AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

Testing for Framing Effects in Environmental Choice Modelling

John Rolfe[#]
and
Jeff Bennett[**]

Abstract

Researchers using stated preference environmental valuation techniques are interested in identifying the extent to which framing effects impact on value estimates. Framing effects occur when the context in which the hypothetical scenarios and tradeoffs put to respondents in an application differ from those that would be important if actual transactions were involved. Because scenarios have to be defined succinctly to respondents, the challenge for researchers is to identify how the particular 'frame' used affects responses, and how different groups of respondents may view settings. In this paper, an application of a stated preference technique termed Choice Modelling is reported in the context of pastoral land development in Queensland and the Northern Territory. Choice Modelling embodies some features that enable the impact of framing to be assessed directly.

Keywords
framing, environmental valuation, Choice Modelling

[#] Central Queensland University, P.O. Box 197, Emerald, 4720. Ph. 07 4982 2904, Fax 07 4982 2031, email: j.rolfe@cqu.edu.au
[**] The University of New South Wales, Economics and Management, ADFA, Canberra.

1.0 Introduction

Framing issues have been important in the development of accurate stated preference techniques because there has often been a concern that under survey conditions, respondents 'frame' substitutes differently from what they would in a 'real life' situation (Boyle 1989, Mitchell and Carson, 1989, Neill 1995, Randall and Hoehn 1996). Framing effects can occur in a stated preference survey through inappropriate tradeoffs being modelled, the provision of inadequate information, various contextual cues and other influences on the decision processes of individuals. All of these factors may mean that the preferences people state they have for particular tradeoffs may differ from those that would be revealed in a real-world situation, leading to inaccurate value estimations.

Several factors limit the ability of stated preference technique researchers to minimise framing issues. First, framing effects cannot be viewed in a simplistic 'present/not present' manner. All preferences that people state or reveal are framed by a large number of factors, such as culture, religion, habit and personal background. This means that each response to a non-market valuation experiment would be framed against a background of a number of different contexts, as would each response revealed in a market transaction. The goal of the researcher is to match the framing effects so that the preferences stated in a non-market valuation survey are very similar to those that would be revealed in a matching real-world situation. In this context, framing effects can be more accurately viewed as divergences between the way that choices are formed in stated and revealed preference situations.

For amenities involving non-use values, it is not always clear how people might frame their tradeoffs in real world situations. This is because there is rarely revealed preference data available for this purpose. Researchers dealing with framing effects in environmental issues are thus engaged with a discovery process to determine what framing effects exist, and partly with a matching process, where they try to ensure that stated preferences are consistent with revealed preferences.

The second problem that researchers face with framing issues is that they are often complex and confounded with each other. For example, a stated preference experiment involving the preservation of a local park may be framed by respondents in terms of environmental, recreation and aesthetic factors. It may be difficult for the researcher to determine exactly how each of these broad purposes should be framed in terms of providing information about the range of substitutes and the options available. These difficulties increase as the diversity and size of the population to be considered expands.

The third problem with framing effects is that their impact remains largely hidden to the analyst in both stated and revealed preference settings. Clearly the choices that people make are closely related to the availability and form of substitute goods. Yet for practical reasons, people do not consider every substitute amenity, nor are they necessarily consistent in the way that they form their preferences. To the outside analyst, it can be very difficult to gain strong insights into where framing effects might be present.

The fourth broad area of difficulty is that there is a variety of contexts in which framing effects might occur in a stated preference survey. Much of the discussion on framing effects associated with the CVM literature has focused on the extent to which survey respondents consider substitute goods, as well as considering their budget constraints (eg Neill 1995, Randall and Hoehn 1996, Whitehead and Bloomquist 1995, 1999). However, framing effects also relate to the ways in which tradeoffs might be structured for respondents (eg the choice of payment vehicle), as well as more subtle contextual cues (how information is presented).

At a broader level, framing effects may also relate to the way in which respondent perceive the importance of issues outside of the group of close substitutes. For example, how do respondents making choices about the conservation of a local park factor in considerations of biodiversity preservation at a regional level? The identification of framing effects becomes more difficult as the scale of the substitute amenity changes relative to the issue in question.

This latter issue is one focus of the discussion in this paper. It is an important research topic because researchers and policy makers are generally interested in how values for small scale environmental issues bundle together to form values for broader issues. How do the preservation values for a single surburban park fit into the preservation values for parks in a city or region? This bundling issue is important in terms of how values might potentially be apportioned from a macro scale (ie at a regional level) down to individual components (ie the local park level). If researchers can identify how specific environmental amenities are framed in terms of wider issues, one step towards the reverse process of benefit transfer, where values at a regional level may be apportioned to individual components, will have been taken.

The other framing issue to be explored in this paper revolves around how different population groups value the same environmental commodity. Values cannot be simply apportioned across populations because proximity and other factors are likely to determine the way that people frame choices. Understanding how factors such as state boundaries and geographic distance impact on value formation is also important in any future benefit transfer process.

In this paper, a series of Choice Modelling experiments designed to explore some of these issues are reported. Choice Modelling (CM) is the preferred stated preference technique for this study because it appears to offer some advantages over the Contingent Valuation Method (CVM) in ensuring that respondents are provided with an appropriate frame in which to answer valuation questions. This is because in CM, a range of substitute goods and tradeoffs can be presented simultaneously to survey respondents.

In the next section, a brief overview of CM is presented, followed in section three by some discussion on its strengths in relation to framing. Section four contains an outline of the methodological issues to be addressed in this paper. In section five the case study areas are described, followed by an explanation of the surveys that were conducted in section 6. A summary of the results is provided in section seven. Final conclusions are reported in section eight.

2.0 The Choice Modelling Technique.

CM is a stated preference technique that developed from conjoint analysis methods used in marketing studies (Louviere 1994). CM bears some similarities to CVM, but gives the researcher a great deal more insight into the components of choices than does CVM. It has only been in recent studies that CM has been used to generate estimates of non-use values associated with environmental amenities (eg Rolfe and Bennett 1996, Adamowicz et al 1998, Morrison et al 1998, Blamey et al 1998a,b).

CM operates by presenting survey respondents with a series of choice sets. From each set, respondents have to indicate their preferred option from a number (two or more) alternatives. The alternatives are set out as systematic profiles, each comprising of a number of attributes that are usually common to each profile. One alternative, static across all the choice sets represents the "status quo" resource use alternative. The attributes can each vary across different levels, thus creating differences between the profiles. By varying the levels in a systematic way with an experimental design process, the choices that people make can be represented with certain statistical properties and models of the choice process developed. These models can not only be used to predict choice probabilities, but also to estimate value changes.

The aim of the CM process is to estimate a model to predict choice on the basis of the attributes that describe the amenities of interest. Because of the number of attributes and levels normally involved in a model, respondents are generally asked to answer a number of choice sets so that enough data are collected to generate robust model parameters.

The theory underlying CM assumes that respondents choose the alternative in each choice set which yields them the highest utility. To the outside observer though, the utility of an alternative j for individual i (U_{ij}) can be divided into a systematic (explainable) component (V_{ij}) and an error (unexplainable) component (e_{ij}), where V_{ij} represents the measurable component of utility and e_{ij} captures the effect of unobserved and omitted influences on choice:

$$U_{ij} = V_{ij} + e_{ij} \qquad (1)$$

The probability that one alternative (j) will be chosen over another (h) can be represented as:

$$P_{ij} = \text{Prob}(V_{ij} + e_{ij} > V_{ih} + e_{ih}) \text{ for all h in Choice set C, } j \neq h \qquad (2)$$

If the errors are distributed according to an extreme value (Gumbel) distribution, the choice probabilities have a convenient closed-form solution known as the multinomial logit model (MNL) (McFadden 1974). This has the general form:

$$P_{ij} = \exp(\lambda V_{ij})/\sum\exp(\lambda V_{ih}) \qquad \text{(for all h in choice set C)} \qquad (3)$$

where λ represents a scale parameter. This scale parameter is inversely proportion to the variance (μ) of the error term, as in the following:

$$\lambda = \pi^2/6\mu^2 \quad (4)$$

The MNL model generates results for a conditional indirect utility function of the form:

$$V_{ij} = \beta + \beta_1 Z_1 + \beta_2 Z_2 + ... + \beta_n Z_n + \beta_a S_1 + \beta_b S_2 + ... + \beta_z S_n \quad (5)$$

where β_1 to β_n is the vector of coefficients attached to the vector of attributes (Z) describing the environmental resource, and β_a to β_z is the vector of coefficients attached to the vector of individual characteristics (S), with the latter usually including income. The intercept (β) represents the influence of unobserved attributes. For some models, particularly when the alternatives are labelled, this intercept term can be disaggregated into alternate specific constants (ASCs) to generate more accurate models of choice. An important attribute included in the indirect utility function is some WTP measure for provision of the described environmental amenity. The parameters of the utility function are estimated in the MNL form using maximum likelihood procedures.

The scale parameter cannot be identified in a specific model because the error terms are confounded with the vector of utility parameters. That is, β (the vector of utility parameters) is more accurately represented as $\lambda\beta$ (Swait and Louviere 1993). Each parameter coefficient is associated with the scale parameter, and hence with the error variance.

