Dairy Businesses for Future Climates

NATIONAL - Research Findings 2016

The profitability of dairy farm businesses was negatively affected by the 2040 climate change scenarios modelled in this research. Three real base farms in different regions and three development options at each site were tested and all were predicted to have a reduction in profit.

Farmers interviewed were generally confident to adapt to incremental climate change based on their past experiences of managing variable seasons.

- Skilled farm managers are essential to the future success of the dairy industry. Training and skills support for farmers to manage future climate challenges will be required.

Dairy farm managers will need to continue to adapt their farm systems to manage risks presented by future climate.

- The growing season for pastures will shift under 2040 climate change scenarios creating feed challenges.
- Year to year climate variability will continue to be a challenge to dairy farm businesses.
- Milk price is likely to have a greater impact on business performance than climate change.

The adaptive or simplified farm production systems tested are realistic alternatives to the long term trend of intensification for dairy businesses in future climates.

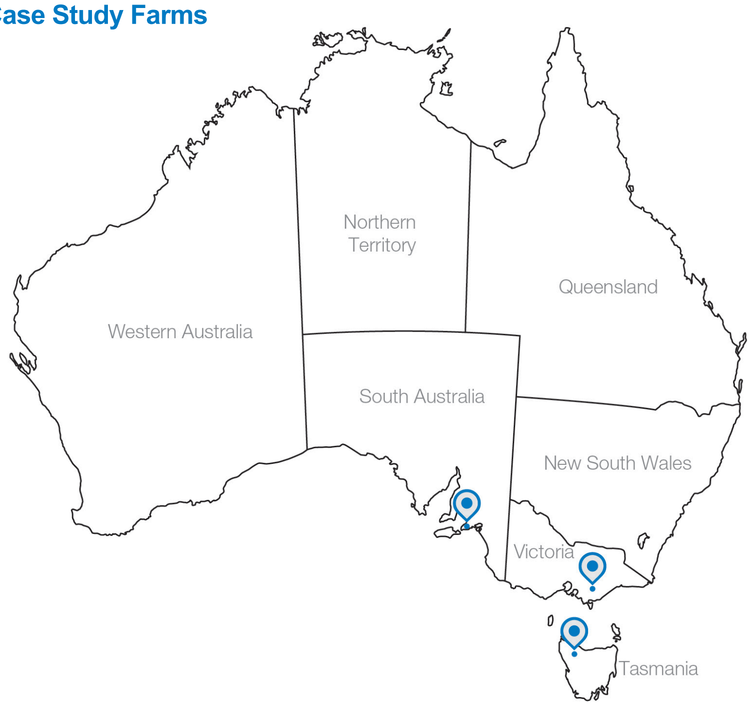
- Milk payment systems may alter the attractiveness and returns of different production systems in the future.

What was the aim of the research?

The Australian dairy industry has been on an intensification pathway over recent decades, utilising higher levels of inputs to produce more milk, this pathway has been questioned in light of projections for warmer and more variable future climates.

This research set out to explore how three different dairy farm systems in Central Gippsland (Victoria), the Fleurieu Peninsula (South Australia) and North West Tasmania may perform under predicted climate changes out to 2040.

Location of the Dairy Business for Future Climates
Case Study Farms



How was the research carried out?

- A case study farm was studied as a representative base farm in each of the three regions, with the intention that other farms in each region could relate to the research findings. Two of these farms were dryland dairy businesses - located in Central Gippsland (Victoria) and the Fleurieu Peninsula (South Australia), the third in North West Tasmania had two-thirds of the farm under irrigation.
- Three development options for each base farm in a high, medium and low climate change scenario were modelled in a '2040' climate by an economist and agriculture systems modellers. Climate in 2040 was modelled for an IPCC high climate change scenario (RCP 8.5).
- Social science researchers initially conducted interviews with dairy farmers to explore climate change adaptive capacity. Following this, focus groups were held in each region to discuss the development options. Farmers were surveyed on their experiences of extreme weather events in the region.
- Working Groups made up of farmers and farm consultants guided the research in each region.

