CRC for
Water Sensitive Cities

Australian Government
Department of Industry, Innovation and Science

Business Cooperative Research Centres Programme

State of knowledge of non-market values of water sensitive systems and practices

Potential of benefit transfer

Benefit-cost analysis for water related projects – Seminar Series

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State of knowledge of non-market values of water sensitive systems and practices

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Structure of the talk

- A background of non-market valuation (NMV) methods
- A snap-shot of NMV studies
- Current work on preparation of a NMV database

Non-market valuation methods

Benefit assessment

There are two parts to estimate benefits:

- First, information is needed on how the condition of the environment will be changed by the project. We would need information on condition with and without the project.

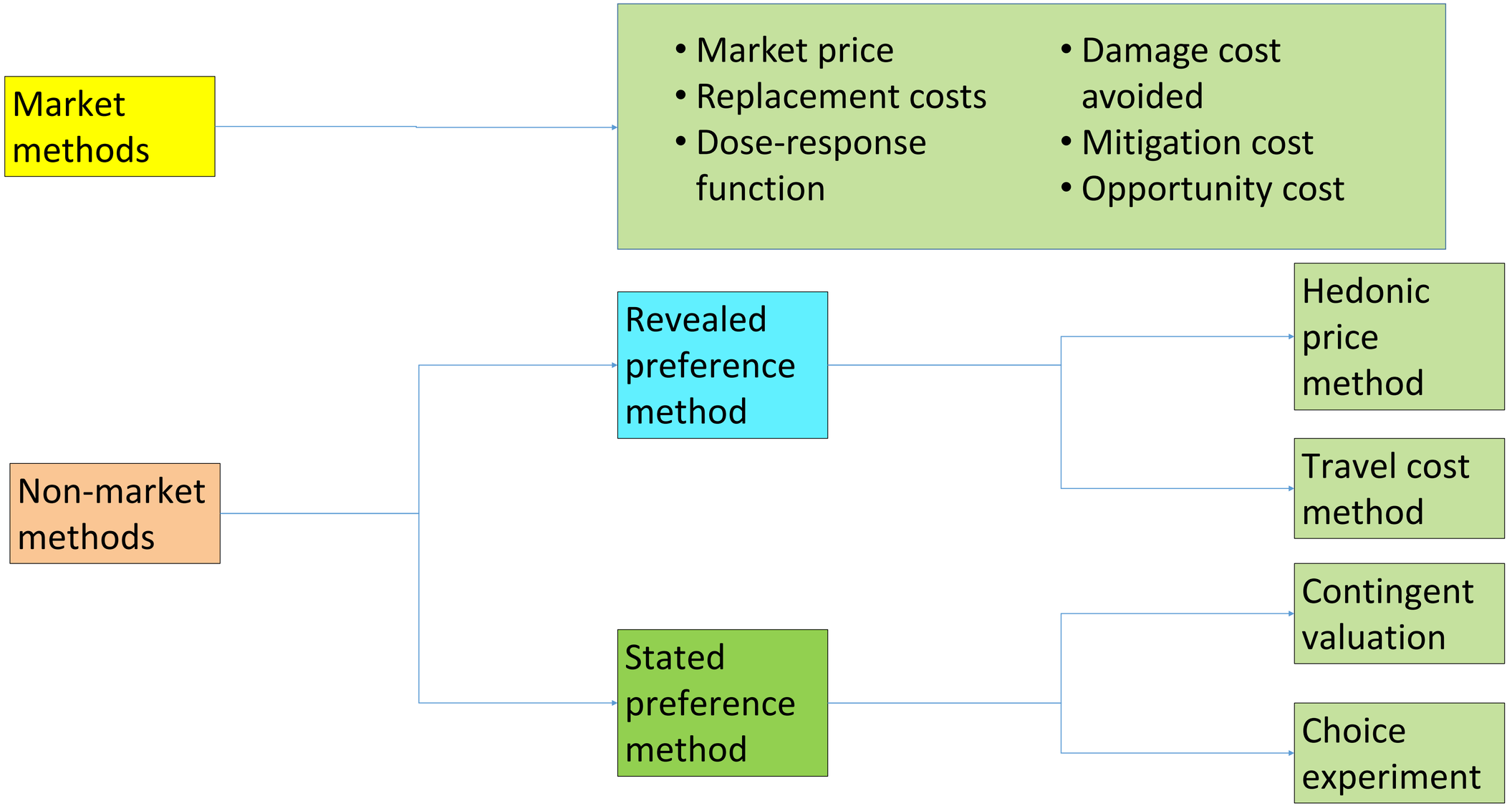
- Second, a value needs to be placed on the change in condition.

Benefit assessment

- Assigning a value can be particularly difficult where values are not reflected in market prices (so called ‘non-market’ values).

- For example, while it is understood that many people value the experience of clear waterways, there are no market prices that directly reflect these values.

Benefit assessment



Benefit assessment

There are two main types of non-market valuation methods: revealed preference and stated preference.

- Revealed preference method: It uses observations of purchasing decisions and other behaviour to estimate non-market values.

- Stated preference method: Stated preference methods involve asking people. People are asked to make choices between project options, their choices are used to estimate non-market values.

Measuring non-market values: Hedonic

- Environmental values built into house prices
- Observe many house sales
- Apply multiple regression to tease out the various factors affecting house prices
- Captures private benefits to local residents, but not benefits to others, e.g., downstream flood mitigation

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Measuring non-market values: Stated preference

- Surveys of general public
- Put various hypothetical scenarios to people
- Ask which scenario they prefer
- Tease out the trade-offs using statistics
- Captures use & non-use values. But, hypothetical and relies on people understanding the issues

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Benefit transfer

- Benefit transfer uses economic information captured at one place and time to make inferences about the economic value of goods and services at another place and time.

- Benefit transfer is often used when it is too expensive and/or there is too little time available to conduct an original valuation study, yet some measure of benefits is needed.

Benefit transfer

- There are various methods of benefit transfer

- Unit value transfer: transfer of a single number or set of numbers from pre-existing primary studies.

- Unit values can be transferred “as is” or adjusted using a variety of different approaches (e.g., for differences in income or purchasing power, or according to expert opinion).

Benefit transfer

- Benefit function transfer: derive information using an estimated, typically parametric function derived from original research.

- Function transfers typically outperform unit value transfers in terms of accuracy. However, unit value transfers can perform satisfactorily if the study and policy contexts are similar enough.

Benefit transfer

- The primary advantages of unit value transfers are ease of implementation and minimal data requirements.

- Moreover, if the study and policy sites (and relevant changes in the good) are very similar, unit value transfers can perform acceptably.

NMV studies of water sensitive cities and practices within the CRC WSC

Use of non-market valuation estimates

- I am going to focus on 4 studies on non-market valuations

  - Local stormwater management
  - Rainwater tank
  - Living stream
  - Buffer zone management

Study 1: Valuing environmental services associated with local stormwater management

Brent, D. A., et al. (2017). "Valuing environmental services provided by local stormwater management." Water Resources Research(53): 4907-4921.

Stormwater

- Stormwater management provides multiple benefits. Few of the secondary benefits associated with local stormwater management have been quantified in dollar-equivalent terms.

- Conducted choice experiments with nearly one thousand households from four metropolitan councils in Melbourne and Sydney.

- Respondents were asked to choose among different options for improving local stormwater management.

Stormwater

- There is significant economic support for stormwater projects. Marginal willingness to pay ($) per household per year (median)

Value	Melbourne	Sydney
Reduction of flash flood by half	22	22
Flood never	83	85
Stream health (medium)	84	117
Stream health (high)	234	229
Removal of level 3 & 4 water restrictions	5	90
Removal of complete water restrictions	155	242
Reduction of temperature by 2 degree	45	54

The values are estimated in comparison to the status Quo (or the current scenario).

Study 2: Capitalization of Decentralised Urban Rainwater Collection Systems in Perth Property Market

Zhang, F., et al. (2015). "The capitalized value of rainwater tanks in the property market of Perth, Australia." Journal of Hydrology 522: 317-325.

