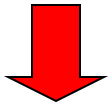
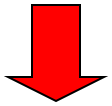
Tipping points – how long can you buffer against a need to move?

Peter Hayman SARDI

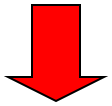
Changes to the atmosphere



Changes to global climate

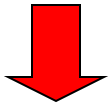


Changes to regional climate

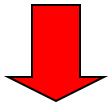


Impacts on local systems

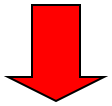
Changes to the atmosphere



Changes to global climate



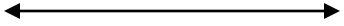
Changes to regional climate



Impacts on local systems

Emission scenarios

Global circulation models



Downscaling models

Impact models

Human agency

Changes to the atmosphere ↔ Emission scenarios

↓

Changes to global climate ⟷ Global circulation models

↓

Changes to regional climate ⟷ Downscaling models

↓

Impacts on local systems ⟷ Impact models

Human agency

Changes to the atmosphere ↔ Emission scenarios

↓

Changes to global climate ⟷ Global circulation models

↓

Changes to regional climate ⟷ Downscaling models

↓

Human agency

Impacts on local systems ⟷ Impact models

Tipping points

- Stress and strain
- Tipping point: the critical point at which strong nonlinearities appear in the relationship between system attributes and drivers;
- Once a tipping point threshold is crossed, the change to a new state is typically rapid and might be irreversible or exhibit hysteresis.

Opinion

Cell PRESS

Does the terrestrial biosphere have planetary tipping points?

Barry W. Brook[1], Erle C. Ellis[2], Michael P. Perring[3], Anson W. Mackay[4], and Linus Blomqvist[5]

[1] Environment Institute and School of Earth and Environmental Sciences, University of Adelaide, Adelaide, SA 5095, Australia
[2] Geography and Environmental Systems, University of Maryland, Baltimore County, MD 21250, USA
[3] School of Plant Biology, The University of Western Australia, Crawley, WA 6009, Australia
[4] Environmental Change Research Centre, Department of Geography, University College London, London, UK
[5] Conservation and Development Program, Breakthrough Institute, Oakland, CA 94612, USA

Question homogeneity of impact and response

Danger of underemphasising current changes

Danger of complacency on safe side and fatalism about after the catastrophe

Adaptation Migration Extinction

140 year old Shiraz vine

Migrate

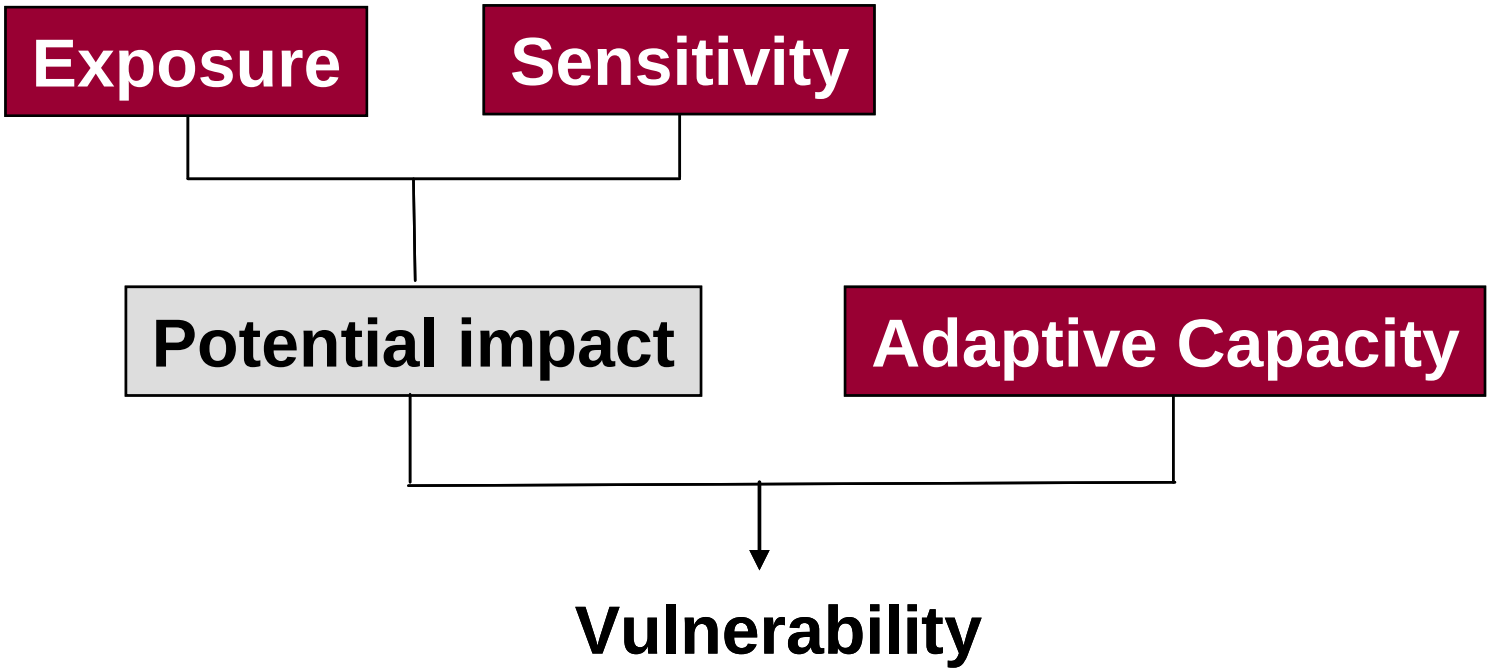
Toward poles and up hills

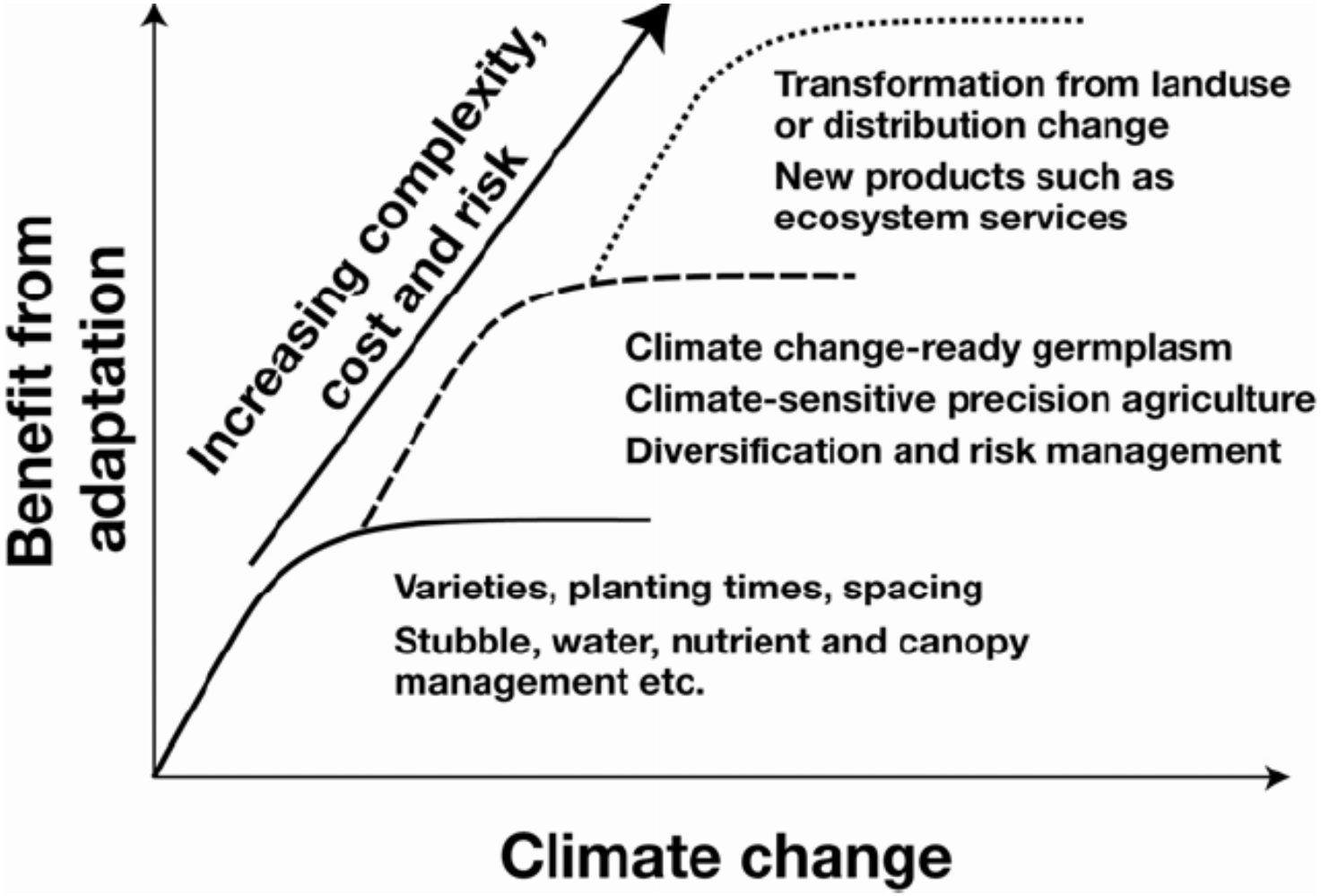
Ferrari moving to higher vines as climate change effects felt

