



Climate projections for key wine growing regions in 2030 and beyond

www.csiro.au

Penny Whetton

Acknowledgments: Leanne Webb and Jonas Bhend (and many others)
Vintage 2030 and Beyond, Melbourne, 19 June 2013



Svante Arrhenius (1859-1927)



Predicted that doubling CO₂ would lead to 5-6 degree warming

THE
LONDON, EDINBURGH, AND DUBLIN
PHILOSOPHICAL MAGAZINE
AND
JOURNAL OF SCIENCE.

[FIFTH SERIES.]

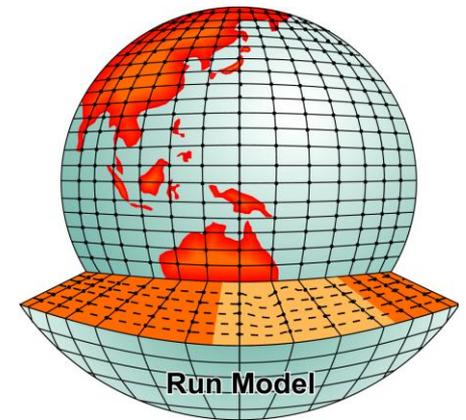
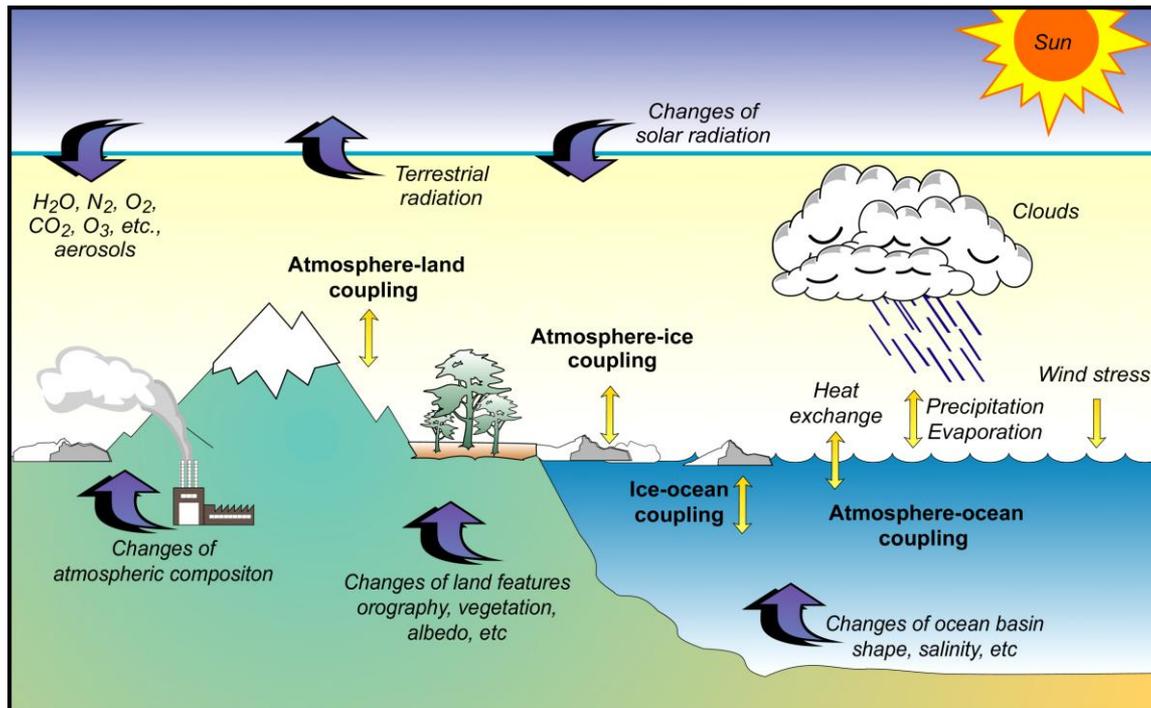
APRIL 1896.

XXXI. *On the Influence of Carbonic Acid in the Air upon the Temperature of the Ground.* By Prof. SVANTE ARRHENIUS*.

I. *Introduction: Observations of Langley on Atmospherical Absorption.*

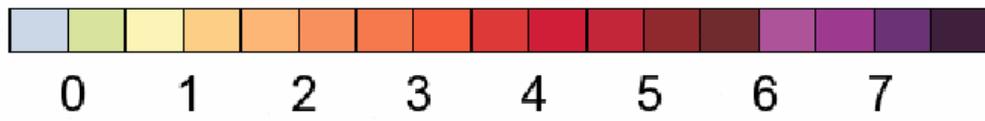
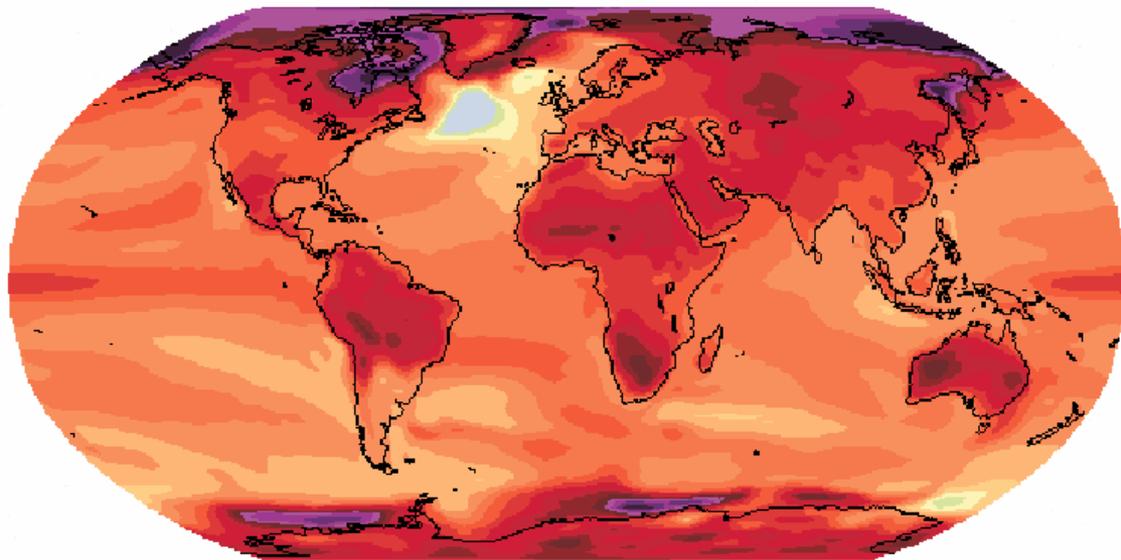
A GREAT deal has been written on the influence of the absorption of the atmosphere upon the climate. Tyndall † in particular has pointed out the enormous importance of this question. To him it was chiefly the diurnal and annual variations of the temperature that were lessened by this circumstance. Another side of the question, that has long attracted the attention of physicists, is this: Is the mean temperature of the ground in any way influenced by the presence of heat-absorbing gases in the atmosphere? Fourier ‡ maintained that the atmosphere acts like the glass of a hot-house, because it lets through the light rays of the sun but retains the dark rays from the ground. This idea was elaborated by Pouillet §; and Langley was by some of his researches led to the view, that "the temperature of the earth under direct sunshine, even though our atmosphere were present as now, would probably fall to -200° C., if that atmosphere did not possess the quality of selective

Climate Modelling



Global warming - future projections

2100



Temperature Change (°C)

Global warming by 2100:

450 ppm:
0.8 – 2.1 ° C

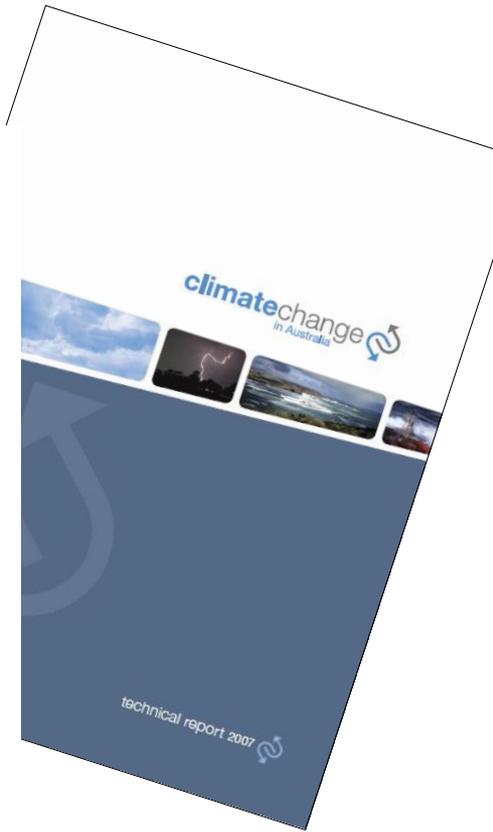
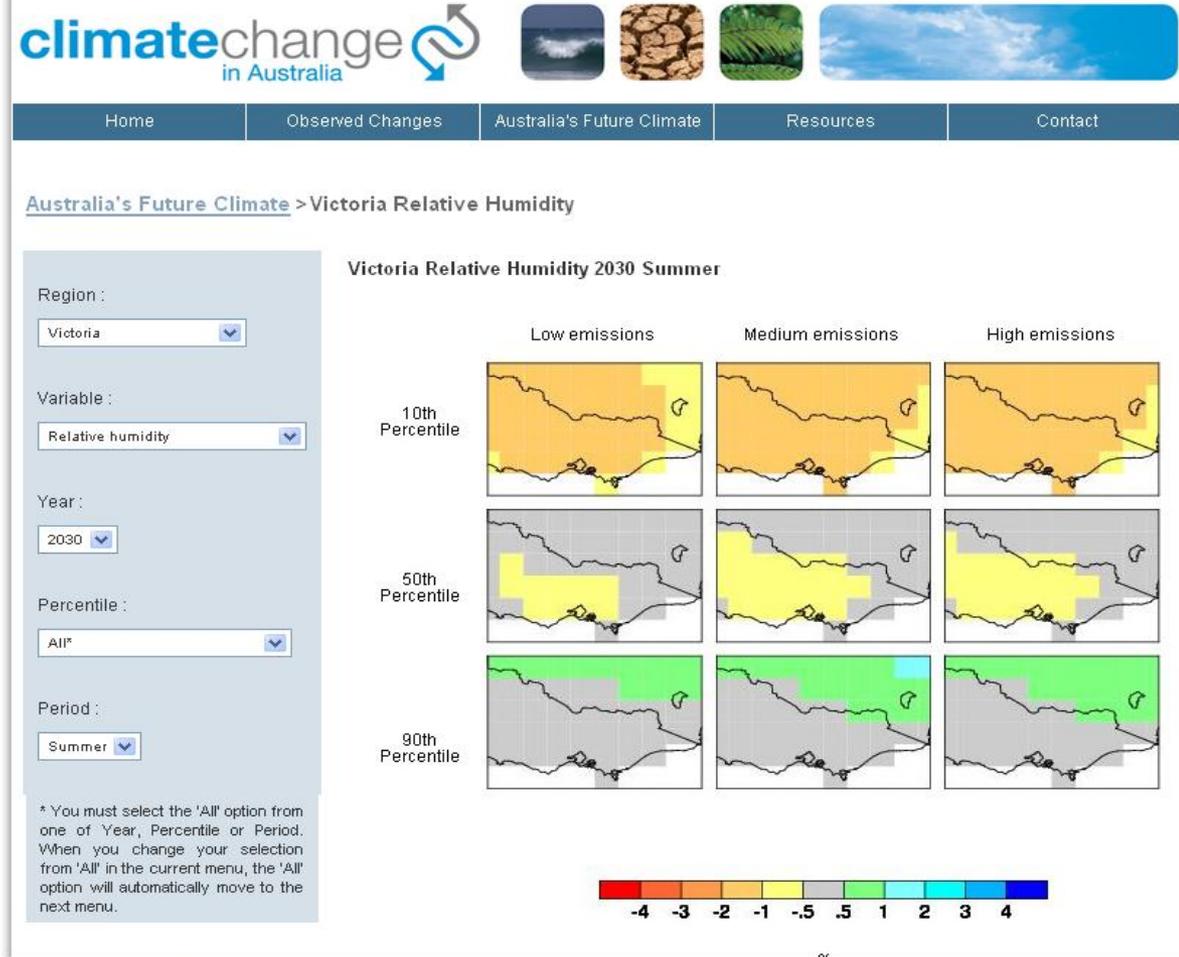
550 ppm:
1.1 – 2.7 ° C

