



bushfire&natural
HAZARDSCRC

BRINGING HAZARD AND ECONOMIC MODELLERS TOGETHER: A SPATIAL PLATFORM FOR DAMAGE AND LOSSES VISUALISATION

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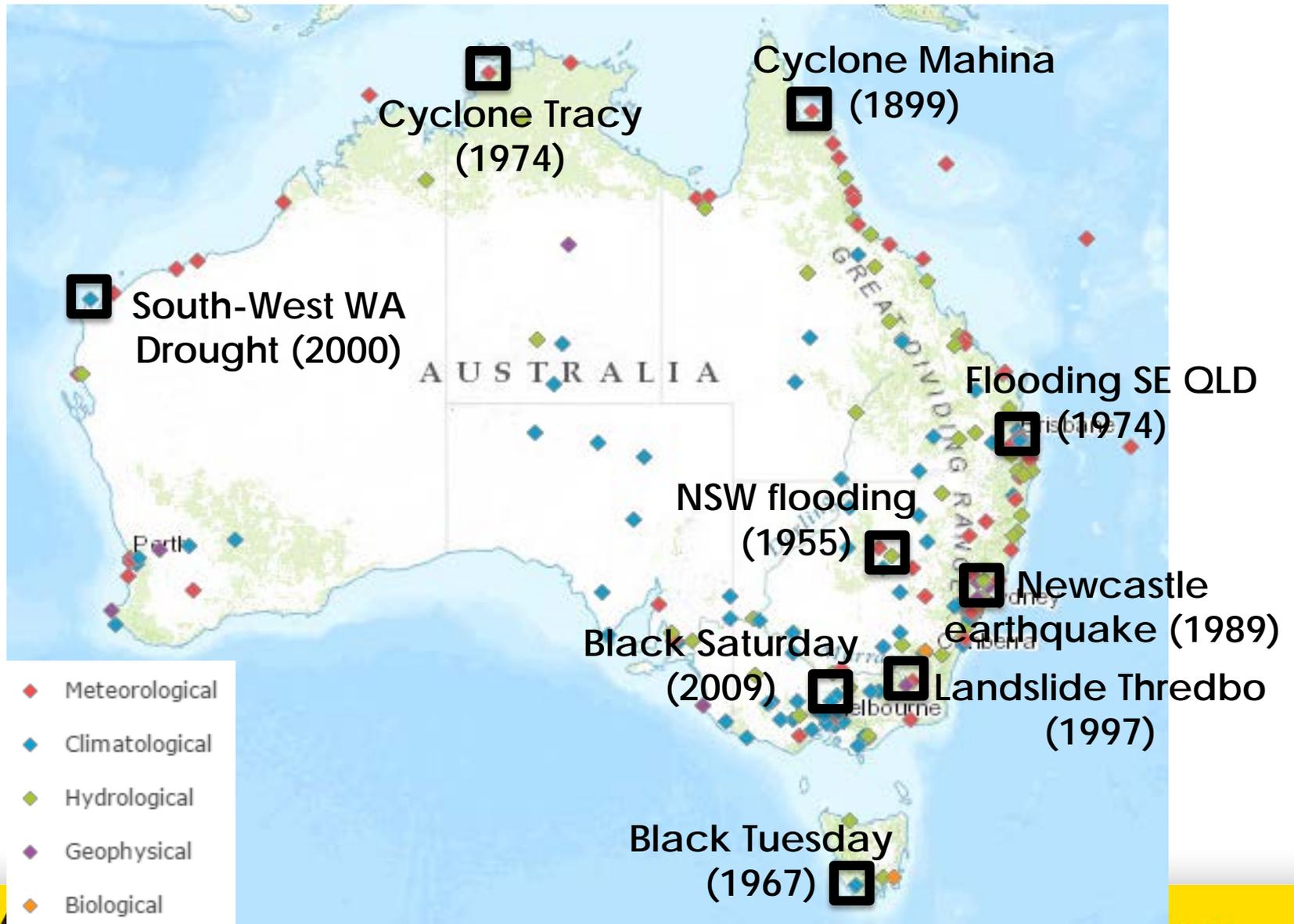
An Australian Government Initiative



THE UNIVERSITY OF
MELBOURNE



BACKGROUND TO THE PROJECT:



NATURAL DISASTERS IN AUSTRALIA

Natural Disasters in Australia

	Bushfires		Floods		Earthquakes		Total	
	1851-2014	1990-2014	1851-2014	1990-2014	1851-2014	1990-2014	1851-2014	1990-2014
ACT	4	2	1	0	0	0	5	2
NSW	18	7	24	9	2	1	44	17
NT	0	0	3	1	1	0	4	1
QLD	6	2	27	12	0	0	33	14
SA	7	1	4	1	2	0	13	2
TAS	3	1	3	0	0	0	6	1
VIC	20	7	9	7	0	0	29	14
WA	3	3	1	1	1	0	5	4
Total	61	23	72	31	6	1	139	55

CRITERIA FOR INCLUSION AS A NATURAL DISASTER

To be included in Disaster Information, natural, technological and human-caused events must meet at least one of the following criteria:

- 1) three or more deaths
- 2) 20 injuries or illnesses
- 3) significant damage to property, infrastructure, agriculture or the environment; or disruption to essential services, commerce or industry at an estimated total cost of A\$10 million or more at the time the event occurred.

