Valuing Wetlands

A Contingent Valuation Approach

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ABSTRACT

This paper details the methodology and results of a pilot study designed to estimate the economic value of the Barmah wetlands. This large wetland system lies along the Victorian side of the Murray River near Echuca. The Contingent Valuation Method was considered the only method able to capture both the use and non-use values associated with the Barmah wetlands. This technique uses direct questioning, and a sample of 203 Victorians was asked about their willingness to pay to preserve the wetlands.

Results show that the present day value of the Barmah wetlands to Victorians lies between $76.9 million and $97.5 million. Of this, preservation value accounts for between $71.1 and $90.1 million, and current use value between $5.8 and $7.4 million. Regression analysis shows poor systematic relationships between an individual's characteristics and willingness to pay. This is possibly due to i) the highly individual nature of utility functions concerning wetland provision; and ii) the heterogeneous nature of the (statewide) sample population. Nevertheless, it is concluded that the method has elicited a reliable estimate of the economic value of the Barmah wetlands.

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1. INTRODUCTION

Decisions concerning the allocation and use of public resources (such as land) are essentially political decisions. Such decisions are made in the context of maximising net social benefits, and are based on advice from professionals, among them economists. Economics cannot say which landuse is "best" - politicians and decision makers do this. It can, however, provide information on the relative economic value of alternative uses of land.

In the public sector, social benefit-cost analysis is commonly used to evaluate land use alternatives. This requires identification and measurement of all the benefits and costs associated with each proposal. However, it is often difficult to value all the effects for the purpose of comparison. While the value of some effects is readily measured through market prices and cash flows, other effects, particularly those impacting on the environment are not easy to value as there are no markets in which to determine value. In reality, natural environments are highly valued, and if rational and optimal social choices concerning land use are to be made, these values must be included in the decision making process.

This paper provides details of a study designed to measure the non-market values associated with a wetland ecosystem in Victoria. The technique chosen to value the wetlands was the Contingent Valuation Method as it is the only method sufficiently developed capable of measuring benefits accruing to both users and non-users of the resource.

2. CONTINGENT VALUATION METHOD

The Contingent Valuation Method has received increasing attention since the focus on the environmental debate has sharpened. The technique relies on surveys to:

> "... elicit people's preferences for public goods by finding out what they would be willing to pay for ... them. The method is thus aimed at eliciting their willingness to pay (WTP) in dollar amounts. It circumvents the absence of markets for public goods by presenting consumers with hypothetical markets in which they have the opportunity to buy the good in question. .... Because the elicited WTP values are contingent upon the particular hypothetical market described to the respondent, this approach came to be called the contingent valuation method" (Mitchell & Carson 1989:2)

By surveying a representative sample, the results can be aggregated and expanded to provide a value of a population's willingness to pay for the preservation, or hypothetical increases in amount or quality of the amenity being valued.

Kirkland (1988) indicates that the major strengths of the method are that it is:

- independent of secondary data
- can be applied to a wide range of public and environmental goods
- is capable of eliciting responses which are analogous to values from alternative market based methods
- provides the only flexible technique for estimating the value of environmental resources to both users and non-users.

While the technique has been subject to extensive review and use overseas, particularly North America, its application in Australia has been limited. Consequently, a pilot study was designed to i) assess the technique's usefulness to measuring the economic values of wetlands; and ii) redress the paucity of knowledge on non-market values of wetlands in Australia.

3. SURVEY METHOD AND SAMPLE

The Barmah wetlands, situated along the Victorian border of Murray River were chosen as the site for a pilot study (see Appendix 1). Given the sensitive and sometimes difficult nature of the questions required to elicit willingness to pay information, a personal face to face interview was considered preferable to either self administered mail-back or telephone interview. While the latter two have been used in Contingent Valuation studies, there are clear advantages to using personal interviews e.g. explanations of questions can be provided, and visual aids such as maps, photographs and prompt cards can be used. Neither mail-back nor telephone interviews can incorporate both of these aids. Furthermore, personal interviews can reduce the potential for respondent self selection which may be a cause of bias in mail-back surveys.

