



# The Potential Impact of Climate Change on Wool Growing in 2029

a CSIRO report by  
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Commissioned by Future Woolscapes

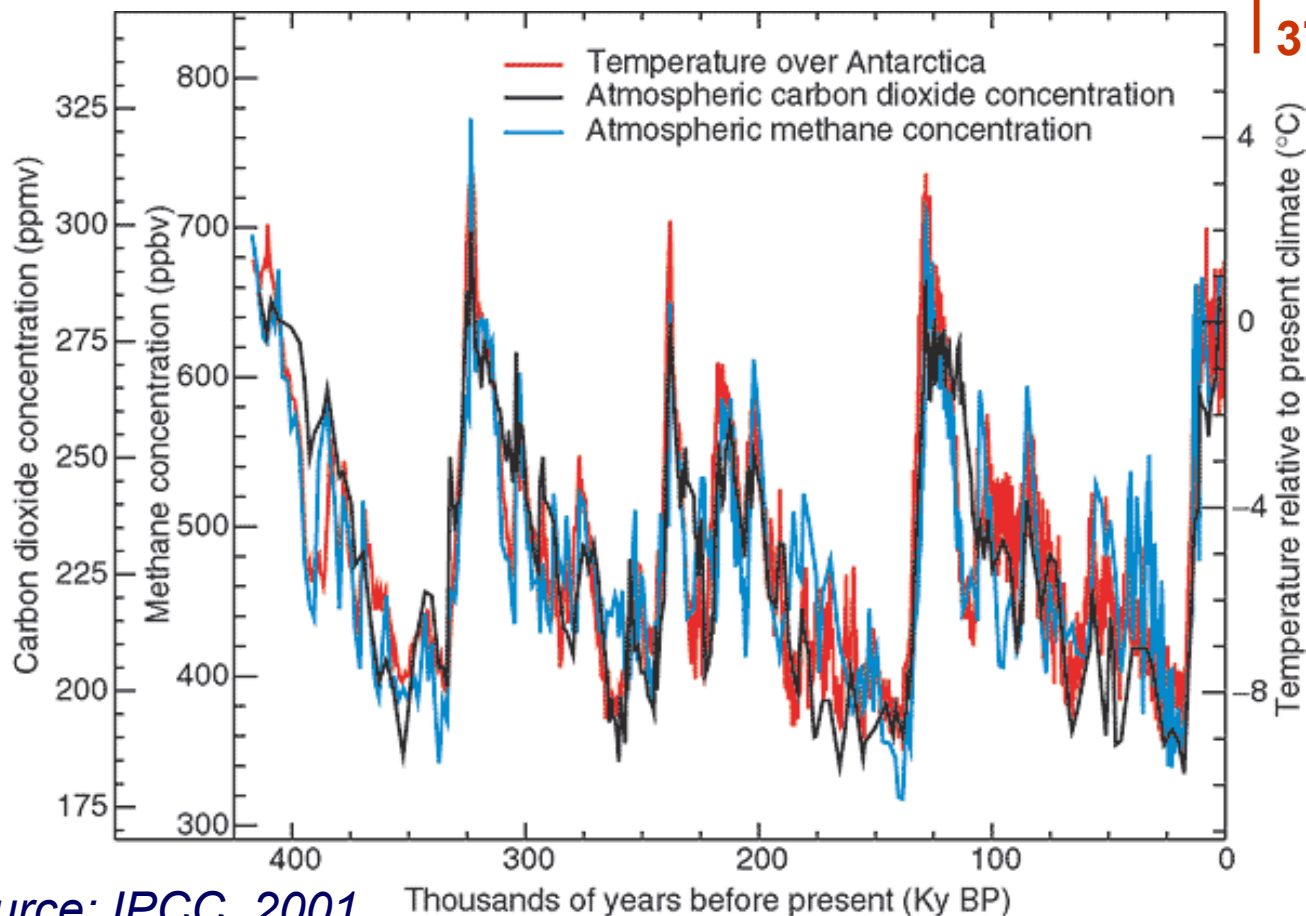
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# Levels of CO<sub>2</sub> unprecedented within the history of our species

Past temperature, atmospheric methane and CO<sub>2</sub> concentrations derived from ice core samples



