Journal of Applied Sciences

ISSN 1812-5654

science alert

ANSInet
an open access publisher
http://ansinet.com

Journal of Applied Sciences 12 (17): 1859-1864, 2012
ISSN 1812-5654 / DOI: 10.3923/jas.2012.1859.1864

Willingness to Pay for Watershed Conservation at Hulu Langat, Selangor

N. Mohamed, M.N. Shamsudin, A.N.A. Ghani, A. Radam, S. Kaffashi,
N.N.R.N.A. Rahim and N.H. Bin Hassin
Faculty of Environmental Studies and Faculty of Agriculture, Universiti Putra Malaysia,
43400 Serdang, Selangor, Malaysia

Abstract: This study attempted to estimate willingness to pay among the communities of Hulu Langat for watershed conservation. Dichotomous choice contingent valuation method was applied to estimate the willingness to pay. Face to face interview survey was conducted to obtain primary data for logit model estimation. The model estimation indicated that bid amount, income, occupation and residential area were the significant determinants influencing the communities' willingness to pay. Hulu Langat communities were willing to pay RM 10.13 per person monthly and the total benefits from watersheds conservation was about RM 27.7 million per year. The yearly aggregated amount provided ample financial resources for watershed conservation purpose. It was concluded that engagement of Hulu Langat watershed conservation initiatives was feasible for execution.

Key words: Watershed conservation, watershed management, willingness to pay, contingent valuation method, economic benefit, Hulu Langat

INTRODUCTION

Malaysia is endowed as one of the twelfth richest of biodiversity in the world (MNS, 2006). Malaysia's flora and fauna faces serious threats and has already lost its original vegetation due to deforestation activities. In Malaysia, forest areas are mainly recognized as important sources of water supply for industry, agriculture, households and recreation purposes. However, the forest areas nowadays are under threats due to deforestation activities. Given to that matter, watershed areas are affected. Based on study by Benavides and Veenstra (2005), tropical deforestation activities in fact lead to detrimental issues to river water quality due to increment in concentrations of sediment, nitrogen and phosphorus.

Forest areas in Selangor have been officially designated as Permanent Forest since 1898 (Selangor Forestry Department, 2009). This designation aimed to protect, manage, preserve and develop forest resources in sustainable manner. However, deforestation activities in Selangor are unavoidable. Hulu Langat forest is one of such forests that suffer from deforestation. It is estimated that, about 14, 567 hectares of the forest have been cut down for timber within 12 years (Jaafar *et al*., 2009). In addition, recent illegal logging activities that have been reported in mass media cause impulse severity in forest destruction. This issue is in fact crucial because Hulu Langat forest serves as watershed areas for communities at Hulu Langat. The reliance of communities for fresh water sources giving rise to the need of Hulu Langat watershed conservation.

Hulu Langat watershed covers the area of Hulu Langat Forest reserve in Selangor, a fast developing state in West Malaysia. This forest reserve represents about 26% of nine forest reserves in Selangor. It is covered with hill dipterocarps forest at elevation of 120 to 1,265 m above sea level (Mohd Shahwahid *et al*., 2003). The serve of Hulu Langat forest as watershed is entrenched from the forest's main river, Langat River. The river constitutes several branches such as; Langat River, Lupok River, Chongkak River, Pangson River, Lolo River and Lui River. These ancillaries are upstream catchment areas which they function as Langat Catchment area, placing a regulatory dam for domestic water supply. The dam releases domestic water supply to downstream to where the water treatment facilities are located for water purification process. These facilities are operated by a private water supply company, Syarikat Bekalan Air Selangor (SYABAS). Apart of important function of upstream catchment areas, the downstream part of Langat River is at leisure used by local people for recreational and fishing activities (Mohd Shahwahid *et al*., 2003).