Rainwater tank

- Total sample size: 77,234

- Hedonic price analysis where total house price is decomposed into attribute prices

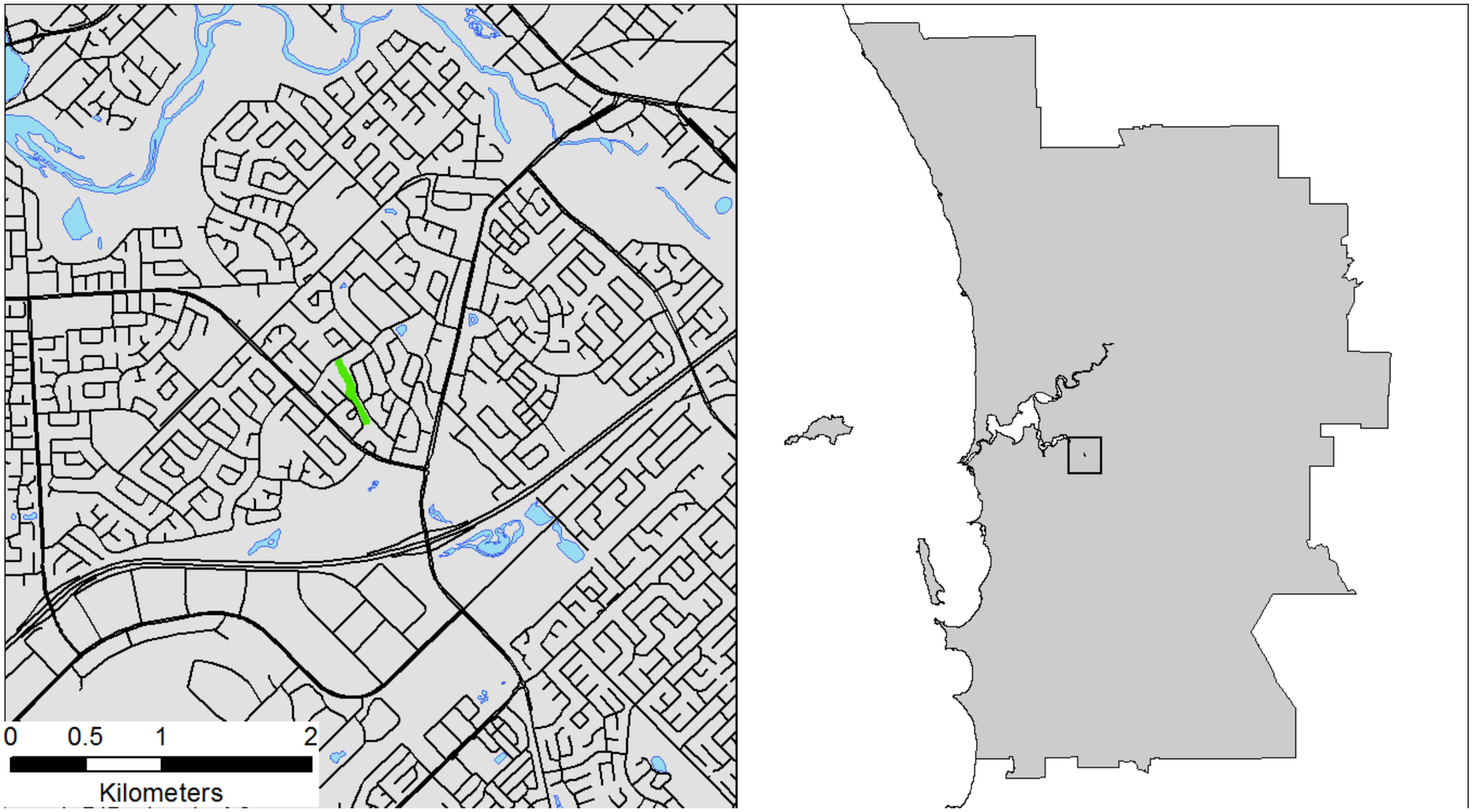
- The attributes:
  - House specific measures including presence of rainwater tank
  - Time effect – general house price changes
  - Spatial effect – captures spatial heterogeneity

Rainwater tank

- Rainwater tanks have a premium of up to AU$18,000

- The robustness of our estimated premium is investigated using both bounded regression analysis and simulation methods and the result is found to be highly robust.

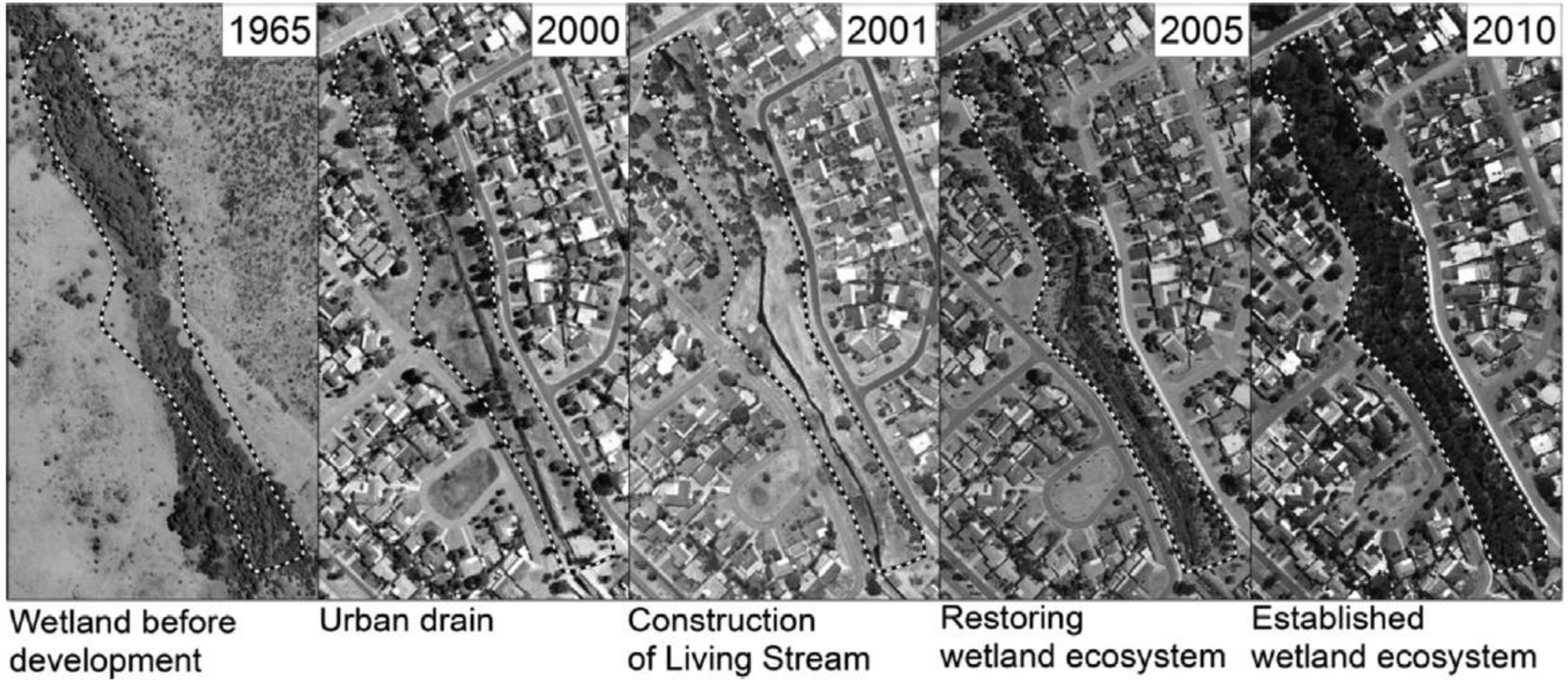
Study 3: Capitalised Amenity Value of Urban Stream Restoration in Perth



Polyakov, M., et al. (2017). "The value of restoring urban drains to living streams." Water Resources and Economics 17: 42-55.

