Australian Agricultural and Resource Economics Society
51st Annual Conference
February 2007

'Willingness to pay for wetland improvement in Vietnam's Mekong River Delta'

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Abstract

A lack of information on economic values, especially non-market values, has contributed to wetland degradation in the Mekong River Delta. To fill this information gap, this study uses choice modelling to estimate biodiversity values of Tram Chim National Park in Vietnam. It is found that Vietnamese respondents are willing to pay for the wetland conservation. However, the willingness to pay estimates differ among sub-populations and are reduced by the use of a cheap talk script. Some issues of applying choice modelling, including questionnaire designs and survey methods are discussed in the context of a developing country.

Key words: Cheap talk, choice modelling, Mekong River Delta, wetland values, willingness to pay.

Acknowledgments

This is a part of the research project 'Impacts of dykes on wetland values: a case study in Plain of Reeds, Mekong River Delta', funded by the Economy and Environment Program for Southeast Asia (EEPSEA). The authors would like to thank Vic Adamowicz, University of Alberta and David Glover, Director of EEPSEA for their valuable inputs during the proposal and analysis of this study.

1 Introduction

1.1 Wetlands in Mekong River Delta

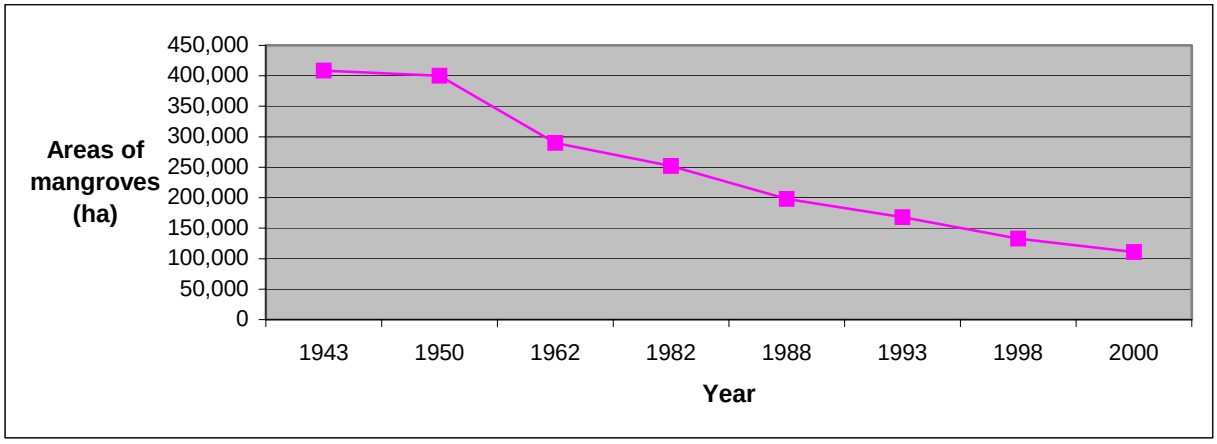
The Ramsar Convention defines wetlands as

> 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
>
> (Ramsar Convention Bureau 2004)

The largest area of wetland in Vietnam is found in the Mekong River Delta (MRD) with about 90 per cent of the MRD being classified as wetlands (Vietnam Ministry of Natural Resources and Environment 2002). These wetlands can be broadly divided into two categories: inland and coastal wetlands. Inland wetlands are dominated by floodplain paddy fields, seasonally flooded grasses and *Melaleuca* forest, while coastal wetlands are generally dominated by mangrove forest (Torell and Salamanca 2003:4).

The wetlands have experienced serious loss and degradation. The area of mangrove forest has decreased about 80 per cent over the last few decades, from 408,500 hectares in 1943 to 110,700 hectares in 2000 (Vietnam Ministry of Natural Resources and Environment 2002:32) (Figure 1). Wetland biodiversity has also experienced losses. For example, in Tram Chim Wetland National Park the number of the endangered species, Sarus Crane, has reduced from 1057 in 1987 to 93 in 2005 (Vietnam Environmental Protection Agency, IUCN and MWBP).

Figure 1 Decrease in mangrove areas in Vietnam 1943-2000



Source: Vietnam Ministry of Natural Resources and Environment, 2002. '*Cac khia canh ve dieu kien tu nhien dat ngap nuoc o Vietnam (Issues of Natural Conditions of Wetlands in Vietnam'*, Vietnam Ministry of Natural Resources and Environment, Ha Noi, Vietnam.

The leading cause of the wetland degradation is the increase in aquaculture, notably shrimp farming (World Bank 2002:18). Other causes include the conversion of mangroves to rice fields and construction land, war destruction and fuel wood collection (World Bank 2002:17). Overexploitation of aquatic resources has threatened some endangered species and decreased biodiversity. Forest fires are another threat to the remaining mangroves of the Delta (Miller el al. 1999:47). Last but not least, an extensive *ad hoc* construction of dykes in the MRD has negatively affected hydrological and biological conditions of the wetlands (UNDP/IUCN/MRC/GEF 2005).

1.2 Research rationale

Information on wetland values is useful to wetland management. Effective wetland management requires data on the rate of harvest of the natural resources and the overall status of natural resources (Torell el al. 2001:3). This information helps to manage and conserve these resources in a sustainable way. Specifically, information on economic values of wetland goods and services is integral to estimating the costs and benefits of development projects (de Groot et al. 2006; Turner et al. 2000; Barbier et al. 1997). The information on wetland values provides inputs for policymakers so that the policies they develop reflect the value of the resources and the issues related to their management and conservation.

However, at present, there is a lack of information on the total economic values of wetlands in the MRD. Only a few of the numerous wetland benefits in the MRD have been quantified in studies by Hang and An (1999), UNEP/GEF (2003), and Do and Bennett (2005). These studies focus only on market values of the wetlands. While substantial wetland non-market valuation has been performed in other parts of the world (for example, Birol et al. 2006; Hein et al. 2006; Whitten and Bennett 2005; Langford et al. 1996), no study on the non-market values of wetlands has been carried out in the MRD (Do and Bennett 2005). That leaves a gap in knowledge of total economic values of wetlands in the Delta. This gap of information, together with a lack of appropriate institutions and a lack of funding for wetland management, poses a big challenge to wetland management in the MRD (Torell el al. 2001:4).

The research reported in this paper helps to fill this information gap by estimating non-market values of the wetlands in the Vietnam's MRD. Specifically, it estimates willingness to pay (WTP) for improvements in the wetland biodiversity, using environmental choice modelling (CM). In addition, this research contributes to the stock of knowledge on wetland management and the application of CM by addressing two questions: first, are the values of wetland conservation affected by the distance of beneficiaries from the wetlands and second, does 'cheap talk' influence value estimates?

With regard to the first question, a number of research projects have been conducted to test the effect of distance to the studied sites (for example, Bateman et al. 2006; Wang et al. in press; Pate and Loomis 1997; Surtherland and Walsh 1985). However, this kind of test has not been conducted for Vietnamese contexts. Therefore, the results of the test in this research not only contribute to the literature on CM application in Vietnam but are also helpful for policy making involving the aggregation of WTP estimates for wetlands over a broad geographic scale.

