conducted related to urban forests' (4.15, ±0.97). Overall, the mean scores of issues related to urban forest management were moderately high (3.9078, ±0.6118). Further, the mean score of 3.30, ±1.254 of the item 'Management and maintenance of urban forests should be fully handed over to the municipal council' was moderately high. In contrast, the item 'Management and maintenance of urban forests should be jointly managed by the government, private and public bodies' had a high score (4.47, ±0.823).

3.6. Willingness-to-Pay for Urban Forests

The results of the analysis showed that 79.1% of respondents said 'yes' to contributing a sum of money for conservation purposes, while the rest (20.9%) said 'no', and the average proposed contribution was as much as MYR 51.32 per year. For the second question related to WTP, 65% of respondents said 'yes', which means that they would agree to pay an entrance fee, with the average of the minimum fee proposed being MYR 3.07 per entrée, while the remaining 35% said 'no'. These results indicate that the majority of the respondents were willing to pay and contribute to the conservation and management of urban forests.

Factors That Influenced Willingness-to-Pay

The model summary in **Table 10** shows an R-squared value of 0.065, indicating that only 6.5% of the variation in WTP entry fees can be explained by variations in the twelve dependent variables. The balance (100% − 6.5% = 93.5%) was explained by other factors.

Table 10. Model summary.

Model	R	R-Squared	Adjusted R-Squared	Std. Error of the Estimate	Change Statistics				
					R-Squared Change	F Change	df1	df2	Sig. F Change
1	0.206 [a]	0.042	0.012	0.95833	0.065	1.391	12	241	0.170

[a]. Predictors: (constant), age, race, gender, income, education, employment status, company at the park, residence, frequency, transportation, ecosystem services, and amenities.

Based on **Table 10**, using the ANOVA test or F-test, the F-value obtained was 1.391, with a significance value of 0.170. Since the significance value was greater than 0.05, it could be concluded that the regression coefficients of the factors of age, race, gender, income, education, employment status, company at the park, place of residence, frequency, transportation, ecosystem services, and facilities did not affect the WTP for conservation purposes or entrance to urban forests.

Referring to **Table 11**, among the twelve variables included in the model, the only significant variable with $\alpha = 0.05$ was the perception of urban forest facilities ($\alpha = 0.045$). The other variables produced significant values greater than 0.05. This multiple regression analysis is used to test whether the independent variable can significantly predict the independent variable. The results of the regression analysis (**Table 12**) shows that all the independent variables could significantly explain as much as 6.5% of the independent variables ($R^2 = 0.065$, $F (2,254 = 1.391; p > 0.005)$), while only urban forest facilities showed a negative and significant influence ($\beta = -0.139$, $p = 0.045$).

Table 11. ANOVA test.

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	15.425	12	1.285	1.400	0.163 [b]
Residual	348.075	379	0.918		
Total	363.500	391			

[a.] Dependent variable: WTP. [b.] Predictors: (constant), age, race, gender, income, education, employment status, company at the park, residence, frequency, transportation, ecosystem services, and amenities.

Table 12. Regression analysis.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	**2.843**	0.640		4.441	0.000
Gender	-0.007	0.102	−0.004	−0.069	0.945
Age	0.153	0.089	0.096	1.733	0.084
Race	−0.004	0.053	−0.004	−0.068	0.946
Education status	0.022	0.048	0.036	0.467	0.641
Employment status	−0.014	0.057	−0.020	−0.252	0.801
Monthly income	0.105	0.069	0.079	1.525	0.128
Place of living	-0.096	0.098	−0.051	−0.977	0.329
Frequency of visit	0.276	0.102	0.140	2.6	0.007
Means of transportation	0.006	0.066	0.005	0.090	0.928
Company at the park	−0.004	0.053	−0.004	−0.068	0.946
Ecosystem services	−0.027	0.046	−0.041	−0.561	0.443
Amenities	−0.085	0.055	−0.117	−2.001	0.037

4. Discussions

This study provides critical insights into how urban visitors perceive and value the ecosystem services of Mount Pulai Forest Eco Park, offering a valuable case study for understanding conservation behavior and sustainable park financing in rapidly urbanizing Southeast Asian contexts. Grounded in the TEV framework and the Millennium Ecosystem Assessment classification, the findings contribute to a growing body of literature that links public perception with ecological economics and practical conservation policy. The results not only reaffirm the value of urban forests for ecosystem service delivery but also reveal socio-cognitive patterns that influence how these values are recognized, experienced, and supported by the public.

4.1. Recognition of Ecosystem Services

The survey revealed that visitors placed the highest

value on regulating and supporting ecosystem services, which include air purification, flood mitigation, biodiversity protection, and habitat provision. These findings reflect an implicit public understanding of the ecological functions that forests perform, even when scientific terminology is unfamiliar. The mean rating for regulating services (4.30) and supporting services (4.21) suggests that visitors intuitively associate forest environments with improved air quality, cooling effects, and wildlife protection benefits that are increasingly important in Malaysia's urban settings.

