bushfire&natural HAZARDSCRC

NON-MARKET VALUATION IN THE ECONOMIC ANALYSIS OF NATURAL HAZARDS

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THE UNIVERSITY OF WESTERN AUSTRALIA

NATURAL HAZARD MITIGATION

1) Natural hazards occur frequently and all around the world

2) Impacts can be devastating and costly to repair

3) Many mitigation actions are available to avoid impacts

4) But which ones should governments invest in?

OBJECTIVES OF MITIGATION

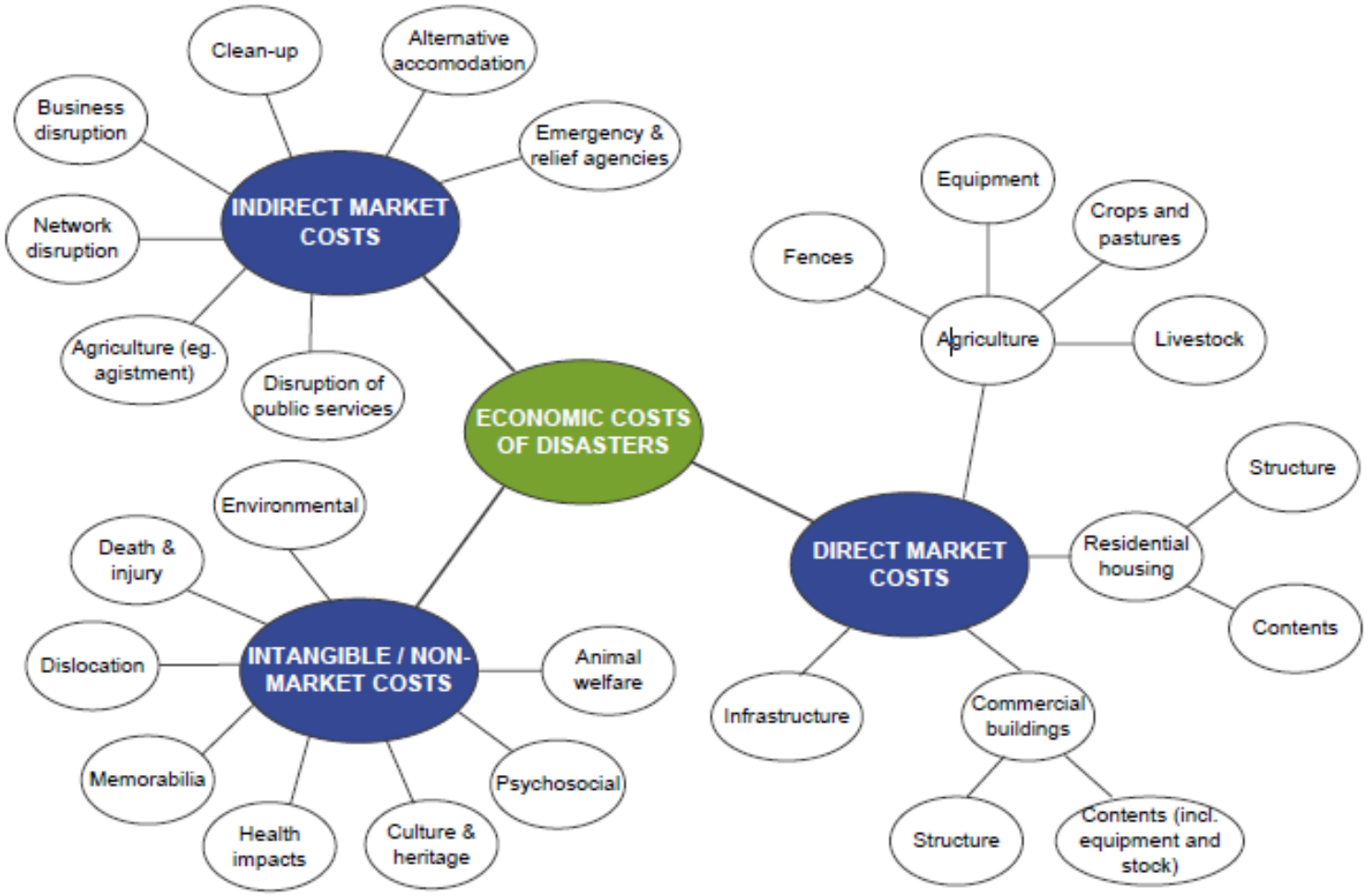
1) Governments invest in mitigation to protect the values affected by natural hazards

2) Values include:

   a) Tangible, market costs and benefits

   b) Intangible, non-market costs and benefits

Figure 2.2 **The economic costs of natural disasters**



Source: Adapted from BTE (2001).