In regard to the second question, while there have been some studies on the effect of 'cheap talk' scripts in eliminating hypothetical bias in contingent valuation method, for example, Cummings and Taylor (1999) and List (2001), few research projects have investigated this issue in CM. In addition, findings on the effects of 'cheap talk' are mixed in both contingent valuation method (CVM) (Poe et al. 2002; Aadland and Caplan, 2003) and CM (List et al. 2006; Carlsson et al. 2004). While many studies conclude that using 'cheap talk' can effectively eliminate hypothetical bias (e.g. Cummings and Taylor 1999; List 2001), some point out that a cheap talk component might induce internal inconsistency in subjects' preferences stated (List et al. 2006) and appears to exacerbate rather than mitigate the bias (Aadland and Caplan 2006; Calrsson and Martisson 2006). Moreover, to the authors' knowledge, most cheap talk studies have been done in developed countries with very different contexts from developing countries. A cheap talk test in a developing country like Vietnam provides some more insights in the context dependent aspects of cheap talk effectiveness.

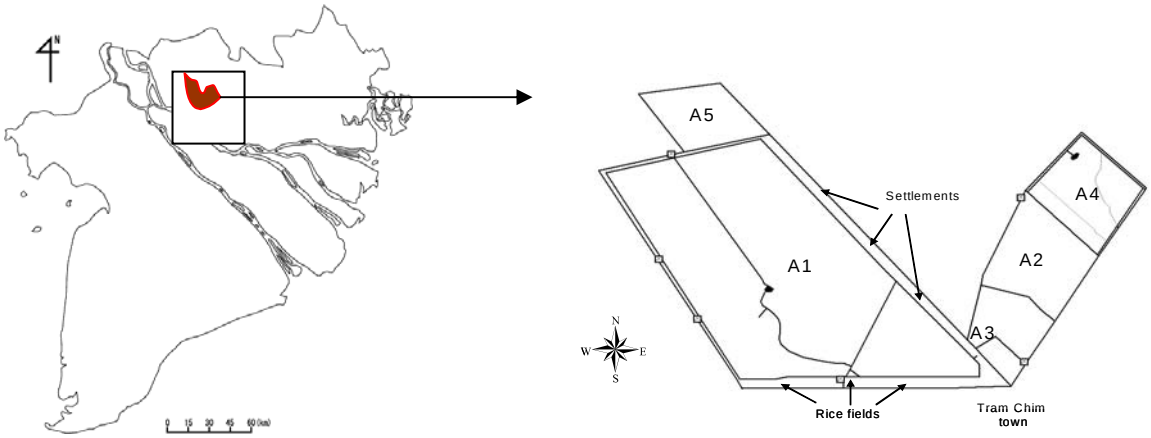
2 Methodology

This section describes the case study of Tram Chim Wetland National Park in the MRD by using the environmental choice modelling approach.

2.1 Case study: Tram Chim Wetland National Park

The case study reported here involves the Tram Chim National Park. Established as a National Park in 1994, Tram Chim is 9,000 ha of wetland located in Tam Nong District, Dong Thap Province (Figure 2). Tram Chim provides habitats for 127 plant species. In addition, it supports a large number of herons, egrets, storks and ibises and some rare species such as Black-necked Storks, Lesser Adjutants and Greater Adjutants. Most notably, Tram Chim provides habitat for Sarus Cranes, the endangered bird species listed in the IUCN red book (UNDP/IUCN/MRC/GEF 2005). Due to its biodiversity values, it is the first wetland national park of Vietnam and has been nominated by Vietnam's Government to be the RAMSAR wetland site (Buckton et al. 1999).

Figure 2 Location and map of Tram Chim

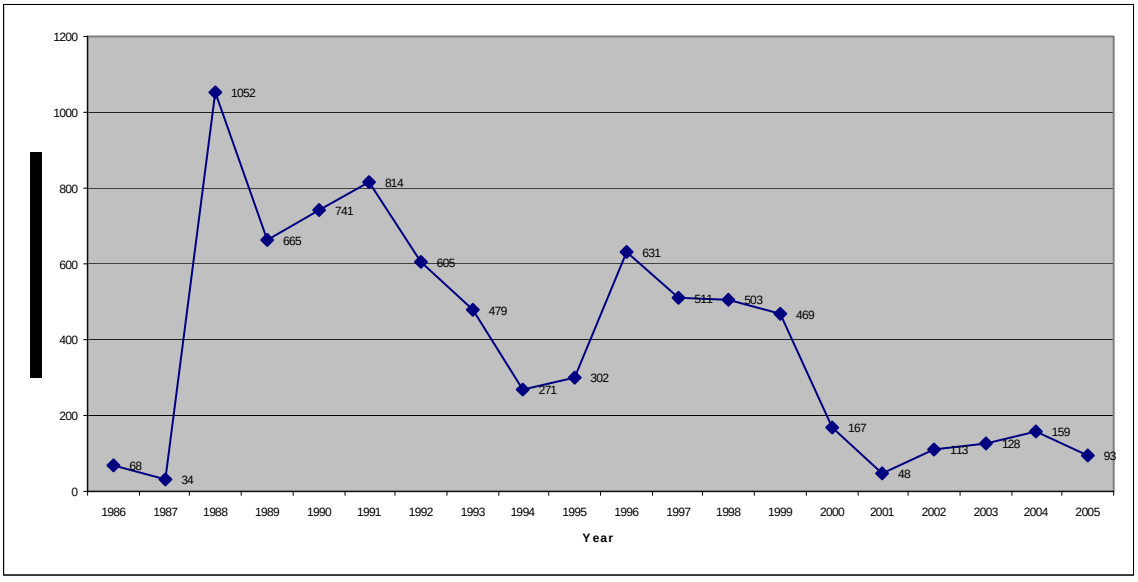


Source: UNDP/IUCN/MRC/GEF 2005. *Integrated Water and Fire Management Strategy Tram Chim National Park*, Cao Lanh 2005.

Tram Chim is enclosed by 53 km of dykes and canals. This dyke and canal system was built in 1985 to retain water in the National Park during the dry season. This has helped restore the wetland ecological systems destroyed during the Vietnam war (Pacovsky 2005). Evidence of ecological restoration in the return of Sarus Crane came some years after the construction of dyke (Figure 5). However, since 1996, to prevent fire, the local authority has raised the height of the dyke to keep the water level all year around higher than an ecological optimum level of 0.5m all year (UNDP/IUCN/MRC/GEF 2005).

This current high dyke system has affected Tram Chim's ecological systems (Hung 2003; Thanh 2003). While the long inundation supports some deepwater species, overall, it has negative impacts on the whole ecological system. Native plants have been replaced by invasive *mimosa pigra* (Triet et al.. 2004). Eleocharis or 'nang' grasses, the favourite food of the Sarus Crane, have been destroyed. That has led to reduced numbers of this endangered bird species visiting the Park (Figure 3). The dyke has also hindered fish migration and hence reduced the number of fish species living in the wetlands. To address this problem, the Park Management Board has proposed to change the current dyke system and wetland management practice to improve the health of the wetland (Tram Chim National Park Management Board 2005).

Figure 3 Number of Sarus Crane visiting Tram Chim



Source: Vietnam Environmental Protection Agency, IUCN and MWBP 2005. *Overview of Wetland Status in Vietnam Following 15 Years of RAMSAR Convention Implementation*, Ha Noi 2005.

2.2 Environmental Choice Modelling

Environmental choice modelling (CM) involves asking survey respondents to choose their most preferred resource use option from a number of alternatives. While there are a number of stated preference techniques, including the CVM, contingent rating, contingent ranking, paired comparison and choice modelling, CM appears to be the most promising technique (Bennett and Blamey 2001). It has the advantages of providing a rich data set, strategic bias reduction, benefit transfer potential, framing effect control and flexibility (Bennett and Adamowicz 2001).

