Risk Management Approach for Climate Adaptation in Australian Agriculture

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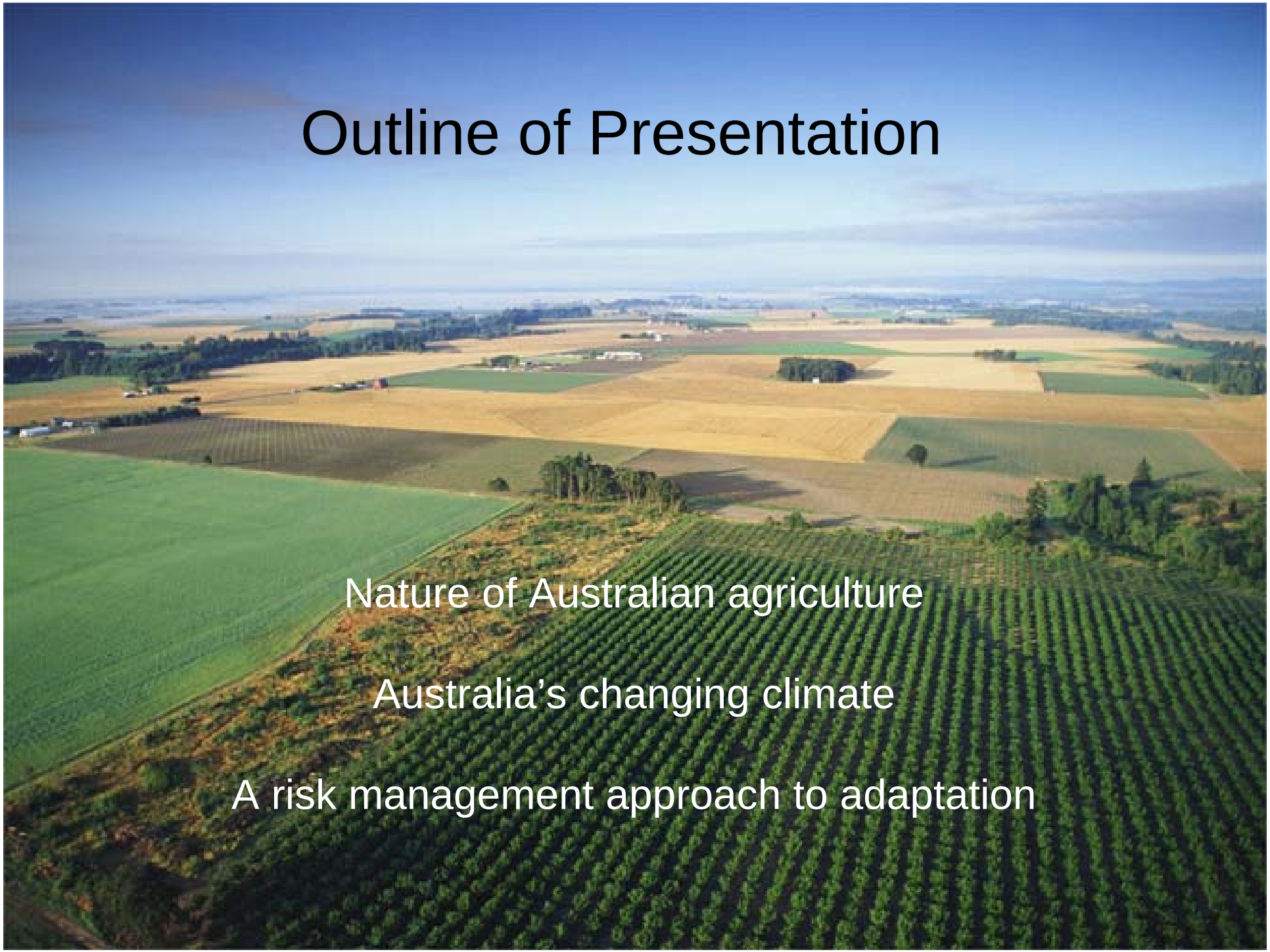
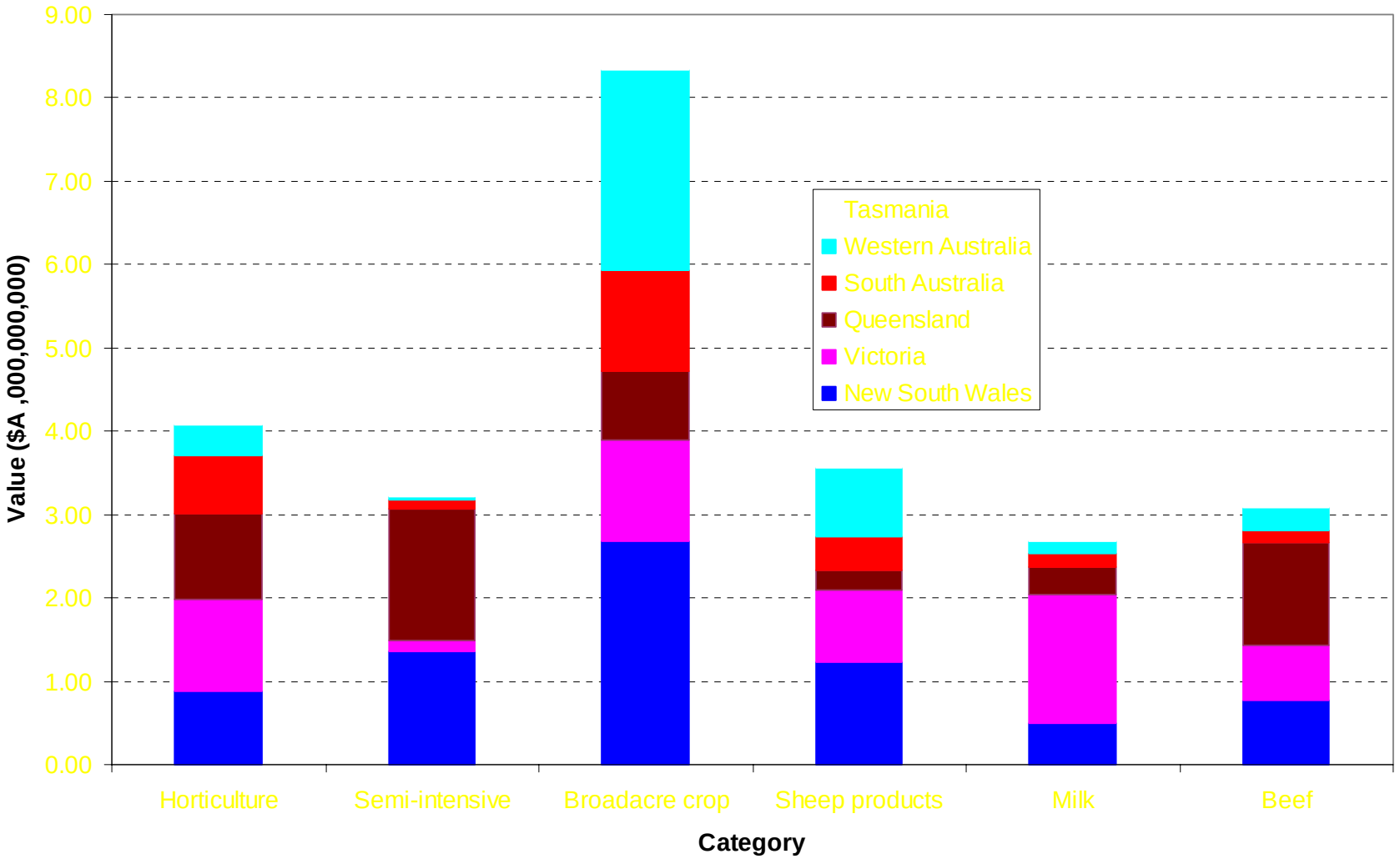
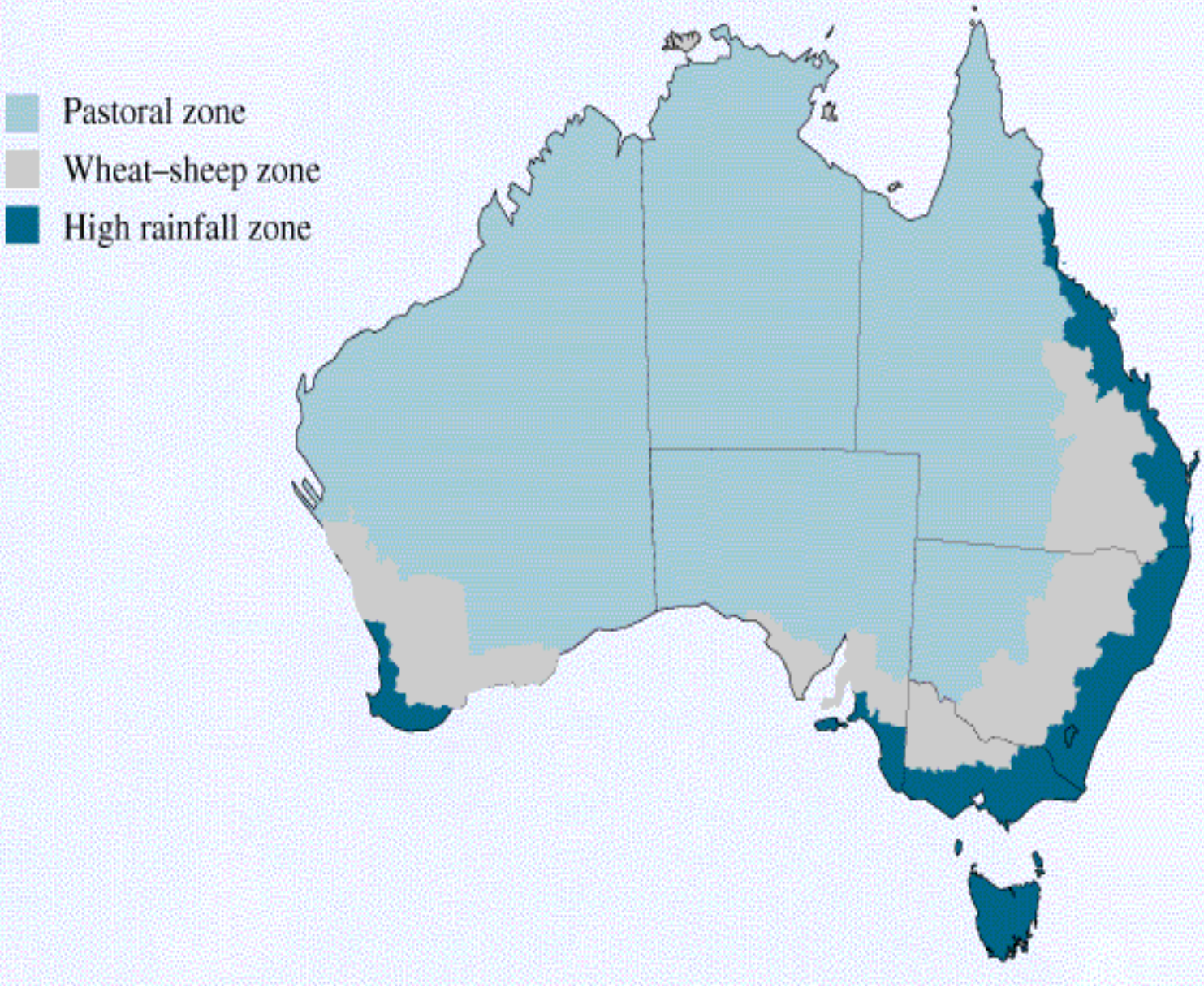

Outline of Presentation
Nature of Australian agriculture
Australia’s changing climate
A risk management approach to adaptation