No mitigation:
2.4 – 6.4 ° C

CSIRO Mark 3.5 climate model
700 ppm emission scenario
Change relative to 1980-1999 average



CSIRO and BoM climate projections in 2007



New projections in 2014

- New climate model simulations
- Focus on serving the needs of natural resource management
- DIICCSTRE- funded
- Mid 2014



CLIMATE CHANGE PROJECTIONS
FOR AUSTRALIA'S NATURAL RESOURCE MANAGEMENT REGIONS

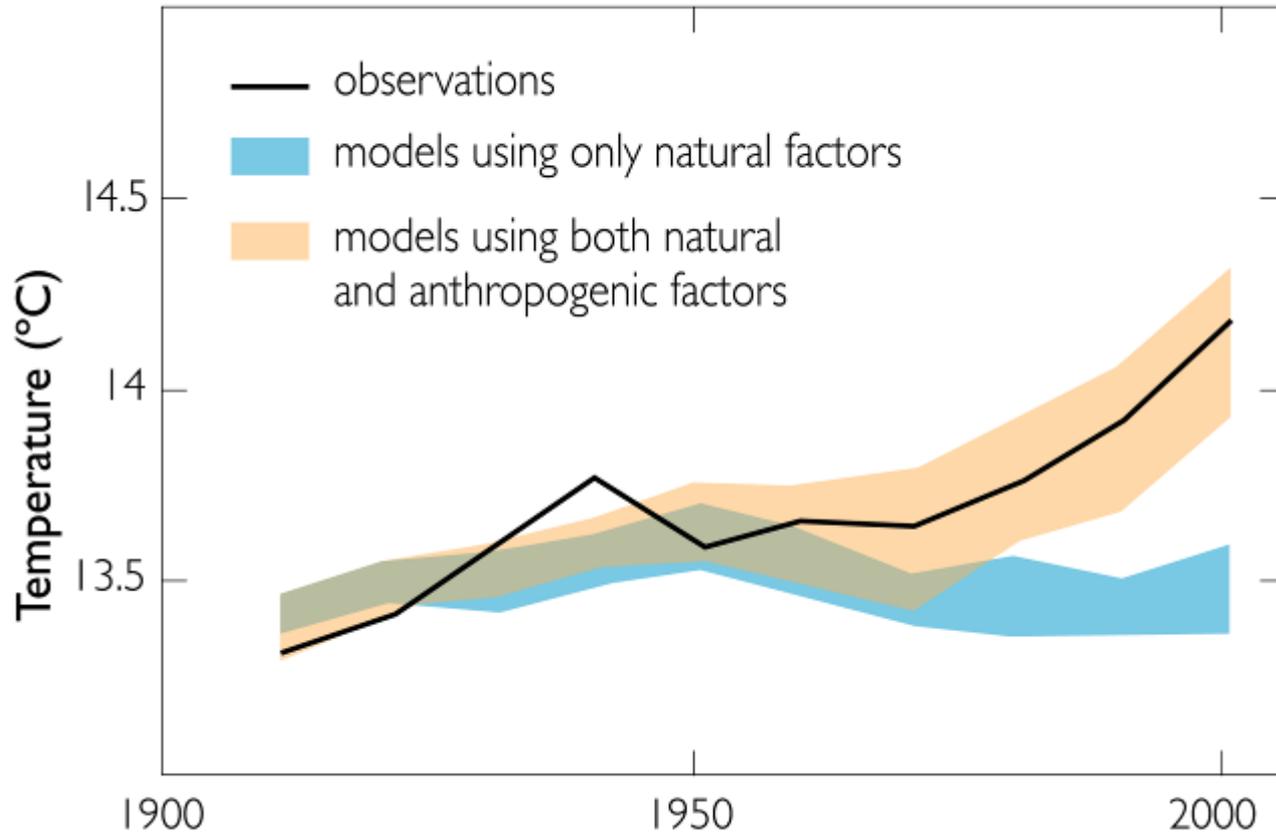


