

Estimating Willingness To Pay For A Payment Forest Ecosystem Services Scheme, Gunung Tebu Forest Reserve In Malaysia As A Case Study

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ABSTRACT

The conceptualization of payments for ecosystem services (PES) is essential for sustainable financing mechanisms for the provision of environmental goods and services. Through the goal of PES programs, sustainable forest management can be achieved by securing forest-derived benefits to support conservation and sustainable livelihoods. The purpose of this study was to determine public Willingness to Pay (WTP) for a payment for forest ecosystems services scheme in Gunung Tebu Forest Reserve, Malaysia. The Contingent Valuation Method (CVM) that involved double bounded dichotomous choice was used in this study. A face-to-face interview which involved 375 respondents in Terengganu was collected between May to September 2022. The data were analysed using the conditional logit and mixed logit models. The findings revealed that the respondents are willing to pay significantly per year to improve the attributes of ecosystem services in Gunung Tebu Forest Reserve (GTFR), Terengganu, Malaysia. This finding shows that PES is a promising program to support forest conservation efforts. This study also enlightens the direction for policymakers to develop the future PES program to support forest conservation.

Keywords: Permanent Forest Reserve; Payment for Ecosystem Services; Contingent Valuation Method; Forest Policy; Willingness to Pay; Gunung Tebu; Malaysia

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I. Introduction

Forest resource management in recent times has shifted from traditional conservation and restoration practices to a more dynamic approach for sustainable management. The shifting is the reason that forest resources are continuously losing their capacity to provide the basic goods and services fundamental to livelihood due to human activities and other variables that threaten the ecosystem. This phenomenon persists in many developing, tropical countries. Malaysia is no exception, and the government is continuously intensifying efforts to reduce its forest loss. Other major challenges the local population faces, especially those living near or bordering the forest areas, are socio-economic status and rural poverty.

A baseline study conducted in the 11th Malaysia Plan (2016-2019) shows that the average community living in Peninsular Malaysia earned a low household income. Their average monthly income was RM2,145, with a poverty rate of 23% due to limited opportunities for employment and better income generation. There is, therefore, an urgent need not only to protect or conserve the ecosystem potentials, but to restore the lost biodiversity. The problem has prompted policy makers of the 'value of ecosystem service' in environmental management decisions. Therefore, there has been a growing search for concrete solutions. Among the approaches that has been applied often in both developed and developing countries are the economic valuation of the ecological resources and Payment for Ecological Services (PES) approach.

Economic valuation enables us to charge reasonable estimates for environmental services. Valuation of environmental services is regarded as an important tool to assist policymakers in comparing the benefits and costs to society in formulating conservation and management policies to protect and conserve environmental services.

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Thus, Payment for Ecological Services is used as a means for conservation activities and supports conservation financing. The lack of comprehensive methodologies for providing economic value for biodiversity and ecosystem services, which can be easily communicated to policy and decision-makers, has also hampered efforts to protect, maintain and enhance habitats and species. (Jones-Walter and & Mulder, 2009). The economic valuation of forest ecosystem services in broad-spectrum, and watershed functions to be specific, are the most pressing and challenging issues confronting environmental economist today. Economist value forest ecosystem services because valuation allow direct comparison with economic value of alternative options, a basis for a cost benefit analysis exercise, this allows room for environmental accounting, natural resource damage assessment and cost benefit analysis (Nijkamp et al., 2008).

Though environmental valuation in Malaysia has gain attentiveness and incorporated into the National Policy on the Environment since 2002. Studies on ecosystem services and conservation in particular using stated preferences are still limited in Malaysia. This study therefore, contribute to the growing literature on ecosystem valuation and watershed conservation in particularly using state preference methods. Therefore, the objective of this study is to examine the preferences and WTP of residents in Terengganu for enhancing the forest ecosystem services provided by the Gunung Tebu Forest Reserve (GTFR) through a Contingent Valuation Method (CVM).