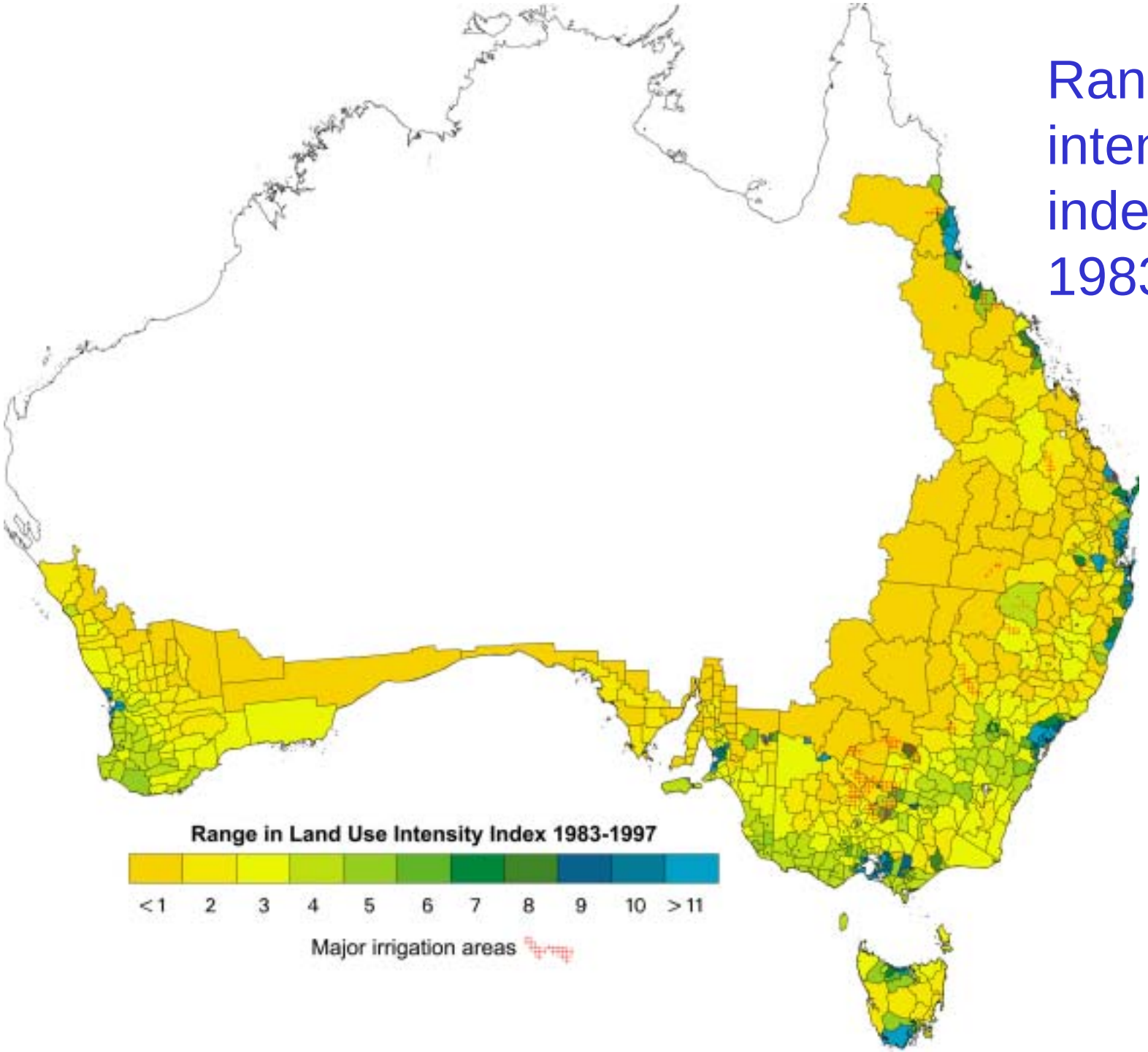
Value of agricultural products by State in 1996-97