- **Tuesday 11 December 2012**
- by Anne Krebiehl

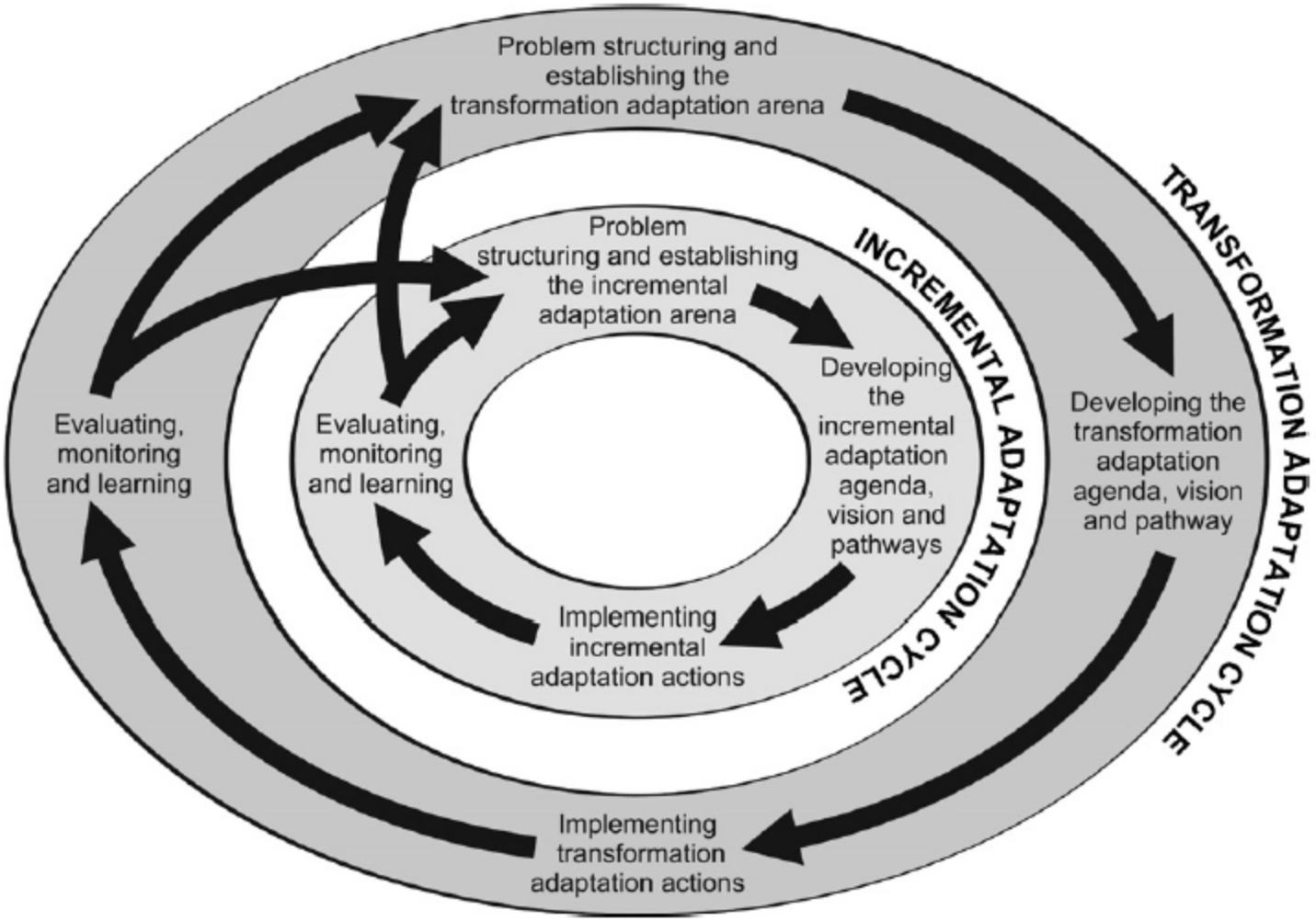
Italian sparkling producer Ferrari Fratelli Lunelli is actively encouraging its growers to plant vines higher in Trentino to avoid the effects of climate change.


COOL OFF
IN
TASMANIA
AVGE TEMPERATURE
HOTTEST MONTH
62·3°


Exposure
Sensitivity
Potential impact
Adaptive Capacity
Vulnerability



Howden et al 2010

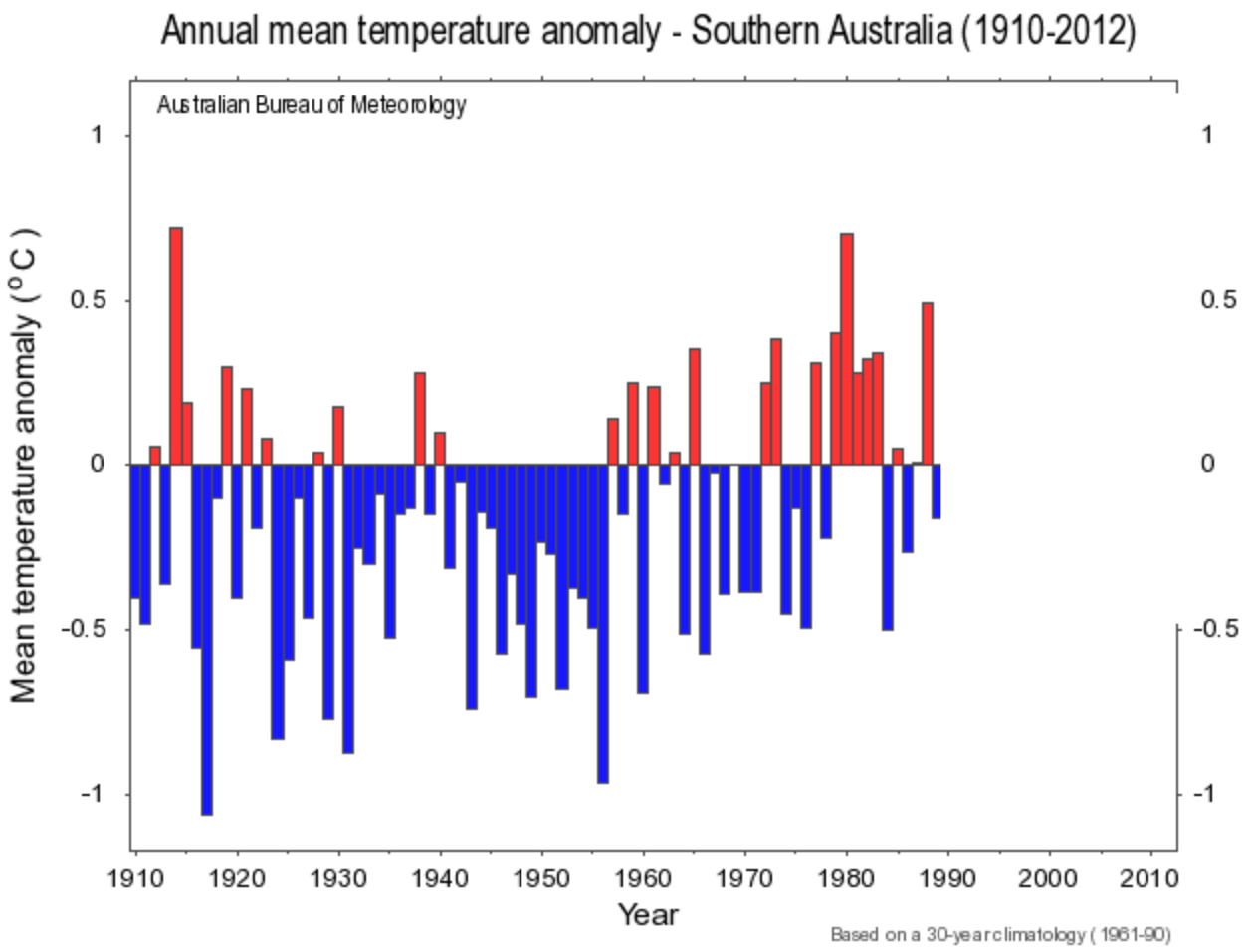


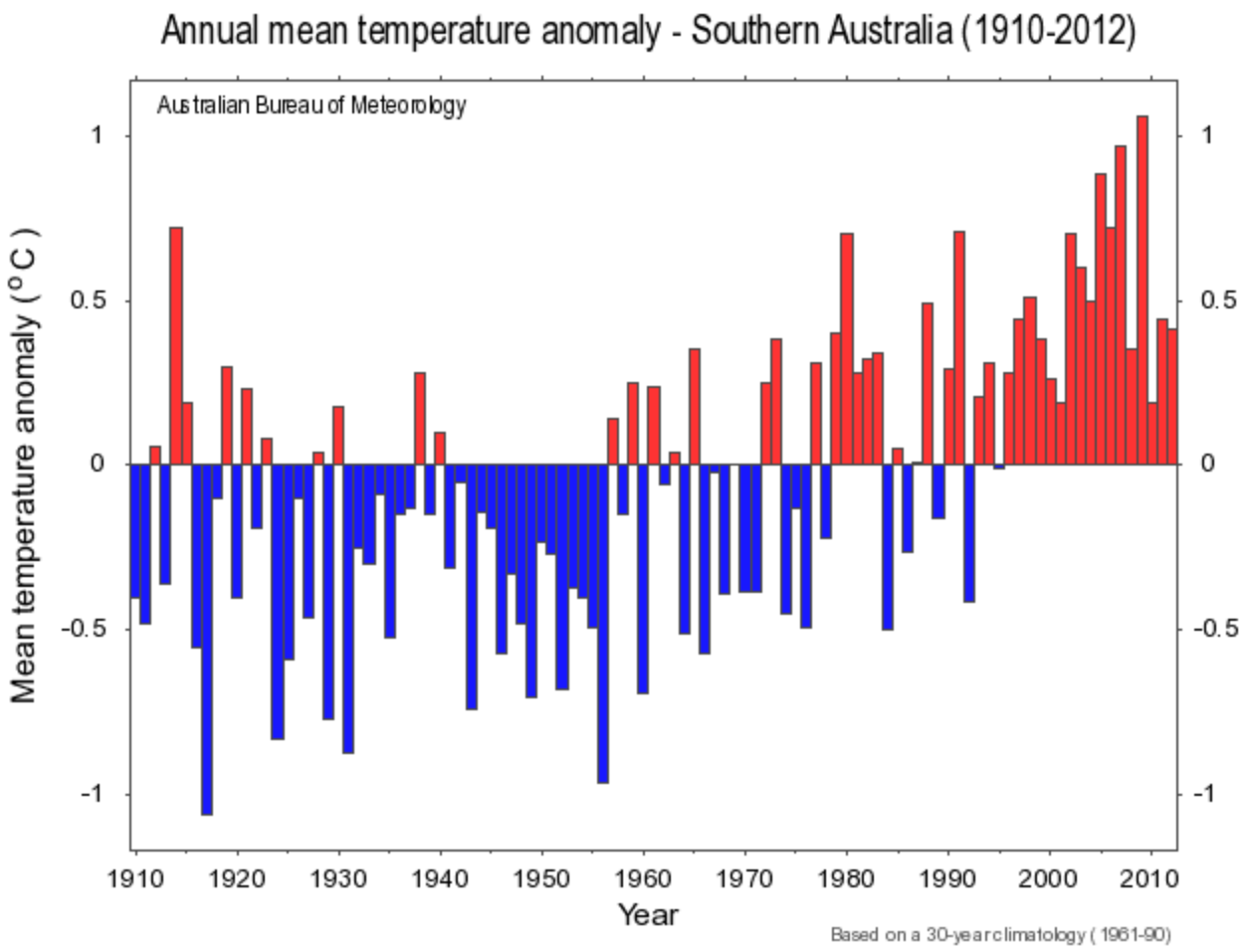
Park et al 2012 Global Env Change

Thinking on climate change not new to wine industry

- Dry, P. R. (1988) Climate change and the Australian grape and wine industry. Australian grape grower and wine maker. 300: 14-15.

