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Sustainable Wetlands-based Recreation: The Case of [illegible] Valuation Shed Some Light[1]

by

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Abstract

The coastal village of Kampong Kuantan in the state of Selangor, Malaysia is noted for its fireflies (*pteroptyx tener*). The fireflies which flashes every non-rainy night is one of world's most spectacular insect shows. The local operators formulated strict but informal rules to ensure the sustainability of the fireflies trade. This includes the prohibition of the use of boats with outboard engines to view the fireflies. However, the natural resource is now under threat from potential development projects and errant boat operators with outboard engines. Boats with outboard engines create air and noise pollution. The air pollution distracts the fireflies while noise pollution affects the serenity of the river. Development projects which are planned in the vicinity of the recreational area potentially lead to irreversible catastrophe to the natural resource. This study attempts to assess the economic value (expenditures and consumer's surplus) of on-site current recreational benefits using the Travel Cost (TCM) and Contingent Valuation Method (CVM). Consumer's surplus per recreationist per trip was found to range between RM62.00 (US $25.00) to RM120 (US $48.00). This yields a gross economic value in the range of RM1.1 mill (US $440,000) to RM1.68 mill (US $672,000) annually. The results indicate that the economic value of the fireflies recreation is highly substantial. Hence recreational function provided by wetlands or forest resources may be important considerations for natural resource policy and management in Malaysia.

Introduction

Kampung Kuantan Fireflies Recreational Center is internationally notable for its unique natural endowment where recreationists can experience the aesthetic relish of viewing millions of fireflies.The fireflies which flashes every non-rainy night is one of world's most spectacular insect shows. The recreation site is located in a wetland mangrove area along the Selangor River, about 9 km and 56 km from Kuala Selangor town and metropolitan Kuala Lumpur, respectively. The main economic activity of the local community is agriculture, particularly fruits orchard, coconut and oil palm cultivation.

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The fireflies recreational activities in Kampung Kuantan started commercially since the early 1970's. It is managed by the local community. To gain the fascinating experience of viewing fireflies, recreationists are taken for a boat ride about 2 km from the recreational center, between 8 - 10 pm. An alluring scene is created when thousand of fireflies flash their light simultaneously in harmony as they gather on the mangrove trees *(Sonneratia caseolaris)* along the riverbank.

The response of the visitors to the recreational area has been very encouraging. In 1995 a total of 19,647 trips were made to this area. About 51 percent of the visits were by Malaysians and the rest were foreign visitors mainly from Japan, Taiwan, USA, England and Australia. To enhance public infrastructural facilities in the recreation area, an office, public utilities and a jetty were constructed with financial support from the Selangor State Government. The numbers of private traditional boats without engines also increased from 4 units in the early 1970s to 20 units currently. Lately, these traditional boats are facing competition from boats with outboard engines.

Research Issues and Objectives

Although the Kampung Kuantan Fireflies Recreational Center is a well known ecotourism site, there exist a number of problems which warrant serious consideration by relevant authorities. A major issue is a proposal for economic development projects affecting part of the mangrove area of Kuala Selangor which includes the recreational site. If the development projects are not ecologically and environmentally friendly, it is feared that the fireflies would be in a danger of extinction. The projects also potentially threaten the ecological functions of the mangrove area.

Another major issue is the competition from boat operators with outboard engines to transport the recreationists to view the fireflies along the river. Although the local community has formulated strict but informal regulation against the use of boats with engines, there is an "errant" operator who insists on using such boats. The use of such boats not only disturbs the tranquility of the river, but more importantly, the air pollution it causes is slowly driving away fireflies.

Relevant authorities, especially policymakers ought to give serious attention to the survival of the fireflies which is regarded as the heart of the ecotourism industry in Kampung Kuantan.The normative conflict between economic development and ecological conservation for the Kuala Selangor mangrove area which includes the fireflies area should be analysed objectively. For this matter, information on the economic value of recreational benefits for the study area is crucial as a basis to address this issue. This value should be considered as part of the benefit foregone, should the Kuala Selangor mangrove area is to be developed.

Motivated by the aforementioned issues, the specific objective of this research is to estimate the monetary value of the fireflies recreational experiences in Kampung Kuantan.

This study is important because failure in estimating the true value of environmental resources (in this case recreational services) will cause public commodities to be a victim of market failure and development. In order to derive a rational decision, free from elements of conflict or dissension between developers and environmentalists, understanding of public values of environmnental resources must be given serious attention by any relevant authority.

