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FARMERS WILLINGNESS TO PAY FOR WATER ECOSYSTEM SERVICES TOWARD FOREST CONSERVATION IN NORTH WEST SELANGOR MALAYSIA

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Abstract

Forest management practices directly influence the provision of ecosystem services from watershed, and are thus key factors for the development of environmental policy programs such as payment for ecosystem services. This study analyses farmers' perception and attitude with respect to forest management and conservation at North West Selangor Peat Swamp watershed in Malaysia. This paper attempts to illustrate the use of a structured social psychology methodology, the Theory of Planned Behaviour. Decisions on payment for water irrigation water was elicited among farmers as a function of their attitudes toward forest ecosystem services, Contingent Valuation Method (CVM) was also employed to developed farmers household survey. A descriptive research design was adopted. The survey questionnaire was administered to 380 paddy farmers at North West Selangor irrigation

scheme, Malaysia. The result of the Mean WTP was estimated from the dichotomous choice contingent valuation (DC-CVM) was (RM 43.73ha/yr). The expected conservation benefit was estimated to be RM398,773.87/ha/per/yr. The analysis reveals positive attitudes toward ecosystem services.

Keywords: Willingness to pay, Water Ecosystem Service, Forest Conservation, Contingent Valuation Method

INTRODUCTION

Payment for Ecological Services is an incentives or market remuneration offered to landowners and forest managers in exchange for managing or providing some of ecological services such as hydrological functions or water ecosystem services. The current forest conservation and restoration practices are no longer produce the desired result, because forest resources are increasingly threatened, largely as a result of anthropogenic activities and other variables such as climate change (Bishop & Pagiola, 2012; Rands et al., 2010). For Example, global net forest loss totaled over 5 million hectares or 31%ofthe world's land total, with 13 million hectares being completely destroyed on a yearly basis (FAO, 2011). This phenomenon is still an on-going scenario in most of the developing countries in the tropical regions, (Kaplowitz, Lupi, & Arreola, 2012). Asian countries particularly Indonesia, Myanmar and Malaysia are facing reduction of forest at the rate of (>70% forest loss),and even if the forest are to survive, they are often logged or degraded (Laurance, 2007). In addition, Forest ecological services are under estimated in development decisions because existing tools for assessing and valuing ecosystem services often fall short of the needs and expectations of decision makers. More so, The North-West Selangor Irrigation site is situated within the watershed catchments of these forests with Sungai Bernam and Sungai Tengi that recharge water downstream into the main canal and the tertiary canals, and to the agricultural drain land. These watersheds ensure the supply of adequate and clean water for domestic and irrigation purposes.

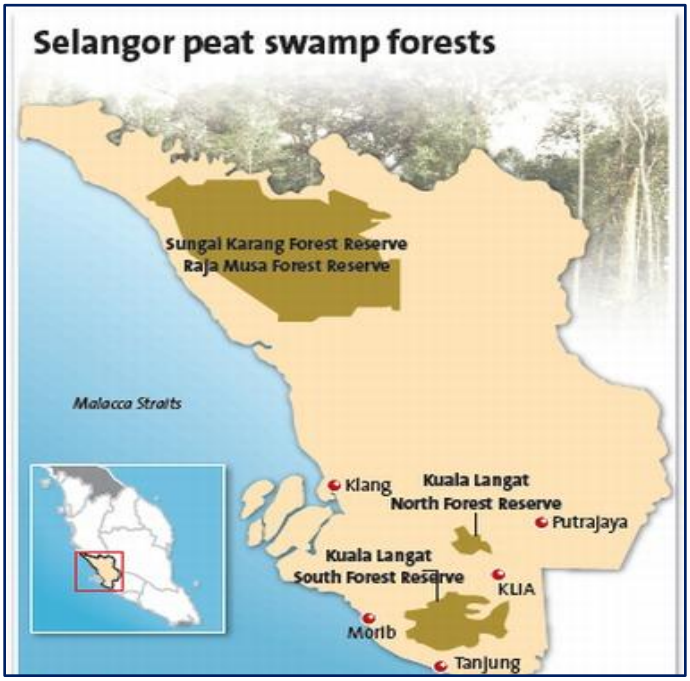
Despite the numerous benefits of the watershed, it is seriously under threat as a result of human activities like Timber harvesting, deforestation couple with reduction in rainfall (Drought). Consequently, reduce water inflow which poses threat to sustainable supply of water for irrigation and domestic uses in the area. Therefore, there is the need for effective mechanism for forest management and conservation like Payments for Ecosystem Services (water ecosystem services) to ensure sustainability. Among these, a mechanism called Payments for Ecosystem Services (PES) is currently used worldwide. PES is a new conservation technique

