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Adaptation to climate change

Rod Keenan, Director

Partner Universities

THE UNIVERSITY OF MELBOURNE · MONASH University · LA TROBE UNIVERSITY · RMIT UNIVERSITY

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Victoria The Place To Be · Department of Sustainability and Environment

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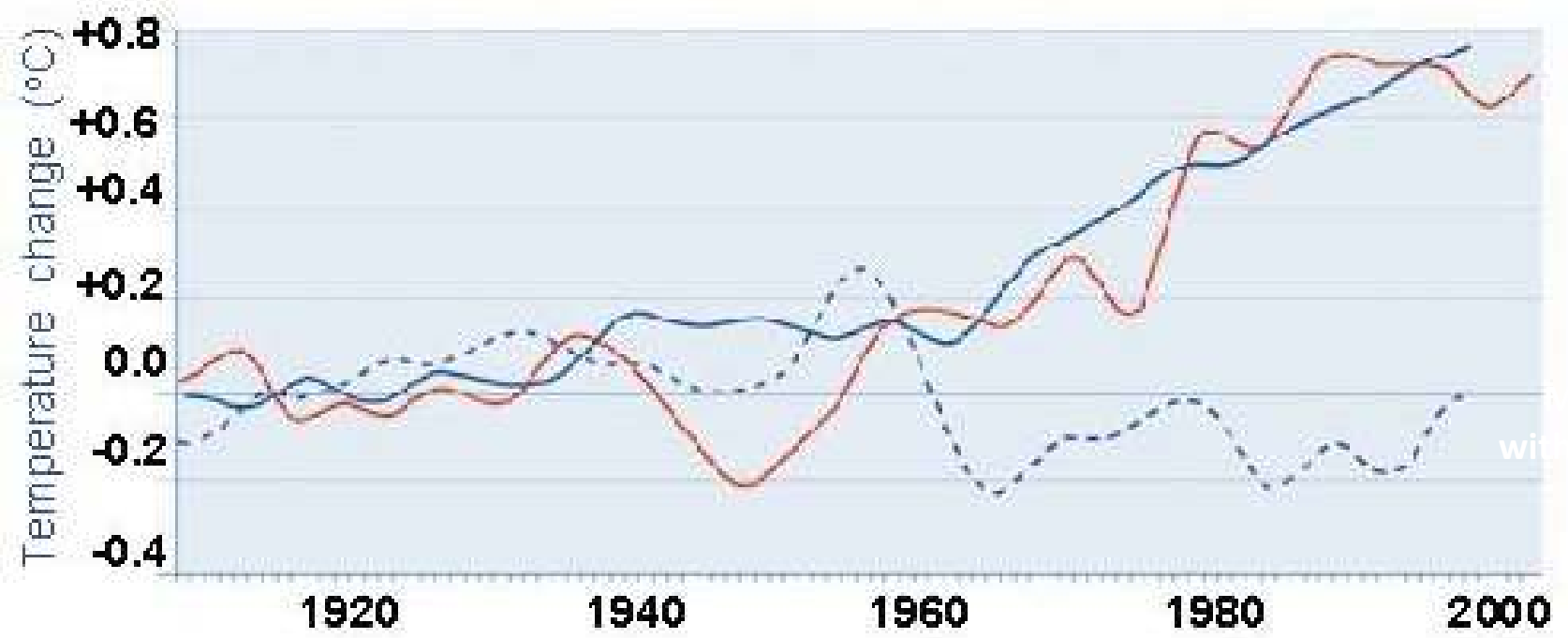
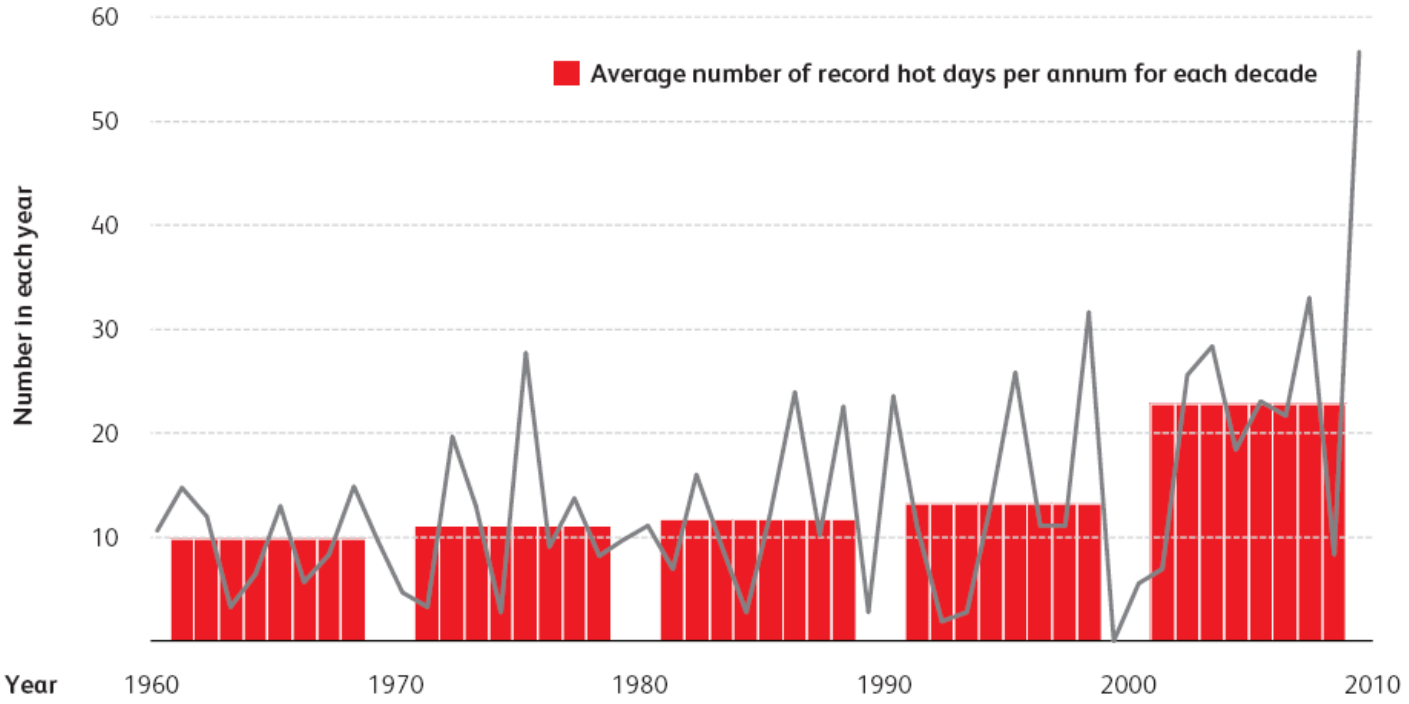
Changes in Australian mean temperature since 1910



Karoly and Braganza (2004) *J. Climate,* 18: 457–464.

