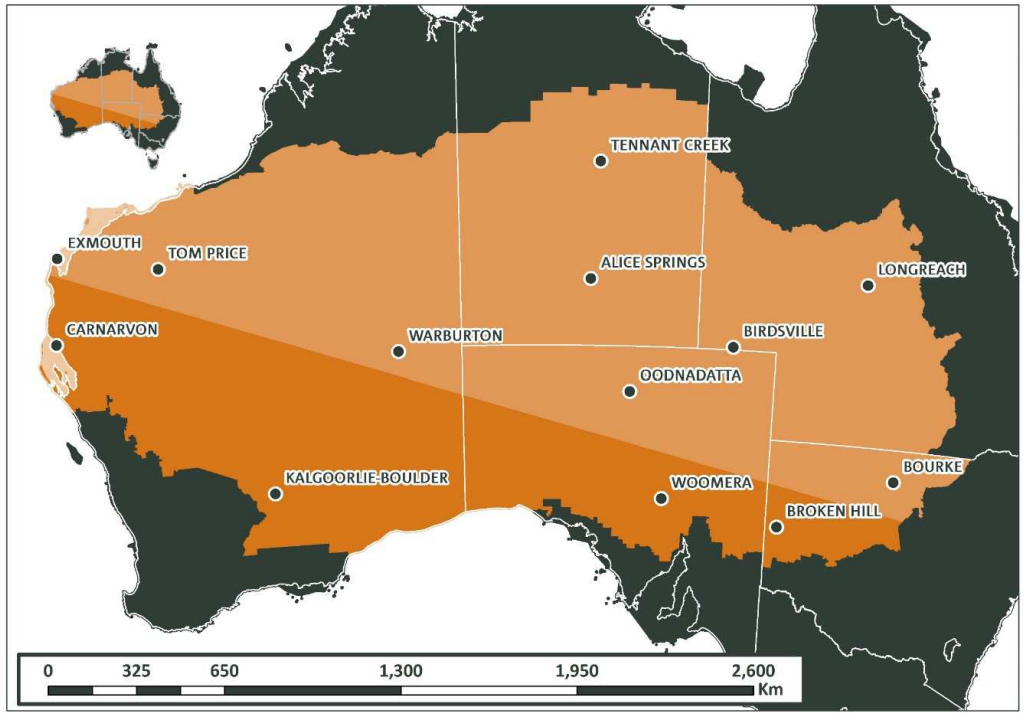
Climate projections for Rangelands



This brochure is for the Rangelands cluster, comprising NRM regions in four States and the Northern Territory. This vast region contains many varied landscapes, including the Flinders Ranges, the ranges of the Pilbara and 'The Centre'; hence much of the iconic 'Outback'. Many Indigenous Australians live in this region. Cattle and sheep grazing are important agricultural activities.

Rainfall systems vary from seasonally reliable monsoonal influences in the far north (lighter orange) through to very low and variable rainfall patterns in much of the centre and south (darker orange).

Some of the content for this Pamphlet drawn from Gerbing, C. Webb, L. and Watterson, I. 2015 Rangelands Cluster brochure, CSIRO and BoM.

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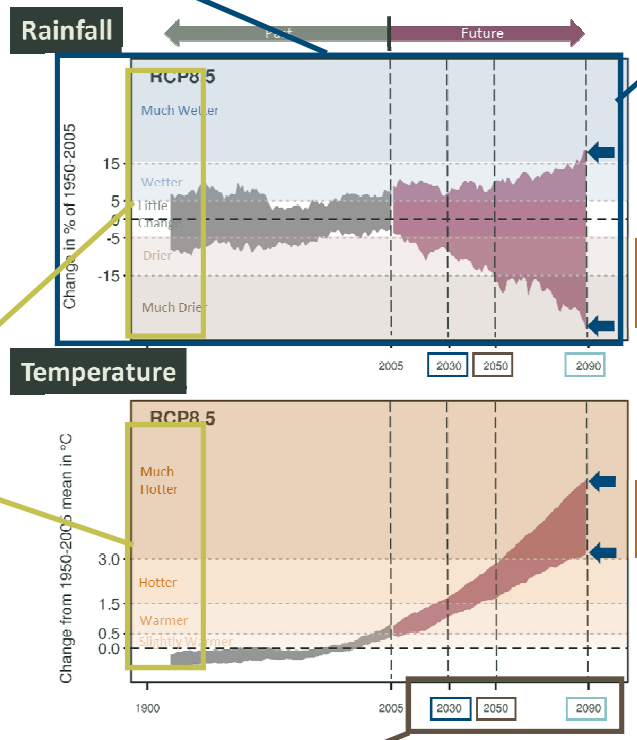
KEY TO THE PROJECTIONS SLIDES

Time series of rainfall (top) and temperature (below) for the historical period (1900 to 2005; grey) and projected period (2005 to 2099; purple) showing the 10th to 90th percentile of the 20-year running mean from 40 CMIP5 models.