- Smart, R.E. (1989) Climate change and the New Zealand wine industry - prospects for the third millennium. Australian and New Zealand Wine Industry Journal, 4: 8-11.


Annual mean temperature anomaly - Southern Australia (1910-2012)
Australian Bureau of Meteorology
Mean temperature anomaly (°C)
1
0.5
0
-0.5
-1
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
Year
Based on a 30-year climatology (1961-90)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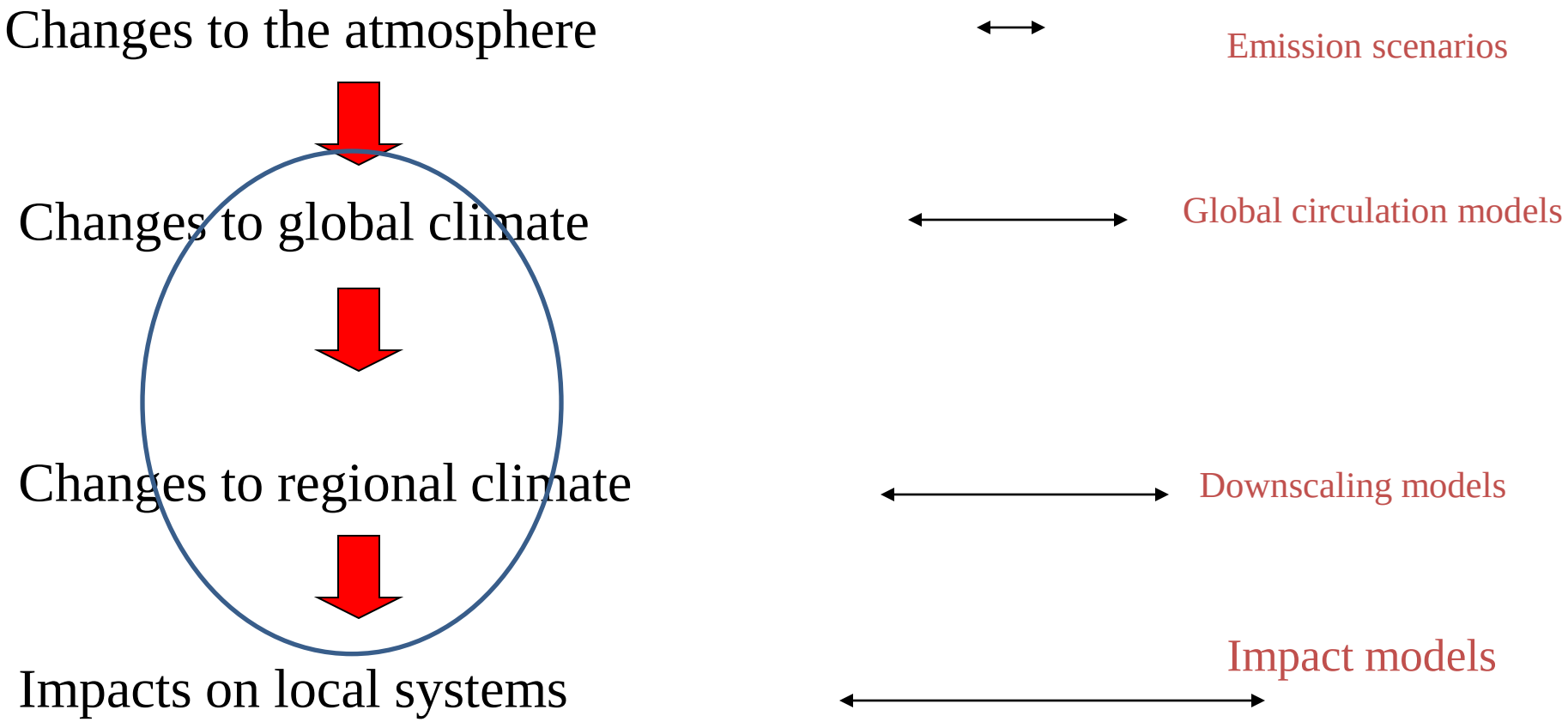

Changes to the atmosphere
Emission scenarios
Changes to global climate
Global circulation models
Changes to regional climate
Downscaling models
Impact models
Impacts on local systems

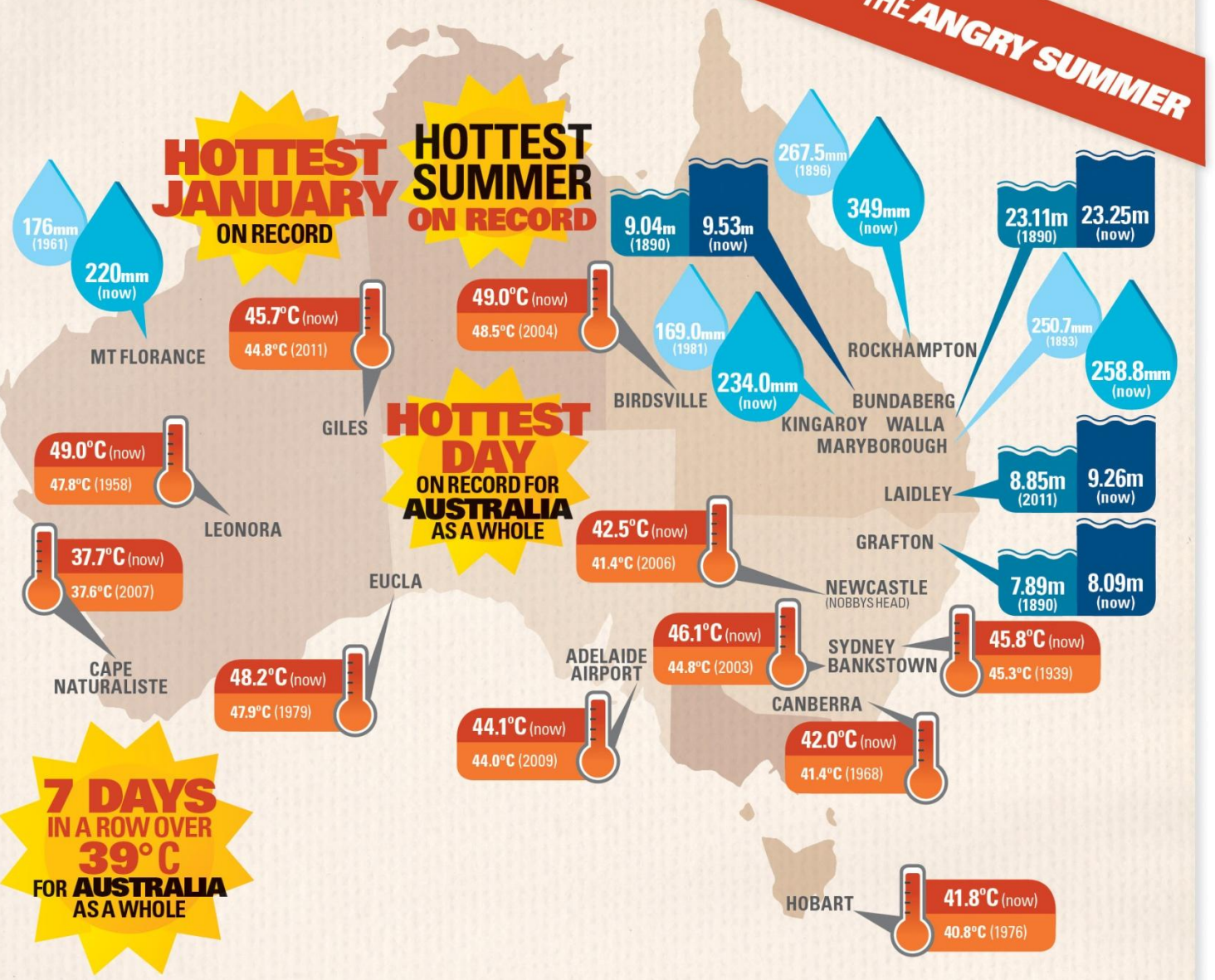
"The climate system is an angry beast and we are poking it with sticks." - *Dr. Wallace Broecker*