II. Non-Market Valuation Method by Contingent Valuation Method

Contingent valuation (CV) is a survey-based method frequently used for placing monetary values on environmental goods and services not bought and sold in the marketplace. CVM is usually the only feasible method for including passive use considerations in an economic analysis, a practice that has caused considerable controversy. In this method respondents are asked to express a WTP or willingness to accept in response to a hypothetical market situation (Carson, 2000).

This is the most widely used technique for estimating the non-market value of environmental resources. The CVM technique was initiated by Ciriacy and Wantrup in 1947, adapted and implemented by Davis in 1963, (Zhang and Zhou, 2012). CVM provide the appropriate estimate of willingness to pay (WTP) or willingness to accept (WTA). This technique is a relatively straightforward approach in valuing environmental resources, because it directly asks people to state the maximum amount of money they would pay/accept for the conservation of an environmental service under the assumed market (Mitchell and Carson, 2013).

Thus, CVM is subjected to a number of limitations that affect the validity and reliability of results including embedding, sequencing, information and elicitation effects, and hypothetical and strategic biases (Venkatachalam and Narayanamoorthy, 2012). In order to reduce these possible deficiencies, a scenario, which includes sufficient accurate information about the resource being valued, is usually provided to the respondent prior to asking for the amount he or she is willing to pay for public goods (Han et al., 2011). A pre-test is also done to check the validity and understanding of the contents of the questionnaire, including the scenarios used in the application of CVM.

III. Study Area

The state of Terengganu is like any other state in Malaysia that is rich in natural environmental treasures as a source or destination for eco-tourism. Natural attractions in this state are not only popular with attractive beaches and islands, but also have highland attractions such as Gunung Tebu as an important attraction in Malaysia. Gunung Tebu has a height of 1,039 meters which consists of hill dipterocarp forest and upper dipterocarp forest. Gunung Tebu is located within the Gunung Tebu Forest Reserve (GTFR). However, Hutan Lipur Lata Belatan, is the starting point for climbing Gunung Tebu. The view from the top with the backdrop of the South China Sea, the beauty of Perhentian Island can be seen from the top is the main attraction for climbers to explore this peak. Also unique from the historical aspect at the top there are the remains of the graves of martial artists to train and meditate in the past becoming an important element of attraction.

The location of Gunung Tebu is located in the Lata Belatan Recreational Forest which is 24 km from Jertih Town and 118 km from Kuala Terengganu. This area is under the administration of North Terengganu Daedah Forest Office, State Forestry Department. Lata Belatan Recreational Forest and Gunung Tebu have already been developed as recreational forests and have provided various basic facilities for daily visitors. Meanwhile, Gunung Tepu has also been known among climbers. Now, this area is becoming increasingly popular as an important recreation and ecotourism destination, especially for local visitors.

The combination of recreational forest and mountain attractions further strengthens the appeal of this area, especially for the natural elements. In fact, the existence of unique biological diversity in this area has yet to be fully explored, especially to be developed as a recreational and ecotourism product. This study aims to assess the existence of natural resources in this area, particularly from the aspect of the environment, the uniqueness and suitability of the natural features that exist towards the potential development of resources and recreational and ecotourism activities.

