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The economic value of forest ecosystem services: insights from recreation and ecotourism

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ABSTRACT

Forests provide a variety of ecosystem services essential for human well-being, with recreation and ecotourism increasingly recognised as valuable non-market benefits. This study assesses the economic value of forest ecosystem services and visitors' perceptions of recreational and conservation roles within two selected Eco Parks in Perak, Malaysia, namely Taman Eko-Rimba (TER) Lata Iskandar and TER Pasir Panjang. Using the Contingent Valuation Method (CVM), primary data were collected through structured surveys of 501 visitors (with a minimum of 250 respondents per site) to estimate their willingness to pay (WTP) for continued recreational access and enhanced conservation initiatives. The findings reveal that recreational and ecotourism services contribute significantly to the local economy through notable non-market values and individual WTP estimates. The OLS and Logistic regression models show mean WTP values of RM5.85 (OLS) and RM8.80 (Logit) for TER Lata Iskandar, and RM8.10 (OLS) and RM10.50 (Logit) for TER Pasir Panjang. Key significant determinants of WTP include income, education, visit frequency, visit duration, and repeat visitation, underscoring the influence of socio-economic capacity and behavioural factors on conservation support. Most visitors expressed strong support for conservation initiatives and recognised the importance of Eco Parks in providing environmental education, biodiversity protection, and community benefits. Positive visitor perceptions further reinforce the role of Eco Parks as essential assets for sustainable tourism and rural economic development. This study highlights the importance of integrating both economic valuation and public perception into forest management strategies to enhance conservation financing, improve visitor experiences, and support community livelihoods.

1. INTRODUCTION

Forests offer more than just timber. Globally, there is growing recognition of forests as providers of multifunctional ecosystem services including carbon storage, biodiversity conservation, water regulation and cultural values. This transition is highlighted by the "Forest Beyond Timber" paradigm, which promotes sustainable forest management by incorporating both market and non-market forest values (FAO, 2020; Watson et al., 2022).

A key component of this broader forest value system is Forest Ecosystem Services (FES), particularly Cultural Services which encompass recreation, ecotourism, spiritual value, heritage and environmental education (Díaz et al., 2019; Chan et al., 2021). Forest-based recreation not only provides mental and physical health benefits to individuals but also contributes to local economies through nature-based tourism. These services are especially significant in regions with Community-Based Ecotourism (CBET) models, where local communities directly benefit from forest conservation and tourism activities (Ahmad et al., 2023; Musa et al., 2023).

In Malaysia, the "Forest Beyond Timber" approach has been gradually integrated into policy discussions, particularly in National Forestry Policy 2020, National Policy on Biological Diversity 2022-2030 and the National Ecotourism Plan 2016-2025. Malaysia has committed to conserve 50% of its land area under forest cover, in line with its obligations under the Convention on Biological Diversity (CBD), United Nations Framework Convention on Climate Change (UNFCCC), and the Sustainable Development Goals (SDGs) particularly SDG 15 (Life on Land) and SDG 12 (Responsible Consumption and Production) (KeTSA, 2021; MNRE, 2020).

Despite these efforts, cultural services such as forest recreation are still undervalued and often excluded from economic planning. These non-market benefits, unlike timber or carbon credits, are rarely quantified in national accounts or forest valuation systems (Costanza et al., 2023; de Valck et

al., 2021). As a result, many recreational forests in Malaysia suffer from underinvestment in infrastructure, environmental education and visitor services.

To address this valuation gap, economists and environmental planners have turned to non-market valuation tools, particularly the Contingent Valuation Method (CVM). CVM estimates people's willingness to pay (WTP) for forest-based experiences and conservation, offering insights into how society values cultural services that lack direct market prices (Carson, 2020; Hanley & Czajkowski, 2022). This CVM method also offer insights into visitors' preferences, their willingness to pay for access and the indirect economic contributions of forest-based tourism. Moreover, understanding the economic value of these services is vital for designing Payment for Ecosystem Services (PES) schemes, enhancing conservation financing and integrating forest-based tourism into broader development strategies (Ojea et al., 2024).

