Pertanika J. Soc. Sci. & Hum. 13(1): 1-8 (2005) ISSN: 0128-7702
© Universiti Putra Malaysia Press

Use of Dichotomous Choice Contingent Valuation Method to Value the Manukan Island, Sabah

[1]ALIAS RADAM & [2]SHAZALI ABU MANSOR
[1]Faculty of Economics and Management
Universiti Putra Malaysia
43400 UPM, Serdang
Selangor, Malaysia
[2]Universiti Malaysia Sarawak,
94300 Kota Samarahan, Sarawak, Malaysia

Keywords: Dichotomus contingent valuation method, outdoors-recreational resources, willingness to pay, Manukan Island

ABSTRAK

Kajian ini menerangkan penggunaan kaedah penilaian pilihan dikotomous kontingen (CVM) untuk menilai sumber rekreasi luar di Pulau Manukan, Sabah. Kedua-dua model logit dan probit adalah digunakan untuk menganalisis data primer yang diperoleh melalui temu duga peribadi. Penganggaran kebolehjadian maksimum bagi model ini menunjukkan pendapatan dan harga adalah pembolehubah yang signifikan dalam menentukan kesanggupan membayar (WTP) seseorang. Nilai WTP yang diterbitkan semasa yang dikenakan kepada pengunjung. Kajian ini juga menganggarkan hasil boleh dijanakan iaitu yuran yang dikenakan menurut rangka kerja WTP.

ABSTRACT

This study presents the application of dichotomous choice contingent valuation method (CVM) to value outdoors-recreational resources in Manukan Island, Sabah. Both the logit and probit models are used to analyze the primary data obtained through personal interview. The maximum likelihood estimates of this model show that income and price are significant variables in determining one is willingness to pay (WTP). The WTP figure derived from the model shows that it is much higher than present fees charged to the visitors. This study has also estimated the revenue that could be derived is the fees were charged according to the WTP framework.

INTRODUCTION

While much economic activity is organized through the private market in which competitive forces determine prices, most of the recreational parks exist as public property because of their non-rival consumption and non-exclusion in nature. If there are some fees charged to it, it is insignificant compared to the utility obtained. The existence of public goods creates problems for a price system, as once a public good is produced, a number of people will automatically benefit regardless of whether or not they pay for it. The designations of parks as public good create free riders and over-usage problems. This could lead to deterioration in its quality. In tandem with the concern of quality environment, the subject of user fees in the management of national parks and protected areas has received increasing interest in the literature (Ana 1988; Leuschner *et al.* 1987; Lindberg and Huber 1993 Rosenthal *et al.* 1984).

The cognizance of charging fees for the utilization of parks should be given special attention in developing countries as government funds are typically in short supply, and enforcement of environmental regulations lax or nonexistent.

[1,2] Alias Radam and Shazali Abu Mansur are lecturers at Universiti Putra Malaysia (UPM) and Universiti Malaysia Sarawak (UNIMAS) respectively.

The majority of the visitors are foreign tourists who incur few of the costs but enjoy many of the benefits stemming from resource conservation efforts. Charging of fees could allow a certain degree of the market system to function, absorbing part of environmental costs.

The potential benefits from charging user fees and differentially pricing access to national parks are significant. As charging fees could lead to a more optimal market (Dixon and Sherman 1991) it could provide the vehicle for capturing benefits of ecotourism which often accrue primarily to the private sector. It can also reduce visitation in areas that suffer from overuse and accompanying ecological damage. Using Manukan Island in Tunku Abdul Rahman Park, Sabah, this paper applies a Contingent Valuation Method (CVM) to access the net economic values of recreational resource in Manukan Island.

This paper is organized into five sections. Section two describes the location of study. Section three explain the methodology and source of data used in the study. Empirical result are presented in Section four while the last section offers some discussion and concluding comments with regard to nonmarket valuation work in this country.