The Australian Emergency Management Glossary (Commonwealth of Australia 1998) defines a disaster as:

"A serious disruption to community life which threatens or causes death or injury in that community and/or damage to property which is beyond the day-to-day capacity of the prescribed statutory authorities and which requires special mobilisation and organisation of resources other than those normally available to those authorities."

Greater investment **Laws**
Economic assessment **Policy**
Awareness raising
Information sharing
Early warning systems
Contingency plans **Community participation**
Sustainable development
Better urban planning
Good governance
Risk assessments
Coordination
Scientific and local knowledge
Education

To date, Disaster Risk Reduction (DRR) strategies have had little success in reducing the adverse economic impacts of these events

COST OF NATURAL DISASTERS

On average, the Australian community spends

\$1.58 billion

each year in recovering from natural disasters, including the costs of injury and death.

(Geoscience Australia, 2007)

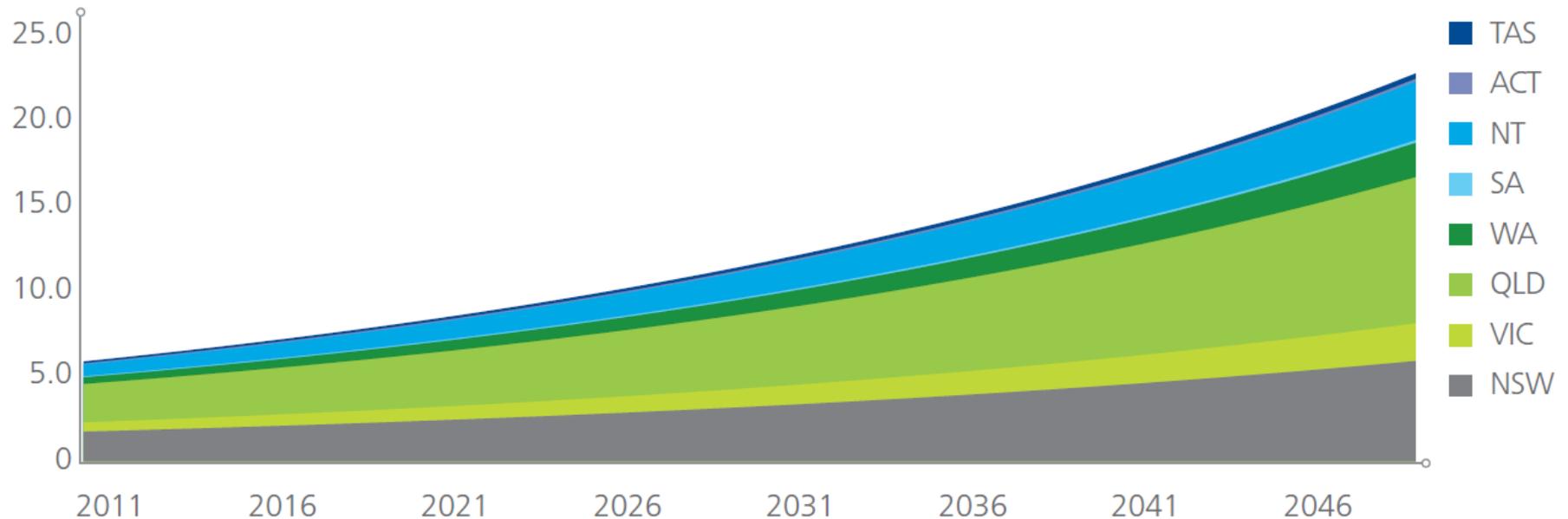
COST OF NATURAL DISASTERS

In **2012** alone,
the total economic cost of natural disasters
in **Australia**
is estimated to have exceeded
\$6 billion

COST OF NATURAL DISASTERS

Chart i: Forecast of total economic cost of natural disasters: 2011 – 2050

\$bn (2011 prices)



Source: Deloitte Access Economics (2013)

This statistic, which includes the costs carried by individuals, governments, businesses etc., along with the rapid economic growth in Australia, makes natural disasters a **significant issue for policy makers**.