Therefore, this study applies CVM to estimate the economic value of forest recreation in selected Forest Ecoparks at state of Perak, Malaysia. By quantifying public WTP for recreational access and environmental improvements, the study aligns with Malaysia's "Forest Beyond Timber" agenda and its international commitments to biodiversity, climate action and sustainable livelihoods.

2. MATERIALS AND METHODS

2.1. Study Context and Conceptual Framing

The valuation of forest ecosystem services is increasingly guided by the "Forest Beyond Timber" paradigm, which recognizes forests not only as sources of timber but as multifunctional landscapes that offer climate regulation, biodiversity support and cultural values (FAO, 2020; Watson et al., 2022). Within this paradigm, Cultural Services including recreation, ecotourism, education and spiritual enrichment play a vital role in connecting people to nature and sustaining forest conservation through non-extractive economic activities (Chan et al., 2021; Díaz et al., 2019).

In this context, recreational services represent a tangible and quantifiable dimension of Cultural Services, where visitor experiences in forest environments provide both private satisfaction and public benefits (de Valck et al., 2021; Ojea et al., 2024). However, these non-market values are often excluded from national economic accounts and forest management plans, resulting in underinvestment in ecotourism infrastructure and community-based conservation (Costanza et al., 2023).

This study operationalizes the Forest Beyond Timber approach by estimating the economic value of recreational benefits in a community-managed forest using the Contingent Valuation Method (CVM), allowing to assess the public's willingness to pay (WTP) for continued access and improved services.

2.2 Site Description

The study was conducted at selected Eco-Parks in state of Perak, Malaysia. The site offers a range of low-impact recreational services such as guided forest trail, forest interpretation, river activities and recreational fishing representing both use and non-use values aligned with Cultural Services (Musa et al., 2023; Ahmad et al., 2023). Selected Forest Eco-Parks (TER) were TER Pasir Panjang and TER Lata Iskandar. TER Lata Iskandar and TER Pasir Panjang, both located in the state of Perak, were selected due to their distinct ecological settings and significance in forest-based recreation.

TER Lata Iskandar, situated along the Tapah–Cameron Highlands route, is a popular inland waterfall site within the Central Forest Spine (CFS), known for its high visitor numbers and strong cultural and recreational value. Its easy access and scenic beauty make it suitable for studying public preferences and the valuation of cultural ecosystem services in a high-use montane forest environment. Meanwhile, TER Pasir Panjang represents a quieter, coastal forest setting with beach-forest ecosystems and a growing appeal for nature-based recreation and environmental awareness activities. Its lower visitor density and different forest landscape allow for comparison of visitor perceptions across forest types.

2.3 Research Design and CVM Application

The Contingent Valuation Method (CVM) was selected to estimate the WTP for maintaining or enhancing recreational and cultural services in the forest. As a stated preference method, CVM is suitable for capturing non-market values of forest experiences and is widely recommended for estimating CES linked to ecotourism and outdoor recreation (Hanley & Czajkowski, 2022; Carson, 2020).

Recent studies in Malaysia have increasingly highlighted the importance of valuing forest ecosystem services (FES) beyond timber, particularly cultural ecosystem services such as recreation, spiritual values and ecotourism. Researchers have used method like the Contingent Valuation Method (CVM) to estimate visitors' willingness to pay (WTP) for forest experiences. For example, Yacob et al. (2020) at Taman Negara and Chin et al. (2022) at Penang National Park found that environmental quality and visitor facilities influenced WTP.

Meanwhile, Salleh et al. (2021) found that forests like

Gunung Jerai are valued for spiritual and cultural reasons and Ismail et al. (2023) showed how forest recreation improves environmental awareness among youth. These studies show growing recognition of cultural services in Malaysia.