CM is consistent with random utility theory (RUT) (Louviere 2001; Adamowicz et al. 1998). In RUT, utility is a latent construct that exists in the mind of the consumer but cannot be observed directly. By using CM, some of this unobservable consumer utility can be explained. However, some proportions of the utility remain unexplained. The utility can be described in the following equation:

$U_{an} = V_{an} + \varepsilon_{an}$

Where U_{an} is the latent, unobserved utility for choice alternative, V_{an} is the systematic, observable component of the latent utility and ε_{an} is the random component of the latent utility associated with option *a* and consumer *n*. Because of the random component, it is impossible to understand and predict preferences perfectly. This leads to formulating expressions of the probability of choice:

$P(a/C_n) = P[(V_{an} + \varepsilon_{an}) > (V_{jn} + \varepsilon_{jn})$
for all *j* options in choice set C_n

The probability of consumer n selecting option *a* from choice C_n is equal to the probability that the systematic and random components of option *a* for consumer *n* are greater than the systematic and random components of option *j* for consumer *n* in choice C_n. To estimate the choice probabilities using Multinomial Logit (MNL), it is assumed that the random components are independently and identically distributed (IID), with the implication that alternatives have independence from irrelevant attributes (IIA). To introduce respondent heterogeneity, socioeconomic variables are used as independent variables in each equation. When IID assumption or IIA property is violated, MNL estimates might be bias. This triggers the use of nested logit, mixed logit or random parameter logit (RPL), and latent class model (for detail of these models, see Louviere et al.. 2000, Layton 2000 or Revelt and Train 1998, and Boxall and Adamowicz 2002, respectively). These models have been widely applied in estimating wetland values (Othman et al. 2004; Whitten and Bennett 2005; Birol et al. 2006; Milon and Scrogin 2006).

Implicit prices are estimated on a ceteris paribus basis. That is, they are estimations of the WTP of respondents for an increase in the attribute of concern, given that everything else is held constant. Implicit prices are determined using the following formula:

Implicit price = $-(\beta_{\text{non-market attribute}}/\beta_{\text{monetary attribute}})$

where β are the coefficients estimated in the MNL

In addition to the estimation of values of individual attributes, the compensating surplus relating to a change in overall conditions can also estimated, using the following formula:

Compensating surplus $= -(1/\beta_{monetary}) (V_1-V_2)$

where V_1 is the value of the indirect utility associated with the status quo
V_2 is the indirect utility associated with the specific levels of the attributes describing the changed resource allocation
β is the coefficients estimated in the MNL

Two common tests for comparing different models are Swait and Louvier (1993) and Poe et al.. (2005). The former is used for testing for scale and parameter equality between two MNL models. The later involves a convolution test for difference in implicit price and consumer surplus by measuring the difference across empirical distributions.

3 Research design

This section details steps involving the development of a questionnaire and the survey implementation.

3.1 Questionnaire development

The development of the CM questionnaire was based on focus group studies. The focus groups were conducted for both studied populations and wetland managers to ensure that inputs from both demand and supply sides of the environmental goods were received. There were five focus groups, four for potential respondents and one for wetland managers. The purposes of the focus group studies were to determine attributes relevant to respondents and wetland managers, determine appropriate cost levels and a payment vehicle, and test the draft questionnaire.

The following attributes listed were found to be of the most interest to both potential respondents and wetland managers:

- Area of healthy vegetation: This is the area having healthy *melaleuca* forest and grassland without any invasive *mimosa pigra*.
- Number of Sarus cranes
- Number of fish species
- The number of local households affected
- Different cost schemes

The levels of the attributes were determined in consultation with wetland experts as well as in the focus groups.

To select a payment vehicle, three criteria were used: a good coverage, acceptability and feasibility. A good coverage means that the payment vehicle should have applicability and relevance across the studied population. Acceptability means that the payment

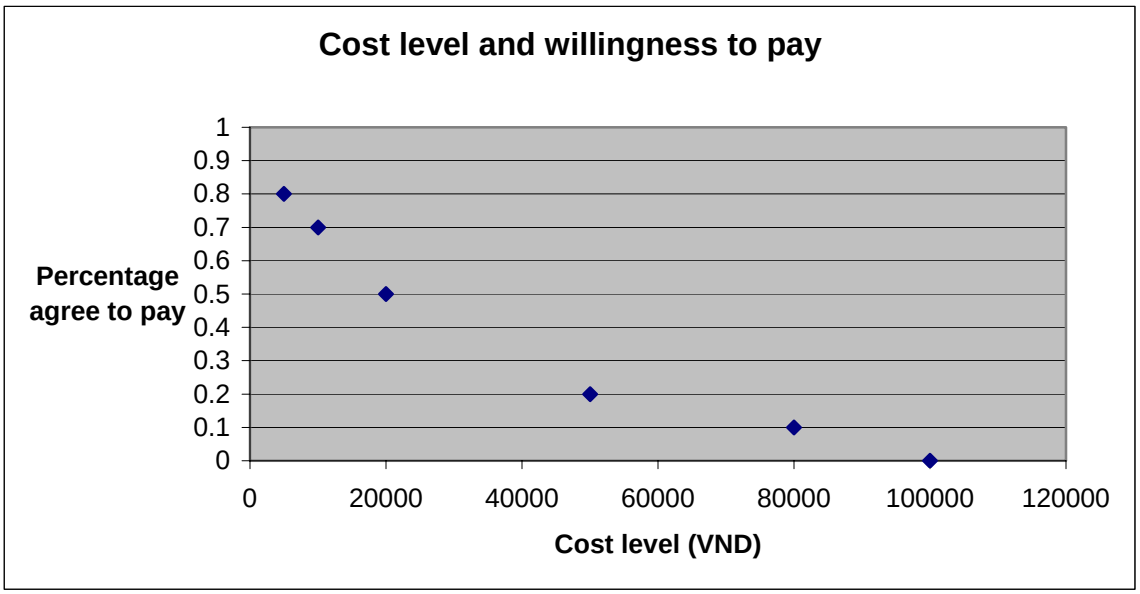
vehicle should be widely acceptable to the respondents. Feasibility means that it is not too costly and complicated to implement in reality. Each criterion was given a score scale of 1-10. Respondents were asked to score the proposed payment vehicles. Consensus was then reached that electricity bills would best suit these criteria with the average score of 7.0, followed by the newly set up fund for wetland improvement in Tram Chim (Table 1).

Table 1 Selecting an appropriate payment vehicle using scoring scales

Payment vehicles	Coverage	Plausibility	Feasibility	Total average score
Electricity bill	8.0	6.0	7.0	7.0
Newly set up fund for wetland improvement in Tram Chim	7.0	7.0	6.5	6.8
Water bill	6.0	7.0	7.0	6.6
Extraction of salary	5.0	6.0	7.0	6.0
Environmental service fee	5.0	7.0	6.0	6.0

The focus group studies showed that that the maximum WTP for the wetland improvement lay within the range of zero to VND 100,000. The percentage of focus group respondents agreed to pay for the proposed costs decreased as the cost levels increases (Figure 4), suggesting a suitable range of cost levels.

Figure 4 Willingness to pay of focus group participants decreases as the cost levels increase



The experimental design was constructed after the attributes and levels were determined. Five attributes and four levels, including the status quo were used in the experimental design (Table 2). Twenty-seven choice sets were selected from a full factorial of an orthogonal main effects experimental design. Two obvious implausible choices were eliminated. Therefore, 25 choice sets were used. As each questionnaire contains five choice sets, it takes five respondents to complete the 25 choice sets.

