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ECONOMIC VALUES OF WETLANDS CONSERVATION FROM THE PERSPECTIVE OF URBAN NON-USERS

JAMAL OTHMAN
Faculty of Economics
Universiti Kebangsaan Malaysia

SHAHARIAH ASMUNI
School of Economics
Universiti Teknologi Mara

ABSTRACT

Benefits of wetlands resources that are tradable in the market, for example, wood products and fish are readily observable through market prices. However, non-marketable benefits such as the preservation of environmental functions and ecosystems are less objective. This study applies the Dichotomous-Choice Contingent Valuation Method on the Paya Indah wetlands in Kuala Langat, Selangor to estimate the non-marketed benefits of conserving the wetland from the perspective of non-users, in particular among urban households in Selangor. Results indicate that the mean willingness to pay (equivalent surplus) which reflects the non-use values of Paya Indah wetlands accrued to urban non-user households in Selangor ranges from RM28 – RM31 annually. The large sum of monetary value that households place in the conservation of Paya Indah illustrates partially the magnitude of social benefits that society at large obtains from the assurance that the wetland is to be maintained as a site for nature conservation. This strongly indicates that conservation of the wetlands is highly valued by the general public.

ABSTRAK

Faedah dari sumber tanah basah yang boleh didagangkan di mekanisma pasaran biasa seperti kayu-kayan dan ikan boleh dianggar secara eksplisit melalui harga pasaran barangan berkenaan. Namun, faedah bukan pasaran seperti pemuliharaan fungsi alam sekitar dan ekosistem tidak bersifat objektif. Kajian ini menggunapakai kaedah Penilaian Kontingen dengan format

dwipilihan bagi menganggar faedah bukan pasaran tanah basah Paya Indah di Kuala Langat, Selangor, khususnya dari perspektif isi rumah bukan pengguna di kawasan-kawasan bandar utama di negeri Selangor. Kajian mendapati purata kesanggupan membayar (lebihan setara) isi rumah yang menggambarkan nilai bukan penggunaan bagi tanah basah berkenaan adalah diantara RM28-RM31 setahun. Nilai yang tinggi ini menggambarkan secara separa magnitud faedah sosial yang diperoleh oleh penduduk di negeri Selangor dari program pemuliharaan Paya Indah. Ini jelas menggambarkan sumber semulajadi tanah basah berkenaan amat dihargai oleh masyarakat secara keseluruhannya.

INTRODUCTION

Values of non-market goods and services such as environmental resources are often being underestimated, making them insignificant when it comes to decision-making involving the use of these goods and services. Ignoring these benefits (or costs) could lead to decisions that are inefficient or socially unjustifiable. For that matter there is a need to ascertain the non-transparent values that these goods hold.

Environmental valuation is the attempt to assign economic (quantitative) values to the flows of environmental goods and services; commodities which are not transacted in the ordinary market mechanism. It was pioneered in the US in the 1960's. Environmental valuation assists policy makers and interested parties in identifying the economic values of a change in resource allocation. Over the past two decades, environmental valuation has been increasingly used in many developed countries, most notably the US, UK and Australia as a complementary tool in public decision-making involving critical environmental-resources such as forests, wetlands, water, wildlife, biodiversity, agricultural externalities, rural landscape, and air quality.

In Malaysia, environmental valuation has not yet been incorporated in any public decision-making processes. However, interest in this field has been increasing as a result of the increased public awareness on environmental quality.

This paper presents the result of a valuation exercise conducted on a wetland site in Kuala Langat, Selangor (Paya Indah Wetlands). The study aims at measuring the non-marketed values of conserving the wetland from the perspective of non-users, in particular among urban dwellers.

Wetlands provide an array of benefits to mankind. For those benefits that are tradable in the market, for example, timber and fish, monetary values of these benefits are apparent. However, for equally essential albeit non-marketable benefits from the wetland such as preservation of species through the conservation of their habitats and ecosystems, these benefits are intrinsic and less objective.

Problems arise when a natural resource site such as the wetland is being considered for conversion to meet development needs. In this case, there is a need for an economic valuation study to justify and weigh its conflicting uses. As for the wetland used for this study – the Paya Indah Wetlands Sanctuary (Paya Indah) — the above issue might possibly arise in the not so distant future since the wetland is located in the vicinity of two growth designated cities: the nation's futuristic administrative capital city, Putrajaya as well as the smart city of Cyberjaya. However, the more immediate issue at hand for the wetland is justifying the cost of conservation. A valuation exercise to measure the benefits of conservation from the society's point of view will provide an economic basis for maintaining the area as a sanctuary for nature. The findings of the study may also be used to assist the management of the wetland in determining the viability of conserving the area in the long run.

