

Impact of climate change on *Meander Valley* opportunities for agricultural enterprises

summary

TIA assessed the changes in frost days and a crop thermal index in the 21st century for two locations at different elevations in the Meander Valley, Tasmania.

The opportunities presented by these future climate scenarios for five irrigated crops were evaluated.

The results suggest that significant opportunities exist for the expansion of agriculture and the development of new crops under irrigation within the Meander Valley region.

Tasmania continues to experience significant variability in climate. Scientists are confident that climate will continue to change in the future.

What does this mean for agricultural production in the Meander Valley?

Meander Valley Profile

The agriculturally important catchment of the Meander Valley is geographically and climatically diverse, covering an altitude gradient from more than 1000 m west of the Western Tiers down to less than 240 m around Deloraine in the east.

The Tasmanian Government's [Wealth from Water Pilot Program](#) (2010-2012) was set up to assist farmers and potential investors to develop their irrigation businesses and assist the transition to growing high value crops best suited to their area. The program derived enterprise suitability maps from a combination of digital soil mapping, localised climate data and crop rules.

This information sheet focuses on the Meander Valley and has applied the crop rules developed in the [Wealth from Water Pilot Program](#) to model the response of five different high-value irrigated crops (barley, poppies, pyrethrum, blueberries and hazelnuts) to a changing climate.

Climate variability and longer term changes in climate

Average temperatures across the Meander Valley have risen in the decades since the 1950s at a similar rate to the rest of Tasmania (up to 0.1 °C per decade). Daily minimum temperatures have risen slightly more than daily maximum temperatures. There has also been a corresponding decline in average rainfall along with fewer wet years since the 1970s. This decrease in rainfall is most marked in autumn and was exacerbated by two recent drought periods of 1993-1995 and 2007-2010. Scientists suggest that the climate will be even more variable in the future.

An assumption in dealing with climate variability is that the weather will oscillate around a baseline or long-term average over a short to medium timeframe. Generations of Tasmanian farmers have dealt and continue to deal with this climate variability, resulting in a culture of resilience and adaptation to a changing climate.

Agriculture and changing climate

Projections of climate from [Climate Futures for Tasmania](#) were used to assess the impacts of a changing climate at two locations in the Meander Valley, with elevations of 179 m and 384 m. Temperature is projected to increase by an average range of 2.6 °C to 3.3 °C from the baseline (1971-2000) to 2085 (2071-2100) across the Meander Valley (Figure 1). Average annual rainfall is projected to increase slightly at the lower elevation location (179 m) and decrease at the higher elevation site (384 m) (Figure 1). While carbon dioxide fertilisation impacts on the five crop species has not been specifically addressed in this information sheet, the general impact of increased atmospheric CO₂ is expected to result in increases in the efficiency of the use of solar radiation and water by plants and thereby increase plant growth rates.

The effects of a changing climate were quantified at both locations for barley, poppies, pyrethrum, blueberries and hazelnuts. These five crops were selected by the Wealth from Water Pilot Project to have the potential, under irrigation, to be grown as a new or expanded crop in the Meander Valley.

Agricultural climate indices include simple thresholds of crop requirements such as ranges in mean annual temperature or rainfall, and more complex calculations, such as growing degree days and chill hours.

This information sheet presents modelling results based on two temperature indices: the number of days with frost and a thermal index; growing degree days. Growing degree days are a measure of the amount of heat required to grow and ripen crops. Other agricultural indices such as chill hours (a measure of cumulative exposure to cold temperatures required to break dormancy) are not dealt with in this information sheet but can have equally significant implications for crop development.

Frost

The annual number of potentially damaging cold and frost days in Meander Valley is critical to planning crop development in the region.

In the past, frosts have caused significant damage to broadacre and horticultural crops in Tasmania. Crops may be more sensitive to the timing and severity of the frost, than the actual number of frosts experienced. A single frost at a critical time of crop development, such as flowering or bud burst, can be very damaging to an industry.