These results are consistent with previous studies in both developed and developing contexts. For example, Gulsrud et al. [18] reported similar patterns in Nordic cities, where regulating services were prioritized due to the perceived benefits of urban cooling and air filtration. In Southeast Asia, Bringezu et al. [19] and Samdin et al. [10] have found that regulating and supporting services are often appreciated by urban residents, particularly those exposed to heat waves, traffic congestion, and urban pollution. The high value placed on these services in Mount Pulai reflects an awareness, if not a technical understanding of the ecological functions that make urban forests indispensable to urban resilience and quality of life.

Moreover, the high perception scores for supporting services such as biodiversity conservation, despite low ecological literacy (mean knowledge score = 1.23), suggest that experiential learning through nature exposure may play a significant role in shaping environmental values. This supports the findings of studies by Atanga [6] and Fedele et al. [20], which emphasize that personal encounters with nature can foster a sense of stewardship even among populations with limited formal environmental education. This "intuitive ecology" highlights the importance of keeping urban green spaces accessible, immersive, and biodiverse, as such interactions influence pro-environmental attitudes and behaviors.

In contrast, provisioning services were rated significantly lower (mean = 2.77), reflecting that most urban visitors do not associate the forest with resource extraction such as timber, fuelwood, or non-timber forest products. This is understandable given that Mount Pulai is legally protected and designed for conservation and recreation, rather than subsistence use. In comparison, rural and in-

digenous communities living adjacent to forests often rank provisioning services highly because they depend on them for livelihood [21]. The low recognition of provisioning services among Mount Pulai visitors underscores the importance of contextualizing forest valuation according to user demographics and legal land-use status.

4.2. Cultural and Recreational Benefits

Cultural services were also appreciated, with a mean score of 3.99, especially in relation to recreation and psychological well-being. Items such as "forests provide peace of mind" (mean = 4.28) and "opportunities for recreation" (mean = 4.21) scored particularly high. This reflects a growing trend in urban ecosystems literature that recognizes the mental health and quality-of-life benefits provided by green spaces [22,23]. In cities like Johor Bahru, where stress levels may be exacerbated by congestion and pollution, urban forests like Mount Pulai serve as therapeutic landscapes where individuals can recuperate psychologically and socially.

However, the relatively lower ratings for educational and research opportunities (mean = 3.23) indicate that cultural services are experienced more passively than actively. This gap signals an underutilized potential: urban forests can and should serve as living laboratories for ecological education and community-based science. Interventions such as interpretive signage, guided biodiversity walks, or citizen science projects could enhance visitors' understanding and appreciation of the forest's educational value. These initiatives would not only improve ecological literacy but may also strengthen long-term conservation behavior, as shown in environmental psychology literature [24].

4.3. Willingness-to-Pay: Public Support for Conservation

One of the most significant findings from a policy perspective is that 79.1% of respondents expressed a WTP for forest conservation, with a mean annual contribution of MYR 51.32. Furthermore, 65% were willing to pay an entrance fee, with a mean of MYR 3.07 per visit. These figures demonstrate that even in the absence of direct pricing mechanisms, the public recognizes the economic value of ecosystem services and is prepared to contribute to their

maintenance. This aligns with studies from other protected and urban parks [25,26], which find that visitors are generally supportive of conservation funding, especially when the benefits are personally or visibly experienced.

Interestingly, the regression analysis identified satisfaction with amenities as the only significant predictor of WTP, with a negative relationship. This suggests that visitors who are less satisfied with park infrastructure may be more willing to pay for improvements, viewing financial contributions as a means to influence better management outcomes [27]. This result offers a unique insight into how public support for conservation may be motivated not just by ecological concern, but also by perceived service quality and expectations for improvement. The implication is that management agencies should treat WTP not merely as an expression of altruism, but also as a feedback mechanism tied to visitor experience [28].

The fact that other variables such as income, education, and environmental knowledge were not significant predictors of WTP may reflect the complexity of conservation behavior, which is influenced by value systems, experience, and emotional connection, rather than purely economic or cognitive factors. This supports the notion that ecological economics must account for the non-linear and affective dimensions of environmental valuation [29].

4.4. Implications for Urban Forest Management and Policy

The findings of this study offer several key implications for urban forest management and policy development. First, the high value assigned to regulating and supporting services confirms that urban forests are not just spaces for recreation but are vital urban infrastructure that deliver climate adaptation and public health benefits. Local governments should integrate these services into broader urban planning and environmental risk reduction frameworks, especially in cities like Johor Bahru, which are vulnerable to heatwaves, flash floods, and biodiversity decline.