The relevant population from which the sample for a Contingent Valuation survey is drawn is i) determined from policy or study objectives, and ii) limited to individuals considered to be in charge of their own financial decisions. One of the objectives of this study was to provide information on how much and why Victorians value the Barmah wetlands. Consequently, the appropriate population for the sample was any Victorian over the age of 18. Details of sample selection and interviewing procedures are contained in Appendix 2.

4. TREATMENT OF BIASES

The Contingent Valuation Method has been criticised for a variety of biases, some of which are introduced through the use of surveys. While split samples were not used to test for the effect of biases, the major biases were addressed in survey design and administration. The following discussion indicates how the biases were minimised or avoided.

Hypothetical bias

Hypothetical bias is described as the difference between hypothetical payment an actual behaviour (Cummings, Brookshire & Schulze 1986). While Mitchell & Carson (1989:216) dismiss hypothetical bias as little more than a misnomer - a random, directionless error, they also indicate that it is perhaps the most troublesome of biases (1989:233). Sinden (1988) reviewed 17 empirical studies comparing actual to hypothetical donations to find there was no statistical difference between the two. He concluded that "...hypothetical bias may not occur when a carefully prepared questionnaire is presented carefully to a cooperative group of subjects (1988:110). To minimise the potential for hypothetical bias, both the hypothetical situation and payment vehicle need to be credible and realistic.

The hypothetical situation, as used in the study was:

> *"Suppose there was a plan to drain the Barmah wetlands and turn the area into farmland. This would mean that there would be more farms which would generate more jobs and local income. Also, all of the forest and much of the wildlife that currently lives there would disappear, and the area would become less suitable for conservation, recreation and scientific purposes.*
>
> *Suppose also that the only way to guarantee that the wetlands would not be drained would be to make a once only donation of money into a special Wetlands Trust Fund to be run by a non-government organisation. The money donated into this fund would be tax deductible, and would only be used to preserve the Barmah wetlands. The fund would be used to save the wetlands from drainage and maintain them in their current condition."*

The *plan* to turn the wetlands into farmland is consistent with surrounding land uses, and wetland drainage for agriculture has been widely practiced in Victoria. The contingent situation was simple - all wetlands versus all farmland, and consequently, it was unnecessary to state the percentage reduction in wildlife, habitat, recreation opportunities or conservation values. The payment vehicle - donating money to a non-government fund, was considered a neutral and familiar way of 'collecting' money.

Strategic bias

Strategic bias may arise when the respondent believes that he/she may be able to influence the outcome of the survey and therefore does not offer a truthful bid. For example, people with strong conservation interests may indicate that they are willing to pay large amounts of money in order to inflate the overall value of the resource, regardless of whether they value it that much. Alternatively, people may intentionally understate their willingness to pay so that the resource is undervalued.

To minimise strategic bias individuals have to be convinced to state their bid honestly. Thus careful description and attention to the hypothetical scenario is necessary. Overall, the motivation for strategic bias is presumed to be weak (Mitchell & Carson 1989:155) and should not be a significant problem in carefully designed surveys (Cummings, Brookshire & Schulze 1986:152).

Obvious strategic bias can be revealed by

i) comparing respondents' bids to their answers to attitudinal and behavioural questions to reveal inconsistencies; or
ii) statistical analysis of bids which are outside predicted ranges.

Strategic bias can also arise where people engage in 'free-riding' behaviour (i.e. they make a low or zero bid in the belief that other people will be willing to pay to ensure provision of the good). In the current study a two stage willingness to pay question was framed to 'uncover' free-riding behaviour. Respondents were initially asked whether they would be willing to pay to preserve the Barmah wetlands (WTP1). They were then presented with the following information and asked again whether they would be willing to pay for the wetland's preservation (WTP2). Specifically:

Suppose a fund to save the wetlands was set up but the money collected was not enough to save them. Would you be willing to donate

i) an additional amount (for those who had already donated)
ii) into the fund? (for those who had not already donated)

Total willingness to pay was calculated as WTP1 + WTP2. The willingness to pay questions were framed in this way to allow respondents to reconsider their initial bid in light of new information, to reveal free-riding behaviour, and to 'push' respondents towards the upper limit of their maximum willingness to pay.

