



New Zealand Farm Structure Change and Intensification

Stephanie Mulet-Marquis
John R. Fairweather

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**Stéphanie Mulet-Marquis
John R. Fairweather**

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Preface

The AERU has published several reports dealing with the topic of New Zealand farm structure and its change over time. The present report gathers data from different sources to update these previous studies, and considers the issue of intensification and its consequences on farming sustainability. It is hoped that this review will be useful to those interested in monitoring agricultural sector change over time.

Professor Caroline Saunders
Director
AERU

Summary

This report presents information about the numbers of farms in New Zealand. The different sources providing such data report very different figures and trends over time, but they all seem to indicate an overall trend of decrease in total farm numbers over the last decades, which appears to be due mainly to a decrease in the numbers of grazing and fattening farms and in the number of arable farms. The distribution of farms by size range over time shows an increase in the proportion of both the smallest and the largest ones, at the expense of the mid-sized categories. However, different trends can be observed depending on the farm type.

The report then explores the change in livestock numbers over time. Thus, during the last 20 years, the main trends consist in an overall decrease in sheep and beef numbers, while dairy and deer numbers increased.

To conclude, the report deals with the question of intensification in New Zealand farming systems. It underlines the increase in numbers of cows per hectare and production per cow in the dairy sector, and the increase in lambing rates and carcass weights in the sheep and beef sector. These changes can be linked to the increasing expenditure in agricultural research and development as well as the increasing use of services such as herd testing. Also reported is the growing use of fertilisers in New Zealand agriculture.

Chapter 1

Introduction and Outline of the Report

This report about farm structure change aims at gathering data from different sources available so as to update previous studies on this topic and examine long-term changes over time. An earlier report on the effects of land use change (Fairweather, 1997) examined long-term changes in numbers and sizes of farms as well as changes in farm types. In the present report, the Agricultural Statistics, and Rural Property Sales Statistics were used to update the figures concerning farm numbers and farm sizes. The Dairy Statistics provided by Livestock Improvement Corporation (LIC) and the Meat and Wool New Zealand Statistics were also used to examine more precisely the changes that occurred in dairy, sheep, and beef farming over time. Another useful document was *Growing for good: Intensive farming, sustainability and New Zealand's environment* (Parliamentary Commissioner for the Environment, 2004) that characterised New Zealand farming systems and the trends that affected them over time, and examined the sustainability of more intensive farming.

The second chapter of this report presents changes in total farm numbers and in the area used by the different farming types over time, and examines the distribution of farms in the different size ranges. The third chapter considers long-term changes in the national flock and herd sizes for the main livestock categories. Finally, the last chapter of the report aims at linking the changes highlighted in farm structure to the intensification of farming in New Zealand.

Chapter 2

Change in Farm Numbers and Land Use

2.1 Introduction

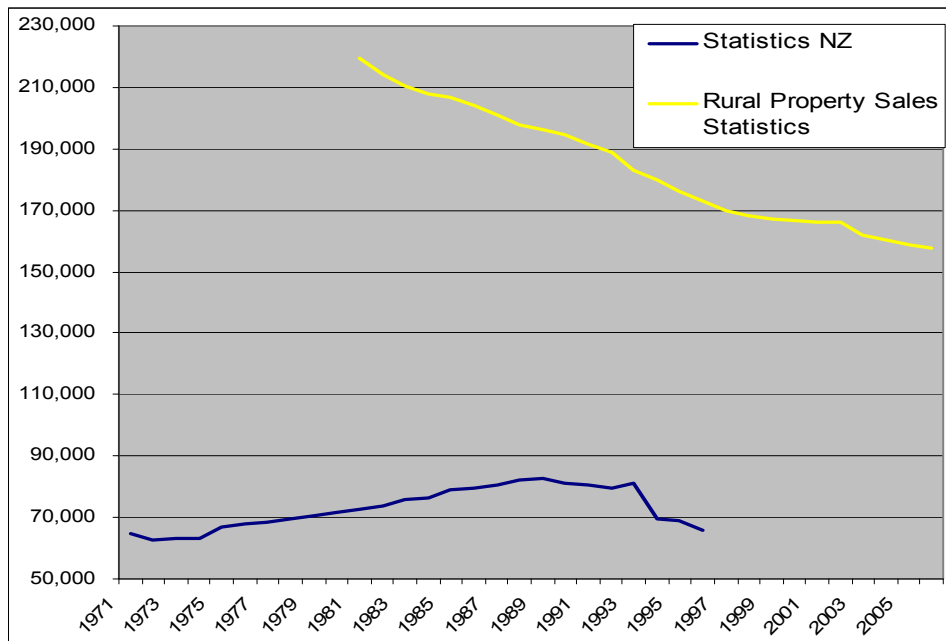
This chapter examines the change in farm numbers over time, first for New Zealand farms as a whole and then for each of the main farming types – dairy, grazing and fattening, specialist livestock, arable, and horticultural farms. It then presents, for each of these main types, the change in the distribution of farms by size range over the last decades.

2.2 Change in the numbers of farms over time

Figure 1 represents the total farm numbers in New Zealand between 1972 and 2006. The two sources used – Statistics New Zealand figures, and *Rural Property Sales Statistics* (by Quotable Value New Zealand) – reported very different figures. To obtain this graph, we used for the period 1971-1996 the figures provided by Statistics New Zealand that had already been used in previous research (Fairweather, 1997). Some further data have been released by Statistics New Zealand concerning the farm numbers for the years 1999, 2002, and 2003, but due to massive change in farm definitions, these figures do not form a consistent data series with the figures presented here, and therefore they were not represented on the graph. Quotable Value New Zealand data were used to try and obtain a consistent series of data. Concerning Quotable Value New Zealand data, while they rather focus on rural property sales, they also provide in each biannual report a category called “Number of Gross Assessments” that indicates the total number of properties, and this category was the one used here. Quotable Value New Zealand states that “the number of assessments is the number of properties for which a separate valuation is listed on the relevant district valuation roll. Each assessment may include more than one property. Gross assessment figures include non-rateable properties”. For these data, available for the period 1981-2006, a change in the property classification in 1993 resulted in an important number of properties being excluded from the count. Consequently, the raw numbers reported by Quotable Value New Zealand showed a dramatic drop in the numbers of farms in the year 1993 that did not reflect any actual change in agriculture. However, the properties being excluded all belonged to the ‘Minor Rural’ category, so this artefact was removed by considering the grand total without this category.

The differences remaining in the figures provided by the two different sources do not allow a conclusion to be drawn on the absolute number of farms. However, the relative changes in farm numbers from one year to the next can be examined in both of the data series obtained, and some trends might be distinguished over time. The first trend observed when examining the earlier data from Statistics New Zealand consists of a steady increase in the farm numbers during the 1970s. During the 1980s, according to Statistics New Zealand, the farm numbers went on increasing, but Quotable Value New Zealand figures rather indicate an overall decrease. Finally, during the 1990s, both sources show a similar trend of decrease in farm numbers, which went on during the 1997-2006 period according to figures from Quotable Value New Zealand.

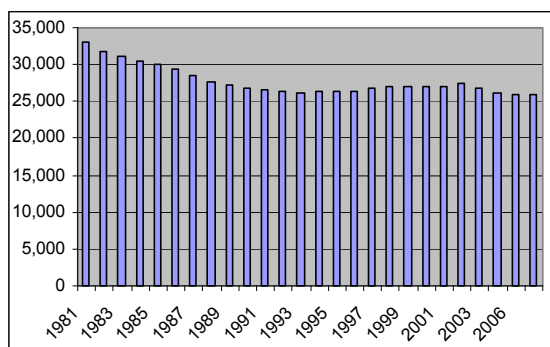
Figure 1: Total numbers of farms, 1972-2006



Source: Agricultural Statistics and Rural Property Sales Statistics.

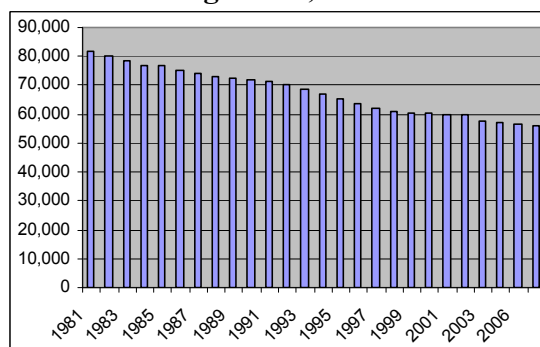
The Rural Property Sales Statistics are the most suitable and up to date data with which to examine changes in farm numbers for the main farm types. Figure 2 to Figure 6 present the Rural Property Sales Statistics counts for the farm numbers in the main farm types from 1981 to 2007, allowing us to determine which farm types were affected by the recent overall decrease in farm numbers described above. It appears that the numbers of dairy farms have fallen by about 20 per cent from 1981 to 1993, and then remained fairly constant. The numbers of grazing and fattening farms have decreased by over 30 per cent during the past two decades, while the numbers of specialist livestock farms have rather been increasing since the mid 1980s. The arable farms have also decreased between 1981 and 2007, from 5,000 to 3,200. The figures concerning the horticultural farms show a first phase of important increase, followed by a phase of sharp decrease, and finally by a stabilization from 1993. However, these figures should be taken cautiously as they do not match the trends of increasing horticultural farm numbers that some figures from Statistic New Zealand tend to indicate, and might reflect changes in the way of counting farms rather than real changes in farm numbers.

Figure 2: Numbers of dairy farms, 1981-2007



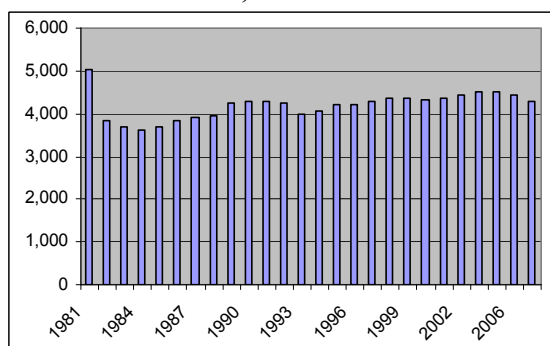
Source: Rural Property Sales Statistics.

Figure 3: Numbers of grazing and fattening farms, 1981-2007



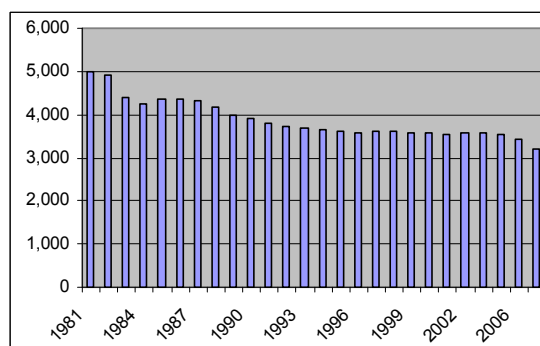
Source: Rural Property Sales Statistics.

Figure 4: Numbers of specialist livestock farms, 1981-2007



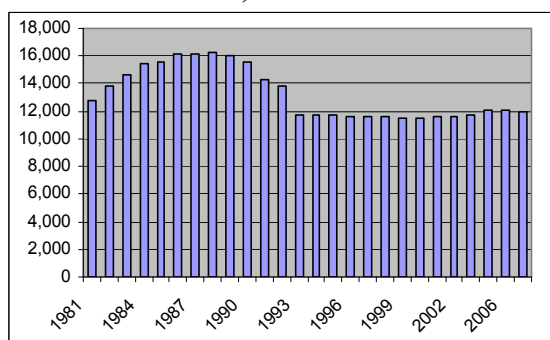
Source: Rural Property Sales Statistics.

Figure 5: Numbers of arable farms, 1981-2007



Source: Rural Property Sales Statistics.

Figure 6: Numbers of horticultural farms, 1981-2007



Source: Rural Property Sales Statistics.

It is relevant here to link these data about farm numbers to the results from research that examined the change in age and numbers of New Zealand farmers and farm workers over time (Fairweather and Mulet-Marquis, N.D.). Thus, the numbers of dairy farms have followed the same trend as the numbers of dairy farmers since the early 1980s, with a slight decrease followed by stabilization. The comparison is less easy for grazing, fattening, and specialist livestock farmers, as some of these categories were combined in a “livestock/crop” category due to mixing within these two farm types over time in Statistics New Zealand figures). The trend for livestock/crop census farmers was for numbers to increase to 1996, then to decrease and this does not fit the pattern of decrease in the numbers grazing and

fattening farms. Concerning horticultural farmers and farm workers, the census farmer data show an increase in their numbers till 1996, followed by a slight decline. This pattern does not fit the one reported here for horticultural, but as it has been underlined before, the data concerning the numbers of farms for this sector seem problematic, so any conclusion or comparison with other data should be considered very cautiously.

In general, it is difficult to enumerate accurately the number of farms in New Zealand in recent years and analysis of long terms trends is considerably hampered by this lack of data. The Rural Property Sales Statistics do provide a good sequence of data but they include multiple properties that make up one farm so therefore overestimate the counts. Presumably, the trends in farm type indicated by these figures are an accurate indication even if the absolute numbers are overestimated.

