

Implications of Agricultural Change in the Waikato Region: Current Trends and Future Scenarios

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Executive summary

This report explores recent trends in land use and agriculture in the Waikato region, as well as how these trends are associated with economic and social changes in Waikato communities. Future scenarios to 2021 are also considered. A mixture of qualitative and quantitative data is used to support the findings, with a focus on the dairy, sheep and beef, and forestry industries.

Significant trends in the dairy industry include a recent wave of dairy conversions, changes in ownership patterns, higher stocking rates, and more intensive farming practices. These changes have been facilitated by, among other things, increases in nitrogen fertiliser, and increased use of feed-pads and supplementary feed. The key drivers of agricultural and land use change were perceived to be economic, especially the dairy payout, land values, and costs of production. The relative profitability of dairying has driven the conversion of large areas of land to dairying, as well as encouraging many sheep and beef farms to move into dairy support roles, such as the grazing of dairy heifers or cropping for maize silage. There has been significant conversion from forestry to dairying in the southern Waikato, although forestry remains significant. Environmental policy drivers were described as likely to increasingly influence farming and forestry practice, but current uncertainty is delaying investment in forestry. Farmers have become more aware of environmental management issues, in part due to community expectations. Farm management practices are changing as a result, but uncertainty about future environmental policy persists.

A number of respondents commented on the difficulties of predicting agricultural norms and noted that adaptive management will be required. Nevertheless, dairying is expected to maintain its status as the dominant form of pasture-based agriculture in the region, and there will continue to be a variety of land use across the region and within industries.

Following analysis of statistical data and interviews with key informants, two divergent scenarios were proposed for the future of agriculture in the Waikato region – intensification and de-intensification. These scenarios are not mutually exclusive, and the quantitative results highlight that the actual development path obtained by the regional economy will depend crucially on the nature of agricultural change, particularly dairying. These quantitative and qualitative results illustrate the broad patterns of change that have occurred, are currently occurring, and will continue to occur in the Waikato region. A careful consideration of these trends and future developments will be necessary in the development of regional agricultural, environmental, economic, and social policy that will affect rural areas.

1 Introduction

This report explores recent trends in land use and agriculture in the Waikato region with the goal of considering possible future scenarios. The first objective is to observe and analyse current agricultural and land use trends and to consider how these are associated with change in Waikato communities. The time period referred to is primarily 1991-2008. The focus is on economic, demographic, technological, policy (both local and central government), and other drivers of change in rural and urban communities within the region, with the main focus on industry trends in dairy farming, sheep and beef farming, and forestry. The second objective is to propose scenarios that encompass the broad range of potential patterns of agricultural and related community change over the period to 2021 on the basis of the analysis from the first objective.

A key aim is to complement other analyses of the impacts of changes in agricultural practices – especially land use change and its effects on the regional environment and economy – undertaken by Environment Waikato. For instance, this report will complement industry sector analyses of the contribution of various industry sectors to Gross Regional Product, trends in these and related changes in employment, and analyses that highlight trends in land use diversification over time. This research also seeks to account for the way sub-regional zones have differing patterns of labour market and economic activity and the way these labour markets have evolved over time (Barrett et al. 2009).

Drivers of change in agriculture

Agricultural change and future trends in agriculture in the Waikato region are linked with, and driven by, multiple factors, including:

- the changing dynamics of rural communities, including change in the nature of the family farm model of business, the amalgamation of farms, and the increasing corporatisation of the farming sector;
- changing patterns of land use due to changes in the relative profitability of different industry sectors, such as the recent decline in the profitability of the forestry sector and the increasing profitability of dairy farming over other farm activities, and the intensification of current dairy farming operations;
- the development and uptake of new technologies;
- government policies framing rural, urban and regional development;
- the export orientation of the major rural enterprises and the immediate impact of international market expectations and commodity prices (particularly for milk products); and
- urbanisation and the movement of people to major population centres.

The resulting changes have important implications for key areas of wellbeing including:

- economic opportunity and the diminishing or strengthening of employment and business opportunity;
- the cultural wellbeing of different groups, as they have implications for the interplay of divergent cultural values and beliefs about land use and other agricultural activities;
- social stability and the prospects for community wellbeing, cohesion and identity; and
- environmental sustainability and the capacity for the region's natural resources to continue to support primary forms of land use.

The concern to understand agricultural change, and the complex drivers behind it, is motivated by the need to plan for the environmental and community implications of such changes and to prepare for these in a proactive rather than a reactive way (Britton and Fenton 2007; Parliamentary Commissioner for the Environment 2004).

In pursuing the objective of examining change in land use and associated changes within Waikato communities it is important to make the, perhaps obvious, observation at the outset that the relationship between the two is complex. The linkages between agricultural practices and the economic and social fabric of rural communities in the Waikato region reflect both long term trends in economic, demographic, and technological drivers, and shorter term cycles of change associated with market returns and policy change. Some have suggested a 'progressive decoupling' of agriculture and its fortunes from the life of rural communities (Smithers and Joseph 1999). Such decoupling is seen as linked with national and international economic, demographic and technological trends, resulting in a view that the fortunes of the agricultural sector are now much more independent from the communities within which they are located. Joseph et al. (2001) explored whether there has been such a decoupling and concluded that there was a complex and ambivalent relationship between agricultural change and rural communities. The fortunes of agricultural and land use practices continue to be closely linked with the fortunes of rural communities, but there is not a simple causal relationship between the two. In sharing the approach taken by Joseph et al. (2001, p.17), this research considers agricultural change and the implications for rural communities in tandem in order to avoid the "trap of simplifying or holding constant one side of the change equation". Hence in this research, which explores the implications of agricultural change for rural communities, the concern is less with identifying cause and effect than with observing associated change.

2 Methods

In reviewing recent agricultural and associated community change to provide a basis for considering future scenarios, this research used both quantitative and qualitative methods.

2.1 Quantitative research methods

Quantitative data in this report are drawn mainly from three sources: Statistics New Zealand, particularly the Agricultural Censuses 1994, 2002, and 2007 and the Longitudinal Business Data frame;

- Livestock Improvement Corporation's "Dairy Statistics" reports; and
- Ministry of Agriculture and Forestry's "A National Exotic Forest Description" reports.
- Future quantitative economic scenarios were developed using the 2009 Waikato Economic Model (described in Section 6.2, below).

2.2 Qualitative research methods

The qualitative component of the research used semi-structured, in-depth interviews with key industry sector and rural community observers as a means of gathering 'on-the-ground' intelligence about current trends and future scenarios. This recognises the value of grounded knowledge and, in this case, these grounded explanations of change in agricultural practices are used to inform the interpretation of the quantitative elements of the research, including the development of scenarios and projections. Including industry sector and community voices provides for a rich account of the nature and drivers of change and the likely direction of change. The development of scenarios is, thus, informed by the interviews with key informants from each of the sectors of interest and their narratives of change within those sectors.

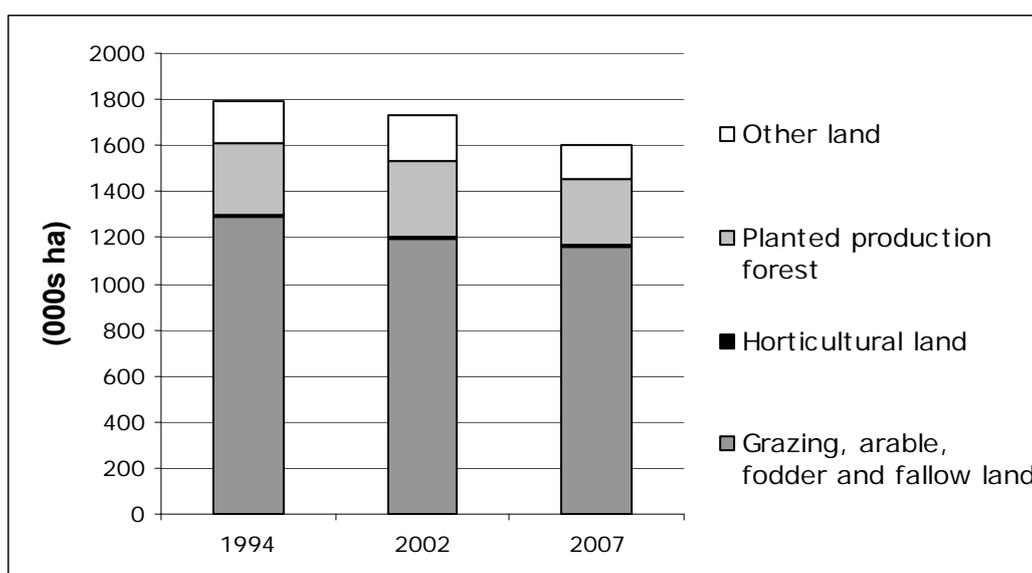
Research participants consisted of a sample of key informants and industry-based stakeholder groups and community observers (see Appendix I for a list of these). The interviews were carried out in two stages. The first stage involved a series of interviews

with key agriculture industry informants and organisations to garner perceptions about, and experience of, change. The focus was on the dairy industry, the sheep and beef industry, and forestry. These interviews explored the participants' descriptions of recent changes in the sector, their understanding of the key drivers of that change, and likely futures in the sectors with which they were most familiar. Having obtained these accounts, the second stage involved a series of interviews with informants who have a keen appreciation of associated community changes, with a view to locating commentaries that would assist in developing understanding about the region's communities' response to agricultural change (see Appendix II for copies of the interview schedules used with both groups of participants).

The interviews were analysed in terms of themes relating to the dairy industry, the sheep and beef industry, and the forestry industry. Interviews in each sector explored changes over the past decade, the current situation, drivers of identified changes, and the influence of these drivers on agricultural practice. Digital recordings of the interviews were selectively transcribed against an analysis framework that was derived from the findings of the quantitative analysis, and predominant themes were identified. Further coding of transcriptions and interviewers' notes was undertaken using NVivo computer software in order to identify sub-themes. The interviews also explored the likely direction of growth in each sector in the short to medium term future and the likely norms around agricultural practice within each sector in a decade's time. This analysis allowed the dimension of 'voice' to be added to the quantitative findings, and provided a basis for identifying the range of plausible future scenarios for which likely demographic, economic and social consequences should be projected.

3 Recent trends in agricultural change in the Waikato region

Changing land use in the Waikato region over the period 1994 to 2007 is summarised in Figure 1. While the number of hectares of grazing land has declined over the period, the share of grazing land in total agricultural land only declined between 1994 and 2002, before increasing between 2002 and 2007. Planted production forest followed the opposite trend, with an increase in forestry land between 1994 and 2002, followed by a decline of around 48,000 hectares over the period 2002 to 2007. The amount and share of horticultural land remained fairly constant and relatively small over the period.



Source: Statistics New Zealand, Agricultural Production Census

Figure 1 Agricultural land use in the Waikato region, (000s) hectares, 1994-2007

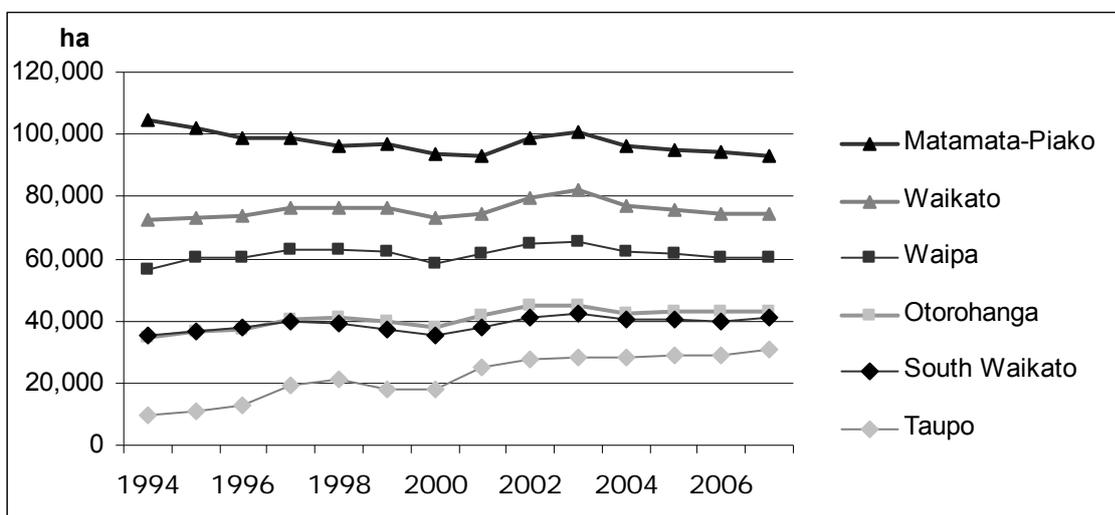
NB: See Appendix Table 1 for data

Despite the apparent lack of significant change by broad agricultural land use at the regional level, there has been a significant increase in the land area applied to dairy farming in some parts of the region, as shown in Figure 2.

Over the period 1994 to 2007, the amount of land applied to dairying has more than tripled in Taupo district (212 percent growth) due to many dairy conversions, and increased by 17.5 percent in South Waikato district.

Nearly all of the growth in dairy area in the region occurred between 1994 and 2002 (for example, 181.3 percent growth in Taupo district, and 15.9 percent growth in South Waikato district). Other areas have also experienced increases in land applied to dairy farming over the period 1994 to 2007, including a 24.3 percent increase in Otorohanga district, a 35.1 percent increase in Rotorua district, and a 125 percent increase in Waitomo district, albeit from a small base (this additional data is included in Appendix Table 2). Again, nearly all of this growth occurred prior to 2002.

Over the same period the amount of land applied to dairy farming has declined in Matamata-Piako district, and remained fairly constant in Waikato and Waipa districts. In total in the Waikato region around 40,000 net hectares was converted to dairy farming over the period 1994 to 2007, a 0.7 percent annual growth rate in the land area (a 9.3 percent growth in the land area applied to dairy farming in that period).



Source: Livestock Improvement Corporation data

Figure 2 Land used for dairy farming for selected territorial authorities in the Waikato region, hectares, 1994-2007¹.

The number of livestock of different types also demonstrates the significant increase in dairy farming, concentrated in the period 1994 to 2002, as shown in Table 1 below. The number of dairy cattle grew by 15.6 percent over the eight year period from 1994 to 2002, but by just 0.4 percent between 2002 and 2007.

The numbers of beef cattle and sheep both declined between 1994 and 2002 (by 23.3 percent for beef cattle, and by 28.1 percent for sheep), before recovering slightly between 2002 and 2007.

At the territorial authority level, the change in dairy stock numbers between 1994 and 2007 mirrors the change in dairy land area (refer to Appendix Table 2). However, dairy stock numbers have grown at a slightly faster rate than dairy land (approximately 18.5

¹ The series for Taupo district includes that part of Taupo district that lies in the Hawkes Bay Regional Council area.

percent regional growth in dairy stock numbers between 1994 and 2007, compared with approximately 9.3 percent regional growth in dairy land over the same period²).

This pattern of dairy stock numbers increasing at a faster rate than dairy land use is repeated in most territorial authority areas. For instance, over the period 1994 to 2007, the number of dairy cows grew by 245.2 percent in Taupo district (compared with the 212 percent increase in dairy land noted above), by 25.1 percent in South Waikato district (compared with a 15.9 percent increase in dairy land), and by 21.3 percent in Waipa district (compared with a 7.1 percent increase in dairy land).

Table 1 Livestock in the Waikato region by type (000s), 1994-2007

Year ³	Total dairy cattle	Total beef cattle	Total sheep	Total deer
1994	1438	870	3606	162
2002	1663	667	2592	143
2007	1669	677	2660	117

Source: Statistics New Zealand, Agricultural Production Census

The faster growth rates of dairy stock numbers when compared with growth rates of dairy land has resulted in a rapidly increasing dairy stocking rate, in terms of the number of dairy cows per effective hectare, as shown in Figure 3. With the exception of Hamilton city, dairy stocking rates were substantially higher in all territorial authorities in 2007 than they were in 1994. The largest increases in stocking rates over the periods from 1994 to 2007 were observed in Waitomo and Waipa districts. Overall in the region, dairy stocking rates increased from 2.65 cows per effective hectare in 1994 to 2.88 cows per effective hectare in 2007.

The nature of dairy farming practices have changed significantly in recent times, as evidenced by this increase in dairy stocking rates. The organisation of business units in the dairy industry has also changed significantly, as demonstrated in Table 2 (with further data included in Appendix Table 6). With the exception of Taupo district, the number of geographic units⁴ in the dairy industry fell in all territorial authorities. Given that the amount of land applied to dairy has not fallen in most of these areas, this reduction in the number of geographic units represents significant amalgamation of small farming units into larger blocks.

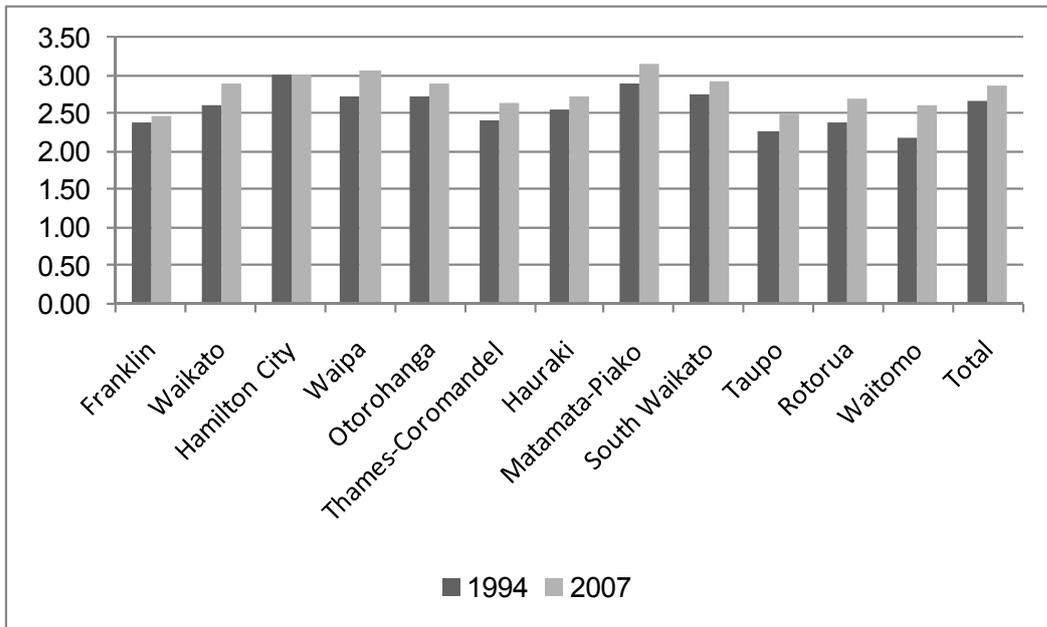
Coupled with this change, there has been a significant increase in the number of employees in the dairy farming industry, with only Hamilton city experiencing a decline in the head count number of employees. While this does not represent the actual number of people employed in dairy farming, since owner-operators are not included, it does suggest that there has been a significant change in the way dairy farms have operated over the period 2000 to 2007. In 2007 the data suggest there are far fewer owner-operators and many more farms employing a larger number of waged labourers.

² Differences in the stock numbers for the Waikato region and for the sum of the territorial authorities occur because of the differences in boundaries between the regional and territorial authority areas.

³ As at 30 June in each year.

⁴ Effectively, the number of dairy farms. Statistics New Zealand define a geographic unit as “a separate operating unit engaged in New Zealand in one, or predominately one, kind of economic activity from a single physical location or base”

(<http://www2.stats.govt.nz/domino/external/omni/omni.nsf/wwwglsry/Geographic+Unit>)



Source: Livestock Improvement Corporation data

Figure 3 Dairy stocking rates for territorial authorities in the Waikato region, 1994 and 2007

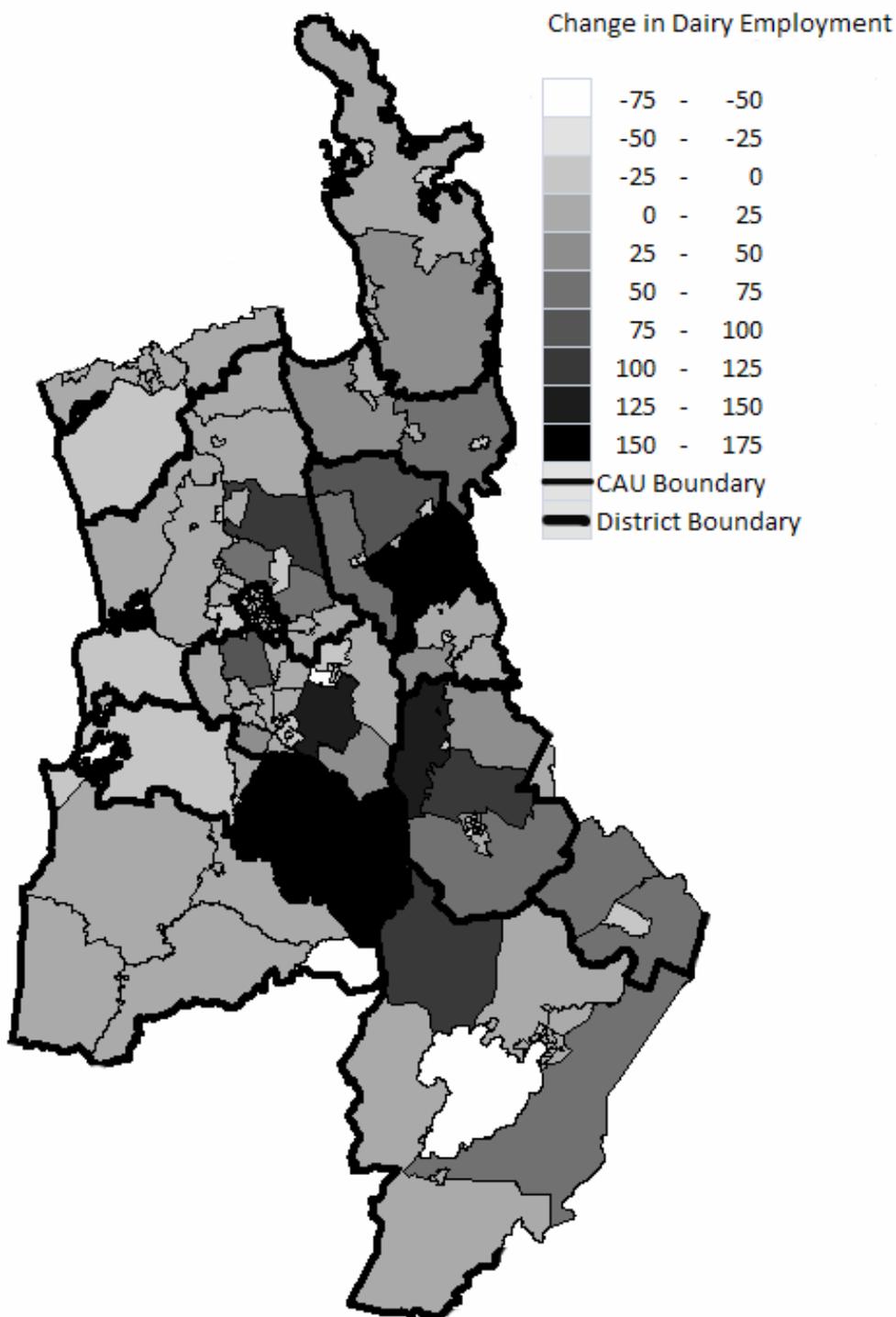
Table 2 Number of dairy geographic units (Bus) and employee head counts (Emp) for selected territorial authorities in the Waikato region, 2000-2007

Year	Waikato		Waipa		Matamata-Piako		South Waikato		Taupo ⁵	
	Bus	Emp	Bus	Emp	Bus	Emp	Bus	Emp	Bus	Emp
2000	1145	660	1126	770	2070	990	635	440	156	260
2001	1129	690	1131	840	2033	1020	620	490	163	300
2002	1139	840	1125	910	2040	1260	642	590	163	340
2003	1092	850	1080	900	1951	1240	621	560	173	360
2004	1048	820	1044	870	1843	1210	608	600	168	370
2005	1040	850	1048	860	1859	1240	585	650	173	380
2006	1002	810	1042	920	1838	1260	595	660	173	410
2007	953	830	996	950	1766	1310	593	640	168	440

Source: Statistics New Zealand, Longitudinal Business Data Frame

Geographically, this change in employment in the dairy industry varies widely. As shown in Figure 4, employment in dairy farming has increased in most of the region, especially in parts of Otorohanga and South Waikato districts. Only in the west of Waikato and Franklin districts has employment in dairy farming decreased.