Subsequent sections in this paper will discuss the following topics: the total economic value framework of environmental valuation, literature review, study methodology, findings and policy implication.

Total Economic Value (TEV) Framework

When valuing the service flows or benefits of an environmental resource, it is important to understand the concept of TEV, which describes the taxonomy of environmental values in the economic sense. The TEV framework recognizes two broad categories of environmental values — **use** and **non-use values**. Total use value consists of the actual use value which is divided into current use value and option value. These values may be in the form of direct or indirect use values. For a wetland, the **direct use values** may be derived from recreation such as hunting and fishing or harvesting of marketed goods such as fishes or wood products (these are **consumptive use values**) or sightseeing, learning about nature, feeding wildlife or photographing (**nonconsumptive use values**).

The **indirect use values** are values emanated from indirect uses of the good. For a protected area such as the wetland, the indirect uses are largely composed of ecological functions, such as hydrological functions and water purification. These services clearly do not lend themselves to measurements by conventional market mechanisms.**Option value** refers to value derived from the option of using the good sometime in the future, which can be direct or indirect. The option value is analogous to 'an insurance premium to ensure the supply of something the availability of which would otherwise be uncertain (Pearce *et al.*, 1994).

Quasi-option value is related to option value. It is the expected future value of information derived from delaying exploitation and conversion of a natural resource. An example is information on the importance of some untested plant genes as medicines or agricultural products.

Non-use values are values that are not in any way linked to use or option value. Bequest and existence values are the most common non-use values mentioned in the literature on non-use value. **Bequest value** is benefit obtained by individuals from knowing that their heirs or future generations will benefit from the goods in the future. **Existence value** is the benefit derived from simply knowing that the goods exists even if one has never utilized or has any intention of using the goods. Existence value can be significant especially when it involves endangered species or very unique environmental assets.

Literature Review

A host of environmental valuation techniques exist in the literature. To date, the Contingent Valuation (CV) has been the most widely used technique. It has the unique ability to estimate all value types including non-use values of environmental services. There have been hundreds of CV applications worldwide. However, there have been very few published works on environmental valuation involving Malaysian cases. The discussion that follows summarizes several selected studies pertaining to the use of CV in estimating use or non-use values.

The study by Kaplowitz and Hoehn (1998) surveyed residents from Chelém, Progresso and Chuburná in Yucatán, Mexico to obtain qualitative and quantitative data on community use and nonuse values of Chelém Lagoon, a mangrove wetland bordered by these three areas. The aggregate use values, derived based on the aggregate use value of

chivita (a water specie which formed the basis of the primary economic activity for the communities), was approximately USD230,000 to USD350,000 annually.

Loomis *et al.* (1993) conducted a survey on the adult population of Victoria state using both open-ended and close-ended CV approaches. The focus of their survey was on the issue of the unreserved national estate forests of southeastern Australia. The mean open-ended willingness to pay (WTP) for forest preservation for different options that cover areas of different sizes was calculated and found to be within the range of USD39 to USD103.

Stevens *et al.* (1991) conducted two separate studies on wildlife and these were studies focused on measuring existence value. One study used the Dichotomous Choice CV to examine the economic value of the Atlantic salmon restoration program to residents of Massachusetts. The other used the Open Ended CV tobit model to value bald eagles, wild turkeys and coyotes in New England. The WTP estimates range from a low USD2.08 to a high USD28.25 depending on the type of goods under study. The results were reported to be 'reasonable' and comparable with other previous studies.

Bateman & Langford (1997) applied the DC CVM to obtain non-users' WTP to preserve the Norfolk Broads, a significant wildlife site in the United Kingdom. The result was a mean WTP of £23.29. This result was then compared to results of two other studies estimating non-use values of forest and forest recreation, which reported significantly lower WTP estimates.

Most Malaysian cases on environmental valuation have applied the Travel Cost Methods (TCM) to estimate the benefits of nature-based recreation - for instance, Shuib (1991), Willis *et al.* (1998), Jamal and Redzuan (1998), Jamal (2000). There have been fewer published studies of a CV application: Mustapha (1993) and Jamal (2001) employed the dichotomous choice and open-ended CV formats to estimate the benefits of a lake recreation and non-use values of forest resources, respectively.