BENEFIT COST ANALYSIS (BCA)

1) BCA: weighs up all of the costs and benefits of mitigation actions

2) The market costs and benefits of mitigation are well documented

3) But there are many intangible, non-market values to consider as well

THE PROBLEM?

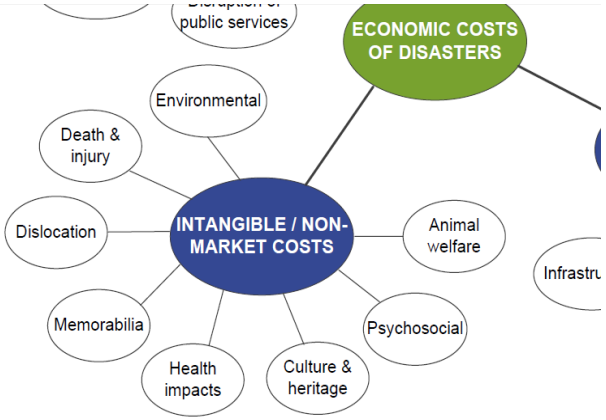
1) Non-market values are often ignored in BCA because they aren't quantified in financial terms

2) But these values can be important:

   the non-market benefits of avoiding a natural hazard could be equivalent to, or even outweigh, the cost of mitigation action

THE SOLUTION…

1) Non-market values can be quantified in financial equivalent terms



Source: Adapted from BTE (2001).

2) Non-market valuation:

A set of economic methodologies able to estimate monetary figures for non-market costs and benefits

→ $ values can be used in BCA

TYPES OF NON-MARKET VALUES:

1) Use related values, e.g.:
   a) Recreation
   b) Amenity
   c) Water consumption

2) Non-use values, e.g.:
   a) Existence of biodiversity
   b) Protecting cultural heritage for future generations

ESTIMATING NON-MARKET VALUES

1) Non-market valuation:

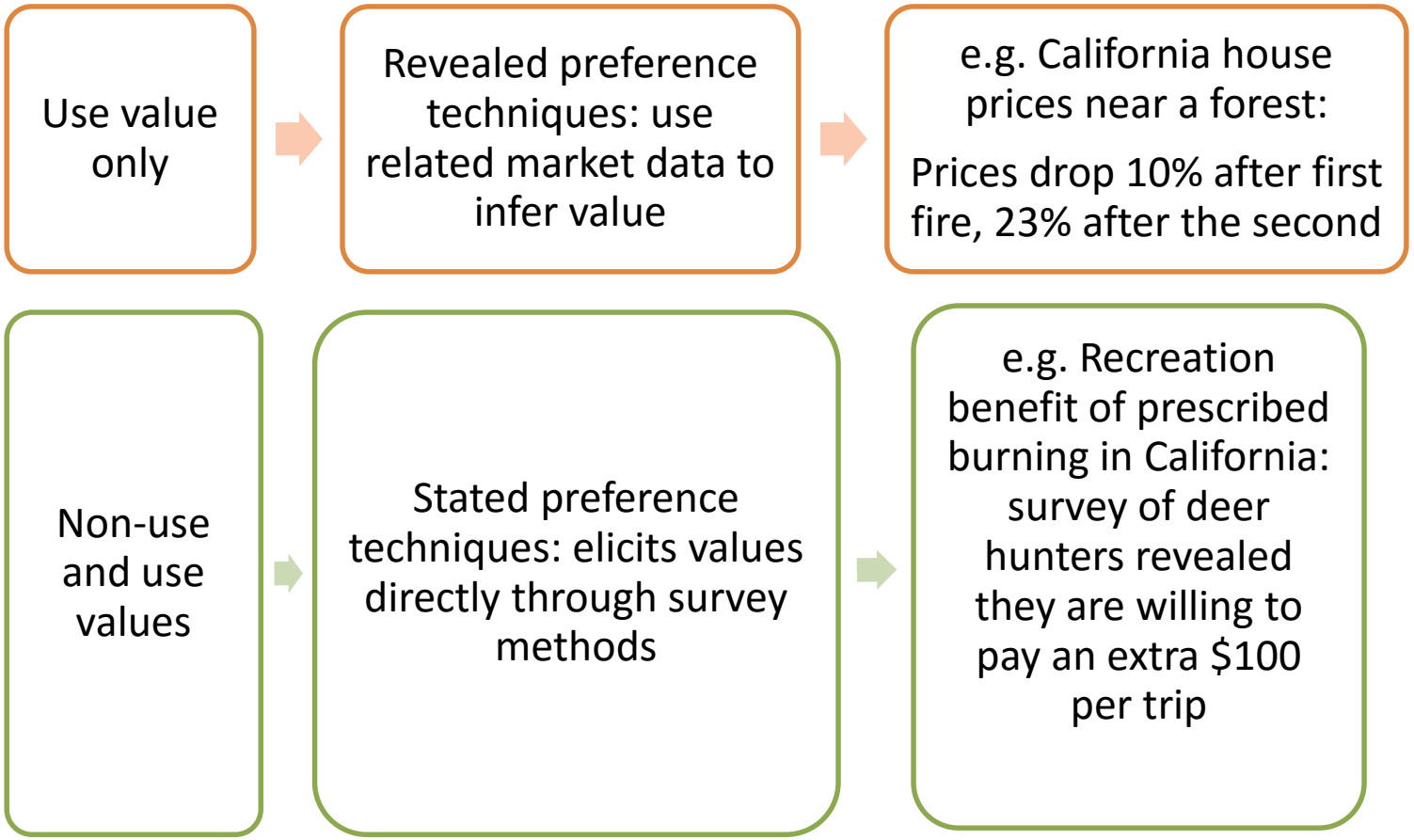
   identifies "willingness to pay" for a change in provision of a public good or service

2) Estimated in $'s

   → comparable with market costs and benefits

3) Approach depends on the value type to be estimated

NON-MARKET VALUATION METHODS



WHICH METHODS COULD WE USE?

1) Natural hazards can impact a large area, meaning multiple values are affected

2) Includes use and non-use values

→ Revealed and stated preferences are both relevant

3) But there are many non-market values to consider:

requires extensive research;

original studies are expensive and time consuming…

AN ALTERNATIVE: BENEFIT TRANSFER

1) Benefit transfer uses values estimated from original studies and applies them to similar policy contexts

2) Values can be transferred by:
   a) A unit transfer – taking a value from a single study
   b) A transfer function – using information about a site or population characteristics to adjust a value from a single study
   c) Meta functions or meta analyses – using multiple original studies

A BENEFIT TRANSFER FRAMEWORK: "VALUE TOOL"

Step 1: Identify non-market values affected by natural hazards and their mitigation

Step 2: Identify original studies providing estimates of each non-market value type

Step 3: Develop a conceptual framework and guidelines for how transferred values can be used in a natural hazard decision context

STEP 1: NON-MARKET VALUES AFFECTED BY NATURAL HAZARDS

Health values	Environmental values	Social values
• Physical health • Mental health	• Ecosystems • Water quality	• Recreation • Amenity & safety • Cultural heritage • Social disruption • Memorabilia • Animal welfare

STEP 2: DATABASE OF AVAILABLE STUDIES

A	B	C	U	V	W	X	Y	Z
STUDY IDENTIFICATION AND RELEVANCE			WILLINGNESS TO PAY					
Observation ID	Hazard types applicable	Brief summary of study objective(s)	Definition of effect size	Currency	Secondary value estimate	Secondary value estimate (2016 $AU)	WTP estimate	WTP estimate (2016 $AU)
Identification nu	*Which natural*	*Describe the main objectives of the study*	*This is what is being measured (e.g. WTP for X square kr*		*e.g. $*			
	1=fire		describe				single value or a range	
	2=flood							
	3=storm							
	4=earthquake							
	5=tsunami							
	6=other							
	7=multiple hazards							
1	1	VSL for death by fire	WTP for one unit reduction in risk from b	SEK	14349000	3808569.2	238.00	51.21
2	1	VSL for death by fire	WTP for one unit reduction in risk from b	SEK	12121000	3216267	199.05	42.83
3	6 (drowning)	VSL for death by drowning	WTP for one unit reduction in risk from b	SEK	14427000	3829268.8	241.90	52.05
4	6 (drowning)	VSL for death by drowning	WTP for one unit reduction in risk from b	SEK	10870000	2099467	181.94	39.15
5	6 (not specifi	VSL for death by any means	VSL for one life	AUD	182000	185989	#########	#########
6	6 (air pollutic	WTP for PM10 air pollution reduction	WTP for a one day decrease in the averag	AUD			5164.00	5408.48
7	6 (road safety	VSL for death by road vehicle accident	VSL transfer function for application to tr	Intl dollars				
8	1	VSL for death due to bushfire smoke	Altrustic VSL for one life	AUD	2600000		#########	

EXAMPLES FROM THE LITERATURE: BUSHFIRES

Health values

- Physical health
- Mental health

Chalak (2016)

- Stated preference approach
- Australian study
- "Value of a statistical life" in the context of death due to bushfire smoke:

- **AUD$5million per life**

EXAMPLES FROM THE LITERATURE: FLOODS

Social values

- Recreation
- Amenity & safety
- Cultural heritage
- Social disruption
- Memorabilia
- Animal welfare

Samarasinghe & Sharp (2010)

- Revealed preference approach
- New Zealand study
- Willingness to pay to avoid being located in a flood-hazard zone:

- **NZ$11,850 difference in property price**

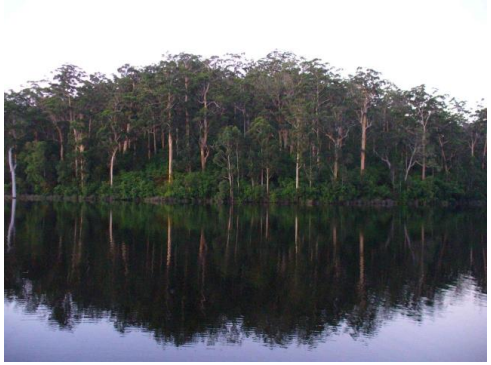
EXAMPLES FROM THE LITERATURE: OUT OF CONTEXT

Hatton MacDonald et al. (2011)

Environmental values

- Ecosystems
- Water quality

- Stated preference approach
- Australian study
- Willingness to pay per % increase in healthy river vegetation:



- **AUD$2.87 to $4.42**

  per household, per year, depending on which State an individual lives in

GAPS IN THE LITERATURE

1) Original studies exist for some values affected by natural hazards

2) Few are in a natural hazard context

3) Even fewer are Australian studies

APPROPRIATE USE OF BENEFIT TRANSFER

1) Original studies need to be good quality

2) There needs to be a close match between original study site & transfer site for:

   a) Policy/decision context, e.g. same natural hazard risk, same mitigation strategy

   b) Population characteristics, e.g. Australian population

   c) The quality, quantity or scale of the change in provision of the thing being valued

WHEN THE CONDITIONS AREN'T MET FOR BENEFIT TRANSFER

1) There is a very limited literature for some values affected by natural hazards
   a) The decision context, population characteristics, and change being valued in original studies are unlikely to match

2) 'Out of context' studies still exist for these value types
   a) May not be accurate enough for a direct value transfer to inform BCA
   b) Still useful for policy advocacy by informing:
      - General magnitude of values, relative to other costs & benefits
      - Anticipated preferences of people for different mitigation actions

STEP 3: "VALUE TOOL" – FOR BENEFIT TRANSFER AND POLICY ADVOCACY

1) Will consist of a user-friendly and searchable database

2) Accompanying framework and guidelines for using the database

3) Value estimates in the database will be categorised:
   a) Relevance for benefit transfer
   b) Relevance for policy advocacy

4) Knowledge gaps will be identified

THE CHALLENGES

1) Intangible values can be measured through non-market valuation, but that isn't enough:

   tools like benefit transfer are needed to efficiently provide $ estimates of non-market values

2) In some cases there is insufficient data for benefit transfer:

   information on preferences is available that can inform decision making

IMPORTANCE OF THE VALUE TOOL

1) It will provide $ estimates of some non-market values
   a) Can be used in prioritisation frameworks, e.g. BCA, integrated assessment

2) It will identify how important different values are to people, and how they are likely to react to mitigation actions
   a) Useful policy information will be generated for all non-market values affected by natural hazards

WHAT'S NEXT?