Dairying in Australia

The Australian dairy industry is a **$13 billion** farm, manufacturing and export industry

1.74 million dairy cows spread across 8 dairy regions producing 9,731 million litres of milk annually

35% of Australia's dairy products are exported, signifying 6% of the world's dairy trade

What development options were explored?

Three development options for the base farm were modelled in detail. The following tables describe the options modelled (development options were modelled under current (2016) and future climate (2040)).

GIPPSLAND	Herd Size	Cow Live Weight (kg)	Peak Calving	Stocking Rate (cows/ha)	Grain Fed (tonnes/cow)	Production per yr kg Milk Solids per cow (today/2040)	Pasture consumed tonnes DM/ha (today/2040)
Base Farm – current system	350	475	Spring	3.2	1.1	395 / 392	9 / 8.1
Intensify – increase stocking rate	500	550	Split 50% mid April 50% mid Aug	4.5	2	531 / 515	9.7 / 8.6
Adapt – more milk per cow	250	550	Autumn	2.3	1.8	512 / 518	8.7 / 8.5
Simplify - self reliant	200	475	Autumn	1.9	0.5	449 / 448	7.8 / 7.8

"The biggest challenges come when we get a tough season (weather-wise) together with a low milk price."
(Dairy farmer, Gippsland)

What development options were explored...[cont]

FLEURIEU PENINSULA	Herd Size	Cow Live Weight (kg)	Peak Calving	Stocking Rate (cows/ha)	Grain Fed (Tonnes DM / cow)	Production per yr kg Milk Solids per cow (today/2040)	Pasture consumed Tonnes DM/ha (today/2040)
Base Farm - current system	350	550	Autumn	1.7	1.6	526 / 520	7.6 / 7.3
Intensify – TMR	400	600	Year-round	n/a	3.0	700 / 700	8.1 / 7.3
Adapt – PMR	400	550	Split 50% mid April 50% mid Aug	1.9	2.2	561 / 553	8.1 / 7.3
Simplify - self reliant	290	520	Autumn	1.4	1.0	473 / 471	7.4 / 7.1

TASMANIA	Herd Size	Cow Live Weight (kg)	Peak Calving	Stocking Rate (cows/ha)	Grain Fed (Tonnes DM / cow)	Production per yr kg Milk Solids per cow (today/2040)	Pasture consumed Tonnes DM/ha (today/2040)
Base Farm - current system	450	500	August	3.0	1.1	496 / 489	12.4 / 12.1
Intensify	600	500	August	4.0	2.0	540 / 531	13.6 / 13.6
Adapt	500	500	August	3.3	1.0	513 / 501	13.9 / 13.6
Simplify	350	500	August	2.5	0.5	442 / 434	11.2 / 10.9

How different is a 2040 climate predicted to be?

- Maximum and minimum temperatures for all sites are expected to increase. As temperatures increase summer-like conditions extend beyond the 'usual' summer period.
- Rainfall events are predicted to vary from year to year and to occur in fewer, larger events, with longer dry spells in between.
- Extreme weather events are predicted to continue under a changing climate – intense rainfall, flooding, drought, heat waves, bush fires and wind events were identified as concerns to farmers surveyed in this research. These events are unpredictable and have the potential to cause disruptions to dairy businesses, such as loss of power, inability to access farms for milk collection, financial hardship, reduction in milk production and stress to animals and farm operators.
- Graphs showing monthly temperature and rainfall changes are included in each of the regional information sheets. These graphs show historical temperature and rainfall patterns as well as those modelled for 2040 climates at each farm location.

How different will pasture production and utilisation be in 2040?