OVERALL OBJECTIVES OF THIS PAPER

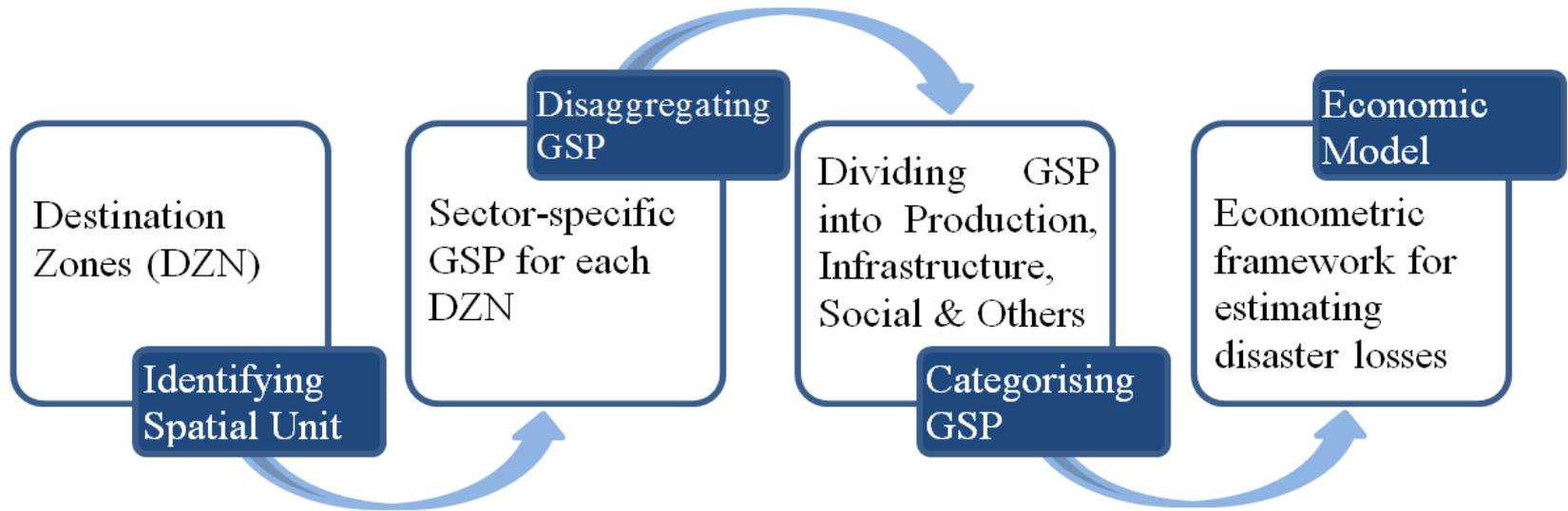
1. Estimate the disaster-specific effect on each sector of Victoria State economy using finer geographic unit level data
2. Identify the economic sectors that are affected by natural disasters positively
3. Identify the economic sectors that are unlikely to get affected by natural disasters
4. Develop a ranked list of the economic sectors that seek more attention for policy intervention (e.g., resource allocation) to minimise potential negative effects of natural disasters



