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# Assessing the Monetary Valuation of Ecosystem Services in Ulu Bendul Forest Park

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**Abstract**
Ulu Bendul Forest Park supports biodiversity, livelihoods, human well-being, and eco-tourism, making its conservation a key priority. Yet, without an economic valuation framework, its ecosystem services risk being undervalued. Using contingent valuation (CVM) and a 300-person willingness-to-pay (WTP) survey, this study applied Binary Logit and Binomial Probit models. Mean WTP was RM24.71 (probit) and RM22.25 (logit). Gender, occupation, income, and perceived ecosystem benefit significantly increased WTP. The logit model slightly overestimated WTP, showing good consistency. Findings guide policymakers in land use planning and resource allocation to safeguard the park's ecosystem services for future generations and inform future conservation research.

Keywords: Eco- Forest; Ecosystem services; Valuation; Willingness to pay (WTP)


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## 1.0 Introduction

Forest ecosystems are among the earth's most comprehensive and predominant assets that offer cultural value, educational value, inspirational value, economic value, and ecological value. Eco-forest park plays an important role as a preservation area that includes conservation, eco-tourism, and sustainability. In addition, biodiversity conservation and maintaining ecological services aid in sustaining the whole ecosystem in the world. Despite the growing climate change issue and urbanisation, conserving and valuing the eco-forest park ecosystem services remains a premeditated approach to resolve protection. Eco-forest parks reflect how a natural ecosystem can be blended with human intention while ensuring forest landscape beauty. Monetary valuation of ecosystem services makes nature's contribution more recognised and explicit in economic terms, overcoming free rider and overexploitation of resources. Furthermore, monetary valuation is linked with sustainability because its operationalized nature values within the economic system, promotes resource efficiency environmental decision making supports sustainable conservation financing. An ecosystem like Ulu Bendul Forest Park in Negeri Sembilan, Malaysia, preserves different flora and fauna, regulates hydrological cycles, and provides public enjoyment. As part of the Berembun Forest Reserve, the park protects species and sequesters carbon, reducing climate change (Mohammad et al., 2023).

Sustainable tourism and sustainable resource use benefit local people (Chong et al., 2020). The economic valuation of Ulu Bendul Forest Park's ecosystem services is understudied, resulting in insufficient financial and policy support for its conservation (Yacob et al.,


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2022). Ecosystem services encompass providing, regulating, cultural, and sustaining services for ecological equilibrium and underpin human survival (James & Abas, 2022; Cheng et al., 2023). These services range from tangible output such as food, timber, medicinal plants, clean water, and fresh water to intangible benefits such as nutrient recycling, landscape beauty, biodiversity conservation, and carbon sequestration. Nevertheless, their prominent role and monetary value of ecosystem services are not fully captured in the conventional market. The economic visibility of ecosystem services remains unrequited, which increases the possibility of underestimation in policy and resource management decisions (Abdullah et al., 2022; Environmental Sustainability Indicators, 2022). In response, an economic valuation approach was developed to assign monetary value to ecosystem services in the eco-forest park. Among them, the Contingent Valuation Method (CVM) is most appropriate to apply, as it measures individual willingness to pay (WTP) for conservation and green management, thereby providing the connection between public preference and environmental policy (Basri et al., 2023; Musa & Nadarajah, 2023). This study calculates the monetary value of forest park ecosystem services. In this regard, this study analyzes visitors' acceptance and rejection of different bid prices and also seeks to determine visitors' willingness to pay for Ulul Bendul Eco-Forest park conservation.