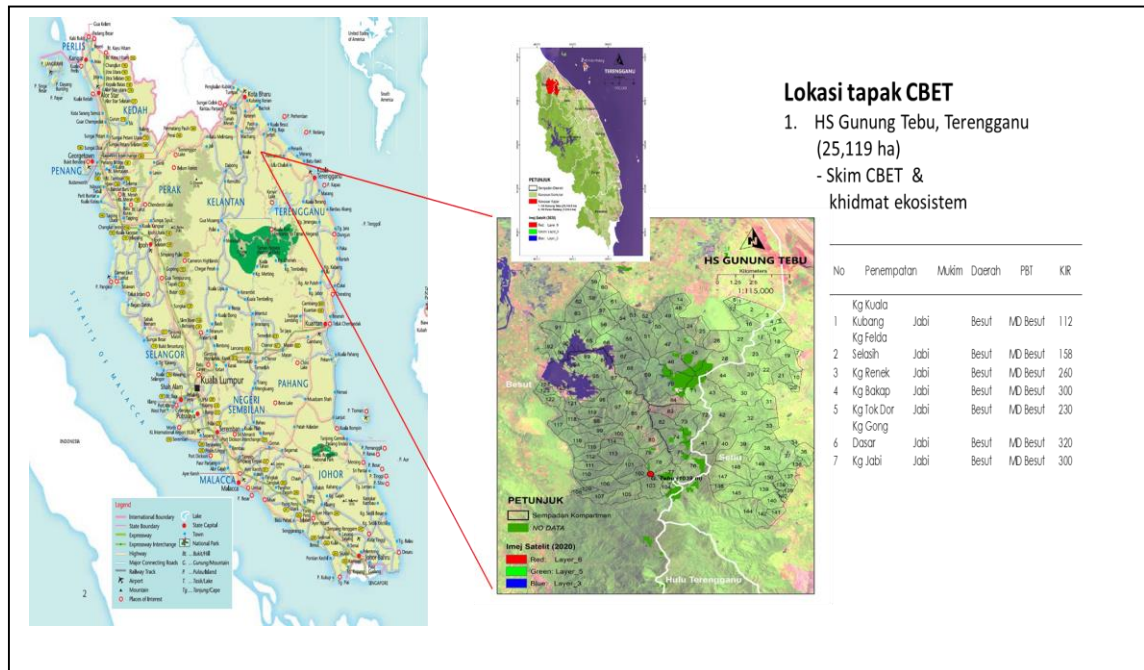


Figure 1. Location of the Gunung Tebu Forest Reserve

IV. Methods

Questionnaire Design

The survey questionnaire is an instrument that sets out a number of questions to elicit the monetary value of a change in a non-market good. Contingent valuation method (CVM) uses survey questions to elicit society's preference for public goods by creating a hypothetical market. CVM questionnaires can be designed to elicit willingness to pay (WTP) or willingness to accept (WTA) estimates for a change in the level of provision of a public good (Mitchell and Carson, 1989). A questionnaire was designed to gather primary information such as socio-demographic profile, attitude, and peoples' willingness to pay for conservation and preservation of forest ecosystem services in Gunung Tebu Forest Reserve (GTFR). For the purpose of this study, primary data from respondent were collected through a face-to-face interview. The dichotomous choice – double bounded format was used as an approach of CVM for this study. The format gives the respondent an opportunity to choose the amount of WTP. Through this format, the response 'yes' or 'no' was needed for the WTP questions. Six different bids were given to different respondents randomly. Each respondent only has to say 'yes' or 'no' to the bid posed to them. Six bids were selected for use: RM20, RM25, RM50, RM75, RM100, and RM120. The charges are chosen based on a pilot study.

Econometric Models

The exploration of whether a person is willing to pay for conservation of the area was done using Logistic model. This model was chosen because of its ability to deal with a dichotomous dependent variable and a well-established theoretical background. The model is specified as follows:

$$P_i = E(Y=1 | X_i) = \frac{1}{1 + e^{-(\beta_0 + \beta_i \sum X_i)}} \quad (\text{Eq. 1})$$

where P_i = the probability that $Y=1$, X_i is a set of independent variables explained above and β_i are coefficients to be estimated corresponding to logistic distribution. Taking a natural logarithm of Eq. (1) we obtain

$$L_i = \ln \left\{ \frac{P_i}{(1 - P_i)} \right\} = \beta_0 + \beta_i \sum X_i + e_i \quad (\text{Eq.2})$$

where L_i , which is called logit, is the log of the odd ratios and is linear in both independent variables and parameters. The estimation method used was the maximum likelihood estimator (MLE).