METHODOLOGY

METHODOLOGY

Spatially Enabled Economic Modelling Process

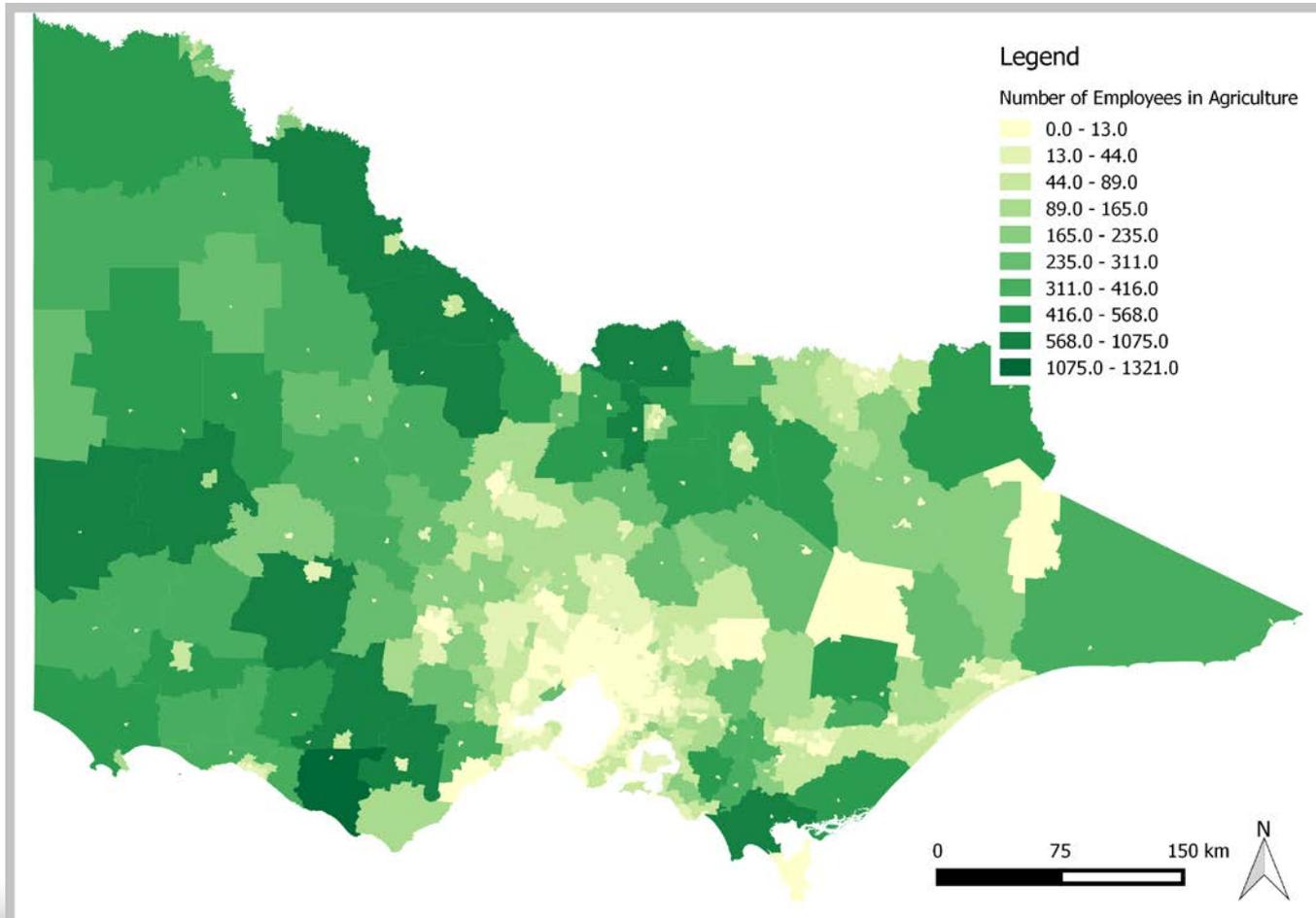


DEFINING THE SPATIAL UNIT OF ANALYSIS

- ❑ In the Place of Work (POWP 2011) dataset collected by ABS, Destination Zones (DZNs) are defined.
- ❑ POWP 2011 dataset provides sector-specific total number of employees for each sector at a finer geographic level (Victoria is divided into 2753 DZNs)

DISAGGREGATING SECTOR-SPECIFIC GSP IN VICTORIA

Number of Employees in Agriculture by DZNs (Victoria, 2011)



CATEGORISING ECONOMIC SECTORS AT DZN LEVEL

- Experimental state accounts were published in 1984, followed by the first official estimates in 1987. This provides data on Gross State Product by disaggregating it into the following 12 sectors for the period 1978 – 1986 in this initial release
 - Source: Australian National Accounts: State Accounts, 1985-86, ABS

Primary	Secondary	Tertiary
A. Agriculture, Forestry, Fishing and Hunting B. Mining	C. Manufacturing	D. Electricity, Gas and Water E. Construction F. Wholesale and Retail Trade G. Transport, Storage and Communication H. Finance, property and business services I. Public Administration, Defense and Community services J. Recreation, personal and other services K. Ownership of dwellings L. General Government

CATEGORISING ECONOMIC SECTORS AT DZN LEVEL

- In 1993, ABS publishes GSP data in terms of 19 economic sectors; such data are digitized and available from 1990 onwards.

Primary	Secondary	Tertiary
A. Agriculture, Forestry and Fishing B. Mining	C. Manufacturing	D. Electricity, Gas, Water and Waste Services E. Construction F. Wholesale Trade G. Retail Trade H. Accommodation and Food Services I. Transport, Postal and Warehousing J. Information Media and Telecommunications K. Financial and Insurance Services L. Rental, Hiring and Real Estate Services M. Professional, Scientific and Technical Services N. Administrative and Support Services O. Public Administration and Safety P. Education and Training Q. Health Care and Social Assistance R. Arts and Recreation Services S. Other Services

CATEGORISING ECONOMIC SECTORS AT DZN LEVEL

- In DRR literature, economic sectors are grouped into four categories:

Production	Infrastructure	Social	Cross-cutting
Agriculture Mining Manufacturing Wholesale Trade Retail Trade Accommodation and Food Services Rental, Hiring and Real Estate Services Professional, Scientific and Technical Services Arts and Recreation Services	Electricity, Gas, Water and Waste Services Construction Transport, Postal and Warehousing Information Media & Telecommunication	Education and Training Health Care and Social Assistance Public Administration and Safety	Financial and Insurance Services Administrative and Support Services Other Services