The CVM survey scenario was designed to simulate a hypothetical conservation fund dedicated to improving parks maintenance, safety, interpretation signage and biodiversity conservation benefits aligned with both ecological integrity and visitor satisfaction. The payment vehicle proposed was through entrance fee. Currently both TER do not collect entrance fees. The valuation scenario followed best practices from NOAA guidelines (Arrow et al., 1993), incorporating a clear explanation of the forest's ecological and cultural importance, realistic improvements proposed under the payment scheme and a dichotomous choice format (yes/no) followed by an open-ended WTP amount.

2.3 Questionnaire Design

The structured questionnaire had three parts, which are Socio-demographic profile (age, income, education, residence), Visit characteristics (travel distance, group size, motivation, satisfaction) and CVM Scenario (description of proposed improvements and WTP elicitation).

2.4 Sampling and Data Collection

This study employed a convenience sampling method to select respondents among visitors at TER Lata Iskandar and TER Pasir Panjang. The sampling was conducted on-site at key visitor points during weekends and public holidays to ensure a larger and more diverse number of visitors. Respondents were approached at park entrances, picnic and camping areas, and activity sites where visitor concentration was highest, ensuring a representative mix of recreational users. Convenience sampling was chosen due to its practicality in capturing real-time data from individuals actively engaging in forest recreation. While this method provides valuable insights into visitor preferences and perceptions, its non-random nature limits the generalizability of findings to the wider population. Nonetheless, it remains a widely accepted approach in ecosystem service valuation and nature-based tourism research (Yacob et al., 2020; Chin et al., 2022).

In Contingent Valuation Method (CVM) research, determining an adequate sample size is critical to ensure the reliability and statistical validity of willingness-to-pay (WTP) estimates. According to Bateman et al. (2021), a minimum sample size of 200 to 300 respondents is typically sufficient for producing robust mean WTP estimates, particularly when employing closed-ended elicitation formats such as dichotomous choice. This is supported by studies such as Yacob et al. (2020), who used 300 respondents to value ecotourism services in Taman Negara and Chin et al. (2022), who surveyed 250 visitors to estimate recreational value at Penang National Park. Similarly, Ahmad et al. (2023) adopted a sample size of 400 to examine recreational preferences using the travel cost method in forest parks across Malaysia.

In a more recent context, Abdullah et al. (2023) conducted a forest-dependency and well-being survey among 700 households at Gunung Tebu Forest Reserve, demonstrating the growing emphasis on localized forest valuation. Similarly, Musa and Nadarajah (2023) estimated recreational WTP at Bukit Larut, Perak using 250 visitors, while Abdullah et al. (2022) surveyed over 300 households in Kelantan to assess watershed services. These practices demonstrate a consistent trend in Malaysian ecosystem valuation studies, aligning with international benchmarks.

Therefore, for this study which focuses on two forest recreation sites TER Lata Iskandar and TER Pasir Panjang a minimum of 250 respondents per site is recommended to capture adequate variability in visitor preferences, ensure subgroup comparisons and support reliable estimation of the recreational value of cultural ecosystem services. A total of 501 respondents completed face-to-face surveys. Data collection was conducted during both weekdays and weekends within Mac to May 2025.

2.5 Data Analysis

The data collected through structured questionnaires were systematically coded and analyzed using the Statistical Package for the Social Sciences (SPSS) Version 26. Descriptive statistics were employed to summarize the demographic characteristics of respondents, such as age, income, education level and frequency of visitation. These variables were examined to understand their potential influence on visitor preferences and perceived value of recreational forest ecosystem services.

The contingent valuation responses were analysed through both non-parametric and parametric approaches. Measures of central tendency (mean, median) and dispersion (standard deviation) were calculated to describe the distribution of visitors' willingness-to-pay (WTP). Following guidelines by Bateman et al. (2021), the reliability of mean WTP estimates was ensured by adhering to a minimum recommended sample size and by checking for outliers or protest zeros.

To explore the relationship between WTP and respondent characteristics, bivariate analyses (Pearson’s correlation) were conducted. Furthermore, multiple regression analysis using the Ordinary Least Squares (OLS) method was performed to identify significant predictors of WTP.