2.3 Numbers of farms in each size range

As the Rural Property Sales Statistics do not provide the farm distribution by size range, the figures used in this section are based on Statistics New Zealand counts. Indeed, even though total numbers seem problematic as explained earlier, the size distribution can still be of interest if the relative proportion of farms in each size range is assumed to be valid. This hypothesis will be discussed in the following section when commenting the results obtained. It has to be noted that, due to incomplete data for the years 1996 and 1999, the figures shown for some of the farm types (especially the dairy and horticultural ones) present a gap with no data for this period.

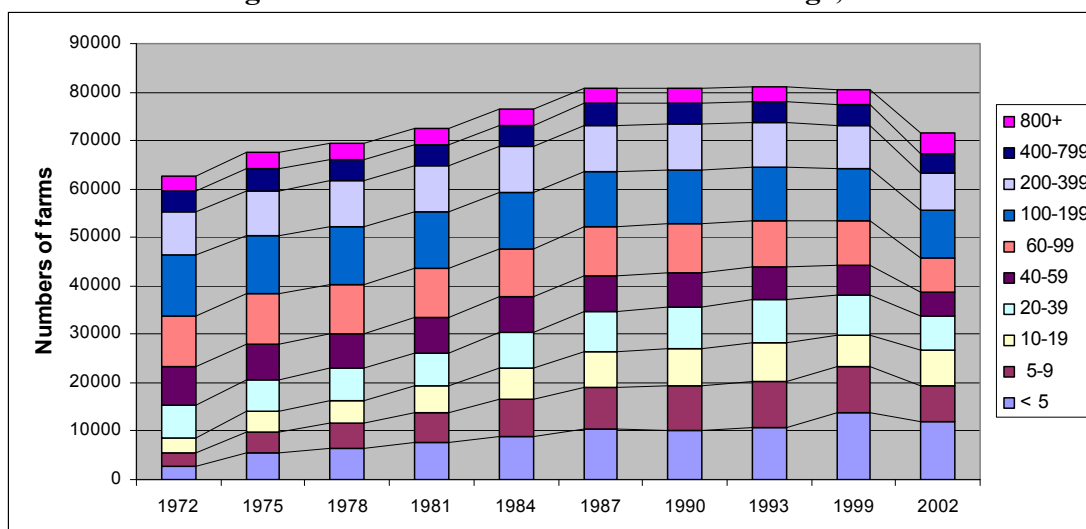
2.3.1 Total numbers of farms in each size range

Figure 7 allows determining which size ranges were affected by the changes in total farm numbers, and helps to explain the main trends described above (early increase, stabilization, and more recently decrease in farm numbers).

Between 1972 and 1987, the numbers of farms in all the size ranges under 39 hectares have increased, which results in a 34 per cent increase in the total number of farms of less than 39 ha. This increase in the numbers of small properties is probably responsible for the increase in the total number of farms, since during the same period the larger farms (39 hectares and over) have recorded a slight decrease of 1.2 per cent. Then during the 1987 to 1999 period, the number of farms in all the size groups over 10 hectares decreased, and this decrease was particularly important for the mid-sized groups (from 40 to 199ha) where the numbers fell from 28,963 to 26,028. However, these losses were offset with a gain of 4,120 farms of less than ten ha, which can explain the fact that total farm numbers were stable during this period.

The farm numbers by size range for the years after 2002 are not available, but the decrease in total farm numbers between 1999 and 2002 can be linked to a decrease of ten to 20 per cent in nearly all size ranges. The only exceptions were for the farms from 10 to 19 hectares that recorded a nine per cent increase, and the largest farms (800 and over) that recorded a 36 per cent increase.

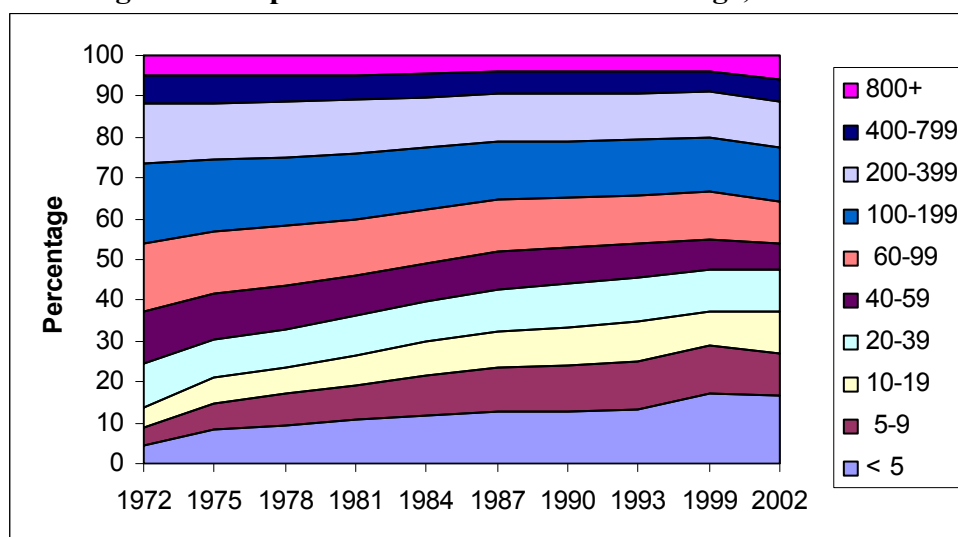
Figure 7: Number of farms in each size range, 1972-2002



Source: Agricultural Statistics.

Figure 8 shows the percentage of farms in each size range, and indicates that the proportion of both the smallest farms (<39 ha) and the largest ones (>200 ha) have increased, while the proportion of those in the mid-sized ranges (40-199 ha) rather decreased between 1972 and 2002. This is known as the ‘disappearing middle’ and has occurred in US farm structure change and has been documented for earlier analysis of the NZ farm structure change (Fairweather, 1997).

Figure 8: Proportion of farms in each size range, 1972-2002



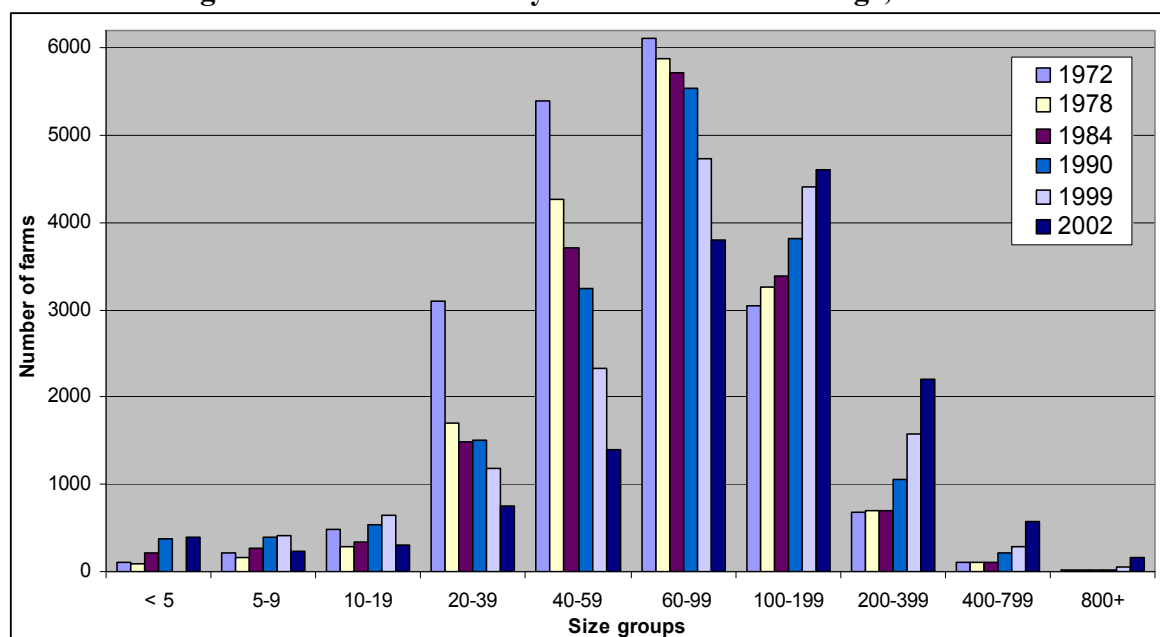
Source: Agricultural Statistics.

2.3.2 Numbers of dairy farms in each size range

An examination of the farm numbers by size and by farm type shows that different trends can be observed among the main types concerning the proportion of farms in each size range. Some of the figures presented in this part question the hypothesis that the distribution of farms in the different categories was not affected by the various changes in definitions that produced problematic data series concerning the total numbers of farms. For example, Figure 10 suggests that an important part of the dairy farms that are not taken into account anymore in the most recent data belonged to the small farm category (even though the nine year gap in the series might emphasize this impression of abrupt change), while it is unlikely that the data concerning sheep and beef farms for the year 1999 shown in Figure 16 would reflect an actual change in farm size distribution, and consequently the figures for that year should be considered with caution.

Figure 9 shows the changes in the numbers of dairy farms in each size range between 1972 and 2002. The main points are an increase in the numbers of farms of less than 19 hectares between 1978 and 1999, followed by a decrease after 1999. The numbers of farms in the mid-sized ranges (20 to 99 ha) have been clearly falling during all the period, with a decrease of over 50 per cent between 1972 and 2002. On the contrary, the dairy farms of 100 hectares and over have become more and more numerous with an increase of 8.5 per cent in their numbers between 1972 and 1984, followed by an even sharper increase of almost 80 per cent between 1984 and 2002.

Figure 9: Numbers of dairy farms in each size range, 1972-2002

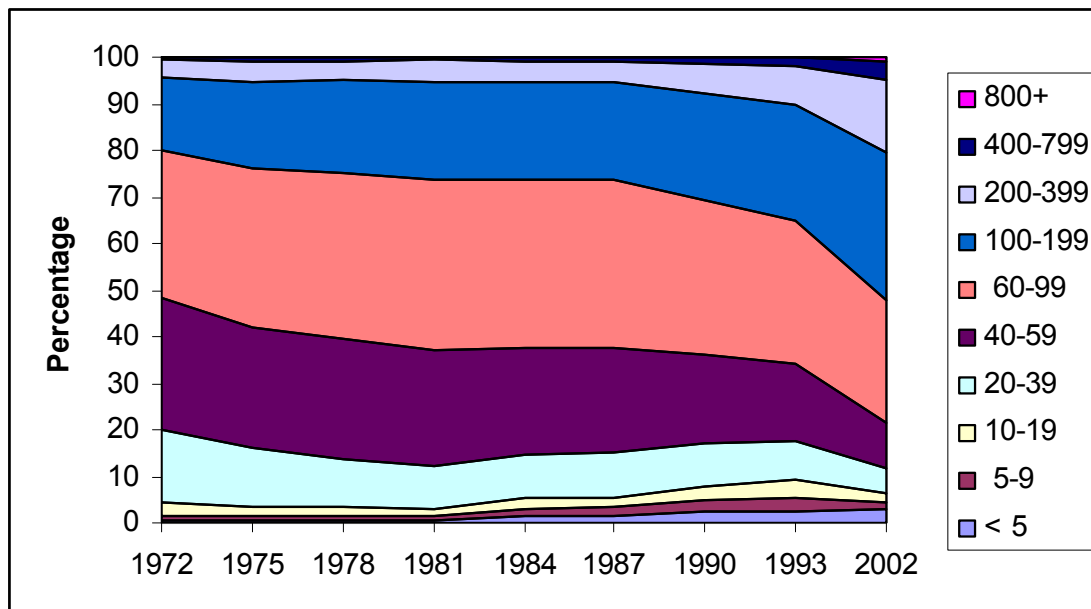


Source: Agricultural Statistics.

Figure 10 represents the proportion of dairy farms in each size range from 1972 to 2002. The results are similar to those just described. The farms with a size over 40 hectares represented more than 80 per cent of them during all the period. Three main trends can be described depending on the size range. The proportion of mid-sized farms (all the size ranges between 20 and 99 ha) decreased between 1972 and 2002. On the contrary, the part of farms over 100 hectares became more and more important, from 20 per cent of the total numbers of dairy farms in 1972 to 52 per cent in 2002. The numbers of smaller dairy farms (less than 20 ha)

seem to have also significantly increased to peak at nine per cent in 1993 and then slightly decrease in the following years. The figure also suggests that a more accentuated change occurred after 1993 but it has to be reminded that this is probably only an artefact of the data as the last time interval spans a nine year period.

