

Practical Challenges in the use of Non-Market Valuation for a Major Policy Issue: The Case of the Murray-Darling Basin Plan

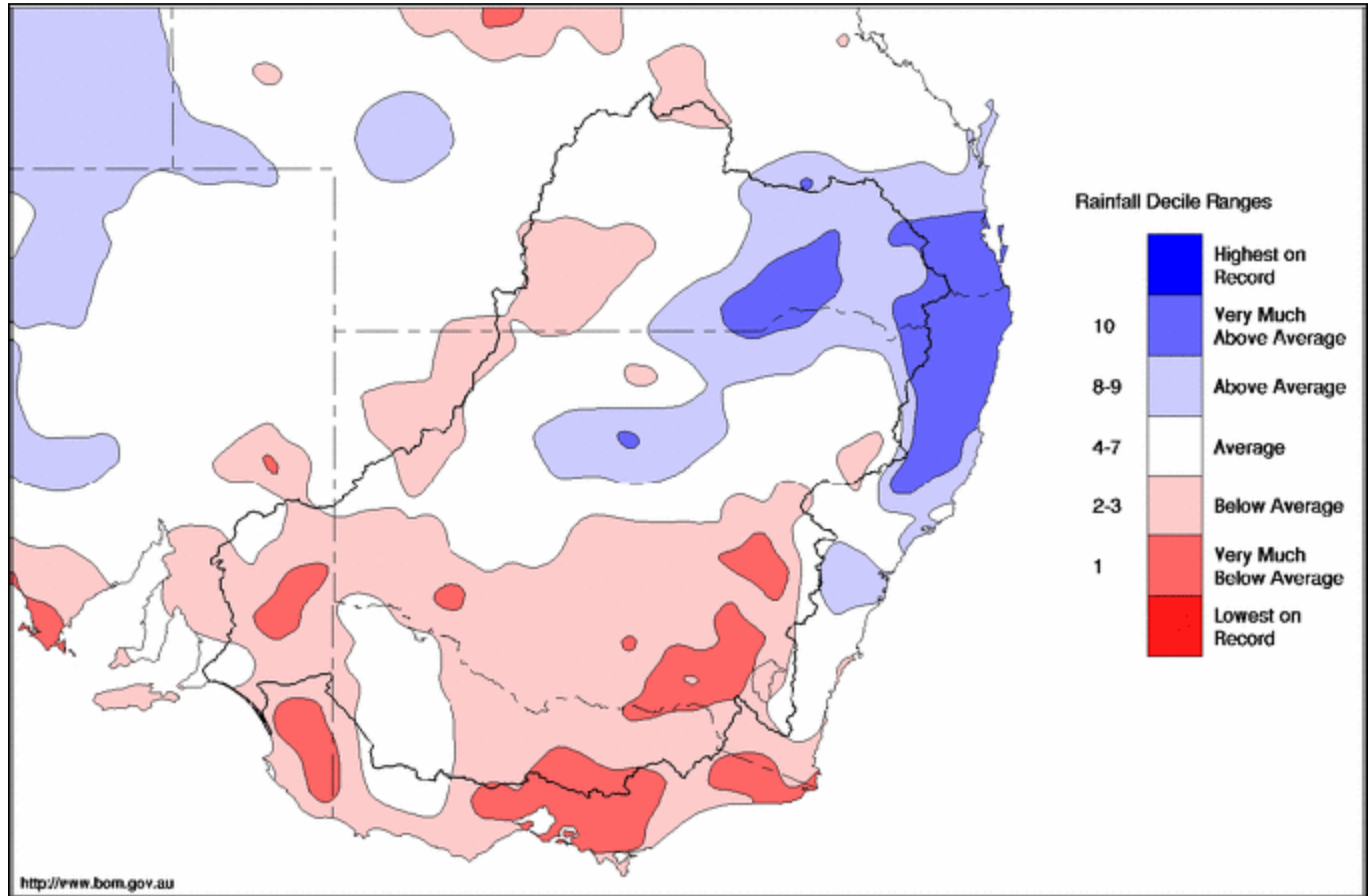
research FOR A SUSTAINABLE FUTURE

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Rainfall deciles for the Murray-Darling Basin, May 2009