Information bias

The amount and quality of information about the resource being valued and the point of the interview at which it is introduced may influence a person's willingness to pay. For example, too much information may bias responses upwards as people previously unaware about certain values become aware of them. However, respondents need some information about the commodity so that they may place a value on it. Indeed, if the study is collect reliable information, it is essential that respondents have a clear image of what it is they are being asked to value. Information provided is either value-relevant and needed so that the respondent can make a valid bid, or value-neutral and needed to establish a credible market for the good (Mitchell & Carson 1989:216).

The potential for information bias can be minimised by keeping information simple and objective, and to present it in a consistent way (Hageman 1986). In the current study the value-relevant information was contained in a booklet given to respondents and showed several wetland types and current uses of Barmah. The value-neutral information was worded to provide a clear description of the hypothetical market and payment vehicle.

Starting point bias

Starting point bias may arise where an iteritave bidding process is used i.e. where respondents are presented with an initial amount and then asked to raise or lower this to reflect their own value. The bias arises when respondents are unsure of their true value and are lead or guided by the amount initially presented to them. One way to minimise starting point bias is to show respondents a payment card which presents a range of values for them to choose from.

Several payment cards were tested in the development of the questionnaire. However, during testing some respondents commented that they felt constrained and/or guided by the amounts on the card and found it difficult to "decide" which value to select, despite being informed that they were free to choose any amount. From this experience it was decided to use an open ended format where the respondent was free to offer their own bid.

Previous studies (in Mitchell and Carson 1989, Cummings, Brookshire & Schulze 1986) indicate that an open ended format may elicit lower bids and/or higher number of protest bids than other methods. However, the two stage willingness to pay format simulates a two step bidding process somewhat, pushing respondents towards their maximum value. This sequence has been used previously by Hageman (1986).

Vehicle bias

Vehicle bias may arise where respondents place a zero bid because they disagree with the way the value is elicited. For instance, if a particular organisation had recently been irresponsible with funds, and it was suggested that the donation would be to a similar, though hypothetical organisation, there may be a level of aversion to the payment vehicle.

Vehicle bias can be partly observed by asking zero bidders whether they would have preferred the money be collected in an alternative manner. If there is a high proportion of respondents indicating disagreement with paying money in the form offered, it could be concluded that vehicle bias was present. The payment vehicle chosen for the current study was a non-government organisation, and was considered to be an appropriately familiar and neutral method of "collecting" donations.

5. RESULTS

Willingness to pay

Interviewing began mid August and continued through to early September, 1990. Just prior to this time, there had been a change of Premier in Victoria, and both the State and Federal budgets were imminent. Additionally, many Victorians, especially Geelong residents, were financially disadvantaged by the foreclosure of a major building society. There was an element of political and economic uncertainty present at the time of interviewing.

Interviews were conducted with 203 people over the age of 18. (Profile of respondents at Appendix 3)

The willingness to pay questions were framed in a two-stage open-ended format as discussed in Strategic Bias above. Respondents were asked initially whether they would be willing to pay to preserve the wetlands (WTP1), and then given a second opportunity (WTP2) after being provided with extra information. Total willingness to pay was calculated as WTP1 + WTP2. The number of people responding to the willing to pay questions is shown below:

TABLE 1: Responses to willingness to pay questions - total sample (n = 203)

	WTP1 (all)	WTP2 (all)	WTP1 (only)	WTP2 (only)	BOTH WTP1 & WTP2	ZERO WTP	TOTAL SAMPLE
% of total sample	48%	33%	27%	13%	21%	39%	100%
(n = 203)	(98)	(68)	(56)	(26)	(42)	(79)	(203)

The first column shows that 48% of the total sample were willing to pay a non-zero amount initially (WTP1), and 33% at the second opportunity (WTP2).

The second column shows that 27% of the total sample were willing to pay a non-zero amount only once at the first opportunity (WTP1), 13% were willing to pay only once at the second opportunity (WTP2), 21% were willing to pay at both opportunities (WTP1 and WTP2) and 39% offered only zero bids. The 13% who were willing to pay only at the second opportunity may have assumed that others would be willing to pay and so offered zero amounts, thereby exhibiting 'free-riding' behaviour. The extra information provided may have prompted them to reconsider their initial strategy and offer a non-zero amount at the second opportunity.

