

# **Employing Benefit Transfer in Environmental Applications - The View from the Real World**

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- Most of the projects listed below employ Benefit Transfer (BT) procedures for quantification of Non-Market Values (NMV) within a Benefit Cost Analysis (BCA) framework.
- Due to a lack of relevant data, none of the projects involved formal statistical methods for BT. However, the last few projects involve original survey work to allow future formal BT in areas of public management of rivers and forests.
- The projects are listed in chronological order to show the evolution in use of non-market estimation methods.
- Some reports are in confidence – not released by the client.
- Half the projects completed since 2001 used ENVALUE and EVRI. Some used Lincoln University's (NZ) BT database.
- The projects have been generally well received by clients, with the more successful (particularly as measured by their influence on policy outcomes), indicated by ☺.

## Consultancy Reports Employing Benefit Transfer (chronological order)

### ☺ 1. Heritage Rivers – Selection of River Segments for Protection

Read Sturgess & Associates, Midas Consulting, Resource and Environmental Group La Trobe University (1990), *Social and Economic Appraisal of the Draft Proposed Recommendations for the Rivers and Streams Special Investigation*, Report prepared for the Land Conservation Council, Victoria. 130 pp.

Dumsday, R.G., K. Jakobsson. and S. Ransome (1991), *Applying Contingent Valuation Estimates to State-wide Assessment of a Proposal to Protect River Segments in Victoria*, Paper presented at the 35th Annual Conference of the Australian Agricultural Economics Society, University of New England, Armidale, NSW, February 11-14. 28 pp.

Dumsday, R.G., K. Jakobsson. and S. Ransome (1992). *State-Wide Assessment of Protection of River Segments in Victoria, Australia*, Paper presented to a symposium on the Management of Public Resources, Resource Policy Consortium, Washington D.C., USA. 13 pp.

One of the first such studies in Victoria. The LCC included representatives from 7 government departments having responsibilities for the management of public land and water. A study which led the consultant to become a 'true believer' in BT – mainly due to success in resolving conflicts within LCC. Literature review running to 15 pages used to extract use values in \$ per visitor day and non-use values in \$ per household per year, including some from the young Jeff Bennett. Outcome – 15 of 23 river segments protected in legislation (recently re-affirmed in State Parliament) and final recommendations largely consistent with those emerging from the economic study.

Environmental values considered -

#### Recreation values:

1. Water based recreation - canoeing, rafting, boating – significance at national, state and regional levels.
2. Angling – exotic and native fish.
3. Recreation – camping, backpacking.
4. Wildlife hunting.

#### Conservation values:

5. Faunal significance – national and state.
6. Botanical significance – national and state.
7. Wilderness, including wetlands.
8. Landscape, amenity, scenery.
- 8a. Geological / geomorphological significance.
9. Cultural heritage – national & state.



## ☺ 2. *Lake Wartook –Refurbishment of Dam Wall*

Dumsday, R.G. and Fraser, I.M. (1996), *Estimating the Environmental Benefits of Lake Wartook Reservoir, The Grampian's National Park, Victoria*, a Report to Wimmera Mallee Water, Horsham. 24 pp.

Potential losses if wall not refurbished – Use values of \$2-6m (based mainly on Read Sturgess travel cost study of Grampians National Park), non-use values of \$1-2m (estimating values for environment, species existence, and cultural and heritage values), justifying costs of refurbishment. Outcome – wall refurbished.

The non-market benefits identified for Lake Wartook were:

- source of environmental flow for the Mackenzie River which was identified as being of high environmental significance in terms of its flora and fauna
- source of continuous flow of water through the Mackenzie Falls which is a major tourist attraction in the Grampians National Park
- The cultural and historical importance of Lake Wartook.

## ☺ 3. *Royal Botanic Gardens, Cranbourne – Investment Plan*

Read Sturgess and Associates (1998), *Economic Contribution of the Royal Botanic Gardens, Cranbourne: Present and Proposed*, for the Royal Botanic Gardens, Cranbourne. 44 pp.

An investment proposal involving about \$25m over 8 years to create an 'Australian Gardens' theme. Estimates of NMVs based on review of 16 travel cost studies for three scenarios. Results of the BCA are summarised in the table below. Project recently largely completed – see photo of part of the development.



Scenario	Additional Benefit (\$)	Capitalised Value of Additional Benefit (\$m)	Return on Capital (%)	Benefit-Cost Ratio
Expected	4,163,200	52	17	2.08
Pessimistic	915,200	11	4	0.44
Optimistic	8,486,200	106	34	4.24



#### ☺ 4. Box-Ironbark National Parks - Establishment

Dumsday, R.G. (2001), *Potential Social and Economic Effects of Recommendations for Victoria's Box-Ironbark Forests & Woodlands Area*, Report prepared for the Environment Conservation Council, Melbourne. 206 pp.