(source: Bureau of Meteorology)

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- Requirement of the Commonwealth Water Act 2007 that the Murray-Darling Basin Authority prepare a Basin Plan
 - Proposed (draft) Basin Plan by mid 2010 and the first Basin Plan in 2011
 - Involves the setting of **sustainable diversion limits (SDLs)** for different parts of the river

The Water Act states, inter alia, that the MDBA must:

- act on the basis of the **best available scientific knowledge and socio-economic analysis**

Economic Analysis for the Basin Plan

- *Once a final set of SDLs has been determined for inclusion in the proposed Basin Plan, **an analysis of the social and-economic implications of the proposed Basin Plan will be undertaken.** This analysis will form the basis of the MDBA's advice to the Murray-Darling Basin Ministerial Council on these implications.*
 - **Potential role for non-market valuation**

Non-market valuation and the Basin Plan

- MDBA interested in the potential use of non-market values
- Need value estimates that can be used for evaluating SDLs
- Will initially involve benefit transfer given time available

What data are available?

Use Values

- A few travel cost studies (eg Whitten and Bennett 2001, Crase and Gillespie 2008, Rolfe and Dyack 2010)
- One hedonic study (Tapsuwan et al 2010)
- Various studies on indirect use values (eg filtration values, cost of salinity to households)

What data are available?

Non-use values

- Nine choice modelling studies valuing 14 different rivers/wetlands in the Murray Darling Basin between 1997 and 2010
 - Whitten and Bennett (2001), Morrison (2002), Morrison et al (2002), Morrison and Bennett (2004), Hatton MacDonald and Morrison (2005), Windle and Rolfe (2007), Bennett et al (2008a), Bennett et al (2008b), Morrison et al (2010)

Choosing A Benefit Transfer Option (non-use values)

- **Marginal point value transfer chosen** because it most allows the analyst to match the changes in environmental quality at the study and policy sites
- Benefit function transfer not viable because multiple studies required to produce attribute values for each region
- Meta-value analysis (pooled model) technically possible, but not possible in the time available

Steps in the Benefit Transfer Process

1. Identify Relevant Attributes

| Regions | Water Based Recreation | Native vegetation | Native fish | Colonial Waterbird breeding | Waterbirds and other species |
|-------------------------|------------------------|-------------------|-------------|-----------------------------|------------------------------|
| Barwon-Darling | | X | X | X | X |
| Border Rivers | | X | X | | X |
| Campaspe | | X | X | | X |
| Condamine-Balonne | | X | X | X | X |
| Eastern Mt-Lofty Ranges | | X | X | | X |
| Goulburn-Broken | X | X | X | | X |
| Gwydir | | X | X | X | X |
| Lachlan | X | X | X | X | X |
| Loddon-Avooca | X | X | X | | X |
| Macquarie-Castlereagh | X | X | X | X | X |
| Moonie | | X | X | | X |
| Murray | X | X | X | X | X |
| Murrumbidgee | X | X | X | X | X |
| Namoi | | X | X | | X |
| Ovens | X | X | X | | X |
| Paroo | | X | X | X | X |
| Snowy Mountains Scheme | | X | X | | X |
| Warrego | | X | X | | X |
| Wimmera | | X | X | | X |

2. Selection of Source Studies

- Large number of studies available from MDB for non-use values
- For some catchments, primary studies are available, for others need to use benefit transfer
- Not all studies have valued all relevant attributes, so have to sometimes use more than one study to derive values for a catchment