Where the CVM design employed a dichotomous choice format, logit models were used to model the probability of a respondent agreeing to pay, as recommended by Hanley and Barbier (2009) and Carson and Groves (2007). The equation as below:

$$Y = \alpha + \beta_i X_i + \varepsilon_i$$

Where Y = dependent variable; α = constant; β = variable coefficient; X = independent variable; ε = error.

Model diagnostics such as tests for goodness-of-fit (pseudo-R^2 for logit models) were carried out to ensure model robustness. The analytical framework was informed by recent Malaysian CVM applications (Abdullah et al., 2023; Chin et al., 2022; Musa & Nadarajah, 2023), which similarly integrated socio-economic and attitudinal variables to estimate the recreational value of forest ecosystem services.

2.6 Ethical Statement

The study involved human participants who provided informed consent prior to participation. All data were anonymized to ensure confidentiality and participants could withdraw at any time without consequence.

3. RESULT AND DISCUSSION

3.1 Visitor Profile and Socioeconomic Characteristics

The demographic composition of visitors to TER Lata Iskandar and TER Pasir Panjang reveals meaningful differences across gender, ethnicity, age, education, occupation and income, which are factors that influence both forest use patterns and perceptions of ecosystem service value (Table 1). Gender distribution shows a female majority at TER Lata Iskandar (55.6%) and a male majority at TER Pasir Panjang (61.4%). This contrast could be attributed to site characteristics and accessibility. Lata Iskandar, being a roadside stopover along the Tapah–Cameron Highlands route, may attract more family-oriented or spontaneous female visitors. In contrast, Pasir Panjang's more remote coastal setting may appeal more to male visitors involved in outdoor activities, consistent with findings by Musa and Nadarajah (2023), which noted gendered preferences in nature-based tourism experiences in Malaysia.

Ethnic composition at both sites reflects the national demographic trend, but with stronger Malay representation at Pasir Panjang (95.6%) than Lata Iskandar (84.0%). This aligns with previous studies (Yacob et al., 2020), which observed that forest parks in rural or semi-urban areas, such as Pasir Panjang, tend to serve predominantly Malay populations due to cultural proximity and location. Marital status data indicate that most visitors to both sites were married 70.8% at Lata Iskandar and 80.9% at Pasir Panjang, suggesting family-oriented visitation patterns.

Table 1: Visitor Profile and Socioeconomic Characteristics

	Demographic Information	TER Lata Iskandar (%)	TER Pasir Panjang (%)
Gender	Male	44.4	61.4
	Female	55.6	38.6
Ethnicity	Malay	84.0	95.6
	Chinese	4.8	3.2
	Indian	4.0	1.2
	Others	7.2	0.0
Marital Status	Married	70.8	80.9
	Single	29.2	19.1
Age Distribution	< 31 years	37.6	26.3
	31–40 years	21.2	28.3
	41–60 years	33.6	38.2
	> 60 years	7.6	7.2
	Average Age	37 years	40.6 years
Education Level	No formal education	1.2	0.4
	Primary school	2.4	0.4
	Lower secondary	4.0	3.6
	Upper secondary	26.4	37.8
	Diploma/Certificate	28.0	34.7
	Bachelor's degree	32.8	21.1
	Master's degree	4.4	2.0
	Doctorate	0.8	0.0
Occupation	Government	16.4	21.1
	Private Sector	36.4	29.5
	Self-employed	11.6	10.8
	Homemaker	6.4	7.2
	Retired	5.2	5.2
	Student	10.4	7.2
	Unemployed	13.6	19.2
Household Monthly Income (RM)	< 1,000	6.8	6.4
	1,000–1,999	12.8	19.5
	2,000–2,999	22.0	22.7
	3,000–3,999	18.0	14.0
	4,000–4,999	12.0	8.8
	5,000–5,999	7.6	6.8
	6,000–6,999	4.8	4.8
	≥ 7,000	16.0	17.2

However, the age profile of visitors differs slightly, with Lata Iskandar having a younger average (37 years) than Pasir Panjang (40.6 years). Notably, a larger proportion of older adults (41–60 years) visited Pasir Panjang (38.2%) compared to Lata Iskandar (33.6%), possibly reflecting stronger community ties and familiarity with the site among older local populations (Hamzah et al., 2020).

