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DESIGNING CHOICE MODELLING SURVEYS USING FOCUS GROUPS: RESULTS FROM THE MACQUARIE MARSHES AND GWYDIR WETLANDS CASE STUDIES

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ABSTRACT

This research report contains an overview of the methodology and the findings of eight focus groups that were used to develop choice modelling questionnaires for the Macquarie Marshes and Gwydir Wetlands case studies. The focus groups provided insight into what information was relevant for inclusion in the questionnaires, participants' preferences regarding wetlands and whether photos should be used. The groups were also used to refine draft questionnaires, with an emphasis on the design of choice sets. Various problems were identified in the draft questionnaires including bias, confusion, implausibility and indicator attributes. Corrective measures to minimise these problems have been suggested. Use of these measures in the draft Gwydir Wetlands questionnaires were found to reduce these problems.

1 Introduction

The key element of any choice modelling (CM) application is the questionnaire in which survey respondents are faced with a number of choices between alternative resource use options (Morrison, Blamey, Bennett & Louviere 1996). It is the analysis of the choices made by respondents that yields estimates of non-market values. The design of the questionnaire is therefore critical to a successful application of CM.

A CM questionnaire is made up of a number of components, including:

- a description of the study site;
- details of the proposed changes;
- a sequence of choice sets made up of combinations of site attributes at specified levels; and
- a series of socioeconomic and attitudinal questions.

To design these components, information must be gathered from external sources. For the Macquarie Marshes and Gwydir Wetlands case studies, this information has been reported in Morrison & Bennett (1997), and for the Desert Uplands case study in Rolfe, Blamey & Bennett (1997). The design process must also involve input from prospective respondents. Which attributes are regarded as important, the simplicity with which information needs to be presented, the clarity of presentation and the existence of bias, are all features of questionnaire design that can only be assessed through feedback from respondents. An effective way of securing this feedback is the use of focus group sessions.

A focus group is a planned discussion involving usually between eight to ten participants (Krueger 1988). The participants are guided by an experienced facilitator and the groups are held in a relaxed and non-threatening environment where participants are encouraged to share openly their opinions and attitudes about a specific topic. Many focus groups are held in specially designed rooms where the people in the group are seated around a table. For stated preference studies, focus groups are usually between one and a half and two hours in duration (Desvousges & Smith 1988, Rolfe & Bennett 1995).

Partly because of the dynamics that result from having a group of eight to ten people discussing a single issue, focus groups can be used to reveal many of the factors which drive people's decision making processes, as well as many of the potential problems within draft questionnaires (Krueger 1988). People are generally less inhibited within focus groups sessions, possibly as a result of other people sharing their views, and are more likely to express their opinions. Also, opinions expressed by others tend to stimulate people to become more critical. An advantage of using focus groups is that many problems with draft questionnaires, which may not be obvious in an in-person interview, may be revealed, and if a survey does work in a challenging focus group setting, there can be greater confidence that it will work when it is put into the field.

A sequence of focus groups was carried out to explore design issues for the CM questionnaires to be used to estimate the value of environmental improvements at the Macquarie Marshes and Gwydir Wetlands. The results of these focus groups are detailed in this research report¹. In Section 2 of this paper the results from the Macquarie Marshes focus groups are reported. The results from the Gwydir Wetlands focus groups are presented in Section 3. Section 4 contains a summary of the results of both sets of focus groups.

2 The Macquarie Marshes focus groups

In conducting the Macquarie Marshes focus groups, four main objectives were addressed. The first was to determine which attributes were relevant to participants and therefore could be included in the choice sets that form the core of the CM questionnaire. The second objective was to gain a better appreciation of the suitability of photographic material for inclusion in the questionnaire. In particular, it was important to determine what information photographs communicate to participants. The third objective for the focus groups was to test a draft questionnaire. This involved assessing whether the information

¹ The results from the remnant vegetation case study focus groups are detailed in Research Report No.4 (Blamey, Rolfe, Bennett & Morrison 1997).

presented was appropriate and whether the main issues were communicated effectively. It also involved understanding the process that participants used to answer choice sets. The final objective was to trial several alternative choice set formats.

In this section, the results from the four focus groups for the Macquarie Marshes survey are presented. The logistics for focus groups are initially outlined to show how participants were chosen for the groups. In Section 2.2 the results regarding attribute selection are reported. In Section 2.3 photo evaluation is discussed, and in Section 2.4 an evaluation of the draft questionnaire is detailed. In Section 2.5 the results from testing several alternative choice set formats are reported. Some conclusions from the Macquarie Marshes focus groups are offered in Section 2.6.

2.1 Macquarie Marshes focus group logistics

Two focus groups were held in Sydney on 20 and 21 November 1996 and two were held in Dubbo about a week later on 2 and 3 December 1996. All of the focus groups were facilitated by the principal author of this report.

The first Sydney focus group was held between 6-8 pm in North Sydney, while the second group was held between 10 am-12 noon in Parramatta. The aim of holding the Sydney focus groups in two different locations was to achieve a more representative sample of the Sydney population. The Sydney groups were held in specially designed focus group rooms that contained a one way mirror so that observers could watch the focus groups without disrupting the sessions. Both groups were video and audio recorded.

The Dubbo focus groups were held at the same location: the first from 6-8 pm on Monday 2 December, and the second between 10 am-12 pm on Tuesday 3 December. The Dubbo groups were held in a conference room within a motel and participants were seated around a table. Both groups were also video and audio recorded.

A professional recruitment agency (Applecorn Research) was contracted to select a sample of 10 people that was representative of the population in terms of age and sex for each of the focus groups. People approached as prospective respondents were told that the focus groups involved the discussion of an 'environmental issue' and payment was mentioned after they had agreed to attend. The two Sydney groups were selected through a random telephone survey about a week before the groups were held. The agency selected the people for the two groups in Dubbo by ringing contacts in Dubbo and asking them to invite people they knew. This method is not ideal, but is a pragmatic approach given the difficulty of recruiting participants for focus groups in country towns.

Nine participants attended each of the focus groups in Sydney and the first Dubbo group, and ten participants came to the second Dubbo group. The age and sex statistics for each of the focus groups is shown in the following table:

Table 2.1: Age and sex statistics for the Sydney and Dubbo focus groups

	Sydney		Dubbo		Total
	FG#1	FG#2	FG#3	FG#4	
Number female	5	9	5	6	25
Number 20-30 years	4	1	4	3	12
Number 31-50 years	4	5	3	4	16
Number 51-65 years	1	3	2	3	11

2.2 Wetland attributes

The first part of each focus group involved a general discussion. The discussion was designed to draw out the attributes of wetlands important to people in deciding whether to choose a particular alternative in the choice sets. Participants were first given a copy of a map of the Macquarie Valley that showed the location of the Macquarie Marshes. They were then introduced to the problem with the following statement:

The issue we're going to be discussing today is deterioration to the quality of the Macquarie Marshes in North-Western NSW. You can see where the Marshes are on the map. The Macquarie Marshes is the largest wetland in NSW. However it has deteriorated because the amount of water reaching the Marshes has fallen substantially. Less water is reaching the Marshes because it is now collected in Burrendong Dam, which is upstream of the Macquarie Marshes, and is used for irrigation.

A possibility is for the government to reduce the amount of water available for irrigation and to increase the amount of water reaching the Macquarie Marshes and thus improve wetland quality.

The facilitator then wrote two letters, A and B, on a whiteboard and stated the following:

Let's assume that there are two possible options that the government could follow in managing the Macquarie Marshes, option A and option B. If you were going to make a choice between the two options, what information would you like to know?

The rationale behind this question was to put participants in a position of choice, where they would reveal what information and attributes were important to them in making this decision. Information participants revealed could then be used to determine which attributes should be included in the choice models. Some information on wetland attributes was available from an earlier contingent valuation survey (Bennett, Blamey & Morrison 1997). However, the scenario for the Macquarie Marshes was different from this previous study, so different attributes may be relevant to participants. Through this form of questioning, participants would also provide an indication of what information should be included in the scenario description at the beginning of the questionnaire. In addition, participants would indicate their level of understanding of the Macquarie Marshes and its problems. An appreciation of what participants actually know is useful for determining how simple and exhaustive information in the questionnaire should be.

All of the comments made by participants were written on a whiteboard. Copying down their comments gave participants a greater sense that they were contributing, and also encouraged them to suggest ideas that had not already been registered.

The information requested by participants can be broadly grouped into two main themes: information about the Macquarie Marshes; and information about the impact of increasing flows to the Macquarie Marshes on irrigators and townships in the Macquarie Valley.

More specifically, participants wanted answers to the following questions about the Macquarie Marshes:

- Why the Marshes should be preserved?
- Of what benefit are the Marshes for wildlife?
- What is the effect of increased water on flora and native animals?
- What is the effect of extra water on the landscape?
- What species of fish have been affected?
- What has changed at the Marshes (because of the use of water for irrigation)?
- Can it be guaranteed that more water will benefit the wetland?
- Have pesticides or other pollutants caused the Marshes to decline?
- What are the current land uses around the Marshes?
- What will happen to farmers around the Marshes if there is increased flooding?
- Is it privately owned or a national park?
- How much water is required to flood the Marshes?
- What is the size of the Marshes?
- Do the Marshes receive water from other rivers?
- If the Marshes weren't there, would birds move to other wetlands?
- What would happen to migratory birds if the Marshes weren't there?
- What has been the effect of reduced water on erosion?
- Is there potential for tourism at the Marshes?
- Do the Marshes improve water quality?
- Have any introduced species or weeds affected the Marshes?

- Are there other options to make more efficient use of the existing water going to the Marshes?
- What volume of water went into the Marshes before irrigation, and what goes in now?

These questions indicate several potential attributes that could be used to describe environmental quality at the Macquarie Marshes. These are wetland area, native vegetation, wildlife, waterbirds and water quality. Several other questions were asked to help determine more precisely which wildlife attributes should be included in the choice sets. It appeared that participants were interested in knowing the effect on rare and endangered bird species, as well as on waterbird populations and the number of waterbirds breeding.

Participants were keen to know whether there would be adverse impacts on irrigators and communities in the Macquarie Valley from increasing allocations of water to the Macquarie Marshes. Participants wanted answers to the following questions:

- What would be the effect on irrigators' livelihoods?
- What is the flow-on effect to other industries, the community, shopkeepers?
- Would irrigators change their agricultural practices if there is less water?
- What is the effect of irrigation on the land eg salinity?
- How is the water going to be reallocated; will irrigators water licenses be changed?
- What did the farmers do prior to the building of Burrendong Dam?
- How much water is needed for irrigation?
- What is the water used to irrigate?
- Will there be any system for prioritising the water? Will it be Marshes first or irrigators first?
- Is there sufficient water for both the irrigators and the Marshes?
- Would enlarging Burrendong Dam solve the problem?