Potential Source Studies and Attributes Valued in Each Study

| Study | Location | Attributes valued | | | | |
|--|---|-------------------|--------------------|-------------|-----------------------------|------------------------------|
| | | Recrea-tion | Native veget-ation | Native fish | Colonial Waterbird breeding | Waterbirds and other species |
| 1. Bennett, Dumsday, Howell, Lloyd, Sturgess and Van Raalte (2008) | Goulburn River | X | X | X | | X |
| 2. Bennett, Dumsday and Gillespie (2008) | Victorian River Redgum Forests, Murray River | | X | X | | |
| 3. Bennett and Whitten (2002) | Upper South East | X | | | | |
| 4. Crase and Gillespie (2008) | Lake Hume, Murray River | X | | | | |
| 5. Hatton MacDonald and Morrison (2005) | Upper South East, SA | | X | | | |
| 6. Morrison (2002) | Macquarie Marshes | | X | | X | X |
| 7. Morrison and Bennett (2004) | Gwydir and Murrumbidgee Rivers | X | X | X | | X |
| 8. Morrison, Bennett, Blamey and Louviere (2002) | Macquarie Marshes and Gwydir Wetlands | | X | | X | X |
| 9. Morrison, Hatton MacDonald, Boyle and Rose (2010) | Murray River | | X | X | X | |
| 10. Rolfe and Dyack (2010) | Coorong and Barmah Millewa Forest (Murray River) | X | | | | |
| 11. Rolfe and Prayaga (2006) | Boondooma Dam, Bjelke-Petersen Dam and Fairbairn Dam, QLD | X | | | | |
| 12. Sinden (1988) | Ovens and Kings Rivers | X | | | | |
| 13. Whitten and Bennett (2001) | Murrumbidgee River | | x | X | | X |
| 14. Whitten and Bennett (2001) | Upper South East | | X | | | X |
| 15. Rolfe and Windle (2006) | Condamine River | | X | | | |

Studies Used to Provide Value Estimates for Attributes in the Nineteen Regions

| Regions | Recreation | | | | Native vegetation | Native fish | Colonial Waterbird breeding | Waterbirds and other species |
|-------------------------|--------------------|------------|----------|---------|-------------------|-------------|-----------------------------|------------------------------|
| | General recreation | Dams/Lakes | Wetlands | Fishing | | | | |
| Barwon-Darling | | | | | 7(M) | 13 | 8(G) | 7(M) |
| Border Rivers | | | | | 7(G) | 13 | | 7(G) |
| Campaspe | | | | | 1 | 1 | | 1 |
| Condamine-Balonne | | | | | 15 | 13 | 8(G) | 7(G) |
| Eastern Mt-Lofty Ranges | | | | | 1 | 1 | | 1 |
| Goulburn-Broken | 12 | | | | 1 | 1 | | 1 |
| Gwydir | | | | | 7(G) | 13 | 8(G) | 7(G) |
| Lachlan | 12 | 4 | | 11 | 7(G) | 13 | 8(G) | 7(G) |
| Loddon-Avooca | 12 | | | | 1 | 1 | | 1 |
| Macquarie-Castlereagh | 12 | 4 | 10(B) | 11 | 7(G) | 13 | 6,8(M) | 7(G) |
| Moonie | | | | | 15 | 13 | | 7(G) |
| Murray | 12 | 4 | 10(B&C) | 11 | 9 | 9 | 9 | 1 |
| Murrumbidgee | 12 | 4 | | 11 | 7(M) | 13 | 8(G) | 7(M) |
| Namoi | | | | | 7(G) | 13 | | 7(G) |
| Ovens | 12 | | | | 1 | 1 | | 1 |
| Paroo | | | | | 7(G) | 13 | 8(G) | 7(G) |
| Snowy Mountains Scheme | | | | | N/A | N/A | | N/A |
| Warrego | | | | | 15 | 13 | | 7(G) |
| Wimmera | | | | | 7(G) | 13 | | 7(G) |