Australian Government
Bureau of Meteorology

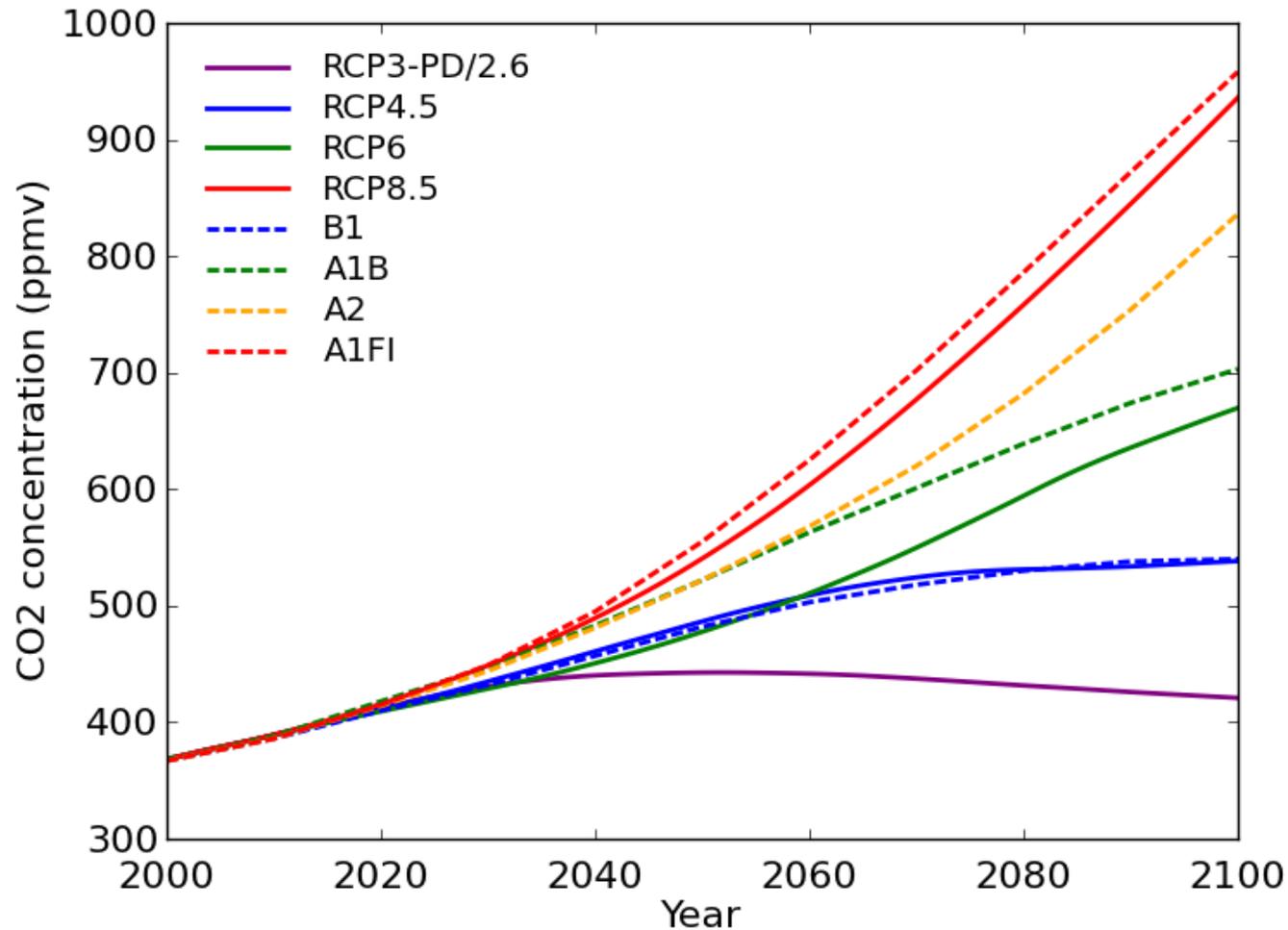


An Australian Government Initiative

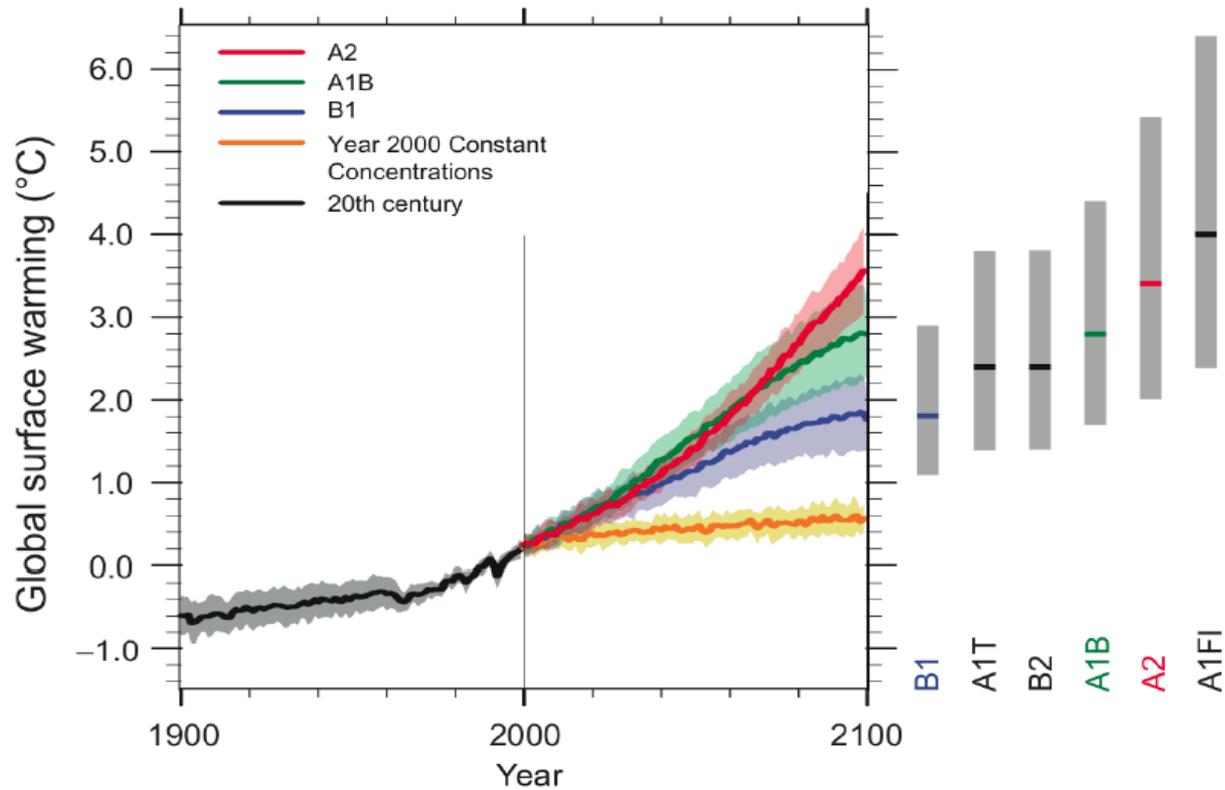
Causes of observed warming



Different greenhouse gas emission scenarios

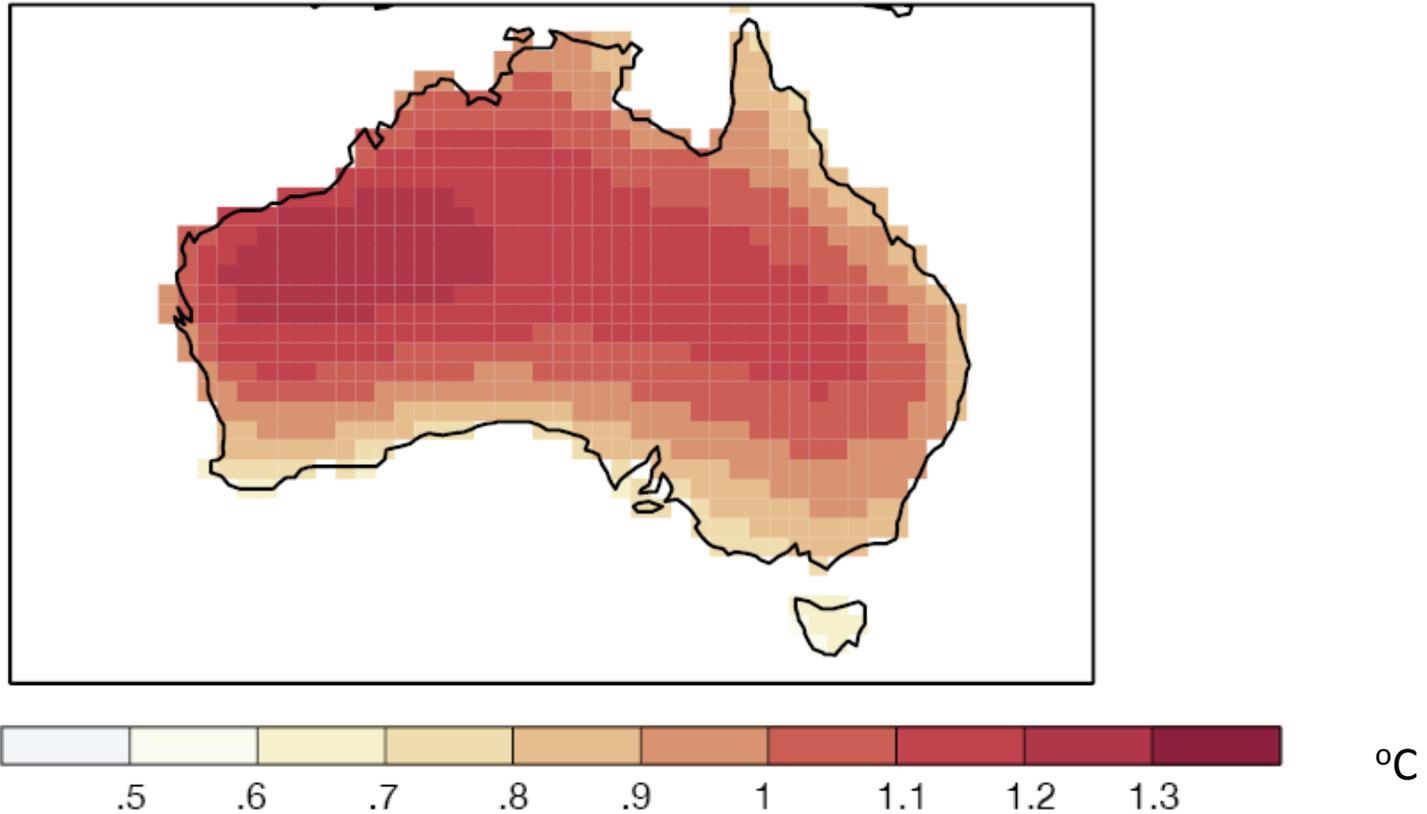


Global warming Projections – IPCC (2007)



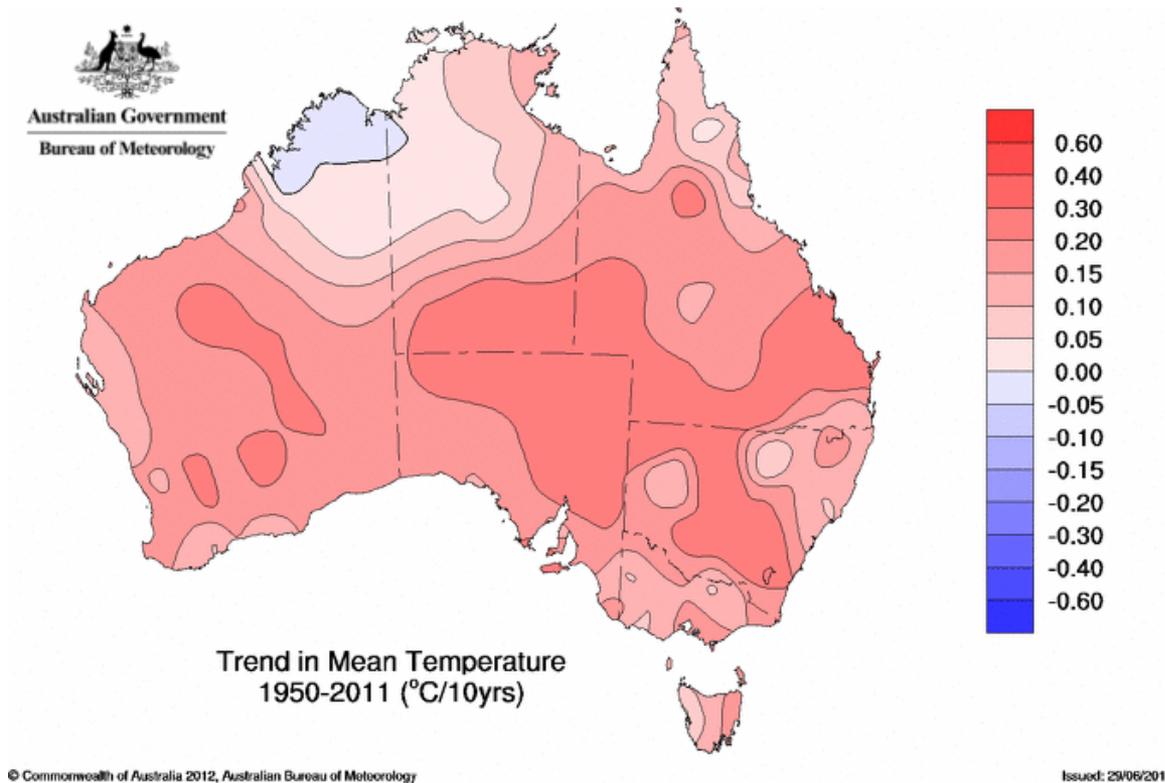
Warming of 0.1 to 0.7° C is projected by 2020, rising to 1.1 to 6.4° C by 2100