Projected period colour code:
Purple: high emissions (RCP8.5)
Blue: intermediate emissions (RCP4.5)
Green: low emissions (RCP2.6)

Categories of warming and rainfall changes are indicated by colour shading on the graph as described in the table:

Rainfall (% change relative to 1950 - 2005)	Temperature (degrees Celsius change from 1950-2005)
Much Wetter (> 15 %)	Much Hotter (> 3.0)
Wetter (5 to 15 %)	Hotter (1.5 to 3.0)
Little change (-5 to +5 %)	Warmer (0.5 to 1.5)
Drier (-5 to -10 %)	Slightly Warmer (0 – 0.5)
Much Drier (> -15%)	



Outlook periods explored are 20 year periods centred on 2030, 2050, 2090.

For adaptation planning, consider top and bottom of the range of plausible change, indicated by the blue arrows.

Descriptions of what could be expected given model representation (40 CMIP5 models) in the various future periods:

2030: Warmer with little change in rainfall or drier indicated by most models, though a chance of wetter also occurs.

2050: Hotter with most models indicating little change in rainfall or drier, but a chance of wetter.

2090: Much hotter with most models indicating little change in rainfall or drier, but a chance of wetter also occurs.

*Seasonal projections may differ from annual. Seasonal detail shown later.
Maximum model consensus by 2090, if it exists, is indicated by orange bar.
For adaptation planning, consider top and bottom of the range of plausible change. The 2090 range is indicated by the blue arrows.

Maximum consensus (at least 33% of models) indicated by orange box. In this example, the maximum consensus future by 2090 could be described as 'much hotter and drier to much drier'.

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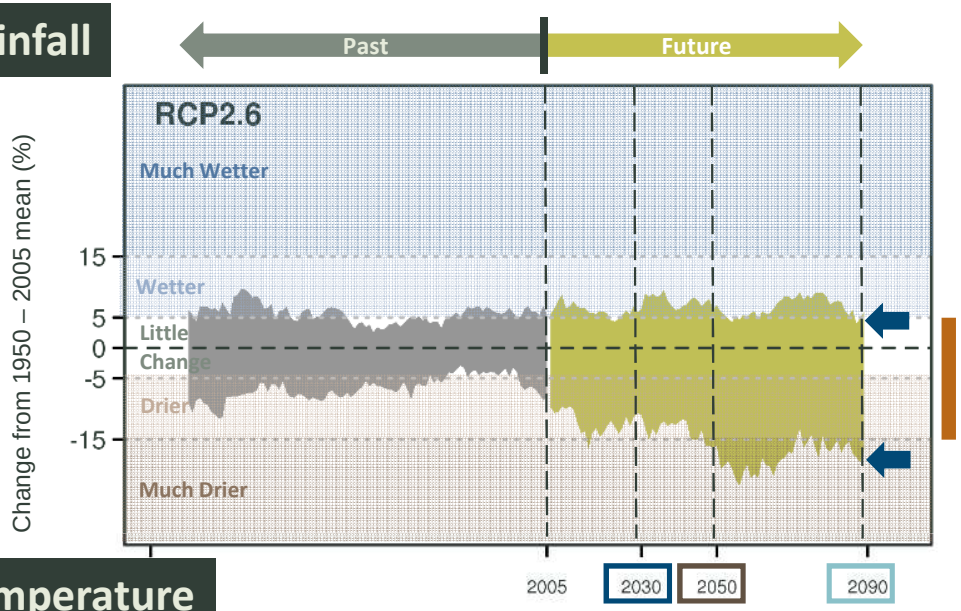
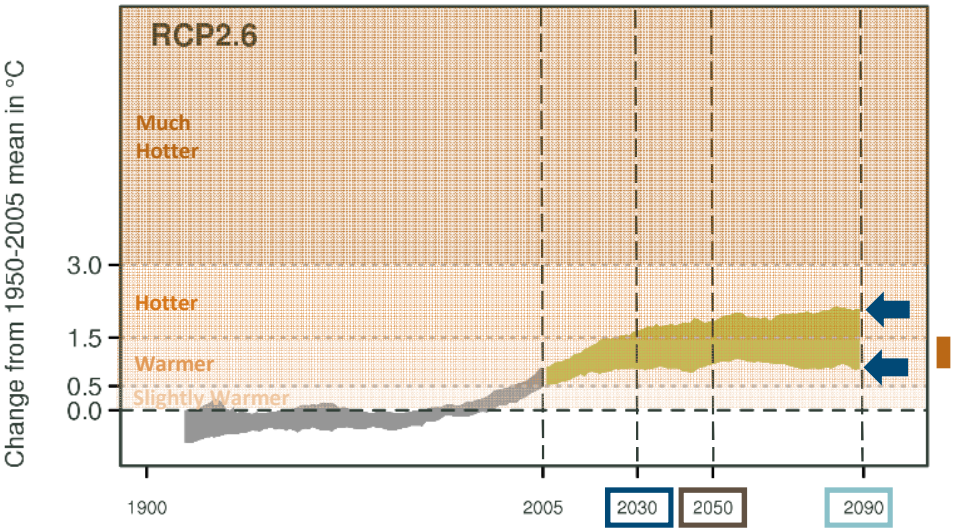
Climate projections for Rangelands (annual*) : Low emissions