Attribute values for the 19 regions

| Regions | Recreation | | | | Native vegetation | Native fish | Colonial Waterbird breeding | Waterbirds and other species |
|------------------------|---------------------------------|------------|----------------------|-----------------------|--|--|--|---|
| UNITS | \$ per person (adult) per visit | | | | \$ per household (present value) | | | |
| | General recreation | Dams/Lakes | Wetlands | Fishing at Dams/Lakes | 1% increase in healthy native vegetation | 1% increase in native fish populations | 1 year increase in frequency of breeding | Unit increase in number of waterbirds and other species present |
| Barwon-Darling | | | | | 2.26 | 0.46 | 13.87 | 2.25 |
| Border Rivers | | | | | 2.19 | 0.46 | | 1.10 |
| Campaspe | | | | | 5.69 | 5.06 | | 3.89 |
| Condamine-Balonne | | | | | 2.63 | 0.46 | 13.87 | 1.10 |
| Mt-Lofty Ranges | | | | | 5.69 | 5.06 | | 3.89 |
| Goulburn-Broken | 55.40 | | | | 5.69 | 5.06 | | 3.89 |
| Gwydir | | | | | 2.19 | 0.46 | 13.87 | 1.10 |
| Lachlan | 55.40 | 35.98 | | 355.90 | 2.19 | 0.46 | 13.87 | 1.10 |
| Loddon-Avoca | 55.40 | | | | 5.69 | 5.06 | | 3.89 |
| Macquarie-Castlereagh | 55.40 | 35.98 | 561.28 | 355.90 | 2.19 | 0.46 | 33.08 | 1.10 |
| Moonie | | | | | 2.63 | 0.46 | | 1.10 |
| Murray | 55.40 | 35.98 | B-561.28 C-270.13 | 355.90 | 13.72 | 12.80 | 65.11 | 3.43 |
| Murrumbidgee | 55.40 | 35.98 | | 355.90 | 2.26 | 0.46 | 13.87 | 2.25 |
| Namoi | | | | | 2.19 | 0.46 | | 1.10 |
| Ovens | 55.40 | | | | 5.69 | 5.06 | | 3.89 |
| Paroo | | | | | 2.63 | 0.46 | 13.87 | 1.10 |
| Snowy Mountains Scheme | | | | | | | | |
| Warrego | | | | | 2.63 | 0.46 | | 1.10 |
| Wimmera | | | | | 2.19 | 0.46 | | 1.10 |

Challenges in the selection of source studies

- Limited studies available valuing smaller catchments
 - Values for Campapse, Loddon, Ovens and Moonie reduced by one third as source study for a more substantial river with greater proximity to state capital
- Methodological differences across studies
 - Attributes used
 - Payment schedules
 - Many studies use single year payments, others multiple year payment
 - We used 28% discount rate to achieve equivalence across studies. While large, the literature suggest that this is needed to generate comparable results across SP studies (Harrison et al 2002, Kovacs and Larson 2008, Bond et al 2009)

3. Aggregating Non-Use Values

- Non-use values are all household values and need to be aggregated
- **Least** conservative approach to aggregative involves assuming that all households in the community have the average sample value.
- **Most** conservative approach to extrapolate to proportion of the population based on survey response rate (Loomis 1987), and assume all non-respondents have a zero value, which is known to be incorrect (Bishop and Boyle 1985).
- Alternative suggested by Morrison (2000) who debriefed non-respondents and concluded that 30% of non-respondents were likely to have the same values as respondents, and a zero value. Similar findings derived by Van Bueren and Bennett (2004), but more research needed on the values of non-respondents

Response Rates and Percentage of Households for Extrapolating Values

| Study | Response Rate | Percentage of non-respondents likely to have values | Extrapolation percentage |
|---|----------------------|--|---------------------------------|
| Bennett et al., (2008a) | 17.0% | 24.9% | 41.9% |
| Whitten and Bennett (2001) | 32.3% | 20.3% | 52.6% |
| Morrison, Bennett and Blamey (1999) | 49.4% | 15.2% | 64.6% |
| Morrison (2002) | 49.0% | 15.3% | 64.3% |
| Morrison, Bennett, Blamey and Louviere (2002) | 49.4% | 15.2% | 64.6% |
| Morrison and Bennett (2004) | 39.6% | 18.1% | 57.7% |
| Morrison, Hatton MacDonald, Boyle and Rose (2010) | 54.2% | 13.7% | 67.9% |
| Rolfe and Windle (2006) | 50.0% | 15.0% | 65.0% |

Calculating Aggregate Non-Use Values

- Aggregate non-use value = Attribute value * extrapolation percentage * relevant population
- **Question:** what is the relevant population, that is, the geographical extent of the market?
 - Murray River valued similarly across Australia (Hatton MacDonald et al 2010)
 - All other studies have only produced state wide estimates
 - Does this mean that households in other states have no values for improvements in these other rivers?