that focuses on incentives payments to land owners or stewards for investing in new land use practice that lead to conservation or production of specific environmental services (Wunder, 2005; Wunder & Wertz-Kanounnikoff, 2009).PES is an instrument of environmental policy, a type of economic incentive, a tool by which beneficiaries of an ecosystem services (e.g water users) reward, through subsidies or payments, the administrators (individual or community) of the land that offers these services, to those whose land use decisions have an impact on the provision of a specific ecosystem services (De Groot, Alkemade, Braat, Hein, & Willemen, 2010).The overall goal of PES is the sustainability of forest conservation, Against this background, this research try to study the potentials of payment for water ecosystem services towards forest conservation under improved water supply conditions of paddy cultivation to ensure financial sustainability of forest management in Selangor Malaysia

METHODOLOGY

This study specifically focuses on North Selangor Peat Swamp Forest at the Tanjung Karang Integrated Agricultural Development Area (IADA) Barat Laut Selangor Rice Irrigation Scheme, Malaysia. Located at latitude 3^{o} 35'' N and longitude 101^{o} 05'' E, which covers an area of about 20,000 ha extending over the length of 40 km along the coast with a width of 5 km on average.

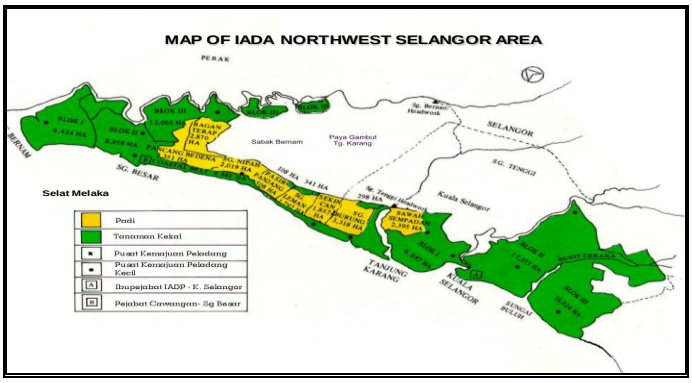
Figure **Error! No text of specified style in document.**1: The Study Area



The North Selangor Peat Swamp Forest (NSPSF) encompasses 73,592 hectres in the state of Selangor in Peninsular Malaysia comprising the Sungai Karang Forest Reserve (50,106

hectres) to the North and Raja Musa Forest (23,486 hectres) to the South. This is largest remaining peat swamp forest on the west coast of Peninsular Malaysia and is critical for biodiversity conservation, water resource management and carbon storage (Parlan, 2001). The forest is home to large mammals such as leopard, tapir and Malaysian sun bear as well as more than 100 species of fish (Azmai, 2014)

Figure 2: Tanjung Karang Rice Irrigation Scheme



Source: Adopted from IADA, 2011

The population of this is farmers at Barat Laut Selangor irrigation scheme, also known as Tanjung Karang paddy rice irrigation scheme, comprising the communities along the Sungai Karang Forest Reserve and Raja Musa Forest. Based on the total population of 9119 farmers in the study area, the sample size of this study was ascertained using the (Scheaffer, Mendenhall, & Ott, 2006) formula;

$$n = \frac{N}{(N-1)\delta^2 + 1} \quad (1)$$

Where n = the number of sample, N = total number of paddy farmers in the study area and δ is the sample error which considered at δ=5%.

$$n = \frac{9119}{(9119-1)0.05^2 + 1} = 383$$

Stratified random sampling was employed. The area is already divides into three (3) sections by IADA as Irrigation Service Areas (ISA). These are ISA I (Sawah Sempadan and Sungai Burong 2310 farmers). ISA II (Sekinchan, Sungai Leman, Pasir Panjang, Sungai Nipah 3706 farmers). ISA III (Panjang Bedena, Bagan Terap 3103 farmers). And, samples were drawn using Proportionate stratified random sampling from the population of each Stratum according to the size of each and based on percentage. The instrument used in this research is a questionnaire.