Source: IPCC, 2001

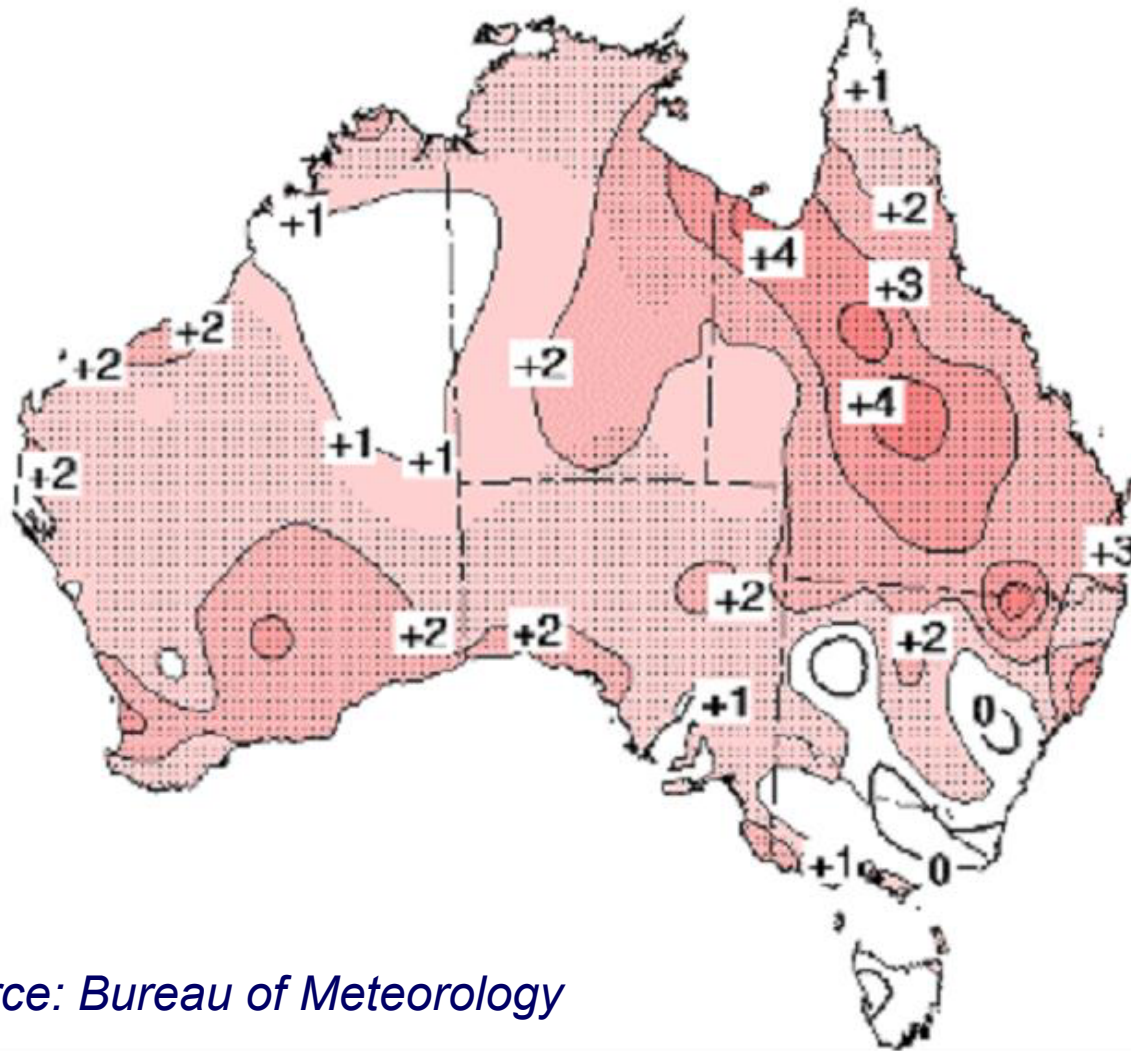
Thousands of years before present (Ky BP)