//www.cbc.ca/news/technology/story/2008/11/18/f-savory-broecker.html

THE ANGRY SUMMER

IN JUST
90 DAYS:
123 RECORDS BROKEN
THROUGHOUT
AUSTRALIA

HERE ARE JUST 23 OF THE 123
RECORDS FROM SUMMER 2012/2013



MAXIMUM TEMPERATURE **RECORDS**

FLOOD **RECORDS**

DAILY RAINFALL **RECORDS**

HEATWAVE **RECORDS**

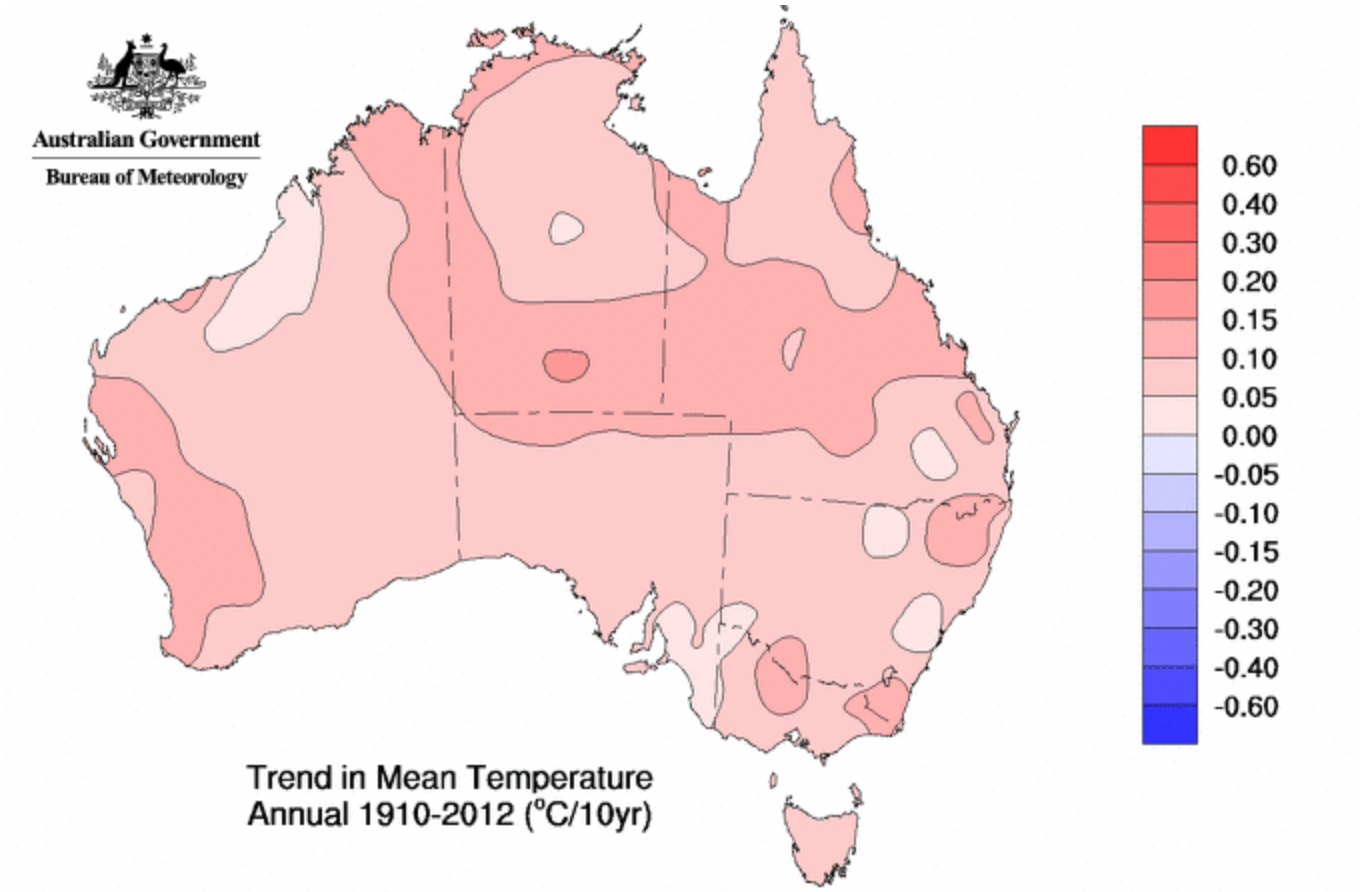
DATA SOURCES: BoM. (2013a). *Special Climate Statement 43 – extreme heat in January 2013*; BoM. (2013b). *Special Climate Statement 44 – extreme rainfall and flooding in coastal Queensland and New South Wales.*

Six impacts of climate change on viticulutre

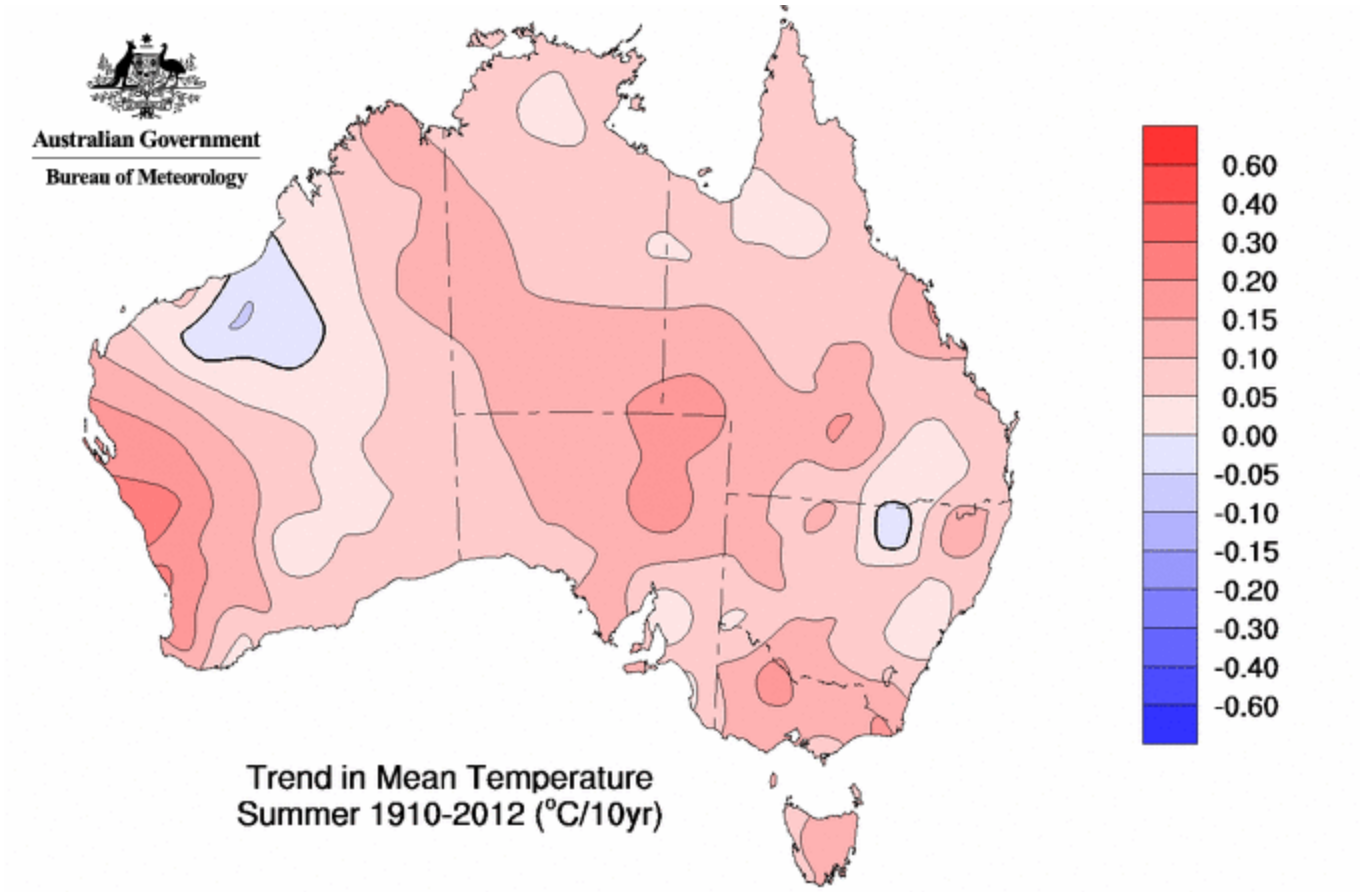
1.Change in mean temperature: faster crop development,higher water use & disease.
2. Changes to extreme max temperatures – heatwaves
3. Changes to frost risk
4. Changes to amount and timing of rainfall influencing soil water and foliar diseases
5. Changes to quality and quantity of water available for irrigation
6. Change to carbon dioxide atmosphere

Greg Jones

	Growing Season Temp (°C)											
Varieties	13	14	15	16	17	18	19	20	21	22	23	24
Pinot Gris	X	X	X									
Riesling	X	X	X	X	X							
Pinot Noir		X	X	X								
Chardonnay		X	X	X	X							
Sauvignon Blanc			X	X	X	X						
Semillon			X	X	X	X						
Cabernet Franc			X	X	X	X	X					
Tempranillo				X	X	X	X					
Merlot				X	X	X	X					
Malbec				X	X	X	X					
Voignier				X	X	X	X					
Shiraz			X	X	X	X	X					
Table Grapes				X	X	X	X	X	X	X	X	X
Cabernet Sauvignon				X	X	X	X	X				
Grenache				X	X	X	X	X				
Carignane					X	X	X	X				
Zinfandel					X	X	X	X	X			
Nebbiolo					X	X	X	X	X			
Raisins						X	X	X	X	X	X	X