The emphasis that participants placed on knowing about the impact of a reallocation on irrigators and townships in the Macquarie Valley suggests a need to include an attribute in the choice model to reflect the impact of any reallocation on employment, and, possibly, regional income. The impact on employment and regional income appeared to be tempering many participants' views about whether there should be improved wetland quality at the Macquarie Marshes. Including one of these attributes may reduce variances by stimulating all respondents to consider environment-development trade-offs, rather than respondents considering development implications to varying degrees, as might be expected if such an attribute is omitted (Blamey 1996).

Participants were also interested to find out how the proposed changes would be implemented, whether economic and environmental impact studies had been undertaken, and what cost would be involved. Participants wanted to know whether the proposed changes were plausible. They wanted to know whether credible studies had been undertaken to evaluate the impact of the proposed changes and whether a credible organisation would be administering the scheme. Specifically they asked the following questions:

- How will the government determine how much water to release from Burrendong?
- What is the cost involved; will it involve extra taxes on people, or be paid for by the government?
- Who would administer the scheme?
- What's involved in administering the scheme?
- Are there any other organisations involved?
- What studies have been done? Any EIS's or economic impact studies?

In summary, this form of questioning was useful in identifying what information should be included in describing the background situation and the proposed changes. The discussions also indicated which environmental and developmental attributes should potentially be included in the choice models. These were wetland area, number of waterbirds, waterbirds breeding, rare and endangered species, vegetation, water quality, employment, regional income and cost. Except for rare and endangered species, employment and regional income, these attributes conformed with the attributes that were selected from the Bennett et al (1997) study for use in the draft questionnaire.

2.3 Photos

At the end of the first part of the focus groups, participants were asked if they would like to see some photos of the Macquarie Marshes. They were then each given a colour photocopy of 8 different photos (see Appendix 1). The top four photos were aerial shots while the bottom photos were taken at ground level. Photos on the left hand side of the page showed areas of the Marshes in a degraded state, while photos on the right hand side depicted areas of the Marshes in a healthy state. Several questions were then asked about the photos including:

- Do the photos look as you expected?
- Do these photos reflect the information presented earlier?
- What does this photo communicate to you?
- Is there any information that you would like to know about these photos?

In showing the photos, the aim was to determine what the photos communicated to the participants. Selecting photos for a survey is a difficult task. Many of the photos did not communicate what had been expected. The aerial shots in particular were confusing to participants and none appeared to be appropriate for use in the survey.

Participants thought that the ground level shots showing degraded areas of the Marshes didn't look at all like wetlands, and they were not inclined to believe that the areas shown had been wetlands. If the photos of degraded areas are to be used in the questionnaire, some information would need to be included to explain to participants why they looked unlike wetland areas. Several comments quoted verbatim below were made about these photos:

It's like a dry river, like in the Northern Territory. (S1)²

It's a typical dry country shot, not like a wetland. (S1)

It's like a western [movie]. Has a fire been through...the tree trunks are black? (S2)

The ground level shots that showed the Marshes in a healthy state coincided more closely with how participants thought the Marshes would look:

It's what I expected...obvious water and aquatic plants. (S1)

Like a Marsh...what I imagine it to look like. (D1)

It's how I remember it...lots of aquatic weed. (D1)

The second photo also looked like a wetland to most participants, although a number of participants thought it looked somewhat like a river or a billabong because of a slight river bank in the photo:

Looks still and picturesque...not like a river. (S1)

More like any river after rain. (S2)

Looks like a billabong or a river. (D1)

Participants asked a number of questions about the photos which may need to be answered in the questionnaire, including:

- What time of year were the photos taken?
- Where were they taken?
- Which photos are normal?
- Where are the animals and birds?

² S1 represents the first focus group in Sydney; S2 the second focus group in Sydney; D1 the first focus group in Dubbo; and D2 the second focus group in Dubbo.

- Will the degraded areas recover?
- Will the healthy areas remain healthy?

2.4 Reactions to the draft questionnaire

After discussing the photos, participants were asked to complete the draft questionnaire that had been prepared prior to the focus groups (see Appendix 2). This took about 30 minutes on average. Participants were then asked a series of questions about the questionnaire. In general, the questions focused either on how the participants answered the choice sets or their reactions to the information provided at the beginning of the survey.

2.4.1 Bias

After completing the questionnaire participants were asked ‘How did you find the questionnaire?’. The initial reaction of most participants showed that they thought the draft questionnaire was biased. Various reasons were given for the existence of bias. One reason given was that in the choice sets the only option was for increased water to be allocated to the Marshes. Participants felt that they could only select improved wetland quality or quantity; that they could not choose to continue the current situation or reduce wetland quality or quantity. An option ‘Choose neither A nor B’ was included, which in effect allowed participants to choose not to have more water allocated to the Marshes (see Section 2.5). However, many participants appeared to be unaware of the existence of this option, possibly because the attribute levels associated with it were not reported in the choice sets.

It doesn’t give you any alternative but to say yes to more water to the Marshes. (S1)

There’s not enough room...to make a valid decision...You’re tied down in what you want to say. (D2)

Another reason given for the existence of bias was a lack of information given about the irrigators and local towns in the Macquarie Valley, and the impact of the reallocation on them:

...it hasn’t done any impact studies on the impact on the community. (S1)

- 1 You really need to know the problems that it’s causing.
- 2 Is there a plus side for anyone? (D1)

...you’ve mentioned nothing about the farmers...and the effect farmers are having on the land...For people to make an informed decision they need both sides of the story...positive and negative effects of irrigation and of the Marshes. (D2)

The photos also proved to be a source of bias:

These photos—you’ve got the really nice greenie ones and then...each time the one that looks like hell. (D1)

A final reason given for the existence of the bias was an excessive concentration on the impact of the reallocation on waterbirds. Three waterbird attributes were included in the draft questionnaire: waterbird species, number of waterbirds and number of waterbirds breeding. Having so many waterbird attributes suggested to people that there may be a pre-existing agenda:

To me water quality was the big issue that should be addressed and I couldn’t understand why birds kept getting mentioned. (D2)

Removing bias is necessary for making accurate estimates of the value of improved wetland quality. It is also important for ensuring high response rates. People are more likely to share their opinions if they perceive that a survey is fair and allows them to express their views. Note how this respondent reacted to a perception of bias:

First of all I started ticking A and then I decided that I wasn't going to tick either and then I went back and crossed them out. I thought it was a trick. I didn't like how every option was giving water to the Marshes...(S1)

From these responses it appears that several measures could be used to reduce perceived bias in the choice sets. One relatively simple option is to include a 'continue current situation' alternative within choice sets. Another option is to use a 'balanced' choice set design where participants have the option of choosing reduced as well as improved wetland quality. A third option for the choice sets is to include an attribute that shows the effect on employment or regional income. A fourth option is to reduce the number of waterbird attributes. In terms of information provided in the questionnaire, information should be reported about the irrigators and the people in towns and how a reallocation would affect them. In terms of photos, a less biased approach may be to just include a photo showing the Marsh in a relatively healthy state to give respondents an idea of what the Marshes look like and avoid showing an extreme contrast.

2.4.2 Confusion

After participants were asked about their initial reactions to the questionnaire, the questioning focused on the choice sets. Each respondent was asked the following two questions: How did you answer the choice sets? What was the most important attribute for you? Several themes arose in each of the focus groups about how participants answered the choice sets. The first of these is that a number of participants found it confusing. This possibly reflects bounded rationality. There is a limit to what respondents can reasonably be expected to understand in a questionnaire (Simon 1982).

Some participants found it difficult to think about seven attributes:

...I can only focus on one issue... (S1)

...You had to really concentrate, that's what I was finding...it was easy to get confused. (D1)

Other participants became confused by what they perceived to be an excessive number of choice sets. They found 16 choice sets to be excessive. When asked how many choice sets would be reasonable to include in a census style drop-off and pick-up survey, most participants said that there should be no more than eight, and probably less.

The first time I was OK but towards the end I was confused because it gave me so many different options and I thought, 'Did I choose something the same back on the other page?' (D1)

Participants were also confused by the changing attribute levels across the choice sets:

You've got an increase in wetland area of 40,000 ha in Option A, Option B is 80,000 ha. Flip over to the next question and it's 40 and 80 again and you come down...the first two lines are the same and then they're just swapped over...that's where the confusion comes from—what are you getting at? (S2)

Confused with all those figures in the tables for a start...because all the other figures were switched and swapped around there...it looked like trick questions, it was confusing. (D2)

This confusion had several effects on the way participants answered the questionnaire. A few participants questioned the seriousness of the survey:

I started and then I was almost going to stop when I looked at the first few. I thought, was this for real? (D2)

Other participants sought to remedy their confusion by using strategies to answer the choice sets. In particular, they would try to focus on just one or two attributes, often justifying this strategy by suggesting that these were the important attributes or that the other attributes depended on the attribute that they selected. This strategy is explored more fully in Section 2.4.4.

I found it rather confusing to answer. At first I'm really studying each alternative and trying to consider it, and by question 10, I'm just looking at the cost of the good. (S1)

Water quality was the main one I focused on, regardless of the cost or anything...To look at it too carefully is just incredibly confusing. (S1)

Apart from reducing the number of attributes and choice sets in the questionnaire, confusion could be reduced by using a simpler main-effects experimental design³. The use of a main effects experimental design that does not allow for the estimation of attribute interactions⁴ could reduce participants' confusion because it is less likely to produce choice sets with what appear to be meaningless differences. Simplicity can also be increased by using a less efficient experimental design, such as an L^{mn} , where not all of the attributes in choice sets have different values across alternatives, rather than a foldover design where no attributes have the same value (see Mazzotta & Opaluch 1995). This reduces the number of trade-offs that a respondent would need to make in choosing their preferred alternative.

A further option for reducing confusion is to include the same number of attributes, but to have some attributes moving together. For example, waterbird breeding and endangered and protected species could always move together. This would potentially be intuitive for respondents, and would also mean that there are fewer trade-offs for them to consider.

2.4.3 Implausibility

Another question that participants were asked was whether any of the choice sets were implausible or contradictory. This problem has been identified in other conjoint analysis applications (Pearmain, Swanson, Kroes & Bradley 1991; Steckel, DeSarbo & Mahajan 1991). Some participants identified implausible options, but it did not appear to be an overriding problem. The main reason participants gave for implausibility was that they could not understand why certain attribute levels went together. Participants were not told in the questionnaire how each of the alternatives in the choice sets would come about. Rather the following statement was included in the questionnaire:

To keep matters simple, we do not describe how each management option would come about. For this reason, some options appear a little unusual, or even unrealistic. Bear in mind that there are a lot of ways that water can be managed, so that options which seem odd are actually quite possible.

