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LANGHORNE CREEK

RAINFALL
Projected Mean Growing Season Rainfall
171 mm 1997–2017
174 mm 2041–2060
168 mm 2081–2100

TEMPERATURE
Projected Mean Growing Season Temperature
19.2 °C 1997–2017
20.1 °C 2041–2060
21.3 °C 2081–2100

EXTREME COLD
Projected Mean Growing Season Frost Risk Days
0.0 days 1997–2017
0.0 days 2041–2060
0.0 days 2081–2100

EXTREME HEAT
Projected Mean Excess Heat Factor
18.9 EHF 1997–2017
20.5 EHF 2041–2060
22.1 EHF 2081–2100

ARIDITY
Projected Mean Annual Aridity Index
0.25 1997–2017
0.21 2041–2060
0.18 2081–2100

AUSTRALIA'S WINE FUTURE
A CLIMATE ATLAS

Wine Australia
ANTARCTIC CLIMATE & ECOSYSTEMS
RESEARCH COORDINATING OFFICE

UNIVERSITY of TASMANIA
Figure 1: Observed mean Growing Season Temperature (Oct–Apr) across all growing years from 1997–2017.

Figure 2: The change in Growing Season Temperature between the current (1997–2017) and historical (1961–1990) periods. Growing Season Temperature has increased across the region over recent decades.

Figure 3: Projected mean Growing Season Temperature (Oct–Apr) for 20-year time periods from 2021 to 2100. Growing Season Temperature is expected to increase steadily into the future. Each grid cell is the mean of the 6 ensemble members.

Figure 4: Projected Growing Season Temperature (October to April) for 20-year time periods from 2001 to 2100.

Figure 5: Distribution of Growing Season Temperature across all growing years from 1997–2017.

Figure 6: Distribution of Growing Degree Days across all growing years from 1997–2017.

Figure 7: Cumulative Growing Degree Days (GDD) across the growing year (July–June). Dashed lines show GDD values (1000, 1500, 2000, 2500) for some example phenological thresholds. Each growing year is represented by a colored line. In future time periods, heat accumulates faster, thresholds are reached earlier and maximum GDD reached is higher.

Figure 8: Distribution of date when Growing Degree Days reaches threshold.
Australia's Wine Future — A Climate Atlas

LANGHORNE CREEK

Moisture

Figure 1: Observed mean Growing Season Rainfall (Oct–Apr). Blue points are the annual values for each grid cell, for each of the 6 ensemble members. Horizontal grey bars represent the mean Growing Season Rainfall value during 1997–2017 in selected regions across Australia. These provide a comparison between current conditions (1997–2017) elsewhere and future conditions in this region and help identify future analogue regions. Coloured bars represent the projected mean global temperature increase into the future (following the RCP 4.5 scenario). These can be used to make decisions based on projected temperature change rather than time.

Figure 2: As with Figure 1, but for Non-Growing Season Rainfall (Nov–Apr). Horizontal grey bars represent the mean Non-Growing Season Rainfall value during 1997–2017 in selected regions across Australia.

Figure 3: Projected mean Growing Season Rainfall (Oct–Apr) for 20-year time periods from 2021 to 2100. Each grid cell is the mean of the 6 ensemble members.

Figure 4: Time series of Growing Season Rainfall (mm). Blue points are the annual values for each grid cell, for each of the 6 ensemble members. Horizontal grey bars represent the mean Growing Season Rainfall value during 1997–2017 in selected regions across Australia. These provide a comparison between current conditions (1997–2017) elsewhere and future conditions in this region and help identify future analogue regions. Coloured bars represent the projected mean global temperature increase into the future (following the RCP 4.5 scenario). These can be used to make decisions based on projected temperature change rather than time.

Figure 5: As with Figure 4, but for Non-Growing Season Rainfall (Nov–Apr). Horizontal grey bars represent the mean Non-Growing Season Rainfall value during 1997–2017 in selected regions across Australia.

Figure 6: Violin plots of monthly rainfall (mm) for 20-year time periods from 2001 to 2100. Each violin represents monthly totals for each grid cell, for each of the 6 ensemble members, and for each growing year within the time period. In each panel the median violin indicates the expected probability distribution of rainfall across the growing year. The current period (2001–2020) is shadowed underneath the future time periods to highlight any differences expected into the future. Dots represent the mean monthly rainfall for each violin. If the violin shifts lower (higher) this indicates a change towards drier (wetter) conditions.

