Manaaki Whenua
Landcare Research

Current and planned adaptation and mitigation in New Zealand dairy farms

March 2025

L McPherson, P Stahlmann-Brown

Manaaki Whenua – Landcare Research

MT Niles, R Mitchell, L Hunt

University of Vermont

Manaaki Whenua Contract Report: LC4592

Prepared for: University of Vermont

Reviewed by:

Oshandhi Samarasinghe
Researcher
Manaaki Whenua – Landcare Research

Approved for release by:

Suzie Greenhalgh
Portfolio Leader – Society, Culture & Policy
Manaaki Whenua – Landcare Research

Contents

Summary

Background and approach

Issue: Just over half of New Zealand's greenhouse gas (GHG) emissions are produced by the agriculture sector, and almost half of those are produced by dairy cows. If dairy farmers do not take active steps to reduce emissions, it will be difficult for New Zealand to meet its obligations under the Paris Agreement. In addition, dairy farmers may have to adapt to changing weather patterns to maintain productivity in the future.

Purpose: This research seeks to understand adaptation and mitigation decisions among New Zealand dairy farmers.

Methodology: The questionnaire was based on a survey of US dairy farmers conducted in 2023, adapted for the New Zealand context. Three hundred and six dairy farmers from across New Zealand responded to the online survey between 25 November to 6 January 2025. These respondents are broadly representative of the dairy sector in New Zealand.

Experience of atypical weather and climate change beliefs

Almost half of respondents reported noticing more variable or atypical weather in their areas in the past 5 years, and a quarter have experienced the negative impacts of changing climate patterns on their own farm. Almost 9 out of 10 dairy farmers believe that climate change is occurring; the rest believe either that it is not real or that there is insufficient evidence to say either way. Sixty-three percent of respondents believe that there is an underlying human cause to climate change.

Uptake of adaptation practices

Almost all respondents have adopted at least one adaptation practice. Providing shade structures and/or trees in paddocks is the most commonly used practice, followed by improved water management and using more tolerant pasture and crop varieties. Indoor housing, cooling in housing, and reducing herd size are less common. Results indicate that there will not be any overall increase in farmers adopting practices to adapt to atypical weather.

Respondents believe that adaptation practices generally support cow welfare, but often with a perceived reduction in farm profitability.

Uptake of mitigation practices

Existing mitigation practices

As with adaptation practices, almost all respondents (93%) had adopted at least one mitigation practice. Reducing fertiliser use and diversifying pasture or forage crops are the most common mitigation practices. Reducing herd size, manure management, and using renewable energy are less common. Results indicate that – with the exception of using renewable energy – existing mitigation practices may have reached their highest rates of adoption as few farmers indicated interest in newly taking on mitigation practices that are already available.

Emerging mitigation practices

While plans to start using mitigation practices that are currently available are low, farmers indicated greater willingness to consider adopting emerging mitigation options. Respondents indicated they are mostly likely to use selective breeding in the next 10 years but they are much less likely to anticipate adopting feed additives/probiotics, methane inhibitors, vaccines, and EcoPond. Larger operators, those who participate in agriculture programmes related to sustainability, those who believe that climate change is anthropogenic, and those whose farms have been negatively impacted by changing weather patterns in the past five years are more likely to plan adoption of emerging technologies.

While respondents generally believe that emerging mitigation technologies will reduce farm emissions, some express concern about the impacts of these practices on cow welfare and farm profitability.

Drivers and barriers to adopting new practices

The primary considerations when deciding whether or not to adopt new farm practices are cow welfare, farmer profitability, and ensuring a viable farm for future generations. Farmers expressed particular reservations about initial costs, maintenance costs, and the technical know-how to implement emerging practices.

Conclusions

There is wide recognition of climate change amongst dairy farmers and 63% of respondents acknowledge an anthropogenic component to climate change despite only 43% indicating that that they have noticed more variable weather patterns and only 26% indicating changes in weather had hurt their farms. While almost all respondents have implemented at least some mitigation and adaptation practices, currently available mitigation options may not see further increase in adoption. Instead, several emerging mitigation options appear to be of interest to at least one-quarter to one-half of farmers, suggesting future opportunities in this area, especially given the New Zealand Government's own goals for reducing biogenic methane. However, farmers are not yet sure about the animal welfare and profitability trade-offs that may be related to these emerging technologies. These findings suggest future research, education, and outreach that may be necessary to enable their adoption if/when they are commercially available. Communicating any co-benefits of mitigations and adaptations – especially any positive impacts on cow welfare and profitability – will underpin and support uptake.

1 Purpose and remit

In the spring of 2023, the University of Vermont (UVM) conducted a nation-wide survey of United States (US) dairy farmers' beliefs and actions regarding climate mitigation and adaptation (Niles et al., 2024). Given the global standing of the New Zealand dairy industry and the broader similar goals of the US and New Zealand dairy industries to achieve net zero GHG emissions, UVM subsequently approached Manaaki Whenua – Landcare Research (MWLR) to conduct a similar survey with New Zealand dairy farmers. This survey was adjusted for the New Zealand context but retained enough similarity to facilitate comparisons with the US survey.

This research aims to better understand New Zealand dairy farmers' beliefs and actions regarding climate mitigation and adaptation to help support adoption of practices that reduce on-farm emissions and adaptation to extreme adverse weather.

2 Context

2.1 The global context

Global greenhouse gas (GHG) emissions drive global warming and therefore climate change. Emissions are generated primarily by burning fossil fuels and from farming ruminant livestock. In 2015, 196 countries were signatories to the Paris Agreement, two goals of which were to limit the temperature increase to 1.5°C above pre-industrial levels, and to adapt to the adverse impacts of climate change and foster climate resilience (United Nations Climate Change, n.d.).

A significant part of global warming comes from business emissions. These emissions can be categorised into Scope 1, 2, or 3 (Toitū Envirocare, n.d.).

- Scope 1 emissions are owned and controlled by the business and come directly from their operations.
- Scope 2 emissions are indirectly sourced from purchased electricity, steam, heating, and/or cooling.
- Scope 3 emissions are indirectly sourced through the value chain, i.e. all upstream and downstream activities associated with its operations. Examples include sourcing raw materials such as dairy products.

With businesses now actively seeking to measure and reduce Scope 3 emissions, those that source dairy products have flagged that lower emissions intensity (emissions per unit of product from all sources, not just livestock) will be a key criterion in their selection process (Fonterra, 2023).

2.2 The New Zealand context

New Zealand has a higher proportion of emissions from the agricultural sector than any other OECD country (Ministry for the Environment, 2024a). Just over half (53%) of New Zealand's greenhouse gas emissions derive from agriculture, mostly in the form of biogenic methane (Figure 1). Of this, almost half comes from dairy cows. As such, the New Zealand dairy sector is a critical actor for achieving New Zealand's GHG reduction goals.

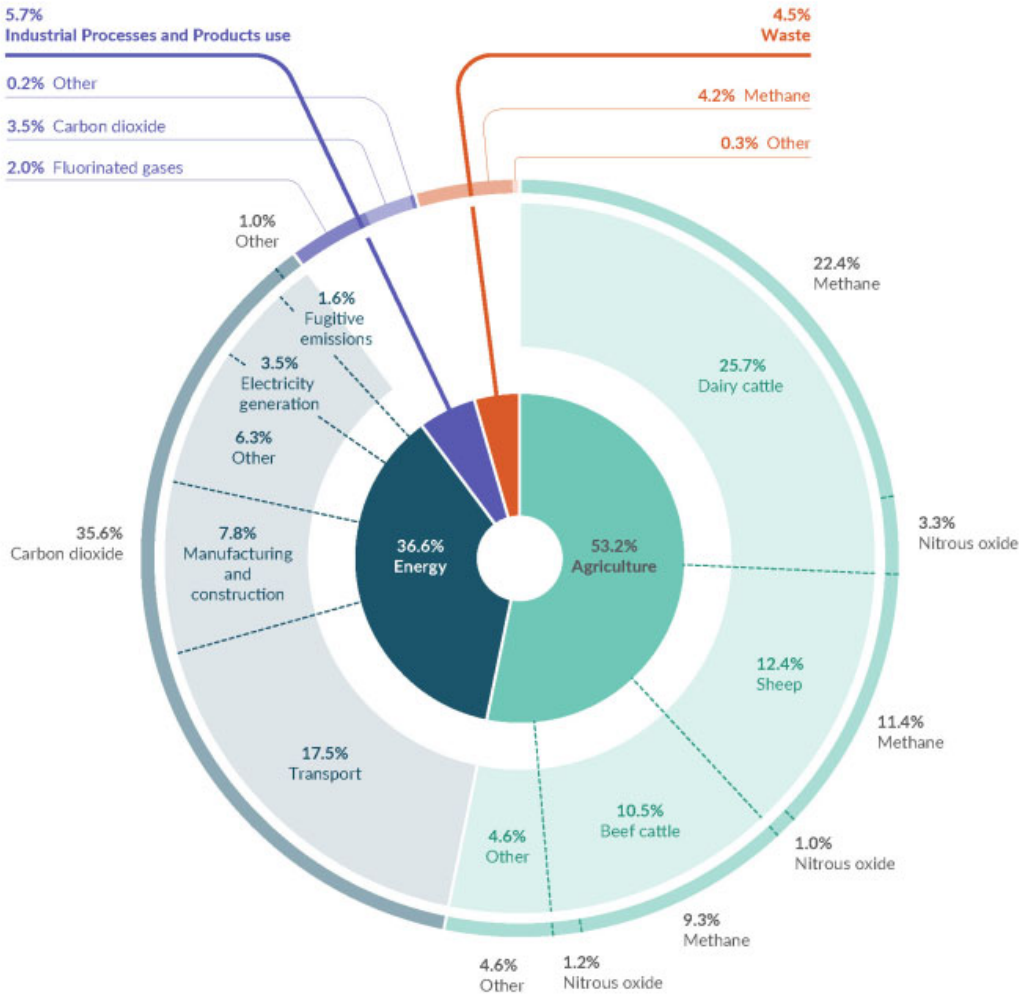

Figure 1. Gross greenhouse gas emissions percentages in 2022 by sector, category and gas type. (Source: New Zealand's greenhouse gas inventory 1990–2022: Snapshot © Ministry for the Environment. Ministry for the Environment, 2024a)

New Zealand dairy farmers face pressure to reduce on-farm emissions (DairyNZ, 2023) from multiple sources, including:

- the New Zealand Government, seeking to meet their targets for reducing on-farm emissions
- international manufacturers and retailers, aiming to reduce their Scope 3 emissions
- New Zealand consumers, wishing to consume products with lower emissions, which affects retail sales and the primary sector's social license to operate.

The New Zealand Government

To deliver on the goals of the Paris Agreement, New Zealand set a 'split gas' target for 2050 in which biogenic methane (a short-lived gas) was treated separately from long-lived greenhouse gases such as carbon dioxide. The legislated 2050 targets for biogenic methane (Ministry for the Environment, 2024b) are as follows:

- a 10% reduction below 2017 levels of biogenic methane emissions by 2030
- a 24% to 47% reduction of biogenic methane emissions by 2050.

Methane science and the above targets have since been reviewed by an independent panel (Ministry for the Environment, 2024c), and the scope of the work did not include recommending any methane targets. The Government has since released new targets for general emissions reduction for 2031–2035 of 51% by 2035 (Radio New Zealand, 2025), but no specific methane targets.

As described by Ministry for the Environment & Treasury (2023), the costs of meeting New Zealand's national determined contribution (NDC) could be significant. These costs may include the following items.

- **Offshore carbon credits**: New Zealand could buy offshore carbon credits to make up the difference between its emissions and its NDC targets (estimated to be up to $23.7 billion).
- **Increased emissions-related costs**: New Zealand could face higher emissions-related costs in the future, as they may be cheaper to abate now than later.

International markets

The Climate Change Commission has flagged that if New Zealand does not reduce its emissions, businesses could lose market access as global markets purchase goods with lower emissions. (Climate Change Commission, 2024). New Zealand has signed trade agreements with the UK and European Union in which the right to access markets is conditional on meeting commitments under the Paris Agreement (Somers, 2024). This means that as manufacturers such as Nestlé and retailers such as some of the UK's largest supermarkets seek to reduce their Scope 3 emissions, they will exert pressure on New Zealand's milk processors to not only know their own emissions profile (and therefore their dairy farmers' emissions) but also to reduce those emissions to remain internationally competitive and to retain market share (McNee, 2024).

General public/consumers

Competition from non-dairy milks and concerns about climate change and animal welfare may affect retail spend on dairy products, although the Ministry for Primary Industries (MPI) is forecasting an increase in dairy export revenue in the near term (Ministry for Primary Industries, 2024). In addition, public sentiment toward the dairy sector could deteriorate if dairy farmers are not seen to be reducing emissions.

2.3 Mitigating dairy GHG emissions in New Zealand

Several technologies to mitigate GHG emissions are already available in New Zealand. Others remain in the research and development pipeline but are nevertheless described as offering meaningful reductions in methane emissions. Existing technologies are described in Table 1.

Table 1. Examples of existing mitigation practices

Existing mitigation practices	How it reduces greenhouse gas emissions	Examples
Using renewable energy	Reduces emissions as it replaces burning fossil fuels as an energy source.	Wind/ solar/ hydro/ geothermal power
Planting trees	Increases carbon sequestration to offset on-farm emissions.	Planting over 1 ha of forest species to cover of at least 30% in each hectare
Manure management	Captures and destroys the methane produced by stored manure. Methane emissions can also be prevented through aerobic decomposition, as oxygen reduces microbes' ability to produce methane.	Anaerobic manure digesters, composting manure
Diversifying pasture and/or forage crops	Low nitrogen crops produce lower emissions.	Plantain, maize silage
Reducing fertiliser use	Nitrogen-based fertilisers leach nitrogen and increase nitrous oxide emissions; therefore, reducing fertiliser use reduces emissions.	n/a
Reducing herd size	Fewer cows mean lower overall methane emissions per farm.	n/a

A range of practices for reducing methane are under development both internationally and nationally (Ministry for the Environment, 2024b). Some of these technologies depend on specific place-based characteristics, e.g. pasture characteristics. Emerging mitigation technologies of particular relevance to New Zealand dairy farmers are described in Table 2.

Table 2. Emerging mitigation practices currently in R&D pipeline tested in this survey

Emerging mitigation practices	How it reduces greenhouse gas emissions	Examples	Estimated efficacy (for dairy)	Earliest date available to NZ dairy farmers
Selective breeding	Breeding from livestock with naturally lower methane emission levels reduces the overall emissions from the herd.	n/a	1% per annum (up to 20% over time)	2029
Feeds / probiotics	Certain supplementary feeds suppress the growth of methane-producing microbes in the rumen.	Tannins, oils, seaweed/ kelp, Kowbucha™	30% to 80% (for Hoofprint Biome probiotic)	Tbc
Methane inhibitors	Compounds administered to a cow suppress the growth of methane-producing microbes in the rumen.	Slow-release capsules	20% to 70%	2028 for inhibitors under development by Ruminant BioTech
Vaccines	Antibodies are triggered in saliva that suppress the growth of methane-producing microbes in the rumen.	n/a	Up to 30%	Tbc
Effluent management	Methane emissions from effluent storage ponds are captured and destroyed, or inhibited by the use of chemicals.	EcoPond (mixes (poly)ferric sulphate (PFS) into effluent ponds to inhibit methane production)	92% of emissions from effluent (for EcoPond)	2025

As first steps in reducing their on-farm emissions, the Government and processors have supported farmers to:

- know what their on-farm emissions are
- have a plan to reduce their on-farm emissions.

In 2023, 95% of dairy farmers had a GHG emissions report from their dairy company estimating each farms' volume of emissions (Wallace, 2023), and 38% of dairy farmers said they would focus on reducing on-farm emissions in the next 2 years (Stahlmann-Brown, 2023).

2.4 Adapting to changing climate in the New Zealand dairy sector

Even as dairy farmers contend with reducing GHGs to meet national emissions objectives, manufacturers and retailers' desire to reduce Scope 3 emissions. The changing preferences of New Zealand consumers and more variable weather patterns are also affecting dairy operations. A variety of adaptation practices are already in use in the New Zealand context, as described in Table 3.

Table 3. Examples of adaptation practices

Existing adaptation practices	How it reduces negative impacts of climate change	Examples
Selecting more drought tolerant pasture/crops	Reduces the risk of less feed during droughts.	Cocksfoot for pasture grass
Reducing stress on herds	Managing stock and providing shelter in extreme weather conditions reduces the chance of herds becoming overheated or too cold.	Providing trees and/or sheds for shade, indoor housing
Managing infrastructure	Reinforcing or moving infrastructure that could be damaged by storms, flooding, or rising sea levels.	Moving a building that is in a flood-prone area
Reducing stocking rates	Fewer cows lead to less competition for feed in seasons where feed is in short supply	n/a

3 Survey methodology

MWLR adapted the UVM questionnaire to the New Zealand context. The questionnaire was reviewed by the social ethics review process at MWLR (Approval number 2425/22) and subsequently tested with farmers and other sectoral experts.

Dairy farmers were contacted by email using a list of individuals who responded to the 2023 Survey of Rural Decision Makers (Stahlmann-Brown, 2023) and who had agreed to be surveyed again. Of the 656 dairy farmers from the 2023 Survey of Rural Decision Makers panel, 155 responded, providing a response rate of 24%.