The error terms associated with each alternative have to be independently and identically distributed (IID) in a MNL model, giving rise to an independence from irrelevant assumptions (IIA) condition. This IIA/IID condition for each alternative is a consequence of adopting the Gumbel extreme value error distribution. The condition is normally tested by omitting an alternative from the choice sets and testing to see if there are significant differences in parameter estimates.

Welfare estimates can be obtained by use of the following formula to estimate compensating variation (CV), described by Hanemann (1984):

$$CV = (-1/\alpha)[\ln\sum\exp v^{io} - \ln\sum\exp v^{i1}] \quad (6)$$

where α is the marginal utility of income, and V^{i0} and V^{i1} represent the utility before and after the change under consideration. Here the welfare estimate is obtained by finding the difference in utility between two options and scaling that utility to a metric measure with the aid of the marginal utility of income. In CM, the monetary coefficient ($\lambda\beta_\$$) generated as a model parameter is used as an estimate of the marginal utility of income (α). Changes in utility can arise from both changes in the attributes of alternatives, or the inclusion or removal of alternatives altogether.

In situations where the choice set includes a single before and after option, the welfare measure described in equation 6 reduces to:

$$CV = (-1/\alpha)[\ln(\exp v^{io)} - \ln(\exp v^{i1)}]$$

$$= -1/\lambda\beta_{\$}[v^{io} - v^{i1}] \quad (7)$$

In some cases the before and after options may differ only because of changes in a single attribute. For attributes representing non-continuous data, the CV will be represented by the difference between the attribute coefficients for the relevant levels, divided by the monetary coefficient, as prescribed by equation 7. For continuous data though, the marginal value of a change within a single attribute – known as the part worth (W) - can be represented as a ratio of coefficients, where equation 7 reduces further to:

$$W = \lambda\beta/\lambda\beta_{\$} \quad (8)$$

This formula effectively provides the marginal rate of substitution between WTP and the attribute in question. The formula also demonstrates that the scale parameter is cancelled out in the estimation process. This means that while model coefficients cannot be directly compared between different CM experiments because of differing scale parameters, the resulting value estimates can.

3.0 Choice Modelling and Framing Issues

Choice Modelling has a number of strengths in minimising framing issues. The first, and perhaps most significant advantage, is that it allows the simultaneous presentation of a pool of alternative and substitute goods. As a result, respondents are automatically required to consider complementary and substitution effects in the choice process. This also reduces potential problems of bias because the amenity of interest can be "hidden" within the pool of available goods used in a CM experiment.

Rolfe and Bennett (1996) and Rolfe, Bennett and Louviere (1997, 1998, 2000) demonstrate this strength of CM in their studies on rainforest preservation values. The issue of interest was the estimation of non-use values held by Australians for rainforest protection in The Republic of Vanuatu, one of the Pacific Island nations. Because Australians are not particularly well informed about rainforest preservation and Vanuatu, the use of the CVM was rejected because of potential problems of bias. Instead, a CM approach was adopted where respondents were asked to select preferred options from rainforest preservation scenarios across a number of countries, including Australia and Vanuatu. This disguised the location of interest (Vanuatu) within a pool of geographic substitutes.

A second major advantage of CM is that it allows a variety of tradeoffs to occur simultaneously, and thus provides more realistic choice sets to respondents. In the rainforest studies reported in Rolfe and Bennett (1996) and Rolfe et al (1997), the profiles were described in terms of seven attributes, being:

Location (country)
Area (of the protection proposal)

Rarity
Potential to visit
Effect on local populations
Special features of the area
Price of the proposal (framed as a donation)

Apart from Location, the attributes are essentially balanced between three environmental factors (Area, Rarity, Special features) and three socio-economic factors (Potential to visit, Effect on local populations, Price of the proposal). There are two main advantages to this approach:

- the WTP attribute is only one of several attributes that defines profiles, and hence is de-emphasised in importance relative to its central role in the CVM
- The introduction of a variety of opportunity costs allows more accurate depiction of real-life situations.

Another advantage of the CM approach is that it allows some identification of the ways in which people frame choices. One example of this is given in Blamey, Rolfe and Bennett (1999) where a CM experiment concerned with estimating preservation values for remnant vegetation identified a nested decision tree as the most appropriate choice model. Under this framework, respondents chose first whether to support a preservation option or not, and then evaluated the options in terms of the component attributes and levels. Other ways of evaluating how choices are framed focus on whether the treatment of alternative choices is consistent with model assumptions, and on identifying the error terms associated with choices and alternatives.

The statistical strengths of CM allow some specific tests for framing effects to be carried out (Rolfe, Bennett and Louviere 1999). Differences in framing related variations in the parameters of the resulting choice models are tested. For convenience, differences in framing can be categorised as variations in the description of essentially the same good, and larger variations that change the structure of the choices involved (Boyle 1989).

In CM, there are three main ways of testing for framing effects. First, tests can be performed to check that violations in model assumptions have not occurred. The internal validity of choice models can be tested by identifying any IIA/IID violations. The presence of these violations would suggest that choices have not been consistent (independent). One possible explanation is that respondents have had difficulty in framing choices through the course of the experiments[1].

Second, tests can be performed to determine whether slight differences in the way that choices are framed for respondents have impacts on model parameters, and hence, on value estimation. If slight differences in framing do not cause value estimates to change, as Cummings, Brookshire and Schulze (1986) and Boyle (1989) hypothesise, then the parameters for the differently framed choice models should be identical.

Third, tests can be performed to determine whether substantial differences in framing between CM applications cause changes in value only to the attributes that are not

[1] There are other modelling reasons why IIA/IID violations might arise.

common between applications[2]. Substantial differences can be introduced into CM applications by including different substitute goods within the choice set. If the proportional influence on choice of particular attributes is independent of other attributes and choice alternatives, and hence unaffected by the introduction of other substitutes, this implies that no framing effects are present. Significant changes in beta coefficients common between CM applications that involve different substitutes will therefore indicate that framing effects have occurred, while insignificant changes will indicate the reverse.

However, the confounding between scale parameters and beta coefficients invalidates any direct comparisons between the beta coefficients of separate models. There are two main approaches to isolating the scale parameter effects and testing whether differences in model parameters are significant. Firstly, log-likelihood tests can be used to identify whether model parameters differ by any more than variations in the relevant scale parameters. Second, confidence intervals for part-worths can be compared to isolate any differences that might exist between models. Here, the relevant tests are described in more detail.

The Scale Parameter (Swait-Louviere) tests

The Swait-Louviere test entails a proportionality restriction on the parameters of one data set relative to the second. The test is generated by determining whether the sum of the log-likelihoods for the two different data sets differs significantly from the log-likelihood for a model estimated from the pooling of the two data sets with the parameter proportion restriction. The pathway for this analysis is through the estimation of the ratio of scale parameters for the different models.

A scale parameter (the constant of proportionality) is inversely proportional to the standard deviation of the error distribution for each data set (Equation 4). The ratio of scale parameters can be estimated by stacking two data sets X_1 and X_2, and conducting a grid search over some hypothesised region for an appropriate scalar value μ that multiplies the design matrix excluding the alternate-specific constant intercepts (ie $X_1^* = \phi X_1$) (Swait and Louviere 1993). One seeks to determine the value of the scalar μ that optimises the log-likelihood of the MNL model fit to the pooled data sets (Swait and Louviere 1993). If both data sets have identical scale parameters, rescaling is unnecessary and the ratio of scale parameters is one (Blamey et al 1997). If data set X_1 has more random noise than data set X_2 the variance-scale parameter ration $\phi^{1/2}$ will be less than one; if the opposite is true, ratios will be greater than one.

The form of the likelihood ratio test (Swait and Louviere 1993) whether the MNL model parameters for the data sets X_1 and X_2 differ only by a variance-scale ratio takes the following form:

$$LR = -2(LogL_{\lambda 1/2} - (LogL_{X1} + LogL_{X2})) \quad (9)$$

[2] Boyle (1989) concludes that substantial framing differences cause value changes. This is not surprising to economists. What is more difficult to ascertain from CVM experiments is whether substantial framing differences causes systematic value changes, or only changes in the components not common across different experiments.

where $LogL_{\lambda 1/2}$ is the log likelihood value attached to the MNL model of the stacked data set at the optimum level of μ, and $LogL_{X1}$ and $LogL_{X2}$ are the log likelihoods of the MNL models for the individual data sets (Swait and Louviere 1993, Blamey et al 1997). The resulting likelihood ratio statistic follows an asymptotic chi-square distribution with (P + 1) degrees of freedom, where P is the number of parameters across the three models involved.

The Part-Worth Tests

The second pathway for identifying framing effects is to compare the part-worths that are available from models estimated from CM applications. These are directly comparable between models because the scale parameter (λ) terms are cancelled out of such equations. In order to estimate whether differences between part-worths generated from different experiments are statistically robust, confidence intervals need to be generated.

This can be done using Fieller's Method as proposed by Krinsky and Robb (1986). It involves the simulation of an asymptotic distribution of the coefficients that are generated in a CM experiment, from which confidence intervals can then be computed. The distribution is achieved by taking repeated random draws of 'the coefficient vectors from a multivariate normal distribution with mean and variance equal to the β vector and variance-covariance matrix from the estimated multinomial logit model' (Morrison et al 1998:10). Implicit prices can then be calculated from each of the random draws of coefficients, and confidence intervals estimated by identifying the values at each tail of the distribution of implicit prices.