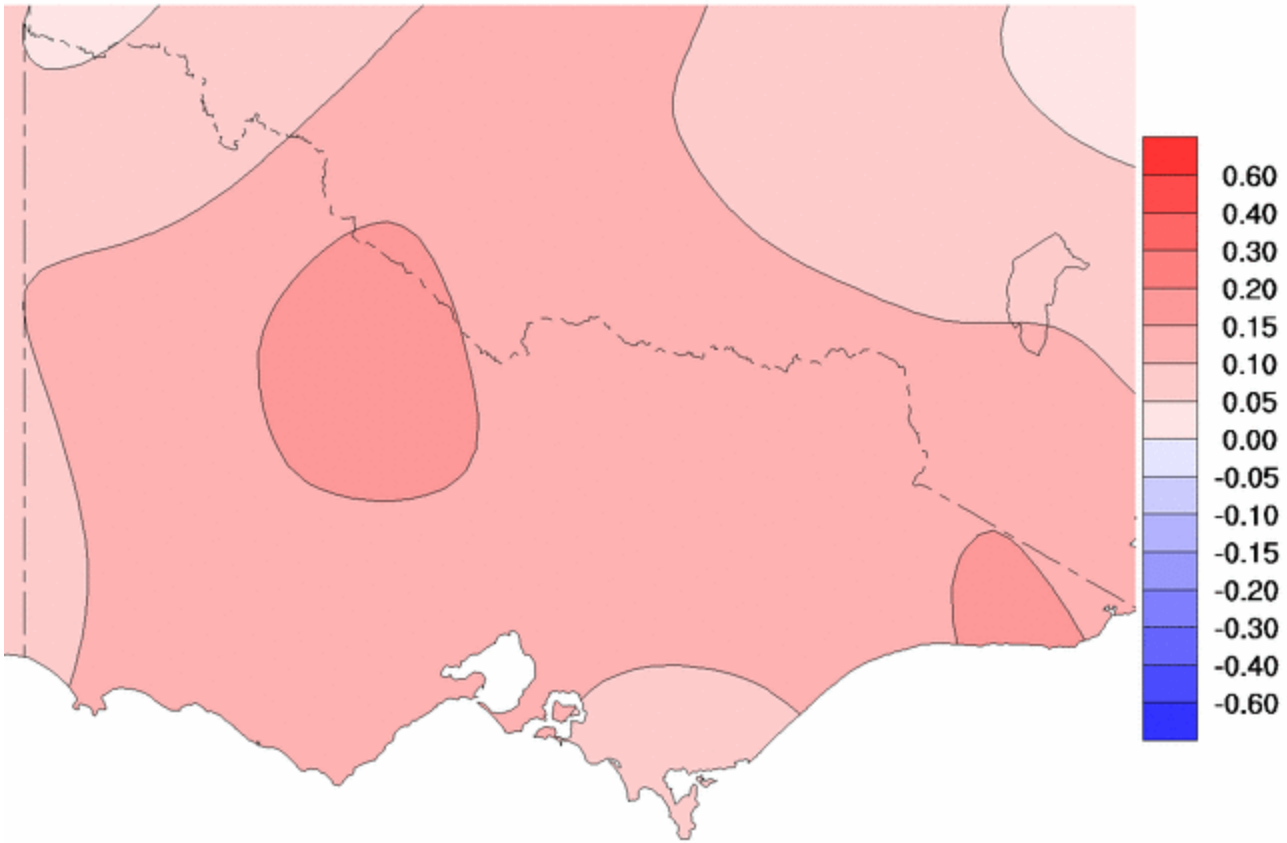


Issued: 05/02/2013

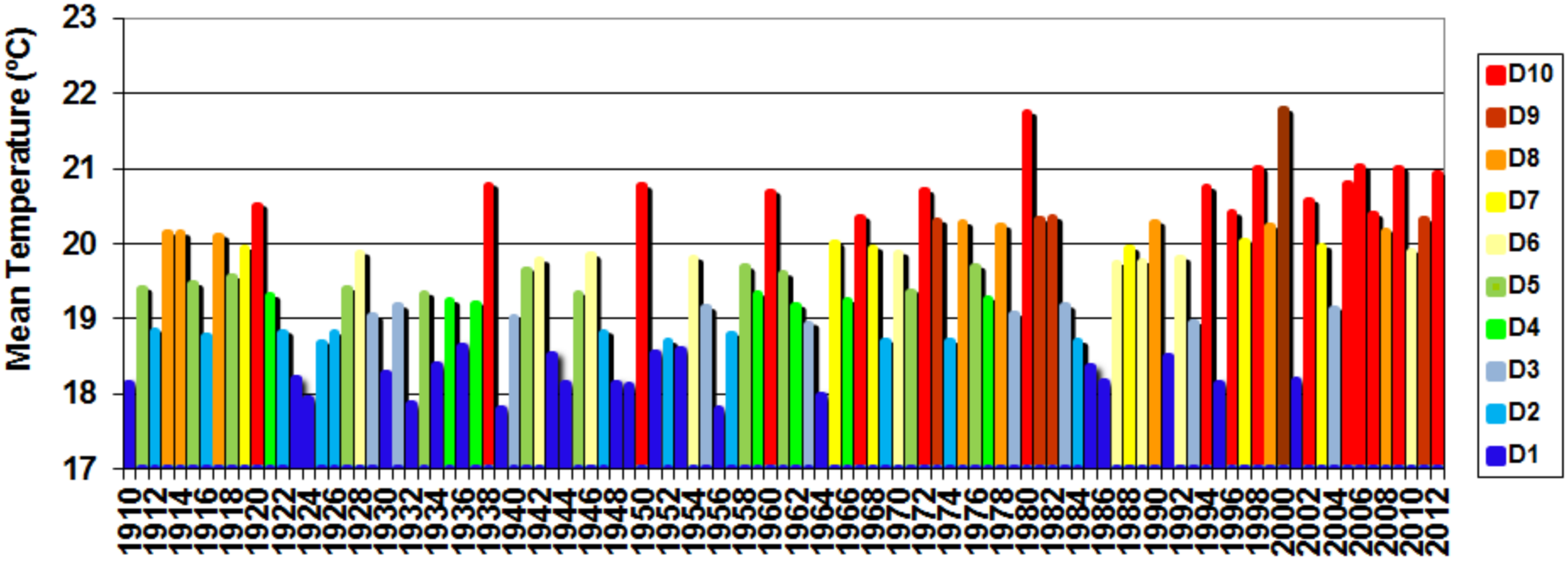


Issued: 03/03/2013

Trend in Mean Temperature Summer 1910-2012 (°C/10yr)



Issued: 03/03/2013


Mean Temperature (°C)
23
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20
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1912
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1926
1928
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1932
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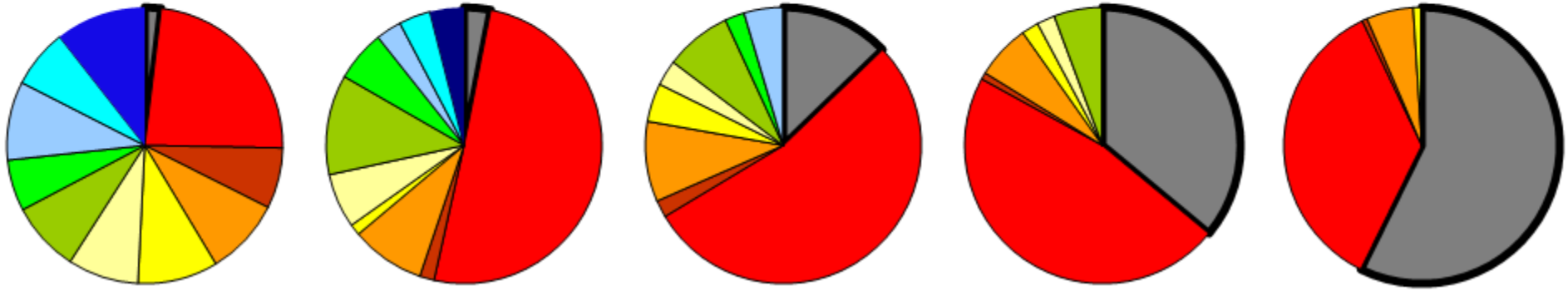
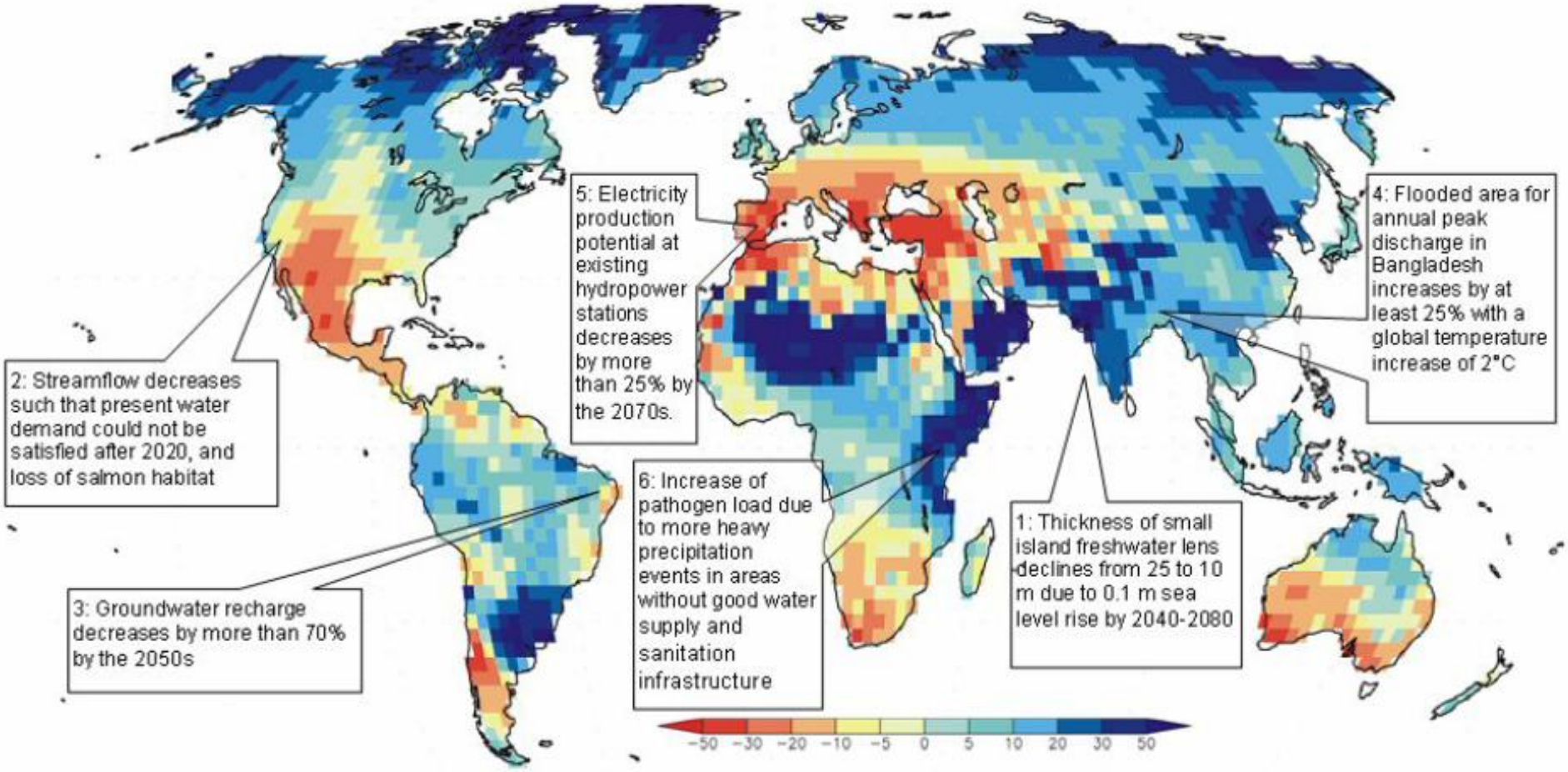
2004
2006
2008
2010
2012
D10
D9
D8
D7
D6
D5
D4
D3
D2
D1