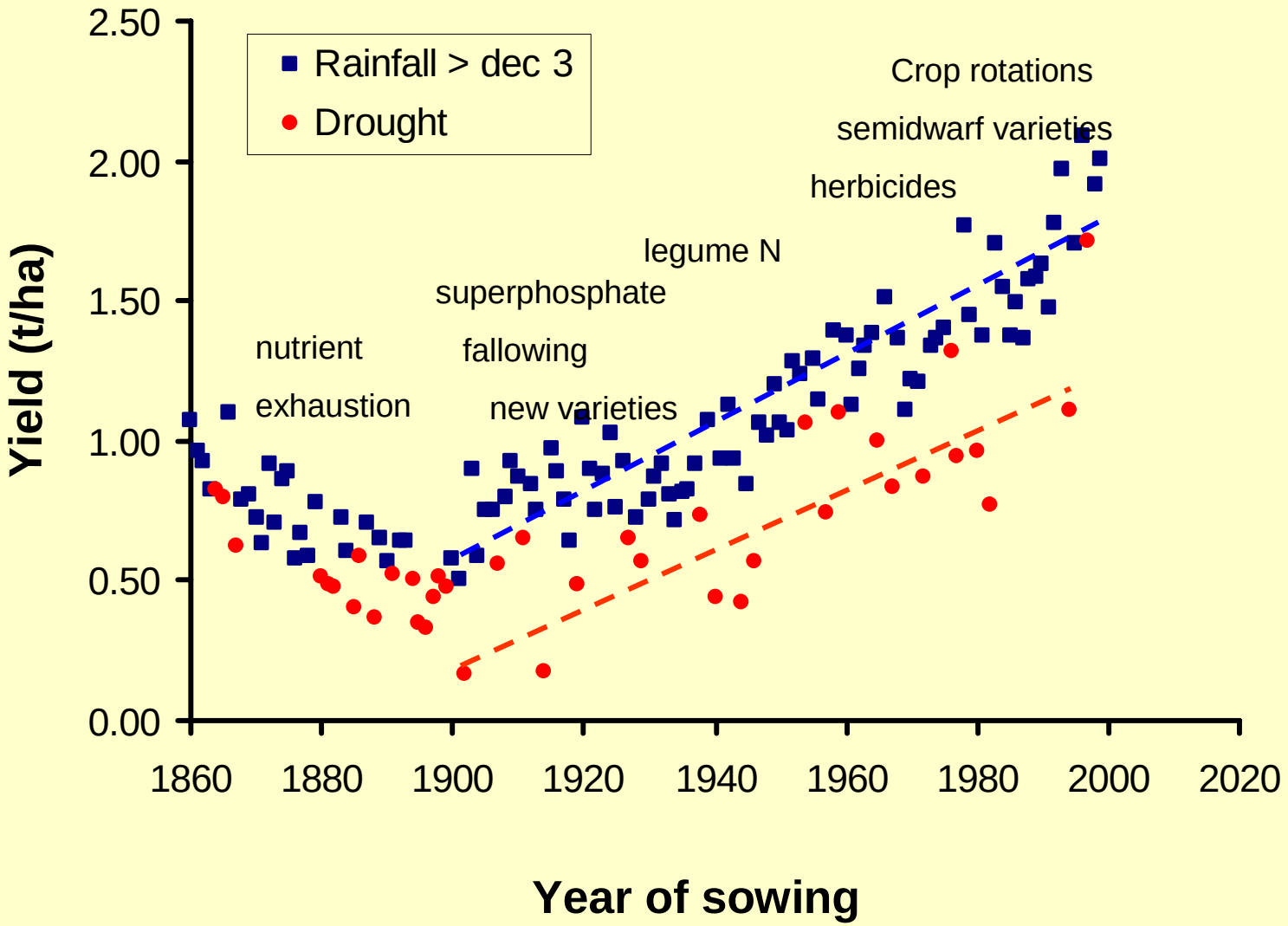
Australian broadacre zones

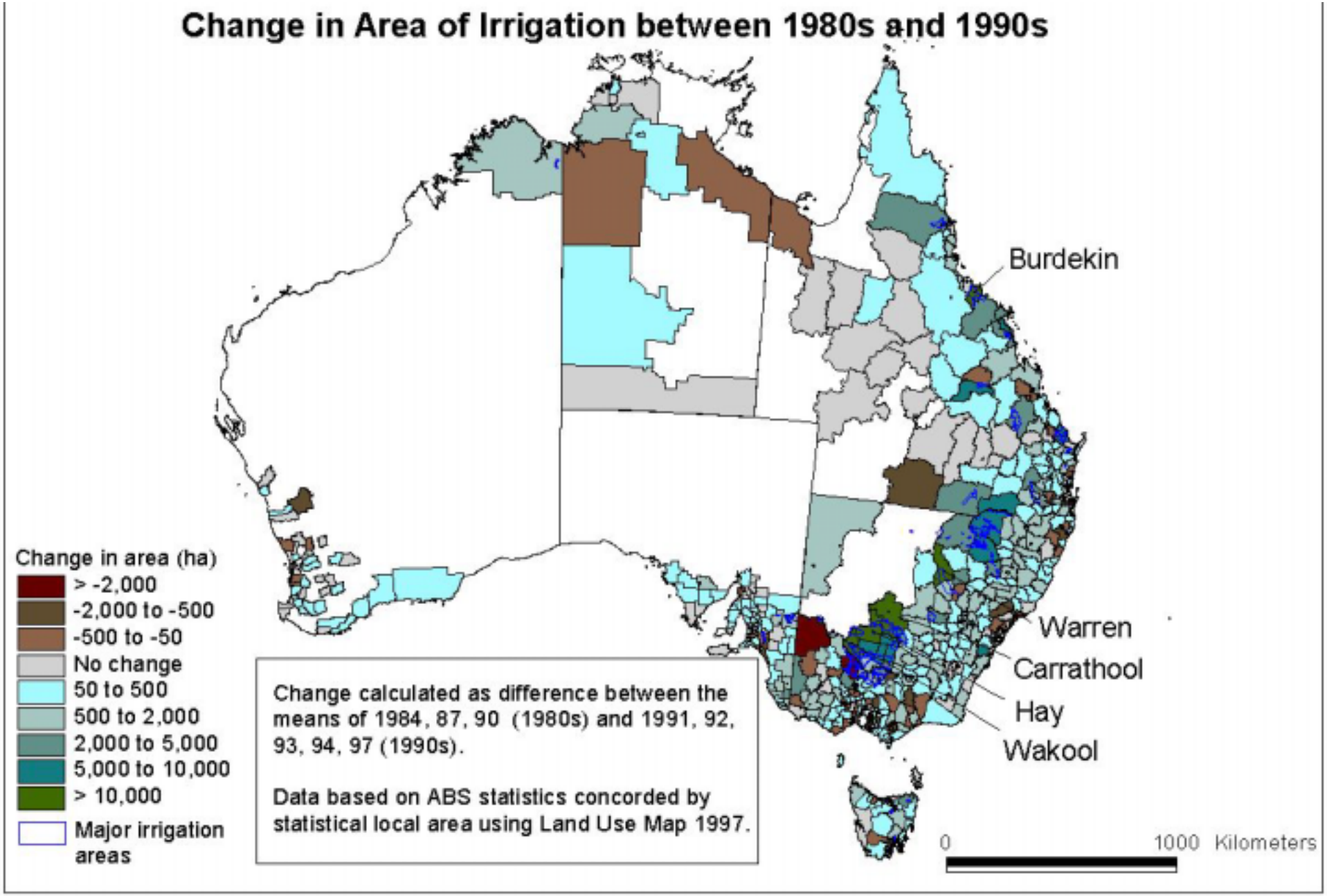


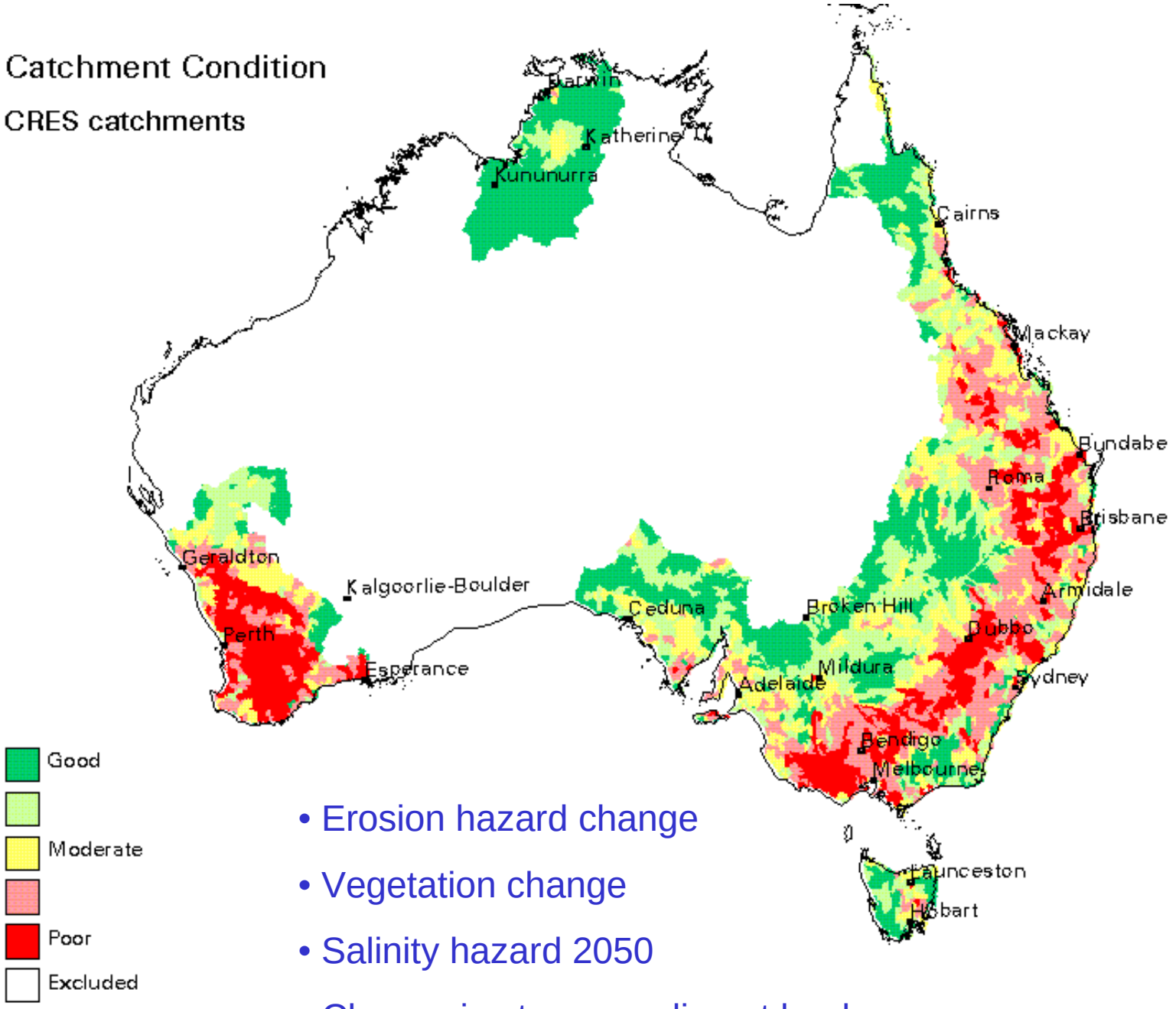
Range in intensity index during 1983 to 1997



Wheat yields in Australia since 1860

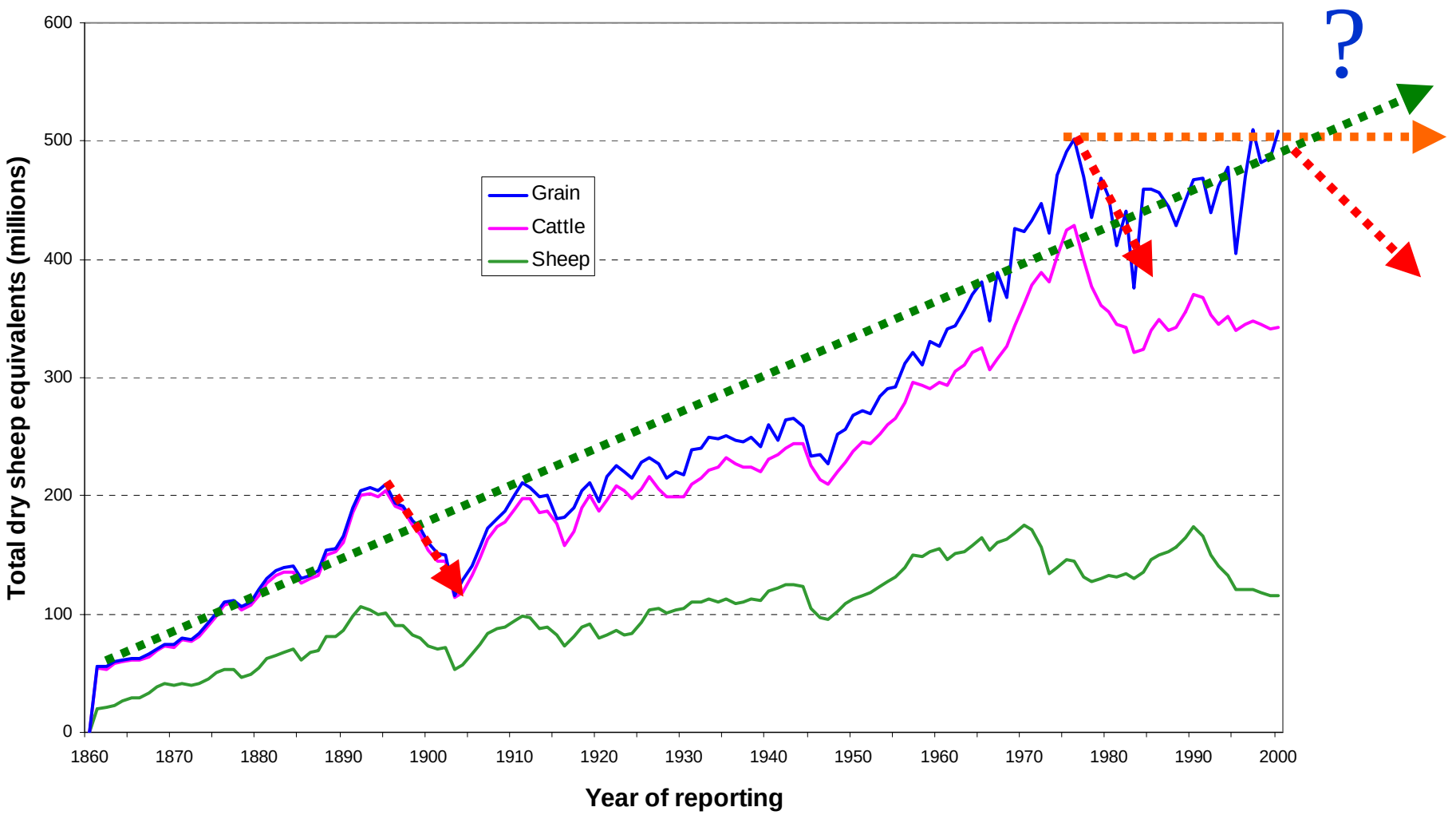


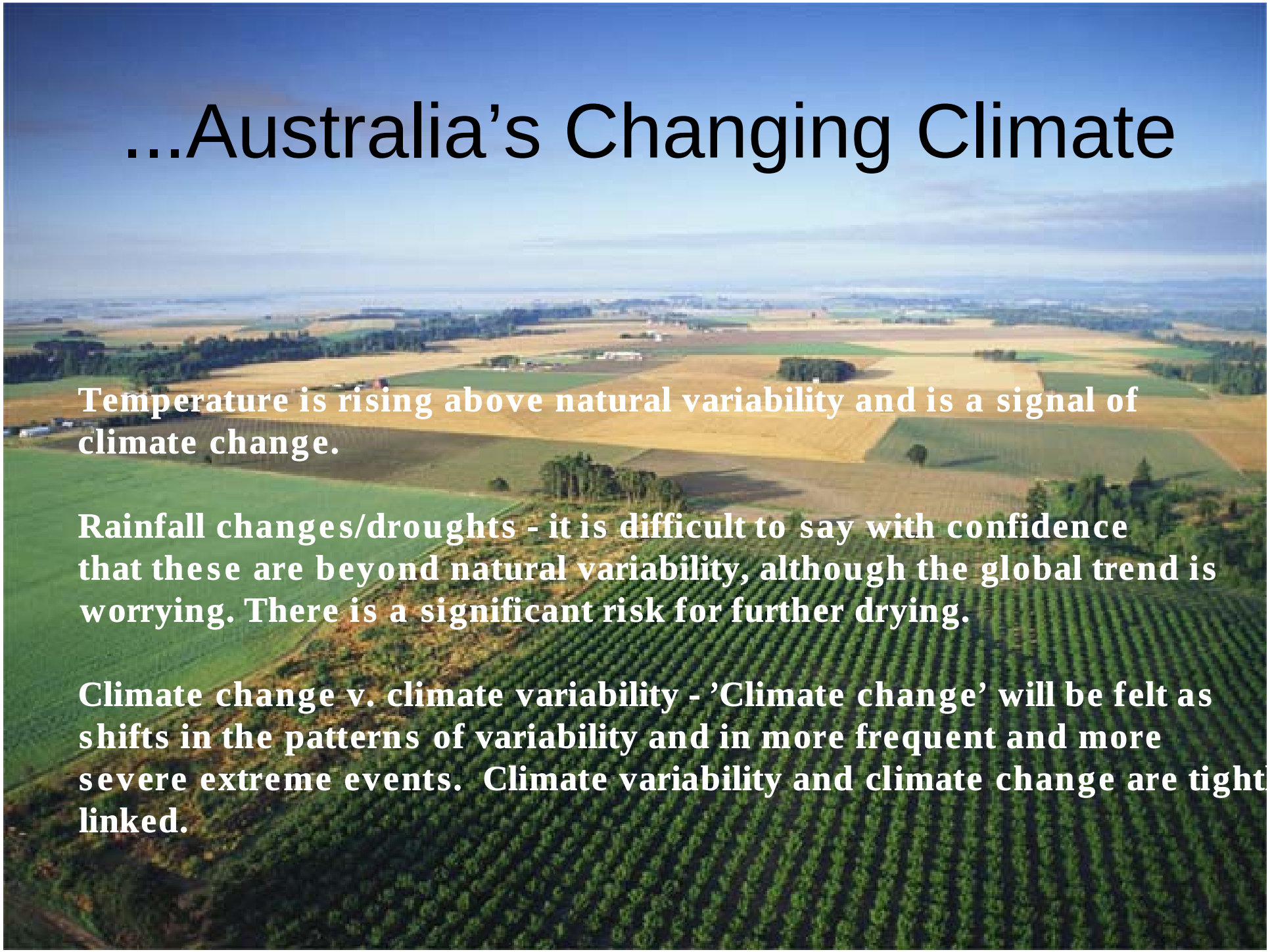

Change in Area of Irrigation between 1980s and 1990s
Burdekin
Warren
Carrathool
Hay
Wakool
Change in area (ha)
> -2,000
-2,000 to -500
-500 to -50
No change
50 to 500
500 to 2,000
2,000 to 5,000
5,000 to 10,000
> 10,000
Major irrigation areas
Change calculated as difference between the means of 1984, 87, 90 (1980s) and 1991, 92, 93, 94, 97 (1990s).
Data based on ABS statistics concorded by statistical local area using Land Use Map 1997.
0
1000 Kilometers



- Erosion hazard change
- Vegetation change
- Salinity hazard 2050
- Change in stream sediment load

Productivity of broadacre agriculture in Australia 1860-2000





...Australia's Changing Climate

Temperature is rising above natural variability and is a signal of climate change.

Rainfall changes/droughts - it is difficult to say with confidence that these are beyond natural variability, although the global trend is worrying. There is a significant risk for further drying.

Climate change v. climate variability - 'Climate change' will be felt as shifts in the patterns of variability and in more frequent and more severe extreme events. Climate variability and climate change are tight linked.