Rainfall



Temperature



2030: Warmer with little change in rainfall although chance or drier or wetter.

2050: Warmer with little change in rainfall though with some models indicating drier.

2090: Warmer to hotter with a drier or much drier climate indicated by many models, but a chance of little change also occurs.

***Seasonal projections may differ from annual. Seasonal detail shown later.**

Maximum model consensus by 2090, if it exists, is indicated by orange bar.

For adaptation planning, consider top and bottom of the range of plausible change. The 2090 range is indicated by the blue arrows.

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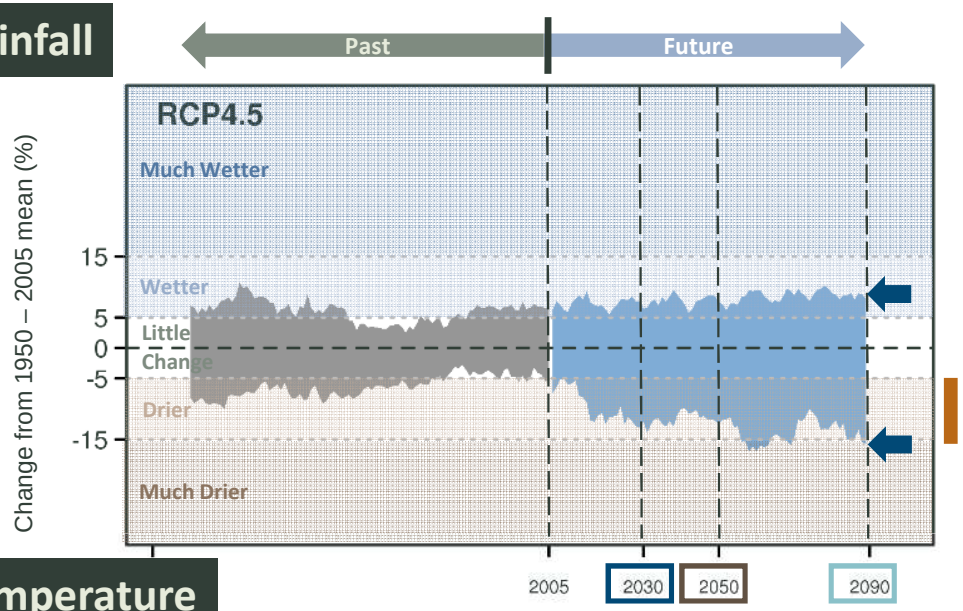
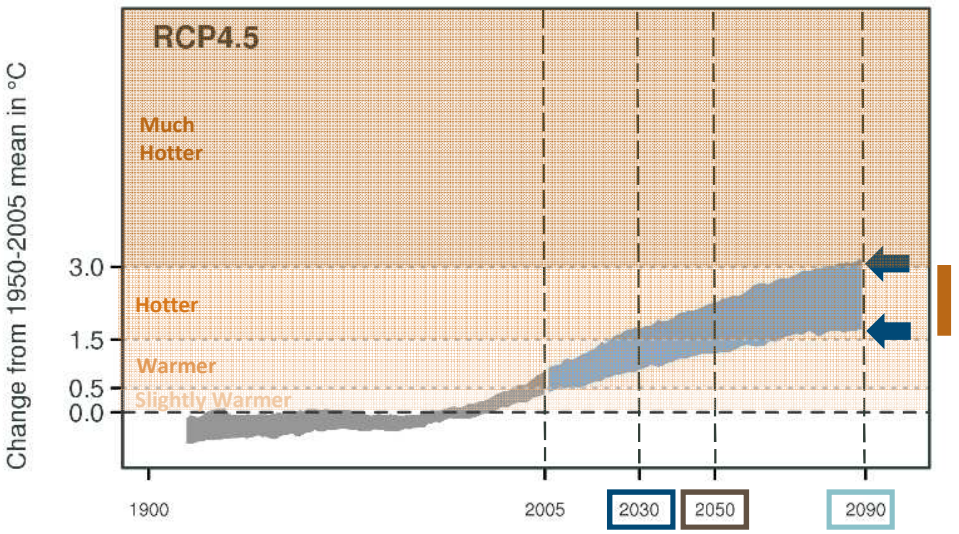
Climate projections for Rangelands (annual*) : Intermediate emissions