Living stream

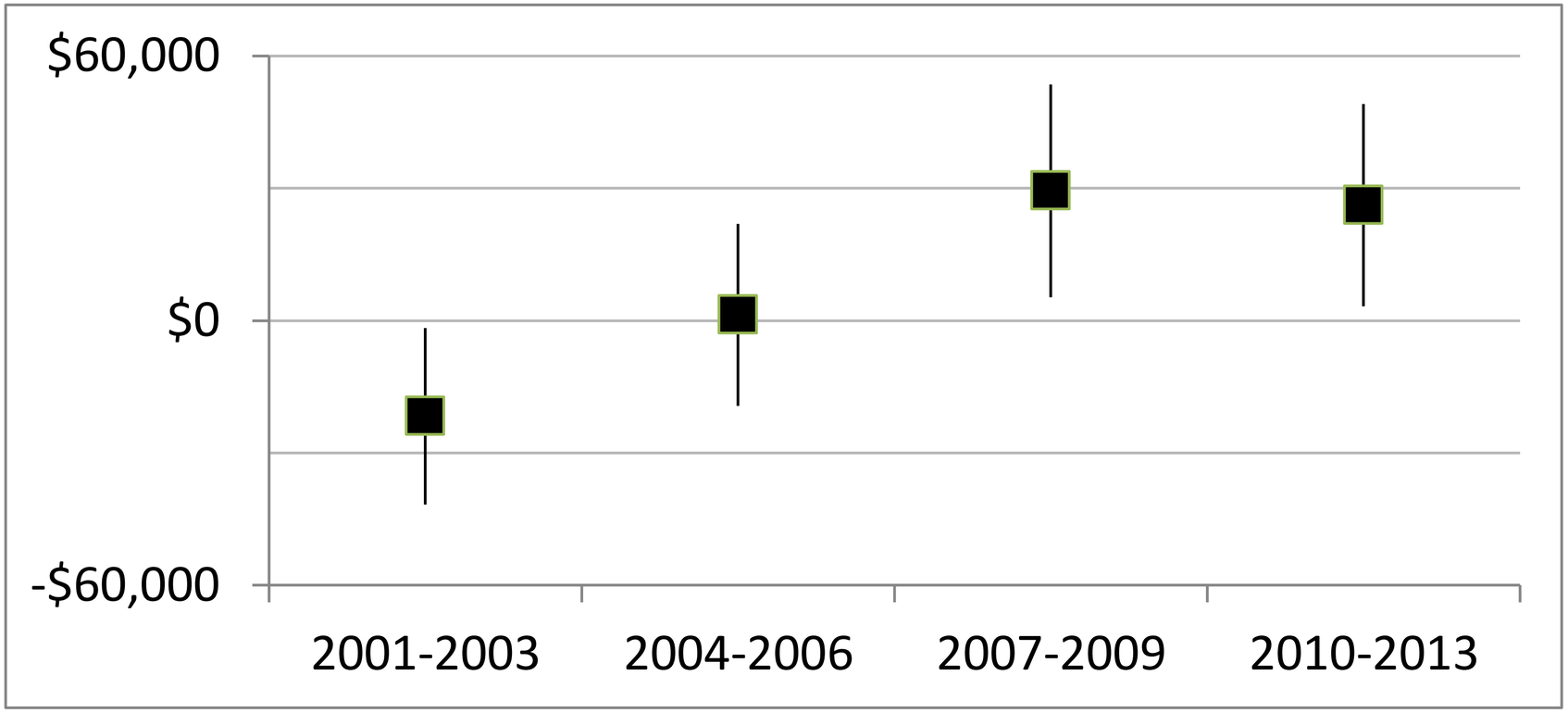
Conversion of drain to “living stream” (Bannister Creek)



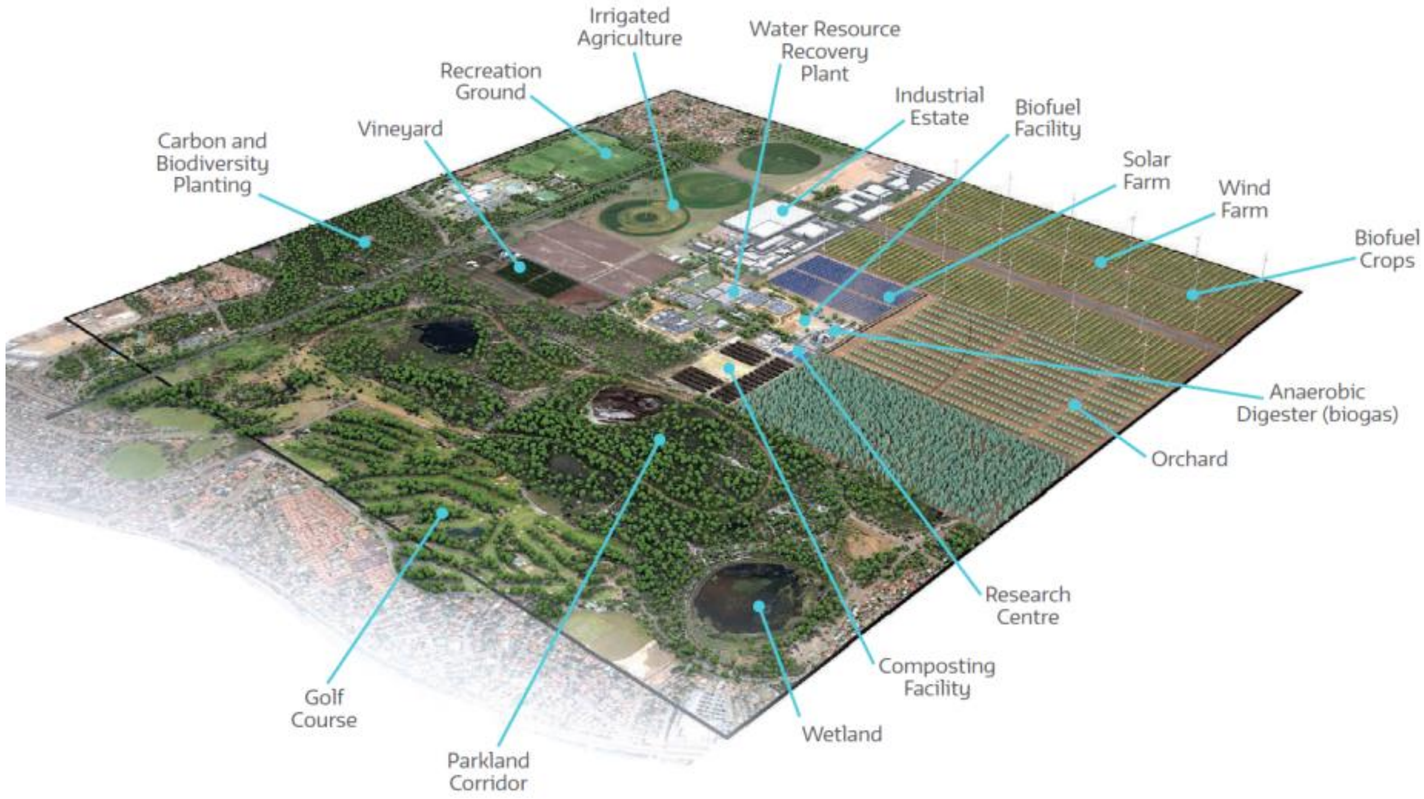
Living stream

- Single-family homes sold 1990-2013
- 16,553 sales of 8,088 properties
- 5020 sold 2 to 7 times
- 339 sales within 200m of the restoration site
- 175 after 2000
- Includes data about land area, no bedrooms, no bathrooms, no car spaces, construction, pool, suburb, house age, year, quarter

Living stream



Study 4: Non-market valuation of buffer zone management of wastewater treatment plants



Iftekhar, M., et al. (2018). "Understanding social preferences for land use in wastewater treatment plant buffer zones." Under Review.

Buffer

- Buffer zones are commonly applied to wastewater treatment plants to identify the area impacted by odour. How that land is best used depends, in part, on community values.

- This study conducted a survey (n=709) to understand community preferences for different land uses within buffer zones in Perth and regional Western Australia.