STUDY METHODOLOGY

Theoretical Framework

This study attempts to measure conservation benefits from the perspective of non-users (non use values). The contingent valuation

method (CV) is used to derive the willingness to pay (WTP) of individuals residing in urban areas within the Selangor state. From this value, the aggregate monetary benefits of conserving Paya Indah for the urban households of Selangor are estimated. The measurement considered non-users instead of users due to the fact that at the time of the study the newly-established site was not readily assessible to the public. In estimating this value, the CV with close-ended WTP elicitation format was employed.

Contingent valuation is defined as *"any approach to valuation of a commodity that relies upon individual responses to contingent circumstances posited in an artificially structured market"* (Seller *et al.* 1985). In the study, individuals were asked directly to reveal how much they were willing to pay to avoid some assumed levels of decline in the provision of a group of services representing a certain quality of Paya Indah as a wetland.

The theoretical basis of CV used in this study is the equivalent surplus (ES) measure of welfare. In obtaining a value for Paya Indah environmental service flows, let us suppose that a person derives utility from a bundle of marketed goods and services, denoted by *X* and a certain quality of Paya Indah denoted by *Z*. In Figure 1, the household is assumed to be initially at position *A* on utility level U_0. The budget line is constant, implying that an individual's budget is unaffected by a change in *Z*, a non-priced item. A decrease in the quality of Paya Indah from a change in land use policy results in the shift to point *B* on a lower utility level, U_1. Assuming that the household has a right to the initial amount of *Z*, then to ensure that Z_0 is maintained, a certain amount of income (WTP^{ES}) is taken from M_0 to allow the individual to remain at the initial quality level but at the subsequent (new) utility level. The individual will move to position *D* where the level of utility remains the same as in position *B*.

Based on the indirect utility functions, the WTP^{ES} as described above can also be illustrated as:

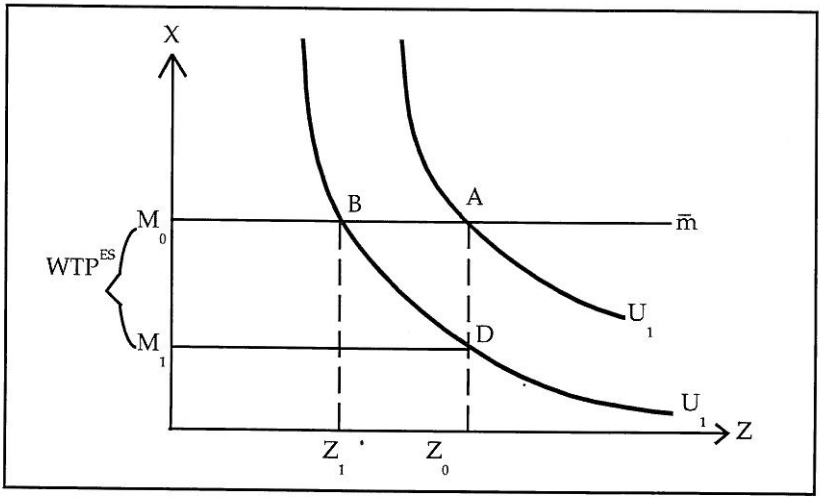
$$V_0(X, Z_0, M_0) = V_1(X, Z_0, M_0\text{-WTP})$$

where M_0 is initial income level, Z_0 and Z_1 represent different sets of environmental attributes (Z_0 being the set of attributes prior to a policy change), and X represents other marketed goods.

The Study Site: Paya Indah Wetlands Sanctuary (Paya Indah)

Located in the district of Kuala Langat in Selangor, Paya Indah is a 3100-hectare man-made wetland encompassing 14 lakes, a peat swamp forest reserve – the North Kuala Langat Peat Swamp Forest Reserve — which takes up an area of approximately 2500 hectares, a logged forest area and some cleared hills. Paya Indah came into existence from the realization of the need to protect the nation's wetlands which has been under continuous threat from human development. Before the area was turned into a sanctuary for nature, much degradation has taken place due to human activities such as tin, clay and sand mining on the open lakes, logging of the peat swamp forests and farming and hunting by the native Orang Asli living on the northern border of the wetland area.