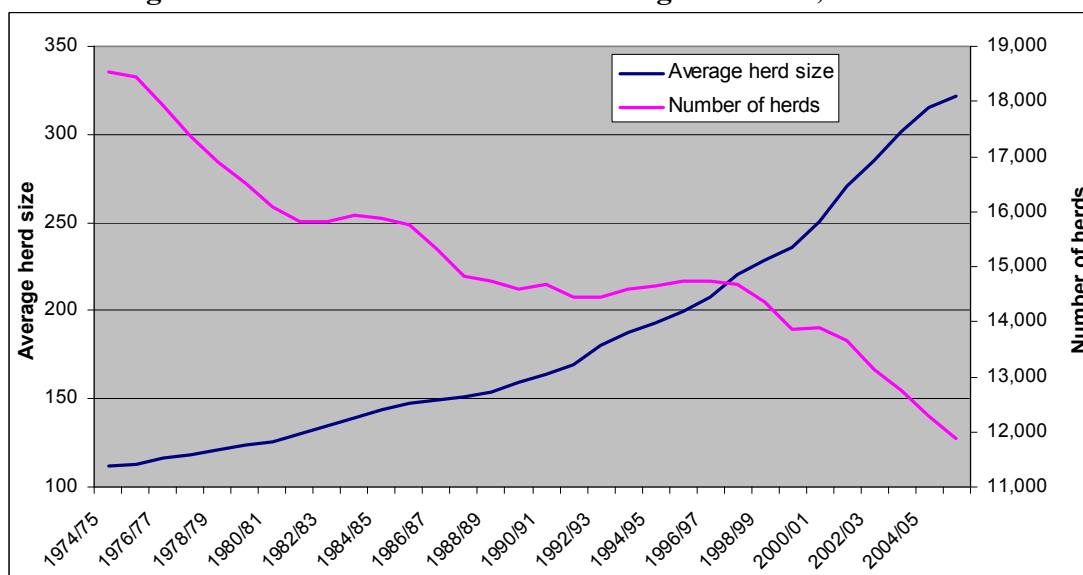
Figure 10: Proportion of dairy farms in each size range, 1972-2002



Source: Agricultural Statistics.

Another indicator of the change in dairy farms size is the change in herd size. Thus, as Figure 11 suggests, the average herd size has been continually increasing during the three last decades, from 112 cows per herd in the 1974/75 season to 322 cows per herd in 2005/06, while during the same period the total number of herds has dramatically decreased. These data show the concentration of dairy farming in a smaller number of larger farms over time.

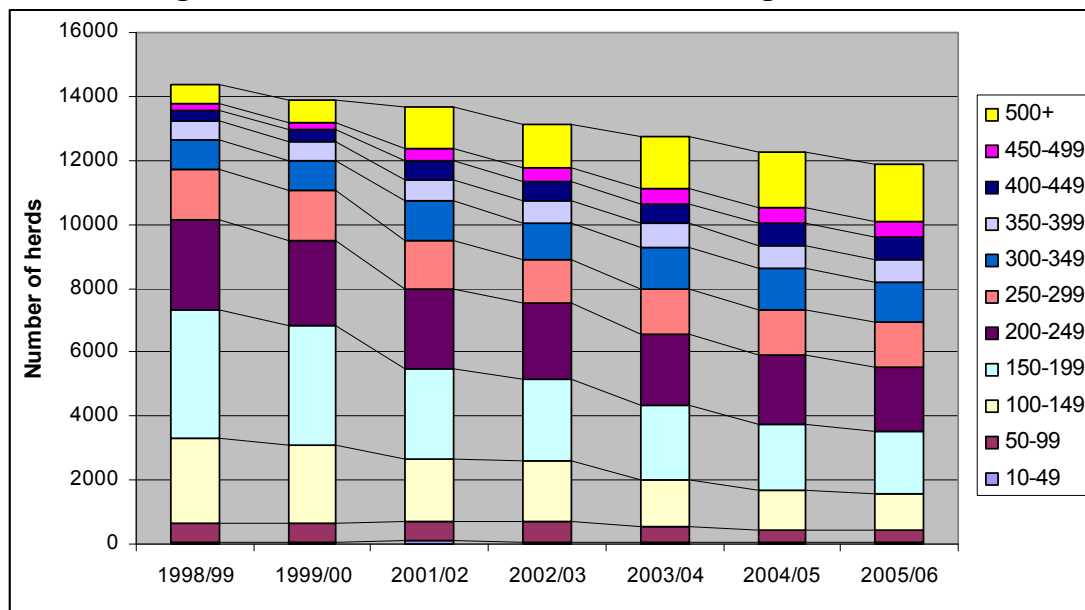
Figure 11: Numbers of herds and average herd size, 1974-75 to 2005-06



Source: LIC (2006). 2005-2006 New Zealand Dairy Statistics (http://www.lic.co.nz/main.cfm?menuid=1&sub_menuid=113)

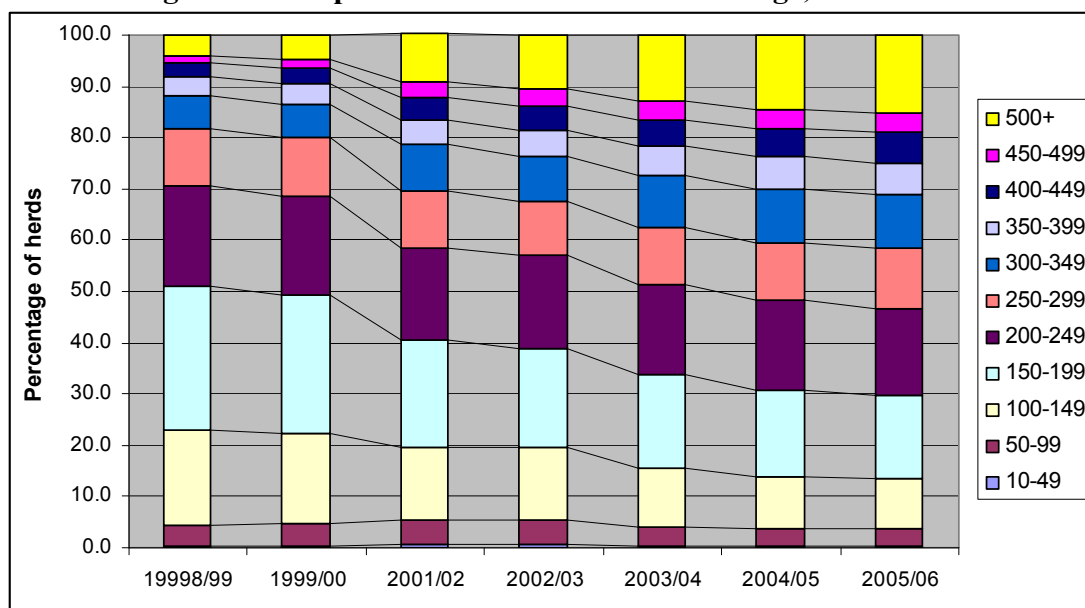
Figure 12 (numbers) and Figure 13 (proportions) represent the change in herd size distribution between 1998/99 and 2005/06. They reflect in particular a clear increase in the number and proportion of the largest herds (300 cows and more), while the mid-sized herds (200 to 299 cows) remained relatively stable, and the smaller herds (200 cows and less) decreased both in number and proportion (with the exception of a slight increase in the two smallest ranges in 1999/00 and 2001/02, that we can explain by the fact that with the large increase in smallholders, some will have dairy cows). This confirms the observation above concerning a trend towards concentration.

Figure 12: Numbers of herds in each size range, 1998/99 to 2005/06



Source: LIC (1999 to 2006). *New Zealand Dairy Statistics* (http://www.lic.co.nz/main.cfm?menuid=1&sub_menuid=113)

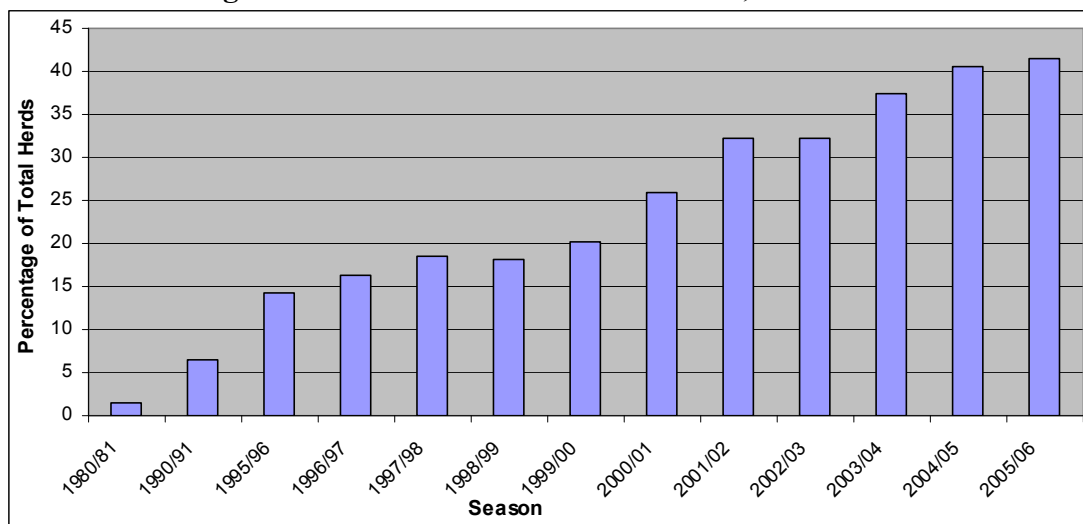
Figure 13: Proportion of herds in each size range, 1998/99 to 2005/06



Source: LIC (1999 to 2006). *New Zealand Dairy Statistics* (http://www.lic.co.nz/main.cfm?menuid=1&sub_menuid=113)

This phenomenon of increase in the percentage of the largest herd size ranges has been obvious for several decades. Thus, Figure 14 represents the percentage of herds with 300 or more cows, which has been dramatically increasing since 1980. Only 1.5 per cent of total herds belonged to this size range in the 1980/81 season, as compared to more than 40 per cent in the 2005/06 season.

Figure 14: Herds with 300 or more cows, 1980/81 to 2005/06

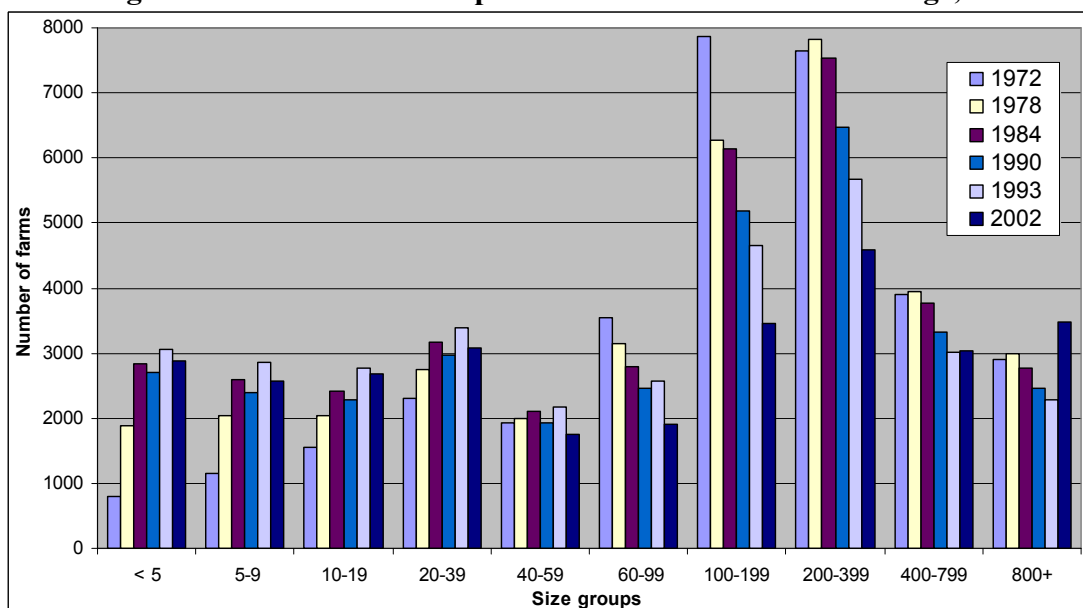


Source: LIC (1999 to 2006). *New Zealand Dairy Statistics* (http://www.lic.co.nz/main.cfm?menuid=1&sub_menuid=113)

2.3.3 Numbers of sheep and beef farms in each size range

The distribution of sheep and beef farms by size range is quite different to that of dairy farms, as Figure 15 shows. The numbers of farms in all the size ranges under 39 hectares increased during the period 1972-2002, while the numbers of larger farms (60 hectares and over) clearly decreased. An exception is to be noted for the farms of more than 800 ha, whose numbers increased between 1993 and 2002.