Note the following comments made by participants:

A lot of the groupings are improbable...like poor water and more species and more bird breeding going together. (S1)

If you've got 80,000 ha of extra wetland why is water quality only fair? (S1)

I found it negated itself really, like why do this if you're not going to get anything out of it and spend sixty bucks for it? It compromised itself the whole way through. It didn't back itself really...it's just wishy washy, it's not black and white it's just grey. (D1)

This suggests a need to explain why different alternatives, that may appear odd, could occur and are being evaluated. If participants understood why certain seemingly implausible alternatives were possible, they may be less confused by unexpected changes in attribute levels.

³ An experimental design is a statistical method of designing choice sets by varying the attribute levels of each alternative (see Morrison et al 1996).

⁴ One of the objectives of the focus group was to test for the existence of attribute interactions. An attribute interaction occurs if the importance of one attribute depends on the level of a second attribute. For example, a respondent may prefer an increase in waterbirds when accompanied by an increase in the area of trees. There were, however, few indications of two way and higher level interactions. Most participants appeared to have additive preferences, possibly because answering the choice sets is cognitively demanding.

Explaining why unusual alternatives are possible has an additional advantage. A number of participants were irritated because there was no explanation of how the alternatives were derived. Some participants felt that by leaving out this information they were being manipulated. Others felt that without the information they were not capable of making an informed decision. Others commented that if the information was provided, it would probably influence how they would answer the choice sets:

- 1 Are they really saying it for that reason or is it because they want to keep the information from us so that we can't make a more informed decision. I mean we might change all those answers if we had more information to go on...I think we need more time and more information to do this survey justice.
- 2 It says bear in mind that there are lots of ways that water can be managed but they're not telling us what they are.
- 3 I don't know what has brought about these choices and as I went along I was getting more and more sceptical...I didn't know what to tick and why. (S2)

Not specifying the actual level of the attributes, but changes in attributes associated with each option, also appeared to add to implausibility. Participants identified problems that they would not have cited if they had been more aware of the actual levels of the attributes:

If you've got the smaller area, and you've got 160,000 birds and you've got new species coming in and they're all breeding like mad and you don't have a lot of trees then you'll have another type of disaster, not just lack of water. (S1)

Implausibility also appeared to cause participants to focus on one or two attributes:

I didn't think that they were very realistic so for just about every one I took the cheapest. (S1)

I actually got quite irritated with the questions...because there are so many and they are unrealistic...in the end I was just looking for good water and the price didn't worry me. (D1)

2.4.4 Indicator attributes

In the focus groups, many participants concentrated on a single attribute when selecting their preferred option from each choice set. For most participants this attribute was water quality, although for a few participants it was the area of healthy river redgums. Rather than evaluating each attribute additively, or even in an interactive way, participants used this single attribute to indicate what would happen to the other attributes. Under this strategy they typically argued that if one attribute was of good quality then the other attributes would 'follow', even though a close examination of the choices would have revealed a contradiction:

...my main focus was water quality because I thought that if the quality of the water was good then everything else would just fall into place. (S2)

...if you don't have healthy redgums the birds can't be supported anyway. (S2)

I went for water quality because if the water quality is good all the rest will take care of itself basically. (D2)

The use of this 'indicator attribute' strategy⁵ is a serious problem because, in effect, participants are dismissing the information about the other attributes in the choice sets. Even if in an alternative, say, the levels of all the other attributes fell but water quality increased, participants would believe that, in the long-run, the levels of the other attributes would actually increase. The result is that it may not be possible to determine the importance that participants' attach to each of the attributes.

Before developing remedies for reducing the use of this strategy, it is necessary to understand why participants use them. In the previous sections, two possible reasons were given for the use of indicator attributes: implausibility and confusion. If participants consider that the survey is implausible (and bias could have the same result) they will not give it careful attention and only focus on one or two attributes.

⁵ In Research Report No.4 this strategy is referred to as the causal heuristic (Blamey et al 1997).

If participants see it as confusing, that their bounds of rationality have been exceeded, they may use a strategy whereby they focus solely on one or two attributes to simplify how they answer the choice sets (see also Blamey et al 1997). Another possible explanation is that participants genuinely believed that the attributes were related, so that, say, water quality is a good proxy for many of the other attributes. In the absence of an adequate explanation about the independence of the attributes, participants may have dismissed much of the information in the choice sets and reverted to default assumptions about what would happen as a result of changes in what they consider to be critical attributes.

Following from these explanations are several options for minimising the use of the indicator attribute strategy. The first option is to reduce implausibility and bias so that participants take the survey more seriously and consider more carefully all of the attributes. In particular, explanation needs to be given about why each of the attributes are independent. Second, confusion should be reduced by limiting the number of attributes used in the choice sets. Another option is to be explicit about the timing and permanency of the changes stated in a choice set so that participants are less likely to look for second round effects whereby changes in one attribute leads to changes in other attributes.

2.4.5 Adequacy of information

After questioning how they answered the choice sets, participants were asked questions about the adequacy of the information in the draft questionnaire. These questions included: ‘Was there any information that was not in the questionnaire that you would have liked to have known?’; and ‘Was there anything that you thought was unclear or ambiguous?’.

Many comments were made about the insufficiency of the information presented about irrigators in the Macquarie Valley, with participants wanting to know the following information:

- Who are the irrigators?
- Will the purchase of water be one-off ?
- Will there be pressure on farmers to sell the water?
- From whom is the water being bought?
- Is there any excess water in Burrendong Dam?
- Will farmers sell water if they don’t have enough?
- Do farmers currently pay for their water?
- What are the benefits of irrigated agriculture to the surrounding community and the economy?
- What will be the effect of the existing reallocation on farmers and on the Marshes?
- Why has the government reallocated water?
- Why and how were the farmers given the water in the first place?
- How much water do the irrigators currently get?
- What are the negative effects of irrigation on the land and on water quality?
- What type of crops are irrigated?

The lack of information about the irrigators appeared to cause some participants to be concerned about the negative effects of a reallocation. Note the following comment:

We don’t have any information about the farmers or the irrigators so we keep coming up with reasons about why we shouldn’t be concentrating on the Marshlands. We keep getting back to how it will affect farmers because we don’t have this information. (S1)

Many participants found the information about the water trading market ambiguous and difficult to understand. Participants asked the following questions:

- How does the water trading market work?
- What is the market’s geographic boundary?
- Who trades in the market?
- From where will the extra water come?
- How much water do the irrigators actually need?
- Will the water be purchased each year?

2.5 Alternative choice set formats

In the choice set format used in the draft questionnaire, the attributes were expressed as increments to the current situation (see Table 2.2).

Table 2.2: Draft Macquarie Marshes questionnaire choice set format

<i>Feature</i>	<i>Option A</i>	<i>Option B</i>
Increase in wetland area	40,000 ha	80,000 ha
Increase in area of healthy river redgums	5000 ha	10,000 ha
Increase in number of waterbirds	80,000	160,000
Increase in waterbirds breeding	20,000	40,000
Increase in waterbird species	10	20
Water quality	Fair	Good
Increase in water rates	\$30	\$60

I would choose A *I would choose B*
I would choose neither A or B

It was thought that choice sets might be simpler to answer if the alternatives were expressed in increments and participants only had to read two and not three alternatives. However, this hypothesis needed to be tested, so three alternative formats were trialed at the end of each focus group. The first alternative involved fewer attributes (see Table 2.3). This alternative was well received, as shown by the following comments:

You've got less to worry about but you're also learning less. (D1)

1 Just easier on the eye.

2 This covers basically what you need to know—it's nice. (D2)

Table 2.3: A choice set with fewer attributes

<i>Feature</i>	<i>Option A</i>	<i>Option B</i>
Increase in wetland area	40,000 ha	80,000 ha
Increase in area of healthy river redgums	5000 ha	10,000 ha
Increase in waterbirds breeding	20,000	40,000
Water quality	Fair	Good
Increase in water rates	\$30	\$60

I would choose A *I would choose B*
I would choose neither A or B

Participants were then shown an alternative in which the current situation was specified as 'Option C' (see Table 2.4). There was strong support for this alternative:

Option C on that one is good because it gives you a basis. You know what's what now. (S1)

It's giving us a starting point. We know where we are now, here [the original] you don't know where you're coming from. (S2)

Yes I think you need to know what's actually happening there now...I mean if you've got no idea how big it is now... (D1)

Table 4: A choice set with the current situation specified

<i>Feature</i>	<i>Option A</i>	<i>Option B</i>	<i>Option C: Continue Current Situation</i>
Wetland area	170,000 ha	210,000 ha	130,000 ha
Area of healthy river redgums	35,000 ha	40,000 ha	30,000 ha
Number of waterbirds	280,000	360,000	200,000
Waterbirds breeding	40,000	60,000	20,000
Waterbird species	40	50	30
Water quality	Fair	Good	Poor
Increase in water rates	\$30	\$60	\$0

I would choose A *I would choose B* *I would choose C*

Participants were then asked whether they would prefer a combination of these two alternatives, where there were fewer alternatives and a constant base. There was agreement in all focus groups that this is the preferred alternative.

2.6 Conclusions from the Macquarie Marshes focus groups

The main factors that appeared to be relevant to respondents in deciding whether to support a particular reallocation option related to the impact of a reallocation on the Marshes as well as on irrigators and local communities. Any of the following attributes could be included in the questionnaire: wetland area, number of waterbirds, number of waterbirds breeding, endangered species, native vegetation, water quality, employment, regional income, cost.

It was apparent that aerial photographs caused confusion amongst participants. Ground level photos were more effective in communicating to participants what the Marshes look like. Distinct contrasts between healthy and degraded areas in photos appeared to be a source of bias.

Several problems were encountered in the draft questionnaire. The most significant was the ‘indicator attribute problem’ which occurs when participants use one attribute as a proxy for several other attributes. Various causes for this problem were noted including implausibility, bias, confusion, and participants giving disproportionate importance to certain attributes.

Participants noted a lack of information about irrigation in the Macquarie Valley and the effect of the reallocation on local towns in the draft questionnaire. There was also confusion expressed about the water trading market. Extra information about irrigation, the effect on employment and about the water trading market will need to be included in the questionnaire.

Alternative choice set formats were trialed in the focus groups. Participants preferred a format which had fewer attributes and an option to continue the current situation specified within the choice set.

3 The Gwydir Wetlands focus groups

The primary objective of the Gwydir Wetlands focus groups was to trial several different draft choice modelling questionnaires relevant to the Gwydir Wetlands case study. These were based on the draft Macquarie Marshes questionnaire and the conclusions reached in Section 2.6⁶.