Australian warming in 2030



Median warming in 2030, relative to 1990, for medium emissions

Australia's climate has changed



Temperature: greatest warming in eastern and central Australia, with more extremely hot days and fewer frosts

More hot days, fewer frosts

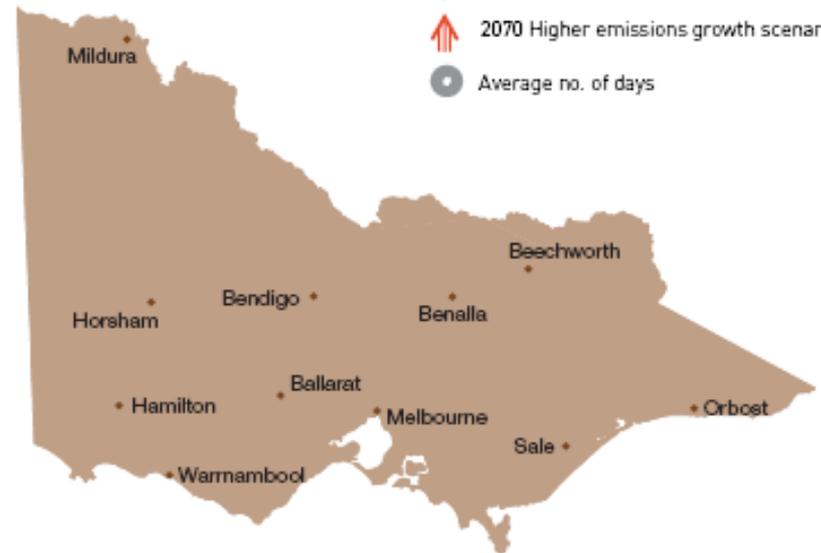
Annual average number of days over 35°C



Annual average number of days below 2°C



- Current
- ↑ 2030 Medium emissions growth scenario
- ↑ 2070 Lower emissions growth scenario
- ↑ 2070 Higher emissions growth scenario
- Average no. of days



The current method may over-estimate the reduction in frosts

Projected warming for southern areas of Australia relative to recent decades

2030 (mid emissions) **0.6 - 1.5 °C**

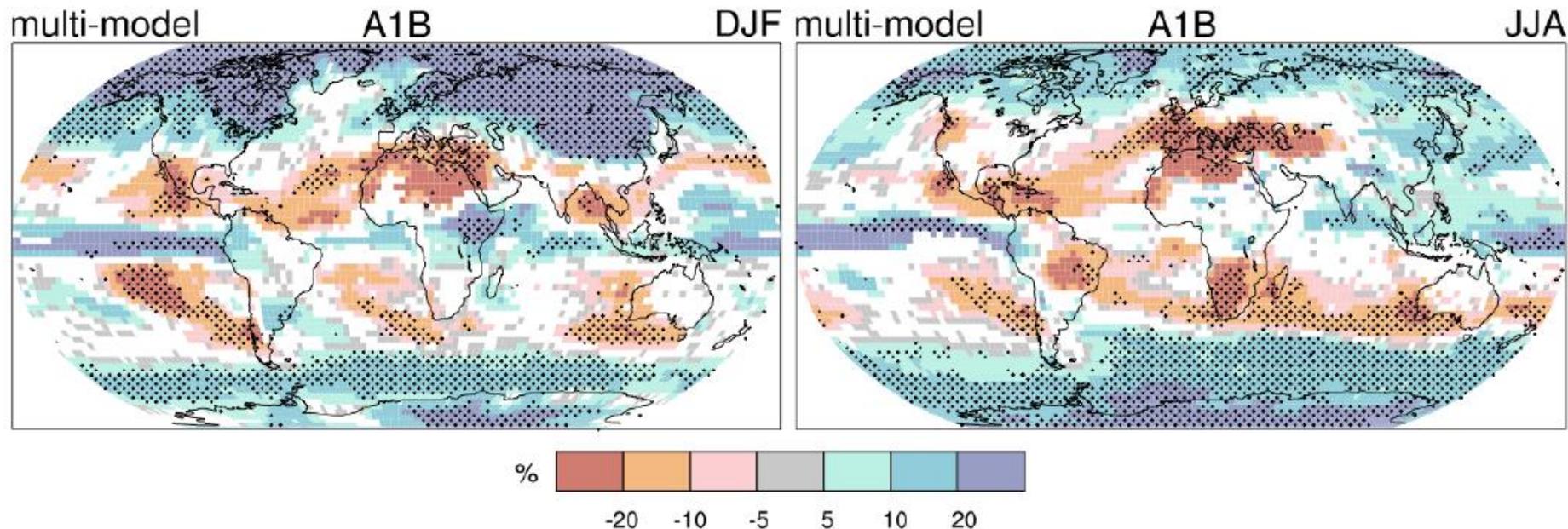
2070 (low emissions) **1 – 2.5 °C**

2070 (high emissions) **2 - 5°C**

A little less in coastal areas and in winter



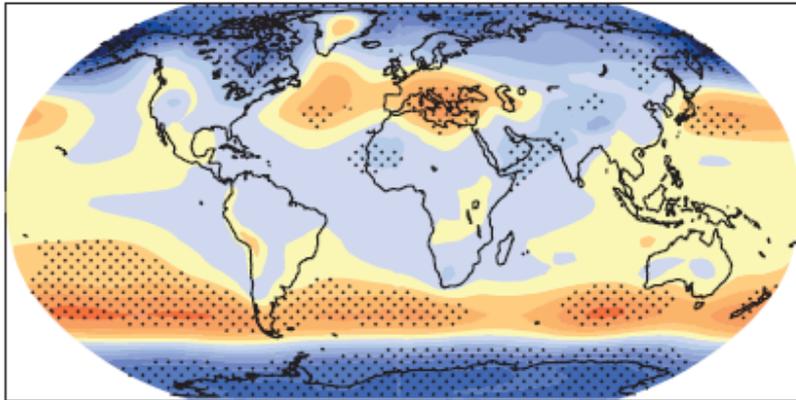
Global rainfall change: consensus of CMIP3 models



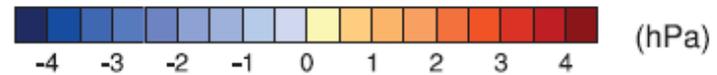
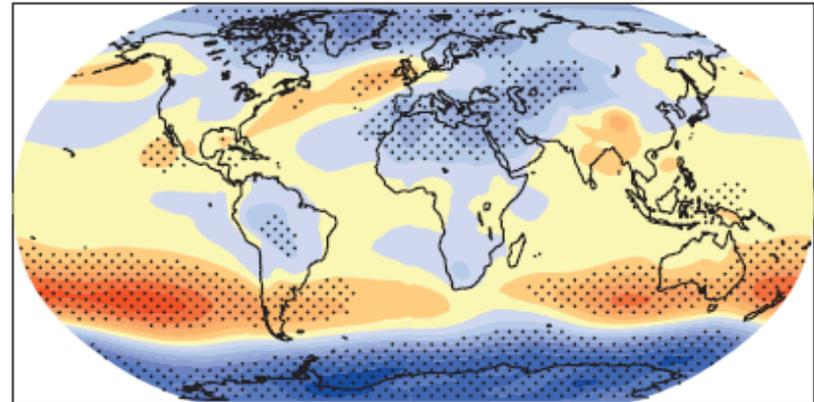
- Precipitation increase in $\geq 90\%$ of simulations
- Precipitation increase in $\geq 66\%$ of simulations
- Precipitation decrease in $\geq 66\%$ of simulations
- Precipitation decrease in $\geq 90\%$ of simulations

Stronger high pressure belt in the southern hemisphere

SL Pressure A1B: 2080-2099 DJF

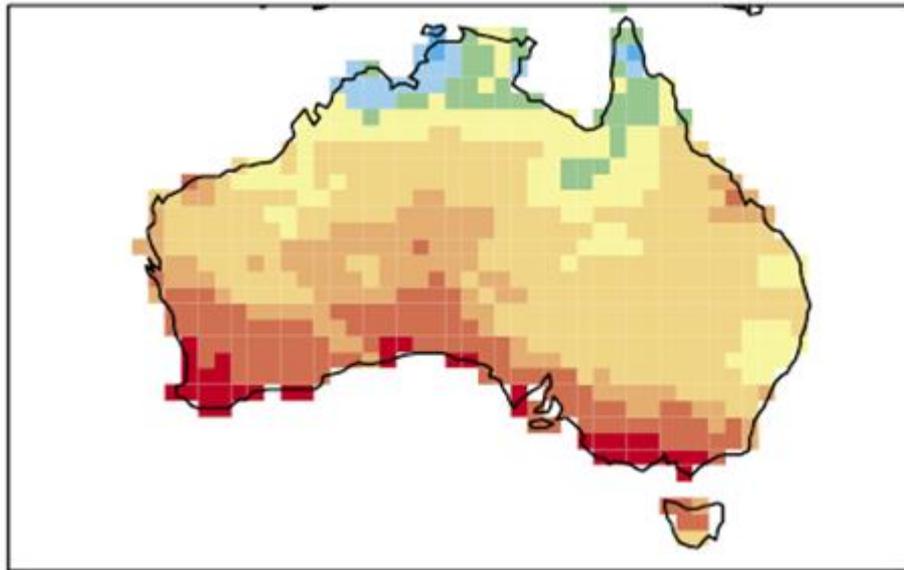


SL Pressure A1B: 2080-2099 JJA



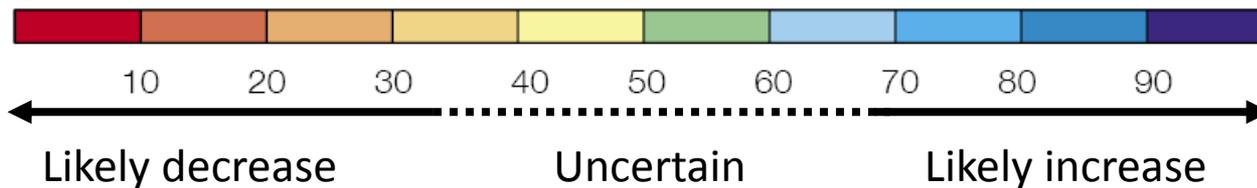
Is rainfall going to increase or decrease?