Overall, 61% of the total sample indicated non-zero bids and 39% zero bids. People who responded with zero bids (n = 79) were asked why, so as to determine the extent of 'protest' rather than genuine zero bids. Examination of the zero bids lead to 43 responses being excluded as protest bids, leaving a final sample size of 160. (see Appendix 4 for discussion on analysis of protest and outlier bids)

Range and distribution of willingness to pay bids

The frequency of dollar amounts that people were willing to pay (WTP1, WTP2 and total WTP) are presented below:

TABLE 2: Willingness to pay bids - excluding protest bids (n = 160)

$	WTP1 (frequency)	WTP2 (frequency)	TOTAL WTP (WTP1 + WTP2)	(%) OF TOTAL WTP
0	62	92	35	21.5
2	1	-	1	0.6
5	11	11	17	10.6
10	37	30	36	22.5
15	1	-	2	1.3
20	22	17	26	16.3
25	4	1	2	1.3
30	-	1	4	2.5
35	-	-	3	1.9
40	1	-	10	6.2
50	9	6	5	3.1
60	-	-	3	1.9
80	1	-	1	0.6
100	10	2	8	5.0
120	-	-	1	0.6
150	-	-	1	1.3
200	-	-	2	1.3
1000	1	-	1	0.6
TOTAL	160	160	160	100
			Mean = $30.01 Standard Error = $6.71 Median = $10	

The above data shows a rather lumpy distribution of bids clustered around 'popular' amounts - $5, $10, $20, $50 and $100. Kirkland (1988:112) speculates that when " ... people are faced with an unusual evaluation exercise they may revert to thinking in more comfortable and familiar lump-sum amounts". This postulation is confirmed here.

The wide variance in the bids can also be expected in general population surveys and arises from " ... the diversity of opinion in large heterogeneous populations." (Mitchell & Carson 1989:fn 224).

Value of Barmah

By extrapolating the sum of the respondents' bids to the population of Victoria a measure of value can be derived. To avoid double-counting the sample population's values, the relevant population needs to be adjusted for the sample. Specifically, value is:

$$\frac{\text{(population} > 18 - \text{number valid responses)}}{\text{number of valid responses}} \times \text{value of Barmah calculated from the sum of the sample total}$$

Using this approach, the maximum present day asset value that Victorians place on the Barmah wetlands, as described in the questionnaire, can be estimated:

$$\frac{3{,}250{,}117^{a} - 160}{160} \times \$4802^{b} = \$97{,}539{,}333$$

a - population of Victoria over the age of 18
b - sum of total willingness to pay

As the willingness to pay questions were designed to push respondents towards their maximum value, the calculation above should be considered the upper range of value. To determine a lower limit for the range of value, the above calculation is repeated using all data. In effect, this assumes that all the excluded protest (zero) bids were, in fact, valid zero bids:

$$\frac{3{,}250{,}117 - 203}{203} \times \$4802 = \$76{,}877{,}273$$

Thus, the estimated value of the Barmah wetlands, as described in the questionnaire, lies between $76.9 and $97.5 million.

Preservation versus Use Values

Respondents who provided a non-zero bid were also asked how they might apportion their bid to use and non-use values. Specifically:

> *Of the total amount you decided you might give, what proportion (%) of this do you feel is to save the wetlands so that:*
>
> *a) you can use them this year;*
> *b) you have the option to use them in the future;*
> *c) your children/future generations may use them;*
> *d) they exist, even if no-one may ever go there.*

The proportion allocated to option a) was considered a value for actual use, and options b) c) and d) for preservation. The relative proportions allocated were:

Option a) - use value	7.6%
Option b) - option value	21.4%
Option c) - bequest value	40.6%
Option d) - intrinsic value	30.4%

Applying this information to the total value calculated above shows the total preservation value of Barmah to Victorians is between $70.7 million and $89.7 million. Similarly, the value that Victorians place on being able to currently use the Barmah wetlands is between $5.8 million and $7.4 million. This breakdown indicates that existence values (i.e. the combination of intrinsic and bequest values) are the dominant elements in value, and that current use of the resource may not necessarily be a major factor in willingness to pay.