Current	0.5	1	1.5	2



Climate change: water



IPCC (2007)

Drought vs Aridity

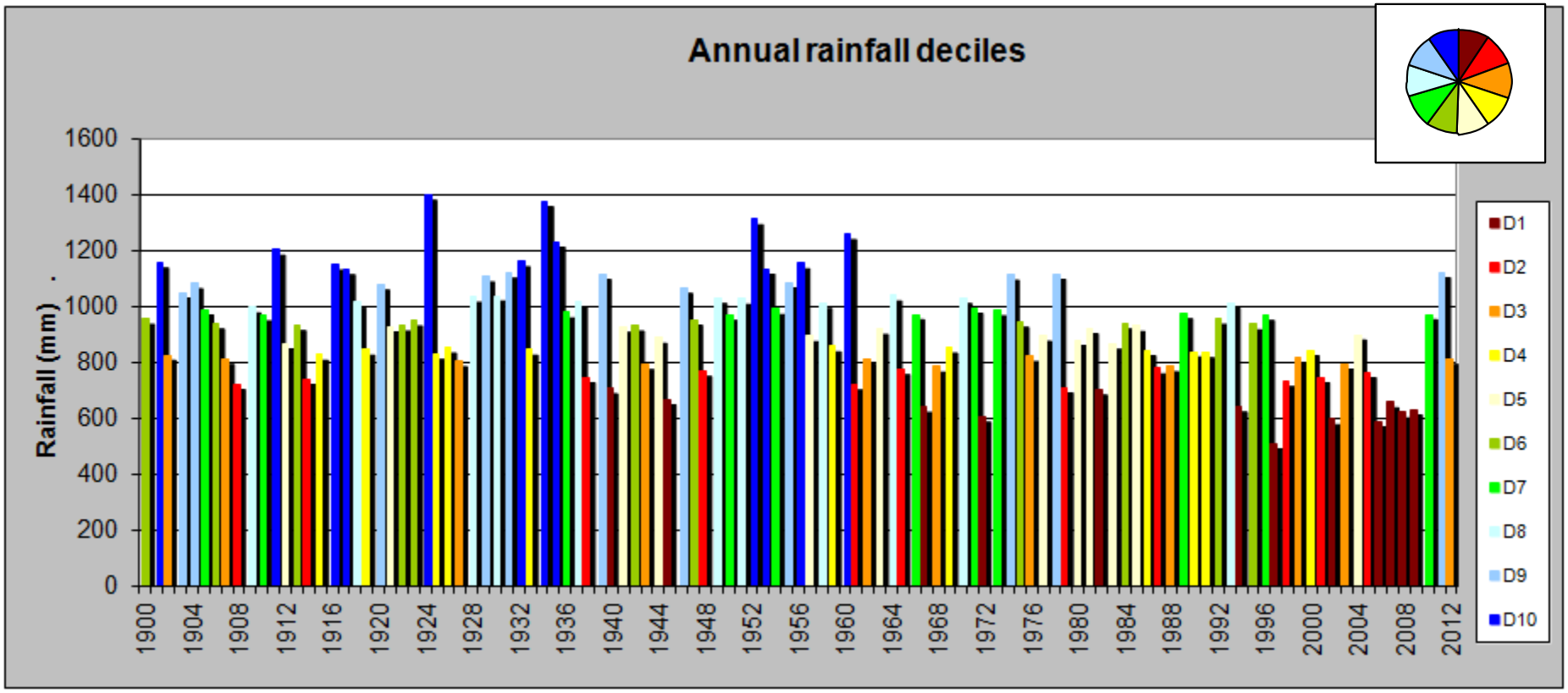
- A principle of drought policy is not to confuse drought (temporary dry spell) and aridity (a dry region or season)
- Drought vs drying; cycle or trend; climate variability or climate shift.

The first irrigation drought

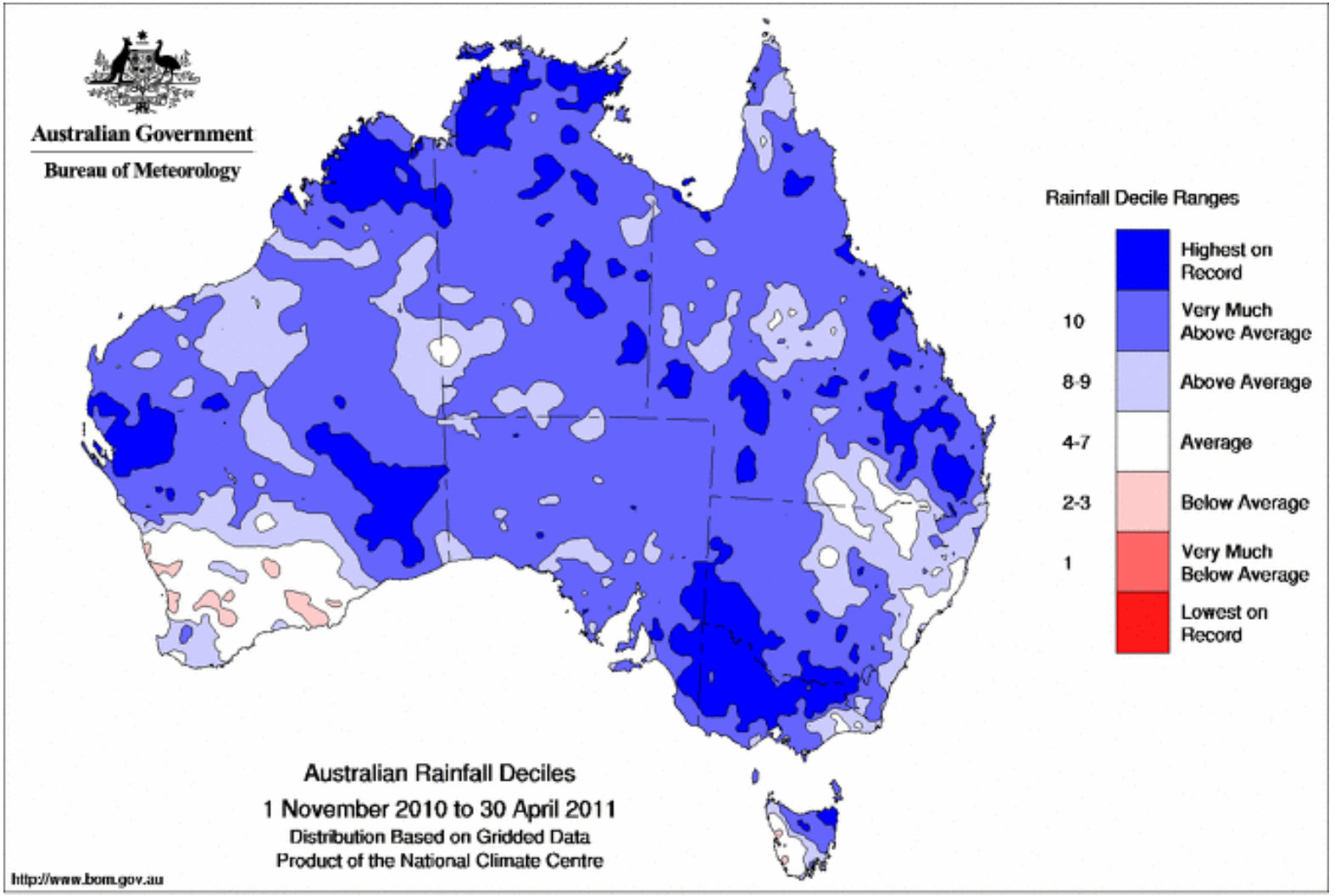
High value horticulture *"were struggling for the first time ever with insufficient water to produce a crop"*

Horticulture Australia described the deepening crisis for the lower Murray Darling Basin as an *"unprecedented process of unplanned structural adjustments on a massive scale…with consequences for growers, farming families, local businesses and regional communities"*.

Tarrawarra Monastery
(met station 86364)