Figure 7: Distribution of seasonal rainfall

Figure 8: Number of rainy days during harvest for each 20-year period. Harvest refers to the date when Growing Degree Days (GDD) reach example phenological thresholds (1000, 1500, 2000, 2500) which were chosen to reflect development time of different grape styles and varieties. Rainy days during harvest were defined as days with >10mm of rain from 7 days before to 7 days after the date each GDD threshold was reached. Variability can occur spatially within the region, across years, or between ensemble members. A shift in the curve to the left (right) indicates fewer (more) rainy days during harvest. A missing time period indicates that the specific phenological threshold was not reached within the growing year (July–June).
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LANGHORNE CREEK

Aridity

Figure 1: Observed mean annual Aridity Index across all growing years from 1997–2017. Aridity Index is a value that characterises the ratio between the mean annual rainfall and mean annual evaporation. Low (high) values indicate drier (wetter) conditions.

Figure 2: Observed percentage change in mean annual Aridity Index between the current (1997–2017) and historical (1961–1990) periods. This shows the change already experienced across the region. Negative (positive) values indicate a trend towards drier (wetter) conditions.

Figure 3: Projected mean annual Aridity Index for 20-year time periods from 2021 to 2100. Each grid cell is the mean of the 6 ensemble members. Decreasing (increasing) values indicate a trend towards drier (wetter) conditions.

Figure 4: Time series of annual Aridity Index. Points are the annual means for each grid cell in the region, for each of the 6 ensemble members. Aridity Index values >2 all indicate very wet conditions. There is no meaningful difference past this value, so values were not presented. Horizontal grey bars represent the mean annual Aridity Index from selected regions across Australia — these provide an example of conditions the region may transition towards in the future. Coloured bars represent the projected global temperature increase expected in the future (following the RCP 8.5 scenario) which can be used to make decisions based on projected temperature change rather than rise (for example, if the rate of warming rapidly increases, where temperature changes are experienced earlier, useful information can still be extracted from these figures by using the coloured bars instead of the time-axis).

Figure 5: Violin plots of monthly Aridity Index for 20-year time periods from 2001 to 2100. Each violin represents monthly means for each grid cell, for each of the 6 ensemble members, and for each growing year within the time period. Each (20-year) panel shows the expected probability distribution of Aridity Index within each month across the growing year. The current period (2001–2020) is shadowed underneath the future time periods to highlight any differences expected into the future. Dots represent the mean monthly Aridity Index for each violin. If the violin shifts lower (higher), this indicates a change towards drier (wetter) conditions.

Figure 6: Distribution of seasonal Aridity Index

Figure 7: Mean annual Aridity Index accumulated from start of the growing season (July) to date of harvest, presented as a probability distribution for each 20-year period. Variability can occur spatially within the region, across years, or between ensemble members. A shift to the left (right) indicates an increase in drier (wetter) conditions. A missing time period indicates that the specific phenological threshold was not reached within the growing year (July–June).
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Figure 1: Observed mean excess heat factor (EHF) during heatwaves (as per Nairn and Emmett (2013)), across all growing years from 1997–2017. EHF is an index that characterises heatwaves, high values indicate more intense heatwaves. The mean EHF is the mean value from all heatwaves that occurred from 1997–2017.

Figure 2: Observed change in mean excess heat factor 1997–2017 minus 1961–1990. EHF is an index that characterises heatwaves, high values indicate more intense heatwaves. The mean EHF is the mean value from all heatwaves that occurred from 1997–2017.

Figure 3: Projected mean excess heat factor (EHF) during heatwaves for 20-year time periods from 2021 to 2100. Each grid cell is the mean of the 6 ensemble members. Increasing (decreasing) values indicate a trend towards more (less) intense heatwaves.

Figure 4: Observed mean number of extreme heat days across all growing years from 1997–2017. Extreme heat days are days when daily maximum temperatures are >30°C and daily minimum temperatures are >25°C. The mean EHF is the mean value from all heatwaves that occurred from 1997–2017.

Figure 5: Change in mean number of extreme heat days between the current (1997–2017) and historical (1961–1990) periods. Positive (negative) values indicate a trend towards more (less) intense heatwaves. The mean EHF is the mean value from all heatwaves that occurred from 1997–2017.