An additional 151 dairy farmers were recruited to complete the survey from an external panel provider. This means that 306 respondents completed the survey in total.

The survey was conducted online from 25 November 2024 to 6 January 2025, and during this time, two reminders were emailed to potential respondents. The questionnaire took approximately 20 minutes to complete, on average.

The questionnaire covered the items listed below.

- General farm characteristics and herd information.
- Participation in agricultural programmes that support sustainable practices provided by milk processors and/or certification organisations.
- Practices to adapt to climate change.
- Practices to reduce on-farm greenhouse gas emissions.
- Perceived impact of various practices on farm emissions, cow welfare and farm profitability.
- Drivers and barriers to adopting mitigation and adaptation practices.
- Impact of climate and weather on farms and the New Zealand dairy industry overall.
- Personal beliefs about climate change.
- Demographics.

The full questionnaire is included in Appendix 1.

4 Sample description

4.1 Respondent demographics

Sixty-nine percent of respondents operated in the North Island. The remainder operated in the South Island (Figure 2)

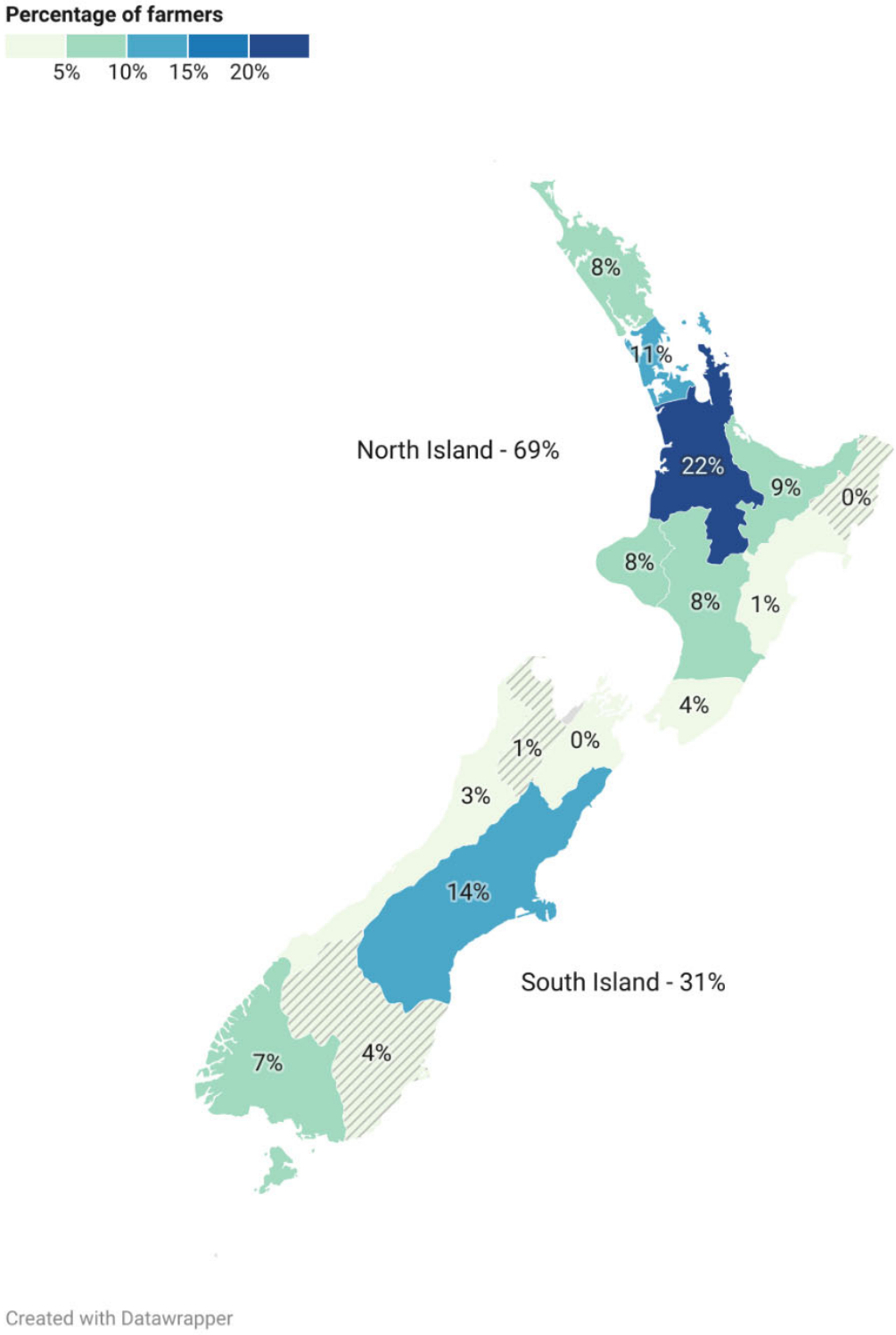

Figure 2. Regional distribution of New Zealand dairy farmers in survey.

Herd size ranged from 20 to 18,000, with a median herd size of 450, which is similar to the national average dairy herd size of 448 (Livestock Improvement Corporation & DairyNZ, 2024). Thirty-eight percent of farmers reported sending their dairy cows to another farm for grazing and 20% reported receiving cows for grazing.

Similar to New Zealand dairy farmers overall, 61% of respondents identified as male and 34% identified as female (the remaining respondents selected 'prefer not to answer').

Farmers in this survey ranged in age between 18 and 88 years old, with an average age of 52 years old. This is consistent with demographic data collected by DairyNZ, which shows the median age of self-employed dairy farmers being between 55 and 64 and the median age of dairy farmers who employ others being between 45 and 54 (T Rutherford, DairyNZ, pers. comm., 6 March 2025). Those aged 60 and over comprise 38% of respondents. Thirty-two percent are under age 44 and 20% are aged 44–59 (Figure 3).

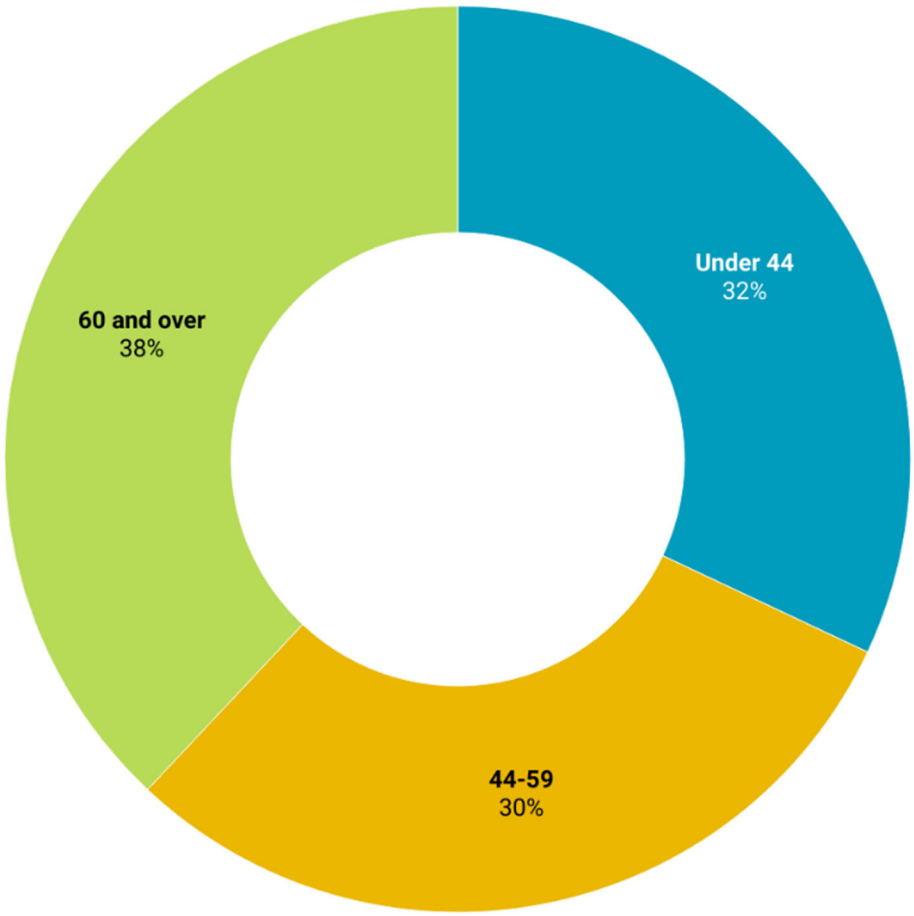

Figure 3. Summary of age distribution in survey.

Respondents were predominantly New Zealanders of European ancestry (81%), compared to 10% who identified as Māori. On average, respondents had been farming for 27 years.

Farm debt was common amongst respondents. 85% reported having some level of debt, and 48% reported their farm's debt as more than 100% of their annual income (Figure 4).

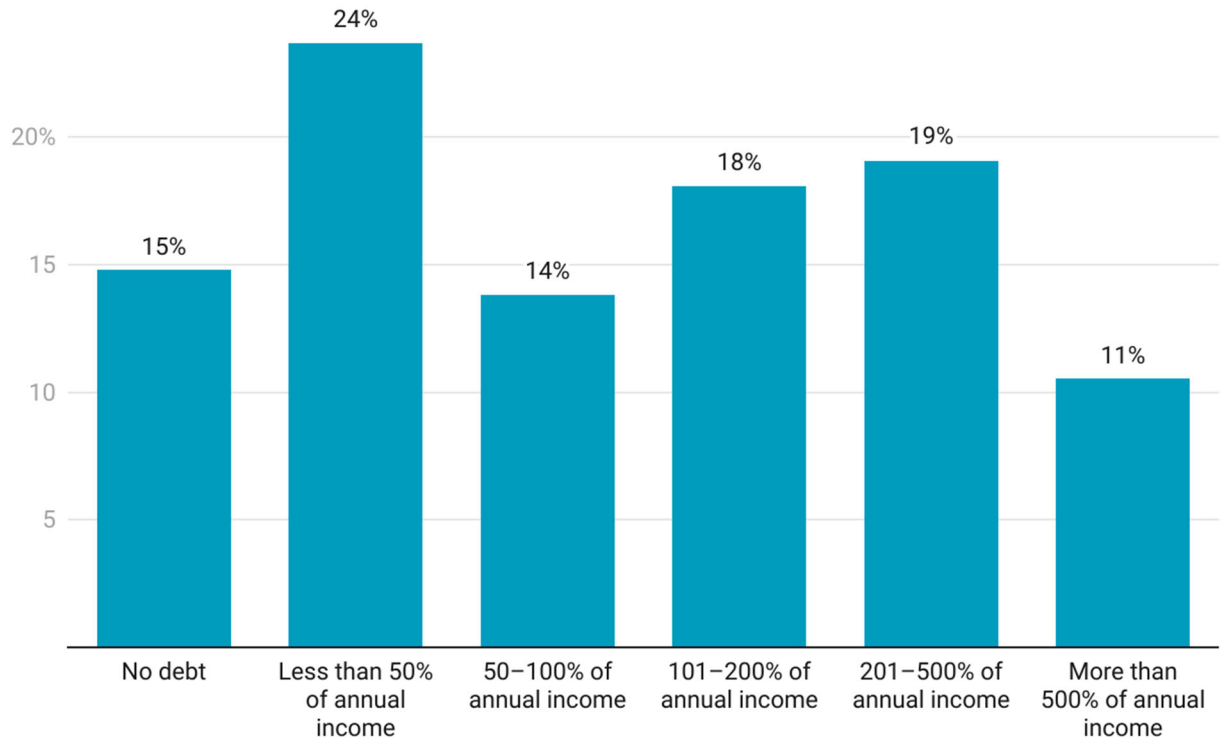

Figure 4. Proportion of respondents(%) reporting farm debt as proportion (%) of annual income.

Additionally, most have some succession plans in place: 49% have full plans and 26% have partial plans.

4.2 Participation in agricultural programmes related to climate change

Participation in agricultural programmes related to climate change is influenced by the farmers' milk processor. Given that Fonterra is New Zealand's largest milk processor, it is not surprising that respondents are most likely to have participated in Fonterra's programmes (Figure 5). Four in five (81%) respondents have participated in at least one programme, and almost half (48%) have participated in more than one programme. The two most popular programmes are: a) Fonterra's Cooperative Difference, which focuses on consistent provision of high-quality milk (Fonterra, 2025a); b) Fonterra's Tiaki Sustainable Dairying programmes, which offers advice and support for environmental plans, consents, environmental reporting, and similar activities (Fonterra, 2025b). Seventeen percent of respondents participate in both these programmes.

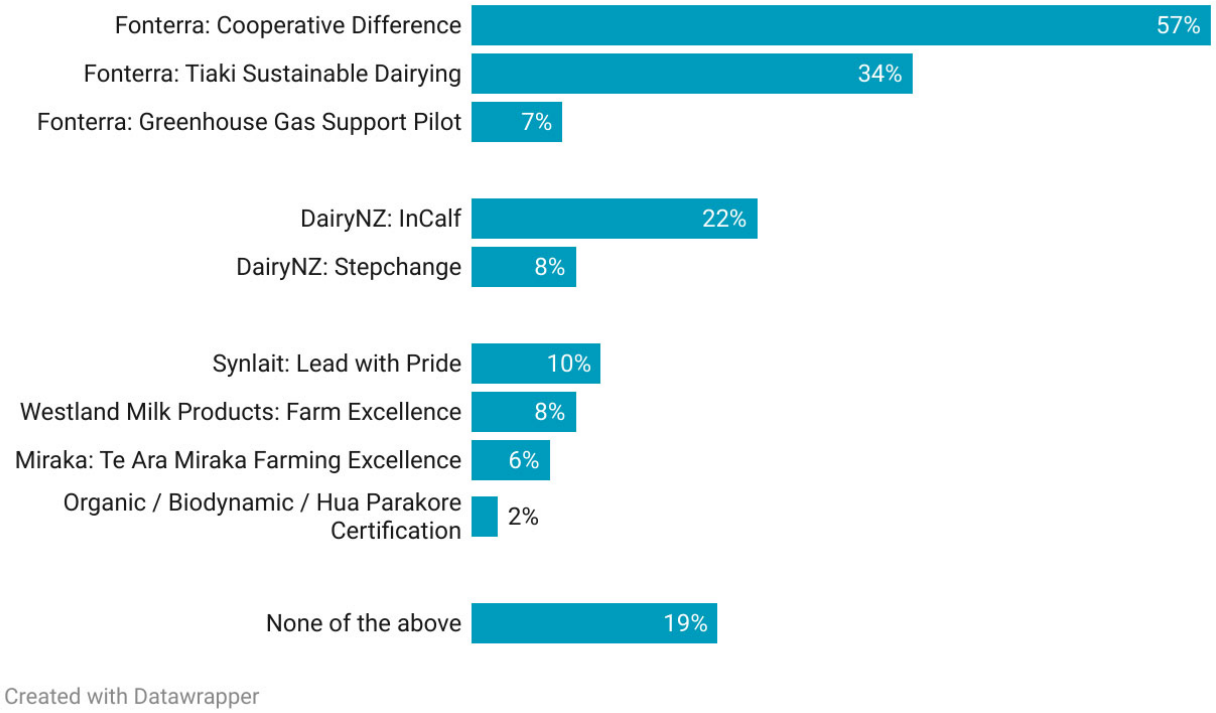

Figure 5. Respondent participation (%) in agricultural programmes

Participation in processors' agricultural programmes is financially incentivised in some cases. For example, payments for milk increase as farmers progress through Fonterra's Co-operative Difference programme and Synlait's Lead with Pride™ programme. Lower agricultural GHG emissions have not previously been financially incentivised, but Fonterra announced that they will pay higher prices for milk produced with lower GHG emissions in February 2025 (Gibson, 2025).

4.3 Climate experiences, beliefs, and concerns

Some 87% of respondents agree that climate change is occurring, a value similar to results reported in the 2021 Survey of Rural Decision Makers (Stahlmann-Brown, 2021). In addition, 63% of survey respondents believe that anthropogenic climate change is occurring (Figure 6), while 24% believe climate change is occurring but is driven mostly by natural causes.

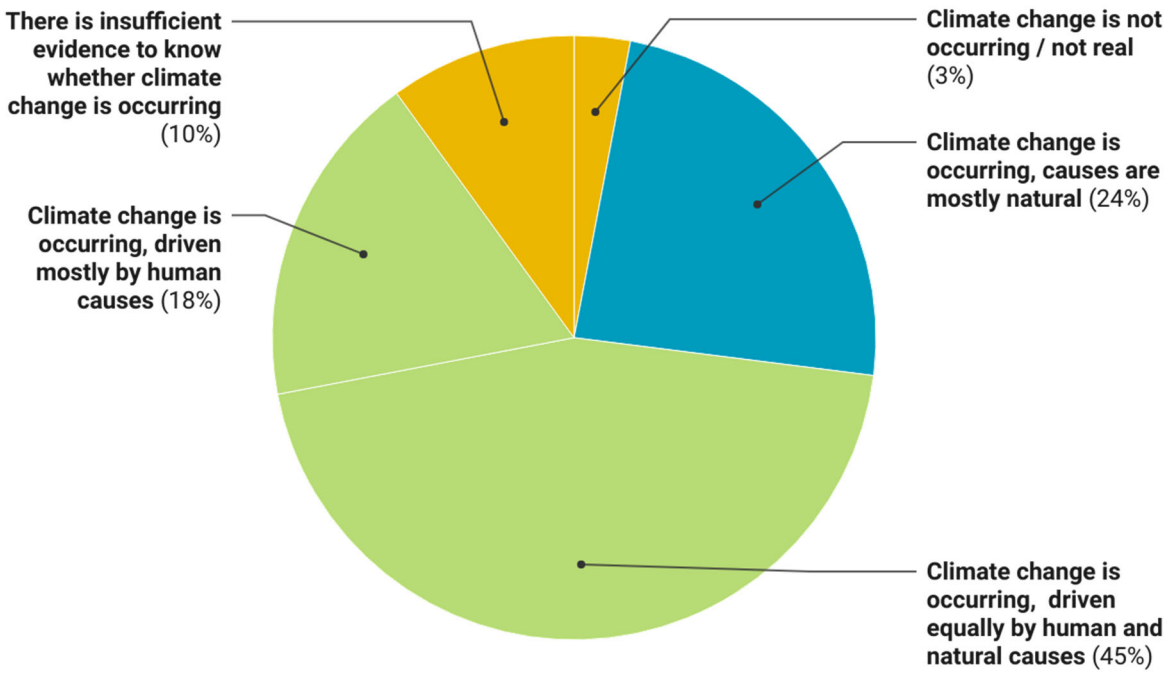

Figure 6. Climate change beliefs, by segment.