Extensive literature review of relevant studies. A study by Lockwood was of greatest relevance to the ECC study. It included market and non-market valuations of conserving remnant native vegetation (RNV) on private land in north-eastern Victoria and overlaps the ECC study area.

Lockwood used two stated preference methods, contingent valuation (CV) and choice modelling (CM), to assess the non-market economic values of remnant native vegetation (RNV) in the two study areas. Each of these methods involved the use of mail surveys of approximately 600 Victorian voters to determine community willingness to pay (WTP) for RNV conservation.

The economic estimates from the two methods were not significantly different and resulted in values of \$4.25m per year for Victorian voters, or \$6.90m per year for all Victorian households (\$5 per household per year). It is likely that Victorians would be willing to pay more for biodiversity conservation in national and state parks than in remnant native vegetation areas on private land so these values are likely to be conservative.

For the purposes of the benefit-cost analysis, non-use values for biodiversity are assumed to be \$1m per annum for the pessimistic case, \$2m per annum for the conservative case (\$1.50 per household per year), and \$4m per annum for the optimistic case. These values are all well below those found in most studies but are discounted because of the difficulties in transferring results from other studies, and because modern forestry practices may deliver some of the benefits of biodiversity protection, even in the absence of the ECC recommendations.

Outcome – new national parks established across northern Victoria.

### Summary of benefits and costs

	<b>Pessimistic</b> (\$m per year)	<b>Conservative</b> (\$m per year)	<b>Optimistic</b> (\$m per year)
<b>BENEFITS OF ECC PROPOSALS</b>			
Increased biodiversity and natural values	1.00	2.00	4.00
Increased value of tourism and recreation in new and expanded parks/reserves	0.34	0.97	1.90
<b>Total benefits</b>	1.34	2.97	5.90
<b>COSTS OF ECC PROPOSALS</b>			
Additional park management	0.40	0.40	0.40
Reduction in value of future timber harvest	0.22	0.18	0.14
Reduction in value of future minerals exploration	0.28	0.19	0.10
Reduction in value of future eucalyptus oil production	0.07	0.05	0.03
Reduction in income for graziers excluded from floodplain grazing licences	0.08	0.08	0.08
<b>Total costs</b>	1.05	0.90	0.75
<b>NET BENEFIT</b>	0.29	2.07	5.15

### ☺ 5. Farm Forestry, Tasmania - Assessment

Freeman, B. and Dumsday, R. (2003), *Evaluation of Environmental Services Provided by Farm Forestry – A Discussion Paper*, Report prepared for Private Forests Tasmania by URS Australia. 70 pp.

#### Environmental Benefits

<b>Type of Benefit</b>	<b>Estimate</b> (\$/ha/year)	<b>BT</b>
<b>Indirect (Private) Benefits</b>		
Crop and livestock shade and shelter	20	Based on Bauer (2003)
Fodder	7	Based on Bauer (2003)
Salinity	10	Derived from NLWRA (2002) data as an average across all areas
Soil erosion	7	Based on Mallawaarachchi (1993, 1994)
<b>Non-Market (Public) Benefits</b>		
Biodiversity	22	Derived from choice modelling survey (NLWRA 2002). Assumes 100 hectares of trees result in 0.1% increase in survival of endangered species.
Riparian restoration and water quality	30	Derived from van Bueren and Bennett (2001)
Salinity	15	Based on Stanton et al. (1995)
Soil erosion	3	Based on Mallawaarachchi (1993, 1994)
Aesthetics/scenic improvement	23	Based on willingness to pay for restored farmland (NLWRA 2002) and van Bueren and Bennett (2001)
Carbon sequestration*	100	Based on Bauer et al. (2003).

Results dominated by WTP to reduce global warming.

## 6. Non-Market Components of R&D

URS (2003), *Non-Market Valuation and Holistic Assessment. Part 1: Non-Market Benefits of Research and Development*, Report prepared for Land and Water Australia, Canberra. 101 pp. incl. appendices.

Review report, no direct outcomes – RDCs didn't adopt recommendations.

### ☺ 7. Environmental Impacts of Gold Mining

Dumsday, R. (2004), *Review of TREM Consulting Economic Impact Assessment for the Supplementary Report to the Deborah Reef EES for Bendigo Mining NL*, URS, Melbourne. 5 pp.

*Biodiversity, tourism and recreation* - The project is to be located in the Bendigo Regional Park, threatening a loss of values in terms of biodiversity, tourism and recreation. By applying the results of the ECC Box Ironbark NP analysis to the site in question, the losses may amount to the equivalent of a Net Present Value (NPV) of up to approximately \$60,000 (discounted at 6% in perpetuity). This compares with a rough estimate of the mining project NPV of \$370-750 million (discounted at 6% over 25 years). The range is dependent on assumptions about gold prices, costs of production and gold output over time. The intuitive explanation of this result is that the BI National Parks protected a large area (approximately an additional 57,600 hectares) of Box-Ironbark Forest. The mining project occupies a relatively small area of about 40 hectares of BI yet produces a high value product. Some environmentalists had estimated the non-market losses at about \$3m per year – NPV of about \$50m (cf. our NPV \$0.6m).