Figure 1
Equivalent Surplus Welfare Measurement



The idea of having a wetland sanctuary for the nation was first proposed in 1995. The Paya Indah area was chosen despite its degraded state due to the awareness that this vast area contains a unique blend of forest and water ecosystems that need to be restored. Paya Indah has been home to some 142 species of birds, 40 species of fish, 35 species of mammals and reptiles and 220 species of aquatic and terrestrial plants and rare herbs. Ecological assessments carried out in the area indicated that among the species found inhabiting there are those on the list of endangered species (Malaysian Wetland Foundation, 1996). These findings plus the importance of the North Kuala Langat Peat

Swamp Forest Reserve as a pool for plant genes highlight the importance of maintaining the area as a conservation site. In September 1997, the sanctuary's masterplan was approved by the Prime Minister. Since then, work to restore the degraded wetland as a sanctuary for nature has begun.

Data Collection

In estimating the non-use values (ES) for conservation of Paya Indah, a survey was conducted on adult non-user urban residents of Selangor. The environmental market (hypothetical situation) was presented to respondents after the background of Paya Indah was explained. Using the dichotomous-choice elicitation format, respondents were asked to either agree or disagree to pay a suggested bid price (as maintenance costs) to avoid a certain percentage of decrease in the environmental quality of Paya Indah. Bid prices used (RM1, 5, 20 and 50) were estimated through a focus group session prior to the actual survey.

A total number of 294 proportionate (according to area populations) and randomly selected non-user respondents representing urban residential areas in Shah Alam, Bangi, Kajang, Klang, Cheras, Petaling Jaya and Subang Jaya were surveyed through either personal interviews or self-administered questionnaires during the months of July through September 2000. Samples used for analysis were reduced to 223 (76 per cent) due to either protest bids or non-response to the CV question. The non-responses were mostly due to the belief that conservation efforts should be the responsibility of the government. The mean age of respondents was 30 while the average monthly household income was RM3141. Male respondents formed 57 per cent of total respondents. Due to a rather significant lack of cooperation from among the non-Malays, the proportion of respondents in terms of ethnic groups was skewed towards the Malays (80 per cent).

The Empirical Model

In estimating values for conservation, the WTP function follows the general WTP function often used in the literature:

$$WTP = f(AGE, INCOME, ENVT, EDU)$$

where AGE represents age of respondent, INCOME represents gross household income, ENVT represents environmental attributes or re-

spondent's perception of the environment, and EDU represents highest education level of respondent.

The WTP function also includes bid price since respondents' answers were expected to be influenced by the price offered. The model specification for Paya Indah is as follows:

$$WTP = \alpha + \beta_1 PRICE + \beta_2 AGE + \beta_3 INC + \beta_4 ENVT + \beta_5 EDU + \beta_6 SCOPE$$

where:

WTP	=	"Yes" (1) or "No" (0) response to the posted price
AGE	=	age
INC	=	gross household income
ENVT	=	dummy variable for level of concern on general environmental issues; 1 = very concerned
PRICE	=	bid price offered to respondent
EDU	=	dummy variable for highest education level; 1 = university or college education
SCOPE	=	dummy variable for percentage change in the environmental quality of Paya Indah; 1 = 30%, 0 = 10%

Following Hanemann (1984), the model takes the form of a cumulative logistic function which allows for WTP estimation when responses to bid prices offered are in the form of 'yes' or 'no':

$$P_1 = (1 + e^{-Z})^{-1}$$

where:

P_1	=	probability of answering 'yes'
Z	=	$\alpha + \beta_1 PRICE + \beta_2 AGE + \beta_3 INC + \beta_4 ENVT + \beta_5 EDU + \beta_6 SCOPE$

Probability of saying 'No', $P_0 = 1 - P_1 = 1 - (1+e^{-Z})^{-1}$.

Thus $P_1/(1-P_1) = (1+e^{-Z})^{-1}/(1- (1+e^{-Z})^{-1} = e^{Z}$.

Taking natural log for the left hand side (LHS) of the previous function results in the following equation for the logistic model:

$$\text{Ln}\,[P_1 / (1-P_1)] = Z,$$

Where the LHS expression denotes the log of probability ratio for respondent answering 'Yes' to the posted price.

RESULTS

Table 1 reports the results of the model. Survey samples were grouped into three categories, which were differentiated by the scope used in the questionnaire. This allows comparison to be made on the relationship between WTP and the rate of change in environmental quality as perceived by respondents.

The overall performance of the 3 models is quite satisfactory with a good fit measure ranging from .76 to .87 (Count R^2) and .3 to .5 (Mc Fadden R^2). These values are comparable to other similar studies in the literature.

The coefficient for price is negative as expected, showing that the higher the bid offered, the less likely the respondent is willing to accept the bid. For all models, bid price is significant at 1 per cent confidence level.

