

Estimating the Willingness to Pay of Residents for the Conservation of Haso Wetland using the Contingent Valuation Method (CVM)

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Abstract. Wetland ecosystems account for about 6 per cent of the global area. Greater scientific understanding of the roles of wetlands in the ecosystem has increased public appreciation of them. Yet, for much of the recent past, wetlands have been destroyed or altered. The present study uses the contingent valuation method (CVM) to estimate the willingness to pay (WTP) of the households of Inuyama City^{1/} for the conservation of Haso wetland. A questionnaire-based survey conducted in June and July 2007 shows the highest and lowest estimates of the total WTP of the households to be ¥55 million and ¥42 million, respectively. Moreover, the study shows the difference in the stated WTP of those households that are keen on environmental conservation from those that are not, in which the former tends to state a WTP value that is twice as much as the latter. In addition, the study econometrically analyses the socioeconomic factors that affect the WTP of the households. By regressing WTP values against independent variables, the statistical best-fit model (model IV) shows that respondents who are interested in wetland conservation tend to indicate significantly higher WTP values than those who are not. The same is true for those respondents who have visited the wetland area at least once. Income was the only socioeconomic factor, which was statistically significant and confirms that respondents with higher income levels tend to state higher WTP values.

KEYWORDS: Contingent Valuation: Wetland: Willingness to Pay.

INTRODUCTION

Wetland ecosystems account for about 6 per cent of the global land area.^{2/} They comprise both the land ecosystems that are strongly influenced by water, and aquatic ecosystems with special characteristics due to shallowness and proximity to land.^{3/} Trying to draw experiences to provide a precise definition of wetlands is a task fraught with controversy and difficulty, largely due to the enormous variety of wetland types and the problems of defining their boundaries.^{4/}

According to Barbier *et al.*,^{5/} fortunately, some pragmatic help is at hand. Some 100 countries have adopted a common definition by signing the *Ramsar Convention on Wetlands of International Importance*, to which Japan is signatory. This research will adopt the definition recognized by this convention. The convention adopts an extremely broad approach in determining the wetlands which come under its aegis.

In the text of Articles 1.1 and 2.1 of the convention, wetlands are defined as:

... areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water, the depth of which at low tide does not exceed six meters... wetlands may incorporate riparian and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than six meters at low tide lying within the wetlands.^{6/}

Greater scientific understanding of the roles wetlands play in the ecosystem has increased public appreciation of them.^{7/} Wetlands have been described as “the kidneys of the landscape,” because of the functions they perform in the hydrological and chemical cycles, and as “biological supermarkets” because of the extensive food webs and rich biodiversity they support.^{8/} Nevertheless, for much of the recent past, wetlands have been destroyed or altered on a global basis, as human society sought to exploit the benefits provided by these natural systems,^{9/} and due to ill-informed decisions on management and development originating from lack of understanding and recognition.^{10/} According to Himiyama,^{11/} the wetland area in Japan has decreased from 1,340 km² around 1920, to 800 km² around 1955, and down to 690 km² in 1985 because of drainage of most lowland wetlands.

Haso wetland lies on very geologically important sediment located in the eastern part of Inuyama City. Owing to its geological nature, the area is rich in biodiversity which is home to a number of species of flora and fauna that range from tiny moss and ferns to big trees, and from tiny insects such as butterflies to many other sedentary and migratory birds. Of these, many are endemic to the area.

The wetland area, as part of the Tōkai walking area, has experienced anthropogenic effects in recent history. Initiated from its goodwill to turn the area green, an afforestation project of the University of Tokyo carried out extensive planting of trees, mainly cypress, e.g., Hinoki cypress (*Chamaecyparis obtuse*) and Sekkan sugi (*Cryptomeria japonica*) in the 1920s. Currently, the area is a green forest that ties the Tōkai walking area chain, which attracts many visitors as campers, hikers, cyclists, and educators.

However, since the forested area was not adequately maintained, the heavy vegetation is threatening the ecosystem immediately under it due to lack of adequate sunlight. Furthermore, trees, mainly Hinoki cypress and Sekkan sugi, have been invading the wetland area through its peripheries. Consequently, the wetland area is shrinking with the passage of time.