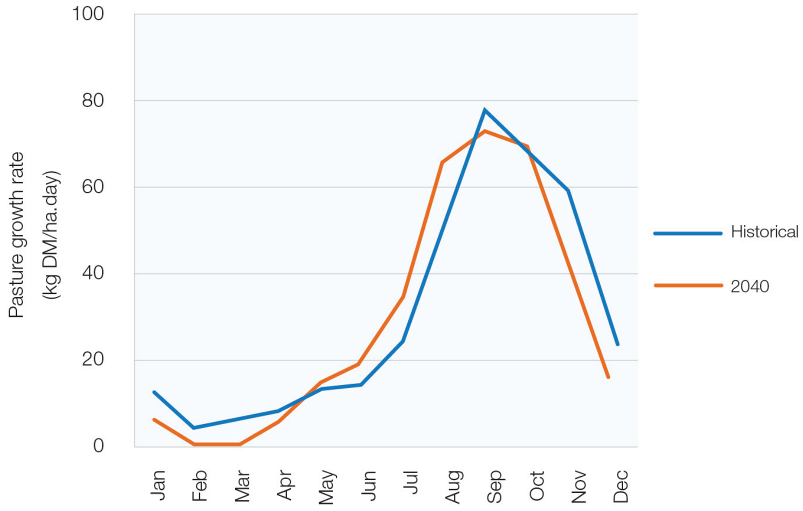
- Australian dairy farms rely on pasture production. Pasture consumed by cows is a key profit driver.
- Modelling showed that pasture growth rates from May to September on the case study farms (winter & early spring) were likely to be higher in the 2040 climates, but lower during the remainder of the year. This results in a lower proportion of pasture being directly grazed and more conserved and fed back to cows.
- The graphs to the right show monthly average pasture growth. These were generated using 38 years of historical data and 2040 modelled climate data. Simulations were conducted assuming pure perennial ryegrass swards with no weeds or pests.

What does a changing climate mean for Australian dairy farms?

- Year to year climate variability already experienced will continue and rainfall variability may be increased. Climate variability can have a greater impact on financial returns compared to the general trend in climate change alone.
- If climate change follows the high change trajectory, less pasture will be grown on farm and profitable years will become less likely. This means that farmers will need to adapt further to greater risk, and will need to have biophysical adaptations and financial plans in place to buffer low production in years with poor seasonal conditions.
- The factors which influence farm profitability in historic climates, pasture utilisation and feed costs together with milk prices, will continue to have dominant influences in the 2040 climates.
- In the 2040 high climate scenario, none of the farm development options modelled in this research increased profit, but the options were affected differently.
- The environment beyond the farm gate will influence farm development pathways - industry reputation, market demand for dairy products, agriculture and environmental policies, workforce access and regional economics and development.

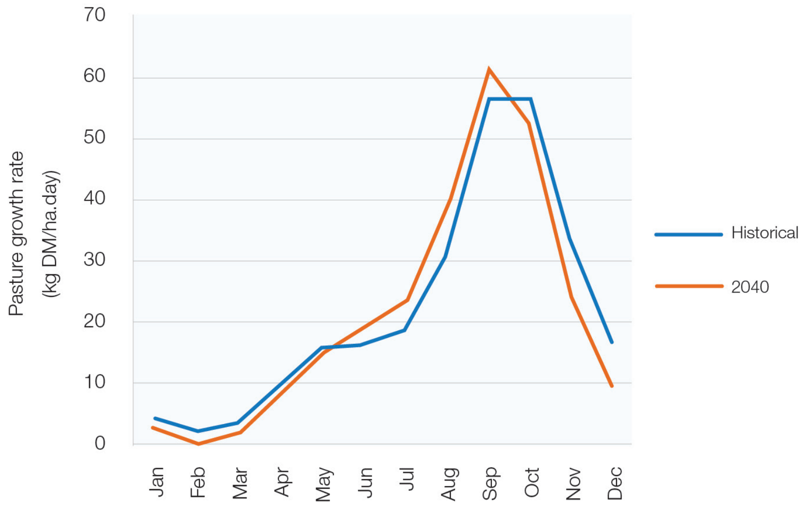
Central Gippsland, Victoria

Monthly average pasture growth rates for a perennial ryegrass pasture in the historical and 2040 High climate scenarios at Gippsland