In terms of education level, Lata Iskandar shows a more highly educated visitor profile, with 32.8% possessing a bachelor's degree compared to 21.1% at Pasir Panjang. This may explain why Lata Iskandar had relatively more respondents from urban and mobile groups, consistent with its status as a major tourist stopover. Conversely, Pasir Panjang had higher proportions with upper secondary education (37.8%) and diploma/certificates (34.7%), aligning with a more local, middle-educated user base.

Occupational distribution also varied. The private sector was the dominant employment sector at both sites, though Lata Iskandar had more private sector workers (36.4%) while Pasir Panjang had a higher representation from the public sector (21.1%) and unemployed individuals (19.2%). This may reflect local socioeconomic conditions, particularly in rural coastal areas where employment opportunities are more limited (Chin et al., 2022).

Household income data reinforce this disparity. While income profiles at both sites were dominated by the B40 group (earning below RM4,850/month), Pasir Panjang had a higher percentage of low-income visitors, 19.5% earning RM1,000–1,999 and 22.7% earning RM2,000–2,999, compared to 12.8% and 22.0% respectively at Lata Iskandar. The average income bracket was lower at Pasir Panjang, suggesting the site serves as a vital low-cost recreational option for economically vulnerable communities. This observation echoes the role of forest parks as inclusive public goods, as highlighted by Bateman et al. (2021).

In sum, the comparative demographics reveal that TER Lata Iskandar attracts a more diverse, urbanised and educated visitor base, while TER Pasir Panjang caters to a more homogeneous, older and lower-income local population. These differences must be considered in forest recreation planning, pricing strategies and ecosystem service valuation to ensure equity and site-appropriate management (Nitanan et al., 2020; Abdullah et al., 2023).

3.2 Visit Characteristics

Main Purpose of Visit: Visitors to TER Pasir Panjang predominantly cited recreational activities as their main purpose (70.1%), followed by appreciating natural surroundings (63.3%), sports and leisure (21.5%) and gaining new experiences (13.1%). In contrast, at TER Lata Iskandar, the most cited reason was enjoying the natural environment (80.4%), followed by recreation (20.8%) and new experiences (18.8%).This difference suggests that Pasir Panjang attracts visitors with a more active recreational focus, possibly due to its layout and facilities that support prolonged leisure activities. In contrast, Lata Iskandar appears to attract more passive, nature-focused visitors, many of whom may be making spontaneous stops while travelling along the Tapah–Cameron Highlands route (Hamzah et al., 2020).

Number of Visits: At Lata Iskandar, 69.2% of visitors were first-timers, indicating a transit or opportunistic visitation pattern, consistent with its roadside location. In contrast, only 57.8% of visitors at Pasir Panjang were first-time visitors, with a significantly larger proportion (27.9%) having visited more than three times. This indicates higher repeat visitation and stronger site attachment at Pasir Panjang, aligning with findings by Musa and Nadarajah (2023), who observed that repeat visits often reflect satisfaction and community-based recreational value.

Duration of Stay: The contrast in time spent at each site is striking. At TER Pasir Panjang, the average stay duration was 18.5 hours, with notable proportions spending 4–5 hours (25.9%), 16–24 hours (17.1%) and over 24 hours (15.9%), indicating its suitability for extended leisure, camping, or group activities. On the other hand, at TER Lata Iskandar, most visitors stayed 1 hour or less (86%), with only 2.4% staying more than 2 hours, reaffirming the short-stay, stopover nature of the site. This brief visitation pattern corresponds with findings by Chin et al. (2022), who noted that roadside or easily accessible ecotourism spots often receive high footfall but low recreational depth. Table 2 shows Visit Characteristics of respondents.

