# Developing a benefit transfer database for environmental values in Queensland

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# The policy setting

- Management of natural resources a key issue in regional areas
- A number of funding initiatives
  - Regional groups and CMAs
  - Governments
- Most initiatives appear to be focused on engagement and are supply driven
- Developing interest in identifying community demands and justifying investments

# The practical issues

- Appropriate framework is cost-benefit analysis
- Most NRM issues involve non-market impacts
  - Need specialised valuation techniques to assess them
  - Limited skill sets
  - Often requirements for evaluations to be performed in a short time frame
- How can value estimates be provided into more rigorous evaluations of NRM investments?

# Benefit transfer

- The transfer of values from one case study to another policy situation
- Most studies focused on particular issues, and are not designed to transfer to other situations
- Values may be sensitive to characteristics
  - The case studies of interest
  - Populations involved
  - The way the tradeoffs are framed
  - The scope at which the issue is pitched
  - The scale of the tradeoffs

# Key mechanisms for benefit transfer

- Point – total value
  - Total value from a previous study
- Point – marginal value
  - Value per unit transferred
- Benefit function transfer
  - Function allows adjustments for site and population differences
- Bayesian transfer
  - A range of previous and current results can be integrated

# Three main approaches to BT

- ‘The Prospector’ – (random foraging) searches for suitable previous studies and transfers results across
- ‘The Systematic’ – designs a database of values suitable for benefit transfer
- ‘The Bayesian’ – combines both a review of previous studies with potential data gathering

# Some issues

- The prospector approach is risky
  - Hard to find suitable studies
  - Most not designed for benefit transfer
- The bayesian approach is difficult
  - Need very high skill levels to perform
  - Not widely used
- The systematic approach is not common
  - Morrison and Bennett – NSW rivers
  - van Beuren and Bennett – NRM values in Australia

# Developing the systematic approach

- This research focused on the development of a systematic database for Qld NRM values
- Identify the values for improvements in 3 key areas of the investment plans for regional groups
  - Healthy vegetation
  - Healthy waterways
  - Healthy soils
- Identify sensitivity to regional issues
- Identify sensitivity to framing issues

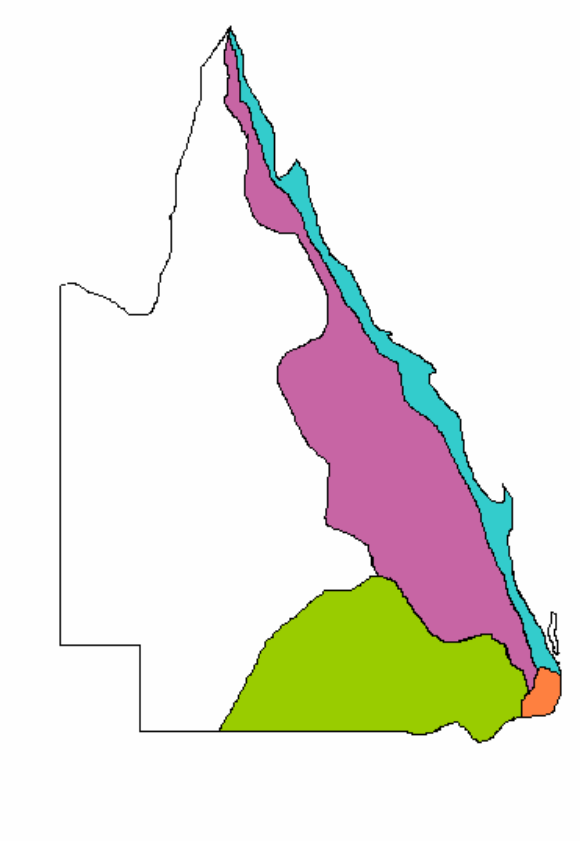
# Non–market valuation

- Used Choice modelling technique
  - Most comprehensive way of assessing values
  - Capable of dealing with several attributes simultaneously
  - Only three key attributes and cost used in this survey
  - Data collected in a survey questionnaire
  - Survey technique was drop-off/collect
  - This study – 2 survey formats – 1200 surveys
  - 7 split samples used