Table 2 Five attributes and four levels used in the experimental design

Attributes \ Levels	Status quo	Level 1	Level 2	Level 3
Percentage of area having healthy vegetation	50	60	70	80
Number of globally threatened birds living in the wetlands	150	300	450	600
Number of fish species	40	50	60	70
Number of local households worse-off	0	600	900	1200
Once-off change in current monthly electricity bill (thousand VND)	0	10	50	100

The questionnaire briefs respondents about Tram Chim National Park and its biodiversity loss due to poor wetland management. It then describes the proposed plan for wetland improvement and the outcomes of different management options. It continues by explaining that to implement the plan, governments needs to raise funding to cover the costs of dyke reconstruction, invasive species removal and control, hydrological and biological monitoring and to pay compensation to local farmers who will suffer from subsequent changes in flood levels. Subsequently, the choice sets are presented to respondents for them to choose their preferred options. An example of a choice set is in Table 3.

To test the effect of cheap talk, a short and neutral cheap talk version by Aadland and Caplan (2006) was used with some revision to make it more appropriate for a CM exercise. The common long version by Cummings and Taylor (1999) and List (2001) was not used for two reasons. First, it is too long and too complex for Vietnamese respondents. Second, it is not easily generalised, i.e. it requires either baseline information of the degree of hypothetical bias or a presumption of the degree of hypothetical bias that exists in the population for calibrating the specific wording of a 'cheap talk' script (Aadland and Caplan 2006). The cheap talk used in this research reads as follows:

'As you prepare to answer the next few questions, please keep in mind the following three things. First, keep in mind your household budget. How much would your household be able to afford a once-off increase in electricity bill? Second, keep in mind that there are other wetland areas in the Mekong Delta such as U Minh Thuong and Lang Sen. And third, keep in mind that in previous surveys we have found that the options of wetland management that people say they prefer are sometimes different from the options that they would actually select when the wetland program takes place and requires a real payment. For this reason, when choosing options, please imagine your household is actually paying for the options you choose.'

Table 3 An example of a choice set

Scenario 1: Suppose options A, B and C are the ONLY ones available

Note: The first column describes different characteristics that will change under different wetland management options. The next columns describe different outcomes of the wetland management options.

The following factors will vary under different management options	OPTION A (status quo- no change)	OPTION B	OPTION C
Percentage of area having healthy vegetation 	50%	60%	80%
Number of Sarus cranes visiting the wetlands 	150 birds	300 birds	450 birds
Number of fish species 	40 species	50 species	70 species
Number of local households worse-off 	0	900	900
Once-off change in your current monthly electricity bill 	No change	Increase VND 10,000	Increase VND 50,000

If there were a vote (in which if the majority votes for the option you choose then the option will be selected), you would vote for:

TICK ONE BOX ONLY

Option A ☐
Option B ☐
Option C ☐

3.2 Survey implementation

The study focused on three sub-populations. The first is the population in the MRD that is not directly affected by changes in the management of Tram Chim. This allows the estimation of environmental benefits resulting from future management scenarios without the confounding effects of changes in farming income. Cao Lanh in Dong Thap Province was selected as this sub-population. The expected sample size was 300.

The second sub-population is the population of urban residents in Ho Chi Minh City who represent the population living in adjacent areas of the MRD. The third population is those who live far away from the MRD. In this case, Vietnam's capital, Ha Noi was selected. The sub-populations in Ha Noi and Ho Chi Minh City were split into two sampling populations for testing two kinds of questionnaires. For the first sub-population, questionnaire without a cheap talk were used while in the second population, a questionnaire embedded with a 'cheap talk' script were used. The expected sample size for each sub-sample was 150. Total expected sample size for the CM exercise was 900 (Table 4).

The sampling frames were the maps of Cao Lanh, Ho Chi Minh City and Ha Noi. Stratified sampling was used with communes as strata. In each commune, systematic sampling technique was used to select samples. Households were the sample units whilst a member of the household was the unit of inquiry.

Table 4 Location and sample size for CM exercise

Location	**Sample size**	
	Without cheap talk	**With cheap talk**
Cao Lanh		300
Ha Noi	150	150
Ho Chi Minh city	150	150

Regarding the method of conducting the survey, some authors suggest that by giving respondents more time to think about their choices, the 'drop off-pick up' method could produce results with fewer violations of utility theory (Cook et al., in press). However, the drop off method was not used in this study for several reasons. First, focus group studies showed that asking respondents to read a complex questionnaire by themselves might be too demanding and hence respondents would be unlikely to answer the questionnaire properly. This would potentially either lead to a low response rate or serial non-participation. Second, provided that interview bias is under control, personal interviews would enable respondents to have assistance from enumerators in understanding the issues and questions.

Third, the effect of drop off proposed by Cook et al. (in press) may not be realised in this study. Despite being conducted in Vietnamese context, the hypothetical goods in Cook et al. (in press) study were cholera and typhoid vaccines, which can be interpreted as quasi-private goods. Respondents might have different behaviours to those goods, as opposed to a pure public good of wetlands in this study. Taking into account both pros and cons of drop off and personal interviews (Champ 2003), and the context of a developing country where respondents, especially those with less education, do not like reading questionnaires, personal interviews with adequate time for respondents to go over the choice sets were used.

4 Results and discussions

This section presents and discusses the results of the study, commencing with socio characteristics of respondents. Then it specifies results of the MNL and RPL models of choice. WTP estimates for wetland improvements are discussed with reference to the effects of distance and cheap talk.

4.1 Respondents' socioeconomic characteristics

The number of useable questionnaires in Ha Noi, Ho Chi Minh and Cao Lanh were 370, 289 and 258 respectively. In Ha Noi, the sizes of the spilt samples for 'cheap talk' and 'non-cheap talk' were 186 and 184 while those in Ho Chi Minh City were 145 and 144 respectively. Cao Lanh had the highest response rate (78.6%), followed by Ho Chi Minh City (59.4%) and Ha Noi (52.5%) (Table 5). This also represents the order of distance to Tram Chim National Park: Cao Lanh (40 km), Ho Chi Minh City (250 km) and Ha Noi (2000km).

Table 5 Response rate

Location	Number of respondents approached	Number of respondents agreed to participate	Response rate (%)
Ha Noi	714	375	52.5
Ho Chi Minh	467	293	59.4
Cao Lanh	388	305	78.6

To examine the representativeness of the samples, a comparison between sociodemographic characteristics of the samples and the populations is useful. It would be ideal to have data from a recent population census. Unfortunately, in Vietnam the census is conducted every 10 years and the latest one was in 1999. Therefore, the census data are outdated. Furthermore, data of this research's interest including a mean age are not available from the 1999 census. Therefore, data from the Vietnam Household Living Standard Survey in 2004 (Vietnam General Statistics Office 2004) were used with the assumption that they represent the socioeconomic structure of the whole population of Vietnam.

It was found that the samples were biased toward young, higher educated people and male in the three locations (Table 6). This might be due to the fact that the surveys targeted urban residents that have younger and more educated populations and that household heads were men. Also, it may be because people with a high education are more likely to accept to participate in the interview, as noted by enumerators.