LITERATURE REVIEW

Considerable research has established the CVM as a sound technique for estimating values for public policy decisions. Some example of these studies are Rendall *et al.* (1974), Bishop and Heberlein (1979), Bishop *et al.* (1983), Hanemann (1984), Seller *et al.* (1986), Abala (1987), Cameron and James (1987), Bowker and Stoll (1988), Cameron (1988), McConnel (1990), Balderas and Laarman (1990), Donaldson *et al.* (1997), Rollins (1997), Rayn (1997), Willis and Powe (1998), Hayes and Hayes (1999), Carlson and Johansson-Stenman (2000), Shackley and Dixon (2000), Loomis *et al.* (2000), and Scarpa (2000), just to name a few.

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: Nik Mustapha (1993), Alias *et al.* (2002), Alias and Ruhana (2003) and Jamal and Shahariah (2003) 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.

Nik Mustapha (1993) carried out a study at Tasik Perdana recreational area in Kuala Lumpur using the dichotomous choice contingent valuation method. Both the logit and probit models are used to analyze the data and the maximum likelihood estimates of these models are encouraging. The consumers' mean and median willingness-to-pay were computed. The mean willingnes-to-pay ranged from RM84 to RM106 from both models while the median WTP ranged from RM109 to RM36. Median WTP measures are argued to be more robust than the mean WTP, and in this study he concluded that the median WTP figure for the outdoor recreational resources in Tasik Perdana recreational resources in Tasik Perdana is about RM36.

Alias *et al.* (2002) conducted a study of willingness of Local Tourists to Pay for Conservation of Tourism Sports in the Damai District Sarawak. The study applied the dichotomous choice of Contingent Valuation Method (CVM), to visitors sampled randomly. Results indicated a per person median value of RM11.64 WTP for the preservation of Damai, using the logit model. The amount could be collected by dividing the whole Damai resort into specific areas (e.g. beach, mangrove swamp, mountain range, etc.). The current environmental condition in Damai is still pristine and undefiled (the mangrove swamps, beaches, and mountain treks), as it has yet to be fully developed into a tourist attraction. As such, each individual area of interest could be developed accordingly with the level of WTP as indicated in this study.

Alias and Ruhana (2003) apply the dichotomous choice CVM to the outdoor recreational resources of the Malaysian Agricultural Park, Bukit Cahaya Sri Alam, Selangor. Both the logit and probit models are used to analyze the primary data obtained from personel interviews. The maximimum likelihood estimates of this model show that income and price are significant variables in determining one's WTP. The WTP figure derived from the model shows that these were much higher than present fees charge to the visitors. The calculated premium mean WTP using the logit model ranged from RM3.85 to RM6.29 for single respondents and, for the marrige respondents from RM2.84 to RM4.80 based on 95.7 percent confident interval, with mean premium value of RM4.87 and RM3.61, respectively.

Jamal and Shahariah (2003) applied the Dichotomous-Choice Contingent Valuation Method on 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 ranged from RM28 – RM31 annually. The large sum of monetary value that households place 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 conservation of the wetlands is highly valued by the general public.

LOCATION OF THE STUDY

The Tunku Abdul Rahman Park lying from 3 to 8 kilometers off Kota Kinabalu, comprises five islands covering an area of 4,929 hectares. Tourists and divers are attracted to the park because the islands namely Pulau Gaya, Pulau Manukan, Pulau Mamutik, Pulau Sapi Pulau Sulug are surrounded by clear waters and coral reefs.

Pulau Manukan is a boomerang shaped island covering an area of 51 acres. It is the second largest island of the Tunku Abdul Rahman Park and has good stretchers of beaches on the southern coast line. The island is ideal for diving and swimming. Among the facilities available on the island are chalets, clubhouses, restaurants, diving centers, pools, football fields, and squash/tennis courts. Other infrastructural support such as water, electricity, desalination plant, sewerage system and a solar-powered public telephone are also provided. The best reefs are just located around the island and are exposed during low tide.

METHODOLOGY AND SOURCE OF DATA

Following recommendations from environmental literature (Arrow *et al.* 1993), the closed-ended (CE) WTP approach to estimate the benefits from the preservation of the Manukan Island was used. Individuals were asked whether they would pay specific additional fees for a given commodity, with possible responses being "YES" and "NO". The bid amount is varied across respondents and the only information obtained from each individual is whether his/her maximum WTP is above or below the bid offered.