Outcome – mine approved but may not go ahead.

### 8. Otway Ranges National Park - Establishment

URS (2004), *Social and Economic Studies in the Angahook-Otway Study Area, Stage 3*, Report prepared for the Victorian Environmental Assessment Council, Melbourne. 98 pp.

The main competing values were environment and timber. Reputedly the only 'sustainable' timber harvest rate in Victoria but Premier Bracks took the timber out of consideration before an election, leaving the economic analysis one-sided. Showed up deficiencies in always relying on BT rather than conducting original CM survey work – sowed seeds with client for later projects.

Outcome – new national parks and reserves in south west Victoria.

### ☺ 9. Environmental Flows – Thomson & Macalister rivers

URS (2004), *Thomson and Macalister River Environmental Flow Project: Benefit Cost Analysis for Proposed Environmental Flow Options*, Final Report Prepared for Department of Sustainability and Environment, Melbourne. 101 pp.

The main environmental outcomes related to healthy native vegetation and wetlands, native fish species and species of waterbirds. BT estimates relied heavily on Bennett and Morrison (2001).

**Attribute value estimates**

Attribute	Value estimate (\$ per within catchment household)	Value estimate (\$ per outside catchment household)
Native Vegetation <sup>a</sup>	2.32	2.61
Native Fish <sup>b</sup>	7.37	6.72
Fauna <sup>c</sup>	0.92	0.87
Water Quality: Boatable to Fishable <sup>d</sup>	53.16	30.10
Water Quality: Fishable to Swimmable <sup>e</sup>	50.14	38.74

**Mean benefits (NPV) relative to continuation of Option 5**

Option	Extra flow relative to Option 5 (ML)	Total benefit relative to Option 5 (\$m)	Mean Value per ML of extra flow
Option 1	57,000	106	\$1,860
Option 2	41,000	86	\$2,098
Option 3	31,000	81	\$2,613
Option 4	20,000	4	\$200

Outcome – clients did not fully embrace the concepts of NMV and BT but their recommendations were largely consistent with the economic analysis based on those concepts.

**10. Non-Market Values Associated with Wind Farms**

URS (2004), *Economic Impact Assessment of the Proposed Wind Farm at Dollar, South Gippsland*, Draft report prepared for Meridian Energy Ltd. 59 pp.

URS (2004), *Regional Economic Impact Analysis of the Proposed Wind Farm at Dollar, South Gippsland*, Report prepared for Dollar Wind Farm Pty Ltd. 48 pp.

☺ **11. Assessing Options for Disposal of Melbourne’s Sewage**

URS (2004), *Economic Assessment of Options for Upgrading Melbourne Water’s Eastern Treatment Plant*, Report prepared for Melbourne Water. 85 pp.

The project involved assessing nine options for upgrading the Eastern Treatment Plant (ETP) which processes 40 percent of Melbourne’s sewage. The options were aimed at improving environmental outcomes. Almost all benefits were non-market while costs were readily estimated and ranged up to \$200m.

The categories of environmental values chosen were:

*‘Use’ values:*

- bathing water quality (impacts on surfers and swimmers);
- fishing (including impacts on beach and rock fishing); and
- beach activities (including walking, horse-riding and sunbathing);