Modelled Changes in Climate

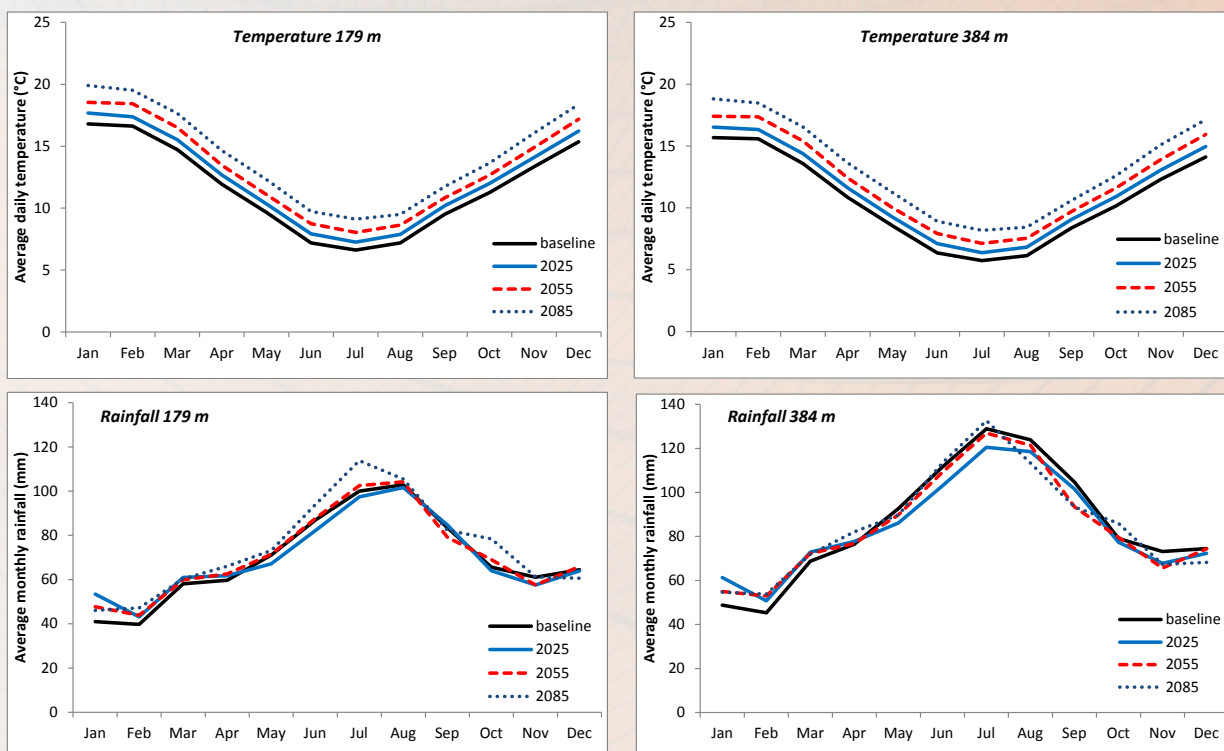


Figure 1

Projected average monthly temperature (°C) and average monthly rainfall (mm) at the 179 m and 384 m locations for the baseline and three future climate periods, 2025 (2011 - 2040), 2055 (2041 - 2070) and 2085 (2071 - 2100).

Frost cont.,

Different temperature values are used to assess frost incidence due to differing susceptibilities of crop species and because temperature is not measured at ground level.

For example, a recorded temperature of 0 °C reflects frost incidence for blueberries and hazelnuts as the susceptible parts of these tree crops are higher than ground level. In contrast, a recorded temperature of 2 °C for pasture and cereal crops is applicable as a measure of frost incidence.

In assessing frost incidence, the number of frost days per year are projected to decrease at both locations in the Meander Valley. At higher elevation, the number of frost days less 2 °C and less than 0 °C are projected to decrease by 58 days and 36 days respectively (Figure 2). The higher elevation location will benefit most from decreasing frost incidence (Figure 2).

- Poppies are susceptible to frost during November and December, during late hook stage and flowering. Days with frost (currently four per year less than 2 °C) during this critical period are projected to disappear by 2085 at the lower elevation location and to significantly reduce at the higher elevation location (Figure 3). This likely decrease in the number of frost days will significantly decrease the frost risk associated with poppy production.