4.0 Methodological issues.

The framing issues explored in this paper are focused on parochial and bundling effects. Here the development of the experiments are described in some detail.

Testing for parochial effects

Economists are aware that geographical factors can influence the way in which people assess values for commodities. Practitioners of non-market valuation techniques recognise this when they select the appropriate population from which to sample when conducting surveys. For national issues, a national sample might be selected, while only a local community might be sampled when the issue is the preservation of a local park.

While there may be some general (inverse) relationship between distance and value estimates for environmental goods, it is by no means clear how it may be structured. For example, Rolfe, Bennett and Louviere (1997) report that there appeared to be strong parochial effects in the ways that Queenslanders valued rainforest preservation in CM studies. Choices about rainforest preservation appeared to be prioritised according to whether they were located in Queensland as compared to overseas locations or even in other Australian States. This may be for several reasons, such as parochial interest, awareness of funding responsibilities, and so on. Within

Queensland, the distance factor appeared to be important in determining values, with closer locations being rated more highly. Thus the parochial effects meant that Queensland locations were preferred to those interstate and overseas, and within the state, closer preservation locations were preferred to more distant ones.

These results raised a number of issues. While the results of the rainforest experiment identified parochial effects, it is not clear whether this is a general Australian phenomenon, or is only confined to Queensland. It is uncertain whether the effects are largely distinguished according to state boundaries, or may also be substantial at regional or local levels. It is also unclear whether parochial effects may be attached to many direct use values and 'icon' causes, or whether they are commonly associated with non-use values. (This is unclear from the rainforest surveys because rainforests in the local areas are associated by many people with recreation and lifestyle values).

To explore the framing effects associated with estimating non-use values by different state populations, a series of split-sample experiments were designed that focused on the preservation of remnant vegetation. The main case study selected was the protection of vegetation from clearing in the Desert Uplands bioregion of central Queensland. This case study area is described in some detail in Rolfe, Blamey and Bennett (1997), and the results of previous CM studies reported in Blamey, Rolfe and Bennett (1999) pertain to this region.

Hypothesis A was that parochial effects might be distinguished within a state. This was tested by conducting a valuation experiment across Queensland, and determining if the location of respondents in either the south-east corner of the state (Brisbane, Gold Coast and surrounds) or the rest of the state was a significant parameter affecting respondents' choices. Experiment A thus involved sampling from the Queensland population to estimate values for protecting remnant vegetationin the Desert Uplands region of central Queensland.

The test was performed in two ways. The first involved determining whether a dummy variable for location was significant in a choice model. The second involved estimating choice models for the separate populations, and determining whether significant differences exist between the models using the scale parameter and/or part-worth tests.

Hypothesis B was that parochial effects might be distinguished between state populations. In this case, the appropriate experiment was to conduct a valuation experiment for a single case study across two different states. For this purpose, a region in the Northern Territory (the Daly-Sturt region) where tree clearing is also an issue was selected, and a valuation experiment performed for respondent samples drawn from both Queensland and the Northern Territory. This was Experiment B.

Determing whether the dummy variable representing the respondent's state of location was a significant variable was thus one test of whether parochial effects existed between state populations. A second test for this hypothesis could be gained by comparing the preservation values that Queenslanders have for the Desert Uplands region (Experiment A) with the values that Queenslanders have for the Daly-Sturt region (Experiment B). To minimise the framing differences that might be involved,

the case studies were carefully selected to be as similar as possible, and the experimental design and layout of the CM exercise held constant across the two experiments.

Testing for Bundling effects

Bundling issues are closely linked with framing effects in CM studies. At one level, the issues relate to how values for a composite good are formed compared to when values are estimated seperately. It is normal for framing differences to be present between these situations, resulting in a sub-additivity effect whereby components sum to a higher value than composite goods. This is because of income effects, and the diminishing marginal utility associated with increasing amounts of a particular good. Thus as choices are framed against varying amounts and bundles of goods, it is unlikely that changes in values will be directly proportional to the quantities involved. Economists recognise this by terming it 'regular embedding'.

Although regular embedding implies that values for components will not necessary add up to be equal to values for composite goods, economists still expect that composite goods have higher value than components. The failure of more inclusive goods to have higher value is termed 'perfect embedding' and violates economic assumptions of more being preferred to less. Scope tests are now regularly prescribed for CVM studies to ensure that perfect embedding is not present in survey results.

This can be summarised as saying that when the values for Good X and Good Y are compared to Good (X+Y), economists would be expect that:
$(X+Y) > X$, $(X+Y) > Y$, and $(X+Y) < X + Y$.
While these expectations help determine where results are consistent with economic theory, they provide little guidance about how component goods are bundled together into composite goods (X+Y), and how the latter may be disaggregated into separate components. There are a number of research questions awaiting exploratory work. Among the first are whether the bundling process is relatively uniform across different population groups. If the process is uniform, then the value relativities between goods X, Y, and (X+Y) would be expected to remain constant across different population groups.

A second key area of research interest is whether the components of choice are treated consistently between component and composite goods. Here the question revolves around whether diminishing marginal utility differs across the various attributes used to describe choice options. If the changes in diminishing marginal utility are relatively consistent across the attributes, then it is likely that any scaling effects in a bundling option are likely to be reasonably constant. Under this scenario for example, the addition of a similar composite good (and effective doubling of the choice set) may lead to a standard increase in value by a factor of (1+x).

The alternative situation is where diminishing marginal utility might vary across components of choice. This might be particularly relevant in cases where choices are comprised of both use and non-use values. Satiation might occur reasonably quickly with respect to use value attributes (eg number of trips to national parks), but more slowly with respect to non-use value attributes (eg number of endangered species

protected). Thus while there may be diminishing marginal utility with all attributes in a choice experiment, each may be associated with a different rate. If this reflects the way that people frame bundling choices, then it will make any subsequent benefit transfer approaches more difficult to perform.

The other issue that is important for CM studies relates to choice structures. To make choice experiments consistent with economic theory, respondents are typically asked to indicate only their most preferred option. This may not always coincide with how respondents would prefer to make choices. For example, in a CM experiment involving environmental issues, respondents may wish to support more than one option, (or to allocate expenditure between different issues). For many consumer goods (such as motor vehicles), a focus on a single choice outcome is not unrealistic. For environmental goods though, this may not be a realistic way of framing individual preferences. CM experiments that confine respondent choices to a smaller set than they would actually prefer may induce framing effects. Thus the way in which bundled goods are presented to respondents may influence subsequent model structure.

To explore these issues, another experiment (Experiment C) was designed which involved respondents being presented with four alternatives in each choice set. The first two involved remnant vegetation protection in the Desert Uplands and the Daly-Sturt regions singly. The third incorporated remnant vegetation protection in both the Daly-Sturt and Desert Uplands regions. The final alternative was the status quo. . Structuring the experiment in this way allowed more hypotheses to be tested. Hypothesis C was that values for preservation in the Desert Uplands by the Queensland population would be the same in both Experiment A and Experiment C. In Experiment A, the choices were only framed against other Desert Uplands options, while in Experiment C they were also framed against the Daly-Sturt region, and allowed a combined choice.

Hypotheses Band C rely on comparisons between different case study areas and different CM experiments. The difficulty in conducting such comparisons is in minimising other framing differences that might exist. Substantial work was invested into the design phase of the project for this purpose, and this is reported in the next two sections.

5.0 The Case Study Areas

The Desert Uplands is a biogeographic region in central-western Queensland that is approximately the same size as Tasmania (Rolfe et al 1997). It is an area of low woodland scrub that is used mainly for pastoral purposes (mainly beef cattle). In the rangelands region of Australia, it is relatively unproductive compared to other regions in Queensland because of poor soils and low (and erratic) rainfall patterns. One reason why the term 'desert' is attached to the area is because spinifex (*Trioda ssp*.), a grass common to drier areas of Australia, is commonplace in the region.

In some areas, particularly the southern part of the region, landholders are finding it worthwhile to clear the vegetation to introduce new grasses, which improves the carrying capacity for livestock. While this clearing was initially concentrated on the

better quality soils, it has become more common in recent years in the more open eucalypt woodland communities, where the productive returns are likely to be lower.

Government policy calls for a balance to be struck between production gains that result from tree clearing and any associated environmental losses. Evidence of a search for this balance comes from the introduction of tree clearing controls over leasehold land in 1995, and proposals to extend controls over freehold land in 2000. The leasehold guidelines limit clearing on any allowable ecosystem type to 80% of the ecosystem on each property, with the condition that at least 30% of each ecosystem type is maintained in each regional area.

The tree clearing guidelines in Queensland represent a compromise between production and preservation goals across a state with many diverse industries and ecosystem types. In this situation, it is not clear how those goals match the values of society for production and preservation in particular biodiversity regions. A CM experiment has already been conducted for the purpose of assessing the preservation values that Brisbane households hold for remnant vegetation protection in the region (Blamey et al 1999).

The Daly-Sturt region in the Northern Territory was specifically selected as being very similar to the Desert Uplands. Both regions are approximately the same size, and are rangelands regions of woodland and scrub vegetation that predominantly used for beef cattle production. In both the predominant environmental changes are coming through tree clearing activities, although this has been more widespread in the Desert Uplands. They are both regions that support small populations, with many townships contracting from the effects of declining rural industries.