The estimation of the values of non-marketable commodities, such as recreational experience is still a novelty in Malaysia. As such, this research may provide an impetus for the application of comprehensive economic evaluation techniques to a wider range of non-market commodities in the country. Such research can assist the government in formulating pertinent policies as whether to develop or to preserve any critical natural environment such as the case of Kuala Selangor mangrove area, which have bearings on the fireflies recreational area. Should any interested party wants to develop such areas, a holistic benefit-cost analysis which includes the valuation of non-marketable commodities such as the benefits of recreational services of fireflies in Kampung Kuantan must be carried out.

Literature Review

Studies pertaining to non-market commodity valuation is quite limited in Malaysia, as in many other developing countries.This section reviews several related studies on the economic value of wetlands-based recreation in the U.S.

Stephen (1987) used both the Travel Cost Method (TCM) and Contingent Valuation Method (CVM) to estimate the value of recreational services of coastal wetlands area in Louisiana. The estimated values from both methods were quite similar. The average consumer surplus which reflects the value of the wetland recreational services was estimated between US$36 - US$111 per acre.

Loomis, et. al. (1985) estimated the economic loss from fishing recreational activities along Henry Fork River, Idaho as result of the construction of a hydroelectric generator in the area. Based on TCM and CVM, the value of annual loss was estimated at US$1.07 million if fishing activity were to decrease by 50% as a result of the contruction of the dam. The results were sent to the Federal Energy Regulatory Commission as a guide in determining the economic feasibility of the project before deciding to construct the dam.

Bergstrom, et.al (1990) analysed the economic value of wetlands recreational areas in the U.S. Using the CVM, they found the aggregate gross economic value for these areas was about US$145 million annually (US$18 mil for expenses value and US$27 million for consumer surplus). These substantial values suggest the critical role of natural resources in providing important recreational functions and thus must be taken into consideration in formulating wetlands policies and management.

Total Economic Value Concept and Benefits of Wetlands-Based Recreation

The Total Economic Value (TEV) (Randall & Stoll, 1993; Pearce & Turner, 1990; and Flint, 1991) framework recognised the importance of economic value and the services of environmental resources.

In the context of wetlands or forest resources, the TEV of environmental services consists of two main components, that is use and non use value. Use value is the current or future benefit that accrue from the physical use of environmental resources. It can be in the form of direct value, indirect value, option value and bequest value. Non use value refers only to the benefit that is derived based on the existence of a natural resource.

Under the use value category, among the benefits associated with direct use value are activities such as fishing, recreational, research and educational. Benefits derived from indirect use value refer to the ecological function or services of the environmental resource such as coastal stabilizer, flood protection and water catchment, climatic cycle and preservation of natural resources or biodiversity.

Option value is the value which reflects individual willingness to pay in order to obtain an option to consume the natural resource, currently or in the future. On the otherhand, bequest value which has similar characteristics as option value concerns only on the future generation.