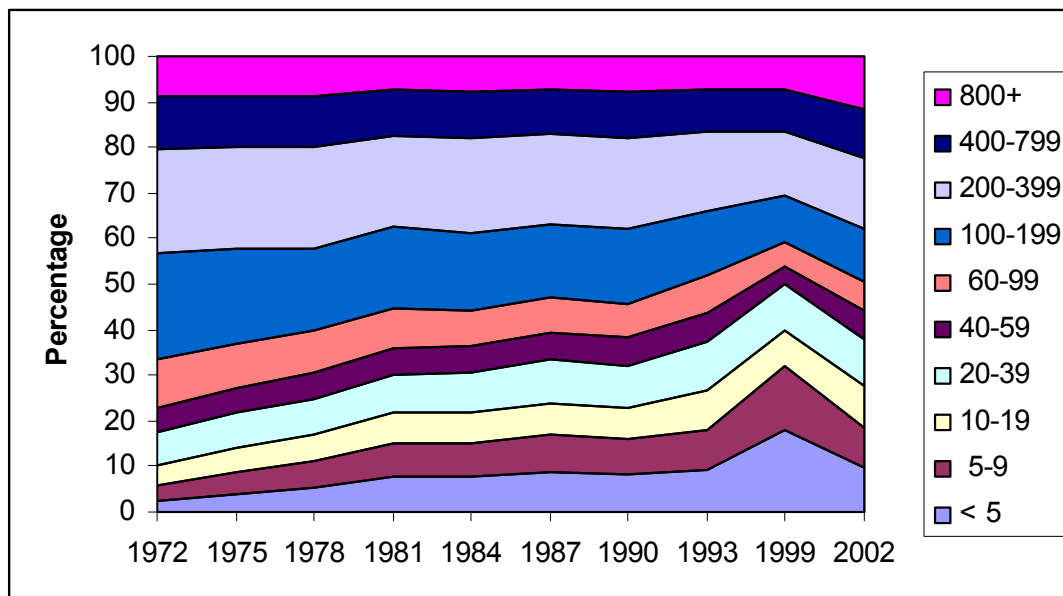
Figure 15: Numbers of sheep and beef farms in each size range, 1972-2002



Source: Agricultural Statistics.

Figure 16 indicates that as a result, the proportion of sheep and beef farms of 60 hectares and less became more and more important from 1972 to 2002, while the proportion of farms of more than 60 hectares rather decreased over the same period. Again, we attribute the increasing number of small sheep and beef farms (less than nine hectares) to the increasing numbers of smallholders.

Figure 16: Proportion of sheep and beef farms in each size range, 1972-2002

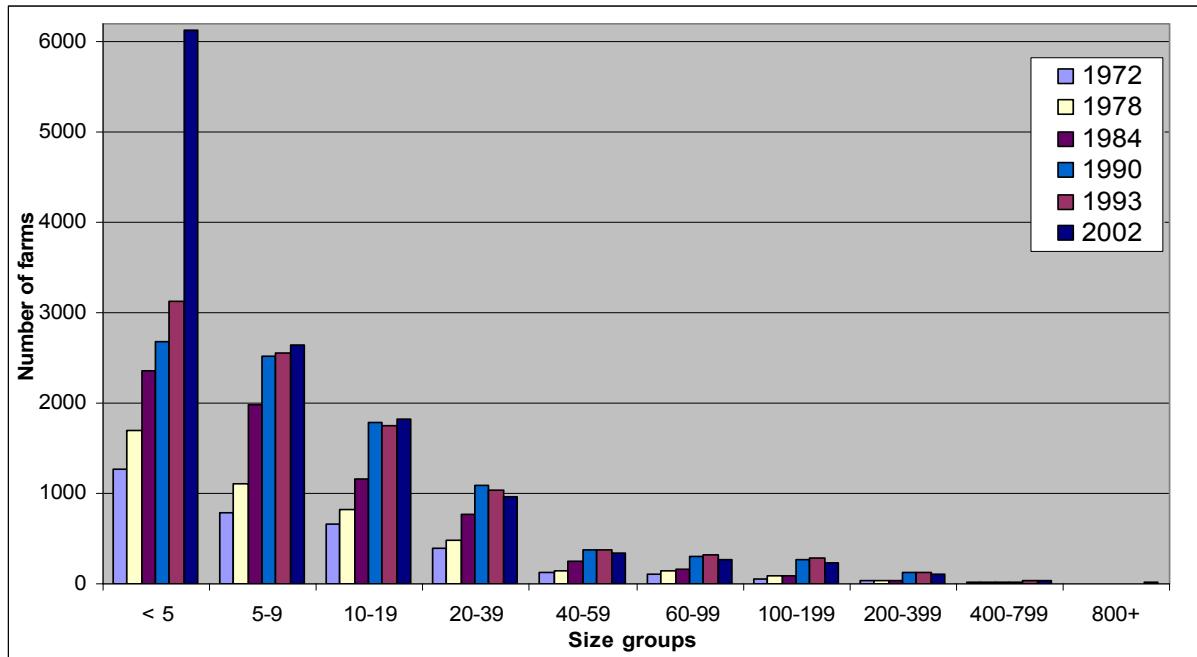


Source: Agricultural Statistics.

2.3.4 Numbers of horticultural farms in each size range

Concerning horticultural farms, Figure 17 shows that their numbers have been increasing in all size ranges between 1972 and 1990, resulting to an increase in their total numbers (from 3,453 farms in 1972 to 9,182 in 1990). After 1990, the numbers of farms in the size ranges under 19 hectares continued to increase, with a very large increase in the less than five hectare size range, while the larger ones slightly decreased.

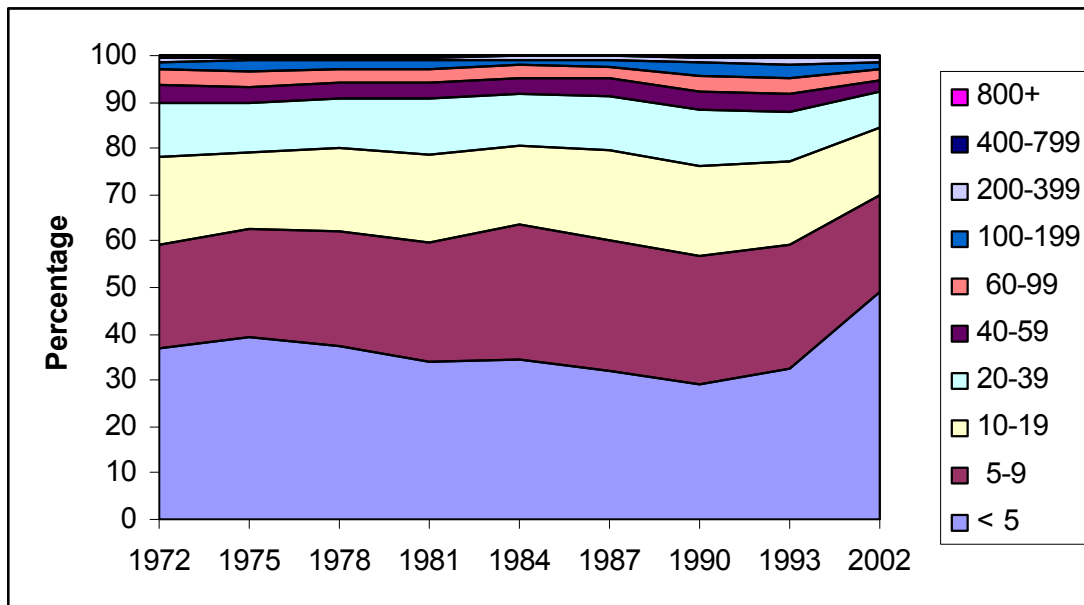
Figure 17: Numbers of horticultural farms in each size range, 1972-2002



Source: Agricultural Statistics.

Figure 18 shows that, as a result, about 90 per cent of horticultural farms had less than 39 hectares during the whole period between 1972 and 2002. The most important changes concern the proportion of farms in the smaller size range (< 5 ha) that increased until 1975, then slightly decreased from 1975 to 1990, and finally increased again between 1990 and 2002, thus reaching the proportion of nearly 50 per cent of the total horticultural farms.

Figure 18: Proportion of horticultural farms in each size range, 1972-2002



Source: Agricultural Statistics.

2.4 Conclusion

In conclusion, an overall decrease could be observed since the 1990s in the total numbers of farms, which could be due to a decrease in dairy, grazing and fattening, and arable farms. The main farm types have followed different trends over the three last decades concerning farm size. Dairy farms have recorded an increase in the smaller and larger size ranges, and a decrease in the intermediate ones. Sheep and beef farms have recorded an increase in the smaller size ranges and a clear decrease in the larger ones. Horticultural farms have increased in number in all size ranges, but this increase was more marked for the smaller size ranges.

This general trend of increase in small farms is probably linked to the increase in smallholdings. Indeed, it seems that some of these smallholdings are included in the Agricultural Statistics. Cook and Fairweather (2003) found in a national survey of smallholders that one third or an estimated 49,000 were productive so it is not surprising that some of these smallholdings would be included in the data presented here.

This trend of increase in small farms combined with an increase in the largest ones leads to the phenomenon of “disappearing middle”. However, while the analysis of the total farm distribution by size range suggests this phenomenon is generally true, it is not observed for all sectors. Thus the dairy sector presents such a trend, but it is less obvious for the sheep and beef sector and the horticultural sector.

Chapter 3

Change in Livestock Numbers

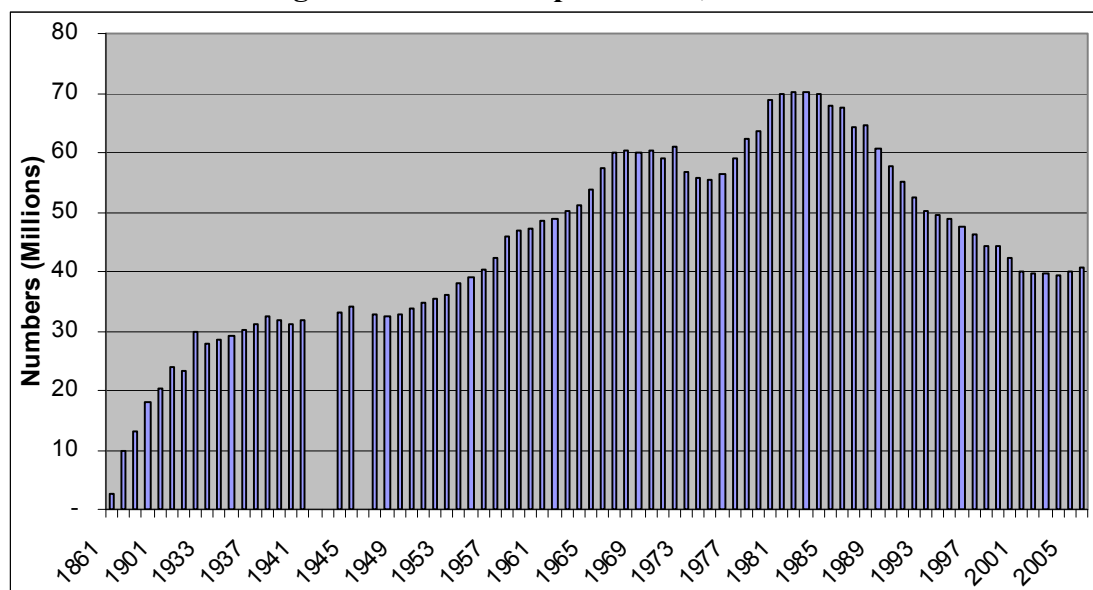
3.1 Introduction

The change in livestock numbers can also be an interesting indicator of farm structure change, and can illustrate for example the move away from some types of livestock farming to more profitable ones over time. The data presented in this chapter were provided by a specialised professional organism, Meat and Wool New Zealand, and therefore they can be expected to form a more consistent and reliable series than the data presented before.

3.2 Sheep numbers

Sheep numbers have been fairly constant over the last five years at about 40 million, after having peaked in the early 1980s at 70 million and then fallen by over 42% by 2002, as Figure 19 shows.

Figure 19: Total sheep numbers, 1881-2006

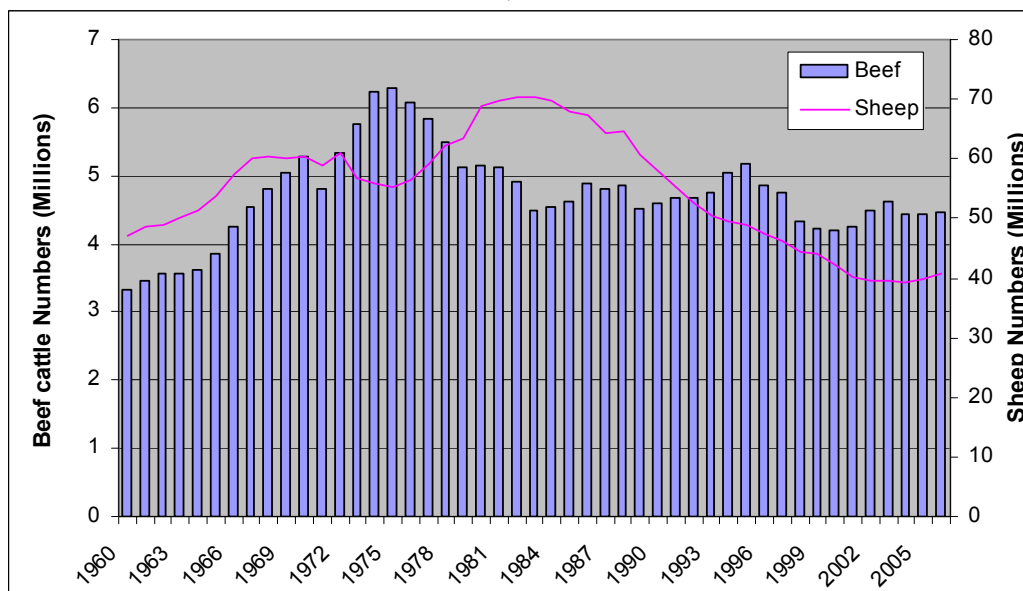


Source: Statistics New Zealand, *Agriculture Statistics 2002* (<http://www.stats.govt.nz/NR/rdonlyres/0FF31BC5-A08B-4217-81D0-641035C6E7C0/0/PDFFile.pdf>) for the period 1861-1959, and Meat & Wool New Zealand Statistics (<http://www2.akl.obm.co.nz/meatnz/Livestock.htm?SECID=528580x6405962030>) for the period 1960-2006.

