



How much is the environment worth?

Catchment management decisions in the Namoi

How much is protecting an endangered species worth? How much should we spend to make sure that native bush stays in good condition? And how much are we willing to pay for healthier rivers in 20 years' time? These are some of the difficult questions catchment managers regularly face.

Some people might argue that environmental assets are priceless and that it is wrong to put a price on saving a species, or protecting a forest or waterway. They believe putting a price on them only subjects them to greater development pressures.

In reality, decisions are continually being made that weigh up environmental protection and development. Putting a value on environmental resources doesn't make any decision outcome any more or less likely. It merely makes the decision process transparent.

The Catchment Management Authorities (CMA)

There are 13 catchment management authorities (CMAs) in NSW, set up by the state government in 2004. The CMAs work in partnership with farmers, Aboriginal communities, local groups, local government,

industry and state government agencies to develop and implement natural resource management (NRM) programs for their catchments.

CMAs receive funding from both Commonwealth and state governments to spend on natural resource improvements in their catchments. Each CMA decides how to spend its funds to meet government priorities.

Making the most of public funds

A major issue for every CMA is how to allocate its limited share of public funds for its own large wish-list of NRM projects. It's not just a matter of predicting the environmental improvements that will flow from the project. It also involves assessing the values placed on those environmental improvements by people both in the catchment and those living outside.

While the costs of NRM projects are relatively easy to identify, the prospective benefits are not. Because most of the benefits are environmental outcomes they are complex to quantify and compare.

If the ultimate goal of the NRM projects is to achieve the best value for the public's money from the community's perspective, this



will inevitably involve trading off outcomes. So how should the decisions be made to achieve this goal?

Choice modelling

One of the methods increasingly being used to help in decision making is choice modelling. Respondents to a choice modelling survey are given sets of hypothetical choices which are used to assess a community's willingness to pay for environmental benefits. Unlike other willingness-to-pay methods, where respondents are asked directly what they would be willing to pay for a particular environmental outcome, choice modelling draws out the information indirectly through a process of observed trade-offs made by the respondents across a sequence of choices.

Choice modelling is based on the idea that any good – or in the catchment management case, environmental or social asset – can be broken down to a number of 'attributes'. NRM outcomes can be described in terms of number of native species, the length of healthy waterways, and the number of people employed in agriculture.

Each of these attributes can take on different levels. Respondents are asked to choose between a number of options, or baskets, containing environmental and socio-economic attributes at different levels. The basket in each option will have a particular cost expressed, for example, as an annual household payment in the form of increased taxes, rates and prices over five years.

By choosing a particular basket of goods at a particular cost over the other baskets, respondents indirectly reveal the relative value they give each of the attributes. Choice modelling allows us to assess trade-offs between environmental and non-environmental goods – for example, a trade-off between employment on one hand and, on the other, an

increase in the area of good-condition native forest and length of healthy waterway. These trade-off values are a further strength of choice modelling over other willingness-to-pay models.

Choice modelling gives us four important pieces of information:

- the attributes that are significant determinants of the values that people place on the environmental and socio-economic assets;
- the implied ranking of these attributes between different groups of survey respondents;
- the value of changing more than one of the attributes at once (for example, if a project results in a particular increase in the total kilometres of healthy streams but a reduction in the number of people employed in agriculture); and
- by extension, the total economic value of a change in a good or environmental asset caused by an NRM investment.

The choice-modelling case studies

The Namoi, Lachlan and Hawkesbury-Nepean CMAs were chosen in 2008 for a willingness-to-pay study using choice modelling.

The Namoi

Jim McDonald, Chairman of the Namoi Catchment Management Authority and fifth generation black soil farmer from Gunnedah, believes there has to be an objective way attributes to choose projects and spend money that's not based on just a whim or personal preference. For McDonald, choice modelling is part of the CMA's decision-making process.

'We don't get these sorts of surveys with this level of sampling very often – so you have to make good use of it,' says McDonald. 'Initially, the CMA targeted particular areas with



only a rudimentary understanding of what we had there or what the priorities were. The choice-modelling project has helped redress that. It tells us how much people are prepared to pay for protecting a certain number of species or a certain length of healthy rivers. That's important.'

The survey

Study respondents in two catchments, Namoi and Lachlan, were asked questions about their willingness to pay for benefits in the Namoi catchment. Running the study in two catchments had the advantage that it could be tested for 'location effect'. As an 'urban control', Sydney residents were also surveyed.