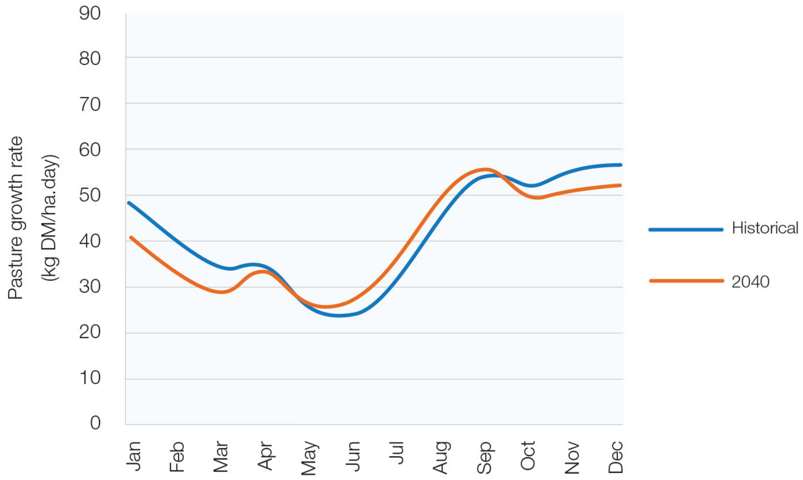
The Fleurieu Peninsula, South Australia

Monthly average pasture growth rates for a perennial ryegrass pasture in the historical and 2040 High climate scenarios at South Australia



North West Tasmania

Monthly average pasture growth rates for a perennial ryegrass pasture in the historical and 2040 High climate scenarios at Tasmania



How are our current dairy businesses vulnerable to a 2040 climate?

The three current (2016) farming systems studied in each region were negatively affected by the 2040 climate scenarios. This research did not find a clear 'winner' in the form of the most resilient farming system for the future. All of the development options explored had positive and negative aspects.

The profitability of the 'base' farm in each region was negatively affected by the 2040 climate scenarios, although the response to specific scenarios (low, mid, high) varied. Lower pasture production and utilisation, increased purchased supplementary feed, greater reliance on cutting silage/hay rather than direct grazing pasture, and lower milk production per cow all contributed to this result.

While it is difficult to compare the development options across regions because they are specific to location, some general trends were evident:

- Milk price was the largest single source of variation in profit across regions and options and caused greater variation in profitability compared with climate change to 2040.
- The impact of climate variability (wet/dry sequences, including effects on pasture utilisation and feed costs) was greater than projected 2040 climate change for most options.
- No single development option was identified in any region that could be considered superior to the others. All had certain strength and weaknesses, for example:
  - *Intensified* options had the greatest year-to-year variability in profit due to high reliance on purchased feed. These options tended to be highly impacted by the climate change scenarios (although the *Intensify* option in SA is an exception) and whether implemented in wet or dry decades (e.g. intensified systems were often the most profitable in wet 10 year sequences, but the least profitable in dry 10 year sequences).
  - *Simplified* options generally had the lowest average profit across development options within sites, but had the least year-to-year variability in profit and were generally less impacted by the 2040 climates.
  - The *Adapt* option in Tasmania that increased cow numbers without an increased percentage of purchased feed, but with increased farm area under irrigation, increased profitability and pasture utilisation, and reduced long-term variability in the same variables. However, this option depended on readily available irrigation water at a relatively low price, which would not be an option available to the majority of dairy farms in southern Australia.