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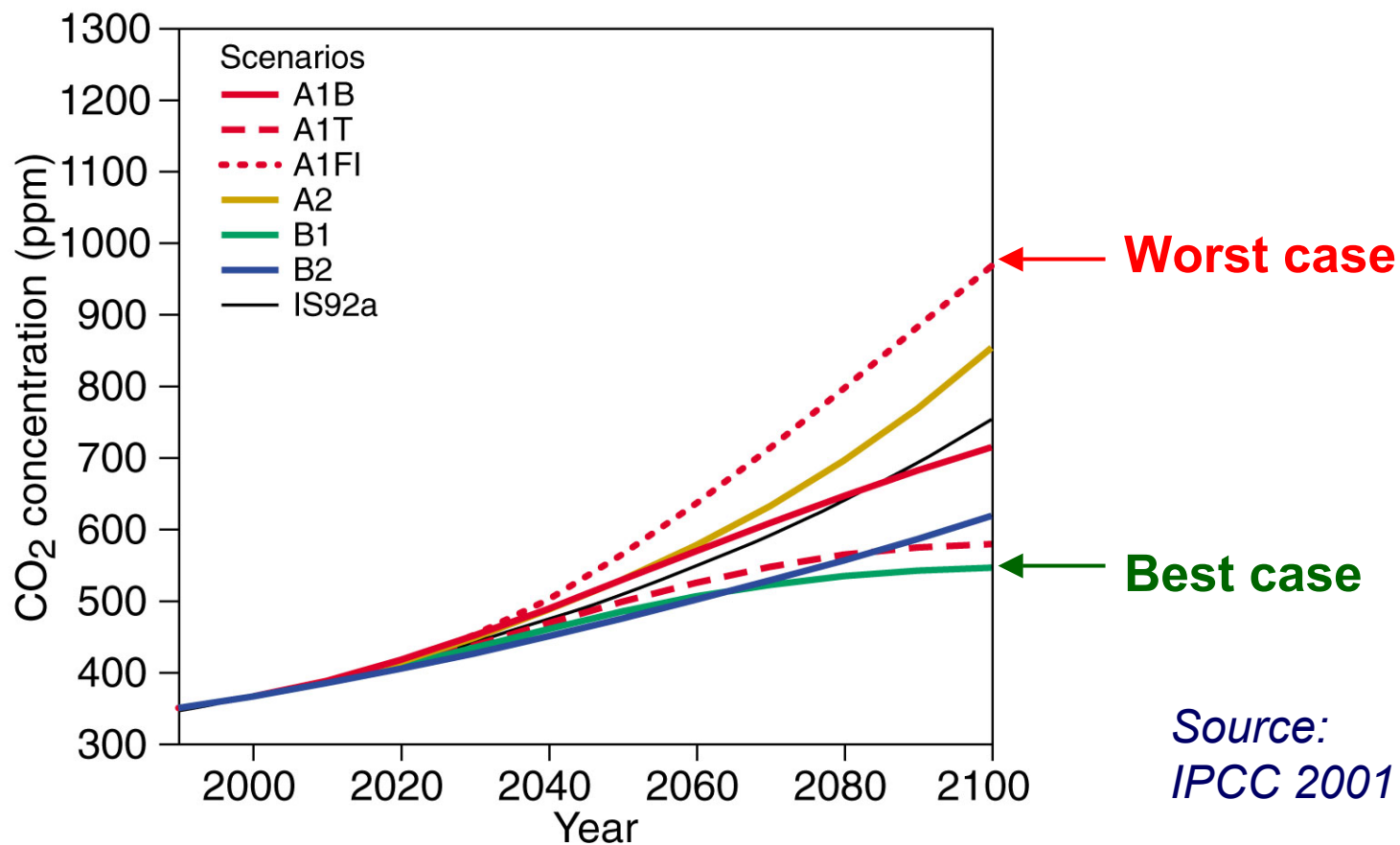
# Minimum temperature 1950-1998