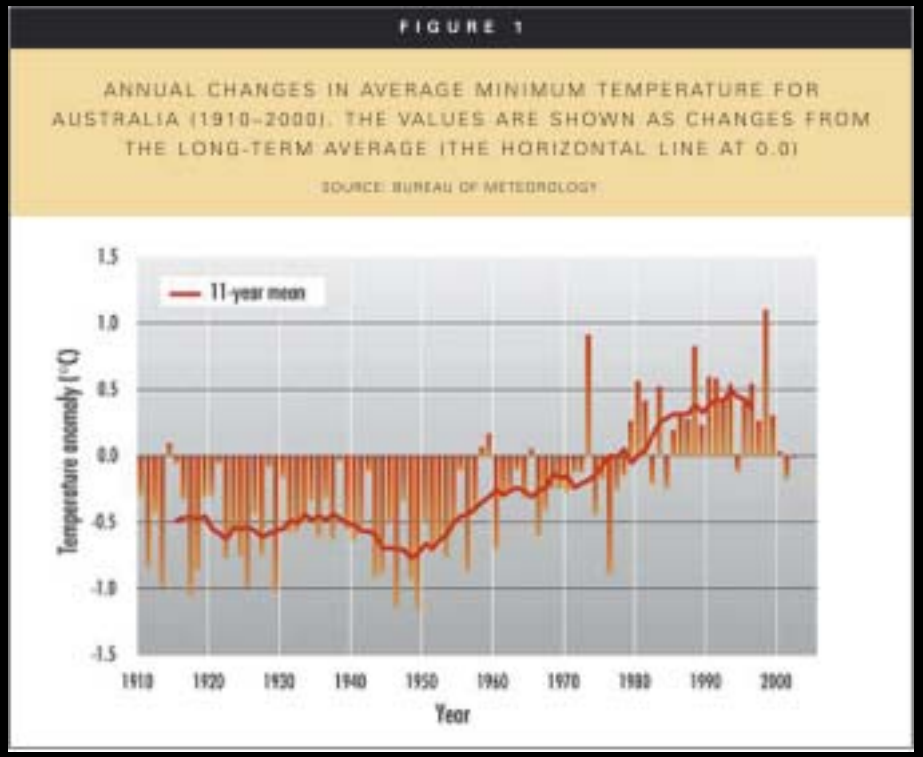
Climate Variability and Climate Change: Extremes and Trends

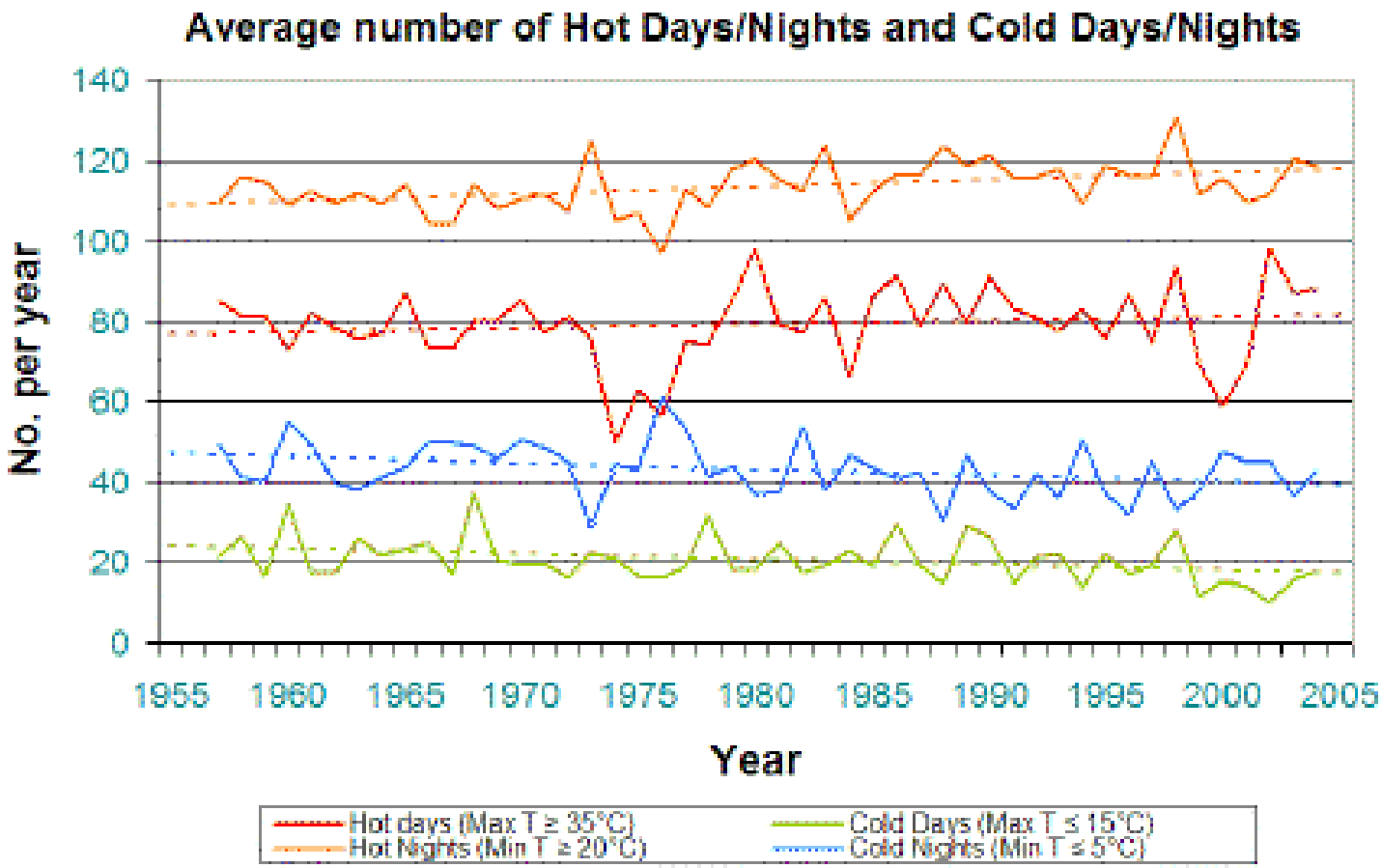
The underlying trends of long-term climate change interact with natural patterns of variability. This has two effects:

Extreme weather events change much more than the slow and modest changes in underlying trends suggest; for example, hot weather extremes become more severe and more frequent while cold events become less severe and less frequent.

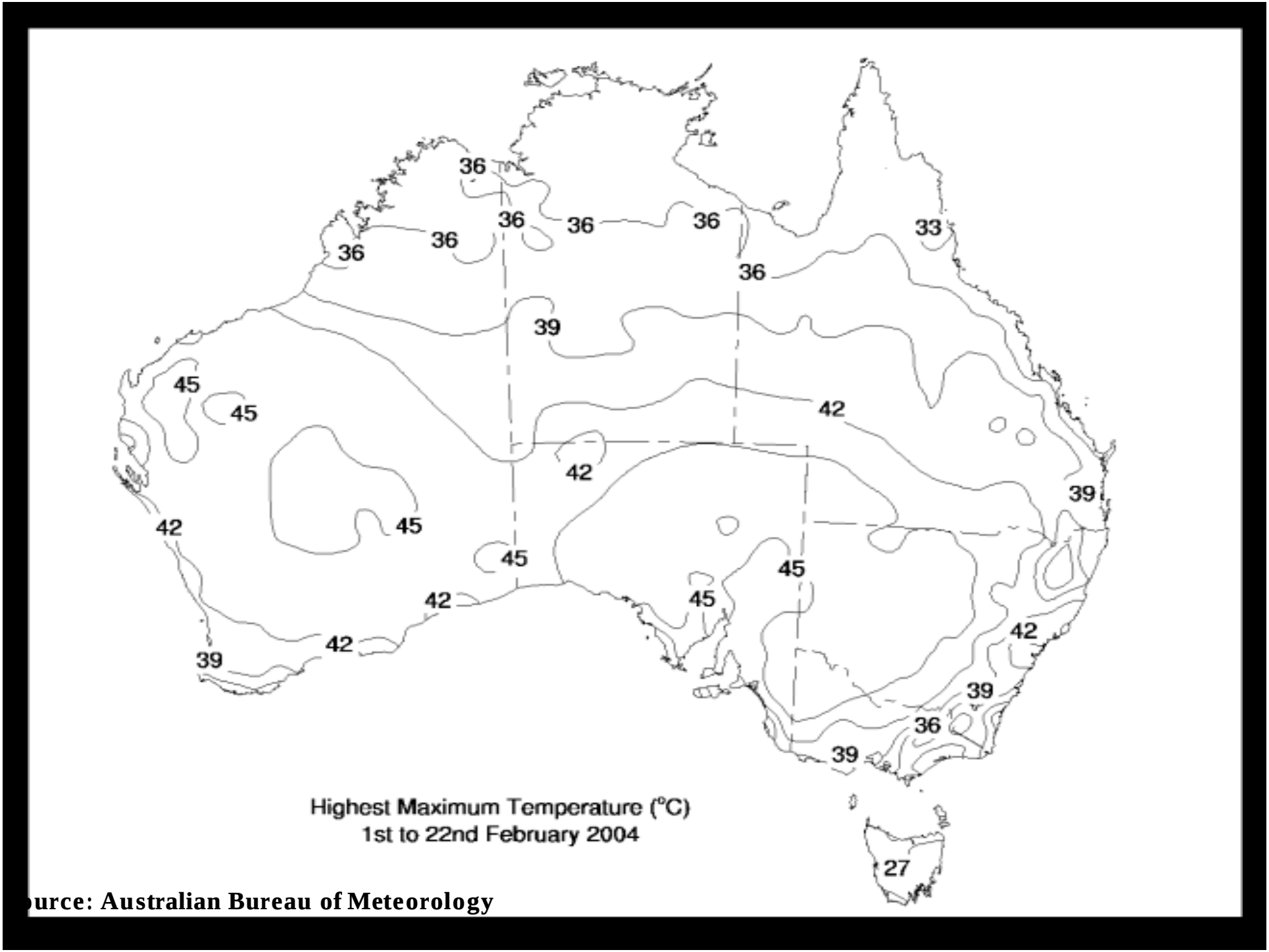
Established patterns of variability (e.g., ENSO) can shift once a threshold in a slow, underlying trend is crossed.

How is Australia's temperature changing?



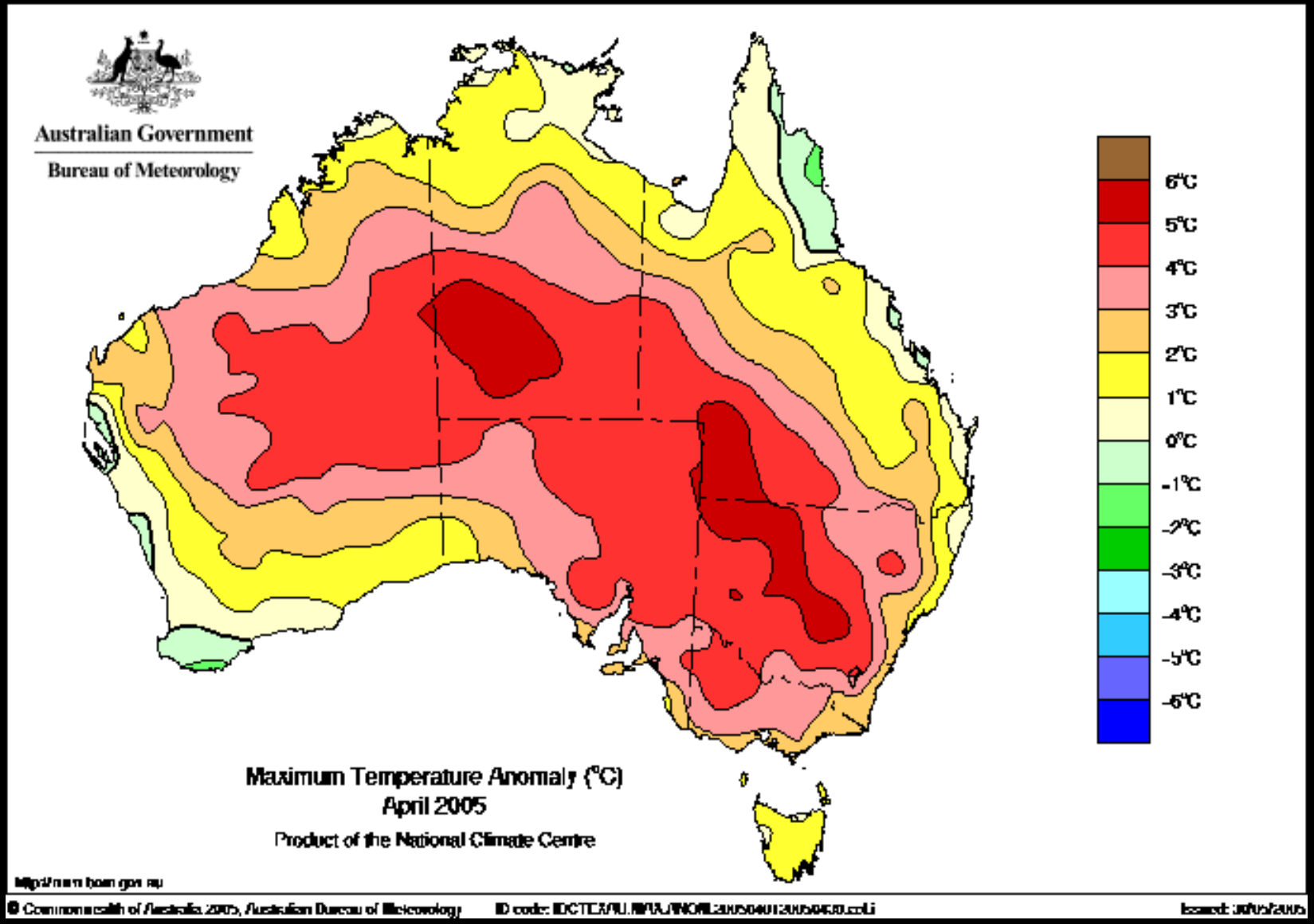


Source: Australian Bureau of Meteorology



Highest Maximum Temperature (°C)
1st to 22nd February 2004

ource: Australian Bureau of Meteorology


Australian Government
Bureau of Meteorology
6°C
5°C
4°C
3°C
2°C
1°C
0°C
-1°C
-2°C
-3°C
-4°C
-5°C
-6°C
Maximum Temperature Anomaly (°C)
April 2005
Product of the National Climate Centre

Australian Climatic Extremes, 2004-05

Severe weather event, Melbourne, 2-3 Feb 2005: extensive flooding; highest 1- and 2-day rainfall totals ever recorded

Highest ever June daily rainfall, Adelaide, 21 June 2005 (168 years of rainfall data)

Feb 2004 heatwave: from 1-22 Feb mean max temperatures were 5-6 ^{o}C above average through most of eastern Australia and 7 ^{o}C above average in parts of NSW. Heatwave caused most significant medical emergency in SE Queensland on record.