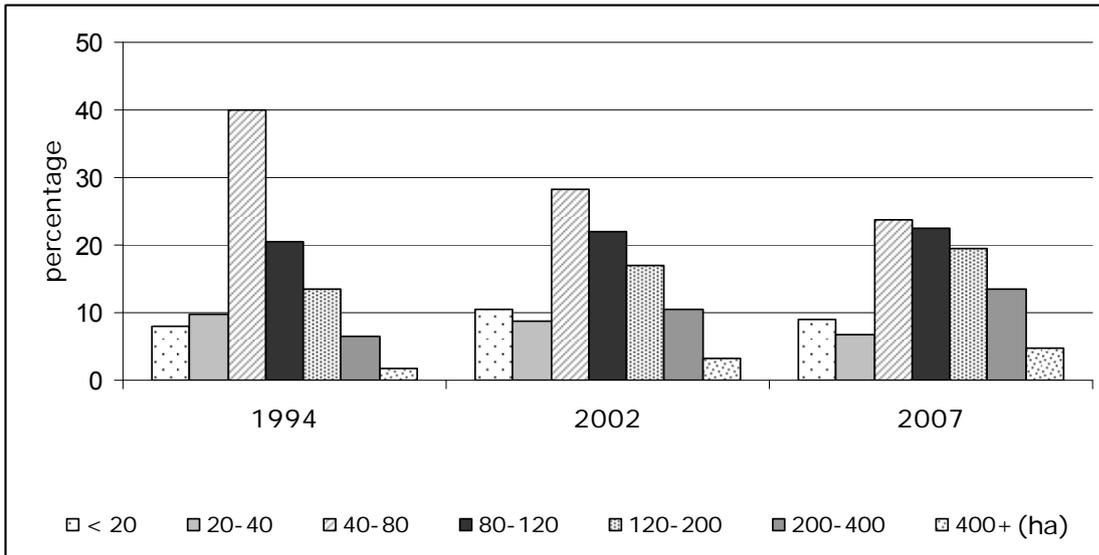
⁵ Includes that part of Taupo District that lies in the Hawkes Bay Regional Council area.



Source: Statistics New Zealand, Longitudinal Business Data Frame

Figure 4 Absolute change in headcount employment in dairy cattle farming, 2000-2006

The change in the size and nature of dairy farms is reinforced by data on the distribution of dairy farm sizes shown in Figures 5 and 6. Figure 5 clearly shows that the size of farms has increased, with the proportion of dairy farms over 200 hectares in size increasing from 8.3 percent of farms in 1994 to 18.4 percent in 2007, and the proportion of dairy farms less than 40 hectares in size declining from 17.6 percent of farms in 1994 to 15.8 percent in 2007. While the proportion of dairy farms between 40 and 200 hectares has fallen somewhat from 74.1 per cent in 1994 to 65.7 per cent in 2007, a notable difference is the drop in the proportion of farms of 40-80 hectares in size from 40.1 per cent in 1994 to 27.7 per cent in 2007.

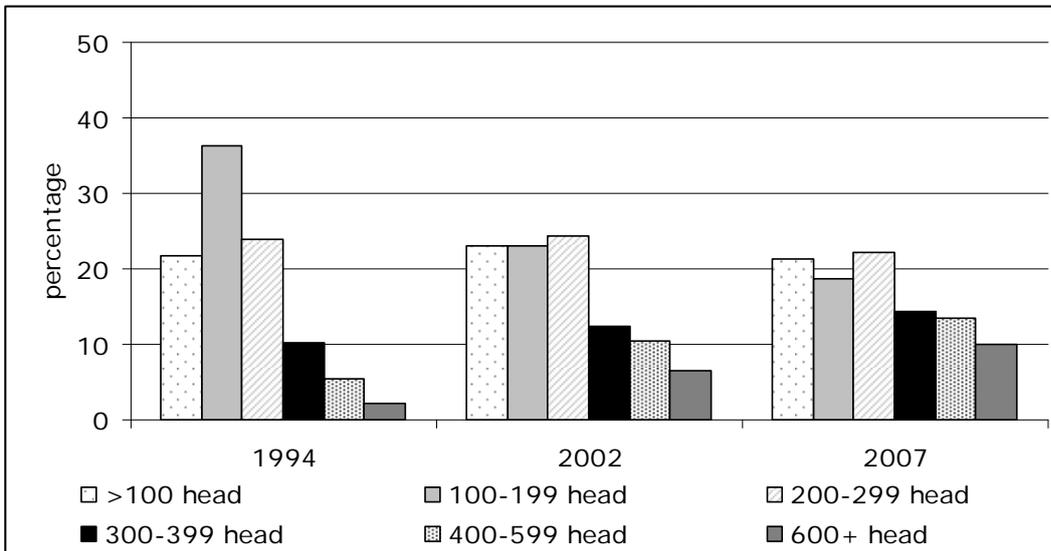


Source: Statistics New Zealand, Agricultural Production Census

Figure 5 Distribution of dairy farms by size (in hectares) in the Waikato region, 1994-2007

NB: See Appendix Table 3 for data

Figure 6 shows the dramatic increase in the proportion of dairy herds larger than 600 head; from 2.2 percent of herds in 1994 to 10.1 percent of herds in 2007, and similarly for herds sized 400-599. Furthermore, the proportion of dairy herds larger than 1000 head has increased from 0.4 percent of herds in 1994 to 2.5 percent of herds in 2007 (data not shown). There have been corresponding decreases in the proportion of herds of less than 200 head, particularly in the 100-199 head range. These dramatic changes in the distribution of farm size and herd size provide further evidence of the considerable consolidation that has taken place in the Waikato dairy industry over the period, with larger farms and herds gradually replacing smaller farms and herds.

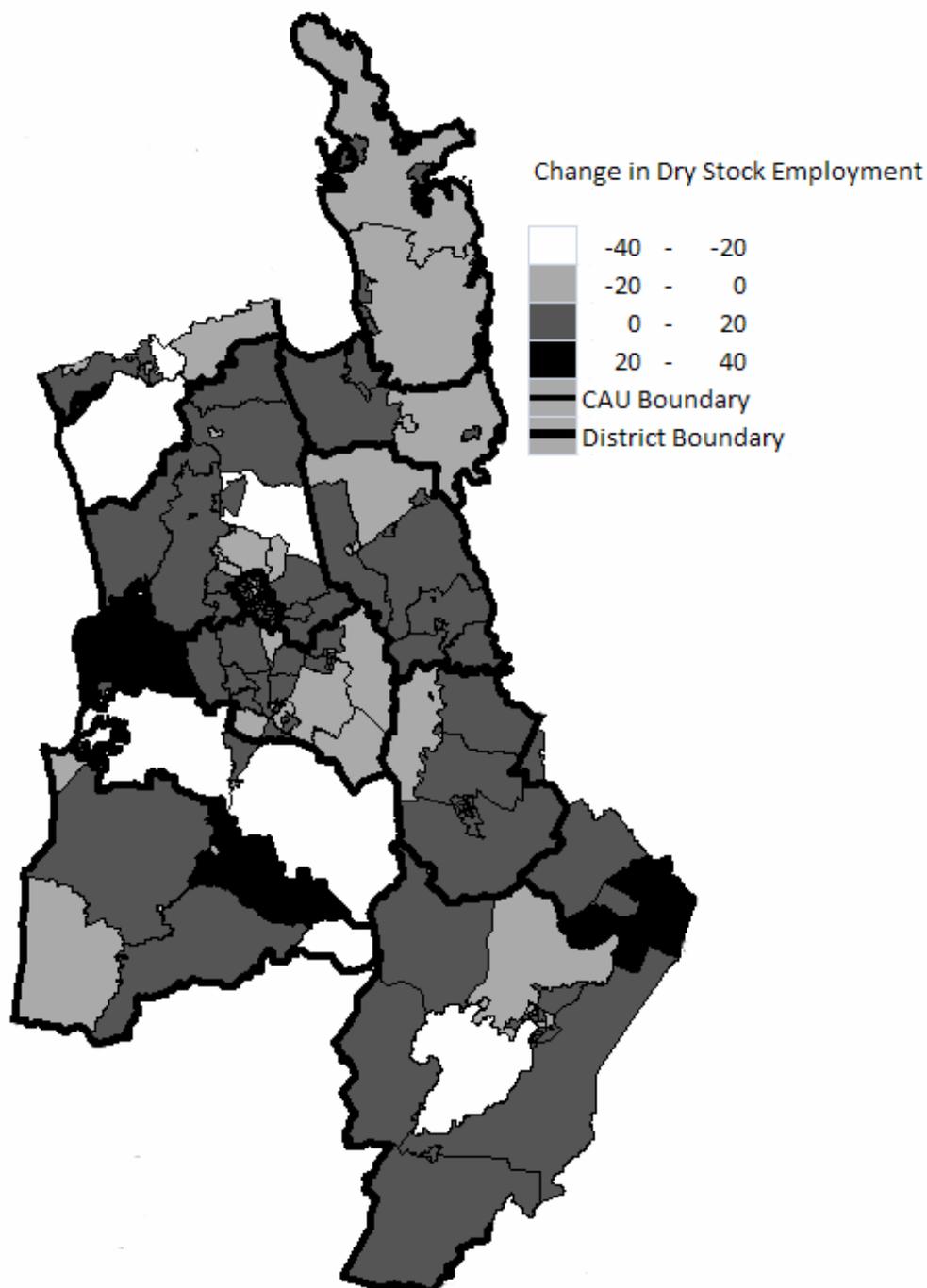


Source: Statistics New Zealand, Agricultural Production Census

Figure 6 Distribution of dairy herds by size (in number of dairy cattle) in the Waikato region, 1994-2007

NB: See Appendix Table 4 for data

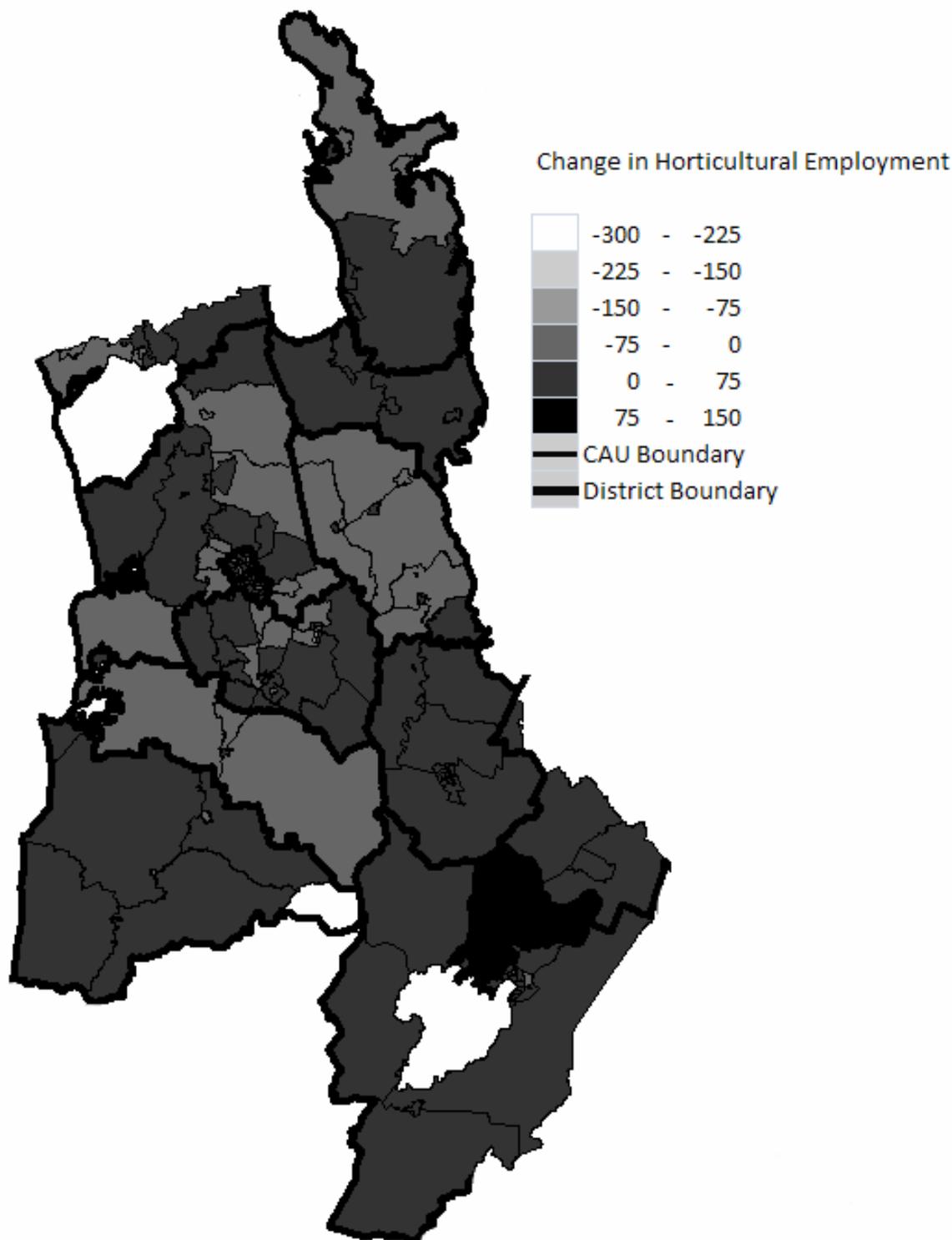
As the dairy industry has expanded and employment in dairy farming has increased, employment in other primary sector industries has decreased.⁶ This is clearly demonstrated by maps of the change in headcount employment in sheep and beef and grain farming (Figure 7) and horticulture (Figure 8). As Figure 7 shows, employment in dry stock and grain farming has decreased or remained static across most of the region between 2000 and 2006, with small pockets of increased employment in Rotorua, Waitomo, and Waikato districts. Similarly, employment in horticulture has only increased in parts of Rotorua and Taupo districts, but remained fairly static in the rest of the region.



Source: Statistics New Zealand, Longitudinal Business Data Frame

Figure 7 Absolute change in headcount employment in dry stock and grain farming, 2000-2006

⁶ Unfortunately, a lack of suitable data precludes the examination of local trends in employment in the forestry industry. Instead, we concentrate here on dry stock and grain farming, and horticulture.



Source: Statistics New Zealand, Longitudinal Business Data Frame

Figure 8 Absolute change in headcount employment in horticulture, 2000-2006

Forestry has gone through a sustained period of decline in the region. Table 3 shows the area planted in exotic forest for the three territorial authorities with the largest areas of forestry, and for all territorial authorities in the Waikato region in total over the period 2002 to 2008 (further data for other territorial authorities are included in Appendix Table 7). As shown in the table, the area of exotic plantation forestry has decreased significantly over the period, by 7.3 percent across the region as a whole, by 9 percent in Taupo district, by 12.5 percent in South Waikato district, and by 6.7 percent in Rotorua district. This trend is not repeated across the region however. Exotic plantation forest has grown moderately between 2002 and 2008 in Waikato (9.8 percent) and Waipa (13.6 percent) districts, and significantly in Otorohanga (39.1 percent) and Matamata-Piako (97.2 percent) districts, albeit from a small base (refer to Appendix

Table 4). The increases in forestry in those four districts were not enough to offset the declines in other areas, and overall the area in plantation forest has declined by around 30,000 hectares between 2002 and 2008.

Furthermore, areas of recent planting (within the previous five years) have declined by 24.8 percent in total and by as much as 41.8 percent in South Waikato (refer to Appendix Table 5). This implies that the region's exotic forests are ageing and not being replaced. Even if new forests are planted now, there will likely be a period of significantly lower regional wood production starting in the late 2010s, resulting in increasing unemployment and human capital losses to the forestry industry.

Table 3 Area planted in exotic plantation forest for selected territorial authorities, 2002-2008

Year ⁷	Taupo district ⁸	South Waikato district	Rotorua district ⁹	Total all TLAs ¹⁰
2002	195623	77785	58984	414407
2003	194229	78830	59546	416388
2004	187998	76822	61223	410362
2005	185994	75273	58051	404683
2006	184870	72910	57195	399740
2007	181774	70816	56513	392387
2008	177928	68033	55022	384140

Source: Ministry of Agriculture and Forestry data

Finally, there have also been observable changes in the interaction between rural and urban areas in the Waikato region. A recent analysis of functional labour market areas in the Waikato region (Barrett et al. 2009) demonstrates that labour market areas have been increasing in size.¹¹ Each labour market area represents a relatively self-contained zone of employment, as defined by the actual patterns of commuting behaviour exhibited by people living and working within it. Geographically large labour market areas arise when people commute further for work, while geographically compact labour market areas are typically centred on a single concentrated area of employment with all workers living nearby.

As shown in Figure 9, in 1991 the Waikato region had 31 distinct labour market areas. Hamilton city dominated the central Waikato, although nearby towns, such as Te Awamutu, Cambridge, and Ngaruawahia, maintained separate labour market areas as only a small proportion of workers living in those areas commuted to Hamilton for work. Other labour markets areas clearly existed because of their co-locational relationship with specific industries — for instance, Arapuni and electricity generation, Tokoroa and forestry processing, Morrinsville and dairy manufacturing. Furthermore, the number of labour market areas centred on small rural service towns such as Te Kuiti, Piopio, Otorohanga, and Kawhia, are a notable feature of the labour market areas of the Waikato region in 1991, and again reflect limited rural-urban commuting.

By 2006, the number of labour market areas in the Waikato region had declined to 14, with each labour market centred on a relatively large urban area or significant industry, as shown in Figure 10. It is clear that the Greater Hamilton labour market area dominates the region, covering the largest land area and having the largest population.

⁷ As at 1 April in each year.

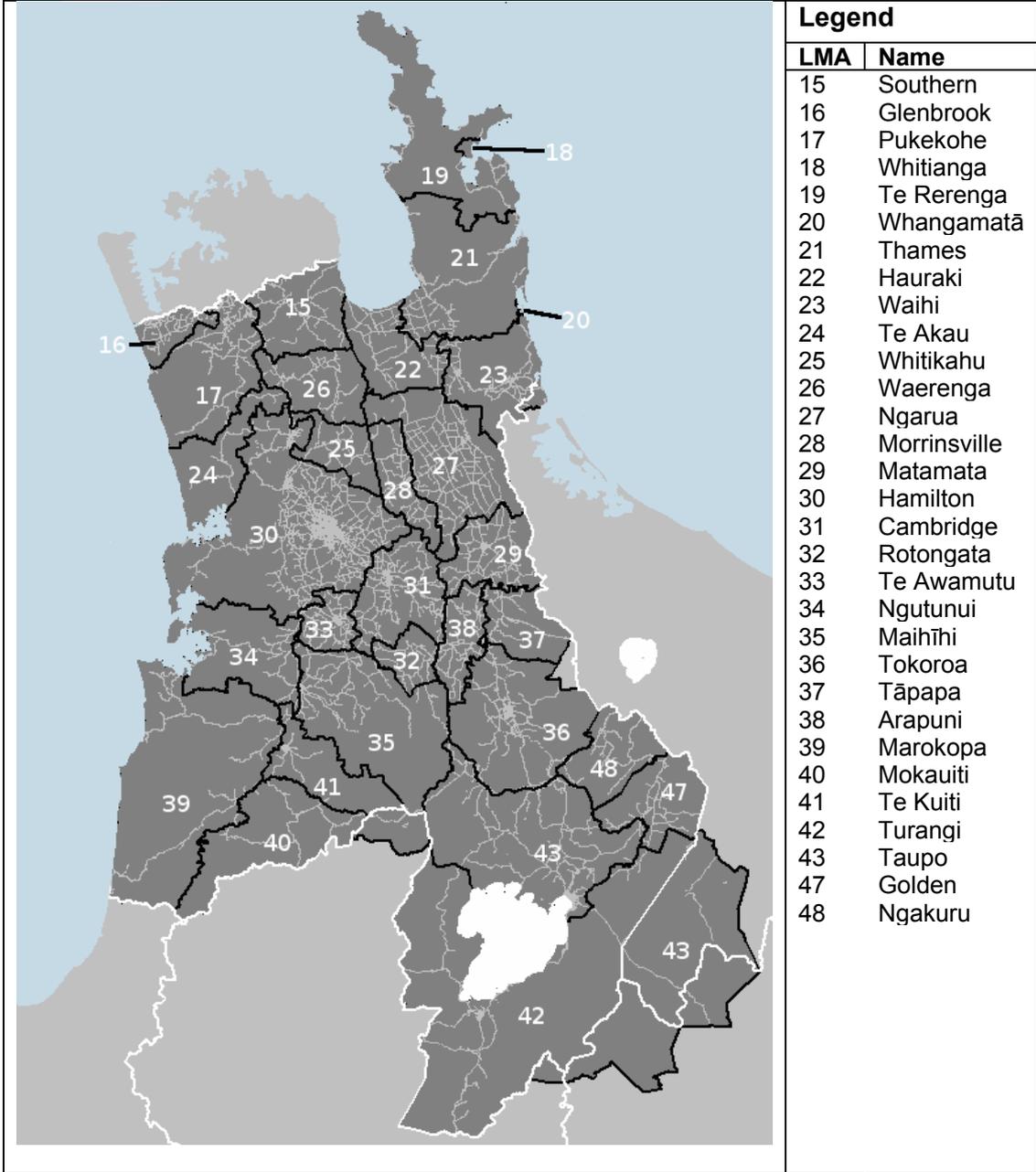
⁸ Includes that part of Taupo District that lies in the Hawkes Bay Regional Council area.

⁹ Includes that part of Rotorua District that lies in the Bay of Plenty Regional Council area.

¹⁰ Includes all parts of all territorial authorities that lie in, or partially in, the Waikato region.

¹¹ These labour market areas are constructed using an analysis of the commute times as recorded in Census data. See Barrett et al. (2009) for further details on the methodology.

The change in labour market areas over this time reflects changes in commuting patterns, with workers in rural areas increasingly commuting further and into urban areas for work. This change in the number of labour market areas probably results from a combination of decreased real costs of commuting, and relative differences in house prices between large urban centres and smaller rural towns – that is, it has become less expensive for urban workers to live outside of town and commute to the urban centre for work each day. This has changed the nature of the people living in rural areas, from farmers and those working in support roles and their families, progressively towards urban workers seeking the lifestyle or lower costs associated with living in rural areas.¹²

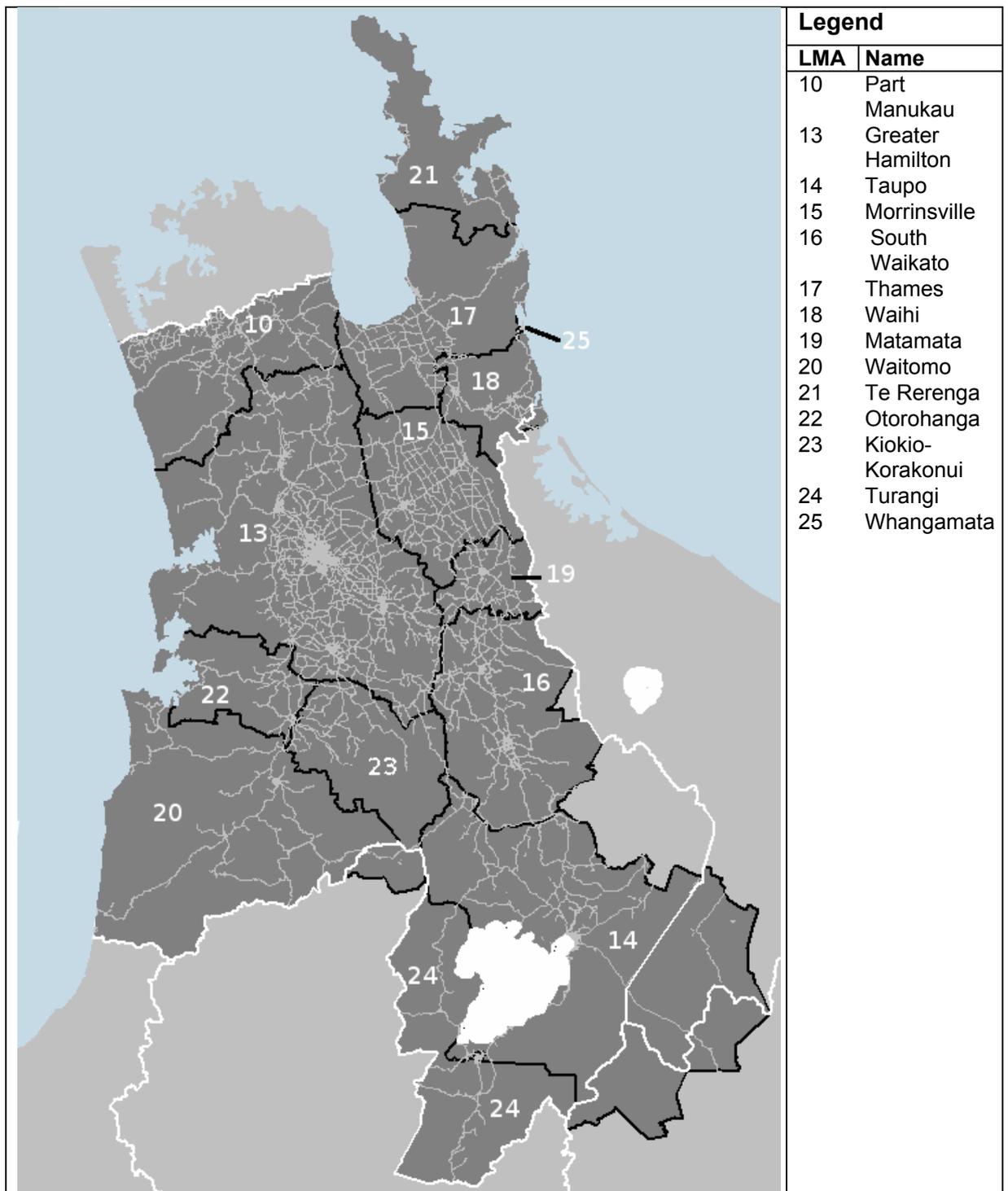


Source: Barrett et al. (2009)

Figure 9 Labour market areas in the Waikato region, 1991

NB: White lines indicate Regional Council boundary. Grey lines denote major roads.