Its designed to follow the CVM survey questionnaire format proposed by Bateman and Turner (1993); (Boyle, 2003). The payment vehicle is Land Tax. The questionnaire was designed in English Language and translated in Bahasa Malayu. And, only the Malay version of the question was administered.

ANALYSIS AND FINDINGS

The perception, attitude of the end user willingness to pay for ecological services were analyzed using different analytical tools including Descriptive statistical analysis on the socio demographic variables and Logit and Probit Regression Analysis for the WTP.

Table 1: Socio Economic Characteristics of the Respondent

Variables (n = 380)	**Frequency**	**Percent**	**Mean**	**SD**	**Min.**	**Max.**
Gender						
Male	321	84.5				
Female	59	15.5				
Age Groups			**53.99**	**12.37**	**25**	**78**
< 35	26	6.8				
35 – 44	51	13.4				
45-54	121	31.8				
55-64	97	25.5				
65 and above	85	22.4				
Marital Status						
Married	330	86.8				
Unmarried	50	13.2				
Level of Education						
Primary School	178	46.8				
High School	161	42.4				
College/Polytechnic	31	8.2				
University	10	2.6				
House Hold Size			**4.12**	**1.73**	**1.00**	**8.00**
< 3	79	20.8				
3-4	138	36.3				
5-6	131	34.5				
7 and Above	32	8.4				
Income Level (RM)			**2047.36**	**931.74**	**1000.00**	**6000.00**
1000-1900	183	48.2				
2000-2900	123	32.4				
3000-3900	48	12.6				
4000 and Above	26	6.8				
Farm Size Category			**2.24ha**	**1.40ha**	**.50ha**	**8.00ha**
< 1 ha	60	15.8				
1 - 3 ha	235	61.8				
Above 3 ha	85	22.4				

Socio-Economic Background of the Respondents

The result shows that, out of the total valid response obtained from the farmers (380), male were 321 which constitute (84.5%) while 59 (15.2) were females. For the Age Group the first category (< 35) is referred to young age group (26) who are young farmers and constitute (6.8%) of the farmers. However, majority (31.8%) and (25.5%) of the farmers fall within the ages of (45-64). The age category conforms to IADA record where the average age of all farmers is 52.9 years and maximum is 75 years old. The last category is the old age (65 and above) which constitute (22.4%) of the respondents. Although this age group have started declining in terms of productivity, they are still relevant in the paddy rice production because of their experience and affection of the occupation.

Ethnic groups among the farming community show a 75.5% Malay, 20.3% Chinese and 9.2% Indians. The survey is clustered based on place rather than ethnicity, in most cases the same race group stay together. For the marital status shows that majority of the farmers 330 (86.8%) were married and only 50 (13.2%) of the respondents were Unmarried, this include singles, divorced and widows. With regards to level of education, 178 of the farmers, constituting (46.8%) have basic primary education, followed by secondary education (42.4%). And those attended College/ Polytechnic constitute (8.2%) while only 2.6% of the farmers have tertiary education. Based on the analysis one can see that the bulk of the farmers acquired only basic primary education, because those with higher level of education stand the opportunity of "white collar job.

House hold size, shows 79 (20.8%) have less < 3 members in the family. The study reveals that, 36.3% of the families have three to four members, 34.5% have five to six members and 8.4% have more than six members in each family. The income level among the household of the farming community, shows an average of income RM 2,047.36. This is in conformity with the IADA record that shows the average net income of RM 2,098.56/month (IADA 2013). Though majority of the farmers 183 (48.2) earns RM 1000-1900 who are considered as small scale farmers, most of the farmers earns between RM 3000-3900. However, some of the farmers 26 (6.8%) earns RM 4000 and above, these are the large scale farmers.

For the farm size category, the analysis shows that, the average size of the farms is 2.24 ha. But the bulk of the farmers 235 (61.8%) have 1-3 ha. And a total of 85 of the farmers who constitute (22.4%) own more than three hectares and are considered the large scale farmers. the analysis of this study shows an average Paddy production of 5.22 mt/ha. But, majority of the farmers 189 (49.7%) produce 4-5 ton/ha while 108 (28.4%) of them produce > 7 ton/ha, others farmers produce up to 10 ton/ha in some areas like Sekinchan area.