Table 2: Visit Characteristics

Characteristics		TER Pasir Panjang (%)	TER Lata Iskandar (%)
Main Purpose	To experience recreational activities	70.1	20.8
	To gain new experiences	13.1	18.8
	For leisure and sports	21.5	12.0
	To enjoy the natural environment	63.3	80.4
	To learn about nature	1.6	2.8
	Others (e.g., work)	1.6	–
Number of Visits	First time	57.8	69.2
	Once	0.8	0.4
	Twice	10.4	9.2
	Three times	3.2	9.6
	More than three times	27.9	11.6
Time Spent	Average Duration	18.5 hours	1 hour

These patterns suggest that Pasir Panjang functions as a destination site, with users engaging in longer, planned recreational activities, potentially linked to local residency or group-based usage (e.g. camping, family outings). Meanwhile, Lata Iskandar operates more as a transit site, offering quick natural appreciation or rest opportunities for travelers. These differentiated patterns imply that visitor management, infrastructure planning and ecosystem service valuation must be tailored to the distinct roles each site plays (Nitanan et al., 2020; Yacob et al., 2021).

3.3 Economic Valuation

To quantify the economic value of forest-based recreational services, this study applied two commonly used econometric approaches under the Contingent Valuation Method (CVM) framework, which are the Logistic Regression Model and the Ordinary Least Squares (OLS) Model. These models are widely recognised for evaluating individuals' preferences for non-market environmental goods such as cultural and recreational ecosystem services (Bateman et al., 2021; Hanley & Spash, 1993).

3.3.1 Level of Willingness-To-Pay (WTP)

The analysis of Willingness to Pay (WTP) among visitors at TER Lata Iskandar and TER Pasir Panjang provides important insights into the public's valuation of recreational and cultural ecosystem services offered by these Forest EcoParks. The results indicate that the mean WTP among visitors at TER Lata Iskandar was RM6.87, while at TER Pasir Panjang, the mean WTP was slightly higher at RM7.25. These values reflect a positive willingness among users to contribute financially to site maintenance and conservation efforts, suggesting both recreational areas are appreciated for their ecosystem services and recreational opportunities.

The percentage distribution of WTP responses further highlights differences between the two locations (Table 3). At TER Lata Iskandar, the majority of respondents (42.8%) were willing to pay between RM5 and RM10, followed by 18.0% in the RM1–RM4 range, and 16.4% in the RM11–RM15 range. In comparison, TER Pasir Panjang showed a slightly higher proportion of respondents in the RM5–RM10 range (45.6%), with 17.5% indicating WTP of RM11–RM15. Notably, fewer respondents at Pasir Panjang (13.5%) reported WTP in the lowest category (RM1–RM4), indicating a generally higher valuation of forest recreation at Pasir Panjang.

Table 3: Level of Willingness-To-Pay (WTP)

WTP Range (RM)	TER Lata Iskandar (%)	TER Pasir Panjang (%)
RM1–RM4	18.0	13.5
RM5–RM10	42.8	45.6
RM11–RM15	16.4	17.5
RM16–RM20	12.4	13.2
RM21 and above	10.4	10.2

These results align with the differing visitation characteristics at the two Forest EcoParks. As discussed earlier, Pasir Panjang is associated with longer visit durations, higher proportions of repeat visits, and more immersive recreational activities, all of which contribute to a higher WTP. In contrast, Lata Iskandar functions more as a short-stay or transit site, with most visitors staying less than one hour and a higher share of first-time users. Previous studies such as those by Yacob et al. (2020), Chin et al. (2022) and Ninan & Kontoleon (2020) have shown that WTP tends to increase with visit frequency, time spent on-site, and environmental awareness all of which appear more prominent at Pasir Panjang.

