IN THIS ISSUE

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Contents

Julian Bateson

Plan ahead and look after the environment

We have all had time to digest the news of the significantly reduced price which Fonterra is projecting for the coming year. The news came out about a month ago that the pay-out would be six dollars a kilogram of milk solids, a significant reduction on the record price last year. Some commentators are suggesting that the final price may eventually have a five at the beginning. What happens over the next few months will be the decider.

It has been mentioned a number of times that New Zealand is too dependent on one product and one country for its success. Primary industry production for export is very important for the foreseeable future but it needs to be adaptable and flexible. It is easy to carry on producing more when times are good, but we need to plan ahead. In particular we also have to look after the environment for the long term.

There has been a recent spat between Nick Smith and Bryce Johnson mainly about the quality of water in New Zealand rivers. Dairying and water quality are inextricably linked, with pressure for more milk from more cows with more irrigation. Admittedly others add pollution to our rivers and streams. The local authorities in some towns and cities do not process sewage to a high standard, in many places old septic tanks leak sewage from domestic dwellings and there are still industrial processes releasing waste into rivers. In other words it is not just farmers causing reductions in water quality. But for dairying to cast blame on others is not the answer. We are all responsible.

One of the options to help control nitrogen run-off from dairying is the use of wintering barns. The first article in this issue of *Primary Industry Management* by Phil Journeaux outlines the advantages and disadvantages of wintering barns. His conclusions are that wintering barns do reduce nitrogen leaching but with further intensification the nitrate loss just gets back to the original level. A six dollar a kilogram pay-out is insufficient for a profit even without further intensification. Add more cows and the figures look worse.

The following article by Christine Christensen and Dave Horne looks at reducing the environmental footprint of dairying using controlled grazing. The use of free stall barns and controlled grazing is a way of reducing nitrogen leaching and the research is still continuing.

Both these articles consider not having cows 'running free' in open paddocks. Is this the future of dairy farming?

Continuing with dairy farming, the article by Natalie Jackson looks at the demographic changes in the industry as labour becomes more difficult to find. The figures, graphs and tables in the article give a complex picture but with definite trends. Jill Greenhalgh and Philippa Rawlinson, in their final article on trends in Southland, look at where the Southland sheep farmers have gone in response to more dairying and higher land prices. The range of options means that there has been quite a variation in what sheep farmers have done in response to the pressure to change to dairying.

A few years ago automatic milking seemed to be the way of the future, removing the need for the manual work of milking cows at set times of the day. Jenny Jago's article summarises the adoption of automatic milking over the past few years, but with only around 15 farms using these systems progress has been slow. Will these early adopters become the leaders for a long-term trend?

Animal welfare on farms is very important and the happier the animal the better it will produce. Keith Betteridge has carried out studies on the value of shade for beef cattle, and his article summarises the results. There are no real surprises in the fact that cows like shade from the hot summer sun, but it does not mean they relax in the shade as we might think. They continue to feed and in fact grazed more than cows without shade. Keith is continuing this study which hopefully will encourage more trees to be planted on farms to benefit the animals.

The remaining articles, all well worth reading, cover agricultural extension, farm succession, wine opportunities in China and land use in Tanzania. The latter has some comparisons with how New Zealand land ownership changed with colonisation.

Phil Journeaux

Wintering barns
Balancing the costs and benefits

Wintering barns on dairy farms are an increasing sight, as farmers look to mitigate nitrogen losses and the effect on wet soils of cows being grazed over the winter. The main problem with barns is their capital cost. A case study carried out in early 2013, funded by Dairy NZ, investigated the costs and benefits of a wintering barn on an average farm in the Tararua District. This was with respect to the financial situation and its effect on reducing nitrogen-leaching losses from the farm. The intent with the latter was to try and achieve a leaching target rate of 18 kilograms of nitrogen per hectare per year.

The case study considered an average farm from within the Tararua District based on Livestock Improvement Corporation and DairyBase statistics. It involved constructing a wintering barn, with the farming system then intensified to cover the cost of the barn. The analysis was on the extra marginal costs and benefits of installing a barn. The farming system was also analysed using the Overseer nutrient budget model to determine the nitrogen leaching under the different scenarios, covering a sedimentary and a sandy soil type and under two different rainfall scenarios of 1,200 and 1,700 millimetres a year.

Farm system

Details of the farm.

- Effective area 119 hectares
- Cows wintered 332
- Peak cows milked 324
- Milk production 113,400 kilograms of milk solids, 342 kilograms per cow wintered, 953 kilograms per hectare
- All cows are grazed off the farm in June and July.

Once the barn was constructed, the cows went on to an on-off grazing system from February to May, where they grazed pasture in situ for four hours in the morning and evening and then in the winter barn for the remainder of the time. They were then housed in the barn for 100 per cent of the time during June and July. The farm was then intensified in two steps in order to carry the costs of the barn.

For the first intensification, cow numbers were increased to 389. This was an increase of 57, and milk production increased to 162,700 kilograms of milk solids, or 418 kilograms per cow wintered and 1,367 kilograms per hectare.

For the second intensification, cow numbers were left as in the first intensification but milk production on the average farm was lifted to 194,500 kilograms of milk solids, or 500 kilograms per cow wintered, and 1,634 kilograms per hectare. Additional feed was bought into the farm system to meet the increased production requirements.

Costs

Capital costs were based on actual costs of barns, which averaged around $2,000 per cow. This is a free-stall type of barn, which also included the cost of extending the effluent system to cope with the extra effluent generated. More recent quotes seen for wintering facilities have varied from $3,500 to $6,600 per cow.

For feed costs, as mentioned earlier the grazing regime with the barn was to graze the cows for four hours in the morning and evening, with the remainder of the time in the barn during the February to May period. For June and July the cows spent 100 per cent of the time in the barn. The extra feed required was assumed as a 50:50 mix of pasture silage and palm kernel. The amount of feed required for the scenarios is given in the table. The feed costs were silage at 27 cents a kilogram of dry matter and palm kernel at 31 cents.

Extra feed requirements

	Tonnes of silage dry matter	Tonnes of palm kernel dry matter
Base scenario	186	186
First intensification		
Wintering barn	219	219
Extra milk	224	224
Second intensification		
Wintering barn	219	219
Extra milk	447	447

For labour costs the basic assumption was that one full-time equivalent labour unit cost $50,000 a year. An extra quarter full-time equivalent was required in the base scenario and a half full-time equivalent for the intensive scenarios.

There were two components to increased tractor and machinery costs, the capital costs of upgrading to bigger and better machinery covering a tractor and feed-out wagon along with increased operating costs covering fuel, repairs and maintenance, and insurance. Cost of increased cow numbers was based on the five-year average of the herd values from the Inland Revenue Department livestock tax scheme. This is a weighted average for mixed age cows across Friesian and Jersey with other breeds. The value equals $1,711.

Final costs include repairs and maintenance on the wintering barn. The assumption behind this was that the repairs and maintenance costs started at 0.5 per cent of the capital cost of the shed in year two, and increased by 0.5 per cent a year through to year 11. At this stage it equalled five per cent, and then remained at this level after that.

Benefits of wintering barns

Before the pre-wintering barn all the cows were grazed off the farm over the June and July period. A benefit of the wintering barn therefore would be the saving in this cost, estimated at $28 per cow per week for an eight-week period.

Increase in pasture production

Pugging and compaction can result in damage to pasture reducing utilisation by 20 to 40 per cent, and a reduction in future pasture yield to between 20 and 80 per cent for four to eight months. This depends on soil type, as well as greater fertiliser requirements and sediment run-off. However, it is difficult to accurately determine an average benefit for wintering facilities given the variations between farms and between years.

Research by AgResearch indicates that the positive effect of eliminating pugging damage on pasture production was generally outweighed by the negative effects of increased machinery traffic by conserving feed or topping pastures. In the restricted grazing assumed for the study, while there would be an increase in mechanical harvesting of feed, this would not be overly significant. An assumption was therefore made to allow for a two per cent increase in pasture production over the whole farm.

Research indicates a three to eight per cent increase in pasture dry matter production in a restricted grazing system using a wintering barn as a result of a more even application of effluent over the farm. However, in the case study, annual average application of fertiliser was 150 kilograms of nitrogen per hectare. In this situation the effluent return may have been more even relative to grazing animals, but the effective application of effluent nitrogen simply substituted for the fertiliser nitrogen. No increase in pasture production was therefore allowed for.

Increased milk production

This relates to the increased number of cows and the move to a more intensive feeding regime to make the wintering barn pay its way. Increased milk production was calculated as the increase over the base scenario, costed at the five-year average milk payout of $6.20, less the gross margin operating expenditure per cow for the increased cow numbers.

Cows are often milked for longer periods due to a combination of factors, particularly better feeding, maintaining cows in better condition and a desire to recoup the costs of the wintering barn. Within the study it was assumed 70 per cent of the herd was milked for three weeks longer at a gross margin of $10 per cow per week.

Better cow condition

As a result of the better feeding regime, and a lower body maintenance requirement due to the shelter of the shed, cows are often in a better body condition at calving. Within the study, the assumption was that the cows averaged 0.5 body condition score better, which equated to an increase of 7.5 kilograms of milk solids per cow.

The better condition and better feeding regime also often results in a reduction in empty cows, which in turn can lead to efficiencies in replacement rates. Within the study it was assumed that there was a two per cent improvement. That meant the replacement heifer numbers were reduced from 20 per cent of the milking cows to 18 per cent.

Saved cost of not applying fertiliser

With the increased feeding regime applicable to the wintering barn and the increased milk production, the amount of effluent required to be spread around the farm increases accordingly. The area required for effluent disposal increased from 16.2 hectares in the base scenario, up to 72 hectares in the 500 kilograms of milk solids per cow scenario, based on the maximum application of 150 kilograms of nitrogen per hectare.

The net result of this is a significant reduction in fertiliser required. It is a direct reduction of the 150 kilograms of nitrogen per hectare of fertiliser nitrogen applied and a reduction of phosphate fertiliser equivalent of 500 kilograms per hectare of Super 10 7K.

Results and analysis

The costs and benefits were discounted across a 20-year investment period. The results are shown in the tables at the top of the next page. These show that the barn is uneconomic unless either a high average payout is achieved, or the system is intensified to a significant degree.

The various scenarios for the average farm were run through the Overseer nutrient budget programme to

Net present value at various discount rates

Scenario	NPV at 4 per cent discount thousands of dollars	NPV at 5 per cent discount thousands of dollars	NPV at 6 per cent discount thousands of dollars	NPV at 7 per cent discount thousands of dollars	NPV at 8 per cent discount thousands of dollars
Base farm	-800	-800	-790	-780	-770
Intensification 1	-270	-320	-370	-400	-440
Intensification 2	560	440	330	240	160

Net present value at differing milk solids payout levels using eight per cent discount rate

Scenario	$5.50 Per kg milk solids	$6.20 Per kg milk solids base	$7.00 Per kg milk solids	$8.00 Per kg milk solids
Base farm	-1,580	-770	150	1,300
Intensification 1	-810	-440	-15	510
Intensification 2	-430	160	830	1,700

Nutrient discharge in kilograms per hectare for a sedimentary soil

	Base with no grazing off			Housing with no increase in production			Housing intensification 1 400 kg milk solids per cow			Housing intensification 2 500 kg milk solids per cow		
Annual rainfall	N	P	NCE (%)	N	P	NCE (%)	N	P	NCE (%)	N	P	NCE (%)
1,200 mm	29	0.9	32	19	1.1	31	23	1.2	37	27	1.2	30
1,700 mm	42	1.5	32	33	1.7	31	39	1.8	37	44	1.8	30

Nutrient discharge in kilograms per hectare for a sandy soil

	Base with no grazing off			Housing with no increase in production			Housing intensification 1 400 kg milk solids per cow			Housing intensification 2 500 kg milk solids per cow		
Annual rainfall	N	P	NCE (%)	N	P	NCE (%)	N	P	NCE (%)	N	P	NCE (%)
1,200 mm	30	1.0	31	20	1.1	31	23	1.2	37	27	1.3	30
1,700 mm	44	1.7	31	35	1.8	31	42	1.9	37	46	2.0	30

determine any changes in nutrient discharge, particularly nitrogen. This was carried out on two soil types, sedimentary and sandy, and for two rainfall parameters, 1,200 and 1,700 millimetres a year. The results are shown in the last two tables above.

- The 'base with no grazing off' scenario shows the nutrient discharge when the cows are wintered on-farm, but with no wintering barn to get them off the pasture over June and July
- The 'housing with no increase in production' shows the scenario where the cows are now grazed on the on-off system over the autumn and 100 per cent in the wintering barn over June and July, with no increase in cow numbers or production having been attempted
- The 'housing with intensification' scenarios show the nutrient discharges following relative intensification.

The on-off grazing, combined with the cows wintering in the barn, had a much more significant effect in reducing nitrogen leaching compared to a normal grazing pattern over the autumn and just having the cows wintered in the barn.

Discussion

The study shows that a wintering barn can provide a significant gain by reducing nitrogen leaching, and therefore helps farmers to meet possible nutrient discharge limits. However, the provision of a wintering barn will reduce nitrate leaching as long as there is no intensification of the farming system, but this can come at a significant cost depending on the level of payout.

If the farm system is intensified to ensure a greater likelihood of profitability, the nitrate leaching level then increases again back towards the original level. In addition, for the farm system to move into a more stable level of profitability the analysis indicates that a high level of intensification is more profitable than a moderate level.

At a payout of seven dollars per kilogram of milk solids the base farm scenario breaks even at a discount rate of eight per cent, meaning the cost of the barn is covered without the need for any intensification. But at a higher capital cost the break-even payout increases in line. At a capital cost of $3,000 per cow it is $7.25, at $4,000 per cow $7.60, and at $5,000 per cow it is eight dollars.

The study highlights the advantages and the costs involved with a wintering barn as part of the farm system. The study relates only to the situation as investigated in the Tararua District. Further case studies are being considered in other regions to give a wider understanding of the problems and solutions.

Phil Journeaux is an agricultural consultant at AgFirst Waikato in Hamilton.

Christine Christensen and Dave Horne

Farm-scale research to increase productivity and reduce the environmental footprint

It is widely recognised that dairying has an adverse effect on the aquatic environment and that the industry needs solutions to this problem, particularly as it aims to increase milk production. A farm-scale systems trial based on controlled grazing has begun at Massey University's No 4 dairy farm.

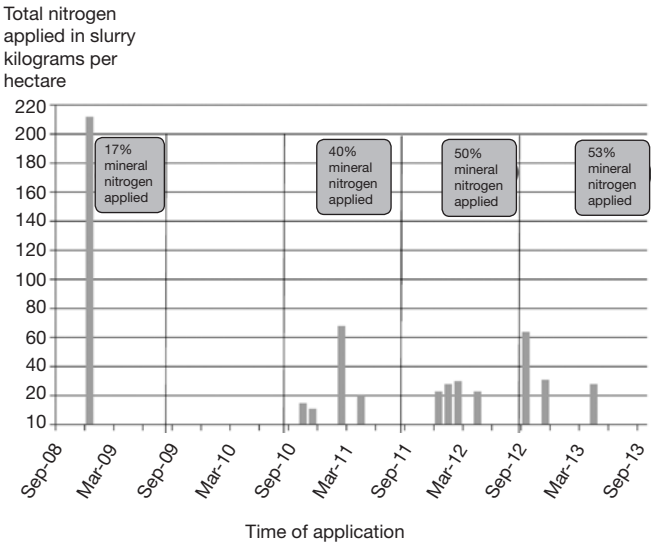
A 200-cow free stall barn was commissioned earlier this year as part of the Pastoral 21 research programme. This is a venture between DairyNZ, Fonterra, the Dairy Companies Association of New Zealand, Beef + Lamb NZ and the Ministry of Business, Innovation and Employment. The aim is to provide accessible solutions for profitably increasing pastoral production while at the same time reducing the environmental footprint of farms. The trial builds on earlier research conducted at Massey on controlled grazing. This earlier field trial evaluated a duration-controlled grazing regime which involved four hour grazing after morning and afternoon milking.

In between grazing the cows were stood off the paddock. Duration-controlled grazing was compared with a standard grazing routine of a seven-hour day grazing and a 12-hour night grazing. Cows in both groups were offered five to six kilograms of dry matter of pasture on plots, with another two to three kilograms of dry matter of supplement. Pasture production and nitrate leaching were measured for each trial plot. Nitrate leaching from the duration-controlled plots was 43 per cent, 65 per cent and 53 per cent less than that measured on the standard grazing plots over the initial three-year trial period. This is an average annual reduction of 52 per cent.

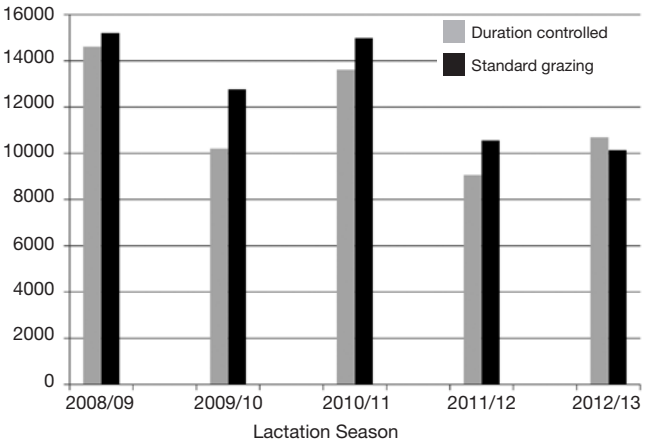
Reduced nitrate leaching

The theory underpinning the advantages of duration-controlled grazing is simple. Urine spots are the major source of nitrate leaching in dairy farming systems in New Zealand. If cows spend less time in the paddock and there is less opportunity to deposit urine, this results in a reduction in nitrate leaching. Interestingly duration-controlled grazing in late summer and autumn – February to May – has the greatest effect on nitrate leaching.

Any time cows spend away from the paddock and in a housing or stand-off facility creates the opportunity to collect urine and dung, and store it for re-application to pasture in a uniform manner as slurry. During this study slurry was applied to areas which had duration-controlled grazing. It was applied at depths of five to 10 millimetres using a slurry tanker and tractor. The graph shows the total nitrogen applied in each slurry application over five years of the study. The aim was to apply approximately 120 kilograms of nitrogen per hectare per year based on the removal of dung and urine from standing cows off, minus storage losses.



Slurry application timings to duration-controlled plots and the total nitrogen applied at each application – the average percentage of mineral nitrogen applied in boxes



Pasture accumulation for the two treatments over five lactation seasons

Following a single but highly concentrated application of 212 kilograms of nitrogen per hectare in the first year, it was thought unnecessary to apply any slurry in the second year. This had a marked effect on reducing subsequent pasture production, with a 20 per cent decrease compared with the standard treatment for that lactation season as shown in the above graph.