¹² For further discussion of the changes in labour market areas in the Waikato region, refer to Barrett et al. (2009).



Source: Barrett et al. (2009).

Figure 10 Labour market areas in the Waikato region, 2006

NB: White lines indicate regional council boundary. Grey lines denote major roads.

4 Developments in the agricultural sectors: dairying, sheep and beef, and forestry

The following sections of this report present the qualitative findings in terms of the themes identified by key informants from the dairy, sheep and beef, and forestry sectors in light of the statistical evidence of changing agricultural practices in the Waikato region. The following sections draw heavily on direct quotes in both presenting and identifying the points raised. By way of introduction, a comment by an agriculture

industry observer and commentator captures recent trends and developments in agriculture across the whole region:

'Dairying is probably the major pastoral land use, there is still significant sheep and beef through the western hill country... the last five years [have] seen forestry blocks in southern Waikato cut and converted to dairying... and there has been a steady trend over the last decade... into fewer bigger farms... [and a] lot more fragmentation into lifestyle blocks around [the] edges of places like Morrinsville, Matamata.'

4.1 Trends in dairying: Recent history and current situation

Within this context, and mirroring the trends outlined in Section 3, the following developments in the recent history of the dairying sector were identified by the respondents.

There has been a wave of conversions to dairy farming, particularly in South Waikato district, and consolidation in the ownership of farms.

These were described as being linked with higher stocking rates and the use of more intensive farming practices, although such intensification was not seen as being the only model of dairy farming, and there was also reference to some farmers pursuing less intensive farming practices.

Informants also referred to the emergence of new farm ownership and management models, and land use changes linked with peri-urban development.

Consolidation

Consolidation was described by a number of informants as a notable feature of the recent history of dairying in the Waikato region, and is taken to mean a process by which farms have become larger through the buying of neighbouring properties. Consolidation here is also taken to mean the growing concentration of farm ownership, which is not simply limited to the merging of neighbouring properties into larger farms, but may involve the concentration of ownership of properties that are not necessarily adjoining.

'There has been... an expansion, to a degree, of dairy entities, so a number of people own multiple farms or are... buying a neighbour and making a larger farm.'

Industry observers reported that the trend towards 'fewer, larger farms' was a process that has been occurring for decades, but one which has increased pace in the past decade. As stated previously, with the exception of Taupo district the number of geographic units in the dairy industry has fallen in all other districts (see Table 2).

Consolidation of ownership implies fewer and larger farms but also the creation of economies of scale, and tends to be associated with more intensive farming practices – something described as 'industrial agriculture', where there is a greater 'reliance on inputs from other sectors of the economy (for example, machinery, fertilisers, feed, agri-chemicals), resource substitution (capital for land and labour), organisational features associated with the business firm, specialisation of labour and mechanisation' (Jay 2007, p.268). There is a substantial academic literature explaining this trend (for example, see Jay (2007), Smithers et al. (2005), and Watters et al. (2004)), but a simple explanation from one of the respondents in this research suggested that consolidation was effectively a means of remaining economically viable.

'This has happened as, if we want to continue as a business, we need to remain competitive.'

Conversions to dairy farming

As shown in the quantitative data in Section 3, the past decade has also seen a process of conversion of what have historically been sheep and beef farms and forestry blocks to dairy farming or to farming activities that support dairying such as the grazing of dairy heifers, cropping, and the production of maize silage for use as supplementary feed. A dairy industry insider commented:

'[There has] been a push outwards of dairy farms into areas that have historically been dry stock, and the conversion of forestry land... The dairy industry [now] occupies more space than simply the land that has a Fonterra number on the gate... [there has] been an expansion of... the area that is contributing.'

One informant referred to land in the King Country that had historically been used for the grazing of Angus beef cattle and which was now grazing dairy heifers:

'Growing Angus cows has gone!'

The falling relative profitability of sheep and beef farming compared to dairying has been the incentive behind many of these conversions. As one observer of the sheep and beef sector commented:

'...with [the] change in the relative profitability between dairying and sheep and beef... we have lost land to dairying generally, and this has been the better class of sheep and beef farmland.'

The price of the land was also referred to as an important contributing factor.

'...the relatively low profitability of the sheep and beef sector or strong relative profitability of the dairy sector... has driven up the capital value of land... [one of] the implications is that... sheep farmers [were]... compelled into dairying as the only way they could make a rational economic future... compelled to very intensive dairying practice.'

There has been much recent attention given to the conversion of forestry blocks for dairying.¹³ With the increase in dairying returns over the past decade, conversion of forestry blocks has become an attractive proposition given that the land in its undeveloped state is relatively inexpensive, and the costs of conversions are able to be reduced through the introduction of new technologies. One of the forestry sector informants commented that a similar process of investment and land use change towards forestry occurred during the early 1990s when returns on forestry were high.

'At the time people saw log prices go up... so people [were] investing... It has proven to be the case with dairy prices... the same thing happened, the payout went up and up, started converting forestry lands, land underneath the forest was comparatively cheap compared with agricultural land and the cost of conversions were reasonable, so it made economic sense to do so.'

New forestry clearing technologies were described as making this more feasible:

'If you go back ten or more years ago, the equipment wasn't there to do it... the whole feasibility to convert forest to pasture is achievable now... drive through to Taupo, see [the] wholesale renovation of that land... it's been achievable because of the relative demise of forestry land and the extreme profitability of dairying. You can buy forest land and convert it and have land worth \$2000 [a] hectare now worth \$10-\$20,000 [a] hectare, so have a margin of \$6,000-8,000 to play with to cover conversion.'

¹³ For example, Britton and Fenton (2007) note forestry land conversion to dairying as the first of five significant land use change trends in the Waikato region.

Intensification and higher stocking rates

Alongside the conversion of former sheep and beef farms and forestry blocks, there has been widespread adoption of more intensive on-farm dairying practices. This was also demonstrated by the increases in average stocking rates in the region shown in Section 3, from 2.65 cows per hectare in 1994 to 2.88 cows per hectare in 2007. While dairying continues to be largely a pasture-based activity in the Waikato region, respondents referred to new feed regimes being developed and off-farm derived feed inputs being increasingly used. More intensive farming practices have greater reliance on off-farm sourced inputs.

'...the intensification has seen a lot more supplementary feed being fed, higher stocking rates, farmers feeding maize silage, palm kernel...'

Higher stocking rates have also been supported by the use of nitrogen fertiliser. In the following quote by a dairy industry informant, reference is made to the way nitrogen fertiliser is now more widely used as a technical means to sustain maximum pasture production. Maximum pasture production is defined and modelled as a pasture production curve. This respondent makes reference to the way nitrogen is used to compensate for seasonally induced deficits in dry matter growth in order to achieve maximum pasture production:

'...now what you are seeing is more high stocking rates, so now [farmers are] targeting their stock rating at a maximum pasture production curve and they are bringing in feed, and filling it up as much with nitrogen, the rest being brought in. So this could be maize silage, or pasture silage, and also bringing in palm kernel extract, so this is the farm system of the future. It has big impact in terms of the footprint, and is partly driven by the capital value of the land.'

Some of the informants who commented on the trend towards more intensive farming practices also noted that, while this primarily involved the intensification of pastoral farming, it also involved cropping, such as the growing of maize for silage. Such cropping activities support the dairy industry and point to the interdependence between dairying and other agricultural sectors.

A related point raised by a respondent with oversight of the dairy industry was the potential for growth in cropping and horticulture, and vegetable production, especially in the northern Waikato. However, as yet this potential has not been realised; indeed in recent years, horticulture has actually been in decline in the northern Waikato, as demonstrated by the change in horticulture employment shown in Figure 6. While this observer suggested dairy would remain dominant, he also noted that:

'...horticulture will invade that – high value cropping, flowers, fruit. We've got fertile soils here and those sorts of crops can out-compete dairying.'

New farm ownership and farm management models

Comments from respondents suggest that over the past decade new models of farm ownership, farm investment practices, and farm management have complemented the traditional family farm model and sharemilking arrangements. According to recent literature such as Smith and Montgomery (2003) it is reasonable to assume that the vast majority of farms remain as family owned and managed units. The family farm model is characterised by the household as an economic unit which manages farm production and includes other income generating activities such as off-farm employment or on-farm non-agricultural enterprises (Taylor et al. 1997). Other approaches to farm ownership referred to in the interviews involved equity partnerships, a type of ownership system referred to by one respondent as the 'family corporate model', and a greater use of waged farm managers and specialist labour, consistent with the increases in head count employment in the dairy industry noted in Section 3. Equity partnerships are part-ownership arrangements involving two or more

parties, some of whom only contribute capital for the purchase of a farm. The family corporate model is a similar arrangement except that the partners are family members and usually have the asset of an original 'family farm', which is the basis for the purchase of additional farms. As one observer commented:

'Over [the] last ten years, lots of equity partnerships... young managers... sharemilking [is] still there, but [there are] other means than the traditional model.'

In part these changes were explained by the increasing value of land and the amount of financial capital now required in order for young farmers to progress into farm ownership, as farms have become bigger in both scale and profitability.

'...the increase in [the] cost of land has meant that dairy farming has to be more of a business. It is less family-focused farming now. It's really becoming a very profitable thing to invest in, so more corporate...'

As land prices have increased, succession to the next generation has become more challenging, and this was seen as a contributing factor to the development of the new models of farm ownership.

'Succession has become an issue. It's been harder for [the] next generation to take over [the] farming business.'

A related observation was that on-farm management has come to be characterised by a greater degree of specialisation, especially on larger, more intensive farms.

'People tend to specialise, it's simpler to specialise... the industry increasingly now contracts out, so [we have] milking platform specialist unit[s], specialist maize growers, specialist feed importers.'

Over the recent decade, farm management has had to cope with a labour market environment that has been characterised by historically low levels of unemployment, both nationally and regionally. This has resulted in farm labour shortages and challenges in attracting 'quality' staff to farms. The response from the dairy industry has been a nationwide publicity campaign to recruit potential staff, and such initiatives have targeted potential staff from urban areas, as well as new immigrants.

'A whole lot of people are coming into [the] country on work visas through immigration policies. Business owners want to grow business. We have been struggling in low unemployment... not enough New Zealanders are taking up opportunities on farms.'

Peri-urban development

Peri-urban development in parts of the region has encroached on farm land and was described as leading to the fragmentation of farms on urban peripheries and in some cases a change in land use from dairying to lifestyle blocks. While this land was being put to a variety of uses, some of the larger blocks in the fragmented periphery were playing a role in supporting the dairy sector through cropping and other support farming.

'Around cities we've seen the de-conversion of dairy farming land into lifestyle blocks... Some [of these] farms support [dairying], growing maize, and growing cows to support farmers.'

The selling of farmland, and particularly smaller farms, as lifestyle blocks was described as a strategy for coping with difficult financial times, but as the second quote below suggests, it has also brought threats to remaining farms.

'...It is a way of dealing with tough times, now the econom[ies] of scale [make it] harder for remaining farms... and while schools will grow, what does it do to your long term land if that trend carries on.'

'We are being pushed out. In last three years we have 3-4 lifestyle blocks on my road.'

Ongoing change to dairy practices

According to respondents, the changes that have occurred in on-farm practices and land use are primarily driven by economic profitability. While the complexities of this driver are explored in more depth in the following section, it is also useful to briefly acknowledge the dynamic relationship that economic profitability has had with on-farm practices and land use change in the recent past.

One change that has occurred in response to economic profitability and the opportunity to increase production has been greater use of feed pads on dairy farms. This practice provides the opportunity to increase the stocking rate through the use of off-farm inputs while protecting pasture, and making the most of high dairy payouts. As the following quote from a dairy industry insider suggests, the profitability of using feed pads is tied closely to the cost of supplementary feed and the dairy payout:

'[For] people who have hard feeding pads, if the payout goes up, it's marginally more profitable at the moment.'

It is important to acknowledge that not all supplementary feed is sourced from off the farm and that such feed is not necessarily consumed by livestock on hard feedpads. Such feed can also be made available to dairy cows in the milking shed or be fed directly to stock in paddocks. Whatever the feeding method, it is the dairy payout and the price of feed that determine the profitability of these more intensive farming methods. This intensive model of farming practice is vulnerable to volatility in the price of inputs, which is in turn linked with international commodity prices and the demand for supplementary feed – which can be influenced by the climate. For example, in the recent drought, feed was short and the price of feed was high.

'The price of cows last year rocketed. Farmers wanted more cows and could afford to feed them. So the cost of green feed maize last year was 26c, so [a] whole lot of farmers put it in this year. Now it's only 19c... unless you had a contract and can keep farmers to it. So, big swings... Feed prices went up because of the drought as well.'

A decade of relatively high returns and the incentives for more land to host dairying has also prompted shifts in practices around the kind of land used for dairy farms. Historically, rolling hill (sheep and beef) and pumice (forestry) country have been considered unsuitable or marginal for dairying purposes. However, as one observer put it:

'Dairy farming is not a fad... but when prices are high, marginal land is brought into it, [and] when prices drop a few go out, ones that shouldn't have been in it...'

Respondents noted that a fall in dairy payouts may see some of this land return to its previous use. Currently, drystock farmers who are grazing dairy heifers are facing difficulty: the projected payout is falling, and some say this pressure may see a return to sheep and beef farming.

'...when dairy prices, the milk solid price, dropped we have seen a lot of farmers have dropped the price of grazing, perhaps grazing back at home. My hill country farmers are getting less opportunity to graze heifers. It's all turning to shit. They [dairy farmers] don't want to buy maize. There is a real struggle out there. It's not a good picture on the hill country. What to do? Go back to basics and sheep and cattle; that is all you can do.'

4.2 Dairying and drivers of change

Those who participated in the interviews were asked to comment on the factors they perceived as driving change in the dairy sector. Their comments can be read alongside

Britton and Fenton's (2007) review of drivers of land use change in the region. The informants we interviewed emphasised the importance of economic drivers in terms of their impact on dairying profitability and returns, land values, and costs of production. The announcement of a falling payout at the beginning of 2009 signalled a reversal of fortune for the dairy sector. This was linked with declining international commodity prices in the wake of the global recession, something that had not been anticipated within the sector, as evident by the positive outlook for dairying announced by the Ministry of Agriculture and Forestry Situation Outlook in August 2008 (Ministry of Agriculture and Forestry 2008). Growing awareness of environmental issues was also identified as a driver of change. Respondents referred to links between farmer awareness of environmental issues and changing community expectations, industry-generated standards of practice, and the growing role of environmental policy and regulation. Finally, a number of technological drivers were also identified as having driven changes in dairying practices.

4.2.1 Economic drivers

Economic returns and dairy farming profitability

'[The] global milk price [is] always a key determinant of what we see in terms of patterns in the dairy industry here.'

There is wide agreement that trends in dairy farming practices are driven primarily by economic profitability. The growing international market for food products and global demand was consistently identified by respondents as driving both intensification and changes to patterns of land use at the local level.

'Economics is the main driver...'

The relative profitability of different primary sector activities acts as a key driver in agricultural change, and consequently there is likely to be ongoing change. International market returns influence the relative prices received for dairy products, meat, wool, forest products, and other agricultural and horticultural products, and therefore influence decisions about farming practices, land use, and capital investment.

'...the price of milk driving [is] one thing, but you get relative profitability of competing land uses internally. So lambs may be \$20 each, milk \$5 a kilo, the incentive to convert may go down. Or if crop prices take off for biofuels then Canterbury may be more attractive for a cropping province than dairy.'

Following the removal of farm subsidies in the 1980s, returns to New Zealand farmers closely reflect the pattern of food commodity prices in international markets. Comments by a region-wide industry observer and participant suggest that, while there is broad support for these market arrangements, the ebb and flow in returns that are a part of fluctuating international markets required flexibility in farm management. The recent rapid drop in the dairy payout was seen as a major threat to farm profitability, especially given that farm costs, which had grown alongside the recent spike in dairy payouts, had not fallen proportionately to the dairy payout. Costs of fuel, freight, animal feed, fertiliser, and interest rates all rose by more than seven percent in the year to 31 March 2008 (Ministry of Agriculture and Forestry 2008). Some farmers:

'got caught out... last year's payout was \$7, but in a year of drought you lost 25% of production, your cost structure went up 30%, and you're paying for that now; paying now when the payout is \$4.65 plus maybe 40c.'

Costs were identified as an important economic driver that influenced agricultural practice and farm profitability. Respondents noted that in recent years costs have increased due to fluctuations in oil prices and the relative strength of the New Zealand dollar. For instance, the producer price index for agriculture suggests that the cost of inputs into agriculture rose by 8.2 percent during 2008, and by 14.9 percent between

2006 and 2008. The following quote by an industry participant and observer refers to the way fertiliser costs rose:

'The market went mad. Fertiliser was a big thing, but others all raised their prices – commodity prices, oil prices – don't know how much was real but [they are] coming back down now.'

Profitability is determined by international commodity prices, and expectations of peak prices over the long term were described by one respondent as driving the pursuit of higher production in those farms that were undertaking more intensive capital investment and management practices.

'The big driver is [the] international price... farmers chase the price. They chase it marginally too, so they look at the long term trend... This is a peak price. A lot of farmers don't farm to today's price, so put the capital in, thinking it's going to be used for the next fifteen years.'

Economic returns are also affected by access to international markets, something which is not guaranteed in the protectionist regimes that continue to characterise much of world agricultural trade. Furthermore, recent developments associated with the international economic recession have led to an increase in the level of price support available to dairy farmers in the United States and Europe, placing New Zealand dairy farmers at a distinct disadvantage. Maintaining access to markets continues to be critical, and a number of informants commented that, in this environment, international expectations about farming practices as they relate to carbon emissions, climate change, and water use – just how 'clean and green' our production systems are – were beginning to play a greater role in determining the saleability and therefore returns from New Zealand dairy products in world markets. International expectations that farming practices were environmentally sound were described by a dairy industry researcher as likely to be increasingly important. As such, they were expected to become an important driver of change and would result in a greater link between the environment and the economic returns from dairying. He said:

'...internationally the trade situation [brings] pressures, particularly environmental ones... carbon footprint, energy miles. We need to clean up our act and look after our rivers and that sort of thing.'

'We are commodity producers... we are still selling on a commodity market... climate change, carbon, water use – those are [market] signals coming from overseas higher value markets... This [is] a small proportion of our markets but we keep a watching brief on it... [we] can't get into high environment markets because of trade barriers.'

As the quote above suggests, though, presently the bulk of our markets are not 'high environment'; that is, they do not place high expectations on the environmental protection practices that are involved, but this was expected to change. These comments point to the link between the environment and the economic returns to farmers, and suggest that there is increasingly an overlap between economic and environmental drivers of agricultural change. Or, as one commentator put it:

'Environmental issues [are] certainly a significant factor out there, [and] you've got economic factors hidden in environmental factors. Farmers are responding to economic factors at [the] same time as environmental factors are bearing more and more heavily on them.'

Land values

Land values were described as a significant driver of agricultural practice. In reference to dairying, as well as the broader agricultural sector, one respondent commented that the price of land had a:

'massive impact. It's very difficult to afford a farm and get into it without a significant [amount] of capital through previous working,

[or] having family money in a farm already – very difficult to get into as an industry as the capital requirements are so large.'

High international dairy prices have led to high payouts and increases in land values, and these factors combined were described as a significant driver of agricultural change. The low relative value of forestry land was a part of the reason large tracts of it have been converted to dairying.

'...the big drivers are the commodity price for dairy products and land values... [the] return from forestry relative to [dairy] land is very low so people tend to move to a use that will generate [a] higher return.'

Land prices were described as being closely linked to the dairy payout:

'...if the payout goes down, land prices will go down. They're going down at moment. In '84-'87 land values went down, in the late 90s, and now 2008 – till we don't know when.'

As the quote below indicates, increasing productivity has been a way of further increasing land values. The drive to increase production, something often described as a 'productivist' ethos (see Smithers et al. (2005) and Jay (2007)), was not simply motivated by the potential for enhanced returns from the sale of milk, but also from the increase in the value of the land.

'... if you can get productivity improvement, [you] will go for it because if you can increase profit you increase land value by at least 20 times... that [has] been a trend over [a] 50 year period.'

Rising land values provide for capital gains which are not taxed under current tax laws. The ability to increase the value of land by increasing productivity was therefore described as driving more intensive farming practices.

'...an increase in land value is tax free, where[as] every dollar you earn as a business is taxable... so what you have seen is significant intensification, primarily into dairying, but into other areas as well.'

The relative ease of access to bank loans and credit was also described as having contributed to greater capital investment in farms, accelerating intensification and production, and further driving the increases in land values. The following respondent described how in the 'easy credit' environment, there has been a greater tolerance of debt and higher levels of borrowing.

'[The] relative profitability of the farm systems has obviously driven that land use change and relative profitability of dairying... some more intensive ones doing the growing... probably a greater comfort with debt, more borrowing, more leveraging themselves and growing... that [has] been a key driver.'

High land values were also identified as a key driver in the adoption of new ownership models.

'One of the issues is [the] price of land. [I] also see more equity partnerships where [the] farmer might have [a] 20% share and four other equity partners who are probably urban-based.'

'The last decade [has] seen growth in [the] family corporate [model of ownership], which is one family owning anything from 6-36 farms. It's quite a trend... another trend is syndicates...'

'Equity partnerships involve both farmers and non-farmers taking a stake in farm ownership, including professional people investing into dairying... through syndicates.'

This was linked with difficulties around the succession of farming businesses within families and as a part of the process of farm consolidation that was identified earlier. Respondents noted that entry to farm ownership was financially more difficult than it had been in the past; this being exacerbated by the requirement of larger, more expensive units in order for farming businesses to be financially viable.

'The cost of land is why there is a need for other models – the cost of entry [is] more expensive... you need 100 hectares rather than 50 hectares. Even if the price of land holds its own, your viable unit is twice as big, so you need a whole lot more money to get going.'

The quote below points to the way in which difficulties associated with succession within families can lead to the breaking up and sale of farms, which in turn contributes to the process of farm consolidation, as neighbours buy out adjacent properties.

'Take an existing farm, 100 hectares, and 50 hectares comes up next door. That 50 hectares combined in with my farm...The guy next door is better to buy it, it makes sense; it's more efficient so you can pay more. [Succession] is less often today, it leads to the division of the farm.'

4.2.2 Growing awareness of environmental issues

An overall impression from the interviews was that over the past decade there has been a growing awareness of environmental issues within the farming sector. A number of respondents linked a shift in attitudes to changing community expectations around land stewardship and farming practices.

'...ten years ago no one talked about it [the environment], and you don't know you have a problem 'til someone helps you or you see... it was not denial but a lack of information.'

'Most farmers understand and [are] doing that by putting together an economic costing of what it costs to pug farms – it costs 10 percent of production, lost if you pug your farm – [that is] a pretty good economic driver to make changes.'

One informant from within the dairy industry commented on the changing attitudes and practices of Fonterra, and the way this has led to changes within the sector, as the following quote illustrates:

'In terms of environmental management that focus has been relevant to farmers and the industry and growth has been exponential... there's a receptiveness from farmers, an awareness by the wider community, a level of demand by local government and [central] government in terms of requirements. Now it is rarely ignored in terms of wider policy, [and] always factored in.'

A number of respondents noted shifting attitudes and behavioural change towards the environment and its protection. This development was captured in the following quote by a fertiliser specialist, which identifies greater acceptance of a specific focus on environmental protection.

'Ballance have sponsored [the] Farm Environment Awards for [the] last seven years. We were very nervous when we went to sponsor them seven years ago... Now it's more mainstream and not radical to sponsor a farm environmental award... Even within peer groups within agriculture you are seeing a behavioural change.'

Policy and regulation

The impact of farming on the environment is a driver that has implications for the viability of more intensive farming practices, and when this was raised by interviewees it tended to be particularly in the context of issues relating to the Taupo catchment. Respondents were generally of the opinion that policy to regulate the impact of externalities is likely to increasingly shape development and that this is beginning to

drive change, especially around the regulation of land use and the levels of permissible discharges from farming practices. With reference to the Waikato Regional Plan (WRP) Variation 5 cap and trade regime for nitrogen in the Taupo catchment, one respondent commented:

'Taupo is an example of the environment as a driver. [It is] one of the causes for locking it [nitrogen] up. In that case you have an extreme example.'