Table 6 Sociodemographics of the respondents

Socioeconomic characteristics	Ha Noi		Ho Chi Minh City		Cao Lanh	
	Sample mean	**Population mean**	**Sample mean**	**Population mean**	**Sample mean**	**Population mean**
Age (>=18 years)	32.7	42	37.1	40.4	35.9	40.1
Education (%>year 12)	55	21.3	43	11.5	16	4.3
Sex (% male)	51	50	56	53	54	48

Respondents' views on the importance of public sectors and environmental issues were homogeneous in three locations. Environment is ranked the second most important issue, preceded by education (Appendix 1). Water pollution was ranked the most important environmental issue, followed by air pollution. Wetland biodiversity conservation was ranked least important in all three locations (Appendix 2).

4.2 Model specification

4.2.1 Multinomial Logit

The LIMDEP software package was used to run MNL models of the choice data. Two models were estimated for each location. The first model is a basic model showing the importance of the attributes in explaining respondents' choices across three different options in a choice set: a status quo (no change) and two alternatives of changes. This model involves the attributes and an alternative specific constant (ASC) only. The second model includes socioeconomic and attitudinal characteristics interacting with the ASC and some selected attributes. In this case, the attribute 'cost' was interacted with 'age', 'gender', 'income' and 'education'. Definitions of the variables used in these models are presented in Table 7.

Models 1 and 2 were estimated twice: the first time including all respondents and the second time excluding those who are scenario rejecting respondents.

Scenario rejecting respondents are those who meet one of the following criteria:

- do not believe in the feasibility of or support the once-off increase in electricity bills
- do not believe in the scenarios presented
- do not believe that the raised funding will be used for environmental purposes
- believe that it is the government who should pay for wetland improvement, not citizens
- select the options randomly without considering the attributes and levels.

Table 7 Definitions of variables

Variables	Description
Attribute variables	
ASC	Alternative specific constant, taking value of 0 for the status quo (no change) and 1 for the changed alternatives
Vegetation	% of Tram Chim National Park covered by healthy *melaleuca* and grass without invasive *mimosa pigra*
Birds	The number of Sarus cranes, an endangered bird species, visiting Tram Chim
Fish	The number of fish species in Tram Chim
Farmers	The number of households affected by the change in dyke and wetland management of Tram Chim
Cost	Cost to respondents in the form of a once-off increase in current electricity bill
Non-attribute variables	
Age	Age of respondents (in years)
Gender	Male: 1, Female: 0
Education	Education level of respondents, taking value of 1 for tertiary and above and 0 otherwise
Income	Income of the household (thousand VND) in cardinal forms: 500, 2000, 4000, 6000, 8000, 10000, 12000, 13000
Knowledge	Respondents have heard or read about Tram Chim, taking value of 1 for YES and 0 for NO
Visit	Previous visit to Tram Chim, taking value of 1 if there is and 0 otherwise
Option	The possible future visit to Tram Chim, taking value of 1 if there is and 0 otherwise
Bequest	The benefit from wetland improvement for future generation, taking value of 1 if there is and 0 otherwise
Prowetland	Support wetland conservation, taking value of 1 if YES and 0 otherwise
Concern	Concerned about wetland biodiversity degradation, taking value of 1 if YES and 0 otherwise
Cheap talk	Receiving 'cheap talk' scrip in the questionnaire, taking value of 1 if YES and 0 otherwise

The models without scenario rejecting respondents were found to have higher Pseudo-R2 than the former models, insignificant ASC and a prior expected signs of the significant variables (Table 5). Therefore, the models excluding rejecting scenario respondents were used for further analyses. Insignificant socioeconomic variables were not included in subsequent model estimation.

Table 8 Results of multinomial logit models for pooled data of three locations

Variables	All respondents included		Protest zero and scenario rejecting respondents excluded	
	Model 1	**Model 2**	**Model 1**	**Model 2**
ASC	0.925***	-0.446*	1.337***	0.182
	(0.148)	(0.248)	(0.177)	(0.347)
Vegetation	0.91E-02***	0.0112***	0.117E-01***	0.014***
	(0.9E-02)	(0.214E-02)	(0.023E-01)	(0.26E-02)
Birds	0.118E-02***	0.001***	0.014E-01***	0.14E-02***
	(0.19E-03)	(0.2E-04)	(0. 2E-03)	(0.2E-03)
Fish	0.35E-02	0.32E-02	0.42E-02	0.003
	(0.28E-02)	(0.31E-02)	(0.34E-02)	(0.004)
Farmers	-0.12E-02***	-0.124E-02***	-0.13***	-0.133E-02***
	(0.9E-04)	(0.1E-03)	(0.1E-03)	(0.12E-03)
Cost	-0.015***	-0.015E-03***	-0.0165***	-0.166E-04***
	(0.7E-03)	(0. 7E-06)	(0. 8E-03)	(0.9E-06)
ASC*age		0.0114***		0.019***
		(0.32E-02)		(0.004)
ASC*gender		0.025		0.024
		(0.077)		(0.103)
ASC*education		0.089***		1.226***
		(0.081)		(0.111)
ASC*income		0.54E-03***		0.05E-02***
		(0. 1E-04)		(0.02E-03)
ASC*knowledge		0.629***		0.44***
		(0.084)		(0.11)
ASC*visit		-0.478***		-0.63***
		(0.129)		(0.15)
ASC*option		0.455***		0.43***
		(0.087)		(0.11)
ASC*bequest		0.925***		0.533***
		(0.08)		(0.111)
ASC*prowetland		-0.369***		-0.0879
		(0.077)		(0.104)
ASC*concern		0.17		-0.061
		(0.13)		(0.209)
ASC*cheap talk		-0.4268***		-0.558***
		(0.817E-01)		(0.117)
Education*cost		-0.228E-02		0.373E-02**
		(0.15E-02)		(0.176E-02)
Income*cost		0.55E-07		0.15E-06
		(0.228E-06)		(0.27E-06)
Age*cost		0.138E-03**		0.447E-04
		(0.58E-04)		(0.714E-04)
Gender*cost		0.656E-03		0.108E-03
		(0.148E-02)		(0.178E-02)
Summary statistics				
Log-likelihood	-4818.714	-3712.726	-3191.307	-2449.007
Pseudo-R2	0.07	0.149	0.09	0.158
Observations	4755	4555	3225	3225

Note: Standard deviations are in parentheses. *** denotes statistical significance at 1% level, ** denotes statistical significance at 5% level and * denotes significance at 10% level.

4.2.2 Random Parameter Logit

To relax the IID assumption and further investigate heterogeneity in respondents' preferences, a RPL model was estimated. In the RPL models, taste parameters are assumed to have statistical distributions arising from potentially different parameters for each individual (Revelt and Train 1998). Steps suggested by Hensher et al. (2003) were followed to estimate the RPL. First, all attributes except for the cost attribute were estimated as random parameters. Second, the random parameters having distributions with insignificant standard deviations were re-estimated as non-random parameters. The RPL model with 100 random draw and normal distribution for random parameters shows that respondents have heterogeneous preferences over vegetation and birds, significant at 1% level (Table 9).