Nonetheless, the budget allocated to maintain the total wetland area is ¥160,000 per year. According to eco-up group^{12/} members, this amount of money is way below the minimum amount needed to maintain the wetland environment. It is for this reason that this research chose this site as a good example of the undervaluation of the environment, especially when considering the estimated monetary value of the wetland.

As a matter of fact, applying an economic value on something as abstract as an ecosystem is a difficult task for most people. We are accustomed to applying monetary values on goods and services. In the case of wetlands, there is no direct market for services such as the availability of clean water, maintenance of biodiversity, and flood control. There is, however, a growing recognition that such natural benefits do have a real economic value and that these values need to be factored into the decision-making process.^{13/} Therefore, known preference techniques such as factors of production, defensive expenditures, and travel costs were dropped since these methods cannot capture the non-market value of the environmental goods in question. As argued by Poor,^{14/} the lack of market data to directly measure the value of wetland (benefits

and functions) makes the valuation of this natural resource conducive to the contingent valuation method (CVM).

The objective of this study is to estimate the monetary value of Haso wetland using CVM and to examine the factors that affect WTP, and to provide policymakers with a tool that will help them in decision making.

Methodology

Theoretically, the value measurement is explained as:

$$V(P, Q_0, Y) = V(P, Q_1, Y-C)$$

V is the indirect utility function, whereas P is the vector of conventional marketable goods prices. Q_0 and Q_1 represent the quality of the wetland area without the implementation of the programme and the quality of the wetland area with the programme implemented, or with status-quo maintained, respectively. Y being the income of the respondent, C represents the Hicksian equivalent surplus measure, which is equivalent to WTP to support the proposed programme to avoid degradation of the wetland area (or maintain the status quo). To estimate the Hicksian equivalent surplus (WTP), the CVM was used.^{15/}

The Contingent Valuation Method

As is stated by Blaine *et al.*,^{16/} economists have long been aware that there are a number of items which, although not typically bought or sold in the markets, add value to people nonetheless. In other words, as explained by Wills *et al.*,^{17/} the conceptual link to non-market valuation is the recognition that while a demand curve is not observable where there is no market for a commodity, there still exists a latent demand curve that can perhaps be teased out through other means. One of the key non-market methods economists have used to measure public attitudes about the value of environmental goods or amenities is CVM.^{18/}

CVM is a survey-based methodology for eliciting the values people place on goods, services, and amenities^{19/} through which respondents are asked to state their WTP for the conservation of an environmental asset, improvement in air quality, and so on,^{20/} the wetland in this case. Obviously, the issues to consider when choosing a survey mode are mainly cost and time. Bearing in mind the fact that mail surveys are by far the least expensive survey mode, a questionnaire-based mail survey was preferred to other techniques, especially considering budgetary and time constraints.

Hypothetical Market Design

Implementation of CVM requires construction of a hypothetical market that contains a description of the proposed policy (or programme) that affects environmental preservation,^{21/} followed by a description of the site. In order to gain a deeper knowledge of the Haso wetland area, the site was visited several times with the eco-up group members serving as guides. Dozens of photos were taken, and further in-depth understanding was acquired through the assistance of ecological experts. Later, a focus group discussion was held, which consisted of teachers, government and non-government employees, housewives, retirees, and researchers. In the focus group discussion, threats being faced by the wetland area were identified as: (a) over-vegetation of Hinoki cypress and Sekkan sugi trees, which have invaded the wetland

area; (b) decaying walkways; and (c) insufficient signboards for visitors. Likewise, possible solutions were identified as: (a) maintain or control the expansion of trees; (b) maintain and construct walkways; and (c) erect signboards for visitors to raise awareness and promote a positive attitude among people towards the environment. Hence, the threats were defined in the-scenario portion using pictures of the wetland area and symbolic species of flora and fauna, which were selected by participants in the focus group discussion. Finally, a hypothetical programme called the “Haso Wetland Conservation Program” was created with the solutions proposed earlier being the main pillars.

The respondents were asked some attitudinal and behavioural questions (see table 1). A payment vehicle question was explained and respondents were asked if they agreed with the payment vehicle proposed. They were also given the option to choose another payment vehicle. The payment vehicle question was presented as follows.