3.3 Beef cattle numbers

Figure 20 shows that the numbers of beef cattle have followed roughly opposite trends, with a decrease in the late 1970s and early 1980s (the numbers of beef cattle fell by 29% between 1975 and 1983), before stabilizing too at around 4.4 million.

Figure 20: Total beef cattle numbers and comparison with total sheep numbers, 1960-2006

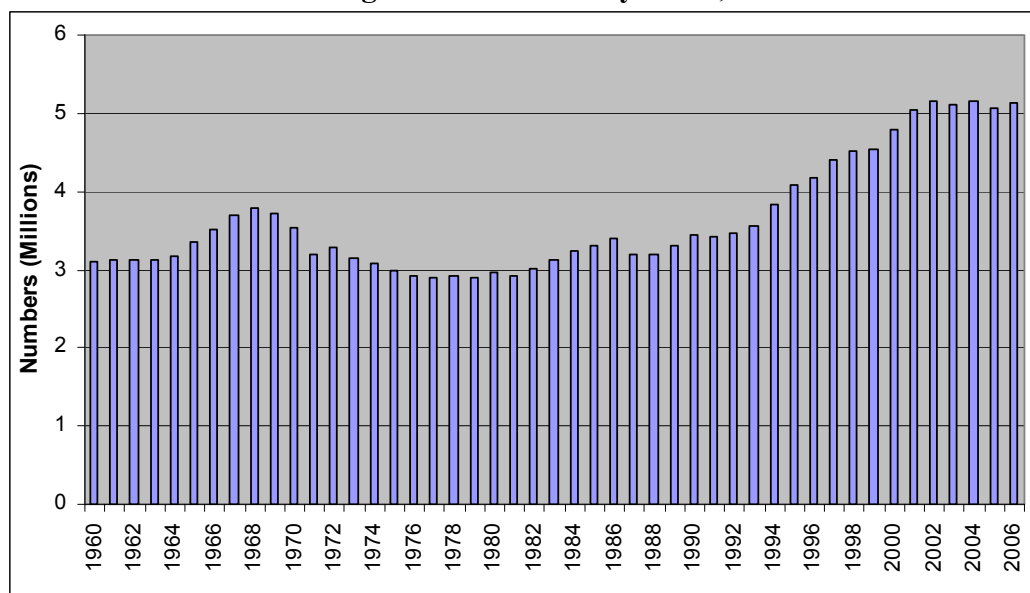


Source: Meat & Wool New Zealand Statistics (<http://www2.akl.obm.co.nz/meatz/Livestock.htm?SECID=528580x6405962030>).

3.4 Dairy cattle numbers

As for dairy cattle, their numbers have increased during the 1960s to peak at almost 3.8 million in 1968, before decreasing during the 1970s. They have then followed an overall trend of increase to reach more than five million in 2001 as Figure 21 illustrates. This number represents a 70% increase between 1980 and 2001.

Figure 21: Total dairy cattle, 1960-2006

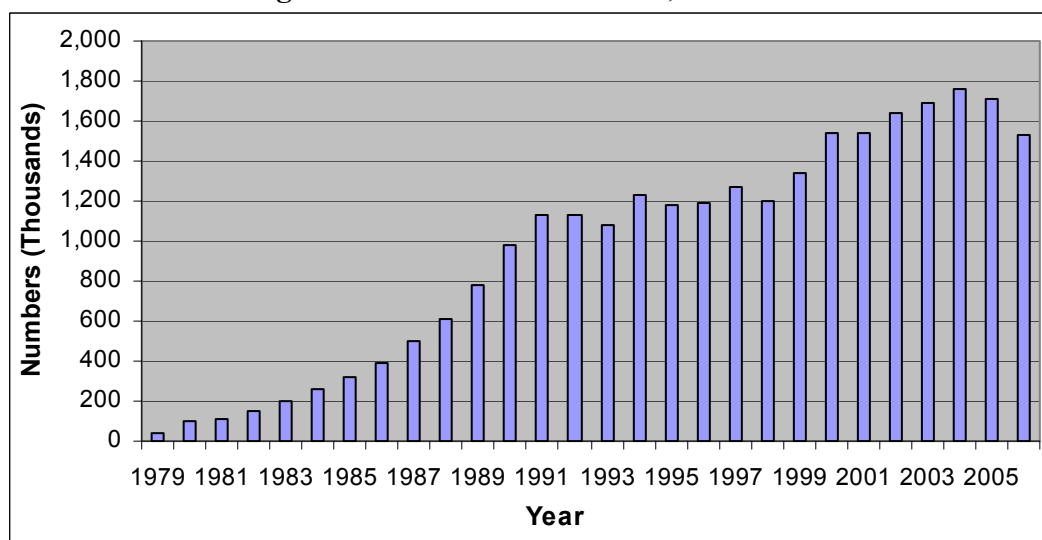


Source: Meat & Wool New Zealand Statistics (<http://www2.akl.obm.co.nz/meatnz/Livestock.htm?SECID=528580x6405962030>).

3.5 Deer numbers

Figure 22 represents the total deer numbers, which have recorded a dramatic increase since the beginning of the 1980s, probably as a result of the move away from more traditional livestock like sheep and beef cattle, as the previous figures showed. However, total deer numbers have declined over the past few years, with a decrease from 1,759 million in 2004 to 1,528 million in 2006.

Figure 22: Total deer numbers, 1979-2006



Source: Meat & Wool New Zealand Statistics (<http://www2.akl.obm.co.nz/meatnz/Livestock.htm?SECID=528580x6405962030>).

3.6 Conclusion

These trends in the different categories of livestock reflect the ability of farming systems to adapt to changed profitability by substituting one type of livestock for another.

It seems interesting here to link these observations about livestock numbers to those made in the second chapter about farm numbers. Thus, it can be noted that as the numbers of grazing and fattening farms were decreasing between 1981 and 2007, the total sheep and beef numbers have also been decreasing. The trends in total deer numbers also correlate quite well with the trends in specialist livestock farms numbers over the same period, even though other types of livestock are involved as well in these latter figures. On the contrary, in the dairy sector, the patterns do not fit in the same way: while the total numbers of dairy farms decreased between 1981 and 2007, the dairy cattle numbers dramatically increased. This suggests an increase in the number of cows per farm, hypothesis that will be examined in the next chapter.

Chapter 4

Intensification in New Zealand Agriculture

4.1 Introduction

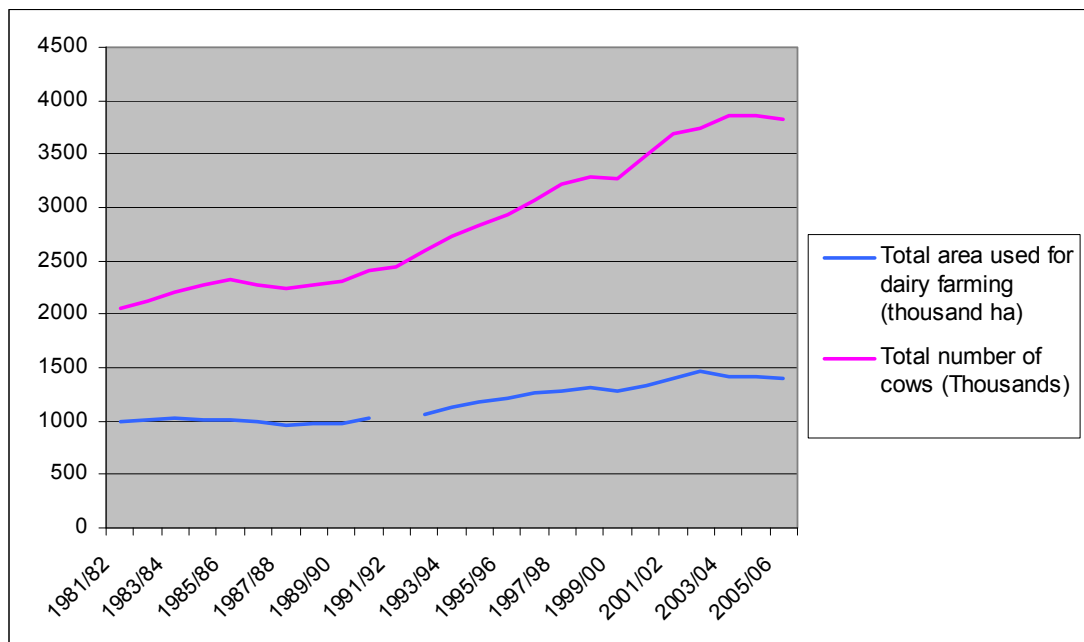
The first part of this chapter examines the main signs of intensification in the different farm types, and the second part aims at determining the main factors having allowed the important phenomenon of intensification that occurred in New Zealand agriculture.

4.2 Signs of intensification in the main farm types

4.2.1 Dairy farms

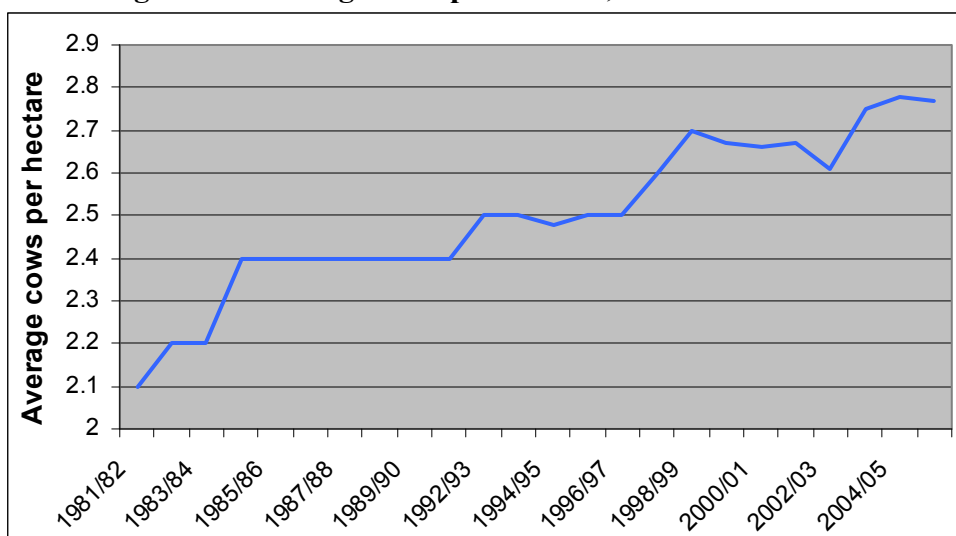
In the dairy sector, one way to intensify agricultural production is to increase the number of dairy cows per hectare. Thus, as Figure 23 shows, between 1981 and 2006, the number of dairy cows increased by 86 per cent while the area of land directly used for dairy farming increased by only 40 per cent. Figure 24 represents the resulting increase in the average number of dairy cows per hectare from the 1981/82 season to the 2005/06 season. While there were on average 2.1 cows per hectare in dairy farms in the 1981/82 season, by 2005, the average number of cows per hectare had reached almost 2.8.