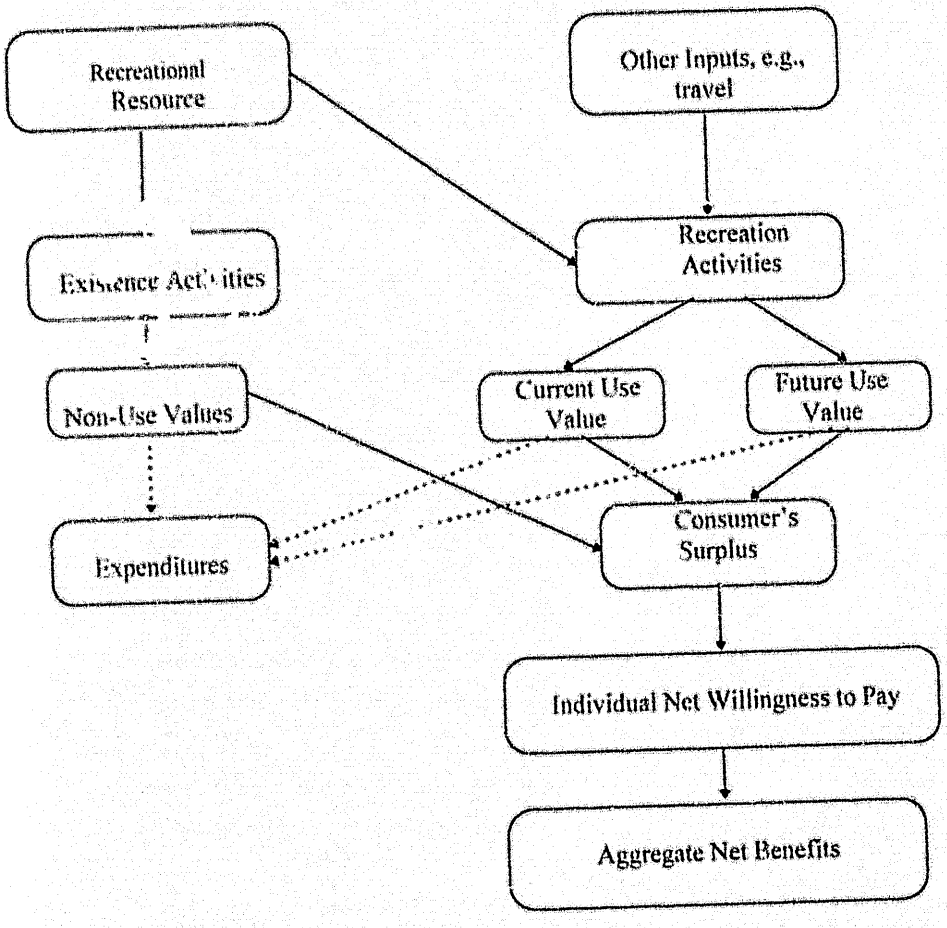
Existence value is the benefit derived from the knowledge that an environmental resource exists undisturbed. It may also include the benefits derived from knowing that important resources are protected. To derive these benefits, an individual is not required to actually consume the resource.

Economic Benefits of Wetlands-Based Recreation

Figure 1 depicts the components of TEV as applied to wetlands-based recreation. It is very useful in illustrating the benefits of Kampung Kuantan fireflies recreation.

Existence activities refer to the appreciation about the existence of a natural resource. In this study, the recreational resource refers to the fireflies and its natural habitat. These activities do not involve actual utilization of the resource. It relates to the existence value derived by recreationists simply by the knowledge about their existence. The existence value can be empirically estimated using the Contingent Valuation Method (CVM). This method uses a survey technique based on an experiment in a hypothetical market which resembles

Figure 1: Conceptual Derivation of Total Economic Value of Wetland-based Recreation



Source: Bergstrom, J.R. et. al., 1990.

the real market. Through this hypothetical market one can estimate the recreationist's willingness to pay (WTP) based on the benefits they secured from the use of certain resources. The net WTP of the individual reflects the consumer's surplus value.

This study focused on the right side of the box of Figure 1, which attempted to estimate the economic value of fireflies recreational experience. Recreational activities involve a combination of basic recreational resources, and other related recreational inputs such as transportation, food and beverages and others (Bockstael and McConnel, 1981). These activities are associated with current and future use value (including option value). Current use value is the economic value associated with current recreational activities provided by the resource while the future use value is associated with recreational activities to be carried out in the future. Non-use values, current use values and future use values can be divided into expenditures and consumer's surplus. The consumer's surplus reflects the net WTP for recreational activities. The net WTP is the theoretically prefered measure of net economic value or net benefits (Bergstrom, et. al., 1990). This study focused only on the estimation of the on-site current use value. This value refers to the economic value (both expenditures and consumer surplus) of the on-site rerceational experience (such as the appreciation of viewing the fireflies display, boat rental expenses and other related on site expenses).

Since the recreational service of natural resources is a non-marketable commodity, their use value can only be empirically estimated using non-market goods valuation techniques. This study employed the CVM and TCM to elicit consumer's surplus. By employing both methods, a comparative analysis of the estimated values can be made.

Research Methodology

The CVM is a valuation technique which depends upon individual responses to contingent situations posited in artificial or experimental markets (Bergstrom and Stoll, 1989; Sellar, Stoll and Chavas, 1985). In a CVM, respondents preferences are solicited through a survey technique to state their WTP for: (i) to secure a benefit from an improvement in environmental quality or (ii) prevent efforts which would degrade environmental quality (in this study the fireflies species and its natural habitat). If the concept of WTP for the latter (ii) is applied, the value of consumer's surplus is known as equivalent surplus. This study applied a survey technique which generates respondents equivalent surplus.