## 2.0 Literature Review

*2.1 Overview of ecosystem services and their classifications*

Ecosystem services refer to the various benefits that humans derive from healthy ecosystems, which are essential for our well-being, economic prosperity, and environmental stability. These services are typically classified into four main categories: provisioning, regulating, cultural, and supporting services. Provisioning services provide tangible resources like food, water, raw materials, genetic resources, and energy (Millennium Ecosystem Assessment, 2005). Regulating services help maintain the conditions necessary for life, such as climate regulation, water purification, pollination, pest control, and erosion prevention (TEEB, 2010). Cultural services are non-material benefits that enrich human experiences, including recreation, tourism, spiritual and cultural values, aesthetic enjoyment, and opportunities for education and research (Costanza et al., 1997). Supporting services are fundamental processes like nutrient cycling, soil formation, primary production, and habitat provision, which are essential for the production of all other services (Daily, 1997). These services are interconnected, with some overlapping, such as regulating and supporting services. The valuation of ecosystem services is essential for guiding policies that support sustainable management and conservation. Their economic valuation is often overlooked in the decision-making process, including land-use planning. Ecosystem services play a vital role in maintaining the balance and functioning of the entire ecosystem. The preservation of natural ecosystems is considered important to ensure that their benefits are available for future generations and to support the achievement of the Sustainable Development Goals (SDGs).

In this regard, from the perspective of Forest Park, these services not only support regional economies via the tourism sector. It creates indirect advantages such as biodiversity conservation and flood mitigation. Moreover, ecosystem services reinforce public resilience by reducing vulnerability to environmental stressors such as floods and droughts. Beyond these ecological and economic dimensions, forest ecosystems hold significant cultural value, shaping the identity of local communities. Forest parks frequently function as vital recreational landscapes, contributing to human well-being by offering opportunities for leisure, relaxation, and reconnection with nature. In Malaysia, sites such as Ulu Bendul Forest Park exemplify this dual role: they attract domestic and international visitors while simultaneously serving as living classrooms for environmental education and awareness, thereby cultivating a deeper societal appreciation for the natural world.

*2.2 Economic valuation of forest park*

Forest Park has attracted a great deal of interest in recent years because it promotes the adoption of land-use practices that are environmentally conscious, drives conservation strategies, and the economic valuation of ecosystem services, particularly. The forest is regarded as crucial for the health of our world, particularly in addressing global warming, as a wide range of key functions are provided, including water control, landslide prevention, biodiversity conservation, and medicinal resources. Therefore, a solid understanding of the monetary values of these services is considered essential to ensure that they are managed sustainably. The fundamental principle of the Contingent Valuation Method (CVM) is to have a clear definition of ecosystem services that have been valued. Creation of a hypothetical market, in which the visitors were asked to state their Willingness to pay (WTP) for the provision of the forest ecosystem.

Ecological compensation (EC) has been recognized as one of the policy measures for promoting sustainable development of the national forest parks (Yu et al., 2025). Policy makers have the capacity to make decisions that are well-informed and that achieve a balance between environmental conservation and development needs. Ecosystem services are given a valuation. Likewise, it emphasizes the economic advantage of natural ecosystems, which are sometimes disregarded, it may persuade individuals to invest in conservation initiatives and land-use planning. Several studies have estimated WTP for forest ecosystem services using the CVM approach. These studies have provided useful insight into the public perception of value sustaining these natural resources. For instance, Zahari et al., (2021) carried out a research project in Ayer Keroh recreational Forest. The study found that visitors are prepared to pay a substantial amount of money for the management of the park. This outcome is crucial for decision makers because it reflects that the community is interested in offering financial contributions to conservation programs, which will ultimately support great efforts to implement forest management approaches that are sustainable. Despite the extensive literature on ecosystem services classification and economic valuation, several gaps remain in the context of forest parks, particularly in Malaysia. While many studies broadly value ecosystem services, limited studies focus on visitors' willingness to pay across specific bid price levels, which is essential for the understanding of price sensitivity and the feasibility of the payment mechanism. Existing studies mostly focus on well-established forest parks, resulting

in a lack of site-specific valuation evidence for lesser-studied parks such as Ulu Bendul forest park, despite their ecological and educational significance.