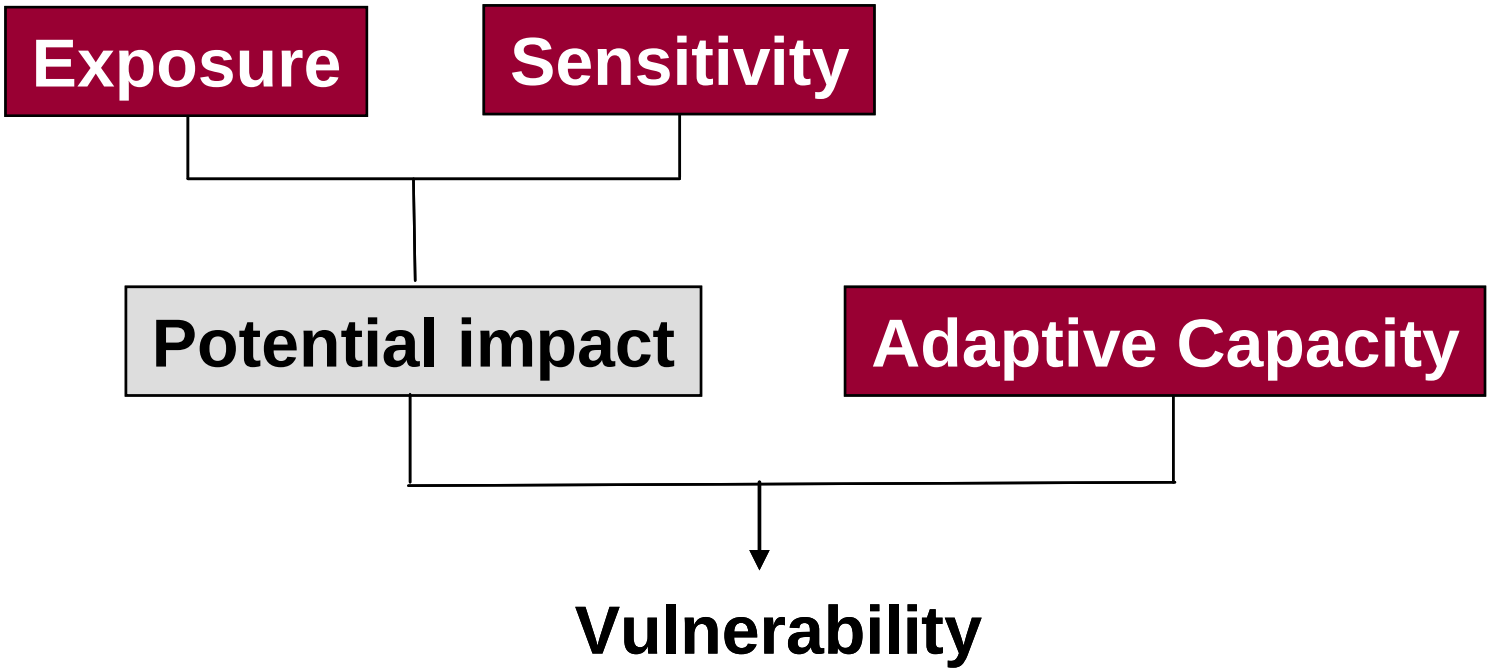


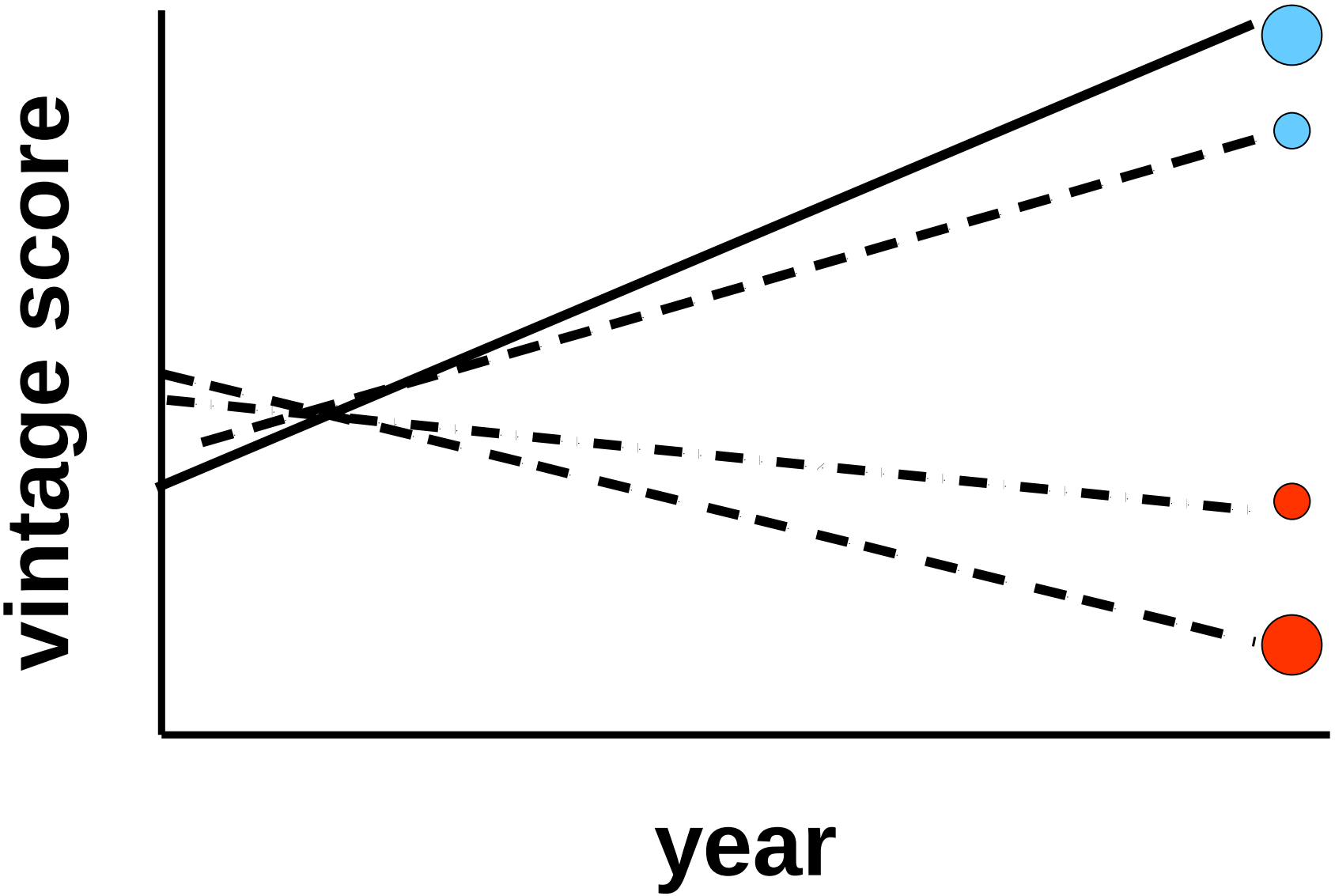
The 2012 annual rainfall was decile 3



 ID code: AWAP

Issued: 27/10/2011


Exposure
Sensitivity
Potential impact
Adaptive Capacity
Vulnerability


vintage score
year

Red wine

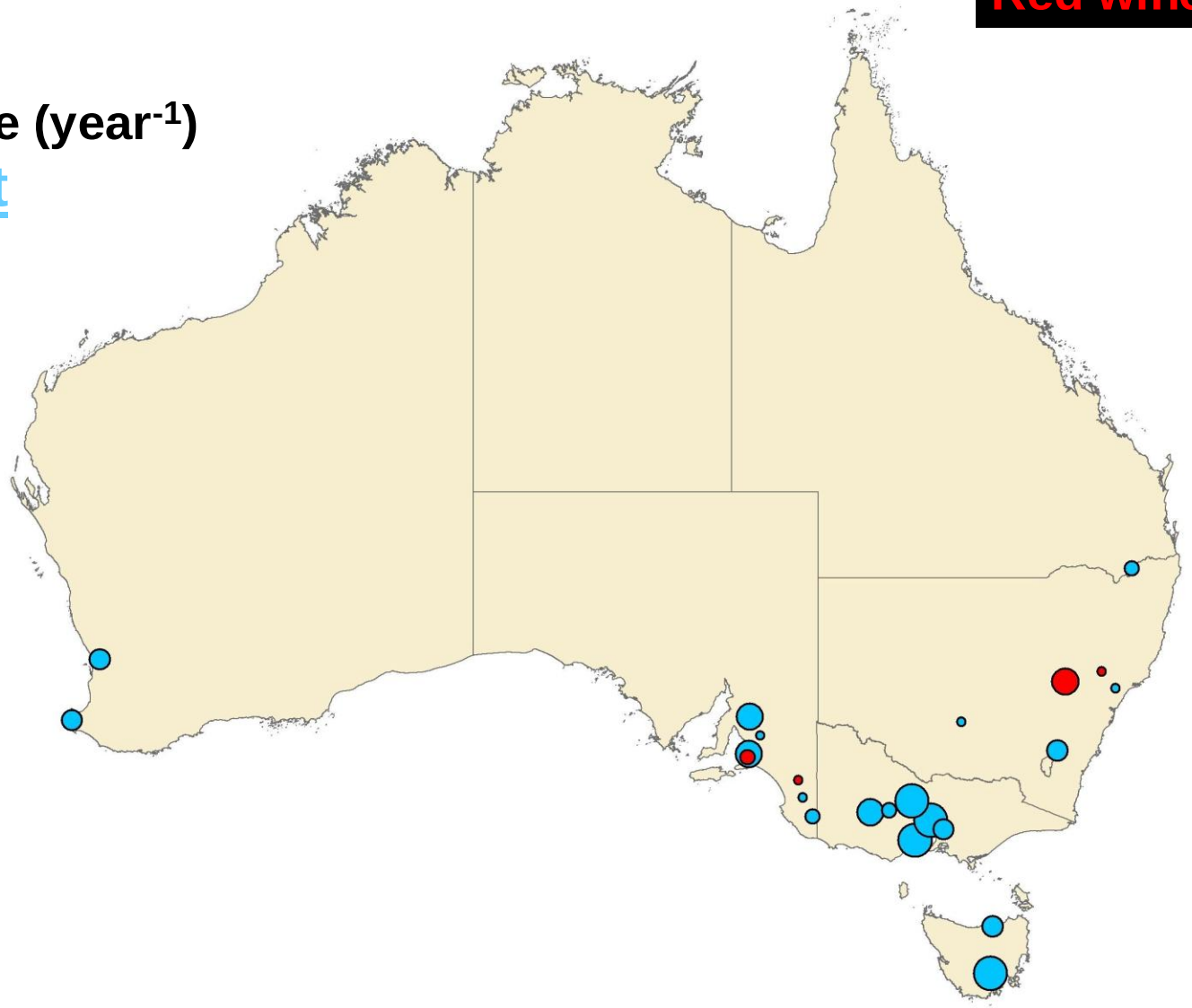
Rate of change (year^{-1})

improvement

- 0.00 - 0.02
- 0.03 - 0.04
- 0.05 - 0.07
- 0.08 - 0.09
- 0.10 - 0.11

decline

- 0.00 - 0.02
- 0.03 - 0.04
- 0.05 - 0.07
- 0.08 - 0.09
- 0.10 - 0.11



Sadras, Soar & Petrie PR (2007) Australian J Grape & Wine Res 13: 117

referring to Trentham Estate Merlot 2006:

“…merlot from the Murray Darling shouldn’t be this good…”

Halliday J (2009). The Weekend Australian Magazine, 25-26 July

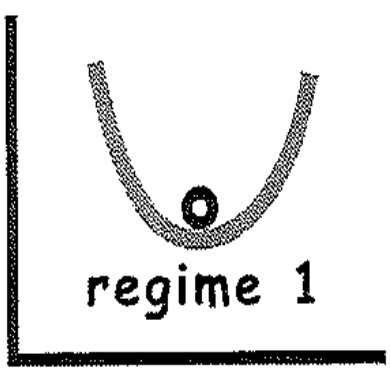
Climate change study 'exaggerated and full of mistakes': Chapoutier

- **Monday 22 April 2013**
- by Jane Anson in Bordeaux

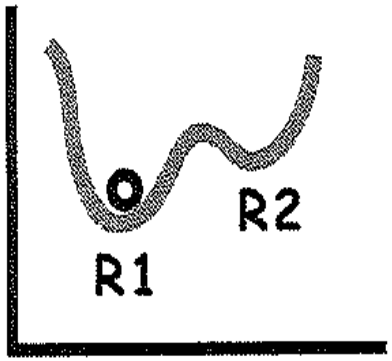
Michel Chapoutier has spoken exclusively to Decanter.com about his frustration over the recent press reports claiming the winemaking map will be entirely redrawn by 2050.