April 2005 heatwave: 100 daily high-temp records set around Australia; Canberra, Alice Springs & Wagga Wagga exceeded their average daily max on nearly every day of the month. More than 150 high-temp records were set in the Jan-Apr 2005 period, including nation-wide and state averages and max and min temperatures for many places.

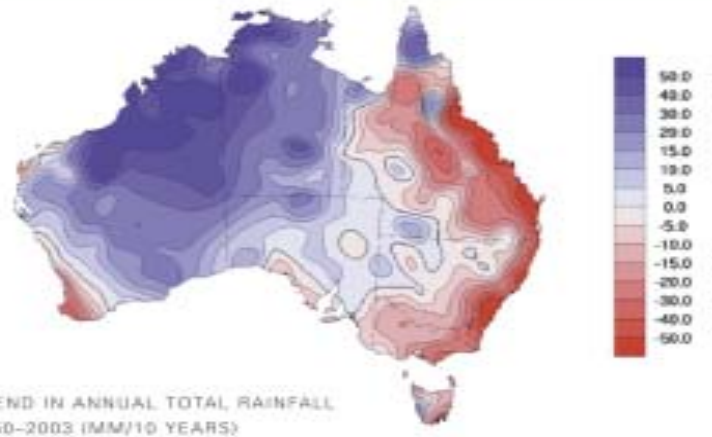
Source: Australian Bureau of Meteorology

How is Australia's climate changing?

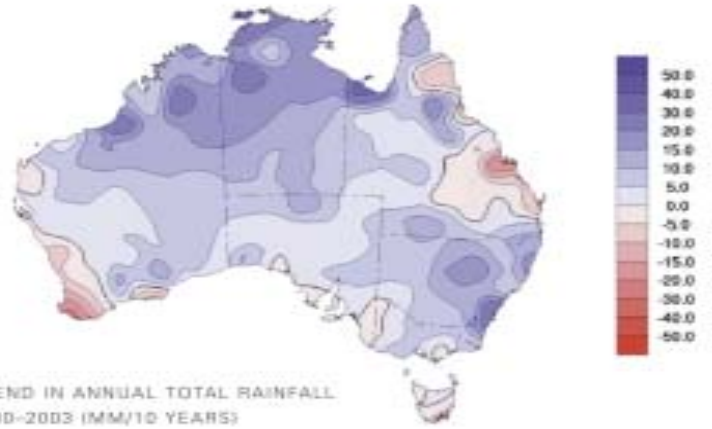
FIGURE 2

TREND IN ANNUAL TOTAL RAINFALL IN MM/10 YEARS FOR THE PAST 50 AND 100 YEARS. BLUE INDICATES AREAS THAT HAVE BECOME WETTER AND RED/PINK INDICATE AREAS THAT HAVE BECOME DRIER.

TREND MAPS OF AUSTRALIAN CLIMATE VARIABILITY AND CHANGE. SOURCE: BUREAU OF METEOROLOGY



TREND IN ANNUAL TOTAL RAINFALL
1950–2003 (MM/10 YEARS)



TREND IN ANNUAL TOTAL RAINFALL
1900–2003 (MM/10 YEARS)

Australia: ”The Never-Ending Drought”

Drought is into its 5th year across much of eastern Australia; this appears to be part of a 30-year drying trend in the region.

87% of New South Wales is currently drought-declared.

Water supplies of Sydney and Canberra are at their lowest levels in history; Sydney has less than two years remaining.

Increasing concern that more frequent, prolonged and more intensive droughts might be linked to climate change

GLOBAL CHANGE
IGBP

Australia: The Never-Ending Drought

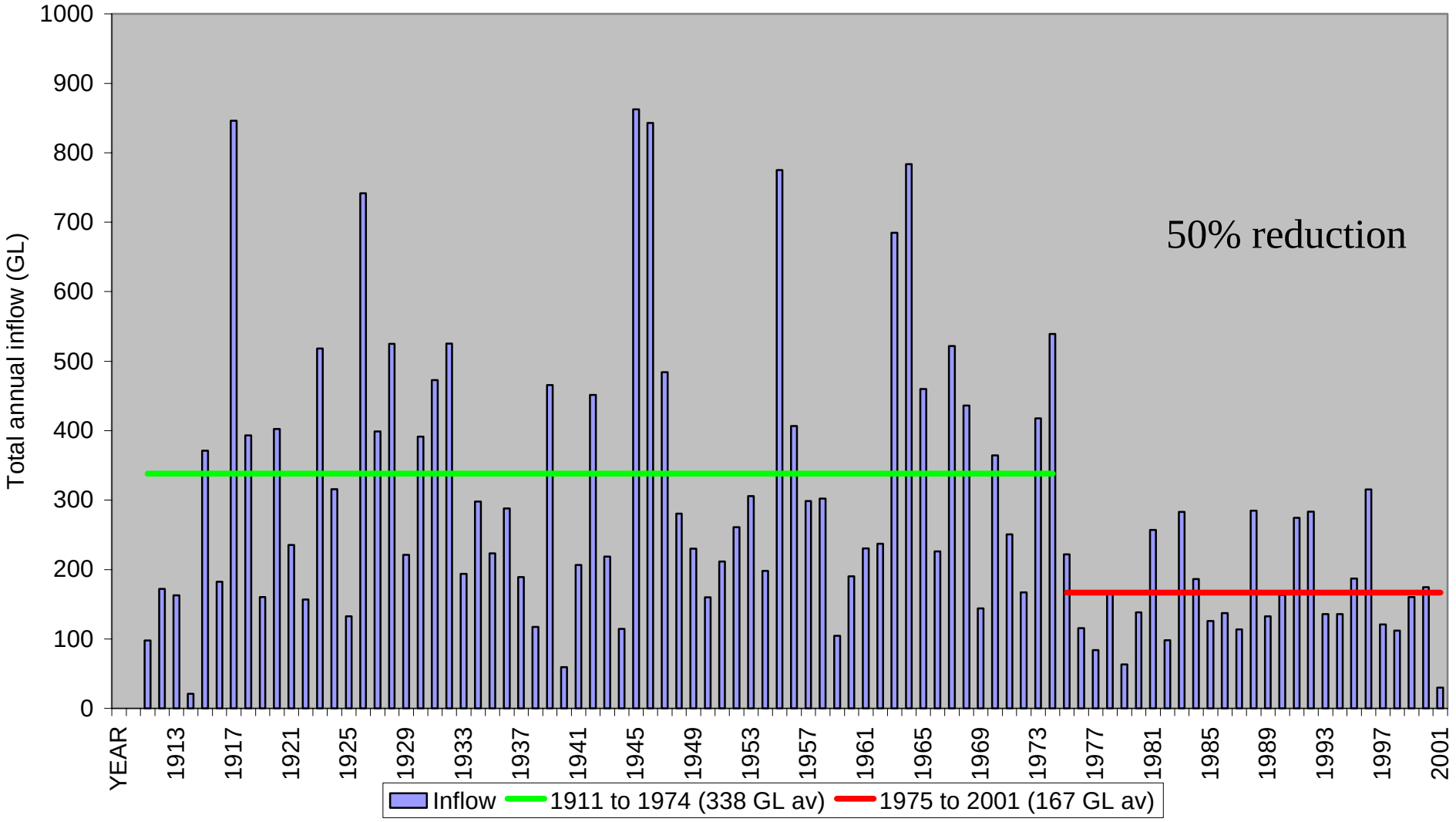
Goulburn (22,500 residents) has only 11% of water supply remaining; will run out by end of year

Industrial users to cut water use by 30%, leading to production cutbacks and job losses

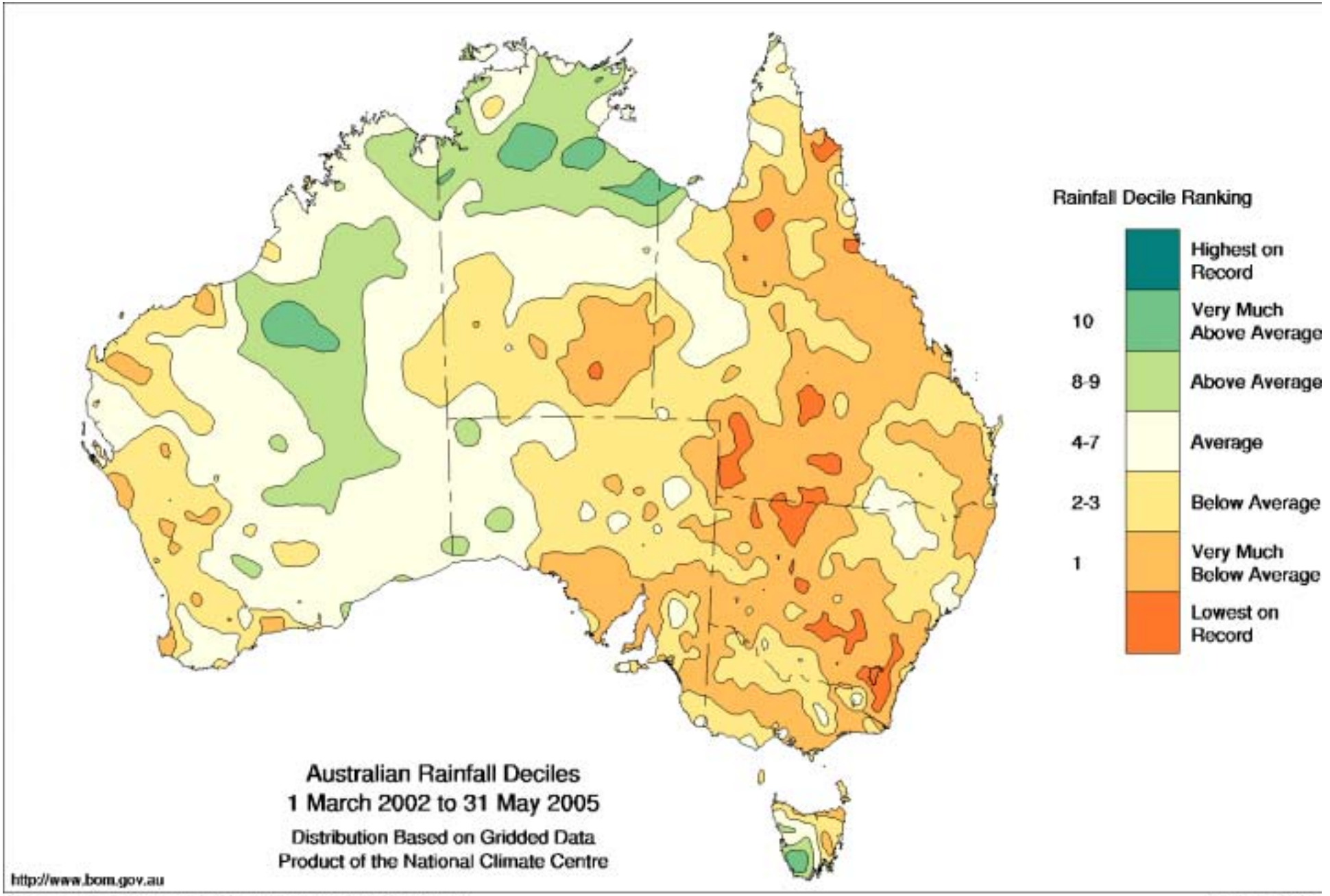
Emergency measures: trucking in water - 100 trucks a day at a cost of AUD 2 million per month.