Source: Bureau of Meteorology

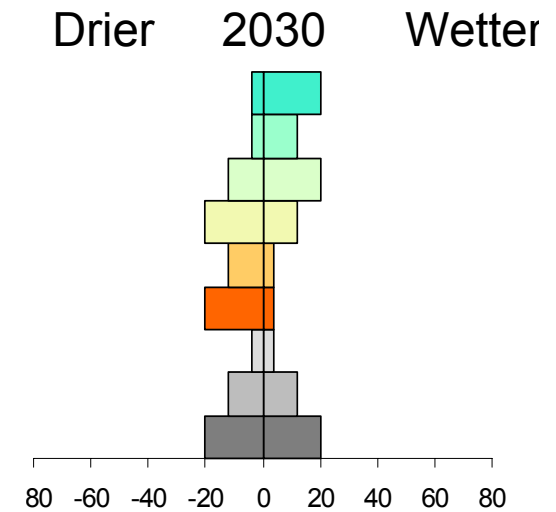
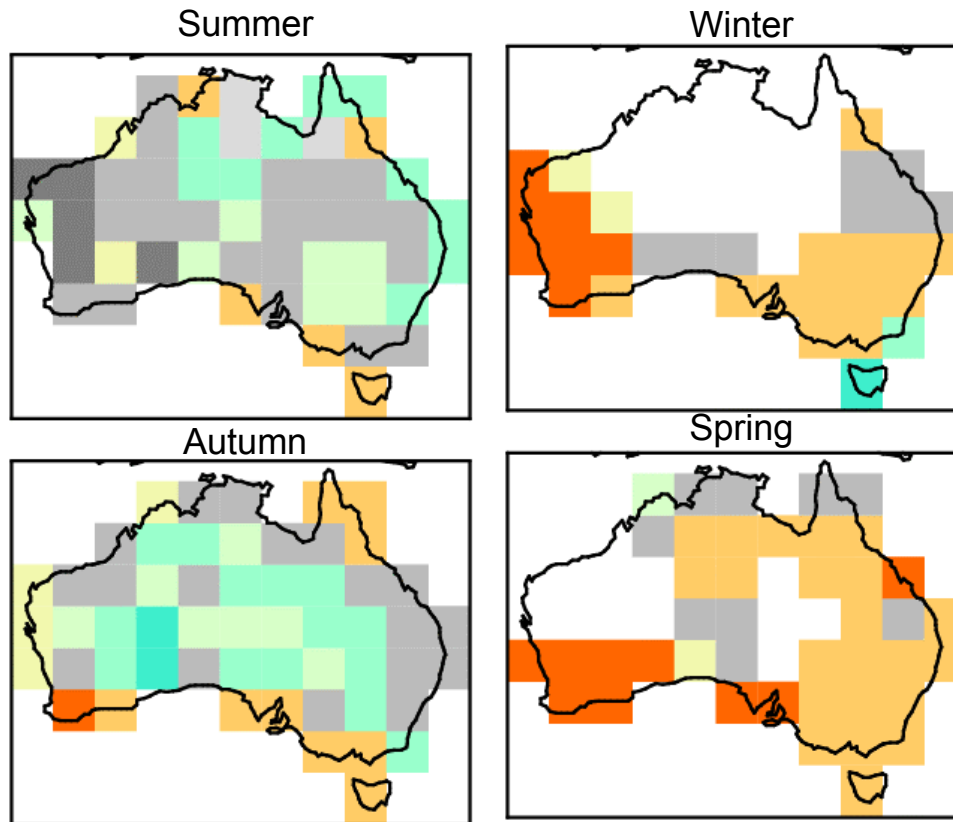
# Future climate change

## Projections of CO<sub>2</sub> concentrations



Source:  
IPCC 2001

# Projected changes in rainfall



Source: CSIRO Atmospheric Research

# Likely impacts of climate change on the Australian wool industry

- pasture and fodder crops
- quality and quantity of wool production
- animal health and reproduction
- water availability and demand
- land degradation and sustainability
- inter linked with each other and with other issues affecting wool industry
- adaptation important in managing impacts

# Pasture & fodder crops

- impacts will vary between regions
- likely increased growth under higher CO<sub>2</sub>
  - growth effects limited
  - reduced nutrient value
  - higher influx of woody weeds
- effect of possible increased drought frequency



# Wool production

- most effects indirect through changes in pasture
  - + changes = increased carrying capacity & production
  - changes = reduced carrying capacity & production
- possible increased climatic variation → more variable production
- interaction with other factors



# Wool quality

- fibre diameter may decrease
- possible increase incidence of tender wool
- possible increase in lambs with impaired secondary follicle production
- clean wool yield affected by change in pasture condition
- possible switch to coarser wool breeds