Table 9 Results of MNL and RPL models for pooled data of three locations

Variables	**MNL**	**RPL**	
		Mean	**SD**
ASC	-0.323E-01	0.189	
	(0.289)	(0.346)	
Vegetation	0.139E-01***	0.149E-01***	0.358E-01***
	(0.257E-02)	(0.299E-02)	(0.719E-02)
Birds	0.137E-02***	0.149E-02***	0.201E-02**
	(0.242E-03)	(0.273E-03)	(0.976E-03)
Fish	0.305E-02	0.449E-02	
	(0.366E-02)	(0.409E-02)	
Farmers	-0.133E-02***	0.159E-02***	
	(0.124E-03)	(0.159E-03)	
Cost	-0.146E-04***	0.172E-04***	
	(0.126E-02)	(0.165E-05)	
ASC*age	0.187E-01***	0.218E-01***	
	(0.43E-02)	(0.541E-02)	
ASC*education	1.339***	1.532***	
	(0.138)	(0.172)	
ASC*income	0.544E-04***	0.699E-04***	
	(0.165E-04)	(0.208E-04)	
ASC*knowledge	0.446***	0.549***	
	(0.11)	(0.139)	
ASC*visit	-0.837***	-1.052***	
	(0.148)	(0.2)	
ASC*option	0.386***	0.467***	
	(0.111)	(0.138)	
ASC*bequest	0.491***	0.627***	
	(0.109)	(0.143)	
ASC*cheap talk	-0.605***	-0.747***	
	(0.115)	(0.148)	
Education*cost	0.373E-02**	-0.282E-02	
	(0.176E-02)	(-0.197E-02)	
Model statistics			
Log-likelihood	-2459.043	-2448.107	
Pseudo-R2	0.15	0.17	
Observations	3225	3225	

Note: Standard deviations are in parentheses. *** denotes statistical significance at 1% level, ** denotes statistical significance at 5% level and * denotes significance at 10% level.

Both the MNL and RPL models show that respondents preferred more healthy vegetation, more birds, fewer farmers affected and less cost. The number of fish species is insignificant to respondents. Older respondents with higher incomes and more education choose wetland improvement options more frequently than young respondents with low income and less education. Respondents who have some knowledge about Tram Chim, and think that they may visit Tram Chim in the future and that their future generations will benefit from Tram Chim wetland improvement choose improvement options more frequently. On the other hand, respondents choose the status quo option more often if they have visited Tram Chim before. The MNL reveals that the respondents with a higher education are more concerned about the increase in the electricity bill. However, this was not observed in the RPL.

While the RPL is more complex, both models produce similar results in terms of magnitudes, signs and significance levels of the coefficients, except for education interacting with the cost variable (Table 9)[1]. In addition, the Pseudo-R^2 of the RPL model is not much higher than that of the MNL model. Moreover, the Poe et al. (2005) test shows that there is an insignificant difference between implicit price estimates produced by the MNL and RPL models (Table 10). Therefore, the MNL was used for further analysis.

Table 10 Testing for difference in implicit price in MNL and RPL

Implicit Price	Total MNL (VND)	Total RPL (VND)	Proportion of $IP_{MNL} - IP_{RPL} > 0$
Vegetation	920 (607~1239)	868 (550~1190)	0.4
Birds	90 (58~119)	84 (56~111)	0.39
Farmers	-87 (-102~ -73)	-83 (-98~ -68)	0.61

Note: Confidence intervals at 95%, calculated using Krinsky and Robb (1986) bootstrapping procedure, are given in brackets.

The MNL model (Table 10) shows that across the whole sample, respondents were on average willing to pay 920 VND for a one per cent increase in healthy vegetation and 90 VND for an additional Sarus crane. However, they needed to be compensated 87 VND for every local household made worse-off.

4.3 Effects of distance to Tram Chim

To analyse the effects of distance to Tram Chim on respondents' choices, the models of respondents receiving cheap talks of Ha Noi, Ho Chi Minh City and Cao Lanh were estimated (Table 11). All signs of coefficients are as expected. Respondents in the three sub samples preferred fewer farmers affected and less cost with coefficients for these attributes significant at the 1% level. The respondents in Ha Noi and Ho Chi Minh City have preference for more birds whilst the respondents in Cao Lanh preferred more healthy vegetation. The number of fish species is insignificant to the respondents in all three locations.

[1] The RPL model for three separate sub-samples also produce similar results (Appendix 3).

Female respondents in Ha Noi chose change options more frequently[2] while female respondents in Ho Chi Minh City prefer the current situation. In Ha Noi and Cao Lanh, the respondents with more education and higher income choose non-status quo options more frequently while this is not observed in Ho Chi Minh City. Knowledge about Tram Chim is significant in determining respondents' preference only in the Ha Noi sub-sample, the most distant sample from Tram Chim. In Ha Noi and Ho Chi Minh city, respondents with a high education are more concerned about the increase in the electricity bill.

Table 11 Results of MNL models for three locations

Variable	Ha Noi	Ho Chi Minh	Cao Lanh
ASC	-0.653	-0.869	-0.372
	(0.536)	(0.755)	(0.634)
Vegetation	0.145E-01***	0.915E-02	0.238E-01***
	(0.493E-02)	(0.69E-02)	(0.666E-02)
Birds	0.182E-02***	0.122E-02*	0.827E-03
	(0.457E-03)	(0.671E-03)	(0.622E-03)
Fish	0.199E-02	0.665E-02	0.983E-02
	(0.695E-02)	(0.973E-02)	(0.946E-02)
Farmers	-0.138E-02***	-0.884E-03***	-0.252E-02***
	(0.234E-02)	(0.333E-03)	(0.335E-03)
Cost	-0.868E-05***	-0.16E-01***	-0.195E-01***
	(0.25E-05)	(0.338E-02)	(0.283E-02)
ASC*age	0.287E-01***	0.432E-01***	0.161E-01*
	(0.891E-02)	(0.165E-01)	(0.852E-02)
ASC*gender	-0.396*	1.023***	0.735E-01
	(0.223)	(0.299)	(0.205)
ASC*education	2.723***	0.687E-01	0.964***
	(0.321)	(0.385)	(0.314)
ASC*income	0.84***	-0.523	1.125***
	(0.284)	(0.32)	(0.293)
ASC*knowledge	0.537**	0.501	0.174
	(0.227)	(0.341)	(0.281)
ASC*visit	-0.966E-01	-0.352	-0.337
	(0.708)	(0.603)	(0.227)
ASC*option	-0.409E-01	0.803	0.439***
	(0.249)	(0.356)	(0.217)
ASC*bequest	-0.143	0.693	1.043***
	(0.26)	(0.33)	(0.228)
Cost*education	-0.572E-02*	-1.104E-01**	-0.623E-02
	(0.331E-02)	(0.493E-02)	(0.491E-02)
Model statistics			
Log likelihood	-635.1893	-327.12	-462.7466
Pseudo-R2	0.17	0.18	0.19
Observations	740	385	540

Note: Standard deviations are in parentheses. *** denotes statistical significance at 1% level, ** denotes statistical significance at 5% level and * denotes significance at 10% level.

[2] This becomes insignificant when the model is re-estimated with significant variables only.

Except for the number of fish species, which always has an insignificant coefficient, implicit prices for the attributes differ in three sub-samples (Table 12). The Poe et al. (2005) test was used to compare the implicit prices in three locations. Ha Noi and Cao Lanh respondents are willing to pay a similar amount of about 1,100 VND (0.08 USD) for an increase of one percent of healthy vegetation in Tram Chim while respondents in Ho Chi Minh are indifferent to vegetation change. Respondents in Ha Noi and Ho Chi Minh have a similar marginal WTP of about 100 VND (0.007 USD) for an increase of one bird while Cao Lanh respondents have zero marginal value for birds. The WTP for reducing one local household affected is about 116 VND (0.008 USD) in Ha Noi and Cao Lanh and 58 VND (0.004 USD) in Ho Chi Minh city.