DISAGGREGATING SECTOR-SPECIFIC GSP IN VICTORIA

- We decompose sector-specific gross product across 2753 zones using total number of employees for each sector as a weight. That is,

$$GSP_{ist} = \frac{GSP_{st} \times Employment_{ist}}{Employment_{st}}$$

where,

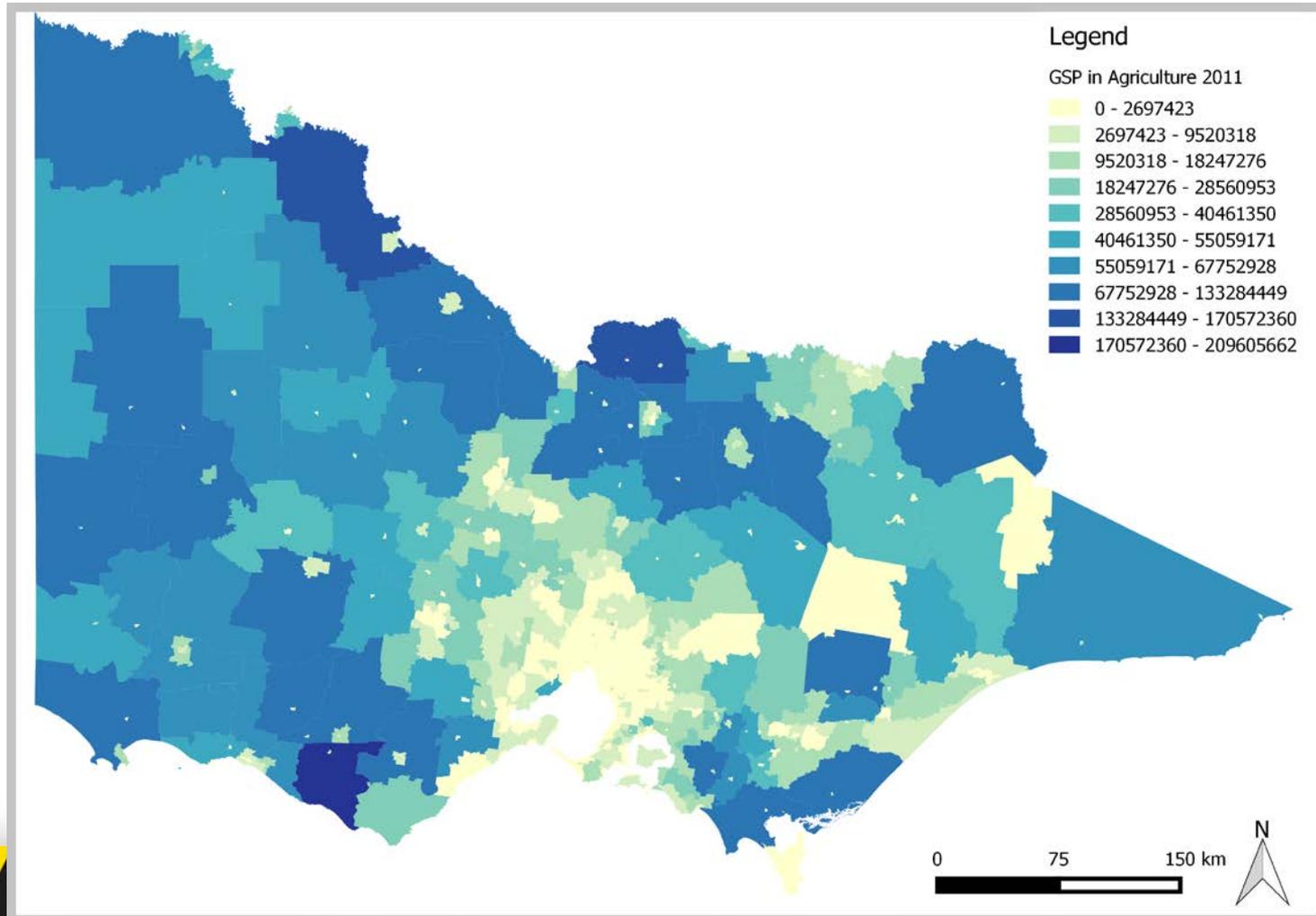
GSP = Real gross state product *s* = Economic sectors