In the following three years, smaller but more regular applications were made to the duration-controlled plots. By the 2012/13 season, pasture accumulation was six per cent greater on the duration-controlled system than on the standard treatment. This was the effect of an earlier application of slurry in spring 2012, along with a greater mineral nitrogen content of the slurry, which was immediately available to pasture plants.

Apply slurry in early spring

The main conclusion drawn from the slurry application was that if collected and stored, the slurry should be re-applied as early in the spring as possible. This would be as soon as machinery could get on to paddocks, when the soil had a high enough moisture deficit. Following the winter drainage period, important nutrients have been leached from the soil with wet and cool conditions not allowing sufficient nitrogen, potassium and sulphur to become available to plants. Growth of pasture can therefore be enhanced if these nutrients are re-applied early as slurry.

In addition, the mineral nitrogen content of that slurry should be 40 to 50 per cent of total nitrogen to ensure sufficient nutrient is immediately available to pasture plants for uptake. This is the proportion which has been measured from housing and stand-off facilities. The following study will be able to further quantify what proportions of mineral nitrogen are in stored housing effluent at different times of the year.

In the current study cows will spend approximately nine hours a day in the house in late summer and autumn to reduce urine deposition in the paddock, and therefore nitrate leaching, during the winter drainage season. The cows will also go into the barn for the whole day or part of the day during the winter and early spring period to get them off wet soils and prevent treading damage which results in poor pasture use and reduced pasture growth. In other words, the barn is being used to increase productivity and reduce the environmental footprint.

The trial

The soil at the No 4 dairy farm is Tokomaru silt loam which is renowned for its poor natural drainage and susceptibility to treading damage. The farm is extensively drained with mole drains and collecting pipelines. The average annual rainfall is approximately 1,000 millimetres. Soil moisture content is often high in July and August. As this coincides with the beginning of lactation, feeding cows adequately can be a challenge and grazing must be carefully managed.

At the start of the systems trial, the 400 cows from the existing milking herd were split into two treatment groups. One group of 200 cows were to be managed according to duration-controlled grazing protocols, making use of the free stall barn. The other herd acts as a control treatment using a standard feedpad and typical grazing management. The two herds have their own farms which are as similar as could be practicably arranged.

The cows are a mix of Friesian and Friesian-Jersey crossbreds. The two treatment herds have been balanced for breeding worth and age. The herds will have closed membership, although as with usual farm practice heifers will be introduced annually as replacements. The freestall barn was built to an animal welfare standard, which means 200 cows can be housed for 24 hours a day for prolonged periods if necessary. However, the plan is to use the barn as part of a stand-off strategy to protect soils in the winter and spring and reduce the paddock urine load in the autumn. That is, the barn will be used part-time only to maximise consumption of the pasture and crop grown on the farm.

In the barn the cows still produce urine and dung but this is retained and stored as effluent and returned to soils evenly in ideal environmental conditions. This is at times which match plant requirements and at relatively low nitrogen loading rates based on the previous study. An objective of the research is to recoup the capital spent on the barn by increasing pasture and crop yield. This will be achieved as a result of less treading on wet pasture with its loss of feed combined with more even and carefully timed applications of effluent on the property.

The grazing protocols

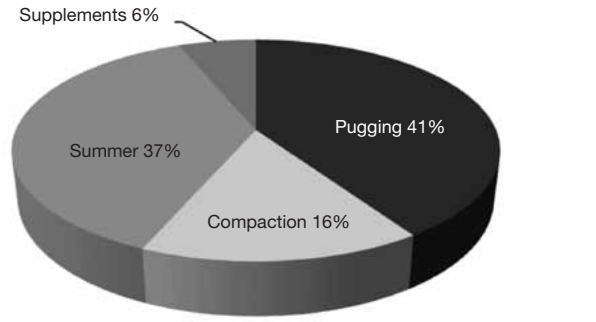
A simple model was constructed to identify the amount of time that cows are likely to spend in the house. The model is based on a soil and water balance. Housing over the previous 10 years from 2003 to 2013 was simulated in

Objectives of housing and the criteria used

Objective	Season	Criteria	Hours in house each day
Protect against worst of pugging and pasture damage	Winter/spring	Soil moisture deficit less than 1.5 mm	24
Protect against soil compaction	Winter/spring	Soil moisture deficit between 1.5 and 5 mm	12
Reduce the number of the most at risk urine patches	Late summer/autumn	1 February to 31 May	9

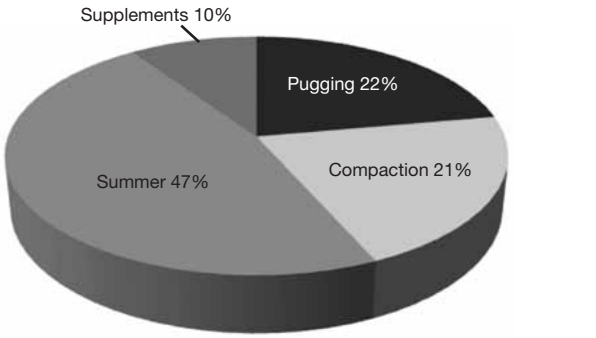
the model using the criteria given in the table. The model predicts slurry dynamics including effluent generation in the house, the nitrogen concentration of this effluent, slurry application to land and changes in volume in the storage pond.

Over the past 10 years, cows would have spent an average of 2,084 hours a year, or 32 per cent of the time, in the house. As expected the cows would have been mostly housed to avoid pugging damage in winter and spring, at 41 per cent of the time, and to reduce the number of urine patches deposited in summer and autumn, at 37 per cent.



The average contribution of each of the housing objectives to the time cows spend in the barn

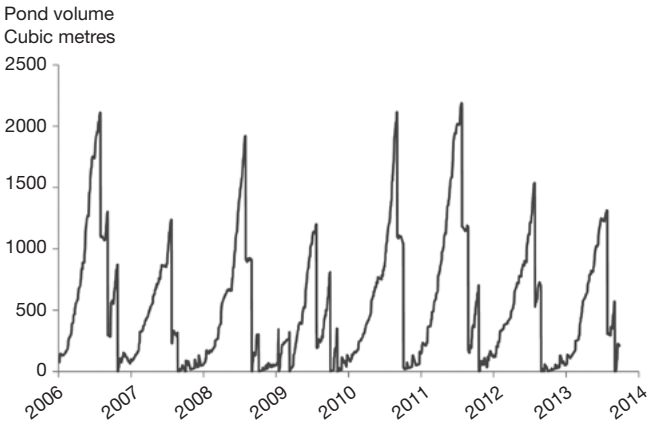
On average, a little over eight tonnes of nitrogen will be harvested in the barn each year. However, following storage in the pond and attendant losses of nitrogen to the atmosphere the quantity applied to the farm will be significantly less than this. As the cows' diet and resulting nitrogen ingestion and excretion vary throughout the year the quantity of effluent nitrogen generated in the house also varies across the seasons.



The average contribution of each of the housing objectives to the quantity of nitrogen produced in effluent from the house

Housing in summer and autumn produces the greatest quantity of nitrogen as shown in the graph. Although the cows will be in the barn for similar amounts of time in the wettest periods and in summer and autumn, much less nitrogen will be produced during the winter and spring housing. This is because most of this housing during wet conditions is when the cows are non-lactating and eating relatively small amounts.

A pond with a working or pumpable storage volume of approximately 2,300 cubic metres, 11 cubic metres per cow, would be required if all of the criteria were to be met. The cyclic or seasonal nature of the change in slurry volume can be seen in the graph where the years 2006 to 2013 are used. Effluent accumulates over the dry summer months and the winter period and is then applied relatively quickly in early spring to coincide with the greatest plant requirement.



The daily volume of slurry in the pond between 2006 and 2013

Summary

Increasingly, limits are being placed on the quantity of nutrients which can be lost from dairy farms to waterways. Farmers require technology and practices which will allow them to farm within these limits.

At Massey University's No 4 dairy farm, the potential of duration-controlled grazing to reduce nitrate leaching losses while increasing profitability of a dairy system is being quantified. In addition to reducing nutrient losses, the use of a freestall barn will increase pasture growth and use. This will be achieved as a result of improved soil protection and timely application of slurry.

Christine Christensen is a Research Officer and Dave Horne is Associate Professor at the Fertilizer & Lime Research Centre in the Institute of Agriculture & Environment at Massey University in Palmerston North.

Natalie Jackson

Demographic change and some observations for the dairy industry

Nationally and globally, demographic change is bringing about a brave new world in which the age and ethnic composition of populations are changing, with increasing competition for workers and migrants. This is a far cry from the heady days of last century when sustained population growth was virtually guaranteed. This article focuses on related trends in the New Zealand dairy industry in which, anecdotally at least, labour is already difficult to find.

Four main changes are outlined –

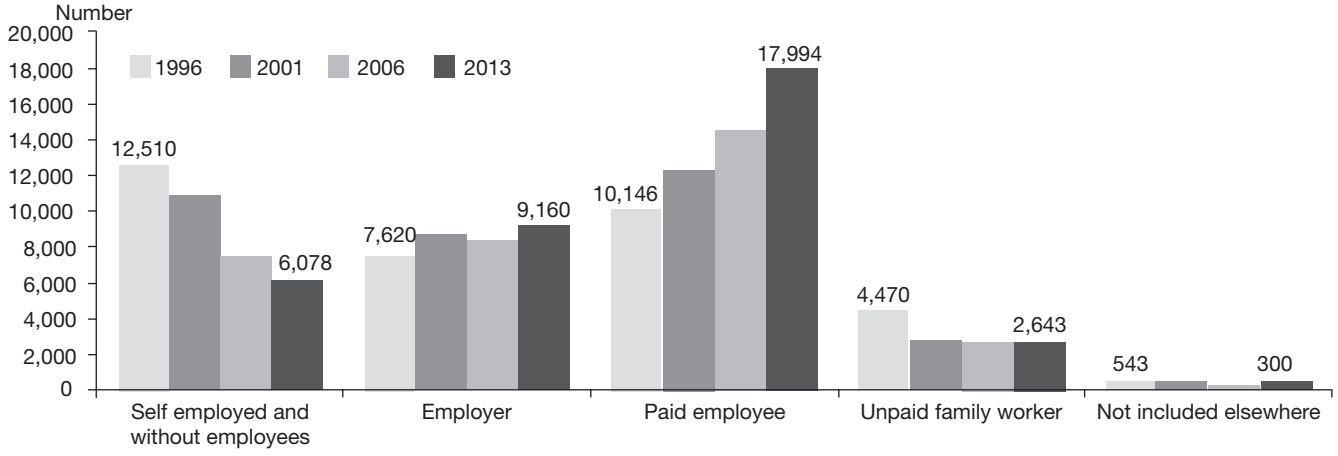
- The industry has undergone significant change in its social structure, uppermost being the change from relatively small single or couple sharemilker units to large multi-employee operations
- The structural ageing of dairy farmers, with more at older ages and fewer at younger ages, which has to be seen along with the ageing of the workforce in general and dairy farmers no older than the average employed
- There has been a recent increase in numbers employed in the industry, reversing a trend of several decades and returning it to 11th position in terms of size after falling from eighth in 1996 to 16th in 2006. The changes are by no means uniform across the country, with the growth concentrated in four South Island regions and decline continuing almost everywhere else.
- Notable changes are also happening in the four South Island regions in terms of the proportions of dairy farmers born overseas and the proportions with post-school qualifications.

Social structure

In 1996, the single largest group of those employed in New Zealand's dairy industry were self-employed with no employees. At the time they outnumbered employers in the industry by 4,980 and paid employees by 2,364. By 2013, this situation had completely reversed, with dairy industry employers outnumbering the self-employed by 3,084 and paid employees outnumbering them by 11,916.

However, as shown in the graph, perhaps the most profound change is that while the numbers of self-employed have halved, and paid employees have increased by almost 80 per cent, employers have increased by just 20 per cent. Many of the previous self-employed group are now likely to be counted among the employers, but at best this would have mopped up just 1,542 of the 6,432 decline.

There has been a big change in who the average New Zealand dairy farmers are. However, before looking into this it should be noted that the above data does not relate just to dairy farmers and dairy farm workers. For



Dairy cattle farming industry, number by employment status

Numbers employed in dairy cattle farming industry and as dairy farmers by occupation

	1996	2001	2006	2013	Percent change 1996 to 2013	Percent change 2006 to 2013
A013 Dairy cattle farming	35,289	35,052	33,501	36,177	2.5	8.0
61211 Dairy farmer, dairy farm worker	29,958	26,331	24,795	26,577	-11.3	7.2
Dairy farmer per cent	84.9	75.1	74.0	73.5	-13.5	-0.7

that we need to turn to occupational data, as shown in the above table.

In 1996, there were 29,958 dairy farmers and dairy farm workers, and they accounted for 85 per cent of the 35,289 people employed in the dairy industry. By 2006, their numbers had fallen to 24,795 and they accounted for 74 per cent of the 33,501 employed in the dairy industry. Between 2006 and 2013 numbers increased for both groups, although for dairy farmers and dairy farm workers remained below the number in 1996. Those whose occupation was dairy farmer and dairy farm worker increased by 1,782, and those employed in the dairy industry by 2,676, with the ratio dropping slightly to 73.5 per cent.

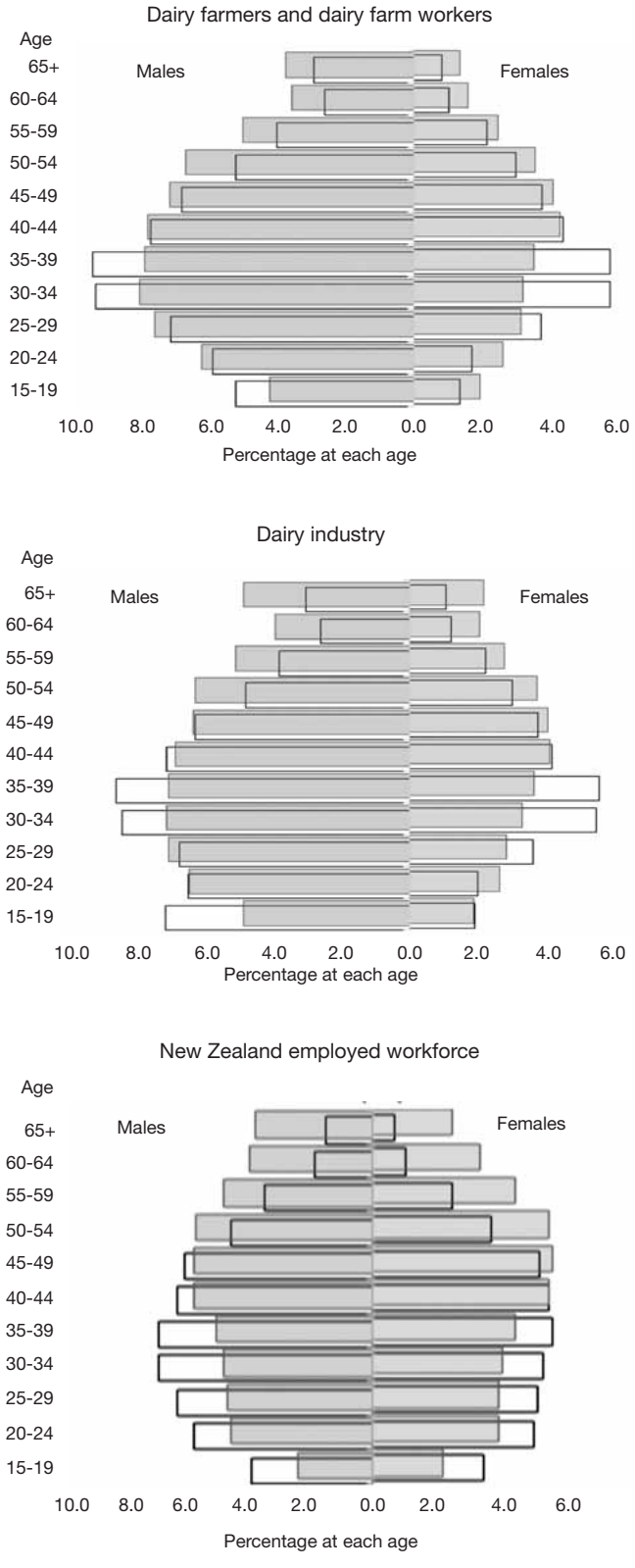
Therefore, while the industry-level data provides a useful approximation of what is going on in terms of the social structure of the industry, the industry-occupation comparison tells two equally interesting stories. A quarter of those employed in the dairy industry are no longer employed on-farm, as opposed to 15 per cent in 1996. The recent increase in dairy industry employment from 2006 to 2013 has been mirrored in employment by dairy farmer and dairy farm worker occupation. As noted, what is also important is that between 1996 and 2006 the dairy industry had fallen from eighth to 16th in terms of size, returning to 11th in 2013.

Workforce ageing

To return to the average New Zealand dairy farmer, we move now to the occupational data and to workforce ageing. In 1996, the average age of a dairy farmer was 39.5 years. In 2013, it was 41.1 years, an increase of four per cent, somewhat lower than that for the national workforce which increased from 38.3 to 43.3 years, a 13 per cent increase. It would seem that the reason for the slower rate of ageing among dairy farmers is a recent influx at younger ages.

Between 2006 and 2013, numbers at ages 20 to 24 and 25 to 29 years increased by 22 per cent, partially reversing the dramatic losses at 15 to 39 years experienced across the 1996 to 2001 period. The changing age structure of the occupation is illustrated in the left-hand panel in the diagrams on the right by the shaded bars, which represent the percentage at each age in 2013 compared with the percentage in 1996 shown by the unshaded bars in the background.

The picture for the total dairy industry in the right-hand panel is noticeably similar, although both differ quite markedly from the total New Zealand employed

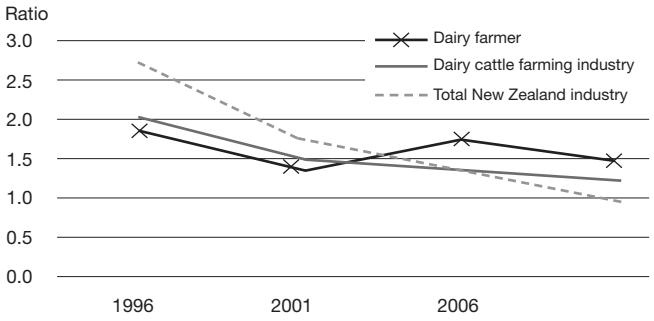


Age structure 1996 unshaded bars and 2013 shaded bars

workforce, which has somewhat smaller proportions below age 40. In 2013, 41 per cent of the total workforce was aged less than 40 years compared with 49 per cent for dairy farmers and 47 per cent for the total dairy industry.