Geographical extent of the market

- Results from the literature suggest that for environmentally significant regions, values should be extrapolated beyond the state in which respondents reside.
 - Bennett et al. (1998) found that respondents in NSW and South Australia had similar values for the Coorong.
 - Loomis (2000) found when evaluating six resource preservation programs that residences across six states in which the unique or threatened species reside only held a fraction (about 13%) of the national value.
- But for other less significant assets it may not be appropriate to extrapolate values beyond the state in which the asset is located.
 - Mishra and Mishra (forthcoming) conducted research in the context of how people evaluate disasters. They found that people consider locations within a state to be part of the same superordinate category but out-of-state locations to be part of a different superordinate category.

What we did...

- Base case – assumed apart from the Murray, that out-of-state households have zero values
- Sensitivity analysis conducted on this assumption

Aggregate Non-use Values

| Regions | Native vegetation | Native fish | Colonial Waterbird breeding | Waterbirds and other species |
|-----------------------|--|--|--|---|
| UNITS | \$'000 (present values) | | | |
| | 1% increase in healthy native vegetation | 1% increase in native fish populations | 1 year increase in frequency of breeding | Unit increase in number of waterbirds and other species present |
| Barwon-Darling | \$3,594 | \$667 | \$24,693 | \$3,578 |
| Border Rivers | \$2,437 | \$414 | | \$1,086 |
| Campaspe | \$3,363 | \$2,990 | | \$2,299 |
| Condamine-Balonne | \$2,926 | \$414 | \$15,337 | \$1,086 |
| Mt-Lofty Ranges | \$1,494 | \$1,329 | | \$1,022 |
| Goulburn-Broken | \$5,019 | \$4,463 | | \$3,431 |
| Gwydir | \$3,482 | \$667 | \$24,693 | \$1,749 |
| Lachlan | \$3,482 | \$667 | \$24,693 | \$1,749 |
| Loddon-Avoca | \$3,363 | \$2,990 | | \$2,299 |
| Macquarie-Castlereagh | \$3,482 | \$667 | \$58,802 | \$1,749 |
| Moonie | \$1,961 | \$277 | | \$728 |
| Murray | \$79,098 | \$73,794 | \$375,369 | \$12,203 |
| Murrumbidgee | \$3,594 | \$667 | \$24,693 | \$3,578 |
| Namoi | \$3,482 | \$667 | | \$1,749 |

Substitution Effects

- Valuation estimates derived separately for each region, which is fine if each region is being separately evaluated
- Theoretically, if values aggregated across the region, there may be substitution effects, such that the value of the whole MDB may be less than the sum of the parts
- In this context, effects not likely to be substantial:
 - In the base case, respondents only value rivers within their state, so no embedding effects for the non-basin states and limited effects for basin states
 - Murray values dominate, eg for a 1% change in vegetation across all catchments, comprise 60% of total value, and 78% for native fish

Are the proposed values conservative?

- Factors increasing values:
 - Substitution effects
- Factors decreasing values:
 - One-shot payments and high discount rates
 - Only aggregating within states for all rivers apart from the Murray
 - Dated studies

Future Research Needs

1. Consistent set of original studies for individual catchments
2. Basin wide non-use valuation study
3. Data on visitation rates + more non-Murray RP studies
4. Appropriate discount rates across varying time periods
5. Effect of removing/adding attributes on values of other attributes
6. Values for smaller catchments
7. Values of non-respondents and appropriate proportion of the population to extrapolate values across
8. Geographical extent of the market for different catchments