Suppose there is a plan for the Haso Wetland Conservation Program to be funded by imposing a new conservation tax. The residents of Inuyama City would pay an additional fixed tax each month from their income for five consecutive years.

The amount of money allocated would be used to maintain the status quo of the environmental quality of Haso wetland by conserving the area from further degradation.

Do you agree if a new tax is imposed to have a certain amount of money deducted according to your income level to be used to implement the “Haso Wetland Conservation Program”?

Yes, I do agree----- > skip to Q. 10
 No, I do not agree

The payment vehicle question was followed by the WTP question. Several elicitation techniques have been proposed to help identify reliable WTP values using CVM,^{22/} including the payment card.^{23/} According to Boyle *et al.*,^{24/} no single CV technique is neutral in the elicitation of Hicksian surplus (WTP). Each technique has its strengths and weaknesses. Yet, Mataria *et al.*^{25/} argue that the payment card technique has been proposed^{26/} and used^{27/} as a valid and efficient elicitation technique — compared to open-ended and dichotomous choice alternatives — to reveal the value, for users, of non-marketed goods and services. Mataria *et al.* further explains that the use of a payment card results in a continuous distribution of WTP values, as opposed to discrete distributions obtained from dichotomous elicitation techniques. Therefore, the payment card technique was used^{28/} since the WTP stated during the focus group discussion were subsets of the payment card used in their study. The WTP question is provided below.

What is the highest amount of money (in Japanese Yen), if anything, that your household would pay each year to make the “Haso Wetland Conservation Program” possible? (Circle the highest amount that would allow your household to still vote for the program)

50	100	200	300	500	800
1,000	2,000	3,000	4,000	5,000	6,000
7,000	8,000	10,000	15,000	20,000	50,000

More than 50,000 _____

TABLE 1. VARIABLE DEFINITIONS AND MEANS OR PERCENTAGES

Variable	Definition	Mean/Per Cent*	Expected Sign
HRD (Dummy)	=1 if the respondent has heard about the wetland area =0 otherwise	0.670 (67)	+/-
VISIT (Dummy)	=1 if the respondent has visited the wetland area at least once =0 otherwise	0.542 (54.2)	+
WCNSRV	Whether Haso wetland is worth conservation =3 I think so =2 neutral =1 I don't think so	(67.0) (32.6) (0.5)	+
EVCP (Dummy)	=1 if the respondent has contributed/participated in an environmental conservation programme =0 otherwise	0.293 (29.3)	+/-
CGEV (Ranking)	Whether the respondent is concerned about global environmental problems =1 not at all =10 very much concerned	7.6	+
CTOC (Ranking)	Ranking by the respondent of the proposed programme compared to other causes such as those related to education and health =1 much less favourably =10 much more favourably	7.093	+
EFCPR	Whether the respondent thinks the proposed programme is effective =3 I think so =2 neutral =1 I don't think so	(33.5) (30.2) (3.3)	+
TAXIP (Dummy)	=1 if the respondent agrees to the payment vehicle proposed =0 otherwise	0.395 (39.5)	+/-
GENDER (Dummy)	=1 male =0 female	0.595 (59.5)	+/-
AGE	Respondent's age in years	48.595	+/-
OCUP	Farmer Employed Housewife Student Retired Others	(1) (55) (12) (3) (13) (16)	
FSIZE	Family size in number	3.270	-
EDUC	Years of schooling of the respondent	14.605	+
ANINC	Annual income in Japanese Yen	5,147,883.721 4,743,232.558	+

Note: *Figures in parentheses indicate per cent.

The final part of the questionnaire addressed the socioeconomic aspect of the respondents. These are also defined and summarized in table 1. Finally, the questionnaire was twice pre-tested with each pre-test comprising twenty respondents.

Sampling Design

An important step in any CV study is to define the population of beneficiaries of the programme being valued.^{29/} Since the wetland area to be valued is located in Inuyama City, the people who reside within the administrative boundaries of Inuyama City were targeted. Mitchel and Carson assert that "... payments for most pure public goods are made at the household level".^{30/} Therefore, the household (not individual values) was chosen as a unit of measurement for values.