Community expectations (particularly urban expectations) around environmental values are changing and this was identified by a number of respondents as driving on-farm changes in environmental management practices. Public information programmes like Fish and Game's 'dirty dairying' campaign have had an impact. An interviewee with oversight across different agricultural sectors mentioned that:

'The clamour by the community has driven awareness and the need for a balance in the farming approach.'

Another interviewee referred to the same issue and commented on the way in which the public image of farming, as shaped by information campaigns, was having an impact on farmers:

'Image is another thing; the 'dirty dairying' campaign has farmers feeling that pressure about trying to incorporate all that as you manage your business.'

One interviewee commented, however, that farmers were wary of externally enforced environmental management regulations and regulators, especially those that were likely to have the impact of holding back expansion.

'...the Biodiversity Strategy released by MfE [Ministry for the Environment]... they went around the country selling it [and] most farmers I spoke to saw it as something dressed-up in 'biodiversity' word[s], [with] all the expected practices – planting trees... Farmers are easily put off when regulatory-type people... use some flash words as if this [is] knowledge [that] has come from [somewhere] external or above.'

Self management was evident in initiatives like the Fonterra Clean Streams Accord, and the new awareness of the potential of nutrient budgets. Fertiliser companies were responding to this, as one industry insider commented:

'The fertiliser industry wants to service the nutrient management space quid pro quo of having that position in terms of nutrient budgets... the driver of nutrient budgets is the 'Clean Streams Accord' and as one of the tools you have to provide that advice.'

The large scale recent conversions of forestry to dairying by corporate farming bodies such as Carter Holt Harvey and Landcorp were described by a dairy industry representative with oversight environmental management issues as having been carried out in a way that has resulted in farms with promising design for greater sustainability and nutrient management. The large scale nature of these conversions was described as a factor in the development of such designs:

'Carter Holt Harvey and Landcorp, two big companies, have enormous advantage in terms of environmental management [and] can invest in a lot of good infrastructure on their conversions... decision[s] made at board level and implemented by managers can often be a good thing in terms of environmental management.'

'If you talk about big corporate type [farms], probably econom[ies] of scale allow you to put in best practice at the time, [and] that is a positive.'

4.2.3 Technological developments

'Farming is a very technologically involved industry – if [you are] thinking about a sophisticated science system [you] can't go past farming for how much science [is] involved, in terms of machinery, genetics, types of grasses.'

In addition to economic, land value, and environment related drivers, changes in agricultural practices on dairy farms were also described as having been driven by technological developments. As the quotes below indicate, on-farm technological developments were designed to enhance the management and feeding of stock, pasture management, and greater efficiency in the 'harvesting' or milking process.

'[They have been] driven by technologies being brought onto the farm, [that] could be as simple as automotive pumps, to expensive setups... that allows individual monitoring of [the] performance of cows... The introduction of more technology – more steel, more concrete, computers – a lot more [is] going on; [there is] a lot more infrastructure than ten years ago.'

'...lots of dairy farmers [have] gone to rotary sheds... they have an advantage, being easier to put technology into – you can tag cows... so they are electronically picked up... so you know the cows' history..'

Investment in such technologies has meant that on-farm workers today have the potential for greater labour productivity, as indicated in the following quote:

'People are managing a bigger number of cows now. Years ago 200 cows would [have] had [one] owner and staff member; now they're milking 240 by themselves. They might have someone for a short time over calving... farmers are tending to do larger numbers themselves... more automation... a little bit more technology available to make that easier than it used to be.'

Technological developments in terms of genetic improvements in livestock and in development of new pastures and new pasture management strategies were described as leading to changes in farm management practices and greater production. While traditional farms were using such technologies, the following quote points to the way such technologies were an important part of more intensive farming strategies:

'...change in the animal performance and [the] degree to which land is being used more intensively... [use of] maize, palm kernel – the modern cows respond better to that sort of feeding.'

The growth in nitrogen use over the past decade can also be thought of as an important technological development that has shaped dairy farming practice. An informant with good knowledge of the fertiliser sector referred both to the recent growth in nitrogen use and the likelihood that such use had reached 'a ceiling':

'...nitrogen use has probably gone (can get actual specifics for this for you) from 50kg of nitrogen per hectare to 140kg per hectare in last ten years, and what is happening is [that] it's reaching a ceiling and so is not likely to go much higher... you hit a white clover plus a nitrogen ceiling, [and the] only way [to grow] is to bring other foodstuffs or [to] grow other crops... and increase production within that fixed land area.'

While the rates of nitrogen application vary across the region, and while the actual reference in the quote above to an increase in the rate of application from around 50 kg per hectare to 140 kg per hectare should not be seen as a generalisable statement about the specific rate of increase across the region, the general trend of an increase in nitrogen use is important.

Technology to reduce energy costs was also identified by one respondent as a current driver of change and as a likely area of future development:

'New rotary sheds pull in the latest energy saving technologies, like variable speed vacuum pumps. You can also have this on little farms – it cuts power consumption by x amount... that [also] improves milk quality, [and] lowers cost, so as well as saved power, [you get] dropped somatic milk count in cows. Energy saving is being thought of as the biggest growth area... in terms of water – wells and water management. In Mangakino, the latest technology is being put in [is] where a computer screen records all the water usage... domestic, cowshed, [and] stock. It text messages through to [the] supervisor or the farm manager saying, "There's a breakdown." It gives a graph on water usage and if it peaks up above [a] certain level, you go and check the troughs... Other energy savings techniques – milk cooling transfer pump systems.'

Also, a number of off-farm technological developments that were leading to new dairy sourced products were identified as driving on-farm practice.

'Other changes have been [a] growth in colostrum, Stolle milk [a specialised milk product that is used in pharmaceuticals], and organics, but these are very small scale.'

As that respondent noted, these are small scale developments, but they point to a link between manufacturing and product developments that have the potential to change on-farm practice.

Technologies have also facilitated improvements in communication, allowing greater access to information, which in turn has influenced decision making about on-farm practices. The following informant commented that farmers today have access to more information and they get it in new ways, facilitated by information technology.

'Access to information – it is very easy to find out about a new technology or a new type of grass, or a genetic change to animals... ten years ago in a discussion group you may have a bit of a yarn every six weeks, or read the Exporter, but like society in general you're now more inclined to look on the internet... to ring up one of the 0800 numbers attached to a company... access to information has increased significantly.'

4.3 Future norms: Dairying in the Waikato region

'If you think of it as an ecosystem – it is evolving all the time. If you think and try to predict it along a nice trend line... what's going to happen next is not going to be like that... In forecasting the future, thinking in an evolutionary way is more useful.'

A number of respondents commented on the difficulties of predicting agricultural norms in the medium to long term when the short term is likely to be volatile. Some suggested that the next decade will be characterised by greater volatility and risk in terms of environmental conditions and economic (price and cost) fluctuations. These conditions will require adaptive management.

Key informants consistently agreed that dairying will maintain its status as the dominant form of pasture-based farming in the Waikato for the foreseeable future, and that there will continue to be variations in land use across the region. In the King Country there is likely to be a continuance of sheep and beef farming and forestry. Some respondents considered that agricultural practice in the Taupo Catchment will remain relatively unchanged due to nitrogen benchmarking (under WRP Variation 5). Despite the dominance of dairying across the region in the future, it is possible that there will be

further diversification of activities, such as horticulture. Commentaries also pointed to the possibility of marginal land being converted to plantation forestry. There will also continue to be pressure caused by peri-urban development in terms of urban areas taking up land for small lifestyle blocks.

After reviewing the commentaries offered by key industry respondents, three broad trajectories within the dairy sector can be identified. These are not mutually exclusive and it is apparent that they are likely to develop concurrently. From our analysis of the interviews, we conclude that future trajectories around agricultural practices in dairying will likely take the following forms, which are discussed further below:

- Persistence of traditional pasture-based practices – which will work towards developing more efficiencies in pasture, rather than heavy reliance on fertiliser and other external inputs;
- Variation of the dairy farming model – use of wintering pads to support production when pasture growth slows, a ‘middle ground’ approach that is less intensive and utilises supplementary feeding in conjunction with production from pasture; and
- Ongoing development of the intensive farming model – Intensive farming practices and high-end production, characterised by the use of feed pads, intensification, higher stocking rates and multiple external inputs, including fertiliser. This scenario will require both a strong skills base and a high level of investment.

Persistence of pasture-based dairying

‘No dramatic changes.’

‘Still see it as the mainstay of the economy in ten years.’

Dairy farming was expected to remain dominant within the region, alongside a diverse range of other forms of primary production. An informant with oversight across a number of key industry sectors commented that:

‘Dairying will be stable – there may be more cropping but you can’t say what there will be, and specialist [equine]. There will still be meat production in the Waikato, and I see a future for beef and even sheep as a niche. Wool’s got too many competitors.’

Given the large capital investment required in order to move into dairy farming, there is a type of inertia or path dependency in the sector. Given the level of investment required, the following informant considered that, despite a falling dairy payout at the moment, those who have converted to dairying are likely to stay there, although the rate of conversions to dairying and the rate of future expansion in dairying will be slow.

‘There is inertia in this – the decision to take a piece of land which is a sheep farm and turn [it] into a dairy [farm] – it is a big investment, so once in you don’t go out very easily. It is a natural cycle with natural points in time at which land use decisions get made; so even if [the] price of milk went down to \$4 all those in dairying will stay as they have sunk costs for machinery to run... So my pick is that the rate of expansion in the next five years in dairying areas will slow down, [and] there will be downward pressure on [the] milk price. Land value still [has] a bit of sorting out to go on, but existing farmers will keep sticking more feed in cows to make more milk and profit and farm their way through.’

However, one informant suggested that low dairy returns in the future may see recently converted marginal dairying land return to its previous use under sheep and beef farming or forestry. Similarly, one possible area of change that was mentioned was the prospect that some dairy farming land, particularly in the northern Waikato, would increasingly be used for high value cropping. Evidence of this was apparent in the

observation that cropping, in support of dairy farms, was proving to be a preferred form of farming for some:

'Some of the best dairy land is growing maize, as some older farmers don't want to be farming.'

While there is a need to distinguish between cropping to support the dairy industry and what is described above as 'high value' horticulture cropping, the general point was that, while there were clear expectations that dairying would continue to be the dominant form of agriculture within the region, there were expectations of an increase in cropping.

Variation in the dairy farm model

'No single industry trajectory.'

Comments from key informants suggest that it is unlikely there will be a uniform model of dairy farming practice across the region. Some farmers will continue to develop in ways that employ capital intensive, high input methods, while others will prefer low cost, low input methods. Debt levels and, according to some informants, the age of the farmer are important factors in influencing the approach taken. It is likely that there will be variation in farm investment patterns, with some investing in more intensive feed pads and others in new farms.

'...some have changed with changing farm systems, [while] others have stayed in the traditional systems. Systems change through investment in subdivision, water, genetics... a lot have retained traditional aspects of not spending a lot of money on capital investment.'

'Some farmers will be feeding a whole lot of feed, on feed pads, up to seven cows per hectare... going in this sort of direction, [they] may have access to cheaper feed... many need less land... [they] have a feeding view of the world. [They] want to feed their cows lots to get lots of production... [another group is] sticking to all grass systems; a simple system may grow [their] business by buying another farm... some franchise – buy another farm [then] repeat the same package... some invest in [the] South Island, some in Chile.'

Debt levels and profitability were identified as important factors in the type of farming system that was adopted, as were lifestyle advantages offered by a low inputs system or through moving into the dairy support sector. What was notable was that farmers had a range of farm models they could pursue depending on their preferences, as the following quote suggests:

'Different farmers have different mental pictures... one's pumping feed into the cows... like to see fully fed cows... [others] business [is] motivated by animal performance, [another] those driven by profitability.'

The low cost approach includes innovations such as once a day milking.

'...once a day milking, a little less stocking rate... a little less production, but a lot less input [and] 10 percent less production... for a few farmers, if you're going to be an owner operator you get nearly the same income. If you're not big enough to get a sharemilker, it's a good lifestyle choice.'

Ongoing development of the intensive farming model

The following quotes, one by a fertiliser specialist and the other by a dairy industry insider, reveal an expectation that there will be a continued trend towards more intensive farming practices and growth in the use of feed pads.

'More dairying, more intensive, so people are concentrating on kilograms of milk solids per hectare need to grow more grass, [and]

first tend to use more nitrogen fertiliser. Fifteen years ago [there was] hardly any nitrogen, now [the] thing is to bring in feed, the maize – used to be just grass silage – a big trend.'

'[A] quarter of Waikato farmers have put in feed pads in the last ten years... big concrete areas, some the size of a football field, [and] they use them sometimes overnight [to] feed cows if they don't want them on the paddock, or feed them on [the] way out of [the] shed.'

This trend is noted in a recently commissioned survey by DairyNZ where 19 per cent of dairy farmers in the region had feedpads (Tarbotton, pers.comm 2009).

So while there is expectation of a period of instability given the international financial crisis, the trend toward intensification is expected to continue in the medium to long term future.

'...[I] ultimately see ongoing continued intensification. [The] only regime you couldn't have intensification in is if you can have significant cost cutting, and I can't see that happening – it's a major international threat, if costs continue to go up [farmers] will continue to intensify... There may be some economic instability to get through but beyond that you will see continued intensification.'

Ongoing intensification was seen as being linked with further changes in ownership structures as identified earlier and, as the second quote below suggests, the possibility of land owners leasing properties.

'I see continued intensification and amalgamation into bigger units.'

'Probably more leasing of properties – a number of farmers getting older want to retire and [it is] too dear for someone to buy – so [they] will lease it rather than sell it.'

Ongoing intensification, supported by technological developments and greater use of labour saving devices, including robotics, raises a number of issues – not least the need for a higher level of technical and management capability.

'Farming at that high level... you've got to have real skills to be able to manage all the change that happens... to push that production... So you've got to be really smart.'

The general point here is that high input, high stocking rate farms require specialised skills, as the following quote emphasises.

'It's bit like driving a formula one rather than a Model T... [It] requires a high level of skill... management skills to manage that business are quite challenging because you have a system [that is] very vulnerable to disease, poor animal health, conception... the operation needs to be very good, the margins aren't high and your feed conversion efficiency has to be high.'

There was some question about transferring the skills that have been built up around the pasture-based approach to dairying to the more intensive, feed pad model, and whether New Zealand farmers could effectively compete internationally while using the more intensive model.

'...we are low cost producers [and] can grow grass in good climate so pad farming [is] more expensive [and] needs lot of water and feed in... [I] don't see how we could be competitive as places all over the world can do that easier.'

Intensive feed pad approaches to farming were described as requiring a significant shift in focus and skills from the pasture-based approach to a feed-input approach:

'Our farmer systems are built around clover and legume and nitrogen fixing... essentially around growing legume and grass, and

then you feed the animal – the whole philosophy [is] feeding the plants to grow... about soil management... Other countries feed the animal not what [is] on the ground – their total focus [is] animal nutrition – ours [is] feeding pasture through systems [to] indirectly feed the animal... If you go into mixed ration feeding, some of the more intensive high supplement use we are starting to get into... [that is] more a focus on animal feeding'

A changeable future

'It may be that in the next ten years [it will be] not so much [about] low cost production as about adaptive management of [the] industry – the ability to move rapidly to make the most of a situation when prices drop. We are moving fast, farmers are now better informed. [They] need flexibility to move between systems, [and] become smarter.'

Respondents agreed that volatility in oil prices and exchange rates will result in changing costs and fluctuating economic signals and that this will continue to influence decisions about farm practices into the future. This is illustrated in the recent example of a spike in the price of phosphate fertilisers, which has been a powerful determinant in shaping fertiliser application practices.

'One of those changes is around the price of nutrients in particular, followed [by] a similar spike to the oil price.'

'We will never go back to 18 months ago, because some of these prices went up six to seven times... only come back to twice... so still doubled the price. That flows through to farmers' cost structures so [I] think fertilisers will be looked at with a harder light... one of the good things [is that it has] driven better recognition of the nutrients in dairy effluent and [farmers] now use this more astutely... effluent [is] now seen as a valuable by-product within the farm.'

Greater volatility will require adaptive management and flexibility.

'Volatility [is] going to be greater going forward [So you mean outside factors?] Whether you are thinking milk prices, forests, environmental conditions, economic thing – range of prices received – [these] all affect farming behaviour.'

Environmental policy settings an unknown

The direction of change in environmental management regulations is unknown, especially in terms of Environment Waikato policy, the implications of the Tainui river settlement, and Ministry for the Environment national standards. Furthermore, the likely pace of regulatory change was said to be unclear, as indicated in the following quote from an industry observer:

'For me it has never been so unknown. [I have] no idea about what it's going to look like in some key areas in the Waikato – [we are] working hard to look at industry self management in some key catchments so that dairy farmers own their own destiny in making changes to avoid regulation... The Tainui river settlement, that is an untried unknown – what will they require for the health and wellbeing of the river, [and] how might that influence dairy farmers... they could be planning away happily and that won't meet their needs or requirement[s] or it may form a fabulous partnership – still an unknown at this stage.'

National policies driven by international agreements, such as New Zealand's obligations under the Kyoto protocol, were described as increasing the uncertainty of the policy environment.

'[The] Kyoto protocol and regulation [is] a whole different ball game. What cost will be put on the industry? This is the biggest outside

driver for us – whether as a country we are willing to impose large costs on agriculture in order to meet the government’s goals internationally. This shapes profitability – if the industry profitability is severely depressed by government regulation then some of the inertia [for change] will unravel.’

Changes to the institutional context in the dairy sector

The organisational arrangements for dairying in New Zealand over the past decade have changed, with Fonterra coming into existence as the dominant manufacturing organisation. While new dairy manufacturing enterprises have since emerged, Fonterra continues to dominate dairy manufacturing and marketing, and given the centrality of returns to farmers, its importance cannot be underestimated in terms of its role as a driver for changing agricultural practices.

One respondent noted that Fonterra will continue to operate as a cooperative, but that it will have a greater international focus.

‘[It will] still have [a] cooperative aspect – still owned by New Zealand farmers [but] more global... [it will] source more milk overseas. [Fonterra] already source[s] one third of our milk overseas... already do other joint ventures with other dairy companies around the world, [and there is an] expectation that half of our milk will be sourced overseas in the next decade.’

Over the coming years it is likely that Fonterra will face new competition from smaller or emerging companies. This may lead to increasing fragmentation within the industry and will present new challenges for the coordination of supply and marketing.

‘At the moment [it is] relatively easy to do things in the dairy industry because Fonterra is so dominant and able to drive things through. But in the meat industry [it is] quite fragmented; your ability to negotiate with more than one player and drive change... [the dairy industry is] relatively privileged with Fonterra but if ‘Open Country Cheese’ or whoever became quite big, suddenly [you] can’t rely on Fonterra to drive change in behaviours.’

4.4 Trends in sheep and beef: Recent history and current situation

Although there has been a decline in sheep and beef farming with the Ministry of Agriculture and Forestry (2008) reporting large scale de-stocking in the sheep industry (for further quantitative evidence refer to Figure 7 in Section 3), it is still a significant form of agricultural land use in the Waikato region with 0.7 million beef cows and 2.7 million sheep in the region in 2007. There have been conversions of better rolling sheep and beef land to dairying alongside an increased level of economic interdependence between the sheep and beef sector and dairying. This has contributed to increasing land values, farm amalgamations, and intensification, but there is variation, and many sheep and beef farms continue to have low capital investment.

There have been a number of important technological developments within the sector. However, returns on production continue to be volatile, and the industry is one characterised by low margins. Today a higher level of business skill is required in order for these types of farming businesses to remain viable. In areas closer to towns, there has been some fragmentation of sheep and beef farms into lifestyle blocks. It is likely that this trend in land use has been driven by decreased profitability of sheep and beef farming and the difficulties associated with intergenerational succession of high value land.

Sheep and beef farming was described as still a significant form of agricultural land use in parts of the Waikato, despite difficulties over the previous decade.

'Farmers were getting crap price[s] for sheep and beef so they sold – sold ewe hoggets, sold some of their cows, de-stocked to keep going. This is not recorded very well, and then they took in more [dairy] grazers.'

Reference was made by one informant to sheep and beef becoming, at the time of the interviews, more economically viable as 'higher intensity sheep and beef systems' with, for example, bull beef playing a greater role in some areas. The current decline in dairying returns were described, as noted earlier, as likely to prompt some farmers to return to their core business in sheep and beef, as dry stock farms would find fewer opportunities to graze dairy heifers and face increasing difficulty selling maize and other crops that support dairy farms.

Impact of the relative profitability of dairying: Conversions and growing interdependence

As noted earlier, the low relative profitability of sheep and beef farming with, for example, poor lamb and wool prices, in comparison with high returns from dairying over the past decade has driven agricultural change in the Waikato. As the following quote indicates, where the land allows it, there has been a tendency for sheep and beef farms to be converted to dairying.

'There have been reasonable dairy payouts in the last few years. Before that general trend, in this area, a typical area [which is] not particularly good for dairy – rolling country – but we're now surrounded by dairy farmers. Now only one [is] not going against the trend. This area should be sheep and cattle. That has transformed [the] area. Down Bucklands Road [it was] all sheep ten years ago when I came here. It grows grass, but it's not what you call ideal dairying. You want to rotational graze; it's a bit marginal here. That means land prices have gone up. So this area [is now] out of sheep and beef.'

The following quote by an observer of developments in the sheep and beef and dairy sectors states that some sheep and beef farmers have been 'compelled' to convert to dairying if they wish to pass on their farm to their children or if they want to buy more land.

'...the relatively low profitability of [the] sheep and beef sector or strong relative profitability of dairy sector relative to all other sectors... [has] driven up the capital value of land... Some friends of mine enjoy being sheep farmers. They have young families coming up, but if they want to give the farm to their children, or to have another farm, the only way they could do that was to convert to dairying. They didn't want to convert, but it's the only economic way to buy more land. They were compelled to dairying. The only way [they] could make a rational economic return was to convert and [they] wanted to grow more land [so were] compelled to very intensive dairy practice.'

The sheep and beef sector has also developed in a way that sees it play a complementary, support role to dairying.

'Significant dairy returns meant support for dairying on sheep farms... Smaller farms with no debt who don't want to milk cows will find another option so that's been dairy support, as well as raising dairy heifers.'

'There is a degree of tension with competing land uses, [with] sets of resources [being] competed for. Then again, complementary – one services the other. [The] dairy industry supplies sheep and beef farmers with calves for rearing, and whole milk for rearing calves,

[and] sheep and beef farmers providing grazing for dairy heifers and silage.'

However, current declines in the dairy payout have reduced the incentives to convert viable sheep and beef land to dairy or to perform the dairy farm support role of grazing or cropping.

'This drop in dairy payout changed some of the dynamics; the pressure to convert some farmland came off, [and] at [the] same token put pressure on some of [my] clients who are serving the dairy industry growing maize for maize silage, grazing cows... [dairy farmers] didn't have money to spend... so one rolls on to the other.'

Rising land prices and succession issues

Conversions to dairying have driven land prices higher, even for the more marginal sheep and beef land not suitable for the grazing demands of dairy farming. Reference was made by one respondent to moves to more intensive farming practices in the sheep and beef sector. This was described as involving some farmers beginning to use nitrogen on hill country, although it is unclear how widespread this practice is. As with dairy farming, land price increases lead to capital gains and these have been seen as compensating for lower returns in the sheep and beef sector.

'If people aren't making a good income off their farming, they tend to make that income through capital gain.'

Land price increases have also presented succession issues, leading to processes similar to those described earlier in the section on dairying. In some areas, problems with succession were linked to trends in the amalgamation of neighbouring farms, and in other areas, such as around Cambridge and Hamilton where there have been sheep and beef farms close to town, one respondent reported farms being broken up and sold as lifestyle blocks.

'So this area [is now] out of sheep and beef, also into green feed maize production. If close to town [the land is] cut up for lifestyle blocks and a bit of [equine].'

New technology

Sheep and beef farming was described by an insider as a more technically complex activity than dairying, and sheep and beef farmers have embraced a range of new technologies as part of their agricultural practice.

'We see dairying as relatively simple technically, [and] sheep and beef [as] much more complex. Dairying [has] one set of animals, all mature stock running on high class land, [while] sheep and beef farmers may have sheep, beef, deer, goats, [and] maybe dairy grazing, all on one production unit with varying classes of land... technically different sorts of farms.'

While not all sheep and beef farmers have this range of animals on their farms, and while the initial comment about the relative simplicity of dairying may be seen as contradicting earlier comments about the high degree of complexity involved in dairy farming today, particularly on the more intensively farmed properties, it does emphasise that there have also been important technological developments and new demands in the sheep and beef sector.

Reference was made to important developments in terms of genetics and stock breeding. New sheep genetics and the ability to identify genetic traits have led to the introduction of high performance animals with better genetic baselines, resulting in increases in both lambing and carrying capacity. There have also been improvements in animal health through genetics and new drenches. As one sheep and beef industry insider commented:

'New sheep genetics continue with [the] ability to identify genetic traits within individual [animals]... this will drive changes forward.'

The improved genetic composition of sheep flocks is allowing higher stocking rates and higher lambing rates, all with less farmer input, as this older farmer described.