Despite the similarities, there are some important differences between the regions. Some of these are environmental. The Daly-Sturt region has substantially more land that has not yet been cleared for pasture production, a wider variety of flora and fauna, and approximately double the number of species that could classified in some way as being threatened. In contrast, the Desert Uplands has a larger number of ecosystem types (which is partly a function of variability in soil types). Both regions remain largely intact in terms of their vegetation, although there is some evidence of land degradation from overstocking in parts of the Desert Uplands, and widespread clearing in a few areas.

Some differences relate to agricultural potential. Much of the prospective tree clearing in the Daly-Sturt region would occur along the Daly and Douglas rivers for agricultural purposes (especially irrigation), while clearing in the Desert Uplands region is focused on pasture improvement. In terms of social factors, development in the Daly-Sturt region appears to be linked closely with the tourism and irrigation industries, with Katherine being a major town in the regions. There appear to be good prospects for increases in agricultural production, jobs and population. In contrast, the pastoral industries are likely to remain dominant in the Desert Uplands, and tree clearing and pasture improvement is simply one factor in maintaining production. Further losses in employment and population appear likely to occur in line with other long-term trends in the pastoral zone of Australia.

In summary, the similarities between the two regions in physical, production and social factors are more striking than the differences. The major differences appear to lie in:

- the production settings (more potential for irrigation development in the Daly-Sturt, but from a low base),
- potential for employment and population change, and
- environmental factors (where the existing greater losses in the Desert Uplands region are perhaps balanced by the larger numbers of species at risk in the Daly-Sturt region).

6.0 Designing the Experiments

The focus of the experiments was to test whether the planned differences in framing caused significant variations in the way that people made choices, and hence in model parameters and value estimates. To be able to link planned differences in framing with changes in model parameters, it was desirable to be able to standardise as many other factors as constant. One of the factors to standardise was the selection of the case study areas, as detailed above. Another was the way these could be depicted in a CM experiment. That is the focus of this section.

To generate consistency the same attributes were used for each case study to form the choice alternative profiles, being:

- Payment levy (once off conservation levy collected by the Government)
- Change in the number of jobs in the regions
- Change in the area of uncleared land in the regions,
- Changes in the number of rare and threatened species likely to be left in each region
- Changes in the number of other native plants and animals likely to be left in each region.

The status quo options were framed in terms of what attribute changes might occur if maximum clearing under the current policy settings of government was allowed. This marginal approach (with the base being defined as the existing situation) had the benefit of emphasising the similarities between the regions, as shown in Table 1. Under both status quo (maximum clearing) options, the potential changes in environmental factors are the same, and it is only with the employment factor that the Daly-Sturt region has a different value to the Desert Uplands region. If the current levels for each attribute were used (as was presented to respondents in the information packages), it would have concentrated more attention on the differences between the regions.

Table 1. Information supplied to survey respondents about case study areas.

Attribute	Desert Uplands	Daly-Sturt	Desert Uplands	Daly-Sturt
	Existing situation	**Existing situation**	**Maximum clearing**	**Maximum clearing**
Levy	**$0**	**$0**	**$0**	**$0**

Jobs in region	**2,000**	**3,000**	**0 change**	**↑100 change**
Area of land left uncleared (sq kms)	**50,000**	**60,000**	**↓20,000 sq kms change**	**↓20,000 sq kms change**
Number of rare and threatened species	**40**	**85**	**↓8 change**	**↓8 change**
% of other plants and animals left	**80%**	**95%**	**↓35% change**	**↓35% change**

The use of maximum changes in attributes as a base facilitated the easy comparison of levels in the experiments. For comparative purposes, it was desirable to hold the changes in levels equivalent between the two case studies. If the current situation had been used as a base, this consistency would not have been as apparent to survey respondents. The actual levels used are shown in Table 2.

Table 2. Attributes and levels used in CM experiments.

Attribute	Desert Uplands	Daly-Sturt
Levy	Base - $0 Options - $25, $50, $75, $100, $125, $150, $175, $200	Base - $0 Options - $25, $50, $75, $100, $125, $150, $175, $200
Jobs	Base – 0 change Options – ↓50, ↓100, ↓150, ↓200	Base – ↑100 change Options – ↑50, 0, ↓50, ↓100
Uncleared land (sq kms)	Base - ↓20,000 change Options – ↓4,000, ↓8,000, ↓12,000, ↓16,000	Base - ↓20,000 change Options – ↓4,000, ↓8,000, ↓12,000, ↓16,000
Rare and threatened species	Base – ↓8 change Options –0, ↓2, ↓4, ↓6	Base – ↓8 change Options –0, ↓2, ↓4, ↓6
Other plants and animals	Base – ↓35% Options – 0, ↓10%, ↓20%, ↓30%	Base – ↓35% Options – 0, ↓10%, ↓20%, ↓30%

The final aspect of possible variation to consider between the experiments was the experimental design. There was little problem in this regard between experiments A and B, as both the Desert Uplands and Daly-Sturt case studies were set up with five attributes and a consistent number of levels. The experimental design used for the previous Desert Uplands study (Blamey et al 1998) was employed for this purpose.

The development of the format for the joint survey was more problematic. The focus of the survey was to give respondents four basic options:

- Support for a conservation profile in the Desert Uplands,
- Support for a conservation profile in the Daly-Sturt,
- Support for both profiles
- Support for neither profile (status quo option).

The minimum number of alternatives that respondents could be asked to consider was four. This was inconsistent with the three alternatives available in the single case studies' choice sets. However, if those case studies were expanded to four options (through the addition of another alternative), a different framing problem would have resulted. Respondents would have been offered three different conservation alternatives in a region compared to only one separate profile in the joint survey. A design tradeoff existed between holding the number of available choices constant or minimising the number of options available in each location. It appeared likely that the use of the four options outlined above was a reasonable compromise between these two framing issues.

To minimise choice complexity (and avoid employing a different experimental design), the 'support for both profiles' option was simply stated like that, with the

sum of the levies for the two single profiles being highlighted to respondents. An example of this type of choice set is given in Appendix One.

The three experiments were administered in a mail-out/mail-back format in July 1999. 5,520 surveys were issued to a random sample of respondents in Queensland, Victoria and the Northern Territory, followed by 2 reminder letters. 745 responses were received by mid-October, giving an overall response rate of 13.5%.

There were several factors that appeared to cause such a low response rates. The original survey forms were posted out in envelopes from the market research company rather than from the University of New South Wales, the envelopes were addressed "To the Householder" rather than to the actual respondent, and the mailing list used had a high level of unsuccessful deliveries, particularly in the Northern Territory. The actual response rates according to the different experiments are reported below. While the low response rates make the resulting models suspect for policy purposes, the results still are useful in providing some insights into framing issues.

Table 3. Response rates for surveys.

Experiment	State sampled	# posted out	# returned	Response rate (%)
No 1 (DU)	Queensland	1680	211 253	12.6
No 2 (DS)	Queensland	960	111 128	11.6
No 2 (DS)	Northern Territory	960	74 91	7.7
No 3 (DU+DS)	Queensland	960	136	14.2
No 3 (DU+DS)	Victoria	960	127	13.2

7.0 Experiment results.

The data from the experiments were coded and analysed with LIMDEP after setting aside the responses that did not include choices in the CM sets. The results for the three experiments using simple multinomial logit models are summarised in Table 4.

Table 4. Simple MNL models for Experiments A, B and C.

	Experiment A	Experiment B	Experiment C
Levy	0.00391*** (0.0006)	0.00423*** (0.0006)	0.00179*** (0.0006)
Jobs	0.00321*** (0.0006)	0.00235*** (0.0006)	-0.00039 (0.0007)
Area	0.02215*** (0.0081)	0.03183*** (0.0087)	0.00115 (0.0088)
Rare and Threatened	0.08904*** (0.0162)	0.09556*** (0.0175)	-0.00516 (0.0174)
Other species	0.01508*** (0.0032)	0.02233*** (0.0035)	-0.00068 (0.0060)
Constant – Option 1	0.3527* (0.1826)	0.17774 (0.1976)	-1.6423*** (0.4037)
Constant – Option 2	0.4483** (0.1816)	0.20078 (0.1764)	-1.7315*** (0.4269)
Constant – Joint option			1.3784*** (0.3678)
Log-Likelihood	-1769.87	-1495.58	-1490.95
Rho-squared	0.05899	0.08017	0.3934
Chi-squared	123.1 (5)	134.1 (5)	8.93 (5)
Signif of Chi-Square	1.0000	1.0000	0.88814
No of observations	1712	1480	1773

* significant at the 10% level
** significant at the 5% level
*** significant at the 1% level

Several conclusions about model fit and respondent choice behaviour can be drawn from these simplified models. First, reasonably well fitting models have been gained from the single case study experiments with highly significant model parameters that are signed as expected. (All attributes, including the levy, were coded to reflect losses, so the positive coefficients mean that respondents preferred to choose options with lower losses to them). In experiment A, the positive values for the constants suggest that there are higher choice probabilities associated with the alternatives to introduce increased controls over tree clearing.