Figure 23: Area used for dairy farming and total numbers of cows, 1981/82 to 2005/06



Source: LIC (2006). 2005-2006 New Zealand Dairy Statistics (http://www.lic.co.nz/main.cfm?menuid=1&sub_menuid=113)

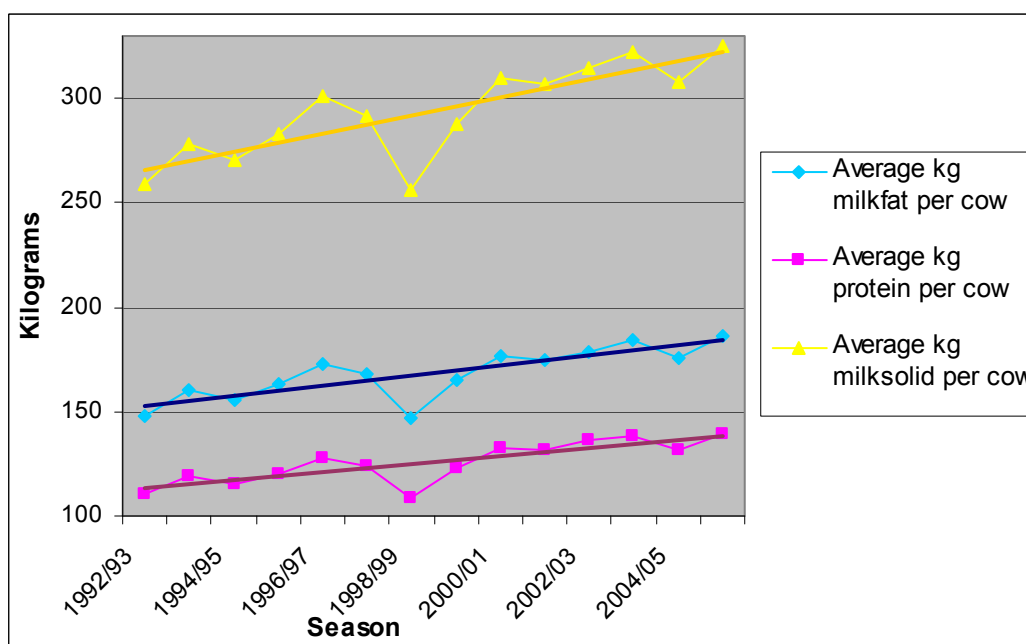
Figure 24: Average cows per hectare, 1981/82 to 2005/06



Source: LIC (2006). 2005-2006 New Zealand Dairy Statistics (http://www.lic.co.nz/main.cfm?menuid=1&sub_menuid=113)

This increase in the number of dairy cows per hectare is not the only sign of intensification in the dairy sector: over the last two decades, the production of milkfat, protein, and milk solids per cow all increased by approximately 25 per cent, as Figure 25 shows.

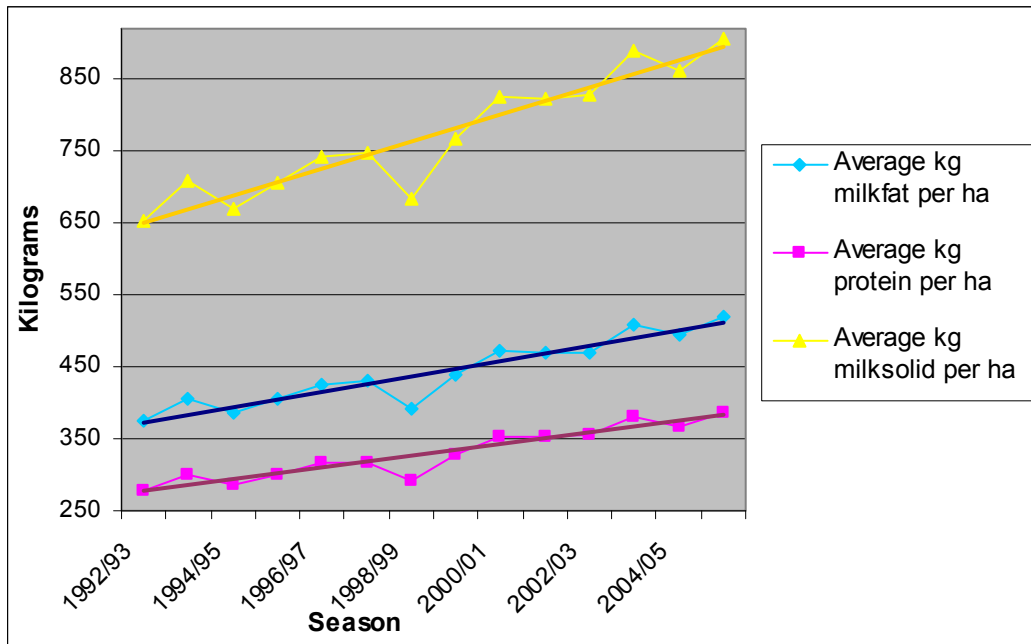
Figure 25: Production of milkfat, protein and milksolid per cow, 1992-93 to 2005-06



Source: LIC (2006). 2005-2006 New Zealand Dairy Statistics (http://www.lic.co.nz/main.cfm?menuid=1&sub_menuid=113)

As a result of these two trends, the quantity of milkfat, protein, and milksolid produced per hectare has dramatically increased too (by 39% between 1992 and 2006), as Figure 26 illustrates.

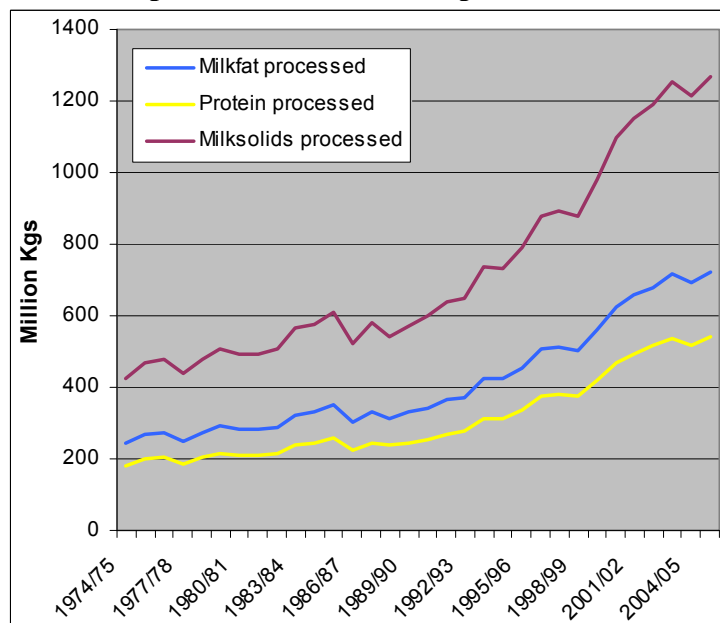
Figure 26: Production of milkfat, protein and milksolid per hectare, 1992-93 to 2005-06



Source: LIC (2006). 2005-2006 New Zealand Dairy Statistics (http://www.lic.co.nz/main.cfm?menuid=1&sub_menuid=113)

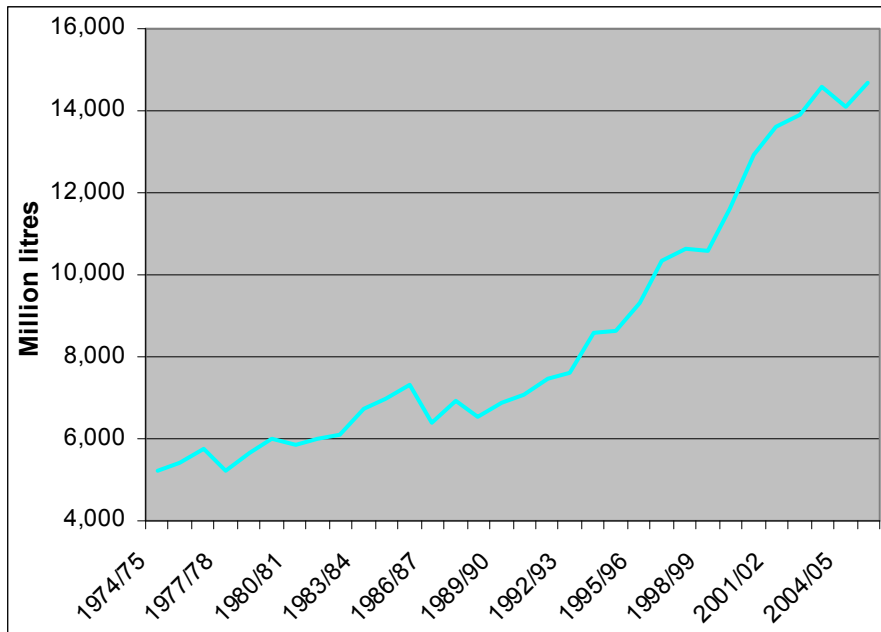
In conclusion, due to this important increase in production per hectare, even though the total area used for dairy farming has only slightly increased, total milkfat, protein and milksolids processed in New Zealand has more than tripled between 1974 and 2006, as Figure 27 illustrates. Figure 28 shows that the total quantity of milk processed also dramatically increased over the same period, from 5.2 billion litres in the 1974/75 season to 14.7 billion litres in the 2005/06 season.

Figure 27: Milkfat, protein, and milksolid processed, 1974-75 to 2005-06



Source: LIC (2006), 2005-2006 New Zealand Dairy Statistics (http://www.lic.co.nz/main.cfm?menuid=1&sub_menuid=113) and LIC (1999), 1998-99 New Zealand Dairy Statistics (http://www.lic.co.nz/main.cfm?menuid=1&sub_menuid=113)

Figure 28: Total milk processed, 1974-75 to 2005-06

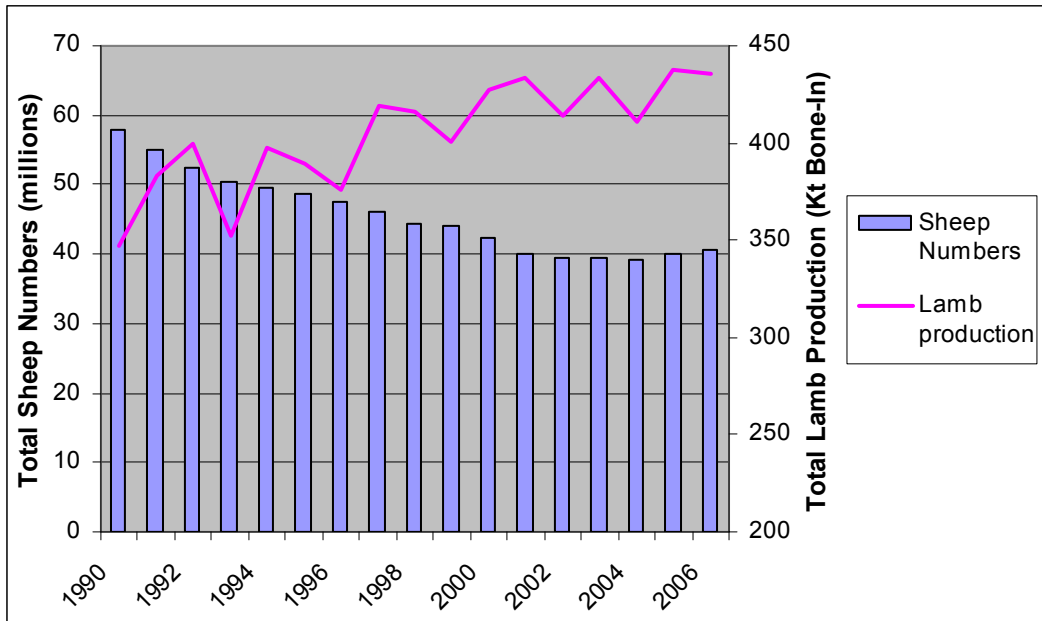


Source: LIC (2006), *2005-2006 New Zealand Dairy Statistics* (http://www.lic.co.nz/main.cfm?menuid=1&sub_menuid=113) and LIC (1999), *1998-99 New Zealand Dairy Statistics* (http://www.lic.co.nz/main.cfm?menuid=1&sub_menuid=113)

4.2.2 Sheep and beef farms

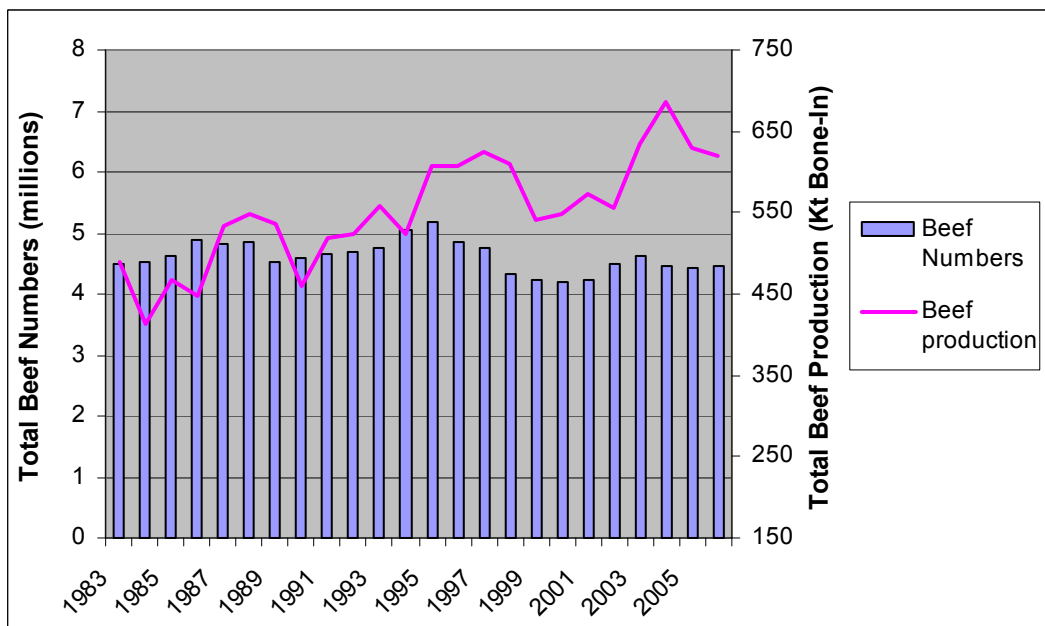
The change in stock units per hectare for sheep and beef farms has been quite different to what could be observed in dairy farms. According to the Parliamentary Commissioner for the Environment (PCE, 2004, p.37), stock units per hectare on intensive sheep and beef farms have declined, from between 10.8 and 13.4 in 1981 to between 10.2 and 12.6 in 2002. This decline can be linked to the decline in total national sheep and beef numbers described above. However, this does not mean that national production from sheep and beef has decreased. On the contrary, Figure 29 and Figure 30 indicate that both sheep and beef production have increased between 1990 and 2006, even though the total numbers of sheep and beef cattle have decreased.