The project not only explored economic and production threats, societal, social and psychological 'threats' were raised in farmer discussions. Conversations with focus groups across three regions, identified that intensified systems* may be vulnerable to community perceptions and expectations around the management of animal welfare issues and agricultural impacts on water resources.

Other risks with intensified systems may be the threat to well-being of farming families and staff from operating a demanding and potentially stressful dairy system. If a dairy region was to adopt the *Simplify* options, the economic and social viability of the region could be under threat because of a decrease in investments in job creation and spending in the local economy.

More detail on the opportunities and trade-offs identified for each of the development options that were explored in the three Dairy Businesses for Future Climates regions can be found in the regional information sheets.

** 'Intensified' systems mean different things in different places. For the SA site it involved a total mixed ration in a housed system with zero grazing by milking cows, for Gippsland it is a higher stocking rate, a feedpad and increased bought in feed and in Tasmania the 'intensified' farm has a higher stocking rate, a feedpad, increased bought in feed, and increased irrigation.*

Will milk price have an impact on farm development into the future?

In most cases a change in milk price of $0.30/kg MS (about a 6% change to the long-term average) was predicted to have a larger impact on profitability than the 2040 high climate change scenario.

Some of the development options analysed (mainly the *Intensify* and *Adapt* options) would be likely to receive a higher milk price than the base farms in the current operating environment. The economic performance of these options was very sensitive to the assumptions relating to milk price.

What is the rate of productivity growth that is required to overcome the negative impacts of a 2040 climate on dairy businesses?

The need for the Australian dairy industry to increase productivity depends largely on the changes in productivity/efficiency of the competitors. The competitors are primarily those countries that compete on the markets for export milk products, but also include other industries within Australia that compete for the same resources (land, water etc) as the dairy industry.

If all competitors were affected by climate change to the same extent (and had the same opportunities for adaptation and mitigation) as the Australian dairy industry, then climate change will not place additional (climate-related) requirements on the Australian dairy industry to increase productivity (but the imperative to increase productivity for many other reasons remains).

If the changed climate has a greater negative impact on the Australian dairy industry than their competitors, or if Australian dairy farmers have less mitigation and adaptation options, then there would be an additional requirement for productivity gains by the Australian dairy industry as a result of climate change.

It is very difficult to isolate the extent that climate change has an impact on the requirement to increase productivity, given the wide range of factors that have an impact on the efficiency of the competitors of the Australian dairy industry. However, the analysis below is an attempt to quantify the extent to which climate change is predicted to affect the requirement to increase productivity, if no competitors were negatively affected by climate change.

This scenario would be one of the 'worst case scenarios', (many competitors would be expected to experience a negative impact from climate change).

At the farm level (if no competitors were negatively affected by climate change), the annual rate of productivity gain required on the base farms to achieve the historical profit in the 2040 high change is:

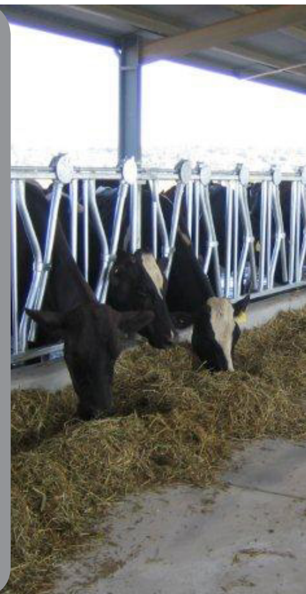
- Gippsland (Vic) = 0.6% per year (but could be as high as 1.2%)
- The Fleurieu Peninsula (SA) = 0.6% per year (but could be as high as 1.1%)
- Tasmania = 0.3% per year (but could be as high as 0.6%)

These numbers have been calculated for a farm business that has been adapting to climate challenges and making required productivity improvements over the last 15-20 years. These projections could approximately double for a farm business that has not made adaptive changes over the last 15-20 years (see numbers in brackets above).