# Survey design – 1200 completed surveys

| Survey | Region/catchment area | Population sampled | NRM improvements |
|---|---|---|---|
| **Regional survey**<br>Four separate regional surveys | S.E. Queensland<br>Murray Darling<br>Mackay Whitsunday<br>Fitzroy | Brisbane<br>Toowoomba<br>Mackay<br>Rockhampton | Soil<br>Water<br>Vegetation |
| **Statewide survey**<br>Four regional areas included in one survey | S.E Queensland<br>Murray Darling<br>GBR – coastal areas<br>GBR – inland areas | Brisbane<br>Toowoomba<br>Mackay | Soil<br>Water<br>Vegetation |

# Regional areas



# Choice Modelling – regional survey

| 5 | **Question 5:** Carefully consider each of the following three options. Suppose options A, B and C were the only options available, which would you choose? | | | |
|---|---|---|---|---|
| **How much I pay each year** | **Soils in good condition** | **Waterways in good health** | **Healthy vegetation** | **I would choose** |
| $ |  |  |  |  |
| **Current condition** | **6,000** sq km<br>**65%** | **420** km<br>**60%** | **6,000** sq km<br>**65%** | |
| | **Condition in 15 years time – Options A,B, and C** | | | |
| Option A | | | | |
| $0 | 50% | 40% | 45% | ☐ |
| Option B | | | | |
| $100 | 65%<br>(15% better) | 55%<br>(15% better) | 55%<br>(10% better) | ☐ |
| Option C | | | | |
| $50 | 55%<br>(5% better) | 55%<br>(15% better) | 60%<br>(15% better) | ☐ |

# Choice Modelling – statewide survey

**Qu 4.** Carefully consider each of the following 5 options. Suppose these were the only options available, which would you choose?

Please indicate which option you prefer ☒ mark one box only

| ☐ I prefer this option | **Murray Darling** | |
|---|---|---|
| **In 15 years time** | **Expected** | **Option** |
| Soils in good condition | 50% or 157,000 sq km | 5% better |
| Waterways in good health | 40% or 8,000 km | 5% better |
| Healthy vegetation | 25% or 78,500 sq km | 10% better |
| How much I pay each year | | $100 |

| ☐ I prefer this option | **Great Barrier Reef – Coastal** | |
|---|---|---|
| **In 15 years time** | **Expected** | **Option** |
| Soils in good condition | 50% or 45,000 sq km | 5% better |
| Waterways in good health | 40% or 2,800 km | 10% better |
| Healthy vegetation | 45% or 40,500 sq km | 5% better |
| How much I pay each year | | $100 |

| ☐ I prefer this option | **South East Queensland** | |
|---|---|---|
| **In 15 years time** | **Expected** | **Option** |
| Soils in good condition | 45% or 10,500 sq km | 5% better |
| Waterways in good health | 35% or 700 km | 10% better |
| Healthy vegetation | 25% or 6,000 sq km | 5% better |
| How much I pay each year | | $20 |

| ☐ I prefer this option | **Great Barrier Reef – Inland** | |
|---|---|---|
| **In 15 years time** | **Expected** | **Option** |
| Soils in good condition | 50% or 215,000 sq km | 15% better |
| Waterways in good health | 30% or 10,200 km | 10% better |
| Healthy vegetation | 25% or 107,500 sq km | 10% better |
| How much I pay each year | | $50 |

| ☐ I prefer this option | **Keep current situation** | How much I pay each year | | $0 |
|---|---|---|---|---|

