Regional changes in the New Zealand Dairy Industry: 1995-2015

Paul Edwards

Kellogg Rural Leadership Programme

Course 36, 2017

ACKNOWLEDGEMENTS

I wish to thank the Kellogg Programme Investing Partners for the support provided to putting on the programme:

STRATEGIC PARTNERS

PROGRAMME PARTNERS

I wish to acknowledge and thank M. Neal, I. Pinxterhuis and G. Edwards for their constructive comments on the report and DairyNZ permitting me time and funds to attend the Kellogg block courses.

Executive summary

During the last two decades (1995 to 2015) the New Zealand dairy industry has undergone significant growth. Nationally, cow numbers have increased 70% from 2.9 to 5 million, the area in dairy has increased 45% from 1.2 to 1.75 million hectares and milk production has increased 129% from 8.1 billion to 18.6 billion milksolids (DairyNZ 2016).

There is significant public concern over the water quality of our streams, rivers and lakes. A number of reports indicate dairying contributes a disproportionate amount of nitrogen to waterways relative to other pastoral land uses. In areas with declining water quality it is easy to assume this is a result of increased dairying, given the overall growth. However, it is likely regional variation exists with some regions having static or declining cow numbers, in which case drawing a link between declining water quality and increased dairying may not be justified. Alternatively, water quality may not have changed in some areas where rapid growth has occurred.

The aim of this report was to present industry trends based on objective data for each region. This can be used to help develop effective regional policies and strategies for the dairy industry, including using knowledge of farm systems and farm demographics to increase effectiveness. For example, targeting a particular segment of the industry such as a certain locality or herd size. Due to time constraints it was out of scope to explore what drivers may have led to any regional changes identified.

Data were sourced from the New Zealand Dairy Statistics and the Dairy Industry Good Animal Database.

These data confirm significant changes in the New Zealand dairy industry between 1995 and 2015, which differ by region. Regions were classified into three sizes (by number of cows): large, medium and small; and into four groups by the scale and direction of the change in cow numbers: decreasing, static, slight growth and strong growth. Five regions, Taranaki, Northland, Wellington, Tasman & Nelson and Marlborough have had static cow numbers for a decade or more and some of these regions are now below their peak numbers. Auckland has fewer cows than it did in 1995. The remaining eight regions have had an increase in cow numbers, and are still growing or have been growing until recently. Waikato, Canterbury and Southland have experienced significant growth and are also large dairying regions.

The planned start of calving date has either stayed the same or moved earlier by up to 15 days, depending on region. This is likely to have resulted in increased feed demand on-farm and a shorter winter period, decreasing the time available to increase body condition. Northland had an increase in autumn calving cows in the late 1990s, as has the Waikato since 2013. The percentage of autumn calving cows was relatively constant or declined in other regions.

There has likely been an increase in feed demand on-farm since 1995 due to stocking rate, with biggest increases in stocking rate in the late 1990s and early 2000s. Canterbury has the highest average stocking rate at 3.4 cows/ha in 2015, but the area used in this report does not include the wintering areas used frequently in this region. The West Coast, Northland and Auckland have the lowest stocking rates at 2.2 to 2.3 cows/ha in 2015. The remaining regions all had stocking rates between 2.8 and 3 cows/ha in 2015, the majority of these have been relatively consistent for at least the last decade. There was a decline in the Friesian breed in herds since 1995. Overall, this means a likely decrease in

liveweight per cow of between 5-15 kg/cow – thus decreasing on-farm maintenance feed demand per cow.

Increases in milk production per cow (and therefore feed demand per cow) has meant milk production also increased in regions with static cow numbers. In most cases the area in dairy declined (at least since 2003), so it would be important to determine the new land use of areas that have exited the dairy industry and drivers behind the increased milk production per cow to determine whether there has been a net increase or decrease in intensity of land use in the region. In the remaining eight regions the intensity of the dairy industry (cows/ha, milk production/cow) has increased, particularly in Canterbury, Southland and Waikato.

The key recommendations of the report were:

- Each region should be treated individually; it should not be assumed that due to the national growth in the dairy industry that this has also happened in all areas. This also applies within regions. Blanket approaches are unlikely to achieve a desired outcome effectively or efficiently. Information/packages/policy should be tailored locally to increase effectiveness.

- This study provides a strong foundation for further research, in particular, linking the regional and sub-regional changes in the dairy industry reported here with changes in water quality.

- Further research could also explore the implications of the farm system changes reported here. In particular, determining the net effect of stocking rate, breed choice, calving date and milk production per cow on on-farm feed demand.

- Quality spatial data and the ability to combine different industry data sources together to generate insight is crucial. No national, farm-level, datasets that cover all aspects of the farm system exist (nor can be created by combining different data sources). Without either comprehensive or reasonably representative datasets of farm-level data, the ability to create tailored solutions locally is severely compromised. Industry organisations, such as DairyNZ, could achieve better informed sector and catchment interactions by being able to verify existing, and collecting additional spatial data. This could be aided by negotiating access to data from MPI, and milk, fertiliser and feed companies.

Contents

List of tables

List of figures

Introduction

During the last two decades (1995 to 2015) the New Zealand dairy industry experienced significant change. Nationally, cow numbers increased from 2.9 to 5 million, an increase of 70%, the area in dairy increased from 1.2 to 1.75 million hectares, an increase of 45%, and milk production increased from 8.1 billion to 18.6 billion milksolids, an increase of 129% (DairyNZ 2016). The value of exported milk powder, butter and cheese increased from NZ$2.75 billion to NZ$12.0 billion, an increase of 338% (Stats NZ 2017a). Dairy was the fastest growing export category in this period in terms of value. In comparison, kiwifruit increased by 268%, total meat and edible offal by 144%, forest products by 78%, apples by 63%, and fish, crustaceans and molluscs by 26%. Wool declined by 36% (Stats NZ 2017a).

There is considerable debate in New Zealand about water quality in our streams, rivers and lakes. The growth of the dairy industry over the last two decades has been linked to declining water quality in some areas (Foote *et al.* 2015). This is in part due to the size of the industry (hectares), but also the fertiliser and imported feed required to support its intensity in terms of cows per ha and milk production per cow. A number of reports state that dairying contributes a disproportionate amount of nitrogen to waterways relative to other pastoral land uses (Foote *et al.* 2015). The main source of nitrogen leaving farms is due to urine patches (Environment Waikato 2008), making the number of cows and stocking rate important. New Zealanders wish to retain swimmable rivers and healthy aquatic ecosystems, prompting the National Policy Statement for Freshwater Management. This requires regional councils to maintain or improve water quality. Consequently, dairying is in the spotlight.

Dairy farming exists in all mainland regions of New Zealand. However, the size of the industry varies markedly between regions, from the Waikato with 23% of the national herd, to the East Coast of the North Island with just 0.1% (DairyNZ 2016). Each region is unique in terms of its demographics, availability of resources, economy and, in particular, its environment. There are many ways to analyse changes to the environment. One method is to compare trends in the water quality of modified catchments (e.g. pastoral or urban) with reference sites (e.g. native forest), which typically report poorer water quality in pastoral and urban areas (Larned *et al.* 2004). However, trends in what was happening on that pastoral land (e.g. land-use, stocking densities, fertiliser use) are more difficult to measure nationally (Larned *et al.* 2004), although some regional studies have had more success, such as Hamill and McBride (2003). An alternative method is to compare the environmental impact of different land uses at a point in time, e.g. dairying was responsible for 68% of the nitrogen entering waterways from 22% of the land area (Elliot *et al.* 2005). Given the increase in the size of the dairy industry nationally, and that dairy can be an intensive land use, it is easy to assume dairy has been responsible for a decline in water quality. An example of this presumption was the contamination of the Havelock North water supply, which was initially blamed on dairy farming despite there being few dairy farms in the area (Radio NZ 2016). However, despite the growth of the industry nationally, it is likely in some areas its size has been static or even declined. Consequently, to understand drivers behind changes in water quality, and to develop effective strategies and policies to reverse trends (if required), a thorough understanding of changes in land use over time is required.

Annually the dairy industry produces the New Zealand Dairy Statistics, which have been published in a similar format since 1991/92 (DairyNZ 2016), although some data is available since the establishment of the New Zealand Dairy Board. The statistics provide a thorough overview of the dairy industry, nationally and regionally, including herd improvement, prices received for milk and land, and disease control. However, much of the data pertains to the year of publication, with comprehensive time series only reported at a national level. Consequently, regional trends are difficult to identify.

In order to develop effective regional policies and strategies for the dairy industry, a thorough understanding of industry trends based on objective data is needed for each region. The aim of this report was to present industry trends based on objective data for each region. This can be used to help develop effective regional policies and strategies for the dairy industry, including using knowledge of farm systems and farm demographics to increase effectiveness.. This analysis will also contribute to a more informed debate about the impact of the dairy industry and can be used by organisations, such as DairyNZ, to develop targeted plans for each region for all aspects of its business, e.g. farm demographics and systems. Due to time constraints the scope of this report is to describe what has happened for the key metrics of numbers of cows, herds, area, milk production and derivatives of these metrics (such as average herd size or production) nationally and for each region. It is out of scope to explore what drivers may have led to these changes or to link these changes to regional water quality trends.

Methodology

Data sources

Annual Dairy Statistics

Data were extracted from the *New Zealand Dairy Statistics* for the seasons 2006/07 to 2015/16 published by DairyNZ and the Livestock Improvement Corporation (LIC), and from the *Dairy Statistics* from 1995/96 to 2005/06 published by LIC. Specifically, data was obtained from Table 3.3 and Table 3.4 in these publications. Dairy Statistics' raw data are sourced from dairy companies and from information stored on the Livestock Improvement National Database.

Dairy Industry Good Animal Database (DIGAD)

The *Dairy Statistics* and *New Zealand Dairy Statistics* only report the total number of herds by district. This means that the appearance of new herds can be masked by herds exiting the industry (e.g. dry-stock, lifestyle or residential). Therefore, data were extracted from the Dairy Industry Good Animal Database under access panel request number 89. Aggregated data was provided by herd, and included season, NZMS1 farm gate identifier (the herd's location), herd number, participant code, and a count of the number of cows calved in that herd within that season, breed composition, and calving and mating information.

Data analysis

Dairy Statistics data

Annual regional dairy statistics are reported by district. However, most policy decisions relating to dairy farms are determined by regional councils, rather than district councils. In some cases, the boundaries of district councils fall across more than one regional council, e.g. the majority of the Taupo District falls inside the Waikato Region, but parts are also in the Bay of Plenty and the Hawkes Bay. Consequently, Dairy Statistics data do not match the regions exactly. Table 1 lists which districts were included in each region.

Table 1. List of districts grouped by region.

Region	District
Northland	Far North Kaipara Whangarei
Auckland	Franklin Papakura Rodney
Bay of Plenty	Kawerau Whakatane Opotiki Rotorua Western Bay of Plenty Tauranga
Waikato	Hamilton Waikato Hauraki Matamata-Piako Otorohanga South Waikato Taupo Thames-Coromandel

	Waipa Waitomo
Taranaki	New Plymouth South Taranaki Stratford
Hawkes Bay & Gisborne	Central Hawkes Bay Gisborne Wairoa Napier Hastings
Manawatu-Wanganui	Horowhenua Manawatu Palmerston North Rangitikei Ruapehu Wanganui Tararua
Wellington	Carterton Masterton Kapiti Coast Upper Hutt South Wairarapa
Marlborough	Marlborough
Tasman & Nelson	Tasman Nelson
West Coast	Buller Grey Westland
Canterbury	Timaru MacKenzie Ashburton Christchurch/Banks Peninsula Hurunui Kaikoura Selwyn Waimakariri Waimate
Otago Region	Clutha Dunedin Waitaki Central Otago
Southland Region	Gore Invercargill Southland

The percentage change in the number of cows (ΔCows%) was calculated using Equation 1 below, where A_0 is area in 1995/96, ΔA is the change in dairy area between 1995/96 and year of comparison (ending in 2015/16), SR_0 is the stocking rate in the 1995/96, and ΔSR is the change in stocking rate between 1995/96 and the year of comparison (ending in 2015/16). Similarly, the percentage change in milksolids (MS) was calculated using Equation 2, where ΔCows is the change in the number of cows between 1995/96 and the year of comparison (ending in 2015/16), $Cows_0$ is the number of cows in 1995/96, ΔMSCow is the change in the average kg MS/cow between 1995/96 and the year of comparison (ending in 2015/16) and $MSCow_0$ is the average kg MS/cow in 1995/96.

Equation 1. $\Delta Cows\% = \frac{\Delta A}{A_0} + \frac{\Delta SR}{SR_0} + \frac{\Delta A \times \Delta SR}{A_0 \times SR_0}$

Equation 2. $\Delta MS\% = \frac{\Delta Cows}{Cows_0} + \frac{\Delta MSCow}{MSCow_0} + \frac{\Delta Cows \times \Delta MSCow}{Cows_0 \times MSCow_0}$

Described simply, ΔCows% is the sum of percentage increase in dairy area, plus the percentage change in stocking rate, plus the percentage change in cows due to the change in stocking rate on the change in area. The ΔCows% due to the final term in the equation (blue shaded square in Figure 1) was apportioned proportionally to the other two terms when reporting the ΔCows% (i.e. change in area and stocking rate). The same method was used for Equation 2 to calculate the change in milksolids due to the change in the number of cows and change in the average milksolids produced per cow.

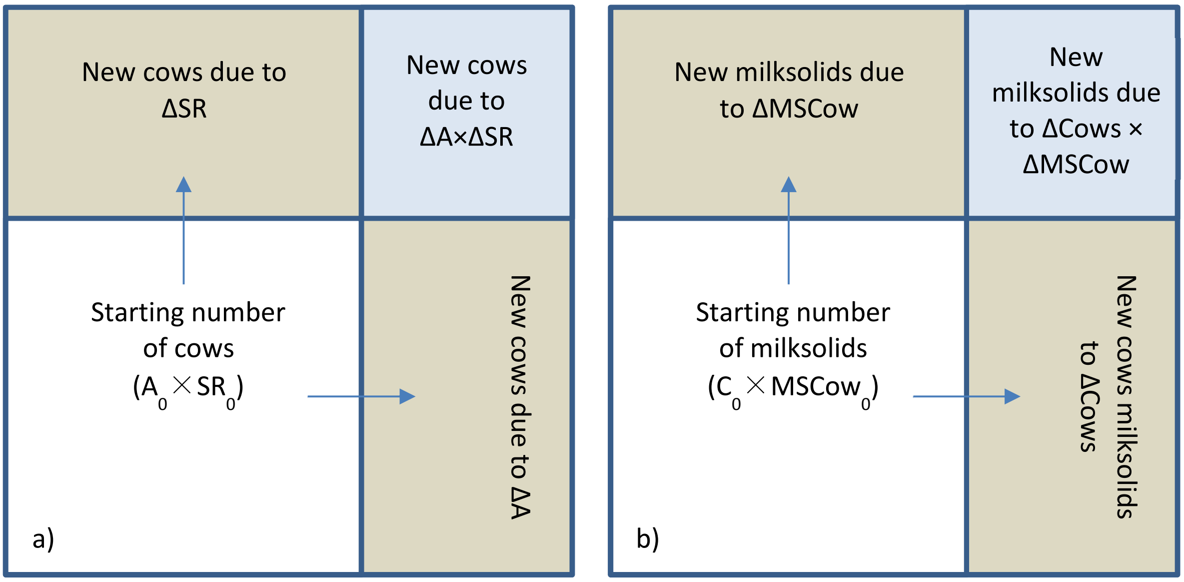

Figure 1. Representation of the three terms in Equation 1 (a) and Equation 2 (b).

Trends in number of cows per year, area per year, and milk production per cow per year, were analysed using the SLOPE and RSQ functions of Microsoft Excel. The number of cows in 2015 and the trend in the number of cows were standardised using the STANDARDISE function of Microsoft Excel and presented in a scatterplot.

DIGAD data

It is not compulsory for farmers to record data in DIGAD. Therefore, to check data consistency, DIGAD data were compared to Dairy Statistics and Statistics NZ data (Stats NZ 2017b). Results are presented in Figure 1. Between 92% and 99% (average 95%) of Dairy Statistics herds were represented in DIGAD and between 82% and 90% (average 86%) of Dairy Statistics cow numbers were represented in DIGAD.

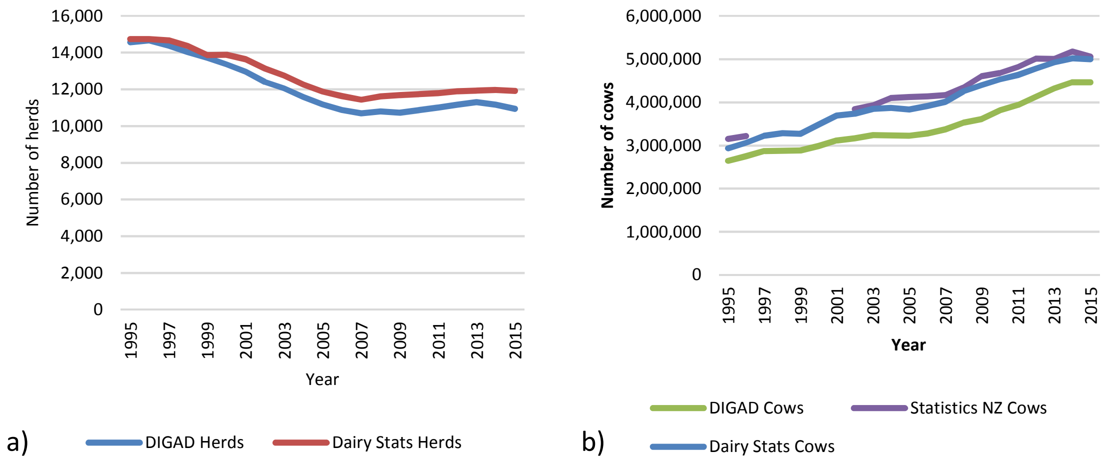

Figure 2. Comparison between DIGAD and Dairy Statistics and Statistics NZ data for number of herds (a) and number of cows (b).

DIGAD data were summarised spatially. The location of each herd was determined using the NZMS1 Farm Gate Identifier field. The farm gate identifier was converted to a GPS co-ordinate using the Land Information New Zealand conversion tool (LINZ 2016). Co-ordinates were plotted with a count of the number of calved cows. These were summarised by grid cells, measuring 7071 m × 7071 m (4999 ha) using a spatial join in ArcGIS Desktop 10.5 (ESRI 2017). Due to the uneven nature of the coast line, some cells were less than 4999 ha. Consequently, the number of cows in each cell was divided by the area of the cell to calculate a stocking rate (cows/ha). Maps for each region were generated for 1995 and 2015. A third map, comparing the change between the years, was also generated by subtracting the 1995 value from the 2015 value for each cell. Herd co-ordinates were also intersected by regional and district council boundaries to determine the region and district of each herd.

An analysis of the percentage change in the number of cows since 1995 due to herds exiting the industry, new herds, or change in cow numbers of existing herds was done by region. The first and last year that each NZMS1 farm gate identifier appeared in the data, along with the number of cows in those two years, was determined. Each year the number of cows that were associated with a new location (new herds) and the number of cows associated with a location appearing in the data for the last time (exiting herds) were aggregated. The change in the number of cows in existing herds was calculated by subtracting cows in new and exiting herds from the total cows appearing at the end of that year. The percentage change each year was calculated for each category by dividing the number of cows in each category by the cows at the start of the year.

For example, region A had 2,500 cows at the start of the year. During the year, a herd of 200 cows and a herd of 350 cows started, one herd of 400 cows sold their farm (exiting the industry) but was bought by a neighbouring dairy farm who took on those cows, a herd of 100 cows was sold as lifestyle blocks, and one farm added 50 cows to their herd, leaving a total of 3,000 cows at the end of the year. The change during the year was 500 cows (200+350+50-100), an increase of 20%. The aggregation of new and exiting herds was 50 (200+350-400-100), so the change due to existing herds was 450 (500-50). The percentage change due to new herds was 22% (200+350÷2500), the percentage change due to herds exiting was 20% (400+100÷2500), and the percentage change due to existing herds was 18% (450÷2500). These three combine to produce the overall net change percentage 20% (22-20+18). Data are presented as a cumulative percentage. Due to not all herds being presented in DIGAD, the overall percentage change in cows from the Dairy Statistics are also presented. Note DIGAD data was calculated using actual regional council boundaries, whereas Dairy Statistics data was calculated using district council boundaries as per Table 1. Of the change in existing herds, the change due to stocking rate, adding non-dairy land or buying a neighbouring farm cannot be estimated without knowing more detail about the farm (not available in DIGAD). Even if farm area was known it would still be difficult to separate buying a neighbouring farm from adding new, previously non-dairy, land.

Variation in herd sizes was determined for each region. Data were summarised as a time series histogram. The 2nd percentile, 25th percentile (lower quartile), 50th percentile (median), mean, 75th percentile (upper quartile) and 98th percentile were calculated. Herds of fewer than 50 cows were excluded from the analysis due to uncertainty over whether these herds were the result of poor farmer record keeping.

Typically, New Zealand herds calve in block periods, rather than throughout the year, to match feed supply and demand from pasture. Consequently, herds were categorised into spring, autumn or split (spring and autumn) calving using mating date and mating type. Mating date was used for classification as this decision determines the start of calving; establishing planned start of calving using calving dates was challenging due to varying gestation lengths and premature births. A herd was categorised as spring calving if 95% of the mating dates within a herd-season occurred in the period August to February of the following year (inclusive). This range was chosen to reflect the regional variation in calving patterns. A herd was categorised as autumn calving if 95% of matings fell outside this window. A herd was defined as split calving if it did not meet either criterion. For spring calving herds, the mating start date and length of artificial insemination (AI) mating period were determined. Most farms had more than one AI mating period within the August to February window, when a new period was declared if there were >3 days without a AI mating. Several AI mating periods may have been used when hormonal interventions are utilised or with short gestation semen. The period with the largest number of matings was declared the primary AI mating period. The mating start date was recorded as the first day of this period. Planned start of calving was defined as the mating start date + 282 days, being the average gestation period. This date was averaged by region as defined in Table 1. Only spring data is presented in the report as spring was the predominant calving season. Trends in the planned start of calving were analysed using the SLOPE and RSQ functions of Microsoft Excel.

Calving split was also determined. Due to the movement of animals, and use of natural matings over empty cows the actual calving split was determined using calving rather than mating records. A calving was classified spring if it fell in the window 10-May through to 6-December (i.e. 282 days from the same criteria used for the mating data), or autumn if it fell between 7-December and 9-May (of the year after). A herd was classified as spring if ≥95% of calvings fell in the spring period, autumn if ≥95% of calvings fell in the autumn period, and split if the 95% threshold was not met. Herds with fewer than 50 calvings were excluded.

The breed composition of herds was determined using DIGAD data. An animal's breed is measured in 16ths. A cow was defined as Jersey, Holstein-Friesian, Ayrshire or Other (e.g. Shorthorn, Guernsey, Brown Swiss) if it was 14 or more parts of that breed. Cows that were 10-13 parts Friesian and 3-6 parts Jersey were defined as Friesian-cross, cows that were 7-9 parts Frisian and Jersey were defined as crossbreed, and cows that were 10-13 parts Jersey and 3-6 parts Friesian were defined as Jersey-cross. The remaining cows were considered Other, e.g. the dominant breed was ≤13/16 but contained a breed not only Jersey and Holstein-Friesian. The herd proportions of each breed were defined as the number of cows in each category divided by the herd size.

The average breed for a region was calculated using classifications for Friesian, Jersey and Other. The contribution of Friesian genes was calculated by multiplying the percentage of the herd classified Friesian by 16, Friesian-cross by 12, crossbreed by 8, and Jersey-cross by 4, then dividing the number by 16. The contribution of Jersey genes was calculated by multiplying the percentage of the herd classified Jersey by 16, Jersey-cross by 12, crossbreed by 8, and Friesian-cross by 4, then dividing the number by 16. Any other breeds or breed combinations not already represented were grouped in 'Other'. The percentage contribution of Friesian, Jersey and Other genes was averaged by region using Table 1. The percentages were multiplied back up by 16 to present the number as part 16ths.

Region areas

The percentage of dairy land area in a region was calculated as the area in dairy from the annual Dairy Statistics divided by the total land area of the applicable region given in Table 2.

Table 2. Area within each region, calculated by summing the areas of each district listed in Table 1.

Region	Area (ha)
Northland	1,249,091
Auckland	491,585
Waikato	2,558,922
Bay of Plenty	1,226,163
Hawkes Bay & Gisborne	2,117,522
Taranaki	794,200
Manawatu-Wanganui	2,197,930
Wellington	804,791
Marlborough	1,048,368
Tasman & Nelson	1,007,048
West Coast	2,333,830
Canterbury	4,089,945
Otago	3,620,911
Southland	3,191,111

Results and discussion

National

Industry changes

As outlined in the introduction, nationally there has been significant growth in the dairy industry, with 70% (2.1 million) more dairy cows since 1995. This analysis indicates that this growth has not been uniform across the country and significant regional variation exists in terms of both the number of cows and stocking rates. For example, the top four growth regions, Canterbury, Southland, Waikato and Otago, contributed 83% of the change in dairy cow numbers (Table 3; Figure 5). Conversely, five regions had their greatest number of cows in the late 1990s or early 2000s and numbers have remained static or declined since then (Table 3; Figure 6). A high level comparison of each region is presented in this section, with a more detailed analysis available for each region in the Appendix.

The trend in cow numbers between 1995 and 2015 is presented by region in Figure 3, Table 3 and Figure 4. Dairy area is presented in Figure 7Figure 7. It shows there has been strong growth (24,100-41,500 cows/year) in Canterbury (+779,100 cows over two decades) and Southland (+449,100 cows). These two regions were responsible for 60% of the growth in cow numbers nationally during this time. The next two regions with strong growth (9,100-15,700 cows/year) were the Waikato (+283,500 cows) and Otago (+183,700 cows), between them responsible for 23% of the change in cow numbers. The West Coast (+104,800 cows) and Manawatu-Wanganui (+92,700 cows) experienced some growth (4,800 cows/year), and Bay of Plenty (+54,500 cows) and Hawkes Bay & Gisborne (+40,000 cows) experienced slight growth (1,900-2,400 cows/year). All of these regions had the highest number of cows in 2014 or 2015, indicating these regions have been growing until recently or are still growing.

The number of cows in Taranaki has increased by 59,100 cows since 1995 but the number of cows peaked in 1996 and since then has decreased by 45,000 cows, with the number of cows essentially remaining static since 1997. Northland had 19,300 more cows in 2015 than in 1995, however, there were 23,500 fewer cows than the peak in 2000. Wellington region had 15,200 more cows in 2015 than 1995; the number of cows peaked in 2002 and remained static until 2012, with a decline of 1,900 cows since then.

Tasman & Nelson was the third smallest dairying region. Cow numbers grew by 15,000 cows between 1995 and 2015; the majority of this growth occurred in the late 1990s and since then this region has experienced minimal growth of 5-6000 cows. The highest number of cows occurred in 2014, and since then cow numbers have declined by 2,300.

Marlborough is the smallest dairying region. Cow numbers in the region remained static since 1995, with deviations of only plus or minus ~2000 cows. Peak cow numbers occurred in 1998 and 1999, and since then have declined by 2,000 cows.

The region of Auckland had the greatest decline in cow numbers with 34,000 fewer cows in 2015 than 1995. Peak numbers occurred in 1998 and were 6,000 more than 1995, and since then there has been a steady decline totalling 40,000 cows.

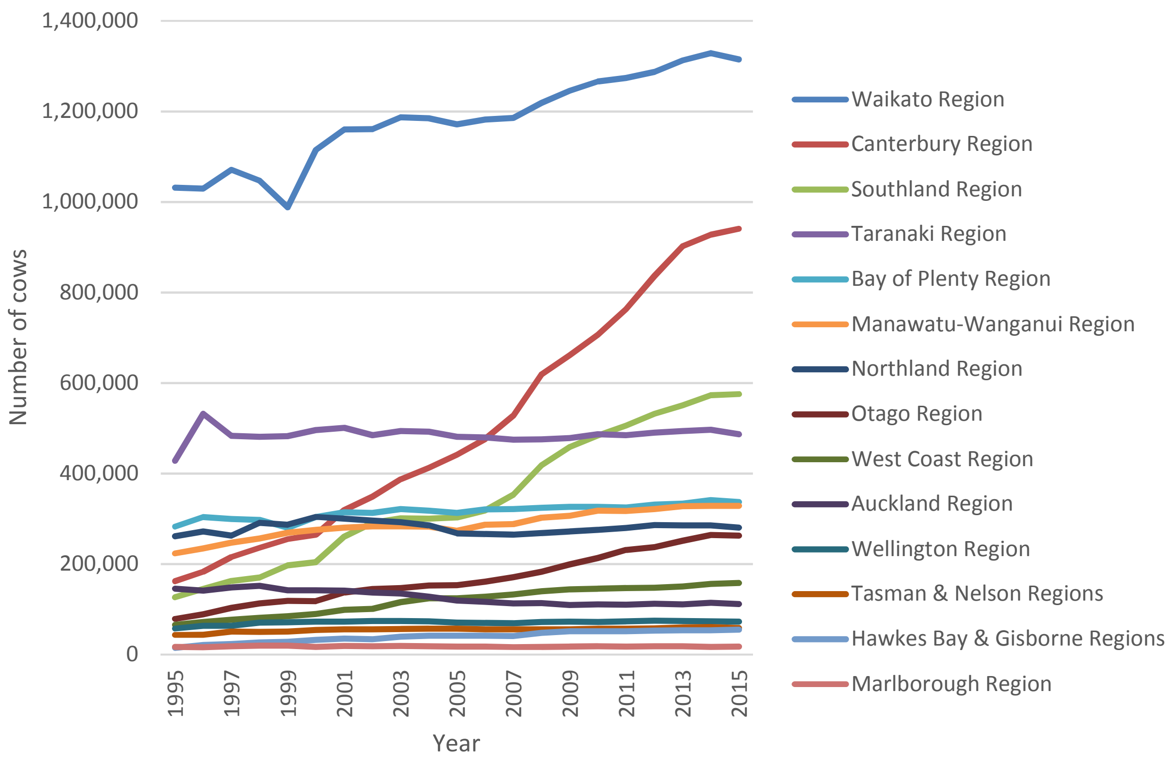

Figure 3. Trend in cow numbers between 1995 and 2015 by region. Source Dairy Statistics.

Table 3. Change in cow numbers between 1995 and 2015, the regions contribution to the overall change, the year of highest cow numbers, and the change between this peak year and 2015. Source Dairy Statistics.

Region	Change 1995-2015	% of national change	Peak year(s)	Change from peak to 2015	Average change in cows per year	R-Sq cows per year
Canterbury	779,116	38%	2015	0	41,533	0.97
Southland	449,139	22%	2015	0	24,068	0.98
Waikato	283,470	14%	2014	-13,825	15,744	0.92
Otago	183,718	9%	2014	-1,700	9,149	0.98
Manawatu-Wanganui	104,850	5%	2013 & 2014	-267	4,768	0.93
West Coast	92,689	4%	2015	0	4,840	0.97
Taranaki	59,069	3%	1996	-45,000	284	0.01
Bay of Plenty	54,504	3%	2014	-3,785	2,429	0.83
Hawkes Bay & Gisborne	40,103	2%	2015	0	1,909	0.95
Northland	19,278	1%	2000	-23,523	-1	0.00
Wellington	15,158	1%	2002 & 2012	-1,873	442	0.41
Tasman & Nelson	15,009	1%	2013 & 2014	-2,307	619	0.70
Marlborough	484	0%	1998 & 1999	-2,224	-20	0.02
Auckland	-34,331	-2%	1998	-40,378	-2,284	0.86
National	**206,2256**	**100%**	**2014**	**-20,522**	**103,480**	**0.98**

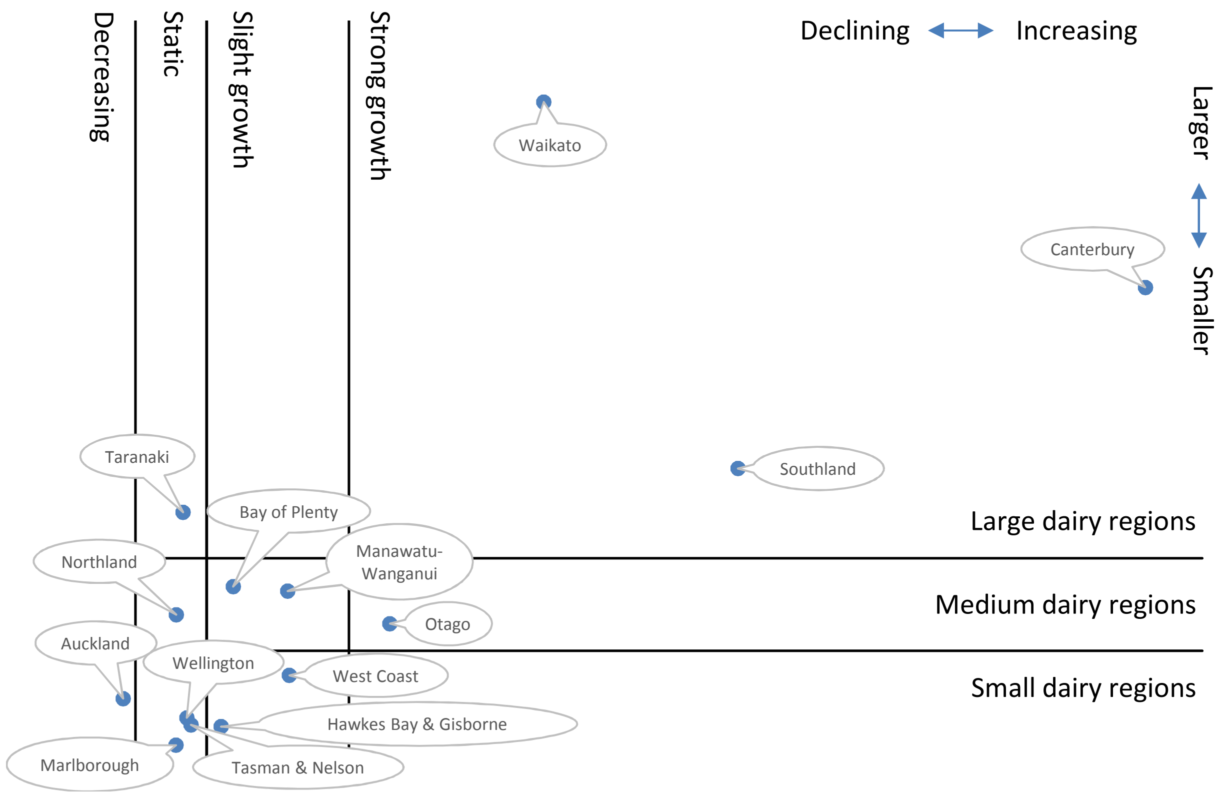

Figure 4. Scatterplot of normalised average change in cow numbers per year between 1995 and 2015 (i.e. position of the regions average change in cow numbers per year relative to the average change and standard deviation of all regions; x-axis) and normalised number of cows in 2015 (y-axis). Source Dairy Statistics.