Figure 29: Lamb production and total sheep numbers, 1990-2006



Source: Meat & Wool New Zealand Statistics (<http://www2.akl.obm.co.nz/meatnz/TotProd.htm?SECID=527537x7684037675>)

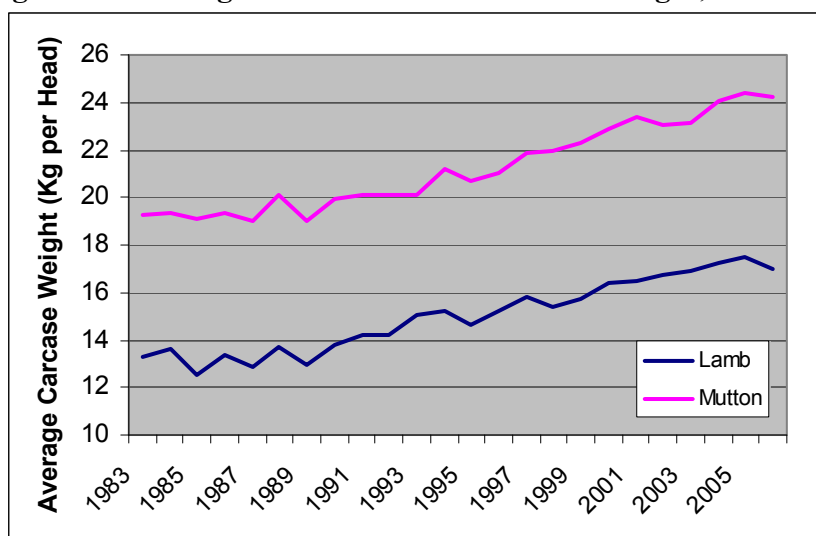
Figure 30: Beef production and total beef cattle numbers, 1983-2006



Source: Meat & Wool New Zealand Statistics (<http://www2.akl.obm.co.nz/meatnz/TotProd.htm?SECID=527537x7684037675>)

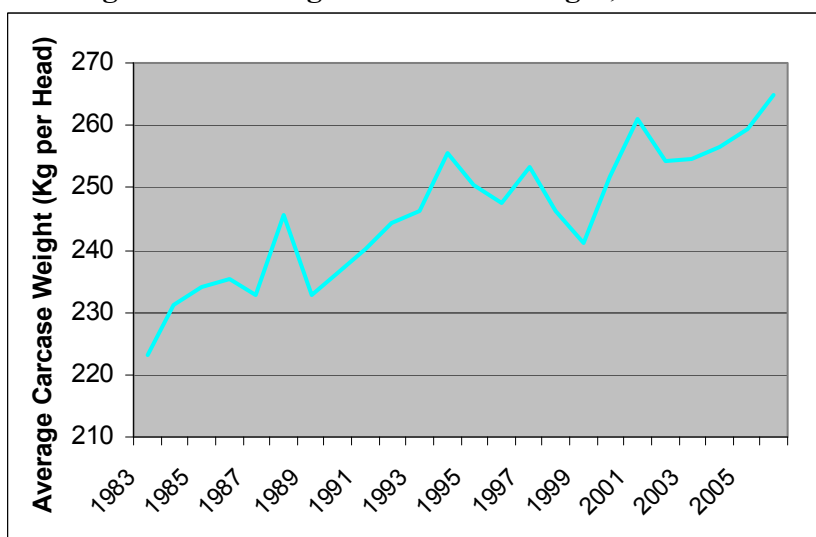
Thus the increase in production in the sheep and beef sector has not been achieved through increased stocking rates as it has been the case for the dairy sector, but rather through increased lambing rates and livestock weights. Indeed, the national average carcass weight of lamb increased by 27% between 1983 and 2006, while that of mutton increased by 25% and that of beef by 18% over the same period. Figure 31 and Figure 32 represent those increases. Lambing rates also increased by 25% between 1980 and 2003 (PCE, 2004, p.37).

Figure 31: Average lamb and mutton carcass weight, 1983-2006



Source: Meat & Wool New Zealand Statistics (<http://www2.akl.obm.co.nz/meatnz/CarcWght.htm?SECID=527537x7684037675>)

Figure 32: Average beef carcass weight, 1983-2006



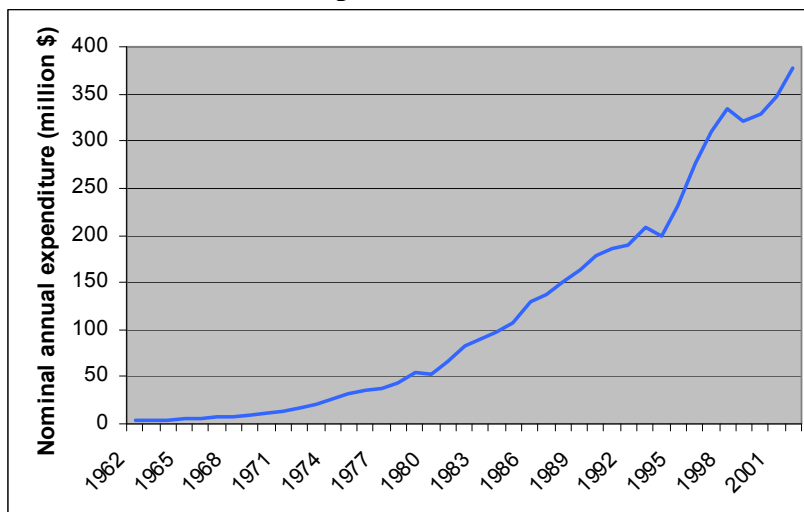
Source: Meat & Wool New Zealand Statistics (<http://www2.akl.obm.co.nz/meatnz/CarcWght.htm?SECID=527537x7684037675>)

4.3 Factors of intensification

4.3.1 Importance of agricultural research

This trend of an increasing productivity in the different sectors of New Zealand may be linked to the increase in expenditure on agricultural research and development. Figure 33 shows the increase in nominal annual expenditure in agricultural research and development, from \$3.9 million in 1962 to over \$378 million in 2002.

Figure 33: Nominal annual expenditure in agricultural research and development, 1962-2002

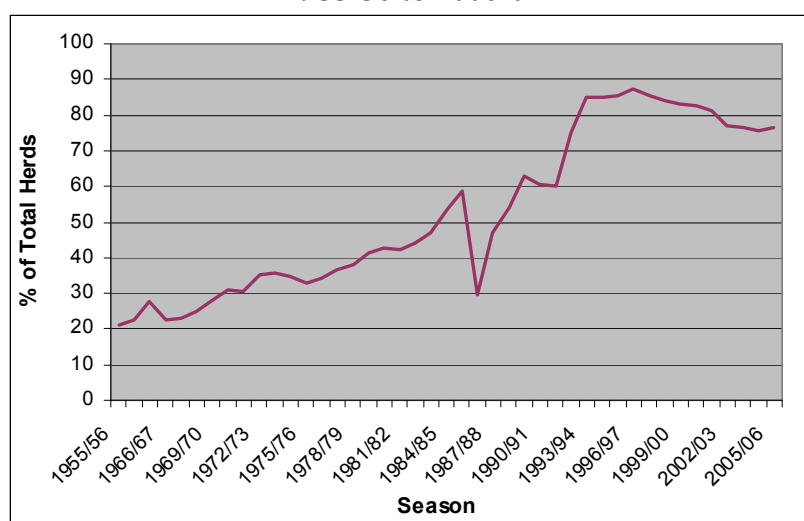


Source: Statistics New Zealand (2005). *Long-term data series*. <http://www.stats.govt.nz/tables/ltds/default.htm>.

4.3.2 Increase in herd testing

The use of herd testing has also dramatically increased over the past decades. Figure 34 represents the increase in the percentage of herds using herd testing services between 1955 and 2006. While herd testing only concerned a minority (21%) of total herds in the 1955/56 season, the proportion of herds using herd testing services peaked at 87 per cent in 1996/97, before slightly decreasing to 76 per cent over the past few years. The percentage of herds using herd testing services also shows a drop in the 1986/87 season, which LIC (2006) explains by the low payout received by farmers in that season, which made them reduce expenditure on herd testing.

Figure 34: Percentage of use of herd testing services, 1955-56 to 2006-07



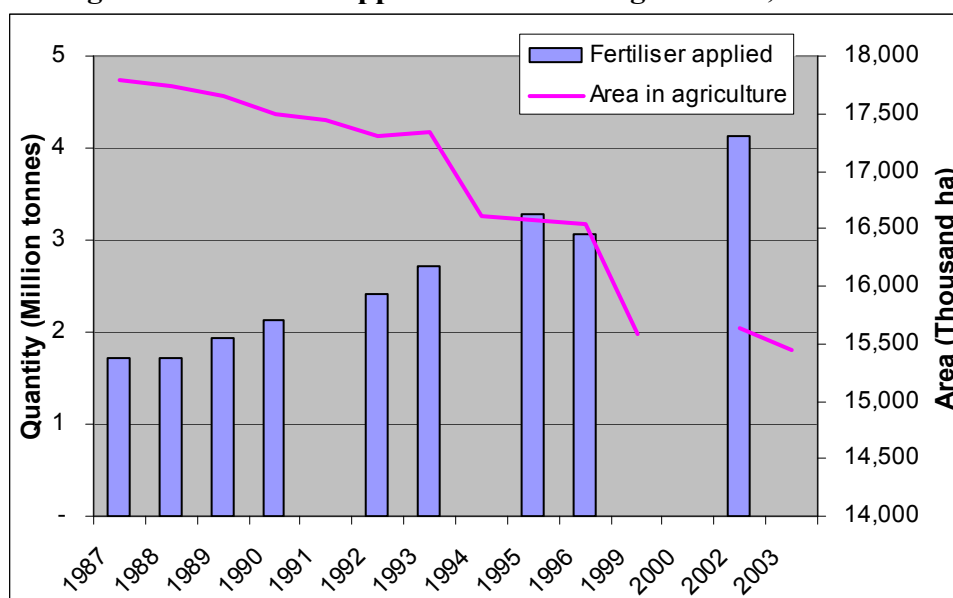
Source: LIC (2006). *2005-2006 New Zealand Dairy Statistics* (http://www.lic.co.nz/main.cfm?menuid=1&sub_menuid=113)

4.3.3 Use of fertilisers

The important increase in the different types of agricultural production without increasing the total area in agriculture has also partly been achieved through a greater reliance on synthetic fertilisers instead of the traditional processes that provided nutrients to the soil. The most common fertilisers used in New Zealand include lime, phosphatic fertilisers such as Superphosphate, potassic fertilisers, nitrogenous fertilisers mainly in the form of urea, and compound fertilisers such as di-ammonium phosphate (DAP).

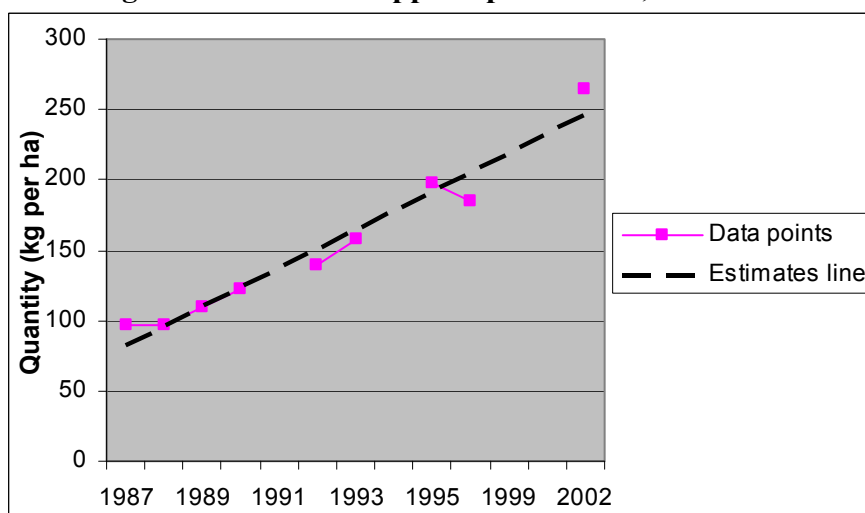
Total fertiliser application in New Zealand has increased from 1.72 million tonnes in 1987 to 4.13 million tonnes in 2002, while total area in agriculture has decreased from 17.8 million hectares to 15.4 million hectares over the same period, as Figure 35 shows. As a result, Figure 36 illustrates the increase in the quantity of fertiliser applied per hectare over the last decades.