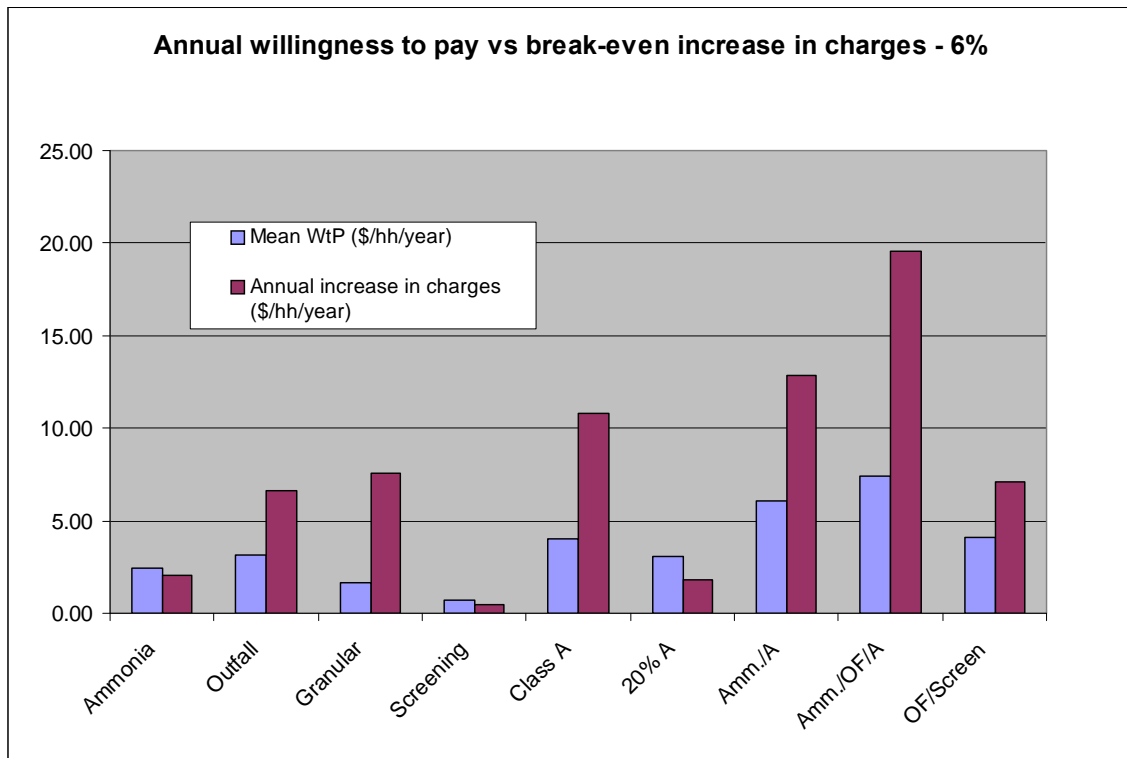
*‘Non-use’ values:*

- aesthetics and amenity (impacts on local households);
- ecosystem, biodiversity (impacts on Melbourne and local households); and
- recycling (impacts on Melbourne and local households).

**Estimates of non-market values**

Category	‘Modal’ value	
	\$/household per year	\$/visitor day
bathing water quality	60	32
fishing	50	72
beach activities	42	19
aesthetics and amenity	62	109
ecosystem, biodiversity	31	-
recycling	20	-

The three options with benefit-cost ratios greater than one show WTP greater than the required increase in charges while for the other six options the required increases are generally more than double the estimated WTP.



Outcome – client’s recommendations likely to be consistent with the economic analysis.

### **12. Non Market Values for Multiple Land Uses**

URS (2004), *Economic Value of the Werribee Precinct*, Report prepared for Parks Victoria. 64 pp.

The Werribee ‘Precinct’ consists of a number of ‘venues’, including: The Mansion at Werribee Park; The Mansion Hotel and Shadowfax Winery; the Werribee Park Reception Centre; The Victoria State Rose Garden; the Regional Park; Victoria’s Open Range Zoo (VORZ); the Werribee Park National Equestrian Centre (NEC); and the Werribee Park Golf Club.

Entry to many parts of the Precinct is ‘free’. The Precinct has not been widely promoted as an integrated facility, although it is estimated that approximately 600,000 people visit it each year.

Parks Victoria initiated this study to value the Precinct, including the ‘non-market’ values associated with ‘free’ entry, partly in order to assess the potential for future private and public investment.

### **13. Non-Market Values Associated with Use of Recycled Water**

URS in association with Gillespie Economics and Dumsday, Cross & Associates (2005), *Community Benefits Study*, Report Prepared for South East Community Water Recycling Scheme Reference Group. 41 pp.

Increasing scarcity of water for domestic and industrial users has resulted in policy makers now seriously examining ‘sustainable’ water resource management including demand management, augmentation of surface and groundwater supplies, rainwater tanks, desalination of seawater, water pricing, and water recycling.

The Scheme has potential to recycle approximately 2,000ML/yr of Class A recycled water from the Eastern Treatment Plant (ETP) to a range of open space and industrial areas. The Scheme is also estimated to result in a reduction in demand for potable water in the order of 909ML/yr.



There are many potential benefits of such a scheme that are not incorporated into standard financial analysis – such as ‘non-use’ benefits of recycling water, recreation benefits, and environmental benefits. The BCA undertaken in this study specifically incorporates these non-market benefits.

The BCA shows that even though some of the potential economic benefits of the Scheme remain unquantified (e.g. health benefits of increased physical activity and education and demonstration values), the Scheme is forecast to generate strong economic benefits, yielding a Benefit:Cost ratio of 1.5.

Outcome – the project was aimed at supporting a business case for government funding but the application was unsuccessful.

#### ***14. Cattle Grazing in the Alpine National Park - Environmental and Cultural Impacts***

URS (2005), *Socio-Economic Assessment of Cattle Grazing in the Alpine National Park*, Report prepared for Department of Sustainability and Environment on behalf of the Alpine Grazing Taskforce, Melbourne. 155 pp.