These findings suggest that the distance decay effect on the implicit prices is not observed. On the contrary, the marginal WTP for birds shows a reverse trend, with respondents in further sites having positive values while the respondents in a closer location have zero value. One reason for this might be respondents' concern about possible bird flu spread by wild birds, as some respondents in Cao Lanh raised the question about the relationship between the birds and bird flu.

To further investigate the distance decay effect, the compensation surplus, which is the overall WTP for a change from the status quo, is calculated for each sub-sample. The status quo and the change scenarios are as follows:

- Status quo scenario: There are 50% healthy vegetation, 150 Sarus cranes, 40 fish species, and no farmers affected.
- Change scenario: In three years, there will be 70% healthy vegetation, 600 Sarus cranes, 40 fish species, and 300 households to be relocated.

Indirect utilities of respondents were calculated using coefficients of significant variables and the sample means of socioeconomic variables. Table 12 shows a reverse distance decay function. Respondents in Ha Noi have highest WTP (39,327 VND or 2.5 USD), followed by respondents in Ho Chi Minh City (14,498 VND or 0.9 USD). Cao Lanh respondents have negative WTP, suggesting that people in the Mekong River Delta may not support the change in wetland management. This is because of the marginal values for wetland attributes are not large enough to compensate for the marginal values for reducing the number of local farmers negatively affected.

Table 12 Implicit prices and compensation surplus in three locations

	Ha Noi	Ho Chi Minh	Cao Lanh
Implicit price (VND)			
- Vegetation	930 (218~1646)	0	1290 (723~1898)
- Birds	121 (57~185)	71 (-16~150)	0
- Farmers	-114 (-146 ~ -81)	-58 (-97 ~ -26)	-119 (-146~ -93)
Compensation surplus (VND)	39,327 (8,613~70,195)	14,498 (50,640~ -23,275)	-10,303 (- 21,635~ 2,336)
Distance from Tram Chim	40km	250km	2000km

Note: Confidence intervals at 95%, calculated using Krinsky and Robb (1986) bootstrapping procedure, are given in brankets.

4.4 Effects of cheap talk

A cheap talk test was conducted with a dummy variable 'cheaptalk' for Ha Noi and Ho Chi Minh City sub-samples. It was found that in Ha Noi, respondents receiving cheap talk script chose status quo options more frequently while in Ho Chi Minh City, this effect was not observed (Table 13). This suggests that cheap talk reduces the WTP in the Ha Noi respondents who live far a way for the Tram Chim. List (2001) and Lusk (2003) also found similar results in a market good, for which cheap talk does not have an effect on those who are more familiar with the good. Also, similar to the findings presented by Aaland and Capland (2003), the effect of cheap talk on respondents' choices increases when the cost levels rise. This is shown by the positive sign of the interaction between cheap talk and cost variables, significant at 5% level in Ha Noi sub-sample.

Table 13 Cheap talk has effect in Ha Noi but not HCM

	Ha Noi	**Ho Chi Minh city**
ASC	0.334E-01	0.501
	(0.426)	(0.537)
Vegetation	0.119E-01***	0.013E***
	(0.35E-02)	(0.485E-02)
Birds	0.173E-02***	0.11E-02**
	(0.329E-03)	(0.464E-03)
Fish	0.258E-02	0.151E-03
	(0.499)	(0.689E-02)
Farmers	-0.119E-02***	-0.103E-02***
	(0.166E-03)	(0.233E-03)
Cost	-0.152E-04***	-0.161E-04***
	(0.225E-05)	(0.286E-05)
Knowledge	0.6***	0.901***
	(0.16)	(0.198)
Age	0.269E-01***	0.186E-01**
	(0.677E-02)	(0.866E-02)
Gender	-0.372**	0.693***
	(0.161)	(0.197)
Income	0.557E-04**	-0.221E-04
	(0.276E-04)	(0.254)
Education	2.375***	0.123
	(0.223)	(0.259)
Education*cost	-0.406E-02*	-0.504E-02
	(0.241E-02)	(0.342E-02)
Cheaptalk	-0.977***	0.955E-01
	(0.2)	(0.259)
Cheaptalk*cost	0.617E-02**	-0.237E-02
	(0.24E-02)	(0.342E-02)
Model statistics		
Log likelihood	-1220.68	-674.412
Pseudo-R2	0.16	0.14
Observations	1430	765

Note: Standard deviations are in parentheses. *** denotes statistical significance at 1% level, ** denotes statistical significance at 5% level and * denotes significance at 10% level.

To further investigate the effects of cheap talk in the Ha Noi sub-sample, the Poe et al. (2005) test was conducted to test the difference between the implicit price estimates using two models: cheap talk and no cheap talk. It is found that there is no significant difference between the implicit prices for vegetation and birds between the two models while the implicit price for farmers in the cheap talk sub-sample is larger than the no cheap talk model (Table 14). This indicates that cheap talk made respondents more concerned about the impacts on local farmers. This also suggests that the effects of cheap talk on compensation surplus will be more evident in changed scenarios involving higher numbers of farmers affected than those with lower ones.

Table 14 Test for the difference of implicit prices between cheaptalk and no cheaptalk

Implicit prices (IP)	Cheap talk	No cheap talk	Proportion of $IP_{cheap\ talk} - IP_{no\ cheap\ talk} > 0$
Vegetation	930 (218 ~1646)	608 (65 ~ 1143)	0.23
Birds	121 (57 ~185)	99 (48 ~ 149)	0.29
Farmers	-114 (-146 ~ -81)	-51 (-75 ~ -27)	0.99*

Note: Confidence intervals at 95%, calculated using Krinsky and Robb (1986) bootstrapping procedure, are given in brackets.* denotes statistical significance at 5% level.

5 Policy implications and conclusion

This section discusses policy implications and draws a conclusion about WTP for wetland improvement and application of CM in Vietnamese context.

5.1 Policy implications

Two main types of policy implications have been identified. The first type is related to wetland management and the second type deals with the application of CM in the Vietnamese context.

5.1.1 Wetland management

Respondents living inside or outside the MRD are willing to pay for the wetland biodiversity conservation in Tram Chim National Park. However, respondents have different marginal WTP for different wetland attributes and their WTP differs among sub-populations. Although they have different values for the wetland attributes, the respondents share a common concern about the impacts of wetland conservation on the local farmers. Their values for wetland conservation, therefore, depend not only on wetland biodiversity but also on the number of households affected. This is consistent with the findings of Whitten and Bennett (2005) and van Bueren and Bennett (2004). Other factors influencing WTP include age, income, education, knowledge about Tram Chim and distance to the wetland. WTP increases when these factors increase.

For the proposed wetland management plan, the overall WTP differs in different locations. On average, respondents in Cao Lanh are not willing to pay for the proposed change plan while respondents in Ho Chi Minh City and Ha Noi are willing to pay 0.9 USD and 2.5 USD per household respectively. Three assumptions are used to aggregate the overall WTP. First, these sub-samples represent three zones (zone 1: inside the MRD, zone 2: on the edge of MRD, and zone 3: far from MRD). Second, seven million urban households in these zones are asked to pay (one million in zone 1, three million in zone 2 and three million in zone 3). Third, respondents who refused to participate in the survey had zero WTP. The overall WTP for the proposed plan is calculated using the following equation:

WTP total = (WTP per house hold zone 1* number of household zone1* response rate zone 1) + (WTP per house hold zone 2* number of household zone 2* response rate zone 2) + (WTP per house hold zone 3* number of household zone 3* response rate zone 3)

The aggregated WTP for three populations would be about 5.4 million USD. This indicative benefit of the wetland improvement outweighs the cost of the management plan of about 3.4 million USD (Tram Chim National Park Management Board 2005). Therefore, the proposed project is justified.