Number of record hot day maximums at Australian climate reference stations



Source: Bureau of Meteorology

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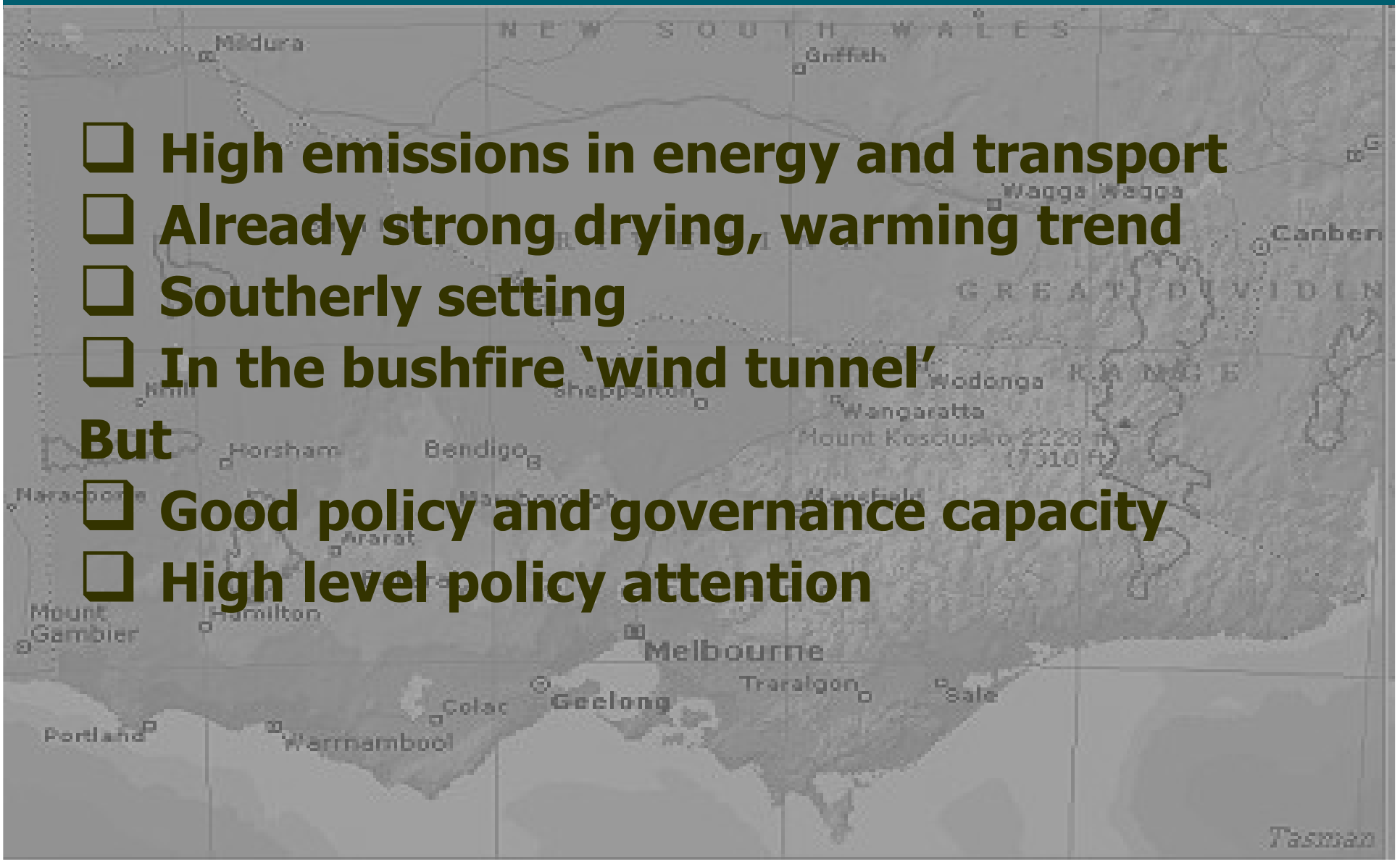
Victoria



- High emissions in energy and transport
- Already strong drying, warming trend
- Southerly setting
- In the bushfire 'wind tunnel'

But

- Good policy and governance capacity
- High level policy attention

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Victoria – future climate risks

Factor	Change	Impacts
Water availability	Rainfall↓ Evaporation↑ Changes in seasonal distribution	Potable water supply Agricultural sector Fire risk Natural systems Rural communities
Coastal Inundation	Sea level ↑ Storm surges ↑ Changing currents	Infrastructure Insurance Lifestyle
Temperature	Average temps ↑ Extreme temps ↑ No extreme days ↑ Minimum temps ↑ Frost ↓ (but more 'out of season')	Human health Infrastructure Natural systems Agriculture and forests Fire risk

Adapted from Pearman G. 2009.

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1 projected increases in average temperatures in Australia

compared with 1990

	2030 °C	2050 °C	2070 °C
Australia	1.0	0.8 – 2.8	1.0 – 5.0
coastal	0.7 – 0.9		
inland	1.0 – 1.2		

Source: CSIRO and BoM (2007).

2 projected future changes in precipitation in Australia

compared with 1990

	2030 %	2050 %	2070 %
annual			
northern areas (and central and eastern for 2050 and 2070)	-10 to +5	-20 to +10	-30 to +20
southern areas	-10 to 0	-20 to 0	-30 to +5
winter and spring			
south east	-10 to 0	-20 to 0	-35 to 0
south west	-15 to 0	-30 to 0	-40 to 0
eastern areas	-15 to +5	-20 to +10	-40 to +15
summer and autumn	-15 to +10	-20 to +15	-40 to +30

Source: CSIRO and BoM (2007).

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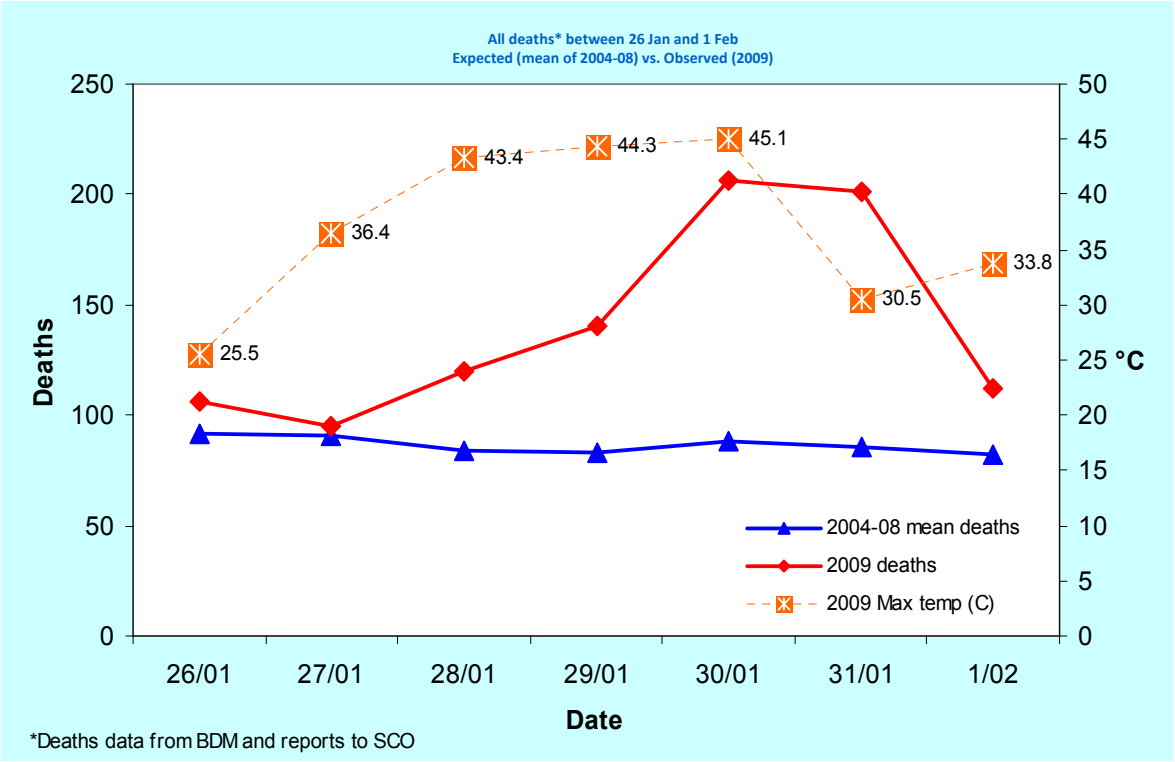
Heatwaves and human health