Sampling design involves deciding what types of people, and how many of them, should be interviewed. The guiding principle is to select a subset of the target population such that the results of the survey can be accurately extrapolated to the entire population.^{31/}

To gauge the effect of information and attitude on WTP values, the sample population was stratified into two groups: interest and non-interest groups. The survey expects the WTP stated by the interest group to be higher than that of the non-interest group. The interest group include those respondents who visited the Satoyama research centre and attended the presentation on the wetland area as well as study plan and objective. All the participants were members of several groups working for environmental conservation. Those categorized as the non-interest group were neither members of the eco-up group, nor were they given any oral explanation about the study and its objectives. Out of the members of the interest group who attended the lecture on environmental valuation, ninety-one were intercepted and asked to fill out the questionnaire.

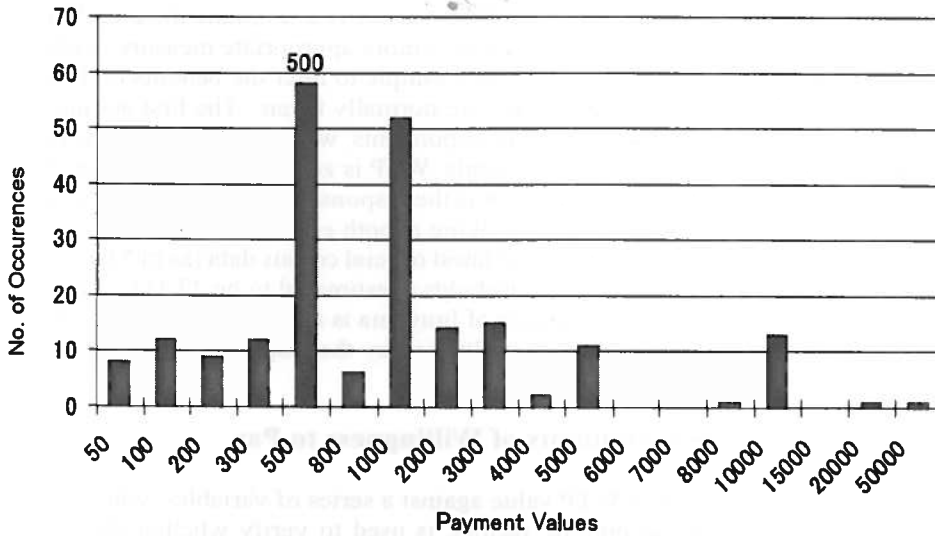
Samples for the non-interest group were identified with the help of the Inuyama municipality office, and this led to the selection of some governmental and nongovernmental institutions. Within these institutions, random sampling was applied. Therefore, the study followed a mixture of both non-probabilistic (or convenience sampling) and probabilistic sampling. As explained by Painter *et al.*,^{32/} while the use of a convenience sample may be practical, it is not typical practice in CVM studies; results will be more useful to policymakers if typical random sample procedures can be applied. However, it can be time-consuming and expensive to obtain a large random sample. Hence, the non-randomness of a convenience or non-probabilistic sample was chosen as a reasonable compromise over the benefit of a fairly larger sample (than would have been covered by random sampling), which would reduce the sample variance of the responses. Moreover, great effort was made to include a broad range of residents of Inuyama City with the wish to provide a fairly reasonable indication of the preferences of the general population.

STUDY RESULTS AND DISCUSSION

As far as we know, there is no CVM survey with a 100 per cent response rate.^{33/} CVM survey response rates are usually between 50 per cent and 70 per cent. In this survey, a total of 300 questionnaires were prepared, out of which 283 were delivered to respondents. Out of these 234 responded which gives a response rate of 82.69 per cent. Compared to other studies, this response rate is fairly high. Out of the completed questionnaires, 216 were categorized as reliable responses. These are those

that had all the questions answered, and which made up 75.97 per cent of the total number of questionnaires distributed. The distribution of the sample and number of occurrences are as shown in figure 1.

Figure 1. Histogram of WTP indicating No. of Occurrences for Each Payment Value



Analysis of Stated Willingness to Pay

WTP results are mainly determined by the preference of the respondents and their income.^{34/} A set of attitudinal and socioeconomic factors were gauged (see table 1). In this table, arithmetic mean and/or percentage of each variable and expected signs are provided.