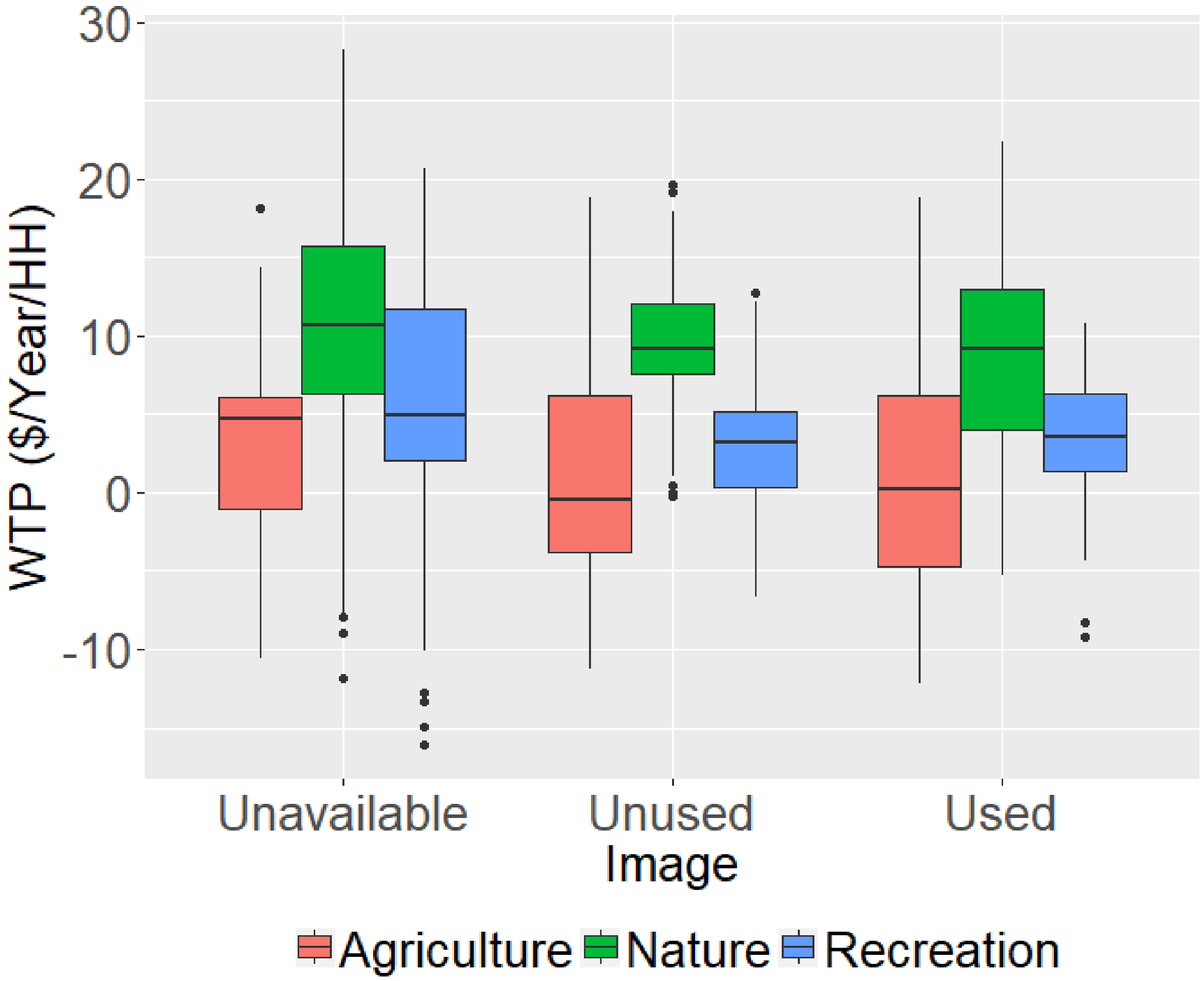
Buffer

- 4 land use attributes: nature conservation, agriculture, sports & recreation and industry.

- The choice experiment involved two information conditions, one using text and tables only, the other had the option for respondent to view land use maps.

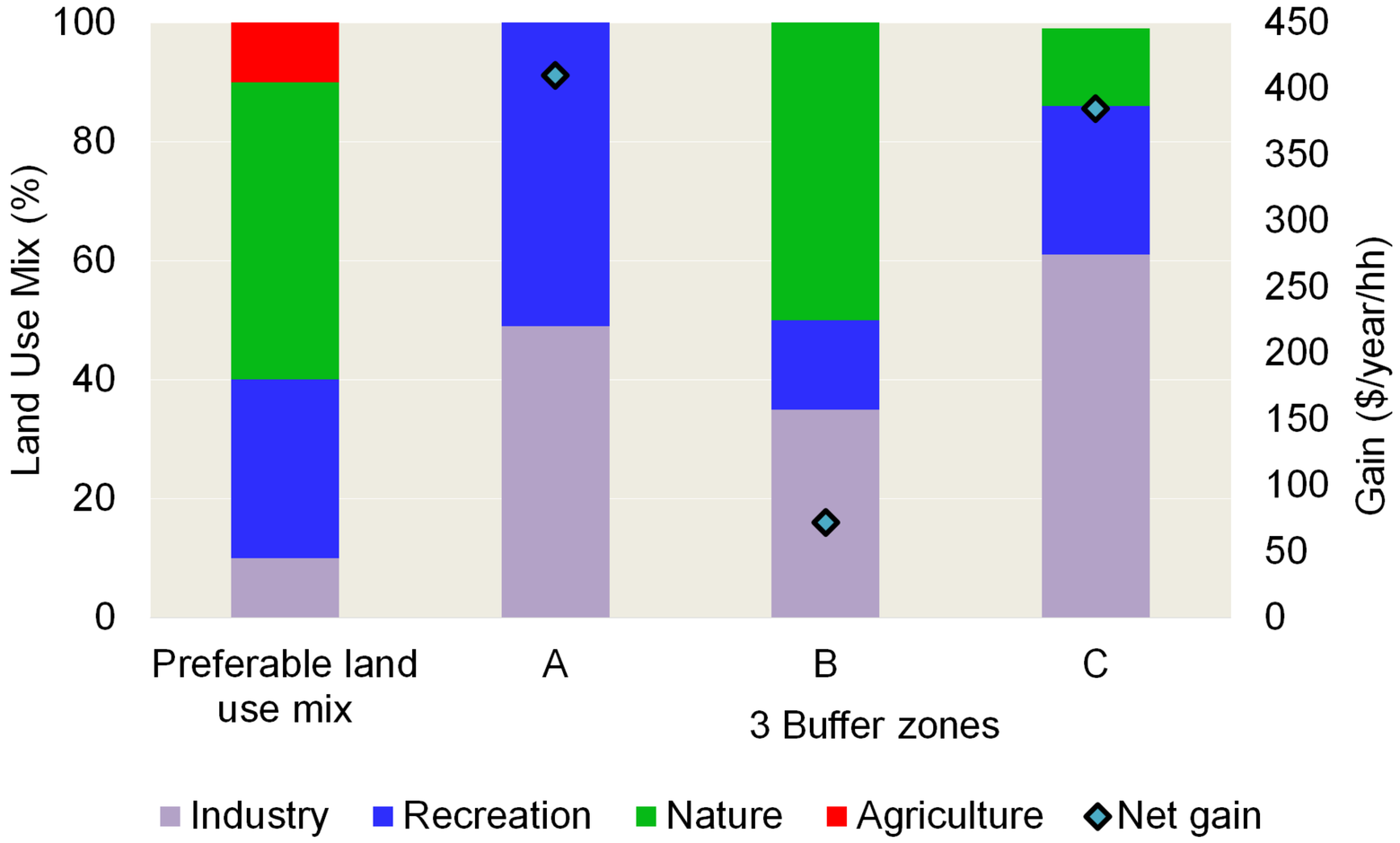
Buffer

- There was a clear, consistent, preference ordering for land use within buffer zones
- The most preferred land use was nature conservation.



Buffer

- Changing current land zoning at 3 treatment plants shows large increases in community welfare, although costs of provision are not considered here.