Logistic regression technique were used to estimate WTP (Hanemann 1984). Uisng this approach, the probability of saying "YES" to a bid at different levels of the independent variable is estimated as:

$$P = (1 - e^{-x})^{-1} \quad (1)$$

where x is estimated regression logit regression equation and P is the probability of accepting the price. Mean WTP is estimated as the area under this probability function. This area shows the proportion of the population who would consume the good at each price level, and their associated utility. The area under the curve is estimated by integration techniques and can be expressed as:

$$E(WTP) = \int_{L}^{U} \left(1+e^{a+bPRICE}\right)^{-1} dPRICE \quad (2)$$

where $(1 + e^{a + bPRICE})^{-1}$, is the probability of saying "YES" and U and L the upper and lower limits of the integration respectively.

Estimating mean WTP within this framework relies on making some assumption about upper and lower limits of the integral, i.e. knowing the price amounts at which the probability of saying "NO" is zero and the probability of saying "YES" is one. Applying this to Manukan Island, and assuming that individuals will not pay if they receive a disutility from it, negative WTP can be ruled out and zero used as the lower limit. Bishop and Heberlein (1979) and Sellar *et al.* (1985) used the upper range for the integration of their price amounts as the upper limit for the integration. Hanemann (1984) argued that such an approach makes assumption about the probability distribution for the unknown WTP in the sample. He argued that the upper limit should be infinity and that using the highest offered amount may be a poor approximation of the mean utility estimated when integrating between zero and infinity. In this study zero was chosen as the lower limit of the integral and maximum value as the upper limit. Confidence interval of WTP was also calculated using the variance-covariance matrix and a technique adopted for dichotomous CVM by Park *et al.* (1991).

For the purpose of this study, primary data were collected through interviews by means of questionnaires. A total of 180 domestic visitors

TABLE 1
Socio-economic characteristic of respondents

	Frequency	Percent
Gender		
Female	98	54.44
Male	82	45.56
Origin of tourist		
Kota Kinabalu	122	67.78
Other Sabah area	20	11.11
Sarawak	4	2.22
Peninsular Malaysia	11	6.11
Foreign tourist	25	13.89
Age distribution		
Less than 25 years	74	41.11
25-34 years	70	38.89
35-44 years	21	11.67
More than 44 years	15	8.33
Marital status		
Single	111	61.67
Married	69	38.33
Race		
Malay	36	20.00
Chinese	11	6.11
Indian	3	1.67
Other bumiputera	105	58.33
Other race	25	13.89
Education level		
Primary school	4	2.22
Secondary school	83	46.11
College and university	93	51.67
Family members		
Less than 5 persons	120	66.70
6 - 10 persons	56	31.10
More than 10 persons	4	2.20
Job category		
Professional	30	16.67
Administrator	14	7.78
Clerical	14	7.78
Services sector	60	33.33
Others	62	34.44
Income level		
Less than RM500	63	35.00
RM501-RM1000	50	27.78
RM1001-RM2000	40	22.22
More than RM2001	27	15.00

were interviewed and only 160 are used for the purpose of this analysis because of missing values. Information on socio-economic characteristics of respondents obtained included race, origin, age, marital status, education, size of family members, occupation, monthly and supplementary gross income (Table 1). Visitors at Manukan Island were asked to by anwer the questionnaires at the chosen location. Each of the respondents was given the details on the purpose of preservation of the island, facilities available and format used in Contingent Value techniques. Respondents were asked the following question and required to respond either 'Yes' or 'No':

> If entrance fees are increased by RM x, would you willing to pay so that you could have continued to use this recreational area?