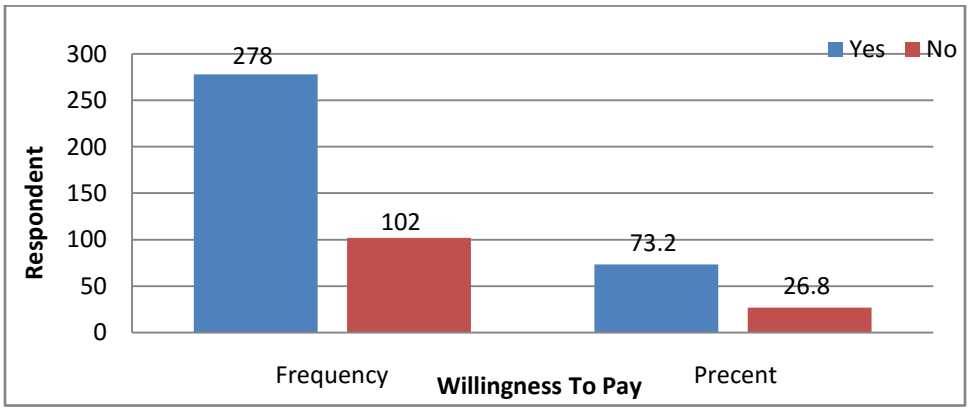
Farmers Willingness to Pay for Forest Watershed Conservation

Table 2: Summary of Willingness to Pay

Bid Price (RM)	Yes		No		Total	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
33.00	69	18.2	10	2.6	79	20.8
36.00	62	16.3	16	4.2	78	20.5
39.00	58	15.3	18	4.7	76	20.0
42.00	44	11.6	30	7.9	74	19.5
45.00	45	11.8	28	7.4	73	19.2
Total	**278**	**73.2**	**102**	**26.8**	**380**	**100.0**

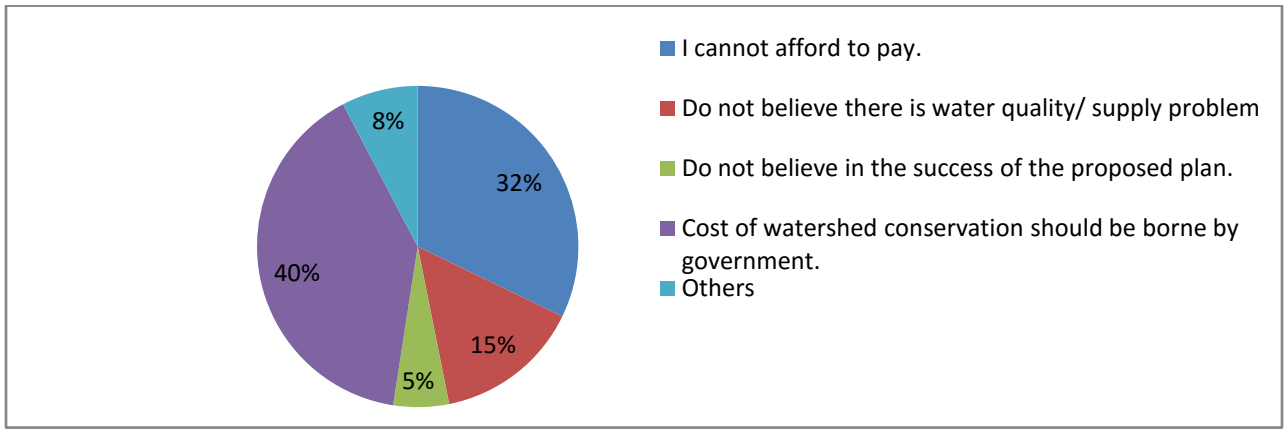
The result show positive response and willingness to pay for water ecosystem services. The bids amount were categories into five different bids amount and distributed at random to the respondent from initial bid of RM 33 to a maximum of RM45. Out of the 380 farmers interviewed during the survey, 278 (73.2%) are willing to pay by responding “YES” to the bids amount offered across the categories, while 102 (26.8%) of the farmers are protest bidders who responded “NO”.