Second, a much poorer model fit has been generated for Experiment C (the combined regions valuation exercise). Of the attributes, only the payment levy is indicated as being a significant contributor to choice. For that model, both the first two constants are negative, indicating that the stand-alone Desert Uplands and Daly-Sturt choice sets had a negative contribution. In contrast, the constant for the joint offering is positive, indicating that this was a preferred choice for most people. Respondent

values were concentrated on the combined options, not ones that only increased preservation in a single region. This is confirmed by a visual appraisal of the data set, which shows that most respondents ticked the joint offering selection throughout their survey forms.

These results indicate that respondents appear to be unhappy with choice options that force them to offer support to only one particular cause. The implication for CM experiments appears to be that forcing respondents to prioritise too harshly may lead to framing difficulties. With reference to Experiment C, a more realistic framing option may have been to ask how respondents might choose between differing levels of development/preservation tradeoffs across the two areas.

*HypothesisA:*The first hypothesis was that valuation effects might be partly framed by parochial views within a State. This was tested with Experiment A on the Desert Uplands by dummy coding respondents according to whether they lived in the south-east corner of Queensland (postcodes 4000 to 4300), or elsewhere in the state (postcodes > 4300). The variable (REGION) is interacted with the Alternate Specific Constant (ASC) in the expanded model with other attitudinal and respondent characteristics data, and shown below in Table 5.

Table 5. MNL model for Desert Uplands with attitudinal data and respondent characteristics.

Variable	Coefficient	Standard Error
Levy	0.0042***	0.001
Jobs	0.0033***	0.001
Area	0.0240***	0.008
Rare and Threatened	0.0931***	0.017
Other species	0.0149***	0.003
ASC	7.8151***	2.229
ASC-Emotional about tree clearing	-0.4052***	0.084
ASC-Production more important	0.5131***	0.075
ASC- Conservation levy a good idea	-0.4800***	0.073
ASC- Landholders can be trusted	0.2083**	0.076
ASC- Government can be trusted with spending	-0.1595*	0.083
ASC- needed more information	0.1097	0.020
ASC- information biased to land clearing	0.1097	0.020
ASC- information biased against land clearing	0.1097	0.020
ASC- questions confusing	0.1097	0.020
ASC- didn't read information provided	0.1097	0.020
ASC- Age	0.0223	0.005
ASC- Sex	0.3317*	0.162
ASC- Education	0.1386	0.051
ASC- Postcode	-0.0026	0.001
ASC- Income	0.0125*	0.006
ASC- Region	0.6571**	0.323
Log likelihood	-1480.36	
Rho-squared	0.1907	
Chi-squared	612.4 (37)	
Significance of Chi-squared	1.000	

* significant at the 10% level
** significant at the 5% level
*** significant at the 1% level

The expanded model shows a stronger statistical fit, as evidenced by the improvement in rho-squared statistics. The Region dummy variable is significant, indicating that there is a significant difference in values held by the population in south-eastern Queensland as compared to the rest of the state, even after the impacts of difference in income, age, sex, etc have been taken into account. The negative sign on the Postcode variable indicates that the population in south-eastern Queensland are more likely to support reduced clearing options.

A more accurate way of testing the hypothesis is to examine whether there are significant differences in the choice models that can be estimated from the different respondent groups. These models are reported in Table 6 below. In Table 7, the part-worths that can be calculated from those parameters are reported, together with their 95% confidence intervals. The confidence intervals have been calculated with the Krinsky-Robb procedure. Only simple MNL models have been reported, as splitting the sample reduced the statistical power needed to estimate more complex models.

Table 6. Split sample models for Experiment A (Desert Uplands region).

	South-East Queensland Sample		**Rest of Queensland Sample**	
	Coefficient	Std Error	Coefficient	Std Error I
Levy	0.0058***	0.0009	0.0022**	0.0009
Job	0.0032***	0.0009	0.0034***	0.0009
Area	0.0205*	0.0115	0.0232**	0.0117
Spec	0.0936***	0.0231	0.0906***	0.0234
Other	0.0168***	0.0045	0.0136***	0.0047
ASC	0.8980***	0.2506	-0.0611	0.2655
Log likelihood		-829.8		-899.7
Rho-squared		0.10288		0.03195

* significant at the 10% level
** significant at the 5% level
*** significant at the 1% level

Table 7. Part-worths and Confidence Intervals for Split Sample models from Experiment A (Desert Uplands).

	South-East Queensland sample			Rest of Queensland sample		
Part-worth	Coefficient	95% Confidence Intervals		Coefficient	95% Confidence Intervals	
ASC	155.339	108.3474	186.3936	-27.2692	-1274.4	116.3855
Jobs	0.555184	0.357691	0.671319	1.502369	1.315177	4.724905
Area	3.545636	-0.2569	5.890823	10.35153	3.118144	11.53754
Species	16.19344	10.91348	18.62387	40.42305	34.60237	132.3406
Other	2.899232	1.849534	3.431092	6.072563	5.710416	8.283792

The split sample tests indicate that the first hypothesis should be accepted. There is little overlap between the 95% confidence intervals for the part-worths from the different experiments, indicating that significant choice variations have occurred between the split samples. The evidence from this survey is that conservation value estimation is sensitive to a broad regional-urban distinction in the state population.

Hypothesis B.

The second hypothesis was that valuation effects might be partly framed by parochial views between States. In experiment B, respondents from Queensland and the Northern Territory were given profiles from the Daly-Sturt region. The main test for the second hypothesis is to determine whether the two groups have significantly different value profiles. Differences between values estimated for the sub-sample groups would indicate that state parochial factors are an influence on value estimation. More information about these factors can also be gained by comparing the part-worths generated by Queenslanders for the Desert Uplands in Experiment A with the part-worths generated by Queenslanders for the Daly-Sturt region in Experiment B.

The first step in examining hypothesis B is to determine whether the state of residence is a significant variable in the choice models for the Daly-Sturt experiment. The expanded model is shown in Table 8. It shows an improved model fit compared to the simple MNL model reported in Table 4. The regional attribute (state of residence) is highly significant, with the negative value indicating that Queenslanders had higher preservation values for the Daly-Sturt region than did Territorians.

Table 8. MNL model for Desert Uplands with attitudinal data and respondent characteristics.

Variable	Coefficient	Standard Error
Levy	0.0042***	0.0007
Jobs	0.0029***	0.0007
Area	0.0404***	0.0096
Rare and Threatened	0.1330***	0.0197
Other species	0.0238***	0.0038
ASC (Constant term)	2.7851**	1.1833
ASC-Plan to visit	0.4067***	0.1171
ASC-emotional about tree clearing	-0.9665***	0.1180
ASC-Production more important	0.6433***	0.0982
ASC-Landholders should be compensated	0.5785***	0.1180
ASC-Levy is a good idea	-0.9461***	0.1116
ASC-Government can be trusted – levy	-0.2538*	0.1242
ASC-Government can be trusted – spending	0.4385***	0.1374
ASC-interest in land development issue	-0.3572***	0.1199
ASC-Sex of respondent	0.5623**	0.2167
ASC-Occupation of respondent	-0.2892***	0.0509
ASC-Education of respondent	0.2782***	0.0765
ASC-Postcode of respondent	-0.0005***	0.0001
ASC-State of residence	-0.4531***	0.1350
Log likelihood	-1104.5	
Rho-squared	0.264	
Chi-squared (35)	671.2	
Significance of Chi-squared	1.0000	

* significant at the 10% level
** significant at the 5% level
*** significant at the 1% level

The second way of testing Hypothesis B is to examine the choice models of the same amenity estimated for different population groups . This information can be gained from Experiment B, where both Queensland and Northern Territory residents were asked to value preservation options in the Daly-Sturt Region. The models are reported below in Table 9, while the coefficient ratios and their confidence intervals are reported in Table 10. Because the coefficient for the Levy attribute was insignificant in the second model, another ratio of coefficients has been used in place of part-worths. Again, only simple MNL models have been used in this exercise

because the low number of valid observations reduced the statistical power needed for estimating complex models.

Table 9. Split Sample models for Experiment B (Daly – Sturt region)

	Queensland Sample		**Northern Territory Sample**	
	Coefficient	Std Error	Coefficient	Std Error
Levy	0.0044***	0.0012	0.0021	0.0015
Job	0.0006	0.0013	0.0019	0.0015
Area	0.0133	0.0158	0.0252	0.0195
Spec	0.0816***	0.0314	0.0816**	0.0389
Other	0.0229***	0.0063	0.0278***	0.0078
ASC	1.4109***	0.2632	1.6255***	0.3198
Log likelihood		-949.3		-623.3
Rho-squared		0.0214		0.03671

* significant at the 10% level
** significant at the 5% level
*** significant at the 1% level

Table 10. Coefficient Ratios and Confidence Intervals for Split Sample models from Experiment B (Daly-Sturt region).

	Queensland sample			Northern Territory sample		
Coefficient Ratios	Coefficient Ratio	95% Confidence Intervals		Coefficient Ratio	95% Confidence Intervals	
ASC/Other	61.48774	38.6397	141.579	58.55915	33.25313	145.4054
Levy/Other	0.19293	0.078476	0.489432	0.078942	-0.03328	0.323386
Jobs/Other	0.029598	-0.0798	0.162827	0.06873	-0.05222	0.226971
Area/Other	0.582301	-0.56535	3.52809	0.907884	-0.52037	3.087994
Species/Other	3.556532	0.867399	9.543611	2.938956	0.311161	10.04987

The results indicate that little significant difference exists in model parameter ratios between the two respondent groups. For example, no significant difference exists between coefficient ratios from the choice model of Queensland respondents and the corresponding 95% Confidence Intervals of the choice model for Northern Territory respondents. The only difference in the reverse situation occurs with the Jobs attribute (which is insignificant in both of these simplified models).