The coefficients for age, income and degree of concern over environmental issues are of the expected signs, but only environmental concern (ENVT) is significant at the 2 and 5 per cent confidence levels for models with large percentage change and overall percentage change, respectively.

Coefficient for scope in the overall model is positively related to the likelihood of accepting the bid. To some extent, this shows that respondents are responsive to the rate of quality change described when answering the WTP question. However, the relationship is not statistically significant.

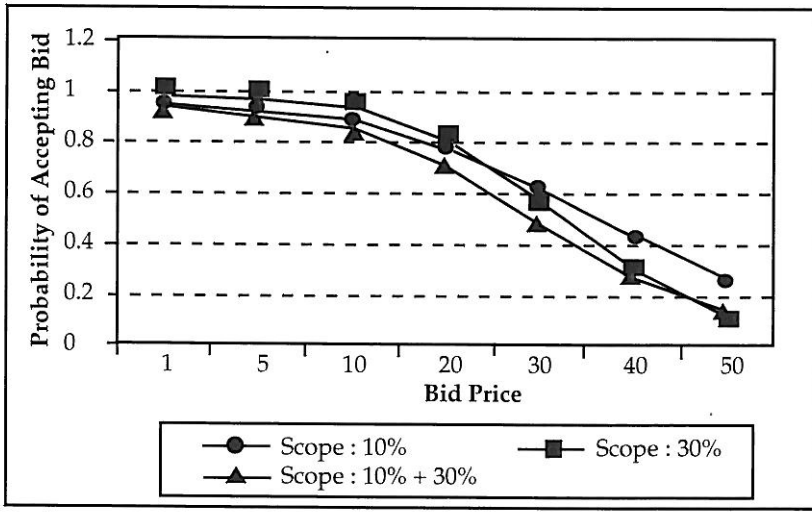
WTP estimation for the logistic model is represented by the area under the cumulative distribution function (CDF), explaining the relationship between the probability of answering 'yes' to the bid offered. Figure 2 illustrates the functions for the 3 sample versions:

Table 1
Maximum Likelihood Estimates of Logistic Regression

	Regression Coefficients [a]		
Scope:	10%	30%	10% + 30%
Variables:			
PRICE	-.072	-.120	-.090
	(-4.235)***	(-5.000)***	(-6.923)***
AGE	-.015	-.043	-.024
	(-.333)	(-.956)	(-.774)
INCOME	.000174	.000756	.000137
	(1.074)	(.4.345)	(1.245)
ENVT	.963	2.000	1.274
	(1.372)	(2.077)**	(2.329)*
EDU	-.231	1.176	.267
	(.387)	(1.429)	(.562)
SCOPE	-	-	.416
			(.965)
CONST	2.095	3.624	2.437
	(1.599)	(2.338)**	(2.579)***
Count R^2	.79	.87	.82
Mc Fadden R^2	.27	.49	.36
N	93	97	190

[a] t-values in parentheses; ***, **, * denote significant at 1, 2, 5 per cent levels respectively.

Figure 2
Cumulative Distribution Function



Calculating the area below the CDF yields the mean WTP estimate for each respondent. Each respondent represents an urban household in Selangor, therefore this monetary value when multiplied by the total number of urban households in the state and the ratio of respondents who are willing to pay will represent the aggregate WTP for the entire urban population.

In Table 2 below, annual mean WTP for each respondent is shown. The value ranges from as low as RM27.70 (for the overall sample version) to as high as RM30.93 (for samples with large scope). Mean WTP is found to be slightly lower for the small scope as compared to the large scope.

Taking the average household size of 4.8 for Selangor with the urban population size of 1,810,000 people (Malaysian Statistics Department, 1999), the number of urban households is estimated at 375,000 units. The annual stream of aggregate WTP for the urban population of Selangor has a 76 percent response rate and is as shown in Table 2.

Table 2
Annual Average and Aggregate WTP Based on Scope

Scope	Average WTP (RM)	Aggregate WTP (RM)
10%	27.50	7,837,500
30%	30.93	8,815,050
10 + 30%	27.70	7,894,500

The aggregate WTP for urban non-user households in Selangor ranges from RM7,800,000 to RM8,800,000 annually. As population typically increases over the years, the estimated values would represent the lower bound annual stream of social benefits (non-use values) accrued to Selangor urban households for the maintenance of Paya Indah as a site for nature, assuming that the proportion of non-user households and all other socio-economic and attitudinal variables remain unchanged.