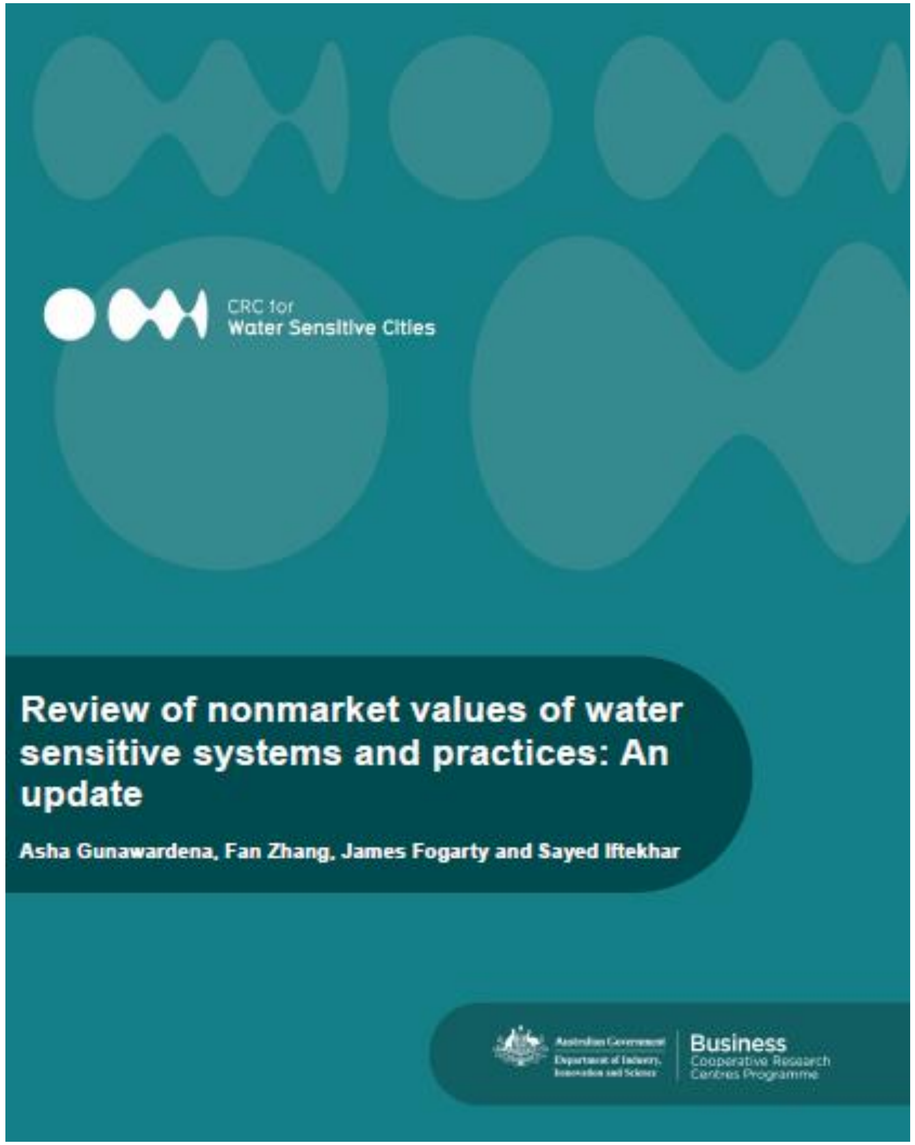


NMV database

CRC WSC IRP2 work

- An extensive review of non-market values of water sensitive systems and practices

Gunawardena, A., Zhang, F., Fogarty, J., Iftekhar, M. S., (2017). Review of nonmarket values of water sensitive systems and practices: An update. Melbourne, Australia: Cooperative Research Centre for Water Sensitive Cities. *Available in the CRC webpage.*



Review of NMVs

- Comprehensive search of literature
  - Online databases
  - Grey literature from google
  - Research reports from CRC partners
  - Working papers/ conference proceedings
  - Author profiles

- Key words : Non-market valuation methods
  Themes related to urban water management