Rainfall



Temperature



2030: Warmer with most models indicating little change or drier.

2050: Warmer to hotter with most models indicating little change in rainfall or drier.

2090: Warmer to hotter with many models indicating a drier climate, although a chance of little change also occurs.

***Seasonal projections may differ from annual. Seasonal detail shown later.**

Maximum model consensus by 2090, if it exists, is indicated by orange bar.

For adaptation planning, consider top and bottom of the range of plausible change. The 2090 range is indicated by the blue arrows.

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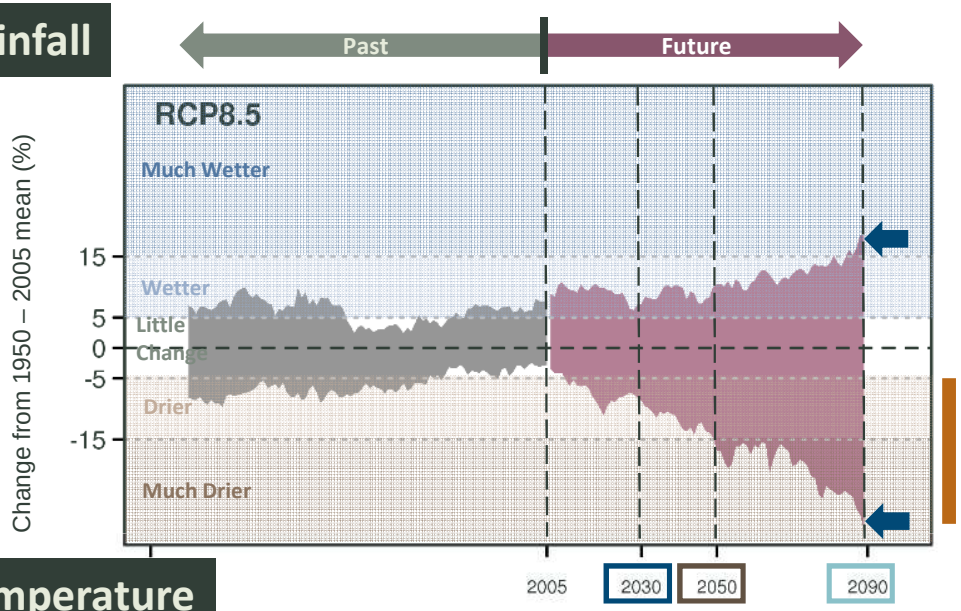
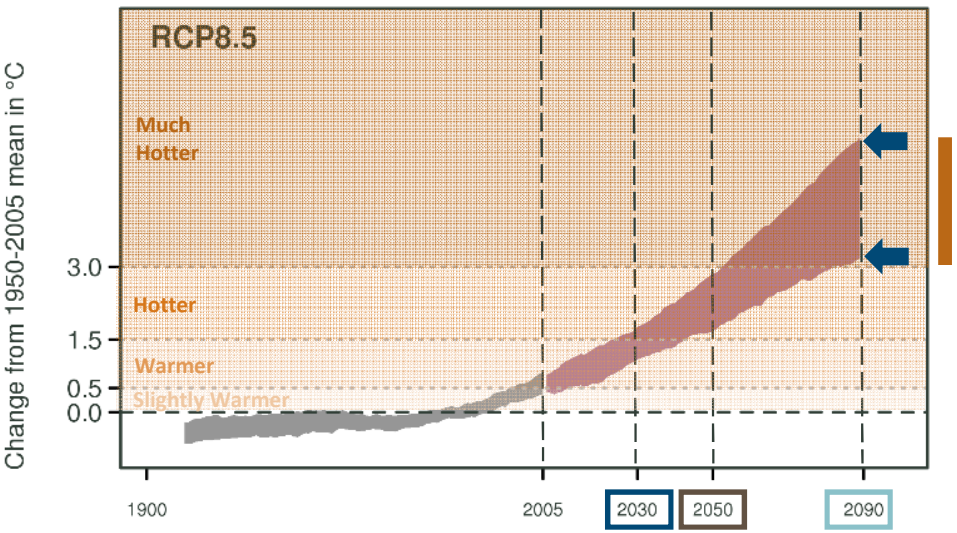
Climate projections for Rangelands (annual*) : High emissions