Total all cause mortality is 374 excess deaths (above expected)

Brook and Carnie, Vic Dept. Health. Presentation to Victorian Parliamentary Standing Committee on Finance and Public Administration December 2, 2009

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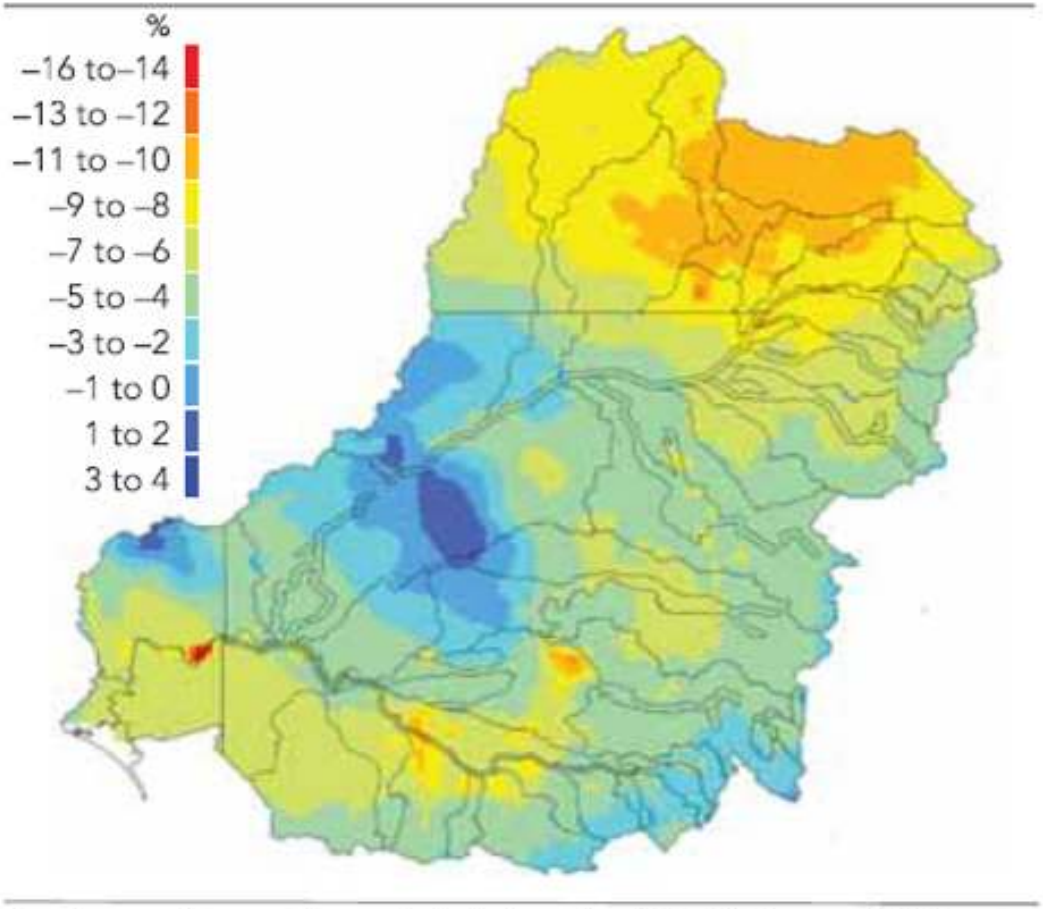
Water

map 1 **projected changes in median runoff in the Murray Darling Basin, 2030**



Based on simulations with a simple hydrological model (CSIRO), using 12 different global climate model patterns, three climate sensitivities and three emissions scenarios.

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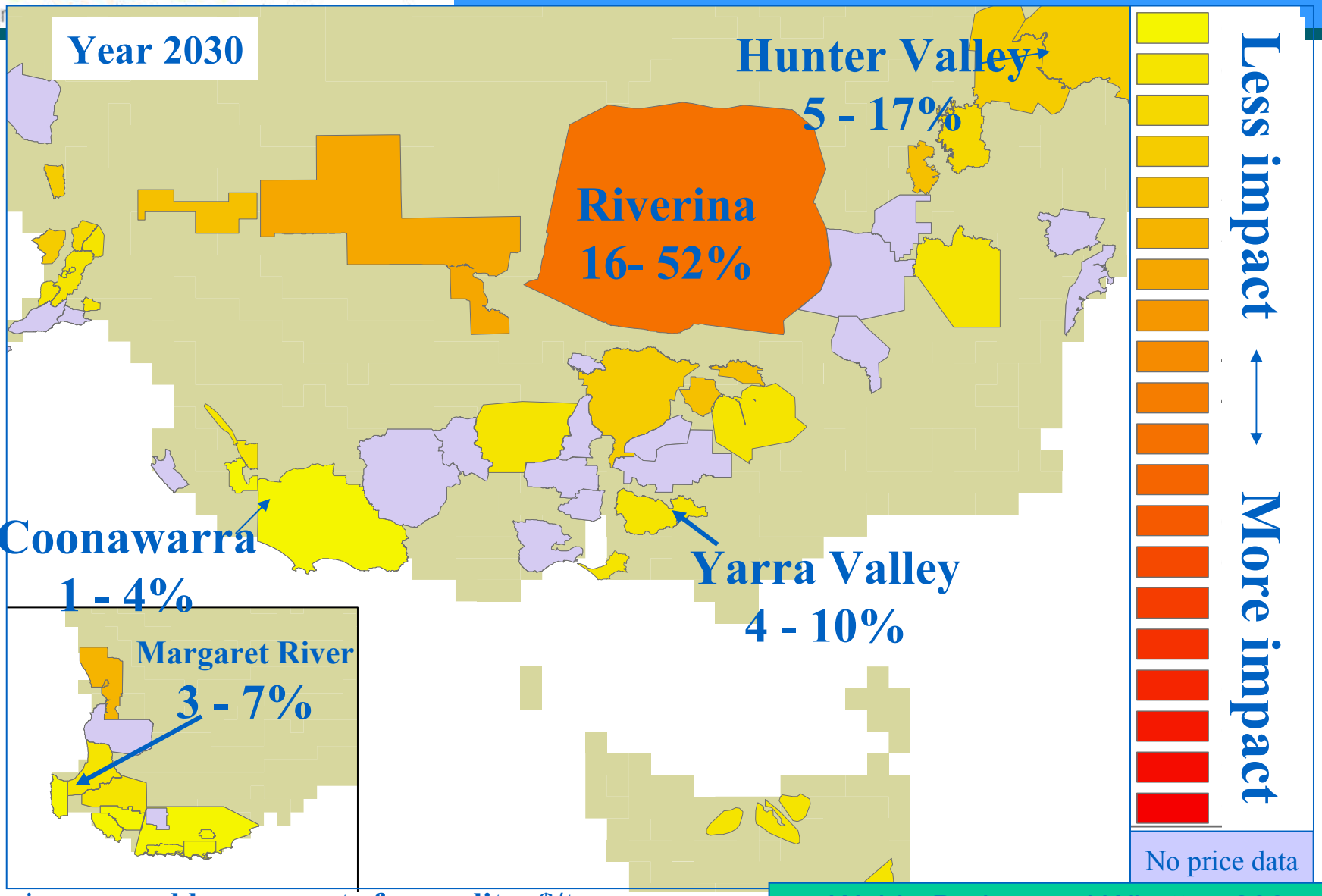
Forest states and processes responding to climate change