The results provide useful information for policy makers on the extent to which preferences are local, regional or more widespread, and whether investment funding might come from local, state or national sources.

A total of 807 people were surveyed about the Namoi catchment. The respondents were split more or less equally between people in the Namoi, Lachlan and Sydney areas. They were each given five NRM scenarios and asked to choose between three options in each scenario. Each of the three options was a basket of attributes for the catchment providing a different level of:

- square kilometres of good-condition native vegetation;
- numbers of native species;
- kilometres of healthy waterways;
- numbers of people working in agriculture; and
- an annual household cost to achieve the above levels of attributes.

These attributes, their wording and the structure of the questions were carefully

The Namoi River catchment

Location:

The catchment is in northern NSW and extends from the Great Divide in the east to the Barwon River at Walgett in the west, linking the cities of Tamworth, Manilla, Gunnedah and Narrabri. Bound by the Nandewar Ranges and Mt. Kaputar (north) and the Liverpool and Warrumbungle Ranges (south).

Extent:

The river flows 350 kilometres from the south-east to north-west, much of it through the black soils of the Liverpool Plains, and covering some 42,000 square kilometres. Tributaries include Coxs Creek and the Peel, Mooki and Macdonald rivers.

Land use:

- **Agricultural** (90 per cent) – mostly grazing, cotton, poultry and horticulture.
- **Parks and reserves** (5 per cent).
- **Native vegetation** (covers approximately a third of the catchment) – less than a fifth of the native vegetation is in good condition.

Drinking water, fishing and swimming:

About a fifth of the rivers and streams in the catchment are good enough for drinking, fishing and swimming.

Threatened species and ecological communities:

More than 100 threatened species and ecological communities including:

- the brush-tailed rock-wallaby (Warrumbungle and Nandewar Ranges);
- one of the largest populations of barking owls in southern Australia (Pilliga woodlands) and many threatened woodland birds, such as the endangered regent honeyeater and the vulnerable grey-crowned babbler;
- the once-widespread box-gum woodlands, the Brigalow community of forests and woodlands, and the Liverpool Plains grasslands; and
- many orchids, grasses, herbs, shrubs and trees – some such as the endangered shrubs, *Hakea pulvinifera* and *Boronia rupii*, occurring nowhere else apart from the Namoi catchment.

Environmental issues:

- urbanisation (top end of the catchment, especially around Tamworth);
- reduced ground cover;
- water use and water sharing;
- mining developments; and
- proposed gas exploration (Liverpool Plains).



developed in focus groups. The 'people working in agriculture' attribute was considered important because feedback from the focus groups suggested people wanted to know the social effects of protecting more species or improving more waterways. The five-year time period for the additional household cost was considered a plausible timeframe.

First option

In each question the first option was always a 'no-new-action' and 'no-cost' option. The levels of the attributes for this option were determined in consultation with policy makers and scientists in the CMA. For Namoi, this represented 1800 square kilometres of good-condition native forest, 2100 native species, 1900 kilometres of healthy rivers and 5000 people working in agriculture. Note that the no-new-action option is not necessarily the same as the current condition as no action can lead to environmental (and employment) decline.

Second and third options

The attribute levels for the second and third options in each scenario were also developed carefully with specialists from the CMA and were then systematically mixed. One option, for example, included for a cost of \$200 a year, a more than two-fold increase in the area of good-condition native vegetation, compared to the current condition, no change in numbers of native species, a 15 per cent increase in length of healthy waterways, but a 12 per cent decline in agricultural employment.

Another option, for \$50 a year, had a tripling of native vegetation, a slight loss of native species (1.5 per cent), a 50 per cent increase in healthy waterways and a 10 per cent drop in agricultural employment.

Difficult choices

Because the amount of information to be considered by the respondent is high for this

type of survey, each respondent is only given a relatively small number of questions and choices. Respondents are placed in the difficult position of having to make choices between differing levels of benefits for different social and financial costs.

This deliberate weighing up of desirable and undesirable outcomes is the core of choice modelling. Systematic mixing of the options and a large number of respondents provides a sound methodology and statistically significant trends.

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Jim McDonald, Chairman,
Namoi Catchment Management Authority.

Survey results

The three sub-samples of respondents surveyed about the Namoi catchment – residents of towns in the catchment, residents from the Lachlan catchment and Sydney residents – were analysed separately.