## 3.0 Research methodology

*3.1 Study area*

Negeri Sembilan is a state located on the west coast of Peninsular Malaysia. It borders four states, including Selangor to the north, Pahang to the east, and Melaka and Johor to the south. Ulu Bendul Forest Park is situated in the state of Negeri Sembilan. Ulu Bendul Forest Eco Park is situated within the Angsi Reserved Forest, at coordinates 2° 44' 25.7064" N, 102° 14' 55.9392" E. It is a well-known recreational destination that is renowned for its ecological significance, picturesque landscapes, and diverse biodiversity. The Park, which is a component of the Titiwangsa mountain range, is approximately 10,000 hectares in size and is responsible for the provision of critical ecosystem services, including water regulation, carbon sequestration, and flood control. The Park is a popular destination for both local and international visitors, who participate in activities such as birdwatching, picnicking, and trekking, because of its recreational and environmental significance. Ulu Bendul Eco Forest Park, Negeri Sembilan, is depicted in Map 1.

*3.2 Contingent valuation method (CVM)*

The Contingent Valuation Method (CVM) approach was applied to evaluate the visitors' willingness to pay. This technique considers a hypothetical market for non-priced (non-market) goods and services, based on which people's demand for such goods and services can be evaluated through their declared needs (Saleh et al., 2025). Purposive sampling technique used to collect visitors' willingness amount of money to pay for conserving the ecosystem services in Ulu Bendul eco-forest park. A structured questionnaire consisting of sections on socio-demographic criteria, environmental perception, and willingness to pay (WTP). used as a survey instrument. Respondents were asked whether they would be willing to contribute an amount of money to financially sustain park preservation initiatives. The SBDC format simplifies the decision-making procedure for respondents by offering a definitive binary choice: "Yes" or "No." A pilot study was conducted with 30 samples to test the clarity, reliability, and feasibility of the instrument questions before the data collection was carried out. The data obtained from the survey is then analysed using econometric models to estimate the probability that a respondent would agree to pay the offered amount. A total of 300 samples were used in this study. Cohen (1992) has suggested that for a population of moderate size, a sample of around 300 can be adequate to achieve a reasonable level of precision and confidence in survey results.

Equation (1) represents the dependent and independent variables that were employed in the study.

$$\text{Willingness to Pay (WTP)} = \alpha + \beta_1\text{Age} + \beta_2\text{Gender} + \beta_3\text{Occupation} + \beta_4\text{Income} + \beta_5\text{Income} + \beta_6\text{Location} + \mathcal{E} \quad \textbf{(1)}$$

The pilot test was carried out by the researchers by inserting six bid pricing; RM1, RM5, RM10, RM15, RM20, and RM25.

## 4.0 Results and discussion

*4.1 Demographic profile*

Table 1 illustrates respondents' demographic profile of respondents. Of the 142 respondents (47.33%), most were 29–39 years old. This is followed by the 18-28 age group with 62 (20.67%), the 40-50 age group with 53 (17.67%), and the 51-60 age group with 30 (10%). The smallest proportion is 13 responses (4.33%) out of 61. There are 182 male responders (60.67%) and 118 female respondents (39.33%). Civil status: 155 (51.67%) are married, 93 (31%) are single, and 52 (17.33%) are divorced. Twenty respondents (6.66%) have primary education, while 25 (8.33%) have secondary. Many have pursued higher education, with 94 (31.33%) attending polytechnics, 57 (19%) attending colleges, and 94 (31.33%) attending universities. The majority of respondents, 156 (52%), work for the government. Additionally, 46 respondents (15.33%) are students, 8 (2.67%) are unemployed, and 13 (4.33%) work in labour. Gross income levels show 38 respondents (12.66%) earn above RM6004, while 70 (23.33%) earn between RM4503 and RM6003. Similarly, 69 respondents (23%) earn between RM3002 and RM4502, and 82 (27.33%) earn between RM1501 and RM3001. Meanwhile, 91 respondents (30.33%) rented a house. About 80 respondents (26.66%) live with relatives, and 50 (16.66%) live in furnished accommodation. Most responders, 134 (44.66%), live in semi-urban settings. Just 59 responders (19.66%) reside in cities. Annual visitor maximum payment averages RM165.29.