Figure 35: Fertiliser applied and area in agriculture, 1987-2003



Source: Statistics New Zealand, *Agriculture Statistics 2002* (<http://www.stats.govt.nz/NR/rdonlyres/0FF31BC5-A08B-4217-81D0-641035C6E7C0/0/PDFFile.pdf>)

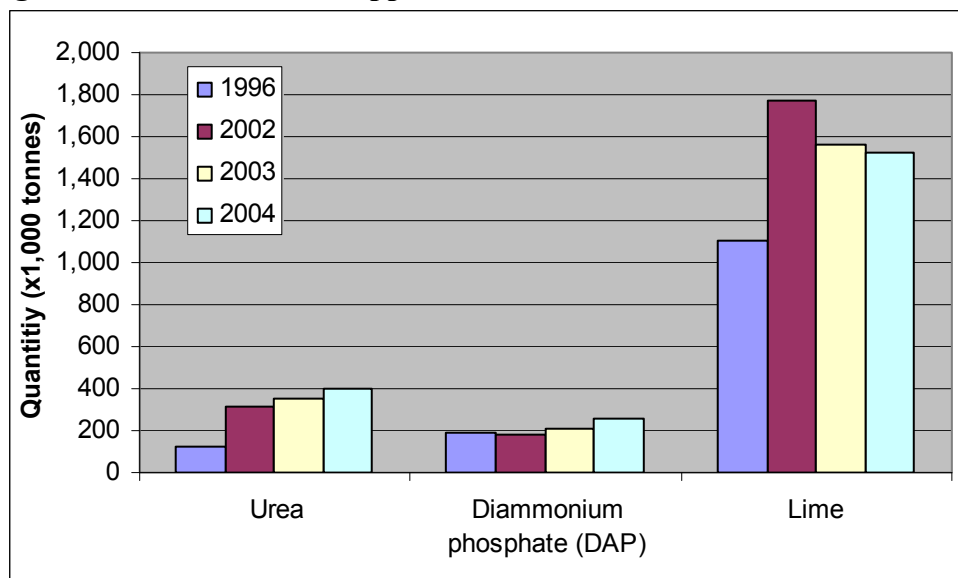
Figure 36: Fertiliser applied per hectare, 1987-2002



Source: Statistics New Zealand, *Agriculture Statistics 2002* (<http://www.stats.govt.nz/NR/rdonlyres/0FF31BC5-A08B-4217-81D0-641035C6E7C0/0/PDFFile.pdf>)

However, Figure 37 suggests that the trends have not been the same for the different types of fertiliser applied in New Zealand. Thus, total use of lime, the most common one, decreased by 14% between 2002 and 2004 after having dramatically increased between 1996 and 2002, while urea and di-ammonium phosphate (DAP) continually increased between 1996 and 2004.

Figure 37: Main fertilisers applied in New Zealand, 1996, 2002, 2003, 2004

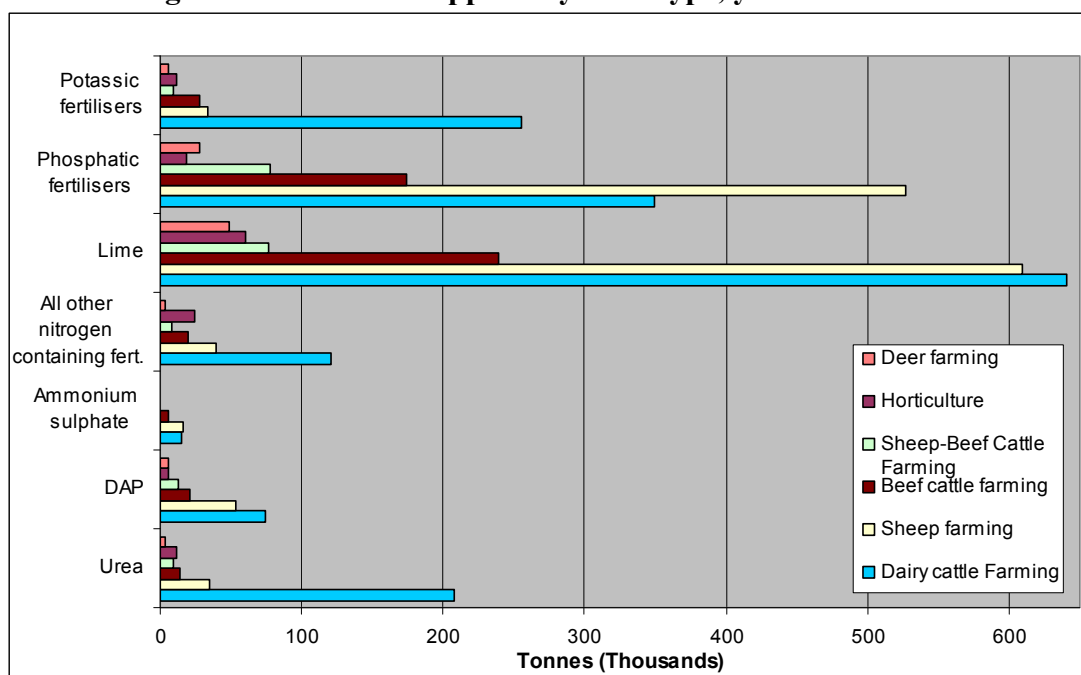


Source: Statistics New Zealand, *Agricultural Statistics 1996* for the year 1996 (<http://www.stats.govt.nz/tables/ag-stat-1996-downloadable-excel-table.htm>), *2002 Agricultural Production Census* for the year 2002 (*Fertiliser Applied by Region during the year ended 30 June 2002*, <http://www.stats.govt.nz/tables/2002-ag-prod/fertiliser-tables.htm>), *Agricultural Production Statistics (Final): June 2004* for the years 2003 and 2004 (*Fertiliser applied by region, during the year ended 30 June*, <http://www2.stats.govt.nz/domino/external/pasfull/pasfull.nsf/7cf46ae26dcb6800cc256a62000a2248/4c2567ef00247c6acc256fe2001333dd?OpenDocument>)

These rates of application also varied between regions. In 2004, Canterbury – which was home to 12 per cent of the country’s dairy cattle and 19 per cent of the country’s sheep – became the heaviest user of the three types of fertiliser mentioned above, while the Waikato region became the second country’s heaviest user (Statistics New Zealand, 2006, p.4).

Differences also exist between farm types. The previous section underlined that dairy farming has been a booming sector in term of livestock numbers since the end of the 1980s. It has to be noted too that dairy farming also requires significantly more fertiliser than the other land use types, especially concerning potassium, nitrogen, and urea, as Figure 38 shows. Horticulture is also a sector that has been booming over the last 25 years and that requires high inputs of fertilisers, as well as mechanical energy, labour, pesticides and herbicides.

Figure 38: Fertilisers applied by farm type, year ended 30 June 2002



Source: Statistics New Zealand, 2002 Agricultural Production Census (<http://www.stats.govt.nz/tables/2002-ag-prod/fertiliser-tables.htm>)

This high use of fertilisers for dairy farming can be explained by the fact milk production at high levels require intensive grazing, and therefore good pasture growth is necessary to remain competitive in this sector, especially since the increase in production in the dairy sector has been achieved partly by increasing the number of dairy cows per hectare. Even though the intensity of nitrogen fertiliser use has increased dramatically between 1996 and 2002 in the sheep and beef sectors (with a 670 per cent increase in urea applied per hectare, compared to an increase of 160 per cent in the dairy sector over the same period), per hectare use of nitrogen fertiliser is still far higher in the dairy sector than in the sheep and beef sector (PCE, 2004, p.91). Table 1 indicates the quantities of urea fertiliser spread per hectare in different sector, for the years 1996 and 2002.

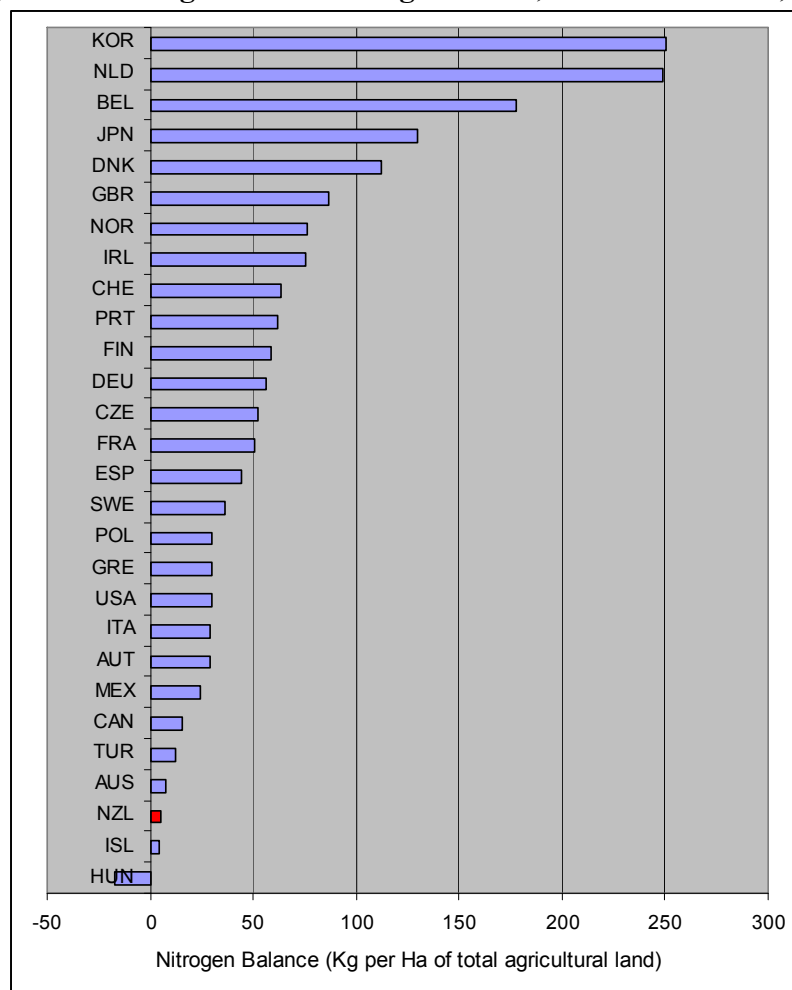
Table 1: Kilograms of urea fertiliser spread per hectare, by sector, for the years ending June 1996 and 2002

Sector	1996	2002
Sheep and beef	0.7	5.7
Dairy	38.8	1015
Deer	2.9	10.1
Cropping	78.2	164.3
Vegetable growing	-	167.2
Pip fruit	41.2	42.6
Kiwifruit	51.8	75
Grape growing	-	8.4

Source: Parliamentary Commissioner for the Environment (2004). *Growing for good: Intensive farming, sustainability and New Zealand's environment*. Note: These figures have been assessed by dividing the 'kilograms of urea spread by each sector' by the 'number of hectares farmed by each sector' for 1996 and 2002.

Despite this growing use of fertiliser, a report by the OECD (2002) showed that New Zealand was one of the most nutrient efficient countries among all OECD countries. This efficiency is measured by the difference between the nutrients available to an agricultural system (inputs onto the soil) and the uptake of nutrients from the soil by agriculture (outputs). Thus, Figure 39 represents the OECD soil surface nitrogen balance indicator for the different OECD countries in 1997 (last data released). New Zealand is represented in red, its nitrogen balance was closed to zero which means that the country had a good nutrient efficiency, with a quite low risk of loss of nitrogen to the soil, the air, and surface water or groundwater. However, as fertiliser application in New Zealand has been increasing since 1997 while total area in agriculture has rather been decreasing, further data on the evolution of this indicator after 1997 would be necessary to draw conclusions on New Zealand nutrient efficiency today.

Figure 39: Nitrogen balance in agriculture, OECD countries, 1997



Source: OECD, 2002, *Working Together towards Sustainable Development*, p.39
http://www.oecdwash.org/DATA/DOCS/working_together.pdf

4.4 Conclusion

Intensification in the different farming systems has probably allowed New Zealand agriculture to remain very competitive over time. However, the increasing stocking rates and use of fertiliser described above also raise questions about the sustainability of these systems. The use of water for irrigation is another problematic subject in New Zealand as it has also been increasing in important ways over time. Today it is estimated that 509,797 hectares of land are irrigated in New Zealand, with among them 21 per cent of dairy pasture, 34 per cent other pasture, 22 per cent arable, 11 per cent horticulture and one per cent viticulture (PCE, 2004, p.112).

Chapter 5

Conclusion

In response to changing economic situations and the development of certain new constraints over time, New Zealand farming systems have proved capable of important adaptation to improve their competitiveness. Among the adaptation process, the switch from one type of livestock to another as a result of changing profitability can be underlined, as well as the change in farm size and level of intensification in accordance with the farming type considered and its specificity.

However, while these changes have led to more productive systems, especially when production per hectare and per animal are considered, they also raise the issue of systems' sustainability and their possible future development. Thus, soil impoverishment, massive use of fertilisers and irrigation water, and loss of biodiversity are subjects of concern with regards to the recent development of the agricultural sector. Thus, insuring the longevity of agricultural systems will most likely need some new adaptation from the different parties involved towards a more sustainable path.

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