Matamata-Piako Climate Resilience & Adaptations

In partnership with Lincoln University and Tatua Dairy Co-operative

DairyNZ partnered with Lincoln University and The Tatua Co-operative Dairy Company to assess the preparedness of dairy farmers for climate change adaptation. Models were used to project pasture persistence, farm performance and heat stress under a changing climate using a case study farm in the Matamata-Piako district, which was scaled up to assess impacts at district level.

The modelling project evaluated the effects of gradual climate change over the rest of this century, with a specific focus on ryegrass persistence, pasture growth rates, farm profitability and heat stress for cows. The insights gained from this study helped in developing adaptations that farmers can implement to reduce the effects of climate change.

Key Takeaways

- Ryegrass persistence into the rest of the 21st century is expected to decrease from medium to low for large parts of the Waikato region, including Matamata-Piako district.
- The decrease in summer pasture growth rates is expected to be more pronounced and extend further into late summer-autumn as the century progresses.
- Decreases in ryegrass persistence and growth rates are expected to impact farm profitability. With no adaptation or change to the farm system, businesses can expect to forfeit 25-60% profit by the end of the century depending on either an optimistic[1](around 25% reduction) or less-optimistic (around 60% reduction) outlook.
- Alternative pasture species that are more drought resistant (e.g., Tall Fescue) and summer crops such as chicory, turnips, or multi-species crops have the potential to reduce the adverse effects of summer-autumn feed deficits.
- The number of heat stress days during summer months is expected to increase over the rest of this century.
- The expected increase in heat stress severity and the expected increase in overall heat stress days per year is anticipated to, without any adaptation, contribute towards milk production losses, which could at least double by the end of the century.
- Heat stress impacts could be reduced by changing milking schedules to avoid the heat of the day, or by providing shade, shelter or cooling systems.

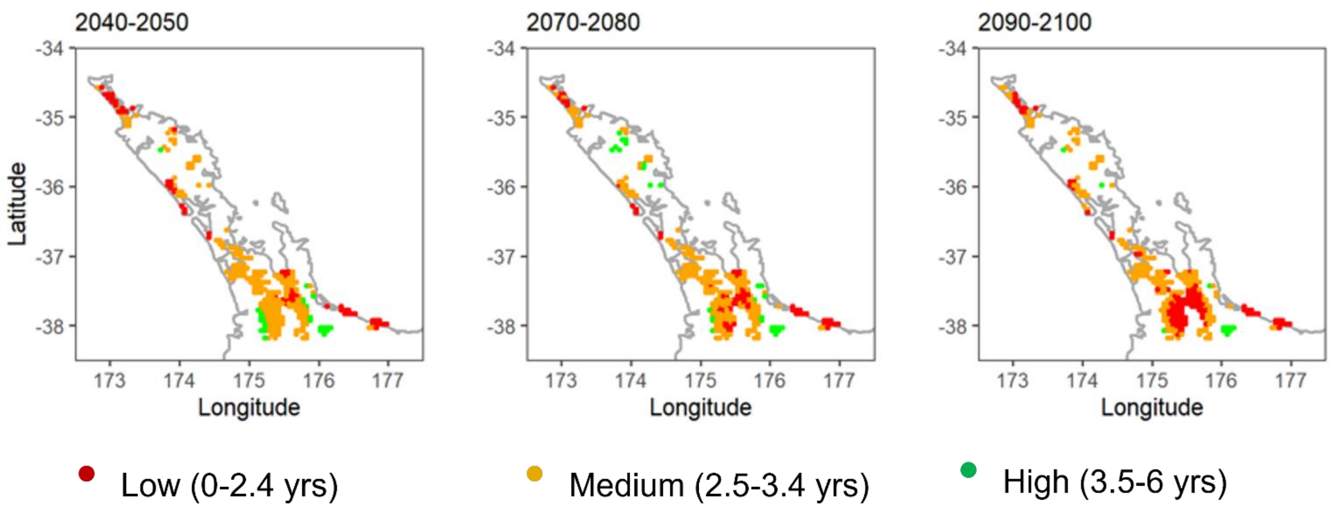
[1]*Levels of optimism are determined based on the six climate models used - "optimistic" refers to the average outcome of the six models and "less optimistic" is one standard deviation below.*

Research Findings

Ryegrass persistence

Projected climate data from NIWA was used to model perennial ryegrass persistence and productivity. The ryegrass model used relies on daily climate data, including average temperature, rainfall, solar radiation, and potential evapotranspiration.