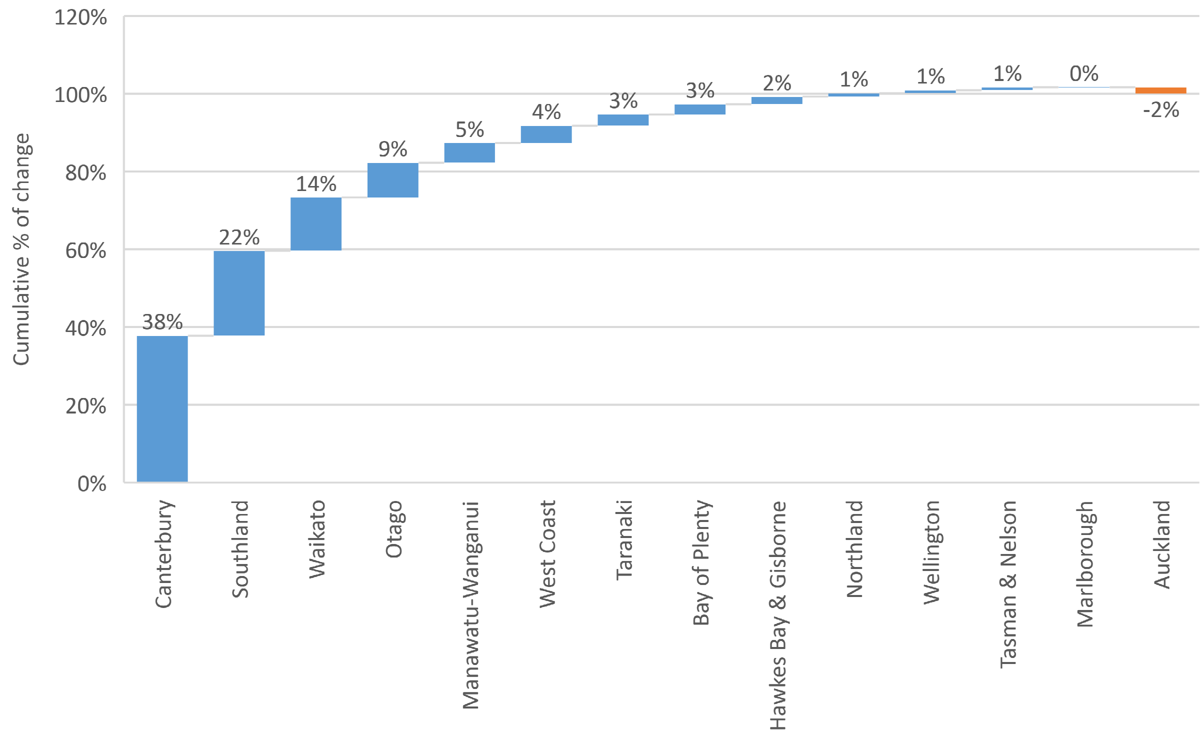

Figure 5. Waterfall chart showing the contribution of each region to the national change in cow numbers, based on Table 3. Source Dairy Statistics.

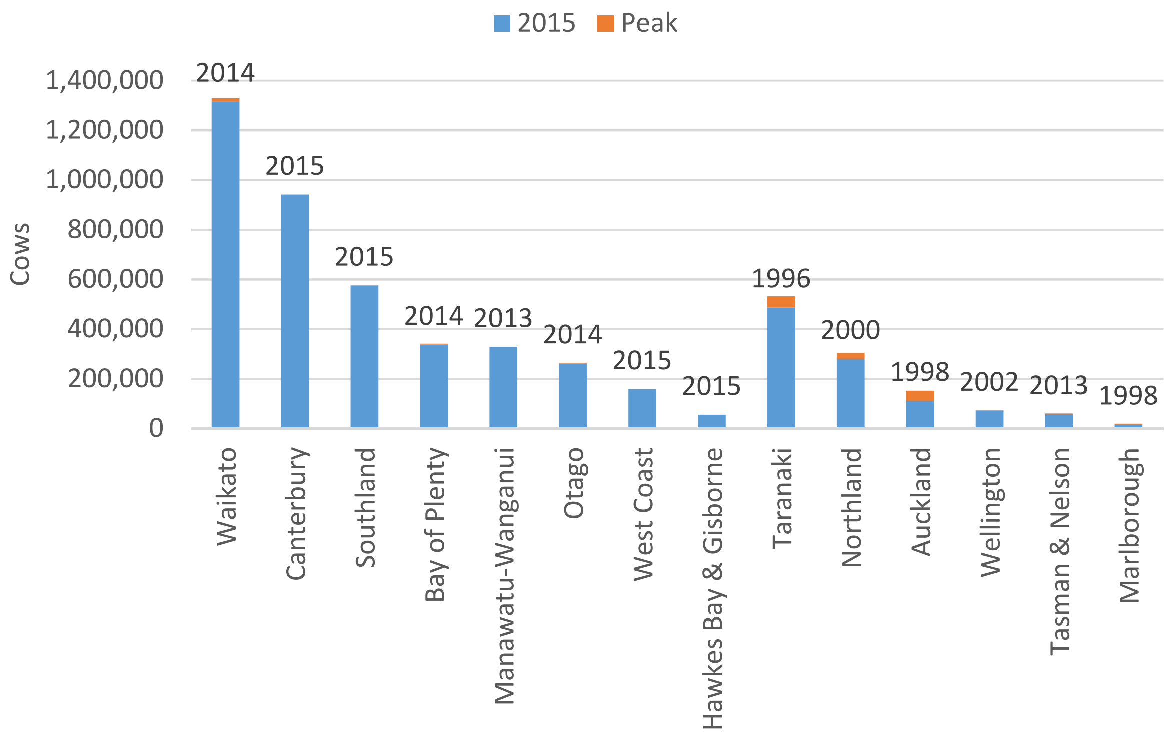

Figure 6. Peak cow number by region, the year of peak and cow numbers in 2015, based on Table 3. Source Dairy Statistics.

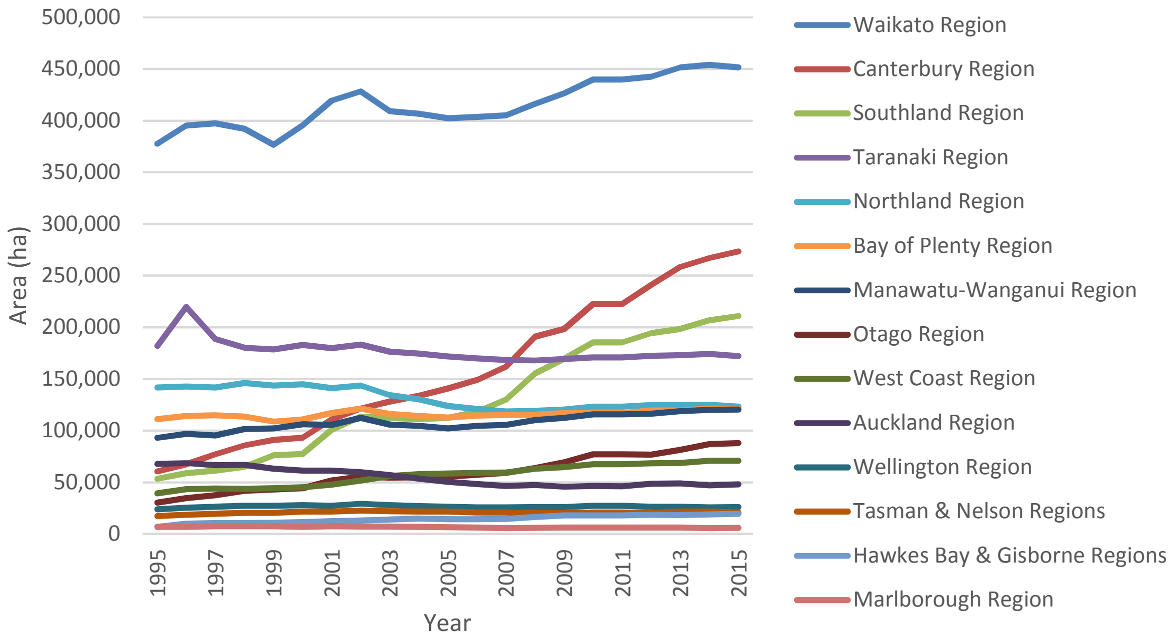

Figure 7. Trend in dairy area (ha land used by dairy milking platforms) between 1995 and 2015 by region. Source Dairy Statistics.

Farm system changes

As well as changes in the size of the industry this dataset can give insight into how farm systems have changed over time. In pastoral dairy farms it is important to match the feed demand of the herd with feed available from pasture to maximise the amount harvested and profit, and minimise supplement use. At times when pasture growth is higher than feed demand it may be possible to harvest silage, or take area out of rotation to grow a crop to store feed for a time of deficit. When demand is higher than pasture growth, supplements in the form of stored feed such as crop or silage, or imported feed must be used (illustrated in Figure 8). This increases cost, reducing profit.

There are three strategic decisions that a farmer makes to influence the relationship between feed supply and demand. The first one is the planned start of calving. This moves the demand line (blue; Figure 8) to the left (earlier calving) or right (later calving). In the example given in Figure 8 the herd may benefit from calving earlier to decrease the surplus in September-October, and decrease the deficit in January-March. The other two strategic decisions a farmer makes will determine the amount of liveweight per hectare. These are the stocking rate (cows/ha), determined by the herd size, and the weight of the cow (kg/cow), determined by the breed. More cows and/or heavier cows increases demand, pushing the line up, fewer and/or smaller cows will bring the demand line down. In the example, having fewer and/or smaller cows decreases the deficit in January-March, but creates a larger surplus in September-October.

An increase in milk production per cow also increases feed demand, lifting the blue line upwards.

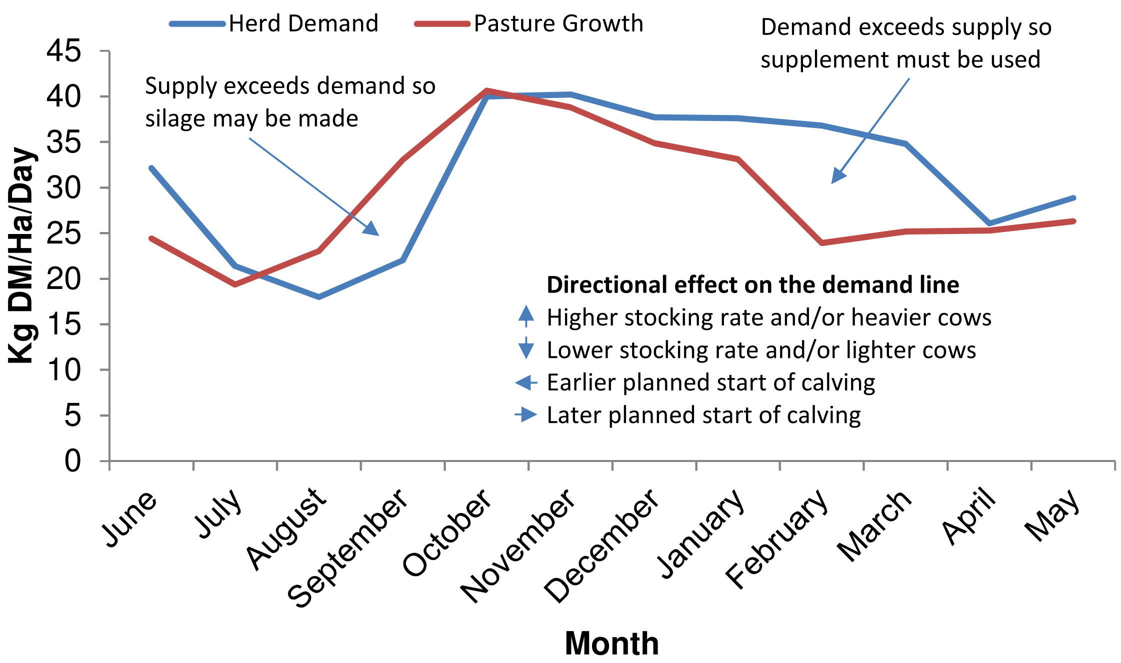

Figure 8. Example pasture growth and herd demand curve over a lactation.

The trend in the planned start of calving is presented in Table 4 and Figure 9. It indicates that in all regions, except Northland, the planned start of calving has moved earlier each year. In some regions, since 1995, this has been by more than two weeks in total. There could be two underlying drivers for this: attempting to better match feed supply and demand, or increasing milk production through increasing lactation length. The latter is more likely. This would imply an increase in the use of fertiliser to boost pasture growth, stored feed (silage/crop) or imported feed, assuming similar pasture utilisation. The economics of doing this may be influenced by wintering costs. It is common practice in the regions where the calving date has moved the most to send cows off farm for June and July, incurring significant cost. This may make it more profitable to bring cows back to the milking platform and calve earlier, if it doesn't compromise future pasture growth. Assuming a similar dry-off date, this change in calving date will likely have resulted in increased feed demand on the milking platform.

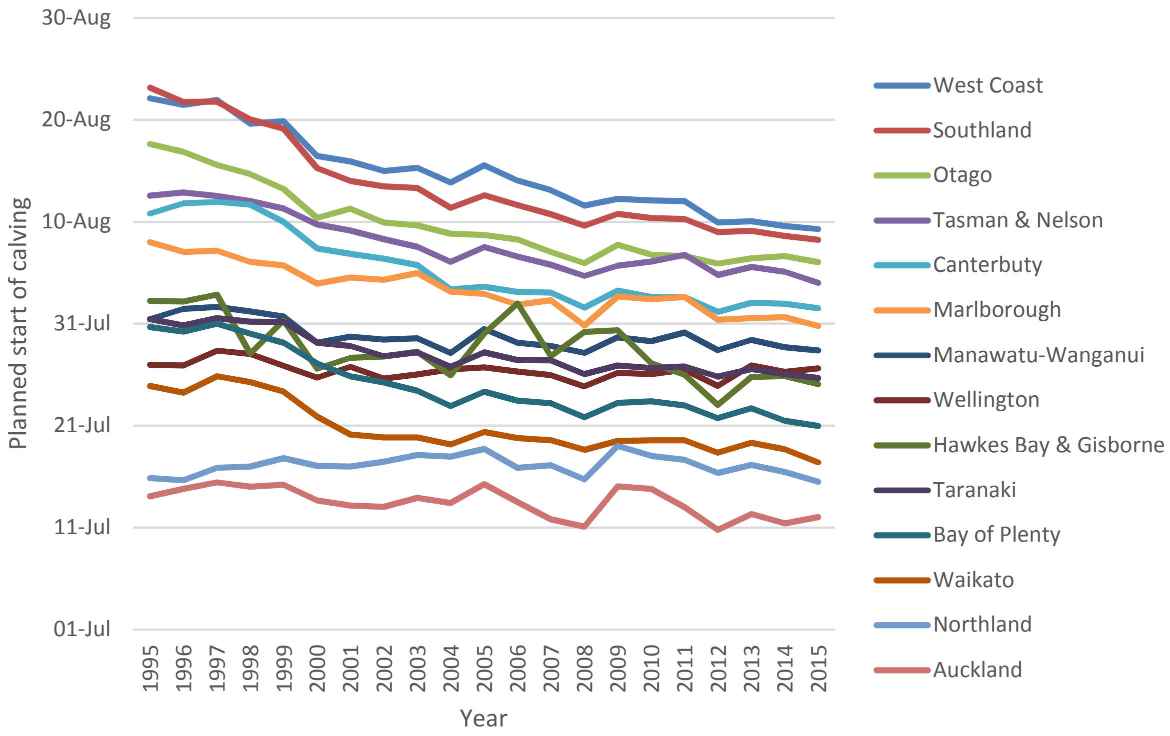

Figure 9. Trend in planned start of calving between 1995 and 2015 by region. Source DIGAD.

Table 4. Slope and r-squared value (RSq) for the trend in planned start of calving (PSC) date by region. Days since 1995 is the difference between the planned start of calving between 1995 and 2015. Source DIGAD.

Region	PSC slope (days/year)	PSC RSq	Days since 1995
Southland Region	-0.72	0.87	-15
West Coast Region	-0.64	0.93	-14
Canterbury Region	-0.57	0.86	-12
Otago Region	-0.55	0.85	-11
Bay of Plenty Region	-0.47	0.85	-10
Tasman & Nelson Regions	-0.44	0.86	-9
Marlborough Region	-0.37	0.87	-8
Waikato Region	-0.36	0.75	-8
Hawkes Bay & Gisborne Regions	-0.33	0.45	-7
Taranaki Region	-0.30	0.85	-6
Manawatu-Wanganui Region	-0.17	0.54	-4
Auckland Region	-0.15	0.40	-3
Wellington Region	-0.06	0.21	-1
Northland Region	0.01	0.00	0
National	**-0.19**	**0.61**	-4

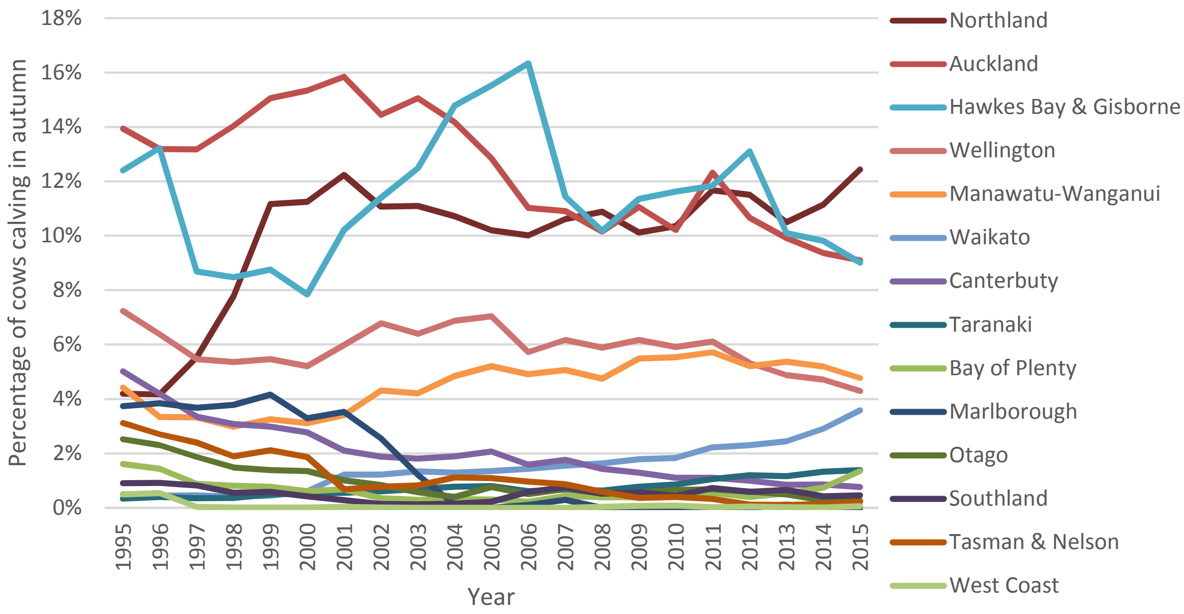

Figure 10. Trend in the percentage of cows calving in autumn between 1995 and 2015 by region. Source DIGAD.

The trend in the percentage of autumn calving cows is presented in Figure 10. Nationally there was little change in the percent of autumn calving cows, around 2-3% of the calved cows in DIGAD. With the exception of Northland and Waikato, there has tended to be either little change or a declining percentage of autumn calving cows. The number of autumn calving cows increased significantly between 1996 and 1999 in Northland, and in 2015 accounted for 12% of cows, spread across 25% of the herds in the region. There was a gradual decline in the percentage of autumn calving cows in Canterbury and an increase in the Waikato. Hawkes Bay & Gisborne, Auckland, Northland, Wellington and Manawatu-Wanganui were areas with a greater than average proportion of autumn calving cows.

The trend in stocking rate between 1995 and 2015 is presented by region in Figure 11. The 2015 data indicate the regions can be grouped into three categories. The West Coast, Northland and Auckland have the lowest stocking rates at 2.2 to 2.3 cows/ha and had the lowest stocking rates since 1995. Their stocking rate has increased since then, however, it has been static since 2004 and has not intensified (cows/ha) during the last decade. Canterbury has the highest stocking rate at 3.4 cows/ha in 2015, but this does not include area used for wintering. The stocking rate increased from 2.7 cows/ha in 1995, but appears to have been static since 2011. The remaining regions all had stocking rates between 2.8 and 3 cows/ha in 2015. Interestingly, the majority of these have had relatively consistent stocking rates since 2003, with stocking rates only increasing by about 0.1 cows/ha since then. This indicates there has been little increase in feed demand on-farm in the last decade due to stocking rate.

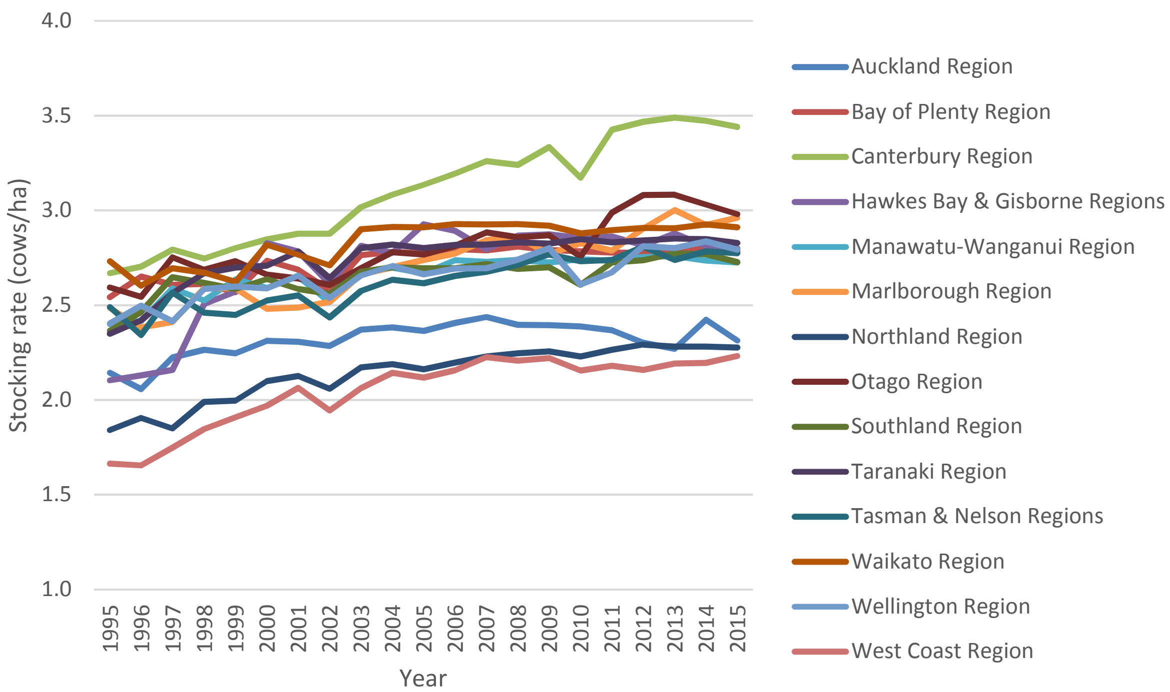

Figure 11. Trend in stocking rate between 1995 and 2015 by region. Source Dairy Statistics.

The trend in the percentage of Friesian genes in herds is presented in Figure 12. It shows a decline in the amount of Friesian in the national herd, and this is consistent across all regions. On average, since 1995, these changes equate to a decline of between 1 and 3/16ths Friesian in all regions, balanced by a corresponding increase in Jersey – mostly through crossbreeding. Taranaki is the exception which had more Friesians in 2015 than in 1995. Given that Jerseys on average weigh 75 kg less than Friesians (DairyNZ 2016), this would imply a decrease in liveweight of approximately 5-15 kg/cow depending on the region (except Taranaki), indicating potentially a small decrease in feed demand due to liveweight. This may also have implications for soil compaction, and consequently pasture growth potential.

The final aspect to feed demand on farm is the level of milk production per cow, presented in Figure 13. Milk production per cow can be influenced by the aspects already mentioned (calving date, dry-off date, stocking rate, breed), but also feeding level. Nationally there was an average increase of 4.4 kg MS/cow/year. However, this differs by region, ranging from 6 kg MS/cow/year in Canterbury to 1.7 kg MS/cow/year in Northland. In 1995 there was a range of only 15 kg MS/cow between the top and bottom regions, in 2015 the range was 91 kg MS/cow. Changes in planned start of calving alone would likely result in at most 1 kg MS/cow/year (e.g. the slopes in Table 4 multiplied by an optimistic 2 kg MS/cow/d production equals 0 or 1 kg MS/cow/year for all regions). For context, the average rate of genetic gain over this period was 1.9 kg MS/cow/year (DairyNZ 2017). This indicates that, on average nationally, there has been an increase in feed eaten per cow during other stages of lactation (i.e. not just due to earlier calving). This may be through improved pasture growth (pasture species and/or nitrogen), pasture utilisation, or imported supplement. In a region such as Canterbury there has clearly been an increase in feed eaten per cow.

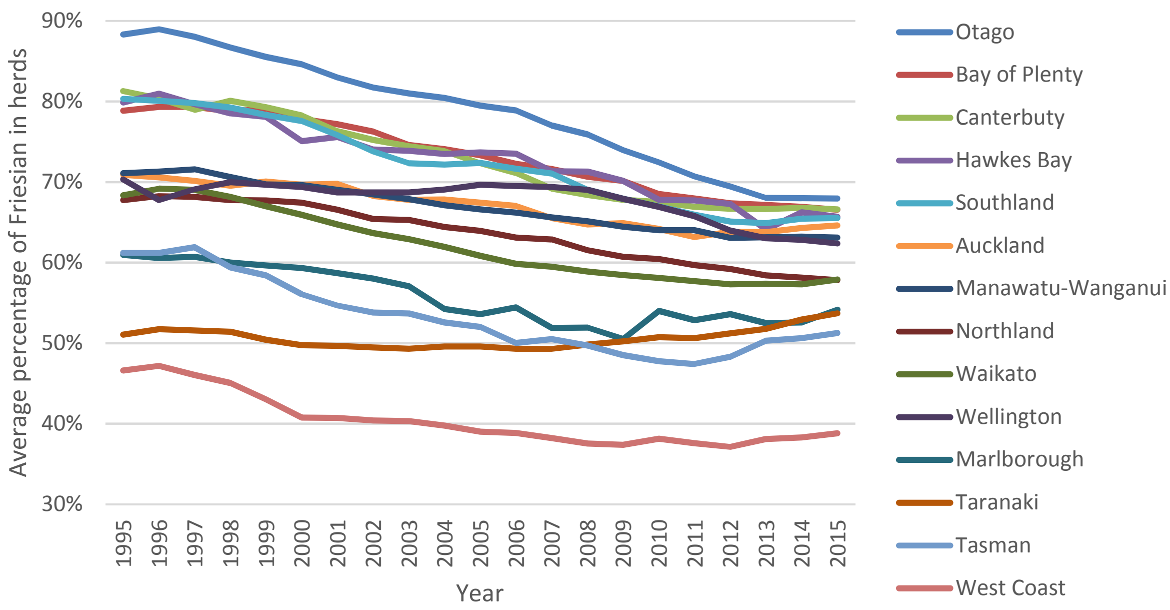

Figure 12. Trend in the percentage of Friesian genes in the herd, i.e. an F8J8 is considered half Friesian.

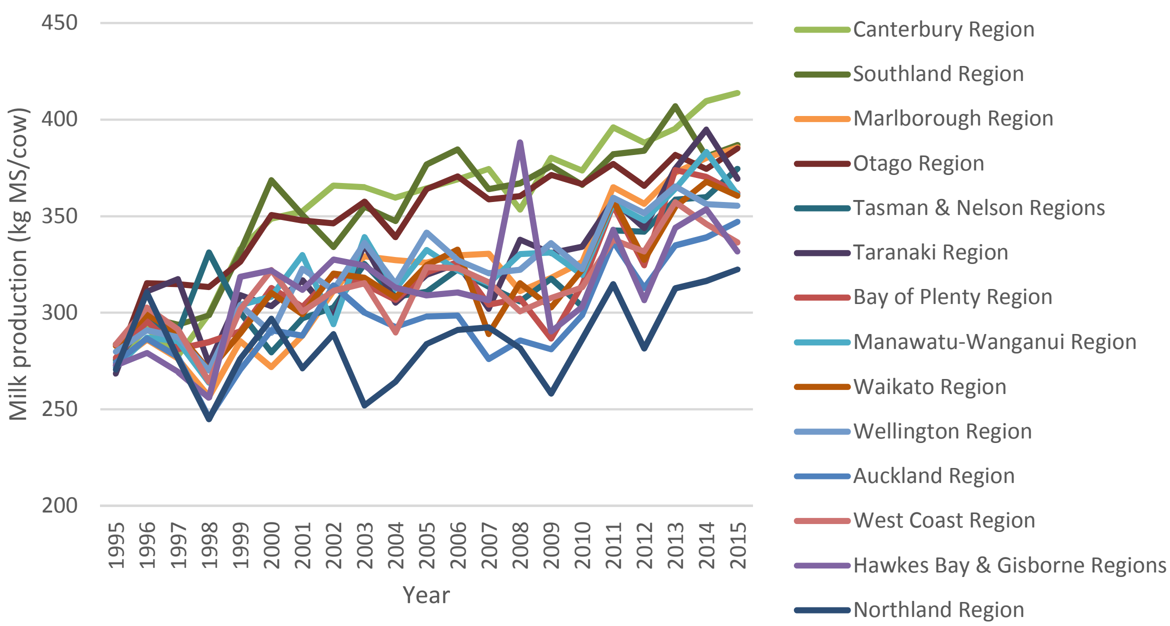

Figure 13. Trend in the average milk production per cow between 1995 and 2015 by region. Source Dairy Statistics.

Overall, there has likely been an increase in feed demand per ha due to earlier planned start of calving and stocking rate, partially offset by a small decrease due to liveweight. Since 2003 there has been minimal change in stocking rate. Given this, increases in milk production per cow would have resulted in increased feed demand. Further analysis should be undertaken to determine the net effect of these factors on feed demand.

Further detail is provided for each region in the Appendix. The structure of the report is consistent for each region; it is intended for the reader to only read the regions of interest.

Summary and conclusions

There have been significant changes in the New Zealand dairy industry between 1995 and 2015, but these changes differ greatly by region. In terms of number of cows, regions can be classified into three groups; large, medium and small, and into four groups in terms of changes in cow numbers; decreasing, static, slight growth and strong growth. Five regions (Taranaki, Northland, Wellington, Tasman & Nelson and Marlborough) had essentially static cow numbers for a decade or more. Some of these regions have had decreases since their peak numbers. Auckland had fewer cows in 2015 than it did in 1995. The remaining eight regions had an increase in cow numbers, and are still growing or have been growing until recently. Waikato, Canterbury, and Southland have experienced significant growth and are also large dairying regions.

The planned start of calving date has moved earlier in all regions except Northland. The change ranged from -15 days to -1 day. This may have resulted in increased feed demand on-farm if dry-off dates remained constant. Most cows calve in spring, however, Northland had an increase in autumn-calving cows in the late 1990s, as well as the Waikato since 2013. The percentage of autumn calving cows was relatively constant or declined in other regions.

There was likely an increase in feed demand on-farm between 1995 and the early 2000s due to increased stocking rate. This would likely have implications for the amount of imported supplements and nitrogen fertiliser used on farm. In the last decade stocking rates have changed relatively little. Canterbury had the highest stocking rate at 3.4 cows/ha in 2015, however, this figure does not include support land for winter. The West Coast, Northland and Auckland had the lowest stocking rates at 2.2 to 2.3 cows/ha in 2015. The remaining regions all had stocking rates between 2.8 and 3 cows/ha in 2015, and most of these have had relatively consistent stocking rates since 2003. Thus, the area in dairy for the regions with static or declining cow numbers has also been static or in most cases has declined.

Breed choice differs by region. In all regions except Taranaki the amount of Friesian in herds declined since 1995. Otago and Southland have decreased by 3 parts Friesian (out of 16), replaced by an increase in Jersey. The remaining regions decreased by 1-2 parts Friesian. The increase in Jersey came via the use of crossbreeds. Overall, this means a likely decrease in liveweight per cow of between 5-15 kg/cow, which would decrease on-farm feed demand for maintenance per cow and may have implications for soil compaction.

Total milk production has increased in all regions except Auckland, with milk production per cow increasing in all regions. The rate of increase in milksolids per cow differed between regions; for regions with the lower rates of increase it was similar to the rate of genetic gain. Increases in milk production per cow has meant milk production increased in regions even if they had static cow numbers. These regions also had a declining area in dairy (at least since 2003). In the remaining eight regions the number of cows and the milk production per cow increased, particularly in Canterbury, Southland and Waikato.

The extent to which changes in the dairy industry has contributed to changes in water quality depends on the land use before or after areas entered or exited the dairy industry. The data presented in this report show there is a large diversity between regions in dairy production systems, and the extent to which they have changed over the last two decades. Notably, Waikato, Canterbury and Southland have seen a significant increase cow numbers, but only confined to some areas in these regions (see Appendix). The data presented in this report, along with knowledge of local and seasonal actual and desired water quality, can be the basis for a more targeted approach to supporting on-farm change.

Recommendations

- Each region should be treated individually; it should not be assumed that due to the national growth in the dairy industry that this has also happened in all areas. This also applies within regions. Blanket approaches are unlikely to achieve a desired outcome effectively or efficiently. Information/packages/policy should be tailored locally to increase effectiveness.
- This study provides a strong foundation for further research, in particular, linking the regional and sub-regional changes in the dairy industry reported here with changes in water quality.
- Further research could also explore the implications of the farm system changes reported here. In particular, determining the net effect of stocking rate, breed choice, calving date and milk production per cow on on-farm feed demand and its likely impact on water quality.
- Quality spatial data and the ability to combine different industry data sources together to generate insight is crucial. The NZMS1 coordinate in the DIGAD database useful for spatially locating some farm system information such as cow numbers, breed and calving date. However, the lack of additional information such as farm area limits the extent of the insight that can be gained about the farm system. No farm-level data on the use of supplements and fertilisers are available to be aggregated at different spatial resolutions (e.g. district, region, catchment). Furthermore, the lack of farm boundary information that can be reliably combined with farm system information (e.g. from DIGAD) limits the ability to use farm physical information such as soil and topography to interpret results. Without either comprehensive or reasonably representative datasets of farm-level data, the ability to create tailored solutions locally is severely compromised. Industry organisations, such as DairyNZ, could achieve better informed sector and catchment interactions by being able to verify existing, and collecting additional spatial data. This could be aided by negotiating access to data from MPI, and milk, fertiliser and feed companies.

References

DairyNZ (2016) New Zealand dairy statistics 2015-16. DairyNZ, Hamilton, New Zealand. Available at https://www.dairynz.co.nz/media/5416078/nz-dairy-statistics-2015-16.pdf [Verified 21 Feb 2017]

DairyNZ (2017) Animal and herd averages. DairyNZ, Hamilton, New Zealand. Available at https://www.dairynz.co.nz/animal/animal-evaluation/animal-and-herd-averages/ [Verified 25 Oct 2017]

Elliot AH, Alexander RB, Schwarz GE, Shankar U, Sukias JPS, McBride GB (2005) Estimation of nutrient sources and transport for New Zealand using the hybrid mechanistic-statistical model SPARROW. *Journal of Hydrology New Zealand* **44**, 1-27.

Environment Waikato (2008) The condition of rural water and soil in the Waikato region. Available at https://www.waikatoregion.govt.nz/assets/PageFiles/10480/Soil%20and%20water%20issues.pdf [Verified 4 November 2017]

ESRI (2017) Finding what is inside a polygon. ESRI. Available at http://desktop.arcgis.com/en/arcmap/latest/manage-data/tables/finding-what-is-inside-a-polygon.htm [Verified 1 November 2017]

Foote KJ, Joy MK, Death RG (2015) New Zealand Dairy Farming: Milking Our Environment for All Its Worth. *Environmental Management* **56**, 709-720. doi:10.1007/s00267-015-0517-x

Hamill KD, McBride GB (2003) River water quality trends and increased dairying in Southland, New Zealand. *New Zealand Journal of Marine and Freshwater Research* **37**, 323-332. doi:10.1080/00288330.2003.9517170

Larned ST, Scarsbrook MR, Snelder TH, Norton NJ, Biggs BJF (2004) Water quality in low-elevation streams and rivers of New Zealand: recent state and trends in contrasting land-cover classes. *New Zealand Journal of Marine and Freshwater Research* **38**, 347–366.