The average dairy farmer is therefore younger than their counterpart in the total employed New Zealand workforce, and the gap between them has been increasing. However, a more useful index when comparing industries and occupations is the labour force entry to exit ratio. This compares the number of people at entry age, say 15 to 29 years, to those in the retirement zone, of over 55 years. They may not all retire, but numbers employed do begin to diminish from age 55.

The occupational entry to exit ratio has fallen from 18 entrants per 10 in the retirement zone in 1996, a ratio of 1.8, to 1.4 in 2013. On the other hand, it has fallen for its slightly older dairy industry counterpart from 2.0 in 1996 to 1.2 in 2013. These are notable declines, but are still positive, with that for dairy farmer actually increasing between 2001 and 2006. The trends are in some contrast to that for the total New Zealand industry where we see a steady decline from 2.7 in 1996 to just 0.9 in 2013.



Ratio of employed aged 15 to 29 years to those 55 and over

Broader demographic context

Despite unemployment rates continuing to hover nationally at around five to six per cent, underlying data indicates that the population potentially available to enter New Zealand's labour force has also declined substantially, from 18 people per 10 aged 15 to 24 years in 1996 to just 13 per 10 at 55 to 64 years in 2013. This ratio is projected to fall to 10 per 10 by 2021. The ratio may then increase slightly, as a recently born baby blip from those born between 2002 and 2008 arrives at labour market entry age. However the arrival of this blip will not be experienced evenly across the country and births data indicates it will be temporary.

In the interim, numbers at school leaving age are projected to decline by 20,000 over the current five-year period from 2011 to 2016 and by a further 8,000 in the following five years, as the declining birth rates of the 1990s translate into fewer young people. At the same time, numbers in the retirement zone are steadily increasing and 100 per cent guaranteed. For the next 15 years, a successively larger number will enter the retirement zone each year to be replaced by a successively smaller number.

Concerning trends

These trends, implying a demographically-tight labour market, have concerns for all industries and occupations but especially dairy farming with its younger than average age structure. This is because the number of migrants that would be required to offset structural ageing are substantially in advance of any migration gains New Zealand has ever experienced and is likely to. For example, let us assume that the total fertility rate were to remain at replacement level, life expectancy at birth reached the highest levels assumed by Statistics New Zealand of around 95 years, and annual net migration was 100,000 a year. Therefore the population in 2061 would number 10.6 million, but 22 per cent would be aged over 65 years, compared with 26 per cent if migration remained at the medium assumption.

Obtaining additional immigrants will also become increasingly difficult as global ageing causes New Zealand to compete for its migrants against countries from which it previously obtained them, such as most of Europe. Between 2011 and 2031 the 58 more developed countries are projected to grow by less than five per cent. For those aged 65 years and older, growth will be approximately 49 per cent, adding around 100 million of this age group to the current 200 million.

All other age groups up to 64 years are projected to decline by around 41 million. This is the primary pool in which New Zealand and other countries look for their skilled migrants. New Zealand is part of this story, with numbers aged 65 years projected to almost double over the next two decades, and all other age groups to grow by just seven per cent. Young New Zealanders will be highly sought-after. We can therefore anticipate increasing competition for the labour of young and old alike.

The dairy industry is already heavily reliant on migrants to supplement its workforce, and we can examine the composition of those employed in terms of country of birth. The data to 2006, the latest available, shows that the dairy industry contained much smaller proportions of overseas-born than their industry workforce counterparts.

However, in neither case can overseas-born be interpreted as recent migration, as some may have moved to this country in childhood. In 2006, a quarter of the New Zealand employed workforce had been born overseas, up from 19 per cent in 1996. For the dairy industry the proportion in 2006 was 10.7 per cent, up from 8.2 per cent in 1996 – in both cases a similar increase.

Regional differences

The situation differs markedly by region, so it is more useful to narrow the focus to just those regions in which dairy farming is prominent. The next table shows that the overall increase in numbers employed in the dairy industry from 1996 to 2013 has not been shared evenly by region. Numbers have been growing steadily since 1996 in four regions – Canterbury, Otago, the West Coast

Numbers employed 1996 to 2013 and percentage overseas born 1996 to 2006

	1996	2001	2006	2013	1996-2013 percent change	1996	2001	2006	1996-2006 percent change
	Numbers employed					Percentage overseas born			
Northland	3492	3153	2526	2466	-29.4	8.5	8.7	8.4	-0.9
Auckland	1677	1464	1194	1020	-39.2	9.1	10.5	15.1	65.2
Bay of Plenty	2481	2274	2058	2070	-16.6	7.7	8.4	10.2	31.9
Waikato	12891	11991	10950	10947	-15.1	10.0	9.7	11.9	19.6
Taranaki	5334	4992	4431	4323	-19.0	5.3	5.2	5.6	5.2
Manawatu-Wanganui	2940	2961	2766	2826	-3.9	6.1	6.8	6.5	6.3
Wellington	816	855	675	690	-15.4	8.8	10.2	8.4	-4.3
Canterbury	1806	2520	3420	4902	171.4	8.0	8.5	14.9	87.0
Otago	762	1089	1272	1710	124.4	8.3	6.9	10.8	31.2
West Coast	843	912	1062	1038	23.1	7.5	8.9	10.2	36.1
Southland	1215	1701	2031	3099	155.1	8.9	9.3	14.9	67.8
Total NZ (A013 dairy cattle farming)	**35271**	**35034**	**33513**	**36198**	**2.6**	**8.2**	**8.3**	**10.7**	**29.5**
Total NZ employed workforce	1630809	1727274	1985778	2001006	22.7	19.2	20.4	24.7	28.7

and Southland – while generally declining elsewhere. In these four regions the percentage of those in the dairy industry in 2006 born overseas was both relatively high and had increased more rapidly than elsewhere.

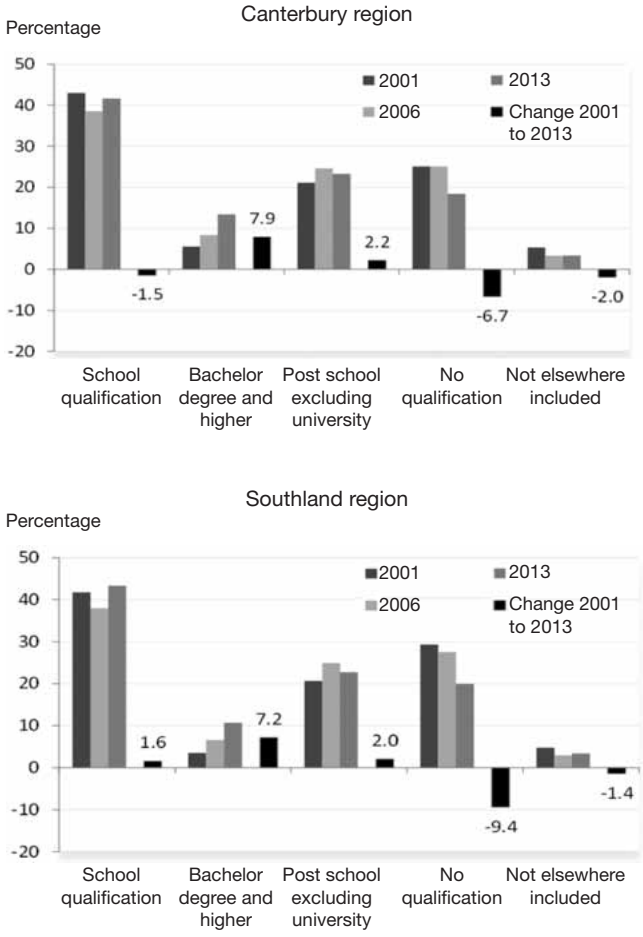
The underlying data by age shows that the increased proportion of overseas born employed in the dairy industry in these regions is pronounced across all age groups, but particularly at 25 to 29 and 30 to 34 years. This data confirms the dairy industry's increasing reliance on international migrants as a source of labour. Along with the unfolding demographically tight New Zealand labour market, the data suggests that the dairy industry will face further increases in competition for local labour.

Finally, it is worth pondering the extent to which the qualification patterns of those employed in the dairy industry may also be changing along with the industry's rejuvenation and importation of labour. The next graphs narrow the gaze to Canterbury and Southland, two regions experiencing the greatest growth in numbers.

The data shows a notable reduction in the proportion with no qualifications across the period 2001 to 2013. Both regions also saw a similar increase in the proportions holding a bachelors' degree or higher.

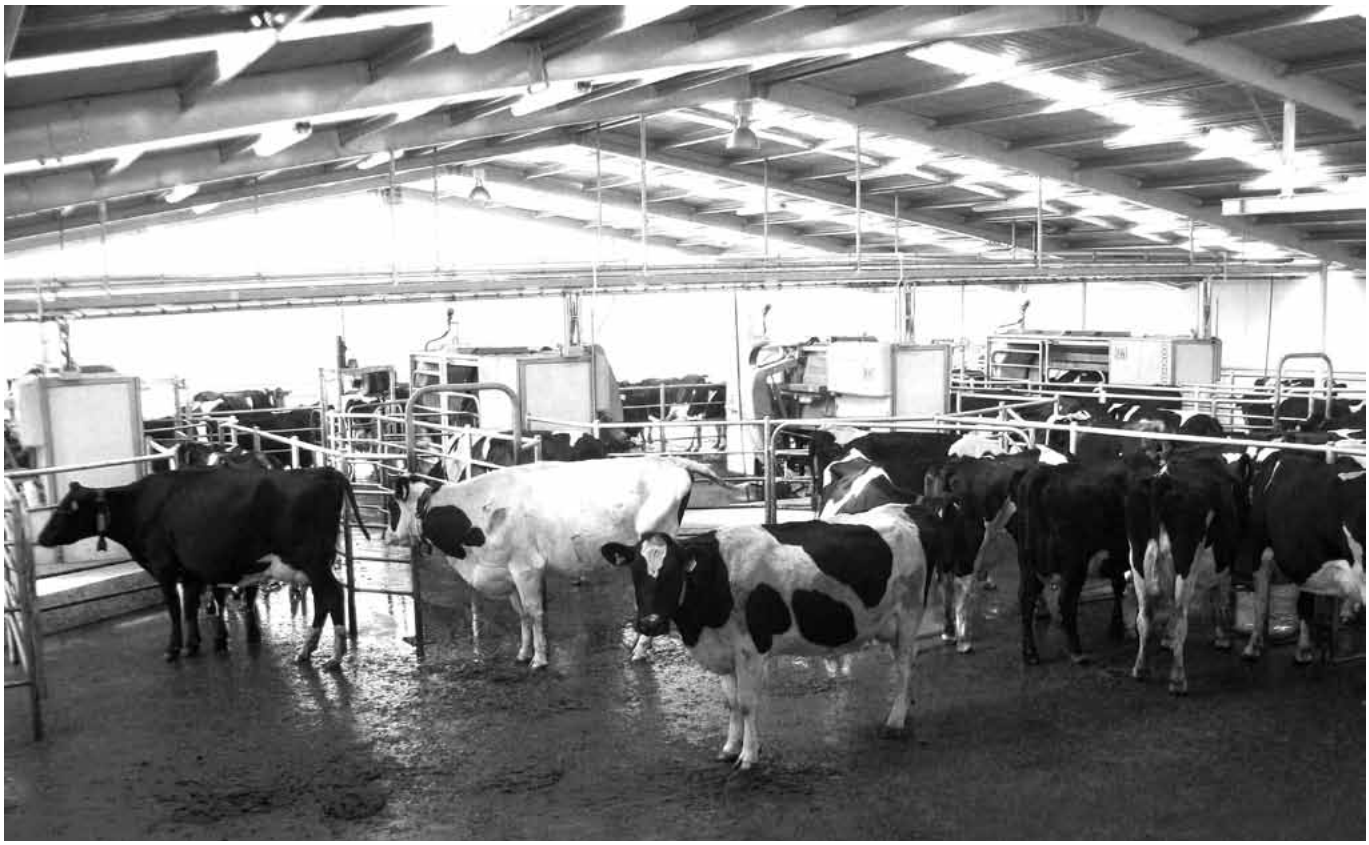
These patterns were mirrored, but at a much lower level, by dairy farmers elsewhere in New Zealand. This indicates that the average farmer in this increasingly technologically smart industry has or needs higher qualifications than in the past.

New Zealand's dairy industry is climbing back towards its previous high ranking among other industries. Its composition in terms of social structure with fewer self-employed and more employees managed by a relatively small number of employers, its population structure which is younger than average and more overseas born, and its qualification levels with fewer people with no qualifications and more with graduate and post-school qualifications, all are fresh and invigorating. The dairy industry will be especially challenged by the demographically tight labour market unfolding both onshore and in other countries. For dairy farmers in particular, there is an urgent need to ponder the implications of having such a dramatically different population and social structure. Who will buy the farms?



Percentage of dairy farmers by highest qualifications

Natalie Jackson is Professor of Demography at the National Institute of Demographic and Economic Analysis at the University of Waikato in Hamilton. She was previously a dairy farmer for 18 years.



Jenny Jago

Update on the adoption of automatic milking systems

In 2008, four automatic milking systems were installed to milk a herd of approximately 300 cows on a South Island dairy farm. This marked a milestone in the history of dairy farming in New Zealand. This probably represented the most significant change to labour organisation on dairy farms since the advent of machine milking in the early 1900s. By combining the learning ability of dairy cows and modern automation technology, milking was no longer a manual task dictating the work routine of dairy farmers.

This article provides an update on the adoption of automatic milking technology. It follows an article in September 2011 in this journal which explored the trends in milking technology. The question was raised about automatic milking systems being an option for the nearly 45 per cent of herds in New Zealand with less than 300 cows. Many of these herds were milked in aging herringbone dairies by a similarly ageing farming population facing decisions on upgrading milking facilities and their future in the industry.

It was recognised that the use of robotic milking was an attractive option to revolutionise the work environment on dairy farms. However there was an apparent contradiction. This was between some of the characteristics of the farming systems that European designed and engineered automatic milking systems had been developed for, housed systems, year-round milk supply, small herds and three-times-a-day milking, and the fundamental principles which have made New Zealand dairying successful.

A bit of a challenge

The principles of high use of grazed pasture, low cost capital infrastructure, seasonal milk production, efficient use of labour and scale present some of the most significant barriers to adoption of the technology. It was concluded that research results and practical experiences of early adopting farmers have shown that the operational barriers to automatic milking can be overcome. However, economically automatic milking systems remained a challenge compared to conventional milking alternatives, mainly due to the capital investment and higher operating costs.

This article outlines the most recent adoption trends in conventional and automatic milking technology, the characteristics of the early adopters of these systems, effects on labour, economic considerations and the latest major technology advances. There is also a view on what is required to ensure New Zealand dairy farm businesses can maintain their competitiveness as they try to integrate advanced milking technology.

Milking technology adoption trends

In 2011 there were five farms in New Zealand using automatic milking systems. In 2014 there are approximately 15 with a total of 66 automatic milking system units milking 4,500 cows. The farms are clustered in the Southland, Canterbury and the greater Waikato regions. Two manufacturers are represented in the market. A wide range of farming systems is represented, from all pasture and organic to fully housed and intensively fed. There is a similar situation in Australia, with approximately 23 farms of varying size and systems using automatic milking systems and three manufacturers operating in the market.

Within the wider New Zealand industry the trend towards larger herds and rotary dairies has continued. Over 500 farmers were surveyed in 2008 and 2013 to quantify milking practices and technology use on New Zealand dairy farms. In 2013, a total of 44 per cent of cows were milked in a rotary dairy compared with 32 per cent in 2008. Over that time the national average herd size increased from 351 to 402 cows. The trend for a reduction in overall herd numbers reversed with the last five years showing a slight increase – from 11,436 in 2007/8 to 11,891 in 2012/13.

More automation

There has been a significant increase in automation, particularly in rotary dairies, including in-bail feeding, cup removers, teat sprayers, plant wash systems, drafting systems, mastitis detection systems and electronic milk meters. There is evidence for improved labour productivity, which is the probable reason for the trend. It has been found that rotary dairies with auto-drafting, teat spraying and cup remover technologies have more milking clusters, are used to milking more cows per herd and have achieved greater labour use than rotary dairies without this technology.

The adoption of automation into herringbone dairies has been less marked. In 2013, around 40 per cent of these dairies were more than 25 years old, although only 12 per cent had not been upgraded or built in the past 25 years. When asked which technology farmers wanted, there was no change in the percentage of farmers with herringbone dairies indicating they would like to install robotic milking technology. For farmers with rotaries, there was increased interest in robotic milking from one to eight per cent. It is uncertain if farmers were considering a robotic cluster attachment on a rotary or single stall automatic milking system when answering this question.

Who are the early adopting farmers?

A striking feature of the early adopters of automatic milking is the diverse range of farming systems into which the technology is being integrated. There is little consistency in herd size with an average of 318 cows but a range between 170 and 600 cows. There is also little consistency in feeding system, calving pattern, use of housing or reasons for investing in the technology. Only two of the herds use traditional spring-only calving, a system used by 90 to 95 per cent of farms nationally, and at least four farms have combined automatic milking with housing systems.

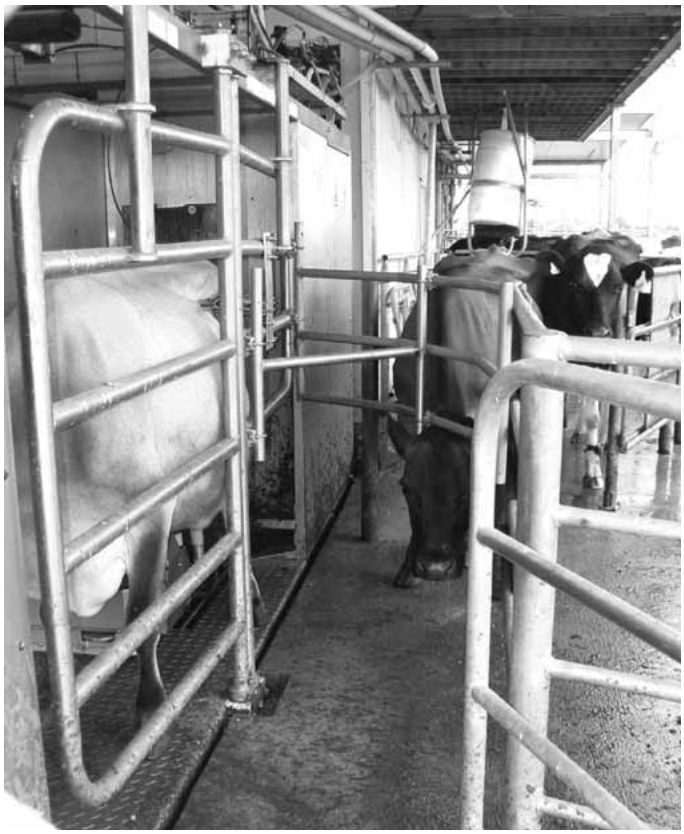
This indicates that it is not the traditional farming systems into which the technology is being integrated. Without stronger evidence of the alignment between pasture-based seasonal calving systems and automatic milking, it remains to be seen if the long-term adoption may be limited to those systems with features similar to that which the technology was originally developed for.