Percent of model distribution showing annual precipitation increase



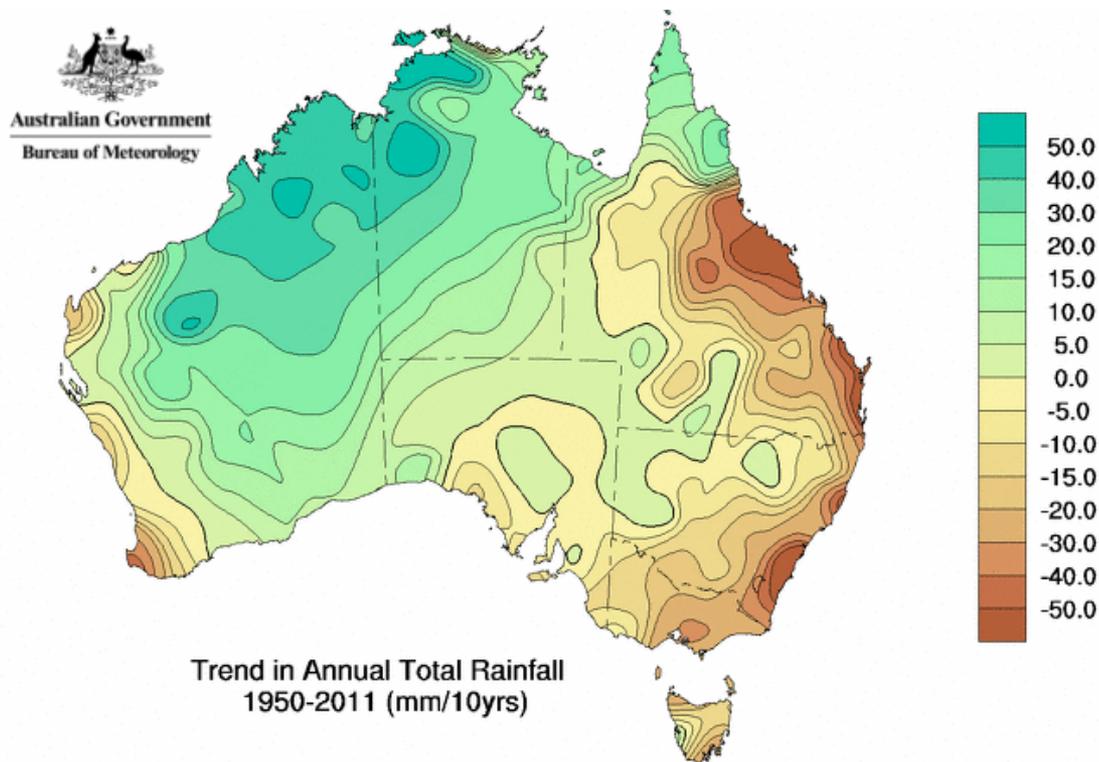
Likely decrease in
the south

No areas of likely
increase



Observed changes: past 60 years

More rain in north-western Australia, less rain in southern and eastern Australia



Summary for annual rainfall change (%)

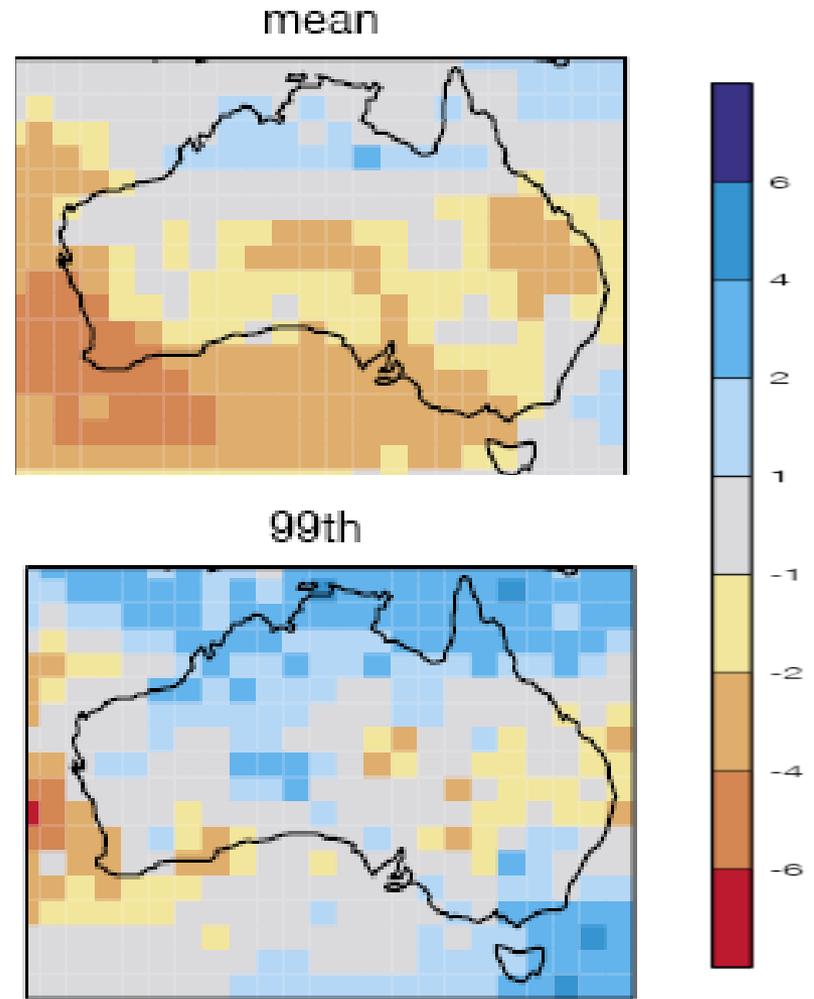
	2030	2070 low	2070 high
Eastern Australia	-10 to +5	-15 to +5	-30 to +10
Southern Australia	-10 to 0	-15 to 0	-25 to +5

- Decreases strongest in winter-spring
- Any increases are most possible in the north and east in summer and autumn
- Local changes may vary significantly

Changes to extreme rainfall



- Tendency for the heaviest falls to become more intense
- Strong effect in some models, absent in a few
- Increases risk of flooding
- *EA is revising the Australian Rainfall and Runoff Handbook*



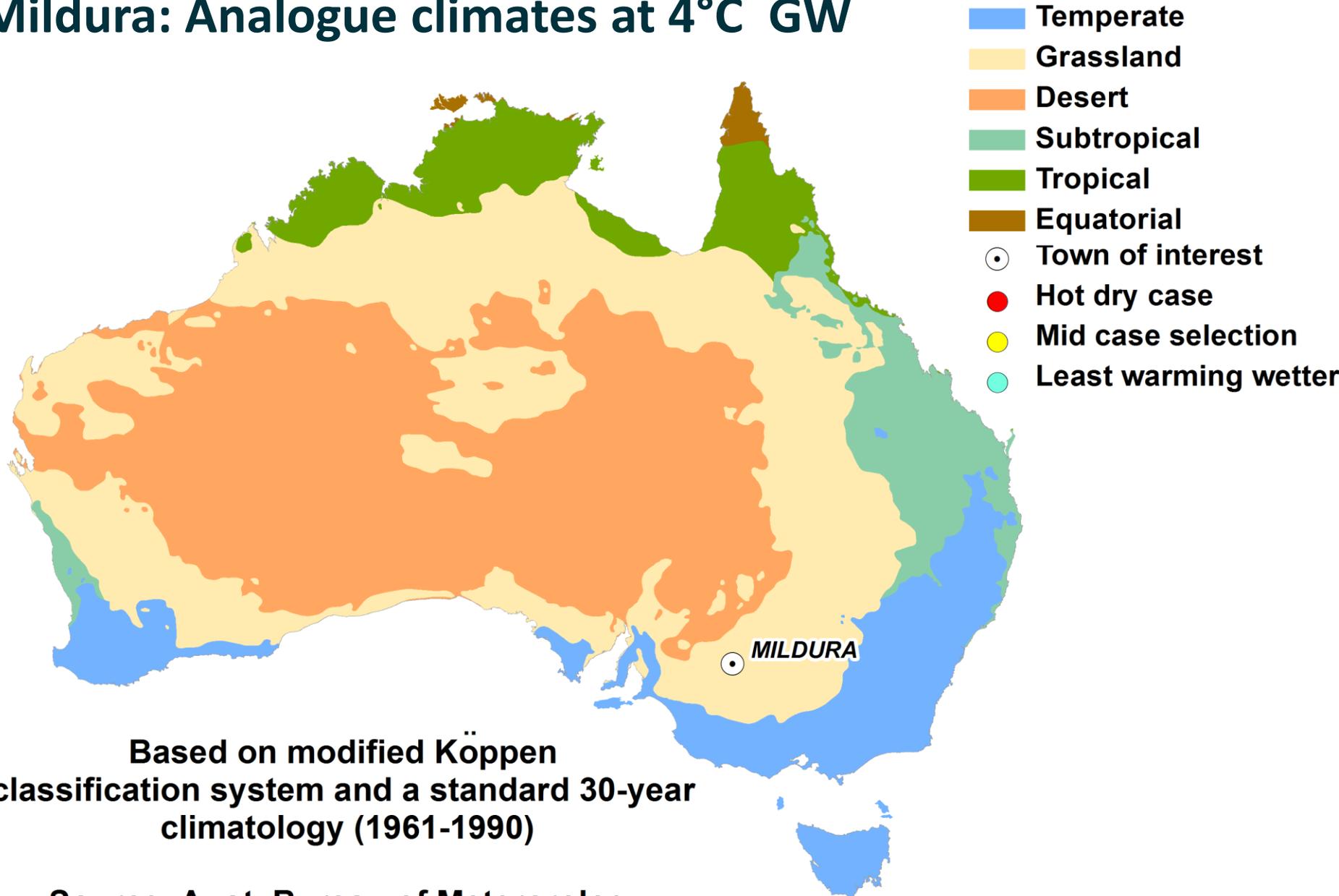
Analogues for future regional climate

What could the climate of some wine-growing regions become with four degrees of global warming?