As can be seen from table 2, the mean of WTP of the total sample population was ¥2,031.628, while that of the interest group and general population (non-interest) group was found to be ¥2,947.333 and ¥1,541.071, respectively. This is exactly consistent with what was expected. According to Boyle,^{35/} information provided to respondents has a strong influence on their statement regarding WTP. Because of this, coupled with the attitude of the people, it is not unusual to expect a WTP value of the interest group to exceed that of the non-interest group. Furthermore, since median values are much less sensitive to outliers than mean values, the median values were also compared. It was found that the median of the total sample was ¥1,000, while that of the interest group and non-interest group was ¥1,000 and ¥500, respectively.

TABLE 2. MEAN AND MEDIAN OF WTP OF DIFFERENT SAMPLE GROUPS

(in Japanese Yen)		
Sample Group	Mean	Median
Mean WTP Total	2,031.628	1,000
Mean WTP Interest	2,947.333	1,000
Mean WTP General Population	1,541.071	500

Putting a Price Tag

According to Poor,^{36/} although the mean (¥2,031.628) may reflect the Kaldor-Hicks potential compensating criteria, the median (¥1,000) may be a more realistic measure of the central tendency of WTP in a world where decisions are based on voting and where concern exists regarding the distribution of benefits and costs of a programme. However, since the goal of this survey is to estimate the total WTP for all Inuyama households, the mean would be a more appropriate measure to adopt.

Yet, when using WTP estimates from a sample to infer the benefits to the population as a whole, two extreme positions are normally taken. The first assumes that non-respondents have the same WTP as respondents, whereas the second (very conservative) assumes that the non-respondents' WTP is zero. WTP for the population is therefore, $WTP_{pop} = \alpha * WTP_{resp}$; where α is the response rate to the WTP question.^{37/} This study takes a neutral position by looking at both estimations before leaving the judgment to the reader. According to the latest official census data (as of March 2006) from Inuyama City, the number of households is estimated to be 27,111. Therefore, the annual highest total WTP of citizens of Inuyama is around ¥55 million, which is reduced to around ¥42 million when multiplied by the response rate of the reliable responses, 75.97 per cent.

Determinants of Willingness to Pay

Regression of the stated WTP value against a series of variables, which include both attitudinal and socioeconomic factors, is used to verify whether the answers given by the respondents are consistent with economic theory, and whether the questions were relevant or not.

The regression results summarized in table 3 show four models of different combinations. The first (model I) aims at examining the relationship between income level and WTP. This clearly indicates a significant positive relationship. The model can be interpreted thus: when the income level increases by 1 per cent, the stated WTP, *ceteris paribus*, increases by around 0.5 per cent. According to Kriström and Riera,^{38/} numerous empirical studies suggest that WTP is an increasing function of income. Those with more income tend to express a higher WTP for environmental improvement than those with less income. The result of this survey also supports this argument.

However, since the income level is not the only explanatory variable that determines the stated WTP, the extracted variables from the questionnaire as defined in table 1 were taken as independent variables. To minimize variation, natural logarithm of both WTP and annual income were taken. In model II (referred to as the full model), the log form of WTP is regressed against all variables. Even though not significant, most of the variables had the expected sign, except for CGEV which unexpectedly gave a negative sign. Nonetheless, although not significant, even at the most humble significance level of 90 per cent, it can be concluded that there was sufficient variation in the answers given by respondents, and hence the stated WTP is not explained by the respondents' concern over the global environment. Obviously, those respondents categorized as interest groups had stated significantly larger WTP values than others. Moreover, those respondents who ranked the conservation of the wetland higher compared to other causes such as education and health had significantly higher WTP statements than those who ranked it less. Even in this model (model II), income showed a significant positive relationship with WTP. As the income level increased by 1 per cent, *ceteris paribus*, the stated WTP increased by