Why farmers invest

The reasons for farmers investing in the technology are diverse including –

- Availability of labour
- Farm succession
- Greater flexibility
- Wanting to remain on the farm although not milking
- A focus on individual cow performance
- An interest in technology
- The challenge of developing new methods of farming
- The need to replace an old dairy.

One interesting observation is the focus on succession and encouraging the next generation of dairy farmers. At least three of the farms using automatic milking systems have some combination of parents and children involved in the business, with the younger generation playing a significant role in choice of milking technology. Another observation is that new conversions with very little or no experience of dairy farming choose automatic milking systems.



There is significant innovation in the way farmers are integrating automatic milking into their systems. It is believed there are only two seasonal pasture-based farms in the world using automatic milking systems, both are in New Zealand. What is believed to be the largest grazing herd using such a system with 600 cows and nine automatic milking system units is also in this country. Most sites are greenfield constructions, but there is one example of a farmer using an existing herringbone dairy, filling in the pit and positioning three automatic milking systems on this base. They are using the existing yard as a pre-automatic milking system waiting area.

Effect on labour

On farms using automatic milking systems, manual milking is no longer required, although some continue to use small conventional dairies for the period immediate following calving. There is an increase in monitoring the farm and cows and a decrease in physical work. More time is spent checking and servicing equipment, training cows, fetching individual or small groups of cows, checking cows that appear on attention lists, and in some cases cleaning. For grazing farms, pasture management and feed allocation require special attention.

Despite the widespread use of automatic milking systems in Europe, North America and elsewhere there is very little published data of the effects on labour. One European study reported a 20 per cent labour saving, but there is a large variation among farms.

A recent comprehensive analysis of the financial records from 63 Dutch farms using automatic milking systems and 337 using traditional milking methods, showed no difference in total full-time equivalents employed. They concluded that there had been no substitution of capital for labour as expected. However they also noted that, from the data available, they were unable to determine if fewer hours were worked or to place a value on increased flexibility.

Work change

In New Zealand, the Greenfield Project data, a DairyNZ proof-of-concept study to integrate automatic milking into pastoral dairy systems, indicated that a 25 per cent decrease in labour could be achieved. This assumed that 50 per cent of labour was required for milking on a conventional farm. Experience from the first farms using automatic milking systems confirms that there is a substantial change in work tasks and the skills required. There is an increased demand for labour during the transition to such a system and possibly when training new animals. The major change is in the type of work and flexibility in undertaking those tasks.

There is some anecdotal evidence that labour input reduces once farms are established. One of the first farmers to adopt an automatic milking system for 320 cows reports spending approximately three hours a day on farm-related work, mainly involving cleaning, shifting fences and checking reports generated by the herd management system. As the number of farms using automatic milking systems increases, it will be important to gather data to understand the labour implications of this technology.

Economic considerations

It is widely reported that the capital, operating and maintenance costs are higher for automatic milking systems compared with traditional milking systems. Costs for energy and water are reported to be 29.5 per cent higher on Dutch automatic milking system farms. However, the adoption of automatic milking continues to increase despite these additional costs and apparent lack of change in total labour input.

The 2011 European Dairy Federation Agri-benchmarking survey of 2,600 farms from 20 countries showed that more than 40 per cent of all new milking system investments are robotics. By 2016, automatic milking systems will be milking 18 per cent of cows in Europe, up from the current nine per cent.

Increased costs

The New Zealand economic data generated following the first phase of the Greenfield Project suggested that costs of production were 27 per cent higher and operating return 1.7 per cent lower on assets for a 450 cow herd milked with an automatic milking system compared to a rotary system. The major differences between the costs associated with the two milk harvesting methods were that the automatic milking system had –

- Substantially higher service and maintenance contract costs
- Higher electricity costs
- Higher depreciation costs
- Lower labour costs as a result of less time required for milking-related tasks
- Lower dairy expenses
- Slightly lower animal health costs due to less lameness, but no change in udder health-related costs.

The model also assumed five per cent lower production. However the experience of the early adopting farmers is that this production difference can be avoided with better training, farm layout and management. The analysis considered traditional pasture-based dairy systems. However, given the broad range of farm systems into which automatic milking is being integrated, further economic analysis is required to determine their relative financial performance and to update the assumptions used in the economic model as new data becomes available from commercial farms.

Technology advances

The development of automation technology to meet the needs of a broader range of herds and management systems has continued. In 2012, Scott Technology Ltd released a prototype robotic arm which attaches clusters alongside a conventional rotary dairy. The development was initiated and supported by a small group of New Zealand farmers. This is a technological breakthrough with significant potential for batch-milking large herds.

The first commercial installation of the automatic milking rotary into a pastoral system was in Tasmania. The system is based around the principles of voluntary distributed milking and uses multiple robotic arms to clean teats, attach cups and apply teat sanitiser while cows are on an internal rotary. As almost all the major milking technology manufacturers have an automatic milking product option, it appears certain that the technology solutions will continue to evolve.

Milking technology and a competitive industry

The dairy industry has a strategic vision of dairy farming working for everyone. To achieve this, the industry has to be locally and internationally competitive and responsible with respect to its people, animals and the environment. Technology advances such as automatic milking must be tested against these objectives.

The experience of the first farmers to adopt the technology suggests that the reorganisation of labour requirements has the potential to encourage a more favourable work environment. However the principles for running a good farm team do not change. There is also a case for improved animal welfare through a better ability to monitor the system, being able to manage individuals within a herd, and an element of choice for dairy cows working in these systems. There is a need for analysis to support these perceived benefits.

To maintain competitiveness a business must be profitable and resilient. Careful analysis of the effect of higher capital costs and any offset of changes in operational costs is required to determine the long-term viability of any new technology. Models developed from the output of the Greenfield Project need to be updated using data from commercial farms.

The rural professional network has an opportunity to help farmers make good decisions about investment in automatic milking technology. This is to ensure that any changes in farm system infrastructure and design are constructed well, and that the management of these farms means optimal results for the farm business. This will require an understanding of the principles of applying automatic milking technology into dairy systems and knowledge of the limitations and opportunities of this technology.

There is an opportunity to work with the early adopting farmers to benchmark performance in all aspects of the business, to help farmers to fine-tune their operations and to share that knowledge with the wider industry. The tradition of New Zealand dairy farms collectively innovating and sharing knowledge needs to be applied to ensure our industry gets the most out of the technology in its current form and any future advances.

Jenny Jago is Strategy and Investment Portfolio Manager at DairyNZ based in Hamilton.

Tony Hammington

Farm succession

Farm succession is a global challenge. It is one of several spokes in a wheel of complex solutions to the challenge facing farmers to feed a world population predicted to increase from seven billion to nine billion by 2050.

History has shown that most countries which have progressed to economic stability have used agricultural production as a cornerstone of their economic plan. In the United States, for every farmer under 25 years old there are seven who are more than 75 years old. In Australia, the average age of farmers has increased from 44 to 56 in the past 30 years. Rabobank's 2013 New Zealand research revealed that 59 per cent of farmers surveyed were expecting their farm to change hands in the next decade.

Social changes and farm values

Rural communities have been built around the strength and resilience of rural families, but we see rural schools and stores closing across the country. The social changes were highlighted in the last issue of this journal in an article on the social influence of dairying in Southland in the last 20 years. How does this fit with the need to increase global food production by 70 per cent to meet expected demand by 2050?

There are many successful family farming businesses thriving into their third or fourth generation, but there are also many families struggling to manage inter-generational transition. A lack of communication and poor commercial literacy has contributed to some families remembering the 'fight' as the legacy, rather than the farm.

Rising farm values have not just heightened interest around who is entitled to what, but also increased the probability of the retiring generation having access to a sum which will offer financial security in their later years. The big numbers around asset values do not make the subject easier to talk about, nor do legal structures set up to create tax efficiency or capital protection. This is where the expertise of rural professionals can help to offer clarity and help to farming families facing these challenges.

Setting expectations

The role of a farmer is often lonely and many tasks are segregated, despite most successful farms being run by teams, historically the husband and wife. Helping couples understand their objectives and the operational implications of these for the business is a good place to spend time in order to work through some 'what if' scenarios. At present, there are lots of baby-boomers who have spent their working lives making personal sacrifices to ensure the success of their business. As they ease out of the workforce, the business now begins to work for them, which is not how members of that generation have operated for most of their working lives.

Getting both working partners on to the same page to define their personal objectives and ascertain financial security is personally challenging. Getting clarity on what these decisions mean is crucial, as is catering for good health or the alternative of injury, illness and death.

The incoming generations are presented with a world which offers more choices for career, education, travel and leisure, and they generally have a different view on what the work-life balance means. Sometimes this can look quite different from what their parents experienced at a similar age.

Communication

Succession involves talking about some extremely uncomfortable subjects – money, growing old, death or disability. It also involves the transfer of soft assets including experience, reputation, business relationships and networks. How do families talk through these problems? This process is one that benefits most from external assistance.

Once family members understand the range of family aspirations and expectations, they will have a wider perspective on how each individual fits in. Talking about personal aspirations can be very challenging in itself. How is the older generation's value and sense of purpose retained? Importantly, securing a desired lifestyle is an essential and constantly evolving consideration. At the same time, the incoming generation are looking for rewarding and secure careers but not at the cost of family relationships.

Creating a conversation which is just about sharing views across the generations, without expectations of committing to a pathway, is a good habit to build into family dialogue. This open conversation is less threatening, overbearing and contentious if it can begin long before decisions need to be made. The conversation becomes a habit, allowing family members to grow in confidence and competence over time. It can also become a culture which can be introduced when bringing in-laws into the fold.

Some aspects of communication are similar to the planting of a forest. Look back 30 years ago and it was the best time to begin planting, and if not then, today is the next best time. Preparation is also important.

The right environment

Creating an environment to produce good family and business content is a good investment. It is important to have an agreed and known agenda circulated early. This also frames the anticipated areas of agreement the meeting is targeting.

An independent person who has the respect of the participants and has commercial experience is useful to help manage emotive content and keep the discussion on track. The physical environment is also important. It should be neutral territory rather than a commonly shared household. A neutral place can also add some formality to the conversation, emphasising the importance of the content to be discussed.

Clear financial information

Talking about financial information is sensitive. Adding financial information to the family discussion can be useful to manage expectations based on fact rather than perception. It is easy and natural for people to have an opinion on what a farm may be worth or what the farm is capable of producing, but introducing concepts such as liabilities and net profitability can help to shed light on what realistic options are available.

Looking at the assets and revenue capability of the business is the ideal platform when it comes to trying to understand how the business owners will have their capital and income needs met as well as adequate income provided. The risk is that the next generation may have expectations of what their inheritance may be. Therefore establishing the main priorities will at least help to manage expectations.

If the family establishes the fact that securing the parents' financial security is the first priority, it might mean that the farm is the main investment and needs to remain a viable business. At this stage the family's emotional connection with the land, which may help or inhibit investment choices, has some perspective.

Legal structures such trusts can also significantly affect decision-making, identifying who can make decisions and how various parties are to be considered. It is important to remain transparent with this discussion, rather than being faced with a surprise around the time of the death of a parent.

An opportunity

Farm succession represents an opportunity to work collaboratively and talk about what the family wants to create, individually and collectively. Land tenure has been a long-term plan for many families, as well as a springboard financially and for New Zealand's cultural tradition of number eight wire pragmatism.

Family collaboration is a much more energising approach than narrow and contentious questions of 'what is my share?' Is land ownership a romantic notion divorced from practical reality? That depends on the family culture, the values children have grown up with, and what age they are when the discussions begin to take place to shape their aspirations.

Husbands, wives, girlfriends and boyfriends are very relevant. Is the best strategy to keep partners at a distance? Over 2,000 years ago a Chinese general and military strategist, Sun-tzu, said, 'Keep your friends close, and your enemies closer.' Ignoring the fact that partners are not necessarily enemies, my application of his statement as it relates to farm succession is that partners can come from non-farming backgrounds or different farming family cultures and may have different perspectives. Understanding what a partner is thinking, and more importantly why, may offer a unique viewpoint which constructively challenges existing philosophies and provides insights into individual opinions and motivations.

Long-term thinking

Sun-tzu also encouraged longer-term thinking. Farm businesses and their capital have the potential to straddle multiple generations as long as the family is prepared to entertain a wider perspective. As farm scale increases it is becoming easier to separate medium-term operational roles, rewards and responsibilities, which may be in a 15-year business cycle, from the long-term capital management and associated challenges, strategies and results.

Encouraging farmers to enlist the support of their team of professional advisers to navigate the inter-generational journey will reward individual businesses and the wider New Zealand economy. The government is looking for an increasingly significant contribution from the rural sector.

Tony Hammington has been a succession planning manager with Rabobank since 2008. He helps New Zealand farming families with the process of developing and implementing family and business objectives.

Keith Betteridge

Cattle want shade trees in summer

A severe drought, the best winter in years, then wet spring soils, fallen trees and shelterbelt damage – what more will be thrown at us? Farming was never promised as an easy road to wealth creation. However, making the right choices to cope with adversity and capitalising on good opportunities as they arise are possibly what defines a good farmer.

My first research appointment was to the Kaikohe Regional Station of DSIR Grasslands. When I arrived in the far north I could not understand why the land had not been cleared of trees and scrub as had most of the rest of New Zealand. When returning to the Manawatu 12 years later, I could not understand why so many farmers had cut down nearly every tree on their farm. This mental flip-flop did not lead to the research looking into the value of shade trees in the summer-dry East Coast hill country, but it supports my view that having more trees on the farm, rather than fewer, is good. Let me explain why.

Animals seek shade

Like it or not, we have many long hot summers and that might increase due to climate change. During summer, livestock are likely to be out in the sun for up to 12 hours, and several hours could have an ambient air temperature hovering around 30°C. If trees are available then animals will always look for shelter during at least some of the very hot mid-day sun. We have all seen it, yet many farmers seem not to link this behaviour to the animal's desire to be comfortable.

Sheep and cattle will often be seen in shade from about 8:00 am to 9:00 am in summer when air temperature is probably lower than 20°C. My interpretation of this is that they will have been grazing since sunrise, have had their fill, so need to lie down to ruminate. This phase of digestion releases a large amount of heat which is very good in winter, but not needed in summer, so why exacerbate the problem of heat dissipation by lying in the sun?

A discussion group in Porangahau sponsored by the Sustainable Farming Fund debated the relative merits of providing shade for cattle on summer-dry hill country. Many were of the view that if cattle are under shade then they cannot be eating and therefore will not be grazing causing a loss of income. Others argued the animal ethics question, while recognising that cattle do not graze all day long, which is income neutral. However as there was little science data to support either argument, AgResearch was asked to undertake a short experiment to provide some hard facts.

Trial details

Porangahau farmer Brenden Reidy, who manages the Parson Estate Trust farm, provided the perfect testing ground with similar sized adjacent paddocks of which two had spaced planted willows and two had no trees. AgResearch had sensing equipment for 24 cows, six in each paddock. The stocking rate of 2.1 Angus cows with calves per hectare was made uniform with additional non-trial animals.

Space planted shade trees improve animal welfare and aesthetics of the landscape

The GPS collar told us where the cows went within the paddock over the 21-day trial. Button temperature logging sensors inside a piece of rubber cycle tube, to replicate the black hair of the cow, were glued to the back of the cows. These logged temperature every 15 minutes.

Cow with GPS collar, temperature sensor on her back and motion sensor on her leg to determine grazing and resting times

A motion sensor was attached to one hind leg of the cow so that we could match grazing, standing, walking and lying down to GPS positions in the paddock. Finally rumen sensors were put in the rumen of four cattle in each of shade and no-shade treatments. These logged rumen temperature and the acidity or pH.

We were also interested in where cows preferred to drink. Where a paddock had both a trough and a dam or an unfenced stream, at times these were isolated with an electric fence so that only one source of water was available. Cows had free access to all water sources for the first five days and the last five days, and in between these options were varied. Water temperature in the troughs and dams was also monitored. Pairs of button temperature loggers were placed around one paddock, one fixed at 1.5 metres above the ground on the south side of a tree trunk. The other was fastened to a short white peg in full sun about 10 metres from the north side of the tree where there was no shade.

Cows and calves under willows during the middle of a warm day

Finally, a surveillance camera which could be remotely controlled from the house was installed at the trial site. This enabled grazing activities to be recorded for subsequent analysis, and allowed Mrs Reidy to keep an eye on Mr Reidy to ensure there was no undue slacking.

The main benefits of the camera were that he worked hard when close to the camera, that a wild deer was seen on the farm, and neighbours came to the house to have a look at the trial which was 1.5 kilometres away. There was little scientific merit as the camera had to scan three paddocks, taking in only small parts of a paddock at a time, and counting cows at various activities was very difficult. We also learned that counting black cows in dark shade was impossible.

The results

The highest air temperature recorded in our meteorological station was only 31.6°C, which was not a typical hot January or early February season for this district. Mean daily temperature ranged from 14°C to 24°C. Night temperature averaged around 14°C. Nevertheless the average maximum air temperature was 10°C higher in full sun than in the shade and average daily temperature was two degrees hotter in full sun than in shade.

The temperature on the cow's back frequently exceeded 50°C in both groups in the hours between 2:00 pm and 3:00 pm. Air temperature above the thermal neutral zone results in animals having to expend energy to keep their body temperature within the normal range of around 38°C. In this trial cows were almost always above this threshold limit.

Shade cows were, on average, 2.6°C cooler than the no-shade cows at peak ambient temperature and 2.4°C cooler between 10:00 am and 4:00 pm. The high temperature on the backs of the cows was no doubt a result of the black hair of the Angus compared to lighter coloured animals, and represents the integration of both incoming solar heat and radiated body heat.

Not surprisingly, cattle with shade made good use of it during the middle of the day. The motion sensor showed that as the day headed towards peak mid-day temperature, grazing became closer to the trees. In this shade treatment the cows generally rested by standing and lying down in the shadow of the trees. At other times of the day resting, like grazing, occurred more widely across the paddock.