# Socio-demographic characteristics

| | Brisbane | Toow'mba | Mackay | Rockh'ton |
|---|---|---|---|---|
| **Average age** | 42 yrs | 37 yrs | 43 yrs | 47 yrs |
| (Range) | (17-89) | (18-82) | (15-81) | (19-86) |
| *ABS 2001 Census* [1 2] | *43 yrs* | *44 yrs* | *42 yrs* | *45 yrs* |
| **Gender** (% female) | 56% | 54% | 51% | 50% |
| Have **dependent children**[3] | 72% | 59% | 80% | 77% |
| **Education**[3] | | | | |
| Have non-school qualification | 46.9% | 56% | 42.7% | 46% |
| *ABS 2001 Census* [1] | *46%* | *43%* | *40%* | *41%* |
| **Annual income (pre tax)**[3] | | | | |
| Missing values | 13% | 23% | 14% | 10% |
| Less than $70,000 | 77% | 80% | 60% | 72% |
| *ABS 2001 Census* | *63%* | *72%* | *66%* | *71%* |
| Member of an **environmental organisation** | 7% | 6% | 9% | 7% |
| Family associated with **farming industry**[3] | 19% | 34% | 33% | 23% |

| **Population** | **Pooled model** | | |
|---|---|---|---|
| **Region** | **All combined** | | |
| | Coefficient | | St Error |
| Cost | -0.0178 | *** | 0.0012 |
| Soil | 0.0663 | *** | 0.0070 |
| Water | 0.1032 | *** | 0.0064 |
| Vegetation | 0.0512 | *** | 0.0067 |
| ASC | -0.7455 | *** | 0.0749 |
| **Socio-demographic variables** | | | |
| Age | 0.0008 | | 0.0030 |
| Gender | -0.2554 | *** | 0.0853 |
| Children | -0.6280 | *** | 0.1005 |
| Education | 0.2746 | *** | 0.0404 |
| **Environmental opinions** | | | |
| Env condition | -0.0834 | | 0.0621 |
| Env favour | 0.4094 | *** | 0.0736 |
| Env knowledge | -0.0328 | | 0.0244 |
| **Choice selection variables** | | | |
| Confidence | -0.2946 | *** | 0.0553 |
| Preference | 0.5410 | *** | 0.0493 |
| Understand | -0.0868 | ** | 0.0420 |
| More info | 0.0379 | | 0.0474 |
| Confused | -0.0913 | * | 0.0482 |
| **Land and water values variables** | | | |
| Use | -0.1049 | | 0.1032 |
| Option | -0.3754 | *** | 0.1144 |
| Bequest | 0.7605 | *** | 0.1396 |
| Existence | -0.1026 | | 0.1404 |
| Quasi option | 0.2642 | *** | 0.1012 |
| **Model statistics** | | | |
| Log Likelihood | -3246.92 | | |
| Adj Rsq | 0.15097 | | |
| Observations | 3492 | | |