Figure 3: Farmers Willingness to Pay for Watershed Conservation



Although willingness to pay response was significantly positive, however, there are some protest bidders (102) who are not willing to pay any bid amount, out of which 32% of them say cannot afford to pay, 15% said they do not believe there is water quality/ supply problem. Lack of institutional trust is one of the reasons for the protest bid as 5% of the respondent does not believe in the success of the proposed plan. Similarly, majority of the respondents 40% believed that Cost of watershed conservation should be borne by government. Others reason such as I have paid enough tax constitutes 8%.

Figure 4 Farmers Reason for Not Willing to Pay



The Logit Regression Model

Binary logit regression model was used in this study to examine the probability of respondent saying "YES" to the bids amount offered for willingness to pay of forest watershed conservation. The model was used to determine the relationship between the willingness to pay (WTP) as dependent variable and the socio-demographic variables such as age, gender, marital status income, , household size, farm size as independent variables, some of the explanatory variables used in the survey instrument (questionnaire) that include, satisfaction, perception and attitude, towards forest watershed conservation. The result of the linear logit model is presented in table 3 below.

Table 3: Result from the Logit Regression Model

Variable	Coefficient	Standard Error	P>|Z|
Constant	.56348837	1.71059171	.7418
INTBIDS	-.14953098	.03423471	.0000
INC	.00068273	.00019831	.0006
AGE	1.34761570	.33419934	.0025
HHSIZE	.16386347	.08347166	.0496
GEN	1.34761570	.33419934	.0001
SAT	.06178341	.01702837	.0003
FARMSIZE	.21322870	.10738015	.0471
MARRIED	-1.13781268	.40780152	.0053

Log likelihood function	-179.6200
Restricted log likelihood	-221.0392
McFadden Pseudo R-squared	.1873837
Percentage prediction.	76.84
Number of Observations	380

Model Specification

Mean WTP = β0 + (Σ βn x n)
- β1

Mean WTP = β(Inc.) + β(Age) + β(HHsize) + β(Gen) + β(Sat) + β(Farmsize)+ β(married)
$-\beta_1$

Mean WTP = RM 43.73ha/yr

The table above shows the result of the model, and the eight explanatory variables were found to be significant, with exception of the intercept. Bid amount and married are the two variables with a negative coefficient in the model while the other six variables with a positive coefficient are; Income, Household size, Age, Gender, Satisfaction and Farm size.

The income level of the respondents (INC) has positive and significant effects at ($\rho < 0.05$) probability level. This relationship indicates that high income households are more likely willing to pay than low income households. This result also shows the general demand theory which states the positive relationship between income and demand for goods. Comparable results have been obtained by (Kong, Xiong, & Zhang, 2014).

Household size of the respondent (HHSIZE) is positive and significant at ($\rho<0.05$) probability level. This implies that households of large family members are more willing to pay for conservation than households with small family members. Households perceived that the output (production) obtained using irrigation water can support the large family members via increasing the supply of enough food to the household. Some family members are engaged in non-farm work. Similar effects have been obtained in other studies by (Chandrasekaran, Devarajulu, & Kuppannan, 2009; Mesa-Jurado, Martin-Ortega, Ruto, & Berbel, 2012). Age of the respondent (AGE) is also found to be the most significant determinant of WTP in the model. The analysis shows that age has positive coefficient of (1.34). Age was expected to bear a positive influence on the WTP because with age, farmers gain more experience in agriculture and are able to perceive the benefits of improvements in water supply.This implies the higher the age, the higher the probability of WTP.

In the analysis gender takes a dummy variable coded as 1= Male and 0 = Female. Owing to the “masculine” nature of irrigation practices (Zwarteveen, 2011) and the fact that women negotiate financial and agricultural decisions within complex and dynamic social situations (Biswas & Venkatachalam, 2015).No specific direction between gender and WTP values was expected. However in this research, gender is found to be positive and the most

significant among all the computed variables with a weight value or coefficient of 1.34 indicating a higher elasticity of gender for WTP.