These rates of productivity gain required to counteract the impact of climate change on farm profitability need to be achieved over and above what would be considered 'business as usual' to maintain profitability in the face of other business pressures such as declining terms of trade.

How Are Farmers Adapting To Climate Change?

- Increasing the amount of shade and shelter for stock during extreme weather events
- Increasing on farm water storages
- Recycling water in the dairy shed to reduce water usage
- Growing summer crops to fill the feed gap during dry times
- Carrying larger fodder reserves from year to year
- Installing a feed pad for flexibility in feeding animals
- Upgrading irrigation systems
- Installing fans and/or sprinklers in and around the dairy for cow and people comfort
- Adjusting the farm system e.g. calving pattern change
- Improving business management skills to manage income variability
- Accessing longer range weather forecasts
- Seeking information about global market conditions





Dairy Businesses for Future Climates

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The rates of gain required represent a substantial challenge for the dairy industry which has achieved an estimated average annual productivity gain of 1.6% over the last 30 years.

Productivity gains may be made by a variety of means including increasing farmer skills, pasture utilisation (e.g. alternate species), cow feed efficiency, and/or labour efficiency (e.g. automatic milking systems). Of particular relevance to the climate impacts modelled on the dryland farms in this study (SA and Gippsland), maintaining pasture utilisation in warmer and drier climates is a direct adaptation to climate change.

What skills, support systems and knowledge is required to support dairy business managers to adapt to a changing climate?

Future dairy farming skill sets will need to be both broad (e.g. human resource management, financial management) and specific (e.g. pasture management for dryland or irrigated systems, precision technology).

Limited access to knowledge and reduced opportunities for skill development is likely to reduce the adaptive capacity of dairy farmers to transition their businesses in response to dynamic operating conditions.

Transitioning and operating dairy businesses into the future will not only rely on the skills and knowledge of managers, but also on existing social networks (e.g. peer-based producer groups), professional relationships with high quality agricultural service providers (e.g. agronomist consultants, input suppliers and banks), good access to counselling services and connections with industry related organisations, local governments, public and private research organisations.

How will Australian dairy farmers be producing milk in 2040?

Different farm managers have different risk tolerance and results of this project indicate that a wide variety of farm systems are likely operate within the Australian dairy industry into the future.

Farm business operators who were interviewed as part of this project were generally confident to adapt to incremental change based on their past experiences of adapting to variable seasons. This was despite the negative impact on profit that was predicted for all the farms analysed. Extreme weather events are unpredictable. The frequency and intensity of extreme events together with climate variability impacts, and the sequencing of milk price paid, present challenges for the future.

Opportunities for adaptation at the farm business level will be primarily enabled by the: trialibility, flexibility and diversity of options for business management under future climate challenges; social learning with peers, advisors, researchers, industry experts and others; equity and assets of farm businesses; the skills and adaptive practices of farm business managers/owners; and the support provided to business owners/managers by the dairy industry, governments and others.

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Researchers included Matthew Harrison and Richard Rawnsley (Tasmanian Institute of Agriculture), Brendan Cullen, Margaret Ayre, Nicole Reichelt, Steven Waller, Ruth Beilin and Ruth Nettle (University of Melbourne), Daniel Armstrong (D-Arm Consulting). Regional context and facilitation provided by Gillian Hayman, Monique White, Rachel Brown and the local Working Groups.

For further information please contact Catherine Phelps at Dairy Australia ph (03) 9694 3730

Link - http://dairyclimatetoolkit.com.au/adapting-to-climate-change/adapting-the-dairy-industry

Research was undertaken between June 2013 and May 2016. The research was conducted on three farms in south eastern Australia. The decision to change a farming system is contextual – an industry wide response is not appropriate.

Other fact sheets in this series

Dairy Businesses for Future Climates *Gippsland Information Sheet*

Dairy Businesses for Future Climates *South Australia Information Sheet*

Dairy Businesses for Future Climates *Tasmania Information Sheet*

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