The Victorian Alpine National Park (ANP) contains significant landscape attributes and biota. Parks Victoria reports that there are more than 1,100 plant species and more than 300 animal species recorded in the ANP. Currently, the ANP is the only part of the Australian Alps National Parks in which grazing by domestic livestock continues. Conservationists and ecologists are concerned that the continuation of cattle grazing threatens the existence and integrity of many of the natural features of the ANP. But the graziers claim that the cattle do little if any environmental damage and that the continuation of grazing yields significant cultural heritage benefits for society.

There are at least two particular features specific to this problem that make it unique in the context of conflicts in the use of natural resources.

First, conservationists and scientists cite evidence that alpine grazing damages the alpine environment and the ecosystem services that it provides – including the protection of biodiversity. The ANP has been identified for possible nomination for World Heritage listing. Conservationists argue that for a potential nomination to succeed, cattle grazing needs to stop - they are of the opinion that cattle grazing is an incompatible activity as it significantly harms the integrity of the ANP. This land use conflict is taking place over a tract of land that is considered by many to be unique by global environmental criteria.

Second, alpine grazing is linked with significant cultural heritage traditions. Alpine grazing has been practised for over 150 years and many of the graziers have a long association with the area. This, in combination with the strong cultural identity forged through poetry and high country imagery, place this land use firmly in the minds of many Australians.

In other words, the case of the Victorian ANP is unusual in that both of the major competing ‘uses’ (ecosystem services/biodiversity, and cultural heritage) are ‘non-market’ in character. Commercial cattle grazing benefits (around \$1m per year) were small in relation to these two benefits. The extent to which the environmental and cultural heritage benefits are competitive is not really known.

The NMV component of the BCA relied heavily on a study by Lockwood et al. in the Bogong High Plains section of the ANP. They found that Victorians were willing to pay \$30-40m per year to retain cultural heritage values associated with the park or \$14m per year to preserve environmental values.

Outcome – cattle grazing has been excluded from the Victorian ANP by the state government.

### ☺ 15. *Environmental Values Using CM – Improvement in River Health*

URS (2006), *The Value of Improved Environmental Health in Victorian Rivers: Results from the Pilot Phase*, Report prepared for the Victorian Department of Sustainability and Environment, Corangamite Catchment Management Authority, Goulburn Broken Catchment Management Authority, and Melbourne Water Corporation. 87 pp.

Bennett, J., Dumsday, R., Howell, G., Lloyd, C., Sturgess, N. and Van Raalte, L. (2006), *The Economic Value of Improved Environmental Health in Rivers*, paper presented to the 9th Riversymposium, 4-7 September 2006, Brisbane. 19 pp.

Kragt, M., Bennett, J., Lloyd, C., Dumsday, R. (2007), *Comparing Choice Models of River Health Improvement for the Goulburn River*, Paper presented at the 51st AARES Conference, Queenstown New Zealand, February. 28 pp.

Approximately 32 per cent of Victoria's rivers are in poor to very poor condition while only 21 per cent are in good to excellent condition. To address this situation, current government targets include delivering significant improvements in river health by 2010. The quantification of benefits associated with improvements in river health arising from policy initiatives and projects is useful because it enables the use of BCA to assess the viability of investment options. The non-market valuation technique Choice Modelling was used to generate such estimates for a selection of Victorian rivers. Monetary values were estimated for four attributes of environmental improvement: the percentage of pre-settlement fish species and populations; the percentage of the river's length with healthy vegetation on both banks; the number of native waterbird and animal species with sustainable populations; and the percentage of the river suitable for primary contact recreation without threat to public health.

Only the in-catchment respondents and Melbourne respondents were willing to pay for water quality improvements in the Goulburn River. That amount for both sub-samples was in the order of \$2 for a one per cent increase in the length of the river suitable for primary contact recreation. The water quality Implicit Prices (IPs) were not significant for the other samples.

Fish health was consistently valued by respondents at around \$5 for a one per cent increase in species and population levels. Gellibrand in-catchment respondents were willing to pay \$2 for more native fish in their river.

Willingness to pay for improvements in riverside vegetation was also significantly different from zero and ranged between \$3 and \$6. This value was for an additional one per cent of the river's length with healthy vegetation on both banks.

Waterbird and animal species were of less interest in the Goulburn River than in either the Moorabool or Gellibrand but implicit prices were consistently significantly different from zero in all sub-samples. Moorabool in-catchment respondents were willing to pay over \$20 for each additional native species of waterbird and animal that could be re-introduced into the riverine area. In contrast, the marginal value expressed by Gellibrand catchment resident respondents for Goulburn River species was around \$3. A possible reason for these differences is that the attribute was starting from a low base for the Moorabool, with potential for significant improvement compared with the Goulburn.