Corresponding Author: M.N. Shamsudin, Faculty of Environmental Studies and Faculty of Agriculture, Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia Tel: +06 0192684755

Every year, certain areas of Hulu Langat forest has being cut down for timber harvest, agricultural and related activities. In 1990, the forest constituted about 45,405 hectares of areas and was reduced to 41, 102 hectares by 2001 (Jaafar *et al*., 2009). In 2012, Selangor Water Management Authority (LUAS) claimed that only 30, 838 hectares of the forest areas are left due to deforestation activities. Occurrences of deforestation are continually damaging biodiversity of the reserved forest. The watershed areas are also affected which the quality and quantity of water supply from Hulu Langat Dam have decreased. Based on the AWER, (2012), daily demand for clean water in Selangor, Kuala Lumpur and Putrajaya reaches 4,907 million liters in 2012, whereas the projected supply capacity is only 4,431 million liters in 2014. The demand for water supply increases annually due to population growth in Selangor expands at 3.2% annually (DSM, 2011). In contrast, the water supply has remained the same or even at decreasing rate due to affected watershed areas. Water supply to Selangor, Putrajaya and Kuala Lumpur decreased since 2010 due to increment in water demand and loss of forest areas. Therefore, this study was conducted to evaluate economic benefit of conserving watershed services to sustain domestic water supply at Hulu Langat, Selangor. This valuation was envisaged to yield the value of Willingness to Pay (WTP) of the communities for the conservation of watershed.

MATERIALS AND METHODS

The contingent valuation for watershed conservation at Hulu Langat, Selangor: Economic valuation is a method used to approximate monetary value of the benefit which accrues to communities from the use of an environmental resource. This study estimated the monetary equivalent of the benefits that Hulu Langat communities derive from conservation of its watershed. This research used Contingent Valuation Method (CVM) that has been commonly used as one of the standard approaches to measure the economic value of non-market goods, such as resources, wildlife and environmental quality goods (Hanemann, 1994). With this method, the value of an environmental good is directly elicited, as answer to a question about WTP. Thus, the monetary value can be presented in terms of a mean or median value per capital or per household, or as a total value for the affected population. Besides, the CVM method is very flexible. It can be used to estimate the economic value of virtually any natural resources (Whitehead and Blomquist, 2006). In CVM format, each respondent was presented with a scenario based on the current status, problems and the conservation program that will be implemented at the watershed area. The scenario was followed by question on WTP elicitation for watershed conservation purpose. The format used was dichotomous choice single bounded; a "take it or leave it" question approach. The question offered a randomly assigned monetary value to the respondents. The respondents have to choose 'Yes' or 'No' answer to indicate their WTP or vice versa.

Questionnaire design: Precedence of questionnaire design for this study was to gather primary information such as socio demographic profiles, awareness and respondents' WTP for watershed conservation. The questionnaire was divided into six sections; (1) warming up questions, (2) questions upon current water supply scheme, (3) awareness towards watershed conservation, (4) respondents' perceptions, (5) WTP and debriefing questions, (6) socio-economic profiles. The first section solicited knowledge about environmental problems for initiating contact with the respondents. In the second section, the respondents were required to give their views regarding current water service and related problems. The third and forth sections included questions about level of environmental awareness and the respondents' perceptions towards the watershed conservation. The fifth section of the questionnaire was mainly comprised of hypothetical scenario and followed by WTP and debriefing questions. The scenario explained about problems encountered in Hulu Langat watershed, which can affect the sustainability of the watershed. Deforestation and conversion of land to different land use is diminishing the forest area leading to the problem of water quality degradation. Therefore, conservation program implementation is necessary. The conservation program includes reforestation, increase in regular patrol, monitoring activities in the forest and effective forest management to ensure reduction in illegal logging, forest fire and wildlife poaching. Following the scenario, the respondents were doffed a dichotomous choice question which the question included bid offer for increment in monthly water bill. The medium used for the bid offer was in terms of percentage value as adapted from CVM study by Yacob *et al.* (2009). The selection of bid offers was validated through pretest. Based on the pretest results, five bid offers were selected including 10, 15, 20, 25 and 30% increment in monthly water bill. Each bid offer was randomly assigned in 100 set of questionnaires prior to survey implementation. The last section of the questionnaire included questions on socioeconomic background comprising of age, residential area, gender, race, number of year in education, occupation, family size and income level.