Figure 6: Projected number of days per growing year of high human heat stress. This is defined as days when daily maximum temperatures are >30°C and daily minimum temperatures are >25°C. These conditions cause severe risk of heat stress to humans (and potentially low productivity) to those working in exposed areas. Humans cannot work in high temperature, high humidity environments without appropriate adaptive behaviours and equipment. Points are for each grid cell from each of the 6 ensemble members. Coloured bars represent the projected global temperature increase expected into the future (following the RCP 8.5 scenario) which can be used to make decisions based on projected temperature change rather than time.

Figure 7: Time series of the number of days per growing year with temperatures greater than 30°C, 35°C, 40°C and 45°C. Areas indicate the number of days such thresholds is exceeded per growing year. Values are averaged across all grid cells and the 6 ensemble members. Coloured bars indicate each of the extreme threshold values. Generally increasing frequencies reflect a warming climate.

Figure 8: Time series of the number of days per growing year with temperatures greater than 33°C, 36°C, 39°C and 42°C. Areas indicate the number of days such thresholds is exceeded per growing year. Values are averaged across all grid cells and the 6 ensemble members. Coloured bars indicate each of the extreme threshold values. Generally increasing frequencies reflect a warming climate.

Figure 9: Time series of the number of days per growing year of high human heat stress. This is defined as days when daily maximum temperatures are >30°C and daily minimum temperatures are >25°C. These conditions cause severe risk of heat stress to humans (and potentially low productivity) to those working in exposed areas. Humans cannot work in high temperature, high humidity environments without appropriate adaptive behaviours and equipment. Points are for each grid cell from each of the 6 ensemble members. Coloured bars represent the projected global temperature increase expected into the future (following the RCP 8.5 scenario) which can be used to make decisions based on projected temperature change rather than time.

Figure 10: Time series of the number of days per growing year with temperatures greater than 30°C, 35°C, 40°C and 45°C. Areas indicate the number of days such thresholds is exceeded per growing year. Values are averaged across all grid cells and the 6 ensemble members. Coloured bars indicate each of the extreme threshold values. Generally increasing frequencies reflect a warming climate.

Figure 11: Time series of the number of days per growing year with temperatures greater than 33°C, 36°C, 39°C and 42°C. Areas indicate the number of days such thresholds is exceeded per growing year. Values are averaged across all grid cells and the 6 ensemble members. Coloured bars indicate each of the extreme threshold values. Generally increasing frequencies reflect a warming climate.
Figure 1: Observed mean number of days at risk of frost during the growing season (October to April) over the period 1997–2017. Days at risk of frost are those with a daily minimum temperature < 2°C. High (low) values indicate high (low) frost risk.

Figure 2: Change in the mean number of days at risk of frost during the growing season (October to April) between the current (1997–2017) and historical (1961–1990) periods. Days at risk of frost are days with a minimum temperature < 2°C. High (low) values indicate increased (decreased) frost risk.

Figure 3: Projected mean number of days at risk of frost during the growing season (October to April) from 2021 to 2100. Each grid cell is the mean of the 6 ensemble members. Increasing (decreasing) values indicate a trend towards higher (lower) frost risk.

Figure 4: Violin plots of daily minimum temperature (°C) for each month for 20-year periods from 2001 to 2100. Each violin represents daily data for each grid cell, for each of the 6 ensemble members, and for each growing year within the time period. The top and bottom of each violin represent the daily minimum temperatures for every January day in the period 2001–2020, for each grid cell in the region, for each of the 6 ensemble members. The current period (2001-2020) has been shadowed underneath future time periods to highlight any differences expected into the future. Dots represent the means for each violin. If the violin shifts lower (higher) this indicates a change towards colder (warmer) conditions.

Figure 5: Monthly average cumulative frost days for 20-year periods from 2001 to 2100. Values are a summary across all grid cells, for all years with each 20-year period, for each of the 6 ensemble members. This reflects how frost risk varies across the year within each 20-year period. The current period (2001–2020) has been shadowed underneath future time periods to highlight any differences expected into the future.

Figure 6: Timeseries of accumulated frost intensity, which is the cumulative total of temperatures less than 2°C over a growing season. This index characterizes exposure to cold conditions. High values indicate cold winters/springs. Points are for each grid cell, averaged across the 6 ensemble members.

Figure 7: Timeseries of the number of days per growing year when temperature falls below selected thresholds (< 2°C, < 0°C, < -2°C). Areas indicate the number of days per growing year that temperatures fall below each threshold. Growing years are represented by different colors, with fewer instances reflecting a warming climate.