Table 1. Demographic profile

| | No. | Percentage (%) |
|---|---|---|
| Age | | |
| 18-28year old | 62 | 20.67 |
| 29-39year old | 142 | 47.33 |
| 40-50year old | 53 | 17.67 |
| 51-60year old | 30 | 10 |
| 61 years old and above | 13 | 4.33 |
| Gender | | |

| | | |
|---|---|---|
| Male | 182 | 60.67 |
| Female | 118 | 39.33 |
| Civil Status | | |
| Single | 93 | 31 |
| Married | 155 | 51.67 |
| Divorced | 52 | 17.33 |
| Education | | |
| No Formal School | 10 | 3.33 |
| Primary School | 20 | 6.66 |
| Secondary School | 25 | 8.33 |
| Polytechnic | 94 | 31.33 |
| College | 57 | 19 |
| University | 94 | 31.33 |
| Occupation | | |
| Unemployed | 8 | 2.67 |
| Labor | 13 | 4.33 |
| Government Employee | 156 | 52 |
| Private Employee | 60 | 20 |
| Self-employed | 17 | 5.66 |
| Student | 46 | 15.33 |
| Gross Income | | |
| >RM6004 | 38 | 12.66 |
| RM4503-RM6003 | 70 | 23.33 |
| RM3002-RM4502 | 69 | 23 |
| RM1501-RM3001 | 82 | 27.33 |
| <RM1500 | 41 | 13.66 |
| Ownership | | |
| Owned | 79 | 26.33 |
| Rented | 91 | 30.33 |
| Living with relative | 80 | 26.66 |
| Provided | 50 | 16.66 |
| House Location | | |
| Urban | 59 | 19.66 |
| Semi-urban | 134 | 44.66 |
| Rural | 107 | 35.66 |

*(Source: Data Analysis)*

*4.2 Willingness to pay (WTP)*

4.2.1 Objective 1: To analyse visitors' acceptance and rejection across different bid price

Table 2 indicated bid price analysis for the respondents. The bid price analysis reveals the respondents' willingness to pay (WTP) at different price levels in Malaysian Ringgit (RM). There are six bid pricing; RM1, RM5, RM10, RM15, RM20, and RM25.

Table 2. Bid price analysis

| Bid Price (RM) | Yes | % | No | % |
|---|---|---|---|---|
| 1 | 28 | 46.67 | 32 | 53.33 |
| 5 | 22 | 36.67 | 38 | 63.33 |
| 10 | 44 | 73.33 | 16 | 26.67 |
| 15 | 27 | 45 | 33 | 55 |
| 20 | 34 | 56.67 | 26 | 43.33 |

4.2.2 Objective 2: To measure visitors' willingness to pay (WTP)

Table 3 demonstrates the results of the binomial probit model, while Table 4 presents the findings of the binary logit model. In the Binomial Probit Model and Binary Logit Model, various factors were analyzed to estimate the willingness to pay (WTP) of visitors to conserve the ecosystem in Ulu Bendul Eco Forest Park, including ecosystem services, age, gender, occupation, income, and the location of the house. This analysis was conducted based on WTP data collected from 300 visitors in the Ulu Bendul Eco Forest Park. The results indicate that ecosystem services in Ulu Bendul, gender, occupation, and income were statistically significant at the 5% level. Mean and Median willingness to pay by the respondents Langat catchment area is RM24.71 and RM23.30 for the binomial probit model, and mean and median WTP is RM22.25 and RM21.17 for the binary logit model. Lindhjem et al. (2010) found similar results in their study on WTP for ecosystem services in Norway, where income and occupation were statistically significant factors influencing WTP. A study by Amponin et al. (2007) in the Philippines also highlighted that income played a crucial role in determining WTP for protected area conservation, which aligns with this study's findings regarding income levels and the importance of ecosystem protection. Furthermore, Kline et al. (2000) examined WTP for ecosystem improvements in the United States and found that individuals who recognized the critical role of ecosystem services such as biodiversity preservation and recreational benefits expressed higher WTP.