Second, the positive response to WTP indicates that sustainable financing models such as entrance fees, voluntary donation schemes, or payment-for-ecosystem-services (PES) programs can be developed and implemented. However, these mechanisms must be transparent, socially equitable, and clearly tied to visible outcomes [30]. Public willingness to contribute is contingent upon the perceived accountability and effectiveness of fund use. For instance, small entrance fees could be used to improve toilets, pathways, and signage amenities, which directly affect visitor satisfaction and thus reinforce the feedback loop between perception, satisfaction, and support [31].

Third, the strong endorsement of multi-stakeholder management, including government, community, and private sector participation, highlights the importance of collaborative governance. As recommended by Xia et al. [24], participatory forest management not only improves decision-making but also builds public trust and long-term engagement. Educational campaigns, community dialogues, and volunteer programs can enhance legitimacy and foster a shared sense of responsibility.

Lastly, the study underscores the need for continued public environmental education, especially among younger, urban populations. Despite high perception ratings, ecological knowledge remains low, and this gap could limit long-term conservation engagement. Schools, universities, NGOs, and park authorities should collaborate to develop targeted, place-based educational programs that increase ecological literacy while maintaining the emotional and recreational appeal of nature [32,33].

5. Conclusion

This study assessed visitors' perceptions and the economic value they assign to ecosystem services at Mount Pulai Forest Eco Park in Johor, Malaysia, offering one of the first comprehensive integrations of ecosystem service recognition and WTP for an urban forest park in Southeast Asia. Grounded in the TEV framework and supported by the Millennium Ecosystem Assessment's classification of ecosystem services, the research contributes new evidence to support public-centered approaches in conservation and sustainable urban green space management.

The findings show that visitors highly appreciate regulating services such as air purification, flood mitigation, and temperature regulation (mean rating: 4.30/5), as well as supporting services like biodiversity maintenance and habitat provision (mean rating: 4.21/5). In contrast, provisioning services such as food, water, and raw materi-

als were perceived as less relevant (mean rating: 2.77/5), while cultural services such as recreation and peace of mind were moderately valued (mean: 3.99/5). Despite low ecological literacy (mean knowledge score: 1.23/5), visitors demonstrated intuitive awareness and appreciation of ecosystem benefits, especially those that directly enhance urban quality of life.

Importantly, the study found that 79.1% of respondents were willing to pay to support forest conservation, suggesting a mean annual contribution of MYR 51.32. Furthermore, 65% of respondents supported the introduction of a park entry fee, with an average suggested contribution of MYR 3.07 per visit. Regression analysis revealed that visitor satisfaction with park amenities was the only significant predictor of WTP, indicating a feedback mechanism where visitors with lower satisfaction levels may be more motivated to financially support improvements.

The innovation of this study lies in its integration of perceptual, behavioral, and economic data within a single assessment framework tailored to an urban forest context. It contributes methodologically by combining ecosystem service classification with contingent valuation, and offers practical insights for policy development by demonstrating that the public not only values ecological functions but is also willing to invest in their protection. The study also advances regional understanding by providing empirical data from Malaysia, a country where ecosystem service valuation studies remain limited, particularly for urban green spaces.

Despite its contributions, the study is subject to several limitations. The sample was skewed towards younger visitors, particularly students, which may affect the generalizability of WTP values across income groups. Additionally, the open-ended WTP format, while informative, may not capture respondents' actual behavior in a real-payment context. The study was also conducted during a limited time frame and did not account for seasonal or cultural variations in visitation and valuation patterns.

Future research should explore longitudinal studies to examine changes in perception and WTP over time, especially in response to environmental changes or park improvements. Qualitative studies could complement the quantitative findings by exploring the emotional, cultural, or symbolic meanings that people attach to urban forests. Researchers may also consider applying choice modeling or referendum-style WTP assessments to test real-world policy scenarios. Expanding this approach to other urban green spaces across different Malaysian cities and Southeast Asian countries would allow for comparative insights and support the design of regionally adaptive conservation finance strategies.

In conclusion, the study demonstrates that public recognition of and support for ecosystem services are both present and measurable, even in highly urbanized settings. Mount Pulai Forest Eco Park is not only a recreational space but also a site of shared environmental value. Policymakers, park managers, and urban planners should leverage these insights to strengthen sustainable management frameworks, enhance public education, and design inclusive financing mechanisms that reflect the values and expectations of urban citizens.

Author Contributions

Conzeptualization, M.F.B; writing—original draft preparation, M.F.B. and A.A.; writing—review and editing, A.A.; All authors have read and agreed to the published version of the manuscript.

Funding

Institutional Review Board Statement

Not Applicable.

Informed Consent Statement

Not Applicable.

Data Availability Statement

Data will be made available upon request.

Acknowledgments

Conflicts of Interest

The authors declare no conflict of interest.

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