	FAST	SLOW
INDIRECT	Fire Disease Insects Water quality	Habitat composition Wood supply Erosion Water yield
DIRECT	Photosynthesis Water relations Regeneration Growth Mortality Storm damage	Decomposition Species distribution Tree nutrient status Genetic change

Reduction to winegrape quality



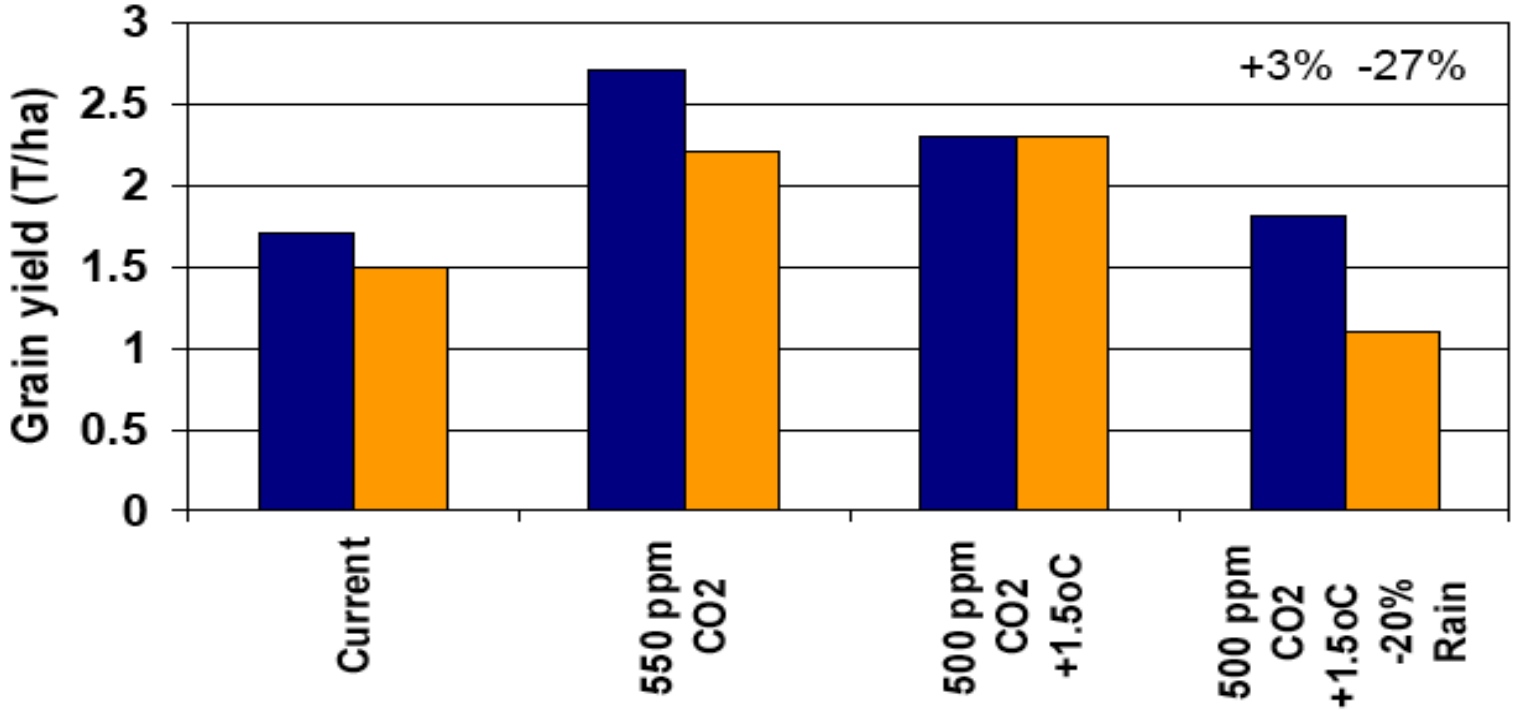
* measured by surrogate for quality: $/tonne