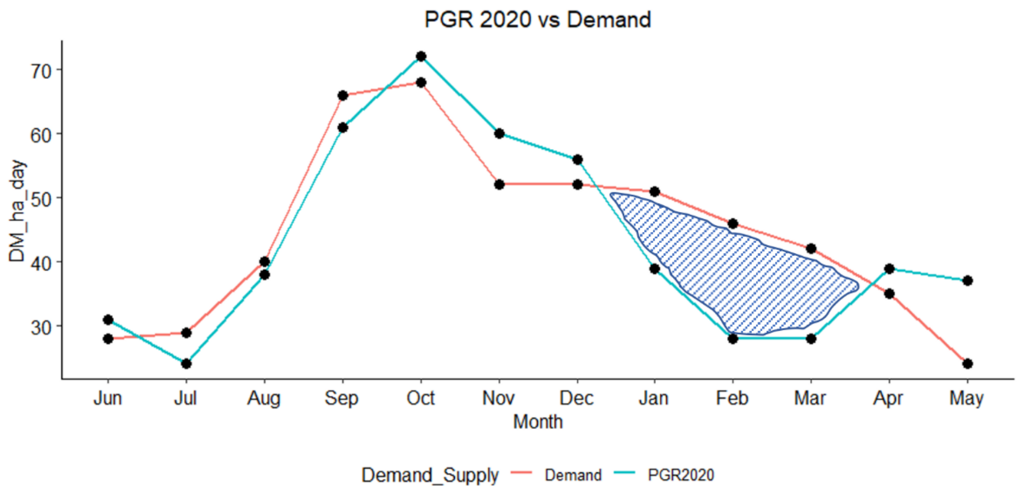
Ryegrass projections for the Upper North Island

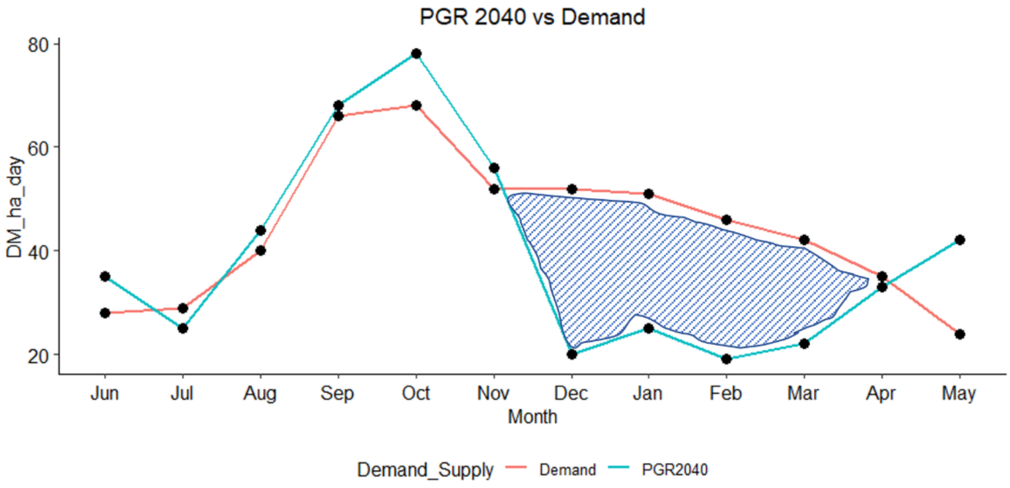


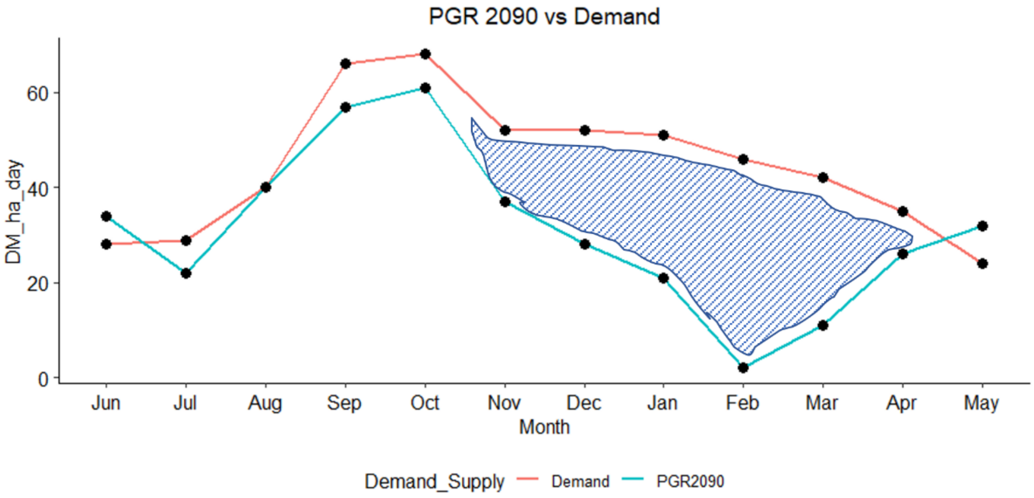
The maps represent ryegrass persistence for mid-century, second half of the century and end of century. We can clearly see how ryegrass persistence into the rest of the century is expected to decrease from medium to low for large parts of the Waikato region, including the Matamata-Piako district.