From a policy perspective, the presence of measurable WTP at both sites supports the feasibility of introducing nominal entrance or conservation fees, particularly if revenues are reinvested transparently into site maintenance, environmental education, and local community benefits. The slight variation in WTP values also reinforces the need for site-specific pricing strategies, acknowledging differences in visitor expectations and recreational behaviour.

3.3.2 Willingness to Pay (WTP) Based on Econometric Modelling

To quantify the economic value of recreational ecosystem services provided by forest reserves, this study employed both Logistic Regression and Ordinary Least Squares (OLS) models to estimate visitors' Willingness to Pay (WTP) at TER Lata Iskandar and TER Pasir Panjang. These models are widely recognised in the environmental economics literature for analysing stated preference data under the Contingent Valuation Method (CVM) (Bateman et al., 2021; Hanley & Spash, 1993).

At TER Lata Iskandar, the OLS model yielded a mean Willingness to Pay (WTP) of RM5.85, while the Logistic Regression model estimated a slightly higher WTP at RM8.80. These values suggest moderate support for conservation financing among visitors to the site. The Logistic model revealed that monthly income, education level and visit frequency were statistically significant in predicting positive WTP.

Similarly, the OLS model indicated that higher income and educational attainment significantly influenced the magnitude of the amount respondents were willing to pay. These findings align with prior research in Malaysia which observed that socio-economic status strongly influences WTP outcomes for forest recreation (Yacob et al., 2020; Chin et al., 2022).

In comparison, TER Pasir Panjang recorded higher mean WTP values under both estimation models. The OLS model produced a mean WTP of RM8.10, while the Logistic model estimated a WTP of RM10.50. These figures indicate that visitors at Pasir Panjang assign a greater economic value to their recreational experience. In addition to income and education, repeat visitation and longer stay duration emerged as significant predictors of WTP, reflecting stronger site attachment and a deeper engagement with the environment. The findings corroborate earlier studies showing that repeat visitors are more likely to contribute to conservation efforts due to a heightened sense of stewardship and perceived benefit (Musa & Nadarajah, 2023; Ninan & Kontoleon, 2020).

The comparison clearly demonstrates that visitors at TER Pasir Panjang exhibit a higher WTP than those at TER Lata Iskandar across both model specifications (Table 4). This is likely attributable to the nature of recreational use at each site. TER Pasir Panjang typically attracts visitors for longer, immersive stays, while TER Lata Iskandar is primarily visited for short-duration or transit-based recreation. This behavioural

difference significantly affects the valuation of recreational ecosystem services and subsequently influences visitors' WTP.

These findings affirm the economic viability of implementing site-specific conservation charges as a tool for sustainable forest management. The presence of measurable WTP, especially at Pasir Panjang, supports the potential for introducing nominal entry fees or voluntary contribution schemes, provided such revenues are transparently reinvested into site maintenance, biodiversity protection and local community benefits.

Table 4: Mean Willingness-To-Pay (WTP) Based on Econometric Modelling

Site	OLS Model (RM)	Logistic Model (RM)	Key Significant Variables
TER Lata Iskandar	5.85	8.80	Income, Education, Visit Frequency
TER Pasir Panjang	8.10	10.50	Income, Education, Visit Duration, Repeat Visitation

The Willingness to Pay (WTP) estimates derived from this study RM8.80 for TER Lata Iskandar and RM10.50 for TER Pasir Panjang are consistent with, and in some cases exceed, WTP values reported for other forest-based recreational sites in Malaysia. This suggests that both study locations are highly valued by visitors for their ecological and recreational functions.

For instance, Chin et al. (2022) estimated a mean WTP of RM8.17 for visitors at Penang National Park, highlighting the public's willingness to contribute financially toward conservation and facility upgrades in a protected coastal forest area. Similarly, Yacob et al. (2012) reported a WTP of RM7.00 for Taman Negara, Malaysia's premier rainforest destination, where biodiversity and pristine environments were key motivators. In Bukit Larut, Perak, a highland recreational site, Musa and Nadarajah (2023) found that visitors were willing to pay RM6.85 on average, particularly for improved eco-tourism services and access management. Meanwhile, a study by Nor Zalina Harun et al. (2010) at FRIM Selangor, an urban forest park, recorded a lower WTP of RM5.00, likely influenced by its accessibility, shorter visit durations and lower perceived wilderness value.