'The introduction of high performance animals like the Finn sheep. [I am] not familiar with all the names but these guys [are] getting 150% lambs, still carrying the same number. My son, he runs 10,000 stock units, with him, his wife and one worker. [They are] getting 160 percent lambs – Coopworth (Romney/Boarder Leicester cross). The carrying capacity since I ran it is just amazing. I couldn't achieve that [as I] didn't have the genetic baseline.'

'[I] witnessed [the] introduction of a new worm drench... magnificent, another tool in my farm advisor box to get increased production. Then others followed... greatest change [was] the Japanese motorbike – the two wheeler – the greatest change, horses out. So amalgamation and genetics [have been] the greatest changes.'

As in the dairying sector, there has been a greater use of computer-based technologies, especially information technology for communication purposes. The availability of the internet has assisted in improving the communication and dissemination of information, but as the following quote indicates, its take-up is not yet widespread given challenges in obtaining access to it in remote areas:

'In terms of farm practice it has changed in [the] last ten years, I guess increase[d] uptake in technology... some of that is driven by economics. With money to spend farmers will take up technology... use of broadband at a marginal level – those things will continue to change. I communicate with a group of farmers through the internet increasingly onto broadband... It will continue. It's not the easiest thing to get in most sheep and beef farming areas, [it's still] relatively minor.'

Environment management issues

In general terms, sheep and beef farming was seen by commentators as having less of an impact on the environment than dairying, although reference was made to some farmers adopting more intensive practices. It is perhaps for this reason that, while the dairy industry has taken on initiatives such as the *Clean Streams Accord*, this has yet to occur in the sheep and beef sector, although there are some expectations that such initiatives will develop in the future.

There is a view that some sheep and beef land is too marginal – that it was developed in the mid-1920s when New Zealand had a regime of land development subsidies that provided the wrong kinds of signals to farmers, and that some of this land may be converted to forest. An observer of the forestry and sheep and beef sector commented:

'Some areas are being retired, some are stuck in dairy. Farmers should not be farming on steep back parts which should not have been a farm – it will revert... to gorse, native will beat it ultimately... it's a time scale thing – economics [will] force that back to what it was.'

4.5 Drivers of change in the sheep and beef sector

Those who participated in the interviews were asked to comment on what they perceived was driving change in the sheep and beef sector. The informants in this research emphasised the importance of economic drivers, particularly the comparatively high returns from dairy farming. As with dairying, growing awareness of environmental issues was also identified as a driver of change.

Economic returns

The high returns from dairying were identified as driving the development of the complementary dairy support role on sheep and beef farms.

'Economic fortunes of sheep and cattle farming perhaps led to change to dairy support grazers. This has been an economic decision, [a] way to make more money.'

The relative profitability of sheep and beef farming compared with dairy farming has therefore been a key driver of change, although, as one observer commented, the recent decline in payout has reduced the incentive to convert.

'[It has] abruptly changed with the drop in payout.'

'This drop in dairy payout changed some of the dynamics; the pressure to convert some farmland came off.'

Costs are related to profitability and increases in the cost of inputs last year (especially fertiliser) have been important.

Informants' comments indicated they were acutely aware of the extent to which returns were affected by the success of off-farm processes, including manufacturing and the marketing activities of the meat industry. There has been recent growth in meat industry production following improving returns from stronger international demand. There continues to be, however, excess processing capacity and potential for further rationalisation, and the structure of the industry works against the adoption of an industry-wide collaborative strategy for processing and marketing (Barrett et al. 2009). The need to respond to market demands was described as an increasingly important driver, especially in terms of the need to provide specialised or carefully targeted products. The following quote from a meat industry observer indicates that the type of large scale, bulk selling of mutton products to the United Kingdom, which characterised the industry for much of the twentieth century, is no longer viable.

'The problem we ran into in the past was being concerned with housewives in [the] UK buying a leg of lamb. Now [we] want the person with the most money paying for that lamb. Providing low cost food [is] not the way to run a profitable business... As an industry we have been forced away from reliance on [the] UK [and] had to widen our horizons [to] look for economic opportunities, [and] become more business focused... got to be looking all the time... anticipate change rather than reacting – having change forced upon you – proactively looking at solutions or opportunities.'

The need to respond to market demands reflects a stronger business or commercial orientation to farming practices than previously.

Fluctuations in economic returns was also described as driving changes in agricultural practice in the sheep and beef industry, but this volatility was also described as providing challenges to planning in the sector.

'...markets drive change... sometimes they are not the best driver because the market may change. In terms of sheep farming [we] might see more meat into China... last year [we were] giving away lambs for \$30-40, [but] this year \$90. The market threw us out... so [farmers] take all the sheep out. [You] couldn't make money [and you] should have some balance. I am an advocate of the market drivers but sometimes markets aren't sending the best signals.'

Land prices

Related to economic returns and the profitability or otherwise of the dairy sector is the impact of high land prices, which have driven change in the ownership structures of sheep and beef farms. As noted earlier, they have contributed to difficulties in farm succession within families.

'[Increases in] land cost has meant families tend not to pass land on to family.'

One informant commented that a related issue was the ageing farmer population, with farms now having to support three generations of a family as people live (and work) longer. In the King Country this has also influenced a tendency towards the concentration of ownership – amalgamations of neighbouring farms, mainly according to the family corporate model rather than the equity investment model that has characterised changing ownership structures in the dairy industry.

Growing environmental awareness

There was a view expressed by several informants that farmers were beginning to recognise that their economic wellbeing is strongly linked to the use of sustainable farming practices and, for example, that they saw the protection of soils, water quality, and the broader environment, as affecting their profitability. As noted for the dairy industry, economic and environmental factors are intertwined. From the perspective of two informants, farmers were not reluctant to respond to greater environmental protection requirements. Farmers recognise that they derive their living from the land, and that adopting sustainable farming practices are integral in maintaining both the use and non-use value of their land. Community expectations about the responsibilities of farmers in terms of mitigating the environmental impacts of their activities were recognised as contributing to a re-examination of on-farm practices.

However, one respondent identified that sheep and beef farmers were not taking on the 'environmental mantra' to the same extent as their dairying peers, and that the pressure to do so was not seen as great given the comparable lower intensity of sheep and beef farming practices.

'The dairy industry has been at the forefront with the 'Clean Streams Accord', but there's not been the same pressure [on] sheep and beef as that's nowhere [near] as intensive.'

Nevertheless, reference was made by one of the informants from the forestry sector about the case for replanting some of the more marginal hill country in trees to address issues of erosion. A further comment to support these developments was made by a sheep and beef industry observer who commented:

'In terms of EW catchment, the environmental pressures are changing. Some farmers have been proactive and have seen it coming and started to work along that line – planting riparian areas, retiring some areas from production.'

4.6 Future norms in the sheep and beef sector

Comments from key informants indicate that it is unlikely there will be major change in the sheep and beef sector in the immediate future. Sheep and beef farming will continue as a pasture-based activity on land that is not suitable for dairying. Farm incomes will continue to fluctuate according to international prices for its products, and the sector will continue to face pressures to maintain profitability. It is likely that ownership structures will continue to evolve, although the family farm model will likely persist, alongside trends towards farm amalgamation and emerging ownership models. Research into new farm technologies will continue, and the outcomes of this will influence on-farm stock and pasture management. At this stage, there is a high level of uncertainty about the implications of environmental management policy.

A steady pasture-based sheep and beef sector

New Zealand farming systems and infrastructure are largely based around pasture. This leads to a specific type of product that has a market advantage of being differentiated from commodities produced in other countries where non-pasture production systems are applied.

'We are relatively unique in the industrial agriculture production system producing livestock on pasture, [this is a] different product from feedlots for Australia, Canada, U.S.'

The sheep and beef sector in the Waikato region has developed in a way that is suited to the regional and sub-regional geographical characteristics and climate, and this is unlikely to change in the coming decade. One informant from the King Country commented:

'Sheep and beef, and dry stock will continue. I don't see a lot of straight out dairying in this district [and it is] not going to be looked upon as a great dairy support area as [it is] too steep. [This district] will get back to basics, no great change but amalgamation will continue... There has been some conversion done, [but already] some people [are] closing down, selling herds [and their] land [is] already on the market.'

Another informant, who had a region-wide oversight of the sector, commented:

'In terms of our industry, norms won't change. A lot [is] constrained in quite a number of areas by environmental pressures. This will vary within our area because of the different issues in different water catchments and restrictions being placed on what we can do. [This will inform the] level of stocking rate.'

The comment was made that reliance on phosphate fertilisers will continue, but that if there was a significant price rise in this input, less fertiliser intensive methods may become more viable. This, however, was not seen as likely in the medium term. According to these informants then, there will be a steady ongoing meat production sector in the Waikato. Production innovation and farming developments in response to new technologies and market demands may result in a greater focus on the growing of sheep and beef meats as niche products.

Fluctuating returns and ongoing pressure to maintain profitability

Within the sector there were expectations of ongoing market volatility and fluctuations in returns. Respondents considered that the future of the sector will be characterised by ongoing flexibility, be it in response to the fortunes of the dairy sector or the returns from sheep and beef products. There were expectations of new demands from markets around product identification and traceability. There were not expectations of significant growth in the sector, even though there will be ongoing research into the potential for this.

'[I] don't see a lot of growth in immediate future. We will see some change in terms of production if [we] tap into new genetic technology, selecting animals for production characteristics or disease resistance characteristics. There is nothing else in technology which will make farming drastically different.'

Evolving ownership structures

Respondents were of the opinion that the traditional family farm model of ownership will continue to dominate in this sector – but it is likely that farms will be bigger and have more reliance on hired labour. It was suggested that there will possibly be more leasing out of properties due to the ageing farmer population and the higher cost of farms for those wanting to get into the industry.

'...[the] traditional family farm will dominate – [I] can see it shrinking but still the dominant form – bigger farms [with] a lot more hired labour rather than [the] family working it itself. Family corporate [farming is] continually growing.'

Uncertain policy environment

The interviews conveyed a sense of insecurity around environmental policy and its implications for farm practices. The current unresolved status of the emissions trading

scheme (ETS) is leading to uncertainty about the benefits of planting former pasture land into new forestry blocks. There is a view that ETS regulations could strengthen the economic returns in favour of forestry, and that this could lead to new plantings on hill country. The potential for carbon trading under the ETS was also unclear and this may impact on the viability of sheep and beef farming.

Technological developments

While there were no major technological breakthroughs perceived to be on the horizon for sheep and beef, new and emergent genetic technologies may provide an enhanced ability to manage production characteristics and disease resistance in farm animals. As one sheep and beef industry informant said:

'[I can] see some change in terms of production if we tap into genetic technology, selecting animals for production characteristics or disease resistance characteristics. There is nothing else in technology which will make farming dramatically different.'

There was also seen to be potential for new products through developments in by-product research, but as the following quote suggests, there are a range of issues around the use of genetic technology yet to be resolved.

'...looking for the next big thing... We have mapped the sheep genome at this stage [and we are] trying to see what comes out of that. [We will be able to] identify certain traits, the same way as for people... [A] whole range of bio-ethical things have to be dealt with – how far you push it, where [we are] going to take it, [are we] not going to allow animals into industry that are susceptible to facial eczema. [It] becomes an animal welfare issue.'

Improved access to broadband and better broadband speeds will continue to enable better access to information, but the same informant who identified this change suggested that its contribution to farm practice should not be overestimated.

4.7 Trends in forestry: Recent history and current situation

Profitability in the forestry sector in the early 1990s saw new planting, but poorer returns on logs and the long term nature of the investment involved has seen a recent pattern of conversion of forestry land to dairying. This trend is obvious from the data in Section 3, where exotic plantation forest has decreased by around 30,000 hectares¹⁴ over the period 2002 to 2008, and the amount of recent plantings has also decreased (see also Appendix Table 7 and Appendix Table 8). This trend has also been driven by the high profitability of the dairy sector over the past decade, improved technologies that facilitate land use change and the capital gains in land prices that can be realised by converting land to a more profitable use.

There have, however, been different trends and drivers identified for change across the Waikato. In the south, significant conversion from forestry to dairying has occurred in response to the strength of dairying profits. Economic incentives have driven a move out of forestry, where the land and the policy context allow for more profitable alternative activities. However, new plantings have occurred on steeper parts in the King Country, especially Otorohanga district where the amount of land in exotic plantation forest has nearly doubled over the period 2002 to 2008. In the Taupo catchment new plantings have been driven by environmental policy, where the WRP Variation 5 has capped nitrogen use and introduced a trading regime.

Conversion to dairying

Between 1993 and 1995 logs were very profitable and this led to large areas of new plantings.

¹⁴ Includes all parts of all territorial authorities that lie in, or partially in, the Waikato region.

'Between 1993-1995 [there were] huge increase in forest plantings [and] the main driver was log prices. So log prices sky-rocketed, logs looked good.'

However, prices did not hold up and this period was followed by an extended period of poorer returns for wood products. New Zealand's lack of competitiveness due to the high relative costs of manufacturing and processing saw forestry returns to growers fall. Over the past five years or more, then, there has been increasing conversion of some of the land that had been in forestry to more profitable uses – particularly dairying. Reference was made to at least 20,000 hectares of former forestry land, particularly in the South Waikato area, that had been converted to dairying. However, it appears that in net terms less than half that amount (9752 hectares) has been converted to date.¹⁵ As noted in the earlier section on dairying, there has been an economic case for converting land that could sustain dairying.

'Land underneath the forest [was] comparatively cheap compared with agriculture land and the costs of conversion were reasonable so [it] made economic sense to do so.'

The decline in land devoted to forestry has been accompanied by a decline in the supporting infrastructure of the forestry sector. One respondent, commenting on the implications for the district around Tokoroa, said that the area:

'has been through a massive community shift and the land use has changed... where there used to be a lot more people in forestry sector, now there are a lot less. Farming picks up some, but [requires] a different skill set – now sharemilking, now the dairy sector industry has emerged... A lot of contractors who had trucks, bulldozers, roading machinery, they had a huge amount of capital investment in infrastructure – multi-million dollars, not small bickies – and those guys have had to sell the machinery or take it elsewhere.'

One observer who was based in the King Country commented:

'There were sixteen [tree] nurseries [and] now [there are] only four nurseries producing seedlings... People don't realise what's happened. In the last four years there has been huge deforestation, and we have lost pruners, thinners, and planters, [and] lost sawmills.'

Different patterns across the Waikato region

Change in land use trends affecting forestry have been observable over the past five years and have taken quite different courses in different parts of the region:

Southern Waikato – in the areas surrounding Tokoroa, out to Mangakino and towards Rotorua, there has been a trend towards dairy conversion of former plantation forest. Demand for dairying land has driven land prices up, and there has been good potential for investors to realise capital gains from the conversion process. Respondents noted that conversions have been to dairy, as opposed to dry stock, despite some of this land being less than optimal for dairying. These observations match well with the data as described in Section 3, where exotic plantation forest in South Waikato district has decreased by over 9700 hectares between 2002 and 2008, and effective dairy land has increased by around 6000 hectares over the period 2002 to 2007.

¹⁵ This figure of 20,000 hectares, often quoted, derives from communications between Carter Holt Harvey and South Waikato District Council in 2005, in which it was suggested that "in excess of 20,000 hectares of land will be taken out of Forestry over the next 5 - 10 years and will be made available for Dairy Farming" (South Waikato District Council, 2006, pp.31). However, Ministry of Agriculture and Forestry data, as reported in Section 3 and Appendix Table 4, suggest that exotic plantation forest in South Waikato district has only decreased by 9752 hectares between 2002 and 2008.

King Country – Over the last fifteen years, commercial forests have been planted on hills that would traditionally have been used for dry stock. Again, these observations match well with the data, where in Otorohanga district exotic plantation forest has nearly doubled over the period 2002 to 2008, as noted in Section 3.

Taupo catchment – The council's Variation to cap nitrogen from land in the Taupo catchment, combined with the mandated role of the Lake Taupo Protection Trust is to stop 20 percent of manageable nitrogen from flowing into Lake Taupo – generally means halting intensification unless people enter into nitrogen trading arrangements. Some respondents recognised this may mean changing some land use from agriculture to forestry. At this stage the data provide some support for large-scale reversion to forestry in Taupo district, but only starting in 2007 and not sufficient in area to offset earlier declines. However, as Taupo district is relatively large geographically, there may be significant geographic heterogeneity in the effects of drivers on forestry in the district, with some areas converting to forestry and other areas of the district outside the Lake Taupo catchment converting out of forestry.

Māori forestry land ownership

Iwi have become more significant owners of forestry land in the Central North Island (CNI) following recent Treaty of Waitangi settlements with the Crown. The CNI settlements have resulted in land with existing forest licenses held by third parties being transferred to Māori. Licenses extend out to periods of up to 35 years, providing the new owners with a long term perspective of the forestry asset.

'One factor that is going to influence everything is the Treaty of Waitangi claims as they get settled... If you look at the Central North Island iwi collective deal... I see this as a good thing as it will bring some stability to the industry for the long term. The CNI are saying they want to get into forestry and not just be landlords. This will be a positive influence on the industry.'

4.8 Drivers of change in forestry

Expectations about longer term returns and the cyclical nature of the wood products industry contribute to a degree of confidence to the forestry sector. The potential to make capital gains from the conversion of forestry land to dairying have been an important driver of conversions to dairy land. However, the availability of suitable marginal land will be a limiting factor on potential for further development. Environmental policy drivers were described as likely to increasingly influence farming and forestry practice, and it is likely that the yet to be clarified Emissions Trading Scheme will also be influential. The latter provides possibilities of carbon farming which, if it eventuates, would become a significant driver in the forestry sector.

Economic drivers of change

There have been economic incentives to move out of forestry where the land and policy context has made it more profitable to undertake other land use activities. Additionally, high relative costs of wood processing in New Zealand have reduced the return to growers. As one region-wide observer commented:

'...the big driver is economics – poor return for logs and wood products and the high cost of processing in New Zealand... the curse of New Zealand is that we live on an island a long way from markets and forestry a good example. [We] haven't got the econom[ies] of scale and have trouble competing in terms of product into [the] U.S. or Australia.'

The same point was made by a forestry industry insider:

'...the big drivers [are] the commodity price for dairy products and land values... [the] return from forestry relative to land is very low so people tend to move to a use that will generate [a] higher return.'

So, changes in forestry have been driven by the relative profitability of dairying compared to lower profitability of other land uses (sheep and beef/forestry), and the good capital gains able to be made on conversion of forestry land for dairying.

'Land values are big and a key consideration when talking about land use change.'

Poor coordination between growers, loggers and processors in the forestry industry has led to uncertainty within the sector and has worked against the development of industry-wide development strategies. The industry currently faces an uncertain economic climate in which the returns on raw product are low and shipping costs are increasing. This short term uncertainty is a further driver for conversions to dairy production where returns were seen as more stable. Interviews with key informants in the forestry sector by Barrett et al. (2009) indicate that there is optimism that more positive results will be achieved over the longer term – especially if the industry is able to achieve a coordinated strategy that establishes strong branding and encourages diversification outside of the traditional *Pinus Radiata* cultivar. Consolidation could also improve pathways for the commercialisation of new wood products, as could advancements in biotechnology.

Different expectations about the long term nature of investment

Forestry is regarded as a long term (30 year) enterprise that generates no flow of income until the end of the investment period.

A distinction can be made between the farm forestry model and the larger forestry blocks of the central North Island. Farm forestry block owners, according to one observer, saw their properties as an investment that could be sold on and some owners were not staying in the industry for the life cycle of the crop. In this sector of the industry, small land holdings tended not to be passed on from one generation to the next. Another commented on new planting arrangements, such as the Green Plan approach, which involved bringing together investors to purchase blocks of land and plant them in forests as a long term investment:

'Within the farming sector, forestry was never seen as a short term economic opportunity.'

'...people are investing for their retirement or as a legacy for their beneficiaries – grandchildren.'

Farm forest ventures, then, were seen as investment opportunities that had long-term promise but were often sold on before they reached their maturity.

Changing ownership structures and forestry management arrangements for some of the larger forests were identified by one informant as leading to a shorter term focus within the industry, and this was described as undermining the future of the sector:

'...in the last ten years... forest owners who have changed. Carter Holt Harvey, Fletcher Challenge, all gone, taken over largely by TIMOs [timber management organisations] who have been investment organisations who tend to have a low investment, [and] don't invest heavily in industry. [This] has not been good for the industry. [They are] mainly overseas investment funds who invest for a certain period, a set time frame, and [at the] end of [the] investment period they are out. They don't want money to be spent on it.'

He went on to say that,

'If they haven't got the money, or if they will not be around for the next rotation, all they do is replant and walk away, no investment in the subsequent rotation, very little investment in R & D [research and development].'

There are currently low expectations about returns in the short to medium term.

Environmental policy drivers

When reference was made to policy drivers affecting the forestry sector, informants referred to WRP Variation 5 in the Taupo catchment as providing an example of how policy can influence decisions about forestry investment. It was described by one of the forestry sector informants as having a significant influence on land use decisions and contributing to the extension of forestry in the catchment:

'Agriculture productivity has been capped and it's been capped by the amount of nitrogen that properties can leach. This has been capped at their historical levels, so essentially [there] can be no more intensification of land use within the catchment and the protection trust's role is to take out 20 percent of the manageable nitrogen that flows into the lake. This means changing land use from farming to forestry.'

The broad point this respondent was making was that the overall effect of WRP Variation 5 was to reduce the level of intensification within the catchment. There was the potential for landowners to buy nitrogen discharge allowances within the cap and trade regime area, which did provide for an increase in agricultural intensification from those who purchased such allowances, but the overall impact within the catchment was expected to reduce intensification.

Within this context, respondents noted that there were some financial incentives available to land owners to convert land from agricultural to forestry uses. There were also reports that some farmers in the catchment had elected to sell land to the Lake Care Protection Trust, a body set up in 2007 and charged with reducing the amount of manageable nitrogen leaching into the lake. The trust has funds it can use to facilitate land use change within the catchment, and this includes the purchase of nitrogen discharge allocations and land itself. It was expected that land purchased by the trust would be converted to forestry.

'They've elected to sell to the Lake Taupo Protection Trust in most instances, which has been set up to buy the land – or buy nitrogen basically... put covenants on it to prevent it ever being able to increase the nitrogen outputs... They'll mostly end up planting trees.'

A key impact of the WRP Variation 5 was that farmers were now paying for the use of nitrogen and this was described as changing farmer attitudes towards its use, and as contributing to the increasing viability of forestry. Despite the fact that forestry was a less profitable form of land use outside of the catchment area, the control of nitrogen within the catchment was seen as increasing the likelihood that forestry would be adopted as a form of land use.

'Buyers coming in to buy land will plant trees – forestry. They're not going to be individuals... [because individuals cannot afford to not have a return for 30 years].'

As the above quote suggests, though, it was not expected that individual land owners would be leading this trend. Rather, it was corporate land owners, particularly, Māori, who were described as likely to play a greater role in the purchase and planting of forestry land within the catchment.

Māori investment in forestry following the CNI settlements was described as being likely to frame much of the future development in the forestry sector with the Taupo catchment. Furthermore, while New Zealand has yet to develop a carbon emissions trading scheme, carbon farming by Māori land owners, in this case Ngati Tuwharetoa, rather than production forestry was described as a possible direction of change that was consistent with Māori land stewardship values.

'If [you] look at the Taupo catchment, half of [the] pastoral land [is] owned by Tuwharetoa – non-forest land. It could be an opportunity within Ngati Tuwharetoa to have a carbon-type forest... even though [the] land [is] owned by individuals or hapū, [it] would be a matter of working that through... people are thinking long term – they need to – and could be longer than thirty years. This is entirely consistent with Ngati Tuwharetoa values.'

For some interviewees, however, these controls on nitrogen were considered an unacceptable impediment to viability and intensification; with costs likely to be disproportionately borne by Māori land owners. Some farmers were reported as having sold up in order to avoid being locked into lower returns on their land. One of the informants who worked with Māori land owners in the catchment commented that for Māori, there were other implications that were not so easily resolved.

'It's a huge impediment to them. They can't sell it [their land]. They can't release their capital. They're locked into whatever benchmark they've been given. And some of them haven't had an impact on the environment, but under this grand-parenting scheme, they're locked in at these levels.'

Referring to Māori owned land, another interviewee commented that:

'They can't develop it into a higher land use. A lot of it's [suitable] dairy farming land – not that they want to convert it to dairying, but they're locked in – trapped by the system. Again. So when people say "oh plant trees, you'll get all this carbon", I'm dubious about it. I think they've got enough trees in Māori ownership in the country now... why aren't the Pakeha planting their farms in trees for carbon?... because they see it as I see it... they might plant a small proportion of their land in trees, but they're not going to put all their eggs in one basket. And that's how they see it from a commercial perspective. There might be [a] place for trees over here, or a percentage of your portfolio in trees, but don't put all your eggs in one basket or be trapped in a system where in ten years time you can't do anything about it... and governments are notoriously bad at signing contracts that they might have to own up on fifty years down the track when they change the laws.'