Table 1: Distribution of respondents by sub-district

Sub-district	Frequency	Percent
Kajang	201	40.2
Cheras	131	26.2
Semenyih	48	9.6
Hulu Semenyih	45	9.0
Beranang	29	5.8
Dusun Tua	46	9.2
Total	500	100.0

Source: Primary data, 2011

The questionnaire survey was conducted from July to September 2011. From 521 of survey, 21 of them were eliminated because of the respondents' refusal to complete WTP questions. Thus, this study was carried out by 500 completed questionnaires as summarized in Table 1. A large percentage of respondents (40.2%) came from sub-district of Kajang followed by sub-district of Cheras with 26.2%. Sub-district of Semenyih comprised of 9.6% of the total respondents, while Hulu Semenyih and Beranang constituted only 9 and 5.8% of the respondents respectively. The number of the respondents selected from each sub-district was based on the ratio of the actual population on the communities in Hulu Langat, Selangor. The sampling plan used in this study was stratified random sampling. The respondents were stratified according to their standard of living indicated by the type of their housing areas. Three strata were used in this survey. First strata represented those who live in high income housing area. The second strata embodied the respondents' in medium income housing area while the third strata represented those who reside in low income housing area.

Willingness to pay estimation: Based on Cameron (1988), the respondents' WTP for watershed conservation is Y_i and variable X_i are the underlying independent variables. Meanwhile, μ_j is assumed to be logistic random variables. Maximum likelihood binary logit model is assumed as follows:

$$Y_i = X_i'\beta+\mu_i \quad (1)$$

Since Y_i is an unobserved continuous dependent variable, so it is manifested through binary response variable I_i. In Cameron's approach, threshold value, t_i is included for generating new form of logistic model, censored logistic regression. The respondents' Yes or No responses towards WTP are either greater or less than t_i. Hence,

$$I_i = 1 \text{ if } Y_i>t_i = 0 \text{ otherwise} \quad (2)$$

So that, the probability of Yes answer is:

$$\begin{aligned} \Pr(I_i = 1) &= \Pr(WTP_i= t_i) \\ &= \Pr(X_i'\beta + \mu_i = t_i) \\ &= \Pr(\mu_i = t_i-X_i'\beta) \\ &= \Pr\{\mu_i/k = (t_i-X_i'\beta) /k\} \\ &= \Pr\{Z_i = (t_i-X_i'\beta) /k\} \end{aligned} \quad (3)$$

where, Z_{ij} is a standard logistic random variable with mean 0 and standard deviation b = $\prod/\sqrt{3}$. Hence, the log-likelihood function can be written as:

$$\log L = Ó\{-I_i \log \{1+\exp[(t_i-X_i'\beta) /k]\}+(1-I_i) \log \{\exp[(t_i- X_i'\beta) /k] / (1+\exp[(t_i-X_i'\beta) / k] \quad (4)$$

The mean of willingness to pay could be determined using the formula:

$$WTP = (\beta_0/\beta_1)+(\beta_2/\beta_1) X_1+(\beta_3/\beta_1) X_2 \quad (5)$$

where, β_0 is the constant, β_1 is the coefficient for the bid price variable, β_2 is the coefficient for independent variable X_1 and β_3 is the coefficient for independent variable X_2 (Santos, 1998; Kaffashi *et al*., 2011). The regression was estimated by utilizing Gretl version 1.9 through logit regression analysis. Based on Eq. 5 the calculation of mean WTP is represented as below:

$$\text{Mean WTP} = \frac{\beta\text{constant}+\beta\text{income}\times \text{INCOME}+\beta\text{education}\times \text{EDUCATION}+\beta\text{resident}\times \text{RESIDENT}}{\beta\text{bid}} \quad (6)$$