Namoi respondents

Respondents from the Namoi were more likely to choose NRM options that increased the level of native species and healthy waterways. They were not concerned about the impact of the loss of agricultural jobs.

Lachlan respondents

The Lachlan respondents were only concerned



about the decline of good-quality native vegetation in the Namoi catchment.

Sydney respondents

The Sydney respondents preferred NRM options that increased the level of native vegetation and native species.

As one of the attributes used in the survey was cost, it is possible to analyse the respondents' willingness to pay (the 'implicit price') for each attribute (refer table below).

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Willingness-to-pay values for the Namoi catchment

Location of respondents		
Namoi	Lachlan	Sydney
Area of native vegetation in good condition (square km)		
ns	\$0.02	\$0.02
Number of native species		
\$2.50	ns	\$2.43
Kilometres of healthy waterways (km)		
\$0.11	ns	ns
Number of people working in agriculture		
ns	ns	ns

ns = value was not statistically significant

As can be seen from the table, those living in the catchment were willing to pay for both maintaining/increasing the numbers of native

species and kilometres of healthy waterways. This is expressed as \$2.50 per respondent for each additional native species and 11 cents per respondent for each additional kilometre of healthy river.

To extrapolate from these figures – 10 kilometres of river (for example) x 11 cents a year for five years = \$5.50 x the number of households in the catchment discounted for time and the response rate of around 30 per cent.

Willingness to pay

Choice modelling has provided the CMA with a willingness-to-pay estimate that it can say with some statistical validity is the value placed by the community on returning to health each 10 kilometres of waterways in the catchment. If the cost of carrying out the improvements is less than the value the community places on them, the CMA can show it is a good investment.

The message the Namoi CMA gets is that people want to invest in the landscape. 'We need to focus on values,' says McDonald.

'Choice modelling allows us to measure people's attachment to values. People don't trust a black box to make decisions. If [a] project like the choice-modelling survey shows a willingness to pay for certain outcomes, that helps us improve the way we choose projects.'

Native vegetation and agricultural employment

The amount that Namoi respondents were willing to pay for maintaining/increasing good-condition native vegetation and employment in agriculture was, however, not statistically significant.

Interestingly, both of the Lachlan and Sydney sub-samples put a greater value on saving and restoring native vegetation in good



condition than their Namoi counterparts. While this might seem surprising, Jim McDonald sees it as a case of 'not valuing our own stuff – you expect your own backyard to stay roughly the same and don't notice it changing'.

Native species

The Sydney respondents, like those in the Namoi itself, were supportive of paying to maintain or increase the number of native species in the Namoi catchment.

Like the values given to the attributes by local respondents, the significant values from the respondents in other areas can be used to extrapolate a community willingness-to-pay to add to the value provided by locals. This can be important in arguing for regional, state or national funding for catchment programs.

References

Mazur, K., Bennett, J., *Choice Modelling in the Development of Natural Resource Management Strategies in NSW*, Environmental Economics Research Hub Research Report No.1, (2008) Crawford School of Economics and Government, The Australian National University.

Mazur, K., Bennett, J., *Using Focus Groups to Design a Choice Modelling Questionnaire for Estimating Natural Resource Management Benefits in NSW*, Environmental Economics Research Hub Research Report No 2, (2008) Crawford School of Economics and Government, The Australian National University.

Mazur, K., Bennett, J., *A Choice Modelling Survey of Community Attitudes to Improvements in Environmental Quality in NSW Catchments*, Environmental Economics Research Hub Research Report No.13, (2009)

Crawford School of Economics and Government, The Australian National University.

Mazur, K., Bennett, J., *Location Differences in Communities' Preferences for Environmental Improvements in Selected NSW Catchments: A Choice Modelling Approach*, Environmental Economics Research Hub Research Report No.21, (2009) Crawford School of Economics and Government, The Australian National University.

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Australian Government
**Department of the Environment,
Water, Heritage and the Arts**

This work was funded through the Commonwealth Environment Research Facilities (CERF) Program, an Australian Government initiative supporting world class, public good research. This project would also like to acknowledge funding it received from NSW Joint Steering Committee to undertake the surveys, and support from collaborating Catchment Management Authorities.

This report was prepared with the assistance of Concise Writing Consultancy www.concisewriting.com.au.