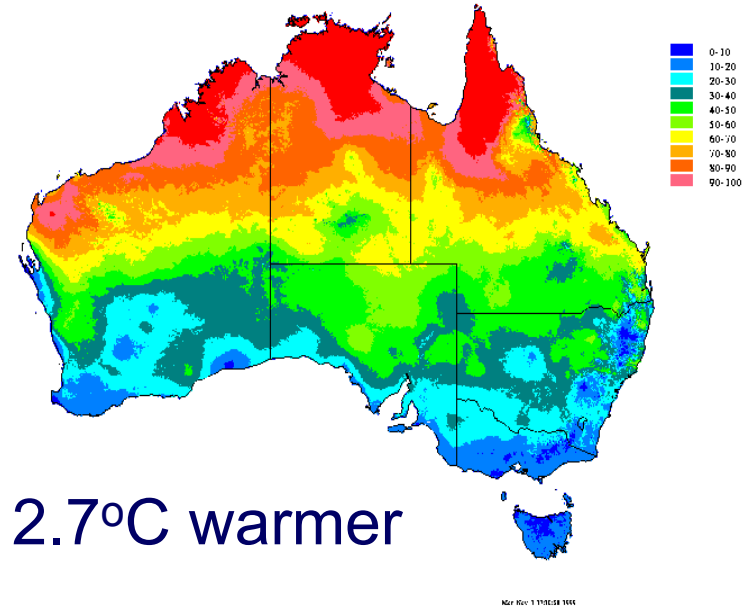
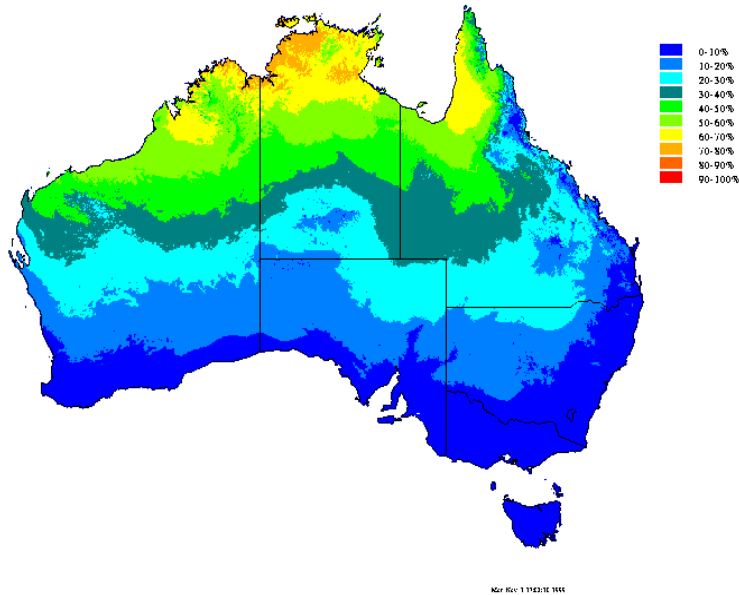
# Animal health and reproduction

- increased thermal stress with rise in temperature and humidity
- reduction in frequency and severity of cold-stress events



# Thermal stress

## Current heat stress

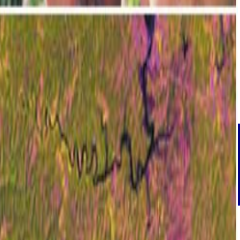
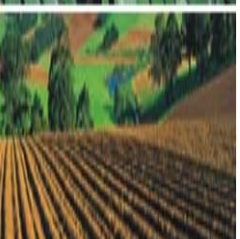


Heat stress 2.7°C warmer

Source: Howden et al. 1999

# Animal health and reproduction

- increased thermal stress with rise in temperature and humidity
- reduction in frequency and severity of cold-stress events
- rise in incidence of pests and diseases
- reduction in nutrition of sheep due to higher proportions of poorer quality forage



# Water availability and demand

- decreased water availability
- water quality potentially affected
- rise in water demand
  - reduced range from watering points
- competition with other sectors



# Some other potential issues

- land degradation, sustainability and stewardship
- increased competition with crops
- national and international markets
- greenhouse gas emissions and sinks



# Broad implications

- wool industry significantly affected by climate change, but on whole relatively robust
- impacts vary between regions and wool sector
- impacts interact with other drivers of change
- management needs integration of complex issues
- early adaptation important