5.1.2 Application of choice modeling in Vietnamese context

As environmental non-market valuation is relatively new in Vietnam, lessons from this study are helpful for CM applications in the future. Some points about the questionnaire design in the Vietnamese context were observed. First, instead of using the term 'referendum', the questionnaire should explain how the voting scheme would work. This is because the term 'referendum' is not familiar to the respondents as Vietnam has not had a referendum in the past 60 years (Tuoi Tre 2006). Second, an example of making choices when building a house was found to help respondents better comprehend the choice tasks they faced.

Third, pictures helped explain the issues and choices much better than text. Fourth, the issue of whether an increase in the electricity bill is an appropriate payment vehicle remains unclear. Similar to Thuy (2006)'s findings, while focus groups think that the electricity bill could be used, about 15 per cent of respondents in the survey did not support this payment vehicle. Last, unlike Aadland and Caplan (2006)'s findings, the test of cheap talk in this research shows that a short, neutral cheap talk can reduce respondents' WTP. However, this effect was observed only for respondents who live far from the studied site. Therefore, caution needs to be taken when using cheap talk in different populations.

Another issue for this CM application is the mode of survey. As discussed in Section 3.2, personal interviews with adequate time for respondents to go over the choice sets were used. Following this method, when selecting options in each choice set, respondents were given some time to think while enumerators stayed away. This was designed to take advantages of both personal interview and drop off methods. However, it is unclear whether this worked better than the drop off. In the survey, some respondents asked for

more time to think about the choice sets while others wanted to finish the questionnaire as quickly as possible. A study about the influence of drop off and personal interview on respondents' choice about wetland management options would provide more insights into this issue.

5.2 Conclusion

A lack of information on the MRD wetland values has contributed to wetland degradation. While information on wetland values provides important inputs for decision making regarding wetland management in the MRD, there seems to be no study on non-market values in this region. This study fills this information gap by estimating WTP for wetland biodiversity conservation for Tram Chim National Park, a wetland nominated for RAMSAR site in the MRD, using the CM approach. Personal interviews were conducted in three sub-populations: Cao Lanh, Ho Chi Minh City and Ha Noi. These represent three zones: MRD, the edge of the MRD and outside of the MRD. It is found that respondents in three locations have different marginal WTP for wetland attributes. The overall WTP for the proposed wetland biodiversity conservation also differs in three sub-samples, ranging from 2.5 USD per household in Hanoi to 0.9 USD in Ho Chi Minh City and zero in Cao Lanh. The aggregated benefit of the wetland improvement is about 5.4 million USD, justifying its implementation.

The WTP for wetland improvement depends on a number of factors. Older, more educated and wealthier respondents have a higher WTP. Those who live further away from the wetland site, have knowledge about the wetland and have option and bequest values about the wetland also show a higher WTP. However, respondents have a lower WTP if they have visited the site. The WTP is also reduced by a short, neutral cheap talk script that explicitly tells the respondents about hypothetical bias problems and reminds them about their budget constraints and substitution for the wetlands. Although cheap talk is found to reduce the WTP, its effect is only observed in respondents living far from the site.

In conclusion, this study has shed some light on non-market values of wetlands in the MRD. For the first time, these values have been quantified and justify wetland conservation in Vietnam. The study also provides some insights into the application of CM in a Vietnamese context. Although further research on issues such as questionnaire design and method of survey is needed, it can be concluded that CM can be applied in a Vietnamese context to estimate non-market values of wetlands. This contributes not only to wetland management in Vietnam but also to other decision making processes involving sustainable development in the whole region.

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Appendixes

Appendix 1 Results of RPL models for three locations

Variable	Ha Noi	Ho Chi Minh	Cao Lanh
Random parameter			
Vegetation (Mean)	0.169E-01***	0.935E-02	0.384E-01***
	(0.61E-02)	(0.799E-02)	(0.01)
Birds (Mean)	0.217E-02***	0.12E-02	-0.135E-02
	(0.526E-03)	(0.74E-03)	(0.123E-02)
Non-random parameter			
ASC	-0.559	-0.847	0.118
	(0.668)	(0.777)	(0.914)
Fish	0.545E-02	0.673E-02	0.158E-01
	(0.803E-02)	(0.103E-01)	(0.125E-01)
Farmers	-0.184E-02***	-0.925E-03***	-0.336E-02***
	(0.318(E-03)	(0.393E-03)	(0.528E-03)
Cost	-0.113E-04***	-0.164E-04***	-0.308E-04***
	(0.303E-05)	(0.523E-05)	(0.505E-05)
ASC*age	0.384E-01***	0.448E-01*	0.212E-01
	(0.124E-01)	(0.236E-01)	(0.135E-01)
ASC*gender	-0.403	1.059***	0.603E-01
	(0.29)	(0.359)	(0.327)
ASC*education	3.305***	0.615E-01	1.288***
	(0.458)	(0.462)	(0.417)
ASC*income	1.082***	-0.696*	1.69***
	(0.373)	(0.415)	(0.577)
ASC*knowledge	0.622**	0.53	0.383
	(0.299)	(0.49)	(0.463)
ASC*visit	0.692	-0.371	-0.464
	(0.981)	(0.641)	(0.376)
ASC*option	-0.251	0.834*	0.657*
	(0.335)	(0.439)	(0.352)
ASC*bequest	-0.703E-01	0.721*	1.713***
	(0.346)	(0.373)	(0.434)
Cost*education	-0.503E-02	-0.106E-01**	-0.305E-02
		(0.523)	(0.645)
Vegetation (Std. Dev.)	0.512E-01***	0.103E-01	0.587E-02
	(0.137E-01)	(0.386E-01)	(0.133E-01)
Birds (Std. Dev.)	0.781E-04	0.121E-02	0.752E-02***
	(0.154E-02)	(0.976E-02)	(0.199E-02)
Model statistics			
Log likelihood	-629.9232	-326.9332	-454.2984
Restricted log likelihood	-812.9731	-422.9657	-593.2506
Pseudo-R2	0.22	0.21	0.22
Observations	740	1155	1620

The RPL shows that the respondents in Ha Noi have heterogeneous preferences over vegetation and birds while preferences over the wetland attributes of the respondents in Ho Chi Minh City are homogenous. In Cao Lanh, respondents have heterogeneous preferences over vegetation.

Appendix 2 Ranking of public sectors that needs more government funding

Issues	Ha Noi		Ho Chi Minh City		Cao Lanh	
	Importance order	Percentage of being ranked 1	Importance order	Percentage of being ranked 1	Importance order	Percentage of being ranked 1
Education	1	71.4	1	49.8%	1	49.6
Environment	2	14.9	2	27.9%	2	21
Health	3	5.1	3	10.5%	3	19.9
Public transport	4	4.6	4	10.1%	4	6.6
Science	5	4	5	1.7%	5	2.9

Appendix 3 Ranking of priority of environmental issues

Issues	Ha Noi		Ho Chi Minh City		Cao Lanh	
	Importance order	Percentage of being ranked 1	Importance order	Percentage of being ranked 1	Importance order	Percentage of being ranked 1
Water pollution	1	49.6	1	54%	1	54.9
Air pollution	2	25.3	2	24.4%	2	12.8
Reforestation	3	15.1	3	13.2%	4	11.3
Solid waste	4	6.2	4	5.9%	3	13.6
Wetland biodiversity	5	3.8	5	2.8%	5	7.4