Outcome – when the drought breaks in Victoria's north?? it is hoped that the pilot study will be expanded to permit development of models for representative rivers that can be used in BT for all rivers. Benefit-Cost Analyses could then provide support to funding applications for expansion of existing projects and programs, or to establishment of new projects and programs in river health. River Managers support the research because they can see that, for the first time, they are able to quantify the benefits of their programs and projects.

## ☺ 16. Environmental Values Using CM – River Red Gum and East Gippsland Forests

Bennett, J. Dumsday, R. Lloyd, C. and Kragt, M. (2007), *Non-Use Values of Victorian Public Land: Case Studies of River Red Gum and East Gippsland Forests*, Report prepared by URS Australia for the Victorian Environmental Assessment Council, Melbourne, June. 60 pp.

Bennett, J. Dumsday, R. Ransome, S. and Kragt, M. (2007), *Valuing the Protection of Victorian Forests: Murray River Red Gums, and East Gippsland*, Paper presented at the 51<sup>st</sup> AARES Conference, Queenstown New Zealand, February. 27 pp.

The Victorian River Red Gum (RRG) forests, wetlands and floodplains of the Murray Valley, and the forests of East Gippsland (EGF), are valuable environmental resources with many, sometimes competing, land uses giving rise to benefits for a wide range of people. Determining the appropriate balance of these uses from a society-wide perspective requires information about the relative economic values generated from those uses.

Information about the commercial value of timber production, mining and grazing is readily available from the markets in which the products are exchanged and are not the focus of this study. More problematic is the estimation of values associated with forest benefits that are not marketed. These benefits arise from recreation and tourism activities, ecosystem conservation and protection of cultural heritage. Choice Modelling was used to quantify these benefits.

### Attributes and their levels for River Red Gum forests

Attribute	Description	Levels
Cost	Compulsory annual payment (\$)	0; 20; 50; 100
Healthy RRGs	Area in hectares	54,000; 67,000; 74,000; 80,000
Threatened Parrots	Number of breeding pairs	900; 1,200; 1,500; 1,800
Murray Cod and other threatened native fish	Percentage of pre-European numbers	10; 20; 40; 60
Recreation Facilities	Number of campsites with facilities	6; 9; 12; 18

### Attributes and their levels for East Gippsland forests

Attribute	Description	Levels
Cost	Compulsory annual payment (\$)	0; 20; 50; 100
Threatened Owl Species	Number of breeding pairs	400; 440; 460; 500
Threatened Long-footed Potoroos	Number of individuals	2,000; 2,500; 3,000; 4,000
Significant Rainforest Sites	Number of hectares protected	3,350; 4,000; 4,500; 5,000
Old Growth Forest	Number of hectares protected	172,000; 190,000; 215,000; 240,000

The results in the table below show that respondents in the Bairnsdale and Melbourne sub samples are willing to pay \$3.29 and \$1.45 respectively for a 1,000 hectare increase in the area of healthy River Red Gum forest (per annum per household for 20 years). Within region respondents recorded an implicit price for increasing the area of healthy forest that is not significantly different from zero. Respondents were found to attach a positive value to increasing the numbers of breeding pairs of threatened parrots, ranging from around \$4 to \$8.40 per 100 pairs. The implicit price for a one-percent increase in the populations of Murray Cod and other threatened native fish species varies across the sub samples from about \$1 to \$1.40. Implicit prices for the recreation attribute are not significant for any of the sub samples.

### Implicit Price Estimates for River Red Gums

Sub sample →	Melbourne (\$/yr/hh)	Bairnsdale (\$/yr/hh)	Within region (\$/yr/hh)
Attribute ↓			
Healthy RRGs /1,000 ha	1.45***	3.29**	0.0677
Parrots /100 pairs	4.39***	8.39***	3.96***
Cod /1% increase	1.02***	1.37***	1.09***
Recreation /campsite	-0.11	-0.85	-0.24

Significance levels indicated by: \* 0.1, \*\* 0.05, \*\*\* 0.01.

The non-significance of the recreation/campsite attribute may be due to a conflict of preferences between those seeing positive outcomes (eg. more facilities providing a better camping experience) and those seeing negative outcomes (eg. more facilities leading to more congestion). Managers should weigh these tradeoffs when considering the development of public land.

The implicit prices for East Gippsland are shown in the table below.

The marginal willingness to pay (per annum for 20 years per respondent household) for increasing the number of breeding pairs of threatened owl species is significant for all sub samples, ranging from 18 to 83 cents per breeding pair. The annual implicit price for increasing the number of threatened Long-footed Potoroos by 100 individuals varies between \$1.20 for Bairnsdale respondents to \$4.50 for East Gippsland Rural respondents. Respondents in the Bairnsdale and Melbourne sub samples are willing to pay, on average per annum, 33 and 65 cents for a 1,000 ha increase in the area of protected old growth forest. Rural East Gippsland respondents were found to be willing to pay \$2.05 for the same increase.