LINZ (2016) Online Conversions - basic. Land Information New Zealand, Wellington. Available at http://apps.linz.govt.nz/coordinate-conversion/ [Verified 12 Sep 2016]

Radio NZ (2016) Farmers reject blame over water contamination. Available at http://www.radionz.co.nz/news/environment/312180/farmers-reject-blame-over-water-contamination [Verified 20 September 2017]

Stats NZ (2017a) Table: Key Statistics Table 7.04 - Value of principal exports (excl re-exports) - SH (Annual-Jun). Statistics New Zealand. Available at http://www.stats.govt.nz/infoshare/SelectVariables.aspx?pxID=77c58eed-eec4-418b-879b-8ae74dc505dd [Verified 19 September 2017]

Stats NZ (2017b) Table: Variable by Total New Zealand (Annual-Jun). Statistics New Zealand. Available at http://www.stats.govt.nz/infoshare/SelectVariables.aspx?pxID=c31243ba-8be4-435c-afc2-6c1607c4dedd [Verified 19 September 2017]

Appendix – breakdown by region

Northland region

The dairy industry in Northland has been relatively static compared with other regions. The change in cows, area and milk production between 1995 and 2015 is presented in Figure 14a. During this time the area in dairy milking platforms decreased by 13%. In 2015 the area in dairy accounted for 10% of the region's land. There were 7% more cows in 2015 than 1995, however this was fewer than the highest number of cows in the year 2000. The 7% net increase in cows was a result of increase in stocking rate (16%), which was offset by a decrease in land area (-9%; Figure 15a). The effect of the decreasing land area was less than the actual change in land area (-13%) due to an increase in stocking rate over this period (Figure 17b), see Figure 1 for explanation. Stocking rate appears to have plateaued since the mid-2000s at 2.2-2.3 cows/ha.

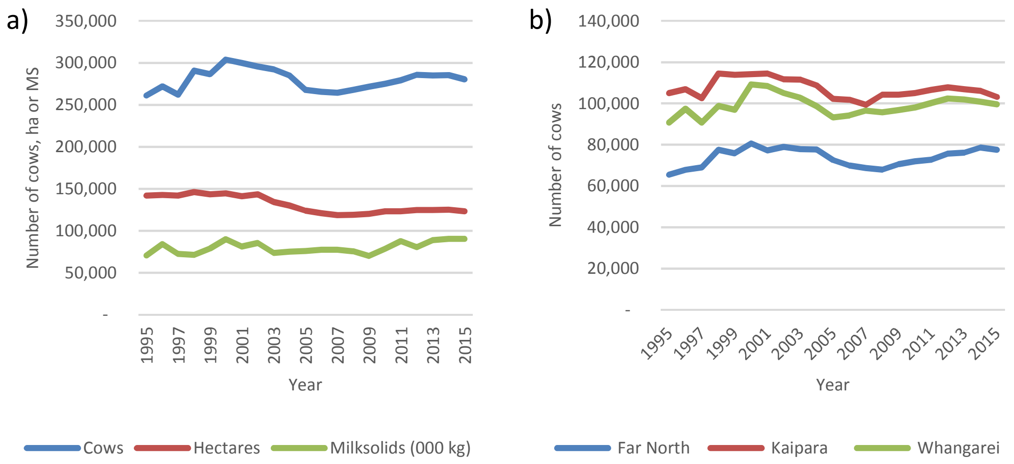

Figure 14. Trend in (a) the number of cows, hectares and milksolids produced in the Northland region between 1995 and 2015 and (b) the number of cows per district. Source Dairy Statistics.

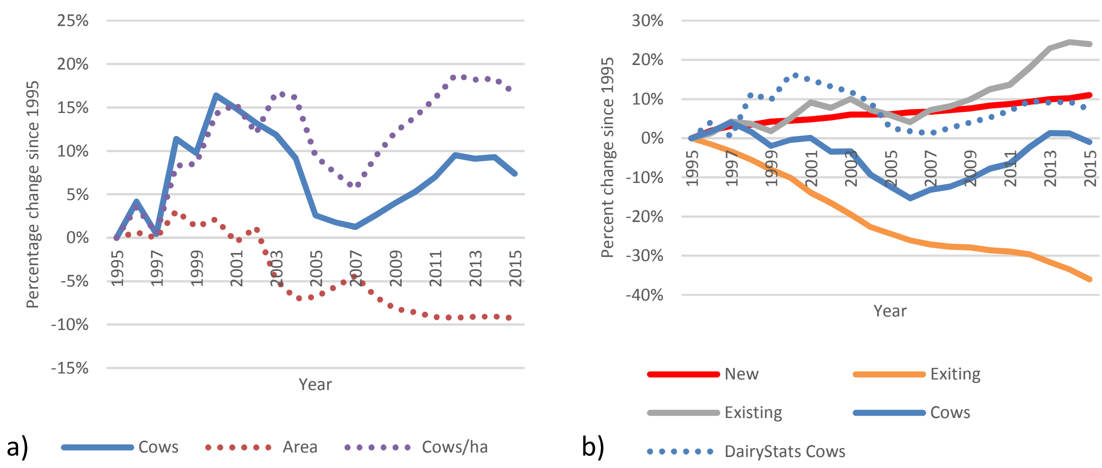

Figure 15. Trend in the percentage of change, since 1995: (a) in total cows and the drivers (area and stocking rate) behind this change. Source Dairy Statistics. (b) in calved cows (including comparison with Dairy Statistics) as a result of new farm conversions, herds exiting the industry, and expansion of existing herds in Northland. Source DIGAD.

The underlying reasons behind the increase in cow numbers can be estimated using DIGAD data (Figure 15b). The data indicates a steady rate of herds exiting the industry, responsible for a 36% decrease in cow numbers by 2015. Herds could exit the industry due to a change in land use (e.g. dairy support, dry stock, lifestyle or urban), or they could be being bought by a neighbouring dairy farm, which would then appear in the data as an increase in the size of existing herds. In Northland, cow numbers grew by 24% in existing herds, which could be due to an amalgamation with a neighbouring dairy farm or through incorporating a neighbouring dry stock block. If all of the exiting herds were merged with a neighbouring dairy farm, then there is still a net decrease of 12%. There was an 11% increase in cow numbers due to new farm conversions. Overall, these combine to an overall net decrease in cows of 1% in DIGAD data. This number differs from the 7% increase in cow numbers reported in the Dairy Statistics. The DIGAD data relies on farmers having entered their calving records into the database, which likely explains why the figure is under-reported compared to the Dairy Statistics. The trend however follows a similar pattern with a peak in 2000 and a decline in the mid-2000s followed by a recovery.

The distribution of cows in the region can also be estimated using DIGAD data and the changes between 1995 and 2015 are presented in Figure 16. In 2015 the heaviest populated areas for dairying were Ruawai, Tokatoka and Te Kopuru/Redhill in the west of the region and Waipu and Poroti in the east. Between 1995 and 2015 the area with the largest increase in cow numbers was south east of Kaitaia. Summarised by district using Dairy Statistics data, Kaipara (the largest dairying area) decreased by 2%, Whangarei increased by 10% and the Far North increased by 19% (Figure 14b).

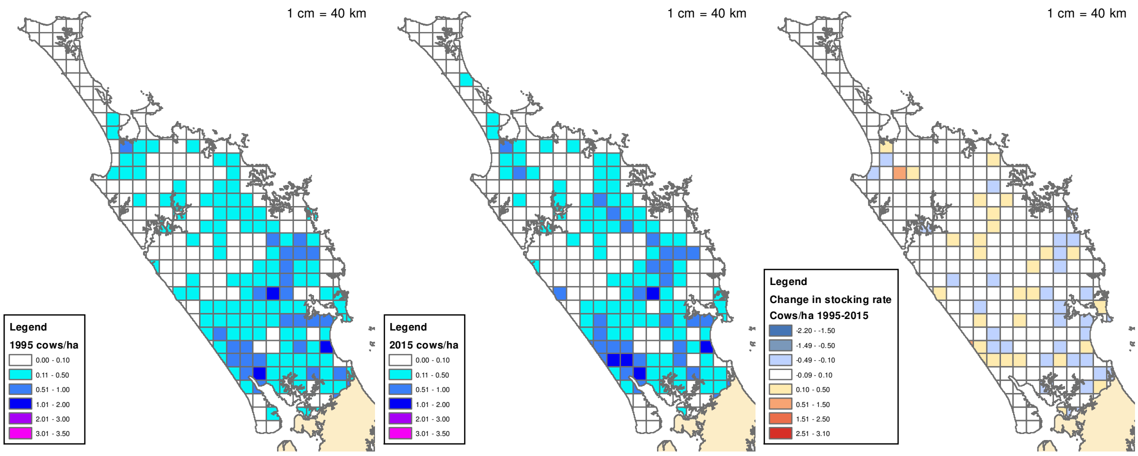

Figure 16. Density (cows/ha) of dairy in the Northland region, summarised by 5000 ha grid cell, for 1995, 2015 and the change between these years. Source DIGAD.

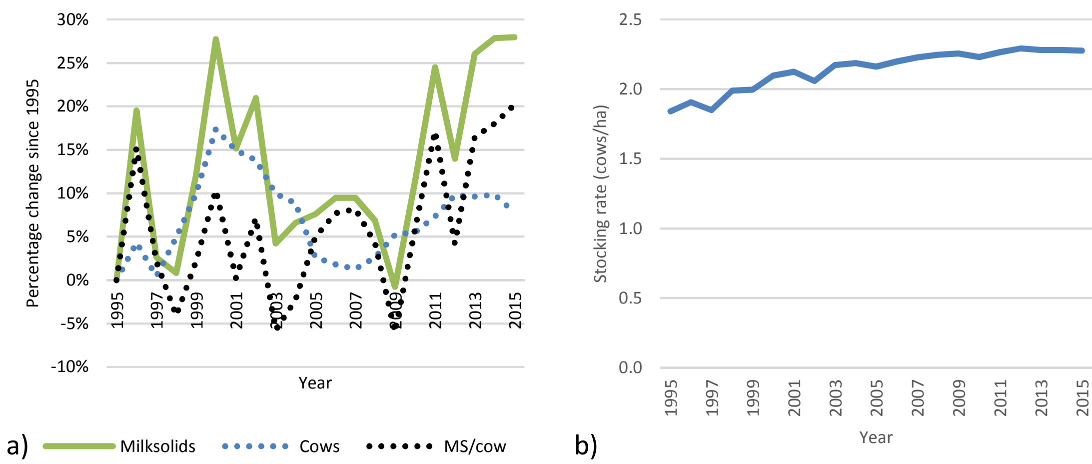

Figure 17. (a) Trend in the percentage change, since 1995, in the total milksolids produced in Northland and the drivers (number of cows and milk production per cow) behind this change. (b) Trend in stocking rate (cows/ha) since 1995 in the Northland Region. Source Dairy Statistics.

Milksolids production increased by 28% during the period 1995-2015, 20% of which could be attributed to improved milk production per cow and 8% due to more cows (Figure 17). Note the 8% figure is slightly higher than the 7% increase in cow numbers due to the increased milk production per cow of the new cows over this period. Improved milk production per cow could be due to improved farm management, animal genetics, or more imported feed such as palm kernel expeller. The trend in milksolids visually correlated well with the milksolids production per cow, likely indicating significant climatic influence in the region, which is subject to summer drought.

The number of herds in the region declined significantly, particularly during the years from 1995 to 2008, after which it remained relatively static at just over 900 herds (Figure 18a). As discussed above, herds exiting the industry will likely result in the existing herds increasing in size (by 84% using dairy statistics data). However, the averages presented in the annual dairy statistics give no insight into the distribution of herd sizes. Distribution data was obtained from DIGAD and is presented in Figure 18b. These data give a similar trend in the mean herd size to the dairy statistics data. More growth has occurred in larger herds with the upper quartile increasing from 222 to 408 cows (84%), compared with the lower quartile, which increased from 126 to 182 cows (44%). This implies that one quarter of herds in Northland had less than 182 cows in 2015. The largest herds in Northland are just over 900 cows (98th percentile).

The trend in breed is displayed in Figure 19, and indicates that in 2015 the predominant breed in the region was Friesian (38%), followed by Jerseys (18%) and Friesian dominant crossbreeds (15%). The number of Friesians declined and the number of cross breed cows increased. Since 1995 the average cow in the region moved from F11 J4 O1 to F9 J6 O1 (out of 16 parts).

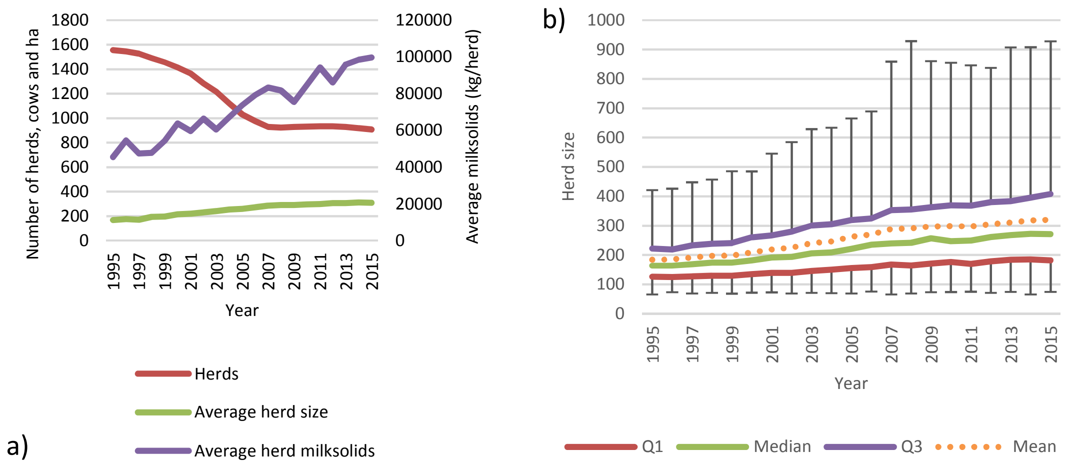

Figure 18. Trend in (a) the number of herds, average herd size and average milk production per herd in the Northland Region. Source Dairy Statistics. (b) the 2nd, 25th (lower quartile, Q3), 50th (median), mean, 75th (upper quartile, Q3) and 98th percentile of herd size. Source DIGAD.

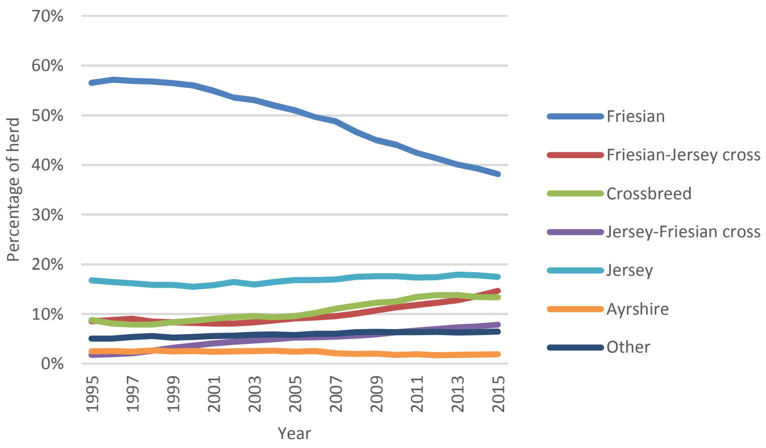

Figure 19. Trend in the breed of cows in Northland herds between 1995 and 2015. Source DIGAD.

Key points for Northland:

- In 2015 dairying occupied a significant amount (10%) of the regions land relative to other regions, only Waikato (18%) and Taranaki (22%) were greater.
- In 2015 the region had more cows than in 1995, but 23,500 fewer cows that the peak number in 2000.
- The region has a low stocking rate (2.3 cows/ha) relative to other regions.
- Herds (typically smaller ones) have been exiting the industry, this has been partially offset by many of these herds being incorporated into neighbouring farms, inclusion of previously non-dairy land into the remaining dairy farms, and a few new conversions. The net result fewer hectares in dairy in 2015 than 1995.
- The increase in cow numbers over this period was driven by an increasing in stocking rate, that has remained relatively static since 2003.
- Changes in milk production appear driven by changes in milk production per cow.
- Planned start of calving date has remained static since 1995.
- There was an increase in the percentage of autumn calving cows in the late 1990s.
- The amount of Friesian declined by 3/16ths since 1995.

Auckland region

The dairy industry in Auckland has contracted between 1995 and 2015. The change in cows, area and milk production are presented in Figure 20a. During this time the area in dairy milking platforms decreased by 29%. In 2015 the area in dairy accounted for 10% of the region's land. There were 24% fewer cows in 2015 than 1995, declining from the peak number of cows in 1998. The number cow cows in the region now appears relatively static at about 110,000 (Figure 20a). The 24% net decrease in cows was a result of increase in stocking rate (8%), which was offset (-32%) by a decrease in land area (Figure 21a). The effect of the decreasing land area (-32%) was more than the actual change in land area (-29%) due to a increase in stocking rate over this land (Figure 23b) – see Figure 1 for explanation. Stocking rate appears to have plateaued since the 2007 at 2.3-2.4 cows/ha.

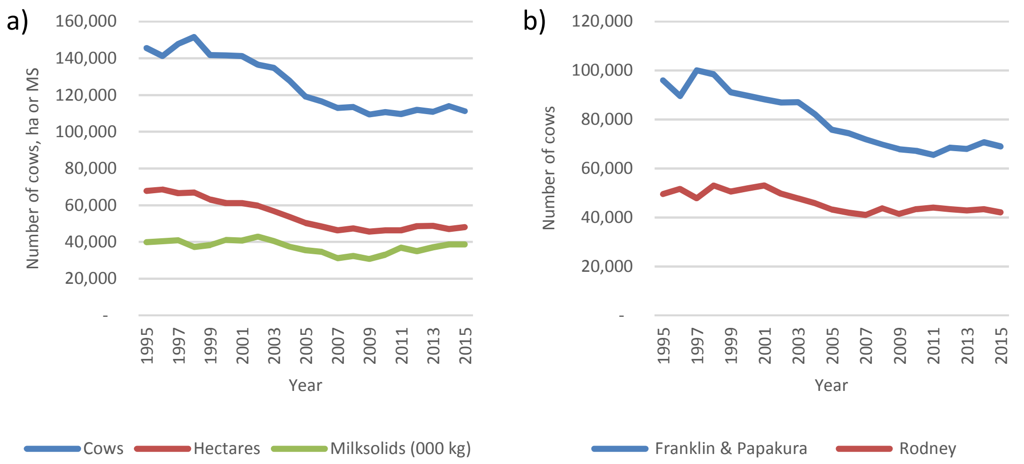

Figure 20. Trend in (a) the number of cows, hectares and milksolids produced in the Auckland region between 1995 and 2015 and (b) the number of cows per district. Source Dairy Statistics.

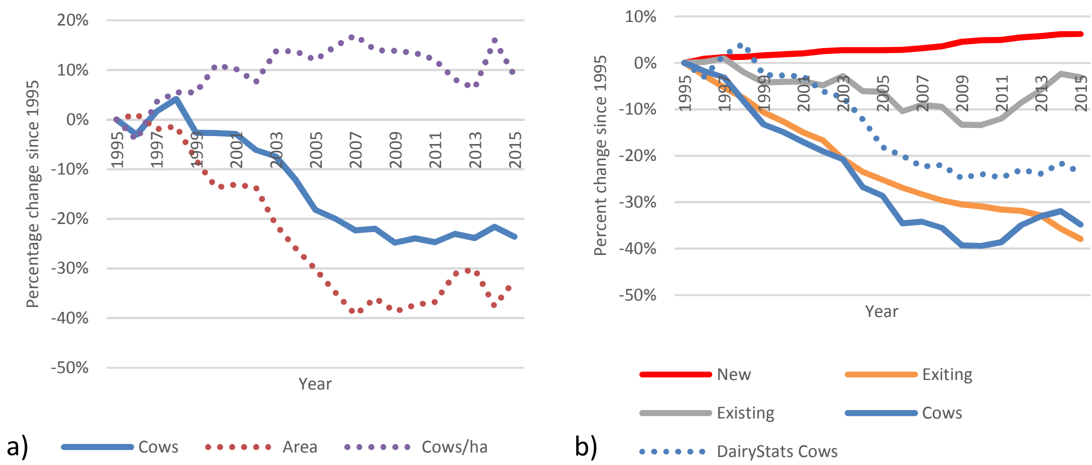

Figure 21. Trend in the percentage of change, since 1995: (a) in total cows and the drivers (area and stocking rate) behind this change. Source Dairy Statistics. (b) in calved cows (including comparison with Dairy Statistics) as a result of new farm conversions, herds exiting the industry, and expansion of existing herds in Auckland. Source DIGAD.

The underlying reasons behind the increase in cow numbers can be estimated using DIGAD data (Figure 21b). The data indicates a steady rate of herds exiting the industry, responsible for a 38% decrease in cow numbers. Herds could exit the industry due to a change in land use (e.g. dairy support, dry stock, lifestyle or urban), or they could be being bought by a neighbouring dairy farm, which would then appear

in the data as an increase in the size of existing herds. In Auckland cow numbers in existing herds was relatively static at -3%, indicating that exiting herds were changing land use rather than being purchased by a neighbouring dairy farm. There was an 6% increase in cow numbers due to new farm conversions. Overall, these combine to an overall net decrease of 35% in DIGAD data. This number differs from the 24% decrease in cow numbers reported in the Dairy Statistics. The DIGAD data relies on farmers having entered their calving records into the database, which likely explains why the figure is under reported compared to the Dairy Statistics. The trend however follows a similar pattern in both data sources.

The distribution of cows in the region can also be estimated using DIGAD data and the changes between 1995 and 2015 are presented in Figure 22. In 2015 the heaviest populated areas for dairying were around Tapora, Tomarata/Te Arai/Te Hana, and Parakai/Te Pua in the north of the region, and Karaka/Waiuku and the south head of the Manukau Harbour in the south of the region. Between 1995 and 2015 the only area with an increase in cow numbers was in the Tomarata and Tapora areas, near the boundary with Northland. Summarised by district using Dairy Statistics data, Franklin and Papakura (the largest dairying distracts/wards) decreased by 27%, with Rodney decreasing by 26% (Figure 20b).

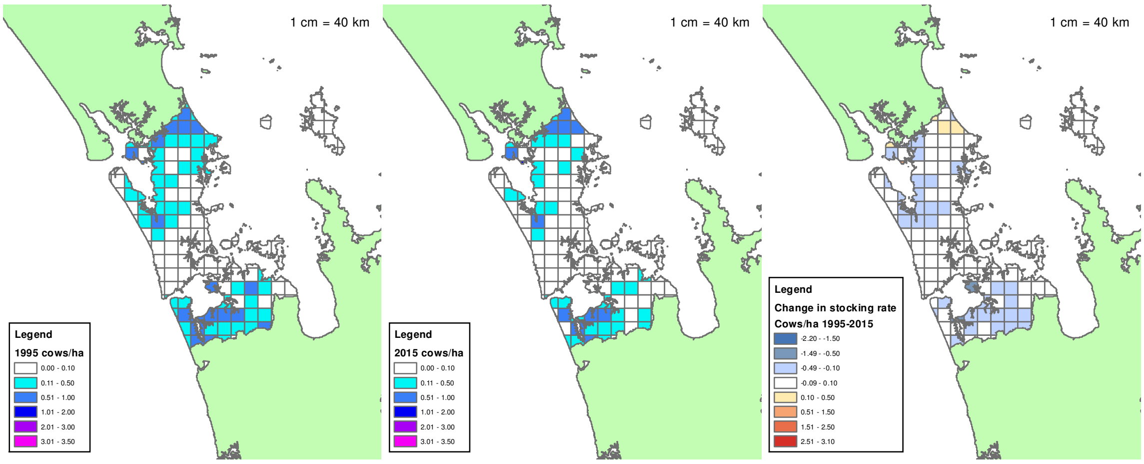

Figure 22. Density (cows/ha) of dairy in the Auckland region, summarised by 5000 ha grid cell, for 1995, 2015 and the change between these years. Source DIGAD.

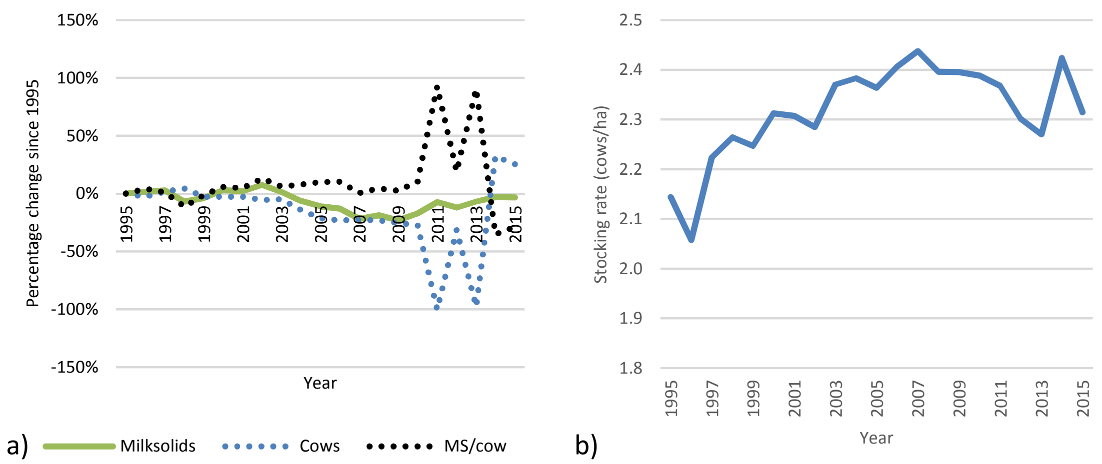

Figure 23. (a) Trend in the percentage change, since 1995, in the total milksolids produced in Auckland and the drivers (number of cows and milk production per cow) behind this change. (b) Trend in stocking rate (cows/ha) since 1995 in the Auckland Region. Source Dairy Statistics.

Milksolids production decreased by 3% during the 1995-2015 period (Figure 23). There appears to be errors in the dairy statistics data for the years 2011, 2013-2015, however, overall the decrease in cow numbers has been largely offset by an increase in the milk production per cow. Improved milk production per cow could be due to improved farm management, animal genetics, or more imported feed such as palm kernel expeller.

The number of herds in the region declined significantly, particularly during the years from 1995 to 2008 (Figure 24a), however, the rate of decline has decreased since about 2006 and is currently sitting at 410 herds. As discussed above, herds exiting the industry did not appear to result in an increase in the size of existing herds. Consequently, it is likely the increase in herd size has been the result of smaller herds exiting the industry. Average herd size increased 65% since 1995 using dairy statistics data. However, the averages presented in the annual dairy statistics give no insight into the distribution of herd sizes. Distribution data was obtained from DIGAD and is presented in Figure 24b, these data give a similar trend in the mean herd size to the dairy statistics data. More growth has occurred in larger herds with the upper quartile increasing from 204 to 337 cows (66%), compared with the lower quartile, which increased from 112 to 169 cows (51%). This implies that one quarter of herds in Auckland had less than 169 cows in 2015. The largest herds in Auckland are around 700 cows (98th percentile).

The trend in breed is displayed in Figure 25, and indicates that in 2015 the predominant breed in the region was Friesian (45%), followed by Friesian dominant crossbreeds (15%). The number of Friesians declined and the number of cross breed cows increased. Since 1995 the average cow in the region moved from F11 J4 O1 to F10 J5 O1 (out of 16 parts).

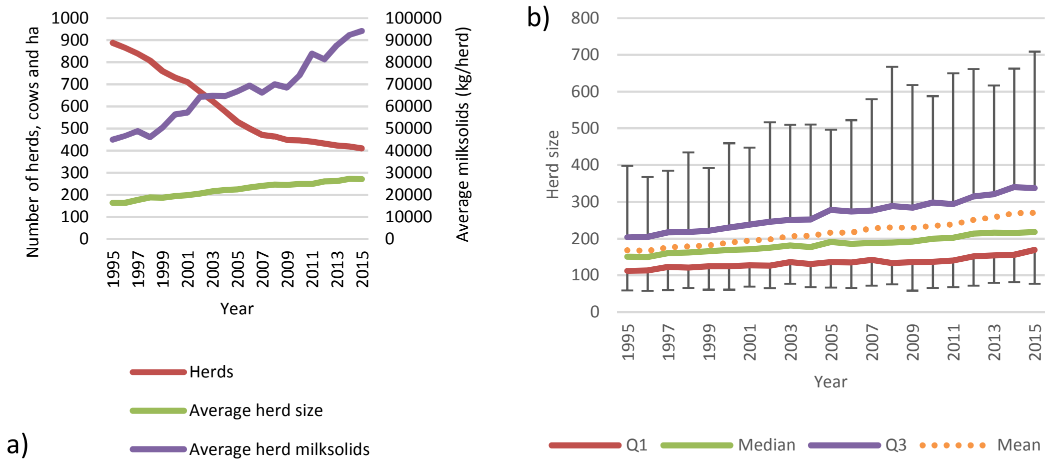

Figure 24. Trend in (a) the number of herds, average herd size and average milk production per herd in the Auckland Region. Source Dairy Statistics. (b) the 2nd, 25th (lower quartile, Q3), 50th (median), mean, 75th (upper quartile, Q3) and 98th percentile of herd size. Source DIGAD.

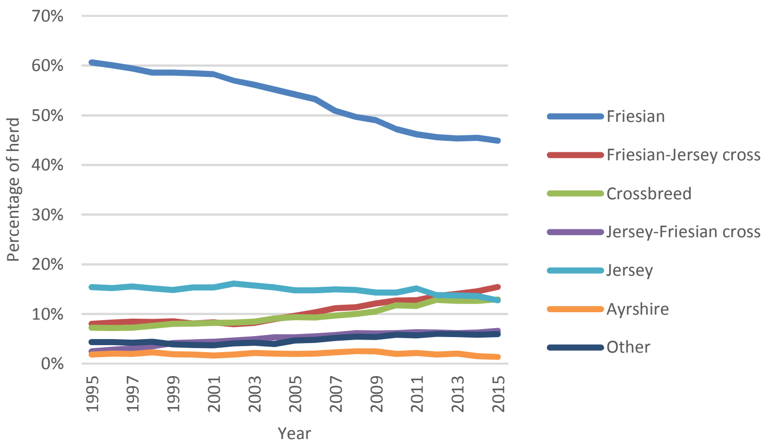

Figure 25. Trend in the breed of cows in Auckland herds between 1995 and 2015. Source DIGAD.

Key points for Auckland:

- In 2015 dairying occupied a significant amount (10%) of the regions land relative to other regions, only Waikato (18%) and Taranaki (22%) were greater.
- In 2015 the region had 34,400 fewer cows than in 1995, and 40,000 fewer cows that the peak number in 1998.
- The region has a low stocking rate (2.3-2.4 cows/ha) relative to other regions.
- Herds have been exiting the industry, this has only been somewhat offset by some of these herds being incorporated into neighbouring farms, inclusion of previously non-dairy land into the remaining dairy farms, and a few new conversions. The net result fewer hectares in dairy in 2015 than 1995.
- Tomarata is the only area to have increased in cow numbers.
- The decrease in cow numbers over this period was driven by decreasing area, partially offset by an increasing in stocking rate up to 2003, but has since remained static.
- Milk production appears static with small increases in per cow milk production offsetting fewer cows.
- Planned start of calving date moved earlier by 3 days between 1995 and 2015.
- The amount of Friesian declined by 1/16th since 1995.

Waikato region

The dairy industry in the Waikato has experienced growth. The change in cows, area and milk production between 1995 and 2015 is presented in Figure 26a. During this time the area in dairy milking platforms increased by 20%. In 2015 the area in dairy accounted for 18% of the region's land. There were 28% more cows in 2015 than 1995. This was fewer than the highest number of cows in the year 2014, however, it is not clear if 2014 is a peak. The 28% net increase in cows was a result of increase in stocking rate (7%), and increase in land area (21%; Figure 26a). The effect of the increasing land area (21%) was more than the actual change in land area (20%) due to an increase in stocking rate over this period (Figure 29b) – see Figure 1 for explanation. Stocking rate appears to have plateaued since the 2003 at about 2.9 cows/ha.

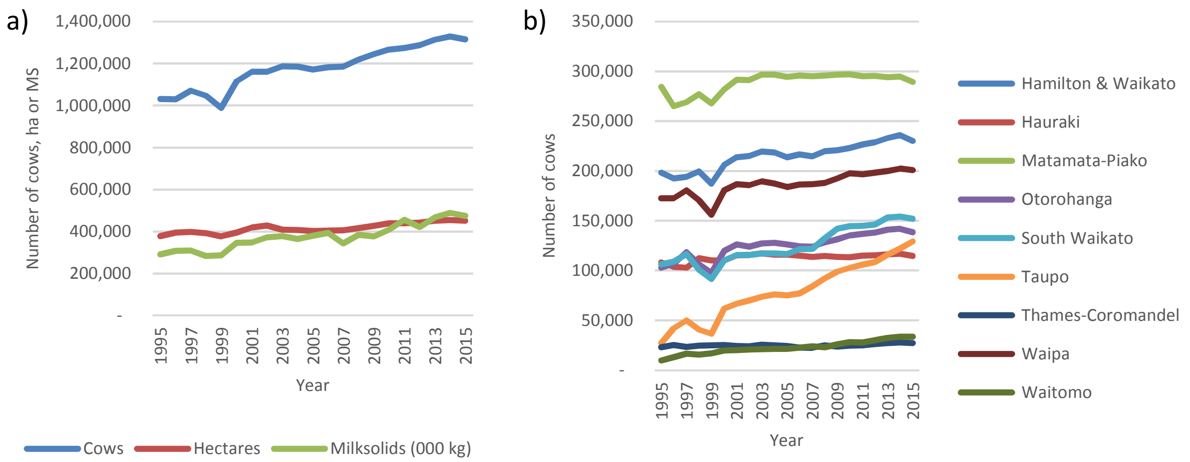

Figure 26. Trend in (a) the number of cows, hectares and milksolids produced in the Waikato region between 1995 and 2015 and (b) the number of cows per district. Source Dairy Statistics.

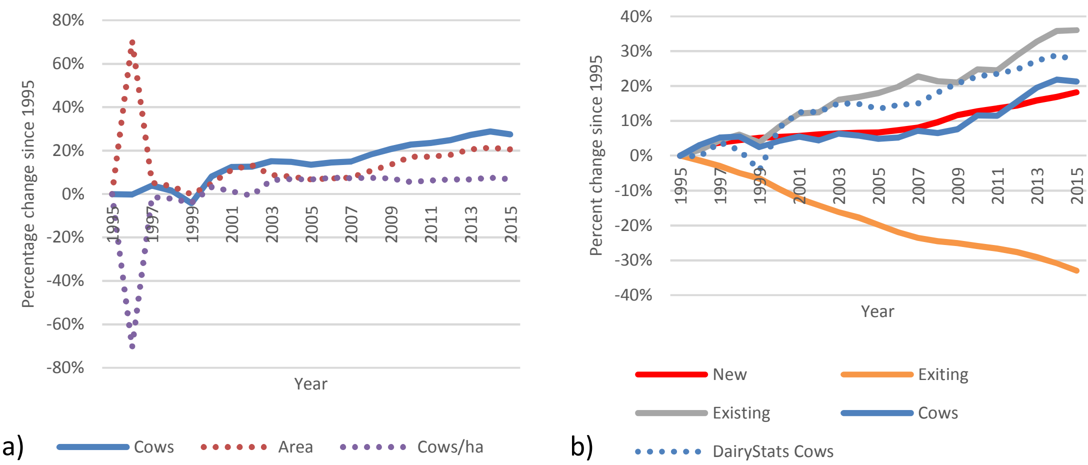

Figure 27. Trend in the percentage of change, since 1995: (a) in total cows and the drivers (area and stocking rate) behind this change. Source Dairy Statistics. (b) in calved cows (including comparison with Dairy Statistics) as a result of new farm conversions, herds exiting the industry, and expansion of existing herds in the Waikato. Source DIGAD.