The TCM on the other hand estimates the value in a monetary form using the travel expenditures data and consumer's surplus value. The combination of both values is the gross on-site current use value. The travel expenditures data include travel transportation costs and other recreational expenses costs such as food, beverages, lodging and others. The TCM is based on the extension of consumer demand theory which gives attention to the value and choice preference of visiting sites. Thus, the TCM approach can empirically estimate the net

economic value through the derivation of a demand curve for recreation by taking into consideration variable factors such as visiting rates and travel costs subject to households characteristic such as eductional level, age, income and others.

CVM and TCM Specifications

The first step in the CVM portion of this study was the setting of the hypothetical market for fireflies recreation. Respondents who were selected recreationists to the area were briefed that a specialTrust Fund will be established to manage the fireflies natural habitat in Kampong Kuantan and to protect the fireflies from extinction. Respondents were asked for their maximum annual WTP to the fund. This implicitly assumes respondents have no previous right to the current environmental quality. Recreationists must pay in order to continue enjoying the current recreational activities or not pay and accept the conversion of the fireflies natural habitat to alternative irreversible uses. The CVM question was in the form of closed-ended referedum (dichotomous choice), in which a certain level of price was suggested to each respondent. The average respondent's WTP was calculated by estimating the area under the logistic curve.

The logistic curve was derived as follows:

$$Y = f(\text{age, income, education, posted price})$$
$$Y = \propto + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4$$

where

Y = Answers by repondents, yes or no
X_1 = Respondent's age
X_2 = Respondent's incomes
X_3 = Respondent's educational level
X_4 = Posted price

Based on economic theory, variables X_1 X_2 and X_3 are expected to have a positive relationship with the probability of a 'yes' response (Y) to contribute to the fireflies Trust Fund. The variable X_4 is expected to be inversely related with Y. This is because as posted price increases, lesser respondents will be willing to pay the higher price.

The TCM estimates the value of non market goods based on the behavior of consumers in related market. Specifically, expenditures spent to consume or gain access to the environmental resource were used as a proxy for the value of the non-market good. The specification for the TCM was as follows:

Number of individual visits = f (age, travel costs, income)

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3$$

where

Y = Number of visits by an individual per year
X_1 = Respondent's age
X_2 = Respondent's travel costs
X_3 = Respondent's income level

Theoretically, the respondents age and income are expected to be positively related with the number of visits.

Sampling Procedures

Data collection was made through a field survey by interviewing recreationists-respondents in the recreational area. A stratified random sampel of 64 respondents was chosen.The posted price suggested to respondents was also randomly selected.

Empirical Results and Discussions

CVM Results

Estimation of the consumer's surplus involved the estimation of a logit function to model the probability of a "yes" response to the CVM question which was the recreationist maximum WTP to the fireflies Trust Fund. In general the logit function was specified as follows:

$$Y = \frac{1}{1 + \exp^{(\beta_0 + \beta_1 X + \beta_2 P)}}$$

where

Y = '1' if the answer is 'yes'
Y = '0' if the answer is 'no'

Variable P is the posted price while β_0, β_1, and β_2 are the estimated parameters. Variable X is the vector of independent variables. Results of the logistic regression are as as follows

$$Y = -0.78983 + 0.03729X_1 + 0.00007X_2 + 0.99293X_3 - 0.08267P$$

where

X_1 = age
X_2 = income
X_3 = education
P = posted price

All coefficients were of the expected signs. Coefficients for age, incomes and education are positively related to the probability of a 'yes' response, while posted price is inversely related. The mean WTP was estimated by intergrating the area under the logistic curve. Maximum posted price was set at RM320 and the minimum was RM1.00. Implicitly the posted price assumed that the probability for recreationists to answer a 'yes' response was zero when the posted price was higher than RM320. Mathematically, it can be shown as,

$$V = \int_1^{320} \frac{1}{1 + \exp^{(3.72589 - 0.08267P)}} \, dp$$

An estimate of the mean WTP *(V)* using *Mathematica* yielded an estimate of RM138.749 (US $55.00) per recreationist per year. The average visits for each visitor was about 2.23 times per year. The value of consumer's surplus for each visit was therefore RM62.22 (US $25.00). In a study on the economic value of U.S. wetlands-based recreation, Bergstrom, et. al. (1990) using the CVM derived a net WTP value of US $360 per recreationist annually. The marked difference between our findings and that of Bergstrom, et. al. is however expected, as there exist huge differences in both countries with respect to income and education levels and the perception of individuals regarding environmental quality.