The implicit prices for a 1,000 ha increase in identified rainforest site protection are significant in the Melbourne and East Gippsland Rural sub samples, and are in the order of \$11 and \$53 respectively. In contrast with the River Red Gum area, East Gippsland Rural respondents – those closest to and most familiar with the region – were willing to pay the highest amounts for all attributes.

### Implicit Price Estimates for East Gippsland Forests

Sub sample →	Melbourne (\$/yr/hh)	Bairnsdale (\$/yr/hh)	East Gippsland Rural (\$/yr/hh)
Attribute ↓			
Owls/pair	0.18**	0.24**	0.83*
Potoroos/100 individuals	1.50***	1.23***	4.50**
Rainforest/1,000 ha	11.16**	8.10	53.08*
Old growth forest /1,000 ha	0.65***	0.33**	2.05**

Significance levels indicated by: \* 0.1, \*\* 0.05, \*\*\* 0.01

Outcome – the results of this study were used in Project 17 to assess the economics of establishing RRG National Parks along the Murray River.



### ☺ 17. *River Red Gum National Parks - Establishment*

Gillespie Economics, DCA Economics and Environmental & Resource Economics (2007), *River Red Gum Forests Investigation – Socio-Economic Assessment of Draft Recommendations*, Report prepared for the Victorian Environmental Assessment Council, Melbourne. 59 pp.

Benefit Cost Analysis employing results from Project 16.

The Victorian River Red Gum (RRG) forests, wetlands and floodplains of the Murray Valley are valuable environmental resources with many, sometimes competing, land uses giving rise to benefits for a wide range of people. Determining the appropriate balance of these uses from a society-wide perspective requires information about the relative values generated from those uses to be incorporated into the conceptual framework of a BCA. Under this framework, alternative forest management scenarios (Scenarios 2, 3 and 4) are compared against the base case or do-nothing new option (Scenario 1) to identify if any of the alternative options will lead to an improvement in well-being for the people of Victoria. The scenarios are:

- Scenario 1 BASE CASE - No new management changes over the next 20 years (including 500 GL per annum already identified for the MDB icon sites, and 127 GL for existing annual environmental allocations)
- Scenario 2 All VEAC's draft proposals including new national parks but with no additional water
- Scenario 3 All VEAC's draft proposals including national parks but with 2,000 GL additional water every five years on average
- Scenario 4 All VEAC's draft proposals including national parks and VEAC's estimated 4,000 GL additional water every five years on average

Information about the commercial values of forest uses such as timber production and grazing in the River Red Gum forests and the cost of water to be used under Scenarios 3 and 4 is available from the markets in which outputs are exchanged. Forest protection benefits arise from recreation and tourism activities, ecosystem and cultural heritage conservation. Quantification of these non-market values were the focus of Project 16.



The assumptions for environmental outcomes were specified by VEAC and are summarised below.

	<b>Scenario 1</b>	<b>Scenario 2</b>	<b>Scenario 3</b>	<b>Scenario 4</b>
Healthy RRGs ('000 ha)	54	60	65	80
Threatened parrots ('00 pairs)	9	10	14	16
Murray Cod & other threatened native fish (% of pre-European)	10	10	20	30

In addition to the above environmental outcomes, VEAC draft proposals involve increased protection of about 7,475 ha of wetlands and restrictions affecting approximately 3,950 duck hunters.

Non-market issues that are not addressed in this analysis include implications for indigenous cultural heritage, and the cultural heritage value of the Barmah muster and other red gum related heritage issues. The environmental benefits of excluding grazing from riparian areas have not been explicitly calculated. The implications of different forest management regimes for emissions of greenhouse gases have not been considered.

VEAC has indicated that there will be no net recreation and tourism benefits or costs associated with their proposals over the next 20 years or so.

The VEAC draft proposals will have positive environmental impacts outside Victoria. Only about 60 percent of the environmental water required under the VEAC draft proposals will flood Victorian ecosystems, the remaining 40 percent will benefit NSW and SA. This effect has not been accounted for in the BCA.

The environmental benefits of the VEAC draft proposals dominate the costs in terms of lost timber, grazing and duck hunting opportunities. However, it is important to note that the costs do not include the costs of provision or storage of water for Scenarios 3 and 4. This is addressed by estimating the break-even water prices which would set the Net Present Values equal to zero.