Three cases were considered

- *Least hot and wettest (of the model results at four degrees)*
- *Mid case*
- *Hottest and driest*

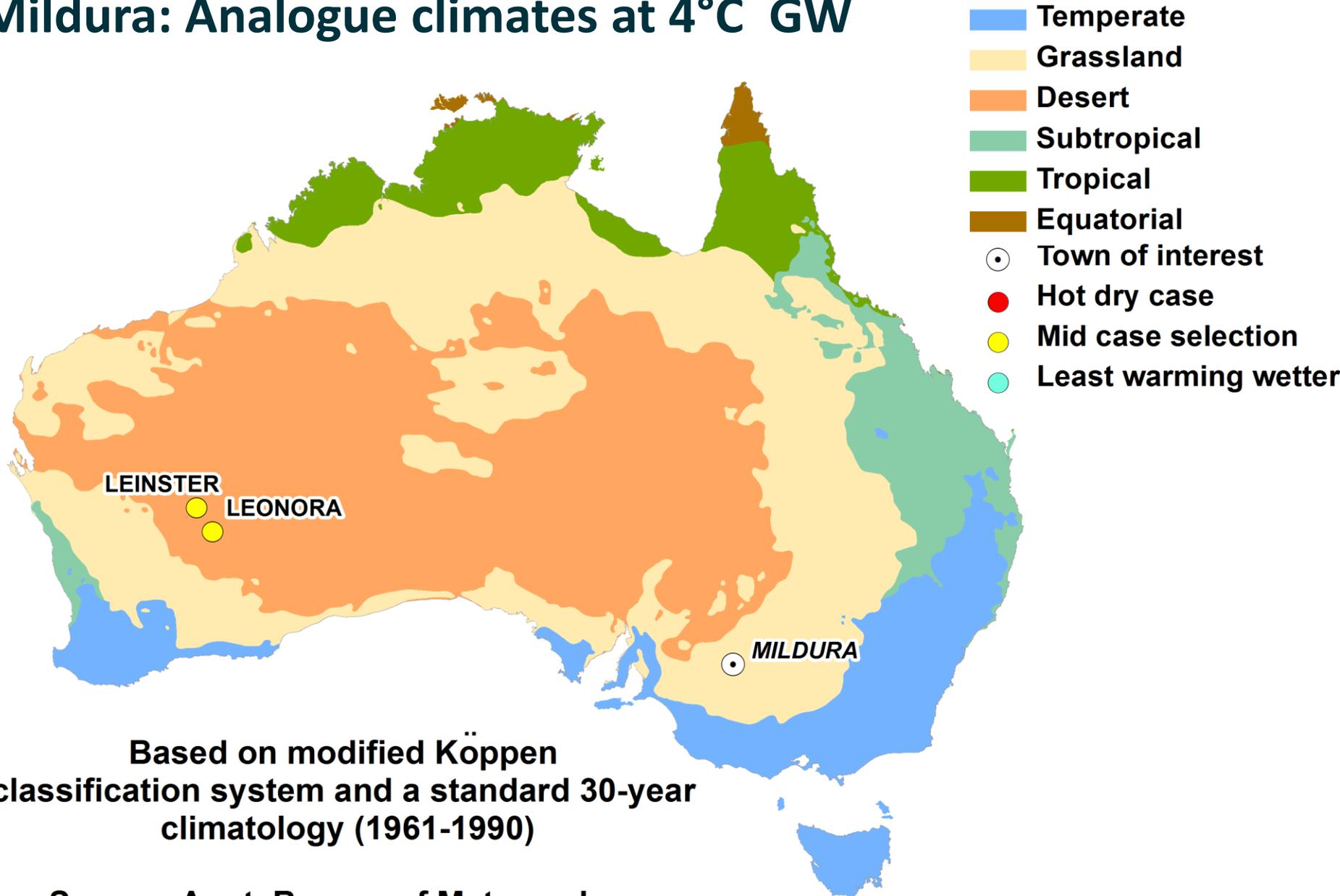
Mildura: Analogue climates at 4°C GW



Based on modified Köppen
classification system and a standard 30-year
climatology (1961-1990)

Source: Aust. Bureau of Meteorology

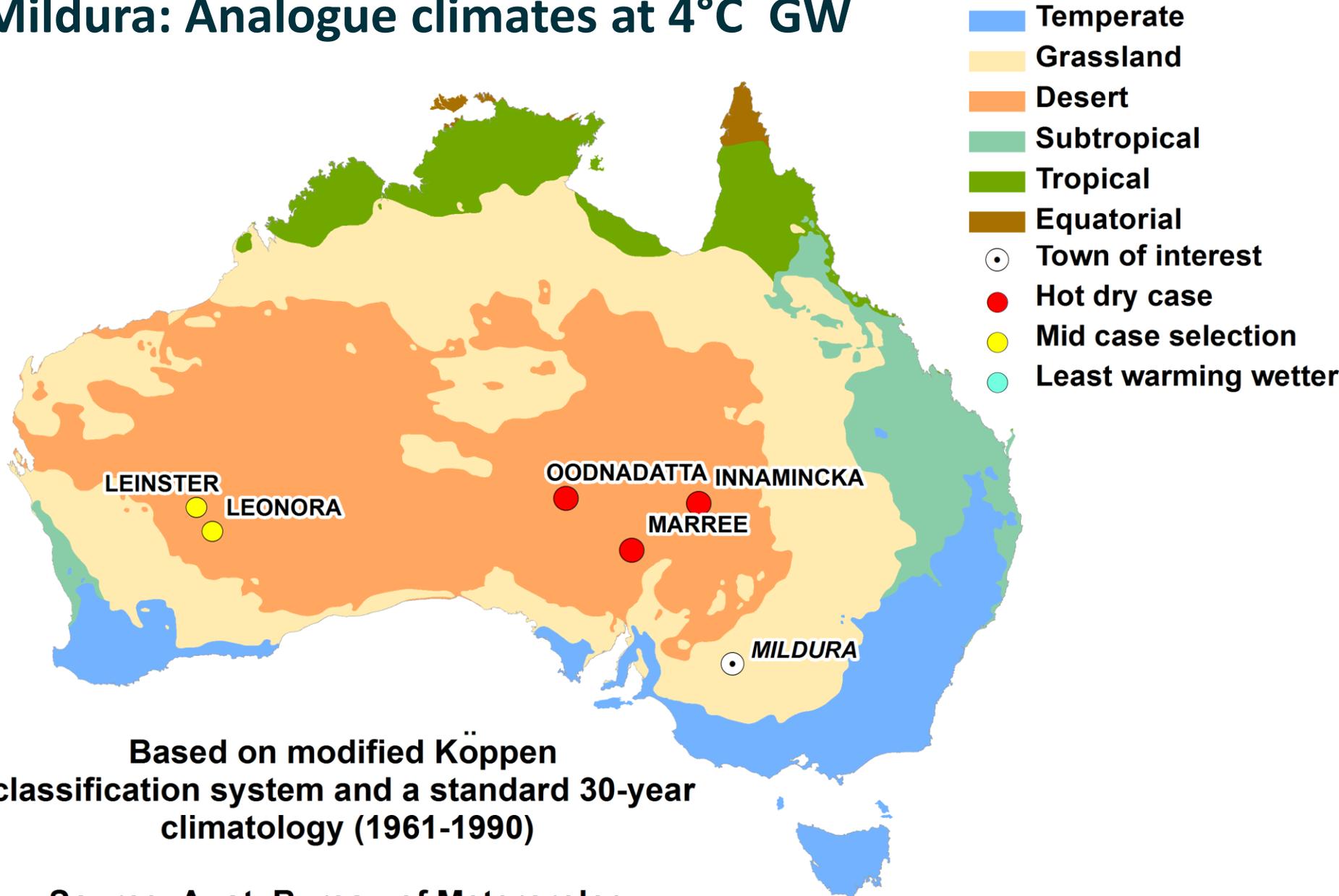
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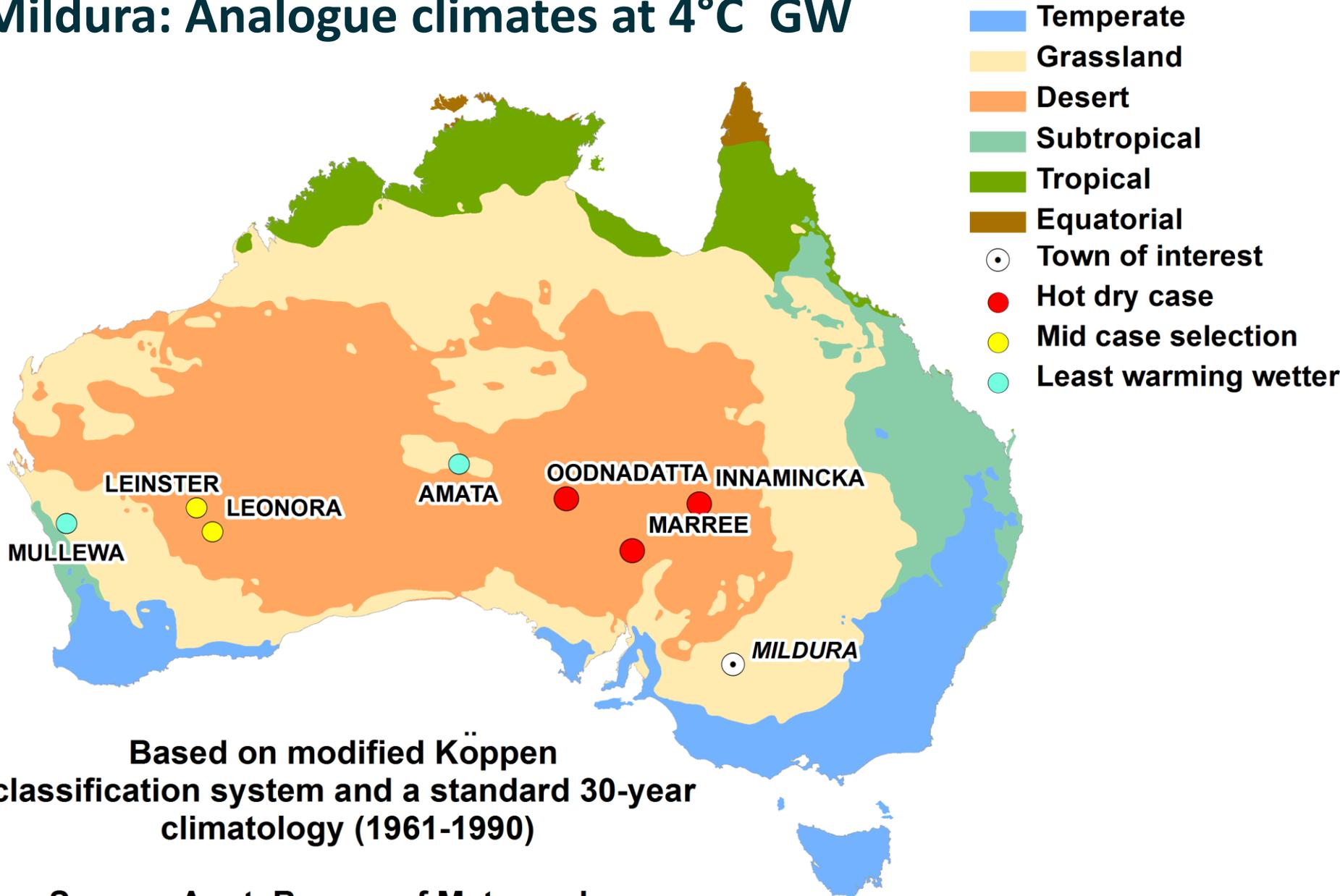
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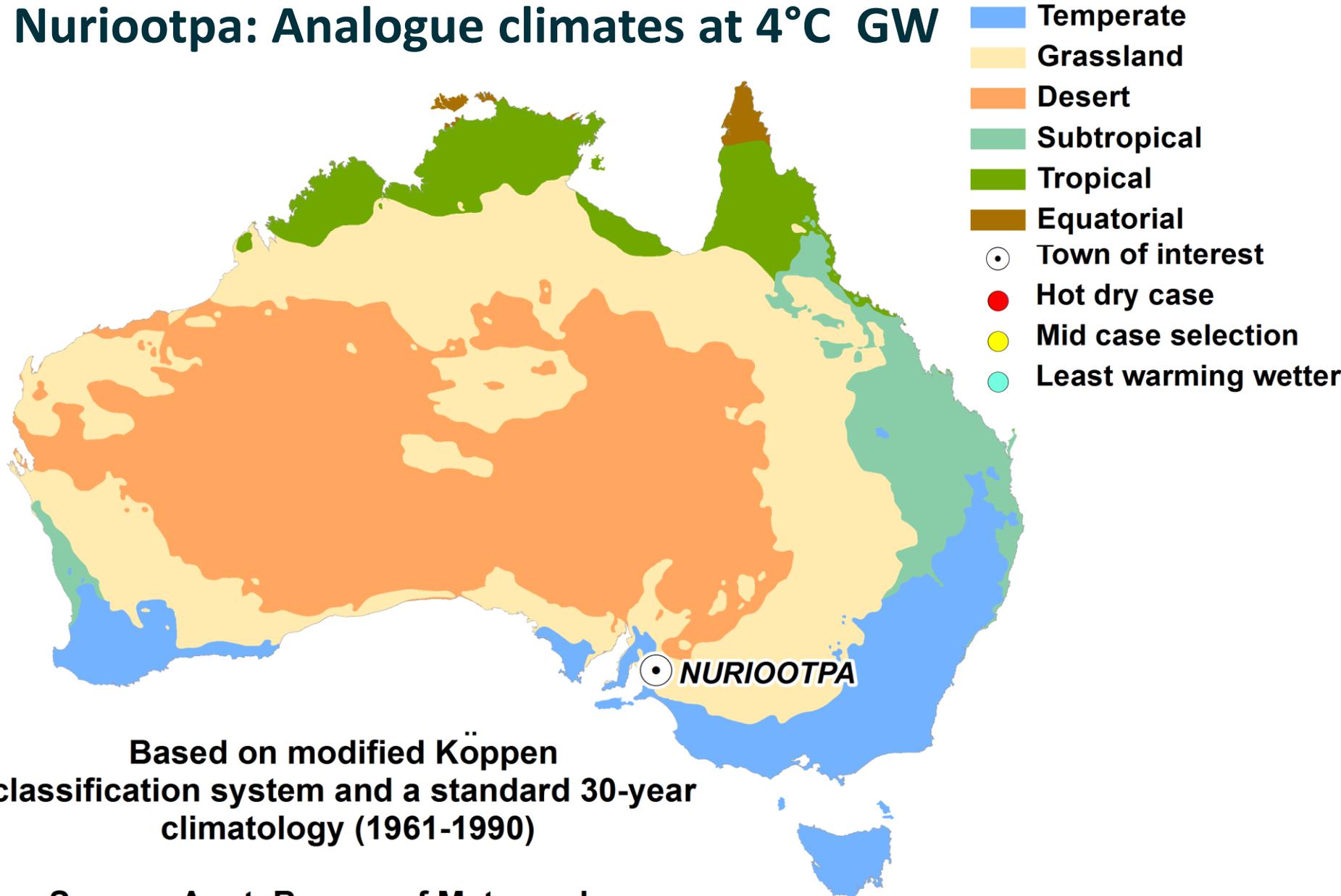
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Nuriootpa: Analogue climates at 4°C GW