Modelled Changes in Frost Days

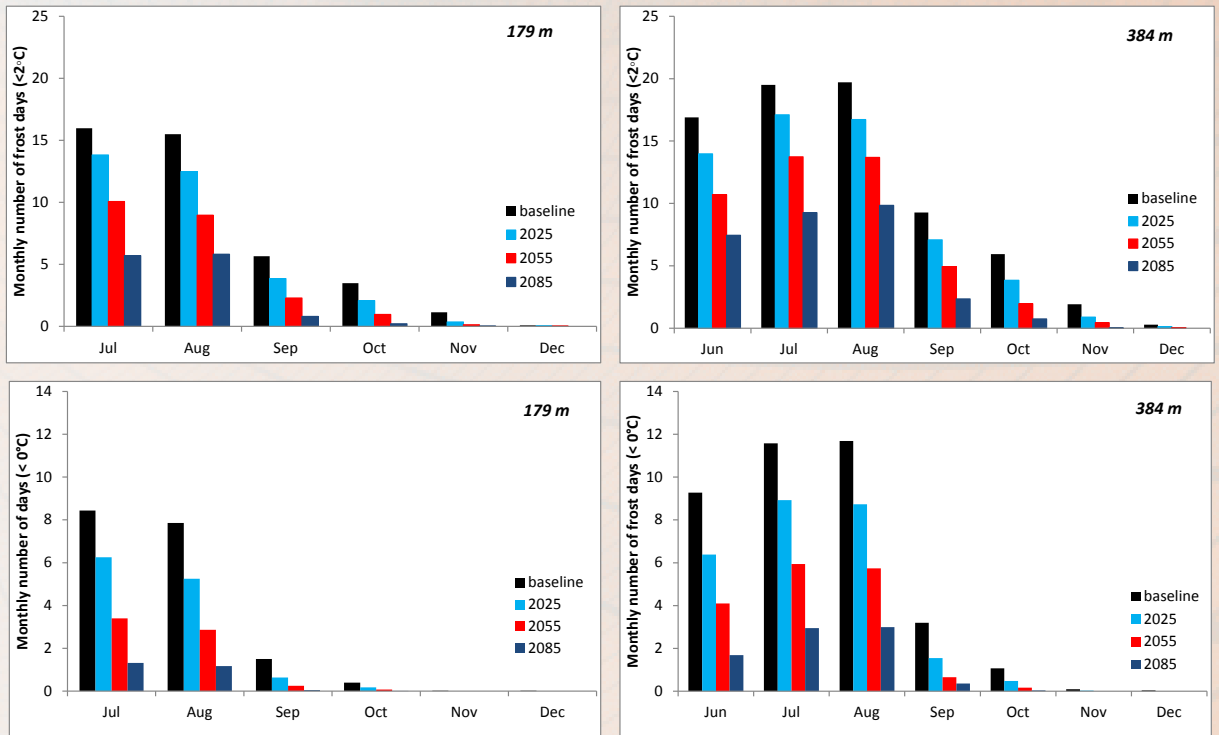


Figure 3

Number of days per year less than 2 °C (top row) and number of days per year less than 0 °C (bottom row) at the 179 m and 384 m Meander Valley locations for the baseline period (1971 2000) and three future climate periods: 2025 (2011-2040), 2055 (2041-2070), 2085 (2071 2100).

Modelled Changes to Flowering Dates

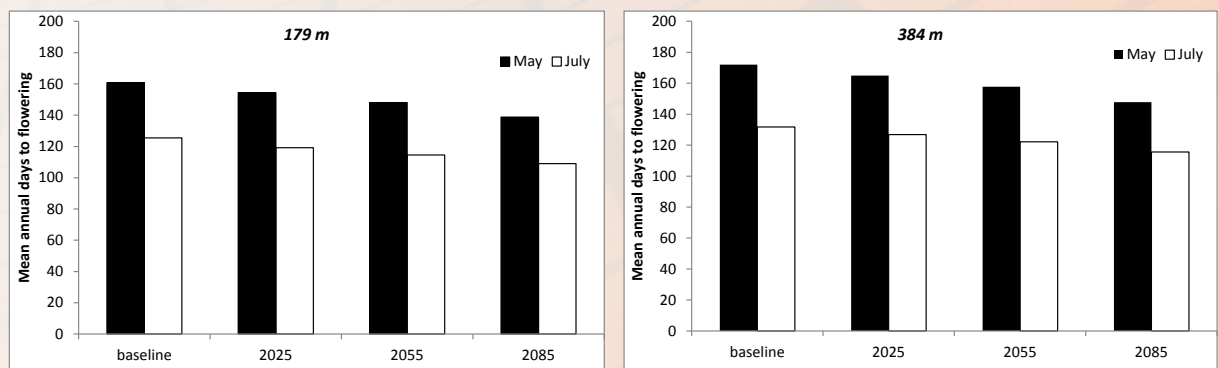


Figure 4

Number of days per year to flowering for barley for two locations (179 m and 384 m) in the Meander Valley for the baseline period (1971 2000) and three future climate periods: 2025 (2011-2040), 2055 (2041-2070), 2085 (2071 2100).