The underlying reasons behind the increase in cow numbers can be estimated using DIGAD data (Figure 27b). The data indicates a steady rate of herds exiting the industry, responsible for a 33% decrease in cow numbers. Herds could exit the industry due to a change in land use (e.g. dairy support, dry stock, lifestyle or urban), or they could be being bought by a neighbouring dairy farm, which would then appear

in the data as an increase in the size of existing herds. In the Waikato cow numbers grew by 36% in existing herds, which could be due to an amalgamation with a neighbouring dairy farm or through incorporating a neighbouring drystock block. Hence, the growth of existing herds approximately cancels out the herds exiting the industry. There was an 18% increase in cow numbers due to new farm conversions. Indicating the majority of growth in the industry in this region has likely been due to new farm conversions. Overall, these combine to an overall net increase of 21% in DIGAD data. This number differs from the 28% increase in cow numbers reported in the Dairy Statistics. The DIGAD data relies on farmers having entered their calving records into the database, which likely explains why the figure is under reported compared to the Dairy Statistics. The trend however follows a similar pattern to the dairy statistics.

The distribution of cows in the region can also be estimated using DIGAD data and the changes between 1995 and 2015 are presented in Figure 28. In 2015 the heaviest populated areas for dairying were the area stretching from Orini down to Gordonton and Puketaha, and the area stretching from Springdale, down to Kereone, including Morrinsville and Tatanui, across to Ngarua and down to Waharoa in the north of the region. The areas of Te Poi, Okoroire, Putaruru, Lichfield, Kinleith and Reporoa in the south-east. In the south-west the areas of Ohaupo/Paterangi, Monavale, Kihikihi, Tokanui across to Puketotara, and Waikeria down to Maihiihi and over to Otewa. Between 1995 and 2015 the areas with the largest increases in cow numbers have been in the south of the region. Summarised by district using Dairy Statistics data, Matamata-Piakao (the largest dairying area) increased by 2%, with Hamilton & Waikato increasing by 16%, Waipa by 16%, South Waikato by 43%, Otorohanga by 35%, Hauraki by 6%, Taupo by 378%, with the significantly smaller dairying districts of Waitomo and Thames-Coromandel increasing by 250% and 19%, respectively (Figure 26b).

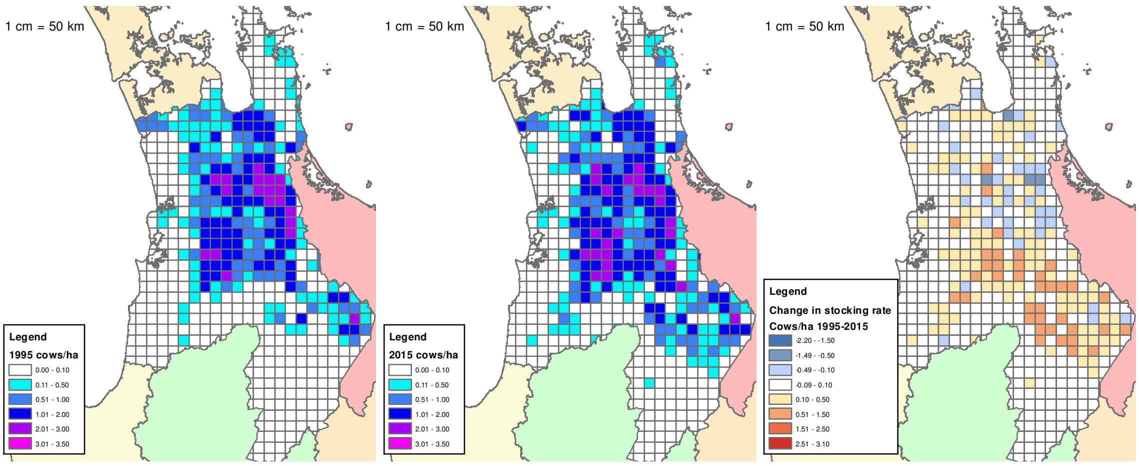

Figure 28. Density (cows/ha) of dairy in the Waikato region, summarised by 5000 ha grid cell, for 1995, 2015 and the change between these years. Source DIGAD.

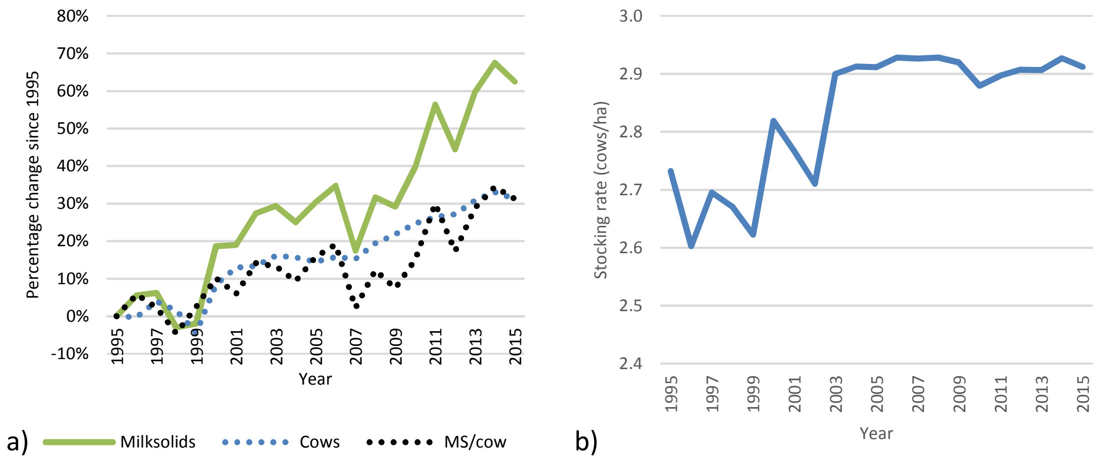

Figure 29. (a) Trend in the percentage change, since 1995, in the total milksolids produced in the Waikato and the drivers (number of cows and milk production per cow) behind this change. (b) Trend in stocking rate (cows/ha) since 1995 in the Waikato Region. Source Dairy Statistics.

Milksolids production increased by 63% during the period 1995-2015, of which could be attributed to improved milk production per cow and half due to more cows (Figure 29a). Improved milk production per cow could be due to improved farm management, animal genetics, or more imported feed such as palm kernel expeller. The trend in milksolids appears correlated with the milksolids production per cow, likely indicating climatic influence in the region, which can experience wet springs and summer droughts.

The number of herds in the region has declined, particularly during the years from 1995 to 2007, after which it has remained relatively static at just over 3,700 herds (Figure 30a). As discussed above, herds exiting the industry will likely result in the existing herds increasing in size (by 80% using dairy statistics data). However, the averages presented in the annual dairy statistics give no insight into the distribution of herd sizes. Distribution data was obtained from DIGAD and is presented in Figure 30b, these data give a similar trend in the mean herd size to the dairy statistics data. More growth has occurred in larger herds with the upper quartile increasing from 232 to 451 cows (94%), compared with the lower quartile, which increased from 136 to 209 cows (54%). This implies that one quarter of herds in the Waikato had less than 209 cows in 2015. The largest herds in the Waikato are around 1000 cows (98th percentile).

The trend in breed is displayed in Figure 31, and indicates that in 2015 the predominant breed in the region was Friesian (33%), followed by Friesian dominant crossbreeds (20%). The number of Friesians declined and the number of cross breed cows increased. Since 1995 the average cow in the region moved from F11 J4 O1 to F9 J6 O1 (out of 16 parts)

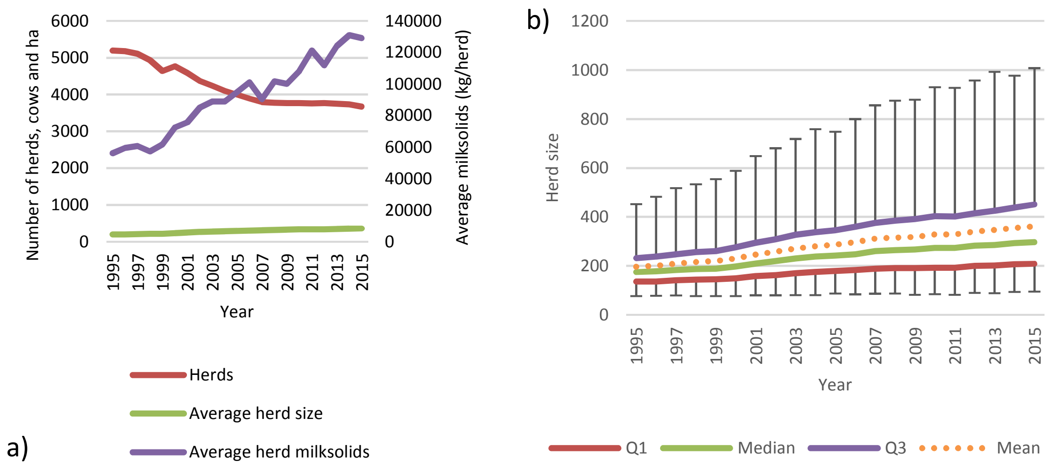

Figure 30. Trend in (a) the number of herds, average herd size and average milk production per herd in the Waikato Region. Source Dairy Statistics. (b) the 2nd, 25th (lower quartile, Q3), 50th (median), mean, 75th (upper quartile, Q3) and 98th percentile of herd size. Source DIGAD.

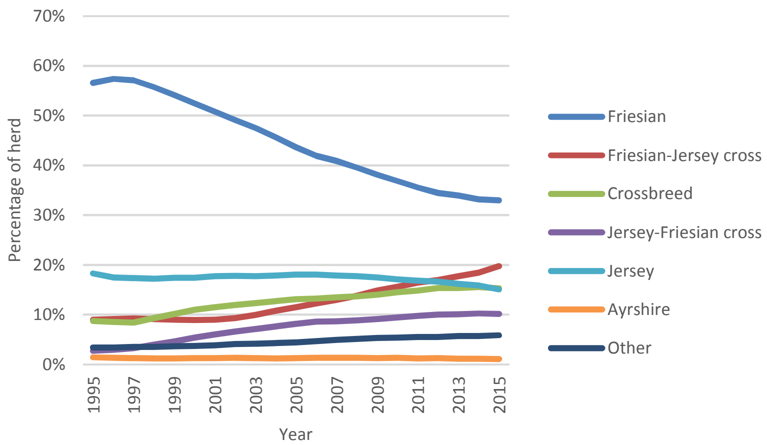

Figure 31. Trend in the breed of cows in Waikato herds between 1995 and 2015. Source DIGAD.

Key points for Waikato:

- In 2015 dairying occupied a significant amount (18%) of the regions land relative to other regions, only Taranaki (22%) was greater.
- The Waikato is the region with the most cows.
- The region is a strong growth region, and has been growing at 15,700 cows/year.
- In 2015 the region had more cows than in 1995, and is growing, or has been growing until recently, with the highest number occurring in 2014.
- The increase in cow numbers has been driven mostly by increasing land area, more so than stocking rate, which has been static since 2003.
- Herds exiting the industry have been offset by an increase in herd size of existing farms (e.g. many of the exiting herds may have been incorporated into a neighbouring farm, inclusion of previously non-dairy land, or increase in stocking rate). The main driver of the increase in cow numbers appears to be new herds.
- The new herds appear to be most likely located in the Taupo, Waitomo, South Waikato and Otorohanga Districts (the south of the region).

- The region's milk production has increased driven equally by changes in milk production per cow and the number of cows.
- Planned start of calving date moved earlier by 8 days between 1995 and 2015.
- The percentage of autumn calving cows increased since 2013.
- The amount of Friesian declined by 2/16ths since 1995.

Bay of Plenty region

The dairy industry in the Bay of Plenty has experience mild growth compared with other regions. The change in cows, area and milk production between 1995 and 2015 is presented in Figure 32a. During this time the area in dairy milking platforms increased by 9%. In 2015 the area in dairy accounted for 10% of the region's land. There were 19% more cows in 2015 than 1995. This was fewer than the highest number of cows in the year 2014, however, it is not clear if 2014 is a peak. The 19% net increase in cows was a result of increase in stocking rate (10%) and land area (9%; Figure 33a). Stocking rate appears to have been static since 2003, at just under 2.8 cows/ha.

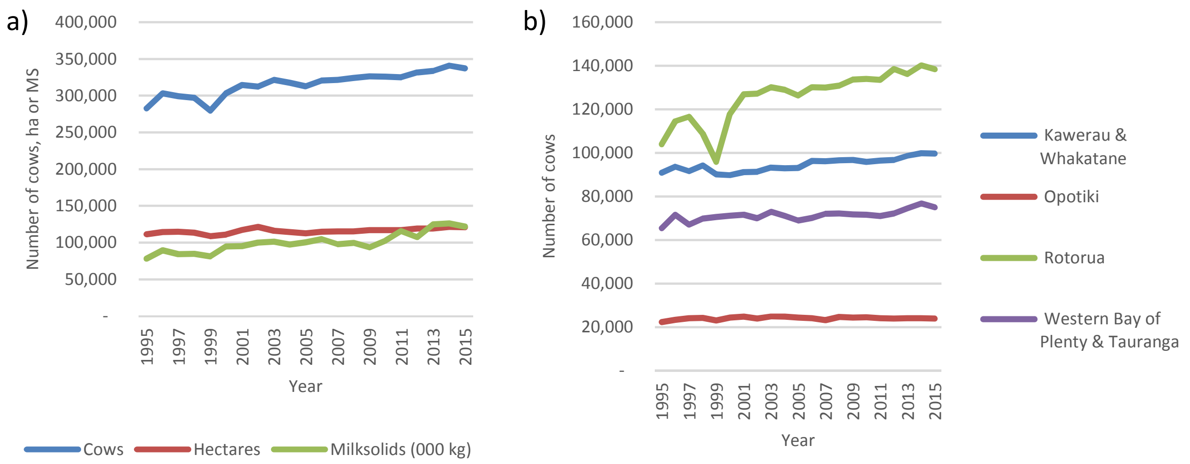

Figure 32. Trend in (a) the number of cows, hectares and milksolids produced in the Bay of Plenty region between 1995 and 2015 and (b) the number of cows per district. Source Dairy Statistics.

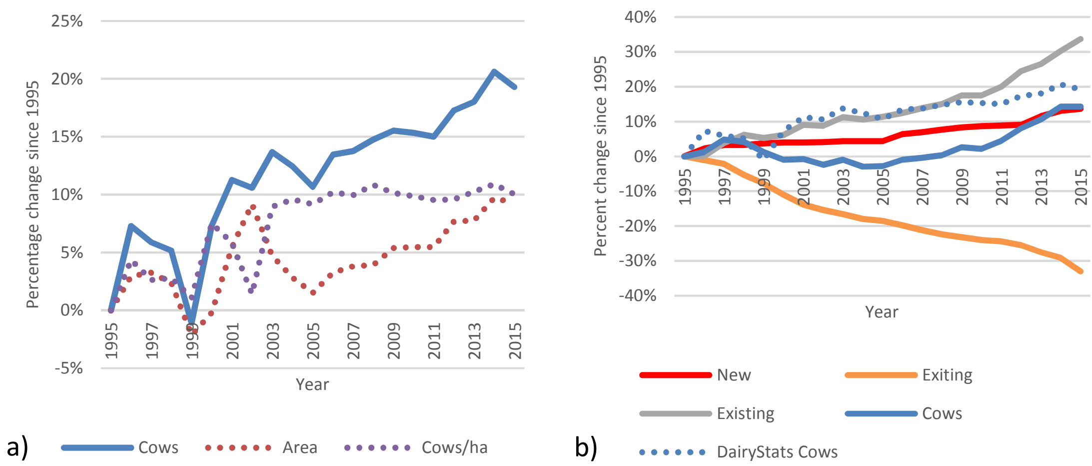

Figure 33. Trend in the percentage of change, since 1995: (a) in total cows and the drivers (area and stocking rate) behind this change. Source Dairy Statistics. (b) in calved cows (including comparison with Dairy Statistics) as a result of new farm conversions, herds exiting the industry, and expansion of existing herds in the Bay of Plenty. Source DIGAD.

The underlying reasons behind the increase in cow numbers can be estimated using DIGAD data (Figure 33b). The data indicates a steady rate of herds exiting the industry, responsible for a 33% decrease in cow numbers. Herds could exit the industry due to a change in land use (e.g. dairy support, dry stock, lifestyle or urban), or they could be being bought by a neighbouring dairy farm, which would then appear in the data as an increase in the size of existing herds. In the Bay of Plenty cow numbers grew by 34% in existing herds, which could be due to an amalgamation with a neighbouring dairy farm or through incorporating a neighbouring drystock block. Hence, the growth of existing herds approximately cancels out the herds exiting the industry. There was a 14% increase in cow numbers due to new farm conversions, indicating they were probably the primary driver behind the increase in cow numbers. Overall, these combine to an overall net increase of 14% in DIGAD data. This number differs from the 19% increase in cow numbers reported in the Dairy Statistics. The DIGAD data relies on farmers having entered their calving records into the database, which likely explains why the figure is under reported compared to the Dairy Statistics.

The distribution of cows in the region can also be estimated using DIGAD data and the changes between 1995 and 2015 are presented in Figure 34. In 2015 the heaviest populated areas for dairying were the area from Maketu down to Pukehina and Edgecumbe. Between 1995 and 2015 the areas with the largest increases in cow numbers were around Kaharoa, north of Lake Rotorua, and in the very south of the region around Rangitaiki. The areas surrounding Tauranga have experienced a decline in dairy. Summarised by district using Dairy Statistics data, Rotorua (the largest dairying district) increased by 33%, with Kawerau & Whakatane increasing by 10%, Western Bay of Plenty and Tauranga increasing by 15% and the smallest dairying district, Opotiki, increasing by 8% (Figure 32b).

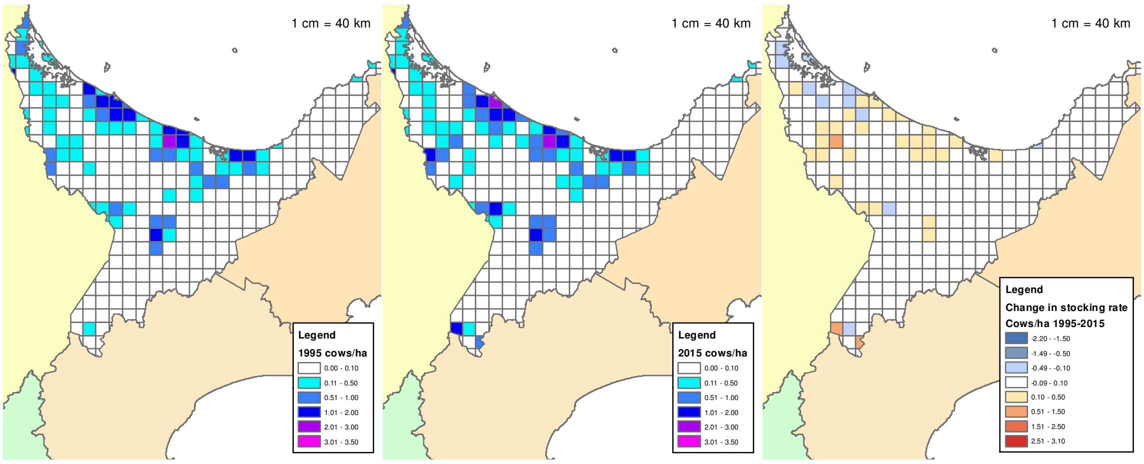

Figure 34. Density (cows/ha) of dairy in the Bay of Plenty region, summarised by 5000 ha grid cell, for 1995, 2015 and the change between these years. Source DIGAD.

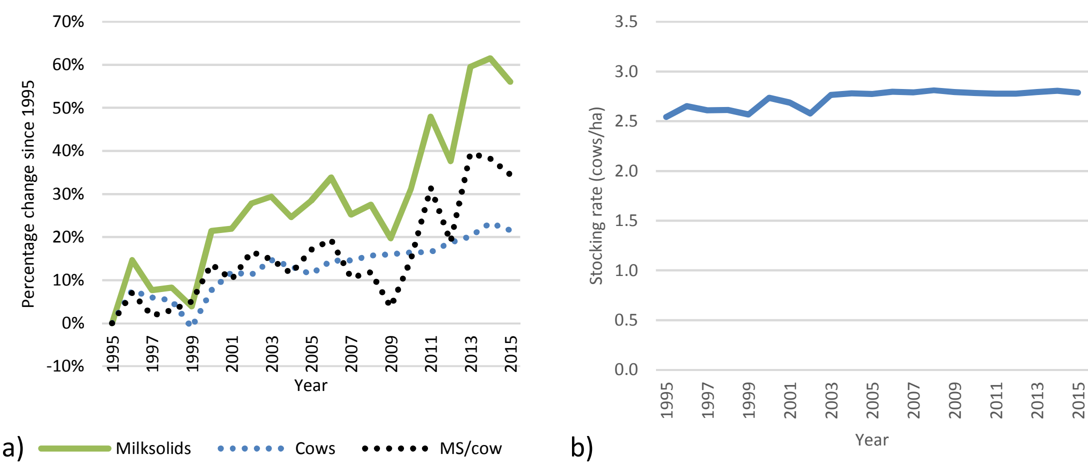

Figure 35. (a) Trend in the percentage change, since 1995, in the total milksolids produced in the Bay of Plenty and the drivers (number of cows and milk production per cow) behind this change. (b) Trend in stocking rate (cows/ha) since 1995 in the Bay of Plenty Region. Source Dairy Statistics.

Milksolids production increased by 56% during the period 1995-2015, 34% of which could be attributed to improved milk production per cow and 22% due to more cows (Figure 5). Note the 22% figure is slightly higher than the 19% increase in cow numbers due to the increased milk production per cow of the new cows over this period. Improved milk production per cow could be due to improved farm management, animal genetics, or more imported feed such as palm kernel expeller. The trend in milksolids appears correlated with the milksolids production per cow, likely indicating climatic influence in the region.

The number of herds in the region declined significantly, particularly during the years from 1995 to 2005, after which it has remained relatively static at just over 900 herds (Figure 36a). As discussed above, herds exiting the industry will likely result in the existing herds increasing in size (by 66% using dairy statistics data). However, the averages presented in the annual dairy statistics give no insight into the distribution of herd sizes. Distribution data was obtained from DIGAD and is presented in Figure 36b, these data give a similar trend in the mean herd size to the dairy statistics data. More growth has occurred in larger herds with the upper quartile increasing from 244 to 457 cows (87%), compared with the lower quartile, which increased from 138 to 218 cows (58%). This implies that one quarter of herds in the Bay of Plenty had less than 218 cows in 2015. The largest herds in the Bay of Plenty are just over 1000 cows (98th percentile).

The trend in breed is displayed in Figure 37, and indicates that in 2015 the predominant breed in the region was Friesian (44%), followed by Friesian dominant crossbreeds (18%), followed by straight crossbreeds (15%). The number of Friesians declined and the number of cross breed cows increased. Since 1995 the average cow in the region moved from F12 J3 O1 to F11 J4 O1 (out of 16 parts).

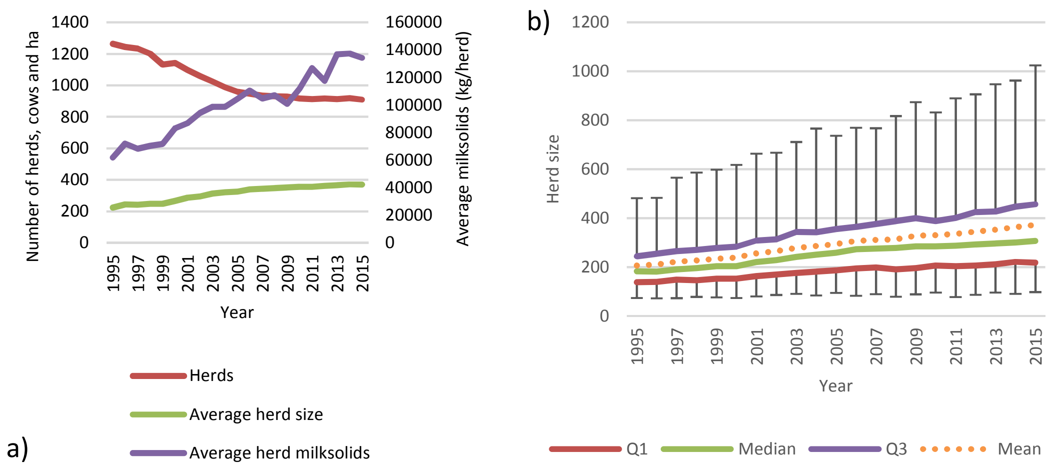

Figure 36. Trend in (a) the number of herds, average herd size and average milk production per herd in the Bay of Plenty Region. Source Dairy Statistics. (b) the 2nd, 25th (lower quartile, Q3), 50th (median), mean, 75th (upper quartile, Q3) and 98th percentile of herd size. Source DIGAD.

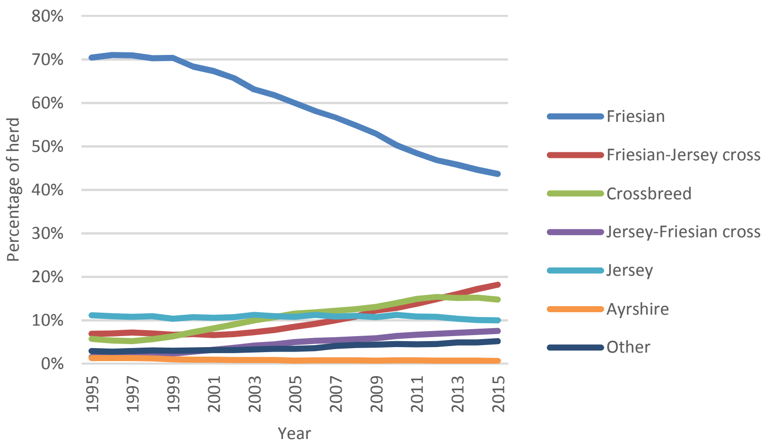

Figure 37. Trend in the breed of cows in Bay of Plenty herds between 1995 and 2015. Source DIGAD.

Key points for Bay of Plenty:

- In 2015 dairying occupied a significant amount (10%) of the regions land relative to other regions, only Waikato (18%) and Taranaki (22%) were greater.
- In 2015 the region had more cows than in 1995, and is growing, or has been growing until recently, with the highest number occurring in 2014.
- The region has been growing at 2,400 cows/year.
- The increase in cow numbers has been driven equally by increasing stocking rate (until 2003) and more latterly by land area.
- Herds exiting the industry have been offset by an increase in herd size of existing farms (e.g. many of the exiting herds may have been incorporated into a neighbouring farm, inclusion of previously non-dairy land, or increase in stocking rate). The main driver of the increase in cow numbers appears to have been new herds.
- The new herds appear to be most likely located in the Rotorua District (note all of the Rotorua Districts cows have been included in the region, when it is partially in the Waikato).
- The region’s milk production has increased, driven equally by changes in both the number of cows and milk production per cow until 2012 and since then by milk production per cow.
- Planned start of calving date moved earlier by 10 days between 1995 and 2015.
- The amount of Friesian declined by 1/16th since 1995.

Hawkes Bay & Gisborne regions

The dairy industry in the Hawkes Bay and Gisborne regions is relatively small, but has experienced significant growth. The change in cows, area and milk production between 1995 and 2015 is presented in Figure 38a. During this time the area in dairy milking platforms increased by 182% but in 2015 the area in dairy accounted for only 1% of the region's land. There were 276% more cows in 2015 than 1995, with significant periods of growth from 1995-2003 and from 2007 to 2009. The 276% net increase in cows was a result of increase in stocking rate (42%) and an increase in land area (233%; Figure 39a). The effect of the increasing land area (233%) was more than the actual change in land area (182%) due to an increase in stocking rate over this period (Figure 41b) – see Figure 1 for explanation. Stocking rate appears to have plateaued since the year 2000 at about 2.8 cows/ha. Consequently, the primary driver behind the increase in cow numbers has been an increase in dairy land.

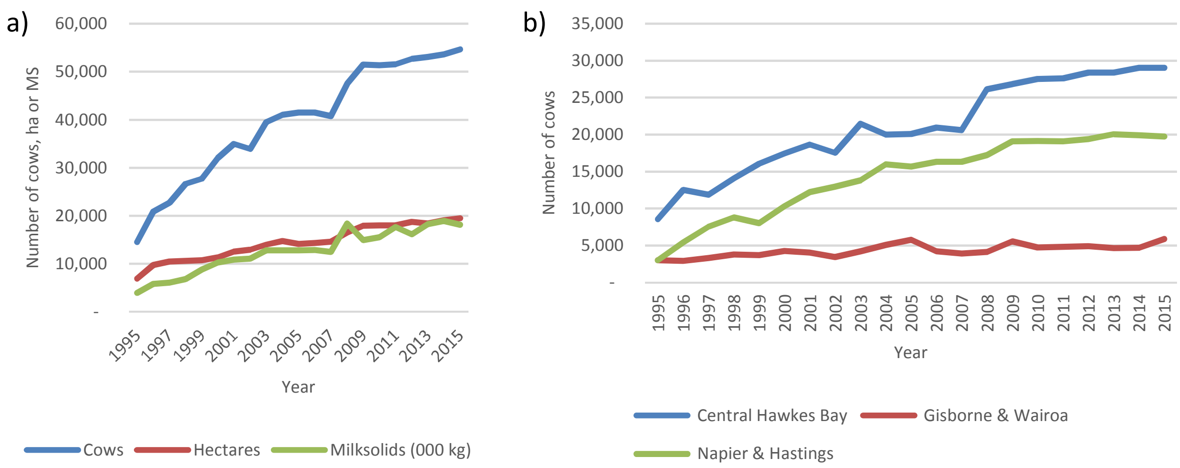

Figure 38. Trend in (a) the number of cows, hectares and milksolids produced in the Hawkes Bay and Gisborne regions between 1995 and 2015 and (b) the number of cows per district. Source Dairy Statistics.

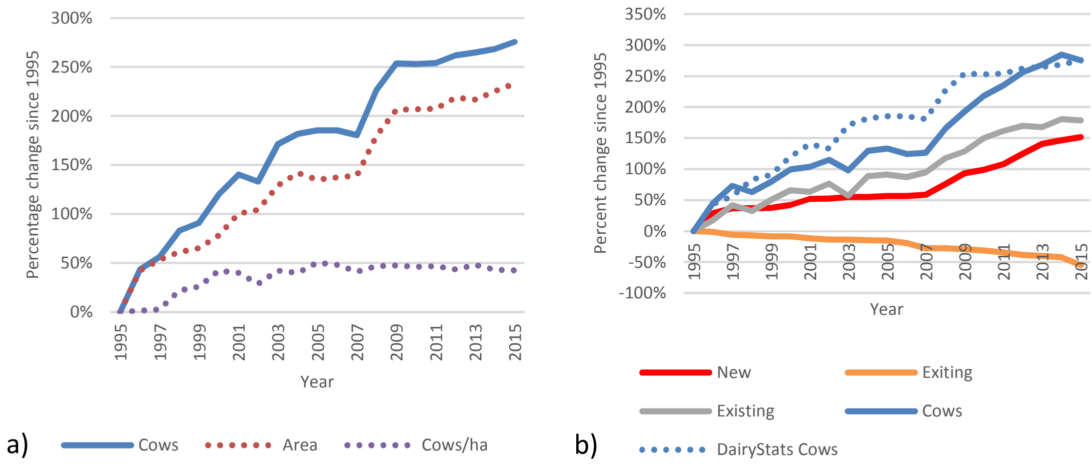

Figure 39. Trend in the percentage of change, since 1995: (a) in total cows and the drivers (area and stocking rate) behind this change. Source Dairy Statistics. (b) in calved cows (including comparison with Dairy Statistics) as a result of new farm conversions, herds exiting the industry, and expansion of existing herds in the Hawkes Bay and Gisborne regions. Source DIGAD.

The underlying reasons behind the increase in cow numbers can be estimated using DIGAD data (Figure 39b). The data indicates a steady rate of herds exiting the industry, responsible for a 55% decrease in cow numbers. Herds could exit the industry due to a change in land use (e.g. dairy support, dry stock, lifestyle or urban), or they could be being bought by a neighbouring dairy farm, which would then appear in the data as an increase in the size of existing herds. In this region cow numbers grew by 178% in existing herds, which could be due to an amalgamation with a neighbouring dairy farm or through incorporating a neighbouring drystock block. The significantly larger increase in existing herds than those exiting, and a static stocking rate since 2000 indicates dairy farms have grown by incorporating adjoining non-dairy land. There was an 152% increase in cow numbers due to new farm conversions. Overall, these combine to an overall net increase of 275% in DIGAD data. This number is very similar to the 276% increase in cow numbers reported in the Dairy Statistics.

The distribution of cows in the region can also be estimated using DIGAD data and the changes between 1995 and 2015 are presented in Figure 40. In 2015 the heaviest populated areas for dairying were around Patoka, between Blackburn and Springhill and Rakautatahi. These areas also experiences the largest increase in cow numbers between 1995 and 2015. Summarised by district using Dairy Statistics data, Central Hawkes Bay (the largest dairying area) increased by 240%, with Napier & Hastings increasing by 554% and Gisborne & Wairoa by 97% (Figure 38b). These large percentage increases are driven by the low initial cow numbers in 1995 (only 14,500). In 2015 there are just over 54,500 cows in the region, making it the second smallest dairying region after Marlborough.

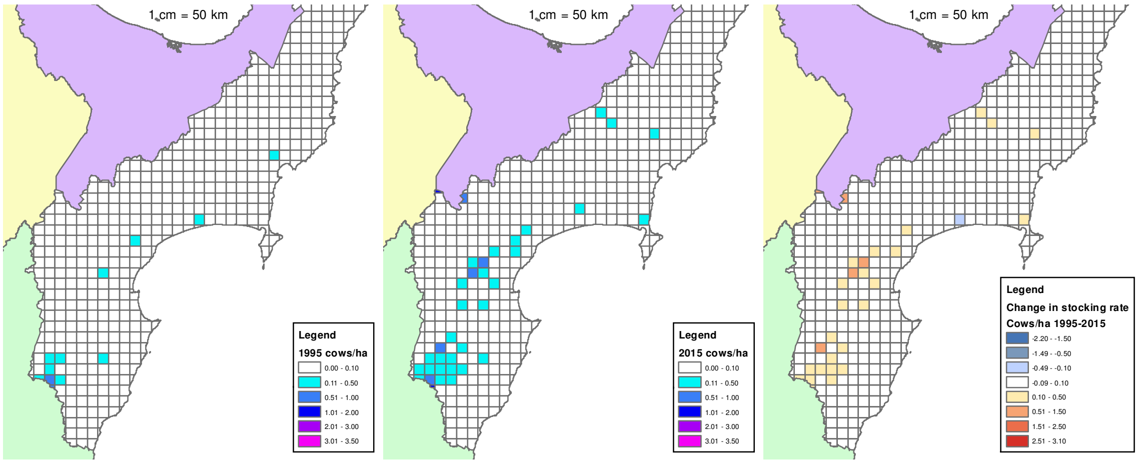

Figure 40. Density (cows/ha) of dairy in the Hawkes Bay and Gisborne regions, summarised by 5000 ha grid cell, for 1995, 2015 and the change between these years. Source DIGAD.