Satisfaction with current irrigation water supplies all had a significant positive impact on WTP. The results from the coefficient (0.06) shows that, farmers who are satisfied with the current water services (quantity and quality) are more willing to pay compared to those with lower satisfaction level. This conforms to findings of (Shultz & Soliz, 2007)

Farm size of the respondent (FARMSIZE) was statistically significant and positive with coefficient of (0.2). The results indicated that farmers with large size of land are willing to pay for watershed conservation than respondent with small cultivated land size. This is probably being the fact that larger cultivated farm size provides greater output (including other crops) and that may make higher income. This is similar to findings (Kong et al., 2014), but it is contrary to the finding of (Chandrasekaran et al., 2009)

Marital Status (Married) was also coded as dummy variable 1= Married and 0 = single, divorce and widow. This variable has a negative coefficient (-1.13) which implies unmarried or singles among the respondent are willing to pay more than the married, this could be attributed high responsibilities among the married respondent.

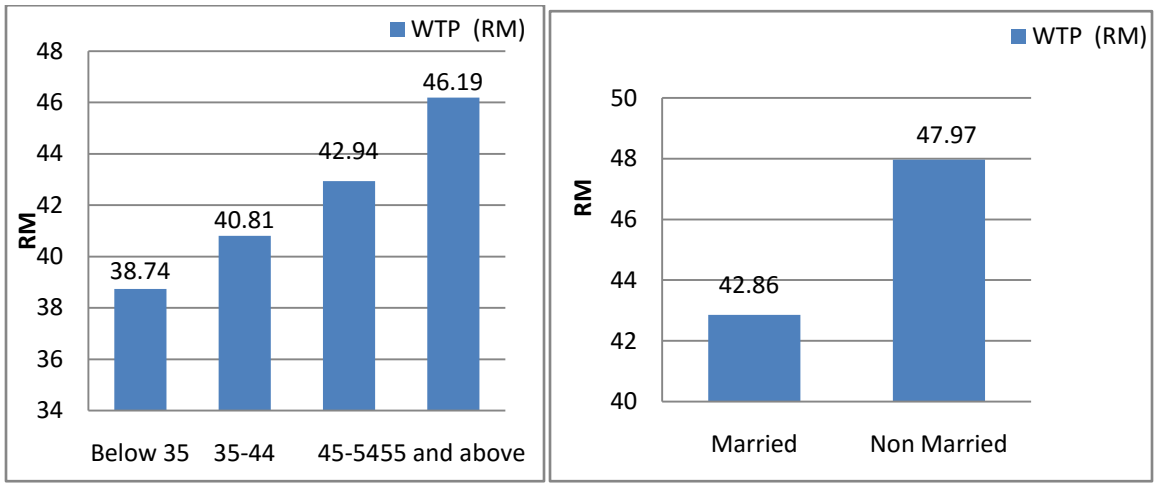
The initial bid offered (INTBIDS) is found to be negative and significant at ($\rho < 0.01$) significance level with willingness to pay for improved irrigation water. The implication of this indicated that as the value of the initial bid increases the probability of the "yes" answer for the bid value decreases and vice versa that is also consistent with the economic theory. This pattern is seen in other empirical studies as well (Biswas & Venkatachalam, 2015; Tang, Nan, & Liu, 2013) and conforms to standard demand theory which states "as the price of a commodity, increases, the demand for it declines" — confirming the theoretical validity.

Estimated Mean WTP based on the Age of the Respondents

The mean WTP based on categories was also significant. The result shows that, age is the most significant determinant of WTP in this study. The mean willingness to pay based on the Age group shows, the higher the age category of the respondents, the higher the amount they are willing to pay for watershed conservation. It shows that respondent below the age of 35 year mean WTP was only RM 38.74 while those between the age of 35- 44 and 45-55 year their mean WTP was RM40.81 and RM 42.94 respectively And those aged 55 and above are willing to pay an average of RM46.19. The result is presented in figure 5 below.

Figure **Error! No text of specified style in document.**: Mean WTP based on the Age

Figure.5 Mean WTP based on Marital Status



The mean WTP of the farmers based on marital status was also estimated and the result revealed that, unmarried are willing to pay higher than the married respondent. While the unmarried are willing to pay RM 47.97, married respondent's mean WTP is only RM 42.86. This is the fact that married respondent have other family responsibilities. The result is present in figure.6 above. Gender is also another significant determinant of WTP in this study. The findings indicate that there are more males in the farming sector than female. This is because agriculture is predominant occupation of the male gender. Therefore, male are willing to pay on average RM 44.90 compared to their female counterpart those mean WTP was RM37.02. See figure.7. The mean WTP based on level of income was calculated and the analysis shows as incomes increases, willingness to pay also increases. The result is presented in figure 8 below. And it shows that, those with income level of RM100-1900 are willing to pay RM40.99, while those with income category of RM4000 and above are willing to pay RM50.72.