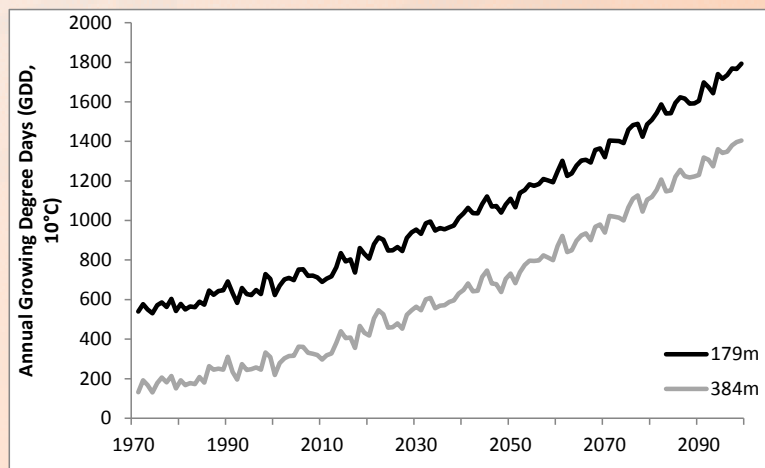


Figure 5

Annual Growing Degree Days (Base 10 °C) for the 179 m and 384 m locations over the period 1971-2100.

Growing degree days (GDD)

For the Meander Valley, growing degree days (GDD) are projected to increase significantly at both locations (Figure 5). These changes are likely to have an impact on the choice of crops, length of growing season, and on yield and quality.

The projected increase in growing degree days means that crops currently marginal in these locations can be considered in the future. Out of the five crops this applies especially to hazelnuts. Hazelnuts require greater than 720 GDD for mature fruit to form but production is best suited to locations with more than 920 GDD. Currently, the number of growing degree days is too low at either location in the Meander Valley for hazelnut production, but in less than a decade the lower elevation location will on average accumulate sufficient growing degree days for hazelnuts. The growing degree days for the higher elevation location will move into the range for hazelnut production by 2060.

Conclusion

Projected climate impacts were quantified for two locations under different elevations within the Meander Valley using the agricultural climate indices of frost incidence and growing degree days. Frost events are projected to decrease significantly under a warming climate at both locations, more discernibly at the higher elevation location (384 m). Growing Degree Days are also projected to significantly increase at both locations throughout the 21st century opening up opportunities for crops with a greater growing degree days requirement such as hazelnuts.



TIA is a joint venture between the University of Tasmania and the Tasmanian Government.



This information sheet is a joint production of the Tasmanian Government and the Tasmanian Institute of Agriculture.

Further information

This information sheet is part of a series produced by TIA on the impacts of climate change in agriculture. The full suite of information sheets is available at:

www.dpipwe.tas.gov.au/climatechange

The Tasmanian Government's Tasmanian Climate Change Office (TCCO) provides information on climate change mitigation, and adaptation programs and options:

www.climatechange.tas.gov.au

Climate Futures for Tasmania reports provide information on the impacts of climate change in Tasmania on general climate, water and catchments, impacts on agriculture and extreme events:

www.climatechange.tas.gov.au

The Bureau of Meteorology provides data on weather forecasts and climate variability:

www.bom.gov.au

For further information to assist farmers and potential investors to allow comparisons to be made between enterprises including cash crop and livestock enterprise tools visit

www.dpipwe.tas.gov.au/wealthfromwater

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About Climate Futures for Tasmania

The material in this information sheet was developed from outputs from the Climate Futures for Tasmania project. In particular, from the Impacts on Agriculture Technical Report (Holz et al. 2010).

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The Climate Futures for Tasmania project was managed by the Antarctic Climate & Ecosystems Cooperative Research Centre (ACE CRC). For more information about the project go to:

www.acecrc.org.au