Correlations with willingness to pay

Correlation coefficients between total willingness to pay and selected variables showed very weak relationships overall (see Appendix 5). However, the signs of the coefficients were intuitively correct. There was a positive relationship between willingness to pay and both closer proximity to the Barmah wetlands and longer hours of employment. Higher bids were consistent with men rather than women, along with people who were aware of Barmah or who agreed with preserving the wetlands for their conservation values. A negative relationship was observed between willingness to pay and expressions of agreement with uses which would destroy or modify the wetlands.

Regression

Regression analysis was used to model the relationship between variables thought to influence willingness to pay.

The analysis was based on the following function:

$$\text{TOTAL WTP} = f(A, V, CUSE, NCUSE, CONS, MODIFY, SEX, AGE, Y, ED, PROX) \qquad (5.1)$$

where:

A	=	awareness of Barmah before the survey
V	=	whether the respondent had visited Barmah
CUSE	=	index showing likelihood to engage in a consumptive recreation use (duck shooting, hunting, fishing)
NCUSE	=	index showing likelihood to engage in a non-consumptive recreation use (walking, bird-watching, viewing the scenery)
CONS	=	index showing respondent's attitude to saving Barmah for its conservation values
MODIFY	=	index showing respondent's attitude to modifying uses of Barmah
SEX	=	of respondent
AGE	=	of respondent
Y	=	respondent's income
ED	=	highest level of education completed
PROX	=	proximity to Barmah

The variables Y (income) and ED (education) were excluded due to high number of non-responses. In order to include an indication of the effect of income on total willingness to pay, employment status was used to provide a proxy measure.

YPROX = proxy for income

Correlations between the variables used in the model indicated multicolliniarity was not a problem. Dropping and adding variables to the model had minimal effect on the regression, further suggesting that the independent variables are un-correlated.

The final equation:

$$\text{TOTAL WTP} = f(A, V, CUSE, NCUSE, CONS, MODIFY, SEX, AGE, PROX, YPROX) \qquad (5.2)$$

The variables in equation 5.2 were introduced into the model, four of which were rejected as they did not meet 0.500 significance level (AGE, V, A and CUSE). The remaining variables (CONS, MODIFY, PROX, YPROX, SEX and NCUSE) were included in the final equation. Results are shown in Table 3.

The data was transformed to natural logs and regressed to investigate the log-linear relationship. The variables from equation 5.2 were used, with V, A, and CUSE, being rejected. Results for both the original and log data are given in Table 3.

TABLE 3: Regression analysis

Independent variables	Dependent variable - Willingness To Pay: Original data	Dependent variable - Willingness To Pay: Log data
CONS	- 3.26 (-1.4)	- 0.47 1.3
PROX	31.22 (2.0)**	0.49 (1.2)
NCNUSE	- 6.41 (-2.2)**	- 0.82 (-2.6)**
SEX	-33.22 (-2.3)**	- 0.86 (2.5)**
MODIFY	- 11.32 (-3.0)***	0.61 (1.4)
YPROX	7.95 (1.6)*	0.69 (2.4)**
AGE	+	- 0.32 (1.3)
Constant	140.07	3.32
R^2	0.16	0.17

+ rejected
(t-values)

*** 99% significant
** 95% significant
* 90% significant

While the log linear model shows a slight improvement in R^2, there was a loss in significant t-statistics for the parameter estimates. Regardless, neither of the models show much of a systematic relationship between the independent variables and willingness to pay. Other surveys report similarly low R^2 values (Bennet 1984, Hageman 1986). Low regression values tend to be typical of surveys which use general populations, rather than homogeneous groups such as on-site recreation users. Indeed, Hageman (1986:49) remarks that

> '.. the reason that regressions have little explanatory power (in the willingness to pay bid function) is that utility functions which determine values for public goods tend to be highly individualized.'

6. CONCLUSIONS

If we accept that a person's willingness to pay is a measure of benefit, then the validity of the estimated value of the Barmah wetlands rests with two assumptions. First, that the data is unbiased, and second, that the sample values represent those of the average Victorian. With regard to the former assumption, the biases common to Contingent Valuation studies and surveys in general were addressed in the study and questionnaire design, following advice from theorists and practicioners. The continuing research on and application of the Contingent Valuation method further validates the method as one which produces replicable and reliable results.