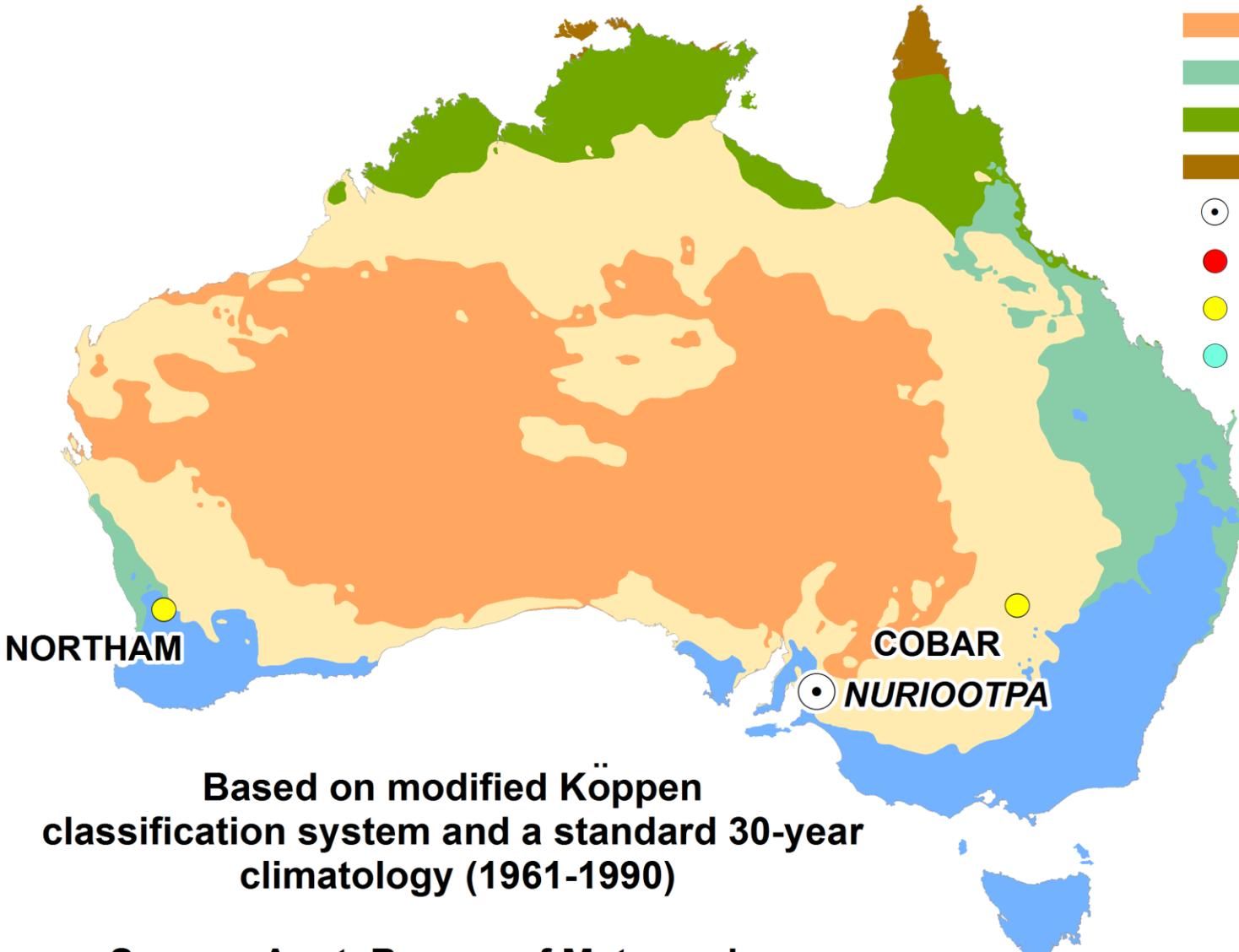


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Nuriootpa: Analogue climates at 4°C GW

- Temperate
- Grassland
- Desert
- Subtropical
- Tropical
- Equatorial
- Town of interest
- Hot dry case
- Mid case selection
- Least warming wetter