Clearly this informant saw that Māori land owners in this context as somewhat disadvantaged because their land use prior to the introduction of the nitrogen cap had resulted in lower discharge allowances through the benchmarking process under the WRP Variation 5. A further example of this was the impact on land values within the catchment. Again, one of the informants, familiar with the management of forests in both the Taupo catchment and beyond, commented:

'It has had an impact on their land values. There is some evidence that land values outside the catchment [are] slightly higher than [those] in the catchment.'

While there is currently uncertainty, there were expectations that policy would lead to incentives for new forestry plantings, as the following quotes indicate.

'The possible introduction of the Emissions Trading Scheme will help.'
'I don't see too much forestry going down [due to] countervailing forces particularly around climate change and [the] Emissions Trading Scheme... depends what shape the scheme comes out in. [It] could skew the economic return... in favour of forestry. [You] could see a lot of hill country [convert] back into forestry.'

'If ETS comes in and agriculture is part of it we will probably see more trees going in as farmers try to offset their emissions – pine trees, all sorts of trees –probably [we will] see the steeper country

around Wanganui going into trees as people get a better return from planting in that area.'

However, there are some commentators who are of the view that an ETS may be problematic.

'There are a number of issues with growing native forests. It costs more to establish and maintain, the forests are slower growing, so takes a lot more time to build up carbon stocks compared with some of faster growing exotic species. It does not stack up – the faster the growing of the tree, the more carbon sequestered earlier, so [the] more carbon you have available to sell.'

4.9 Future norms in forestry

Comments by industry informants suggest that forestry will still be a viable industry on marginal land, and policy drivers will strongly influence where forestry occurs. As noted earlier in the report in the context of farming activities, when reference was made to policy drivers, the respondents generally referred to the WRP Variation 5. It was seen as an example of the type of change that was probable in the future. Again, one of the informants, familiar with the management of forests in both the Taupo catchment and beyond, commented that policies of this type were more likely in the future. He said it was more likely to be:

'Legislation rather than regulation – that will increase in the future, I don't think these things are going away. What's going on around here will happen in other areas of country. You can expect increasing regulation on agriculture and pastoral land use.'

There were expectations that some converted land would be replanted in forestry:

'...super marginal land [may] go back to forestry and environmental policy will determine that...'

'I am optimistic [that] a lot [of] land unsuitable for pastoral purposes will be better off in trees. Land owners will be better off economically as well as meeting environmental concerns of the area.'

No specific reference was made to particular sub-regions within the Waikato where this was more likely to occur.

The future was also described as likely to be influenced by technological developments resulting from research and development around new uses of wood and wood products, and diversification in terms of the tree species used in plantings.

There is also reference to the potential for innovation and the use of forestry for biofuels.

'In ten years time there will be a lot more trees. Will they all be pine trees? They may not be, but I would think so... they may not be because there's carbon involved now. But it would appear that trees like Douglas fir, Redwoods – they've got longer life cycles... they might be brought in by people who want to farm carbon... there will be innovations... the people I'm working with... will probably have different looking farms in the future if we can get the management and innovation into those properties.'

'...looked at growing willows for bio-fuel purposes, [there is] still an interest in bio-fuels – still early days... still a question mark over the economics of it and just where the whole bio-fuel thing is going to end up – can we do it using residual forest, existing forest waste, or grow a whole new crop to do it.'

There is uncertainty over the impact of environmental policy, particularly around the imminent introduction of an emissions trading scheme, but there are some who expect it will lead to replanting of forestry. This is most likely in the immediate Lake Taupo catchment area, due to the WRP Variation 5, and possibilities of policy support for the carbon sequestration of forestry. Māori involvement in the forestry sector is likely to increase with further investment following the CNI settlements.

5 Agricultural and associated community change

There is not a clear causal relationship between agricultural change and community change (Joseph et al. 2001). Change in both rural and urban Waikato communities appears to be an inferred rather than absolute result of changes to agricultural practices. The following section, therefore, reviews important community changes that are associated with the land use changes outlined in the previous sections of this report. These include the population decline in rural communities and related changes in the character of rural service towns and in the forms of community and social support. Labour shortages in the rural sector have resulted in recruitment practices that have resulted in a new rural workforce that is more diverse with less of a background in farming practice. This workforce is more mobile and is not tied to the communities within which the farms are located to the same extent as in the past. Together with a growing number of lifestyle blocks and unused farm houses being rented out, these developments suggest important changes in the character of rural communities.

Population decline

Rural workers increasingly live off-farm, including in nearby rural towns and larger centres, where they can take advantage of urban amenities and urban lifestyles. So, in spite of increases in the number of dairy farms and dairy employment (see Section 3), the population of rural areas is actually declining with further declines projected in the future. For instance, between the 1996 Census and the 2006 Census, the populations of Waitomo, Otorohanga, and South Waikato districts have fallen by 3.2 percent, 6.5 percent, and 10.1 percent respectively. Furthermore, each of these districts is projected to continue to decline in population through to at least 2021 (Statistics New Zealand, 2009).

The following quote captures the scope of changes linked to rural population decline. This respondent commented that the changes had been subtle:

'We don't have as much time to put into our communities, to put into our neighbours or friends, to watch out for them. So some of the social things that happen, which were first class support networks – people who historically used to tend to them and had time – because of pressures in their own lives and businesses, and more things to do, and higher things to achieve, you're not seeing so much involvement – this is compounded by farms having got[ten] bigger, the population smaller, so less people.'

The amalgamation of small farms into larger operations is associated with changes in employment practices. Increasing herd sizes have seen a new wave of investment in dairy sheds, many of which are now capable of milking more cows in a shorter time and with less labour required. In the dairy sector then, bigger, more mechanised, and more efficient farms may be each employing fewer workers.

'As farms get bigger and people try to be more productive they use less labour... and the community starts to die basically.'

The development of larger farms, then, was described as a contributing factor to there being fewer people in rural communities, and this had many flow on effects including the closure of small schools, something which, as one respondent described, 'rips the

guts out of communities,' and fewer clubs and opportunities for social gatherings in rural areas. Although the extent to which this is a general factor is unclear, as the data from Section 3 clearly show increases in the amount of employment in the dairy industry in the region. However, not all of these workers live in rural areas.

Changing age structure

In addition the age structure of rural communities is changing. Younger residents in rural communities may move elsewhere (for a variety of reasons, including education and training, career opportunities, overseas travel, or urban lifestyles), leaving an older population behind.

'If you take a circle around an area and look at a community – the only thing that might have changed is [that] the younger people who were born and educated there have gone. The people left have got[ten] older and are wondering what is going to happen next.'

Respondents considered that there were more choices available to young people in terms of training and careers – and that the younger generation doesn't feel the same level of obligation to stay on the farm as did previous generations.

'I have got three daughters and one son, none of them farming, all [have] got other interests – a doctor, computer programmer, primary school teacher, and [an] HR person... I don't think that is a backlash against farming, people [are] encouraged nowadays... [in the] old days [there was] pressure to stay farming... [there is] more choice now and so many educational opportunities.'

Some informants also noted that contractors with specialist skills such as fencing and shearing now tended to be in the older age groups, as young people were no longer attracted to this kind of work, and that this was likely to present problems in the future.

'... fencers round here are about 50 years old, most of them.'
'the average age of a shearer is now 50... there's not enough sheep to support the young guy learning... when the sheep [numbers] have dropped off... you don't want to pay some guy [who is only] shearing a hundred sheep... our last wool cheque might have just covered our shearing...'

It was noted, though, that retention of people in the younger age groups was better in areas that were economically successful and were in closer proximity to a main centre.

'Another community, perhaps more densely populated, is where people have wanted to come back into it. Economically [a more densely populated area] has attracted people and socially it's attractive...'

'I'm thinking of the Putaruru group (one of the dairy push focus groups). And... that whole area... we're blown away from the commitment of that particular group, that started from nothing, and we have 60 farmers, and every time we have a meeting we have no less than 60 farmers. And I keep saying why is that?... I see that area as... economically productive in terms of land productivity... It's close to main centres – Putaruru, Matamata, Cambridge, Hamilton, Tokoroa – and because of those things the people that have gone there and settled there... Their children have grown up and gone to university and those that want to come back do come back. And within that linkage to those centres, there's still enough zing in those nearby centres to continue what they've experienced when they've gone away.'

Changing forms of community and social support

The declining population, then, has had significant impact on the form that rural communities are taking and the capacity of these to provide social support.

Historic trends that have seen the demise of rural halls; sports clubs and interclub activities have continued. Respondents reported that there were not as many social support activities and local fundraising activities as there used to be. Many community organisations, such as Plunket and Playcentres, now centralise their organisational efforts in larger centres.

Respondents referred to the way in which the declining population and the higher mobility of families and individuals who live in rural communities have reduced opportunities to get to know your neighbours. For example, the practice of 'welcoming in' new residents in rural communities has dwindled – and such events are now not well supported or attended by newcomers.

'Not as strong as [it] used to be. That is a problem. Certainly [there are] strong links still between a few, but often now a new one will come into [the] district and perhaps is more isolated. In the old days, everyone, somebody would turn up with [a] plate of scones. [We] used to have 'welcome ins' and farewells for new people coming and others going, but attendance dropped off and in last 8-10 years ceased happening.'

'I don't know a number of people who live on my road now, and I am ashamed about that. I used to know everybody. [There is] nothing to bring everybody together, no community left, [it is] quite sad...'

Federated Farmers groups and farm discussion groups have historically provided opportunities for involvement in social life, but the regularity and level of farmer participation in these have dwindled. The following quote describes how, previously, discussion groups were a social outlet for farmers:

'We used to have farm discussion groups and everyone turned up... on the farm and it was be the same localised area each time, and they would turn up and discuss how things were going and look at pastures, the farm, [and] discuss what was topical for that time of year. You thought you had no grass, but there was always someone worse off, and farmers had that opportunity to see what was happening with everyone else, have a talk and get off their farm... generally that was a good social outlet 'cause the guys don't [get] off the farm.'

Changes to the regularity and support for these discussion groups had occurred and were explained in part by the attempt to respond to the diversity of farming systems in different geographical areas, but comments also referred to the declining support for groups due to, amongst other things, the greater busyness of people. Additionally, Dairy NZ has undertaken a more specialised approach to educating farmers, which has somewhat removed the social networking and support element.

'Dairy NZ, they used have farm discussion groups, and they have gone away from that to more specialised groups – pasture management, financial management...'

Younger people were described as reluctant to get involved in the traditional rural support groups such as Rural Women NZ, and this was accounted for by respondents as being linked with a perception that such groups are for 'older people'.

Historically, schools have been significant social hubs for rural communities. They continue to be important centres for rural communities and it was observed that, in many rural communities, there are now limited opportunities for day-to-day social interaction for adults unless people are involved with the local school. A declining rural population, dwindling student numbers, and an ageing farming population have seen school amalgamations and closures. Other research into the effects of school closures refer to the social costs to communities (see, for example, Witten et al. (2001; 2007)

and Kearns et al. (2009)), and these observations were borne out in the comments from participants in this study.

'[There is] less sense of community in a lot of areas. A lot of little schools have closed down. Schools are a focal point of the community... [School closures do] tend to stop the community, the sense of belonging disappears, people are going off further distances to school. You don't have functions that pull in people, grandparents and others in community.'

Respondents referred to these developments as leading to the demise of traditional forms of rural social interaction around calf clubs and pet days that brought together farmers, grandparents and the broader community, as well as the farming services sector (for example, Wrightsons).

Improved transport infrastructure was seen by some as contributing to the development:

'The school closing down was the most significant change, and I think some of the drivers for that were around people having cars and roads being better and people travelling... to wherever – kids' rugby at Taupiri, go into rugby or netball, you go to Hamilton for all sorts of things.'

In rural communities with declining populations, the size of the families coming in and moving out of the area for work on farms was described as having an important impact on the viability of the local school. Reference was made to the way a family with five children could boost a school roll and keep it viable.

Additionally, reference was made to the greater number of people in rural communities who are not land owners. Farm workers were described as tending to be less tied to a particular location and its local schools and other social groups. As farm workers and sharemilkers were more likely to move to new jobs in new areas, they were less likely to develop long-term links with a local school and were therefore less engaged. A related point was that some schools were likely to have a higher turnover in rolls and less security in their continuing viability. These points were noted as having implications for schools and school age children:

'[The annual]... changeover of staff means [that] you've got more kids coming who have been to seven schools, and that was a local school, so just the fact of high labour requirements, more people working in those communities who are not owners and perhaps a different approach to education. I know there [have] been some different needs in country schools that have been identified – more transient [families] as you got bigger [farming] operations.'

Some of the stronger rural schools, however, are attracting urban enrolments and others are developing new services for their communities. For example, some were described as introducing Playcentres and early childhood education opportunities.

'The local school that we have at Hinuera has got a healthy role [of] about 150. They have a lot of children coming out from town. [They] have four to five schools in Matamata but parents bring them out. [They] value the community family feel, and the involvement in the small school. [They are] driving ten minutes out each day, a lot of them who commute.'

While the role of the local church as a hub for social life in rural communities was identified as having dissipated over the years – schools were still seen as important. For those without direct connections to local schools – that is, those without school age children – there are more limited opportunities for becoming a part of a local community.

'...mostly through schools. Once upon a time... churches and schools were also very important. Historically churches were important. Churches don't have presence now. The challenge is that families move into those areas in a rural capacity and don't have kids in school [so it is] much harder to get into those communities. People [are] more transient.'

Traditional community activities, then, were described as undergoing change, and opportunities for becoming involved were now often more informal and directed by older members of the community.

Such changes in opportunities for community and social support have an impact on community resilience—the capacity of communities to meet the social needs of their members. Community resilience was said to vary, depending on the characteristics noted above and by the proximity to bigger centres. Furthermore, the availability of services and support networks in rural areas was associated with economic fluctuations – when the farming (especially dairy) economy was strong, this supported businesses, capital investment and job creation. But low payouts, drought conditions, and the current recession were having a significant impact that affected all sectors, especially contractors.

The new rural workforce

Labour shortages in the rural sector, particularly following the recent period of very low unemployment, have resulted in nationwide recruitment campaigns. Many of the new recruits are not necessarily from a rural background and this is adding to changes in the community environment in rural areas. One respondent made reference to a recent survey that found that women comprised 30 percent of non-owner dairy labour. A number of respondents referred to the way that many applicants for positions on farms now have less affinity for farm work; they described it as less 'instinctive' farming behaviours. Furthermore, because they tend to view their work on a much shorter timeframe, these applicants were seen as having a different relationship with the land.

'Over a ten year period, the type of applicant has changed. They used to have an affinity with a rural background, now they have less of an affinity. They're coming from a more urban background. People from an urban background have a willingness to learn but don't tend to show the instinctive behaviour we used to see.'

Respondents noted that due to the greater degree of specialisation on larger farms, where each employee's work could be more focused on one aspect of the operation such as milking cows, farm workers were less able to develop expertise in the full range of farm work tasks. Although the skills required were now more specialised, in some ways the movement away from generic farming skills was described as representing a 'deskilling' of the rural labour force. These developments have also increased the demands for stronger human resource management skills from farm owners and managers.

New farming practices have also seen an increase in the use of contractors for tasks such as fencing and the activities involved in cropping. Specialisation, mechanisation and greater dependence on contractors were noted as contributing to a loss of traditional occasions for on-farm group activities, such as haymaking.

Farm workers were described as being more transient, spending only two or three years in an area, with little motivation for a long term investment in the local community. This was observed as being accompanied by a preference for socialising in larger urban centres – a bright lights effect – rather than local communities, and this was seen as having an impact on the degree of local social integration. One of the community observers from central and south Waikato commented:

'[There is] a certain type of person now in our community [linked with dairy farming]. There is a move from June 1st to June 1st. They're not as committed to the industry, not as committed to ownership... more transient...'

Changing farm labour requirements and employment practices are contributing to an increasing number of people who are not tied to a particular farm on a long-term basis.

Another aspect of changes to the rural population is the growing number of people who live in farm houses because of the cheaper rents when compared to urban rental properties. Surplus farm houses (due to farm amalgamation) that are no longer needed for farm-related staff are being rented to non-rural workers. Such farm houses are not always in a good state of repair and some of these renters were described as particularly transient, and not attached to the work of the farm or integrated into the rural communities.

'Farm workers come and go reasonably often, and a lot of rented houses change hands quite often.'

New social groups and increasing social, economic and ethnic diversity

The rural communities today were described as being increasingly diverse:

'If [you] go back 10-15 years, farmers tended to be generic. [Farms were] roughly the same size, [with the same] aims and aspirations, [with] roughly the same system [and] roughly the same age. Now in terms of our farming systems, age, [and] in terms of aims and objectives [they are] incredibly diverse as well as [there] being a lot fewer of us. [It is] far less generic now.'

One aspect of the increasing diversity in rural communities was identified as the evolving social division between farm/capital owners and others. Increases in land values and the concentration of farm ownership were said to be contributing to growing gaps between the 'haves' and the 'have nots'.

'It tends to be locals who have expanded. Sometimes one of the farms has been sold and someone – not an original settler – someone will come in and put two together, or it's someone who is already here.'

Smaller sized farms were identified as increasingly less financially viable and unable to support a family unit, let alone multi-generational families. Respondents, then, referred to an increasing and more marked level of economic and social stratification in rural communities. One commented:

'[The] number in agriculture increase[d] substantially, but number of farm owners has fallen 50-60 percent... [We are] not as egalitarian as we used to be.'

Another observed a link between this and the process of farm amalgamation and intensification:

'But what intensification has done is subtle and we could have [an] argument about what intensification has allowed us to do. The high performers or those who have done well under it have been able to acquire [more land], good or bad. This has changed the fundamental structure of society. It's been a progressive thing [over the] last five years... the gap between the haves and the have not's – the rich and poor – has become far wider and continues to become far wider.'

High land prices were identified as critical in this process:

'[The high price of land] means that most sharemilkers have to move away to more marginal land to get a foot in the door to buy their own place. There are sharemilkers with more than one job in the area.'

Even realistically if [they] cash it all up they have to go [to] smaller farms for their first farm or move out of these areas where [the] land price is high, because there is no choice.'

The following quote shows how most farm workers saw farm ownership as not being possible:

'...now have farm staff – not workers – rightly or wrongly they don't aspire or don't think they can achieve land ownership or substantial asset ownership. They see themselves as farm staff.'

The continuing development of lifestyle blocks in rural communities is contributing further to diversity and new social groups moving into rural communities. People who have chosen to live rurally for lifestyle reasons tend to stay longer than those who purchase smaller blocks of land with a business enterprise in mind. Businesses of this scale tend not to be economically sustainable, and this contributes to a turnover in ownership – a further component of rural transience.

'The larger blocks, say our block up the back. That's part of someone's business. They can make it viable, but [for] most of the others a lifestyle block... People want little space in the country... a lot of that around...'

'...if they buy it as a place in the country and are not intending to make money they stick longer. If they think they're going to have two acres and make an income, they decide it's not viable and move on.'

Owners of lifestyle blocks were described as more likely to live in the country and work in non-rural occupations in the larger centres, commuting to access employment, education and social activities, rather than participating in these activities in the community in which they reside. Because their needs are met elsewhere they are less likely to connect or invest socially within their local community. Other research (Barrett et al. 2009) examining commute areas in the Waikato also supports the presumption that functional labour market areas have expanded to encompass peri-urban areas, reflecting geographically larger commute patterns, and this is a notable trend around the main centres in the region, particularly Hamilton city.

[Are they commuting?] 'Most do. Then renters in farm cottages do the same. People will commute quite a long way. People [are] travelling a lot further like Tirau. A lot of families live there... [and commute] to Tauranga or Hamilton. People are travelling a lot further for their jobs.'

Absentee owners

New ownership structures and farm amalgamation have meant that there is a trend towards fewer resident owners. Equity partnerships and corporate family ownership models, where farm owners do not live on the property, were increasingly common, as is evident from the following quote.

'Where my parents live in Hinuera valley, almost all of those farms are now dairy farms and the value has gone up. Not that land use has changed, but the value of your dairy farm land has increased significantly, which means that the people who are buying it tend to be [a] slightly different crowd. In the last three to four years, quite a bit of investment in the dairy industry is from urban, city investors. So, for example, most of the farms surrounding my parents are now owned by or part-owned by somebody from Auckland, and it is managed by some of the local people. So that is a different dynamic.'

It was evident that the attractions and amenities of larger urban centres were not only attractive to farm workers but also to some owners, and there were reports of farm owners who lived in the city and commuted to their properties.

It was suggested that absentee owners had less of a commitment to the communities within which their farms were located and that this was contributing to the loss of the local community infrastructure. Respondents recounted a number of instances where traditional social activities requiring land (such as dog trials, hunts etc) had been disallowed by absentee owners on land which had been recently converted to dairy farming.

'In the farm over the back, in the last five or six years was sheep and beef. They sold to an Auckland investor who converted it to a dairy farm, and the dog trial club which had had dog trials for the past 50 years... the owner said, "No, you can't have your dog trials here anymore." That's an interesting local dynamic. The local hunt used to go across our farm and that farm at the back, and it needs two farms to get a decent hunt going. A dairy farm can't have horses haring around everywhere, so we can't have the hunt.'

The changing character of rural service towns

'You can see as you drive around – small garages, corner store-type places [have closed down].'

'...used to be a local store, [and a] local garage. The garage at Ohinewai closed when [the] four lane motorway went through. There used to be a supermarket at Ohinewai. That closed and now in Huntly shops [are] closing. [I] heard of another two closing in [the] near future. The hardware store can't compete with Bunnings.'

Respondents identified change in their ability to obtain many services locally. There has been a trend towards the centralisation of supply, and goods and services that were previously available in rural service towns are now stocked on order only, or have to be accessed in Hamilton.

'Rural towns have got[ten] weaker... everything's more centralised... If I want anything for the farm, Huntly is useless. You can wait two or three days... from Hamilton you can get it the same day.'

Improved roads allow people to use services in larger centres rather than those in the local communities in which they live. This was linked with changes in community events and access to retail businesses and services. With regard to community events, one respondent commented:

'In different communities it will be slightly different. My observation around the country in general is that the community gatherings impact is less localised, but that's got to do with the quality of transport and the roads. It is not hard to go to make a bigger event at a slightly further distance.'

In rural communities there were observable closures of garages and corner stores that were unable to compete on price with larger businesses in urban centres. Respondents referred to larger service areas, but also reported difficulties in having services brought from the central urban areas out to rural areas, with the effect that they travelled larger distances to get access to essential services such as banking, petrol and medical care. For example, an after-hours doctor was no longer operating in some arterial towns such as Huntly.

The decline of smaller service townships has also lead to white-collar workers moving out of these areas – taking their social capital with them. For example, there is a developing shortage of experienced members of high school boards of trustees.

While a number of respondents commented that the changing character of rural towns involved processes of 'decline', one of the community-oriented informants observed that there were still strong communities within the Waikato region:

'My observation of the small communities in the Waikato is that they are quite lively by comparison with other parts of the country. They appear to be reasonable wealthy, and there appear to be some fairly good support services and businesses and industries around the farming sector.'

In response to the challenges of maintaining business viability in service towns, a number had adopted new business focuses that were less reliant on servicing the rural sector. Te Aroha and Tirau, for instance, had adopted a tourism focus to their businesses in response to the tendency to lose farming business to the larger centres.

High debt, high stress

Farming life today, particularly on the larger, more intensive dairy farms, was described by a number of rural community observers as being characterised by people working harder, for longer hours, and with less spare time for community interaction. While this was not the case for all farms, the observation was made that many farms now carry higher debt as a consequence of higher land prices and in some cases amalgamation, facilitated by recent banking practices and lending criteria, leading to what one respondent described as 'the unremitting economic grind'. An informant with an industry-wide view, commenting on the issue of high debt, said:

'It is a real key topic in our discussion with Dairy NZ and amongst ourselves. It is a key topic in terms of the debt that is existing on farms. I think there has been a \$10 to 12 billion dollar debt increase on farms in the last twelve months. That's phenomenal; the debt servicing is massive. It puts a lot of stress [on farmers]... It's a key concern – a major, major problem.'

The following quote points to the way easy credit was described as having contributed to the high level of debt some farmers are carrying:

'People in the industry, they have purchased more farms, more cows, at budgets which are pretty optimistic. It was encouraged, or should I say it wasn't discouraged, by our bankers. Some have grown hugely and very quickly and now when... the rug gets pulled out, the stresses are equally magnified.'

A number of respondents referred to the current economic climate, following the recent announcements of the falling payout, and described the situation as 'hugely stressful'.

'Yes people get stressed out. Most of it is financial. This is what effects them most, but other things beyond it – the drought last year and even this year [were] not very good. We may have theoretically had a good income on paper, but you had that long, long time with no income coming in.'

More intensive forms of farming, especially dairying, are more high risk as they involve higher levels of financial debt, higher stress levels, and less room for mistakes – especially under current margins.

'...as the intensification has increased the numbers got bigger [and] the need to manage the finances more has increased. [There is] a greater need for more careful monitoring. Whereas once [if you] had 150 or 200 cows you could fly by the seat of your pants, now when you have got 1700 cows you can't fly by the seat of your pants because if you muck up it's a major.'