Figure6: Mean WTP based on Gender

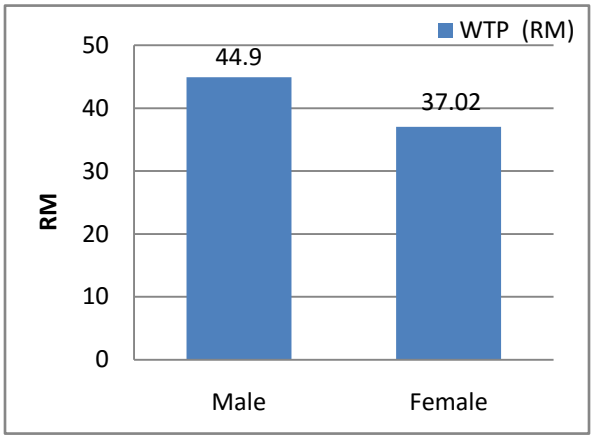
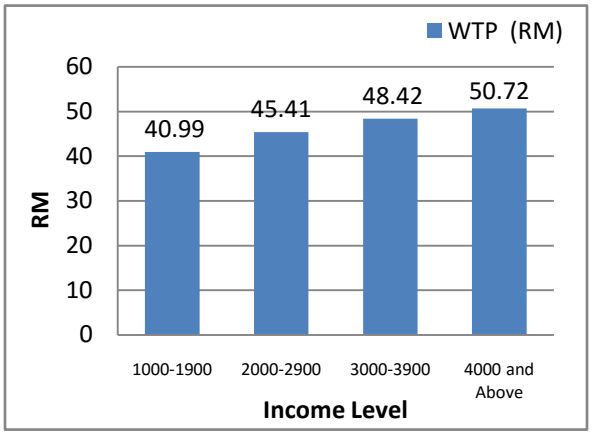


Figure.7: Mean WTP based on the Income



In case of Households size (HHSIZE) is another significant determinant of the WTP in this model. The result shows that the variable has a positive coefficient of 0.20. The mean WTP revealed that the larger the household size the greater the probability of willingness to pay. Although the result shows family size of 3-5 are willing to pay high amount than those with 5-6. Nonetheless those with less than 3 family members are willing to only RM42.28 while those with more than 7 family members are willing to pay RM45.11. The result of the mean WTP is presented in figure 5.9 below. The mean WTP based on the farm size category of the respondent was also estimated and the result is presented in figure 5.9 below. The mean WTP of those with less than 3hactres was estimated and found to be RM42.14, while those with farm size of more than 6hactres are willing to pay RM49.71. This indicates that the bigger the farm size the higher the probability of willingness to pay for watershed conservation.

Figure 8: Mean WTP based on the Households Size

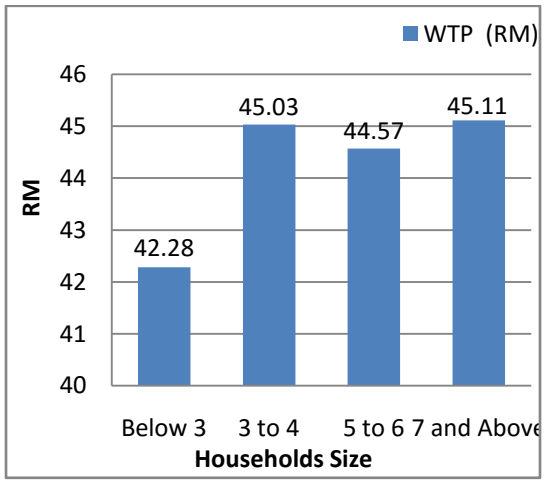
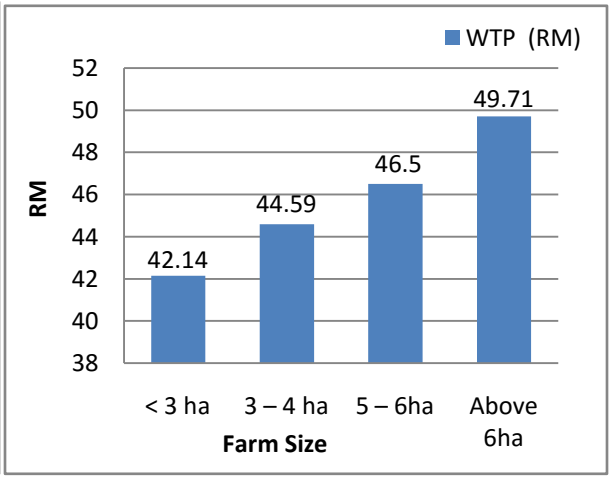