Photo: The Canberra Times

Water flow into Perth water supply dams



Note: A year is taken as May to April and labelled year is start (winter) of year
Year 2001 inflows are not for a full year



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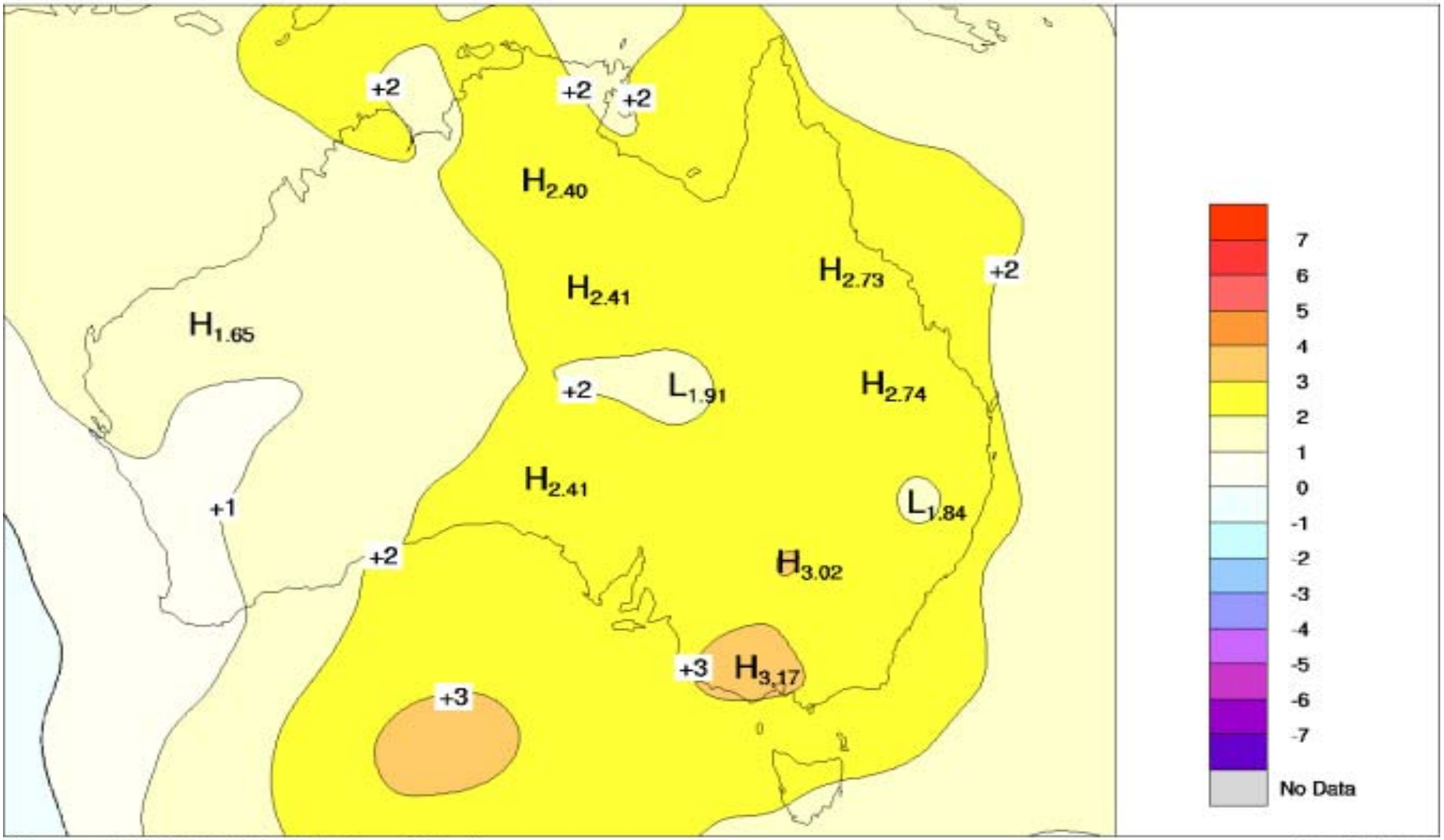

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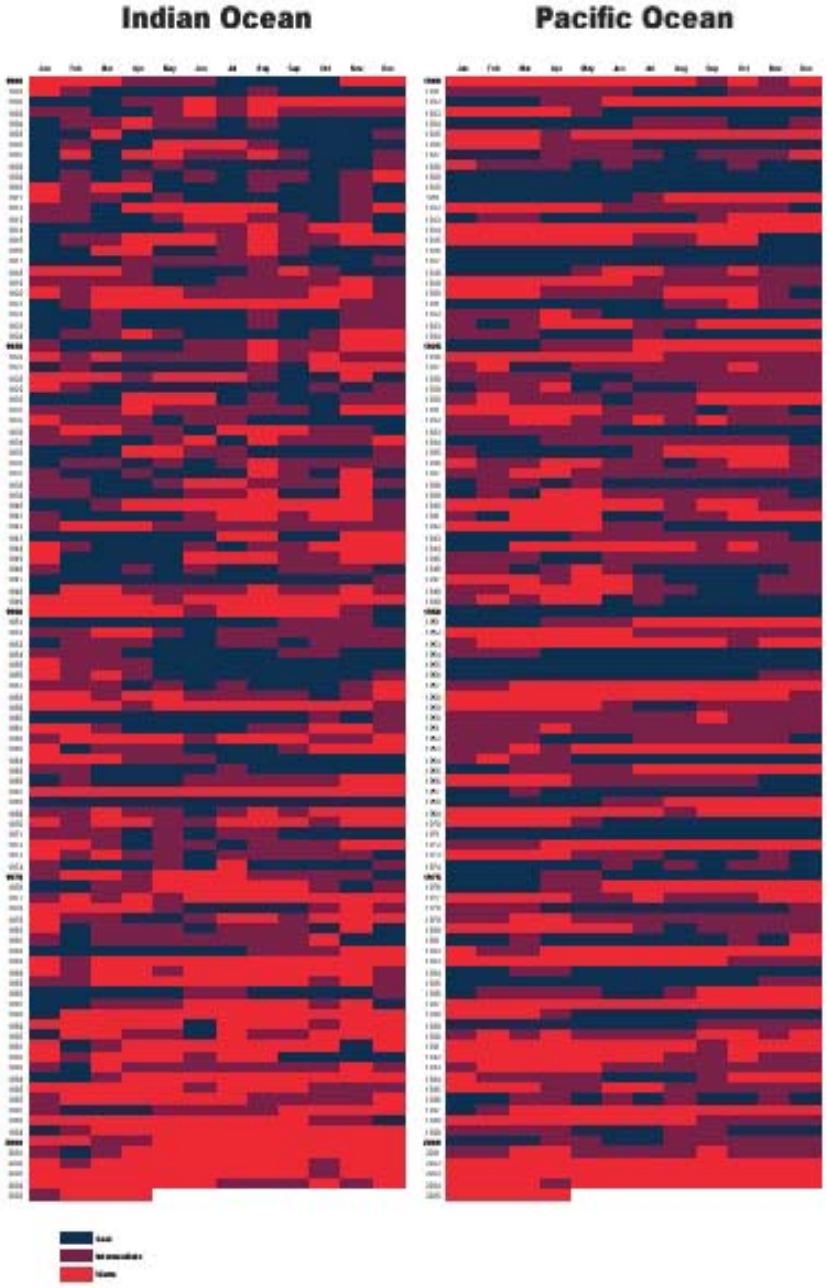
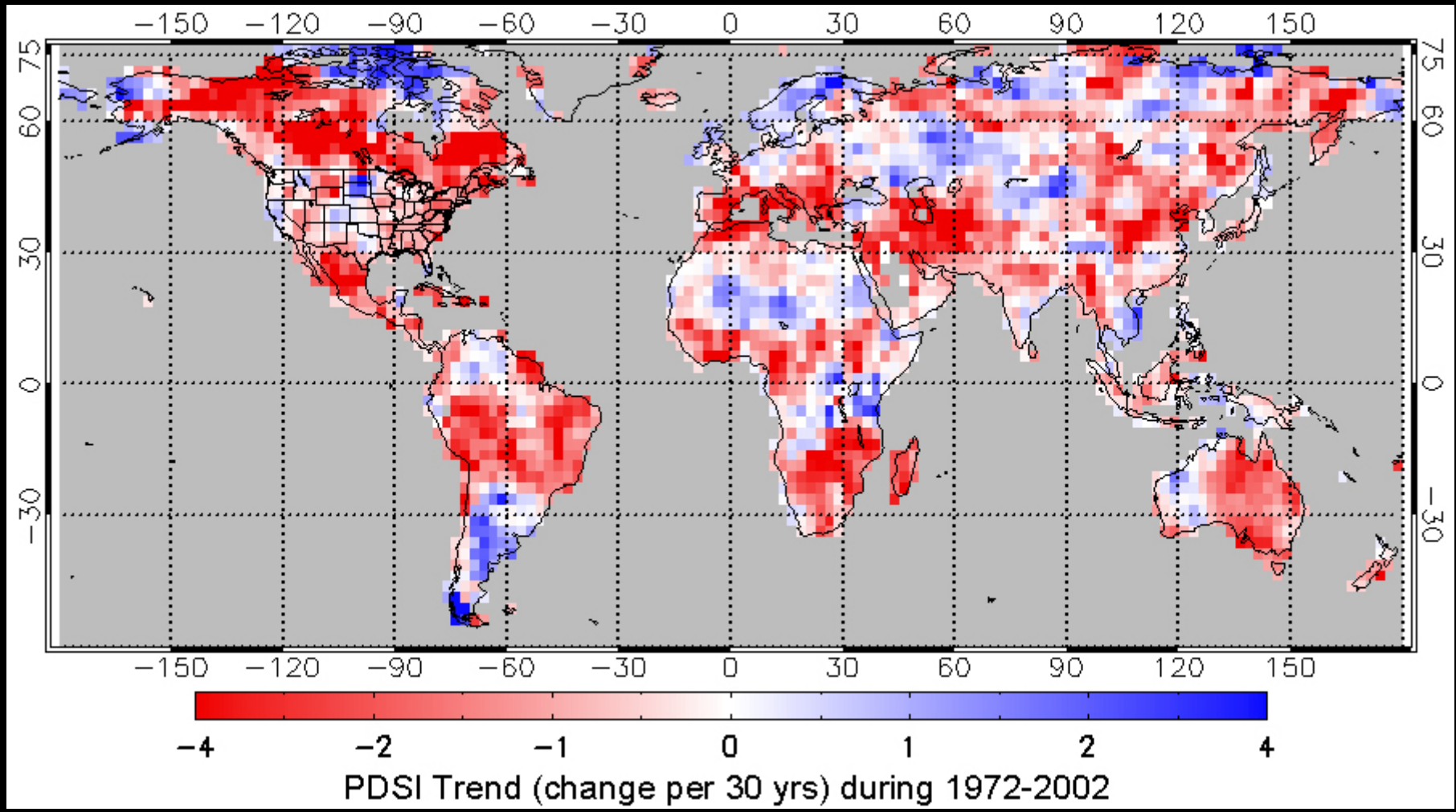
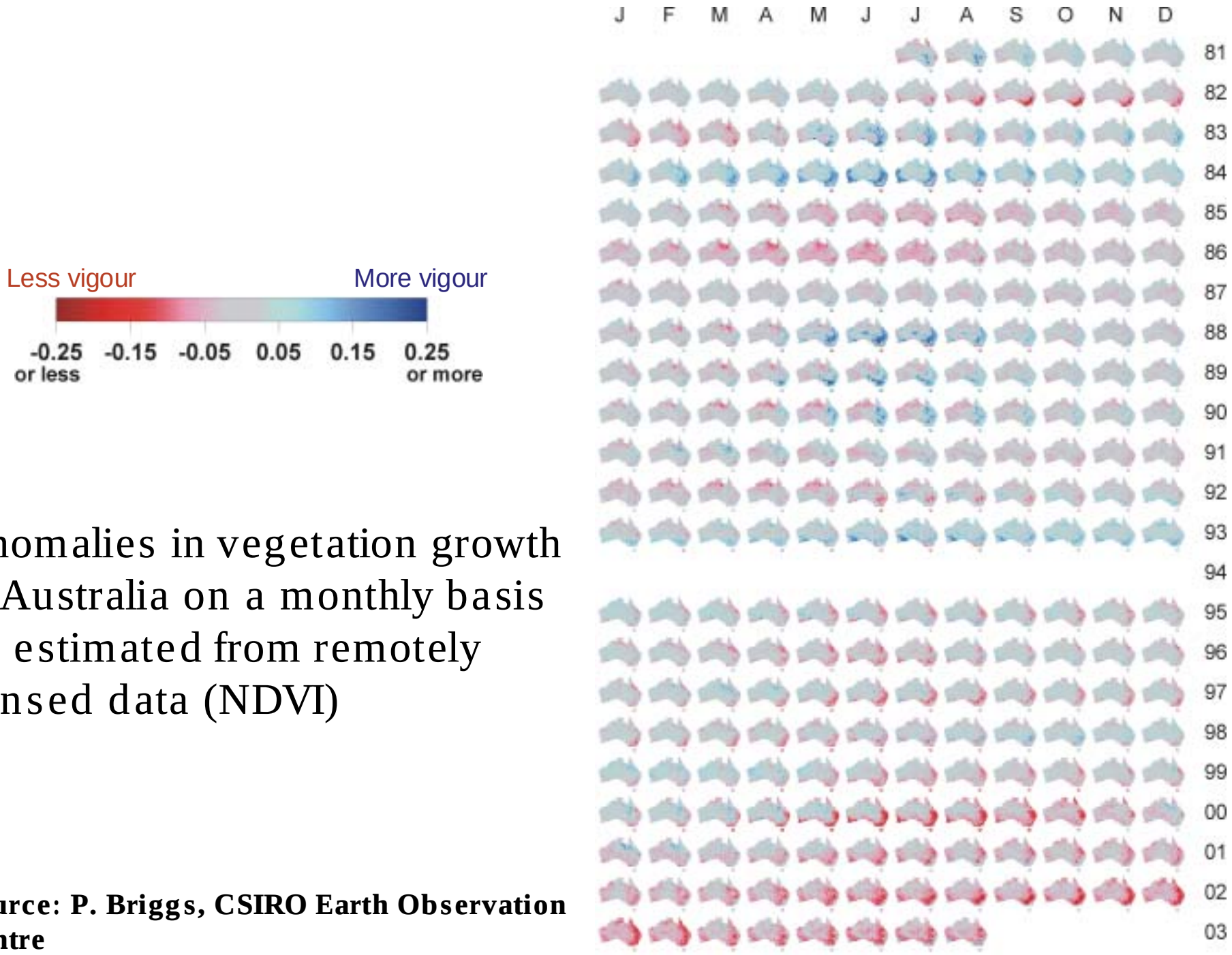
Sea Surface Temperature
1900 - 2005