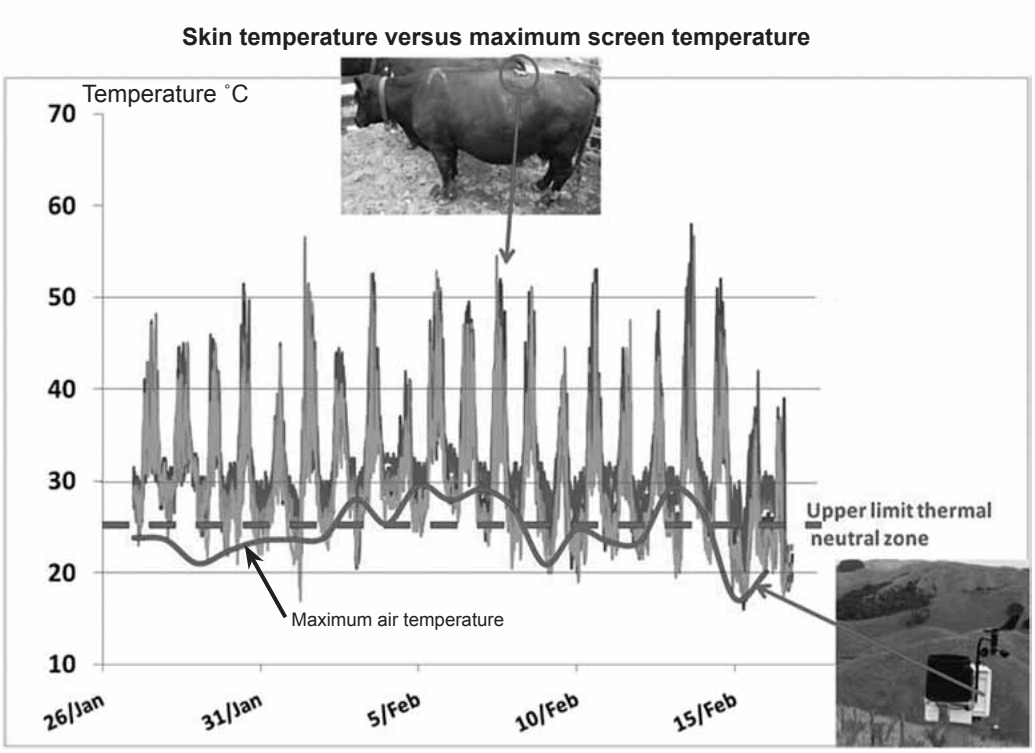
Of greatest revelation was that cows with shade still carried out some grazing during the period of peak temperature, but from between about 3:00 to 6:00 pm they grazed more than no-shade cows. Although there was a small reversal of this pattern between 7:00 and 9:00 pm, shade cows grazed 35 minutes longer each day than no-shade cows. Serious grazing starts at around sunrise and ends around sunset, but there is intermittent grazing during the night. We know from other work that this often occurs after a cow stands to urinate and that sometimes these cows will also drink.

Two interesting results came from the rumen sensor, the first being that we could count the number of drinks the cow had each day. More importantly, we noted that rumen temperature which should be stable at around 38°C to 39°C often rose to between 40°C to 42°C, at which temperature the cow had to have a drink no matter what the time of day or night. This must have been an indication of heat stress and was seen not in the afternoon, but typically in the period from 9:00 pm to midnight.

No-shade cows spent more time lying down during the heat of the day or suffered more heat loading, but drank with the same apparent frequency as shade cows. We could not estimate water consumption because much of it was from the stream or dam.

More efficient

Another positive feature of summer shade is, according to the literature, that the efficiency with which consumed feed is used is higher in cows without heat stress compared to those with heat stress. What is unknown from this trial is the liveweight change of the cows and calves. While we know that a three week trial is not long enough to confidently make this measurement, the trend was for



Temperature recorded on the back of each of 12 Angus cows

the shade cows to have gained more weight than no-shade cows.

The water story is less clear cut. In one paddock when cows had free access to both a trough and a dam during the first five days, the cattle drank almost exclusively from the dam. However, after being forced to drink solely from the trough during one five-day period, when both trough and dam were again accessible together, the cattle drank almost exclusively from the trough. Mean diurnal temperature in the water troughs ranged between 14°C and 27°C, indicating that the cow's ability to cool down is not great during the middle of the day.

The mean daily maximum surface water temperature on the two dams was 5°C higher than in the water troughs. So cows without shade get greater heat loadings and graze for a shorter time each day than cows with access to shade. Farm water systems are also likely to be so warm that ready relief from heat stress is minimal when they need it most.

Creating a magnet

Over recent years tree plantings in hill country have been made by many farmers for soil stabilisation. Some are no doubt made for improved animal welfare and many are plantation blocks planted for income diversity and aesthetics. One further attribute I suggest is that we are creating a magnet to have animals camping away from the riparian margins of streams where faecal nutrients and bacterial contaminants can be readily transferred to the water.

The area around trees will become a new critical source area in hill country. However, if these are distributed across the face of the hills, rather than concentrated along stream edges, this aggregation of nutrients back on the hill faces must be beneficial. More intense use of hill slopes because of increased fertility will also reduce the amount of rank pasture and increase the content of higher quality pasture species such as cocksfoot, ryegrasses and legumes.

Tactical use of electric fences can, where possible, also be used to force animals on to hill slopes to redistribute nutrients and change pasture composition towards high fertility species which provide improved nutrition for sheep and cattle.

It is well known that nutrients are transferred off the hill slopes to the flatter hill tops or gully floors in hill country because this is where animals camp. Enticing cattle and sheep on to the hill faces during summer should be good for stimulating hill pasture growth. The same may not apply for fenceline shelter belts because shade is only found on one side. Shadow from hedges will probably be less beneficial than from space planted trees where animals can follow the shade around the tree as the sun moves across the sky.

Perhaps we need to take closer note of what the animals are telling us – We need shade on hot summer days, even from early morning, so please replace what you have removed and we will promise to distribute excreted nutrients across the farm, stop sulking, and might even consider growing faster in return.

Plans are afoot to repeat this summer shade trial. This time we will concentrate more on animal performance to confirm that the additional 35 minutes each day of grazing time by cattle in paddocks with space planted shade trees translates to faster liveweight gain of young cattle.

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Alison Sewell and Maggie Hartnett

Transforming agricultural extension to promote farmer knowledge

New Zealand pastoral farmers need to develop practices which will allow them to compete successfully internationally. If farmers can increase productivity and sustain improved farm systems it will help New Zealand's future economy. This article looks at current educational research which highlights the critical factors that help farmers gain new knowledge which can be used to transform new models of agricultural extension.

New Zealand has played an important role in developing innovative extension designed to help farmers adopt new evidence-based farming practices. However, this momentum has been lost over recent years. A fresh and innovative model of extension will ensure that farmers learn more effective technology. We need more research into how and why farmers learn about and adopt new technology.

Current thinking in agricultural extension is to develop participatory research between scientists and farmers. Central to this is the value of knowledge exchange and partnerships between farmers and scientists which focus on evidence and innovation. Such partnerships modify the role of communication and knowledge by allowing farmers and scientists to share and challenge ideas. This contrasts with extension models based solely on the transfer of information from expert to farmer. The Farmer Learning Project based at Massey University has been researching ways to promote this area and the adoption of new on-farm technology.



The Farmer Learning Project

The Farmer Learning Project has brought together 25 pastoral farmers with a team of agricultural scientists and social scientists in a sequence of innovative experiences designed around a lamb-finishing pasture experiment. This compares two herb pasture mixes – plantain, red and white clovers with and without chicory – with perennial ryegrass and white clover pasture. Interest in these herb mix pastures is based on the work undertaken by Peter Kemp, Paul Kenyon and Steve Morris in 2010. This showed an increase in multiple-bearing ewe and lamb performance and improved growth rates in weaned lambs on herb mix pastures in comparison to an industry standard perennial ryegrass and white clover pasture.

Participants from the Manawatu, Hawke's Bay and the Wairarapa were invited to join the project. Some of these farmers already used herb pastures, others were thinking about it, and some were yet to be convinced of the value to their farm system. The role of the scientists was to design and oversee the experiment, to collect lamb and pasture growth data, and to use this as a basis for discussion and debate with the farmers. The role of the social scientists was to design experiences with the scientists and to collect data about the growth in knowledge by farmers.

Observation and discussion

The farmers attended 12 sessions over a three-year period. The main feature of these sessions was observation and discussion of data relating to pasture growth, along with lamb weight production from the experiment. An example of data shared with farmers is shown in the table .

A variety of experience was designed to help farmers find out more about herb pasture establishment, grazing management and the effect of these pastures on lamb production. Informal social times, including shared meals, were also planned to help develop relationships. Some activities were designed to appeal to the farmers' wider interests. For example, they observed and discussed glasshouse herb pasture experiments conducted by doctoral students.

The farmers also viewed autopsies of ewes in poor condition where they could see abscessed teeth, lungworm and intestinal disease in the gut. A further related activity was finding out about the intra-muscular fat content and the flavour differences of lambs grown on the plantain and chicory pastures compared to rye grass and white clover pastures. Specific examples designed to promote farmers' knowledge are shown in the next table.

Examples of farmers' experiences

Experience	Example
Observing the herb experiment	To observe growth of herb mix pastures and to discuss principles of effective establishment and management
Discussing data from the experiment	To learn about pre- and post-grazing sward heights, carcass weight production and botanical composition in different seasons and years
Digging up the herb plant	To learn about taproot, leaf growth and reserves and its effect on grazing decisions
Talks from experts with brief summary	To learn about weed control, and how to manage pasture and parasites and conduct feed budgets
Glasshouse experiments on herb pasture	To learn more about the capability of herb pastures under controlled levels of stress
Visiting farms that integrate herb mixes into their system	To learn from farmers who had used or changed to herb mix pasture practices

Live and carcass weight production on plantain and chicory mixes

Data	Spring year 1			Spring year 2			Spring year 3		
	Pasture mix	Plantain mix	Chicory mix	Pasture mix	Plantain mix	Chicory mix	Pasture mix	Plantain mix	Chicory mix
Live weight production kg per hectare	276	288	255	321	406	371	392	467	425
Carcass weight kg per hectare	141	162	146	122	182	165	133	181	176

Factors which help knowledge growth

Five critical success factors were shown to help with knowledge growth, the most important of which was the development of a farmer-scientist community. Also significant was to maximise the interest of farmers, making connections to their farming systems and ensuring alignment between the activities, the new technology and the science behind it. Encouraging farmers to enquire into their farming practices drawing on scientific and farm-based evidence was also important.

Farmer-scientist community

An important part of the farmer-scientist community was their open and responsive interactions and building mutually respectful and trusting relationships. The farmers respected the scientists' insistence on measurements as a basis for their decision-making, information sharing which was free from commercial bias and vested interest, as well as their enthusiasm for herb mix pastures. The scientists valued the practical knowledge and experiences of farmers and their willingness to challenge ideas.

Another distinctive aspect of this community was the opportunity for informal conversation between farmers and scientists. The farmers preferred to talk in small groups, which allowed them to test ideas or to hatch new ones. Their interactions gradually became more confident and the farmers contrasted this two-way talk to the way information is transferred at field-days.

The third important feature of the farmer-scientist community was that everyone had a say with their experience and expertise valued. The main examples were valuing the expertise of farmers and scientists, sharing thinking processes behind decisions made, as well as learning about new knowledge. The farmers compared this innovative approach to what typically happened in discussion groups where some felt overpowered by consultants and their tendency to direct the conversation.

Building interest

Farmers showed significant interest as they listened to and talked about the data from the experiment, grazing management and weed and parasite control. This often resulted in spontaneous conversation. The appeal to their interests also helped them to grapple with important pasture and grazing management concepts. The scientists' openness to share the positive and the negative maximised the interest of farmers. They came to see that there was often more new knowledge gained when the experiment did not progress as expected.

The variety of relevant experiences raised their interest by attempting to meet their objectives and motivational needs. The farmers shared the same objective of optimising lamb growth because some bred the lambs which they finished. However others used herb mixes for ewes and bulls and some bought in lambs to finish. This diversity of objectives, viewpoints and experience became a valuable source of new knowledge for them.



Making connections

The experience was designed so that the farmers could make connections to their own farming systems. They were able to use the data from the experiment as points of comparison to the growth rates they were getting from their systems. Similarly, examination of the plantain and chicory taproots helped them to apply principles and adapt their own grazing practices using the new knowledge which they needed.

Developing notes, which farmers referred to as one-pagers, also made accessible important facts on herb mix pasture growth, grazing management and weed control. This helped them to make connections between their experience and farming practice.

Enquiry

As the project evolved, the farmers began to participate with the scientists in their enquiry processes by asking questions, sharing experiences and using evidence to challenge and justify ideas. Initially, most of the farmers felt unqualified to contribute ideas, but by the third session they were increasingly confident about questioning the scientist's decisions and contributing their own knowledge based on their shared experience of herb mix pastures.

Sometimes this was in response to a deliberately posed question, but at others it came up in an open exchange of ideas. Knowing they could contribute ideas and that there was still much more to learn helped to motivate them. For example, the scientists are currently testing the farmers' idea of rearing lambs from single-bearing ewes to allow for early weaning and sale.

Increasingly evident was the thinking that each farmer was involved at the sessions and back on their farms. Thinking about their farming practices formed the basis of individual and enquiries which allowed them to see how their discovery of new technology could be applied to their unique farming systems. These individual or shared farmer enquiries became an important source of new knowledge.

Teaching and learning principles

The success factors highlighted in the project can be linked to what is currently known about how people learn. A number of learning and teaching principles help to explain success and they can pass on the next generation of agricultural extension models. The following table identifies the educational principles which underpin the five critical success factors.

Success factors and their links to educational principles

Success factor	Teaching and learning principles
Community	• Building relationships • Opportunities for informal conversations
Interest	• Providing a variety of relevant experiences • Sharing the good and the bad
Connection	• Making clear connections between new knowledge and their own farming system • Making accessible the main facts and knowledge
Alignment	• Planning repeated activities that reinforce new knowledge • Designing activities that align to scientific knowledge • Glasshouse experiments on herb pasture • To learn more about the capability of herb pastures under controlled levels of stress
Inquiry	• Supporting farmer thinking and enquiry into current practice based on evidence

The central principle of the project's improved extension model of new knowledge is building and sustaining mutually respectful and trusting relationships between farmers and scientists. These relationships can develop by building high levels of mutual support and trust around shared activities.

Within this professional community, farmers and scientists benefit individually and collectively by sharing knowledge and experience as well as by receiving help and being exposed to new ideas. This is a continuing process of participation with others, rather than a one-off opportunity, and it depends on the community being well established. This shared and active method is vital to successful innovation in agricultural extension.

Providing opportunities for informal conversation is an important way of allowing new ideas to be generated within the community. The honest and objective nature of these informal conversations was highlighted by the farmers as being different from traditional methods where information is given from a consultant to a farmer.

Variety and honesty

Valuing this open exchange of ideas means that farmers were given the opportunity for new insights. The main point here is that for effective new knowledge, people need to be given opportunities to talk to each other and for their ideas to be valued without them all being passed through one expert. The expert is just one member of the community. Using a variety of different activities helped the farmers to remember and to understand core principles about herb mix pastures. This variety of activities held the farmers' interest.

The openness of the scientists to share the trial's successes and its mistakes became an important source of new knowledge. Their willingness to be honest, objective and unbiased encouraged the farmers to do likewise. The trust and mutual respect developed within the group made it easy to share mistakes and this will help them to practice change.

It was also important to make deliberate connections between the focus of new knowledge and the farmer's own farming system. When people experience activities which connect to their lives the content is more easily remembered and applied. The farmers were actively encouraged to use their own experiences as a point of comparison with the trials.

Simply presented information

The farmers asked for normal notes or one-pagers which gave the main facts related to herb pasture establishment, grazing management and weed control. They also asked for them to be illustrated with photographs of the chicory and plantain mix swards and roots at different stages of growth. These materials became a valuable and readily accessible resource they could refer back to. Another example is the development of a ruler to quickly and accurately measure sward height in the paddock. This reminds us of the importance of providing them with information which is straightforward and at the time it is needed.

Providing repeated learning opportunities helped the farmers to remember important evidence-based ideas and to develop conceptual understanding of plant physiology and the main principles of establishment and grazing management. This reinforcement helped them recall these ideas and principles and apply them to their farm. Educational research highlights the importance of repeated exposure to new ideas and repeated practice for growth in knowledge and to make sustained change.

The farmers' involvement in the trial gave them opportunities to grapple with and challenge the scientists' interpretations of the results. This helped them to think about herb pastures in their own complex farming system. As a result of taking part in the trial, most farmers have altered their herb pasture practices by adopting evidence-based establishment practices, increasing the area in herb pasture, and changing the herb pasture mix to suit their climate, farming system and objectives.

Implications for rural professionals

The partnerships between farmers and scientists created a joint opportunity for new knowledge and innovation, an important factor in helping them with a new pastoral practice. The challenge for rural professionals will be to develop extension programmes which build on these educational principles. This is likely to require a change in their role from being the expert or the central point in the network, to being just one important member of a community of farmers and scientists with a common purpose to learn with and from each other. The farmers' group coined the term slow science to encompass this approach because of the time needed to build trust within the group to the point of free and open conversations.

It is probable that this new approach to agricultural extension will cost more in terms of time and resources than current models. However, if the rate of adoption of new technology is to be increased to improve the production and profitability of the agricultural sector, then the challenge for extension providers will be to implement research-informed models of new knowledge into their practice.

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Jill Greenhalgh and Philippa Rawlinson

Where have all the Southland sheep farmers gone?

This is the third and final article in the series on changes in Southland farming.

Following research for DairyNZ in Southland in 2013 investigating the social effect of the growth of dairying, we reflected that we had not really found out much about the sheep farmers. Census data up until 2006 had shown a steadily increasing average age of sheep and beef farmers, and research indicated that many planned to farm well into their 60s.

How did the Southland sheep farmers respond to the rapidly changing land prices? We knew that many of their lives have changed dramatically as a result of dairying. Some had converted to dairying themselves but many had sold their farms. Where had they gone to and what have they done? Sheep farmers were once at the top of the rural social hierarchy in Southland but have now been displaced. This project set out to specifically look at the effect dairying has had on this group.

Farmer interviews

Ten sheep farmers were interviewed. The data from a further five from the previous work was also used to build a picture of how these people have responded to the rising land prices created by the dairy boom. The farmers were also asked about their previous sheep farming neighbours, resulting in finding information on 93 farmers spread across the province from eastern Southland to western Southland.

Two-thirds of the 15 interviewed farmers were on generational family farms and they ranged in age from their early 40s through to their mid-60s. They had between two and four children with a significant predominance of sons. Only a small minority of the children who were beyond school age were potentially interested in farming.