'I think also when money [is] short and you have got 800 [or] 1700 cows [going] hungry and you can't buy enough feed, and you see it day and day in and out,[it is] huge!'

While anyone exposed to high debt has the potential to be stressed, reference was made to the specific impact this had on young farmers, who were noted to be more vulnerable to the impacts of the recent drought and the current recession, as they were typically carrying a higher debt and if they had bought land recently, they were likely to have done so at an inflated price. The financial stress was described as having a trickle-down effect within the rural contracting and dairying support sectors. Losses in equity had also had an impact on sharemilkers as the price of cows had dropped.

Reference was made to the notion of a new busyness and a lack of time, given the workload and need for constant attention on the larger and more intensively managed farms. Bigger farms and larger investment mean that people have less time to invest in their community. Although labour saving technologies have assisted, there are still pressures that impact in terms of people's free time. This pointed to the belief by a number of respondents that some members of the rural community were increasingly 'time poor' due to trends toward larger farms and more intensive systems that require closer management. It was noted that the social impacts of population decline in rural communities were compounded for the remaining population because there were effectively fewer people to fulfil volunteering roles, offer support, and organise social life. Those who did remain were also less likely to be able to take on these roles due to on-farm time commitments. The following quotes capture these points:

'[Communities are] holding strong, but are not as strong as they used to be, again because of time pressure. [We are] not interacting as [we] used to because of basically time pressure – lots of things on our plate, lots of things we had to do. Where before we used to turn to each other, more so than what we do now, [we] tended to be closer... share more confidences with friends and neighbours than what we do now.'

'From personal experience around here, people don't have time to be part of things now. [They are] too busy on the farm and I think that has changed, from when farms were less intense. Farmers had more time to be the voluntary workers in those communities...'

There was recognition that these types of developments were typical of broader trends:

'I think that in wider society it's the same. We're not unique. So there're less people available for voluntary roles... within those communities...'

Changing experiences of women

The general observation was made that women were more likely to be in paid work – either heavily involved in the farm (or more than one farm) or working in another role outside the farm.

'Some milk cows and are involved [on the farm] as a labour unit, before changing gumboots and they're out the door again.'

The 'out the door again' reference referred to women's involvement in off-farm work, be it paid or voluntary. Another said,

'I think more people work off-farm than used to. The wives were always at home – [I] won't say they weren't working – they were out on the farm... a lot of them have part time jobs now.'

Women were described as playing a greater role in the management of farms:

'The women are still very involved on-farm... and fill the gap around milking and are financial officers for sure, definitely calf rearing and filling those roles. We know they are very involved, and that involvement has increased. Once upon a time there might have been some discussion around [the] kitchen table. When you talk to

women they clearly identify that they are involved in strategy and decision making around the farm.'

Reference was also made to the greater number of non-owner farm workers who are women. Together with childcare roles, this was seen as contributing to new experiences and challenges for women in rural communities. One informant who had good knowledge of the issues facing women on dairy farms commented:

'In a recent survey of farms milking over 700 cows, a third of employees were women, strict employees, [not owners] so I guess it is more necessary now.'

Childcare is an issue for women who continue to be primarily responsible for domestic and family work in rural communities – fitting in activities such as Playcentre alongside work commitments. Respondents referred to an increase in the use of formal day care and early childhood education services by rural families – an increase in a process of 'dropping a child off at care and rushing back to work'. This was associated with farms that were using more intensive practices.

'One community thing is [the] need for child care. They race down to nearest centre several [kilometres] away [and] drop off [the] children, [then] race back. I don't think that was there when [there were] more owner operator farms... they talk about getting there between the available hours when open. The time Playcentre finishes, say 1 o'clock, these women are more involved and managing, and some of their partners are off the farm doing the other farm. [I have] seen that change with intensification. Once upon a time [a] couple on a farm now do one or two farms each.'

'...seen an increase in the number of new dairies that have a room for children in it. [They] didn't worry about that once upon a time. Now [with] more women working, [they] need a room where children can be safe... because of large herds...'

Women were also identified as doing more driving to access activities (including extra-curricular activities for children) that have been centralised.

'Women are driving all the time... don't know if [this is the] result of intensification [or] just a result in changes over time... women spend a lot of time driving in cars. [They] also take up more after-school activities, and we all do that, so one woman spends hours in her car a week. We are looking at how we can utilise that, do learning through podcasts [for example,] while driving along [the] road... it is also the time they use to make telephone calls [for on farm reasons] while driving.'

This evolving role of women, be it working on the farm or off it, was described as having implications for participation in local community and social activities.

Technology and wired households

The use of computers and the internet for the transmission of information and networking has become central to much farming practice. While one respondent reported that the influence of the internet should not be overstated, not least because many in the rural areas of the Waikato do not have high speed broadband, others referred to the increased use of internet for banking, for gaining access to information, and even for the conduct of farm discussion groups. This was seen as reducing the need for people to travel off their farms and allowing more people to work from home. Access to communication has improved in remote areas, but there were concerns about future access when the guarantee for supply of power and telecommunications ceased in 2013. Currently there is some interest in micro-generation of electricity. While the internet provides various forums to link people (for example, Dairy Women NZ), it is also seen as potentially inhibiting rural dwellers from going to organised

events if they are able to get all the information on-line. In this way technology could also contribute to isolation.

New urban-rural tensions

'We have moved from a population that had a direct linkage through uncle, cousin, school friend, who would invite us to a farm. Now those linkages [have] largely broken down...'

A number of respondents referred to their perceptions of an increasing gulf between people living and working in larger urban centres and rural people. Notwithstanding the increasing number of urban workers living in rural areas as noted earlier, there were reportedly fewer direct links between urban and rural lifestyles, and therefore less of an understanding between communities. Fewer urban people today have access to rural experiences, although the values of urban lifestyles were increasingly observed in rural environments. New dimensions to the tensions between urban and rural communities are therefore evident. One of these is related to urban attitudes about what constitutes acceptable farming practice, and the implications of different farming practices for the environment (carbon footprint, etc.).

Some saw the loss of rural land to urbanisation, especially peri-urban development and the encroachment of lifestyle blocks into productive rural land, as problematic, not only in terms of the loss of good quality farmland, but because of the greater level of commuting and more transient nature of these populations.

Ongoing impact on Māori

While this report focuses on a relatively short timeframe, for Māori the impact of agriculture and other land use changes extends over a much longer period. A comment from a respondent with good knowledge of the issue from a Māori perspective suggested:

'...since the beginning of agriculture we have seen the massive loss of fish life, tuna, massive loss. Dams contributed to that as well. Generation of energy has cost our people traditional food grounds, mahinga kai, the plant biodiversity, bird life... with fertiliser and growth of [the] dairy industry now there is very minimal fish life in those sorts of streams...'

It was suggested that Māori approaches to land management and water quality tended to be informed by a longer term perspective, with greater consideration being given to sustainability of resources. Reference was made by that same respondent to the absence of a long term perspective in approaches to farming, with consequent impacts of the environment and water quality.

'...people's time frames become shortened. Our water quality has gone down the toilet, to put it bluntly. There are massive impacts on soils, and we are only beginning to understand the implications of the build up of heavy metals, [such as] cadmium, as a result of heavy fertiliser use. We have pumice soils – Taupo volcanic ash – whatever goes through the soil goes through quickly. Nitrate leaching [is a] very big issue...'

6 The implications of change for the future

This section reviews the key themes that have emerged from the interviews with industry informants, and considers them in terms of their implications for the future directions of change in land use and agricultural practice in the Waikato region. It then develops those themes into two divergent scenarios for the Waikato region,

intensification and de-intensification; scenarios which are further explored quantitatively using an economic model at the end of the section.

6.1 Agricultural change and social trends in the Waikato region

The interviews with dairy industry observers pointed to a recent wave of dairy conversions, consolidation in ownership, higher stocking rates, and more intensive farming practices – as well as reference to less intensive practices on some farms – and new farm ownership and management models. Farm consolidation, a process which has been occurring for decades, often, but not necessarily involving the buying of neighbouring properties, has contributed to farms becoming larger and farm ownership becoming more concentrated. Similar processes were identified by sheep and beef industry observers as having occurred in that sector.

References to processes of farm amalgamation and intensification, evident in higher stocking rates, might be interpreted as contributing to the development of a distinctively New Zealand type of 'industrial' dairy farming practice, which continues to be pasture-based, but which has potential for economies of scale, greater reliance on off-farm feeds and inputs, greater specialisation of labour, greater mechanisation, and a style of organisation that is more commercially-oriented. While dairy farming continues to be a pasture-based activity, the capacity to farm more intensively can be largely attributed to nitrogen fertilisers that support higher levels of pasture growth, and by feed inputs grown off the farm. In dairying in some places, higher stocking rates were also facilitated by the greater use of feed-pads. Technological developments that enhance stock and pasture performance and management, and which provide farm and business related information, were also identified as a driver of changes in agricultural practice in the dairy and sheep and beef sectors.

Economic factors within the dairy sector – these being the dairy payout, land values and costs of production – were emphasised as the primary drivers of changes in dairy farm practice. The higher returns from dairying relative to the returns from other forms of land use had driven the conversion of land on the better rolling sheep and beef country to dairying and the conversion of some forestry land, notably in the Southern Waikato, to dairying. Land values, and the capacity to increase these by increasing on-farm production and conversion to higher value uses, were also an important economic driver of changes in land use and agricultural practice. Banking practices over the past decade and the relative ease with which credit could be obtained was also identified as a factor that has led to increases in land values. While the family farm model of ownership and management continues to predominate, other farm ownership and management models were said to be becoming more prevalent. These included equity partnerships, one variation of which was described as the family corporate model. These developments might be taken as pointing to the way many farms are increasingly managed for their commercial values. Rising land prices were identified as an important factor in the emergence of these new ownership models, contributing to challenges to the intergenerational succession of farms within families as the high value of farms may lead to significant debt problems for both the retiring family members and the succeeding generation. These changes in ownership structure have implications for people's relationship with the land (stewardship) and with the communities in which they live. Off-farm owners are less likely to invest in the social and cultural capital of the communities in which their farms are set.

Many sheep and beef farms were also described as changing their practices to include the carrying out of activities that support dairying, such as the grazing of dairy heifers or cropping for maize silage. Some peri-urban development was also identified as playing a dairy support function. This was said to involve smaller farms on the periphery of both larger and smaller urban centres being broken up and sold as even smaller blocks, some of which were playing a role in supporting other dairy farms through cropping or grazing, or were sold as lifestyle blocks.

Dairy and sheep and beef farmers were described as becoming more aware of environmental management issues, and reference was made to attitudinal shifts in farm management practices. Sheep and beef farming were seen as having less of an impact on the environment than dairying, although reference was made to some sheep and beef farmers adopting more intensive practices. Reference was also made to expectations that policy to regulate the impact of externalities was increasingly likely to shape land use and development. At the moment, there was a degree of uncertainty about just what those policy settings were likely to be. Community expectations, particularly urban expectations, about environmental values were also identified as shaping farmer attitudes to environmental management and were therefore beginning to become a driver of on-farm management practices. It was apparent from industry observers that self-management approaches, rather than externally enforced regulations by, for example, central and local government, were preferred by some farmers.

High returns to dairy farming within the context of New Zealand's openness to international agricultural markets, are subject to fluctuations in international food commodity prices, the value of the New Zealand dollar, and the level of on-farm costs which, with recent high oil prices, have risen sharply. Returns in the sheep and beef sector are subject to similar processes. Farm incomes are expected to continue to fluctuate and change the relative returns of sheep and beef, dairying, and forestry. An absence of clear environmental policy settings will add to the context of uncertainty within a fluctuating economic environment.

A number of respondents commented on the difficulties of predicting agricultural norms in the medium to long term when the short term was likely to be volatile. Some suggested that the next decade will be characterised by further volatility and risk in terms of economic (price and cost) fluctuations and environmental management regulations. These conditions will require adaptive management. Nevertheless, dairying is expected to maintain its status as the dominant form of pasture-based agriculture in the region. The direction of development in dairying is likely to involve various combinations of established approaches – traditional pasture based practices, greater use of feed pads to support pasture-based production, and more intensive farming practices with a high degree of off-farm sourced inputs. The interviews suggest there is unlikely to be a single model of practice that is adopted on a universal basis, since farmers have at their disposal a variety of approaches to suit individual preferences, particular family and financial situations, and the distinctive characteristics of the farm properties. While Fonterra is expected to remain the dominant industry organisation, new competition from smaller or emerging companies is expected.

In addition to dairying, there will continue to be a variety of land use across the region. In the King Country there is likely to be a continuation of sheep and beef farming and forestry on land that is not suitable for dairying. Variation of farming practices is likely in the sheep and beef sector, with some beef farms adopting more intensive block grazing and cell grazing methods, while others adhere to less intensive set stocking and rotational grazing practices.

It was considered that agricultural practice in the Taupo catchment will remain relatively unchanged due to nitrogen benchmarking (under the WRP Variation 5). Despite the dominance of dairying across the region in the future, it is possible that there will be further diversification of activities, such as horticulture. Commentaries also pointed to the possibility of marginal land being converted to plantation forestry.

In the forestry sector, there are different trends and drivers of change across the Waikato. In the south, significant conversion from forestry to dairying has occurred; while there have been new plantings on steeper parts in the King Country. In the catchment new plantings have been driven by policy changes affecting land use. The potential to make capital gains from the conversion of forestry land to dairying have

been an important driver of conversions to dairy land. However, the availability of suitable marginal land will be a limiting factor on potential for further development. Environmental policy drivers were described as likely to increasingly influence farming and forestry practice, and it is likely that the yet to be clarified Emissions Trading Scheme will also be influential. The latter provides possibilities of carbon farming which, if it eventuates, would become a significant driver in the forestry sector and may result in reversion of some land to plantation forest.

The economic future of farming has implications for both rural and urban communities. The profitability of farming has a roll-on effect in terms of opportunities in the labour market, retail spending, and cash circulating in the local economy.¹⁶ For example, in the short to medium term, the success of contracting and agricultural servicing businesses will be dependent on the dairy payout, especially in areas where this is the dominant sector.

The decline in the numbers of people in rural communities is associated with decline in the number of farms/consolidation, and an ageing rural population. Further consolidation may reinforce this trend. Declining population results in changes to the proximity of services (further away) and opportunities for social interaction (closures of small local business, schools, etc), changes in commuting distances in order to get social and consumption needs met, and increased reliance on larger centres rather than local communities for social and cultural interaction. Rather than looking inward to communities, people now look outwards, resulting in a loss of community cohesion and identity. This was noted particularly in relation to younger age groups. There is an increasingly urban mindset among this group around career aspirations, labour, pathways into farming, access to quality education for children, and so on.

Respondents referred to the likelihood of continuing tensions between rural and urban communities over the environmental impacts of agriculture and around balancing the maintenance of economic and social quality of life with the physical quality of the environment. They also referred to ongoing competition for resources – land and water – for urban expansion on land with good agricultural capability.

6.2 Future economic trends resulting from agricultural change in the Waikato region

The comments by informants summarised above can be separated into two major themes related to future scenarios of agriculture in the Waikato region over the next decade:

- A pathway of **intensification** – where there are ongoing changes in ownership structures driven by economic incentives, towards fewer farms and fewer land owners, more equity partnerships and more corporate ownership, fewer on-farm owners, and with land ownership generally becoming more difficult to achieve. This scenario includes continuing conversion of productive land to dairy farming, more specialisation of labour, increasing intensification of fertiliser use, increasing use of feed-pads, and increased stocking rates.
- A pathway of **de-intensification** – where there are changes in farming towards more environmentally sustainable practices, whether driven by costs, consumer and urban expectations, or increasing environmental regulation. While ownership structures continue in a process of consolidation as farmers seek efficiency gains, this scenario includes reversion of marginal land to forestry, less intensive use of fertiliser and other inputs, and conversion of land from dairy farming towards less intensive sheep and beef.

¹⁶ Hughes et al. (2005) and Barrett et al. (2009) both demonstrate the close correlation between dairy payout and subsequent retail spending in the Waikato region.

Noting the wide variation in comments between informants, it is expected that the actual future obtained by the Waikato region will probably involve some combination of these two futures, with substantial differences between sub-regions. Exploring these two apparently contradictory scenarios, then, will provide a plausible range of possible futures for the region.

The qualitative research has identified a wealth of perspectives on likely directions of agricultural change in the Waikato region, both within individual sectors and collectively, and the potential effects on communities. To evaluate the potential economic impacts of a range of futures based on the quantitative evidence and the qualitative reports, several economic scenarios were developed.

The economic scenarios considered capture a range of plausible futures, indicated by the two divergent scenarios of intensification and de-intensification presented above. These economic scenarios are included in this report simply to 'map out' the economic impacts of different directions of future agricultural change on the Waikato region. They should not be interpreted as forecasts of the future, as the assumptions implicit in their construction are unlikely to represent the actual future that is obtained. These scenarios employ the 2009 Waikato Economic Model (Environment Waikato, 2009), a dynamic input-output simulation model capable of capturing the economic impacts of changes in land use, household consumption and exports.

About the Waikato Economic Model

Dynamic input-output models are used extensively throughout New Zealand to inform policy makers on the economic implications of various economic growth scenarios, policy options, external shocks, and so on. Auckland Regional Council, Auckland City Council, North Shore City, Christchurch City and Gisborne District Councils are among other local government users of these models.

The model is built using data obtained primarily from the Statistics New Zealand National Accounts team. The model includes 48 economic sectors for the Waikato Region, the rest of the North Island, and the rest of New Zealand. This model has a base year of 2006, meaning that all projections begin in 2006. The model's base scenario allows for productivity increases moving forward.

Base productivity growth rates 2006 - 2031					
	Horticulture and fruit growing	Livestock and cropping farming	Dairy cattle farming	Other farming	Forestry and logging
2006 to 2011	0.82%	1.99%	3.86%	1.58%	1.86%
2011 to 2016	1.48%	2.15%	3.23%	1.79%	1.72%
2016 to 2021	1.32%	1.98%	2.62%	1.68%	1.88%

Some limitations of the model should be noted, the model:

1. is not spatial, so cannot provide estimates at the sub-regional or territorial authority level to show the spatial distribution of the costs or benefits change, which are likely uneven with some areas would be affected more than others
2. assumes that relative prices and industry interdependencies remain stable throughout time, so is unable to adequately evaluate scenarios that include large structural changes in the economy. However, given the short (ten year) time horizon considered in this report, this assumption is probably reasonable
3. cannot evaluate short term economic gains or losses, such as those that arise from short run fluctuations in market conditions
4. is not a cost benefit analysis of change and therefore does not take into account the 'development bubble' effect of land use change that occurs for example with dairy conversions.

Source: Environment Waikato (2009)

An exploration of five scenarios

In all, five scenarios were considered, based on different assumptions about changing land use patterns and the productivity of land. These scenarios broadly encompass the intensification and de-intensification scenarios described above. The quantification of qualitative scenarios is as much an art as a science. Given the considerable uncertainty associated with these scenarios, some indicative changes were modelled, rather than employing a sophisticated quantification of the qualitative scenarios (such as methods described in Tietje (2005), for example).

Based on the qualitative and quantitative results described earlier, scenarios considering a range of 25 percent higher to 25 percent lower productivity growth than the base scenario were chosen, representing a plausible level of increased productivity from intensification and decreased productivity from de-intensification respectively (see Appendix Table 9),

The five scenarios modelled, then, capture a range of plausible futures, and are described as follows:

- **(Scenario 1 – Base)** A base scenario in which the default projections of land productivity growth from the 2009 Waikato Economic Model were used, and where no changes in land use from the 2006 base values were assumed;
- **(Scenario 2 – Current trends)** A current trends scenario based on a continuation of current trends in land use change (an increase in land applied to dairy farming by 0.7 percent per year, a 1.3 percent decrease in production forestry land, a 0.3 percent decrease in other farming land, and a 1.2 percent increase in horticulture land), and the default projections of land productivity growth from the 2009 Waikato Economic Model – this current trends scenario is the scenario against which other scenario results will be compared;
- **(Scenario 3 – Intensification)** A scenario identical to Scenario 2 in land use, but with productivity growth in dairy farming being 25 percent higher than the default projections of land productivity from the 2009 Waikato Economic Model (see Appendix Table 9);
- **(Scenario 4 – Reverse trend)** A scenario where the current trend in dairy conversion was assumed to reverse, with net conversion of dairy farming land to forestry¹⁷ at a rate of 0.7 percent of dairy farm land per year; and
- **(Scenario 5 – De-intensification)** A scenario identical to Scenario 4 in land use, but with productivity growth in dairy farming being 25 percent lower than the default projections of land productivity from the 2009 Waikato Economic Model (see Appendix Table 9).

Projections were run over the period from 2006 to 2021, and the results are summarised in Figures 11 and 12 with more detailed results available in Appendix Table 10. The results from each of the scenarios may be summarised as follows:

In the base scenario (Scenario 1), Gross Regional Product (GRP) increases by an average of 1.9 percent per year from \$15.3 billion in 1996 to \$20.2 billion¹⁸ in 2021;

In the current trends scenario (Scenario 2), GRP increases by an average of 2.0 percent per year to \$20.5 billion in 2021;

In the intensification scenario (Scenario 3) GRP increases by an average of 2.1 percent per year to \$20.9 billion in 2021;

In the reverse trend scenario (Scenario 4) GRP increases by an average of 1.8 percent per year to \$20.1 billion in 2021;

In the de-intensification scenario (Scenario 5) GRP grows by 1.7 percent per year to \$19.8 billion in 2021.

Notably, these small differences in growth rates add up to a substantial difference in the regional economy by 2021. It appears from these scenarios that:

- increased intensification (under the assumptions noted above) would have a moderately positive incremental effect of around 0.1 percentage points on the growth of the Waikato economy beyond a continuation of current trends

¹⁷ Although more realistically this would represent conversions of dairy farms to dry stock, and conversion of existing dry stock land to forestry, rather than direct movements of land from dairy farming to forestry.

¹⁸ In 2007 New Zealand dollars.

- de-intensification (under the assumptions noted above) would reduce the rate of economic growth more substantially, by around 0.3 percentage points annually.

However, these quantitative results should be interpreted with some caution as they are based on the assumptions noted for each scenario, and for the model as a whole.

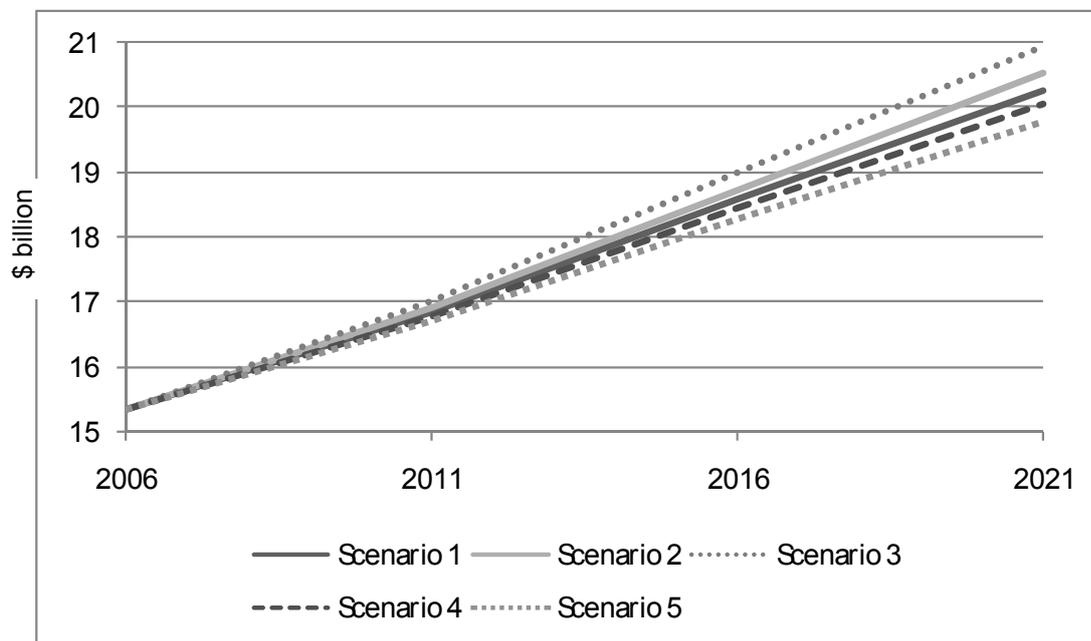


Figure 11 Economic effects on Gross Regional Product (GRP) in \$NZ2007bn of agricultural change scenarios, 2006-2021

A similar pattern is observed in employment (Figure 12), with modified employment counts¹⁹ increasing by 0.5 percent per year on average under the base scenario and the continuation of current trends, from 193,242 in 1996 to 207,229 in 2021. In the intensification scenario (Scenario 3), employment increases by 0.6 percent per year on average, to 211,181 in 2021; and in the de-intensification scenario (Scenario 5) employment increases by 0.4 percent per year on average, to 204,822 in 2021.

Overall, by 2021 there are 2339 more people employed in the intensification scenario (Scenario 3) compared to the current trends scenario (Scenario 2), and 4020 fewer people employed in the de-intensification scenario (Scenario 5) compared to the current trends scenario (Scenario 2).