The conclusion that can be drawn is that Queensland and Northern Territory respondents do not appear to have framed the choices differently. While Queenslanders may have higher values for the Daly-Sturt preservation options (as evidenced by the regional coefficient in Table 7), the overall structure of their choices does not appear to vary significantly from respondents in the Northern Territory.

A third way of examining Hypothesis B is to look at whether Queenslanders have significantly different values for similar regions inside the state and outside the state. This test is available by comparing the values that Queensland respondents held for the Daly-Sturt region (Experiment B) with the values that Queenslanders held for the Desert Uplands region (Experiment A). If Queenslanders were strongly parochial, it would be expected that the latter exercise would generate significantly different parameter estimates compared to the former.

Table 11. Values that Queenslanders hold for different regions.

	Daly Sturt region		**Desert Uplands region**	
	Coefficient	Std Error	Coefficient	Std Error
Levy	0.0044***	0.0012	0.0038***	0.0009
Job	0.0006	0.0013	0.0026***	0.0009
Area	0.0133	0.0158	0.0152***	0.0112
Spec	0.0816***	0.0314	0.0642	0.0227
Other	0.0229***	0.0063	0.0148***	0.0045
ASC	1.4109***	0.2632	1.6235***	0.2218
Log likelihood		-949.3		-1837.6
Rho-squared		0.0214		0.02299

* significant at the 10% level
** significant at the 5% level
*** significant at the 1% level

Table 12 Part-worths and Confidence Intervals for Split Sample models from Experiment B (Daly-Sturt region).

	Daly-Sturt region			Desert Uplands Region		
Part-worth	Estimate	95% Confidence Intervals		Estimate	95% Confidence Intervals	
ASC	318.7042	215.0089	592.2371	419.7913	302.8011	760.398
Jobs	0.153414	-0.43524	0.807529	0.677217	0.154519	1.583852
Area	3.018193	-3.17389	12.6243	3.823994	-2.31043	13.14504
Species	18.43427	4.161951	50.28806	16.65884	4.407843	37.95416
Other	5.183216	2.043183	12.74269	3.74634	1.686645	9.448021

The results indicate that little significant difference exists in part worth estimates between the two respondent groups. For example, no significant difference exists between part-worths from the Desert Uplands choice model estimated for Queensland respondents and thethose estimated from the Daly-Sturt choice model for Queensland respondents. The only difference in the reverse situation occurs with the Jobs attribute where the coefficient value is just below the corresponding lower confidence interval. This may because the Job coefficient is not significant in the Daly-Sturt model.

While more accurate modelling is needed to replicate these results, the preliminary conclusions that can be drawn are that the State in which people live does not appear to be associated with framing issues.

8.0 Conclusions.

In this paper the results of three different experiments to value the preservation values that Australians might hold for woodland regions of northern Australia have been reported. The two separate regions on which the CM experiments focused where the Desert Uplands region of central Queensland and the Daly-Sturt region of the Northern Territory. In both regions, tree clearing because of land development pressures are key issues. The focus of the experiments was to determine how parochial and bundling issues associated with the framing of stated preference questionnaires affect value estimates

Three key conclusions can be drawn from the experiments. The first is that there appear to be strong parochial effects within a state. When the results for a survey from Queensland residents were classified according to whether respondents lived in South-East Queensland or elsewhere in the state, the dummy variable for the classification was highly significant. These results were confirmed when separate models were estimated for the two groups of respondents, and significant differences in part-worths were calculated.

The second conclusion is that parochial effects do not appear to be significant between states. This was tested in two ways: by comparing the choices that Queenslanders and Territorians made for preservation options in the Daly-Sturt region, and by comparing the choices that Queenslanders made for preservation options in the Daly-Sturt region and the Desert Uplands. In both cases, little significant difference could be identified between part-worths from models for the specific sub-samples. The conclusion to be drawn is that while the state of residence may have some influence on values (as shown by the significance of dummy variables), there is little evidence that respondents frame environmental choices differently according to state boundaries.

The third conclusion relates to bundling effects. The purpose of one experiment was to determine if respondents would prefer to choose between additional preservation options in the two regions, or combined choices that covered both regions. The overwhelming choice was for the combined options to the extent that choice models became insignificant. One implication is that the respondents were uneasy with choice trade-offs that appear to favour one region over another, preferring to support environmental improvements generally.

A second implication is that the simple bundling approach adopted in the experiment was not appropriate for the task at hand. A great deal more work and some innovative approaches are needed to understand better how people frame environmental values at different levels.

References.

Adamowicz, W., Boxall, P., Williams, M. and Louviere, J.J. 1998 "Stated Preference Approaches for Measuring Passive Use Values: Choice Experiments and Contingent Valuation", *American Journal of Agricultural Economics*, 80:64-75.

Blamey, R.K., Bennett, J.W., Louviere, J.J., Morrison, M.D. and Rolfe, J.C. 1998a "Attribute Selection in Environmental Choice Modelling Studies: The Effect of Causually Prior Attributes", *Choice Modelling Research Report No 7*, University College, University of New South Wales, Canberra.

Blamey, R.K., Bennett, J.W., Louviere, J.J., Morrison, M.D. and Rolfe, J.C. 1998b "The Use of Policy Labels in Environmental Choice Modelling Studies" *Choice Modelling Research Report No 9*, University College, University of New South Wales, Canberra.

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

Boyle, K.J. 1989 "Commodity Specification and the Framing of Contingent-Valuation Questions", *Land Economics*, 65(1):57-63.

Carson, R.T. and Mitchell, R.C. 1995 "Sequencing and Nesting in Contingent Valuation Surveys", *Journal of Environmental Economics and Management*, 28:155-173.

Cummings R.G., Brookshire D.S. and Schultze W.D. (eds) 1986 *Valuing Environmental Goods: A State of the Art Assessment of the Contingent Valuation Method*, Rowman and Allanheld, Totowa.

Cummings, R.G., Ganderton, P.T. and McGuckin, T. 1994 "Substitution Effects in CVM Values", *American Journal of Agricultural Economics*, 76:205-214.

Hanemann, W.M. 1984 "Applied Welfare Analysis with Quantitative Response Models", Working Paper No. 241, University of California, Berkeley.

Hoehn, J.P. 1991 "Valuing the Multidimensional Impacts of Environmental Policy: Theory and Methods", *American Journal of Agricultural Economics*, 73:289-299.

Hoehn, J.P. and Loomis, J. 1993 "Substitution Effects in the Contingent Valuation of Multiple Environmental Programs: A Maximum Liklihood Estimator and Empirical Tests", *Journal of Environmental Economics and Management*, 25:56-75.

Hoehn, J.P. and Randall, A. 1987 "A Satisfactory Benefit-Cost Indicator from Contingent Valuation", *Journal of Environmental Economics and Management*, 14(3):226-247.

Kotchen, M.J. and Reiling, S.D. 1999 "Do Reminders of Substitutes and Budget Constraints Influence Contingent Valuation Estimates? Another Comment", *Land Economics*, 75(3):478-482.

Krinsky, I. and Robb, A. 1986 "Approximating the Statistical Properties of Elasticities", *Review of Economics and Statistics*, 68:715-719.

Loomis, J.B., Gonzalez-Caban, A. and Gregory, R. 1994 "Substitutes and Budget Constraints in Contingent Valuation, *Land Economics*, 70:499-506.

Louviere, J J 1994 "Conjoint Analysis", in R Bagozzi (ed) *Handbook of Marketing Research*, Blackwell, Oxford.

Louviere, J.J. and Woodworth, G.G. 1983 Design and Analysis of Simulated Consumer Choice or Allocation Experiments: An Approach Based on Aggregate Data", *Journal of Marketing Research*, 20:350-367.

McFadden, D. 1974 "Conditional Logit Analysis of Qualitative Choice Behaviour", in Zarembka, P. (ed) *Frontiers in Econometrics*, Academic Press, New York.

Mitchell R C and Carson R T 1989 *Using Surveys to Value Public Goods: The Contingent Valuation Method*, Resources for the Future, Washington.

Morrison, M.D., Bennett, J.W. and Blamey, R.K. 1998 "Valuing Improved Wetland Quality Using Choice Modelling", *Choice Modelling Research Report No 6*, University College, University of New South Wales, Canberra.

Neill, H.R. 1995 "The Context for Substitutes in CVM Studies: Some Empirical Observations", *Journal of Environmental Economics and Management*, 29:393-397.

NOAA 1993 *Report of the NOAA Panel on Contingent Valuation*, Federal Register, 58(10):4602-4614.

Randall, A. and Hoehn, J.P. 1996 "Embedding in Market Demand Systems", *Journal of Environmental Economics and Management*, 30:369-380.

Rolfe, J 1996 "Why the Cost of Performing Analysis Matters for CV Practitioners", paper presented at the 40th annual conference for the Australian Society of Agricultural Economics, February, Melbourne.