<b>Break-even water prices (\$/ML/yr)</b>			
	Low	Average	High
Scenario 3 (2,000GL/5 years)	\$44	\$118	\$192
Scenario 4 (4,000GL/5 years)	\$45	\$115	\$185

<b>NPVs for water value (\$/ML/20 years)</b>			
Scenario 3 (2,000GL/5 years)	\$505	\$1,356	\$2,206
Scenario 4 (4,000GL/5 years)	\$520	\$1,322	\$2,123

<b>NPVs for water value (in perpetuity)</b>			
Scenario 3 (2,000GL/5 years)	\$734	\$1,970	\$3,205
Scenario 4 (4,000GL/5 years)	\$756	\$1,921	\$3,085

<b>NPVs for water value (in perpetuity @ 4% discount rate*)</b>			
Scenario 3 (2,000GL/5 years)	\$1,102	\$2,955	\$4,808
Scenario 4 (4,000GL/5 years)	\$1,134	\$2,881	\$4,628

The first sub-table shows break-even prices in the range of \$44 to \$185 per ML per year and fall approximately within the range paid by irrigation farmers for annual charges (assuming that their water entitlements are delivered). They are also comparable with the prices paid in water markets for temporary water, except in times of severe drought where prices can be higher.

The second sub-table shows the break-even prices that might be paid for a once-off purchase of water needed over the next 20 years and ranges from \$505 per ML to \$2,123 per ML. These ranges are comparable with market prices for permanent trade of entitlements for irrigation water

in 'average' years. They are also consistent with the values for environmental flows that were estimated in Project 9 for the Thomson & Macalister rivers.

There are economic arguments for accepting lower discount rates and longer planning horizons for some environmental projects, for example as discussed in the Stern report on climate change. Sub-tables 3 and 4 present the results for considering net benefits in perpetuity rather than over 20 years, and for a discount rate of 4 percent (compared with Stern's 2.5 percent) in the fourth sub-table.

Outcome – this is a draft assessment, however Premier Brumby has already indicated that the water will not be made available to the project, at least in the short run.

### ***18. Environmental Values of Urban Streams***

Ecological Engineering (2007), *Cabbage Tree Creek Pilot Project: Methods for Assessing the Status, Benefit, Vulnerability and Value of Riparian Zone Ecosystem Services*, Draft report prepared for Brisbane City Council. 74 pp.

Brisbane City Council's Water Resources Group is undertaking a pilot application of their new 'Project Prioritisation Process for the Waterway Health Enhancement Program' (referred to hereafter as the 'prioritisation process'). The purpose of this is to test its robustness as a management tool to guide capital works investment on catchment and waterway corridor based initiatives to improve the health of Brisbane's waterways.

Of some concern to Council's Water Resources Group is the difficulty they have had in the past providing justification for capital expenditure on works within waterway corridors, such as protection or restoration of riparian zone vegetation. Consequently, there has historically been a disproportionate level of capital expenditure given to catchment based works such as stormwater quality improvement devices (SQIDS). To address this imbalance, it was agreed that the first step in the pilot project should be to establish a defensible method to assess the waterway health benefits provided by management initiatives aimed at the protection or restoration of riparian zones. It was considered that having such a method would allow catchment based works and waterway corridor based works to be assessed and prioritised within the 'prioritisation process' on a more equitable basis.

The approach developed for BCC involves a combination of scoring methods based on technical criteria; the use of environmental valuation data within a BCA framework; and 'Triple Bottom Line' (TBL) analysis.

### ***19. Environmental Contributions by Agriculture***

Gillespie Economics, DCA Economics and Environmental & Resource Economics (2007), *Estimating the Value of Ecosystem Services Provided by Australian Farmers*, Draft report prepared for the Australian Farm Institute, Sydney. 99 pp.

Agriculture is the predominant land use activity in Australia, occupying 63% of Australia's total area. These lands produce in the order of \$35.6 billion worth of private agricultural commodities each year. They also retain most of Australia's native vegetation and biodiversity and hence provide (public) environmental goods and services such as biodiversity conservation, water quality and nutrient recycling, otherwise known as 'ecosystem services'. These ecosystem services have an economic value which can be identified under the total economic value (TEV) framework. However, most economists consider estimates of the *gross* value of environmental services to be profoundly flawed, both conceptually and methodologically.

Much of the focus of public debate and policy development has been on the reduction in supply of ecosystem services arising from the expansion and intensification of agriculture. Dryland salinity and other forms of land degradation and consequential loss of TEV are evidence of this declining supply.

This report presents case studies across a number of agricultural sectors to demonstrate how changes in farming practices are providing increases in the provision of ecosystem services. The

case studies employ 'benefit transfer' techniques for valuation of ecosystem services rather than primary valuation studies.

Work still in progress.

## Conclusions

- The application of NMV and BT to environmental management and policy problems has evolved steadily over the past 20 years and has mostly met with success in my experience.
- There is a plethora of potential problems awaiting solutions – young practitioners can look forward to a professionally rewarding future.

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