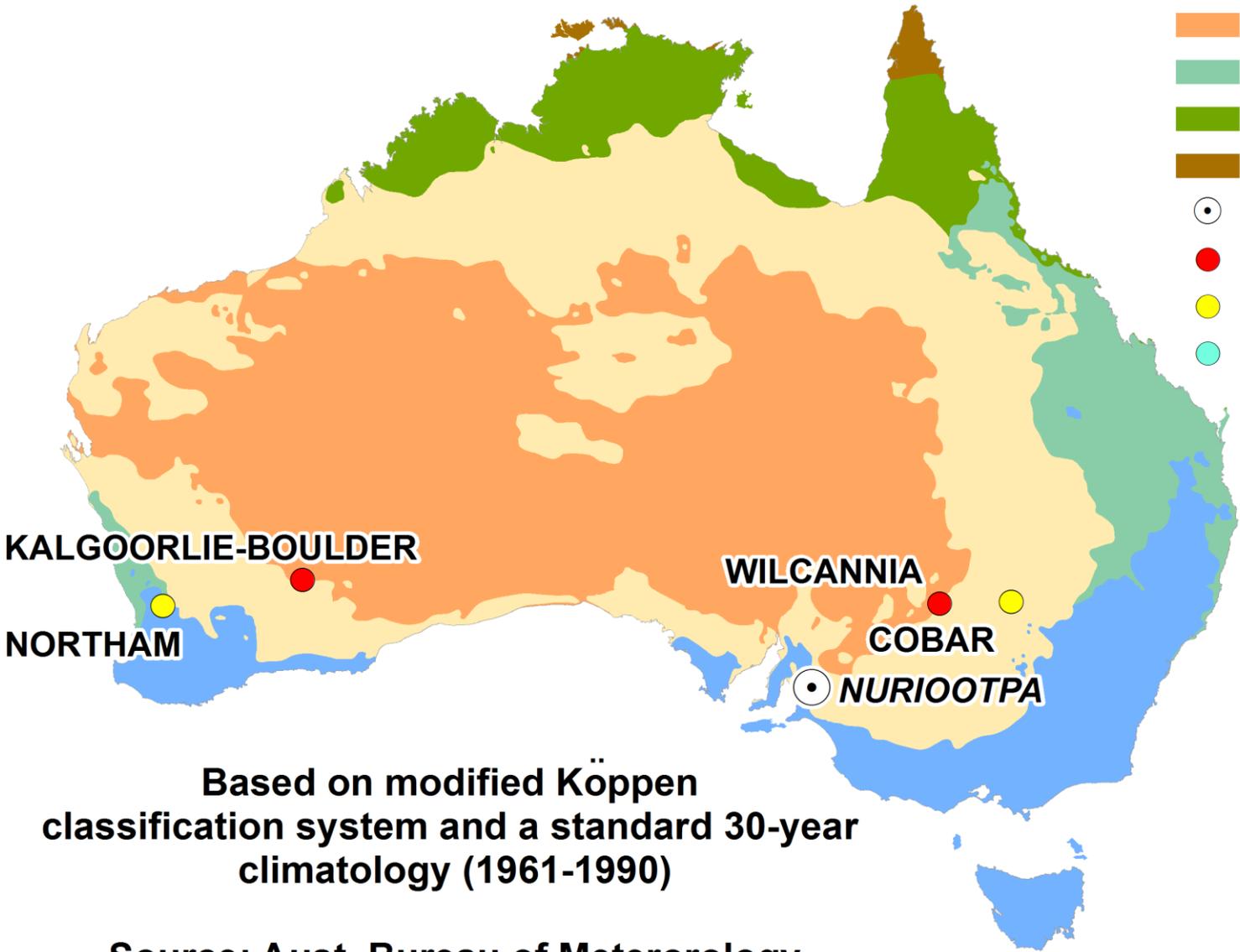


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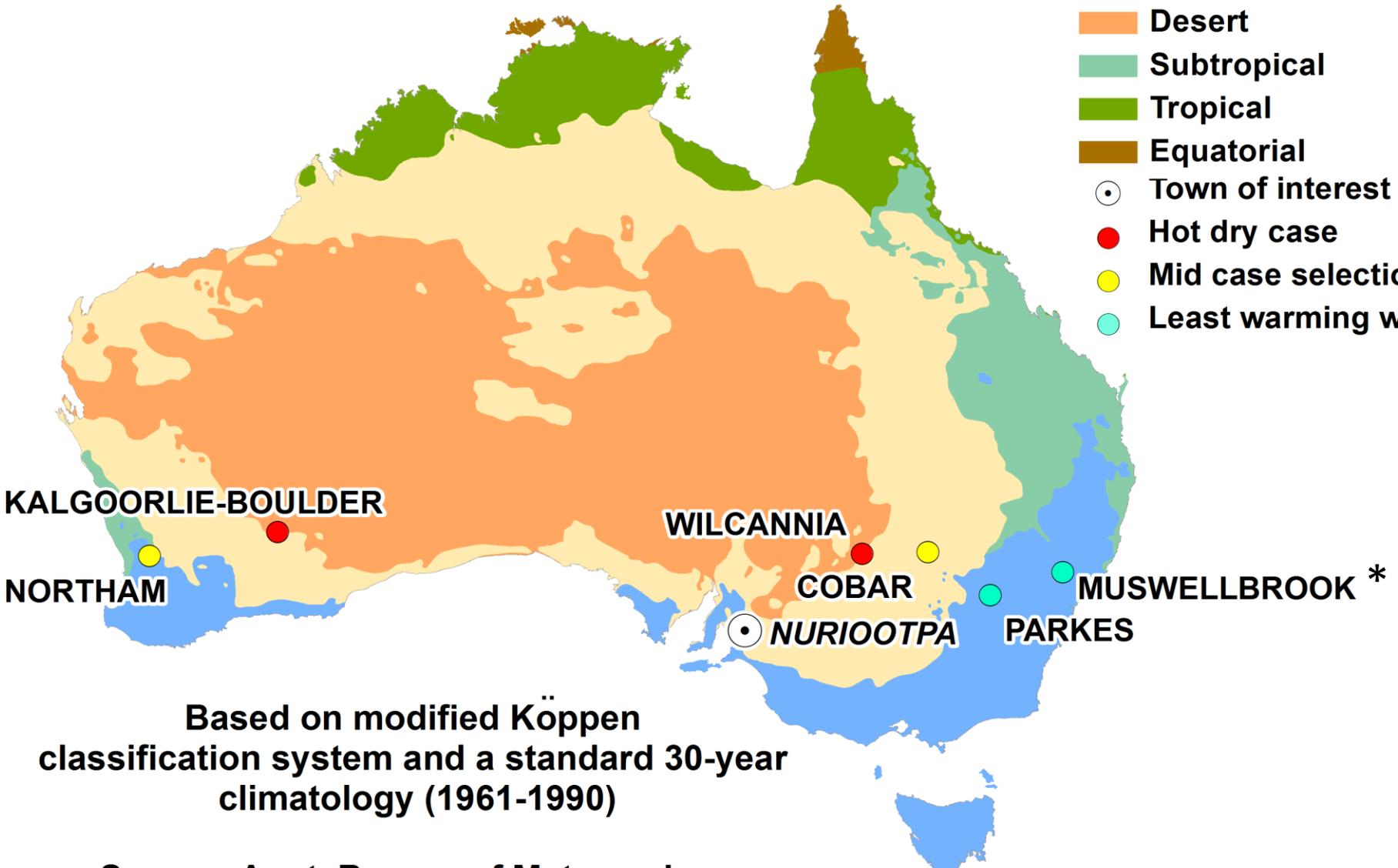


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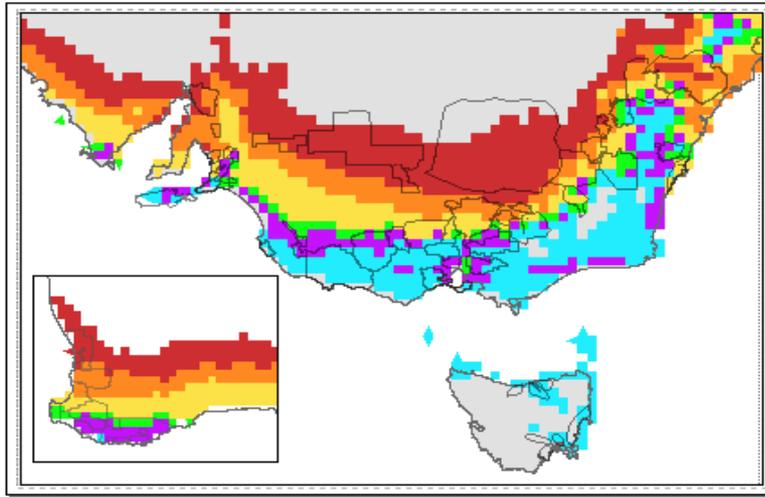


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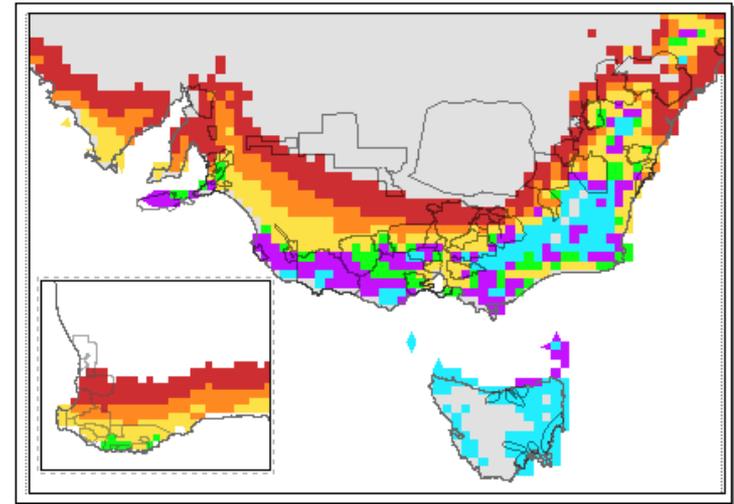
Source: Aust. Bureau of Meteorology

Projected climate suitability for viticulture

(Webb et al. 2007)



Present Climate



Year 2050 mid warming

← Cooler climate varieties

Pinot Noir
Chard.

Cab Sauv.
Merlot

Shiraz
Riesling

Shiraz
Semillon

Verdelho
Riesling

Chenin
Blanc

E.g.

Warmer climate varieties →

Thank you