Employment = Total number of employees *t* = Year

i = DZNS

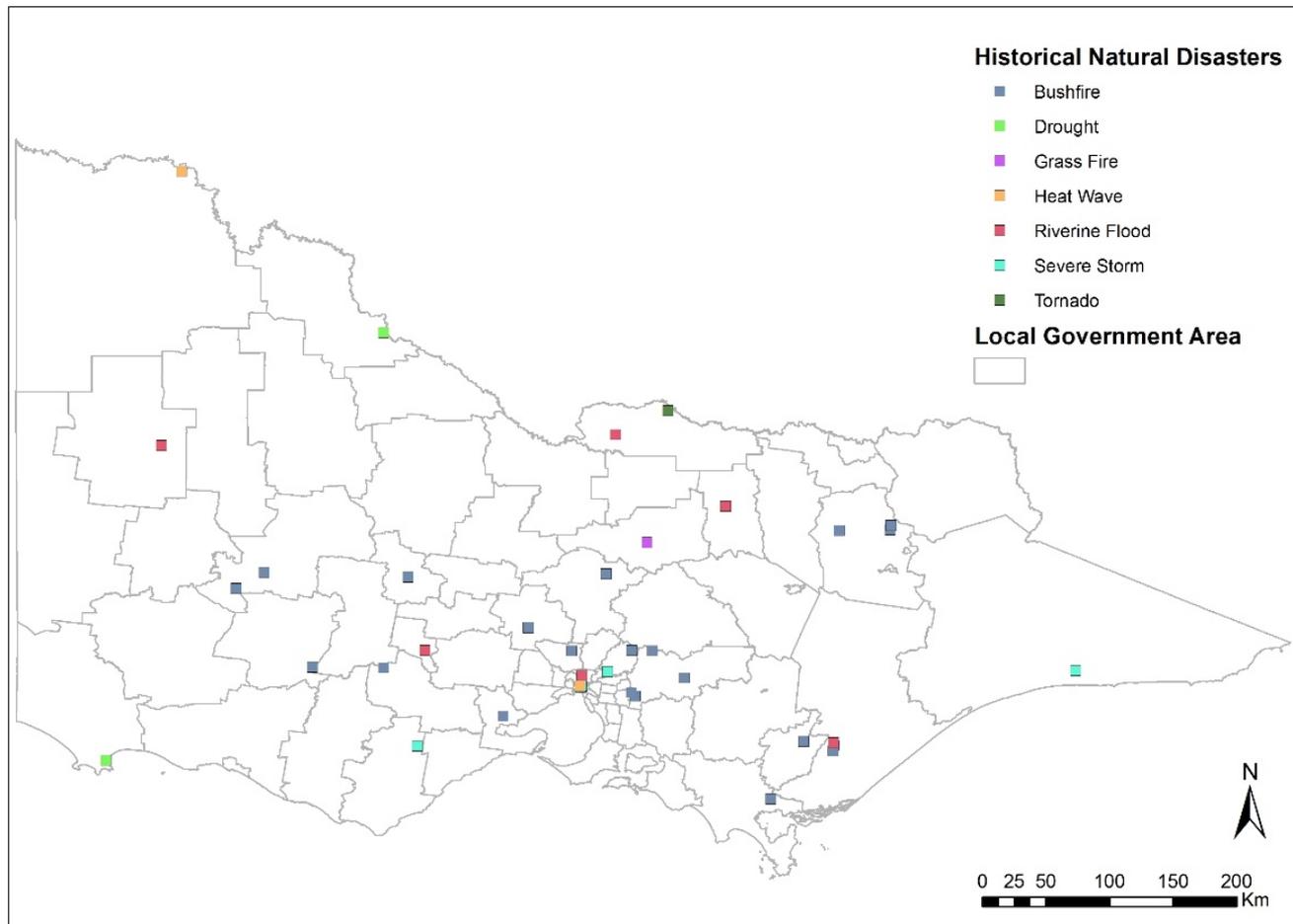
DISAGGREGATING SECTOR-SPECIFIC GSP IN VICTORIA

Distribution of Agriculture Value Added by DZNs (Victoria, 2011)