RESULTS

Respondents' socioeconomic profile: Summary of the respondents' socioeconomic profile is presented in Table 2. On average, age of the respondents was 39 years old. As expected the gender was composed mostly of male (83.8%) since they were the ones who represented the leader of the households during the survey. The respondents' study background was recorded based on their level of educational qualification. The proportional distribution of respondents' level of education showed that 50.6% of the respondents had spent six to twelve years studying. This implies that half of the total respondents have either studied until primary or secondary school while the rests further their studies until college or university. The average number of years spent studying was 13 years. The average household size was five members per household. The average household income was about RM 3933.00 in which 48.2% of the

Table 2: Socioeconomic profile of the respondents

	Frequency			
Variable	No.	%	Mean	SD
Age (year)			39.25	8.67
Gender				
Male	419	83.80		0.37
Female	81	16.20		
No. of years study				
6-12 years	253	50.60	12.99	2.65
13-16 years	140	28.00		
17-22 years	107	21.40		
Household size			5.46	1.63
Household income (RM)				
RM 1000-RM 2999	157	31.40	3933.00	2277.13
RM 3000-RM 4999	241	48.20		
RM 5000-RM 6999	39	7.80		
Above RM 7000	63	12.60		
Occupation				
Unemployed	3	0.60		0.87
Self-employed	116	23.20		
Government servant	94	18.80		
Private sector	287	57.40		
Residential area				
Urban	368	73.60		
Suburban	132	26.40		

Table 3: Respondents' responses towards bidding offers

	WTP		
Bid (%)	No	Yes	Total
10	3	97	100
15	8	92	100
20	40	60	100
25	72	28	100
30	84	16	100
Total	207 (41.4%)	293 (58%)	500(100%)

respondents earned an income range of RM 3000 to RM 4999 per month. Of the total respondents, only 0.6% was unemployed, while 23.2% were self-employed and another 18.8% were civil servants. With respect to occupations, most respondents were in the private sector and constitute about 57.4% of the total respondents. In addition, most respondents (73.6%) lived in urban areas while the rest lived in sub-urban.

Estimation of mean willingness to pay: The survey revealed that out of 500 respondents, 58% showed willingness to pay for the watershed conservation while 42.4% declined. Table 3 depicts frequency of responses to the five set of bidding offers. The survey revealed that the respondents have more tendencies to pay lower price for watershed conservation. While 97% of the respondents who were presented with the first set of bid offer (10% increment in monthly water bill) were willing to pay for watershed conservation. In contrast, only 16% of 100 respondents were willing to pay when they were presented with bid offer of 30% increment in monthly water bill.

Table 4: Binary logit estimation results

Variable	Coefficient	SE	p-value
Constant	-0.327859	1.00445	0.74412
Bid	-0.331598	0.0299543	<0.00001***
Income	0.000541547	0.000113056	<0.00001***
Education	0.390332	0.0881509	<0.00001***
Resident	1.02618	0.346451	0.00306***
Mean dependent variable	= 0.586000		
McFadden's R^2	= 0.544331		
Adjusted R^2	= 0.529588		
Number of cases 'correctly predicted'	= 87.2%		
Observation	= 500		

***Significant at 1%

Based on the logit regression analysis in Table 4, probability of "YES" responses for WTP was regards as dependant variable and explanatory variables comprised of offered bid amounts, income, education and residential area. The results revealed that explanatory variables are significant which have the best fit to the model. Positive sign of coefficients from regression denotes direct relationship between explanatory and dependent variables. In contrast, negative sign of coefficient otherwise implies indirect relationship. The bid amount offered to respondents for the watershed conservation showed negative sign and it was statically significant at 1% significant level. Meanwhile, income showed positive sign signifying its positive correlation with WTP at 1% significant level. The third explanatory variable, education was categorized into number of year study. The positive sign of this coefficient indicates that it has parallel relationship with "Yes" responses to WTP and it is highly significant at 1% level. The final explanatory variable, the residential area also gave significant result with positive regression coefficient. The mean of WTP for the watershed conservation was derived from regressed results in logit model as in Eq. 6. Thus, the result of mean WTP for watershed conservation was 23.01% increment for monthly water bill.