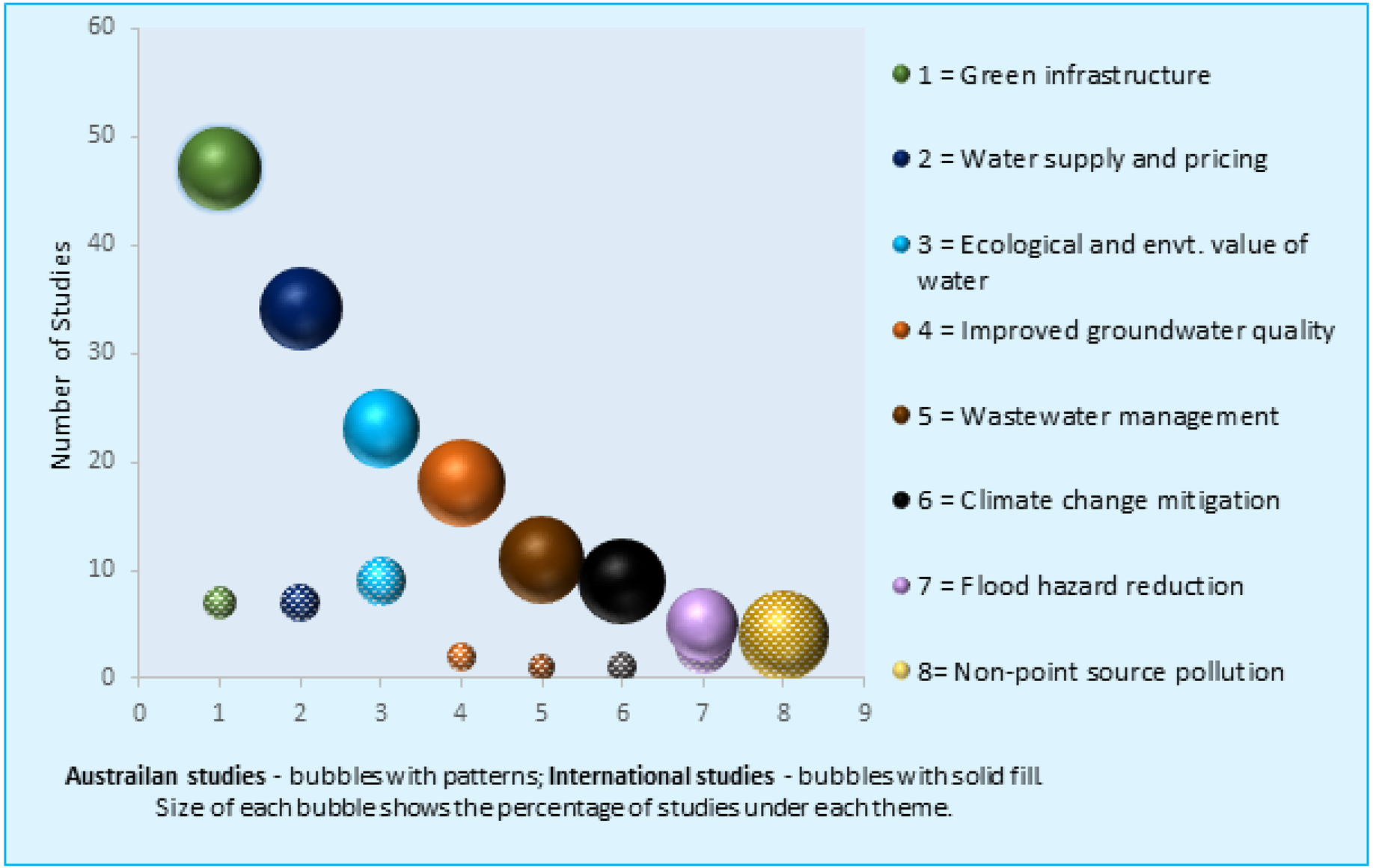
- Studies published during 2000-2017

- Review Report

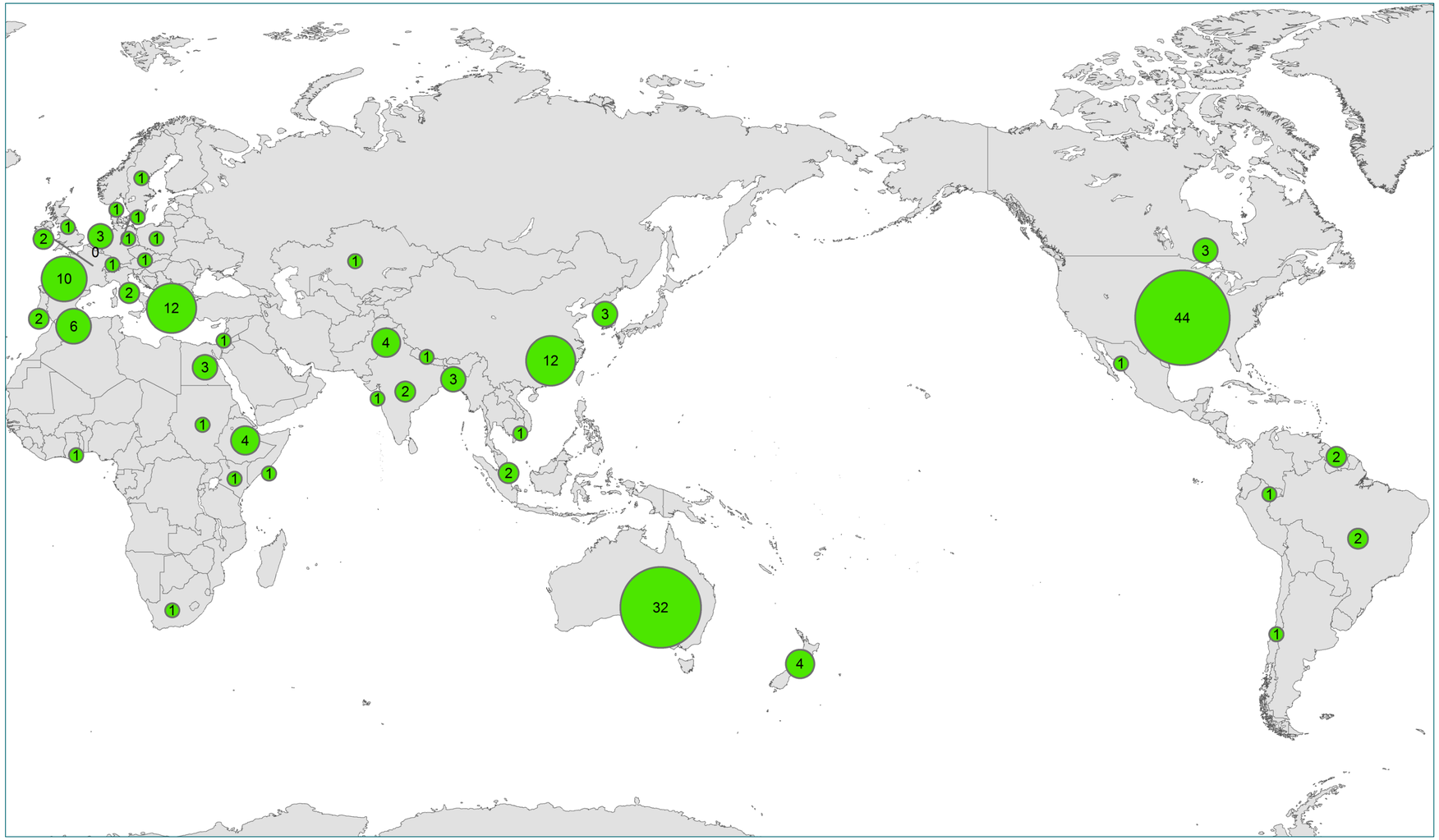
Review of NMVs

- Reviewed 345 studies related to water sensitive urban systems and practices
- 181 studies reported non-market values
- More than 400 non-market values were recorded

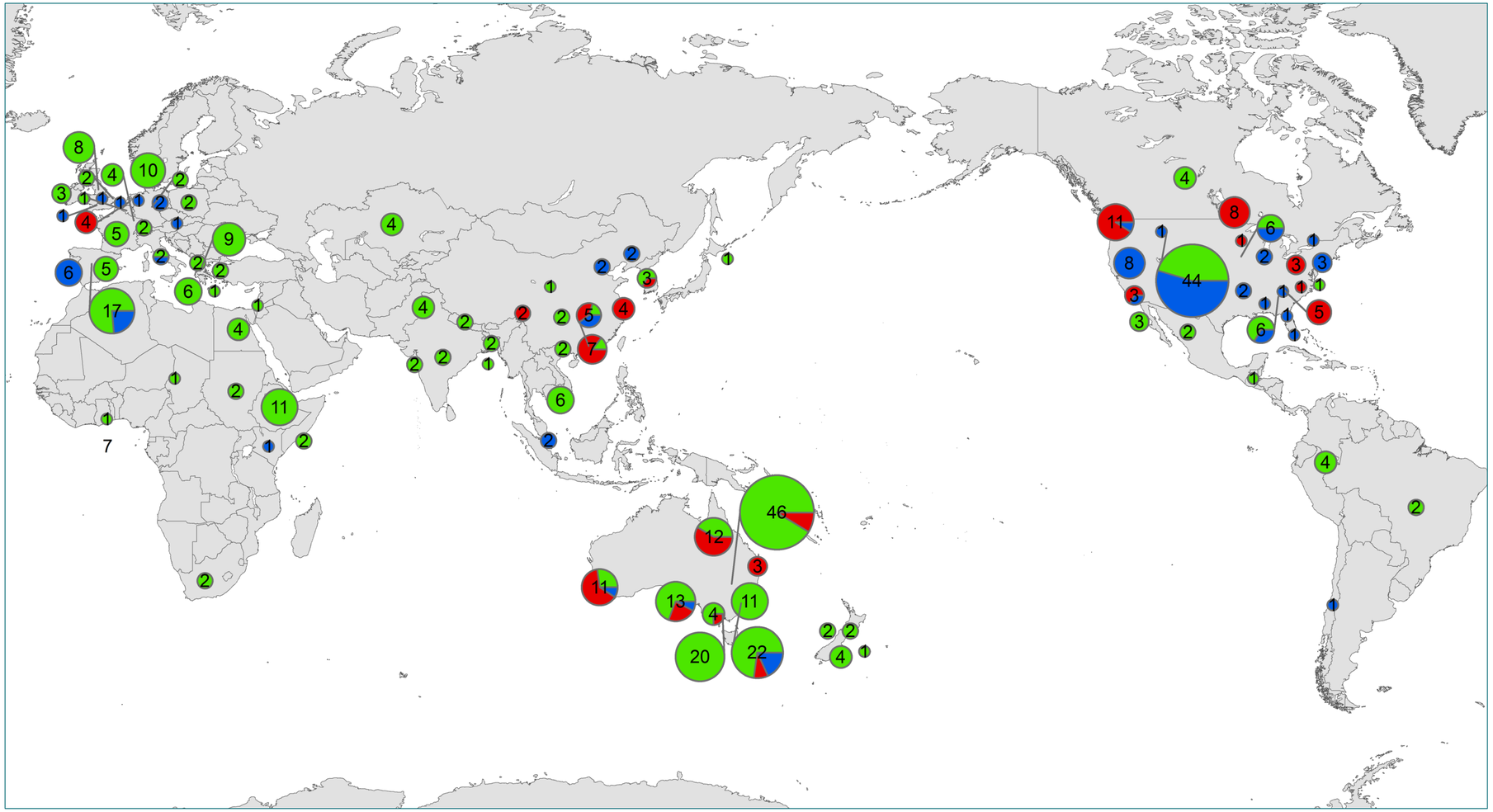
Distribution of studies by themes



Distribution of studies by location



Distribution of studies by method used



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Stated Preference

Revealed Preference

Other

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NMV database

- Started with the Australian studies
- Information from 52 studies (233 non-market values) have been included so far
- Information organized in an excel spreadsheet-based database