Overall, this comparative analysis confirms that the recreational forest sites studied are economically significant in the eyes of the public and their conservation should be prioritised through sustainable financing mechanisms such as modest entrance fees or visitor contributions.

3.3.3 Aggregation of Willingness to Pay (WTP)

The aggregation of individual Willingness to Pay (WTP) estimates provides a useful monetary measure of the total economic value that society places on recreational ecosystem services at protected forest areas. This valuation is crucial in supporting evidence-based decisions related to conservation financing, ecotourism planning and forest resource allocation (Bateman et al., 2021; Freeman et al., 2014). In this study, aggregation was conducted by multiplying the mean WTP (based on logistic model estimates) by the average number of annual visitors for each study site.

For TER Lata Iskandar, the mean WTP was estimated at RM8.80, and the average annual visitation was reported at 206,500 visitors. This results in a total aggregated annual recreational value of approximately RM1,816,200. In contrast, TER Pasir Panjang had a higher mean WTP of RM10.50, but a substantially lower annual visitor volume of 7,630, resulting in a total aggregated WTP value of RM80,115 per year.

These results underscore the variation in economic contribution across sites, driven not only by visitor preferences but also by differences in visitor volume and site accessibility. While TER Pasir Panjang attracts visitors with higher individual WTP values, its limited visitation restricts the total recreational value accrued annually. Meanwhile, TER Lata Iskandar, despite its lower mean WTP, generates a substantially higher total value due to its high volume of annual visitors and strategic location along a frequently travelled tourist corridor, which contributes to its role as a popular and easily accessible recreational site.

The findings reaffirm the economic importance of forest recreation, particularly when aggregated over large user populations. These values can inform site-specific financing strategies, including the implementation of modest conservation or entrance fees. Such approaches align with Malaysia's ongoing efforts to strengthen the sustainability of forest-based ecotourism and fulfill its commitments under the Post-2020 Global Biodiversity Framework and Sustainable Development Goals (SDG 15).

Nonetheless, aggregated values should be interpreted cautiously. They assume constant visitation rates and uniform WTP across the population and they do not account for substitution effects or potential behavioural change in response to fee implementation (Hanley & Spash, 1993; Ninan & Kontoleon, 2020). Future research may explore dynamic models that integrate visitor elasticity, equity considerations and long-term conservation outcomes.

The aggregated WTP values should, however, be interpreted with caution. They are contingent upon assumptions such as stable visitation rates, absence of substitute sites and continued willingness to contribute under formal payment schemes. Despite these limitations, the

results underscore the economic justification for incorporating payment-for-ecosystem services (PES) schemes or ecotourism user fees as part of Malaysia's broader forest financing strategy, aligned with the country's obligations under the Post-2020 Global Biodiversity Framework and Sustainable Development Goals (SDG 15: Life on Land).

4. CONCLUSION

This study provides clear evidence of the economic importance of cultural ecosystem services provided by forest-based recreation at TER Lata Iskandar and TER Pasir Panjang. Visitors at both sites showed a clear willingness to pay (WTP) for conservation, with higher individual WTP at Pasir Panjang and greater overall economic value at Lata Iskandar due to higher visitor numbers. These findings highlight the potential for introducing modest, site specific conservation fees to support sustainable forest management. As a way forward, forest valuation should be more widely applied in national planning to reflect the full range of forest benefits, in line with Malaysia's "forest beyond timber" approach. Expanding valuation to include other ecosystem services such as biodiversity, education and climate regulation—will support Malaysia's commitments to the Post-2020 Global Biodiversity Framework and Sustainable Development Goals, especially SDG 15. Strengthening collaboration among government agencies, researchers and local communities will be key to advancing sustainable and inclusive forest conservation.

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