'I am not a global warming denier': Michel Chapoutier

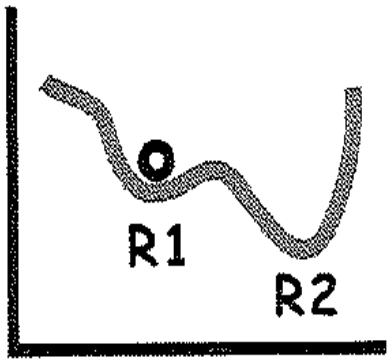
140 year old Shiraz vine



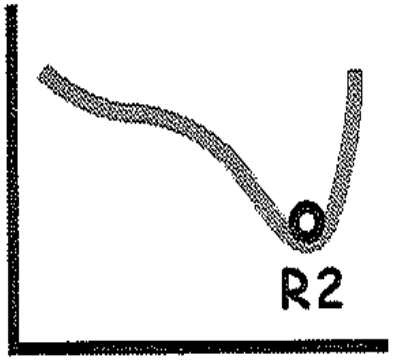
low P in mud



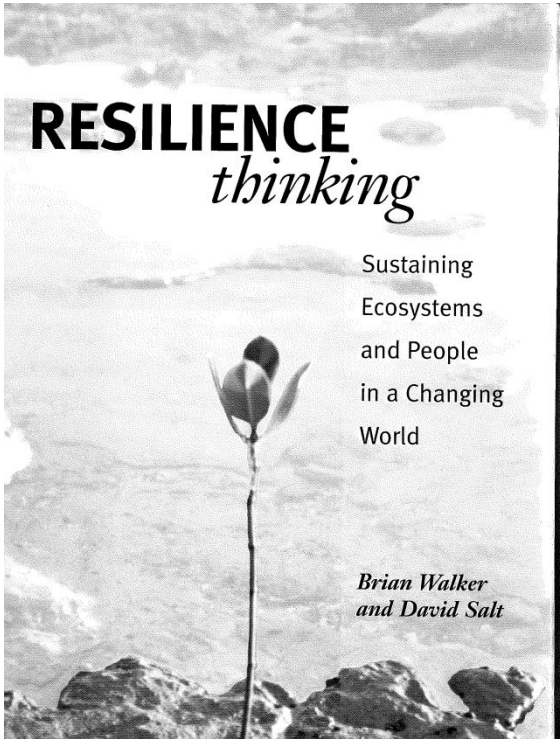
some P in mud

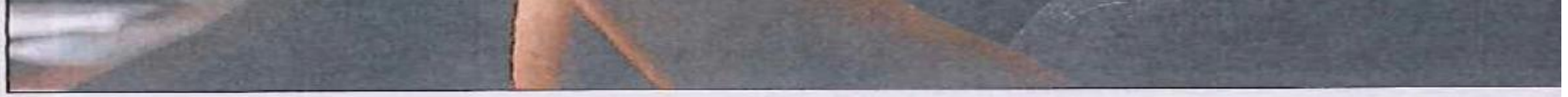


more P in mud



high P in mud





KEEPING COUNT: Maria Schmidt from Andre's Cucina & Polenta Bar uses the Jacob's Creek iPhone app to calculat

Disgruntled wine growers are ...

Looking for a grape escape

BYLINE1

A THIRD of grape growers in South Australia's premier wine regions want to leave the industry, a State Government-backed study has found.

Only one in four of those surveyed in the Barossa Valley, Clare Valley, McLaren Vale, Langhorne Creek, Coonawarra and Adelaide Hills say their properties are profitable.

Only two in three who responded to the Department of Primary Industries-funded survey say they want to remain in the industry.

Wine Grape Council of SA executive officer Peter Hackworth said yesterday all South Australians should be concerned about the problems in one of the state's most important industries.

He said the industry needed relief from high water prices, especially in the Clare Valley, where the SA Water-dependent growers had experienced a doubling of prices over several years.

"Wine production is one of our foundations ... which gives all South Australians a sense of pride," Mr Hackworth said.

"People should be very concerned that few grape growers are making a profit.

"Few rely on wine grapes for an income and have to do other things to make money. There are 70-year-old farmers getting back on the tractor because they can't afford to employ people."

Mr Hackworth said the association wanted the Wine Grape Industry Act reformed to ensure growers were paid promptly. He said prices had dropped by half but only about 10 per cent of growers were being paid on time.

Pending a sustained devaluation of the Australian dollar, which would make exported local wine more affordable, the industry may have bottomed out and be about to bounce back.

"I think it's unlikely to get worse," Mr Hackworth said. "We need the Australian dollar to be worth about 90 US cents."

The survey of more than 1000 growers was conducted by the Wine Grape Council to plan for the future. It did not include Riverland growers because the region has already undergone significant restructuring, including the removal of vines.

Grape grower Frank Vigara, of Piccadilly, said low stocks held by wineries might stimulate a revival this year. "There are a lot of wine tanks empty, so hopes are up this year," he said.

Hawkins ties the knot

JENNIFER Hawkins married her long-time love, Jake Wall, in a long-awaited wedding in Bali last night.

The couple, who met in a Newcastle nightclub when fresh out of school, wed on the cliffside of ritzy Semara resort, a popular wedding destination in the island's more private Uluwatu precinct.

The Myer supermodel flew to Bali with the groom on Saturday.

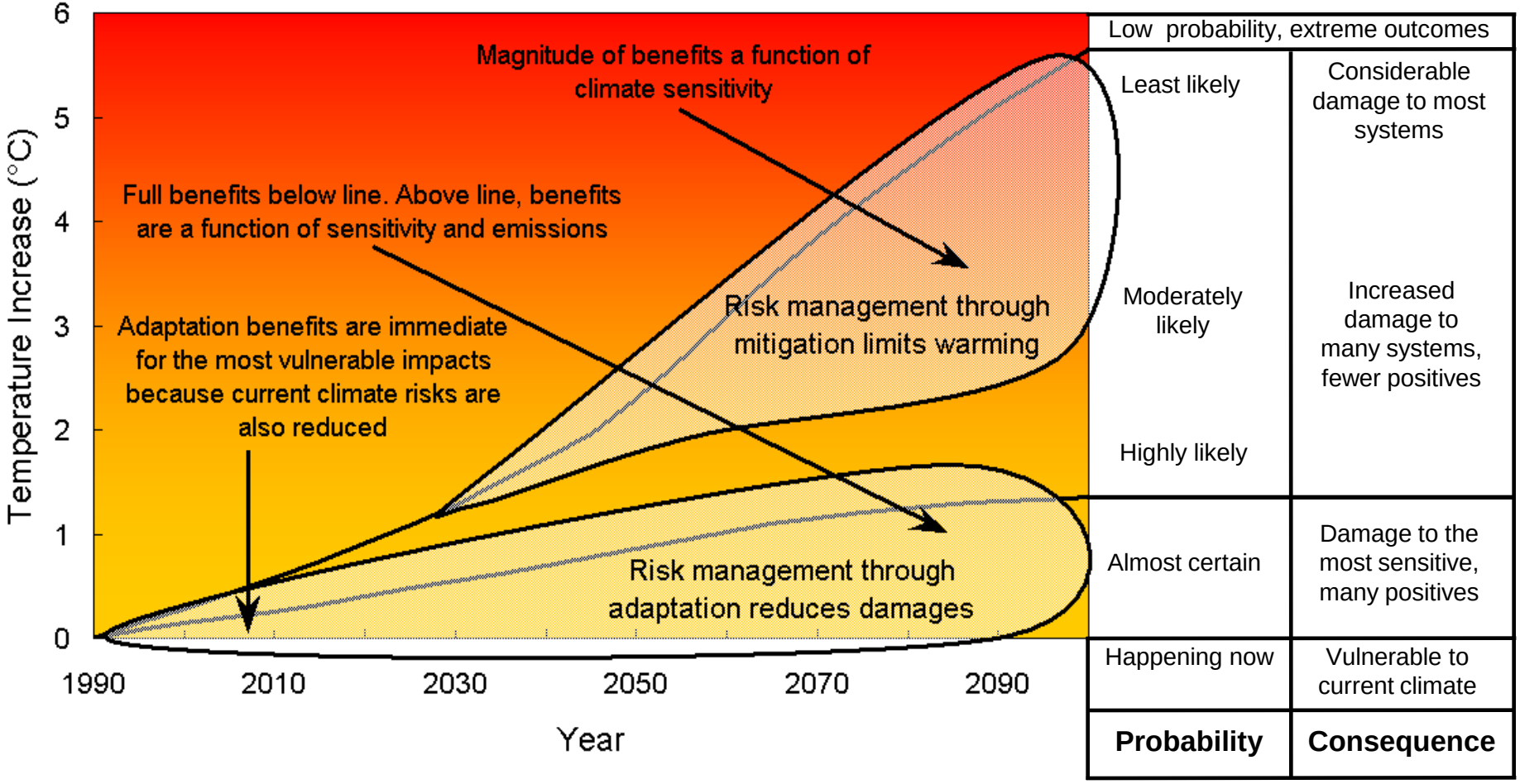
The nuptials were planned as an intimate affair, with fewer than 100 guests.

RITZY: Jennifer Hawkins' wedding last night. Picture: CHANNEL 7

The

Many stressors

- Demand and Supply
- Currency
- Conflicting demands for water
- Labour costs
- Policy risk
- Wine tax
- Debt



Core benefits of adaptation and mitigation

Probability – the likelihood of reaching or exceeding a given level of global warming
Consequence – the effect of reaching or exceeding a given level of global warming
Risk = Probability × Consequence

Current	0.5	1	1.5	2