Webb, Barlow and Whetton 2007

Impacts depend on a combination of factors

Barley Yield (cv Grimmett) & Climate Change*

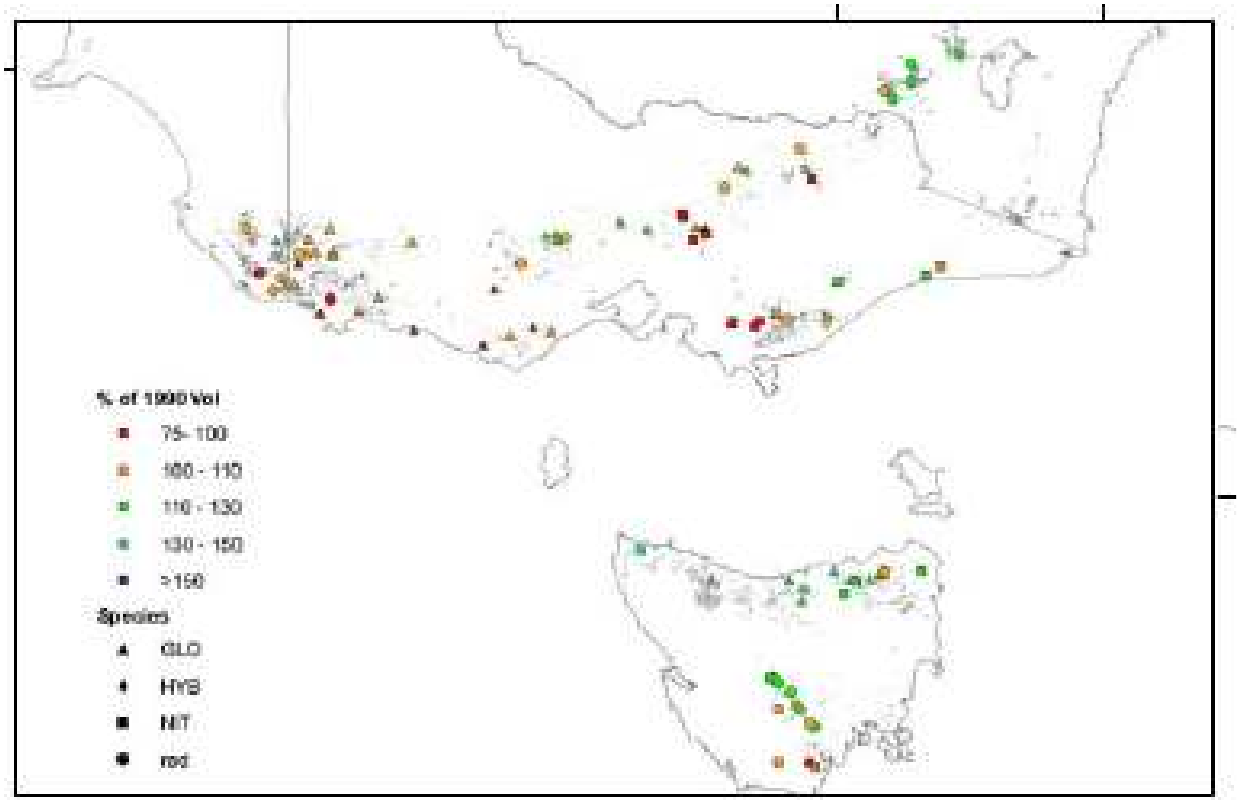
Mid-Northern NSW & Southern Mallee



*Simulated using DSSAT 4.0.2

Forest plantation impacts

- Without significant benefit from elevated CO_2 production in some regions will decrease, up to 25% depending on no. of hot, dry days and pests and disease
- With CO_2 benefits, production could increase, particular in cool wet locations



Battaglia et al 2009. FWPA project report

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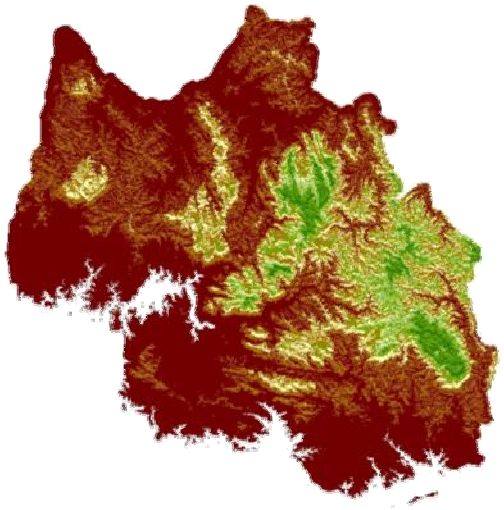
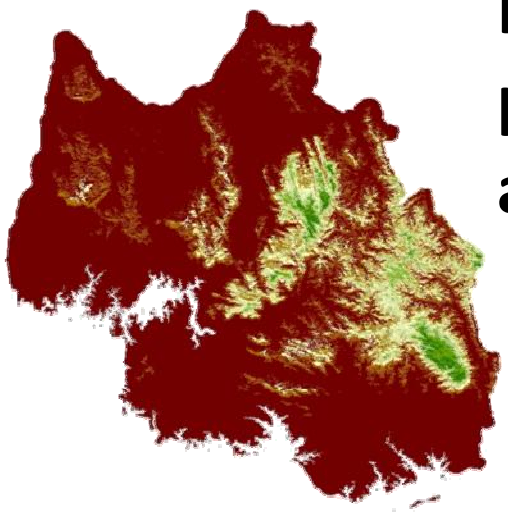
Impacts on forests

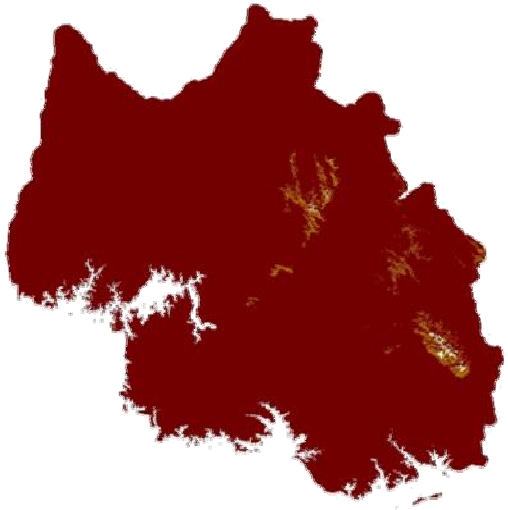


Current



Regeneration potential of alpine ash

1.4 °C increase and 5 % decline in annual rainfall caused a significant contraction in potential ranges of 20 of 22 tree species in the Central Highlands



2025 (+0.5°C)

2055 (+1.4°C)

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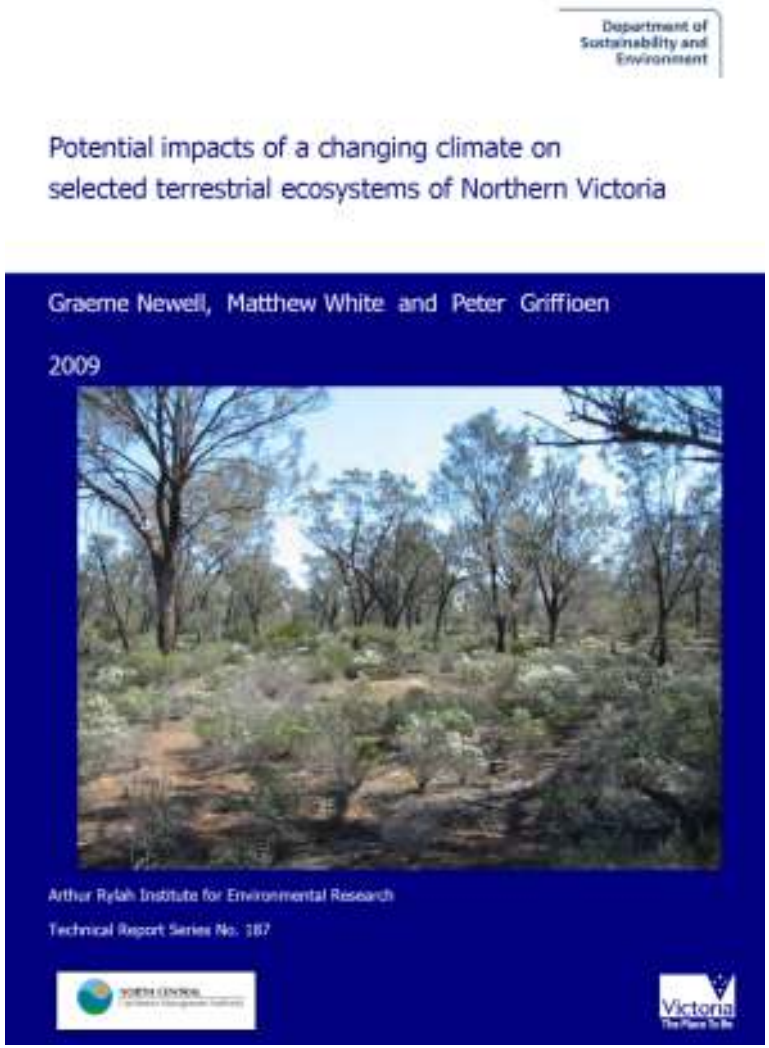
Climate change impacts on native vegetation



- Forest and woodland biomes relatively stable but generally moved up-slope
- Semi-arid biome showed no major range shifts but persisted for longer periods in the south
- Mallee biome contracted rapidly
- Big uncertainties: wetlands and groundwater dependent systems