Table 3. Binomial probit model

| Variables | Coefficient | Standard Error | b/St.Er | P[\|Z\|&z] | Mean |
|---|---|---|---|---|---|
| Ecosystem | 0.42442797 | 0.15887505 | 2.671 | 0.0076 | 0.72333333 |
| Age | -0.01783272 | 0.15384751 | -0.116 | 0.9077 | 0.58333333 |
| Gender | -0.17228334 | 0.05000237 | -3.446 | 0.0006 | 2.94666667 |
| Occupation | -0.38823493 | 0.14833665 | -2.617 | 0.0089 | 0.40666667 |
| Income | 0.17074553 | 0.05737894 | 2.976 | 0.0029 | 3.27000000 |
| Location | 0 .04423464 | 0.05718442 | 0.774 | 0.4392 | 3.10666667 |

Table 4. Binary logit model

| Variables | Coefficient | Standard Error | b/St.Er | P[\|Z\|&z] | Mean |
|---|---|---|---|---|---|
| Ecosystem | 0.68891718 | 0.26140161 | 2.635 | 0.0084 | 0.72333333 |
| Age | -0.04883698 | 0.25431666 | -0.192 | 0.8477 | 0.58333333 |
| Gender | -.27782212 | .08298028 | -3.348 | 0.0008 | 2.94666667 |
| Occupation | -.62094414 | .24373122 | -2.548 | 0.0108 | 0.40666667 |
| Income | .28075873 | .09524727 | 2.948 | 0.0032 | 3.27000000 |
| Location | .06603479 | .09426642 | 0.701 | 0.4836 | 3.10666667 |

## 5.0 Discussion

The findings of the study provide crucial insights into visitors' willingness to pay (WTP) for forest park conservation and contribute to growing empirical evidence on the economic valuation of ecosystem services. The bid price analysis demonstrated that visitors' acceptance of the bid price declines as the bid price increases. This finding is consistent with economic theory, indicating that while visitors value ecosystem services, their WTP is constrained by affordability. In contrast with the earlier case study conducted in the recreational forest in Malaysia, the result shows a comparable level of public support for protection and conservation funding. For instance, a positive WTP among visitors reported to offer economic support toward Ayer Keroh Recreational Forest Park management (Zahari et al., 2021). In contrast, a study by Francis (2025) measured that WTP is influenced by income, bid prices, wildlife species population, habitat quality, and protection level, which vary from this study.

## 6.0 Conclusion and Recommendation

Binomial Probit and Binary logit models were applied to determine in the Ulu Bendul eco-forest park. Incorporating economic valuation into forest management practice can assist decision makers, such as the forest department, in generating a reliable financing mechanism for ecosystem services. A complex framework approach that merges financial, governance, and community-driven solutions is highly recommended to sustain the eco-forest park. Payment for Ecological Services (PES) should pay for park maintenance and restoration, protection, and conservation. Foster public-private partnerships to fund conservation, infrastructure, and sustainability efforts. These strategies can protect Ulu Bendul Eco Forest Park while boosting economic and ecological resilience. Despite its contribution, this study is subject to several limitations. The findings are specific to Ulu Bendul Eco Forest Park and its visitors and may not apply to other parks with different ecological backgrounds and socioeconomic conditions. On the other hand, this study employed self-reported responses, which may affect the response bias, including hypothetical bias and social desirability bias, specifically valuation-based studies. Respondents may overstate or understate the willingness to pay to boost conservation initiatives. Future research could expand the study area and incorporate a mixed-method approach to integrate behavioral and institutional variables. Importantly, these insights contribute to the broader literature and knowledge by informing the design of a realistic conservation pricing mechanism and strengthening the application of economic valuation as a decision-support tool in sustainable forest park management.

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## Paper Contribution to Related Field of Study

This paper enriches the body of knowledge on forest ecosystem services by providing empirical evidence on their economic valuation within the context of an eco-forest park in Malaysia.

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