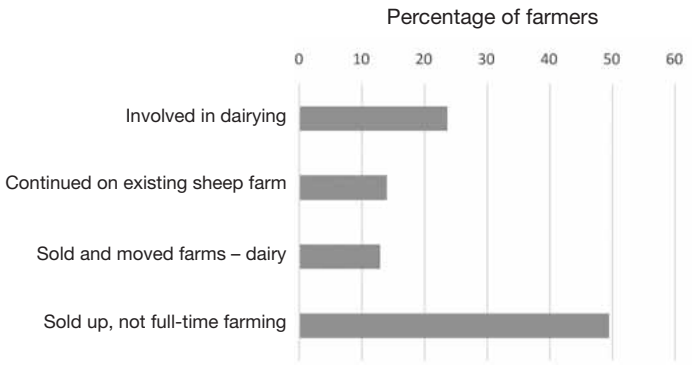
What has happened to 15 Southland sheep farmers since the 1990s

Farmers 1 and 2	Converted to dairying and were actively managing their dairy farms
Farmer 3	Formed an equity partnership which converted the farm, then worked as a farm assistant for two years before travelling overseas
Farmer 4	Leased his sheep farm to dairying neighbours as a milking platform, not converted
Farmer 5	Joined an equity partnership while continuing to run his own farm
Farmers 6 and 7	Remained sheep farming with their traditional systems
Farmers 8, 9 and 10	Upsized to bigger sheep and cropping farms, two have dairy-based enterprises
Farmer 11	Sheep farming and purchased a second sheep farm
Farmer 12	Downsized but farming still forms a significant part of his income, also a contractor
Farmers 13 and 14	Sold up and bought a lifestyle block, one of these has another job
Farmer 15	Sold up and moved to town, works in a job five days a week

While farmers responded to the growth of dairying in many different ways there are four basic results -

- Becoming actively involved in dairying in some way
- Continuing farming on the same farm but not converting
- Selling the existing farm and moving to another non-dairy farm
- Selling up and ceasing to be a full-time farmer.

There are also various combinations of these. Half of the 93 farmers have stopped being full-time farmers, while nearly a quarter have converted to dairy or have an active interest in dairy farming. The remaining quarter are almost equally split between remaining on their existing farm or moving farms but remaining as non-dairy farmers. The fate of these groups will be discussed with the focus on the experiences of the 15 farmers who were interviewed, as representatives from each group.



The general results of 93 Southland sheep farmers

Converting from sheep to dairy

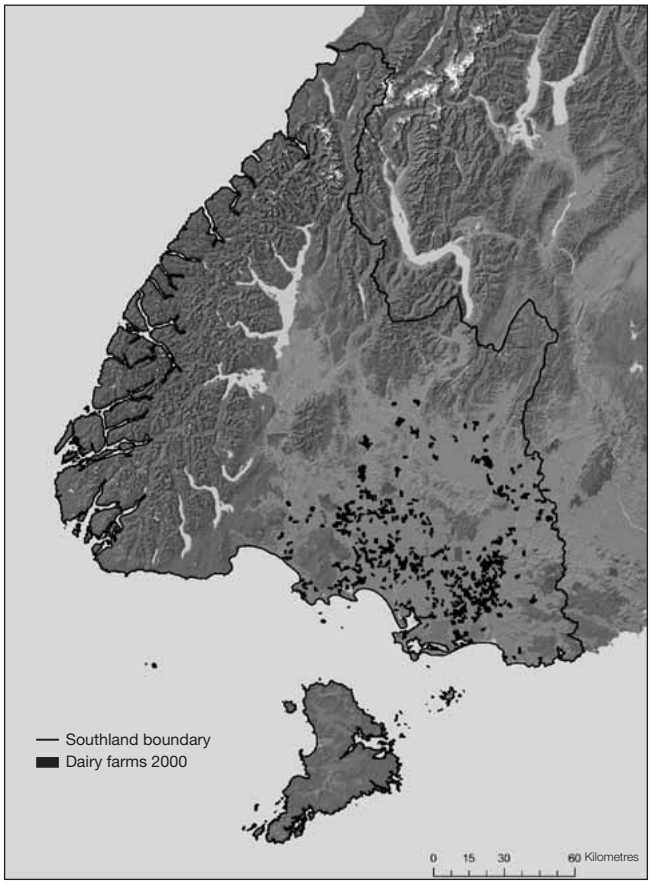
Many Southland sheep farmers have converted their farms and become dairy farmers. For some, sheep farming had become routine and somewhat tedious and they relished the challenge of creating a new business. Previous research into Southland sheep farmers who converted to dairying described how some felt frustrated by the lack of ability to develop their businesses and how sheep farming did not offer the same daily reward that putting milk into a tanker gives dairy farmers.

Some of the interviewed farmers recognised the opportunities from dairying with the chance to grow a business. This enabled them to offer their successors better options than their sheep farm would permit, whether through ownership, management or work. It was about providing some security for the future if their children wanted to go farming.

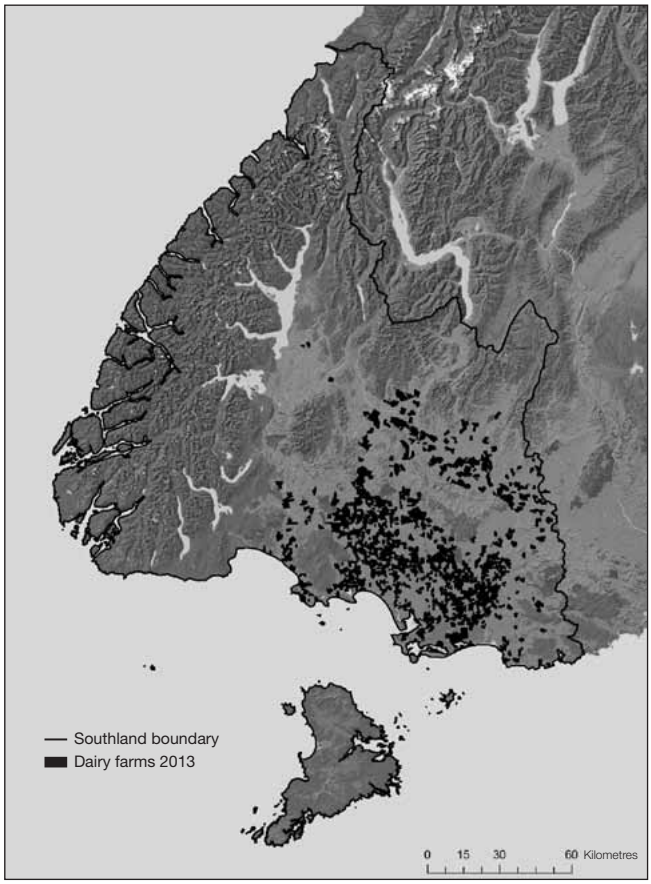
One couple talked about the physical demands of sheep farming as they aged, such as having to regularly handle heavy ewes. Dairying has a different physical requirement, but unlike sheep farmers most dairy farmers can pass on the heavier work to a younger workforce. It also offers the opportunity to step back from the day-to-day demands of farming but remain involved at a more tactical and strategic level.

Therefore, while nearly half the farmers who have become dairy farmers have converted and manage their farms, 14 per cent who want governance and ownership but not hands on, have converted but employ sharemilkers or contract milkers to take on those day-to-day demands. Another 14 per cent have become equity partners, either on their own farm or on a separate farm.

Farmer three decided to convert his farm by using an equity partnership. The locals were shocked that he had sold his farm. However, he started out with a 29 per cent shareholding which has grown to 71.5 per cent with no



Dairy farms 2000



Dairy farms 2013

personal debt, and his son is now looking at eventually owning the farm and it will all be back in the family again.

The remaining 27 per cent of this group have leased their farms to dairy farmers. Farmer four was an innovative sheep farmer as the dairy farmers moved into his area. He thought that because he had irrigation but struggling financially, and getting sick of the stress of the weather, could see that with rising land values, if dairying was going to be successful it might be a big improvement.

Today he and his wife remain living in their third generation family home with a view across the family land. The lease, which is tied to the milk price, returns a comfortable living including regular overseas travel. It also allows him to indulge in a life-long hobby on a full-time basis.

Remaining sheep farmers

Southland still has a number of sheep farms dotted across the plains where farmers have not yet been lured into the dairying boom. With DairyNZ predicting a possible jump in conversions this year, more of these farms may be converted, either by the existing sheep farmer or expanding dairy farmers.

Of those who are still not dairying, over a third had retained their traditional farming systems, while nearly half had taken advantage of the diversification that dairying offered by dairy grazing or providing fodder for their neighbours' cows. Some farmers had tried dairy grazing but did not like the effect on their soils.

For these farmers, succession is a real problem. Out of the 93 farms, we heard of only two instances of sheep farming succession. Strong language accompanied one farmer's comment that, putting one son in and trying to even it out for the other one, as well as having a living, just cannot be done. If succession is not relevant, and the farming family is nearing retirement age, they can be assured of a comfortable retirement based on their ever-rising land values.

Some sheep farmers have managed to grow their businesses in spite of the higher land prices. Farmer 11 invested serious money in a second sheep and beef farm five years ago because he believed that this was something he would rather be involved in.

Moving on and further out

Dairying holds no appeal for some sheep farmers and they prefer sheep and the sheep farming system. As Farmer three noted in hindsight, after milking on a 19 days on with two days off roster, the lifestyle was sensational, with every Saturday and Sunday off. In one case a younger farmer had moved off the plains and doubled his land area for the same level of debt, but dairying has followed him. While he gains a substantial part of his farm income from dairy grazing, the dream is to own a bigger farm.

It would be impossible to expand their current farm as they are boxed in by dairy farms. His wife, who

describes the farm as beautiful due to the planting they have done, is more attached to it than he is. He says that when they sold up to dairying all he wanted was a blank canvas, be the farmer and do what he wanted to do. He was confident that he would enjoy what he was doing when he was 60.

He recognised that it would make more financial sense and offer better security and succession options for his young family to have gone dairying. However, he had seen the stress created by the need for high productivity to service and repay debt and he did not want to be in a similar position.

For other sheep farmers, the risk involved in borrowing the large amount of capital needed to convert was a deterrent. Having farmed and suffered through the 1980s, the courage needed to convert was too great for one farmer. The family had upsized to a farm surrounded by dairying although reflected that, in hindsight, should probably have jumped into dairying. 'But sheep farming is a real passion, I love it.'

Leaving the farm

Almost half of the 93 farmers have stopped being full-time farmers, but almost a fifth of them have retained a connection to the land. A small proportion have sold off land to a dairy farmer and remained living in their farm house, often with an off-farm job. A larger number have down-sized to a lifestyle block where they combine hobby farming with either an off-farm job or semi-retirement.

Nearly half of those who have sold have continued to work. Some have had major career changes such as buying a business or becoming a professional, while others have taken on casual or unskilled jobs. Almost 30 per cent said they were retired. Families or better climates enticed a third of those who sold up to leave Southland, most to Central Otago.

Reasons for selling varied. Farmer 13 talked about it being a mixture of wanting to try something else, health reasons, stress from farming beside a flood-prone river, and having sons who were not that interested. Leaving the farm was not as simple as he envisaged. Money was not the reason. 'I thought I was ready, but when I went out of the gate it was not easy. There is still not a day goes by when I don't think about it.' While he had a vision of owning a small business this had not happened and he still saw himself as a farmer. Previous researchers have also noted the importance of identity to farmers.

Another of the interviewed farmers noted that some of his former neighbours were in jobs that they did not particularly enjoy. Farmer 14 appreciated why this might be the case. He had left school and gone farming with no ambition to be anything else. He enjoyed the mix of all sorts of jobs in one job, being jack of all trades, master of none. He had thought about selling the farm for seven years before he put it on the market. He finally realised that if you get too old, and you have no qualifications, you are limited in what you can do.

Timing is everything

The timing of the sale of the farm made a difference to the result. Those selling in the early days did not benefit from the higher land prices which came later. There were several stories of ex-farmers spending their farm sale proceeds extravagantly and then having to re-enter the workforce. However stories were also told of ex-farmers loving their new lifestyles, particularly those who had developed interests outside farming.

For some farmers the disconnection from the land is hard. Several told of driving the long way round to avoid passing their former farm. An existing sheep farmer, with an impeccable farm well planted in natives and surrounded by dairying, commented that when the time comes to leave, he would never come back because 'I don't want to know what it will look like.'

Conclusion

The growth of dairying with the resultant rise in land prices offered the ageing sheep farmers of Southland a range of options. Those who loved farming and were seeking new challenges, or were concerned about succession and the lack of options as sheep farmers, converted their farms to dairying. Others saw the opportunities that equity farming offered and some saw the option of retaining their family farm but gaining an easier income by leasing land to the dairy farmers.

The farmers for whom milking cows had no appeal have stayed put, happy to see their equity rising and knowing there is a buyer for the farm when retirement time comes. They have more options by supplying dairy support. Other sheep farmers have sold to dairying and purchased larger farms off the Southland plains. Some sheep farmers have been able to expand their businesses.

By far the largest proportion of sheep farmers have sold up and either down-sized to a lifestyle block, taken the opportunity to make a career change, or have settled for an easier life with a regular weekly income. Some of these farmers enjoy their new lifestyle, others miss their land and their livestock, while still others might have made different decisions if the clock could be turned back. The change to dairying offered sheep farmers a wider range of options and opportunities they never would have had if Southland had remained a province of sheep. Whether farmers had good or not-so-good results from dairying depended on the timing and quality of their decision-making and their individual circumstances and abilities.

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Keith Woodford and Xiaomeng (Sharon) Lucock

New Zealand's wine opportunities in China

Wine production and consumption in China has been increasing rapidly. The wine producing regions are mainly in the drier northern part of the country and span the geographic breadth of China from west to east. About 80 per cent of the wine consumed in China is produced locally with the remainder imported. New Zealand's wine exports to China increased from less than $24,000 in the year 2000 to $28 million for the 12 months ending October 2012.

However wine exports then declined sharply by 25 per cent in the 12 months to October 2013, with further declines likely. In this article we explore the causes for first the dramatic increases and then the more recent decline in wine sales. We also look at the long-term opportunities for China as a major destination for New Zealand wines and the factors that will determine success.

China's wine producing history dates back for centuries, yet it is only in recent decades that rapid growth has occurred. According to the Statistics Division of the FAO, wine production in China increased more than six-fold from 1986 to 2011. By early 2012, China had overtaken the United Kingdom to be the fifth largest wine producer in the world. However, consumption per

person is still low at somewhere between 0.6 and 1.5 litres a year, depending on the source.

According to the Wine Institute, the figures above contrast with 46 litres per person in France, 24 litres in Australia, and 22 litres in New Zealand. With wine consumption rising rapidly as wealth levels increase, contrasting with static or declining consumption in most parts of the world, it is realistic to consider that China will soon move beyond Germany, Italy and France, and then perhaps the United States to become the world's largest wine market.

New Zealand wine exports to China

There are inconsistencies in the statistics from different sources, but all show a rapid increase in New Zealand's wine exports to China since around 2000. According to FAO statistics, the volume of wine exported from New Zealand to China increased from almost negligible amounts before 2000 to more than two million litres in 2010, but as outlined earlier, experienced a significant drop. In contrast, the overall value of sales continued to increase through into early 2013.

However the story emerging in the latter half of 2013, and supported by recent New Zealand monthly export statistics, indicates that a sharp downturn in volume and value is now happening. This is associated with the major anti-corruption campaign led by President Xi Jinping which has in turn led to a ban on officials holding publicly-funded banquets.

The campaign began in May 2013 and the ban is having a major effect on all top-end food and beverage items. This is in contrast to products consumed by the middle classes, such as milk and meat, which remain on rapid growth paths. The anti-corruption campaign appears to be gaining further momentum and has the potential to lead to further declines in the import of wines throughout 2014.

China's wine imports from elsewhere

Despite the spectacular increase of wine exported to China in the past decade, New Zealand remains a small player in the Chinese wine market. For example, whereas in 2011 New Zealand exported just under two million litres of wine to China, France exported over 127 million litres. In the same year Spain exported 74 million litres, Australia 45 million and Chile 43 million. In recent years, New Zealand has usually been in about eleventh as a source of foreign wine into China.

All wine imported into China is subject to a consumption tax of 10 per cent and a value added tax of 17 per cent calculated by compounding. There is also a compound import tariff of 14 per cent which New Zealand has been exempt from since 2012 because of the free trade agreement. Chile will also have exemption from this tariff from 2015, but all other countries will still have to pay it.

Wine in the supermarkets

About 90 per cent of the shelf space in wine sections in supermarkets in China is taken up by red wines. However the younger generation, particularly professional women, are becoming more interested in varieties of white wine. Despite the relative unimportance of New Zealand in the overall market, it is easy to find a small selection of New Zealand wines in most high-end supermarkets in the tier one cities and also many of the tier two cities. Most New Zealand wines sell for the equivalent of between $40 and $85 a bottle. Relative to the wines from other countries, this places them towards the upper end in terms of price.

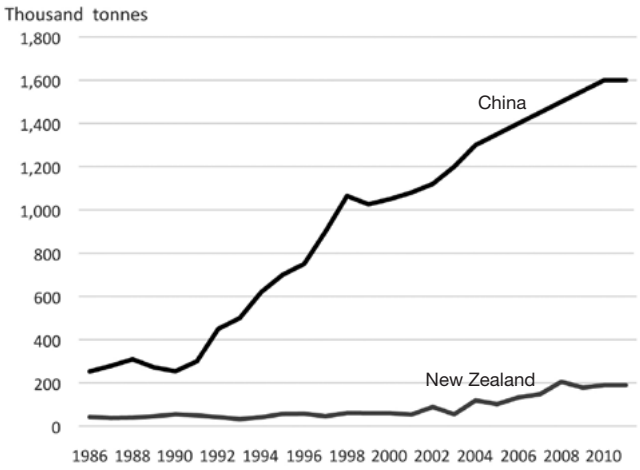
One example of a New Zealand wine was a Cloudy Bay Pinot Noir selling for the equivalent of $84 in a Shanghai supermarket in September 2013 and for $68 online at Taobao, one of the largest online shops, in December 2013. Exactly the same wine was selling in Countdown in New Zealand in December 2013 for $50.

Opposite to the phrase 'lost in translation', the Chinese translations for some wine varieties have

sentimental values that Chinese can find appealing. For example, Sauvignon Blanc is often being translated as Chang Xiang Si, the name for a type of ancient Chinese poem with a set rhythm which literally means 'thinking of you always'. Brand names can also be translated into meanings which have special connotations. For example, Australian wine Penfolds is being translated to Ben Fu in Chinese, meaning 'running towards wealth'. Such a connotation can be very appealing to Chinese people who often buy things for a good omen, for self-consumption or as a gift.