The logistics of the focus groups are reported in Section 3.2. Participants’ reactions common to each of the draft questionnaires are reported in Section 3.3, while responses associated with different

⁶ The questionnaire was edited by Ed Highley of Arawang Pty Ltd prior to use in the focus groups. A copy of part of one of the questionnaires trialed in the Gwydir Wetlands focus groups is contained in Appendix 3.

questionnaire formats are reviewed in Section 3.4. In Section 3.5 some conclusions from the Gwydir Wetlands focus groups are offered.

3.1 Differences between the Macquarie Marshes and Gwydir Wetlands questionnaires

A number of changes were made to the draft Gwydir Wetlands questionnaire based on the findings of the Macquarie Marshes focus groups. The most significant of these changes are as follows:

- Framing

In the Macquarie Marshes questionnaire respondents were asked to rate the importance of improving wetland quality at the Macquarie Marshes relative to the importance of five other environmental issues. Because of the difficulty expressed by some participants in providing this rating, a simpler but more comprehensive framing was used in the Gwydir Wetlands questionnaire (see Bennett et al 1997).

- Information about irrigation

To reduce bias, a page of information was included about irrigation in the Gwydir Valley. This included information on production, employment, water use and water trading.

- Information on why attributes change independently

A primary cause of confusion, implausibility and the indicator attribute problem in the Macquarie Marshes questionnaire was a lack of explanation about why attributes change independently. In the Gwydir Wetlands questionnaire, the following paragraph was included to provide an explanation of this:

The removal of water for irrigation has altered the natural pattern of flooding. This has had a different effect on each aspect of the Gwydir Wetlands. Wetland vegetation requires regular floods of various sizes to remain healthy. Waterbird breeding requires flooding of sufficient size at a suitable time of year. Endangered species require the preservation of certain habitats through regular flooding. These different flooding needs mean that water managers must choose which aspect of the Wetlands to preserve if extra water is available.

- Photos

No photos were included in the draft Gwydir Wetlands questionnaire. Rather, participants were given a sheet containing four different photos of the Gwydir Wetlands (see Appendix 1). All of these showed the Gwydir Wetlands in a healthy state. It was envisaged that one of these photos, together with a photo of a cotton farm, would eventually be used on the cover of the questionnaire.

- Experimental design

Main effects experimental designs were selected from Hahn & Shapiro (1966) for the Gwydir Wetlands questionnaires. Two way and higher level interactions were assumed to be negligible. For three versions of the questionnaire an L^{mn} design was used, and in the fourth version a foldover design was used. L^{mn} designs were favoured because they are generally simpler for respondents to answer, even though they are less efficient. To reduce implausibility, experimental designs for the Gwydir Wetlands questionnaires were selected to have few dominant options. All remaining dominant options were deleted.

- Choice sets

Based on the conclusions of the Macquarie Marshes focus groups, two alternative choice set formats were trialed in the Gwydir Wetlands focus groups. The first is a 'non-balanced' choice set format (see Table 3.1), while the second is a 'balanced' format (see Table 3.2). In contrast to the draft Macquarie Marshes questionnaire, in the non-balanced format a constant base was included, all of the attributes (except household cost) were expressed as absolute values rather than as increments, and labels were used. In the balanced format, respondents have the option of choosing reduced as well as increased water to the wetlands.

Table 3.1 The non-balanced choice set format

Outcome	Option 1: Continue current situation	Option 2: Increase water to Gwydir Wetlands	Option 3: Increase water to Gwydir Wetlands
Water rates	no change	\$100 increase	\$30 increase
Employment	2800	2780	2720
Wetland area	400 km ²	800 km ²	500 km ²
Waterbirds breeding	every 5 years	every 2 years	every 4 years
Endangered and protected species	12	20	14

Choice (tick a box)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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Table 3.2 The balanced choice set format

Outcome	Option 1: Continue current situation	Option 2: Increase water to Gwydir Wetlands	Option 3: Reduce water to Gwydir Wetlands
Water rates	no change	\$30 increase	\$30 rebate
Employment	2800	2780	2880
Wetland area	400 km ²	800 km ²	100 km ²
Waterbirds breeding	every 5 years	every 2 years	every 9 years
Endangered and protected species	12	20	4

Choice (tick a box)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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- Attributes

In the Gwydir Wetlands questionnaire the number of environmental attributes was reduced from six to three. The three waterbird attributes were replaced by two attributes: frequency of bird breeding events, and number of endangered and protected species using the wetland as habitat. Frequency of bird breeding was used because of a lack of information about actual numbers of waterbirds breeding, and because it was thought that it would be easier for respondents to comprehend. Endangered and protected species was used because participants in the Macquarie Marshes focus groups indicated that it was an important attribute. Area of healthy river redgums was excluded because it was similar to the wetland area attribute and there was an obvious need for parsimony, and because wetland area was thought to be more useful for benefit transfer. Water quality was deleted because the Gwydir Wetlands are terminal and it is therefore not an outcome that would be achieved by increased flows to the Gwydir Wetlands.

In two of the focus groups (one in Sydney and one in Moree) an employment attribute was also included. This was only included in half of the groups because it did not appear to be obvious that a

decline in employment would result from the government purchasing water from irrigators (see Section 3.4).

3.2 Gwydir Wetlands focus group logistics

Two focus groups were held in Sydney on 16 and 17 April 1997 and two were held in Moree on 18 April 1997. All of the focus groups were facilitated by the principal author of this report⁷. The first Sydney focus group was held in North Sydney between 6-7.30 pm, while the second group was held in Parramatta between 10-11.30 am in the same locations as the Macquarie Marshes focus groups. The focus groups held in Moree were conducted in a conference room in the Skillshare offices between 2-3.30 pm and 6-7.30 pm. All four of the focus groups were audio and video recorded.

A professional recruitment agency (Applecorn Research) was again contracted to select participants for the Sydney focus groups, using a similar approach to that described in Section 2.2. The participants for the Moree groups were recruited through a contact in Moree⁸. There were seven participants in the first Sydney focus group and nine in the second group. There were ten participants in the first Moree group and eleven in the second group. The age and sex statistics for each of these groups are shown in the following table:

Table 3.3: Age and sex statistics for the Sydney and Moree focus groups

	Sydney		Moree		Total
	FG#1	FG#2	FG#1	FG#2	
Number female	2	4	5	3	14
Number 20-30 years	2	1	3	6	12
Number 31-50 years	3	5	5	1	14
Number >51 years	2	3	2	4	11

3.3 Reactions to the draft Gwydir Wetlands questionnaires

At the beginning of each focus group, participants were asked to complete the draft questionnaire. This took most participants about twenty minutes.

3.3.1 Bias

The initial reactions in the Gwydir Wetlands groups revealed that the extent of bias had been reduced in comparison to the draft Macquarie Marshes questionnaire. In only one of the four groups was the initial reaction that the questionnaire was biased, and less than half of the participants in this group expressed this reaction, as shown by the following comments. None of the participants in the Sydney groups noted the existence of bias, although one participant in the first Sydney group commented that it was not possible for them to know because of a lack of knowledge:

I think it is good because I really don't know much about it and it brings it to your attention that there are problems out there that I'm not really aware of... (S3⁹)

Well the information I'm not so sure about...I mean I know nothing about it. Who's writing it, what are their interests...? (S3)

I thought that it was quite reasonable (S4)

Little bit one sided isn't it...biased from the start (M2)

⁷ Russell Blamey assisted in facilitating the first of the Sydney focus groups, and Jeff Bennett assisted in facilitating the two Moree groups.

⁸ This proved to be a much more cost-effective means of recruitment, and was identical to the approach used by Applecorn Research in Dubbo.

⁹ S3 represents the first Gwydir Wetlands focus group in Sydney; S4 the second Gwydir Wetlands focus group in Sydney; M1 the first focus group in Moree; and M2 the second focus group in Moree.

It could have been termed inflammatory in certain parts. It raises a lot of areas that people have held back for some time...(M2)

More careful probing revealed that many of the participants in the Moree groups, who believed that the questionnaire was biased, thought that the bias was subtle and difficult to identify:

- 1 I think that it's pro-wetlands
- 2 But I don't see how you'd get away from it
- 3 It's just the issue
- 4 You could talk more about the economic benefits of the irrigation for Moree. (M1)

- 1 Yes...it's just my initial impression. They...have some stuff later on about cotton. But it still seemed more against it.
- 2 I didn't think it was biased. It presents both sides...
- 3 My initial impression too, but I can't put my finger onto it.
- 4 Just initial things like...wetlands disappearing. (M2)

Many participants felt that the extent of the bias was not particularly large, as shown by the following exchange with a participant who had a background in the cotton industry:

- Q: Would you be angry and say well I'm not going to do it because it's so one-sided?
A: No I don't think it's that strong

Some participants were able to identify parts of the questionnaire that were causing bias. A few participants thought it was biased because the uncontrolled flooding in the wetlands area that occurred before Copeton Dam was constructed was not mentioned:

- Q: So you'd want to know the beneficial effects of the dam [for the wetland]?
A: Oh, absolutely, yes...I think that Sydney people should get that sort of thing because they don't understand irrigation. It's like criticising motherhood when you criticise not having water for wetlands. (M1)

Another source of bias identified was the phrase 'The removal of water for irrigation':

Just your first sentence there 'The removal of water for irrigation'. It hasn't been totally removed...it's very confrontationalist...it makes people think that it's taken all the water. (M1)

The opening paragraph in the questionnaire may also be a source of bias, although this was questioned by other participants, as shown by the following exchange:

- 1 The opening paragraph says that the wetlands have fallen because of Copeton Dam irrigation. That basically slaps the irrigators in the face when you start...
- 2 It's a true statement
- 3 How cushy do you want to make it really. If you're just laying out the facts and you're a sensible person, surely you can make your own judgment. (M2)

Another source of bias identified was in the paragraph on water use:

Varying the water use. Then it goes on to say 'However this is supplemented by...' Is this making the reader feel that they're always going to get their 100%...? (M2)

A final source of bias identified relates to the rationale given for why farmers would choose to sell water:

It implies that present irrigation practices are very inefficient. (M2)

3.3.2 Confusion

While bias had been considerably reduced in the draft Gwydir Wetlands questionnaire compared to the draft Macquarie Marshes questionnaire, many participants still appeared to find the questionnaire confusing:

1...it was bloody confusing

2 In 15 minutes it was a bit overwhelming. If you're wanting to respond...and take on board all the facts and figures...it's sort of a bit difficult to cut to the chase. (S3)