DATA ON NATURAL DISASTERS

Location of historical natural disaster events in Victoria



ESTIMATION FRAMEWORK

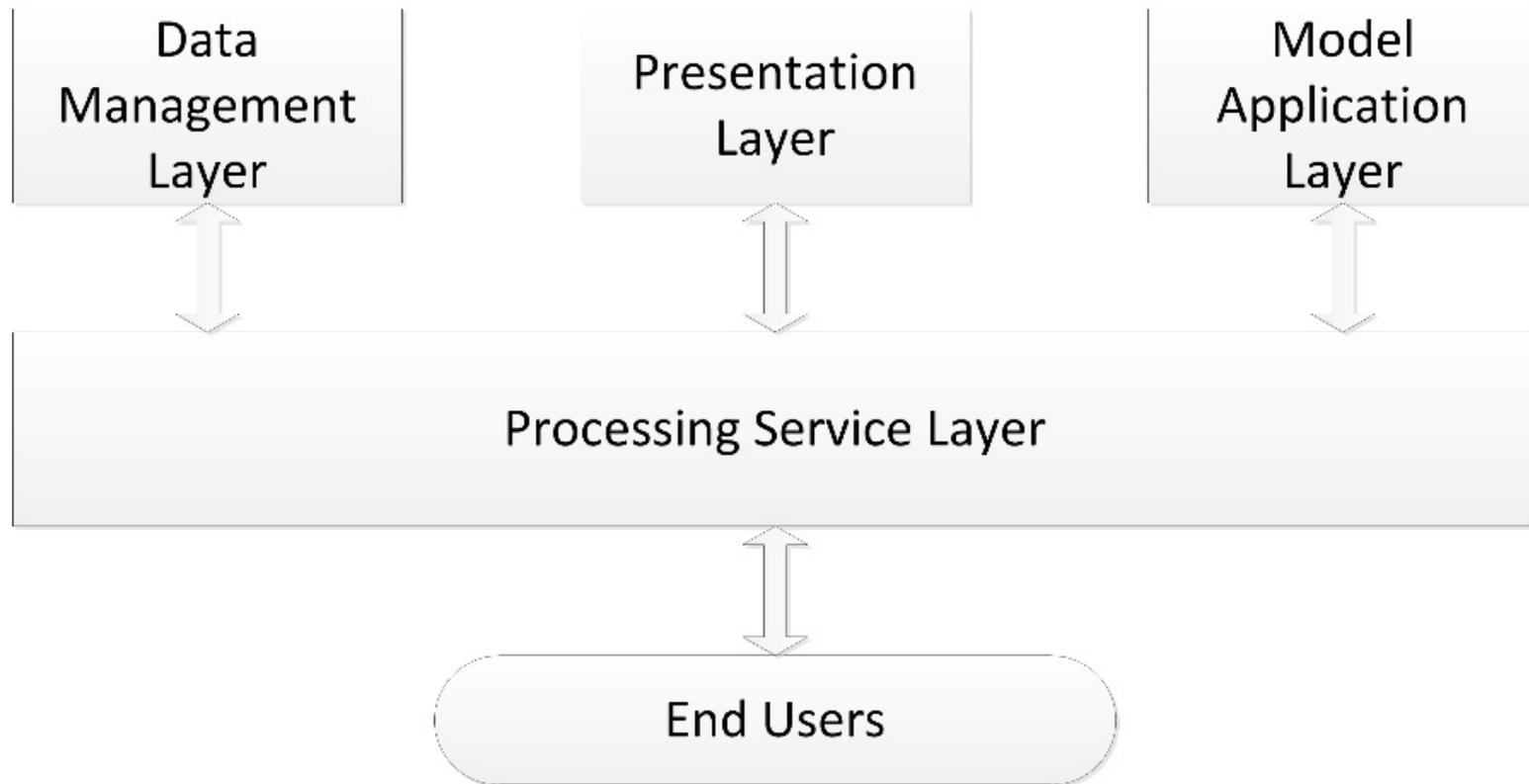
We use a difference-in-differences (DD) estimation approach with continuous shocks, using cross-state annual panel dataset:

$$\begin{aligned} y_{i,t} &= \alpha_k + \rho_k trend + \phi_t + \beta_1 Bushfire_{i,t} + \beta_2 Flood_{i,t} \\ &+ \beta_3 ExtremeTemperature_{i,t} + \beta_4 ExtremeRain_{i,t} \\ &+ \beta_5 (ExtremeTemperature_{i,t} \times Bushfire_{i,t}) \\ &+ \beta_6 (ExtremeRain_{i,t} \times Flood_{i,t}) + \varepsilon_{i,t} \end{aligned}$$

Where:

y	= Log real GDP per capita	ϕ	= Common time-varying shocks
α	= DZN-specific fixed effect	i	= DZN
$trend$	= DZN-specific time trend	t	= Year
ε	= Disturbance term		

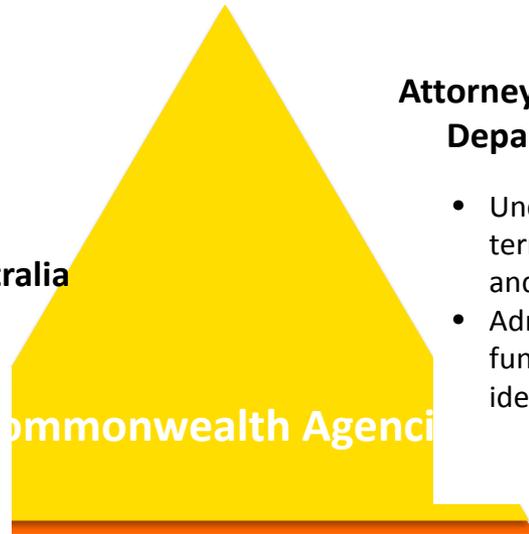
PRE-DISASTER HAZARD LOSS ESTIMATION PLATFORM - CONCEPTUAL MODEL



PROJECT UTILISATION (1)

- The end users can visualise the estimation of disaster-specific effects on each sector of the Australian economy at both local and national levels
- The end users can identify the economic sectors that experience negative, positive and net effects of natural disasters
- The decision makers can obtain a ranked list of the economic sectors that seek more attention for policy intervention to minimise potential negative effects of natural disasters

PROJECT UTILISATION (2)



Geoscience Australia

- Key spatial information of Victoria state with an emphasis on the identification of hazardous events that could occur
- Estimation data of the likelihood or probability of such events occurring
- Evaluation data of the consequences from the hazard

- Identification of the most vulnerable areas in Victoria with regard to natural disasters to assist in the coordination of emergency mitigation, preparedness, response and recovery
- More effective design of post-emergency recovery activities for minimising potential negative effects of natural disasters

Attorney-Generals Department

- Understanding the consequences of hazards in terms of its potential economic costs at national and local levels
- Administering disaster resilience and recovery funding more effectively through the identification of economic sectors that are at risk

SAFECOM

Improved strategic policy planning, governance and resource allocation for the overall fire and emergency services

- Opportunity to observe the Victoria case study
- Observations of how the economic costs of natural disasters can be quantified at local level to assist in the design of disaster risk reduction interventions.