1) Updating the value tool database(ongoing)

2) Integration of data from the value tool in other BNH CRC projects

3) Capacity building with decision makers

4) Filling the gaps – original non-market valuation studies

THANKS FROM THE UWA TEAM

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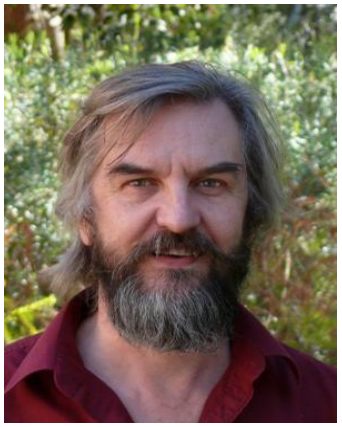

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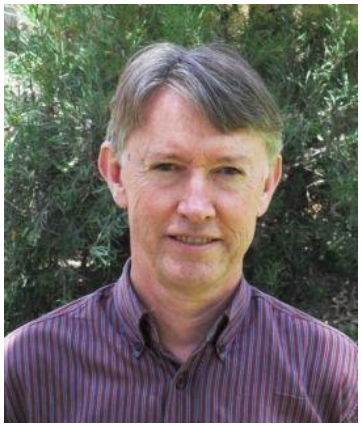

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Value type	Intermediate processes	Final outcomes	Applicable NMV methods*
Health values			
Physical health	Cause emergency/ health services to be overwhelmed, resulting in further deaths directly attributable to the hazard event.	Change in number of deaths Change in number of injuries, serious illness and/or pain	Stated preferences Hedonic wage model (VSL) QALY/EQ5D
Mental health		Change in reported cases of grief, stress and anxiety	QALY/EQ5D

Value type	Intermediate processes	Final outcomes	Applicable NMV methods*
Environmental values			
Ecosystems	Change in spread of invasive species Change in amount of debris and pollutants to enter marine or estuarine/riverine environments Change in carbon stored in vegetation and soils Change in occurrence of algal blooms in rivers and estuaries	Change in the number of flora and fauna species Change in the status of vulnerable environmental ecosystems and/or identified critically endangered species. Change in ocean surges and wave activity resulting in marine inundation and erosion of sandy coastlines/dune systems.	Stated preferences
Water quality	Change in turbidity in water bodies Change in occurrence of algal blooms in rivers and estuaries Change in debris and pollutants to enter marine or estuarine/riverine environments	Change in vulnerable environmental ecosystems and/or identified critically endangered species. Change in ocean surges and wave activity resulting in marine inundation and erosion of sandy coastlines/dune systems. Change in the aesthetics in the area.	Stated preferences Revealed preferences

Value type	Intermediate processes	Final outcomes	Applicable NMV methods*
Social values			
Recreation	Change in turbidity in water bodies Change in occurrence of algal blooms in rivers and estuaries Change in debris and pollutants to enter marine or estuarine/riverine environments Impact heritage buildings and cultural significant facilities Change in aesthetics in the area. Change in native vegetation communities	Change in recreation activity within the area	Revealed preferences Stated preferences Contingent behaviour
Amenity **(**and safety: while these are separate values, they are often linked, e.g. natural environments that are aesthetically pleasing are often accompanied with higher risks of hazards such as fire)**	Change in turbidity in water bodies Change in algal blooms in rivers and estuaries Change in debris and pollutants to enter marine or estuarine/riverine environments Change in native vegetation communities	Change in aesthetics in the area. Change in amenity related recreation	Revealed preferences
Cultural heritage	Impact to heritage buildings and cultural significant facilities	Change in cultural significance Change in heritage related recreation Impact sense of place	Revealed preferences Stated preferences

Value type	Intermediate processes	Final outcomes	Applicable NMV methods*
Social values			
Social disruption	Evacuation to safe accommodation away from people's homes and work places Evacuation of indigenous communities away from their country, as well as being housed together in groups not aligned to their culture Change in existing social service providers (NGOs, Lions, Rotary, Salvation Army, CWA, other volunteer organisations), impacting community wellbeing. Change in day to day functionality of facilities for vulnerable people (aged, childcare, disability) Change in day to day functionality of facilities	Breakdown of existing family and support networks (including social community networks) Change in community services and wellbeing Change in availability of basic commercial products and services	Stated preferences Wage differentials
Memorabilia		Impact to residential dwellings and contents	Stated preferences
Animal welfare		Displacement, death or injury to animals	Stated preferences