Following this, another nonlinear model using bivariate probit was employed to estimate the values with a binary dependent variable, the "yes" and "no" responses to the WTP question. For this model, the estimation of mean and median WTP was done by using the estimated coefficients which is given by Cameron and Quiggin

(1994). The estimation of the coefficients using bivariate probit model include two related models, which can be expressed as:

$$Y^*_1 = \alpha_1 + \beta_1 B_1 + \sum_{i=2}^n \beta_i x_i + \varepsilon_1 \tag{Eq.3}$$

$$Y^*_2 = \alpha_2 + \beta_1 B_2 + \sum_{j=2}^m \beta_j x_j + \varepsilon_2 \tag{Eq.4}$$

$$corr [\varepsilon_1, \varepsilon_2] = \rho$$

Where Y_1 and Y_2 are the binary responses to the WTP questions; B_1 and B_2 are the bids in the first and second bid question; X_i represents socio-demographic variables and α 's and β 's are the coefficients to be estimated.

V. Results

Socioeconomic Profile of the Respondents

The study sample consists of 375 respondents completed interviews . The majority of the respondents (57.6%) are male and 86.9% are married. The respondents ages ranged above 60 represent 24% from total respondents with majority of them more than 40 years old (65.6%). Majority of the respondents are Malays (90.5%). Many household heads had low incomes (56.5% less than RM200 per month). This study considered an individual income be low as compared to National minimum wages (RM1500, in 2022). Most respondents (98%) were not members of an environmental association particularly related to environment and forest community (Table 1).

Table 1. Respondents Profile (N=375)

Item		Frequency	Percentage (%)
Gender	Female	159	42.4
	Male	216	57.6
Nationality	Malaysian	375	100.0
Marital status	Single	49	13.1
	Married	326	86.9
Age	18-30 years old	60	16.0
	31-40 years old	69	18.4
	41-50 years old	78	20.8
	51-60 years old	78	20.8
	Above 60 years old	90	24.0
Gross Monthly Individual Income	Less than RM 2001	212	56.5
	RM 2001-RM 4000	103	27.5
	RM 4001-RM 6000	37	9.9
	Above RM 6000	23	6.1
Membership in Environmental Organizations or NGOs	No	371	98.9
	Yes	4	1.1
Watching Documentary or National Geographic Channel	Never	27	7.2
	Seldom	112	29.9
	Sometimes	82	21.9
	Frequent	112	29.9
	Always	42	11.2
Have you visited or participated in any program or activity related to forests?	Yes	236	62.9
	No	139	37.1
Have you visited or familiar with Gunung Tebu Forest Permanent Estate (HSK)	Yes	254	67.7
	No	121	32.3

Conditional Logit Model

This section presents the results of the survey undertaken for this study. Data obtained from 3 375 respondents using a questionnaire were used in the contingent-valuation method (CVM) analyses. The survey results are related to the economics and valuation of Gunung Tebu Forest Reserve (GTFR). The economic data described the factors that influence the demand for GTFR, Terengganu. In measuring respondents Willingness-to-Pay (WTP) to GTFR, the respondents were asked to indicate their willingness to pay for the conservation of resources at GTFR.

The analysis shows that 76% of the respondents agreed to contribute to the conservation of the GTFR area, while the other 24% did not agree (protest bidders). The study used the double-bounded dichotomous choice (DBDC) format to collate data. The format allows the respondent to choose the amount of WTP they can afford. A “yes” or “no” response is needed for the WTP questions by using this format. The WTP questions were divided into six different bid prices: RM20, RM25, RM50, RM75, RM100, and RM120.

For this study, estimations were taken using the single- and double-bounded dichotomous choice models. For a single-bounded dichotomous choice model, the WTP was estimated using a logistic model. Meanwhile, a bivariate probit model was used for the double-bounded dichotomous choice analysis. Results for the logistic model show that the coefficients for bid offered (BID1) are negatively correlated with the probability of acceptance as expected (Table 1). The negative and statistically significant coefficients on bid suggested that the higher the amount respondents were asked to pay, the less likely they would pay. This is consistent with the theory of demand for normal goods and the findings of similar studies (Trang, Toan, and Hanh, 2017; Emiru and Gemechu, 2017).