Ryegrass growth rates and farm performance

Average monthly pasture growth rates (supply) vs feed requirements (demand) for a typical Matamata-Piako farm without adaptations.







The shaded area shows feed deficit, making it clear that deficits increase further into the century. Anticipated changes suggest that peak spring pasture growth rates will decline in the future. Compared to present times, the decrease in summer pasture growth rates is expected to be more pronounced and extend further into late summer-autumn as the century progresses. Summer-autumn pasture deficits will become more severe and prolonged without adaptations.

The Impact:

Without implementing any adaptation or changes to the farm system, businesses can anticipate a decline in profit ranging from 25% to 60% by the end of the century, depending on whether an optimistic (approximately 25% reduction) or less optimistic (approximately 60% reduction) outlook is considered.

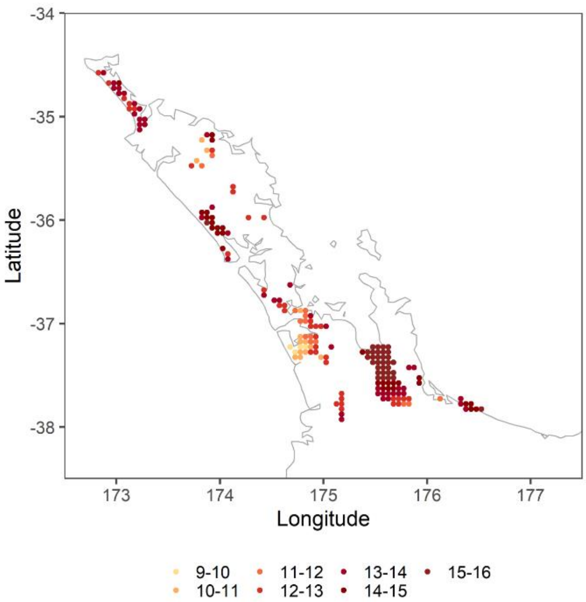
Adaptation:

Alternative pasture species that are more drought resistant (e.g., Tall Fescue) and summer crops such as chicory, turnips, or multi-species crops have the potential to reduce the adverse effects of summer-autumn feed deficits. Better matching feed demand with supply by changing stocking rate, or by shifting calving and culling dates are further options. The timing of implementing these adaptations is important, especially where adaptation requires a longer lead-in time. In an optimistic scenario, pasture growth conditions, including CO_2 fertilisation, may continue to improve until mid-century. Therefore, replacing some pasture with costlier crops could be counterproductive during this period. However, it is advisable to consider adapting to the summer-autumn feed deficits during the latter half of the century.

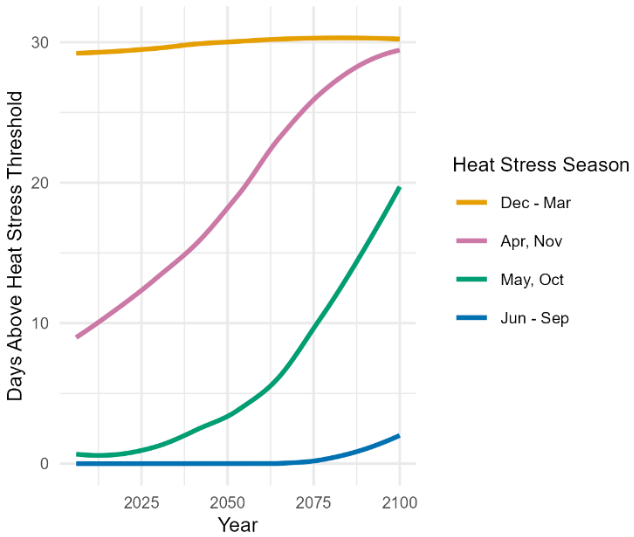
Heat Stress

When cows gain more heat than they can get rid of, it leads to discomfort and lower milk production. Heat stress on cows for the current decade and the rest of the century was estimated using NIWA projections of daily temperature and humidity. These calculations of heat stress are directly related to decreases in milk production.

Heat map showing expected milksolids losses (kg MS/cow/year) by the end of the century for Holstein Friesian cows under RCP8.5



High, medium and low heat stress months and how these change over time



Note: The graphs above demonstrate the worst-case scenarios.

The Impact:

The months December, January, February, and March are expected to continue being the worst heat stress months. The peak heat stress season for Jerseys and Crossbreds are January and February, with Holstein Friesian cows experiencing more heat stress days. Both the expected increase in heat stress severity and the expected increase in overall heat stress days per year is anticipated to, without some adaptation, contribute towards milk production losses, which could at least double by the end of the century.

Adaptation:

Holstein Friesian cows are already experiencing a high number of heat stress days in these months. This is not going to change into the future unless adaptation occurs. These could be changing milking schedules to avoid the heat of the day, or by providing shelters or cooling systems, or by introducing more heat tolerant genetics.