# Information slides

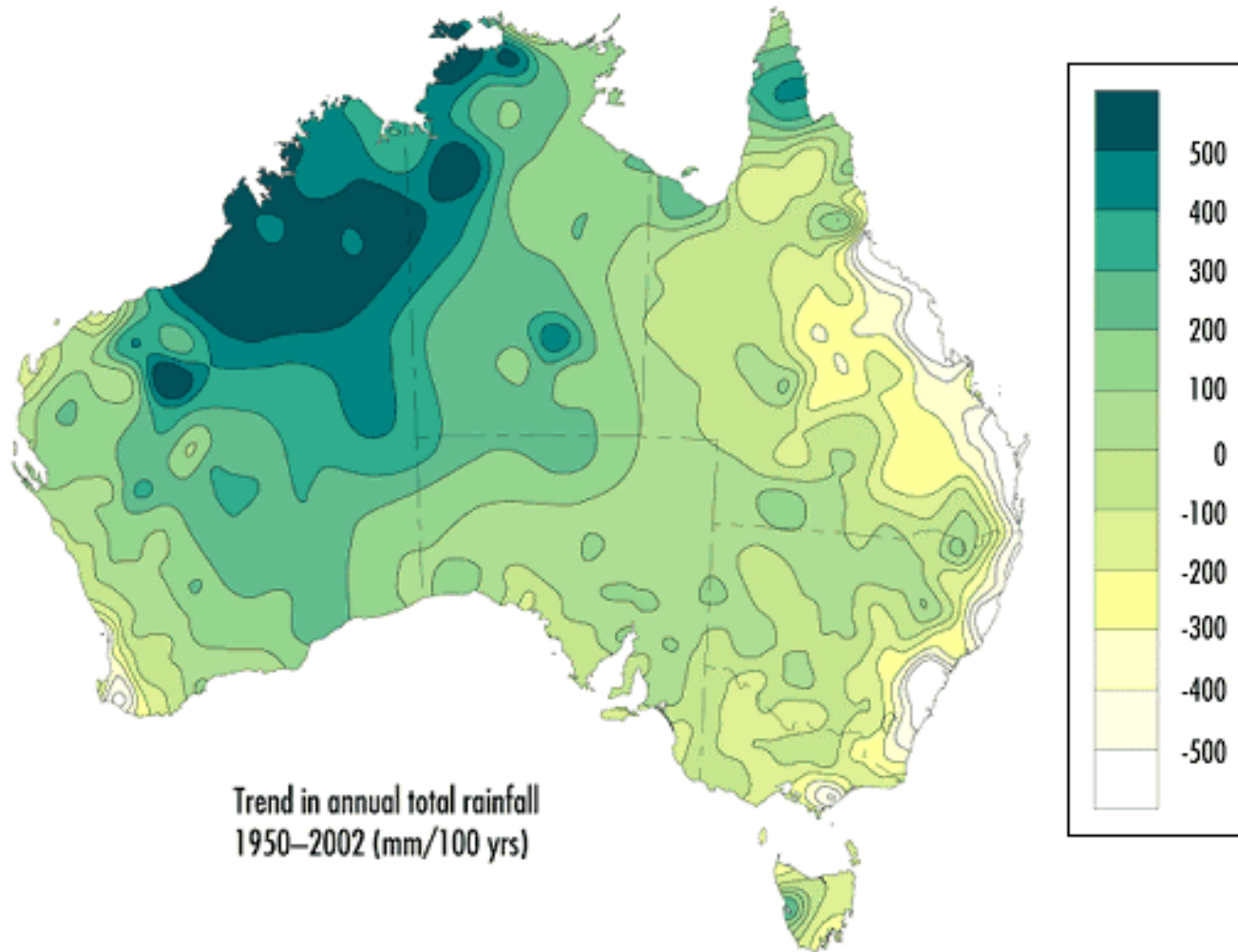


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# The evidence for climate change



# Key effects of elevated CO<sub>2</sub>

- increase efficiency with which plants convert water into dry mass
- elevation of CO<sub>2</sub> to 700 ppm could lead to significant increases in plant productivity:
  - 10-15% in mesic environments
  - 20-40% in water limited environments
- productivity limited by temperature, rainfall, soil moisture and soil nutrient availability (esp. nitrogen)
- increases in productivity offset/negated by reductions in rainfall and increases in evaporation
- increases biomass but decrease nutrient value



# Scenario analysis - baseline

## *Scenario 1*

- wool remains less profitable than cropping in wheat-sheep zone
- sheep area determined by changes in cropping productivity
- increased cropping intensity and water use
- cropping (into high rainfall zone) and agroforestry displace sheep
- reduction in cropping at dryer margin and expansion of sheep

## *Scenario 2*

- wool (& lamb) prices continue to rise
- increase relative profitability of sheep against cropping
- cropping intensification reaches limit with grazing still important
- limited expansion of cropping into high rainfall zone
- agroforestry remains small scale

# Scenario analysis - impacts

## *Scenario 1*

- sequestration of carbon through agroforestry & woody re-growth
- shift to cropping in high RF zone accelerated = reductions in fine wool production
- greater focus on cropping slows adaptation to climate change in management of pasture & animal health
- substantial pressure on water for stock
- fewer sheep & ready supplies of feed-grain make dry years easier to manage

## *Scenario 2*

- greenhouse gas mitigation shared between cropping & grazing, but leads to conversion of much pasture
- some expansion of cropping in high RF zone
- expansion of grazing in dry zones more significant
- faster adaptation to climate change in management of pasture & animal health
- some reductions in water for stock
- managing more frequent dry years a challenge