**TABLE 3. REGRESSION RESULTS: INDEPENDENT VARIABLE = LOGWTP,
N = 214**

Variables	Model I	Model II	Model III	Model IV
Constant	1.582548*** (0.332210)	1.107531* (0.629557)	1.061590 (0.348505)	1.271238 (0.318819)
HRD	-	-0.013941 (0.098488)	-	-
INTEREST	-	0.190079** (0.081974)	0.176004** (0.074288)	0.163963** (0.074035)
EVCP	-	0.017429 (0.084375)	-	-
WCNSRV	-	0.031109 (0.085328)	-	-
VST	-	0.107286 (0.096397)	0.135595* (0.070418)	0.146790** (0.070168)
CGEV	-	-0.015541 (0.023158)	-	-
EFCPR	-	0.080624 (0.067824)	0.078275 (0.063343)	-
CTOC	-	0.077496*** (0.021647)	0.069332*** (0.018815)	0.082874*** (0.016963)
TAXIP	-	0.082691 (0.076092)	0.085692 (0.072113)	-
AGE	-	-0.004377 (0.003728)	-	-
GENDER	-	0.017883 (0.083885)	-	-
EMPL	-	0.047515 (0.362182)	-	-
HOSW	-	0.077818 (0.375633)	-	-
RET	-	0.222563 (0.362917)	-	-
STD	-	-0.409303 (0.431468)	-	-
OTHERS	-	0.106859 (0.367914)	-	-
FSIZE	-	0.005887 (0.024301)	-	-
EDUC	-	0.009555 (0.021101)	-	-
LOGANINC	0.515423*** (0.127461)	0.349851** (0.142263)	0.382260*** (0.120984)	0.356246*** (0.119537)
R ²	0.071608	0.282316	0.252190	0.242313

Note: Standard errors are in parentheses. Single, double, and triple asterisks (*) indicate significance at 90 per cent, 95 per cent, and 99 per cent, respectively.

0.35 per cent. The elderly and students were found to elicit negative signs; this could be mainly explained by their levels of income.

A third model shows a better statistical result by dropping (accepting the null hypothesis) most of the less significant variables. In this model, both attitudinal and socioeconomic factors are included. In addition, the question on payment vehicle preference is included to check if it had any effect on the respondents' statements pertaining to WTP. The attitudinal part of this model explains that the variables INTEREST, CTOC, and VSIT have significantly positive signs. The first two are explained in the same way as the previous model. In this model, those who have visited the wetland area at least once tend to have a higher WTP than those who haven't. Moreover, those who think the proposed programme (scenario) is effective (EFCPR), and those who agreed with the proposed payment vehicle (TAXIP) tend to have a higher WTP, albeit insignificant. Yet, from the socioeconomic perspective, only annual income was found to be significantly indicative.

The last model (model IV) shows all those explanatory variables, which are statistically significant, and presents it as the most statistically fit model. From this model, the equation can be written as:

$$\ln WTP = 1.27 + 0.164(X_{INTEREST}) + 0.147(X_{VSIT}) + 0.083(X_{CTOC}) + 0.356(X_{lny})$$

CONCLUSION

As in other similar surveys, due to both budgetary and time constraints, the total economic value of Haso wetland could not be determined. The total WTP of the citizens of Inuyama to preserve the wetland area was roughly estimated to be around ¥55 million as an upper bound, and ¥42 million as a lower bound. Moreover, those respondents identified as interested group stated almost twice as much WTP, and showed the tendency of being willing to pay much more than those not in this group, as shown from the regression result. Those respondents who have visited (or usually visit) the wetland area, and those who ranked the proposed programme higher than other causes such as those related to health and education, also revealed the tendency to pay more than those who did not. From the socioeconomic aspect, income was the only statistically significant indicative variable, which proved that WTP is an increasing function of income.

Therefore, it is wise to conclude that the respondents' attitudinal (interest, CTOC) and behavioural (VISIT) factors significantly affected their WTP statements. Likewise, the stated WTP was found to be an increasing function of income. These factors prove that the survey protocol and response are valid and reliable. However, there is one caveat: the results from this survey should not be taken for granted. Like in any other CV survey, even though it is beyond the scope of this study, careful investigation on the validity of the result should be made before decisions are taken, or before policies are drafted.

Nonetheless, the results from this study do not fail to indicate that the currently allocated budget for the conservation of Haso wetland is significantly below the estimated annual WTP of the residents for the conservation of the wetland area.

NOTES

- 1/ Inuyama City is located in the northwest of Aichi Prefecture, a 30-min. ride by train from Nagoya City, one of the major cities in Japan.
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