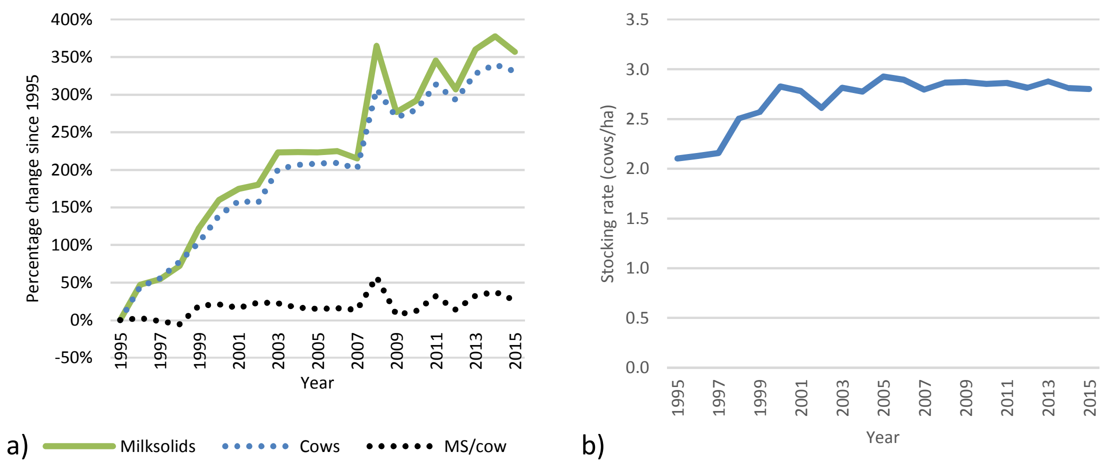

Figure 41. (a) Trend in the percentage change, since 1995, in the total milksolids produced in Hawkes Bay and Gisborne regions and the drivers (number of cows and milk production per cow) behind this change. (b) Trend in stocking rate (cows/ha) since 1995 in the Hawkes Bay and Gisborne Regions. Source Dairy Statistics.

Milksolids production increased by 357% during the period 1995-2015, 26% of which could be attributed to improved milk production per cow and 331% due to more cows (Figure 41a). Note the 331% figure is slightly higher than the 276% increase in cow numbers due to the increased milk production per cow of the new cows over this period. The trend in milksolids appears well correlated with the number of cows, indicating this has been the primary driver of change in the region.

The number of herds in the region has remained static at about 80 herds (Figure 42a). As discussed above, herds exiting the industry will likely result in the existing herds increasing in size (by 175% using dairy statistics data). However, the averages presented in the annual dairy statistics give no insight into the distribution of herd sizes. Distribution data was obtained from DIGAD and is presented in Figure 42b, these data give a similar trend in the mean herd size to the dairy statistics data. More growth has occurred in larger herds with the upper quartile increasing from 254 to 801 cows (215%), compared with the lower quartile, which increased from 128 to 294 cows (131%). This implies that one quarter of herds in this region had less than 294 cows in 2015. The largest herds in the region are around 1500 cows in 2015 (98th percentile). The decrease in the size of larger herds (from 2000 cows in the late 2000s to 1500 cows) likely indicates some of these herds have split into two farms, which would appear as new herds in DIGAD.

The trend in breed is displayed in Figure 43, and indicates that in 2015 the predominant breed in the region was Friesian (42%), followed by Friesian dominant crossbreeds (17%), followed by straight crossbreeds (17%). The number of Friesians declined and the number of cross breed cows increased. Since 1995 the average cow in the region moved from F13 J2 O1 to F11 J4 O1 (out of 16 parts).

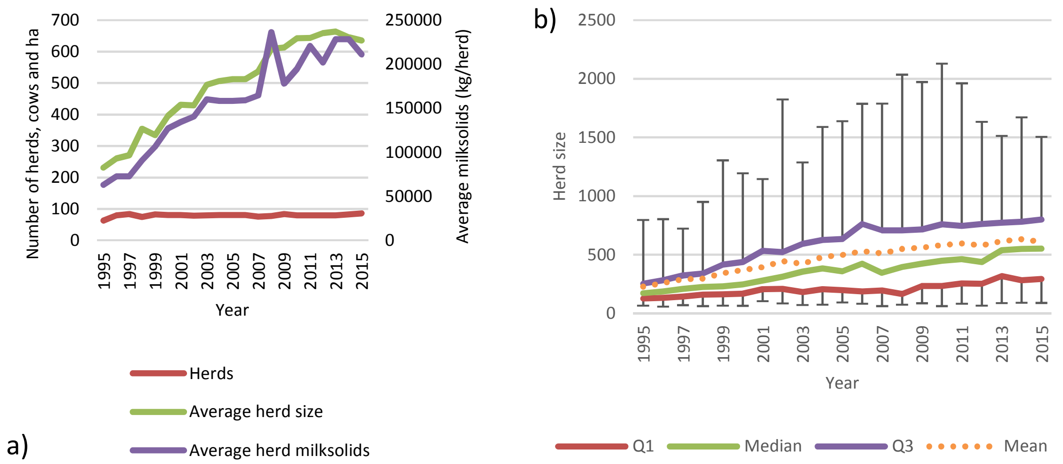

Figure 42. Trend in (a) the number of herds, average herd size and average milk production per herd in the Hawkes Bay and Gisborne Regions. Source Dairy Statistics. (b) the 2nd, 25th (lower quartile, Q3), 50th (median), mean, 75th (upper quartile, Q3) and 98th percentile of herd size. Source DIGAD.

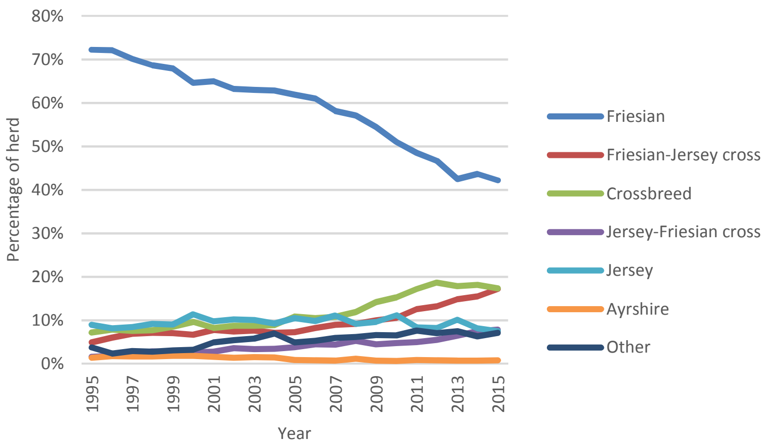

Figure 43. Trend in the breed of cows in Hawkes Bay and Gisborne herds between 1995 and 2015. Source DIGAD.

Key points for Hawkes Bay and Gisborne:

- In 2015 dairying occupied a small amount (1%) of the regions land relative to other regions.
- In 2015 the region had more cows than in 1995, and is growing, or has been growing until recently, with the highest number occurring in 2014.
- The region has been growing at 1,900 cows/year.
- In percentage terms the region has grown significantly, due to having few cows in 1995.
- Despite the growth the region has the second smallest dairy herd after Marlborough.
- The increase in cow numbers has been driven largely by increasing area, as stocking rate has been constant since 2000.
- Herds exiting the industry have been more than offset by an increase in herd size of existing farms. Given stocking rate has been constant since 2000, this indicates as well as some exiting herds likely being incorporated into a neighbouring dairy farm, existing herds have also been incorporating land previously non-dairy. Over half of the increase in cow numbers has been due to new herds.
- The region's milk production has increased, driven by the increase in cow numbers.
- Planned start of calving date moved earlier by 7 days between 1995 and 2015.
- The amount of Friesian declined by 2/16ths since 1995.

Taranaki region

The dairy industry in Taranaki has been relatively static compared with other regions. The change in cows, area and milk production between 1995 and 2015 is presented in Figure 44a. During this time the area in dairy milking platforms decreased by 5%. In 2015 the area in dairy accounted for 22% of the region's land. There were 14% more cows in 2015 than 1995, however this was fewer than the highest number of cows in the year 1996 and the number has remained static since 1997. The 14% net increase in cows was a result of increase in stocking rate (19%), which was offset (-5%) by a decrease in land area (Figure 45a). Stocking rate appears to have plateaued since the 2003 at about 2.8 cows/ha (Figure 47b).

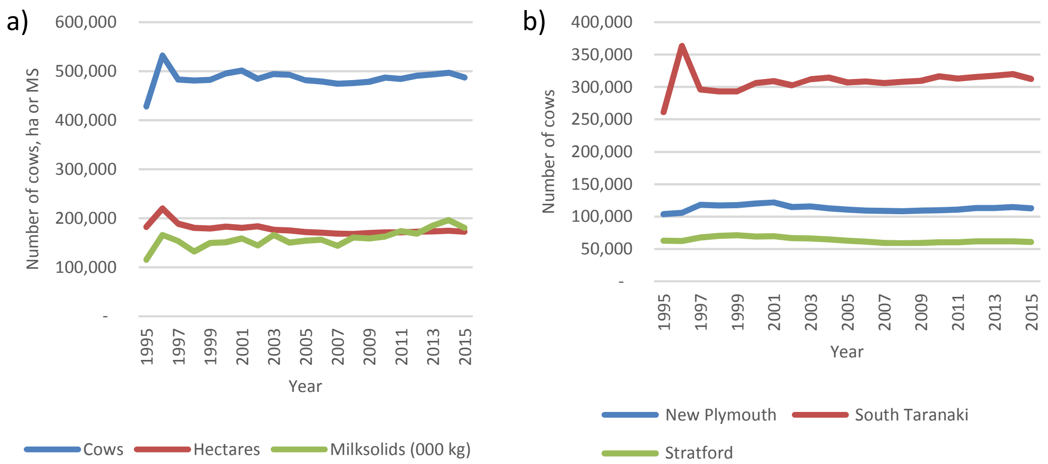

Figure 44. Trend in (a) the number of cows, hectares and milksolids produced in the Taranaki region between 1995 and 2015 and (b) the number of cows per district. Source Dairy Statistics.

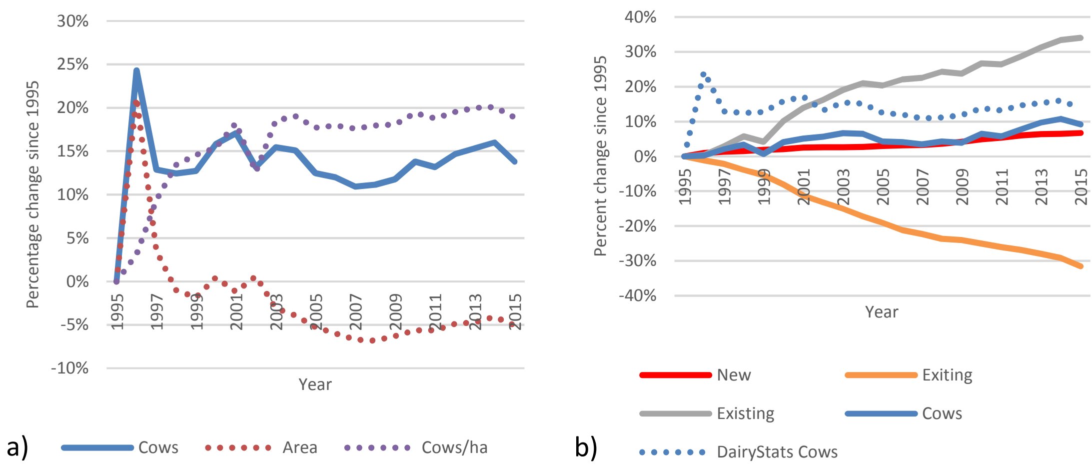

Figure 45. Trend in the percentage of change, since 1995: (a) in total cows and the drivers (area and stocking rate) behind this change. Source Dairy Statistics. (b) in calved cows (including comparison with Dairy Statistics) as a result of new farm conversions, herds exiting the industry, and expansion of existing herds in Taranaki. Source DIGAD.

The underlying reasons behind the increase in cow numbers can be estimated using DIGAD data (Figure 45b). The data indicates a steady rate of herds exiting the industry, responsible for a 32% decrease in cow numbers. Herds could exit the industry due to a change in land use (e.g. dairy support, dry stock, lifestyle or urban), or they could be being bought by a neighbouring dairy farm, which would then appear in the data as an increase in the size of existing herds. In Taranaki cow numbers grew by 34% in existing herds, which could be due to an amalgamation with a neighbouring dairy farm or through incorporating a neighbouring drystock block. There was an 7% increase in cow numbers due to new farm conversions. This indicates than some of exiting herds were taken over by neighbouring dairy farms, as well as the exiting herds increasing in size due to stocking rate. Overall, these combine to an overall net increase of 9% in DIGAD data. This number differs from the 14% increase in cow numbers reported in the Dairy Statistics. The DIGAD data relies on farmers having entered their calving records into the database, which likely explains why the figure is under reported compared to the Dairy Statistics. The trend however follows a similar pattern.

The distribution of cows in the region can also be estimated using DIGAD data and the changes between 1995 and 2015 are presented in Figure 46. In 2015 the heaviest populated areas for dairying were from east of Eltham, towards Opunake on the southern side of Mt Taranaki, as well as Ohawi towards Opunake along the coast. Other areas included the western coastline from Warea down to Oaonui and and Alton in the southern end of the region. Between 1995 and 2015 the area with the largest increase in cow numbers was around Patea and south of Waverley. Summarised by district using Dairy Statistics data, South Taranaki (the largest dairying area) increased by 20%, with New Plymouth increasing by 9% and Stratford decreasing by 3% (Figure 44b).

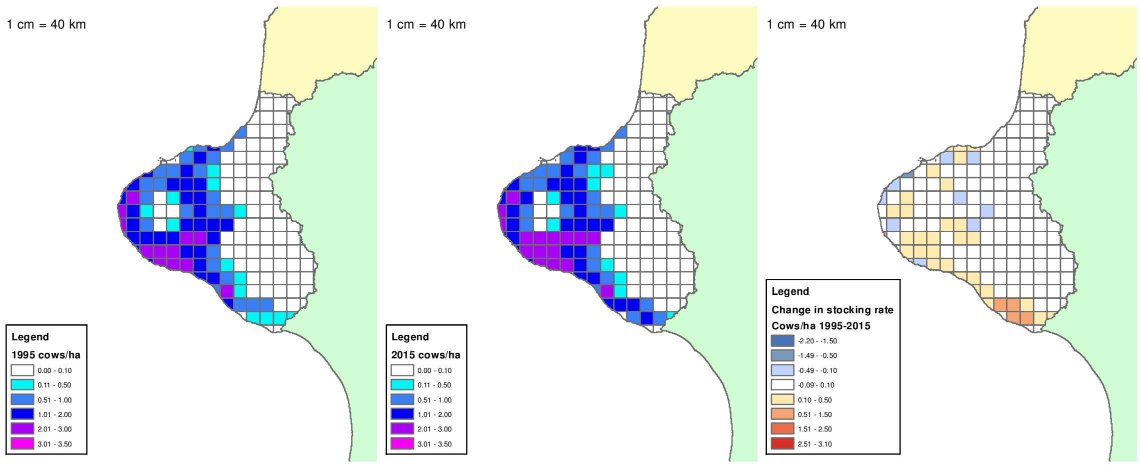

Figure 46. Density (cows/ha) of dairy in the Taranaki region, summarised by 5000 ha grid cell, for 1995, 2015 and the change between these years. Source DIGAD.

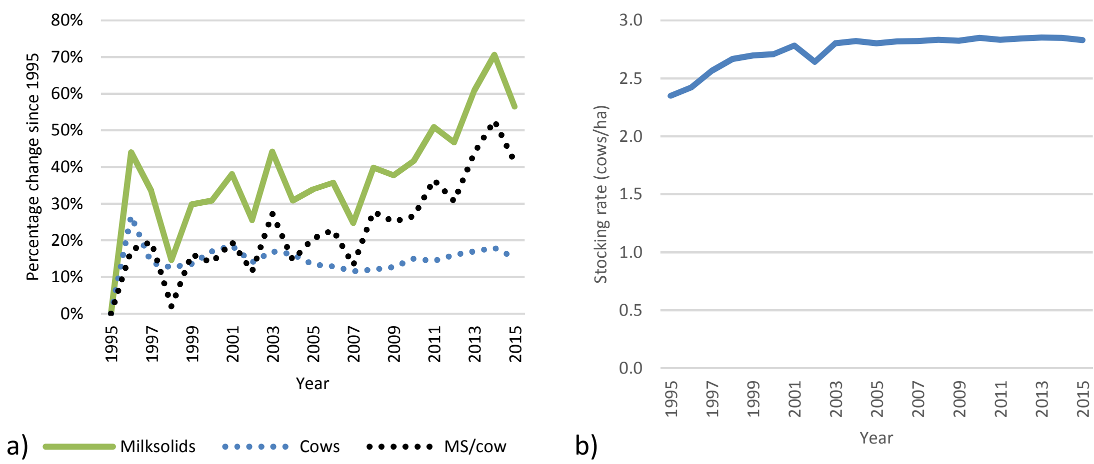

Figure 47. (a) Trend in the percentage change, since 1995, in the total milksolids produced in Taranaki and the drivers (number of cows and milk production per cow) behind this change. (b) Trend in stocking rate (cows/ha) since 1995 in the Taranaki Region. Source Dairy Statistics.

Milksolids production increased by 56% during the period 1995-2015, 41% of which could be attributed to improved milk production per cow and 15% due to more cows (Figure 47a). Note the 15% figure is slightly higher than the 14% increase in cow numbers due to the increased milk production per cow of the new cows over this period. Improved milk production per cow could be due to improved farm management, animal genetics, or more imported feed such as palm kernel expeller. The trend in milksolids appears well correlated with the milksolids production per cow, likely indicating significant climatic influence in the region, which is subject to summer drought.

The number of herds in the region declined significantly, particularly during the years from 1995 to 2007, after which it remained relatively static about 1,700 herds (Figure 48a). As discussed above, herds exiting the industry will likely result in the existing herds increasing in size (by 73% using dairy statistics data). However, the averages presented in the annual dairy statistics give no insight into the distribution of herd sizes. Distribution data was obtained from DIGAD and is presented in Figure 48b, these data give a similar trend in the mean herd size to the dairy statistics data. More growth has occurred in larger herds with the upper quartile increasing from 210 to 362 cows (72%), compared with the lower quartile, which increased from 127 to 193 cows (52%). This implies that one quarter of herds in Taranaki had less than 193 cows in 2015. The largest herds in Taranaki are around 750 cows (98th percentile).

The trend in breed is displayed in Figure 49, and indicates that in 2015 the predominant breed in the region was Friesian (31%), followed by Friesian dominant crossbreeds (19%), followed by straight Jerseys (18%). The number of Friesians declined and the number of cross breed cows increased. Since 1995 the average cow in the region moved from F8 J7 O1 to F8 J6 O2 (out of 16 parts).

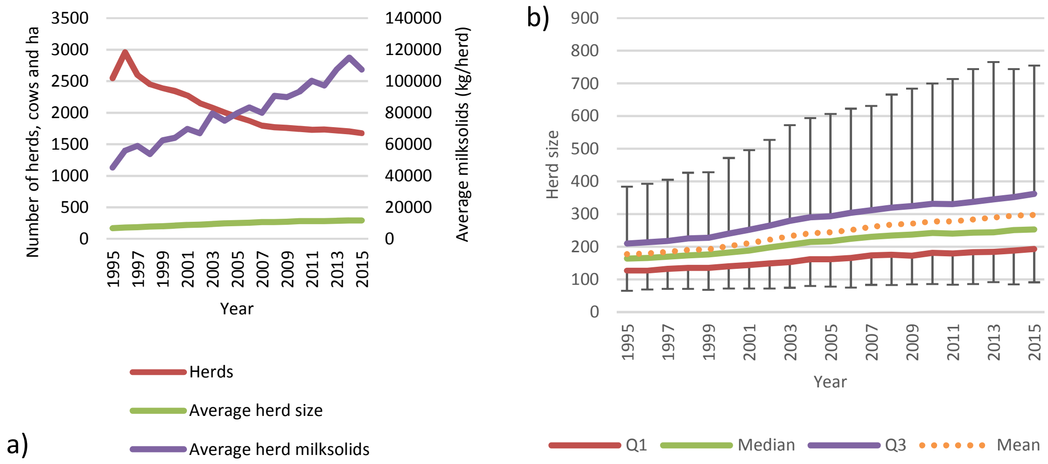

Figure 48. Trend in (a) the number of herds, average herd size and average milk production per herd in the Taranaki Region. Source Dairy Statistics. (b) the 2nd, 25th (lower quartile, Q3), 50th (median), mean, 75th (upper quartile, Q3) and 98th percentile of herd size. Source DIGAD.

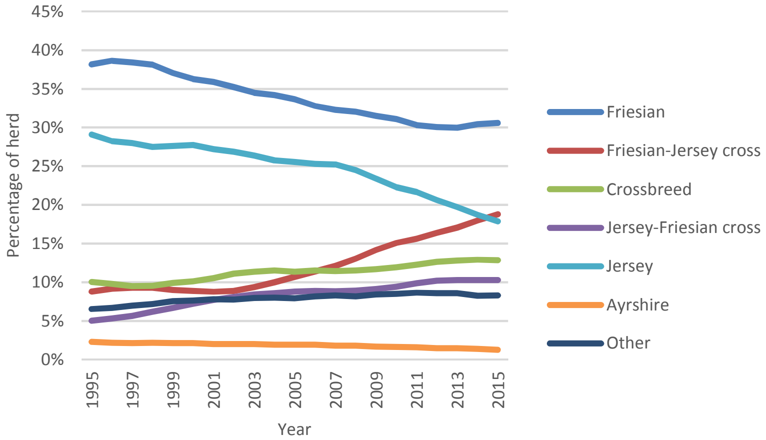

Figure 49. Trend in the breed of cows in Taranaki herds between 1995 and 2015. Source DIGAD.

Key points for Taranaki:

- In 2015 dairying occupied a significant amount (22%) of the regions land, the greatest of all regions.
- In 2015 the region had more cows than in 1995, but 45,000 fewer cows that the peak number in 1996.
- There has been a decrease in dairy land area, which has been offset by an increase in stocking rate – although this has been static since 2003.
- Herds exiting the industry have been largely offset by an increase in herd size of existing farms (e.g. many of the exiting herds may have been incorporated into a neighbouring farm, inclusion of previously non-dairy land, or increase in stocking rate up to 2003). There have been a small amount of new herds.
- The growth has been mostly in South Taranaki, with potentially new herds located around Patea.
- Changes in milk production appear driven by changes in milk production per cow.
- Planned start of calving date moved earlier by 6 days between 1995 and 2015.

Manawatu-Wanganui region

The dairy industry in Manawatu-Wanganui has experienced growth. The change in cows, area and milk production between 1995 and 2015 is presented in Figure 50a. During this time the area in dairy milking platforms increased by 29%. In 2015 the area in dairy accounted for 5% of the region's land. There were 47% more cows in 2015 than 1995, with two period of growth, between 1995 and 2001 and between 2007 and 2014. The 47% net increase in cows was a result of increase in stocking rate (15%) and an increase in land area (32%; Figure 51a). The effect of the increasing land area (32%) was higher than the actual change in land area (29%) due to an increase in stocking rate over this period (Figure 53b) – see Figure 1 for explanation. Stocking rate appears to have plateaued since the 2006 at just over 2.7 cows/ha.

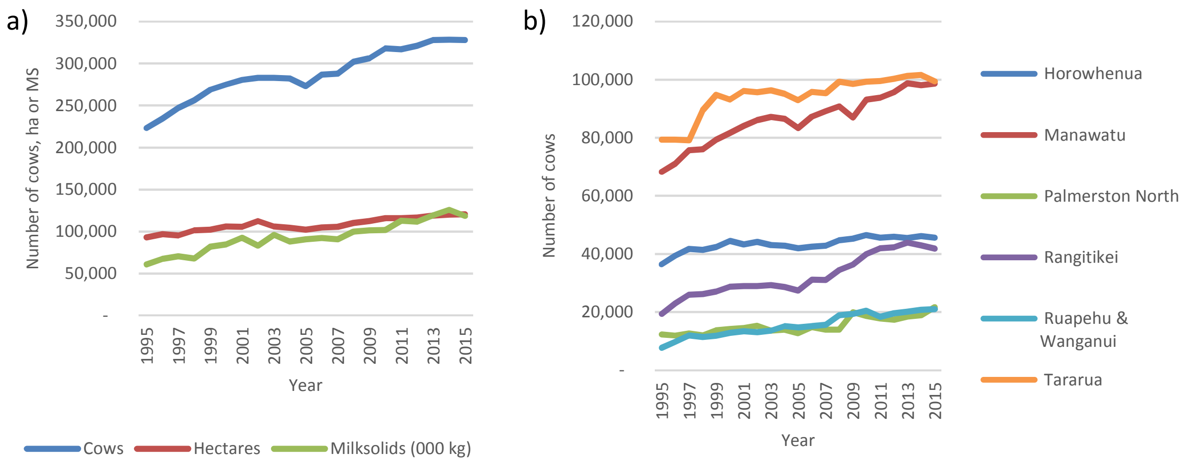

Figure 50. Trend in (a) the number of cows, hectares and milksolids produced in the Manawatu-Wanganui region between 1995 and 2015 and (b) the number of cows per district. Source Dairy Statistics.

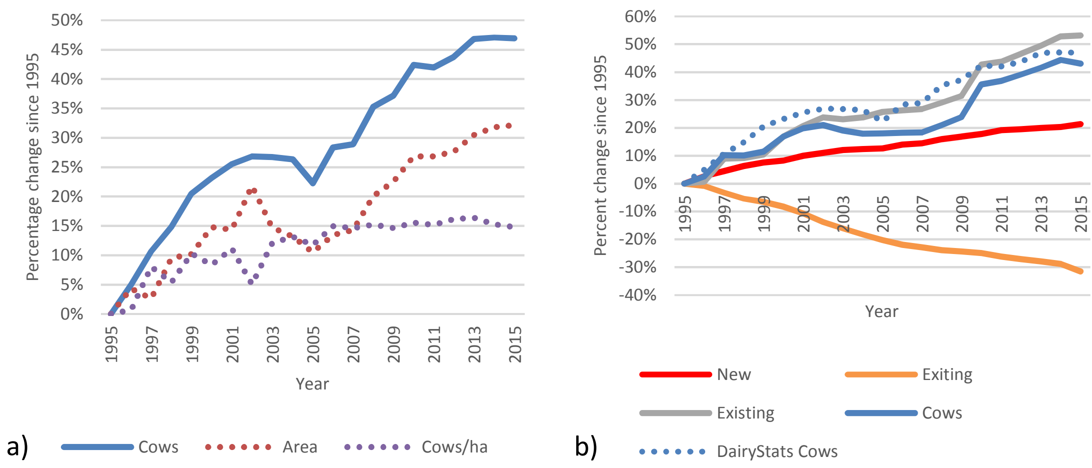

Figure 51. Trend in the percentage of change, since 1995: (a) in total cows and the drivers (area and stocking rate) behind this change. Source Dairy Statistics. (b) in calved cows (including comparison with Dairy Statistics) as a result of new farm conversions, herds exiting the industry, and expansion of existing herds in Manawatu-Wanganui. Source DIGAD.

The underlying reasons behind the increase in cow numbers can be estimated using DIGAD data (Figure 51b). The data indicates a steady rate of herds exiting the industry, responsible for a 32% decrease in cow numbers. Herds could exit the industry due to a change in land use (e.g. dairy support, dry stock, lifestyle or urban), or they could be being bought by a neighbouring dairy farm, which would then appear

in the data as an increase in the size of existing herds. In Manawatu-Wanganui cow numbers grew by 53% in existing herds, which could be due to an amalgamation with a neighbouring dairy farm, through incorporating a neighbouring drystock block or an increase in stocking rate. There was an 21% increase in cow numbers due to new farm conversions. Therefore it appears that the change in cow number is partly due to new herds and partly due to an increase in existing herds. Overall, these combine to an overall net increase of 43% in DIGAD data. This number differs from the 47% increase in cow numbers reported in the Dairy Statistics. The DIGAD data relies on farmers having entered their calving records into the database, which likely explains why the figure is under reported compared to the Dairy Statistics. The trend however follows a similar pattern.

The distribution of cows in the region can also be estimated using DIGAD data and the changes between 1995 and 2015 are presented in Figure 52. Dairying in concentrated at the southern end of the region. In 2015 the heaviest populated areas for dairying were around Norsewood, north of Oringi and Woodville on the eastern side of the ranges, and west of Sanson and Rongotea, between Longburn and Linton, Foxton and the area north and west of Shannon. Between 1995 and 2015 the areas with the largest increases in cow numbers were between Kakahi and Owhango in the north, between Beaconsfield and Stanway, Carnarvon, Foxton and Poroutawhao. Summarised by district using Dairy Statistics data, Tararua (the largest dairying area) increased by 25%, with Manawatu increasing by 44%, Horowhenua increasing by 25%, Rangitikei by 116%, Palmerston North by 77% and the smallest districts Ruapehu and Wanganui, which started with just over 7,500 cows by 173% (Figure 50b).

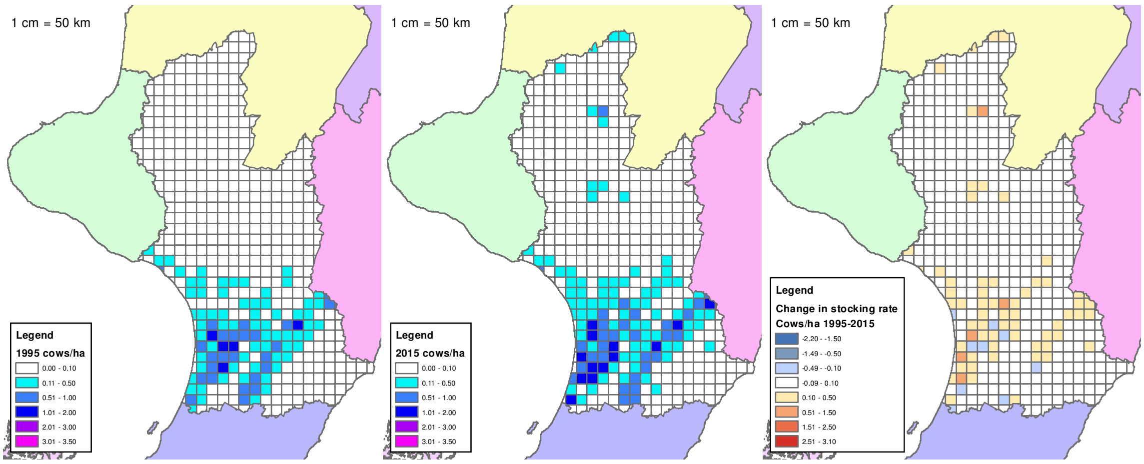

Figure 52. Density (cows/ha) of dairy in the Manawatu-Wanganui region, summarised by 5000 ha grid cell, for 1995, 2015 and the change between these years. Source DIGAD.

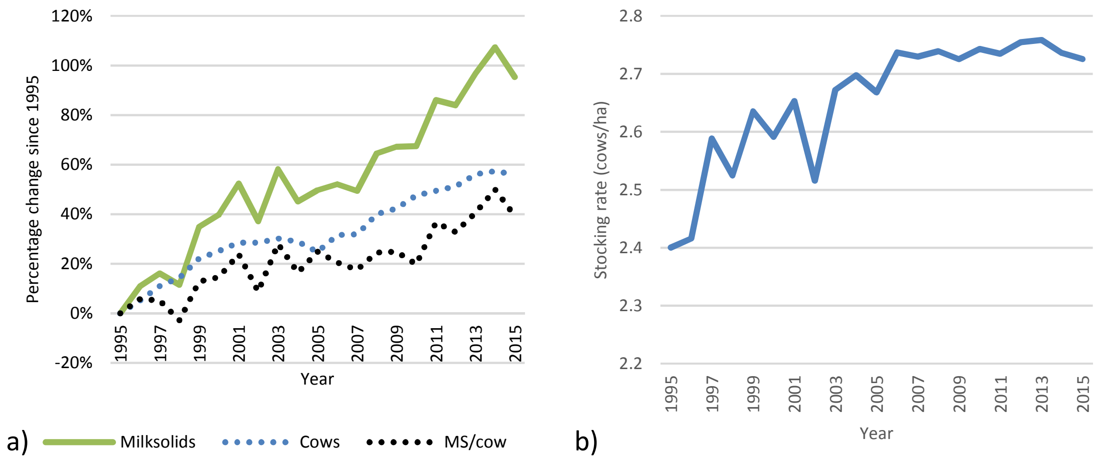

Figure 53. (a) Trend in the percentage change, since 1995, in the total milksolids produced in Manawatu-Wanganui and the drivers (number of cows and milk production per cow) behind this change. (b) Trend in stocking rate (cows/ha) since 1995 in the Manawatu-Wanganui Region. Source Dairy Statistics.

Milksolids production increased by 95% during the period 1995-2015, 39% of which could be attributed to improved milk production per cow and 56% due to more cows (Figure 53a). Note the 56% figure is slightly higher than the 47% increase in cow numbers due to the increased milk production per cow of the new cows over this period. Improved milk production per cow could be due to improved farm management, animal genetics, or more imported feed such as palm kernel expeller. The trend in milksolids appears correlated with the milksolids production per cow, possibly indicating significant climatic influence in the region.

The number of herds in the region declined significantly, particularly during the years from 1995 to 2005, after which it remained relatively static at just over 850 herds (Figure 54a). As discussed above, herds exiting the industry will likely result in the existing herds increasing in size (by 82% using dairy statistics data). However, the averages presented in the annual dairy statistics give no insight into the distribution of herd sizes. Distribution data was obtained from DIGAD and is presented in Figure 54b, these data give a similar trend in the mean herd size to the dairy statistics data. More growth has occurred in larger herds with the upper quartile increasing from 241 to 462 cows (92%), compared with the lower quartile, which increased from 131 to 225 cows (72%). This implies that one quarter of herds in the region had less than 225 cows in 2015. The largest herds in the region are around 1050 cows (98th percentile). The small decrease in the size of larger herds (from 1150 cows in 2011 to 1050 cows) likely indicates some of these herds have split into two farms, which would appear as new herds in DIGAD.

The trend in breed is displayed in Figure 55, and indicates that in 2015 the predominant breed in the region was Friesian (43%), followed by Friesian dominant crossbreeds (16%), followed by Jerseys (14%). The number of Friesians declined and the number of cross breed cows increased. Since 1995 the average cow in the region moved from F11 J4 O1 to F10 J5 O1 (out of 16 parts).

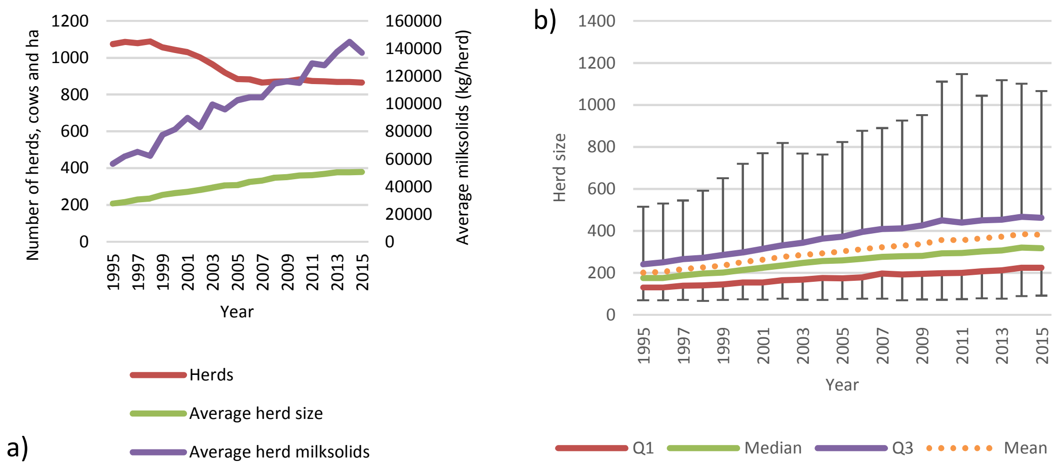

Figure 54. Trend in (a) the number of herds, average herd size and average milk production per herd in the Manawatu-Wanganui Region. Source Dairy Statistics. (b) the 2nd, 25th (lower quartile, Q3), 50th (median), mean, 75th (upper quartile, Q3) and 98th percentile of herd size. Source DIGAD.