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THE UNIVERSITY OF WESTERN AUSTRALIA

Database of non-market values of water sensitive systems and practices

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Centre for Environmental Economics and Policy, University of Western Australia
Date 1/02/2018

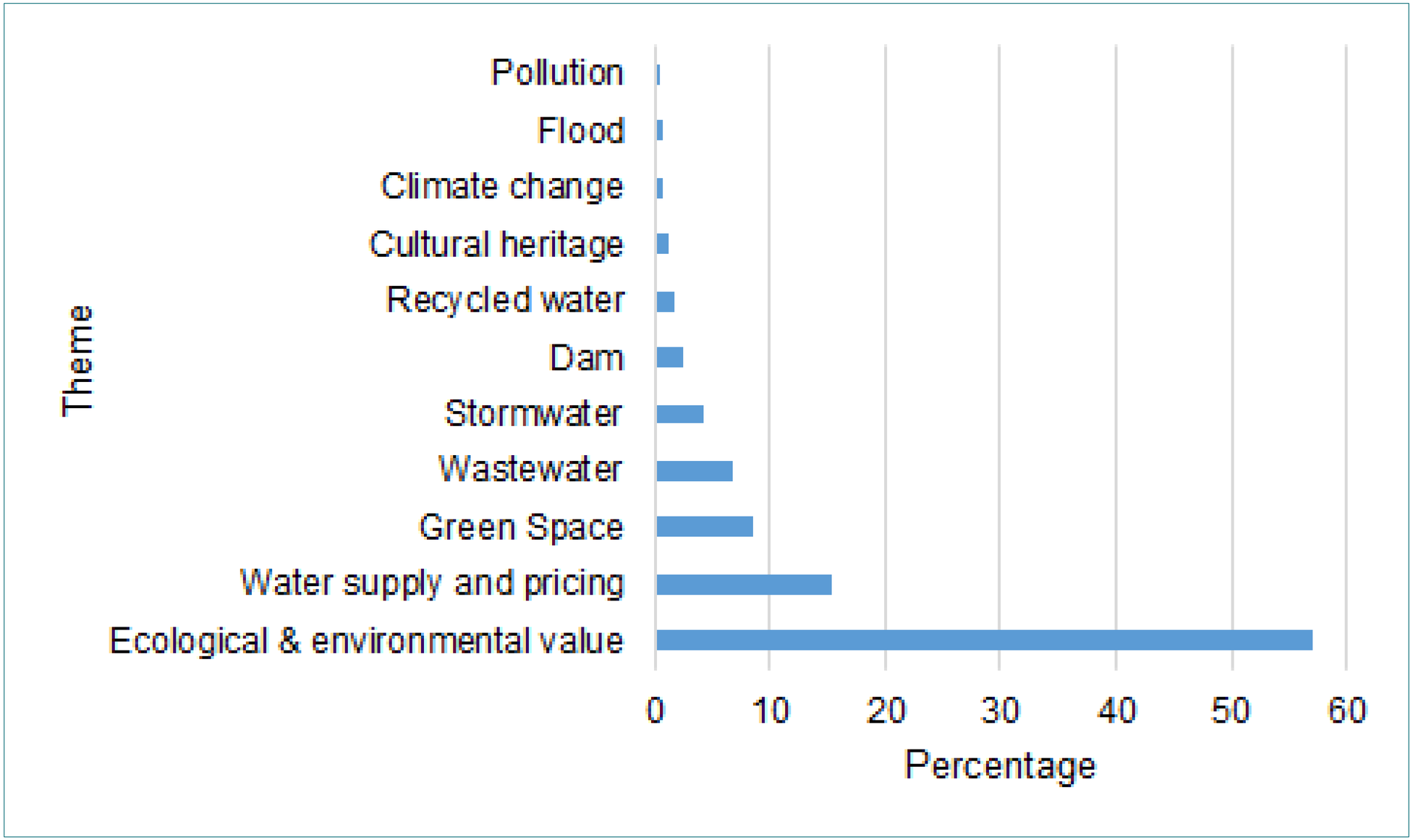
Introduction

This database was developed as part of CRC for Water Sensitive Cities IRP2 prject
It is supported by a set of guidelines: Gunawardena, A., Iftekhar, M. S., Fogarty, J., (2018). Non-market value database on water sensitive systems and practices: User Guideline. Melbourne, Australia: Cooperative Research Centre for Water Sensitive Cities
Contact: mdsayed.iftekhar@uwa.edu.au
This database is a collection of non-maket values of water sensitive systems and practices from primary studies from Australia from 2000 to December 2017.

NMV database

Study identification				WTP measure			
Obs. ID	Paper ID	Citation	Title	Value location	Theme	Value Type	System
1	1	Ambrey and Fleming (2014)	Public Greenspace and Life Satisfaction in Urban Australia	Entire Australia	Green Space	Amenity	Green Space
2	1	Ambrey and Fleming (2014)	Public Greenspace and Life Satisfaction in Urban Australia	Entire Australia	Green Space	Amenity	Green Space
3	2	Bennett et al (2008)	The economic value of improved environmental health in Victorian rivers.	Moorabool river (large pre-urban regualted river)	Ecological & environmental value	Native Fish	River
4	2	Bennett et al (2008)	The economic value of improved environmental health in Victorian rivers.	Moorabool river (large pre-urban regualted river)	Ecological & environmental value	Native vegetation	River
5	2	Bennett et al (2008)	The economic value of improved environmental health in Victorian rivers.	Moorabool river (large pre-urban regualted river)	Ecological & environmental value	Water Birds	River
6	2	Bennett et al (2008)	The economic value of improved environmental health in Victorian rivers.	Moorabool river (large pre-urban regualted river)	Ecological & environmental value	Native Fish	River

Distribution of values by themes



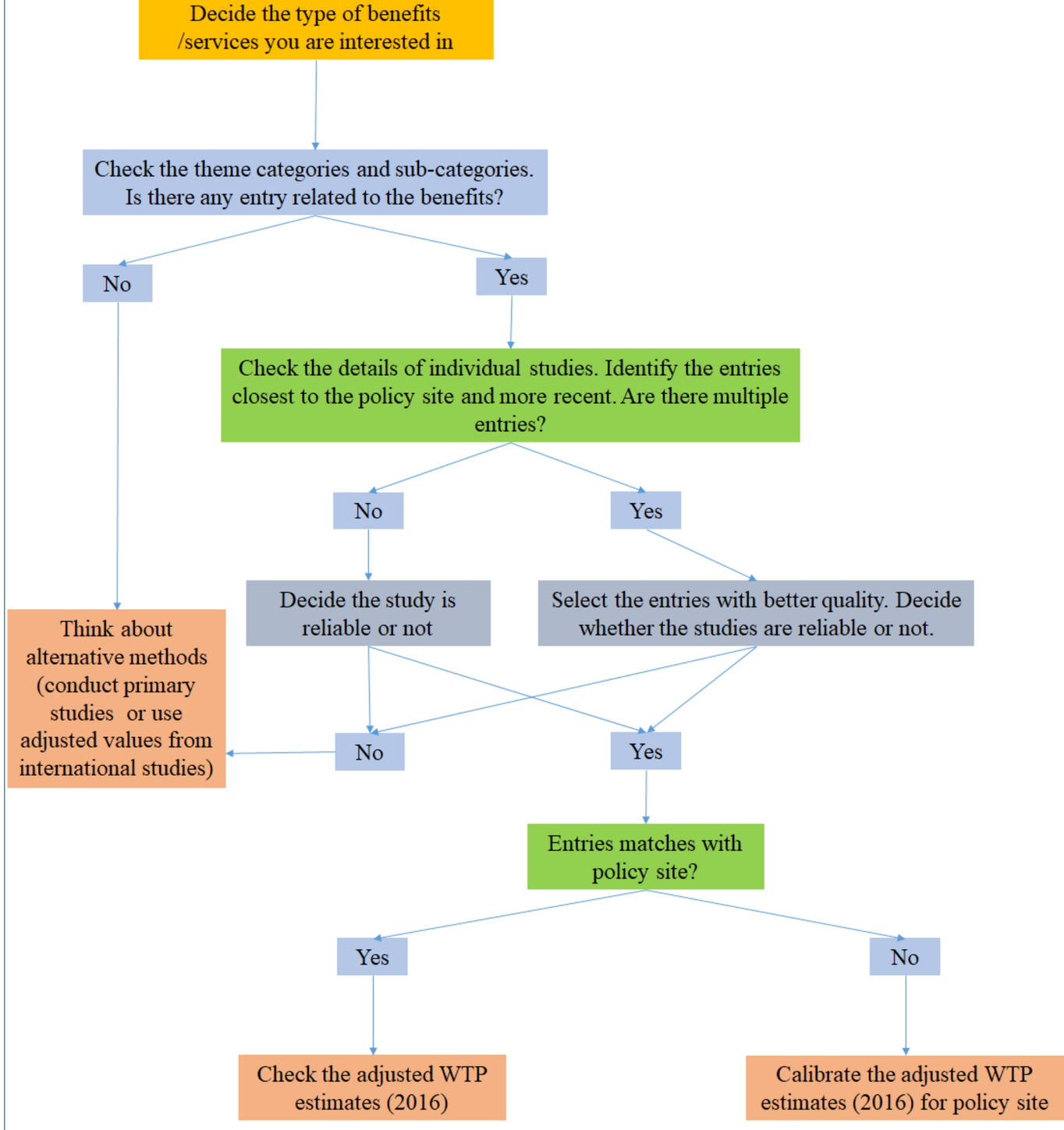
Distribution of values by themes and methods used