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Bushfire risk

- Frequencies of days with VH and extreme FFDI ratings likely to increase
  - 4-25 % by 2020
  - 15-70 % by 2050
- Higher fire-weather risk in spring, summer and autumn will increasingly shift periods suitable for prescribed burning toward winter

(Hennessy et al 2005)

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The real challenge

Appropriate policy and community responses

Photo: Diamond Valley Leader

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Adaptation policy goals

- Enable Victoria's regions, industries and communities to capture opportunities and adapt to a changing climate
- Promote resilience and improve the management of Victoria's natural resources, ecosystems and biodiversity
- Manage the risks to Victoria's infrastructure, built environment and communities through good planning and emergency response systems

Long term impacts
High uncertainty

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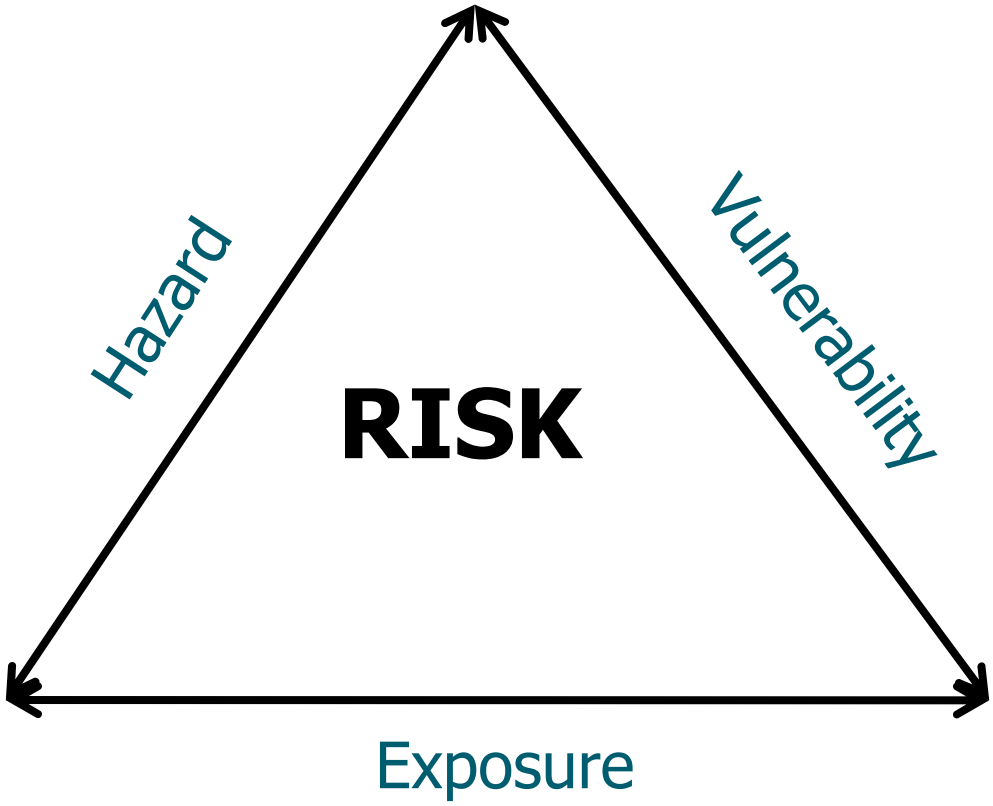
Adaptation as risk management



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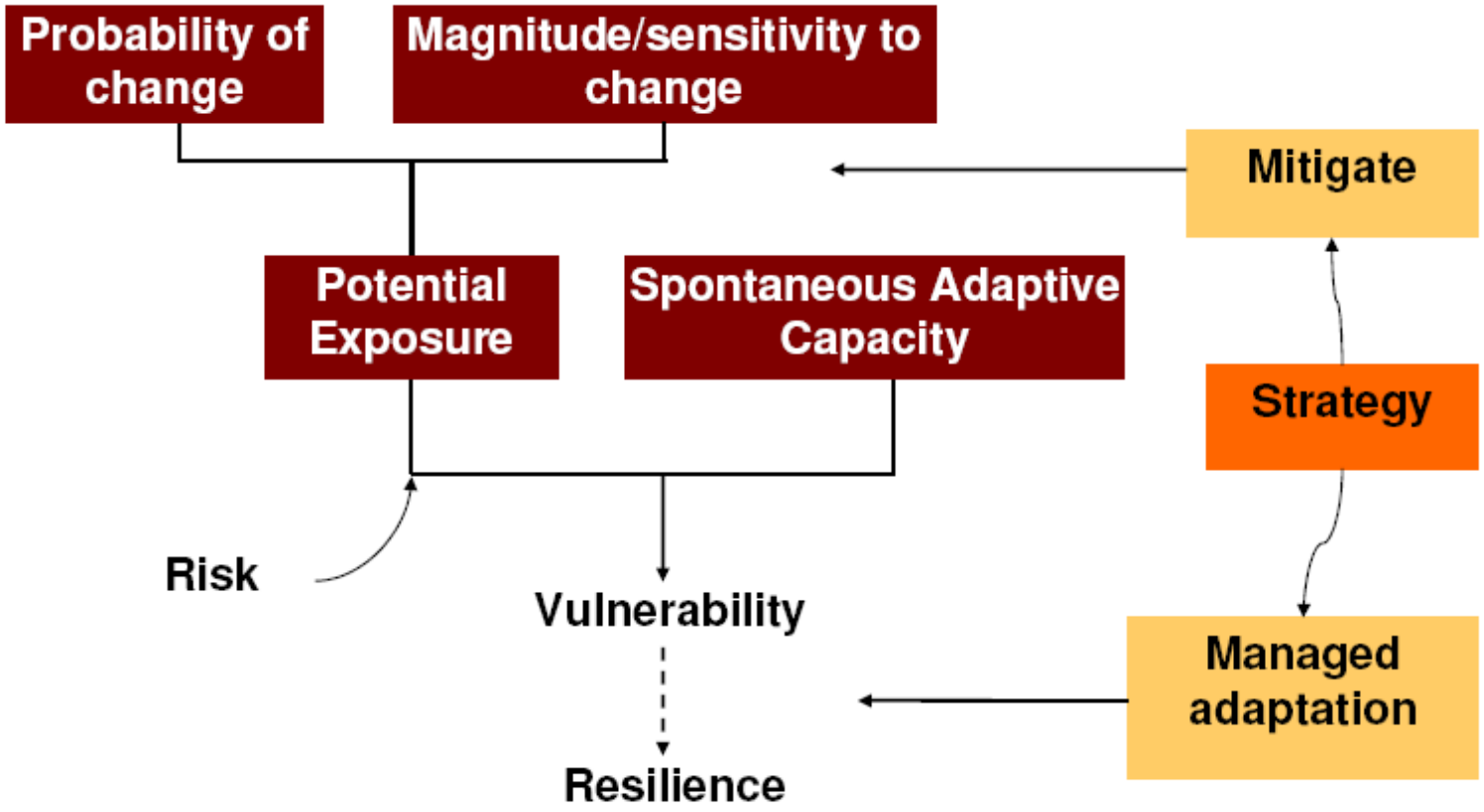
Managing risk