With regard to the second assumption, comparisons between the sample and Victorian population's socio-economic characteristics drew acceptable parallels. Any potential bias in willingness to pay arising from the differences between the two data sets may have arisen in the following areas:

Gender	more women in the sample, suggesting a downward bias;
Employment	lower participation rates and higher unemployment rates in the sample, both suggesting downward bias;
Education	higher qualified sample suggesting upward bias; and
Income	higher income levels suggesting upward bias.

While it is difficult at this stage to estimate the net effect of these potential biases, the information obtained from the survey is nonetheless useful. Clearly, Victorians place a substantial value on the Barmah wetlands, enhancing considerably any economic value based on expenditure or cash flow data.. It appears that much of the economic value estimated from this study arises from non-use benefits arising from knowing the wetlands exist regardless of whether anyone uses them and exists for future generations. A comparatively small proportion of value arises from current use benefits.

The main results of the survey are reiterated:

i) Victorians place a value of between $76.9 and $97.5 million on the Barmah wetlands as described in the questionnaire;

ii) Values associated with preservation (non-use) of the wetlands are far in excess of current use values. Specifically, Victorians apportioned 92% of total value ($70.7 - $89.7 million) to non-use values and 8% ($5.8 - $7.4 million) to current use values;

iii) Analysis shows poor systematic relationship between willingness to pay and the respondents' characteristics. This reflects a) that the reasons why people value an environment are highly individualized and b) an expectation that responses from heterogeneous populations will vary more than specific user surveys.

Despite theoretical confirmation that contingent valuation studies are a useful tool in economic analysis, the values elicited through application of the method are often subject to criticism. Some say the values are too high and are concerned that decisions based on benefit-cost analysis which considers environmental values may reveal that resource uses which are financially optimal may not, in fact be socially optimal. Others say the values are too low and argue that certain environments are "priceless" and that economics can never capture true value. However, the important fact is that the evaluation process serves to facilitate responsible social choice and decisions made without full consideration of all effects cannot be considered optimal.

REFERENCES

Bennett, J.W. (1984) Using Direct Questioning to Value the Existence Benefits of Preserved Natural Areas, *Australian Journal of Agricultural Economics*, 28 (2 & 3), 136-152.

Cummings, R.G., Brookshire, D.S., & Schulze, W.D. (1986) *Valuing Environmental Goods - An Assessment of the Contingent* Valuation method, Rowman & Allenheld, New Jersey.

Hageman, Ronda (1985) *Valuing Marine Mammal Populations: Benefit Valuation in a Multi-species Ecosystem*, Administrative Report no. LJ-85-22, National Marine Fisheries Service, La Jolla, California.

Kirkland, William Thomas (1988) *Preserving the Whagamarino Wetland - An Application of the Contingent Valuation Method*, Unpublished Thesis for the Degree of Master of Agricultural Science - Massey University, Christchurch, New Zealand.

Mitchell, Robert Cameron & Carson, Richard T., *Using Surveys to Value Public Goods - The Contingent Valuation method*, John Hopkins University press, Baltimore.

Sinden , J.A. (1988) Empirical Tests of Hypothetical Bias in Consumers' Surplus Surveys *Australian Journal of Agricultural Economics*, 32 (2 & 3), 98-112.

APPENDIX 1 - STUDY AREA

The Barmah wetlands cover 29,500 ha of floodplain along the Victorian side of the Murray river between Tocumwal and Echuca. They lie about 3 hours drive or about 200 kms north of Melbourne. The area is made up of a collection of permanent and temporary wetlands such as billabongs, lakes, lagoons, marshes and grasslands.

The area over which these wetlands extend is also known as the Barmah Forest due to the predominance of River Red Gums (*Eucalyptus camaldulensis*) and associated vegetation. However, the frequent and often prolonged flooding combined with the vegetation mean that the area is more correctly termed a wetland.

These wetlands are important habitat for many animal species, several of which are significant (Tuan, Squirrel Glider, Carpet Python and Superb Parrot). Over 550 plant species have been recorded in the area, 27 of which have statewide significance due to limited distribution or rare occurrence.