Theme	Method (% of total)			Total
	RP	SP	Other	
Climate change	0	0	100	2
Cultural heritage	0	100	0	3
Dam	50	50	0	6
Ecological & environmental value	23	77	0	133
Flood	0	100	0	2
Green Space	70	20	10	20
Pollution	0	0	100	1
Recycled water	0	100	0	4
Stormwater	0	100	0	10
Wastewater	0	100	0	16
Water supply and pricing	0	100	0	36
All themes	21	77	2	233

Distribution (%) of values by themes and states

Theme	ACT	NSW	NT	QLD	SA	TAS	VIC	WA
Climate change	1	0	0	0	0	0	0	0
Cultural heritage	0	0	0	1	0	0	0	0
Dam	0	0	0	2	0	0	0	0
Ecological & environmental value	2	14	1	15	7	1	10	6
Flood	0	0	0	1	0	0	0	0
Green Space	1	1	0	2	3	1	1	4
Pollution	0	0	0	0	0	0	0	0
Recycled water	0	0	0	0	1	0	0	0
Stormwater	0	2	0	2	0	0	2	0
Wastewater	4	2	0	0	1	0	0	0
Water supply and pricing	6	0	0	3	3	0	0	1
Total	**13**	**18**	**2**	**26**	**15**	**2**	**14**	**10**

Use of the spreadsheet database



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Use of the spreadsheet database – an example

- Step 1: Identify the key benefit / service that you are interested

- *Lets assume that you are interested in the value (amenity benefits) of urban street trees in Adelaide (i.e., if you plant trees on footpaths would it generate benefits to local residents?)*

- *There are currently 5 unique records in the database*

Use of the spreadsheet database – an example

Study identification				WTP measure						
Obs. ID	Paper ID	Citation	Title	Value location	Categories of values/services	Sub-category of valued / services	Definition of marginal change	Unit of measurement	Frequency of payment	WTP estimate (2016 $AU)
149	28	Pandit et al. (2014)	Valuing public and private urban tree canopy cover	Perth metropolitan area in WA	Tree canopy cover	Amenity	Property price increased due to 10 per cent increase in tree canopy cover on the adjacent public space	%	One off-payment	16,934.14
150	29	Pandit et al. (2013)	The effect of street trees on property value in Perth, Western Australia	Perth, Western Australia	Street trees	Amenity	Median property price increaed due to having a broad leaved tree on street verge (public place), (median house price is 395000)		One off-payment	21,434.34
155	31	Plant et al. (2017)	Evaluating preferences for street tree cover targets	Residential suburbs, Brisbane	Street trees	Amenity	Implicit price for 50% increase in tree cover in the footpath by 2031 with in 100m (median house value is 530000)	Area	One off-payment	24,843.98
156	31	Plant et al. (2017)	Evaluating preferences for street tree cover targets	Residential suburbs, Brisbane	Street trees	Amenity	Marginal implicit price for a 1% increase in footpath tree cover within 100 m (lower limit) (median house value is 530000)	Area	One off-payment	384.87
157	31	Plant et al. (2017)	Evaluating preferences for street tree cover targets	Residential suburbs, Brisbane	Street trees	Amenity	Marginal implicit price for a 1% increase in footpath tree cover within 100 m (upper limit) (median house value is 530000)	Area	One off-payment	484.79

Use of the spreadsheet database – an example

Step 2: Understand details of the primary studies

- Description of marginal change (Commodity/service being valued) to understand the policy changes are relevant for you or not.

  In all the studies (except one) the changes have been expressed percentage.

- Study method: Check the study methods. Compared to survey-based methods hedonic analysis is usually more reliable as they are based on observed data.

  All the studies have used hedonic analysis.

- Study details: Check the details of the data collection procedure. If there are socio-demographic information of the study site available to compare with the policy site (the site that you are interested).

  There is no socio-demographic information recorded in the database. Please check the original source.

Use of the spreadsheet database – an example

Step 3: Check the requirement for adjustment

- Comparison of income level of the cities reveals that studies from Brisbane could be relevant.

- However, tree cover percentage shows that perhaps information from Perth might be suitable. In either case, we would have to adjust for income differences.

	Adelaide	Perth	Brisbane	Source
Median age	39	36	35	ABS (2016)
Median weekly household income	$1,265	$1,643	$1,562	ABS (2016)
Tree cover (%)	27	31	43	Jacobs et al. (2014)

Use of the spreadsheet database – an example

Step 4: Adjustment of numbers

- Assuming people's willingness to pay is proportional to their income we could adjust for income differences.

Source	Definition of marginal change	Adjusted WTP for 2016	Adjusted WTP for Income
Pandit et al. (2014)	Property price increased due to 10 per cent increase in tree canopy cover on the adjacent public space	16,934.14	13,038
Pandit et al. (2013)	Median property price increased due to having a broad leaved tree on street verge (public place), (median house price is 395000)	21,434.34	16,503

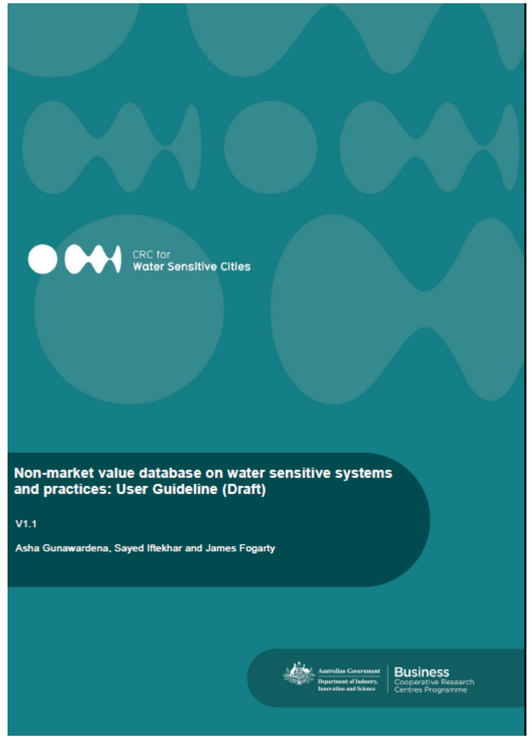
Use of the spreadsheet database – an example

Step 5: Calculate aggregate value

- Aggregation of values would require information on physical changes (e.g., number of trees to be planted or changes in proportion of vegetation coverages, etc.).

NMV database – work in progress

- Finalize the user guideline in collaboration with the Steering Committee members and case study partners
- Working on benefit transfer examples for selected case studies
- Add new information in the database as required



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Thank you.