Rainfall



Temperature



2030: Warmer with little change in rainfall or drier indicated by most models, though a chance of wetter also occurs.

2050: Hotter with most models indicating little change in rainfall or drier, but a chance of wetter.

2090: Much hotter with most models indicating little change in rainfall or drier, but a chance of wetter also occurs.

***Seasonal projections may differ from annual. Seasonal detail shown later.**

Maximum model consensus by 2090, if it exists, is indicated by orange bar.

For adaptation planning, consider top and bottom of the range of plausible change. The 2090 range is indicated by the blue arrows.

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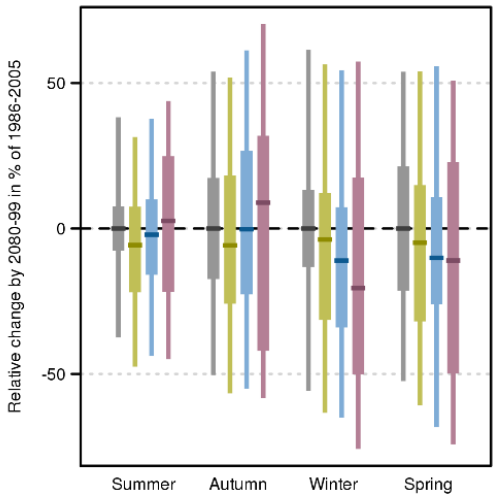
Seasonal Rainfall

Graph shows projected change in seasonal precipitation for 2090 (2080-99) in (from left) summer, autumn, winter and spring. Anomalies are given in % relative to 1995(1986-2005) under RCP2.6 (Green), RCP4.5 (blue) and RCP8.5 (purple). Natural climate variability is represented by the grey bar.

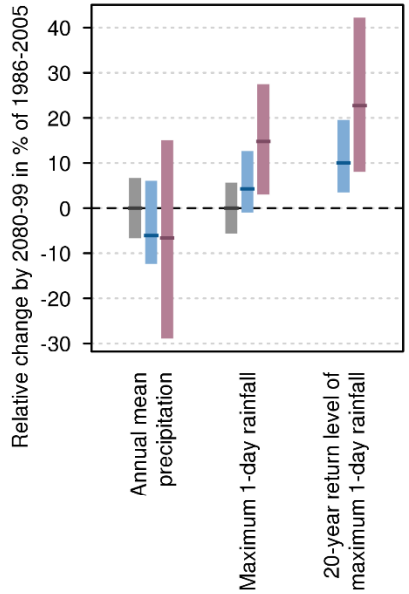


Winter rainfall in the south is projected to decline over the century. There is a good understanding of the physical mechanisms driving this change (southward shift of winter storm systems together with rising mean pressure over the region).

Changes to annual and summer rainfall for late in the century are possible, but the direction of change cannot be confidently projected given the spread of model results. Impact assessment in this region should consider the risk of both a drier and wetter climate.

Extreme Rainfall

Modelled differences (per cent) in annual average rainfall, rainfall on the wettest day of the year, and rainfall on the wettest day in 20 years for 2080-2099 compared to 1986 to 2005 under RCP4.5 (blue) and RCP8.5 (purple). Natural climate variability is represented by the grey bar.



Understanding of the physical processes that cause extreme rainfall, coupled with modelled projections, indicate with high confidence a future increase in the intensity of extreme rainfall events, although the magnitude of the increases cannot be confidently projected.

Time spent in drought is projected, with medium confidence, to increase over the course of the century.

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