How much is the environment worth?

Catchment management decisions in the Lachlan

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

The Lachlan

Guy Geeves has been a catchment coordinator with the Lachlan Catchment Management Authority for three years. He grew up in rural NSW and has a background as a soil scientist.

'Choice modelling is something we can use at the generic level to put values on things as supporting evidence for funding proposals,' says Geeves. 'It shows the total value of something to households in the catchment and also in the state. The valuations that are thrown up through the choice modelling survey

help us with setting our priorities. In particular it can help the Board make decisions within our investment strategy.'

The survey

Study respondents in two catchments, the Lachlan and Hawkesbury-Nepean, were asked questions about their willingness to pay for benefits in the Lachlan. 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.

More than 860 people were surveyed about the Lachlan catchment. The respondents were split more or less equally between people in the Lachlan, Hawkesbury-Nepean and Sydney areas. They were each given five 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 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

The Lachlan River catchment

Location:
The Lachlan River rises near Goulburn and flows west for more than 600 kilometres. The catchment includes the centres of Cowra, Forbes, Parkes, Condoblin and West Wyalong, and terminates in the Great Cumbung Swamp near Oxley. The Lachlan notionally flows into the Murrumbidgee River, connected only when both rivers are in flood. The catchment is unique in the Murray Darling Basin in the way it terminates in wetlands and diverging creeks.

Extent:
Major tributaries of the Lachlan include the Abercrombie, Boorowa, Belubula, Crookwell, Goobang, Bland and Mirrool. The catchment covers 84 700 square kilometres.

Land use:
- **Agricultural** (90 per cent of the catchment) – mostly grazing, and dryland crops such as wheat.
- **Parks and reserves** (4 per cent of the catchment).
- **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:
Only 10 per cent 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 endangered kultarr, bustard, bush stone-curlew, swift parrot and booroolong frog;
- the Nelia (Acacia loderi) shrublands, Myall woodlands and inland grey box woodlands; and
- 34 threatened orchids, grasses, herbs, shrubs and trees including the crimson spider orchid, the mountain pea (Swainsona erecta) and the Mt Canobolas box.

Environmental issues:
- weeds;
- ground cover maintenance;
- feral animals;
- water quality; and
- vegetation clearance.

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 Lachlan, this represented 5800 square kilometres of good-condition native forest, 2085 native species, 160 kilometres of healthy rivers and 8500 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 90 per cent increase in the area of good-condition native vegetation. This was compared to the current condition, a loss of 10 native species (0.5 per cent), a 50 per cent increase in length of healthy waterways, but a 7 per cent decline in agricultural employment.

Another option, for $50 a year, had a doubling of native vegetation, maintenance of native species numbers, a 36 per cent increase in healthy waterways and a 7 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.

'The valuations that are thrown up in the choice modelling help us with setting our priorities. In particular it can help the Board make decisions within our investment strategy.'

Guy Geeves, Catchment Coordinator, Lachlan Catchment Management Authority.

Survey results

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

Lachlan respondents
Respondents from the Lachlan were more likely to choose NRM options that increased the level of native species and healthy waterways. They were also concerned about the extent of quality native vegetation. They were the only sub-sample concerned about the impact of the loss of agricultural jobs.

Hawkesbury-Nepean respondents
Respondents from this catchment were concerned about native species and healthy rivers in the Lachlan 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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Guy Geeves, Catchment Coordinator, Lachlan Catchment Management Authority.

Willingness-to-pay values for the Lachlan catchment

Location of respondents		
Lachlan	**Hawkesbury-Nepean**	**Sydney**
Area of native vegetation in good condition (square km)		
$0.01	ns	$0.02
Number of native species		
$4.51	$7.45	$8.11
Kilometres of healthy waterways (km)		
$0.83	$1.29	ns
Number of people working in agriculture		
$0.27	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 all the attributes. This is expressed as 1 cent per respondent for each additional square kilometre of native vegetation, $4.51 for each additional native species, 83 cents for each extra kilometre of healthy river or stream and 27 cents per respondent for each additional person working in agriculture.

To extrapolate from these figures – $4.51 for each additional species saved from extinction in the catchment (for example) for five years = $22.55 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 net present value that it can say with some statistical validity is the value placed by the community on saving each additional species (or square kilometre of native vegetation, kilometre of river, agricultural job) 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.

'Choice modelling allows us to evaluate past projects as well', says Guy Geeves. 'Was there a net benefit in fencing that bit of remnant native vegetation? Or revegetating that section of riverbank?'

Interestingly, respondents from all three catchments put a value on saving native species in the Lachlan catchment. The Sydney and Lachlan respondents also put a significant value on saving native vegetation in the Lachlan. And both Hawkesbury-Nepean and Lachlan respondents put a greater value on healthy rivers and streams in the Lachlan catchment than people in Sydney.

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 Reports 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 Reports 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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