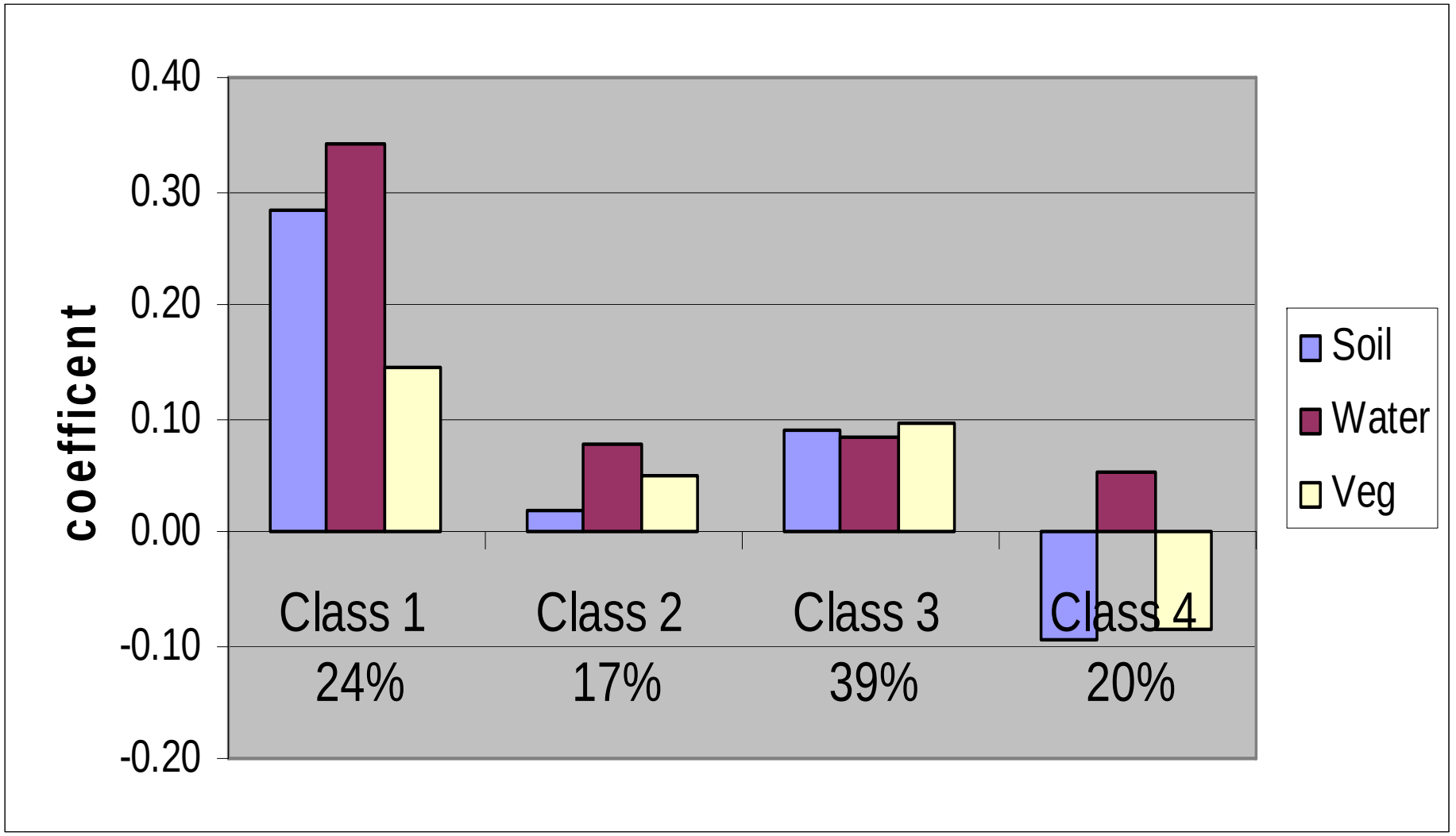
# MNL models for statewide survey (part)

| | ALL | | BRISBANE | | TOOWOOMBA | | MACKAY | |
|---|---|---|---|---|---|---|---|---|
| | Coefficient | S.Error | Coefficient | S.Error | Coefficient | S.Error | Coefficient | S.Erro |
| **All regions** | | | | | | | | |
| COST | -0.0073*** | 0.0009 | -0.0081*** | 0.0015 | -0.0064*** | 0.0016 | -0.0074*** | 0.001 |
| SOIL | 0.0334*** | 0.0068 | 0.0448*** | 0.0116 | 0.0306** | 0.0127 | 0.0276** | 0.011 |
| WATER | 0.0489*** | 0.0068 | 0.0595*** | 0.0114 | 0.0445*** | 0.0126 | 0.0481*** | 0.011 |
| VEG | 0.0335*** | 0.0068 | 0.0537*** | 0.0114 | 0.0232* | 0.0128 | 0.0228* | 0.012 |
| **Murray Darling** | | | | | | | | |
| ASC-MD | -2.8651*** | 0.4483 | -2.8042*** | 0.7350 | -2.2914*** | 0.7190 | -2.4449*** | 0.771 |
| AGE | 0.0058 | 0.0060 | 0.0053 | 0.0098 | 0.0161 | 0.0139 | 0.0087 | 0.011 |
| GENDER | -0.3837*** | 0.1377 | -0.6601** | 0.2595 | -0.7705*** | 0.2224 | 0.6314** | 0.276 |
| CHILD | -0.6163*** | 0.1706 | -0.5507 | 0.3545 | -0.4928* | 0.2817 | -0.4977 | 0.335 |
| EDUCAT | 0.3681*** | 0.0666 | 0.2693** | 0.1184 | 0.4318*** | 0.1231 | 0.3659*** | 0.126 |
| INCOME | 0.0815 | 0.0519 | 0.0948 | 0.0877 | 0.0143 | 0.1167 | -0.0040 | 0.097 |
| POPULATION | 0.2226*** | 0.0858 | | | | | | |