Where x ranged from RM1.00 to RM10.00, it represents a 'reasonable' additional amount

of entrance fee to many privately managed recreational areas in Sabah. The ability to seek willingness to pay is represented by the dichotomous variable of WTP with values of 1 for those willing to pay the additional amount of entrance fee and 0 is otherwise. An OLS regression of the above relationship with WTP as the dummy variable is beset by several problems namely: (1) non-normality of the error term, (2) heteroscedasticity, and (3) the possibility of the estimated probabilities lying outside the 0-1 boundary (Gujarati 1988). Since the dummy WTP is actually a proxy of the the actual propensity or ability of willingness to pay, the probit and logit models guarantee that the estimated probabilities lie in the 0-1 range and that there are non-linearly factors related to the explanatory variables. The difference between these two approaches are mainly in the distribution of the regression error terms. The logit approach assumes that the cumulative distribution of the error term is logistic while probit assumes that is normal.

RESULTS AND DISCUSSION

An initial estimation of the model using all the socio-economic characteristics as independent variables reveals that all variables are insignificant except for income and price (refer to Table 2). The maximum likelihood estimates of the specification for logit and probit models are estimated using Shazam, version 7.0 and the means of WTP are calculated using MATEMATICA, version 2.2 (Sherlock 1993). The results are given in Table 2. The chi-squared statistics shows that the model is highly significant. The value of adjusted McFadden's pseudo R^2 is 0.0982 and 0.0980 for logit and probit models, respectively. The percent of right prediction is 62.92 percent for both models. The price and income in both models are significant at one- percent level. The result also shows the logit and probit models differed little in terms of summary statistics. This corresponds with prior work in which neither model dominated the other empirically in the binary dependent variable case (Bowker and Stoll 1988).

Based on the estimation results, equivalent WTP measures were calculated using logit and probit models at income level (Table 3). The calculated mean WTP ranged from RM3.99 to RM6.14 for the logit model, and for the probit model it ranged from RM4.34 to RM5.69 based on 95 percent confident interval. As shown in Table 1, the logit model performed slightly better than probit model both in terms of percent correct prediction and McFadden-R^2. In the light of this the mean WTP obtained from the logit

TABLE 2
Parameter estimates for dichotomous choice model for Manukan Island, Sabah

	Logit Model	Probit Model
Intercept	0.6658 (1.9919)***	0.3985 (1.927)***
Price	-0.2008 (-3.5284)*	-0.1213 (-3.510)*
Income	0.00017 (2.7195)*	0.00010 (2.991)*
Log-likelihood	-112.45	-112.44
Chi-square	23.8558*	23.8760*
McFadden R^2	0.0982	0.0980
% Right Prediction	62.95%	62.92%

* Significant at 1% level

TABLE 3
Estimating of mean mean WTP for Manukan Island Sabah

	Lower Limit 95% Confident Interval	Mean	Upper Limit 95% Confident Interval
Logit Model	3.99	5.02	6.14
Probit Model	4.34	5.00	5.69

Source: Computed from field survey

TABLE 4
The estimation of additional benefit of Manukan Island, Sabah 1988 - 1998

	Domestic Visitors	Expected Increase Benefit	Foreign Visitors	Expected Increase Benefit	Total Visitors	Expected Increase Benefit
1988	11,127	55,857.54	1,228	6,201.40	12,355	62,058.94
1989	13,513	67,835.26	1,208	6,100.40	14,721	73,935.66
1990	30,214	151,674.28	886	4,474.30	31,100	156,148.58
1991	34,722	174,304.44	536	2,706.80	35,258	177,011.24
1992	48,269	242,310.38	9,691	48,939.55	57,960	291,249.93
1993	52,514	263,620.28	15,041	75,957.05	67,555	339,577.33
1994	67,517	338,935.34	17,376	87,748.80	84,893	426,684.14
1995	72,889	365,902.78	18,490	93,374.50	91,379	459,277.28
1996	59,729	299,839.58	15,199	76,754.95	74,928	376,594.53
1997	53,930	270,728.60	17,480	88,274.00	71,410	359,002.60
1998	47,492	238,409.84	18,110	91,455.50	65,602	329,865.34

Source: Computed from the Sabah National Park, Various issues.

model would be a more reliable measure. Therefore, the premium value of RM5.02 would be taken as the conservative WTP measure.