Global Drying Trends for Last 30 Years



Source: Dai et al. 2004



Anomalies in vegetation growth in Australia on a monthly basis as estimated from remotely sensed data (NDVI)

Source: P. Briggs, CSIRO Earth Observation Centre

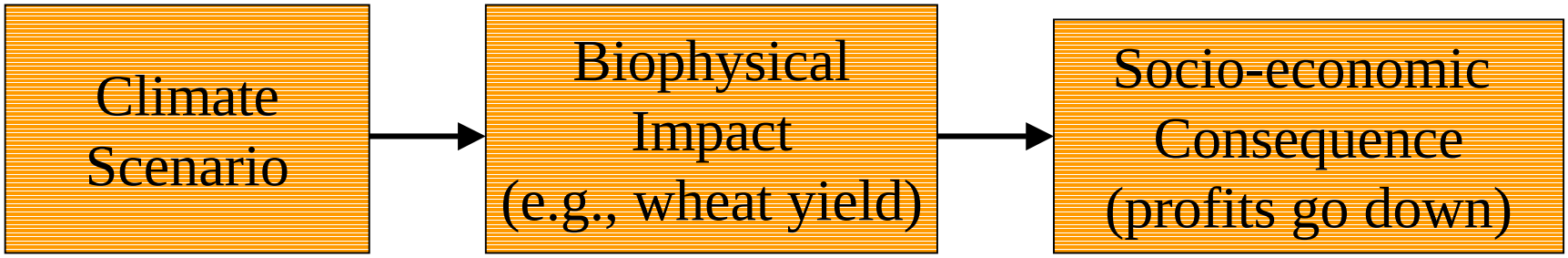
Australian Government
Bureau of Rural Sciences

From Climate Change…….
…….to Australian Agriculture

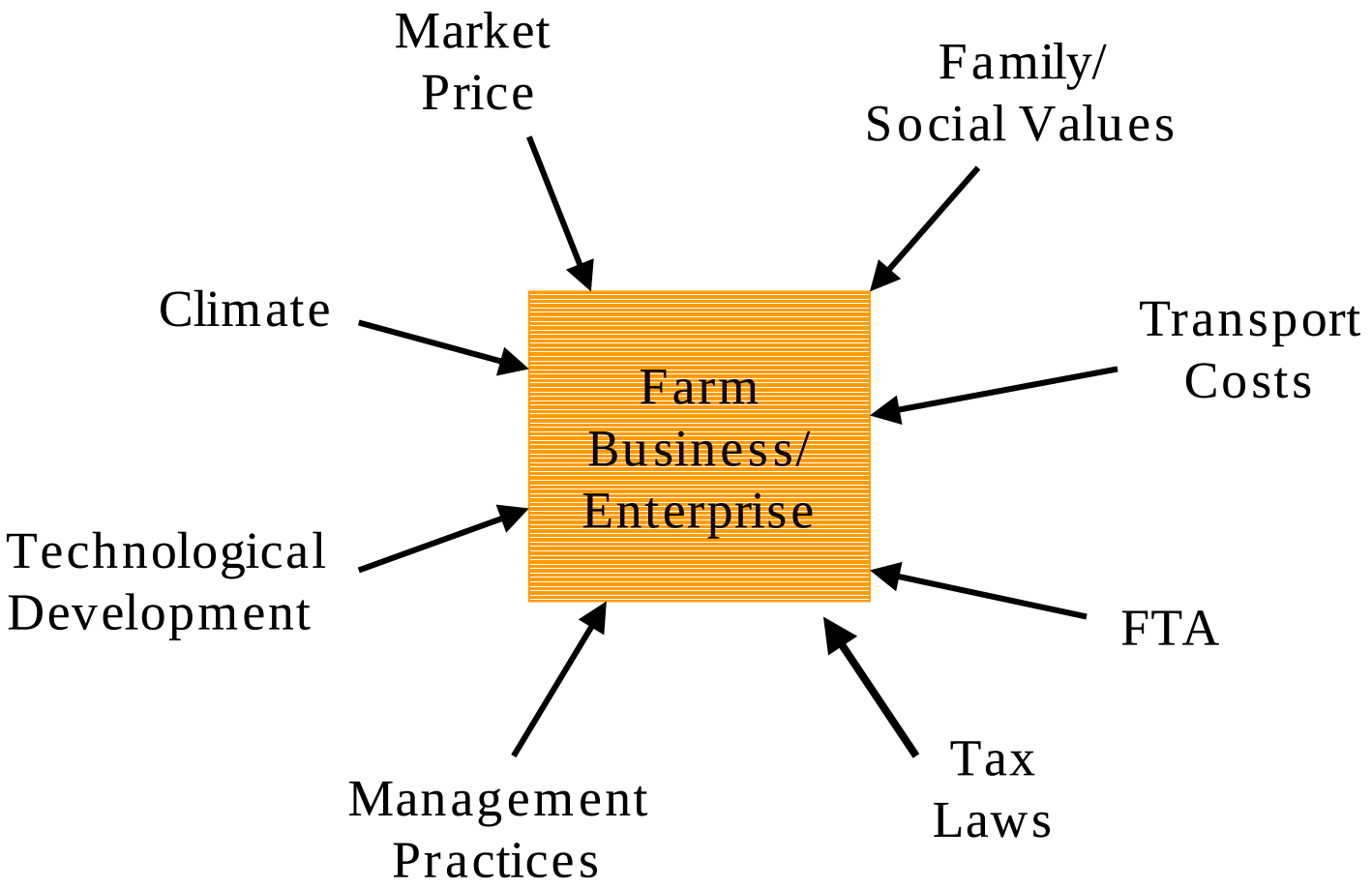
Climate Risk Management:
A New Approach to Adapatation

DEPARTMENT OF AGRICULTURE, FISHERIES AND FORESTRY

’Traditional’ Approach to Climate Impact Studies



Different Approach to Climate Adaptation



Climate Risk and Agriculture: A New Approach

The overall emphasis is on maintaining or enhancing profitability and viabilility under a changing climate.

The approach has several important characteristics:

- based on risk management
- focus on adaptation and resilience (grab the opportunities!)
- farmer/industry-driven rather than science-driven (although science can be very important in a supporting role)
- knowledge-based strategy building on earlier and existing work (cf. MCVP)

Risk Assessment Approach

Climate Impact Sciences Program, BRS
Dr John Sims, Program Leader

1. Establishing criteria for identifying and assessing the risk: Determining the nature of the management challenge

2. Identifying the risk: Industry perspectives on vulnerability and adaptability

3. Analysing the risk: Australia's changing climate

4. Evaluating the risk of climate change from industry: Exploring management options for minimising the risk

5. Treating the risk: Implementation of strategies for maintaining viable agricultural industries

Application of the Approach

1. Consultation with producers, industry and policymakers

2. Tool definition and development
   - Interpretation of climate change science
   - Climate Change Wizard – variability patterns, reliability (Greg Laughlin, BRS)
   - Vulnerability assessment (Jim Walcott, BRS)

3. Feedback from stakeholders

Farming Profitably in a Changing Climate

Canberra Workshop, 7-8 December 2004

Sensitivity to climate: A critical question is: will climate change unfold as gradual change in underlying averages, to which agricultural industries can adapt in many cases, or will it unfold as a series of abrupt or stepped changes that will severely stretch industries' capacity to cope?

Climate and decision-making: Within-season variability remains the most important feature of climate that affects profitability. The ways in which underlying, long-term trends in climate affect within-season variability is the most important feature of climate change for most rural industries.

Managing for a changing climate: The risk management strategy should be based on a holistic approach to climate change, considering changes in temperature, rainfall, humidity, winds, storms, etc. The approach provides a sound framework for identifying, analysing, evaluating and dealing with the challenges and opportunities associated with climate change.

Farming Profitably in a Changing Climate

Canberra Workshop, 7-8 December 2004

Maintaining and increasing profitability: The key to managing profitably under a changing climate is flexibility and adaptability, with industry driving the process.

Government policy and scientific research strategy: The workshop felt strongly that a 'whole-of-Australia' approach is needed to deal effectively with climate change. This requires integration of effort and resources across the producer/industry, government and research sectors, and integration of adaptation and mitigation approaches, whilst maintaining the individuality of climate adaptation strategies for particular industries.