Importantly, the Barmah wetlands are covered by two international conservation agreements which relate primarily to waterfowl and wetlands. They have been declared internationally significant under the RAMSAR (UNESCO 1971) convention which concentrates its efforts on waterfowl and wetland conservation, establishing reserves and other wetland issues. The Japan-Australia Migratory Birds Agreement (JAMBA 1974) requires that participating countries conserve habitats of bird species which migrate between the two countries and are listed under the agreement. Similar arrangements are being negotiated with China.

The Yorta Yorta Aboriginals have had a long and continuing association with the Barmah wetlands area, and hundreds of archaeological sites occur throughout. There is also evidence of more recent European history associated with timber and grazing activities.

Over 100,000 people visit the Barmah wetlands each year to engage in recreational activities such as camping, canoeing, fishing, hunting and walking. The Red Gums which rely on the flooding regime of the wetlands for regeneration are commercially harvested for sawlogs, sleepers, poles and firewood. When the water retreats from the open Red Gum forest areas, leaving grassy plains, designated parts of the wetlands are grazed by cattle by leasehold arrangement.

APPENDIX 2 - SAMPLE AND INTERVIEWING PROCEDURE

The sample for the pilot study consisted of 203 people from across Victoria, drawn from the Melbourne metropolitan area (n = 122) and rural Victoria (n = 81). Half of the rural interviews were conducted with people who lived within a 50 mile radius of Barmah (n = 40) to test for the effects of proximity to Barmah on willingness to pay. The Australian Bureau of Statistics (ABS) assisted with the sample design. Twelve collector districts (CD's) were randomly selected in the Melbourne metropolitan area, 4 within 50kms of Barmah, 2 in a rural city (Geelong) and 2 in a rural area (Yea district). The sample by location is shown below:

AREA	NUMBER OF CD's SURVEYED	DWELLINGS AVAILABLE IN EACH CD	VALID RESPONSES
Metropolitan			
Box Hill	4	903	41
Melton	4	1,258	41
Werribee	4	995	40
Rural City			
Geelong West	2	585	21
Rural Area			
Yea	2	262	20
Within 50 kms of Barmah			
Echuca	2	490	20
Kyabram	2	394	20
TOTAL	20	4,887	203

Approximately one in 24 dwellings was interviewed in the above areas. 10 interviews were to be completed in each CD, with oversampling in Box Hill, Melton and Geelong West (3 extra interviews). More than 10 dwellings were approached in all CD's to achieve 10 completed interviews as people were not at home or refused to be interviewed. Cost constraints prevented return visits. Instead, interviewers continued around the CD until 10 interviews had been collected. Interviewing took place at different times throughout the day and week so that working and non-working individuals were represented.

Random sampling was maintained by selecting every 10th dwelling along a predetermined route. Shops, offices, factories and accommodation houses were not counted in the skip interval of 10, nor selected for interview. A household selected for interview could be excluded if it was felt that personal safety could have been compromised. To avoid introducing a bias through subjective on-site route selection, a starting point was randomly selected and a route around the CD organised before interviewing commenced.

Once permission to proceed with the interview was granted, the respondent was given a booklet to assist them with answering the questionnaire. The booklet contained:

i) a map showing the location of the Barmah wetlands;
ii) 8 colour photocopies with accompanying text showing a sample of the wetland types, birds, flooding, recreation and productive uses of Barmah; and
iii) prompt cards to assist the respondent in answering some of the questions.

Interviewers followed a script to standardise the information given to respondents and reduce the scope for interviewer bias. Interviewers were instructed to delay answering queries considered extraneous to the actual interview until after the interview so as not to influence or bias answers with extra information.

APPENDIX 3 - PROFILE OF RESPONDENTS

TABLE 5: Profile of respondents comparing sample to Victorian residents

	% inSAMPLE	% in VICTORIA*
Sex		
Male	41	49
Female	59	51
Age		
18-20	4	3
21-30	27	24
31-40	24	23
41-50	15	17
51-60	12	12
over 60	19	21
Employment		
Unemployment rate	9	7
Participation rate	51	65
Education		
Up to secondary/not stated	67	71
Trade certificate/diploma	14	24
University degree	19	5
Income (n=111)		
less $14,999	25	9
$15,000 - $24,999	30	28
$25,000 - $34,999	24	33
$35,000 - $44,999	15	22
over $45,000	6	8

* Australian Bureau of Statistics - Information Services

APPENDIX 4 - ANALYSIS OF ZERO BIDS

Zero bids

Seventy-nine people responded to the two willingness to pay questions with zero bids. They were questioned further as to why this was to discriminate between protest and valid zero bids. The reasons for zero bids and the responses of the 79 people were:

a) 16% not enough information to place a dollar value
b) 3% did not want to place a dollar value on the wetlands
c) 39% disagree with paying money into a fund
d) 5% the wetlands are worth nothing (ie. don't receive any benefit from them and therefore see not reason to pay anything)
e) 34% couldn't afford to pay anything
f) 3% other

It was considered that people who gave zero bids and who answered a) b) or c) (n = 43) were registering a protest bid. While these people may value the wetlands, the questionnaire design was unable to elicit this. These responses were excluded from the data set for correlation and regression analysis.

Option c) registered the highest 'protest' factor (n = 29), indicating some payment-vehicle bias. These people were then asked whether they would rather pay for the preservation of the wetlands from State Government taxes (increase or redistribution) than pay into a non-government fund. The vast majority opted for the redistribution option (23 out of 29), possibly indicating that when faced with valuing public goods, some people may be more comfortable with ordering their preferences rather than indicating a monetary value.

People who indicated zero bids and who either d) or e) (n = 29) were considered to be registering genuine zero bids. This was 39% of all people initially responding with zero bids, and 14% of the total sample. These responses were retained in the final data set as genuine zero bids.

Outliers

Outliers are a common feature of Contingent Valuation surveys which use open ended format in the willingness to pay question as respondents are not constrained to an upper limit to their bid. The range maximum of the data in the current study was $1000. Careful inspection of responses to attitudinal and valuation questions showed answers consistent with a bid of this magnitude and the bid was therefore considered valid.

APPENDIX 5 - CORRELATION COEFFICIENTS

Four variables were compiled from responses covering respondents' attitudes to i) conservation and recreation uses of Barmah, and ii) uses which could potentially modify or destroy the wetlands. These were:

NCUSE — index of likelihood that people would engage in non-consumptive activities at Barmah (viewing the scenery, walking and bird-watching)

CUSE — index of likelihood that people would engage in consumptive activities at Barmah (hunting, duck-shooting and fishing)

CONS — index of respondent's attitude to preserving Barmah for conservation values (i.e. to study science, habitat, for rare and endangered species etc.)

MODIFY — index of respondent's attitudes to uses which could modify the Barmah (disposing of saline water and sewage)

Income and education were excluded from the analysis as there was a large number of non-responses for these variables. In order to include an indication of the effect of income on total willingness to pay, employment status was used to provided as a proxy measure for income and included in the analysis.

YPROX = proxy for income

TABLE 6: Correlation matrix

	PROX	YPROX	AGE	SEX	MODIFY	CONS	NCUSE	CUSE	VISIT	AWARE
WTP	0.178	0.143	0.022	-0.152	-0.182	-0.118	-0.154	-0.006	0.045	-0.123
AWARE[a]	-0.458	0.100	-0.279	0.128	0.151	0.081	0.092	0.154	-0.897	
VISIT[a]	0.324	-0.134	0.242	-0.050	-0.145	-0.090	-0.005	-0.082		
CUSE[b]	-0.030	0.010	-0.127	0.340	0.274	-0.163	-0.103			
NCUSE[b]	-0.039	0.016	-0.004	-0.091	0.154	0.207				
CONS[c]	-0.025	0.000	-0.472	-0.143	-0.097					
MODIFY[c]	-0.061	0.018	-0.198	0.005						
SEX[d]	-0.057	-0.151	-0.017							
AGE[e]	0.050	-0.415								
YPROX[f]	0.002									
PROX[g]										

Coding for variables:

a 0 = yes, 1 = no
b 1 = definitely not ... to ... 5 = definitely
c 1 = strongly disagree ... to ... 5 = strongly agree
d 1 = male, 2 = female
e 1 = 18-20 years old ... to ... 6 - over 60 years old
f 1 = not in work force/unemployed 2 = part-time 3 = full- time
g 0 = (Geelong, Melbourne, Kinglake and Yea), 1 = (Echuca and Kyabram)