Forty-three percent of respondents reported noticing more variable or atypical weather in their areas over the last 5 years and 32% of respondents perceived changes in weather patterns hurting other dairy farms in their area. Twenty-six percent have experienced negative impacts or more variable or atypical weather on their own farms (Figure 7).

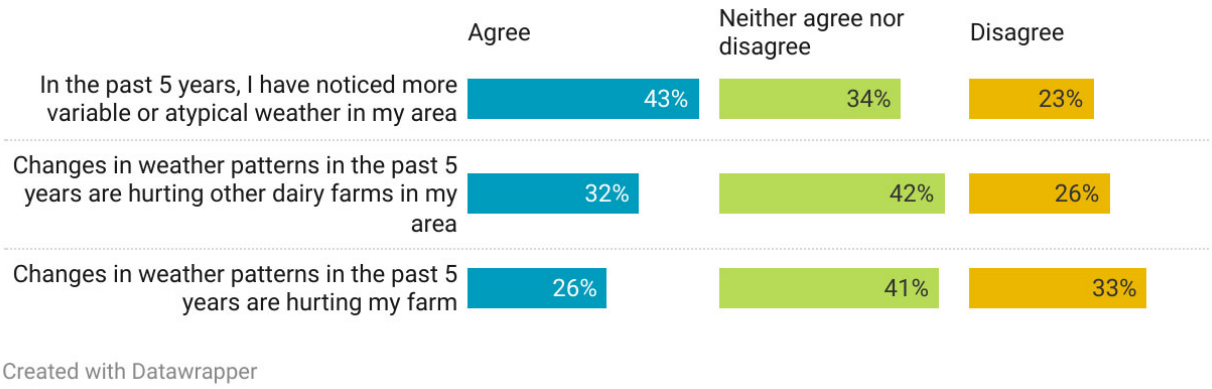

Figure 7. Experiences of atypical weather patterns, 2019–2024.

Respondents were also asked how the changing climate and weather could affect distinct aspects of their farming operation, namely, feed costs, crop production, milk production, cow welfare, and labour availability. Sixty-five percent anticipated no change for labour availability and 51% anticipated no change for cow welfare; 45% of respondents anticipated no changes to milk production (Figure 8). However, 44% of respondents anticipated negative impacts on feed costs.

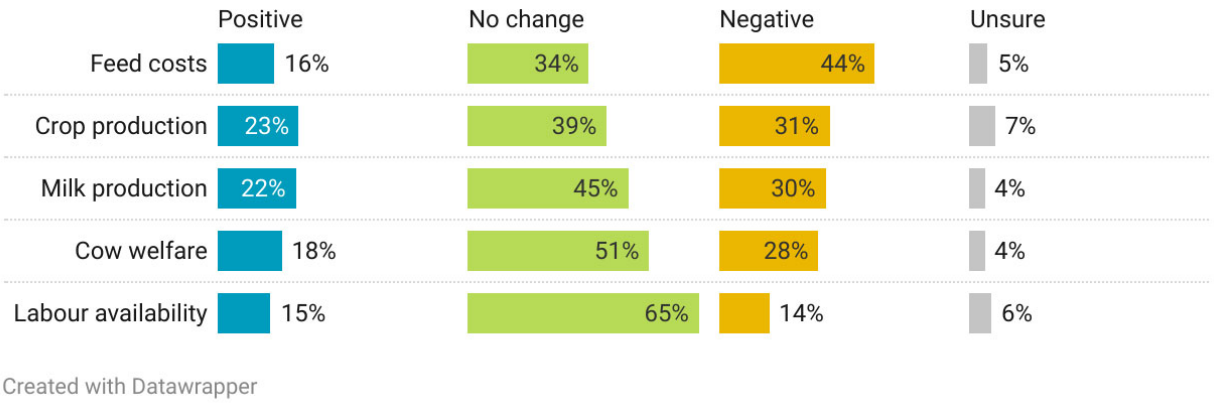

Figure 8. Expectations of how changing climate and weather will affect farming operations.

Finally, respondents were asked an open-response question about how they anticipated changing climate and weather might affect the New Zealand dairy industry (if at all) and what specific concerns they might have. For those who felt the changing climate would affect the New Zealand dairy industry, the main impacts were thought to be on water supply for irrigation and livestock and cow welfare generally. These impacts would lead to lower milk production and increased costs to adapt to or mitigate the impact of the changing climate, which will ultimately drive down profitability and reduce farmer confidence.

Farmers anticipated more damage to farm infrastructure, increased insurance costs, and a general reduction in the number of dairy operators over time. They also anticipated shifts to the rhythm of farm life – such as when to provide supplements and the timing of the calving season.

Nevertheless, there is confidence in farmers' adaptability and ability to innovate.

'New Zealand farmers [are] very adaptable…will cope/change/adapt as we always have.'

A minority of farmers felt that positive impacts from climate change may balance out the negative impacts. Their comments about the benefits may be categorised as expecting:

- hotter summers but milder winters
- some areas becoming warmer and growing better pasture
- a net decrease in production balanced by an increase in price due to global supply and demand
- if one region is having a poor year another region will be doing well
- the change in climate is allowing different crops to thrive.

See Appendix 2 for a full list of comments.

5 Adaptation practices

Respondents were provided the following list of adaptation practices that can reduce the negative impacts of climate change. For each practice, they were asked to indicate their previous, current, and intended future use, and these are listed below.

- Indoor housing (e.g. barns, sheds, shelters) to reduce heat and cold stress
- Shade structures / trees in paddocks.
- Cooling in animal housing such as sheds or shelters (e.g. sprinklers, fans).
- Selling part or all of their herd to adjust to weather changes.
- Improved water management such as increasing storage capacity (e.g. tanks, dams, wetlands), improving irrigation efficiency (e.g. precision irrigation), and/or recycling of water.
- More drought / flood tolerant pasture / crop varieties.

5.1 Adoption of practices

A total of 93% of respondents have adopted at least one adaptation practice in response to changes in climate and weather, and almost half (44%) use three or more practices (Figure 9).

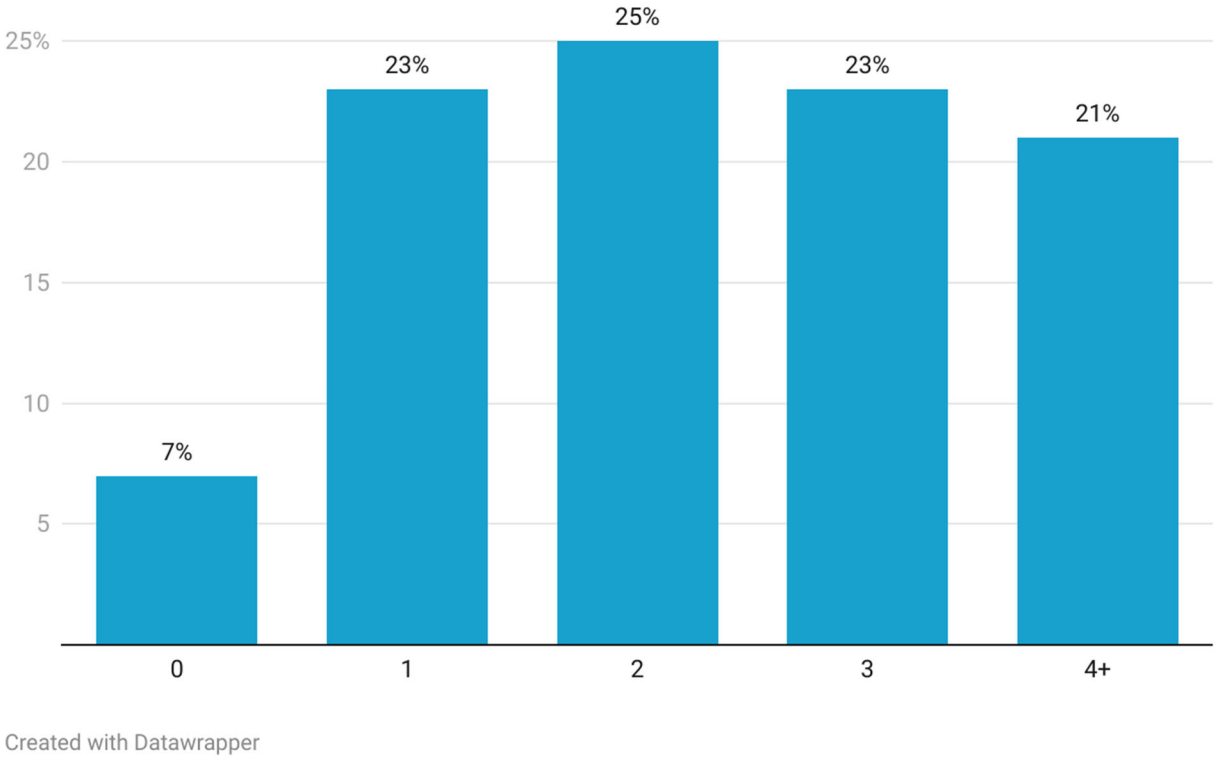

Figure 9. Proportion (%) of respondents and the number of adaptation practices they have adopted to adapt to changes in climate and weather.

5.2 Adoption of specific adaptation practices

Providing shade via structures and/or trees in paddocks was the most commonly used adaptation practice (74%), followed by improvements to water management (50%) and growing more drought/flood tolerant pasture/crop varieties (48%) (Figure 10). Most respondents have never sold part of all or their herd to adapt to changing climate (74%), used indoor housing (65%), or used cooling in animal housing (61%).

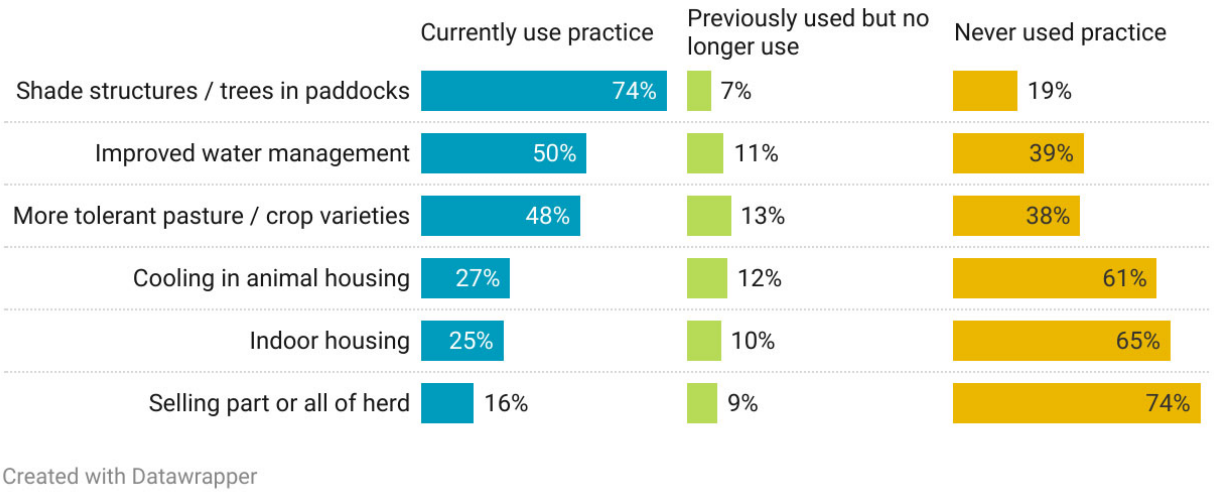

Figure 10. Current and previous use of adaptation practices.

5.3 Likely adoption of specific adaptation practices

The likelihood of future use of adaptation practices followed a similar pattern to current usage (Figure 11). However, many respondents reported that they were either neutral or unsure about future adoption.

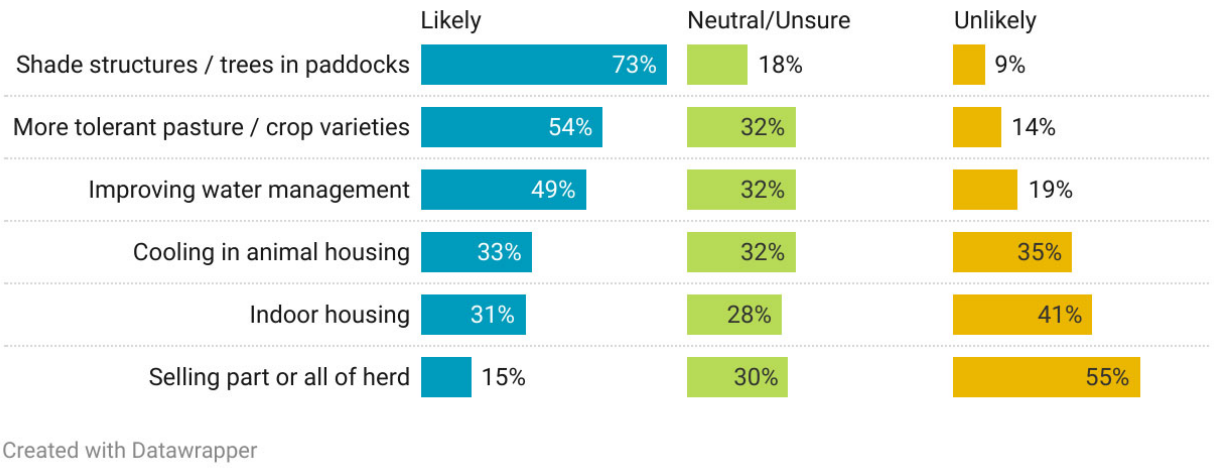

Figure 11. Likelihood of using adaptation practices in the next 10 years.

5.4 Changes in use of adaptation practices

The following figures (Figures 12–17) illustrate the previous, current and future likelihood of adoption for each adaptation practice. The left side of each diagram indicates the share of respondents who have ever used a practice. The middle of the diagram indicates current usage. The right side of the diagram indicates anticipated future usage. The flow lines indicate transitions from one state to the next.

For example, 35% of respondents reported having ever used indoor housing and 65% have not. Among the 35% who had used indoor housing, 25% currently use indoor housing (blue flow line) while 10% have stopped using indoor housing (downward sloping peach flow). Most of those who currently use indoor housing anticipate using it in the future as well, although some reported being neutral or unsure (downward sloping green flow), and one current user reported being unlikely to use indoor housing in the future (downward sloping yellow flow). Some farmers who did not currently use indoor housing anticipated using it in the future (upward sloping teal flow) or being neutral/unsure (upward sloping green flow).

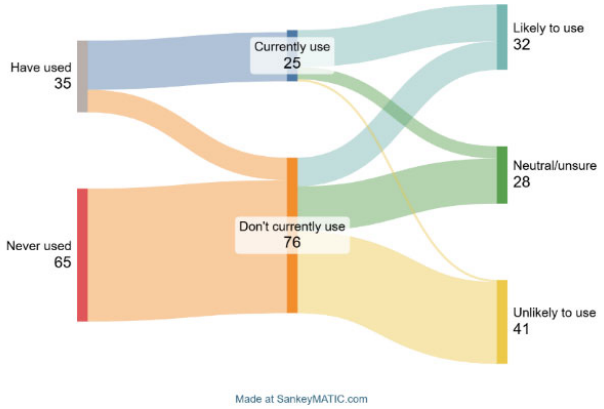

Figure 12: Changes in indoor housing use.

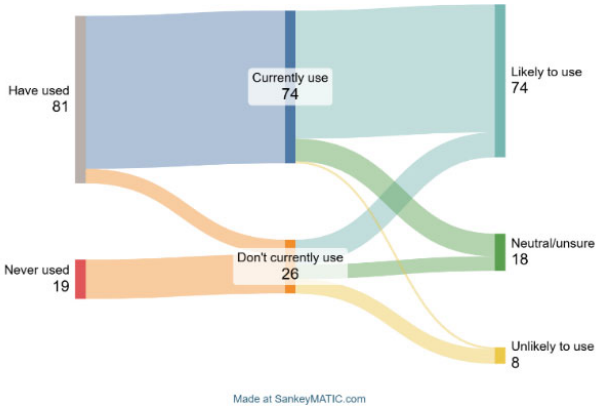

Figure 13: Changes in shade structures/tree use.