From these values of consumers' surplus or the additional maximum willingness to pay to Manukan Island Recreation Area, Sabah, one can compute the additional net benefit of Manukan Island for the respective year by multiplying WTP by the number of visitors to this island (refer to Table 4). The number of visitors has increased from 12,355 in 1988 to 91,379 in 1995, and decreased to 65,602 in 1998 as the result of the regional economic crisis and haze disaster. The number of visitors can be translated to huge monetary economic benefits for the relevant authorities.

CONCLUSION

This study has shown that visitors to the Manukan Island park are willing to pay more than the current RM1.00 to RM2.00 entrance fees. By employing the logit model, it is estimated that the visitors are willing to pay about RM5.02 for the entrance fee. The revenue collected from the visitors could be used as an additional support to the limited fund allocated for maintenance and conservation of the park. Moreover, the revenue derived from the tourism industry is not being earmarked for park maintenance or resource conservation efforts; rather, it is frequently merged with other sources of revenues. Also, without users' fees to effectively capture eco-tourism revenues, alternative land use that provides greater short-run return will often be pursed on public as well as private land. Setting fees to recreational parks, would enable apportioning the use of resources to the rationale user.

REFERENCES

Abala, D.O. 1987. A theoretical and empirical investigation of WTP for recreational serv. (A case study of Nairobi National Park). *Eastern Economic Review* **3:** 111-119.

Alias Radam, Shazali Abu Mansor, Abas Said and Afizah Merican. 2002. Willingness of local tourists to pay for conservation of tourism sports in the Damai District Sarawak. *ASEAN Journal on Hospitality and Tourism* **1:** 53-63.

Alias Radam and Ruhana Busu. 2003. Consumer perception and willingness to pay toward facilities in Malaysian Agro Park, Bukit Cahaya Shah Alam, Selangor. In Seminar FEP 2001 *Proceedings in Hospitality and Recreation*, ed. Ishak *et al.*, p. 41-52. Faculty of Economic and Management, Universiti Putra Malaysia.

Anas, A. 1988. Optimal preservation and pricing of natural public lands in general equilibrium. *Journal of Environmental Economics and Management* **15(2):** 158-72.

Arrow, K., R. Solow, E. Leamer, P. Portney, R. Randner and H. Schuman. 1993. Report on the NOAA Panel on Contigent Valuation. *Federal Register* **58(10):** 4601-14.

Bishop, R.C. and T.A. Heberlein. 1979. Measuring value of extramarket goods. *American Journal of Agricultural Economics* **61:** 926-930.

Bishop, R.C., T.A. Heberlein and M.J. Kealy. 1983. Contigent valuation of environmental assets: comparisons with a simulated market. *Natural Resource Journal* **23:** 619-633.

Bladares, M.J. and J.G. Laarman. 1990. Derechos de Entrada a las areas protegidas de Costa Rica. *Ciencias Economicas* **10:** 63-67.

Bowker, J.M. and J.R. Stoll. 1988. Use of dichotomous choice nonmarket methods to value of whooping crane resource. *American Journal of Agricultural Economics* **70:** 372-381.

Cameron, T.A. 1988. A new paradigm for valuation nonmarket goods using referendum data: maximum likelihood estimation by censored logistic regression. *Journal of Environmental Economics and Management* **13:** 355-379.

Cameron, T.A. and M.D. James. 1987. Efficient estimation methods for use with closed-ended contingent valuation survey data. *Review of Economic Statistics* **69:** 269-276.

Carlsson, F. and O. Johansson-Stenman. 2000. Willingness to pay for air quality in Sweden. *Applied Economics* **32:** 661-669.

Dixon, J.A. and P.B. Sherman. 1991. Economics of protected areas, *AMBIO* **20:** 68-74.

Donaldson, C., R. Thomas and D.J. Torgerson. 1997. Validity of open-ended and payment scale approaches to eliciting willingness to pay. *Applied Economics* **29:** 79-84.

Gujarati, D.N. 1998. *Basic Econometrics.* New York: McGraw Hill.

Hanemann, M. 1984. Welfare evaluation in contingent valuation experiments with discrete responses. *American Journal of Agricultural Economics* **66:** 332-341.

Hayes, C. and A. Hayes. 1999. Willingness to pay versus willingness to travel: Assessing the recreational benefits from Dartmoor National Park. *Journal of Agricultural Economics* **50(1):** 124-139.