Figure 9: Mean WTP based on the Farm Size



Estimated Mean WTP Value

The result of the Mean WTP was estimated from the single bounded dichotomous choice contingent valuation (DC-CVM) model. The mean WTP value was calculated from the logit regression result using the mean WTP equation explained above. Although farmers enjoy free supply of irrigation water, with no conservation fees for watershed conservation, the outcome of the WTP was significant. From the mean WTP obtained from the farmers (RM 43.73ha/yr.), the expected conservation value of the forest watershed of the Sungai Karang and Raja Musa forest reserves are estimated base on the result from the logit model and the number of farmers in the irrigation scheme(9119). Computing this figure with the mean WTP, the total conservation value is estimate at RM398,773.87/ha/per/yr. This implies farmers are willing to pay for water ecosystem services to ensure sustainable water supply.

CONCLUSION AND RECOMMENDATIONS

Environmental valuation studies are increasingly applied in both developed and developing countries as popular instrument for environmental resource management. Techniques such Contingent Valuation Method (CVM) has demonstrated a promising approach in eliciting WTP because they include a wide range of societal concerns about environmental management. However, the WTP is lacking in the inclusion of nonmonetary contribution for environmental conservation. From the study the WTP has a positive response which implies farmers' commitment toward watershed conservation. The result shows that 73.2% of the farmers have positive response on the WTP with mean WTP of RM 43.73/ha/yr. And total conservation benefit of RM 398,773.87/ha/year for the conservation of the forest watershed to ensure sustainable water supply in the irrigation site. The analysis also shows that variables such as income, Household size, Age, Gender, Satisfaction and Farmer size have significant correlation with the farmers' WTP.

This suggests that farmers are willing to pay order to improve water supply and ensure effective forest conservation. Thus implementation of conservation funds such as PES, program in this area will no doubt be an important tool for the conservation of Sungai Karang and Raja Musa forest reserves, which forms the watershed catchment of Barat Laut Selangor irrigation scheme. Therefore, the following policy implication is recommended as a way forward.

- It is difficult to impose or assign a monetary value to for ecological conservation from local farmers who are given free agricultural facilities and services. And traditionally view the long term use of environmental resources as free gift of nature. So there is the environmental education.

- Government and Non-governmental Organizations should raise the farmers' awareness to appreciate ecological conservation as an obligation and to see that conservation as corporate collective responsibility.
- All stakeholders such IADA, Irrigation Departmen and Department of Agriculture should enlighten the farmers on the need for good environmental management practices such as water saving, contribution to ecological funds.
- Establishment of farmers group and cooperatives for joint development, and the establishment of conservation funds like PES.
- Lastly we recommend PES as special conservation fund generated from the farmers WTP for forest and other ecological conservation. And if fully implemented, will no doubt supplement the cost of forest management as a result of the moratorium policy.

LIMITATIONS AND FUTURE RESEARCH

The scope of this study is limited to the valuation of forest ecosystem services and the analysis of conservation and management attributes in North Selangor Peat swamp forest based on the information obtained from the respondents' willingness to pay.

The farmers' positive feelings may be exaggerated because they may have answered the questions according to what they think the researchers would want to hear, this occurrence may lead to a more conspicuous social desirability bias and eventually, biased data. Countermeasures, including the provision of more detailed explanation before the questionnaire items and encouragement of the farmers to be honest, were implemented to reduce such bias. Therefore, future research should consider additional factors to achieve more valuable information and improve understanding of the farmers' behaviour in PES programs. In addition, respondent who are opportune to participate in the survey are aware of the need to assign monetary incentives to the forest stewards as conservation fees for forest ecosystem services from different conservation and management scenarios to ensure sustainable water supply.

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