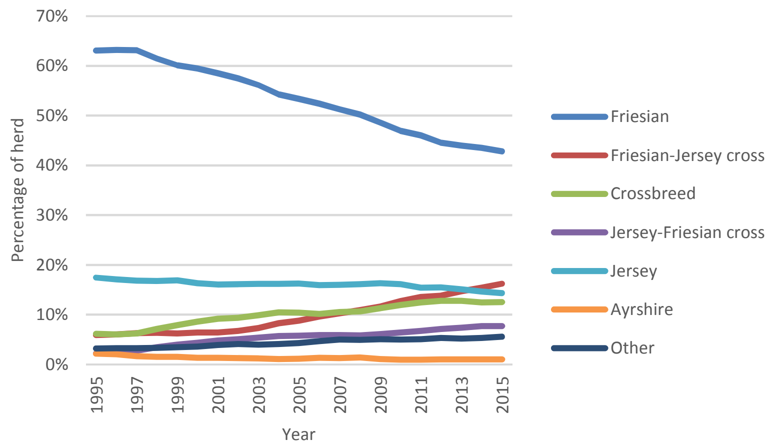

Figure 55. Trend in the breed of cows in Manawatu-Wanganui herds between 1995 and 2015. Source DIGAD.

Key points for Manawatu-Wanganui:

- In 2015 dairying occupied a small amount (5%) of the regions land similar to many other regions.
- In 2015 the region had more cows than in 1995, and is growing, or has been growing until recently, with the highest number occurring in 2014.
- The region has been growing at 4,800 cows/year.
- The increase in cow numbers was driven by increasing area and stocking rate until 2007, since then stocking rate has been constant and the increase has been driven by area.
- Herds exiting the industry have been more than offset by an increase in herd size of existing farms. Given stocking rate has been constant since 2007, this indicates as well as some exiting herds likely being incorporated into a neighbouring dairy farm, existing herds have also been incorporating land previously non-dairy. Over half of the increase in cow numbers has been due to new herds.
- The Tararua District expanded in the late 1990s, with more recent growth occurring in the Rangitikei and Manawatu Districts.

- The region’s milk production has increased, driven by the increase in cow numbers as well as milk production per cow.
- Planned start of calving date moved earlier by 4 days between 1995 and 2015.
- The amount of Friesian declined by 1/16th since 1995.

Wellington region

The dairy industry in Wellington experienced growth between 1995 and 1998 but has been relatively static since. The change in cows, area and milk production between 1995 and 2015 is presented in Figure 56a. During this time the area in dairy milking platforms increased by 9%. In 2015 the area in dairy accounted for 3% of the region's land. There were 27% more cows in 2015 than 1995, the number of cows has been constant since 1998. The 27% net increase in cows was a result of increase in stocking rate (17%), and an increase in land area (9%; Figure 57a). Stocking rate may have plateaued at about 2.8 cows/ha (Figure 59b).

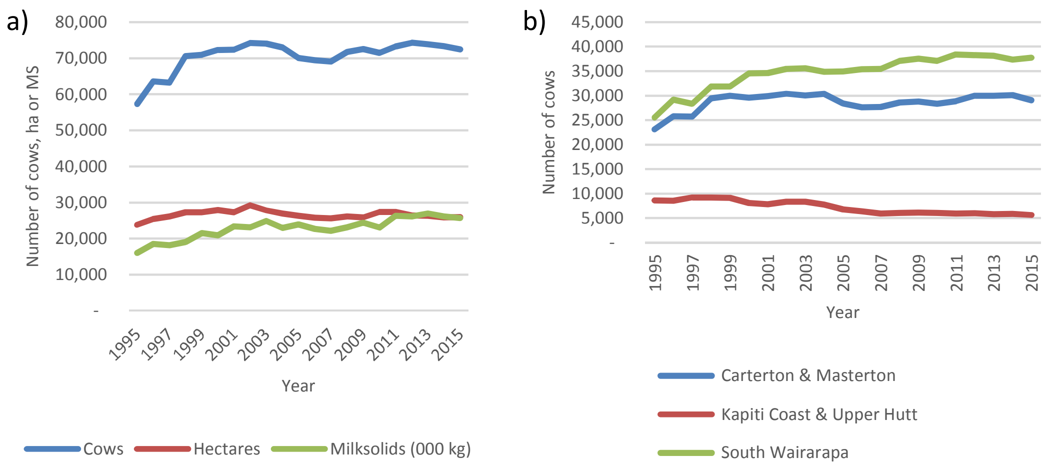

Figure 56. Trend in (a) the number of cows, hectares and milksolids produced in the Wellington region between 1995 and 2015 and (b) the number of cows per district. Source Dairy Statistics.

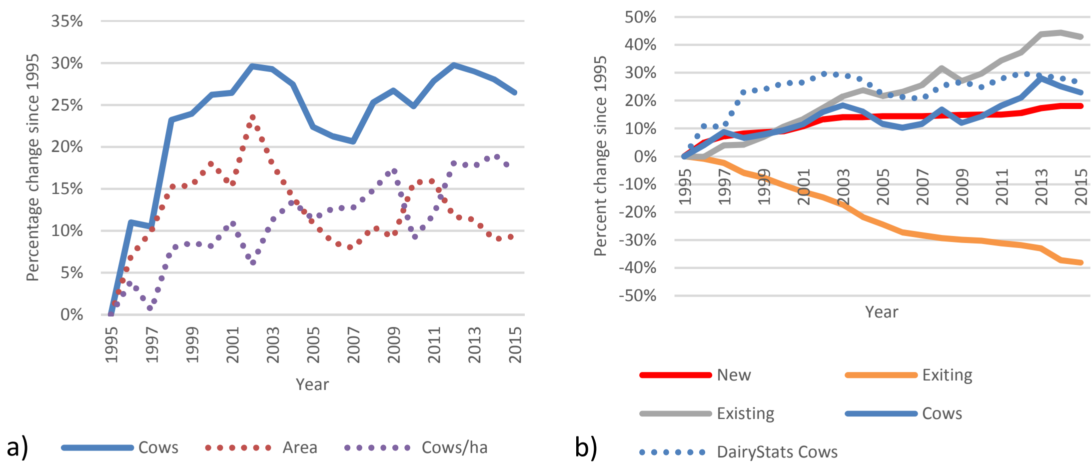

Figure 57. Trend in the percentage of change, since 1995: (a) in total cows and the drivers (area and stocking rate) behind this change. Source Dairy Statistics. (b) in calved cows (including comparison with Dairy Statistics) as a result of new farm conversions, herds exiting the industry, and expansion of existing herds in Wellington. Source DIGAD.

The underlying reasons behind the increase in cow numbers can be estimated using DIGAD data (Figure 57b). The data indicates a steady rate of herds exiting the industry, responsible for a 38% decrease in cow numbers. Herds could exit the industry due to a change in land use (e.g. dairy support, dry stock, lifestyle or urban), or they could be being bought by a neighbouring dairy farm, which would then appear in the data as an increase in the size of existing herds. In Wellington cow numbers grew by 43% in existing herds, which could be due to an amalgamation with a neighbouring dairy farm or through incorporating a neighbouring drystock block. There was an 18% increase in cow numbers due to new farm conversions. Therefore, most of the growth appears to have been from new conversions with some increase in stocking rate. Overall, these combine to an overall net increase of 23% in DIGAD data. This number differs slightly from the 26% increase in cow numbers reported in the Dairy Statistics. The DIGAD data relies on farmers having entered their calving records into the database, which likely explains why the figure is under reported compared to the Dairy Statistics.

The distribution of cows in the region can also be estimated using DIGAD data and the changes between 1995 and 2015 are presented in Figure 58. In 2015 the heaviest populated areas for dairying were between Carterton and Greytown, and between Kaiwaiwai and Kahutara. Between 1995 and 2015 the area with the largest increase in cow numbers was along the eastern side of the ranges. Summarised by district using Dairy Statistics data, South Wairarapa (the largest dairying area) increased by 48%, with Carterton & Masterton districts increasing by 26% and the Kapiti Coast and Upper Hutt districts decreasing by 34%, now having only 5,600 cows (Figure 56b).

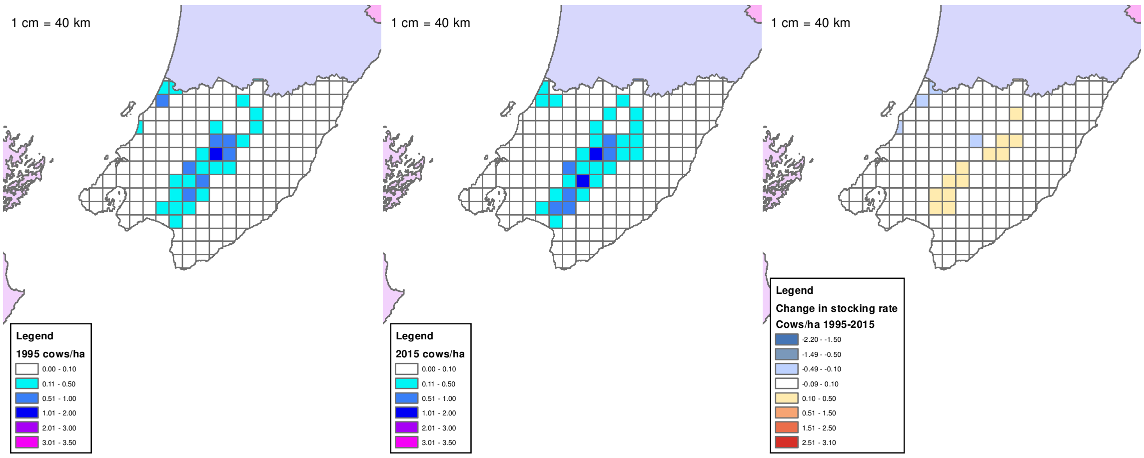

Figure 58. Density (cows/ha) of dairy in the Wellington region, summarised by 5000 ha grid cell, for 1995, 2015 and the change between these years. Source DIGAD.

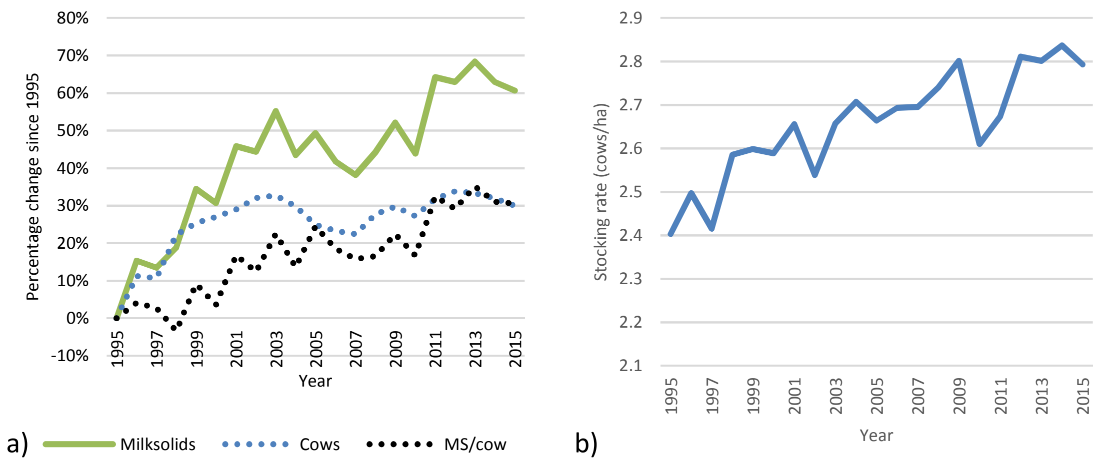

Figure 59. (a) Trend in the percentage change, since 1995, in the total milksolids produced in Wellington and the drivers (number of cows and milk production per cow) behind this change. (b) Trend in stocking rate (cows/ha) since 1995 in the Wellington Region. Source Dairy Statistics.

Milksolids production increased by 61% during the period 1995-2015, half of which could be attributed to improved milk production per cow and half due to more cows (Figure 59a). Improved milk production per cow could be due to improved farm management, animal genetics, or more imported feed such as palm kernel expeller or home grown feed via irrigation. The trend in milksolids appears correlated with the milksolids production per cow, likely indicating significant climatic influence in the region, which is subject to summer dry.

The number of herds in the region has declined, particularly during the years from 1995 to 2007, after which it has remained relatively static at just under 200 herds (Figure 60a). As discussed above, herds exiting the industry will likely result in the existing herds increasing in size (by 95% using dairy statistics data). However, the averages presented in the annual dairy statistics give no insight into the distribution of herd sizes. Distribution data was obtained from DIGAD and is presented in Figure 60b, these data give a similar trend in the mean herd size to the dairy statistics data. More growth has occurred in larger herds with the upper quartile increasing from 267 to 531 cows (99%), compared with the lower quartile, which increased from 143 to 237 cows (66%). This implies that one quarter of herds in Wellington had less than 237 cows in 2015. The largest herds in Wellington are around 1100 cows (98th percentile).

The trend in breed is displayed in Figure 61, and indicates that in 2015 the predominant breed in the region was Friesian (42%), followed by Crossbreeds (16%), followed by straight Friesian dominant crossbreeds (14%). The number of Friesians declined and the number of cross breed cows increased. Since 1995 the average cow in the region moved from F11 J4 O1 to F10 J5 O1 (out of 16 parts).

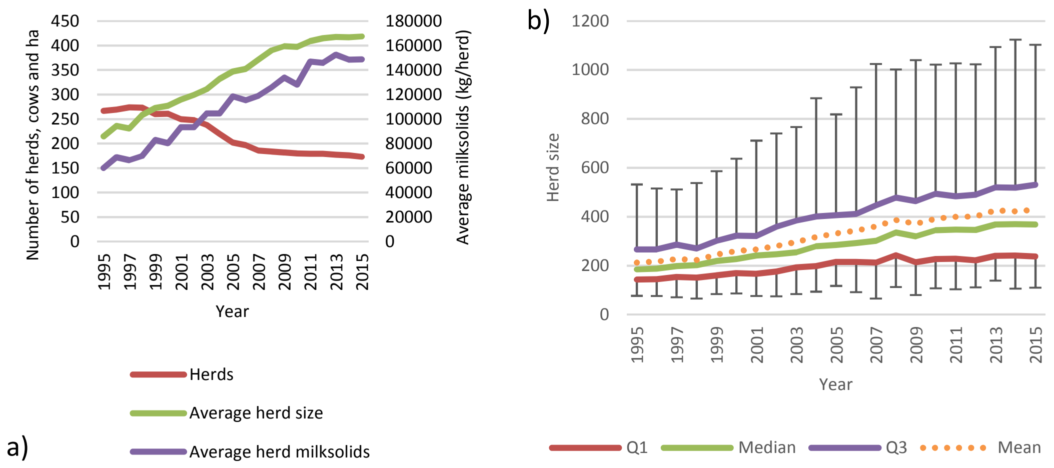

Figure 60. Trend in (a) the number of herds, average herd size and average milk production per herd in the Wellington Region. Source Dairy Statistics. (b) the 2^{nd}, 25^{th} (lower quartile, Q3), 50^{th} (median), mean, 75^{th} (upper quartile, Q3) and 98^{th} percentile of herd size. Source DIGAD.

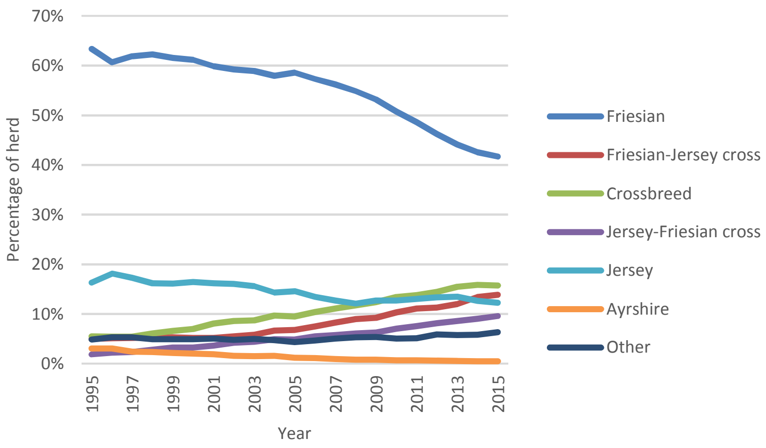

Figure 61. Trend in the breed of cows in Wellington herds between 1995 and 2015. Source DIGAD.

Key points for Wellington:

- In 2015 dairying occupied a small amount (3%) of the regions land, similar to many other regions.
- In 2015 the region had more cows than in 1995, but the number of cows has been relatively static since 1998 with peaks in 2002 and 2012. There are now 1,900 fewer cows than peak.
- Herds exiting the industry have been largely offset by an increase in herd size of existing farms (e.g. many of the exiting herds may have been incorporated into a neighbouring farm, and there has been an increase in stocking rate indicating there may have been little inclusion of previously non-dairy land into existing farms). More than half of the new cows have been in new herds.
- The growth has been mostly in South Wairarapa, with a decrease in the number of cows on the Kapiti Coast and in Upper Hutt.
- Changes in milk production appear driven equally by the number of cows and by milk production per cow.
- Planned start of calving date moved earlier by 3 days between 1995 and 2015.
- The amount of Friesian declined by 1/16th since 1995.

Marlborough region

The dairy industry in Marlborough has been relatively static compared with other regions. The change in cows, area and milk production between 1995 and 2015 is presented in Figure 62. In 2015 it was the region with the fewest cows in the country at just over 17,000. During this time the area in dairy milking platforms decreased by 14%. In 2015 the area in dairy accounted for 1% of the region's land. There were 3% more cows in 2015 than 1995, however this was fewer than the highest number of cows in 1998. The 3% net increase in cows was a result of increase in stocking rate (10%), which was offset (-7%) by a decrease in land area (Figure 63a). The effect of the decreasing land area (-7%) was less than the actual change in land area (-14%) due to an increase in stocking rate over this period (Figure 65b) – see Figure 1 for explanation. Stocking rate appears to have plateaued at just under 3 cows/ha.

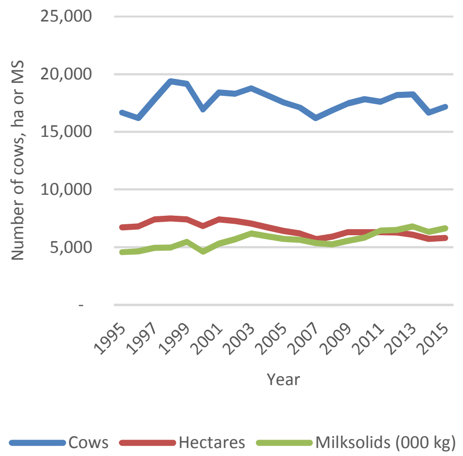

Figure 62. Trend in the number of cows, hectares and milksolids produced in the Marlborough region/district between 1995 and 2015. Source Dairy Statistics.

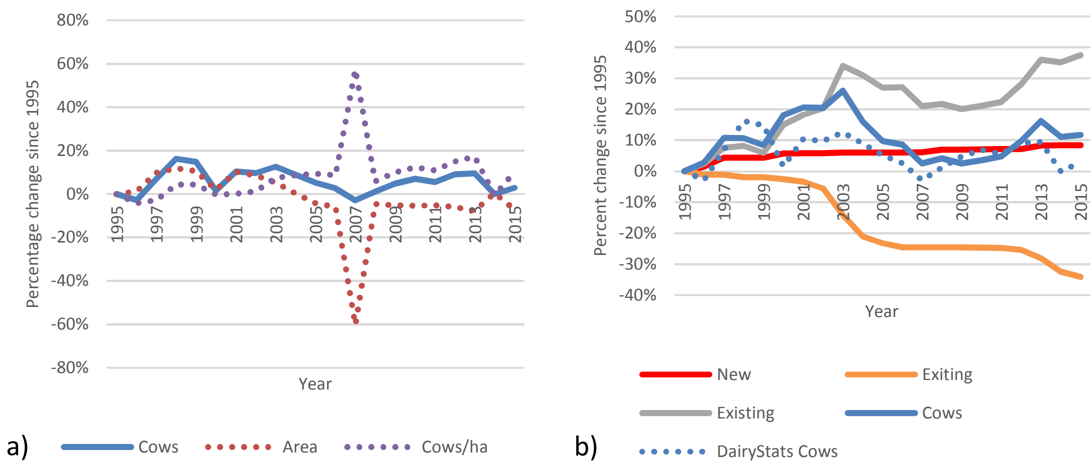

Figure 63. Trend in the percentage of change, since 1995: (a) in total cows and the drivers (area and stocking rate) behind this change. Source Dairy Statistics. (b) in calved cows (including comparison with Dairy Statistics) as a result of new farm conversions, herds exiting the industry, and expansion of existing herds in Marlborough. Source DIGAD.

The underlying reasons behind the increase in cow numbers can be estimated using DIGAD data (Figure 63b). The data indicates a steady rate of herds exiting the industry, responsible for a 34% decrease in cow numbers. There appears to have been two waves, between about 2001 and 2005 and again since 2012. Herds could exit the industry due to a change in land use (e.g. dairy support, dry stock, lifestyle or urban), or they could be being bought by a neighbouring dairy farm, which would then appear in the data as an increase in the size of existing herds. In Marlborough cow numbers grew by 37% in existing herds, which could be due to an amalgamation with a neighbouring dairy farm or through incorporating a neighbouring drystock block. There was an 12% increase in cow numbers due to new farm conversions. Overall, these combine to an overall net increase of 12% in DIGAD data. This number differs from the 3% increase in cow numbers reported in the Dairy Statistics. This is one of five regions where the dairy statistics report fewer cows than DIGAD. The DIGAD data relies on farmers having entered their calving records into the database. Given the percentages are relative to 1995 it is likely this figure was under reported in DIGAD in this year.

The distribution of cows in the region can also be estimated using DIGAD data and the changes between 1995 and 2015 are presented in Figure 64. In 2015 the densest area for dairying was the Pelorus Bridge/Rai Valley area. Between 1995 and 2015 the Grovetown/Wairau Pa area decreased in cow numbers.

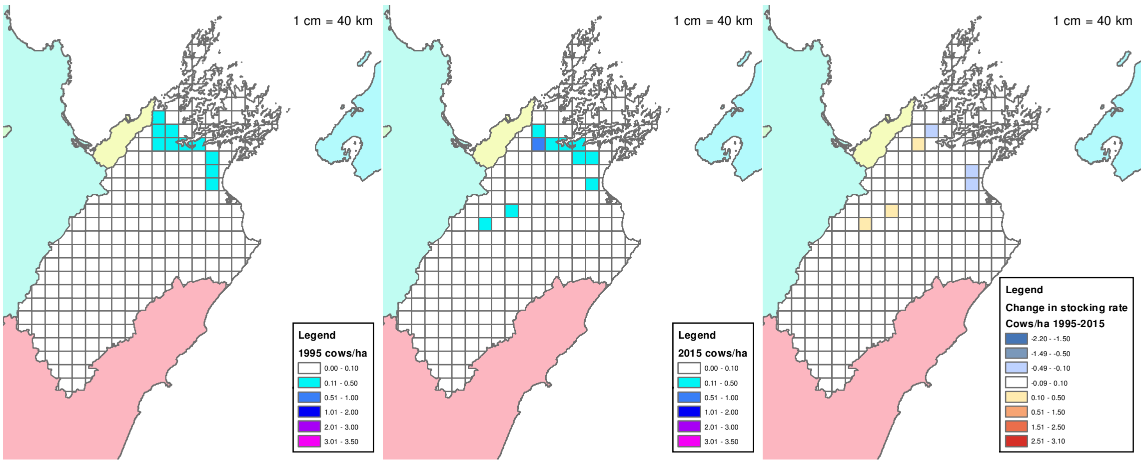

Figure 64. Density (cows/ha) of dairy in the Marlborough region, summarised by 5000 ha grid cell, for 1995, 2015 and the change between these years. Source DIGAD.

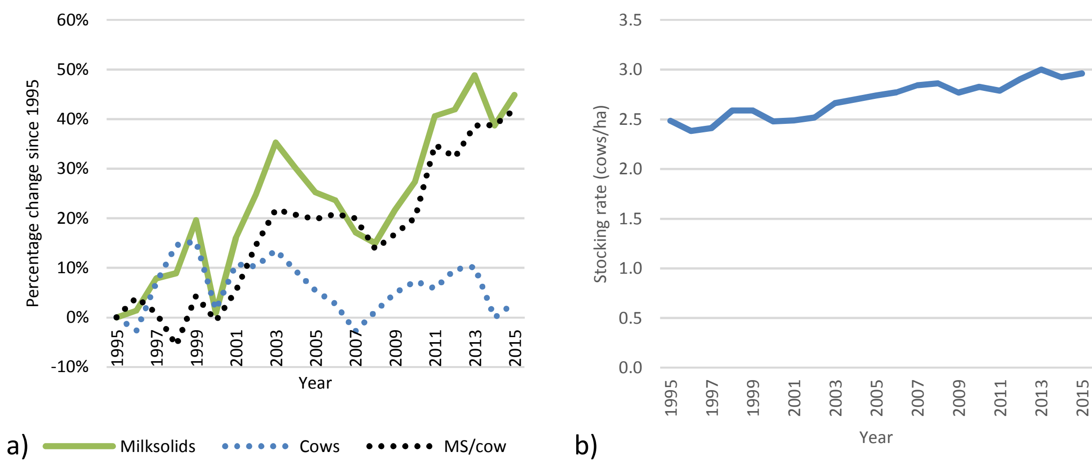

Figure 65. (a) Trend in the percentage change, since 1995, in the total milksolids produced in Marlborough and the drivers (number of cows and milk production per cow) behind this change. (b) Trend in stocking rate (cows/ha) since 1995 in the Marlborough Region. Source Dairy Statistics.

Milksolids production increased by 45% during the period 1995-2015, 42% of which could be attributed to improved milk production per cow and 3% due to more cows (Figure 5). Improved milk production per cow could be due to improved farm management, animal genetics, or more imported feed such as palm kernel expeller. The trend in milksolids appears well correlated with the milksolids production per cow, indicating a climatic influence in the region.

The number of herds in the region has decline, particularly during the years from 2001 to 2005, after which it has remained relatively static at about 60 herds (Figure 65a). As discussed above, herds exiting the industry will likely result in the existing herds increasing in size (by 58% using dairy statistics data). However, the averages presented in the annual dairy statistics give no insight into the distribution of herd sizes. Distribution data was obtained from DIGAD and is presented in Figure 65b, these data give a similar trend in the mean herd size to the dairy statistics data. More growth has occurred in larger herds with the upper quartile increasing from 234 to 391 cows (67%), compared with the lower quartile, which increased from 113 to 158 cows (40%). This implies that one quarter of herds in Marlborough had less than 158 cows in 2015. The largest herds in Marlborough are about 750 cows (98th percentile).

The trend in breed is displayed in Figure 67, and indicates that in 2015 the predominant breed in the region was Friesian (35%), followed by Jersey (18%). The number of Friesians declined and the number of cross breed cows increased. Since 1995 the average cow in the region moved from F10 J5 O1 to F9 J6 O1 (out of 16 parts).

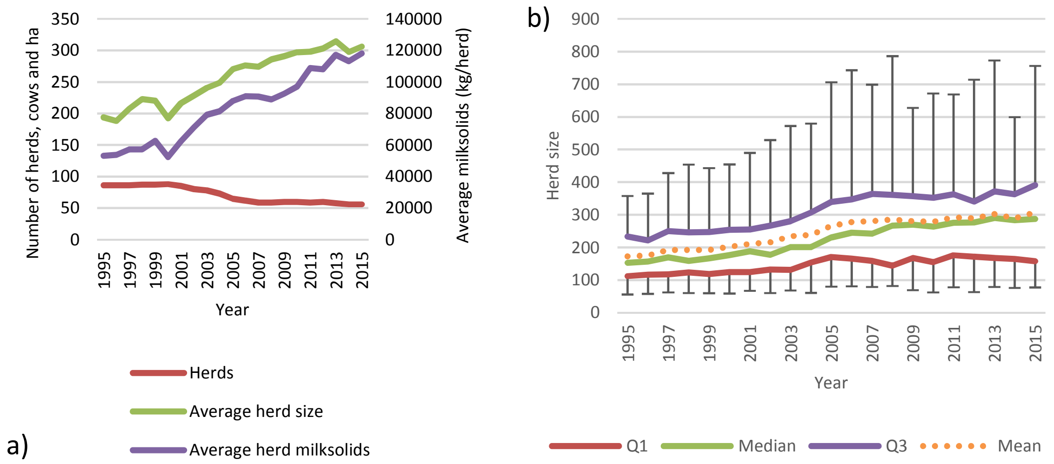

Figure 66. Trend in (a) the number of herds, average herd size and average milk production per herd in the Marlborough Region. Source Dairy Statistics. (b) the 2^{nd}, 25^{th} (lower quartile, Q3), 50^{th} (median), mean, 75^{th} (upper quartile, Q3) and 98^{th} percentile of herd size. Source DIGAD.

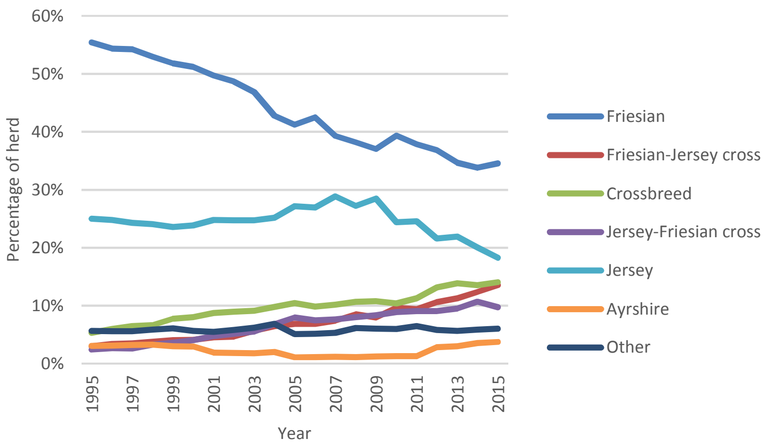

Figure 67. Trend in the breed of cows in Marlborough herds between 1995 and 2015. Source DIGAD.

Key points for Marlborough:

- Marlborough is the region with the fewest cows
- In 2015 dairying occupied a small amount (1%) of the regions land
- In 2015 the region had a slightly more cows than in 1995, but 2,200 fewer cows than the peak number in 1998.
- The area in dairy has decreased by 14%, which has been offset by an increase in stocking rate.
- Herds exiting the industry have been offset by an increase in herd size of existing farms. Given the decrease in land area, it appears not all of these herds have been absorbed by neighbouring dairy farms nor have existing herds been incorporating much previously non-dairy land. There have been a small number of new herds.
- Dairying is largely concentrated in the north of the region.
- Increases in milk production appear driven by milk production per cow.
- Planned start of calving date moved earlier by 8 days between 1995 and 2015.
- The amount of Friesian declined by 1/16th since 1995.

Tasman & Nelson regions

The dairy industry in Tasman & Nelson has experienced mild growth. The change in cows, area and milk production between 1995 and 2015 is presented in Figure 68. During this time the area in dairy milking platforms increased by 21%. In 2015 the area in dairy accounted for 2% of the region's land. There were 35% more cows in 2015 than 1995, which appeared to peak in 2014. The 35% net increase in cows was a result of increase in stocking rate (12%), and land area (23%; Figure 69a). The effect of the increasing land area (23%) was greater than the actual change in land area (21%) due to an increase in stocking rate over this period (Figure 71b) – see Figure 1 for explanation. Stocking rate appears to have plateaued since the 2008 at 2.8 cows/ha. The increase in the number of cows was almost entirely due to area between 1995 and 2002.

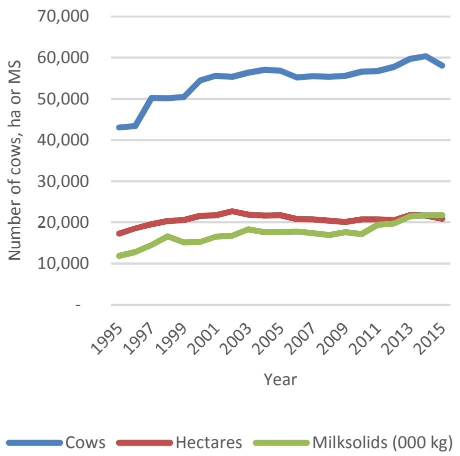

Figure 68. Trend in the number of cows, hectares and milksolids produced in the Tasman and Nelson regions/districts between 1995 and 2015. Source Dairy Statistics.

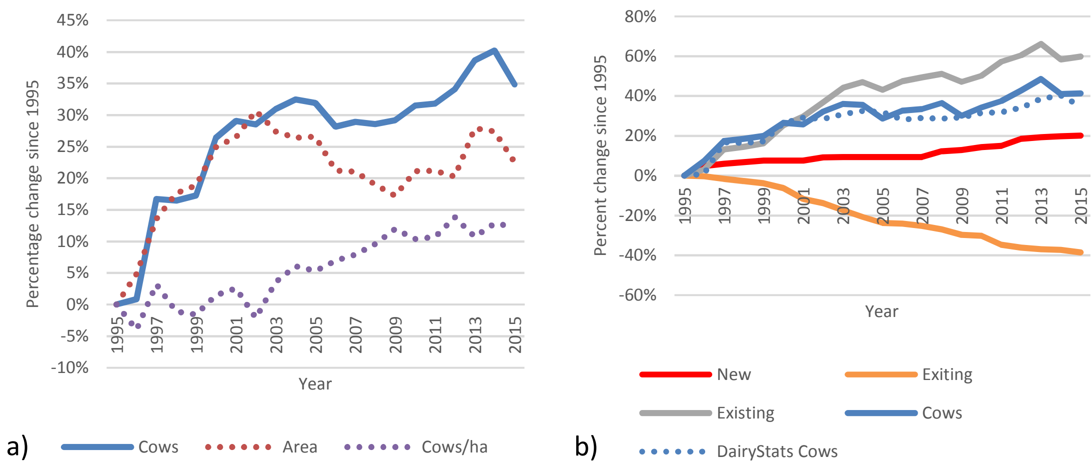

Figure 69. Trend in the percentage of change, since 1995: (a) in total cows and the drivers (area and stocking rate) behind this change. Source Dairy Statistics. (b) in calved cows (including comparison with Dairy Statistics) as a result of new farm conversions, herds exiting the industry, and expansion of existing herds in the Tasman and Nelson regions. Source DIGAD.