Result from estimated parameters for Forest Ecosystem Services in GTFR for Logistic single bounded show the GEN is significant at a 1% significance level and has a positive sign. On the other hand, estimated double bounded model found that the variable INC has a statistically significant positive impact on both the respondent's initial and subsequent decision on their contribution toward a willingness to pay for Forest Ecosystem Services in GTFR. This variable only proved to be a statistically significant determinant of an individual’s initial bid on willingness to pay for the preservation of GTFR.

Table 2. Estimated parameters for the Forest Ecosystems Services in GTFR

Variables	Logistic Model			
	Single bounded		Double bounded	
	Coefficients	S.E.	Coefficients	S.E.
BID1	-0.0223244	0.004073 ***		
Gen	0.6336714	0.2219374 ***	0.1788769	0.2532994
Age	0.000046	0.0083048	-0.0094483	0.0092943
Edu	0.086585	0.098882	0.119715	0.1101875
Inc	0.000075	0.0000567	0.0002061	0.00006 ***
BID2			-0.0093721	0.0045779 **
Constant	0.5384457	0.7168793	-1.185607	0.7819872
-2 log likelihood	238.148		197.546	
No. of obs. (n)	375		375	
Pseudo R ²	0.08		0.06	

Note:

** denotes significant at the 5% level ($p < 0.05$)

*** denotes significant at the 1% level ($p < 0.01$)

Estimation of the mean willingness to pay

Two approaches, Initial and upper bids Logistic Models were used to estimate the mean WTP in this study. The calculated mean values according to the different approaches are listed in **Table 3**. The estimated mean WTP fro initial bid was RM40.50. Meanwhile, the logistic model for upper bidding price, the mean WTP was RM71.

Table 3. Means WTP from Logistic Models

Model	Mean Willingness to Pay	
	Logistic	Initial bid
	Upper bid	71.0

VI. Discussion and Conclusions

The study also revealed that the respondents gained higher utility in Gunung Tebu Forest (GTFR) with the richness of the forest resources, preservation of landscape, aesthetical aspects, and services available. The management should prioritise conserving and preserving natural landscapes and provide better recreational facilities and services. The findings shows that the developed programme has been proven to help improve the socio-economy of the local population and the conservation of forest ecosystems. And also, this programme has also expected to contribute to state revenue, especially the Terengganu Forestry Department and the state government.

The other implication of this study is that the respondents were only willing to pay if the fee collection was to be channelled back to improve the management of forest ecological services. The management of GTFR must ensure that the collected conservation charge will be used to develop ecotourism solely in GTFR.

GTFR has various potential and existing ecotourism activities and products to be promoted and marketed. However, some of these products were not well promoted. For example, visitors were inclined to visit other natural attractions such as Sungai Ular and Gua, instead of only focus on climbing Gunung Tebu. Thus, incorporating relevant agencies and stakeholders in promoting GTFR and its surrounding area will help introduce and disseminate information about GTFR to broader potential prospects. Agencies such as the local municipal council, Besut Districts and Land Offices, Tourism Terengganu and Terengganu Forestry Department may help promote by sharing relevant information on their websites and social media.

GTFR is increasingly known for its natural beauty, thus attracting more visitors to this amenity forest and waterfall. The visitors to GTFR had positively impacted the local community regarding job creation, directly increasing their income and socio-economic status. The locals, especially the youth, benefited from GTFR through nature/tour guiding activities. Apart from that, the local community could serve as an ambassador that promotes nature conservation. Therefore, letting the community manage the GTFR via Payment for Ecosystem Services Scheme (PES) and its surrounding area is appropriate.

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