DISCUSSION

There are various determinants that can influence one's WTP towards assessing values for environmental services. Economic valuation in this study attests to the communities' acceptances towards watershed conservation by scrutinizing the influences of offering bids and the communities' socioeconomic backgrounds. First indicator of the communities' acceptances for watershed conservation is their responses to the bid offers. This study discovered that higher bid offer resulted in less preference for WTP among the communities. Since the payment for watershed conservation was monthly payable, it gives loads to the

communities' commitment. Hence, the utility declines as more of their financial resources need to be spent continuously for watershed conservation purpose. This result is consistent to the previous study by Lyssenko and Martinez-Espineira (2009), which the finding showed that fewer respondents were willing to pay as the bid value increases.

The second indicator of WTP for watershed conservation is income. It is expected to play a major role in determining the WTP coherent with results from previous studies by Day and Mourato (1998), Fujita *et al.* (2005), Pak and Turker (2006), Ghorbani and Hamraz (2009) and Sathya and Sekar (2012). The previous results showed that income is habitually a significant variable with positive sign. The positive sign of income denotes that the tendency to pay for watershed conservation increased with higher income level. Thus households with relatively higher income level are willing to pay more for watershed conservation as compared with those with relatively lower income.

Education is an important indicator in influencing WTP towards watershed conservation. The result signifies that communities with higher education background are more inclined to pay. In normality, decision making made by educated communities are more fundamental due to knowledge advantages they owned. Therefore, their decisions towards WTP are influenced by their developed knowledge rather than emotional driven decisions (Samdin *et al.*, 2010).

The WTP for watershed conservation is also driven by residential status either to be living in urban or sub-urban. Previous CVM study revealed that people who live in urban or rural area have significant different perspectives towards environmental protection (Solomon and Johnson, 2009). This study revealed that urban residents are more concerned towards conserving the watershed, hence their WTP was higher.

The result showed that the communities agree to pay about 23.01% increment for monthly water bill for watershed conservation purpose. The interpretation of this result can be initiated by estimating the average monthly water bill. On average, household payable for water was RM 44.02 per month. Hence, the value of 23.01% for monthly payable increment is equivalent to RM 10.13. When this amount is calculated across 228376 households in Hulu Langat districts, it gives aggregated value for watershed conservation of RM 2,313,449 monthly. In an annual basis, the total benefit paid by the communities estimated in Hulu Langat was RM 27,761,387. The increment in monthly water bill offers adequate fund for the watershed conservation. This amount of money will be covering the watershed management, reforestation and patrolling activities to ensure reduction of destruction activities in the watershed area.

CONCLUSION

The key objective of this study was to execute economic valuation for watershed conservation with the purpose of sustaining domestic water supply. Two important components in this study were deforestation and water shortage issues. These components hinder efficient water supply scheme provided by SYABAS. The overall results indicated that the communities in Hulu Langat were willing to pay for watershed conservation. Out of 500 respondents, 58% are willing to pay while the rest declined. On average, the communities were willing to pay 23.01% or RM 10.13 increment for monthly water bill. Meanwhile, anticipated results in this study showed that WTP is influenced by the bid amount, income, number of year attainment in education and residential area (urban or suburban) of the respondents.

The WTP value for this study is sufficient enough for protection of the watershed. This value can be used in the future for cost-benefit analysis for policy maker, authorities and local manager especially in environmental protection and forest management field. The result of the watershed valuation can also help to encourage the government and other decision maker to allocate more resources for conservation. From the viewpoint of government, a regular budget appropriation for Hulu Langat watershed conservation is a step forward in addressing the social benefit of conservation.

REFERENCES

AWER, 2012. Water crisis may hit Selangor before year 2014. Association of Water and Energy Research Malaysia.

Benavides, F. and J.N. Veenstra, 2005. The impact of tropical deforestation on river chemical pollution. Global NEST J., 7: 180-187.

Cameron, T.A., 1988. A new paradigm for valuing non-market goods using referendum data: maximum likelihood estimation by censored logistic regression. J. Environ. Econ. Manage., 15: 355-379.