The underlying reasons behind the increase in cow numbers can be estimated using DIGAD data (Figure 69b). The data indicates a steady rate of herds exiting the industry, responsible for a 39% decrease in cow numbers. Herds could exit the industry due to a change in land use (e.g. dairy support, dry stock, lifestyle or urban), or they could be being bought by a neighbouring dairy farm, which would then appear

in the data as an increase in the size of existing herds. In Tasman & Nelson cow numbers grew by 60% in existing herds, which could be due to an amalgamation with a neighbouring dairy farm or through incorporating a neighbouring drystock block. Given this number is much larger than the amount exiting it appears existing farms have incorporated some neighbouring non-dairy land. There was an 20% increase in cow numbers due to new farm conversions. Overall, these combine to an overall net decrease of 41% in DIGAD data. This number differs from the 35% increase in cow numbers reported in the Dairy Statistics. This is one of five regions where the dairy statistics report fewer cows than DIGAD. The DIGAD data relies on farmers having entered their calving records into the database. Given the percentages are relative to 1995 it is likely this figure was under reported in DIGAD in this year. The trend is very similar for each data source.

The distribution of cows in the region can also be estimated using DIGAD data and the changes between 1995 and 2015 are presented in Figure 70. In 2015 the heaviest populated areas for dairying were Aorere/Rockville and Kotinga/Hamama in the north of the region. Between 1995 and 2015 the area with the largest increase in cow numbers was the Matakitaki/Mount Ella area. There was a decline in cow numbers around Nelson.

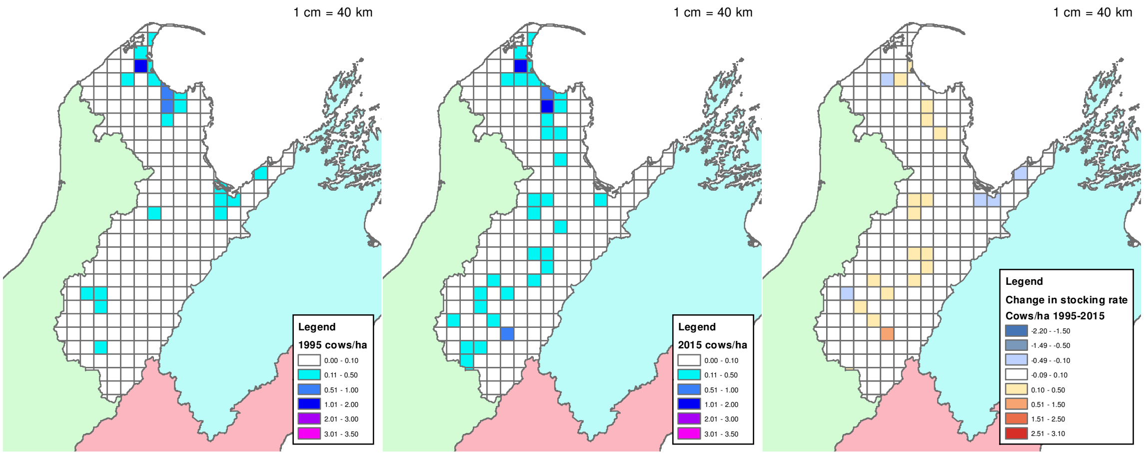

Figure 70. Density (cows/ha) of dairy in the Tasman and Nelson regions, summarised by 5000 ha grid cell, for 1995, 2015 and the change between these years. Source DIGAD.

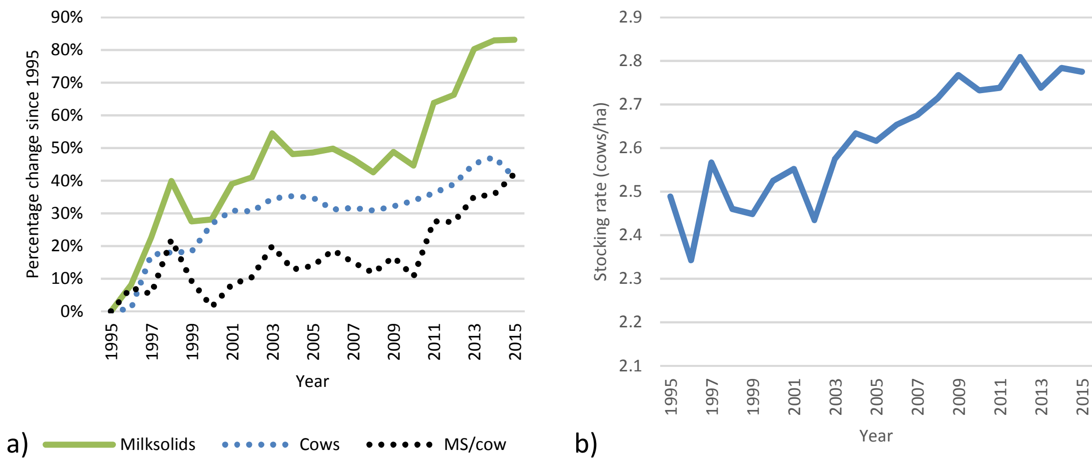

Figure 71. (a) Trend in the percentage change, since 1995, in the total milksolids produced in Tasman and Nelson and the drivers (number of cows and milk production per cow) behind this change. (b) Trend in stocking rate (cows/ha) since 1995 in the Tasman and Nelson Regions. Source Dairy Statistics.

Milksolids production increased by 83% during the period 1995-2015, half of this could be attributed to improved milk production per cow and half (41%) due to more cows (Figure 71). Note the 41% figure is slightly higher than the 35% increase in cow numbers due to the increased milk production per cow of the new cows over this period. Improved milk production per cow could be due to improved farm management, animal genetics, or more imported feed such as palm kernel expeller.

The number of herds in the region has declined, particularly during the years 2002 to 2005, after which the number has remained relatively static at just over 150 herds (Figure 72a). As discussed above, herds exiting the industry will likely result in the existing herds increasing in size (by 86% using dairy statistics data). However, the averages presented in the annual dairy statistics give no insight into the distribution of herd sizes. Distribution data was obtained from DIGAD and is presented in Figure 72b, these data give a similar trend in the mean herd size to the dairy statistics data. More growth has occurred in larger herds with the upper quartile increasing from 217 to 439 cows (102%), compared with the lower quartile, which increased from 127 to 189 cows (48%). This implies that one quarter of herds in Tasman & Nelson had less than 189 cows in 2015. The largest herds in the region are just over 1000 cows (98th percentile).

The trend in breed is displayed in Figure 73, and indicates that in 2015 the predominant breed in the region was Friesian (27%), followed by Jersey (19%) and Friesian dominant crossbreeds (18%). The number of Friesians declined and the number of cross breed cows increased. Since 1995 the average cow in the region moved from F10 J5 O1 to F8 J7 O1 (out of 16 parts).

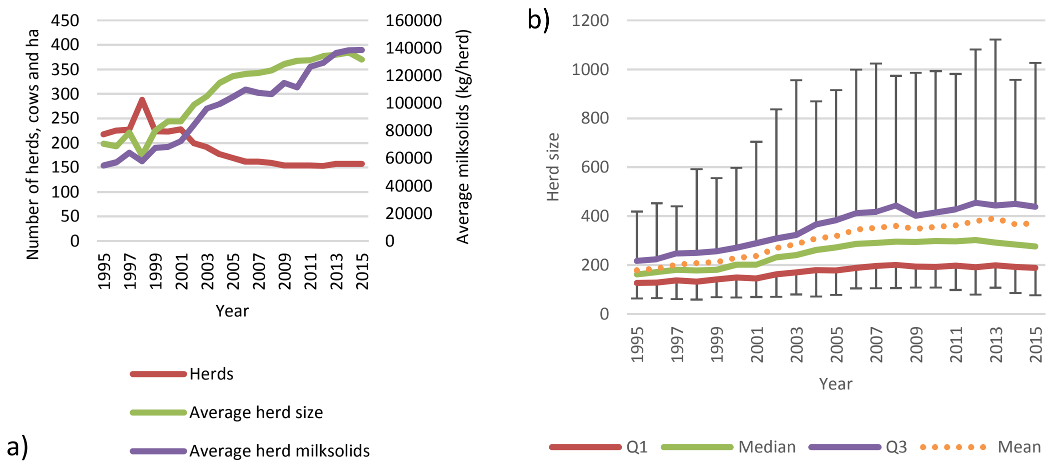

Figure 72. Trend in (a) the number of herds, average herd size and average milk production per herd in the Tasman and Nelson Regions. Source Dairy Statistics. (b) the 2nd, 25th (lower quartile, Q3), 50th (median), mean, 75th (upper quartile, Q3) and 98th percentile of herd size. Source DIGAD.

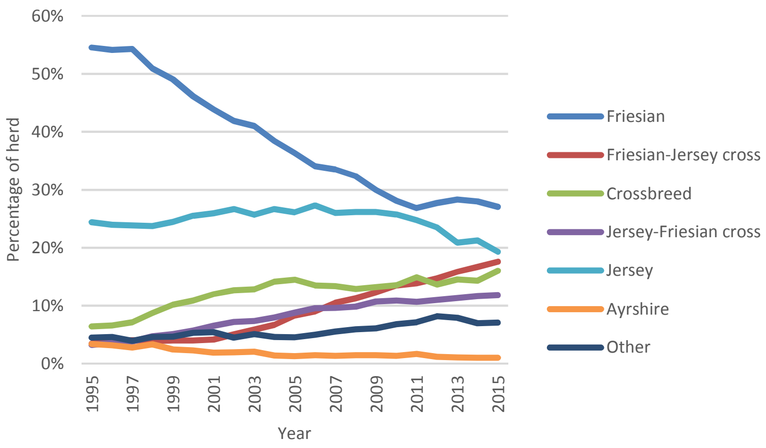

Figure 73. Trend in the breed of cows in Tasman & Nelson herds between 1995 and 2015. Source DIGAD.

Key points for Tasman & Nelson:

- In 2015 dairying occupied a small amount (2%) of the regions land.
- The region has experienced mild but steady growth in cow numbers (15,000 cows).
- The peak number of cows was in 2014, it is the only region that has been growing until recently, or is still growing that has been growing at less than 1000 cows per year. In 2015 there were 2,300 fewer cows than 2014.
- Most of this growth occurred prior to 2001.
- The increase in cow numbers has been due to increased area more so than stocking rate – which has plateaued since 2008.
- Herds exiting the industry have been more than offset by an increase in size of existing herds, indicating that as well as absorbing some of the exiting herds (e.g. incorporated into a neighbouring farm) the remaining herds also incorporated sufficient neighboring land that was previously non-dairy as well as increasing stocking rate (up to 2008) to offset land that did not remain in dairy. Part of the increase in cow numbers was due to new herds, in particular between 2007 and 2012.
- Changes in milk production appear driven equally by the number of cows and by milk production per cow.
- Planned start of calving date moved earlier by 9 days between 1995 and 2015.
- The amount of Friesian declined by 2/16ths since 1995.

West Coast region

The dairy industry on the West Coast has experienced growth. The change in cows, area and milk production between 1995 and 2015 is presented in Figure 74a. During this time the area in dairy milking platforms increased by 80%. In 2015 the area in dairy accounted for 3% of the region's land. There were 142% more cows in 2015 than 1995. The 142% net increase in cows was a result of increase in stocking rate (42%), and land area (100%; Figure 75a). The effect of the increasing land area (100%) was greater than the actual change in land area (80%) due to an increase in stocking rate over this period (Figure 77b) – see Figure 1 for explanation. Stocking rate appears to have plateaued since the 2007 at 2.2 cows/ha.

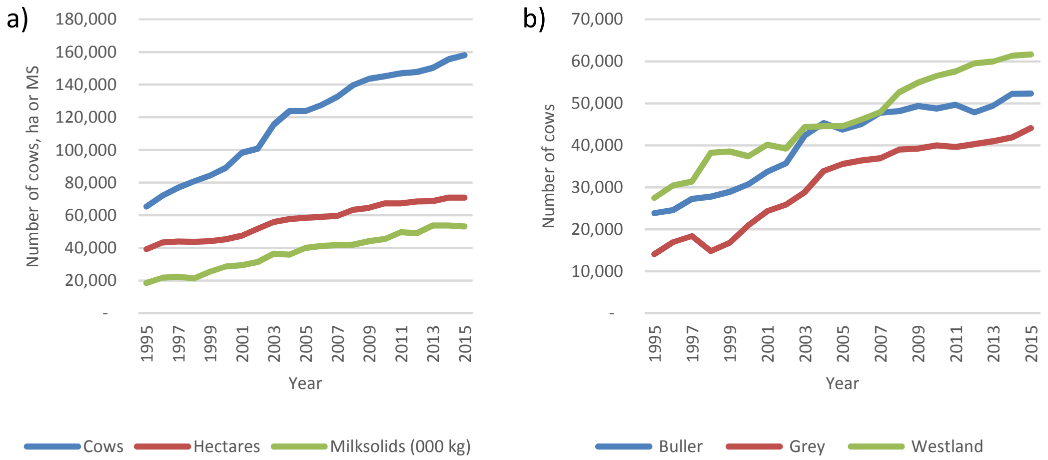

Figure 74. Trend in (a) the number of cows, hectares and milksolids produced in the West Coast region between 1995 and 2015 and (b) the number of cows per district. Source Dairy Statistics.

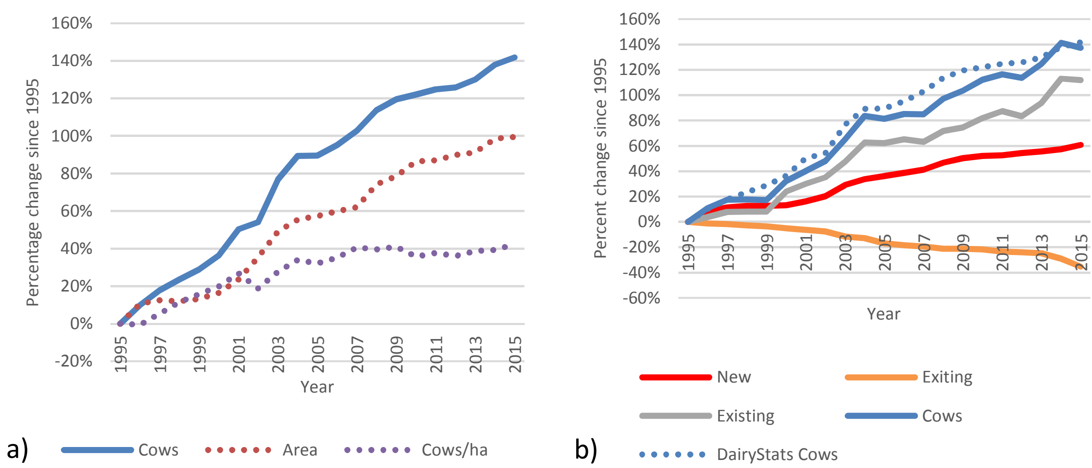

Figure 75. Trend in the percentage of change, since 1995: (a) in total cows and the drivers (area and stocking rate) behind this change. Source Dairy Statistics. (b) in calved cows (including comparison with Dairy Statistics) as a result of new farm conversions, herds exiting the industry, and expansion of existing herds in West Coast. Source DIGAD.

The underlying reasons behind the increase in cow numbers can be estimated using DIGAD data (Figure 75b). The data indicates a steady rate of herds exiting the industry, responsible for a 35% decrease in cow numbers. Herds could exit the industry due to a change in land use (e.g. dairy support, dry stock, lifestyle or urban), or they could be being bought by a neighbouring dairy farm, which would then appear in the data as an increase in the size of existing herds. On the West Coast cow numbers grew by 112%

in existing herds, which could be due to an amalgamation with a neighbouring dairy farm or through incorporating a neighbouring drystock block. Given this number is much larger than the amount exiting it appears existing farms have incorporated some neighbouring non-dairy land. There was an 61% increase in cow numbers due to new farm conversions. Overall, these combine to an overall net decrease of 137% in DIGAD data. This number differs from the 142% increase in cow numbers reported in the Dairy Statistics. The DIGAD data relies on farmers having entered their calving records into the database, which likely explains why the figure is under reported compared to the Dairy Statistics. The trend however follows a similar pattern.

The distribution of cows in the region can also be estimated using DIGAD data and the changes between 1995 and 2015 are presented in Figure 76. In 2015 the heaviest populated areas for dairying were Kokatahi, Ikamatua and Cape Foulwind. Between 1995 and 2015 the areas with the largest increases in cow numbers were Matai/Atarau, Ikamatua, Springs Junction and Cape Foulwind. Summarised by district using Dairy Statistics data, Westland (the largest dairying area) increased by 124%, with Buller increasing by 120% and Grey by 214% (Figure 74b).

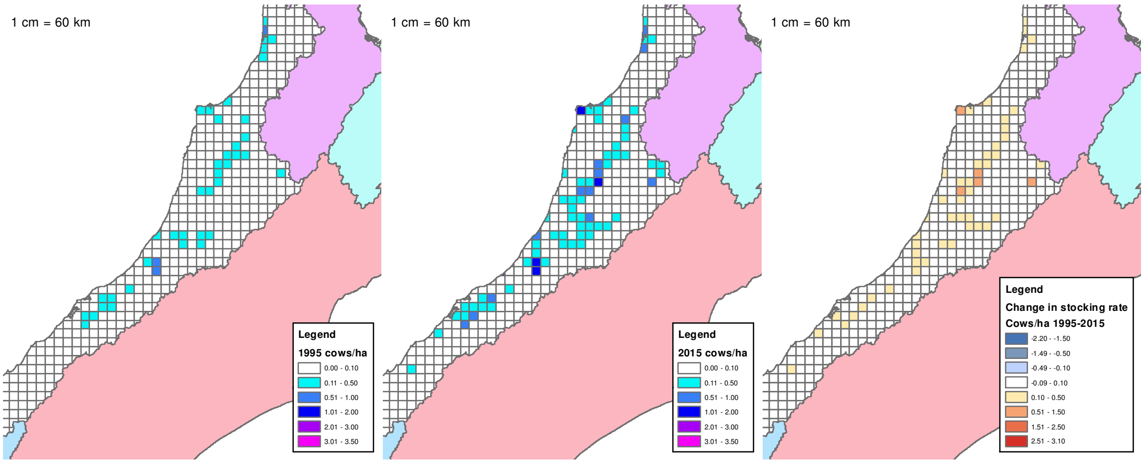

Figure 76. Density (cows/ha) of dairy in the West Coast region, summarised by 5000 ha grid cell, for 1995, 2015 and the change between these years. Source DIGAD.

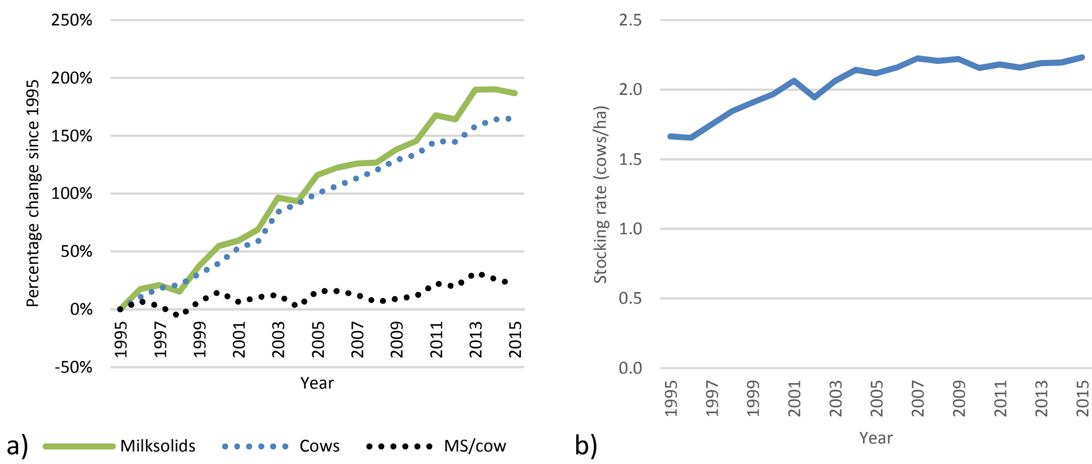

Figure 77. (a) Trend in the percentage change, since 1995, in the total milksolids produced in West Coast and the drivers (number of cows and milk production per cow) behind this change. (b) Trend in stocking rate (cows/ha) since 1995 in the West Coast Region. Source Dairy Statistics.

Milksolids production increased by 187% during the period 1995-2015, 22% of which could be attributed to improved milk production per cow and 165% due to more cows (Figure 77). Note the 165% figure is slightly higher than the 142% increase in cow numbers due to the increased milk production per cow of the new cows over this period. Improved milk production per cow could be due to improved farm management, animal genetics, or more imported feed such as palm kernel expeller. It appears that the increase in milksolids has been driven mostly by an increase in the number of cows.

The number of herds in the region has remained relatively static at about 370 herds (Figure 78a). As discussed above, herds exiting the industry will likely result in the existing herds increasing in size (by 128% using dairy statistics data). However, the averages presented in the annual dairy statistics give no insight into the distribution of herd sizes. Distribution data was obtained from DIGAD and is presented in Figure 78b, these data give a similar trend in the mean herd size to the dairy statistics data. More growth has occurred in larger herds with the upper quartile increasing from 219 to 514 cows (135%), compared with the lower quartile, which increased from 121 to 247 cows (104%). This implies that one quarter of herds on the West Coast had less than 247 cows in 2015. The largest herds in the region are just over 1050 cows (98th percentile).

The trend in breed is displayed in Figure 79, and indicates that in 2015 the predominant breed in the region was Jersey (26%), followed by straight crossbreeds (17%), and Friesian (16%). The number of Friesians declined and the number of cross breed cows increased. Since 1995 the average cow in the region moved from F7 J7 O2 to F6 J8 O2 (out of 16 parts).

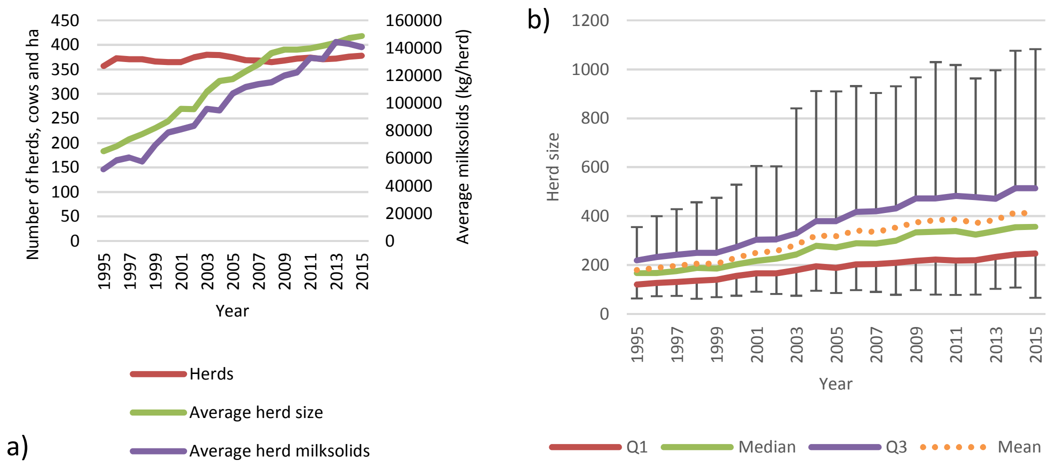

Figure 78. Trend in (a) the number of herds, average herd size and average milk production per herd in the West Coast Region. Source Dairy Statistics. (b) the 2nd, 25th (lower quartile, Q3), 50th (median), mean, 75th (upper quartile, Q3) and 98th percentile of herd size. Source DIGAD.

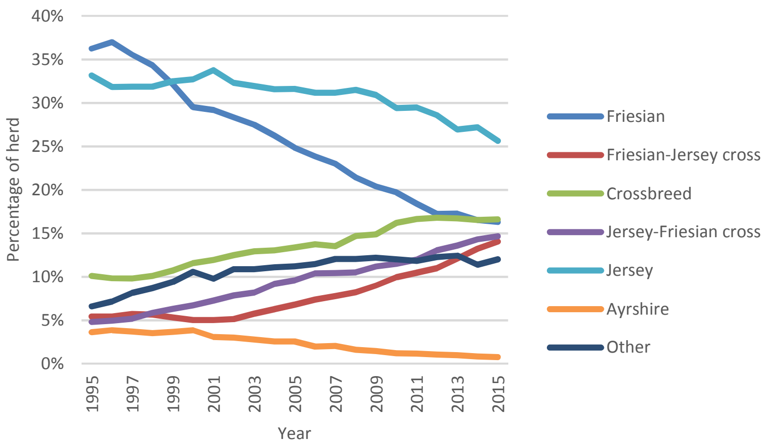

Figure 79. Trend in the breed of cows in West Coast herds between 1995 and 2015. Source DIGAD.

Key points for the West Coast:

- In 2015 dairying occupied a small amount (3%) of the regions land similar to many other regions.
- In 2015 the region had more cows than in 1995, and is growing, or has been growing until recently, with the highest number occurring in 2015.
- The region has been growing at 4,800 cows/year.
- The increase in cow numbers was driven by increasing area and stocking rate until 2007, since then stocking rate has been constant and the increase has been driven by area. Area accounts for about two thirds of the increase.
- Herds exiting the industry have been more than offset by an increase in herd size of existing farms. Given stocking rate has been constant since 2007, this indicates as well as some exiting herds likely being incorporated into a neighbouring dairy farm, existing herds have also been incorporating land previously non-dairy. Slightly under half of the increase in cow numbers has been due to new herds.
- All of West Coast districts have been growing.
- The region’s milk production has increased, driven by the increase in cow numbers.
- Planned start of calving date moved earlier by 14 days between 1995 and 2015.
- The amount of Friesian declined by 1/16th since 1995.
- It is the only region where Jersey is the dominant breed.

Canterbury region

The dairy industry in Canterbury has experienced significant growth. The change in cows, area and milk production between 1995 and 2015 is presented in Figure 80a. During this time the area in dairy milking platforms increased by 351%. In 2015 the area in dairy accounted for 7% of the region's land. There were 482% more cows in 2015 than 1995. The 482% net increase in cows was a result of increase in stocking rate (37%), and land area (445%; Figure 81a). The effect of the increasing land area (445%) was more than the actual change in land area (351%) due to an increase in stocking rate over this period (Figure 83b) – see Figure 1 for explanation. Stocking rate appears to have plateaued since the 2011 at 3.5 cows/ha, although this does not include area for wintering.

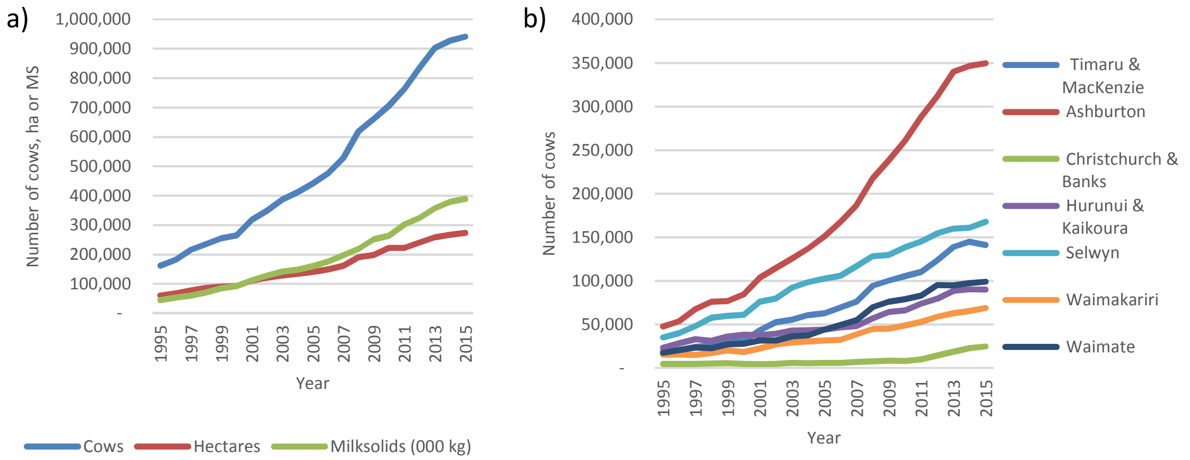

Figure 80. Trend in (a) the number of cows, hectares and milksolids produced in the Canterbury region between 1995 and 2015 and (b) the number of cows per district. Source Dairy Statistics.

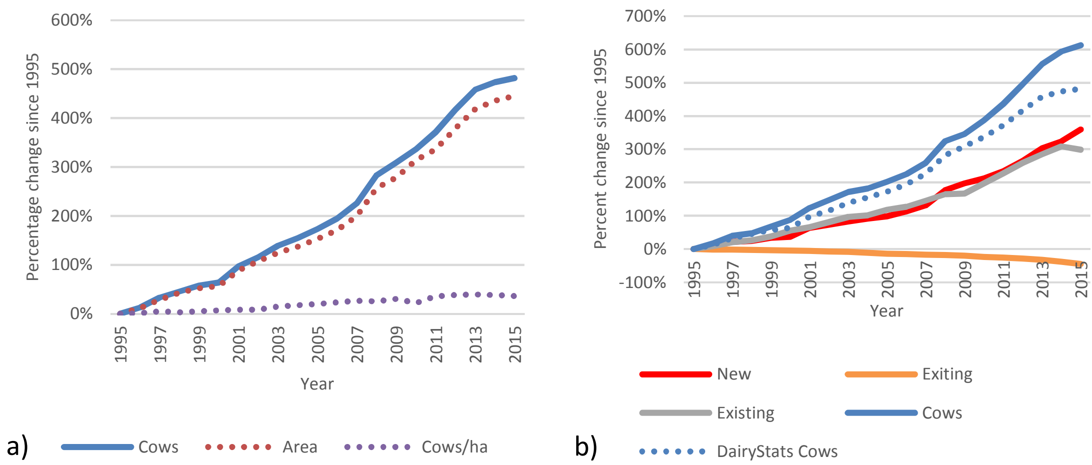

Figure 81. Trend in the percentage of change, since 1995: (a) in total cows and the drivers (area and stocking rate) behind this change. Source Dairy Statistics. (b) in calved cows (including comparison with Dairy Statistics) as a result of new farm conversions, herds exiting the industry, and expansion of existing herds in Canterbury. Source DIGAD.

The underlying reasons behind the increase in cow numbers can be estimated using DIGAD data (Figure 81b). The data indicates a steady rate of herds exiting the industry, responsible for a 45% decrease in cow numbers. Herds could exit the industry due to a change in land use (e.g. dairy support, dry stock, lifestyle or urban), or they could be being bought by a neighbouring dairy farm, which would then appear in the data as an increase in the size of existing herds. In Canterbury cow numbers grew by 298% in existing herds, which could be due to an amalgamation with a neighbouring dairy farm or through incorporating a neighbouring drystock block. Given this number is much larger than the amount exiting it appears existing farms have incorporated some neighbouring non-dairy land as well as an increase in stocking rate. There was an 359% increase in cow numbers due to new farm conversions. Overall, these combine to an overall net increase of 613% in DIGAD data. This number differs from the 482% increase in cow numbers reported in the Dairy Statistics. This is one of five regions where the dairy statistics report fewer cows than DIGAD. The DIGAD data relies on farmers having entered their calving records into the database. Given the percentages are relative to 1995 it is likely this figure was under reported in DIGAD in this year. The trend is similar for each data source.

The distribution of cows in the region can also be estimated using DIGAD data and the changes between 1995 and 2015 are presented in Figure 82. In 2015 the heaviest populated areas for dairying were Culverden and Bankside. Between 1995 and 2015 the areas with the largest increase in cow numbers was Culverden, Lagmhor, Orari and Bankside. Summarised by district using Dairy Statistics data, Ashburton (the largest dairying area) increased by 635%, with Selwyn increasing by 380%, Timaru & Mackenzie by 646%, Waimate by 472%, Hurunui & Kaikoura by 286%, Waimakariri by 352% and Christchurch & Banks Peninsular by 448% (Figure 80b).

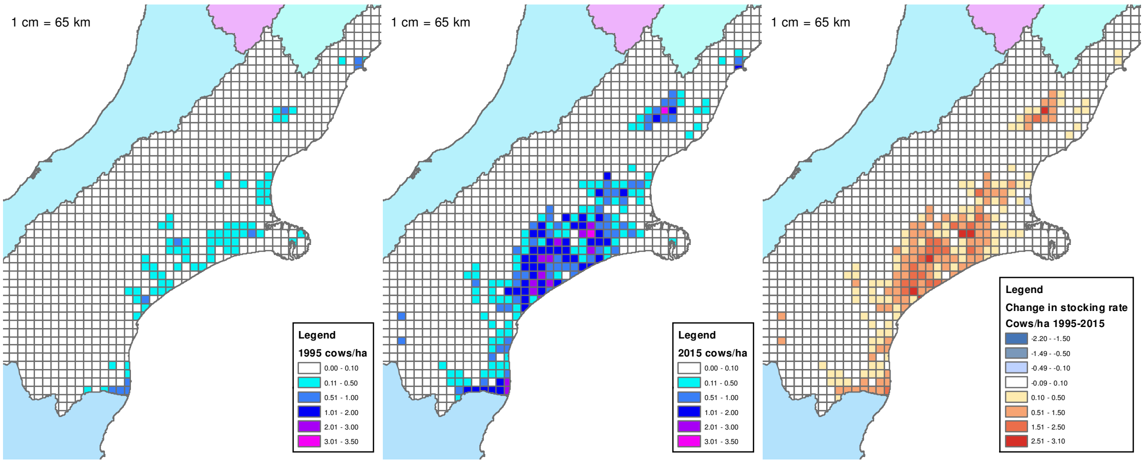

Figure 82. Density (cows/ha) of dairy in the Canterbury region, summarised by 5000 ha grid cell, for 1995, 2015 and the change between these years. Source DIGAD.

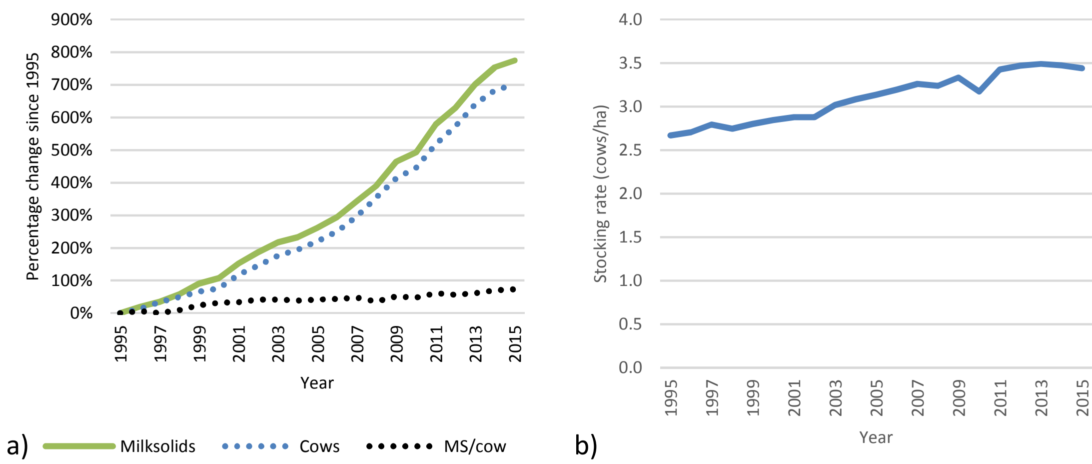

Figure 83. (a) Trend in the percentage change, since 1995, in the total milksolids produced in Canterbury and the drivers (number of cows and milk production per cow) behind this change. (b) Trend in stocking rate (cows/ha) since 1995 in the Canterbury Region. Source Dairy Statistics.

Milksolids production increased by 774% during the period 1995-2015, 73% of which could be attributed to improved milk production per cow and 701% due to more cows (Figure 83a). Note the 701% figure is slightly higher than the 482% increase in cow numbers due to the increased milk production per cow of the new cows over this period. Improved milk production per cow could be due to improved farm management, animal genetics, or more imported feed such as palm kernel expeller. The primary driver behind the increase milk production has been via more cows.