Future of New Zealand wine in China

The short-term opportunities for marketing New Zealand wine in China are likely to be challenging due to the general downturn affecting all top end restaurants. This is a direct effect of China's anti-corruption campaign having a major effect on the behaviour of officials. However in the longer term it is highly likely that demand for wine will increase and that China will be globally the biggest growth market for wine. The question for New Zealand companies is how they should approach this market.



Wine production in NZ and China 1986 to 2011 FAOSTAT

In contrast to products such as dairy and meat, New Zealand has no natural physical advantage over China in wine production. China has the bio-physical capacity itself to produce large quantities of wine at a low cost. In addition, unlike dairy and meat, New Zealand has lots of competitors who have the capability to market wine into China. If New Zealand is to prosper it will be by creating a reputation for superior quality.

New Zealand does have some characteristics that it can turn to advantage. There is an enviable image of clean and green, even if here we know that there are some weaknesses when it comes to the reality. However to the Chinese, anything coming from New Zealand is going to be trusted a lot more than any home product.

An increasing number of Chinese are coming to New Zealand each year as tourists. These people come from the demographic groups – the upwardly mobile middle and wealthy classes – who can be attracted to what New Zealand produces. There are opportunities to link Chinese tourism to New Zealand by marketing food and wine. In previous articles we have highlighted the challenges of distribution to Chinese supermarkets, but have pointed out the enormous opportunities which exist for online selling. It is similar for wine.

The main difference with wine, in comparison to so many land-based products, is that the Chinese are not going to develop the trade between the two countries. With meat and dairy products, Chinese importers seek out New Zealand companies with great determination because there are few other sources they can go to. However with wine it is very different as the opportunities are significant, but so is the competition.

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Donn Armstrong

Land use, ownership and investment in Tanzania

This is a brief account of a study trip of Tanzania undertaken in June 2013 with a group of 20 mainly rural-orientated people and led by a New Zealander who spent many years working in Tanzania.

The East African United Republic of Tanzania dates from 1964 when it was formed out of the union of the much larger mainland territory of Tanganyika and the coastal archipelago of Zanzibar. Tanganyika in more distant historical times was a colony and part of German East Africa from the 1880s through to 1919, and then following the end of World War I under the League of Nations it became a British mandate until independence in 1961. The island of Zanzibar has a complex and colourful history having been controlled by the Portuguese, the Sultanate of Oman and then as a British protectorate in the 19th century. It is famously known for its spices and historically for its involvement over a long period of time in the international slave trade.

Tanzania is a big country, with 75 per cent of the population being rural, and who to a large extent have not benefited from the economic successes reported to have occurred in the last few years. There are significant agricultural mineral and hydrocarbon resources in the country, leading it to being referred to by some as Africa's sleeping giant. The large rural component of the population find themselves in their traditional rural environment being challenged by international interests endeavouring to acquire arable and horticultural land.

Many of the rural owners of customary land do not fully understand the consequences of the disposition of their traditional common land. This misunderstanding is clear in an observation made by the participant in a community focus group discussion recorded in a report prepared by the Oakland Institute in 2010, *Understanding Land Investment Deals and Africa – Country Report Tanzania* –

> We agreed verbally to give our land to the investors because we wanted their promises of social services in the area but we don't know exactly how much land per person was taken as we have no documents and plans to let us know where our land starts and finishes. I did not know my land laws and land rights, so did not understand what I had agreed to until my land was gone and I received no compensation.

This observation has a very familiar ring in the New Zealand Treaty of Waitangi settlement context. To more easily understand some of the problems as they seem to a casual visitor in Tanzania it is helpful to take a quick look at what makes up the country, its economy and its people.

Geography and demography

Tanzania is the world's 31st largest country and covers 947,300 square kilometres. Compared to other African countries it is slightly smaller than Egypt and comparable in size to Nigeria. To the north it bounds Kenya and Uganda and to the south Mozambique. To the south-west are Malawi, Zambia and the Democratic Republic of Congo and west of the southern edge of Lake Victoria towards Burundi and Rwanda. The location is mostly between latitudes one and 12 degrees south and a longitude of 29 and 41 degrees east.

Approximately a third of the land area rises from sea level westward to 1,000 metres above sea level, beyond which the predominant altitude appears to be 1,000 to 1,500 metres with some more mountainous areas rising 2,000 to 3,000 metres in places. Notably in the north-east is Mt Kilimanjaro at 5,985 metres above sea level.

The total population reported in July 2012 was 46.9 million, of which the urban population is 26 per cent. AIDS is reported to have had a significant effect on the demographic distribution as can be seen from the age structure.

- 0 to 14 years – 45 per cent of the population
- 15 to 24 years –19.4 per cent of the population
- 25 to 54 years – 29.2 per cent of the population
- 65 years and over – 2.9 per cent of the population.

The major cities are –

- Dar es Salaam on the coast with a population of 4.36 million
- Mwanza, on the southern shores of Lake Victoria with a population of 706,000
- Arusha, slightly south of Mount Kilimanjaro and close to the Kenyan border with a population of 416,000.

The economy

The 2012 *World Bank Tanzania Economic Update Report* notes –

> As a key message in terms of macroeconomic indicators Tanzania has been a top performer. Over the past year, its economy has grown at a rate of more than six per cent. It has achieved significant reductions in its fiscal deficit. Despite some volatility at the end of 2011, its financial indicators, with the exception of the inflation rate are now mostly indicative of good economic performance, as they have been throughout much of recent history. Given current global context, Tanzania's economic performance must be applauded.

The report then goes on and makes further comment, which is a reality check on the observation you see throughout particular rural areas of Tanzania, although on a limited geographical basis –

> However, there is another side to this story. Growth has been increasingly concentrated and it is generated through a limited number of capital intensive activities. In addition, growth has become increasingly dependent on government spending rather than on private investment and job creation and despite the economy's growth poverty remains prevalent and stagnant.

The World Bank commentary indicates a relatively optimistic outlook over the next three to four years with the expectation that growth will continue and costs and inflation will be controlled. However, further reading of this report makes you realise that these projections depend on the massive complexity of a third world country endeavouring to lift its productivity and at the same time cope with problems surrounding land tenure and lack of resources in the rural sector.

The rural sector

The rural sector consists of close to 75 per cent of the population and includes 80 per cent of the country's poor people living below the international classification of the poverty standard. The average annual income for Tanzania is reported to be less than US$500 a year. This is then eroded by high inflation rates, such as those reported in 2012 to be running at 15 per cent.

The plight of the Tanzanian people is best summed up in the following quotation from the same 2012 World Bank report which notes that 'Rapid economic growth and stability has generated high dividends for Tanzania in recent years, driving increases in per capita income of 70 per cent over the past decade. However, these benefits have not been evenly shared.' This uneven distribution of the economic benefit arising from the development

is quite apparent in the wider rural area which suffers from lack of infrastructural development and problems surrounding tribal lands.

This results in these people not being able to finance the rural development necessary to benefit 75 per cent of the population whose economic status is reported to have remained flat for over 20 years. As such they have not benefited from the country's reported six per cent growth in gross domestic product. To try to understand why such a large proportion of the population have not benefitted from this growth it is helpful to make some comment on Tanzania's political history, land ownership and tenure and the push by international investors to acquire agricultural land.

Political history

Before increasing European interest in the East African region throughout the 19th century, Tanzania or Tanganyika as it was then known was occupied by approximately 130 tribal groups. By 1880 Europeans began arriving as hunters, missionaries and traders, some of whom were motivated and interested in acquiring land and political influence.

The German involvement was significant and appears to have been the dominant European group through until the beginning of World War I. They entered into agreements with local chiefs and set about building railroads and infrastructure and developing farming and commercial interests on some of the lower coastal lands. There was little or no involvement in the central area or southern areas where the tsetse fly makes cattle grazing and dairy farming almost impossible.

After the war Tanganyika was mandated to Britain and remained as a colony until 1961 when political independence was established under a one-party rule regime by Julius Nyrere. In 1964 Zanzibar and Tanganyika formed a federation, renaming the combined states as Tanzania. The current literature reports it as being one of the most politically stable countries of Africa. Nyrere adopted a strong socialist policy, which in recent years has been modified to facilitate the known economic development potential of the country.

Land ownership and investment

Since colonial times land in Tanzania has been administered under two separate types of tenure. This dual tenure arrangement provided a formal legal system to enable non-African settlers to acquire rights to land which was not deemed to be customary land held by indigenous people. This process has led to different pieces of land being subject to different and sometimes multiple sets of rules.

Underlying this dual structure were four important principles which have to be adhered to in the administration of land in Tanzania –

- Land belongs to the state and not individuals
- Rights to land depend upon the use made of the land
- Land rights are controlled administratively as opposed to judicially
- Land is not a saleable commodity.

Villigisation

During the colonial period there were some large-scale investments in Tanzania, and major efforts were made to modernise agriculture and encourage development of cash crops for export. After independence, there was a decade of socialist transformation involving nationalisation and efforts to encourage agricultural crop production and industry. The vision of the president was that of a communal living and working environment, resulting in a concerted effort to move the rural population back into villages. 'Villagisation' was made compulsory throughout Tanzania so that by 1975 almost all of its people were reported to be living in villages.

Subsequent changes to economic policies led to changes in legislation. In particular, following a review by a government-appointed commission, new land legislation came into force in 2001 which provides an overall framework for the exercise of the administration of land rights under three basic categories –

- **Reserved land** set aside by legislation for national parks and game reserves
- **Village land** within the agreed boundaries of any of Tanzania's 12,000 villages. This is managed by the village council, an elected body answerable for management decisions to the entire adult population of the village
- **General land** which does not fall into the other two categories and as such is theoretically available to potential investors to lease from the president.

Some commentators report that while these three definitions appear clear, the respective legislation relating to each of the land classes has created some anomalies. One such anomaly is that the Land Act defines general land as all public land not reserved for village land and includes unoccupied or unused village land.

New limits on foreign ownership

Under the provisions of the rules noted above, general land is the only land which can be leased to foreign investors in Tanzania. The standard agriculture lease is for 99 years at a price of 200 Tanzanian shillings, or 15 New Zealand cents per hectare per year. The price per hectare rental does not vary according to location of land or the crops grown. The rent due on the land is collected by Ministry of Lands district staff and the money goes into the consolidated government budget.

The Tanzanian Investment Centre takes 10 per cent of the rental as a facilitation fee and the leases become invalid if investors do not start production within two years or do not ask for an extension or give an explanation for the lack of production. Prospective purchasers of land have to make application to the Tanzania Investment Centre. This organisation is referred to as a one stop shop, being an investment promotion agency to identify and provide land to investors. All investors, even if they have identified land, cannot start the land acquisition process without the support of this organisation.

By 2008 it was reported that four million hectares of land had been requested by foreign investors for both fuel and food production, of which 640,000 hectares had been allocated to foreign investors with only 100,000 hectares being formally leased. It would appear that official records in Tanzania are unclear and information on the actual level of transactions is difficult to determine. This is because, as another report by Yefred Myenzi of the NGO Land Rights and Resources Institute suggests, the area taken up by 2008 was 80,000 hectares and that on average in 2012 there were five land disputes daily in the country and three of those involved powerful investors.

Myenzi is the Programme Officer for the Land Rights Research and Resources Institute based in Dar es Salaam. Writing in a 2005 paper, 'Implications of the Recent Land Reforms in Tanzania on the Land Rights of Small Producers', he predicted –

> … the future of small landowners and users, especially in regard to the rights to access, and control land is darkening. The reforms are increasingly delinking them from their natural means of earning and sustaining their living and pushing them to the margins of abject poverty. … poor people, especially in rural areas need land for sustainable subsistence. For them to be able to withstand the waves and pressures of market-driven policies, civil society must chip in to play one of its traditional roles which is facilitation.

The advice provided by Myenzi in 2005 and others concerned about land grabbing by international and well-connected local investors appears to have been recognised by the authorities in Tanzania. They announced in December 2012 that the country would start restricting the size of land which single-scale foreign and local investors can lease for agricultural use. The news media release on this noted that there has been local and international criticism of major investors grabbing large chunks of land in Tanzania, often displacing small-scale farmers and local communities.

Small-scale operations

We had the privilege of observing some of these small-scale arable farming operations along with the extensive grazing of cattle by Maasai tribal people. We also saw the national parks which are strictly controlled and managed to provide a sustainable food supply for the wildlife. All of this supports the important safari tourism. We were also able to visit locations where communities were making some progress in improving their local economies by education and in two instances were adopting a sustainable annual grazing regime.

In areas that we visited, the main crop grown appeared to be maize, but these crops looked poor compared to production in New Zealand. We were advised that they do not have the benefit of hybrid seed sources, have limited or no fertiliser, no irrigation and in most cases in the village locations all cultivation and harvesting is carried out manually. We were advised that villagers did not have the resources to buy high-quality seeds but selected next season's crop by picking out the best grains from the current crop being harvested. These were then planted one seed at a time on significant areas of village land.

Extensive grazing of cattle

The tribal people, particularly the Maasai tribe who inhabit large areas of traditional land in the west north-west region of Tanzania, have been cattle grazing for generations. Some of their land has been incorporated into the Ngorongoro National Park, with the tribe continuing their traditional grazing by cattle over an extensive area. The grazing involves walking cattle to

pasture during the day and containing them in yards over night, then moving from one location to another as the supply of fodder diminishes. From a roadside viewing it was difficult to see where there would be sufficient feed supply available for the cattle being grazed.

It was interesting to move from this location to the adjoining Serengeti National Park, which is a massive area of land administered by the equivalent of the New Zealand Department of Conservation. Here grazing cattle by tribal groups is not permitted and the land is reserved for wildlife which was observed in vast numbers systematically grazing and migrating northwards following the rains. The available feed for wild animals was significantly better in this well managed controlled park regime than on the adjoining dry plains lands which were being grazed by the Maasai. In some locations, controlled burning was being undertaken to stimulate regeneration of native species with impressive results in the quality of regrown areas in the following year.

The National Park authorities appear to have ensured that the whole ecosystem is balanced with a systematic grazing following the rains and the mass migration which these animals have been embarking on for thousands of years. The migration from the Serengeti alone is reported to involve 1.3 to 1.5 million wildebeest, over 250,000 gazelles and at least 200,000 zebra which move off the high altitude plateau in the dry season to Kenya and return for calving later in the year. The Tanzanian agencies appear to manage these national parks at a very high level and protect the valuable resource of the native animals and their natural feed supply.

Regeneration of conservation land

The Maasai have a long history over many centuries of grazing cattle. A man's wealth is measured by the number of cattle that he owns and as his wealth grows he also increases the number of wives he has. We visited a small community which our tour guide has been involved with since 1995 where the husband of three wives had died and left them and his children land decimated by over-grazing. At the time of his death his family had virtually no ability to sustain themselves.

With help from the local community and guidance outside the community, the land has been regenerated, a small cattle herd has been established using a small zero grazing system, significant areas have been planted in eucalypt trees, and the three traditional mud houses have been renovated. The local community also provides tourists with the opportunity to see how these people live and observe how, with some guidance, they can lift themselves from an almost impossible situation to one where they can sustain themselves and their children.

It is interesting to note that this particular project has all been carried out by the women involved and the extended female members of their community. A group of these women welcomed us to the houses. They were all dressed traditionally and sang songs of welcome as we entered their area. Some of them had walked up to 15 kilometres to participate in this welcome.

It was also pleasing to hear that the tour companies which drove us to within a kilometre of the site from where we had to walk the relatively steep dirt track covered in dust and silt were providing a financial contribution to this project. The short walk in and back to our transport showed us in a dramatic way how these people have to carry in all their food and water. They have no electricity, sewerage system or access to motor vehicles, with cell phones in some limited cases being their only modern convenience.

Dairy farm development

We visited a model dairy farm in the Usa River area. On the way we picked up the local vet who provided the bus driver with directions to the location. It was necessary because this particular dairy farm is located in a fully developed residential part of the town. The farm consisted of approximately 4,000 square metres of land on which stood the landowner's dwelling, a non-traditional bungalow which was well constructed and appeared to be about 120 square metres.

The land also contained a milking shed, a dry cow shed with some green feed fodder crop being grown. All animals were zero grazed, and the total stock on the property was eight milking cows and four dry stock. The effluent from the farm was processed through a biogas system imported from the United States and provided some fuel. All milk was sold to the local community and the proceeds were sufficient for a good income for the farmer and enabled him to provide an education for his children.

The whole farming operation was being promoted by the local extension and veterinary officers as a model farming operation where prospective and existing farmers are brought to observe the farming system being practised. The farmer was rightly very proud of his operation and the fact that he had developed it, having

taken advice from some of the local experts. He had a viable business and more importantly was providing his facilities for other people to observe disease control, effluent control, good livestock management and modern breeding techniques using imported genetics and artificial insemination.

Lake Victoria village

We visited a village on the shores of Lake Victoria. The village is home to 3,000 people on the shores of the lake where the men are mainly occupied as fishermen. We were able to gain access by arrangements established with our tour company and a very astute woman from the village. She was a trained teacher and had returned to help the local people.

The village had traditional mud huts for housing and some shops. There was no power, no reticulated water, no sewerage system and the streets were just earth. We were taken out on the lake by this woman and some of her helpers in traditional fishing boats to observe fish nets and to be told about life in the village. We heard about the ravages of drugs, AIDs and a continuation of the process of circumcision of males and in some cases of females.

We were told of how the men spent all their money on drugs and alcohol. In addition we heard how the women purchased the fish caught by the men, and then retailed it to people outside the village to provide an income for the community and to stop all the money being spent on drugs and alcohol. We heard about how this woman was endeavouring to set up a budgeting programme to ensure that the children had at least one meal a day but, most importantly, the opportunity to be educated.

She has now established a school for a large number of the village children, greatly helped by the proceeds from the tourist-related enterprise. Her objective is to have all the children educated to a level well beyond that which their parents experienced. The drive, ambition and results which she is achieving in this village, which historically appears to have been dominated by traditional values, has to be seen to be believed.

Reaping the benefits of growth

This brief observations of these examples of the initiatives of people helping themselves with some indirect help from tourists and people like our tour guide, provides some hope for the future. Helping them in the manner described appears to be a very good model to be followed. There were many more similar reports in the media during our visit and continuing to be recounted. Observations and recent reports indicate that the country is now creating better opportunities for people to get above that poverty level. Importantly, it would appear that the government is moving to protect the rights and opportunities of the 75 per cent of its population who live in the rural communities and are mainly dependent on traditional food sources for their sustenance.

