Case study 2:

# Adaptation options for a **sugar cane farm near Bundaberg**

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# Case Study 2: Adaptation options for a sugar cane farm near Bundaberg

This case study—Adaptation options for a sugar cane farm near Bundaberg—aims to highlight the impacts of climate change on production. The University of Southern Queensland provided a multi-model ensemble—combining the Agricultural Production Systems Simulator (APSIM) and the Decision Support System for Agrotechnology Transfer (DSSAT)—to established crop performance under three different climate scenarios across three time frames. The three climate scenarios used were: Representative Concentration Pathway (RCP) 2.6—low emissions scenario; RCP 4.5—intermediate emissions scenario; and RCP 8.5—high emissions scenario. Results were averaged and applied to understand the impacts on the farm, and to identify on-farm adaptation measures that could help reduce the simulated impacts.

## Farm profile

The farm near Bundaberg, in the Burnett Mary Natural Resource Management (NRM) region produces sugar cane and draws water from the Burnett River to irrigate the crops. The 100 hectare, irrigated farm has red vertisol and sandy soils that yield differently. From 2012-2018, the red soil paddocks have yielded up to 130 tonnes per hectare, with slight variations above and below this amount. The sandy soils have yielded less, at 100 tonnes per hectare. Sugarcane is widely grown throughout the Bundaberg region, as are a range of horticultural crops.

## Weather statistics

**Table 1: Mean maximum and minimum temperature, and rainfall at Bundaberg Aero**

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean maximum temperature (°C) | 30.3 | 30.1 | 29.2 | 27.5 | 24.8 | 22.7 | 22.2 | 23.5 | 25.6 | 27.0 | 28.5 | 29.6 | 26.8 |
| Mean minimum temperature (°C) | 21.5 | 21.4 | 20.1 | 17.6 | 14.2 | 11.7 | 10.3 | 10.8 | 13.7 | 16.5 | 18.8 | 20.5 | 16.4 |
| Mean rainfall (mm) | 174.2 | 157.8 | 113.4 | 55.9 | 67.5 | 50.7 | 39.7 | 34.0 | 35.6 | 78.1 | 84.8 | 126.6 | 1021.8 |

Major risks for farms in the Bundaberg area are droughts and floods, which were both demonstrated in 2018 with extreme rainfall in February 2018 followed by several months of rainfall well below the mean, and an annual total rainfall of only 742.8mm.

**Table 2: Mean rainfall for Bundaberg in 2018**

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | 2018 total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rainfall (mm) | 126.8 | 266.8 | 10.2 | 21.2 | 14.8 | 4.2 | 10.4 | 17.4 | 6.6 | 164.0 | 32.0 | 68.4 | 742.8 |

## Climate change projection summaries for Australia

The following changes are were predicted with very high confidence:

- rising average temperatures will continue in all seasons
- more hot days and warm spells
- rising mean sea level
- rising height of extreme sea-level events.

The following changes are predicted with high confidence:

- fewer frosts
- increased intensity of extreme rainfall events
- a harsher fire-weather climate.

The following changes are predicted with medium confidence:

- lower average winter and spring rainfal
- changes in summer and autumn rainfall, but unclear.

On annual and decadal bases, natural variability in the climate system can act to either mask or enhance any long-term human induced trend, particularly in the next 20 years and for rainfall.

## Predicted impacts—crop modelling outputs

There are some limitations and assumptions in predicting the impacts of climate change on production. Modelled outputs on crop performance are based on many assumptions and may not be representative of what will happen on farm. The results indicate what could happen with the farming system under the different future predicted climate scenarios. Results do not consider any future adaptation that might occur on farm. Although the modelled runs have been distilled down to percentage change, there is a lot of variation in the modelled outcome that cannot be represented in this simple case study. Models are for climate change scenarios and do not consider weather variability. Cells with red text indicate a reduction in crop yield over the 2012–2018 average.

### Table 3: Modeled percentage change in sugarcane yield

| Time | Model runs | Climate scenario RCP 2.6 | Climate scenario RCP 4.5 | Climate scenario RCP 8.5 |
|---|---|---|---|---|
| 2030–2049 | 720 | 0.4 | - 0.5 | - 13.1 |
| 2050–2069 | 720 | 6.3 | 7.3 | - 1.7 |
| 2070–2099 | 720 | - 4.7 | - 1.1 | - 10.7 |

When these percentage changes are overlayed on the 2012-2018 average yield, the impacts of climate change become noticeable.

### Table 4: Modelled change to yield in tonnes per hectare (t/ha)

| Time | Climate scenario RCP 2.6 | | Climate scenario RCP 4.5 | | Climate scenario RCP 8.5 | |
|---|---|---|---|---|---|---|
| | Red soil yields (t/ha) | Sandy soil yields (t/ha) | Red soil yields (t/ha) | Sandy Soil yields (t/ha) | Red soil yields (t/ha) | Sandy soil yields (t/ha) |
| 2012–2018 | 130 | 100 | 130 | 100 | 130 | 100 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 2030–2049 | 129.48 | 99.6 | 129.35 | 99.5 | 112.97 | 86.9 |
| 2050–2069 | 138.19 | 106.3 | 139.49 | 107.3 | 127.79 | 98.3 |
| 2070–2099 | 123.89 | 95.3 | 128.57 | 98.9 | 116.09 | 89.3 |

## Adaptation potential

As outlined in the East Coast North sub-cluster Action Plan, the farm has some options to reduce the impacts of climate change. Yield decrease is a typical impact and will affect business profitability over time. For this business, there are two main paths for climate change adaptation.

1. **Business resilience to manage reduced yields and income**

Options for the farm include:

- talk to insurance providers or brokers and industry representatives about insurance options (find out more about insurance at www.qff.org.au/projects/insurance)
- get involved with projects to increase understanding of insurance and the development of insurance markets for producers
- connect with the Queensland Rural and Industry Development Authority and the Regional Investment Corporation to leverage concessional loans for adaptation
- include climate risks in on-farm decision making and investments
- develop a rolling budget, with the 'Rules of thumb' setting out the expectations for a ten-year yield prediction and translate the outlined climate risk into crop expectation over a decade, which can be useful for farm management decision making.

2. **Increase understanding of the impacts of climate change, work with extension officers and implement research and development, to reduce the potential yield decrease**

Options for the farm include:

- utilise the expertise at Bundaberg CANEGRGOWERS Ltd, particularly on improving irrigation
- complete industry BMP, evaluate score and implement recommendations
- seek advice and support from agronomists, local universities, industry or NRM groups
- participate in projects and on-farm trials that can benefit the farm, and share lessons with other farms.

## Conclusion

As demonstrated in this case study, climate change is likely to impact the farm yield. Adaptation can help reduce decline in yield. Climate change adaptation is a repetitive process. It requires continued management over time that incorporates updated data and information. The East Coast North Sub-cluster Action Plan details climate adaptation options that could be considered and utilised on the farm. Ultimately, the responsibility is on farmers to understand their risks and take suitable actions to minimise the risk.