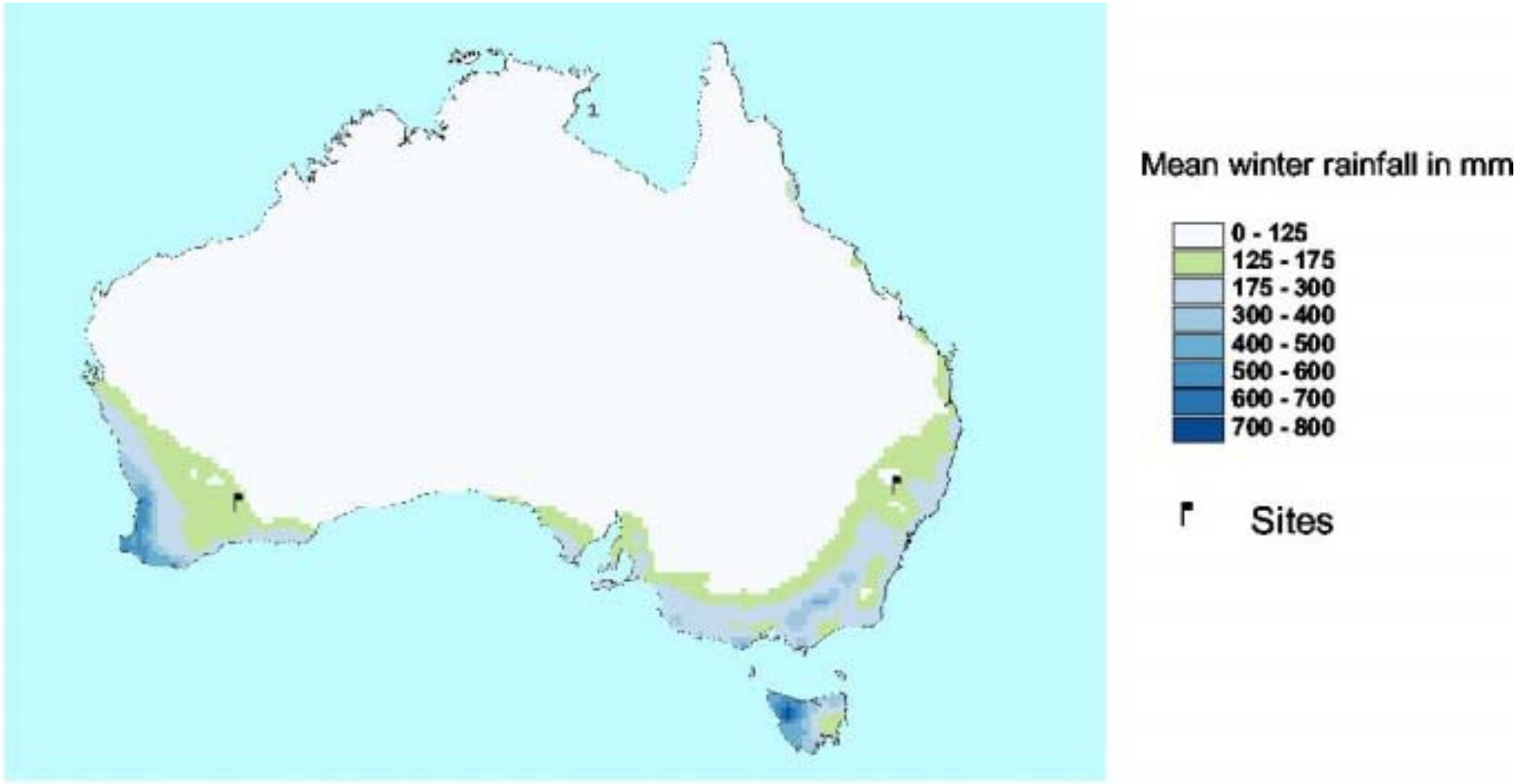
Climate Change?

The Producers' Perspective

For most Australian agricultural industries, within-season variability remains the most important feature of climate that affects profitability. **The ways in which underlying, long-term trends in climate affect within-season variability is the most important feature of climate change for rural industries.**

Source: Farming Profitably in a Changing Climate: Workshop, Canberra, December 2004

Develop a tool to systematically detect and map changes to the metrics producers use every day



Source: G. Laughlin, BRS

Variability v. Reliability?

Producers are more interested in reliability than in means or in variability. But what do they mean by ”reliability”?

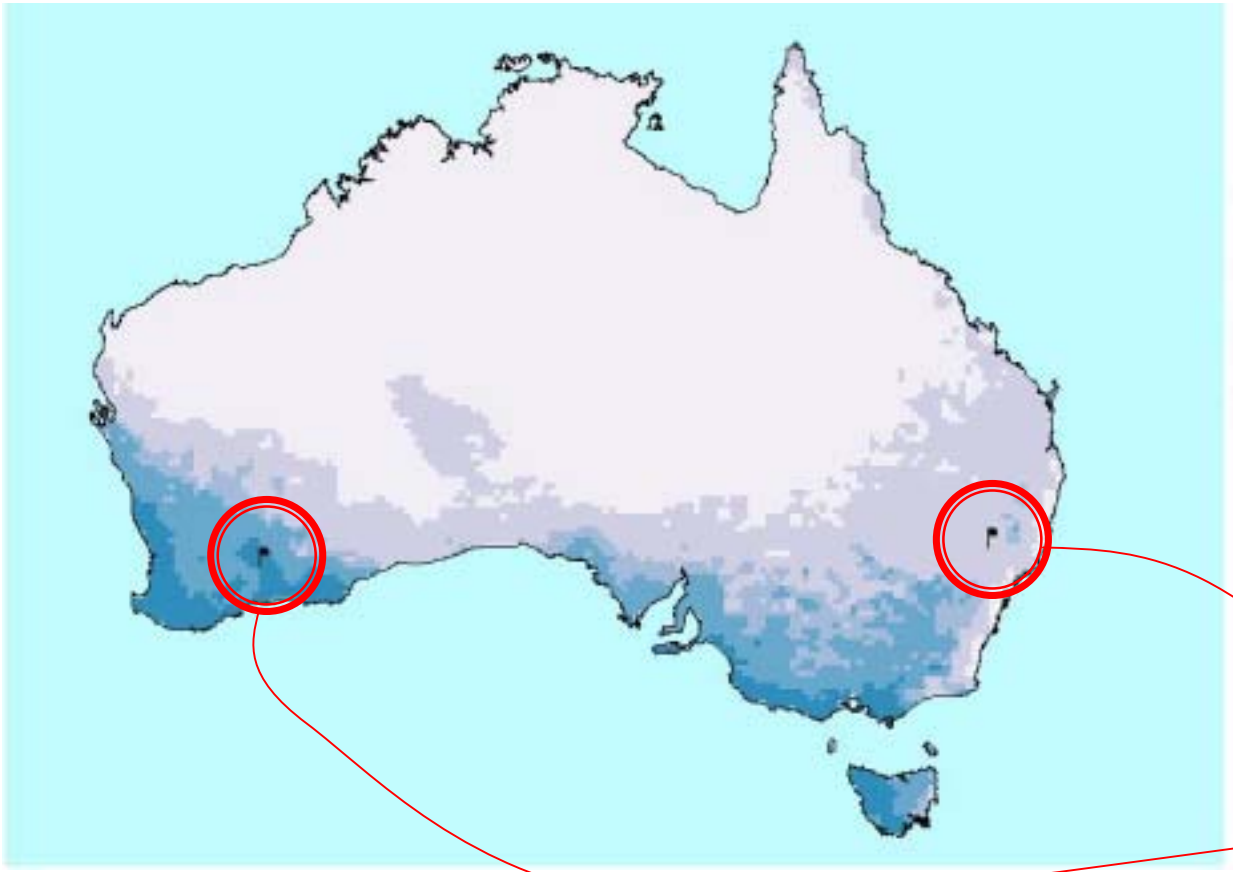
Consider a winter wheat growing season (June, July, August):

Mean rainfall: 125 mm for the winter months

Variability: By how much does that mean vary?
(e.g., 3 SDs gives range from 35 to 185 mm)

Reliability: In how many years out of 10 does at least 25 mm of rain fall in <u>each</u> of June, July and August?

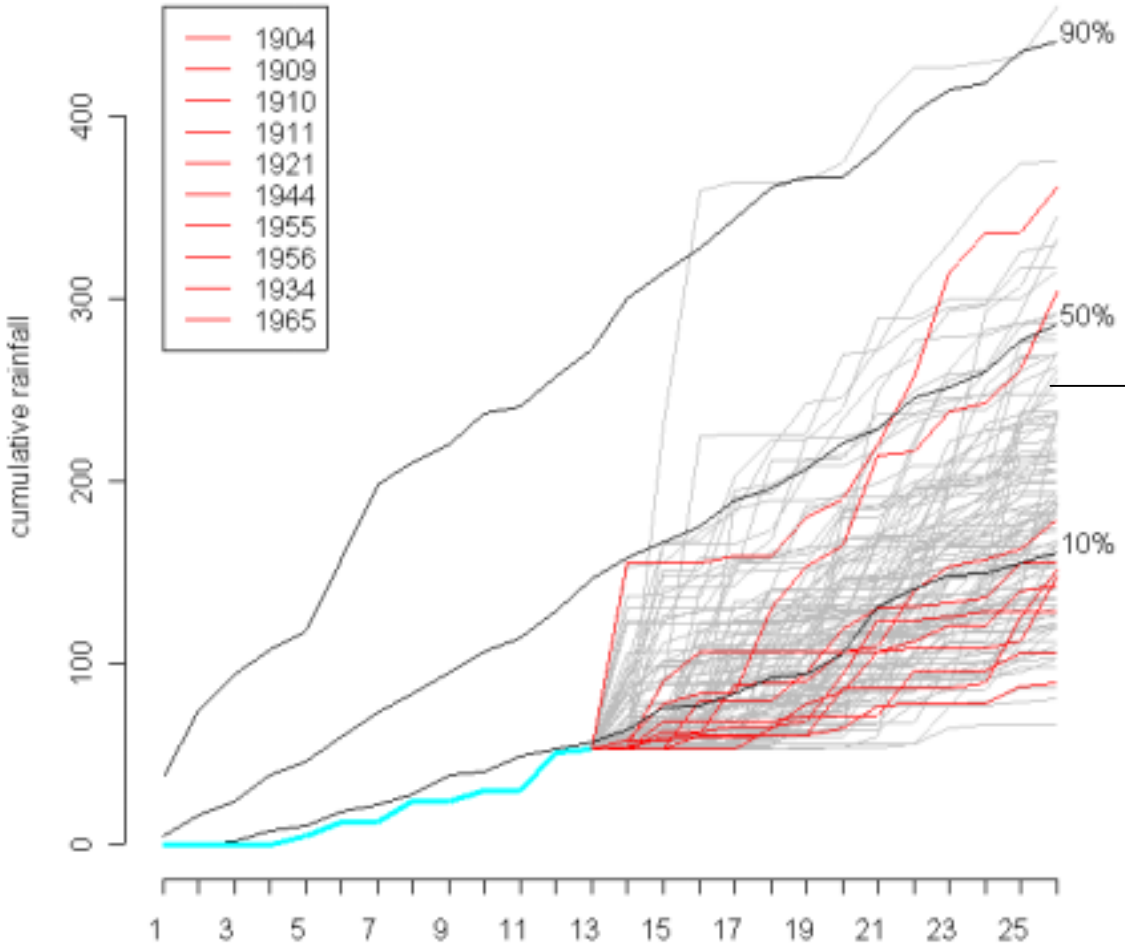
Develop a tool to systematically detect and map changes to the metrics producers use every day



You cannot infer <u>reliability</u> from means or similar parametric stats

Source: G. Laughlin, BRS

Rainfall variability within a growing season



The red and grey lines show the individual years that made up the statistical summaries. Are later years behaving differently, that is, is the pattern of variability changing over the last few decades?

Source: G. Laughlin, BRS

The Climate Change Wizard

Greg Laughlin, BRS

- Producers will set the metrics
- BoM and CRES as partners/using the entire historical record rather than GCMs and ‘risky’ projections (e.g.2050)
- BRS will ensure agriculturally-relevant changes will be mapped and made available
- Not just rainfall…
- …evaporation, temperature, frost, …
- But most important: **climate change will be mapped (linked) to the key drivers of agriculture and in a ‘language’ producers use**

Vulnerability Assessment

Work about to begin on a pilot project

Primary audience is policy (i.e., Department of Agriculture, Fisheries and Forestry

ATEAM methodology will be adopted (vulnerability is a function of exposure, sensitivity and adaptive capacity)

Estimating the adaptive capacity of agricultural sectors and rural regions is the most challenging aspect of the project

Output will be vulnerability maps

Conclusions

Climate change is real, and in the coming decades Australian farmers will likely experience climatic patterns and extremes beyond previous experience.

Climate change will present both threats and opportunities; those with improved knowledge of changing climate will be in the best position to benefit.

A risk management approach is the most robust strategy to deal with uncertain but potentially significant change. Industry must drive the strategy, but science and government can play strong supporting roles.