| | Soil | Water | Vegetation |
|---|---|---|---|
| | $ value of each 1% improvement | | |
| **Brisbane – South East Queensland** | | | |
| Regional - marginal values | **3.05*** ** | **3.42*** ** | **3.01*** ** |
| **Toowoomba – Murray Darling** | | | |
| Regional marginal values | **4.02*** ** | **6.28*** ** | **2.35*** ** |
| **Mackay – Mackay Whitsunday** | | | |
| Regional marginal values | **4.60*** ** | **7.82*** ** | **2.42*** ** |
| **Rockhampton - Fitzroy** | | | |
| Regional marginal values | **3.70*** ** | **6.69*** ** | **4.48*** ** |
| **All combined** | | | |
| Regional - marginal value | **3.72*** ** | **5.80*** ** | **2.88*** ** |
| State – marginal value | **4.65*** ** | **6.74*** ** | **3.68*** ** |

# Latent class model – preference characteristics

**Coefficient values for attributes by different respondent classes**



# How to use results

- A related project involved running a competitive tender to improve vegetation management in the Fitzroy
- Auction process run in mid-2006
- About $180K committed in payments to landholders over 2 years
- Is it possible to demonstrate that this investment is worthwhile?
- Fitzroy population values vegetation in good condition at $4.48 per 1%
- Brisbane population (state-wide) estimates are $7.69 per 1%

Survey results: Fitzroy Basin  1% (on current level) = 64,500ha

FBA biodiversity Tender = 13,647 ha

| | **Rockhampton and Fitzroy Basin[1]** | **Brisbane** |
|---|---|---|
| Population[2] | 193,722 | 1,508,161 |
| Average household size | 2.5 | 3.3 |
| No of households | 77,489 | 457,018 |
| Survey response rate | 72% | 50% |
| **Valid households** | **55,792** | **228,509** |
| Household value for an improvement in 13,647ha | $0.43 | $0.74 |
| **Total value - $/year** | **$23,991** | **$169,097** |
| **Total value - $/year** | **$193,087** | |

# Outcomes of different survey formats

- Full survey with all regional areas only successful in Brisbane
- Pooled models from combining four regional models
- Pooled models gave higher values than statewide model ?
- Suggesting scope issues are not serious

| | Soil | Water | Vegetation |
|---|---|---|---|
| | **$ value of each 1% improvement** | | |
| **Pooled models** | | | |
| Regional model | **3.72** | **5.80** | **2.88** |
| | (2.94 – 4.57) | (4.98 – 6.88) | (2.10 – 3.71) |
| Statewide model | **4.64** | **6.62** | **4.54** |
| | (2.64 – 7.09) | (4.68 – 9.43) | (2.66 – 7.03) |

# Developing a data base for BT

- Could report marginal values in either % or actual terms (kms. or sq. kms.)
  - Which is more realistic / minimises abuse?
- What to do about non-participation rates?
  - Normally take out non-participants when estimating values conservatively
    - Should we ignore
    - Add another table of rates (and another calculation)?
    - Adjust values by the non-participation rates?

# A sense of perspective

- This systematic BT approach not fully accurate
- Focus here is on improving the investment decision
  - At the broad level at least
  - More complex when we go to the case study level
- But many groups are not even making cost-effective allocations, let alone efficient ones
- Benefit transfer is going to be very useful way of doing a preliminary evaluation of proposals

# Final points

- The template of NRM values in Queensland will be freely available on a website

  **www.resourceeconomics.cqu.edu.au**
- Designed to be used by regional groups and governments to do preliminary appraisals of investment options
- Number of other reports and material as well