¹⁹ Modified employment counts (MEC) are the headcount employment counts (that is not full-time equivalent employment), modified to include owner-operators.

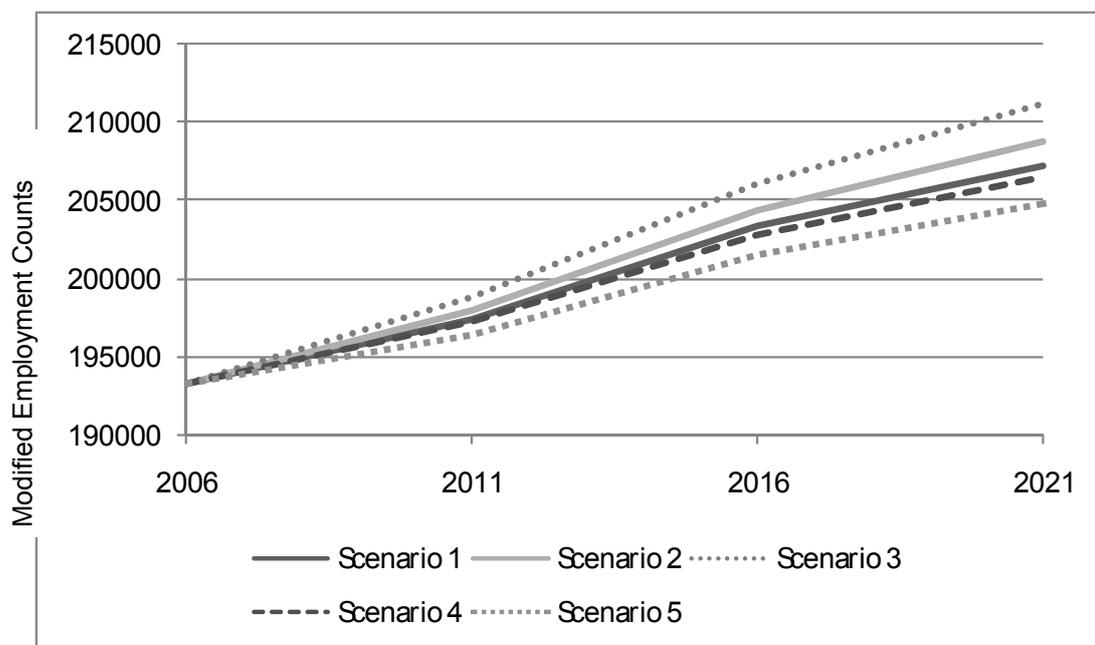


Figure 12 Economic effects on Modified Employment Counts (MEC) of workers of agricultural change scenarios, 2006-2021

These scenarios highlight that the actual development path obtained by the regional economy will depend crucially on the nature of agricultural change, particularly in dairying. As these scenarios cover a range of potential outcomes, from a substantial increase in intensification of dairy farming to a substantial de-intensification, we can conclude that agricultural change is likely have significant impact on the regional economy over the period to 2021.

Increases in dairy intensification above current trends, will benefit the regional economy through the forward and backward linkages from the dairy farm sector to other sectors of the economy, by up to \$400 million (from \$20.5m to \$20.9m) and 2300 jobs (up from 208,842 to 211,181) by 2021. Conversely, reductions and/or de-intensification of dairying from current trends will negatively impact the regional economy by up to \$760 million and 4000 jobs by 2021.

It is clear that reductions in dairy farming in the region come with an associated economic cost. However, further work on pricing of externalities is required in order to create a full understanding of the impact of land use change. For example, some of this cost may be offset by carbon credits if de-intensification is linked to increases in plantation forestry, although the extent of these benefits will depend crucially on the final form of the Emissions Trading Scheme.

In addition, emerging environmental direction is likely to be provided nationally by the Land and Water Forum and the forthcoming National Policy Statement for water and already, locally by the Waikato-Tainui River Settlement and subsequent Vision and Strategy for the Waikato river – Te Ture Whaimana, indicating future pathways that take greater account of environmental externalities.

7 Conclusions

This report explored recent trends in land use and agriculture in the Waikato region, considered how these trends were associated with change in Waikato communities, and proposed quantitative scenarios that encompass the broad range of potential patterns of agricultural and related community change over the period to 2021. A mixture of qualitative and quantitative data was used to support the findings, with a focus on the dairy, sheep and beef, and forestry industries. Overall a number of important social and economic trends, drivers, and implications were noted.

Significant trends in the dairy industry included a recent wave of dairy conversions, consolidation in ownership, higher stocking rates, and more intensive farming practices – as well reference to less intensive practices on some farms – and new farm ownership and management models. These changes were facilitated by, among other things, increases in nitrogen fertiliser use that promoted pasture growth, and increased use of feed-pads and supplementary feed that have increased economic returns.

The key drivers of agricultural and land use change were perceived to be economic. The dairy payout, land values, and costs of production, were emphasised as the primary drivers of changes in dairy farm practice. The relative profitability of dairying, in comparison to sheep and beef and forestry, has driven the conversion of large areas of land to dairying, in part to capture the capital gains from higher use value of the land when it is applied to dairy farming. Banking practices and relatively easy access to credit facilitated the amalgamation of farms and resulted in rapidly increasing land values. Many sheep and beef farms, and peri-urban lifestyle blocks, were described as moving into dairy support roles, such as the grazing of dairy heifers or cropping for maize silage.

Farmers have become more aware of environmental management issues, in part due to community expectations about environmental values. Farm management practices are changing as a result, but uncertainty about future environmental policy settings persists. Self-management approaches, rather than external regulations, are preferred by some farmers. Technological developments that enhance stock and pasture performance and management, and which provide farm and business related information, were also identified as a driver of changes in agricultural practice.

In the forestry sector, there has been significant conversion from forestry to dairying in the South Waikato, but new plantings in other areas such as Otorohanga district. In the Taupo catchment new plantings have been driven by environmental considerations and local policy. Environmental policy drivers were described as likely to increasingly influence farming and forestry practice, such as the potential for carbon farming depending on the final form of the Emissions Trading Scheme. However, current uncertainty is delaying investment in forestry, where owners must take a long-term view of their investment.

A number of respondents commented on the difficulties of predicting agricultural norms in the medium to long term when the short term was likely to be volatile. High volatility requires adaptive management by the agricultural industries. Nevertheless, dairying is expected to maintain its status as the dominant form of pasture-based agriculture in the region, and there will continue to be a variety of land use across the region and within industries.

The economic scenarios highlight that the actual development path obtained by the regional economy will depend crucially on the nature of agricultural change, particularly dairying. Increases in dairy intensification beyond current trends would benefit the regional economy by up to \$400 million and 2300 jobs by 2021. Conversely, reductions and/or de-intensification of dairying will negatively impact the regional economy by up to \$760 million and 4000 jobs by 2021, although some of those losses may be offset by carbon credits depending on the final form of the proposed Emissions Trading Scheme. The considerable uncertainty inherent in the development of the economic scenarios means that the quantitative projections should be read with due caution.

These quantitative and qualitative results illustrate the broad patterns of change that have occurred, are currently occurring, and will continue to occur in the Waikato region. A careful consideration of these trends and future developments will be necessary in the development of regional agricultural, environmental, economic, and social policy that will affect rural areas.

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Appendix I: Industry sector and rural community interviewees

Graeme Milne	Professional Director, former CEO of New Zealand Dairy Group
Ian Jamieson	Meat and Wool New Zealand
Jim Cotman	New Zealand Farm Environment Award Trust
John Barton	Farm Consultant, Greenplan Forestry
John Hura	New Zealand Forest Managers, Lake Taupo Protection Trust
Charlotte Rutherford	Environment Programme Manager, Fonterra Cooperative Group
Warwick Cato	Ballance Agri-Nutirents
Phil Journeaux	Ministry of Agriculture and Forestry
Bruce Thorrold	DairyNZ
Mark Paine	DairyNZ
Bob Cottrell	Federation of Māori Authorities
Theresa Stark	Ohinewai sheep and beef farmer, Rural Women New Zealand
Alan McDermott	AgResearch Ruakura
Annette Bolstad	Sharemilker, Te Aroha
Fiona Duncan	Rural Support Trust
George Moss	Rural Support Trust
Stephanie O'Sullivan	Raukawa Trust Board
John Hall	AgFirst Waikato
Nicola Waugh	AgFirst Wailato
Neil Bateup	Rural Support Trust
Wendy Rowe	Rural Support Trust
Lynda Clark	Dairy Women's Network

Appendix II: Interview schedules

The implications of agricultural change in the Waikato region

Schedules for semi structured interviews

Interview schedule for key agricultural industry informants

Context:

- Please tell us a little bit about the function of your organisation, and your role within it

Changes to agricultural practices – past and present:

- What are some of the major changes that have occurred within your industry sector in terms of agricultural practices over the past decade? What changes are occurring now?
- What are some of the major changes that have occurred within your industry sector in terms of land use over the past decade? What changes are occurring now?

Drivers of change:

- What has driven these changes?

Future scenarios:

- Given these changes, what do you see as being the likely direction of growth in short and medium term future?
- Where do you see your industry sector in ten years time?
- What do you envisage as being the 'norms' around agricultural practice and patterns of land use in ten years time?

Interview schedule for key rural community informants

Context:

- Please tell us a little bit about the function of your organisation, and your role within it.

Changes to agricultural practices – past and present:

- Earlier parts of our research into changes in agricultural practices and patterns of land use indicate changes in land use and land value (for example, some people have referred to changes from forestry to dairying, and towards more intensive farming practices).
 - What can you tell us about this?
 - What has driven this? (*Probe for reasons behind change, especially within the industry, trade, economic, and practice*)
- Are there any other trends in agriculture and land use that you see as affecting this part of the Waikato?
 - *If Yes:* What can you tell us about this?
 - What has driven this? (*Probe for reasons behind change, especially within the industry, trade, and practice*)
 - (*Probe based on some of the trends observed by the key Informants.*)

Community impacts:

- In what ways have these changes impacted on your community (your industry, people you know, local businesses, your family and friends)?
- What specifically have you seen happening? (What leads you to this conclusion?)

- Are there particular groups in your community that benefit more than others from these changes?
- Who are they? In what ways do they benefit?
- Are there particular groups in your community that are disadvantaged more than others by these changes?
- Who are they? In what way have changes disadvantaged them?
- *Probe for:*
 - Economic opportunity: the diminishing/strengthening of employment and business opportunity.*
 - Social stability: the effect of these changes on community cohesion and identity.*

Future scenarios:

- What do you anticipate as being the outcomes of these changes for your community over the medium term/next decade?
- What trends do you expect to observe in terms of the direction of future agricultural practices and pattern of land use over the next decade?
- What do you think will drive these trends?

Appendix III: Additional data tables

Appendix Table 1 Agricultural land use in the Waikato region, 1994-2007

Year ²⁰	Grazing, arable, fodder and fallow land		Horticultural land		Planted production forest		Other land		Total agricultural land	
	ha. (000s)	%	ha. (000s)	%	ha. (000s)	%	ha. (000s)	%	ha. (000s)	%
1994	1290	72.1%	10	0.6%	312	17.4%	176	9.8%	1789	100.0%
2002	1196	69.1%	10	0.6%	330	19.1%	195	11.3%	1730	100.0%
2007	1162	72.6%	10	0.6%	282	17.6%	146	9.1%	1600	100.0%

Source: Statistics New Zealand, Agricultural Production Census

²⁰ As at 30 June in each year.

Appendix Table 2 Land used for dairy farming by territorial authority, 1994-2007

Year	Franklin district ²¹	Waikato district	Hamilton city	Waipa district	Otorohanga district	Thames-Coromandel district	Hauraki district	Matamata-Piako district	South Waikato district	Taupo district ²²	Rotorua district ²³	Waitomo district ²⁴
1994	35,642	72,349	779	56,507	34,679	8,950	40,663	104,919	35,157	9,887	35,683	3,843
1995	37,222	73,416	810	60,079	36,267	8,856	40,800	101,990	36,498	11,094	40,299	4,230
1996	36,646	73,796	836	60,225	37,440	9,272	41,883	98,910	37,908	12,558	41,912	4,743
1997	36,860	76,235	869	62,852	40,180	10,400	41,961	98,865	39,648	19,314	45,100	6,832
1998	36,426	76,480	836	62,624	41,140	10,287	41,688	96,525	39,440	21,122	44,844	7,296
1999	36,693	76,221	780	62,489	39,525	10,416	43,168	96,968	37,315	18,256	43,279	6,930
2000	34,400	73,248	847	58,080	37,932	10,208	41,503	93,909	35,002	18,020	40,135	7,936
2001	33,600	74,285	1,053	61,910	41,760	10,062	41,965	93,219	38,106	24,800	44,694	7,752
2002	33,864	79,672	1,148	64,703	44,649	9,810	44,455	98,560	40,755	27,816	47,710	7,788
2003	34,282	82,026	992	65,623	45,174	9,882	45,241	100,464	42,370	28,338	49,190	8,300
2004	32,789	76,946	1,001	62,536	42,638	10,073	42,765	96,258	40,370	28,315	48,658	8,444
2005	30,827	75,486	1,003	61,698	43,284	9,917	42,493	95,172	40,497	29,073	48,000	8,179
2006	29,056	74,434	1,031	60,362	43,198	9,795	42,250	94,545	39,920	28,557	47,331	8,207
2007	28,101	74,132	983	60,542	43,109	8,577	42,123	93,324	41,311	30,844	48,212	8,673

Source: Livestock Improvement Corporation data

Appendix Table 3 Distribution of dairy farms by size (in hectares) in the Waikato region, 1994-2007

Year	Under 20 ha.	20-40 ha.	40-80 ha.	80-120 ha.	120-200 ha.	200-400 ha.	400+ ha.
1994	7.9%	9.7%	40.1%	20.5%	13.5%	6.6%	1.7%

²¹ Includes that part of Franklin district that lies in the Auckland Regional Council area.

²² Includes that part of Taupo district that lies in the Hawkes Bay Regional Council area.

²³ Includes that part of Rotorua district that lies in the Bay of Plenty Regional Council area.

²⁴ Includes that part of Waitomo district that lies in the Manawatu-Wanganui Regional Council area.

2002	10.4%	8.7%	28.2%	22.0%	17.0%	10.5%	3.3%
2007	9.0%	6.8%	23.7%	22.4%	19.6%	13.6%	4.8%

Source: Statistics New Zealand, Agricultural Production Census

Appendix Table 4 Distribution of dairy herds by size (in number of dairy cattle) in the Waikato region, 1994-2007

Year	Under 100 head	100-199 head	200-299 head	300-399 head	400-599 head	600+ head
1994	21.7%	36.4%	23.9%	10.3%	5.5%	2.2%
2002	23.0%	23.1%	24.3%	12.5%	10.5%	6.6%
2007	21.2%	18.7%	22.1%	14.4%	13.5%	10.1%

Source: Statistics New Zealand, Agricultural Production Census

Appendix Table 5 Dairy stock numbers by territorial authority, 1994-2007

Year	Franklin district ²⁵	Waikato district	Hamilton city	Waipa district	Otorohanga district	Thames-Coromandel district	Hauraki district	Matamata-Piako district	South Waikato district	Taupo district ²⁶	Rotorua district ²⁷	Waitomo district ²⁸
1994	85,027	188,653	2,351	153,505	94,232	21,648	104,177	302,680	97,044	22,307	85,239	8,397
1995	83,434	192,974	2,361	167,550	99,715	21,524	102,426	279,817	101,643	22,250	99,188	9,355
1996	83,869	195,954	2,185	172,468	102,599	22,823	108,184	284,474	106,297	27,071	104,006	9,573
1997	78,620	190,189	2,251	172,412	106,642	25,155	103,616	265,026	108,943	41,972	114,597	12,952
1998	88,571	192,041	1,995	180,663	118,463	23,126	102,840	269,174	116,424	50,072	116,583	16,486
1999	87,035	197,638	1,891	170,616	106,218	24,459	112,216	277,181	100,888	40,645	108,836	15,394
2000	81,584	185,088	2,030	155,974	97,528	24,967	110,229	267,738	91,478	36,299	95,893	16,681
2001	81,239	203,036	2,818	180,639	119,755	25,167	110,260	281,929	110,004	61,767	117,996	19,621
2002	80,071	210,670	3,070	186,826	126,320	24,327	115,364	291,404	115,583	66,747	126,850	19,989
2003	79,270	212,100	2,796	185,572	123,834	23,834	115,715	291,130	115,526	69,892	127,154	20,661
2004	79,919	216,194	3,203	189,513	127,286	25,510	117,228	296,607	117,300	73,468	130,140	20,902
2005	75,687	215,421	2,959	187,188	127,856	24,724	115,743	296,541	117,175	76,011	128,966	21,350
2006	70,465	210,888	2,942	183,727	126,250	24,258	115,934	294,334	116,541	74,916	126,306	21,458
2007	69,198	213,764	2,974	186,258	124,372	22,740	115,001	295,757	121,378	77,002	130,155	22,588

Source: Livestock Improvement Corporation data

²⁵ Includes that part of Franklin district that lies in the Auckland Regional Council area.

²⁶ Includes that part of Taupo district that lies in the Hawkes Bay Regional Council area.

²⁷ Includes that part of Rotorua district that lies in the Bay of Plenty Regional Council area.

²⁸ Includes that part of Waitomo district that lies in the Manawatu-Wanganui Regional Council area.

Appendix Table 6 Number of dairy geographic units (Bus) and employee head counts (Emp) by territorial authority in the Waikato region, 2000-2007

Year	Franklin district ²⁹		Waikato district		Hamilton city		Waipa district		Otorohanga district		Thames-Coromandel district		Hauraki district		Matamata-Piako district		South Waikato district		Taupo district ³⁰		Rotorua district ³¹		Waitomo district ³²	
	Bus	Emp	Bus	Emp	Bus	Emp	Bus	Emp	Bus	Emp	Bus	Emp	Bus	Emp	Bus	Emp	Bus	Emp	Bus	Emp	Bus	Emp	Bus	Emp
2000	659	330	1145	660	119	90	1126	770	634	480	187	85	753	380	2070	990	635	440	156	260	544	480	110	110
2001	648	340	1129	690	105	70	1131	840	633	520	182	95	764	420	2033	1020	620	490	163	300	546	540	120	130
2002	631	400	1139	840	99	75	1125	910	619	610	176	100	747	510	2040	1260	642	590	163	340	533	600	122	170
2003	613	390	1092	850	102	75	1080	900	619	550	166	110	715	490	1951	1240	621	560	173	360	511	580	129	170
2004	591	410	1048	820	110	80	1044	870	600	530	151	100	704	500	1843	1210	608	600	168	370	485	580	125	170
2005	578	400	1040	850	106	70	1048	860	605	570	154	120	685	500	1859	1240	585	650	173	380	481	610	116	140
2006	568	370	1002	810	103	60	1042	920	608	590	155	110	686	430	1838	1260	595	660	173	410	486	620	119	130
2007	527	350	953	830	103	55	996	950	589	590	155	110	651	470	1766	1310	593	640	168	440	478	640	110	160

Source: Statistics New Zealand, Longitudinal Business Data Frame

Appendix Table 7 Area planted in exotic plantation forest by territorial authority, 2002-2008

Year	Franklin district ³³	Waikato district	Hamilton city	Waipa district	Otorohanga district	Thames-Coromandel district	Hauraki district	Matamata-Piako district	South Waikato district	Taupo district ³⁴	Rotorua district ³⁵	Waitomo district ³⁶
2002	6841	13787	72	2124	3657	24275	3587	1478	77785	195623	58984	26194
2003	6788	16057	72	2152	3615	24729	3479	1323	78830	194229	59546	25568
2004	7149	15105	1	2483	4345	23798	3372	1249	76822	187998	61223	26817

²⁹ Includes that part of Franklin district that lies in the Auckland Regional Council area.

³⁰ Includes that part of Taupo district that lies in the Hawkes Bay Regional Council area.

³¹ Includes that part of Rotorua district that lies in the Bay of Plenty Regional Council area.

³² Includes that part of Waitomo district that lies in the Manawatu-Wanganui Regional Council area.

³³ Includes that part of Franklin district that lies in the Auckland Regional Council area.

³⁴ Includes that part of Taupo district that lies in the Hawkes Bay Regional Council area.

³⁵ Includes that part of Rotorua district that lies in the Bay of Plenty Regional Council area.

³⁶ Includes that part of Waitomo district that lies in the Manawatu-Wanganui Regional Council area.

2005	6896	14779	1	2669	4809	23442	3487	3526	75273	185994	58051	25756
2006	6631	14859	1	2717	5110	23552	3471	3385	72910	184870	57195	25039
2007	6107	14882	1	2780	5102	23049	3546	3304	70816	181774	56513	24513
2008	5543	15136	1	2413	5088	23199	3529	2914	68033	177928	55022	25334

Source: Ministry of Agriculture and Forestry data

Appendix Table 8 Area recently planted in exotic plantation forest (within the previous five years) by territorial authority, 2002-2008

Year	Franklin district ³⁷	Waikato district	Hamilton city	Waipa district	Otorohanga district	Thames-Coromandel district	Hauraki district	Matamata-Piako district	South Waikato district	Taupo district ³⁸	Rotorua district ³⁹	Waitomo district ⁴⁰
2002	880	2277	0	845	602	3625	819	234	19263	34727	15717	5365
2003	762	3905	0	865	639	3910	869	183	19796	34028	13369	4018
2004	368	4663	0	656	1218	4021	422	157	20194	35649	13379	5511
2005	415	4482	0	355	1260	4159	479	649	18422	35867	12753	4575
2006	318	2805	0	188	1281	4373	348	572	16261	33988	11315	4326
2007	200	2090	0	134	968	4637	319	623	13313	32424	10320	3895
2008	90	1820	0	91	775	5242	252	716	11204	28754	9517	5003

Source: Ministry of Agriculture and Forestry data

³⁷ Includes that part of Franklin district that lies in the Auckland Regional Council area.

³⁸ Includes that part of Taupo district that lies in the Hawkes Bay Regional Council area.

³⁹ Includes that part of Rotorua district that lies in the Bay of Plenty Regional Council area.

⁴⁰ Includes that part of Waitomo district that lies in the Manawatu-Wanganui Regional Council area.

Appendix Table 9 Land productivity for economic scenarios

	Horticulture and fruit growing	Livestock and cropping farming	Dairy cattle farming	Other farming	Forestry and logging
SCENARIOS 1, 2, 4					
2006 to 2011	0.82%	1.99%	3.86%	1.58%	1.86%
2011 to 2016	1.48%	2.15%	3.23%	1.79%	1.72%
2016 to 2021	1.32%	1.98%	2.62%	1.68%	1.88%
2021 to 2026	1.33%	1.95%	2.62%	1.75%	1.61%
2026 to 2031	1.36%	1.94%	2.63%	1.82%	1.35%
SCENARIO 3					
2006 to 2011	0.82%	1.99%	4.82%	1.58%	1.86%
2011 to 2016	1.48%	2.15%	4.04%	1.79%	1.72%
2016 to 2021	1.32%	1.98%	3.28%	1.68%	1.88%
2021 to 2026	1.33%	1.95%	3.27%	1.75%	1.61%
2026 to 2031	1.36%	1.94%	3.28%	1.82%	1.35%
SCENARIO 5					
2006 to 2011	0.82%	1.99%	2.89%	1.58%	1.86%
2011 to 2016	1.48%	2.15%	2.42%	1.79%	1.72%
2016 to 2021	1.32%	1.98%	1.97%	1.68%	1.88%
2021 to 2026	1.33%	1.95%	1.96%	1.75%	1.61%
2026 to 2031	1.36%	1.94%	1.97%	1.82%	1.35%

Appendix Table 10 Economic effects on Gross Regional Product (GRP) in \$NZ2007bn, and on Modified Employment Counts (MEC) of workers, of agricultural change scenarios, 2006-2021

		2006		2011		2016		2021	
		GRP	MEC	GRP	MEC	GRP	MEC	GRP	MEC
Scenario 1: Base		15.348	193242	16.843	197439	18.582	203326	20.263	207229
Scenario 2: Current trends	Value	15.348	193242	16.904	197922	18.735	204361	20.529	208842
	Difference from base	0.0%	0.0%	0.4%	0.2%	0.8%	0.5%	1.3%	0.8%
Scenario 3: Intensification	Value	15.348	193242	17.014	198744	18.978	205999	20.93	211181
	Difference from base	0.0%	0.0%	1.0%	0.7%	2.1%	1.3%	3.3%	1.9%
Scenario 4: Reverse trend	Value	15.348	193242	16.796	197197	18.464	202828	20.068	206523
	Difference from base	0.0%	0.0%	-0.3%	-0.1%	-0.6%	-0.2%	-1.0%	-0.3%
Scenario 5: De-intensification	Value	15.348	193242	16.699	196450	18.269	201509	19.773	204822
	Difference from base	0.0%	0.0%	-0.9%	-0.5%	-1.7%	-0.9%	-2.4%	-1.2%