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

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

Jamal Othman and Shahariah Asmuni. 2003. The economics of wetlands conservation: Case of Paya Indah Wetlands, Malaysia. Paper presented at *International Ecotourism Conference, 2003: Sustainability of Ecotourism Development in a Competitive Global Environment,* organized by SEAMEO-SEARCA and UPM, at Bangi, Malaysia, p. 15-17.

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

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

Loomis, J., C. Pierce and M. Manfredo. 2000. Using the demand for hunting licences to evaluate contingent valuation estimates of willingness to pay. *Applied Economics Letter* **7:** 435-438.

Leuschner, W.A., P.S. Cook, J.W. Roggenbuck and R.G. Oderwarld. 1987. A comparative analysis for wilderness user free policy. *Journal of Leisure Research* **19:** 101-114.

Lindberg, K. and R.M. Huber Jr. 1993. Economic issues in ecotourism management. In *Ecotourism: A Guide for Planners and Managers* ed. K. Lindberg and D.E. Hawkins. Bennington, VT: The Ecotourism Society.

Moran, D. 1994. Contingent valuation and biodiversity: Measuring the user surplus of Kenyan protected areas. *Biodiversity and Conservation* **3:** 663-684.

McConnel, K.E. 1990. Models for referendum data: The structure of discrete choice models for contingent valuation. *Journal of Environmental Economics and Management* **18:** 19-24.

Nik Mustapha Raja Abdullah. 1993. Valuating outdoor recreational resources in Tasik Perdana using dichotomous choice contigent valuation method. *Malaysian Journal of Agricultural Economics* **10:** 39-50.

Park, T., J. Loomis and M. Creel. 1991. Confidence intervals for evaluating benefit estimates from dichotomous choice contingent valuation studies. *Land Economics* **67:** 64-73.

RYAN, M. 1997. Should government fund Assisted Reproductive Techniques? A study using willing to pay. *Applied Economics* **29:** 841-849.

RENDALL, A., B.C. IVES and C. EASTMAN. 1947. Bidding games for valuation of aesthetic environmental improvement. *Journal of Environmental Economics and Management* **1:** 132-149.

ROLLINS, K. 1997. Wilderness canoeing in Ontario: Using cumulative results to update dichotomous choice contigent valuation offer amounts. *Canadian Journal of Agricultural Economics* **45:** 1-16.

ROSENTHAL, D.H., J.B. LOOMIS and G.L. PETERSON. 1984. Pricing for efficiency and revenue in *Research* **16:** 195-208.

SCARPA, R. 2000. Contingent valuation versus choice experiments: estimating the benefits of environmentally sensitive areas in Scotland. Comment. *Journal of Agricultural Economics,* **51(1):** 122-128.

SELLER, C., J.P. CHAVAS and J.R. STOLL. 1986. Specification of the logic model. The case of valuation of nonmarket goods. *Journal of Environmental Economics and Management* **13:** 382-390.

SHACKLEY, P. and S. DIXON. 2000. Using contingent valuation to elicit public preferences for water floridation. *Applied Economics* **32:** 777-787.

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

STEVENS, T.H., J. ECHEVERRIA, R.J. GLASS, T. HAGER and T.A. MORE. 1991. Measuring the existence value of wildlife: What do CVM estimates really show? *Land Economics.* **67(4):** 390-400.

SHERLOCK, T.W. 1993. *Mathematica.* Enhanced Version 2.2. Wolfarm Research Inc.

WILLIS, K.G. and N.A. POWE. 1998. Contigent valuation and real economic commitments: A private good experimant. *Journal of Environmental Planning and Management* **45(5):** 611-619.

WILLIS, K., G. GARROD and T. CHEE. 1998. Valuation and analysis of consumer demand for forest recreation areas in Peninsula Malaysia. In *Conservation, Management and Development of Forest Resources. Proceedings of the Malaysia-UK Programme Workshop,* ed. S. Lee, D. May, I. Gauld and J. Bishop. Forest Research Institute Malaysia.

(Received: 17 January 2001)