Pearman G. 2009. Presentation to Victorian Adaptation Symposium June 2009

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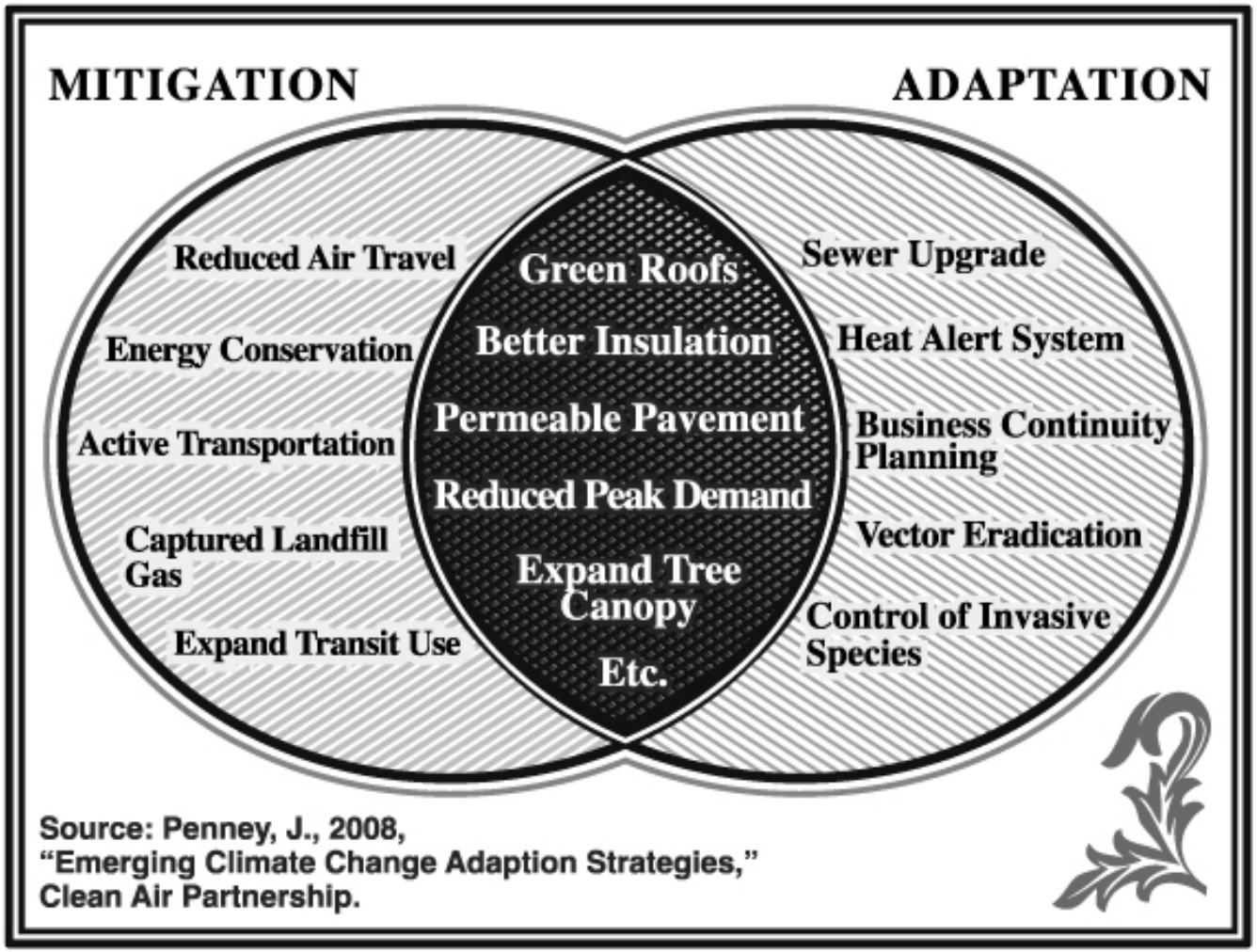
Mitigation vs Adaptation



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Adaptation research

- New research discipline
- At the end of the information supply chain
  - Climate science>impact science>adaptation analysis
- Place and context-based, few general rules or principles across sectors or locations
- Generally requires local engagement and support rather than top-down policy

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Future climate for Melbourne

2030 A1B

	Little change (up to 0.5C warmer)	Warmer (0.5 to 1.5C warmer)	Hotter (1.5 – 3.0C warmer)	Much hotter (more than 3.0C warmer)
Much wetter (more than +15%)	*No evidence*	*No evidence*	*No evidence*	*No evidence*
Wetter (0 to 15% wetter)	*No evidence*	Possible *5 models*	*No evidence*	*No evidence*
Drier (0 to 15% drier)	Slight evidence *2 models GISS AOM, PCM*	Most Likely *16 models*	*No evidence*	*No evidence*
Much drier (More than 15% drier)	*No evidence*	*No evidence*	*No evidence*	*No evidence*

Whetton, P. CSIRO personal communication

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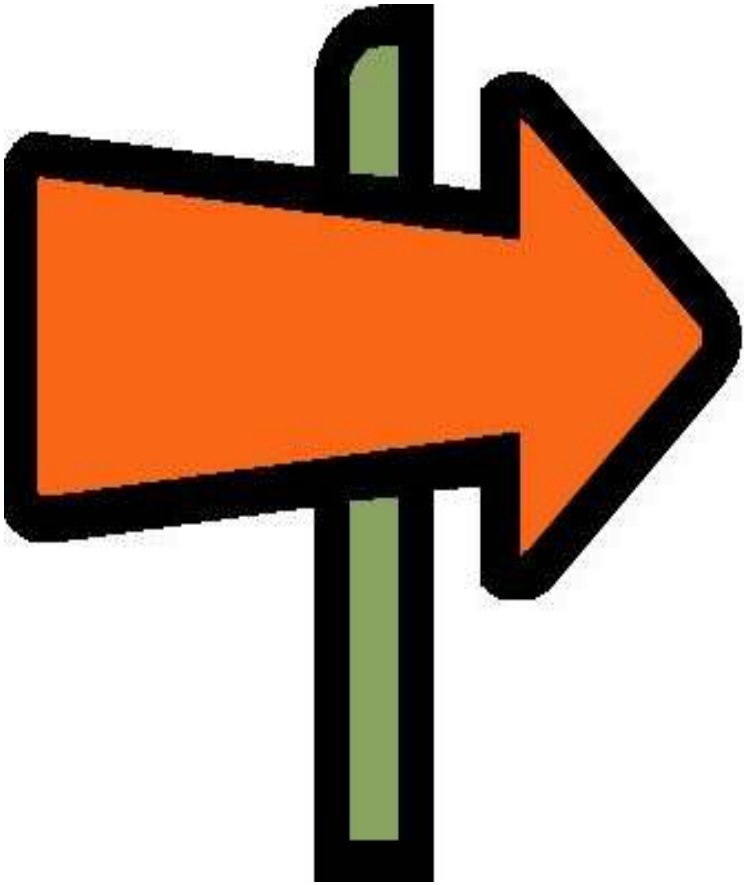
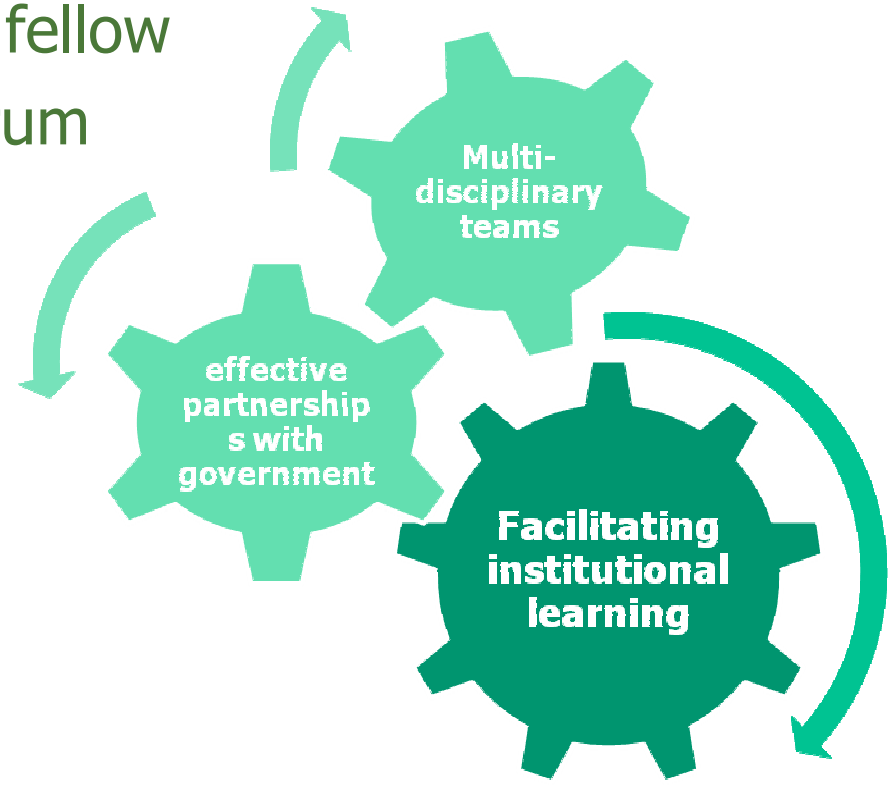
Centre Objectives