In 1995, about 10,020 visits were made by domestic visitors. Mean expenditures per trip was RM48.00. Based on this information, the gross economic benefit from fireflies recreation is estimated at RM1,105,345 (US $442,138) annually.

TCM Results

Based on the OLS estimator, results of the TCM are shown below:

$$\underset{}{Y} = \underset{(-1.074)}{-1.94838} + \underset{(2.420)}{0.19354X_1} - \underset{(-0.577)}{0.00938X_2} - \underset{(-1.388)}{0.00065X_3}$$

$$R^2 = 0.10$$

where

Y = number of individual visits
X_1 = respondent's age
X_2 = respondent's travel costs
X_3 = respondent's income

The values in parenthesis are t ratios. The coefficient for age is positive and significant in relation to the number of visits. Relationships between the number of visits and both travel costs and income variables although negative are not significant at the 10 percent confident level. Estimation of consumer's surplus based on the TCM results yielded a value of RM268.04 (US $107) per recreationist annually. Actual expenditures per recreationist were RM48.05 * 2.23 = RM107.37. Thus, gross aggregate benefits of fireflies recreation per recreationist following the TCM results equal RM375.4 annually. Total economic value for recreational experience for all visitors in a year ($\sum$ number of visits a year/average number of visits per recreationist per year) * RM375.4 = RM1.68 million (US $0.7 mill).

Conclusion and Suggestions

This study is an example on how valuation techniques of non-market goods can be applied to conduct an economic evaluation of environmental resources, especially with respect to ecological recreation in Malaysia.

Total economic value (gross) of the fireflies recreation estimated using CVM and TCM were about RM1.1 million and RM1.68 million, respectively, annually. It should be recalled that this value refers to the on-site current use value of recreational experience. Other values as depicted in Figure 1 (e.g future use value) were not considered in this study. If they were, recreational value will certainly be much higher.

From the results, gross economic benefits of fireflies recreation using CVM and TCM were about RM245 and RM370 a year respectively, per recreationist. Of these, the public value of fireflies recreation, represented by the consumer's surplus was RM62 and RM120 per trip per recreationist. Since consumer's surplus measures the net benefits of habitat protection, it is the appropriate measure of the contribution of the fireflies recreation to Malaysian economic development.

If economic benefits from recreational activities only consider entrance fees and boat rental, the recreational value will be only RM8 (RM2 + RM6) per visit or RM80,160 for total visits annually. This value grossly underates the real value of the fireflies recreational service.

Based on CVM and TCM analysis, it is clear that the economic value of the fireflies recreation function of Kuala Selangor mangrove wetlands is substantial. This value might

be higher than the private values as derived from potential alternative development projects. If developmental projects were to degrade the quality of the mangrove eco-system, they will not only affect the fireflies recreational activities but also thereaten the mangrove ecological services as a whole. Thus, the benefits foregone as a result of mangrove conversion would be be magnified. Further research to evaluate the economic value of mangrove ecological services in Kampong Kuantan needs to be carried out.

Although the values derived from the CVM and TCM were quite comparable, the TCM results should be given more priority since this method is based on market generated data and does not involve utility subjectivity. Theoretically, CVM is only a good technique provided the TCM cannot be employed.

All relevant parties associated with development planning, especially government policy planners and decision makers should take into account the public values of environmental resources which includes both the ecological and intrinsic services. Based on the findings of this study, it is suggested that recreation functions of wetlands or forestry resources be given serious consideration in policy formulation affecting allocation and use of such resources.

A holistic benefit cost analysis which takes into account all categories of benefits and costs must be employed in considering alternative developmental projects affecting critical natural habitats. In the estimation of benefits, dependency on private values which are based on observed market prices will result in an inefficient allocation and consumption of environmental resources. This is because market mechanism tends to undersupply non-marketable commodities. An objective evaluation of environmental resources would also reduce normative conflict and dissensions between the need for development and resource preservation/conservation. In the case of fireflies in Kuala Selangor, the use of boats with outboard engines potentially affect the existence of fireflies. Firm action must be taken to stop such activity and prevent its recurrence.

In practice, economic evaluation of non-market commodities in Malaysia as a basis for natural resource allocation and use to date is virtually non-existence, but its future seems highly promising. This study can be used as a basic reference to help Malaysian policymakers appreciate this important tool (valuation of non-market goods) in environmental resource management towards attaining "win-win" opportunities - economic growth and the promotion of environmental goals.

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