Rolfe J C and Bennett J W 1996 "Valuing International Rainforests; A Choice Modelling Approach", *Vanuatu Conservation Research Report No 12*, University College, University of New South Wales, Canberra.

Rolfe, J.C., Bennett, J.W. and Louviere, J.J. 1997 "Choice Modelling - An Exercise in Environmental Valuation", paper presented to the 41st annual conference of the Australian Agricultural and Resource Economics Society, Gold Coast, January.

Rolfe, J.C., Bennett, J.W. and Louviere, J.J. 1998 "Framing Issues in the Application of the Choice Modelling Technique to International Conservation Proposals", paper presented to the 42nd annual conference of the Australian Agricultural and Resource Economics Society, Armidale, January.

Rolfe, J.C., Bennett, J.W. and Louviere, J.J. 2000 "Choice Modelling and its potential application to tropical rainforest preservation", Ecological Economics, forthcoming.

Rolfe, J.C., Blamey, R.K. and Bennett, J.W. 1997 *Remnant Vegetation and Broadscale Tree Clearing in the Desert Uplands Bioregion of Queensland*, Choice Modelling Research Report No 3, University College, The University of New South Wales, Canberra.

Swait, J. and Louviere, J.J. 1993 "The Role of the Scale Parameter in the Estimation and Comparison of Multinomial Logit Models", *Journal of Marketing Research*, 30:305-314.

Whitehead, J.C. and Bloomquist, G.C. 1995 "Do Reminders of Substitutes and Budget Constraints Influence Contingent Valuation Estimates: Comment?", *Land Economics*, 71:541-543.

Whitehead, J.C. and Bloomquist, G.C. 1999 "Do Reminders of Substitutes and Budget Constraints Influence Contingent Valuation Estimates: Reply to Another Comment?", *Land Economics*, 75(3):483-484.

Appendix 1

Choice Modelling Questionnaire:

Combined Desert Uplands/Daly Sturt Version

community attitudes

to pastoral land development

in Northern Australia

What this survey is for

We want to know your views on options for managing land development in two regions of Northern Australia, including how you rate different environmental, social and economic benefits.

This survey will help governments and non-government organisations make better decisions on managing natural resources.

How you were chosen

You were chosen at random from the most recent telephone listing of residents in your area.

What we ask you to do

While your name has been selected at random, any member of your household, 18 years or over can complete this survey.

You don't need to know about land management, and there are no correct answers — we are interested in your views.

The survey will take about 30 minutes to complete.

If you have any questions, please …

Call John Rolfe, Central Queensland University:

- (07) 4982 2904.

All your answers will be kept strictly confidential.

We hope you enjoy completing this questionnaire and thank you for helping us with our survey.

Return this survey by..

Survey of

Please place your completed survey in the enclosed stamped, self-addressed envelope and post it to us by 19 July.

1. *To start, we want to know how you compare and rate different goals for Australians.*

   Governments are considering funding reductions. Please rank the following from the most (1) to the least (5) important area to maintain funding:

   Number all boxes — from 1 to 5

   ☐$_1$ crime prevention

   ☐$_2$ education

   ☐$_3$ environment

   ☐$_4$ hospitals

   ☐$_5$ unemployment

2. Please rank the following environmental goals from most (1) to least (5) important:

   Number all boxes — from 1 to 5

   ☐$_1$ reducing water pollution

   ☐$_2$ conserving wetlands

   ☐$_3$ controlling land degradation

   ☐$_4$ reducing air pollution

   ☐$_5$ reducing clearing of native forests and woodlands

3. *We now want to ask you about the two regions of Northern Australia shown on the cover map — the Desert Uplands and the Daly Sturt Region. These areas are described in the enclosed brochure.*

   Have you visited the Desert Uplands or the Daly Sturt regions? *Tick for each region*.

Desert Uplands	Daly Sturt
Yes ☐$_1$	Yes ☐$_1$
No ☐$_2$	No ☐$_2$

4. Do you think you will visit them in the future? *Tick for each region.*

Desert Uplands	Daly Sturt
Yes ☐$_1$	Yes ☐$_1$
No ☐$_2$	No ☐$_2$
Maybe ☐$_3$	Maybe ☐$_3$

5. **The problem**

   - in both areas, land development could increase agricultural and pastoral productivity and employment
   - in the Desert Uplands, development mostly involves clearing trees to increase cattle production
   - in the Daly Sturt, development, including tree clearing, is aimed at increasing cattle grazing and enabling crops to grow
   - if land development goes ahead as currently planned, both environments would be affected, including:
     - — less land would be left in a natural state
     - — more rare and threatened species would be lost from the regions

— the populations of non-threatened species would be reduced

6. Generally, tree clearing issues make you: *Tick*

☐ 4 very emotional

☐ 3 somewhat emotional

☐ 2 slightly emotional

☐ 1 not at all emotional

7. **Option for managing pastoral land development**

- Governments have set minimum standards to prevent major environmental losses
- Governments could further restrict development to protect the environment more
- different restrictions will have different impacts on the environments and economies of the Desert Uplands and Daly Sturt Regions
- imposing restrictions will be expensive as governments would have to pay compensation to landholders for any loss of rights to develop their land

8. **How these options affect you?**

- Governments do not have the money to pay compensation out of existing tax revenues
- The Commonwealth Government could collect a one-off 'conservation levy' on all income tax payers — including you — in the 2000-2001 taxation year
- The size of the levy would depend on how governments may restrict land development
- The money from the levy would be used only to pay compensation to landholders

9. *Please circle how strongly you agree or disagree with the following statements on restricting land development in the Desert Uplands and Daly Sturt.*

The economic benefits from beef production are more important than the environmental costs of land development — *Circle:*

1	2	3	4	5
strongly agree	agree	neither	disagree	strongly disagree

Landholders should be compensated for any production they are forced to forego — *Circle:*

1	2	3	4	5
strongly agree	agree	neither	disagree	strongly disagree

A conservation levy is a good idea — *Circle:*

1	2	3	4	5
strongly agree	agree	neither	disagree	strongly disagree

Landholders can be trusted to comply with restrictions on land development — *Circle:*

1	2	3	4	5
strongly agree	agree	neither	disagree	strongly disagree

Government can be trusted to make a one-off levy — *Circle:*

1	2	3	4	5
strongly agree	agree	neither	disagree	strongly disagree

Government can be trusted to spend the levy only on landholders — *Circle:*

1	2	3	4	5
strongly agree	agree	neither	disagree	strongly disagree

10 How interested are you in pastoral land development in Central Queensland and the Northern Territory? *Tick:*

☐ 4 very interested

☐ 3 moderately interested

☐ 2 slightly interested

☐ 1 not at all interested

What do you think?

We want to know what you think about possible ways of managing land development in the Desert Uplands and Daly Sturt. We want you to consider some options. We will describe each option by giving you information:

- cost to you of a one-off levy on your income
- change to jobs in the region
- change in the area of undeveloped land
- changes in the number of rare and threatened species that are likely to be left in the region
- changes in the number of other native plants and animals likely to be left in the region

The enclosed brochure gives details of the current situation for both regions.
When deciding on the options you prefer, keep in mind your available income and all other things you have to spend money

11. *Please examine each option for clearing land, then answer the question below:*

A. MAXIMUM CLEARING	DESERT UPLANDS	DALY STURT
One-off levy on your income	$0	$0
Change in:		
▪ jobs	0	↑100
▪ uncleared land, sq.kms	↓20,000	↓20,000
▪ rare and threatened species	↓8	↓8
▪ other plants and animals	↓35%	↓35%
B. LESS CLEARING	**DESERT UPLANDS**	**DALY STURT**
One-off levy on your income	$125	$75
Change in:		
▪ jobs	↓50	↑50
▪ uncleared land, sq.kms	↓16,000	↓12,000
▪ rare and threatened species	↓4	0
▪ other plants and animals	0	↓30%

Which set of options do you prefer? *Tick one:*

☐$_1$ maximum clearing in both regions — *costing you nothing*

☐$_2$ maximum clearing Desert Uplands, less in Daly Sturt — *costing you $75*

☐$_3$ maximum clearing Daly Sturt, less in Desert uplands — *costing you $125*

☐$_4$ less clearing in both regions — *costing you $200*

12. *Here is another set of options: Please examine them, then answer the question below:*

A. MAXIMUM CLEARING	DESERT UPLANDS	DALY STURT
One-off levy on your income	$0	$0
Change in:		
▪ jobs	0	↑100
▪ uncleared land, sq.kms	↓20,000	↓20,000
▪ rare and threatened species	↓8	↓8
▪ other plants and animals	↓35%	↓35%
B. LESS CLEARING	**DESERT UPLANDS**	**DALY STURT**
One-off levy on your income	$50	$75
Change in:		
▪ jobs	↓200	↓100
▪ uncleared land, sq.kms	↓4,000	↓12,000
▪ rare and threatened species	↓2	0
▪ other plants and animals	↓30%	↓20%

Which set of options do you prefer? *Tick one:*

☐$_1$ maximum clearing in both regions — *costing you nothing*

☐$_2$ maximum clearing Desert Uplands, less in Daly Sturt — *costing you $75*

☐$_3$ maximum clearing Daly Sturt, less in Desert uplands — *costing you $50*

☐$_4$ less clearing in both regions — *costing you $125*

13. *Here is another set of options: Please examine them, then answer the question below:*