CONCLUSION AND POLICY IMPLICATIONS

The aggregate lower bound non-use values of maintaining the wetland as a sanctuary is estimated at RM7.9 million (using the overall sample version) annually or RM79 million in terms of present value (using a 10 per cent social discount rate). This value is rather substan-

tial considering that the value merely represents non-use values and only accruable to urban households in Selangor. This value type presumes that households do not obtain direct tangible benefits from the area. This implies that the aggregate value may decline as more and more urban households in Selangor derive use values by having direct contact with the resource in the future.

The large sum of monetary value that urban households allocated for the conservation of Paya Indah illustrates partially the magnitude of social benefits that society at large obtains from the assurance that the wetland is to be maintained as a site for nature. This strongly indicates that the conservation of Paya Indah wetlands is highly valued by the general public.

The implication from this study is important especially when considering the rate at which our natural resources are being depleted to meet development needs. The study depicts how an environmental valuation exercise can make a difference when deliberating whether or not a particular natural resource is to be converted to alternative uses.

For Paya Indah, the result of this study provides an economic basis for its management, as well as directly affecting policy makers' decision to continue maintaining the area as a wetland sanctuary. The result of study may also be incorporated into the economic analysis of determining the viability of conserving the area in the long run. Furthermore, the estimated benefits obtained from this study (source) may be transferred to other similar (target) wetlands site for the purpose of policy or management decisions affecting the target resource.

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REFERENCES

Bateman, I.J., & Langford, I.H. (1997). Non-users' willingness to pay for a national park: An application and critique of the contingent valuation method. *Regional Studies, 31*(6), 571-582.

Hanemann, W. M. (1984). Welfare evaluations in contingent valuation experiments with discrete responses. *American Journal of Agri-*

cultural Economics, 66 (3), 332-341.

Jamal Othman & Redzuan Othman (1998). Economic benefits from wetland biodiversity: Case of fireflies recreation, Malaysia. *Tropical Biodiversity, 5*(1), 65-74.

Jamal Othman (2000). Benefits of wetland-based recreation: Case of Kuala Selangor Nature Park and Fireflies. *Malaysian Journal of Environmental Management, 1*, 41-54.

Jamal Othman (2001). Estimating non-use values of environmental resources using contingent valuation: Case of Matang Mangroves. In Jamaluddin Jahi, et al. (Eds). *Environmental Management 2000* (214-222). Bangi: Center for Graduate Studies, Universiti Kebangsaan Malaysia.

Kaplowitz, M.D., & Hoehn, J.P. (1998). Using focus groups and individual interviews to improve natural resource valuation: Lesson from the mangrove wetlands of Yucatán, Mexico. (Early draft, Paper presented in the 1998 World Congress of Environmental and Resource Economists, Venezia, Italy). Online.

Loomis, J., Lockwood, M., & DeLacy, T. (1993). Some empirical evidence on embedding effects in contingent valuation of forest protection. *Journal of Environmental Economics and Management, 25* (1), 45-55.

Malaysian Wetlands Foundation, Kuala Lumpur. (1996). *Preliminary ecological assessment of the Malaysian Wetland Sanctuary, Selangor.*

Malaysian Statistics Department 1999. *Buku tahunan perangkaan Malaysia 1999.* September, Kuala Lumpur.

Pearce, D., Whittington, D., Georgiou, S., & Moran, D. (1994). *Economic values and the environment in the developing world.* Report to the United Nations Environment Programme, Nairobi. Environmental Economics Series. No. 14. London: The Centre for Social and Economic Research on the Global Environment (CSERGE).

Shuib, A. (1991). Effects of time cost on recreational benefit estimation. *Malaysian Journal of Agricultural Economics, 8*, 41-51.

Stevens, T.H., Echeverria J., Glass, R.J., Hager, T., & More, T.A. (1991). Measuring the existence value of wildlife: What do CVM estimates really show?. *Land Economics, 67* (4), 390-400.

Seller, C., Stoll, J.R., & Chavas, J-P. (1985). Validation of empirical measures of welfare change: A comparison of nonmarket techniques. *Land Economics, 61*(2), 156-174.

Willis, K., Garrod G., & Chee, T. (1998). Valuation and analysis of consumer demand for forest recreation areas in peninsular Malaysia. In S. Lee, D. May, I. Gauld & J. Bishop (Eds),. *Conservation, management and development of forest resources* (Proceedings of the Malaysia-UK Programme Workshop). Malaysia: Forest Research Institute Malaysia.