- Provide multi-disciplinary, research, analysis and advice to Government, industry and the community
- Increase decision-making capacity on climate adaptation
- Include adaptation needs into strategic planning
- Build partnerships between Victorian universities
- Expand funding for adaptation research

VCCCAR: research in support of policy

- Funding of research projects targeted to State priorities
- Regional think tanks
- International research fellow
- Annual stakeholder forum



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Centre Outputs

- Short papers and policy briefs
- Technical and scientific reports
- Peer reviewed journal publications
- Public presentations

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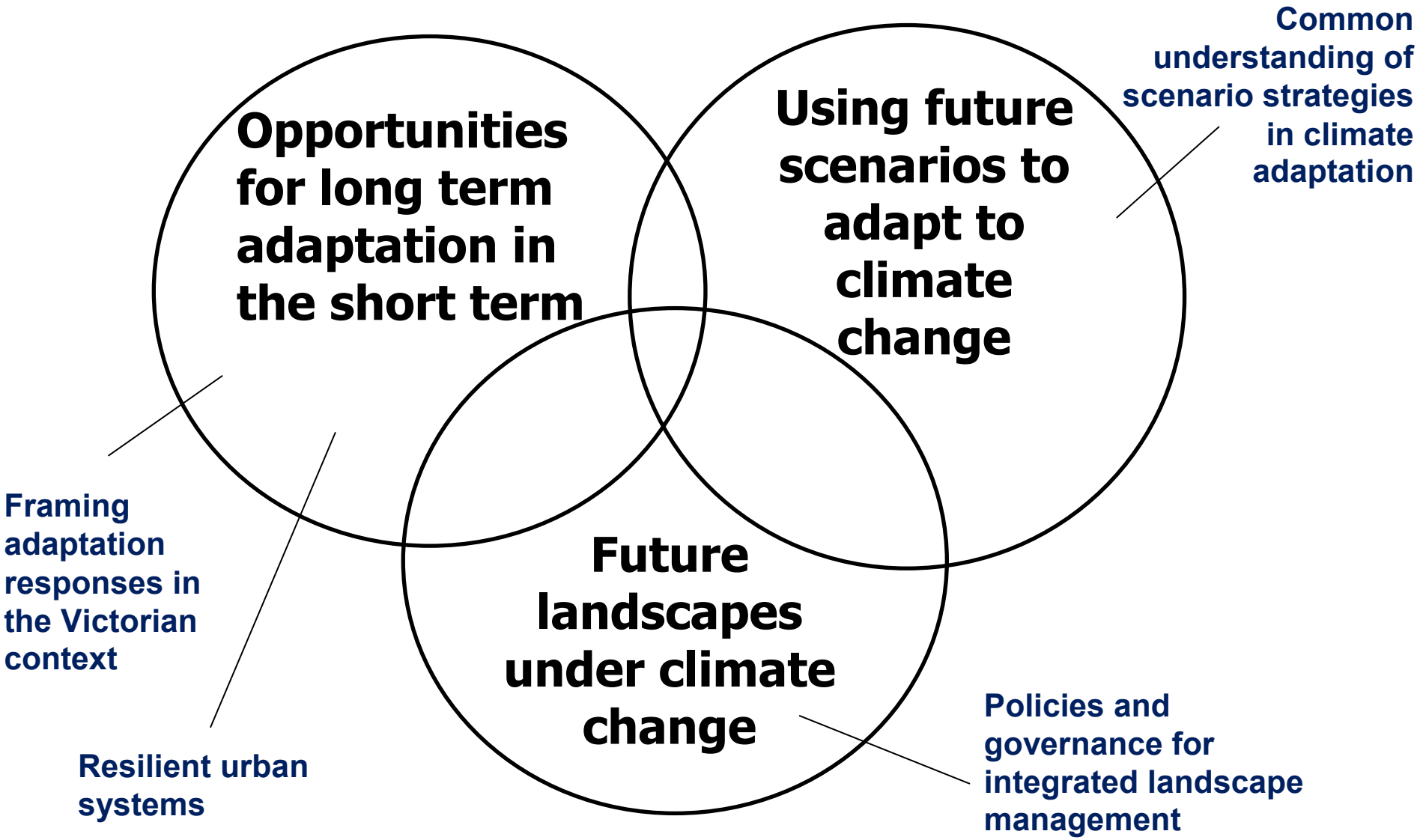
Research priorities and initial projects



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Integration

Explore adaptation options

Investigate policy alternatives

Identify institutional barriers

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Adaptation options in native vegetation management

1. Understanding vulnerability at ecosystem, species and genetic scales
2. Monitor trends in forest processes and condition
3. Research to investigate impacts and translocation issues
4. Incremental adaptation
   - Plantations orrevegetation: planting timing, thinning, water management, site diversification
   - Native forest management: partial harvesting, seed bank risk management
   - Active fire management and risk reduction
   - Pest and disease monitoring and controls
   - Selection of genotypes that can accommodate new conditions
   - Take advantage of opportunities from better growth
5. Transformational adaptation
   - New species
   - Plant in new regions
6. Ecosystem-based adaptation, social issues and policy options

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Land managers, whether they are managing farm land, conservation reserves or Indigenous lands, need to be preparing now for these new and changing climatic conditions. Together we need to be thinking on a continental scale, because that is the scale of the challenges being faced. We need to coordinate our investment and our efforts at the national scale to build resilience into our landscapes so they can survive the rigours of the future.