I think it's good to have the opportunity to give your view on such things because it's easily done but this survey is not so easily done. (S4)

Reading this is a bit complicated for me and a lot of Aboriginal people. (M1)

However, the extent of the confusion was notably less than with the draft Macquarie Marshes questionnaire. Some participants thought that, while the questions were difficult, they were able to express their preferences. Moreover, the replies of many participants about how they answered the choice sets can be viewed as being in line with the assumptions of random utility theory. This suggests that the effect of confusion on these participants may have been limited:

I concentrated on the wetland area...I think I only chose the \$100 increase once when the waterbird breeding came in at two years. (S4)

Pretty much the same in regard to the hip pocket nerve but also I took into consideration the area and the species... excepting one case...where the \$100 increase brought great changes or in one case absolutely nothing for a \$30 increase. (S4)

If you look at...[the] \$100 increase...and you say 'well I'm not [prepared to pay it]' so you don't...If you'd like to see the area doubled and birds breeding there every two years then there's an option there...I didn't find it that difficult in that if you sat down and looked to all the different options...You nut out what you want and try and find your best fit. (M1)

Most of my answers revolved around the breeding time...and rates and things...maintaining it and bearing in mind the town's business. (M1)

Various reasons were given by participants for the existence of confusion. Some participants found the choice sets difficult to understand:

1 You need to go over it several times. I changed a couple of my answers after I perused it.

2 I did that too...I crossed out the ones which I had actually ticked and changed them to a different box after I had read further...and discovered that there were several options. (S3)

Really the only thing I felt happy about committing myself to was the amount of money I'd be prepared to put into it. (S4)

What has tricky questions got to do with what we feel should be done?...You want to ask a...straight out question whether we want more water to go to the watercourse or whether you don't...but I tell you I couldn't work out this. (M1)

1 Damned confusing...all these boxes and things. When I first looked at them I thought they were all the same...It was only when I came back and had a look that I thought, oh, it's not quite the same.

2 It was hard...it's a very subtle change that you're...looking for. (M1)

Other participants found it difficult to understand how the water trading market worked. In particular there was confusion about the difference between charges for the use of water and costs associated with the permanent purchase of water licenses:

1 Why has water become so expensive?

2 I got a little bit confused. In the water use farmers paid about \$5/ML for the water they use each year. I found it difficult seeing the relationship...to the price of the water rights.

Q: Water rights: that came across as a yearly amount?

1 Sort of seems to me that it is per year. (S4)

One participant was also confused about the attribute 'endangered and protected species', thinking that increasing the number of endangered and protected species was a negative outcome:

If I'm really a greenie I'd want to save as many endangered species as I probably could. I'd always be choosing option 3 because you've got less endangered species...it does seem strange that now we're going to increase the area of the wetland and we're going to have 20 endangered species. (M2)

These responses suggest that there is a need to simplify choice sets, and also that the information presented in the questionnaire needs to be simplified and clarified further so that respondents can better comprehend what is presented to them and feel that they can meaningfully contribute to the survey. The extent to which the questionnaire can be simplified, however, must be tempered by the possibility that simplification may involve the exclusion of potentially relevant information.

Some participants (mostly from S4) indicated that confusion resulted because their general understanding and knowledge about the Gwydir Wetlands was limited. These participants suggested that, because of their limited knowledge they were not capable of responding to this survey and that the survey would be more appropriately completed by people in Moree¹⁰. Some participants in Moree had a similar attitude: they did not think that Sydney people should be completing the questionnaire.

1 Should be done by the people living in that area

2 They know the area better and probably have seen the changes and what the effects have been on bird migration there and they'd be better to make comments. (S3)

1 Rather complex really...too many options...I mean what are people more interested in: are they interested in how much it's going to cost them or the size of the wetlands or the bird species and that changes each time.

2 They're also extremely specific for people like us who are fairly removed from the situation and obviously something you don't give thought to on a day to day basis....I don't know...what would be the best option to look for.

3 It's nice to have been asked these questions but I'm not the person to ask, because if you ask me about televisions I can tell you how they work because that's my job, but I'm not an expert on how much area you need for a heron to successfully reproduce and survive... (S4)

1 I'd rather have someone tell me 'look there are so many numbers of birds and this is the cycle that we need...to have them reproducing ...and this is how much area we need for them to successfully survive'...I'm worried that a whole lot of people who don't really know anything about it will put all these forms in and then from that data comes the magic number which could be totally wrong...there must be a very critical number...

2 ...you've got to have some specialist understanding of the whole situation cause otherwise you can't make an acceptable comment. It's not up to the average Joe Blow to be able to come up with the answer to the situation presented to us... (S4)

On an initial reading, these comments may cast doubt on the appropriateness of undertaking choice modelling exercises outside the region in which an environmental issue is occurring, and suggest that the more straightforward contingent valuation method may be more appropriate. It is, however, possible that part of the problem, especially in Sydney, is that participants were asked in the draft questionnaire how they would like the Gwydir Wetlands to be *managed*. Participants felt unable to say how it should be managed, because they did not fully understand the ecological or the economic issues. If the emphasis was instead placed on finding out what aspects of the wetland are important to people, or that they would like to see preserved, rather than how they thought the wetland should be managed, this

¹⁰ This response has been identified in other situation involving the estimation of non-use values (eg Bennett, Blamey & Morrison 1997)

problem may have been minimised. Respondents who have limited knowledge about an area may be much happier to reveal their *preferences* rather than stating what they think *should be done*.

3.3.3 Implausibility

Compared to the draft Macquarie Marshes questionnaire, there was less evidence of implausibility. In terms of the choice sets, respondents generally appeared to find them plausible. However, it was apparent that some participants did not understand the relevance of the paragraph explaining why unusual alternatives were actually possible because it was included too early in the questionnaire. Note, in particular, the first comment:

- 1 I kept wondering if there was a big area why aren't there more birds? Why don't things correlate?... I found it a really confusing thing...Now I've read it and noted it and now I understand where you're coming from. I kind of didn't notice it. What you're saying is it depends on water releases, it's not just a matter of size of the wetlands area.
- 2 It wasn't relevant enough until you'd gone through the rest of it. (S3)

Is there an ideal answer for the wetland area that waterbirds breed in and endangered species?
(S4)

I based my decision...on quality and not quantity...having a huge wetland is probably going to guarantee you a great quality of bird life and breeding seasons etc but there should be a point where you are still going to get pretty good quality in terms of your endangered species increasing and your breeding cycles coming down. (M1)

Some participants commented that they found it difficult to treat each of the choice sets as independent. One remedy for this problem could be to put each choice set on a separate page:

Trick questions...how you answered question four related directly to how you should answer question six. The increase in water rates was \$30 whereas in this one it was \$100...with the same wetland area...breeding cycle...endangered species and employment. (S3)

Like they were meant to be totally independent of each other but you sort of got a feeling that if you answered one way for one [it excluded you from answering a certain way for other options]...They weren't really separate entities. (S4)

I don't understand why they can do one thing that would cost \$100 and...they can do the same for \$30...why the differences?...I suppose they're giving us options which we would prefer. (S4)

Participants also suggested that some parts of the payment scenario were implausible. In the Moree groups some participants questioned whether the government would actually purchase water from irrigators rather than simply reducing their allocations:

Option 2: is that...fair dinkum? I thought like if they want the water they'd just take it. (M1)

Q: Did you believe it when you read it, did you think it was reasonable?

[Several nos]

1 I didn't think they'd buy it

2 I did. (M1)

Q: Did you believe it...the government buying rights?

[Two yeses]

1 I don't really know

2 I'm against the whole concept

3 If that system is voluntary and it's not taken up there will be some scepticism. (M2)

Some participants doubted that irrigators would agree to sell water, except in a fairly narrow set of circumstances. This suggests that further explanation needs to be given about why irrigators would agree to sell water.

I've never known a farmer to have too much water (M1)

- 1 ...I don't think that the government has got a hope in hell of buying any back to be honest.
- 2 It all hinges on the fact that the growers will sell the water because they want the money and it's generally not the case...
- 3 ...the people that...have licenses to sell are probably people who want to get out of the industry; [people]...who have gone through pretty rough times with the drought and have got to sell; and unused licenses...that would be the three categories. (M2)

A few respondents also questioned whether it was possible to save water through increased efficiency. They typically noted that drip irrigation, which is a method suggested for improving water efficiency, had not proven very successful. This suggests a need to elaborate more carefully how water could be saved.

My theory was with the drip irrigation and it's not necessarily working properly...(M2)

Finally, one participant commented that the suggestion that some farmers might cease irrigating and return to dryland farming was implausible. He suggested that once farmers had made the investment necessary to set up irrigation, there was no way that they would return to dryland farming because their capital investment had been too great.

3.3.4 Indicator attributes

There was little evidence of the indicator attribute problem in the draft Gwydir Wetlands questionnaire, suggesting that the steps taken to minimise this problem had been effective. In the Sydney focus groups, wetland area was the most important environmental attribute for a number of participants. However, when questioned, participants revealed that the reason for this was that there had been a large decrease in area at the Gwydir Wetlands, and not because it was an 'indicator attribute'.

3.3.5 Adequacy of information

Participants asked for extra information about the following issues. While this information may be relevant for some participants, what is perhaps more salient, given that many participants are already being overloaded with information, is whether the extra information is relevant for the majority of participants.

- History

Several respondents in the Moree focus groups thought that the questionnaire should include more information about the history of the Gwydir Wetlands. A couple of participants noted that uncontrollable flooding of the wetlands and surrounding farms occurred before Copeton Dam. They thought that the flood mitigation benefit of Copeton Dam should be explained. Other participants thought that the benefits of the wetland for grazing should be more fully explained; in particular, the reliability of feed around the wetlands.

- What has happened to the land that used to be wetlands?

In the draft questionnaire participants were told that the area of the Gwydir Wetlands had fallen from 2000 km² to 400 km². One participant queried what had happened to the 1600 km² that had ceased to be wetland. A related question, asked by another participant, was whether this area could again become wetland. Had it been turned into cultivated land so that it could not again become part of the Gwydir Wetlands?

- Administration of the scheme

As was asked in the Macquarie Marshes focus groups, some participants wanted to know who would be administering the purchase of water from farmers.

- Origin of the information in the questionnaire

Several participants questioned the origin of the information used in the questionnaire. They were unsure of its validity, and wanted references to guarantee this:

I really don't know whether there were 19 bird species listed. I mean how many people know that?...I wouldn't know if somebody told me that 225 bird species were found in the area. I'd [just] think there must have been. (M1)

Some of these statistics you've got. I don't know how you got them... (M1)

- The use of on-farm dams by waterbirds

A question asked in one of the Moree groups was whether on-farm dams provided replacement breeding areas for waterbirds.

- Employment

A couple of participants in the first Moree focus group thought that more people were employed in irrigation:

- 1...there's vastly more people employed in irrigation.
- 2 A lot of people just come here for the season too.
- 3 You've got 1600 employed here. I'm sure that I passed 1600 trucks just getting here. (M1)

In contrast, a couple of participants in the second Moree group suggested that irrigation had been associated with a shift from full-time to casual or seasonal employment:

The number of people employed there would be half of what there used to be permanently... Mostly now seasonal workers. Years ago when you had sheep and cattle you had permanent workers. All these people now are only casuals. (M2)

While it would be difficult to describe trends in employment in Moree, these comments suggest a need to include references for the employment and other statistics used in the questionnaire.

3.3.6 Middle of the road effects

A tendency for some participants when completing the choice sets was to choose the middle option. This can be identified by participants stating that they tried to go for the 'middle of the road' or that they wanted 'balance'. This could mean that participants wanted environmental improvements, but they did not want excessive cost in terms of increased water rates or employment. More in-depth questioning usually led participants to suggest that what they were seeking were cost-effective management options.

I tried to go for the middle of the road...I thought middle of the road \$30 increase OK can cope with that. Didn't cut down too many jobs, 500 kilometres for the wetlands—well you need that really, and every 2 years. I thought that's middle of the road...[Q: What do you mean by 'middle of the road?'] You're not causing too much rift everywhere [Q: You're not causing too much cost?] Yes, you're right. The whole thing seems to be easier to accept to my way of thinking. (S3)

I was sort of hoping for a little bit of a balance...without one area suffering...[Q: Did you mean that you didn't want the costs to be too big?...] Yes just a happy medium with nothing...totally ruled out and everything has to suffer a little bit for there to be benefits all around... (M1)

Without anything suffering too much...sharing. (M1)

It is possible that this response strategy may result in ‘perfect embedding’ (also known as part-whole bias) (see Morrison et al 1996). Perfect embedding occurs when the value respondents have for one good is the same as the value given to a more inclusive good. In other words, the amount that respondents are willing to pay may be insensitive to the scope of the good. It is possible that by focusing on ‘balance’, some participants may make choices independent of the absolute magnitude of each of the attributes. If there is a large increase in, say, the magnitude of each of the levels of the cost attribute some respondents may still choose a middle option. A potential way of minimising this effect is to use four level¹¹ instead of three level attributes. A three level attribute has a natural ‘middle’ whereas the middle is less clear with four level attributes, which may cause respondents to be more discerning.

3.4 Alternative questionnaire formats

- Balanced and non-balanced formats

As described in Section 3.1, balanced and non-balanced questionnaire formats were trialed in the Gwydir Wetlands focus groups. Each of these alternatives appear to have advantages. The balanced format is potentially less biased, as it provides respondents with the option of choosing increased as well as reduced water to the wetlands. However, it was thought that an advantage of the non-balanced format is that respondents may be more discriminating about what environmental improvements they were actually receiving. In other words, a possible weakness of the balanced format is that respondents may simply choose to increase water to the wetlands without looking carefully at the attributes.

To trial these two formats, participants in each of the focus groups were asked to complete both surveys. Participants in the first focus groups in Sydney and Moree initially received the balanced version, while participants in the second groups initially received the non-balanced version. As expected, some participants found the balanced version broader and less biased:

I preferred that option...leave it the same, increase it, decrease it. Even if you’re not going to go anywhere near that option [option 3]. (M1)

To keep the survey accurate you need a point where somebody can say I want more money to go into irrigation. If you’re going to get the real cross section of people...you need a box where they can tick that. (M1)

Less biased than the first one. (M2)

There was, however, scepticism about the plausibility of the rebate, although some participants thought that the rebate was plausible:

Q: Did you find the rebate believable?
[Several nos]
I thought that it was amusing. (S3)

Q: What about the rebate, did you believe that?
1 It’s a possibility
2 Probably just as likely as option 2. (M1)

This one offering the \$30 rebate. Are we going from the sublime to the ridiculous? Are we saying that people don’t care about the environment that much...? (M2)

One participant voiced concern about using the balanced version, as he thought that many people might choose the rebate. However, this may be an exaggerated fear. Out of the 36 people who completed the questionnaire in the focus groups, only one person chose option 3, and in only one choice set.

¹¹ In the questionnaire only 3 level attributes were used: one level was used for the base option, and the other options each had two levels.

...including a rebate might be a bit of a risk to the people who are looking to get the wetlands supported financially because many ratepayers would be happy to take a rebate anytime. (S4)

Especially in the first Sydney focus group, participants appeared to be more discriminating under the non-balanced format. Participants appeared to be less likely to focus solely on labels such as 'Increase water to Gwydir Wetlands' or 'Reduce water to Gwydir Wetlands':

- 1 It's to nut out what we feel is important...what we feel is a major priority
- 2 I agree...it did really focus your attention on what you were getting. (S3)

Q: Who preferred this one to the other one?

[Lots of yeses]

- 1 More confronting
- 2 This one really got to the issue better. (S3)

In summary, it appears that participants thought that the balanced version was less biased although some respondents doubted the plausibility of the rebate. The propensity of some participants to focus on labels rather than attributes under the balanced format (and even to an extent the non-balanced format) is also a concern, although the extent to which participants do this is unclear.

- Combined balanced and non-balanced format

When the advantages and limitations of the balanced format had become apparent after the first two Sydney focus groups, another format was developed and trialed in the Moree focus groups which is a hybrid of the balanced and non-balanced formats (see Table 3.3). The format is similar to the non-balanced format except that a respondent can still choose to increase water for irrigation and reduce wetland quality. It was expected that this format would be seen as less biased than the original non-balanced format.

Table 3.3: Combined balanced and non-balanced format

Outcome	Option 1: Continue current situation	Option 2: Increase water to Gwydir Wetlands	Option 3: Increase water to Gwydir Wetlands
Water rates	no change	\$100 increase	\$30 increase
Wetland area	400 km ²	800 km ²	500 km ²
Waterbirds breeding	every 5 years	every 2 years	every 4 years
Endangered and protected species	12	20	14

- I would choose option 1, to continue the current situation
- I would choose option 2
- I would choose option 3
- I wouldn't choose any of these options but would prefer more water to be allocated for irrigation and less to the wetlands

Participants in the Moree focus groups voiced moderate support for the use of this format:

1 ...if you're going to put that fourth box in there people might like to suggest ways. I mean they might be totally unachievable but...as it is there it doesn't mean anything. (M1)

- 1 I think that it helps a bit
- 2 It helps... (M2)

- Inclusion of an employment attribute

A conclusion from the Macquarie Marshes focus groups was that it would be appropriate to include an employment attribute to show the effects of the reallocation on employment on farms and in country towns. However, it is not clear that the purchase of water from farmers would necessarily result in a decline in employment, especially if the reallocation resulted in the installation of more labour intensive irrigation equipment and an increase in employment by graziers. Because of this uncertainty, an employment attribute was only included in the questionnaires given to participants in the first Sydney and first Moree focus groups.

None of the participants in either the second Sydney or Moree focus groups suggested that an employment attribute should be included in the choice sets. Participants were also asked whether they thought that the purchase of water would result in increased or decreased employment. Most participants were uncertain about the effect:

- 1 Difficult question to answer
- 2 You're going to get more people employed on equipment, but can't say more or less. (S4)

- 1 ...if the farmers get access to money they will try and save labour through better machinery
- 2 Not sure
- 3 Could be more jobs
- 4 Might be short term increase and long term decrease
- 5 If the farmer had more money he'd look for productivity which is bound up with efficiency...how he interprets that is individual. (M2)

These responses suggest that it is not necessary to include an employment attribute. However, there is still a rationale for including an employment attribute. It may serve to reduce bias as well as moderating the lexicographic environmental preferences of some respondents who may be inclined to choose improved environmental quality regardless of cost.

- Alternative choice set formats

Towards the end of the first three focus groups, participants were given a sheet that contained four alternative methods of presenting choice sets. The first of these formats is identical to the original non-balanced format except that participants were asked to explain their choice (see Table 3.4).

Table 3.4: Alternative 1

Outcome	Option 1: Continue current situation	Option 2: Increase water to Gwydir Wetlands	Option 3: Increase water to Gwydir Wetlands
Water rates	no change	\$100 increase	\$30 increase
Wetland area	400 km ²	800 km ²	500 km ²
Waterbirds breeding	every 5 years	every 2 years	every 4 years
Endangered and protected species	12	20	14

Choice (tick a box)			
--------------------------------	--	--	--

Why did you choose this option?

The reaction to this format was mixed:

- 1 I think everybody's answered it
- 2 It's too hard
- 3 You've only got one line there [not enough room]
- 4 I would tend to keep it the way it is...let the back page cover it. (S3)
- 1 Rather than writing 'Why did you choose this option' under alternative 1, people sometimes like a comments section so they can say what they couldn't get across in answering the question.
- 2 Or you could have a number of questions for people to answer about why they chose a particular option. (S4)

In the second alternative the boxes which participants would tick to indicate their choice were written differently and had a statement next to each (see Table 3.5). This format did not receive much support:

- 1 Much of a muchness
 - 2 Same dog different legs. (S3)
- Top one [Alternative 1] is easier. (S4)

Table 3.5: Alternative 2

Outcome	Option 1: Continue current situation	Option 2: Increase water to Gwydir Wetlands	Option 3: Increase water to Gwydir Wetlands
Water rates	no change	\$100 increase	\$30 increase
Wetland area	400 km ²	800 km ²	500 km ²
Waterbirds breeding	every 5 years	every 2 years	every 4 years
Endangered and protected species	12	20	14

I would choose option 1, to continue the current situation

I would choose option 2

I would choose option 3

In the third alternative the options were listed in the first column and the attributes were listed in the first row (see Table 3.6). This allows respondents to read an option from left to right, rather than down a column.

Table 3.6: Alternative 3

Outcome	Water rates	Wetland area	Waterbirds breeding	Endangered and protected species
Option 1: Continue current situation	no change	400 km ²	every 5 years	12
Option 2: Increase water to Gwydir Wetlands	\$100 increase	800 km ²	every 2 years	20
Option 3: Increase water to Gwydir Wetlands	\$30 increase	500 km ²	every 4 years	14

- I would choose option 1, to continue the current situation
- I would choose option 2
- I would choose option 3

Alternative 4 was identical to Alternative 3, except that participants ticked a box after each option (see Table 3.7).

Table 3.7: Alternative 4

Outcome	Water rates	Wetland area	Waterbirds breeding	Endangered and protected species	Choice (tick a box)
Option 1: Continue current situation	no change	400 km ²	every 5 years	12	<input type="checkbox"/>
Option 2: Increase water to Gwydir Wetlands	\$100 increase	800 km ²	every 2 years	20	<input type="checkbox"/>
Option 3: Increase water to Gwydir Wetlands	\$30 increase	500 km ²	every 4 years	14	<input type="checkbox"/>

Both Alternative 3 and 4 received some support. Further testing would, however, be required to determine whether any of these alternatives are improvements over the choice set format used in the focus groups. The format for Alternatives 3 and 4 could be difficult to use with more than four attributes.

1 I think it's better because most people read left to right rather than up and down. With all these the print needs to be bigger and you need one per page so that you're not being distracted.
 2 three or four are the best (S3)

[Alternative 4] It's the best (S3)

- 1 [Alternative 4] It's like a ballot box
- 2 Much of a muchness
- 3 We're used to the one we did this morning (S4)

3.5 Conclusions from the Gwydir Wetlands focus groups

The changes made to the questionnaire format used in the Macquarie Marshes focus groups in order to minimise bias, implausibility and the use of indicator attributes in the Gwydir Wetlands questionnaire appeared to work relatively successfully. Bias was substantially reduced, although some instances of bias were still detected in the Moree focus groups. Implausibility was reduced by the deletion of dominated options. However some implausibility remained because a few respondents still had difficulty understanding the relevance of the paragraph explaining why unusual alternatives were actually possible. This paragraph needs to be re-worded and placed in a more appropriate part of the questionnaire. There was little evidence of the use of indicator attributes. Confusion was also less apparent than in the Macquarie Marshes groups, yet it was still significant. Further simplification and clarification of the more difficult to understand parts of the questionnaire are needed. While this can partly be achieved through improved communication and presentation, it also necessitates reductions in the amount of information presented to respondents.

There was some evidence of middle of the road effects in the Gwydir Wetlands focus groups, in which participants emphasised the selection of 'balanced' options. The use of four level attributes has been suggested as a method of encouraging respondents to more carefully discern the benefits and costs of each options.

Several alternative questionnaire formats were trialed in the Gwydir Wetlands focus groups. The balanced format appeared to minimise bias and was well received by participants. However, the implausibility of using a rebate and the tendency of some respondents to focus on 'labels' in the balanced format rather than outcomes suggests that other formats may be more appropriate. The non-balanced format worked well, however, it appeared to be more biased than the balanced format. A third alternative was trialed that exploits the advantages of both the balanced and non-balanced format. This format appears to be the most appropriate format for use in the Macquarie Marshes and Gwydir Wetlands surveys. Various different methods of presenting choice sets were also trialed, however further testing would be required before it could be concluded that any of these versions offered a significant improvement over the existing format.

4 Summary

Focus groups are a vital part of any choice modelling application. They are useful for determining which attributes should be included in choice sets, determining what information should be included in questionnaires, for trialing alternative questionnaire formats and for detecting the existence of bias or other problems. This is especially the case given the limited experience of using choice modelling to estimate non-market and, particularly, non-use values.

The importance and iterative nature of the focus group process are evident from this paper. The first questionnaire used in the Macquarie Marshes focus groups suffered from a number of significant problems including bias, confusion, implausibility and indicator attributes. It was apparent that these problems were causing many participants to answer the choice sets in a way that could be considered contrary to random utility theory, the behavioural basis of choice modelling. Using the information gathered in the Macquarie Marshes focus groups, strategies for dealing with these problems were developed. These strategies appeared to have worked relatively successfully so that the Gwydir Wetlands questionnaire was less problematic. Most participants appeared to complete the questionnaire in a way that is consistent with random utility theory.

Further changes remain to be made to the draft Gwydir Wetlands and Macquarie Marshes questionnaires prior to pretesting. Some minor changes need to be made to minimise bias and implausibility, but more substantive changes are needed to minimise confusion. Several sections, such as water trading, require clarification. Simplification is also required through the deletion of information of lesser relevance.

The design of a choice modelling questionnaire is an exercise involving many constraints. For example, the selection of relevant background information, the development of a plausible payment scenario and the selection of attributes depends not only on what is relevant to respondents, but also on the policy context and respondents' capacity to digest the information. As a result, there are many compromises involved in designing a choice modelling questionnaire. Frequently, assessments must be made about the relevance of a particular piece of information to the majority of respondents, whether respondents

actually need the information to complete the questionnaire, and whether the information is likely to be understood. Focus groups are a useful vehicle for designing choice modelling questionnaires and providing answers to many of these questions.

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Appendix 1 Photos trialed in the focus groups

Photos trialed in the Macquarie Marshes focus groups

Photos trialed in the Gwydir Wetlands focus groups

**Appendix 2 The Macquarie Marshes draft
questionnaire
(excluding choice sets and debrief questions)**

Your views on the management of the Macquarie Marshes

An environmental issue facing people in New South Wales is the deteriorating size and quality of the Macquarie Marshes. This deterioration has occurred because the amount of water in the Macquarie River that flows downstream into the Macquarie Marshes has fallen substantially. Instead, most of the water in the Macquarie River is now collected in Burrendong Dam and is used to irrigate crops, such as cotton and wheat.

It has been proposed to reduce the amount of water used for irrigation and increase the amount of water reaching the Macquarie Marshes by setting up a scheme to purchase water from farmers.

We would like to ask you a number of questions about these proposed changes.

Where is the Macquarie Marshes?

The Macquarie Marshes is located in the Macquarie Valley and are about 500 km north-west of Sydney (see Map).

What is the Macquarie Marshes?

The Macquarie Marshes is the largest wetland in NSW. It contains the largest area of common reeds in NSW and the largest area of river redgums in northern NSW.

The Macquarie Marshes is well known for its waterbirds. It is the largest breeding area in NSW for waterbirds such as ibis, egrets, spoonbills and herons, which only breed in large groups or 'colonies'. These colonial waterbirds use few other wetlands in NSW for breeding. The Macquarie Marshes is used by 15 birds that are listed as endangered.

The Macquarie Marshes acts as a filter that improves water quality in the Macquarie River. It does this by slowing down the flow of water which causes sediment to settle out, and by trapping other impurities.

Within the Macquarie Marshes is a Nature Reserve covering approximately 18,000 ha which is administered by the National Parks and Wildlife Service. The Nature Reserve is listed as a wetland of international importance.

Parts of the Macquarie Marshes have been used for grazing sheep and cattle since the 1830s. The sheep and cattle primarily graze on 'water couch', which is a high quality feed. Grazing is not permitted within the Nature Reserve.

Effect of reduced water on the Macquarie Marshes

The Macquarie Marshes require regular periods of flooding to maintain wetland quality. The number and size of floods that occur in the Marshes have fallen because water is held upstream in Burrendong Dam for use in irrigating crops.

The best available scientific evidence suggests that reduced flooding has had the following effects on the Macquarie Marshes since irrigation began:

Wetland area

The total area of the Macquarie Marshes during flood periods has fallen from more than 250,000 ha to 130,000 ha.

Vegetation health

The health of the vegetation in the Macquarie Marshes has declined. The long term health of vegetation is indicated by the area of healthy river redgums. It is estimated that the area of healthy river redgums has declined from 55,000 ha to 30,000 ha.

The area of water couch has also decreased and been replaced by weeds. This has affected the earnings of graziers operating within the Marshes.

Waterbird numbers

The average number of waterbirds found in the Marshes each year has fallen from about 500,000 to 200,000.

Waterbird breeding

The number of different waterbird species found in the Marshes has declined from about 60 species to 30 species.

Water quality

The water quality within and downstream of the Marshes has fallen because the Marshes are less able to filter water. The water quality has fallen from being classified as 'high' to being 'poor' water quality.

What environmental issues are important?

Before considering what should be done about the Macquarie Marshes, we would first like you to think about a range of environmental issues.

Please rate the importance of improving wetland quality at the Macquarie Marshes relative to the importance of each of the following issues.

(eg circle 5 if you think that improving wetland quality at the Macquarie Marshes is much more important than improving water quality at Sydney beaches)

	Much less important	Slightly less important	Same Importance	Slightly more important	Much more important
Improving water quality at Sydney beaches	1	2	3	4	5
Controlling land degradation in farmland in NSW	1	2	3	4	5
Preventing logging of native forests in NSW	1	2	3	4	5
Improving air quality in Sydney	1	2	3	4	5

The Proposed Water Purchasing Scheme

Extra water is needed to improve wetland quality in the Macquarie Marshes. Yet reducing the amount of water used for irrigation would be costly for farmers who have purchased irrigation equipment because they expected this water.

Currently, irrigators have an unreliable supply of water and only receive the water that they are entitled to in six out of every ten years. Increasing the amount of water going to the Macquarie Marshes would reduce the reliability of their water supply.

Irrigators have already had their water supply reduced. In 1995 the NSW Government reduced the average amount of water available for irrigation in the Macquarie Valley by 50,000 ML or 8%. Another reduction in water for irrigation is expected to put some irrigators out of business.

A possible way of increasing the amount of water reaching the Marshes while compensating farmers for receiving less water, is for the Government to set up a scheme to purchase water from farmers. Water is currently bought and sold in the Macquarie Valley in a water trading market. The Government could buy water from farmers in this market. The amount of water purchased would depend on how much the community wants to improve wetland quality at the Macquarie Marshes.

How would the Water Purchasing Scheme be funded?

The purchasing scheme is expected to be costly and the NSW Government does not have the necessary money available to pay for the scheme from existing taxation revenue.

If the purchasing scheme was to go ahead it would be necessary to charge households in NSW a **once-off** levy on their water rates to pay for the scheme. The revenue would go into a special fund that would only be used to pay for the scheme.

Options for the Macquarie Marshes

To help determine how the community would like to see the Macquarie Marshes managed we have prepared 16 sets of management options for the Macquarie Marshes. We would like to know which management option you prefer the most in each set of options. You'll find some of the options more attractive than others. You may choose to give up attractive features in one option (eg larger area), to get some other features in a second option (eg more waterbirds breeding).

We are asking your opinion about these options to help the government determine which characteristics or features of the Macquarie Marshes matter to people.

To keep matters simple, we do not describe how each management option would come about. For this reason, some options appear a little unusual, or even unrealistic. Bear in mind that there are a lot of ways that water can be managed, so that options which seem odd are actually quite possible.

When thinking about which option you prefer, keep in mind your available income and all the other things that you have to spend money on. It is possible that in the future other environmental projects may cost you additional money.

EXAMPLE

Here is an example of how to answer questions 1 to 16.