I had set out to write some notes on land valuation and agricultural problems, but soon realised that the mathematics of the population distribution in the rural community and the challenges to traditional values indicate a vast problem for over 75 per cent of the population of Tanzania. A review of the land administration matters finds problems comparable in a number of ways to the historic ones which occurred in New Zealand, but where the dominant population was not the indigenous people as it is in Tanzania. In New Zealand new settlers quickly dominated, leading to problems which are now being addressed through the Treaty of Waitangi settlement process. Similar problems now appear to be being faced by the indigenous rural people of Tanzania.

A visit to an East African country like this provides an opportunity to gain a close-up view of its economy and the people and a better understanding of some of the development issues facing third world countries. As noted at the outset, Tanzania has substantial resources in agriculture and other assets and is considered to be the sleeping giant of Africa. It now appears that the government may have moved to limit to some extent land exploitation by international investors and sovereign states. More importantly it has recognised the effect that any such exploitation is having, and could continue to have, on large numbers of its rural population who have not had the benefit of the economic growth which has occurred in the economy over recent years.

Donn Armstrong operated a farm management and rural valuation consultancy in Pleasant Point, South Canterbury for over 40 years along with running his own farming business. He now lives in Christchurch where he continues to provide advice to private clients and government agencies on forestry land and Treaty settlement issues.

Jacqueline Rowarth

Leadership and governance in agriculture

Leadership has been deemed the skill of the decade. It is also becoming increasingly challenging, not the least because as soon as something goes wrong, everyone knows about it. Conventional and social media instruments have an effect and public opinion appears to be formed at least partly by weight of coverage. People are also eager to offer comment, whether informed or not, without considering the issues and alternatives. Being a leader is not easy, nor is being a director. Despite this, CEO of the Institute of Directors William Whittaker stated earlier this year that, 'Being a director is the most popular activity in New Zealand; there are about 500,000 legal directors.'

The problem is that many companies are not performing as well as they could. Across the country, Right Management's 2013 report indicated that although business leaders were more involved than ever, over two-thirds of non-managers were not, a significant increase since 2009. The survey revealed that the leadership skills required to create and lead an employee and customer centred culture were missing, and suggested that directors and senior managers were failing to understand the significance of their activities.

The consultants involved went on to say that their frustration was in finding that senior industry leaders think they are doing a fantastic job. The result was reported as a high level of complacency and rapid blame of others.

The Ministry for Primary Industries has calculated that New Zealand agriculture needs 271,000 trained workers to achieve the government's aim of doubling the value of exports from the primary sector by 2025. This means that involving staff as well as attracting new recruits is paramount. Leadership and governance together is vital in getting it right.

Leadership

Good leaders are creative people. They create visions which inspire others. They identify aims and establish credible strategies. They help others to put their skills and energies to achieving their objectives. This is known because leaders are the subject of considerable research and are themselves prolific writers on their theories.

Jack Welch, author of many books on leadership, summarises attributes for leadership as edge, execution, energy and energise. These four factors are in addition to the basic requirements of integrity and intelligence, which includes both mental and emotional intelligence. Edge, being ahead of competitors, requires knowledge of the sector in terms not only of its foundation, roots, development and potential, but also in what competitors are doing. It requires contacts and networks. With knowledge comes the ability to be innovative and creative and to see potential before competitors see the same opportunity.

The leader therefore must have the energy to execute the plan to make the potential a reality before anyone else does, and then energise the followers so that they are also committed. To do all this, a leader must have the experience to be able to 'walk the talk'. Trust is then inspired in the followers and they have confidence in the vision. Good leaders are passionate about the industry in which they are participating, and almost certainly this means they will have become involved in that sector early in life.

Failure the option

Leadership development programmes often fail to achieve what is required. In January this year the *McKinsey Quarterly* identified the reasons – overlooking context, decoupling reflection from real work, underestimating mind sets and failing to measure results. The bottom line is that a course cannot make up for real life experience.

For agriculture the problem is that the primary sector faces all the usual challenges of business, as well as those faced by dealing in export markets, the vagaries of the weather, pests and diseases, as well as long investment

and production cycles. Politics are also important, particularly around food security, as are perishability and food safety problems.

The complexities make it very difficult for people not experienced in agribusiness to make a difference. Andrew Oswald, Professor of Economics at the University of Warwick, made the point clearly – leaders need instinct. 'When you are sailing into the Bermuda Triangle, it is better to have a cussing tattooed skipper with a lifetime of salt water in rum-soaked veins than a reliable and charismatic captain who is a brilliant organiser, gorgeous figurehead and savvy harbour-party public speaker.'

Instinct is the critical factor in an unexpected situation, or troubled times. Instinct has also been termed common sense, and in addition to experience and judgement implies a practical way of understanding how problems are solved. It reflects knowledge and knowledge is a pre-requisite for creativity. The person who is knowledgeable about the sector has the ability to make changes, to react instinctively and appropriately, creating a plan to solve the predicament.

Where the buck stops

Leaders know that if anything goes wrong, ultimately they are to blame, so they work hard to ensure the chances of anything going wrong are minimised. In addition to the traditional attributes discussed above, increasing uncertainty and risk are complicating factors. Add crises not of the making of the leaders and the complications escalate.

A 2012 *McKinsey Quarterly* report focussing on leading in the 21st century suggests that to be able to adapt their company's strategy to the external crisis, good leaders create a culture of constructive scepticism and surround themselves with people who bring multiple perspectives and have no fear of challenging the boss. This is necessary at management level as well as governance.

A great leader will also ensure that other people have time to dream and imagine. Global leader in human resource consulting, Mercer, has published *Nine Rules for Leading Creative People*. Although there are theories about creative people being those in the arts, they are everywhere. The Mercer authors say that leading creative people is an art because they have certain attributes which run counter to various aspects of corporate life. However, managing that paradox effectively is precisely what unleashes the power of their contributions to their organisations.

The rules

Number one in their list of rules is to be wary of rules. Creative types are individuals and are found throughout organisations. Rule two is to find their motivators. The Mercer paper suggests that in general, creative people need praise and attention. Giving them what they need can be time-consuming, and employers might think that it is something which will change. However the point about creative people is that they are always striving to do better and push the boundaries. They need reassurance and encouragement.

Rule three is that they also need boundaries, but must be allowed autonomy within them. Creative people tend to respond poorly to unilateral and seemingly arbitrary orders to do something. Rule four is that titles are irrelevant – creative people respect the judgement of leaders who have demonstrated, and continue to demonstrate, that they themselves are capable of great work. Leaders of creative people therefore have to stay in the game to maintain the respect of their employees.

Rule five is that leaders of creative people have to 'ignore the rebellious rhetoric' and assume that 'sarcasm, disrespect for authority and a contrarian insistence on ignoring the rules comes with the territory.' The next few rules suggest differentiating between producers and prima donnas, treating them as people who should understand the business, allowing them to be individuals within a group and celebrating the challenge and the passion.

The problem is that remarkable employees ignore job descriptions, are eccentric, and they challenge the norm. They are likely to speak up when others will not because they really want the answer, or want others to hear the answer even though they know it. Perhaps most irritatingly, they like to be right. Self-motivation is often connected with a desire to prove others wrong.

Difficult as they are, it is the wayward people who add value in the workforce because they challenge the norm and develop the innovative approaches required for progress. This is particularly important in all aspects of agriculture because of the requirements of resource management and sustainability, as well as the fact that 'agribusiness is different'.

Leadership in the future

The 2012 *McKinsey Quarterly* report suggests that in addition to the timeless principles discussed, future leaders will need three more attributes. They must be able to –

- See with a telescope as well as a microscope for future vision and attention to current detail
- Compete as a tri-sector athlete for inter-sector teamwork
- Stay grounded during a crisis to show grit and resilience.

For younger generation leaders the first factor of telescope and microscope will require considerable attention. Younger generations tend not to have had rote learning and attention to detail as a requirement in their education because the emphasis has been on self-expression rather than spelling and grammar. They are likely to describe themselves as big picture people without

realising what that means or the implications in terms of missing detail. However, they have had a focus on team work during their education and are socially connected. Bringing these skills into leadership will help with their tri-sector performance, linking the private, public and social sectors.

Finally, the ability to stay grounded in a crisis will also require development. The literature is full of terms such as 'the cotton-wool generation' and 'helicopter parents', indicating that the young have been protected from the problems of life. Current leaders have grit and resilience because of what they have experienced in getting to where they are now.

Another challenge is the aspirations of the younger generations. Deloitte's research indicates that 90 per cent of people born in the 1980s to early 2000s want a leadership position but of these, 70 per cent want their own companies and only 20 per cent are interested in leading a large organisation. The challenge for the future is to build leadership within New Zealanders towards a common goal rather than have everyone doing their own thing, and allow that leadership to appear in governance as well.

Governance

The United Nations defines good governance as having eight major characteristics –

- Participatory
- Consensus oriented
- Accountable
- Transparent
- Responsive
- Effective and efficient
- Equitable and inclusive
- Follows the rule of law.

Good governance also assures that corruption is minimised, the views of minorities are taken into account, and the voices of the most vulnerable in society are heard in decision-making. It is also responsive to the present and future needs of society. Participation must be informed and organised.

The purpose of a board is therefore to use the diversity of directors' skills and business networks to maximise long-term sustainable financial returns to shareholders. CEO employment is another important role, as is the leadership that the board provides around the vision, mission, business plans and ethics of the organisation. The first duty of the board is to the company. The same applies to the CEO and management. The board appoints the CEO to run the company successfully, with the assistance of senior management, within the agreed framework.

Liability a deterrent

Pita Alexander, who is a specialist farm accountant and commentator, has said that all businesses are getting more complicated and increasingly should be focussed on targeting optimal production. What is optimal for the leader, however, might be beyond the capabilities of staff, but it is the leader who is under fire. In a company the board of directors is also implicated when something goes wrong. Equally, for a company, directors should not say that operational matters are someone else's responsibility. They are liable for finance, health and safety – there is a case of extension of liability to matters which affect the reputation of the company. The problem with this approach of liability is that it will deter people from becoming involved.

New Zealand companies need people who are knowledgeable, forward thinking, and have all the skills and attributes identified in leadership. These people are also likely to be the type who push the limits, and sometimes go over them. Knowledge is important, and knowledge which underpins the business being governed and experience in that business is vital for good decision-making as well as credibility.

Conclusions

Right Management reported that people in leadership do not understand that they are responsible for creating the organisation's culture and the culture they create is reflected in the attitude and involvement levels of the people who actually do the work. The board appoints the CEO and so is responsible for culture at the top.

However, good leaders do far more than govern and manage. Real leadership inspires people to follow the vision, and the credible vision will be created only if the leader knows the industry. To help top people to want to become leaders in governance and management in agriculture and agribusiness we need to be considering how best to create pathways of excellence. We also need to be challenging the norm.

Changing times and new goals mean fresh thinking. It should also mean action. All current directors should be scrutinising themselves for the value they add to a board, while checking the risks inherent in their own activities. They should also be thinking about the leadership within their organisation, and ensuring that this leader is allowing others to develop their leadership abilities with a view to the future.

For the primary sector, land and labour will continue to be very important, but to go on creating wealth we need new thinking. Shimon Peres puts it clearly – the mind of a leader must be free to dream and imagine. This applies to agriculture just as in other industries, but agribusiness is more complex and so requires even greater thinking.

Jaqueline Rowarth is Professor of Agribusiness at the Waikato Management School, University of Waikato in Hamilton.

Profile

Nicky Hyslop

Nicky grew up on an intensive high country property, Clayton Station at the top of the Fairlie Basin, and always had a strong desire to be involved in agriculture. Her parents, Andrew and Ruth Orbell, involved their three children Nicky, Hamish and Phillippa in all aspects of farming, including the challenges of farming in the 1980s.

Clayton Station was developed aggressively, pioneering many farming practices which are mainstream today such as subdivision of hill country, direct drilling, artificial insemination programmes for sheep and cattle, as well as live export of lambs and deer farming. It was being part of a farming family with a drive for increased production using new technology and management changes that became an important building block for Nicky to develop in her career.

She was initially keen to pursue a veterinary degree at Massey University in Palmerston North, but was not successful in being selected after the first year. Cross-crediting papers into agricultural science so that she could continue to reapply for vet school was a first priority. However, the increased focus on a broader base of farming systems, not just animals, appealed to Nicky. Her parents had always worked with farm advisors on Clayton. The profession where the integration of soil, animal, agronomic science, financial systems, capital structure and ultimately working with people on the land, really took shape. She finished Massey University with a Bachelor of Agricultural Science (Hons) in rural valuation and farm management.

Starting as a farm advisor

Nicky's first job as a farm advisor was in 1995 with Baker & Associates, specifically David Baker and Chris Garland, in the Wairarapa. She was given the opportunity to launch Wai Tech, a monitor farm programme, which went on to be developed into the firm's pastoral monitoring system, and had regular input into their other flagship publication, the *Ag Letter*. She credits her time at Baker & Associates for helping to develop her facilitating ability and the base skills required for farm advisory work. Her focus was the sheep, beef and deer sectors, on intensive and extensive hill country properties.

In 1996, she left for a seven month trip overseas and on returning her parents offered Nicky and her partner Jonty Hyslop the opportunity to move south and manage an intensive finishing farm, Levels Estate. This is a 220 hectare sheep, beef, deer, arable property which started with 26 hectares of border-dyke irrigation. Recognising that the property's ability to be economic was limited due to scale and vulnerability to summer dry, over a two year period starting in 2001 it was converted to spray irrigation. At the same time the opportunity came to purchase Levels Estate, with help from both their families, and this was settled in 2003. They now have three daughters and value being able to raise a family in a strong rural setting.

Farm management consultant

In moving to South Canterbury Nicky continued her career as a farm advisor, initially working for Tavendale & Co in Ashburton and in 2009 joining Macfarlane Rural Business, also based there. Nicky has gone on to work with them for 16 years, with 10 as a shareholder. She feels they have been an outstanding team of people to work with, as they continue to push for more efficient farming systems while helping farming families to grow their businesses.

In 2013, Nicky resigned as a farm management consultant with Macfarlane Rural Business to spend more time for family and her own farm business. Nicky still contracts her services back to them while she completes projects for industry technology transfer programmes.

Lifting production and profitability

Her work as a farm advisor over the last 20 years has involved one-to-one client support offering advice on

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business structure, asset growth and technical support. She has also been heavily involved in facilitating discussion groups and industry monitor farm programmes in the sheep, beef and deer sector. These have provided valuable experience for the main common factors which influence production and profitability. She feels that as an industry we must continue to lift production and profitability as enterprises compete for land use with other alternatives and inflation lifts cost of inputs.

Focus on irrigation

Nicky and Jonty's first-hand experience of the value of water in their own farming business and surrounding community has focussed her attention on irrigation and her directorship roles reflect this focus. She believes that water is a fundamental resource for all New Zealanders, but that while we have the luxury of an abundance of water it is not always in the right place and at the right time. Water storage can provide the opportunity to help with this and farmers who can then irrigate are only one of many beneficiaries of water storage.

In her view, surrounding communities and the service industry benefit immediately and the wider New Zealand public also benefit from viable farm businesses significantly contributing from a range of existing rates and taxes. Farming practices must work within the environmental framework set to minimise adverse effects.

It is the setting of the environmental frameworks that she recognises as one of the biggest challenges which New Zealand communities face in the next five years. Many in Canterbury are working through this with the Canterbury Water Management Strategy. She is a strong believer in local communities pushing for local solutions and sees the strategy working towards this. Her experience with the Opuha Dam is a good example of how local community and stakeholders can come together to find economic, environmental and recreational solutions.

Irrigation continues to be a personal focus because Levels Estate has had further development in the last 12 months, with older spray irrigation systems replaced with a linear irrigator and two pivots. Nicky says that the confidence to reinvest heavily in their property has only come about due to significant increases in production in the last 10 years, seeing water as a way to achieve their business growth, and to focus on using water resources as efficiently and effectively as they can.

Nicky is passionate about South Canterbury and rural communities. Having experienced the production opportunities first-hand, and the effect on the wider community of investment in water storage, she is committed to sustainable irrigation and strong communities. New Zealand, in Nicky's opinion, has an abundance of water, which gives the opportunity for positive economic, social and environmental results for the country. To achieve this we need good leadership, investment in research and development, smart marketing, industry collaboration, and farmers willing to take up new technology or change management. This will lead to increased production and profitability.

Governance roles

One of Nicky's other areas of interest has been in governance. In 2003, she was approached to become a director of Levels Plain Irrigation Company and in 2006 was elected chairperson. In 2006, she became a director of Opuha Water Limited, of which Levels Plain Irrigation Company is a shareholder.

In 2009, she was elected as a director of Irrigation New Zealand and in 2011 deputy chair. She also has governance roles on several farm business boards. Nicky is looking forward to growing her governance experience and career in the future.

Nicky's challenge in the future is to balance her ambitions to continue to contribute to the agricultural sector with a young growing family. There is also the continuing challenge of running a farm business with her husband Jonty.

From the CEO

Increasing need for support services

On 6 June *The Future capability needs for the primary industries in New Zealand* report was released. The report provides an outlook of future workforce requirements for horticulture, red meat and wool, arable, dairy, seafood, forestry, other primary industries and support services. The report also outlines workforce numbers from the wider New Zealand primary industry using data from the last three censuses. A forecasting model was then applied to project future workforce numbers for the sectors over the next 10 years.

The report shows that the number of people employed in support services within primary industry is rising. In 2002 this number was 82,343 employees, rising to 106,902 in 2012. The forecasts are that the number of people employed in support services is expected to increase to 127,430 by 2025 under a business as usual option, representing 34 per cent of the primary industry workforce.

The census data is very broad and it is difficult to obtain specific detail on the rural profession, but it does illustrate a growing employment trend within the support service area. This trend is backed by what we are seeing in the field, with increased services offered to the farming community by specialist providers within the rural profession. This reflects increased scale and sophistication on the farm.

The report also makes a direct reference to the increasing need to build capability for individuals with knowledge of integrated farm systems. This is to help implement innovative and productivity improvements on farm. There is also greater focus on the management of our natural resources and in meeting food safety requirements.

In this respect the report mirrors conclusions drawn from the Ministry for Primary Industries earlier publication *Survey of Technology Transfer Services to Farmers and Growers in New Zealand* published in 2013. It is widely acknowledged within the membership and our main stakeholder groups that more must be done to support the development and capability of the rural profession in the face of increasingly sophisticated and technical advanced farming systems.

The question is, how can we build the capability and capacity across the rural profession to meet the increasing demand for effective and leading edge professional advice by the farming community? From my perspective this requires more meaningful discussions with tertiary providers, industry and government agencies to come up with a clear picture of what the aim is and the respective roles each play in expanding the talent base and considering a career in, the rural profession. In this respect the NZIPIM and its members have a critical role to play in raising the discussion in how we can build the capability of the rural profession to prepare and address the many challenges for the farming community in the years ahead.

Stephen Macaulay