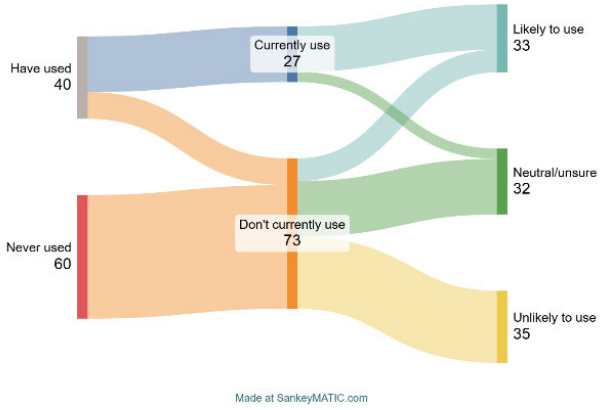

Figure 14: Changes in use of cooling in animal housing.

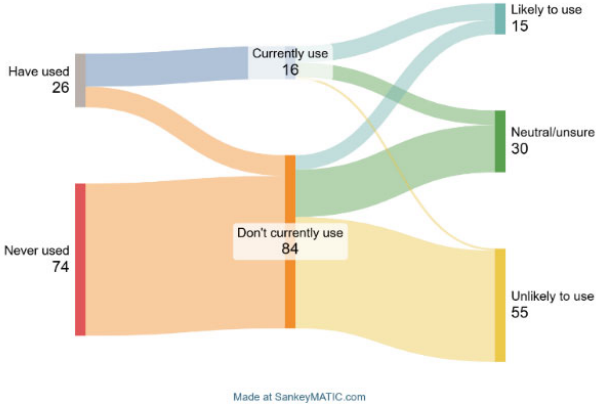

Figure 15: Changes in reducing herd size.

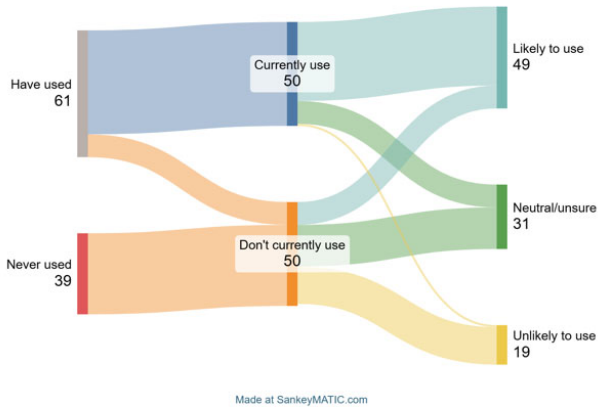

Figure 16: Changes in improved water management

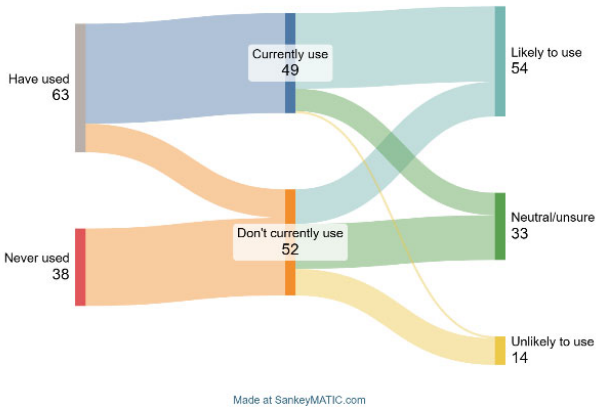

Figure 17: Changes in use of more tolerant feeds.

For each practice, expected use in the future was either similar to or below the levels that indicated ever having used a practice. Continued use of shade structure is the most likely, although at a lower rate than past usage.

5.5 Perceived impact of adaptation practices

Depending on the practices, between 29% and 72% of respondents believed that climate adaptation practices would improve cow welfare (Figure 18). Providing shade was viewed as increasing cow welfare by the greatest portion of respondents, followed by indoor housing and cooling (although the latter was expected to have a more negative impact on profit). Most practices were thought to have no effect on farm emissions, with the exception of selling some or all of the herd.

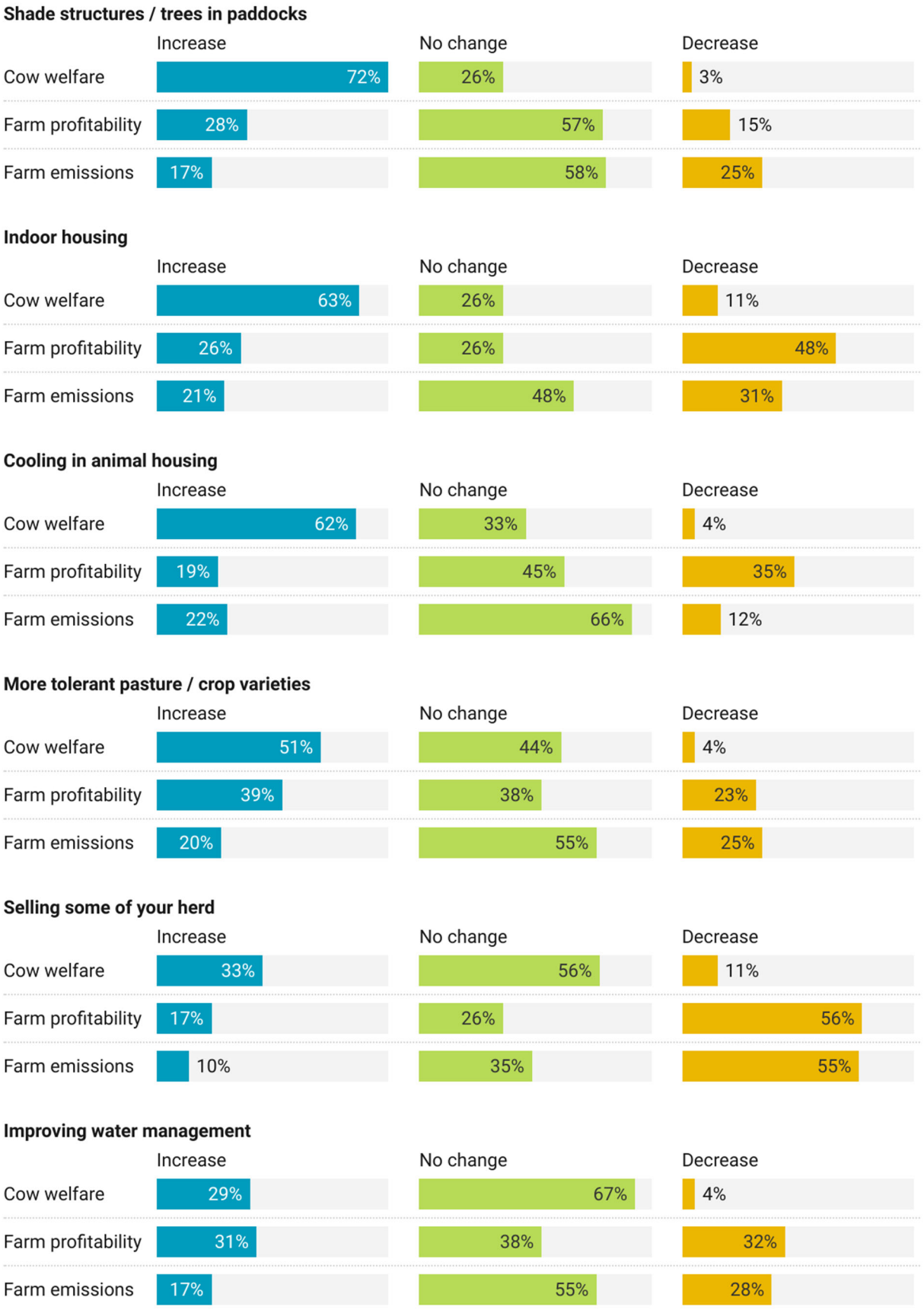

Figure 18. Perceived impact of climate adaptation practices as proportion (%) of respondents.

6 Mitigation practices

Respondents were provided the following list of practices that can reduce on-farm emissions. For each practice, they were asked to indicate their previous, current, and intended future use future use:

Existing practices:

- manure management (e.g. anaerobic manure digesters, composting manure, separation of solids and liquids)
- diversifying pasture or forage crops grown (e.g. kale, fodder beets, straw, baleage, summer turnips)
- reducing fertiliser use
- using renewable energy on farm (e.g. solar, wind, geothermal, hydro power)
- reducing herd size.

Emerging practices:

- EcoPond (adding ferric sulphate to reduce effluent pond emissions)
- using a cow vaccine to reduce methane,
- selective breeding to reduce methane,
- using methane inhibitors (e.g. slow-release capsules that cows swallow)
- using feed additives or probiotics (e.g. tannins, oils, seaweed/kelp, Kowbucha™) to reduce methane emissions.

6.1 Adoption of existing practices to reduce emissions

Most respondents (93%) have adopted at least one of the practices listed in the above bullets to reduce on-farm emissions, and 69% have adopted at least two practices (Figure 19).

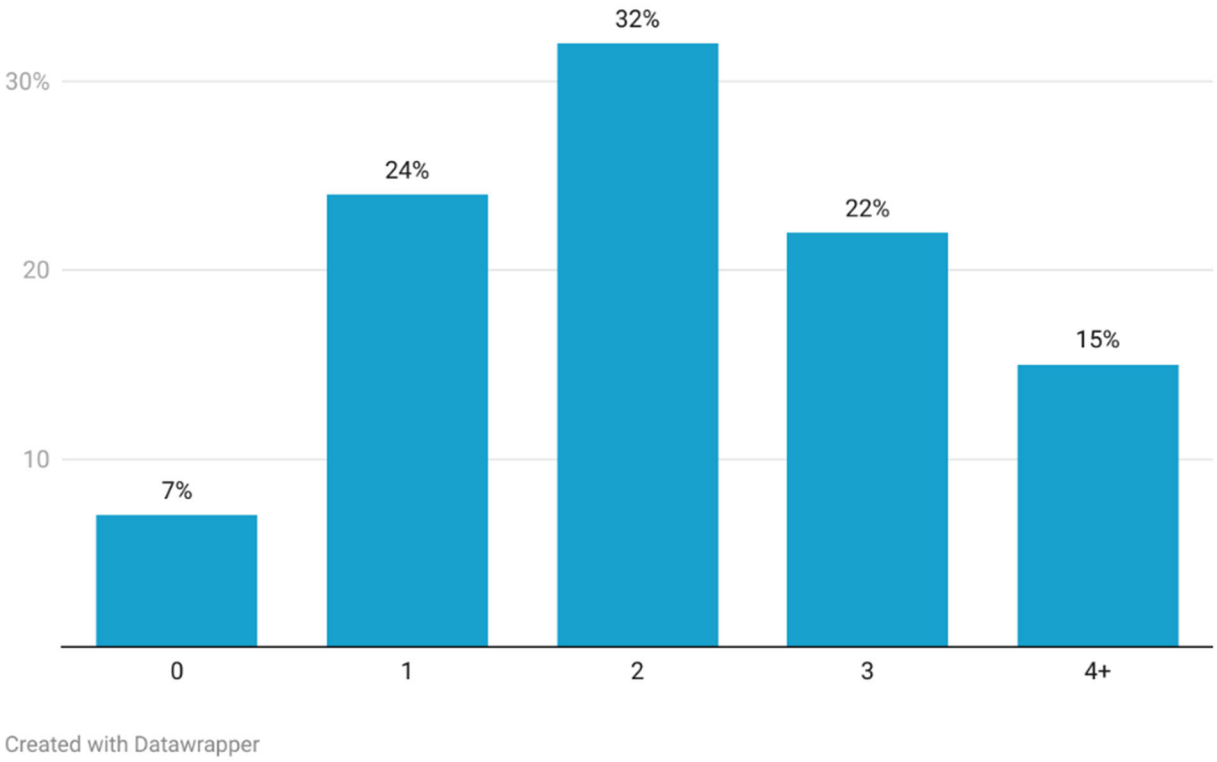

Figure 19. Number of mitigation practices adopted to reduce on-farm emissions and proportion of respondents adopting them.

6.2 Adoption of specific existing mitigation practices

Land-based practices

Land-based practices such as reducing fertiliser use (66%) and diversifying pasture or forage crops (62%) have been most widely adopted (Figure 20).

Animal-based practices

Over one-third of respondents (38%) said they were reducing their herd size (and another 21% said they have reduced their herd in the past). A comment from one farmer suggests those who reduce their herd sizes do so despite the impact to their bottom line:

> *We have reduced herd size this season by 10%. Our milk solid production has also fallen by 10%. 30,000 milk solids on a $10 payout is a lot of money!!'*

Effluent management

Nearly two in five respondents (37%) reported currently using some form of effluent management.

Energy-based practices

Renewable energy is not widely used, with fewer than one in five respondents (18%) currently using some form of renewable energy on their farm.

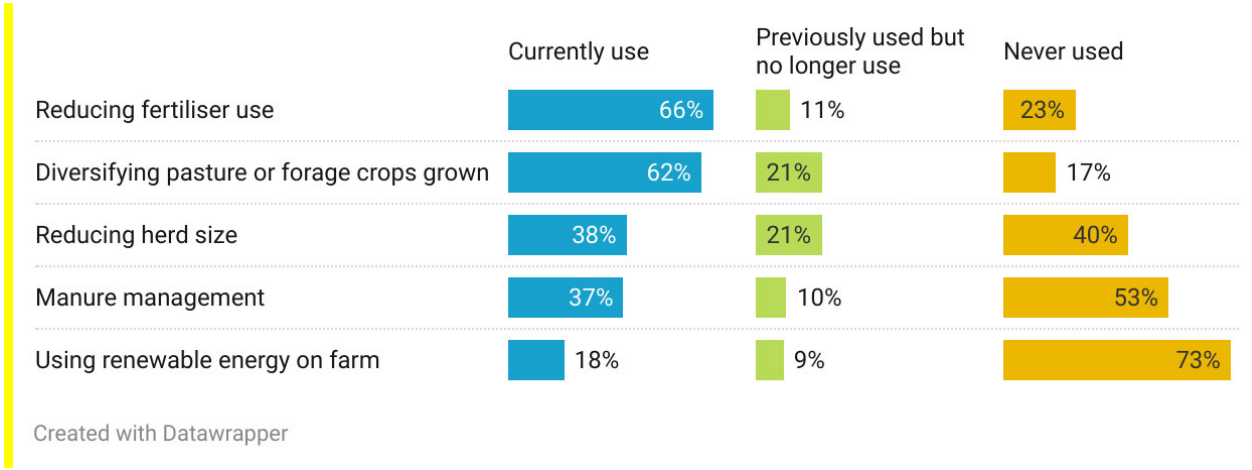

Figure 20. Current and previous use of existing mitigation practices.

When asked what else they do to reduce on-farm emissions, respondents commonly mentioned:

- planting more trees and/or regrowing native trees for carbon sequestration
- increasing milk yield per cow to reduce emissions; for some respondents, this included breeding smaller, more efficient cows such as Jerseys
- planting no-till/direct-drill crops and new pasture instead of full cultivation to maintain soil health and enhance soil carbon sequestration
- doing once-a-day milking, resulting in reduced feed demand by cows and hence reduced emissions
- using coated urea to reduce nitrogen emissions.

6.3 Likely adoption of existing mitigations

The likelihood of future uptake of adaptation practices is reported in Figure 21. The most commonly anticipated uptake in the future was for the practices of diversifying pasture or forage crops and reducing fertiliser use within the next 10 years (whether or not these practices are currently used). Respndents were less likely to anticipate adopting manure management, renewable energy, and reducing herd sizes.

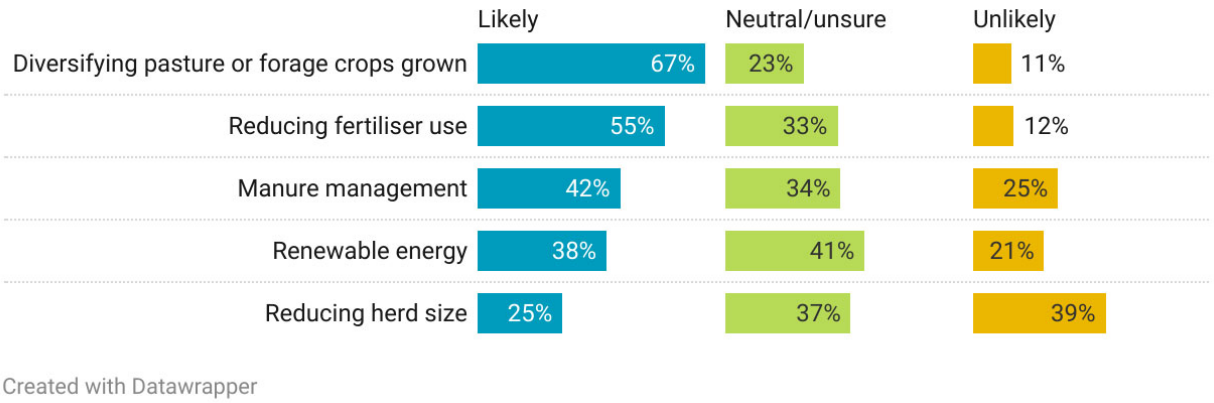

Figure 21. Likely adoption of existing mitigation practices in the next 10 years.