DSM, 2011. Market report (CONT'D): Annual report 2011. Department of Statistic Malaysia, Malaysia.

Day, B. and S. Mourato, 1998. Willingness to pay for water quality maintenance in Chinese rivers: Working paper No. WM 98-02. Centre for Social and Economic Research on the Global Environment, London, UK.

Fujita, Y., A. Fujii, S. Furukawa and T. Ogawa, 2005. Estimation of Willingness-to-Pay (WTP) for water and sanitation services through Contingent Valuation Method (CVM): A case study in Iquitos City, The Republic of Peru. Japan Bank for International Cooperation, pp: 59-87. http://www.jbic.go.jp/en/research/report/jbic-review/pdf/report10_2.pdf

Ghorbani, M. and S. Hamraz, 2009. A survey on factors affecting on consumer`s potential willingness to pay for organic products in Iran (A case study). Trends Agric. Econ., 2: 10-16.

Hanemann, W.M., 1994. Valuing the environment through contingent valuation. J. Econ. Perspectives, 8: 19-43.

Jaafar, O., S.A. Sharifah Mastura and A.M. Sood, 2009. Land use and deforestation modelling of river Catchments in Klang Valley, Malaysia. Sains Malaysiana, 38: 655-664.

Kaffashi, S., M.N. Shamsudin, A. Radam, K. Abdul Rahim, M.R. Yacob, A. Muda and M. Yazid, 2011. Economic valuation of shadegan international wetland, Iran: Notes for conservation. Reg. Environ. Change, 11: 925-934.

Lyssenko, N. and R. Martinez-Espineira, 2009. Respondent uncertainty in contingent valuation: The case of whale conservation in Newfoundland and labrador. MPRA Munich Personal RePEc Archive, Germany.

MNS, 2006. An introduction to species conservation in Malaysia. Malaysia Nature Society, Malaysia.

Mohd Shahwahid, H.O., A.G. Awang Noor, N. Abdul Rahim, Y. Zulkifli and U. Razani, 2003. Economic benefits of watershed protection and trade-off with timber production: A case study in Malaysia: Report. International Development Research Centre, Ottawa, Canada.

Pak, M. and M.F. Turker, 2006. Estimation of recreational use value of forest resources by using individual travel cost and contingent valuation methods (Kayabasi Forest Recreation Site Sample). J. Applied Sci., 6: 1-5.

Samdin, Z., Y. Abdul-Aziz, A. Radam and M.R. Yacob, 2010. Factors influencing the willingness to pay for entrance permit: The evidence from Taman Negara National Park, Institute of Tropical Forestry and Forest Products (INTROP). J. Sustain. Develop., Vol. 3,

Santos, J.M.L., 1998. The Economic Valuation of Landscape Change: Theory and Policies for Land use and Conservation. Edward Elgar Publishing, Northampton, ISBN-13:9781858987811, pp: 83-91.

Sathya, T. and C. Sekar, 2012. Mangrove eco-system and their multifunctionalities: An analysis of the provision of economic and environmental livelihoods to the fishermen communities in the South-East Coast of India. Trends Agric. Econ., 5: 31-47.

Selangor Forestry Department, 2009. Annual report 2009. Selangor Forestry Department.

Solomon, B.D. and N.H. Johnson, 2009. Valuing climate protection through willingness to pay for biomass ethanol. Ecol. Econ., 68: 2137-2144.

Whitehead, J.C. and G.C. Blomquist, 2006. The Use of Contingent Valuation in Benefit-Cost Analysis. In: Handbook On Contingent Valuation, Alberini, A. and J.R. Kahn (Eds.). Edward Elgar Publishing, USA., ISBN-13:9781840642087, pp: 92-115.

Yacob, M.R., A. Radam, W. Khairil and A. Shuib, 2009. Contingent valuation of ecotourism in marine parks, Malaysia: Implication for sustainable marine park revenue and ecotourism management. World Applied Sci. J., 7: 1474-1481.