The number of herds in the region has grown significantly, particularly in the years 2007-2008. In 2015 there were 1203 herds in Canterbury (Figure 84a). As discussed above, herds exiting the industry will likely result in the existing herds increasing in size (by 146% using dairy statistics data). However, the averages presented in the annual dairy statistics give no insight into the distribution of herd sizes. Distribution data was obtained from DIGAD and is presented in Figure 84b, these data give a similar trend in the mean herd size to the dairy statistics data. Unlike other regions (except Otago and Southland) more growth has occurred in smaller herds with the lower quartile increasing from 140 to 515 cows (268%), compared with the upper quartile, which increased from 351 to 987 cows (181%). This implies that one quarter of herds in Canterbury had less than 515 cows in 2015, and a quarter larger than 987 cows. The largest herds in Canterbury are about 2000 cows (98th percentile).

The trend in breed is displayed in Figure 85, and indicates that in 2015 the predominant breed in the region was Friesian (38%), followed by Friesian dominant crossbreeds (24%), followed by straight crossbreeds (18%). The number of Friesians declined and the number of cross breed cows increased. Since 1995 the average cow in the region moved from F13 J2 O1 to F11 J4 O1 (out of 16 parts).

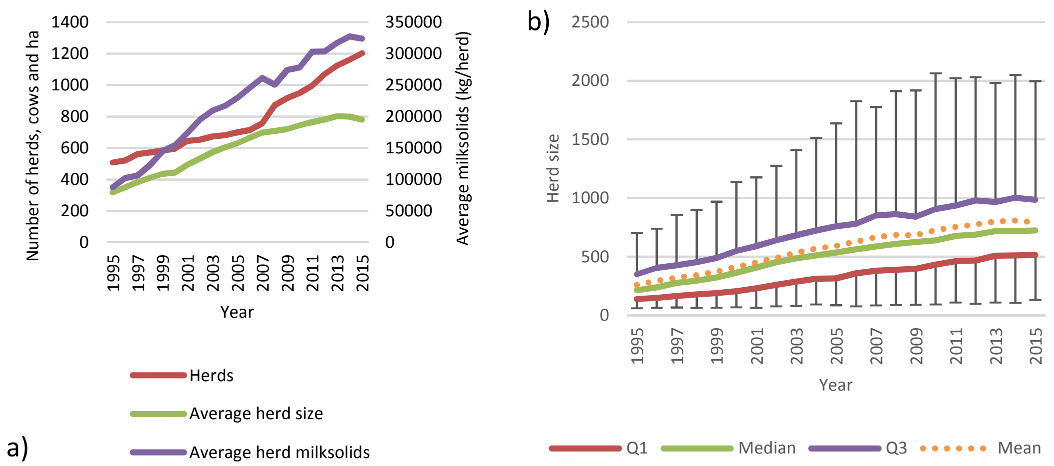

Figure 84. Trend in (a) the number of herds, average herd size and average milk production per herd in the Canterbury Region. Source Dairy Statistics. (b) the 2nd, 25th (lower quartile, Q3), 50th (median), mean, 75th (upper quartile, Q3) and 98th percentile of herd size. Source DIGAD.

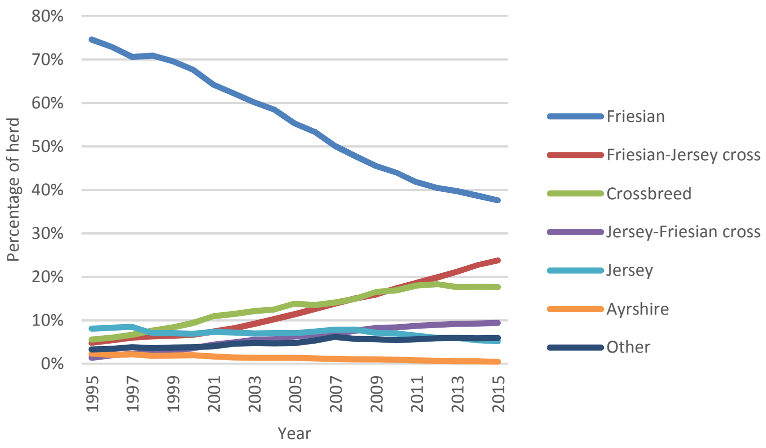

Figure 85. Trend in the breed of cows in Canterbury herds between 1995 and 2015. Source DIGAD.

Key points for Canterbury:

- In 2015 dairying occupied 7% of the regions land.
- Canterbury has the second most cows, behind the Waikato.
- The region is a strong growth region, and has been growing at 41,500 cows/year. It accounts for 38% of the national increase in cow numbers between 1995 and 2015.
- In 2015 the region had more cows than in 1995, and is growing, or has been growing until recently, with the highest number occurring in 2015.
- The increase in cow numbers has been driven mostly by increasing land area, more so than stocking rate, which has been static since 2011.
- Herds exiting the industry have been offset by an increase in herd size of existing farms (e.g. many of the exiting herds may have been incorporated into a neighbouring farm, inclusion of previously non-dairy land, or increase in stocking rate). About half of the increase in cow numbers appears to be due to new herds.
- The Ashburton District has experienced the largest increase in cow numbers.
- The region’s milk production has increased driven primarily by more cows, however an increase in milk production per cow has also contributed.
- Planned start of calving date moved earlier by 12 days between 1995 and 2015.
- The amount of Friesian declined by 2/16ths since 1995.

Otago region

The dairy industry in Otago has grown significantly. The change in cows, area and milk production between 1995 and 2015 is presented in Figure 86a. During this time the area in dairy milking platforms Increased by 191%. In 2015 the area in dairy accounted for 2% of the region's land. There were 234% more cows in 2015 than 1995, however this was slightly less than in 2014. The 234% net increase in cows was a result of increase in stocking rate (17%) and land area (217%; Figure 87a). The effect of the increasing land area (217%) was more than the actual change in land area (191%) due to an increase in stocking rate over this period (Figure 89b) – see Figure 1 for explanation. Stocking rate appears to have plateaued since the 2011 at 3 cows/ha. The increase in cows has been driven by an increase in area, although this does not include area for wintering.

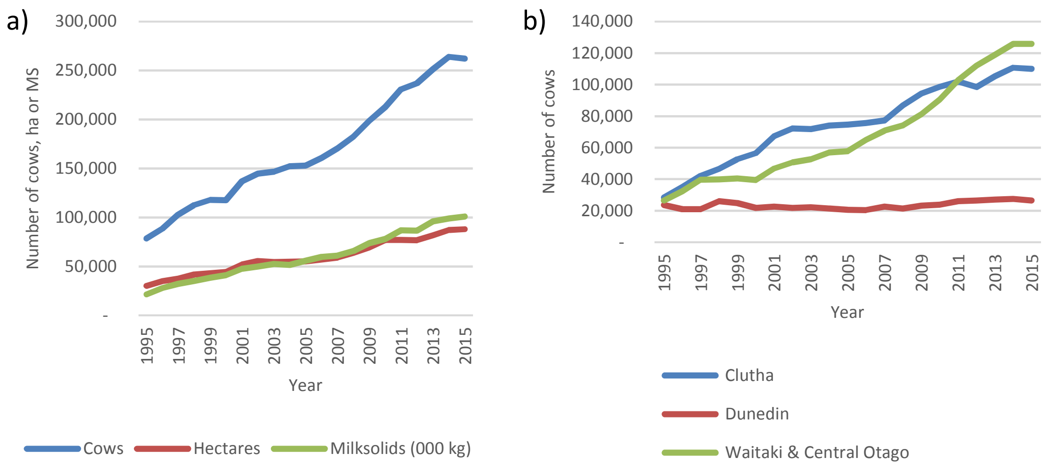

Figure 86. Trend in (a) the number of cows, hectares and milksolids produced in the Otago region between 1995 and 2015 and (b) the number of cows per district. Source Dairy Statistics.

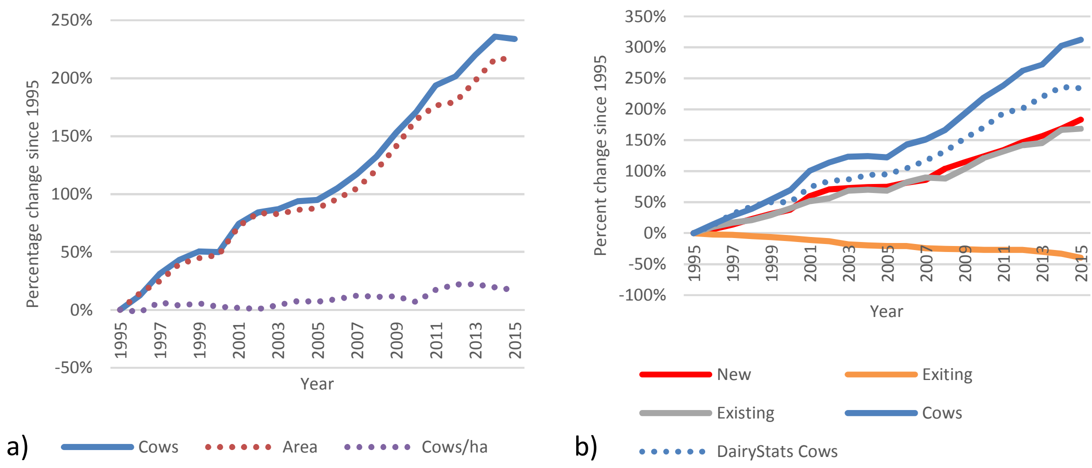

Figure 87. Trend in the percentage of change, since 1995: (a) in total cows and the drivers (area and stocking rate) behind this change. Source Dairy Statistics. (b) in calved cows (including comparison with Dairy Statistics) as a result of new farm conversions, herds exiting the industry, and expansion of existing herds in Otago. Source DIGAD.

The underlying reasons behind the increase in cow numbers can be estimated using DIGAD data (Figure 87b). The data indicates a steady rate of herds exiting the industry, responsible for a 40% decrease in cow numbers. Herds could exit the industry due to a change in land use (e.g. dairy support, dry stock, lifestyle or urban), or they could be being bought by a neighbouring dairy farm, which would then appear

in the data as an increase in the size of existing herds. In Otago cow numbers grew by 169% in existing herds, which could be due to an amalgamation with a neighbouring dairy farm or through incorporating a neighbouring drystock block. Given this number is much larger than the amount exiting it appears existing farms have incorporated some neighbouring non-dairy land as well as an increase in stocking rate. There was an 183% increase in cow numbers due to new farm conversions. Overall, these combine to an overall net decrease of 312% in DIGAD data. This number differs from the 234% increase in cow numbers reported in the Dairy Statistics. This is one of five regions where the dairy statistics report fewer cows than DIGAD. The DIGAD data relies on farmers having entered their calving records into the database. Given the percentages are relative to 1995 it is likely this figure was under reported in DIGAD in this year. The trend is similar for each data source.

The distribution of cows in the region can also be estimated using DIGAD data and the changes between 1995 and 2015 are presented in Figure 88. In 2015 the densest area for dairying was between Peebles and Waitaki Bridge. Between 1995 and 2015 the areas with the largest increases in cow numbers were Enfield/Elderslie in the north and Wharetoa/Pomahaka in the south. Summarised by district using Dairy Statistics data, Waitaki & Central Otago (the largest dairying district) increased by 375%, with Clutha increasing by 288% and Dunedin by 12% (Figure 86b).

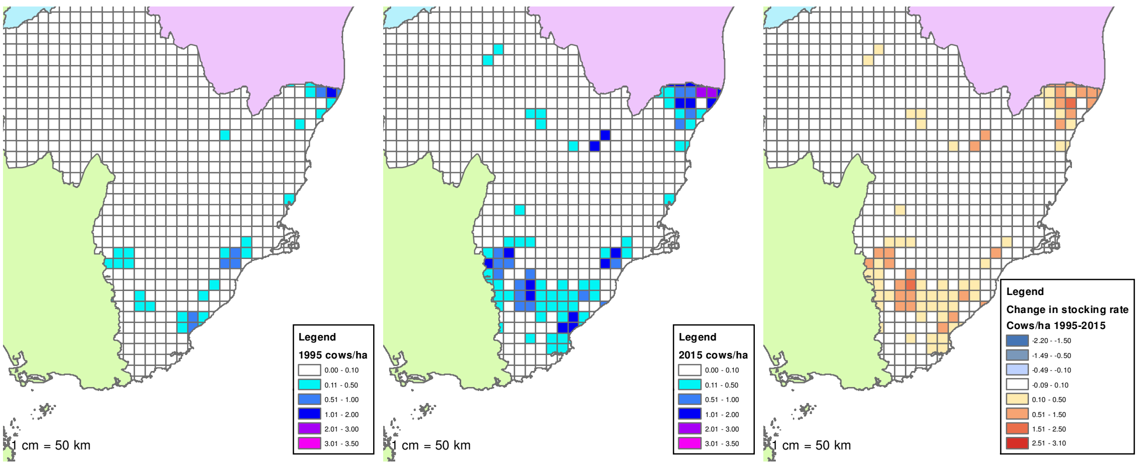

Figure 88. Density (cows/ha) of dairy in the Otago region, summarised by 5000 ha grid cell, for 1995, 2015 and the change between these years. Source DIGAD.

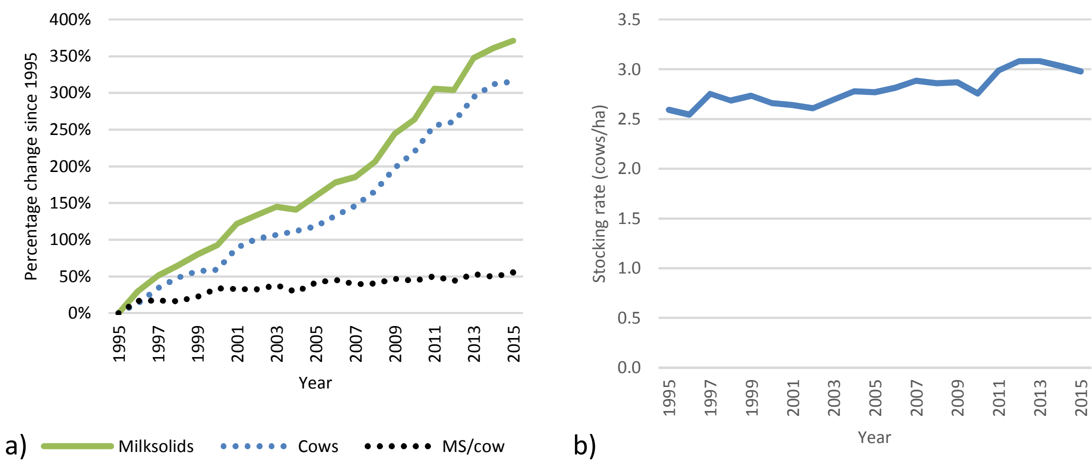

Figure 89. (a) Trend in the percentage change, since 1995, in the total milksolids produced in Otago and the drivers (number of cows and milk production per cow) behind this change. (b) Trend in stocking rate (cows/ha) since 1995 in the Otago Region. Source Dairy Statistics.

Milksolids production increased by 371% during the period 1995-2015, 56% of which could be attributed to improved milk production per cow and 316% due to more cows (Figure 89). Note the 316% figure is higher than the 234% increase in cow numbers due to the increased milk production per cow of the new cows over this period. Improved milk production per cow could be due to improved farm management, animal genetics, or more imported feed such as palm kernel expeller. The increase in milksolids appears driven by the increased number of cows.

The number of herds in the region has increased, particularly since 2006. In 2015 there were 438 herds (Figure 90a). As discussed above, herds exiting the industry will likely result in the existing herds increasing in size (by 100% using dairy statistics data). However, the averages presented in the annual dairy statistics give no insight into the distribution of herd sizes. Distribution data was obtained from DIGAD and is presented in Figure 90b, these data give a similar trend in the mean herd size to the dairy statistics data. Unlike other regions (except Canterbury and Southland) more growth has occurred in smaller herds with the lower quartile increasing from 137 to 396 cows (189%), compared with the upper quartile, which increased from 337 to 710 cows (111%). This implies that one quarter of herds in Otago had less than 396 cows in 2015, and a quarter larger than 710 cows. The largest herds in Otago are just over 1500 cows (98th percentile).

The trend in breed is displayed in Figure 91, and indicates that in 2015 the predominant breed in the region was Friesian (42%), followed by Friesian dominant crossbreeds (21%), followed by straight crossbreeds (16%). The number of Friesians declined and the number of cross breed cows increased. Since 1995 the average cow in the region has moved from F14 J1 O1 to F11 J4 O1 (out of 16 parts).

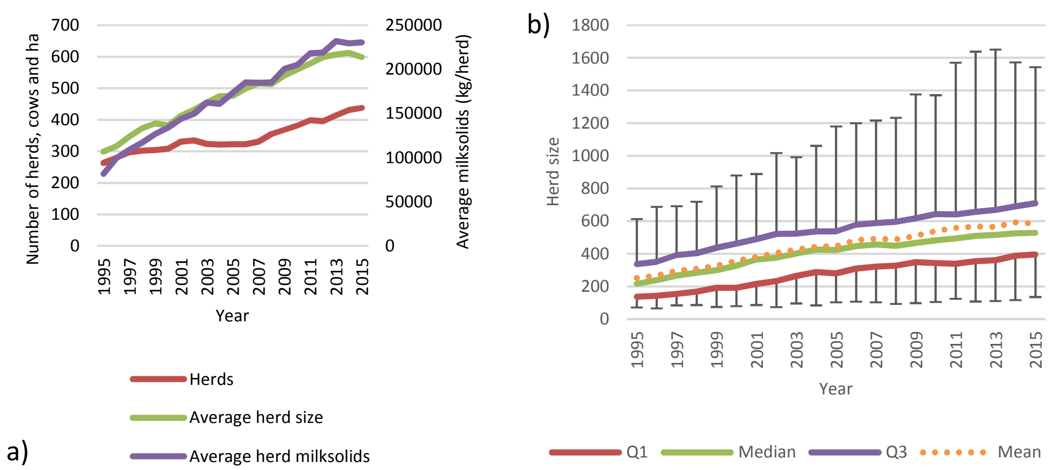

Figure 90. Trend in (a) the number of herds, average herd size and average milk production per herd in the Otago Region. Source Dairy Statistics. (b) the 2nd, 25th (lower quartile, Q3), 50th (median), mean, 75th (upper quartile, Q3) and 98th percentile of herd size. Source DIGAD.

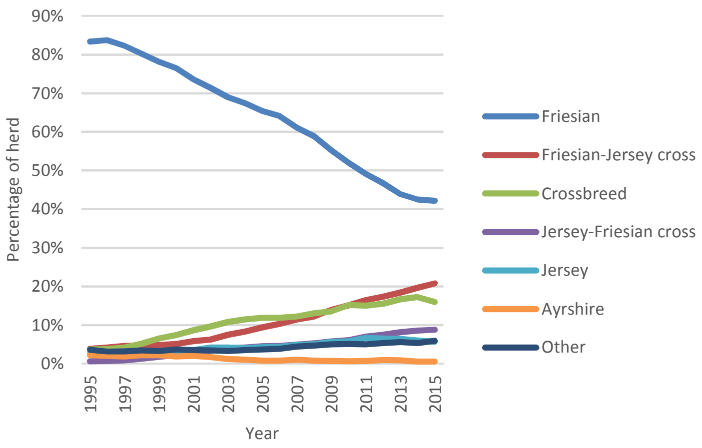

Figure 91. Trend in the breed of cows in Otago herds between 1995 and 2015. Source DIGAD.

Key points for Otago:

- In 2015 dairying occupied a small amount (2%) of the regions land similar to many other regions.
- In 2015 the region had more cows than in 1995, and is growing, or has been growing until recently, with the highest number occurring in 2014.
- The region has been growing at 9,100 cows/year.
- The increase in cow numbers was driven by increasing area, with only a small amount due to stocking rate.
- Herds exiting the industry have been more than offset by an increase in herd size of existing farms. This indicates as well as some exiting herds likely being incorporated into a neighbouring dairy farm, existing herds have also been incorporating land previously non-dairy, as well as an increase in stocking rate. Slightly over half of the increase in cow numbers has been due to new herds.
- Growth has been in the Clutha and Waitaki & Central Otago Districts.
- The region's milk production has increased, driven predominantly by the increase in cow numbers.
- Planned start of calving date moved earlier by 11 days between 1995 and 2015.
- The amount of Friesian declined by 3/16ths since 1995.

Southland region

The dairy industry in Southland has experienced significant growth. The change in cows, area and milk production between 1995 and 2015 is presented in Figure 92a. During this time the area in dairy milking platforms increased by 295%. In 2015 the area in dairy accounted for 7% of the region's land. There were 356% more cows in 2015 than 1995. The 356% net increase in cows was a result of increase in stocking rate (18%) and land area (338%; Figure 93a). The effect of the increasing land area (338%) was less than the actual change in land area (295%) due to an increase in stocking rate over this period (Figure 95b) – see Figure 1 for explanation. Stocking rate appears to have settled at 2.7 cows/ha. The increase in cows has been driven by an increase in area.

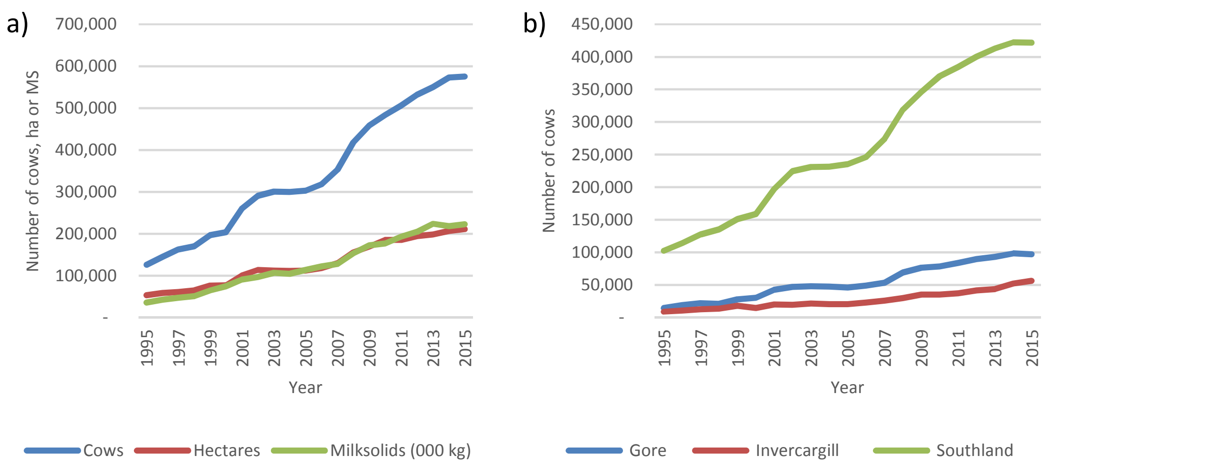

Figure 92. Trend in (a) the number of cows, hectares and milksolids produced in the Southland region between 1995 and 2015 and (b) the number of cows per district. Source Dairy Statistics.

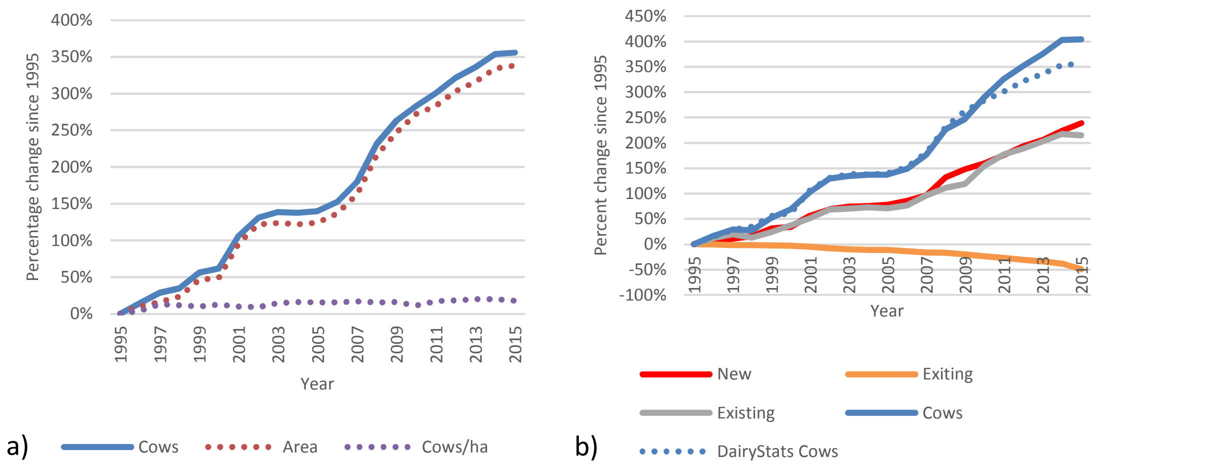

Figure 93. Trend in the percentage of change, since 1995: (a) in total cows and the drivers (area and stocking rate) behind this change. Source Dairy Statistics. (b) in calved cows (including comparison with Dairy Statistics) as a result of new farm conversions, herds exiting the industry, and expansion of existing herds in Southland. Source DIGAD.

The underlying reasons behind the increase in cow numbers can be estimated using DIGAD data (Figure 93b). The data indicates a steady rate of herds exiting the industry, responsible for a 49% decrease in cow numbers. Herds could exit the industry due to a change in land use (e.g. dairy support, dry stock, lifestyle or urban), or they could be being bought by a neighbouring dairy farm, which would then appear in the data as an increase in the size of existing herds. In Southland cow numbers grew by 215% in existing herds, which could be due to an amalgamation with a neighbouring dairy farm or through incorporating a neighbouring drystock block. Given this number is much larger than the amount exiting it appears existing farms have incorporated some neighbouring non-dairy land as well as an increase in stocking rate. There was an 239% increase in cow numbers due to new farm conversions. Overall, these combine to an overall net decrease of 404% in DIGAD data. This number differs from the 356% increase in cow numbers reported in the Dairy Statistics. This is one of five regions where the dairy statistics report fewer cows than DIGAD. The DIGAD data relies on farmers having entered their calving records into the database. It's not clear why the numbers in the datasets diverge after 2010.

The distribution of cows in the region can also be estimated using DIGAD data and the changes between 1995 and 2015 are presented in Figure 94. In 2015 the heaviest populated areas for dairying were Waituna/Oteramika and Fairfax/Isla Bank. Between 1995 and 2015 the areas with the largest increases in cow numbers were Wairio/Woodlaw, Fairfax/Isla Bank and Mabel Bush. Summarised by district using Dairy Statistics data, Southland (the largest dairying area) increased by 312%, with Gore increasing by 556% and Invercargill by 523% (Figure 92b).

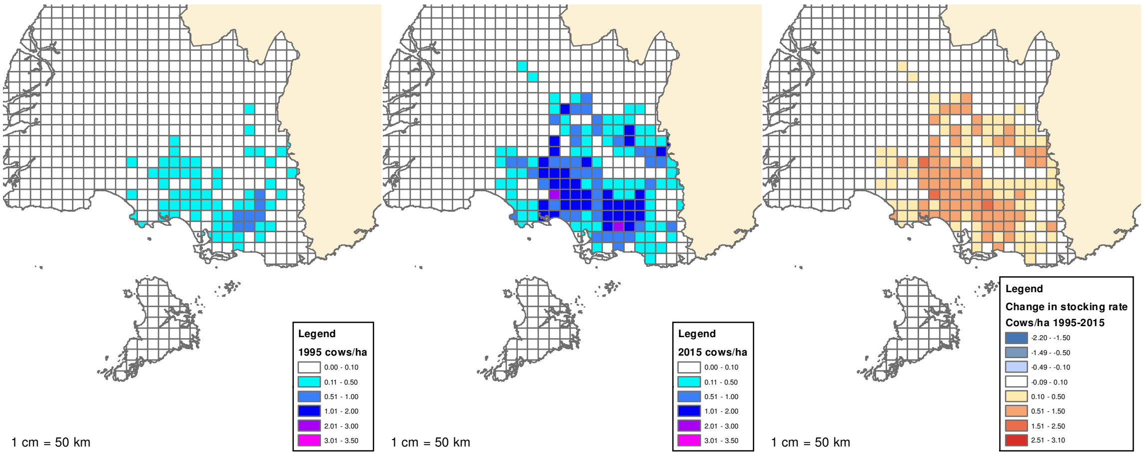

Figure 94. Density (cows/ha) of dairy in the Southland region, summarised by 5000 ha grid cell, for 1995, 2015 and the change between these years. Source DIGAD.

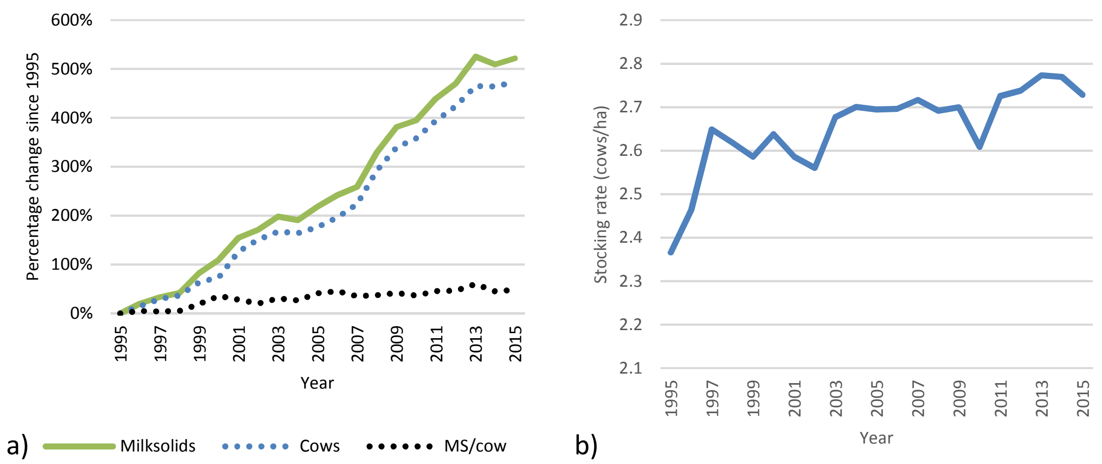

Figure 95. (a) Trend in the percentage change, since 1995, in the total milksolids produced in Southland and the drivers (number of cows and milk production per cow) behind this change. (b) Trend in stocking rate (cows/ha) since 1995 in the Southland Region. Source Dairy Statistics.

Milksolids production increased by 522% during the period 1995-2015, 48% of which could be attributed to improved milk production per cow and 473% due to more cows (Figure 95a). Note the 473% figure is higher than the 356% increase in cow numbers due to the increased milk production per cow of the new cows over this period. Improved milk production per cow could be due to improved farm management, animal genetics, or more imported feed such as palm kernel expeller. The trend in milksolids appears to be driven by an increase in cow numbers.

The number of herds in the region has increased, particularly in 2007-2008, in 2015 there were 990 herds (Figure 96a). As discussed above, herds exiting the industry will likely result in the existing herds increasing in size (by 97% using dairy statistics data). However, the averages presented in the annual dairy statistics give no insight into the distribution of herd sizes. Distribution data was obtained from DIGAD and is presented in Figure 96b, these data give a similar trend in the mean herd size to the dairy statistics data. Unlike other regions (except Canterbury and Otago) more growth has occurred in smaller herds with the lower quartile increasing from 157 to 407 cows (159%), compared with the upper quartile, which increased from 320 to 730 cows (128%). This implies that one quarter of herds in Southland had less than 407 cows in 2015, and a quarter larger than 730 cows. The largest herds in Southland are around 1550 cows (98th percentile).

The trend in breed is displayed in Figure 97, and indicates that in 2015 the predominant breed in the region was Friesian (37%), followed by Friesian dominant crossbreeds (22%), followed by straight crossbreeds (19%). The number of Friesians declined and the number of cross breed cows increased. Since 1995 the average cow in the region moved from F13 J2 O1 to F10 J5 O1 (out of 16 parts).

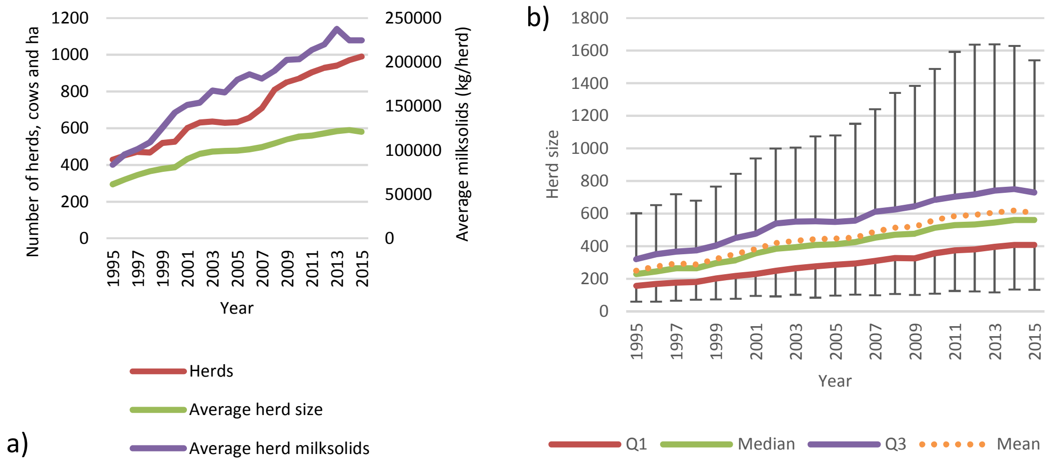

Figure 96. Trend in (a) the number of herds, average herd size and average milk production per herd in the Southland Region. Source Dairy Statistics. (b) the 2nd, 25th (lower quartile, Q3), 50th (median), mean, 75th (upper quartile, Q3) and 98th percentile of herd size. Source DIGAD.

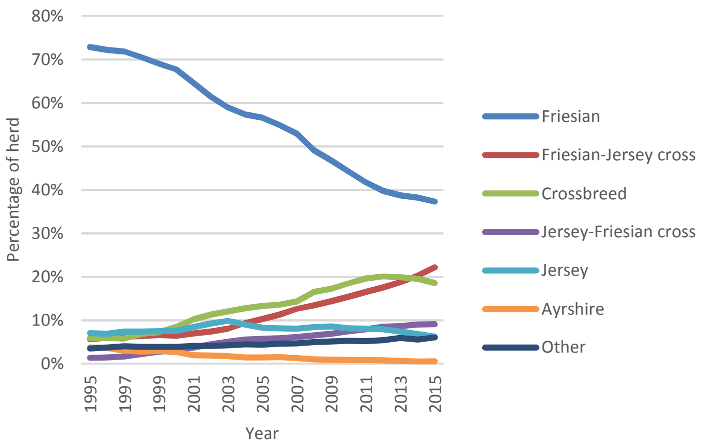

Figure 97. Trend in the breed of cows in Southland herds between 1995 and 2015. Source DIGAD.

Key points for Southland:

- In 2015 dairying occupied 7% of the regions land.
- Southland had the third most cows in 2015, behind the Waikato and Canterbury.
- The region is a strong growth region, and has been growing at 24,100 cows/year. It accounts for 22% of the national increase in cow numbers between 1995 and 2015.
- In 2015 the region had more cows than in 1995, and is growing, or has been growing until recently, with the highest number occurring in 2015.
- The increase in cow numbers has been driven mostly by increasing land area.
- There appear to have been two phases, with an increase up to 2002 and then again from 2007.
- Herds exiting the industry have been more than offset by an increase in herd size of existing farms. This indicates as well as some exiting herds likely being incorporated into a neighbouring dairy farm, existing herds have also been incorporating land previously non-dairy, as well as an increase in stocking rate. Over half of the increase in cow numbers has been due to new herds.
- The Southland District has experienced the largest increase in cow numbers.
- The region’s milk production has increased driven primarily by more cows.
- Planned start of calving date moved earlier by 15 days between 1995 and 2015.
- The amount of Friesian declined by 3/16ths since 1995.