6.4 Changes in use of existing mitigation practices

Figures 22– 26 illustrate the journey of usage for the five mitigation practices discussed above. The left side of each diagram indicates the share of respondents who have ever used a practice. The middle of the diagram indicates current usage. The right side of the diagram indicates anticipated future usage. The flow lines indicate transitions from one state to the next. See Section 5.4 above for a detailed explanation.,

With the single exception of renewable energy, expected use in the future was either similar to or below levels that indicated ever having used a practice. This is not surprising in the case of reducing herd size or fertiliser use as further reductions may be impossible. However, fewer respondents were likely to manage manure or diversify pasture or forage crops.

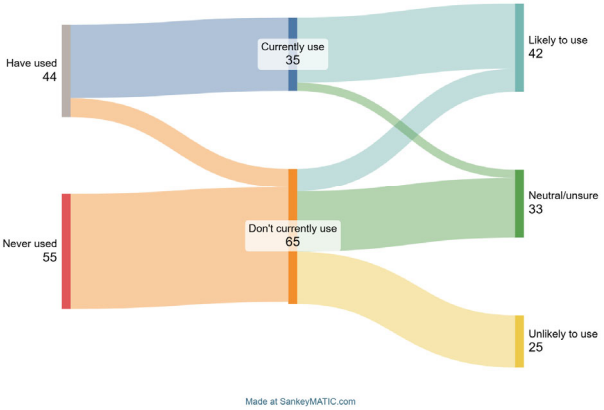

Figure 22. Changes in manure management use.

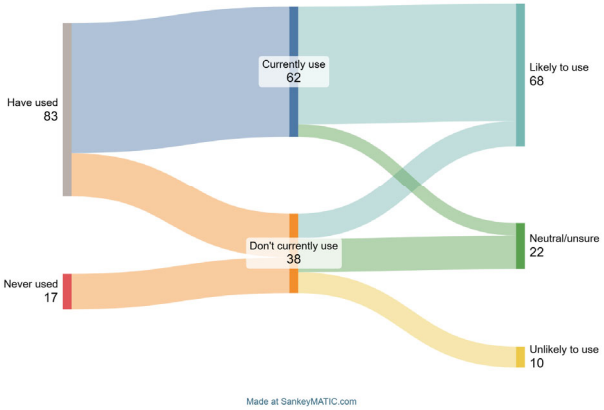

Figure 23. Changes in diversifying feed.

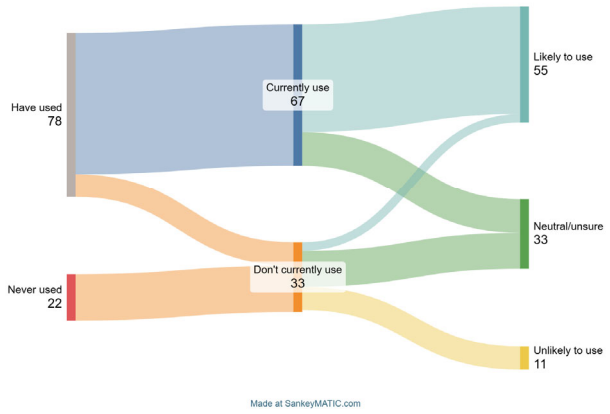

Figure 24. Changes in reducing fertiliser use.

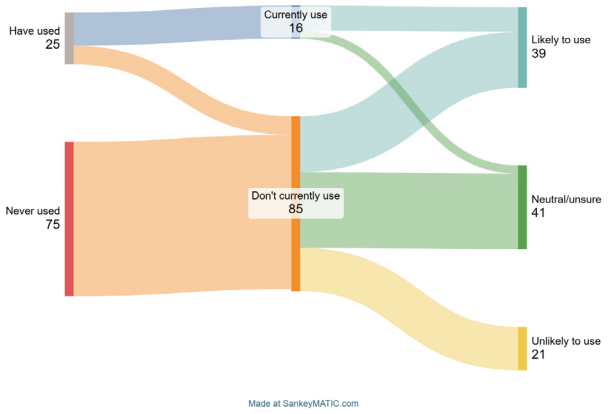

Figure 25. Change in renewable energy use.

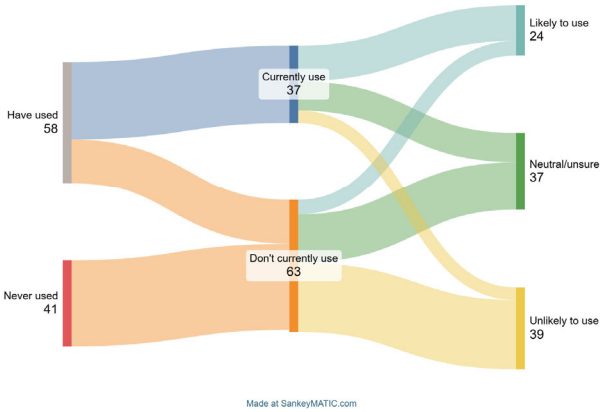

Figure 26. Changes in reducing herd size.

6.5 Perceived impact of existing mitigation practices

Respondents were asked to evaluate the impact of existing mitigation practices on farm emissions, cow welfare, and farm profitability (Figure 27).

Farm emissions

Most respondents perceived that herd size reduction (61%) and reducing fertiliser use (57%) could reduce farm emissions.

Cow welfare

Mitigation practices that are most commonly identified as positively affecting cow welfare were diversifying pasture and forage crops grown on farm (46%) and reducing herd sizes (41%).

Farm profitability

Mitigation practices that were perceived to have a positive impact on farm profitability by the most respondents were diversifying pasture and forage crops on farm (41%) and using renewable energy (40%). The perceived negative impact of reducing herd size on farm profitability was reflected in the 55% of respondents who selected this option.

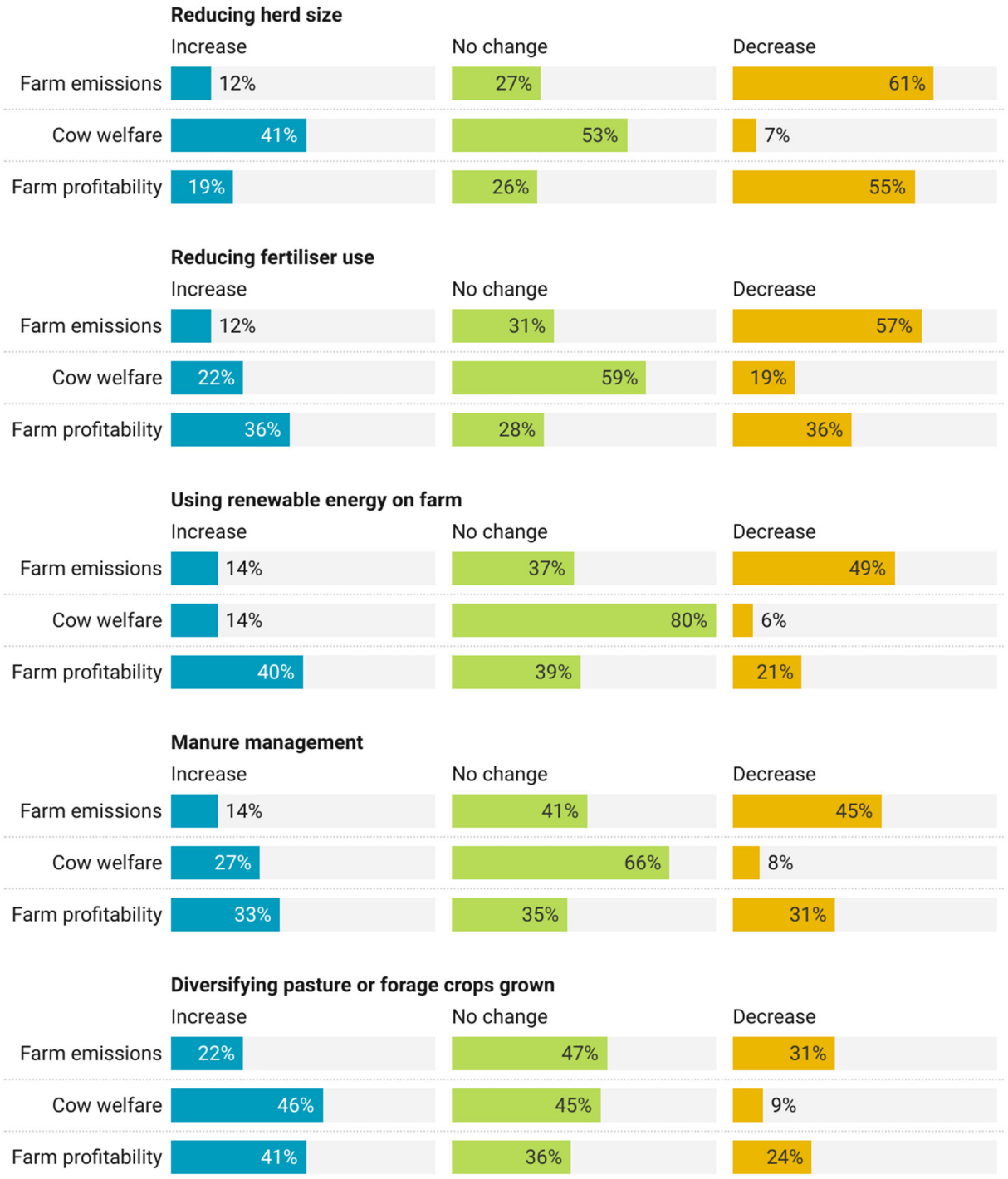

Figure 27. Perceived impact of existing mitigation practices.

7 Anticipated adoption of emerging mitigation practices

Respondents were asked about the likelihood of adopting emerging mitigation practices that are still in the research and development pipeline. While the efficacy and costs of emerging mitigation practices have yet to be determined, EcoPond is closest to being fully developed. Hence, we expected that farmers would have greater certainty regarding EcoPond than for other emerging technologies further down the pipeline.

The emerging mitigation practices included in this survey fall into two categories:

- effluent management, namely Ecopond
- animal-based practices, namely selective breeding, a vaccine, feed additives or probiotics, and methane inhibitors such as slow-release capsules that cows swallow.

We found 46% of respondents indicated that they were likely to adopt selective breeding in the future (Figure 28). Only 28% of respondents indicated that they were likely to adopt cow vaccines, but we suspect this may be due to concerns about impacts of the vaccine on the health and productivity of the herd; indeed, this seems likely given that cow health and productivity are two key concerns when making decisions about new practices (see Section 8.1, Drivers).

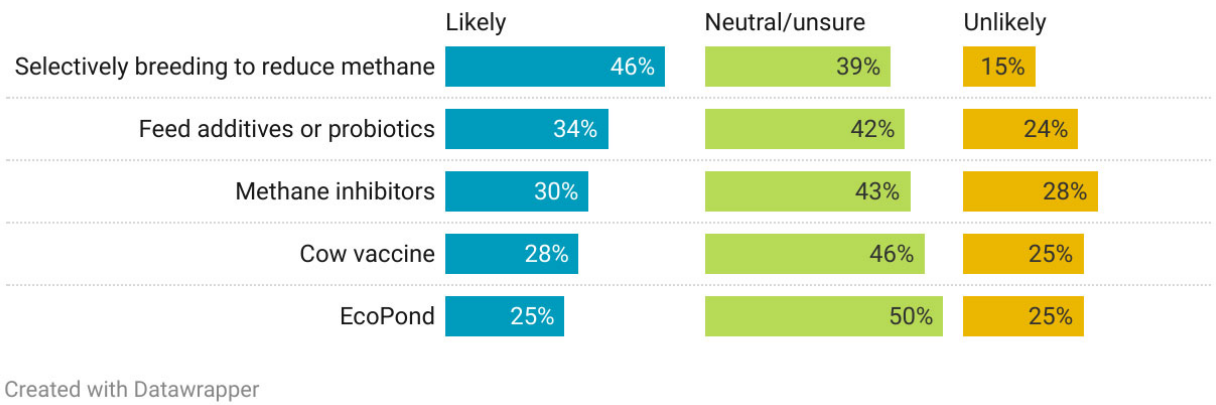

Figure 28. Likely adoption of emerging mitigation practices in the next 10 years.

7.1 Anticipated adoption of emerging mitigation practices by demographic and farm type

We analysed anticipated adoption of emerging mitigation practices by demographics and farm type using Pearson's Chi-square test for independence. Statistically significant differences are summarised qualitatively in Table 4. There were no statistically significant differences in anticipated adoption of any emerging mitigation practice by age group, ethnicity, education, or location; hence, these demographic categories are not included in Table 4.

Overall, those who were more likely to adopt the emerging mitigation practices were larger operators, those who had participated in more agricultural programmes related to sustainability,

those who believe that climate change is partially or mostly anthropogenic, and those whose farms had been negatively impacted by changing weather patterns in the past 5 years.

More specifically, experienced farmers were more likely to anticipate adopting selective breeding and vaccines than less experienced farmers, who were in turn more likely to anticipate adopting EcoPond. In addition, men were more likely to anticipate adopting methane inhibitors than women, and women were more likely to anticipate adopting EcoPond than men.

Table 4. Likely adoption of a new emerging mitigation in the next 10 years by different subgroups. Subgroup names shown in *italics* in Column 1.

	Emerging mitigation type				
	Selective breeding	**Feed additives/ probiotics**	**Methane inhibitors**	**Vaccine**	**EcoPond**
Gender					
More likely adopt…			Men		Women
Less likely adopt…					
Farming experience					
More likely adopt…	Farmers with more than 30 years of experience			Farmers with more than 30 years of experience	Farmers with up to 10 years of experience
Less likely adopt…	Farmers with up to 30 years of experience			Farmers with up to 10 years of experience	
Herd size					
More likely adopt…	Larger operators	Larger and medium operators	Larger operators		Larger operators
Less likely adopt…	Medium and smaller operators	Smaller operators	Smaller operators		
Participation in agricultural programmes related to sustainability					
More likely adopt…	Farmers who participated in more programmes	Farmers who participated in more programmes	Farmers who participated in more programmes	Farmers who participated in more programmes	Farmers who participated in more programmes
Less likely adopt…	Those who participated in none	Those who participated in none	Those who participated in none	Those who participated in none	
Debt					
More likely adopt…		Farmers with middle levels of debt			
Less likely adopt…		Farmers with low debt are more likely to be neutral.			

	Emerging mitigation type				
	Selective breeding	**Feed additives/ probiotics**	**Methane inhibitors**	**Vaccine**	**EcoPond**
Climate change (CC) belief					
More likely adopt…	Farmers who believe that CC is anthropogenic			Farmers who believe that CC is anthropogenic	
Less likely adopt…	Farmers who do not believe that CC is anthropogenic	Farmers who do not believe that CC is anthropogenic	Farmers who do not believe that CC is anthropogenic	Farmers who do not believe that CC is anthropogenic	Farmers who do not believe that CC is anthropogenic
Farm negatively impacted by changing weather patterns in the past 5 years					
More likely adopt…		Those affected by weather	Those affected by weather	Those affected by weather	Those affected by weather
Less likely adopt…		Those not affected	Those not affected	Those not affected	

7.2 Perceived impact of emerging mitigation practices

Respondents were also asked to evaluate the impact of the emerging mitigation practices on farm emissions, cow welfare, and farm profitability (Figure 29~~Figure 29~~). As noted earlier, the efficacy and costs of these emerging mitigation practices are not known, so most respondents are cautious about the impact the practices will have on cow welfare and farm profitability.

Farm emissions

As with existing practices, all emerging mitigation practices were expected to reduce farm emissions by over half of respondents, with feed additives/probiotics and methane inhibitors garnering the highest level of agreement at 60% and 59%, respectively.

Cow welfare

The practices were generally thought to have no impact or a positive impact on cow welfare. For example, EcoPond was thought to have no impact on cow welfare by 82% of respondents and selective breeding thought to have no impact on cow welfare by 70% of respondents. Methane inhibitors and cow vaccines cause the most concern among respondents with 32% and 24% believing that they will reduce cow welfare, respectively.

Farm profitability

The emerging mitigation practices thought to have the most negative impact on farm profitability were methane inhibitors (51%), feed additives/probiotics (47%), and cow vaccines (43%). However, between 15% and 26% of respondents believed that any given emerging mitigation practice would increase farm profitability.

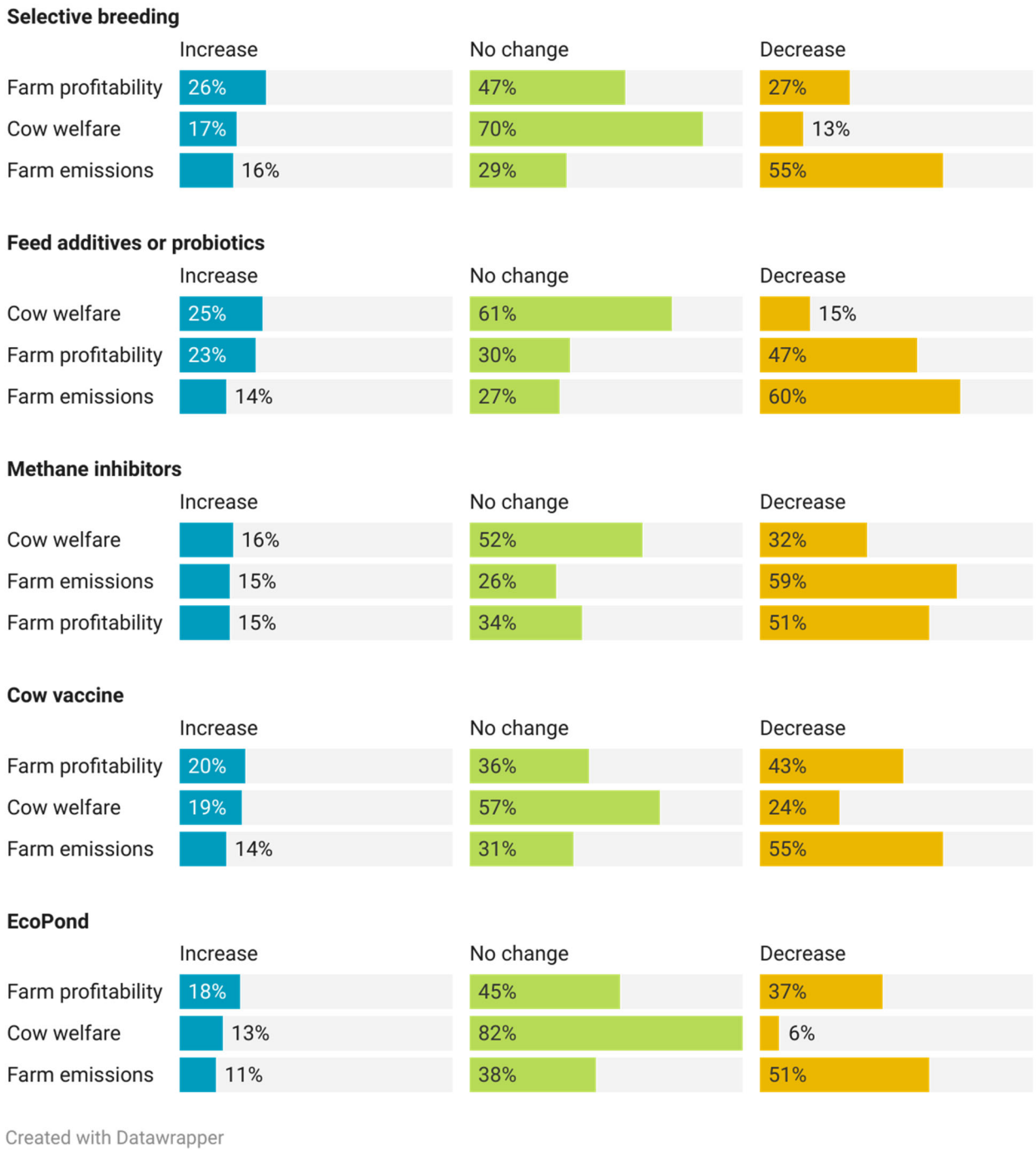

Figure 29. Perceived impact of emerging mitigation practices.

8 Drivers and barriers to adopting adaptation and mitigation practices

8.1 Drivers

Respondents were asked to select and rank the three most important considerations when adopting new practices on the farm, selecting from the following: cow welfare; farm profitability; ensuring a viable farming practice for future generations; protecting the environment; minimizing costs; labour and staffing required; regulatory compliance; and ethical and social concerns. As indicated in Figure 30, the three considerations that clearly stand out were cow welfare (the top consideration for 39% of respondents and in the top three considerations for 72% of respondents) farm profitability (the top consideration for 28% of respondents and in the top three considerations for 67% of respondents), and ensuring farm viability for future generations (the top consideration for 23% of respondents and in the top three considerations for 57% of respondents).

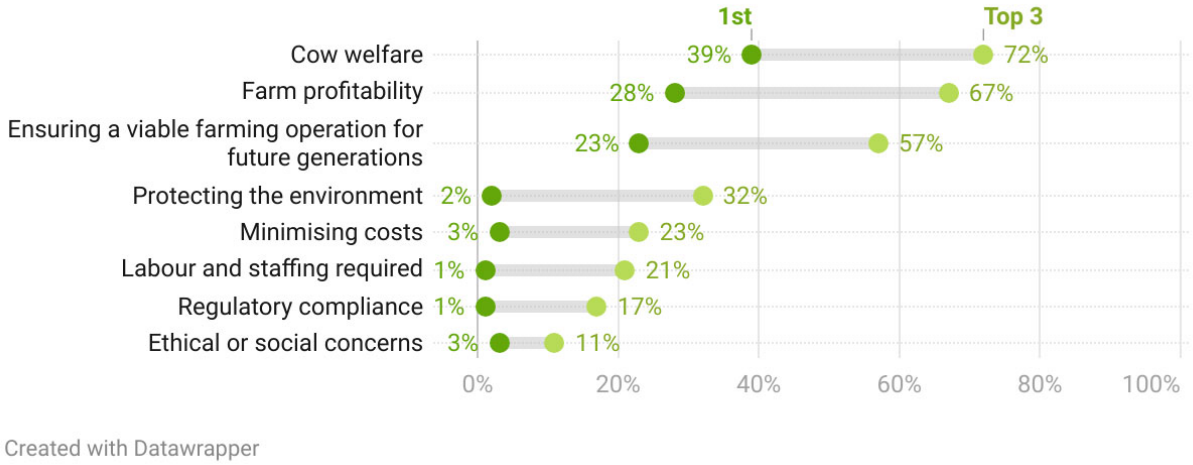

Figure 30. Drivers rated most important (dark green) and top three overall (pale green), by proportion (%) of respondents.

Protecting the environment was not a strong driver; it was among the top three factors for only 32% of respondents despite 63% indicating that they believed in climate change and that its cause is either mostly or partially anthropogenic (see Figure 6).

8.2 Barriers

Respondents were asked to identify barriers that may prevent them from adopting the various adaptation and mitigation practices described in this report, selecting from the following list: concern about triggering new regulations; debt payments; initial costs; maintenance costs; lack of capacity and time available; lack of cost information; lack of necessary equipment; lack of staffing; lack of technical assistance to implement (e.g. from extension or industry); lack of technical knowledge about practices; and other. Respondents could select as many barriers as they wished.

We report the share of respondents selecting each barrier in Figure 31. Cost considerations were most common, followed by concerns regarding capability.

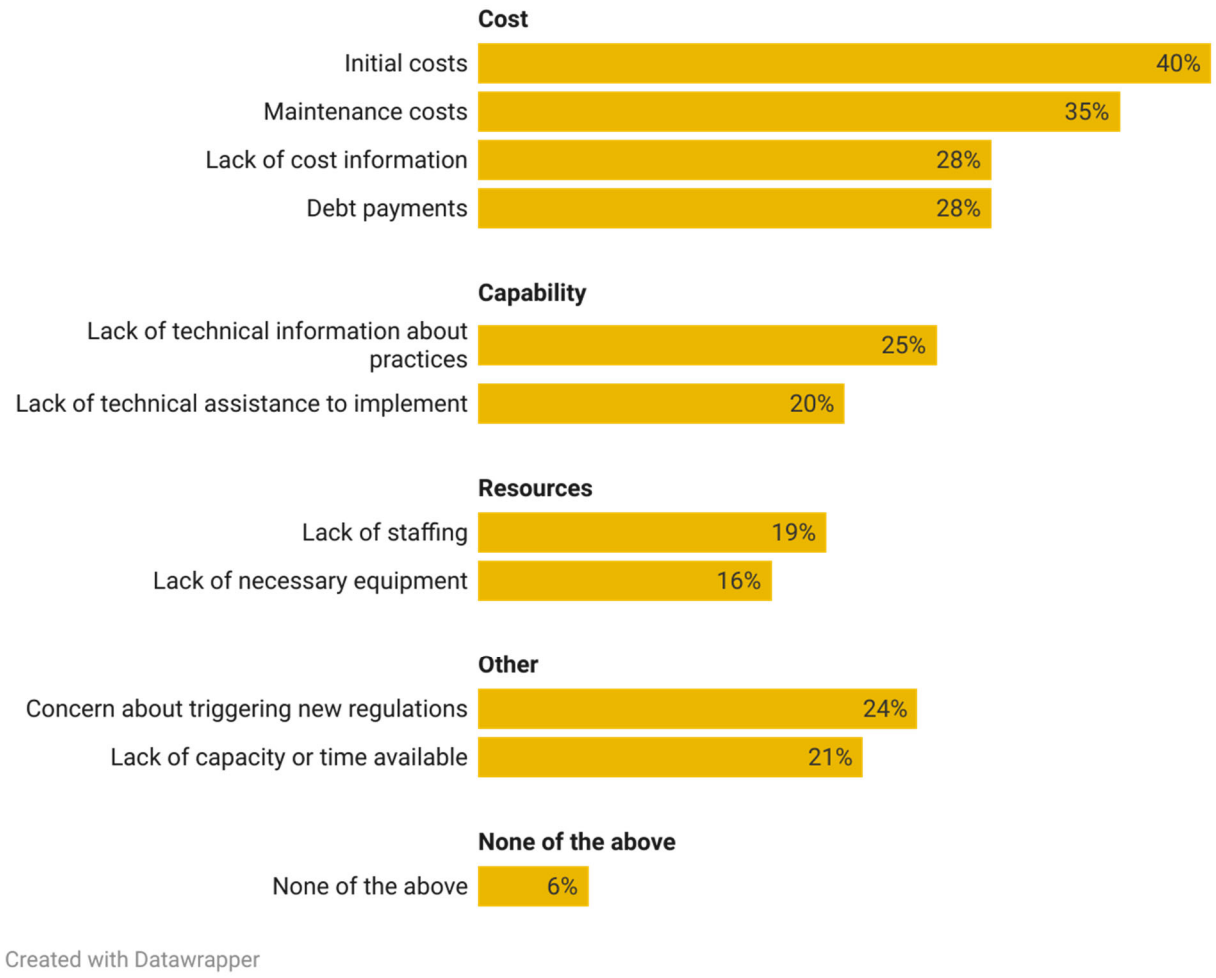

Figure 31. Perceived barriers to adoption of new practices, by proportion (%) of respondents.

Of those who provided other barriers, roughly half disagreed that there was a need to change practices to adapt to climate change and/or mitigate GHG emissions.

9 Discussion

New Zealand is warming and experiencing more extreme temperatures and greater weather variability (National Institute of Water and Atmospheric Research, 2022). While dairy farmers are already using a range of on-farm adaptation and mitigation practices, these survey results suggest that future adoption of existing practices has reached its height, with the exception of using renewable energy. However, many emerging mitigation strategies are of notable interest to dairy farmers, with one-quarter to one-half indicating interest in adoption within the next 10 years, which could assist New Zealand in meeting its obligations under the Paris Agreement.

This research shows that cow welfare, profitability, and ensuring a viable farm for future generations are more important to dairy farmers than environmental outcomes when deciding whether to adopt emerging mitigation practices – despite almost two-thirds of dairy farmers believing that anthropogenic climate change is occurring. Dairy farmers who believe in climate change, who are more experienced, who have larger herds, and who have participated in industry

programmes are significantly more likely to anticipate adopting emerging mitigation technologies than other dairy farmers.

There are few immediate incentives to encourage dairy farmers to adopt emerging mitigation practices, but this is likely to change. First, the New Zealand Government has indicated that it will implement a pricing system for on-farm GHG emissions by 2030 (Ministry for the Environment, 2024b). Second, while milk processors' conditions of supply currently emphasise food safety, milk quality, and animal welfare, processors are increasingly supporting farmers to reduce GHG emissions. For example, Fonterra's Co-operative Difference Payment incentivises sustainable on-farm practices and milk quality by providing graduated payments for milk supplied based on specific criteria. In February 2025, Fonterra also reported that they will pay higher prices for milk produced with lower GHG emissions (Gibson 2025). Third, international food conglomerates such as Nestlé and Danone have flagged their commitment to reducing their Scope 3 emissions (Danone 2025; Nestlé 2025). To this end, they increasingly require suppliers to provide them with the suppliers' mitigation data.

Supporting adoption now will help ensure that the dairy industry is well placed as new regulations, conditions of supply, and Scope 3 requirements come into play. Communicating any co-benefits of mitigations and adaptations – especially any positive impacts on cow welfare and profitability – will underpin and support uptake. This research suggests that future adoption of emerging mitigation strategies must consider animal welfare as well as on-farm productivity; we also find that many farmers remain uncertain or neutral about the emerging mitigations, and additional education, outreach, and commercialization may be useful.

10 Acknowledgements

Funding for this work was supported by The University of Vermont College of Agriculture and Life Sciences as well as the Robert L. Bickford Endowment. Funding for the original development of this survey that was adapted to the New Zealand context was provided by the USDA Department of Agriculture IDEAS (grant #2021-68014-34141).

We gratefully acknowledge the following people who shared their extensive knowledge about the New Zealand dairying system and provided feedback on the questionnaire: Caroline Amyes (Ministry for Primary Industries and former dairy farmer), Vicki Compton (Ministry for Primary Industries), Donna Cram (dairy farmer), Brad Hancock (dairy farmer), Jacqui Horswell (New Zealand Agricultural Greenhouse Gas Research Centre), Gerald Rys (Ministry for Primary Industries), Dan Schofield (Ministry for Primary Industries).

11 References

Climate Change Commission. (2024). FAQs: The context for Aotearoa New Zealand. https://www.climatecommission.govt.nz/get-involved/exploring-the-issues/aotearoa-context/, accessed 3 February 2025.

DairyNZ. (2023). Climate overview. https://www.dairynz.co.nz/environment/climate/climate-overview/, accessed 29 January 2025.

Danone. (2025). Transforming food systems for climate action and resilience. https://www.danone.com/sustainability/nature/driving-climate-action.html, accessed 18 February 2025.

Fonterra. (2023). Fonterra announces climate plans for the future. https://www.fonterra.com/nz/en/our-stories/media/fonterra-announces-climate-plans-for-the-future.html, accessed 8 February 2025.

Fonterra. (2025a). Together we make the difference. https://www.fonterra.com/nz/en/campaign/make-the-difference.html#what-co-op-diff, accessed 5 March 2025.

Fonterra (2025b). Tiaki: Farm source sustainable dairying. https://www.fonterra.com/nz/en/campaign/tiaki.html, accessed 5 March 2025.

Gibson W. (2025). Thousands of farmers to earn cash for their climate efforts. https://www.rnz.co.nz/news/environment/542203/thousands-of-farmers-to-earn-cash-for-their-climate-efforts, accessed 18 February 2025.

Livestock Improvement Corporation & DairyNZ. (2024). New Zealand Dairy Statistics 2023–24. https://www.dairynz.co.nz/resources/resource-list/new-zealand-dairy-statistics-2023-24/, accessed 16 December 2024.

McNee W. (2024). Achieving domestic agricultural emissions goals & climate ambitions [Conference presentation]. New Zealand Agriculture & Climate Change Conference 2024, November 3–4, Wellington, New Zealand.

Ministry for Primary Industries. (2024). Situation and outlook for primary industries. https://www.mpi.govt.nz/dmsdocument/66648-Situation-and-Outlook-for-Primary-Industries-SOPI-December-2024, accessed 13 March 2025.

Ministry for the Environment. (2024a). New Zealand's greenhouse gas inventory 1990–2022: Snapshot. https://environment.govt.nz/publications/new-zealands-greenhouse-gas-inventory-19902022-snapshot, accessed 29 January 2025.

Ministry for the Environment. (2024b). Our journey towards net zero: New Zealand's Second Emission Reduction Plan 2026–30. https://environment.govt.nz/publications/new-zealands-second-emissions-reduction-plan/, accessed 9 January 2025.

Ministry for the Environment. (2024c). Independent panel reports on methane science and targets. https://environment.govt.nz/news/independent-panel-reports-on-methane-science-and-targets/, accessed 3 February 2025.

Ministry for the Environment & Treasury. (2023). Ngā kōrero āhuarangi me te ōhanga: Climate economic and fiscal assessment 2023. https://www.treasury.govt.nz/publications/climate-

economic-fiscal-assessment/nga-korero-ahuarangi-me-te-ohanga-2023, accessed 13 March 2025.

National Institute of Water and Atmospheric Science. (n.d.). Seven-station series temperature data. https://niwa.co.nz/climate-and-weather/nz-temperature-record/seven-station-series-temperature-data, accessed 4 February 2025.

National Institute of Water and Atmospheric Science. (2022). New Zealand experiencing 5x more temperature extremes than expected. https://niwa.co.nz/news/new-zealand-experiencing-5x-more-temperature-extremes-expected, accessed 4 February 2025.

Nestlé. (2025). Our road to net zero. https://www.nestle.com/sustainability/climate-change/zero-environmental-impact, accessed 17 February 2025.

Niles MT, Goldstein Z, Hunt L, Mitchell RC, Tabor S. (2024) U.S. dairy farmer perceptions and actions around climate change. College of Agriculture and Life Sciences Faculty Publications report No. 205. https://scholarworks.uvm.edu/calsfac/205

Radio New Zealand. (2025). New Zealand's second emissions reduction target revealed. https://www.rnz.co.nz/news/political/540442/new-zealand-s-second-emissions-reduction-target-revealed, accessed 3 February 2025.

Somers E. (2024). Failure to meet climate commitments from Paris Agreement could cost New Zealand in trade partnerships, warns Climate Change Commission. https://www.interest.co.nz/economy/129031/failure-meet-climate-commitments-paris-agreement-could-cost-new-zealand-trade, accessed 16 December 2024.

Stahlmann-Brown P. (2021). Survey of Rural Decision Makers 2021. https://doi.org/10.7931/3tcs-wb24

Stahlmann-Brown P. (2023). Survey of Rural Decision Makers 2023. https://doi.org/10.7931/9kdt-0g35

Toitū Envirocare. (n.d.). The rise of Scope 3 and value chain carbon emission measurement. https://www.toitu.co.nz/news-and-events/news/measure/the-rise-of-scope-3-and-value-chain-carbon-emission-measurement, accessed 16 December 2024.

United National Climate Change. (n.d.). Key aspects of the Paris Agreement. https://unfccc.int/most-requested/key-aspects-of-the-paris-agreement, accessed 17 December 2024.

Wallace N. (2023). NZ farmers on top of their emissions numbers. https://www.farmersweekly.co.nz/news/nz-farmers-on-top-of-their-emissions-numbers/, accessed 6 February 2025.

Appendix 1: 2024 New Zealand Dairy Farmers Questionnaire

This survey is about practices that could possibly

A) reduce on-farm greenhouse gas emissions and

B) help farms adapt to changing climate and weather in the New Zealand dairy sector.

It is only open to invited dairy farmers.

The survey is conducted by Manaaki Whenua - Landcare Research, a New Zealand Crown Research Institute that was established in 1992. A similar survey was undertaken in the USA in 2023. Before we begin, a few important notes related to your privacy: Your participation in this survey is **optional**. You can stop the survey at any time.

Individual results will remain confidential and all data will be stored on password-protected computers. Click here to read Manaaki Whenua's statement on survey privacy and ethics.

Data are collected for **research purposes only**.

Anonymized results will be analysed and may be shared with researchers at other institutions. The results may be disseminated in scientific articles, presentations, news articles, and other publicly available outlets. **We will not share information that identifies you personally with anyone**.

The survey is designed to take 20 minutes. It closes at 11:59 PM on Sunday 15 December 2024. **We will donate $5 to Westpac Chopper Appeal** for each complete response we receive. In addition, we will have a prize draw for a $500 supermarket voucher for every 40 complete responses we receive.

If you have any questions about the survey, please contact Dr Pike Stahlmann-Brown at surveys@landcareresearch.co.nz.

Q2 Click **YES** to begin the survey. *Then click the right arrow to continue.*

- ○ YES, Take me to the survey (1)
- ○ NO, I don't want to do the survey (2)

Skip To: End of Survey If Click YES to begin the survey. Then click the right arrow to continue. = NO, I don't want to do the survey

Section 1 - General Farm Characteristics

Q4 In what **region and district** is your dairy farm located? *If your dairy farm is located in multiple regions / districts, please choose the location where your main operation is located.*
Region (1)
District (2)

- ☐ ▼ Northland (1) ... Prefer not to say ~ NA (95)

Q5
What is the **postal code** for this property?
_____

Q6 What is the total area of the property, including unproductive area and support blocks? *Please separate land that is owned from land that is leased. Do not count land that is leased to others or used by others.*

For reference, 1 hectare = 2.5 acres.

- ○ Area of **owned** land (hectares) (1) _____
- ○ Area of **leased / managed / contract milked / share farmed** land (hectares) (2) _____

Section 2 - Herd Information

Q8 What was the **total size** of your dairy herd as at 31 May 2024? *Please enter numbers only.*
_____

Q9 On average, what percentage of your cows' **dry matter intake** (DMI) comes from the following sources? *Please enter numbers only.*
Pasture : _____ (1)
Forage crops grown on farm (e.g. kale, fodder beets, straw, baleage, summer turnips) : _____ (2)
Grain grown on farm : _____ (3)
Purchased forage crops : _____ (4)
Palm kernel extract (PKE) : _____ (5)
Purchased grain (excluding PKE) : _____ (6)
Other : _____ (7)
Total : _____

Q10 At any point during the year, do you **send or receive** dairy cows for grazing?

	Yes (1)	No (2)	Unsure (3)
Send cows to another farm for grazing (Q10_1)	○	○	○
Receive cows from another farm for grazing (Q10_2)	○	○	○

Section 3 - Programme Participation

Q12 In which of the following **voluntary agricultural programmes** have you ever participated? *Select all that apply.*

- ☐ DairyNew Zealand: InCalf (1)
- ☐ DairyNew Zealand: Stepchange (2)
- ☐ Synlait: Lead with Pride (3)
- ☐ Fonterra: Greenhouse Gas Support Pilot (4)
- ☐ Fonterra: Cooperative Difference (5)
- ☐ Fonterra: Tiaki Sustainable Dairying (6)
- ☐ Miraka: Te Ara Miraka Farming Excellence (7)
- ☐ Westland Milk Products: Farm Excellence (8)
- ☐ Organic / Biodynamic / Hua Parakore Certification (9)
- ☐ ⊗None of the above (10)

Section 4 - Dairy Farm Practices for Weather and Climate

Q14 There are a variety of practices that could possibly **reduce greenhouse gas emissions** in dairy systems. Some are already available and some are just emerging. For practices that have been available for some time, please indicate whether you have used the practice before and your likelihood to use the practice in the next 10 years. For emerging practices, please indicate your likelihood to use the practice in the next 10 years (assuming it becomes readily available). *Please select one option for each practice.*

	Past and current use of practice			Likelihood to use the practice in the next 10 years			
	Never used (1)	Previously used but no longer use (2)	Currently use (3)	Unlikely (1)	Neutral (2)	Likely (3)	Unsure (4)
Manure management (e.g. anaerobic manure digesters, composting manure, separation of solids and	○	○	○	○	○	○	○

	Past and current use of practice			Likelihood to use the practice in the next 10 years			
	Never used (1)	Previously used but no longer use (2)	Currently use (3)	Unlikely (1)	Neutral (2)	Likely (3)	Unsure (4)
liquids) (Q14_1)							
Diversifying pasture or forage crops grown (e.g. kale, fodder beets, straw, baleage, summer turnips) (Q14_2)	○	○	○	○	○	○	○
Reducing fertiliser use (Q14_3)	○	○	○	○	○	○	○
Using renewable energy on farm (e.g. solar, wind, geothermal, hydro power) (Q14_4)	○	○	○	○	○	○	○
Reducing herd size (Q14_5)	○	○	○	○	○	○	○
EcoPond (adding ferric sulfate to reduce effluent pond emissions) (Q14_6)	○	○	○	○	○	○	○
Cow vaccine to reduce methane (Q14_7)	○	○	○	○	○	○	○
Selective breeding to reduce methane (Q14_8)	○	○	○	○	○	○	○

	Past and current use of practice			Likelihood to use the practice in the next 10 years			
	Never used (1)	Previously used but no longer use (2)	Currently use (3)	Unlikely (1)	Neutral (2)	Likely (3)	Unsure (4)
Methane inhibitors (e.g., slow-release capsules that cows swallow) (Q14_9)	○	○	○	○	○	○	○
Feed additives or probiotics (e.g. tannins, oils, seaweed/kelp, Kowbucha) to reduce methane (Q14_10)	○	○	○	○	○	○	○

Q15 Are there any **other practices** that you have used to reduce greenhouse gas emissions on your farm? *Please list below.*

_____

Q16 The following is a list of practices that could possibly **help farms adapt to changing climate and weather**. Please indicate whether you have used the practice before and your likelihood to use the practice in the next 10 years. *Please select one option for each practice.*

	Past and current use of practice			Likelihood to use the practice in the next 10 years			
	Never used practice (1)	Previously used but no longer use (2)	Currently use practice (3)	Unlikely (1)	Neutral (2)	Likely (3)	Unsure (4)
Indoor housing (e.g, barns, sheds, shelters) to reduce heat and cold stress (Q16_1)	○	○	○	○	○	○	○
Shade structures / trees in paddocks (Q16_2)	○	○	○	○	○	○	○
Cooling in animal housing (e.g. sprinklers, fans) (Q16_4)	○	○	○	○	○	○	○
Selling part or all of your herd to adjust to weather changes (Q16_5)	○	○	○	○	○	○	○
Increasing storage capacity (e.g. tanks, dams, wetlands), improving irrigation efficiency (e.g. precision	○	○	○	○	○	○	○

	Past and current use of practice			Likelihood to use the practice in the next 10 years			
	Never used practice (1)	Previously used but no longer use (2)	Currently use practice (3)	Unlikely (1)	Neutral (2)	Likely (3)	Unsure (4)
irrigation), and/or recycling of water (Q16_6)							
More drought / flood tolerant pasture / crop varieties (Q16_7)	○	○	○	○	○	○	○

Q17 Are there any **other practices** that you have used to help you farm adapt to changing climate and weather? Please list below.

_____

Q18 As you consider adopting new practices on your farm, which of the following are the top three most important factors? *Please write 1 for the most important factor, 2 for the second most important factor, and 3 for the third most important factor.*

_____ Cow welfare (1)
_____ Ensuring a viable farming operation for future generations (2)
_____ Ethical or social concerns (3)
_____ Farm profitability (4)
_____ Labor and staffing required (5)
_____ Minimizing costs (6)
_____ Protecting the environment (7)
_____ Regulatory compliance (8)

Q19 This section asks you to evaluate how the practices described above might affect your **farm emissions**, the **well-being of your cows**, and your **farm's profitability**. If you have implemented these practices already, please indicate how they have affected your operation. If you haven't, please indicate how you think they would affect your operation.

Q20 **Manure management (e.g. anaerobic manure digesters, composting manure and/or separation of solids and liquids)** - *Practice 1 of 16*

	Decrease a lot (1)	Decrease somewhat (2)	No change (3)	Increase somewhat (4)	Increase a lot (5)
Farm emissions (Q20_1)	○	○	○	○	○
Cow welfare (Q20_2)	○	○	○	○	○
Farm profitability (Q20_3)	○	○	○	○	○

Q21 **Diversifying pasture or forage crops grown (e.g. kale, fodder beets, straw, baleage, summer turnips)** - *Practice 2 of 16*

	Decrease a lot (1)	Decrease somewhat (2)	No change (3)	Increase somewhat (4)	Increase a lot (5)
Farm emissions (Q21_1)	○	○	○	○	○
Cow welfare (Q21_2)	○	○	○	○	○
Farm profitability (Q21_3)	○	○	○	○	○

Q22 **Reducing fertiliser use** - *Practice 3 of 16*

	Decrease a lot (1)	Decrease somewhat (2)	No change (3)	Increase somewhat (4)	Increase a lot (5)
Farm emissions (1)	○	○	○	○	○
Cow welfare (2)	○	○	○	○	○
Farm profitability (3)	○	○	○	○	○

Q23 **Using renewable energy on farm (e.g. solar, wind, geothermal, hydro power)** - *Practice 4 of 16*

	Decrease a lot (1)	Decrease somewhat (2)	No change (3)	Increase somewhat (4)	Increase a lot (5)
Farm emissions (Q23_1)	○	○	○	○	○
Cow welfare (Q23_2)	○	○	○	○	○
Farm profitability (Q23_3)	○	○	○	○	○

Q24 **Reducing herd size** - *Practice 5 of 16*

	Decrease a lot (1)	Decrease somewhat (2)	No change (3)	Increase somewhat (4)	Increase a lot (5)
Farm emissions (1)	○	○	○	○	○
Cow welfare (2)	○	○	○	○	○
Farm profitability (3)	○	○	○	○	○

Q25 **EcoPond (adding ferric sulfate to reduce effluent pond emissions)** - *Practice 6 of 16*

	Decrease a lot (1)	Decrease somewhat (2)	No change (3)	Increase somewhat (4)	Increase a lot (5)
Farm emissions (1)	○	○	○	○	○
Cow welfare (2)	○	○	○	○	○
Farm profitability (3)	○	○	○	○	○

Q26 **Cow vaccine to reduce methane** - *Practice 7 of 16*

	Decrease a lot (1)	Decrease somewhat (2)	No change (3)	Increase somewhat (4)	Increase a lot (5)
Farm emissions (1)	○	○	○	○	○
Cow welfare (2)	○	○	○	○	○
Farm profitability (3)	○	○	○	○	○

Q27 **Selective breeding to reduce methane** - *Practice 8 of 16*

	Decrease a lot (1)	Decrease somewhat (2)	No change (3)	Increase somewhat (4)	Increase a lot (5)
Farm emissions (1)	○	○	○	○	○
Cow welfare (2)	○	○	○	○	○
Farm profitability (3)	○	○	○	○	○

Q28 **Methane inhibitors (e.g. slow-release capsules that cows swallow)** - *Practice 9 of 16*

	Decrease a lot (1)	Decrease somewhat (2)	No change (3)	Increase somewhat (4)	Increase a lot (5)
Farm emissions (1)	○	○	○	○	○
Cow welfare (2)	○	○	○	○	○
Farm profitability (3)	○	○	○	○	○

Q29 **Feed additives or probiotics (e.g. tannins, oils, seaweed/kelp, Kowbucha) to reduce methane** - *Practice 10 of 16*

	Decrease a lot (1)	Decrease somewhat (2)	No change (3)	Increase somewhat (4)	Increase a lot (5)
Farm emissions (1)	○	○	○	○	○
Cow welfare (2)	○	○	○	○	○
Farm profitability (3)	○	○	○	○	○

Q30 **Indoor housing (e.g. barns, sheds or shelters) to reduce heat and cold stress** - *Practice 11 of 16*

	Decrease a lot (1)	Decrease somewhat (2)	No change (3)	Increase somewhat (4)	Increase a lot (5)
Farm emissions (1)	○	○	○	○	○
Cow welfare (2)	○	○	○	○	○
Farm profitability (3)	○	○	○	○	○

Q31 **Shade structures / trees in paddocks** - *Practice 12 of 16*

	Decrease a lot (1)	Decrease somewhat (2)	No change (3)	Increase somewhat (4)	Increase a lot (5)
Farm emissions (1)	○	○	○	○	○
Cow welfare (2)	○	○	○	○	○
Farm profitability (3)	○	○	○	○	○

Q32 **Cooling in animal housing (e.g. sprinklers, fans)** - *Practice 13 of 16*

	Decrease a lot (1)	Decrease somewhat (2)	No change (3)	Increase somewhat (4)	Increase a lot (5)
Farm emissions (1)	○	○	○	○	○
Cow welfare (2)	○	○	○	○	○
Farm profitability (3)	○	○	○	○	○

Q33 **Selling some of your herd to adjust to weather changes** - *Practice 14 of 16*

	Decrease a lot (1)	Decrease somewhat (2)	No change (3)	Increase somewhat (4)	Increase a lot (5)
Farm emissions (1)	○	○	○	○	○
Cow welfare (2)	○	○	○	○	○
Farm profitability (3)	○	○	○	○	○

Q34 **Increasing storage capacity (e.g. tanks, dams, wetlands), improving irrigation efficiency (e.g. precision irrigation), and/or recycling of water** - *Practice 15 of 16*

	Decrease a lot (1)	Decrease somewhat (2)	No change (3)	Increase somewhat (4)	Increase a lot (5)
Farm emissions (1)	○	○	○	○	○
Cow welfare (2)	○	○	○	○	○
Farm profitability (3)	○	○	○	○	○

Q35 **More drought / flood tolerant pasture / crop varieties** - *Practice 16 of 16*

	Decrease a lot (1)	Decrease somewhat (2)	No change (3)	Increase somewhat (4)	Increase a lot (5)
Farm emissions (1)	○	○	○	○	○
Cow welfare (2)	○	○	○	○	○
Farm profitability (3)	○	○	○	○	○

Section 5 - Barriers to Adoption

Q37 Are any of the following preventing you from adopting practices discussed previously? *Tick all that apply.*

- ☐ Concern about triggering new regulations (1)
- ☐ Debt payments (2)
- ☐ Initial costs (3)
- ☐ Maintenance costs (4)
- ☐ Lack of capacity or time available (5)
- ☐ Lack of cost information (6)
- ☐ Lack of necessary equipment (7)
- ☐ Lack of staffing (8)
- ☐ Lack of technical assistance to implement (like from extension or industry) (9)
- ☐ Lack of technical information about practices (10)
- ☐ Other (11) _____
- ☐ ⊗None of the above (12)

Section 6 - Impact of Climate and Weather on your Farm

Q39 To what extent do you agree or disagree with the following statements related to **weather**?

	Strongly disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly agree (5)
In the past 5 years, I have noticed more **variable or atypical weather in my area** (Q39_1)	○	○	○	○	○
Changes in weather patterns in the past 5 years are **hurting other dairy farms** in my area (Q39_2)	○	○	○	○	○
Changes in weather patterns in the past 5 years are **hurting my farm** (Q39_3)	○	○	○	○	○

Q40 How do you expect changing climate and weather to affect the following on **your farm**, if at all?

	Very negative (1)	Negative (2)	No change (3)	Positive (4)	Very positive (5)	Unsure (6)
Cow welfare (Q40_1)	○	○	○	○	○	○
Milk production (Q40_2)	○	○	○	○	○	○
Crop production (Q40_3)	○	○	○	○	○	○
Labor availability (Q40_4)	○	○	○	○	○	○
Feed costs (Q40_5)	○	○	○	○	○	○

Q41 How do you expect changing climate and weather to affect the **New Zealand dairy industry overall**, if at all? Do you have any specific concerns?

_____
_____
_____

Q42 Please select the statement that best indicates **your personal beliefs** about climate change.

- ○ Climate change is not occurring / not real (1)
- ○ There is insufficient evidence to know whether climate change is occurring (2)
- ○ Climate change is occurring, causes are mostly natural (3)
- ○ Climate change is occurring, driven equally by human and natural causes (4)
- ○ Climate change is occurring, driven mostly by human causes (5)

Section 7 - Demographics

Q44 In which **year were you born**?

☐ ▼ 1920 (1) ... 2006 (87)

Q45 What is your **gender**?

- ○ Male (1)
- ○ Female (2)
- ○ Another gender (3)
- ○ Prefer not to answer (4)

Q46 Which of the following best describes your **highest level of education** completed so far?

- ○ Some secondary school (1)
- ○ Secondary school (2)
- ○ Certificate (level 1-6) (3)
- ○ Diploma (level 5-7) (4)
- ○ Bachelor's degree (5)
- ○ Post-grad certificate or diploma / Honour's degree (6)
- ○ Master's degree (7)
- ○ Doctoral degree (8)
- ○ Other (9)
- ○ Prefer not to answer (10)

Q47 What is your **ethnicity**? *Tick all that apply.*

- ☐ New Zealand European (1)
- ☐ Māori (2)
- ☐ Chinese (3)
- ☐ Indian (4)
- ☐ Samoan (5)
- ☐ Cook Islands Māori (6)
- ☐ Tongan (7)
- ☐ Niuean (8)
- ☐ Other European (e.g. British) (9)
- ☐ Other (please specify below) (10) _____
- ☐ ⊗Prefer not to answer (11)

Q48 Approximately **how many years** have you been farming?

- ☐ ▼ 1 (1) ... 100 (100)

Q49 Do you consider yourself a **full-time** farmer?

- ○ Yes (1)
- ○ No (2)

Q50 Does your farm have a **succession plan**?

- ○ Yes (1)
- ○ No (2)
- ○ Partial (3)

Q51 Approximately what share of your household income comes from off-farm sources?

☐ ▼ 0% (1) ... 100% (21)

Q52 As a percentage of your annual income, **how much debt does your farm currently have**? As an example, if you grossed $100,000 annually, and your debt was $200,000, you would have debt at 200% of your annual income.

- ○ None (1)
- ○ Less than 50% of annual income (2)
- ○ 50-100% of annual income (3)
- ○ 101-200% of annual income (4)
- ○ 201-500% of annual income (5)
- ○ More than 500% of annual income (6)

Section 8 - Concluding Questions

Q54 Are there any additional comments you'd like to share about your experience as a dairy farmer and your farm?

_____

Appendix 2: Impact on the dairy industry overall

Respondents were asked how they anticipated changing climate and weather to affect the New Zealand dairy industry, if at all, and what specific concerns they may have. The following table provides the verbatim responses, grouped by those who anticipated negative impacts, those who thought there could be pros and cons, and those who thought there would be no impact.

Yes, it will affect the New Zealand dairy industry
Increasing droughts or irregular rainfall patterns may affect water supplies for irrigation and livestock, leading to lower milk production in some areas.
A gradual reduction in total milk production over time due to more extreme weather events increasing cost of production and reducing farmer confidence and moral.
A prolonged drought means less grass and water for cows. This will certainly reduce milk production.
Adverse weather events e.g. Cyclone Gabrielle very costly and only partly covered by insurance Hot, dry summers - extra costs of purchased feeds, regrassing etc Animal welfare concerns during adverse weather events - flooding, damaging winds, high temperatures.
Affects the health of the cows as well as feeding grains and pastures.
Agricultural technology innovation.
As extreme weather events increase, our insurance costs may rise.
Better management will help with this.
Big shifts to when to make supplements, animal health, calving etc.
Certain areas will of course be impacted more. Our farm has been pretty stable.
Challenge adaptability and resilience in some scenarios. Increase costs of production and related reduction in profitability.
Changes in management will be needed, adaptability and trying new ideas.
Climate change is going to affect all NZ. All farmers will adapt. However, the focus on gases is misguided after all a couple of days of war is more detrimental to the environment than decades of NZ's emission's. Focus on NZ BIODIVERSITY and farmers will lead the way.
Climate change is likely to have an impact on the New Zealand dairy industry, particularly through affecting precipitation patterns and temperatures. Extreme weather, such as drought or flooding, can reduce the productivity of grasslands, which can affect the feed supply and overall yield of dairy cows.
Dairy industry down 8% in cow numbers over past couple of years as farmers take on board new regulations and requirements, so less milk produced so less exports so less money for NZ.
Concern about longer droughts and possibly more cyclones of a tropical nature.
Finding good information with tangible and cost-effective results is our biggest problem. At the moment there's a lot of rubbish commentary out there, silly rules, ineffective tools (Overseer) and a lot of jumping through hoops, e.g. green loans with the banks-admin headache when there is already plenty of compliance. Still seems that the only way to reduce emissions is to reduce numbers which either kill the oppression or requires a different use for the land, increasing emissions again. I also have much bigger questions such as if we grounded our politicians, corporates would the reduction in plane hours be more effective than a reduction in cows/ profit on my farm.
Drought or bad weather can cause grass and forage quality to decline.
Droughts and extreme weather events do impact the farm operations and affect the bottom line. However, we farm to mitigate the risks as much as is possible but the milk production is affected which means there is loss in production and loss of income.
Farmers are practical and innovative. They adapt to any changes.
Farmers might have to reduce their number of cows, and plant more trees.

Grass will grow better when there is more rain, but risk of prolonged dry periods cause challenge to grass growth.
Greater regional variations in milk solid production, feed availability, and its cost.
Have to manage extremes more often so hold more supplement which has a cost.
Heavy rains and flooding can wash out pastures and damage barns and equipment.
Higher cost rising for PK feeds more often as pasture decreases.
I think it will have a negative impact overall on dairy production in New Zealand.
I think Southland is probably going to do better than other regions, we tend to have a more stable weather season.
I think there will be a dampening effect on production and a greater impact on profitability because of the increased costs to mitigate climate change impacts.
If more reports emerge about climate-related issues in the dairy industry, consumers may begin to question the sustainability and quality of our products.
If production drops due to climate issues, dairy prices could rise.
If the seasons are mixed up, it disrupts the breeding and calving cycles of dairy cows, affecting the number of calves and ultimately the milk supply.
If we have to buy more feed because of bad weather, it will increase our costs and reduce our profits.
I'm a huge fan of milder, dryer winters and wetter summers. Feed growth is utilised all year as grass growth is better. Crops in spring are getting more yields as rain continues to fall over summer.
Impact on farmer mental health when faced with increasing adverse events. Impact on viability when a series of climate change events occur.
Impact on water resources: climate change may lead to more frequent droughts, reducing water availability for irrigation, which could affect pasture growth and milk production.
Improve soil health through mulch crops and organic fertilizers, increase soil water retention, and reduce wind erosion and water.
Extremes, dry, flood.
Extreme Weather Events: More intense storms and flooding could damage dairy farm infrastructure, disrupt operations, and increase costs for recovery and repair.
Increase of adverse weather events.
Increase the cost of buying supplements, damage permanent pasture, more lame cows.
It all depends on if we are prepared to work with the science and modern techniques as they appear.
It gets hotter each year - it may be compulsory [to have] shelter sheds.
it will be tough, but we will pull through together.
It will make farming trickier to manage.
Lack of consistence and predicable weather pattens causing severe crop damage leading to dead shortages.
Lower production and fewer farms.
Major impact in certain districts; more cow distress and for humans.
Make it more sunny.
Marginal dairying regions may be forced to reduce cow numbers to better match their environment.
More droughts, lower production &/or higher cost of feed, more cows culled early More storms, roading and access problems. On farm, more land damage, slips, pasture damage from pugging and land under water, fences and tracks washed out.
More extreme weather events harder rain events that drop too much water too fast. Some positives in more rain however. Hotter summers and unseasonable cold snaps damaging to spring growth as the polar vortex has more collapse events releasing cold streams of air over NZ from Antarctica.

More extremes. we've already seen the east cost droughts and extreme floods. LT projections for W Southland are for increase in heavy winter rain events and longer summer dry periods.
More flooding.
More intense weather events i.e. heavier rain or longer dry periods. Planning for more sustainable feed reserves.
More severe adverse weather events.
More variable.
My concern is that the regulations being implemented around climate change are causing a decrease in food produced on farms. This is driving up food prices and is now the main cause of the cost of living crisis. The consequences of climate change policies are more negatively outweighing the real effects of actual climate change!
NZ farmers very adaptable.....will cope/change/adapt as we always have.
Plant cover crops during the off-season to prevent erosion and improve soil quality.
Rising temperatures may affect the health, fertility and milk production of dairy cows.
Seasons seem to be moving further into the year, so need to adapt e.g. move calving dates Will need to be able to demonstrate shelter availability in summer if temperatures increase further
Secure irrigation from the Waitaki hydro dams. Increase in heat stress on plants and animals.
Severe weather can disrupt shipping and logistics, making it more difficult to deliver our dairy products on time.
Some areas that are flood prone or drought prone will likely see more problems.
Some areas will be affected but every year it is liable to be different areas. Been happening every year of the 56 years we've been farming.
Some farms suffer from water insecurity. I see so many farms where the cows have no shade, this is a bad look for the industry. We are too reliant on palm kernel as a feed when pasture is dry in summer stress.
Some of the more vulnerable areas will have to make changes to systems or land use change. Other areas say with irrigation will benefit from slightly more moderate temps in winter spring and autumn.
Some parts of the country will definitely be effected, however in Southland it is probably the least effected area.
Some regions will suffer more from extremes than others.
The social expectation from urban voters will have a significant effect on future profitability of dairy farming in NZ do to the added cost of compliance.
The summers are getting drier and hotter, which may impact pasture growth, food supply for cows and make it less desirable for them with no shade.
The weather will greatly affect the productibility of our animals.
There might be some impact in certain areas like up close to the mountain.
There will be more outgoing costs.
Trying to reduce C02 is a lot of crap. Less grass will be grown.
Unnecessary regulation and strict compliance rules that are not practical and will push farmers out of business.
Unsure, for us the summers may be wetter which is better for summer grass growth.
Warmer temperatures can stress cows, potentially reducing milk yield and quality. Heat stress also increases the risk of diseases.
We are dryland farming, so weather plays a huge part. Not being able to grow crops on farm is a issue and so input feed is our only option if in serious drought like last year. The weather changes are playing a big part daily for us it can change our circumstances in a day. Regulations forbid us to increase stock numbers to deal with extra grass and as we are a low input system we have to manage this as best we can. Some of the options suggested in this survey would be great for us but would come at a high price tag that we cannot afford with interest rates so high at the moment.
We will adapt to change.

We will do everything we can to protect the environment provided it is back by sound science and will not affect the welfare of our animals or people living and working on farm. Your questions about heat stress are not often relevant in the south and you seem to be pushing barns as gold standard for the environment; in our opinion barns also cause effluent to be spread in a much smaller area and prefer to winter graze on grass and mature silage with cows in small groups.

We will have some plans in place. Production and expenses up and down.

Weather, temperature and drought changes.

Will add costs, affect cow health and possibly markets.

Will affect different areas differently. Many negatively. Some may get better rain fall?

Worried about heat stress. This farm not doing enough yet for the cows to prepare for a very hot summer.

Yes.

Yes - decreased production in many areas with heat and water shortages.
On the West Coast we may get more heavy rainfall events so increased likelihood of flooding or negative grass growth implications.

Yes, different challenges in different regions.

Yes, for growing the harvest.

Yes. It's being hyped up.

Yes, with more intense adverse events.

Yes, the concern is as we all look for ways to find solutions to the problem people look for someone to blame. And farmers are an easy target. For example, to the person who may read this, will you take less flights next year or travel less distance in a fuel driven car or bus? Unlikely. You will say, "We need to do something about agriculture emissions". So let's all work together for answers.

Pros and Cons

Climate variability is part of farming always has been and always will be, variations will have both positive and negative effects which may well balance each other out, e.g. hotter summer but milder winter.

Swings and roundabouts. East Coast with irrigation needs to increase as much production potential and earnings for the country. Hawkes Bay and Wairarapa with water storage and irrigation will compensate Waikato and Northland production drop due to population growth and lack of farm scale, and climate may not be so inducive to pasture growth matching cow demand. Our breakeven is $2.00 a kg of milk solids, less in mid Canterbury than in the Waikato. My major concern is that stupid politicians will tax methane emissions thinking they are going to stop the sun from heating up the planet. Talk about a scam.

Depends on location and local weather conditions and what drought resistant pasture / crops are grown. Some areas may become warmer and grow better. Other areas may become drier.

No overall net change, some areas improve some ae worse off, any net decrease in production is balanced by an increase in price due to global supply/demand.

Depends what region you live in; I believe mine won't be compromised.

So much science apportions to warming when cooling may occur. Where is the each way bet?

Some areas will do better, some worse. Overall, I see a balancing out with very little net effect.

The industry will need to be prepared for more extremes. These changes will sometimes be favourable and sometimes not.

Usually if one region is having a poor year another is doing well. Importing feed helps in poor seasons by helping maintain cow condition.

You diversify land to suit climate. Our area 20 years ago couldn't grow maize, now many do. Our rainfall patterns over the last 33 years have stayed pretty constant annual rainfall has increased slightly.

No, not impacted

Farm the land well, prepare for drought, feed the soil, it feeds the cows/animals.
climate changes in patterns throughout the years. We are being fed exaggerated information by companies to profit from. Droughts and floods come and go. look at where you live - if it's in a dumb place (e.g. valley between mountains) then expect to have incidents. Pine plantings will have a huge effect going forward 20 plus years.

Climates are never consistent. The last three seasons have been good.

Do not expect any long-term effects from climate change.

Don't think it will effect.

Don't think the climate or weather will affect the dairy industry at all. The only thing that could affect the dairy industry is if the government listens to all the lies being told about the climate. Nature does what Nature does, and we have had these cycles in the past.

Farming in Northland we are used to dry and wet conditions and already plan for the worst and hope for the best. I have been farming for 40 years and the climate conditions have not changed. I am reluctant to implement policies that have questionable cost/benefits ratios. Climate change and gas emissions have always been politicised rather than truly based on science - including how science is funded. Our national herd is already the most efficient globally and we need to keep this lead. However, it must be based on productivity and science - not political opinion. Reduction of herd numbers is simply poor policy driven by people who have little to no understanding.

I am not sure that the average weather over the whole country has changed. Each area seems to have its climatic challenges. Next year it will be another area.

I don't.

I don't expect it will at all. West Coast weather runs on a 7-year cycle. I've been farming here 21 years. It hasn't changed in the last 5 years; in the next 5 years who knows? I don't think much will change. Climate is only long-term weather stats; they can't predict 5 days ahead let alone 5 years.

I have been dairy farming for 35 years. During that time the climate has never been the same from one day to the next. This gives me no specific concerns.

I'm on a multi-generational dairy farm in Canterbury and my father tells me the current weather is just like it was in the late 80's early 90's for our area. Weather patterns are cyclic. Climate change yes. Climate crisis NO!

It won't..

It won't.

Minimal effect and the last 2 seasons have been near perfect for pasture, animals and profit.

It's about building climate resilience. the weather is in a 30 to 40-year weather cycle and not this climate change BS. We have always been a lower stocked farm due to our soil types and try to work with the soils and with the weather making the right decision at the right time. THAT is not climate change!!! We can all do that!

Nature has always been variable that's why it's called farming. People need to except they can't control nature that's the beauty of it. We have to work with her, or she will always win. People are making a big thing out of something that has evolved for millions of years through cycles, and they have got out of touch at how variable nature is. Try changing pollution yes, but not methane - it's a natural cycle and they need to get their facts right before they create a human imbalance in nature or then we really will be in trouble. People are going to go hungry.

Need to be prepared for more adverse events but then farming has always had to be adaptable to the weather so maybe no change from normal.

No.

No, it is just the weather going in cycles.

No change.

No change in industry, keeping consistent is fair.

No concerns.

No concerns at all, we always adapt. Some of the suggestions you made like vaccines, boluses etc are still experimental, and I am definitely contemplating these, until it works and I get paid for doing it, one way or another. Theoretically containing methane loss could enhance better feed utilisation, i.e. better feed efficiency, so I am

watching, but that's all. Practices like shelter, trees etc are part of my farming style and have been for a longtime, nothing to do with climate change, just about giving my cows good life.

No not at all.

No not really - we will adapt and there's nothing new.

No real concerns. The climate is ever changing, and no 2 seasons are the same. It's a matter of planning and adapting for adverse circumstances. Cows excrete methane through a natural process and are part of the carbon cycle, so I think this methane reduction focus is misplaced.

No significant effect will [come] from a 1 degree temp change.

No specific concerns, working with or against the weather is always difficult.

No we have irrigation.

No.

None.

Not that I can think of yet.

Not at all.

Not at all. No concerns.

Not at this stage.

Not really.

Nothing,

Nothing to say about it really.

The climate has changed since the dawn of time. It's no different now and certainly not caused by farming practices. You giving it credence is what does the damage. Leave us alone.

The climate is cyclical - what might seem out of place now has all happened before. If you listen to the news, they start by saying we haven't had this much rain since... or it hasn't been this dry or windy since...everyone just needs to calm down - it'll all be ok.

There was nothing I see that can affect the dairy [industry] because that's what we do every day.

Unsure

Unsure.

Just not enough information to accurately predict. So no specific concerns, but if and when conditions do become more difficult, we will become increasingly concerned.

Other comments

The greatest issue will be regulation enforced by green idealists, creating financial burdens, Farmers adapt with every season and will do so long term of their own accord to maintain animal welfare and profitable, sustainable farming practices as they have in years gone by without woke intervention.

More the forestry is actually worse than cow methane such and runoff from the forestry. Farmers get slammed why don't the government look into the damage forestry is doing.

Price gouging by business selling solutions for problems they have invented.