A. MAXIMUM CLEARING	DESERT UPLANDS	DALY STURT
One-off levy on your income	$0	$0
Change in:		
▪ jobs	0	↑100
▪ uncleared land, sq.kms	↓20,000	↓20,000
▪ rare and threatened species	↓8	↓8
▪ other plants and animals	↓35%	↓35%
B. LESS CLEARING	**DESERT UPLANDS**	**DALY STURT**
One-off levy on your income	$75	$75
Change in:		
▪ jobs	↓50	↓50
▪ uncleared land, sq.kms	↓8,000	↓16,000
▪ rare and threatened species	0	↓6
▪ other plants and animals	↓20%	↓10%

Which set of options do you prefer? *Tick one:*

☐$_1$ maximum clearing in both regions — *costing you nothing*

☐$_2$ maximum clearing Desert Uplands, less in Daly Sturt — *costing you $75*

☐$_3$ maximum clearing Daly Sturt, less in Desert uplands — *costing you $75*

☐$_4$ less clearing in both regions — *costing you $150*

14. *Here is another set of options: Please examine them, then answer the question below:*

A. MAXIMUM CLEARING	DESERT UPLANDS	DALY STURT
One-off levy on your income	$0	$0
Change in:		
▪ jobs	0	↑100
▪ uncleared land, sq.kms	↓20,000	↓20,000
▪ rare and threatened species	↓8	↓8
▪ other plants and animals	↓35%	↓35%
B. LESS CLEARING	**DESERT UPLANDS**	**DALY STURT**
One-off levy on your income	$100	$125
Change in:		
▪ jobs	↓100	↑50
▪ uncleared land, sq.kms	↓16,000	↓12,000
▪ rare and threatened species	0	↓6
▪ other plants and animals	0	↓20%

Which set of options do you prefer? *Tick one:*

☐$_1$ maximum clearing in both regions — *costing you nothing*

☐$_2$ maximum clearing Desert Uplands, less in Daly Sturt — *costing you $125*

☐$_3$ maximum clearing Daly Sturt, less in Desert uplands — *costing you $100*

☐$_4$ less clearing in both regions — *costing you $225*

15. *Here is another set of options: Please examine them, then answer the question below:*

A. MAXIMUM CLEARING	DESERT UPLANDS	DALY STURT
One-off levy on your income	$0	$0
Change in:		
▪ jobs	0	↑100
▪ uncleared land, sq.kms	↓20,000	↓20,000
▪ rare and threatened species	↓8	↓8
▪ other plants and animals	↓35%	↓35%
B. LESS CLEARING	DESERT UPLANDS	DALY STURT
One-off levy on your income	$200	$100
Change in:		
▪ jobs	↓100	0
▪ uncleared land, sq.kms	↓4,000	↓12,000
▪ rare and threatened species	↓4	↓4
▪ other plants and animals	0	0

Which set of options do you prefer? *Tick one:*

☐$_1$ maximum clearing in both regions — *costing you nothing*

☐$_2$ maximum clearing Desert Uplands, less in Daly Sturt — *costing you $100*

☐$_3$ maximum clearing Daly Sturt, less in Desert uplands — *costing you $200*

☐$_4$ less clearing in both regions — *costing you $300*

16. *Here is another set of options: Please examine them, then answer the question below:*

A. MAXIMUM CLEARING	DESERT UPLANDS	DALY STURT
One-off levy on your income	$0	$0
Change in:		
▪ jobs	0	↑100
▪ uncleared land, sq.kms	↓20,000	↓20,000
▪ rare and threatened species	↓8	↓8
▪ other plants and animals	↓35%	↓35%
B. LESS CLEARING	DESERT UPLANDS	DALY STURT
One-off levy on your income	$25	$75
Change in:		
▪ jobs	↓100	↓50
▪ uncleared land, sq.kms	↓4,000	↓4,000
▪ rare and threatened species	↓6	↓2
▪ other plants and animals	↓10%	↓30%

Which set of options do you prefer? *Tick one:*

☐$_1$ maximum clearing in both regions — *costing you nothing*

☐$_2$ maximum clearing Desert Uplands, less in Daly Sturt — *costing you $75*

☐$_3$ maximum clearing Daly Sturt, less in Desert uplands — *costing you $25*

☐$_4$ less clearing in both regions — *costing you $100*

17. *Here is another set of options: Please examine them, then answer the question below:*

A. MAXIMUM CLEARING	DESERT UPLANDS	DALY STURT
One-off levy on your income	$0	$0
Change in:		
▪ jobs	0	↑100
▪ uncleared land, sq.kms	↓20,000	↓20,000
▪ rare and threatened species	↓8	↓8
▪ other plants and animals	↓35%	↓35%
B. LESS CLEARING	**DESERT UPLANDS**	**DALY STURT**
One-off levy on your income	$125	$150
Change in:		
▪ jobs	↓150	↓50
▪ uncleared land, sq.kms	↓4,000	↓16,000
▪ rare and threatened species	0	↓4
▪ other plants and animals	↓30%	0

Which set of options do you prefer? *Tick one:*

☐$_1$ maximum clearing in both regions — *costing you nothing*

☐$_2$ maximum clearing Desert Uplands, less in Daly Sturt — *costing you $150*

☐$_3$ maximum clearing Daly Sturt, less in Desert uplands — *costing you $125*

☐$_4$ less clearing in both regions — *costing you $275*

18. *Here is another set of options: Please examine them, then answer the question below:*

A. MAXIMUM CLEARING	DESERT UPLANDS	DALY STURT
One-off levy on your income	$0	$0
Change in:		
▪ jobs	0	↑100
▪ uncleared land, sq.kms	↓20,000	↓20,000
▪ rare and threatened species	↓8	↓8
▪ other plants and animals	↓35%	↓35%
B. LESS CLEARING	**DESERT UPLANDS**	**DALY STURT**
One-off levy on your income	$125	$50
Change in:		
▪ jobs	↓200	0
▪ uncleared land, sq.kms	↓4,000	↓8,000
▪ rare and threatened species	↓6	↓4
▪ other plants and animals	↓20%	↓20%

Which set of options do you prefer? *Tick one:*

☐$_1$ maximum clearing in both regions — *costing you nothing*

☐$_2$ maximum clearing Desert Uplands, less in Daly Sturt — *costing you $50*

☐$_3$ maximum clearing Daly Sturt, less in Desert uplands — *costing you $125*

☐$_4$ less clearing in both regions — *costing you $175*

19. Did you always chose "maximum clearing in both regions" when selecting your preferred option? If No, go to 20. If yes, which of the following statements most closely describes your reason for doing so? *Tick one:*

☐$_1$ I oppose further restrictions on land development

☐$_2$ I support further restrictions but cannot afford any of the conservation levies mentioned

☐$_3$ I support further restrictions but object to a conservation levy of any amount

☐$_4$ I didn't know which option was best so I stuck to the current situation

☐$_8$ Some other reason

20. Please circle how strongly you agree or disagree with the following statements on the information about the Desert Uplands and Daly Sturt regions presented earlier.

I needed more information than was provided. *Circle:*

1	2	3	4	5
strongly agree	agree	neither	disagree	strongly disagree

The information was biased toward land development. *Circle:*

1	2	3	4	5
strongly agree	agree	neither	disagree	strongly disagree

The information was biased in opposition to land development. *Circle:*

1	2	3	4	5
strongly agree	agree	neither	disagree	strongly disagree

I found questions 11 to 18 confusing. *Circle:*

1	2	3	4	5
strongly agree	agree	neither	disagree	strongly disagree

I did not read the information provided in detail. *Circle:*

1	2	3	4	5
strongly agree	agree	neither	disagree	strongly disagree

You and your background

In this section of the questionnaire we would like to ask you a few questions to make sure the people we are surveying are from a wide range of backgrounds**.**

21. What is your age?_____

22. What is your sex? *Tick:*

☐$_1$ Male

☐$_2$ Female

23. What is your current Work Status? *Tick:*

☐$_1$ employed full or part-time

☐$_2$ unemployed/looking for work

☐$_3$ retired/pensioner

☐$_4$ home duties (home-maker)

☐$_8$ Other (please specify)

24. What is the highest level of education you have obtained or are obtaining? *Tick:*

☐ 1 Never went to school

☐ 2 Completed primary only

☐ 3 Completed Junior/ Intermediate/Year 10

☐ 7 Completed Senior/Year 12

☐ 4 Diploma or certificate (trade qualification)

☐ 5 Tertiary degree

☐ 8 Other (please specify)

25. What is the postcode of your residential address?

……..

26. Which of the following categories does your total **household** income (before tax) fall into, that is, the total income of all people in the household? *Tick:*

☐ 1 Under $6,239

☐ 2 $6,240 — $10,399

☐ 3 $10,400 — $15,599

☐ 4 $15,600 — $20,799

☐ 5 $20,800 — $25,999

☐ 6 $26,000 — $31,199

☐ 7 $31,200 —$36,399

☐ 8 $36,400 — $41,599

☐ 9 $41,600 —$51,999

☐ 10 $52,000 — $77,999

☐ 11 $78,000 — $103,999

☐ 12 more than $104,000

☐ 99 Don't know

If you would like to make any further comments, please place them in the space below