Suppose options A and B are the only available options. If you preferred option A, you would tick the box labelled 'I would choose A' as shown below:

<i>Feature</i>	<i>Option A</i>	<i>Option B</i>
Increase in wetland area	40,000 ha	80,000 ha
Increase in area of healthy river redgums	5000 ha	10,000 ha
Increase in number of waterbirds	80,000	160,000
Increase in waterbirds breeding	20,000	40,000
Increase in waterbird species	20	10
Water quality	Good	Fair
Increase in water rates	\$30	\$60

I would choose A

I would choose B

I would choose neither A or B

Appendix 3 The Gwydir Wetlands balanced choice set questionnaire (excluding choice sets and debrief questions)



Management of the Gwydir Wetlands in Northern New South Wales

**A Community Survey
1997**

How To Fill Out This Questionnaire

The questions take different forms. In most cases you only need to tick the box which is closest to your view. Here is an example:

EXAMPLE

Do you think the government should spend more or less on education?

Spend more on education

Spend less on education

Don't know

If you think the government should spend more on education, you would tick the box as shown.

Sometimes you need to write an answer—in these cases, simply write your answer in the space provided. If you have any questions regarding this survey, please contact Professor Jeff Bennett of The University of New South Wales on 06 268 8833

Completion of this survey is voluntary

All your answers will be kept strictly confidential

Your completed questionnaire will be collected by a surveyor at an agreed time. If you are unable to give the questionnaire to the surveyor at this time, please use the reply paid envelope to mail it to:

Professor Jeff Bennett
School of Economics and Management
University College
The University of New South Wales
Canberra ACT 2600

We hope you enjoy completing this questionnaire and thank you very much for taking part in this survey.

Your views on the management of the Gwydir Wetlands

An issue facing people in NSW is the reduction in the size and quality of the Gwydir Wetlands. This has occurred because the amount of water that flows into the Gwydir Wetlands has fallen substantially. Instead, much of the water in the Gwydir River is now collected in Copeton Dam and used to irrigate crops.

There are several options available to the government in deciding how much water to allocate for irrigation and to the Gwydir Wetlands. We would like to ask you a number of questions about these options.

What issues are important?

Question 1

Before considering what should be done about the Gwydir Wetlands, we would first like you to think about a range of issues that Australians face today. Below is a list of areas where the government has been considering reductions in funding. Please rank these five areas by placing the numbers 1 (most deserving of continued funding) to 5 (least deserving) in the following boxes:

Education

The Environment

Crime Prevention

Hospitals

Unemployment

Question 2

One of the areas just mentioned was 'The Environment'. Please **rank** the following five environmental goals by placing the numbers 1 (most deserving of continued government funding) to 5 (least deserving) in the following boxes:

Improving water quality in rivers in NSW

Conserving wetlands in NSW

Improving land quality in rural areas in NSW

Preventing logging of native forests in NSW

Improving air quality in urban centres in NSW

THE GWYDIR WETLANDS

Where are the Gwydir Wetlands?

The Gwydir Wetlands are in the Gwydir Valley, about 600 kilometres north of Sydney and about 70 kilometres west of Moree (see map).

What are the Gwydir Wetlands?

Before water from the Gwydir River was diverted for irrigation, the Gwydir Wetlands were the third largest wetlands in NSW. They had an area of about 2000 square kilometres. This included 200 square kilometres containing reeds, rushes and other aquatic plants and 1800 square kilometres of woodlands containing acacias, coolabahs and lignum bushes.

The Gwydir Wetlands were an important habitat for birds. Before irrigation, some 225 bird species were found in the area, with 125 species breeding there. The wetlands are one of the largest breeding areas in NSW for waterbirds such as ibis, egrets, spoonbills and herons, species which breed only in large groups. These waterbirds breed in only a few other wetlands in NSW. Before irrigation the number of waterbirds in a single breeding event stimulated by flooding ranged from 5000 pairs to well over 200,000 pairs. Many of these waterbirds are found throughout NSW, including urban areas.

Before irrigation, the Gwydir Wetlands were used as habitat by 19 bird species listed as endangered by the National Parks and Wildlife Service and 18 migratory waterbirds protected under international agreements.

All of the Gwydir Wetlands are owned by private landholders. Several whole properties have been declared wildlife sanctuaries.

The Gwydir Wetlands have been used for grazing sheep and cattle since the 1800s. They have been an important drought refuge for cattle from throughout NSW and parts of Victoria and Queensland. About 260,000 sheep and cattle were held on properties surrounding the Gwydir Wetlands in 1991.

How has less water affected the Gwydir Wetlands?

The removal of water for irrigation has altered the natural pattern of flooding. This has had a different effect on each aspect of the Gwydir Wetlands. Wetland vegetation requires regular floods of various sizes to remain healthy. Waterbird breeding requires flooding of sufficient size at a suitable time of year. Endangered species require the preservation of certain habitats through regular flooding. These different flooding needs mean that water managers must choose which aspect of the Wetlands to preserve if extra water is available.

Wetland area

The area of the Gwydir Wetlands had fallen from 2000 to 400 square kilometres by 1996 (400 square kilometres is about equal to the area of a large country town such as Dubbo or Goulburn). The area of weeds—such as lippia, roly-poly and scotch thistle—had also increased significantly.

A consequence of the reduction in area is that the amount of stock feed has fallen by 50%. This has reduced the income of graziers.

Waterbird breeding

Waterbird breeding used to occur every second year but now occurs every five years.

Endangered and protected species

The number of endangered bird species using the Gwydir Wetlands had fallen from 19 to 5 species by 1996. The number of visiting migratory species protected under international agreements has fallen from 18 to 7.

IRRIGATION IN THE GWYDIR VALLEY**Production**

Irrigation in the Gwydir Valley began after the construction of Copeton Dam in 1976. The most widespread irrigated crop is cotton. The Gwydir Valley is the largest cotton producing area in Australia, with 500-900 square kilometres harvested each year. The estimated annual revenue from cotton production between 1989 and 1993 was \$110 million. Other irrigated crops include wheat, soybeans, sorghum, vegetables and pecan nuts. The total annual revenue from these other crops is \$25 million. Irrigated agriculture makes up 58% of total agricultural production in the Gwydir Valley.

Employment

About 1600 people are employed on irrigated farms in the Gwydir Valley. Two towns in the valley—Moree and Mungindi—also rely on the revenue from irrigated agricultural production. It is estimated that irrigation creates about 1200 jobs in these towns.

Water use

Most of the water in Copeton Dam is used for irrigation. About 517,000 megalitres is allocated for irrigation in the Gwydir Valley each year. Farmers pay about \$5 per megalitre for the water they use each year.

Farmers received licenses to irrigate by applying to the Department of Water Resources. These licenses specify an amount of water that will be allocated to farmers for irrigation, provided that there is enough water available. In five out of every ten years there is enough water available for farmers to receive all of the water specified in their licenses. In the remaining years they receive less than 100% of their allocation. However, this is supplemented by water they collect from tributaries to the Gwydir River and keep in on-farm storages.

Water trading

Water is currently bought and sold in a water trading market which covers the entire Gwydir Valley. Farmers can buy or sell the rights to receive water to other farmers permanently. The price of water rights in the Gwydir Valley has been about \$600 to \$700 per megalitre in recent years.

OPTIONS FOR MANAGING THE GWYDIR WETLANDS

The three broad options for managing the Gwydir Wetlands are discussed below.

Option 1: Continue current situation

Under this option the amount of water allocated for both irrigation and the Gwydir Wetlands would remain constant. Wetland size and quality would also remain constant.

Option 2: Increase water allocated to the Gwydir Wetlands

This option would increase wetlands size and improve wetlands quality. One way of increasing water for the Gwydir Wetlands is for the NSW Government to purchase water from farmers using the existing water trading market. This would be voluntary.

Farmers would be expected to sell water if the price offered was high enough. The money received from selling their water would enable farmers to purchase more efficient irrigation equipment that would reduce their water needs. It would also compensate other farmers who decide to stop irrigating and return to dryland farming. The sale of water would cause a decline in employment on farms and in Moree and Mungindi.

Purchasing water from farmers would be costly and the NSW Government does not have money to pay for the scheme from existing taxation revenue. If the purchasing scheme were to go ahead it would be necessary to **charge households in NSW a one-off levy on water rates**, payable only in 1998. The revenue would go into a special fund that would only be used to pay for the scheme.

Option 3: Reduce water allocated to the Gwydir Wetlands

This option would further reduce the quality of the Gwydir Wetlands, but would mean that there would be more water available for irrigation. As a result the income of farmers and the number of jobs would increase.

This extra water could be allocated to farmers by selling it to them on the water trading market. This would provide extra revenue for the NSW Government which could be used to fund a once-off rebate on water rates. This would be paid to all households in NSW in 1998.

WHICH OPTION DO YOU PREFER?

To help find out how the community would like the Gwydir Wetlands managed, we have prepared eight sets of potential management options. These options are defined in terms of five different outcomes: wetland area, waterbirds breeding, endangered and protected species using the wetland as habitat, employment, and household cost or benefit. We would like to know which management option you prefer in each set of options.

The outcomes in each of the options have been specifically defined so that you have a **broad range** of choices. Within this range some options may seem strange according to your experience, but bear in mind that there are many ways of managing water.

When thinking about which option you prefer, keep in mind your available income and all the other things that you spend money on. It is possible that in the future other environmental projects may cost you additional money.

EXAMPLE

Here is an example of how to answer questions 3 to 10. Suppose Options 1, 2 and 3 are the only available management options for the Gwydir Valley. If you preferred Option 1, you would tick the box under Option 1 as shown below:

Outcome	Option 1: Continue current situation	Option 2: Increase water to Gwydir Wetlands	Option 3: Reduce water to Gwydir Wetlands
Water rates	no change	\$30 increase	\$30 rebate
Employment	2800	2780	2880
Wetland area	400 km ²	800 km ²	100 km ²
Waterbirds breeding	every 5 years	every 2 years	every 9 years
Endangered and protected species	12	20	4

Choice
(tick a box)



Previous Research Reports in this Series

Morrison, M.D., Blamey, R.K., Bennett, J.W. & Louviere, J.J. (1996). *A Comparison of Stated Preference Techniques for Estimating Environmental Values*. Choice Modelling Research Report No.1. University College, The University of New South Wales.

Morrison, M.D. & Bennett, J.W. (1997). *Water Use Trade-offs in the Macquarie and Gwydir Valleys*. Choice Modelling Research Report No.3. University College, The University of New South Wales.

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Blamey, R.K., Rolfe, J.C., Bennett, J.W. & Morrison, M.D. (1997). *Environmental Choice Modelling: Issues and Qualitative Insights*. Choice Modelling Research Report No.4. University College, The University of New South Wales.