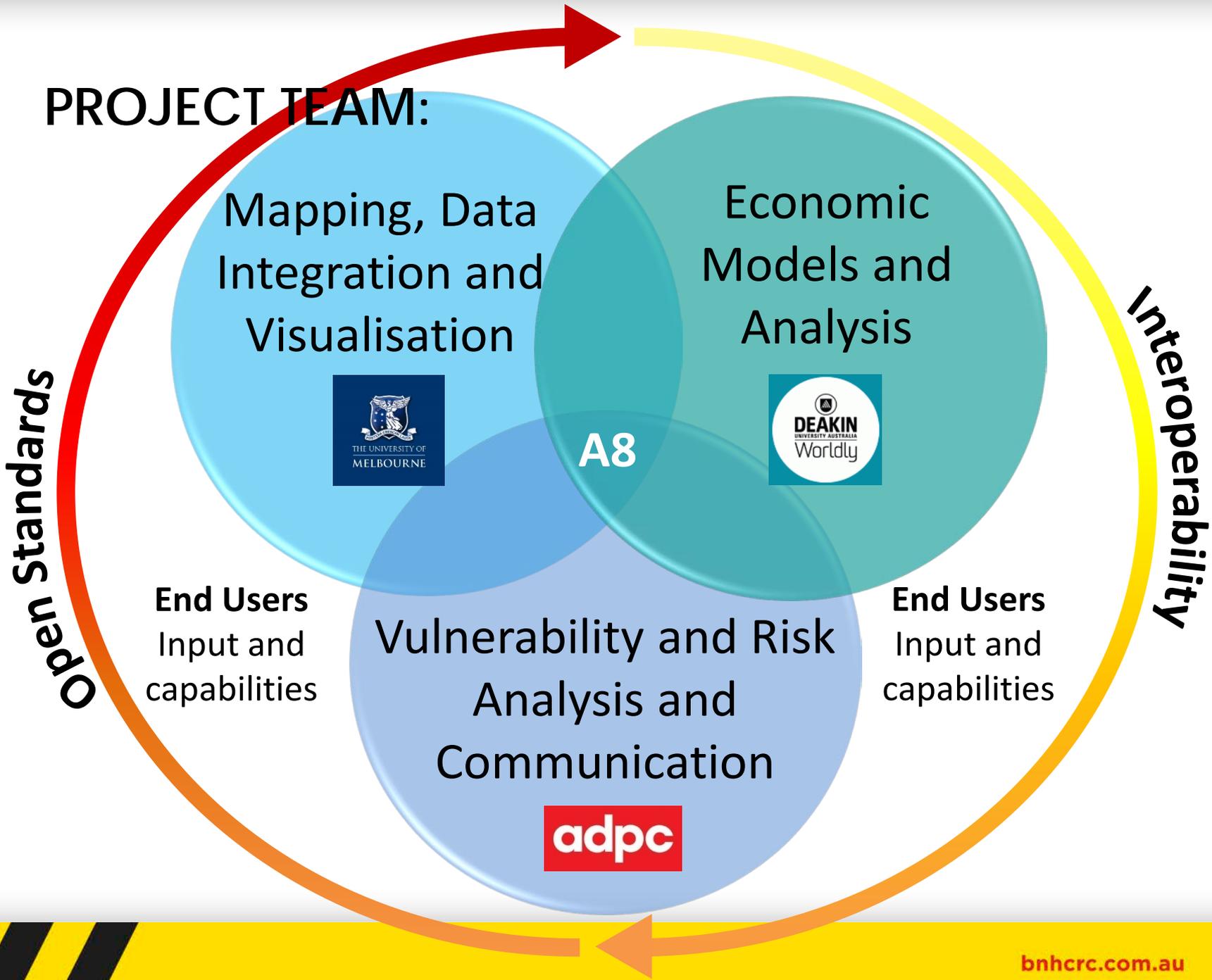
Country Fire Authority (VIC)

- A spatially-enabled estimation of potential damage and losses for Victoria as a decision support tool in pre-positioning emergency response resources in the potentially higher risk zones



THANK YOU

PROJECT TEAM:



Mapping, Data
Integration and
Visualisation



Economic
Models and
Analysis



A8

End Users
Input and
capabilities

Vulnerability and Risk
Analysis and
Communication



End Users
Input and
capabilities

Open Standards

Interoperability

PROJECT PHASES:

