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Primary Industry Management



THE OFFICIAL JOURNAL OF THE NEW ZEALAND INSTITUTE
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NZ Institute of
PRIMARY INDUSTRY
MANAGEMENT

WARDLE'S NATIVE TREES OF NEW ZEALAND and their story

Written by John Wardle
Photographs by Ian Platt

Over 400 pages, A4
300 full colour photographs, hardback \$95



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Wardle's Native Trees of New Zealand and their story is a book that anyone interested in trees will want to buy and read. There is no other similar book available on New Zealand native trees.

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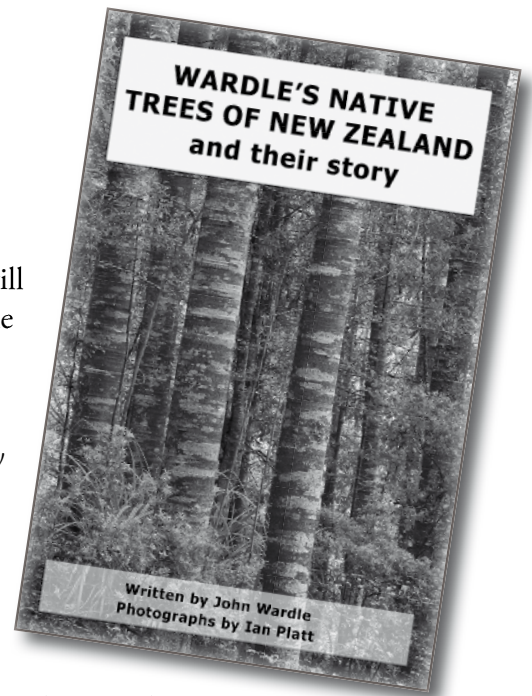
There is detailed geographic distribution along with the types of site and plant associations in which they are normally found. Information is also provided on propagation, establishment and the potential for planting.

The author of *Wardle's Native Trees of New Zealand and their story* is John Wardle who has spent many years working on the text. The majority of the photographs have been taken by Ian Platt who spent almost as many years travelling throughout New Zealand to find just the right specimens at the right time for the photographs.

The NZ Farm Forestry Association and the Indigenous Forest Section of the NZFFA are the main funders of this book. Sales of the book will be used to raise the profile of native trees and of the NZFFA.

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This book will be available for sale in October for \$95. All proceeds from the book will go to the NZFFA.



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To order a copy of the book send this form or a copy to NZFFA, C/o BPL, PO Box 2002, Wellington or telephone your order to 04 385 9705. Delivery will be in October

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Nico Mouton

Crucial to agriculture and New Zealand's wealth

This issue of *Primary Industry Management* covers a range of topics, many of which are crucial to agriculture and New Zealand's wealth. These include water harvesting and various schemes to manage irrigation systems, well thought out farming processes and performance, the contentious issue of the ETS and improving the governance of agricultural businesses.

In addition, more coverage of IFMA 2011 Conference papers and a feature on Hawke's Bay an area synonymous with large scale pastoral farming and spectacular iconic New Zealand landscapes.

Natural disasters are an inherent risk to agriculture and we have been warned by various climate experts that the degree of weather events and their severity, be it drought, floods, dramatic temperature changes, may well increase in the future. In recent weeks, we have seen extreme winter weather conditions, large snowfalls after an apparent lack of snow in the South Island, and a record low temperature in Auckland.

The description of the extreme events which occurred in Hawke's Bay in April, with dramatic high rainfall amounts in a very short time and the damage to a specific area, highlight the variability of climate.

The April 2011 Hawke's Bay storm clearly highlights the effect on a small area of land and a specific site. The storm was similar to Cyclone Bola in 1988, but not as wide ranging, although rainfall was similar in intensity. Rated as well over a one-in-hundred year event it showed the vulnerability of the landscape and soils in that specific location. Effective responses from the East Coast Rural Support Trust and the MAF Adverse Event Process has shown its benefit, with both governmental and community assistance to the affected properties and communities.

Learning from disaster

The main issue, however, is to understand and learn from these problems so that a property and area can be better protected from extreme weather in the future. In this case the opportunity exists for extending forestry areas. Land which was forested during this storm suffered less damage on the steeper parts of the properties. The added benefit is that there may be some carbon trading benefit. The ETS scheme for areas in forestry to further enhance and sustain highly erodible East Coast soils will be an advantage for

producers.

It is an excellent opportunity to re-evaluate the farming business on highly erodible areas and those properties in locations of high rainfall, with flooding risk, snow damage or other. Farmers who have gone through this process, and agricultural professionals who have worked with the farming community in these areas, are succeeding in mitigating damage and loss when these events occur.

Water storage

Highlighted in this issue of the journal is a specific water storage scheme in Hawke's Bay showing the importance of developing a scheme of storage rather than run-off river water extraction for irrigation. Water management and water harvesting has become one of the main features exposing agriculture to the general public, as river water is used and the catch-cry of rivers drying up due to irrigation is made.

The Green Party recently issued a policy covering the next five years to clean up the water courses in New Zealand and the terminology of dirty dairying has been hard to remove from the vocabulary. However, there are excellent remedies and options available and a less litigious process is encouraged to work through a scheme as highlighted in the Ruataniwha storage scheme. Water storage schemes are also being considered in the South Island.

It was recently reported that in the UK, following 25 years of river care, that otters are now present in every county of England. In the early 1970s otters were nearly extinct, proving that agricultural can live within normal bounds, control its effluent and discharges successfully and still maintain a viable business around water management and river management.

Forward thinking

An enlightening example of forward thinking is by Sam and Hannah Morrah on a property at Ohinemuri. It shows what well-educated, clear thinking farm operators can achieve with an integrated sales programme, marketing their lambs through the Marks & Spencers supermarket in the UK to provide specific lambs to a specific market requirement. They show they are adaptable to farm practices to meet criteria required by the market, but they make a profit while having a sustainable business in all senses, including the management of land.

They are open to further learning and the business has come through a severe dry weather period and a global recession. They are great promoters of a future view and make the point that there is intransigence in the meat industry which requires a change to new leadership in an important sector of farming in New Zealand.

New technology

Technology in the form of robotic milking and the use of technology to remove the burden and process of milking cows has now been fully commercialised. It is a key farming system in many European countries, specifically Holland, Denmark and parts of the UK.

Initial trials were carried out in New Zealand. The trial farm has now closed down and some operators have taken up the AMS system. A useful example is John Fisher of Cambridge, who recently converted to an AMS system. Managing the grazing is the key in the New Zealand grazing and Australian pastoral systems and a good resource of information is now available via Dairy NZ showing the options .

The ETS

This journal has previously reported on the ETS and agriculture be liable for its first payment to the ETS in 2015. The article by Tony Rhodes clearly highlights that, in many Western European countries, there are schemes and support available for on farm energy mitigation and greenhouse gas mitigation schemes. However in New Zealand there is little support from a farm perspective to manage the reduction of greenhouse gases and energy.

The point of obligation for agriculture has been agreed as being the processor and most farmers will most probably see a charge from their processor, be it milk, meat or other agricultural product, in their monthly or annual returns. However this will benefit the individual farmer who is more innovative in reducing his greenhouse gas output profile by additional afforestation, higher performance or other on farm systems.

The ETS has both detractors and promoters and all members of the NZIPIM need to follow this debate carefully as it evolves because the scheme will go through some amendments. It is unusual for agriculture to be included, especially for an agricultural production country as New Zealand, as in most other countries carbon emissions are mainly industrial as opposed to agricultural.

As John Paul Pratt points out, New Zealand is currently carbon positive, but this will change as more forest harvesting ramps up from 2020 onwards. The carbon market needs to

develop and needs to be at a sensible price to encourage afforestation rather than reversion and removal. Trading schemes for carbon will vary between countries and as pointed out, there will be no particular universal scheme, but within-country schemes.

The debate as to 'Does agriculture require to be within the ETS or not?' appears to have been made. It is important that good advice is given to the farming community from NZIPIM members around models and options which are laid out in this journal so that farm owners can clearly make a call as to how to manage and offset their carbon emissions. No doubt with lobbying, there will be some changes, but essentially the ETS scheme is here to be worked with in some form or other.

Governance strategies

Farm business governance is becoming an important feature, as the family farm becomes corporatised and scale of farming increases. Interesting observations are made by James Lockhart and they show that we are behind in agriculture in having clear, thought out governance strategies in the farm boardroom.

There is an interesting discussion around the independence of a board of directors in that by default, existing advisers, accountants or others are used, and this may not be to the benefit of the farming business. Therefore true independence is an important role in successful governance of a large scale farm business.

The PKW incorporation is a Maori incorporation showing how, as a result of many changes, they are now a substantial milk supplier to Fonterra in Taranaki and it has vision of an enduring, large scale farming business to benefit its beneficiaries. There are many Maori incorporations beginning to manage their land assets for the long-term, and even involved in the further processing of product, as evidenced in the recent new dairy start-up company Miraka near Taupo. Large scale Maori incorporations will be a feature of land management in New Zealand in future and members of the NZIPIM are involved in helping the successful development of this process.

The value of food production is increasing, resulting in good returns for most sectors of the pastoral industry. As a result there are excellent opportunities for farm businesses to improve their environmental footprint, manage environmental risks and think through technologies and plans how to better manage their business as they scale up and become more complex, associating themselves with competent external advisers .

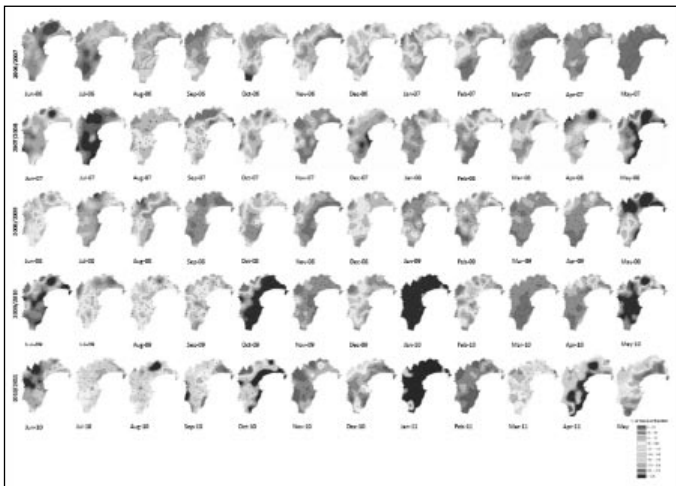


Land Management Team, Hawkes Bay Regional Council

Hawke's Bay overview

The last five years in Hawke's Bay have been years of extreme contrast. We have had at least three droughts and another very dry autumn, exceptionally heavy rainstorms and now snow for the third time in as many weeks. We have had a number of small earthquakes, nothing by Canterbury standards, and several tsunamis. Coupled with this we have seen the sheep industry go from unprecedented lows to unbelievable highs. In contrast the grape industry has done the virtual opposite, and the dairy industry has had its share of volatility as well. This article is about the climatic effects we have been experiencing and how they have affected our primary industry and what the long term ramifications may be.

Hawke's Bay Regional Council maintains an extensive rainfall and climate station network. The data that has been compiled from this network over the last four to five years is very revealing. It shows that while we have had very dry summers we have also had very wet months within these summers. The most dramatic contrast has been to last summer which had extreme rainfall deficits as well as extremely wet months. This is exactly the pattern that climate change scenarios predict.



Rainfall summaries for the Hawke's Bay region 2006 to 2011
Dark = wet, light = dry

Extreme rain

At the end of this summer parts of Hawke's Bay were hit by an extreme rain storm that dropped between 300 and 600 millimetres of rain over 48 hours on quite distinct zones on the southern coast and north of Wairoa. These exceeded 1 in 150 year events in those areas. They caused localised but severe damage to hillsides and infrastructure. More information about the effects of this storm is in the

following article on page 5.

The wet weather was hard on the people affected as they were looking to recover from a series of droughts and enjoying the current prices when they were hit hard again. But true to form they have regained focus and are busily replacing the infrastructure that they can.

It has happened before in Hawke's Bay. This part of the country can lay claim to owning over half the top ten places for national heavy rain events. There was the 1924 flood where 512 mm fell at Rissington in 10 hours, the infamous 1938 Esk flood where 1000 mm fell over three days. Of course in recent memory the Bola storm saw 400 to 900 mm fall over different parts of Hawke's Bay during a three to four day drenching.

The staggering thing about these numbers is they occur in a region known for its droughts and they can compete with the best of the west coast. The 1938 storm stimulated the formation of the soil conservation boards. These boards have led to the planting of tens of thousands of hectares of trees in order to stop soil erosion. Looking around the damage from the Easter storm it is apparent that, where this has been done early enough, it has been largely successful. This begs the question as to why it is not more widely implemented.

Soil loss

The 2004 'Growing for good' report quite elegantly states the state of play with soil loss in this country. 'New Zealand loses between 200 and 300 million tonnes of soil to the oceans each year. This rate is about 10 times faster than the rest of the world, and accounts for between 1.1 and 1.7 per cent of the world's total loss to the oceans, despite a land area of only 0.1 per cent of the world's total.'

The 2009 Royal Society report *Reaping the Benefits* shows that this issue is not unique to us. In fact it could be said that due to the young age of our country, we have not

yet degraded our soils to the same extent but at the current rate we most surely will.

The cost of these storms is large and will continue for some time. It will be difficult to know the true cost until the affected have had a chance to get everything repaired and then take stock. The financial capital cost will be a heavy burden for most in the short term. The Esk storm had a 2006 dollar cost of \$16 million and Bola had a comparative cost of \$173 million. The long term cost in relation to the loss of natural capital will be intergenerational.

Adaption to change

World wide the cost of weather related disasters are massive. German insurer Munich Re has released figures on natural disasters in 2010. Amazingly 90 per cent were weather related. Total damages were \$130 billion. A recent study by the American National Centre for Atmospheric Research found that every sector of the economy and every state are sensitive to changes in the weather. No surprises there. What is mildly surprising is that they put an initial estimate of \$485 billion on weather variability. That is as much as 3.4 per cent of GDP – which would be quite handy right now.

It seems obvious to us that the way we have been viewing our landscape and the type of utility we demand from it is short-sighted in the extreme. With our national economy dependant on the primary sector, the rate of soil loss and infrastructure damage is debilitating. It would seem that we have structural inadequacies within our primary sector that does very little to demand improvement.

There has been much debate around the notion of climate change and the need for adaption. With support for both sides the argument is equally as boisterous. However it would seem that given the damage we have been experiencing from extreme weather and the fact that they

have been happening since we started farming, it seems that the argument may be missing the point. Is it that the people who are resistant to the notion of climate change are also the same people that cannot see that the current farming systems and structures are failing us?

Long term solutions

We at the Hawke's Bay Regional Council are working to try and understand those systems better and to develop real long term solutions to soil loss and systems failure. It is quite simply unsustainable for a region which is so dependent on primary industry to absorb the massive swings in GDP which we experience from climate variability. We see enormous economic benefit in trying to mitigate or avoid our exposure to climate variability as it removes a major source of variation our international competitors are increasingly exposed to. From greater economic stability we start to develop more enduring solutions around the environment and society.

One of the major projects we have developed in conjunction with the Sustainable Farming Fund, Landcorp and Hatuma is the Huatokitoki catchment group. This project is about trying to understand the natural capital we have and how we manage it. It is concerned with the ability of an entire community to understand and address problems at the catchment scale. This is enabling us to ask questions around community governance and externalities that we have not been able to in the past. At its core is how we can make a larger and more consistent income from this land and what needs to happen at the farm scale to achieve this. There can be little doubt that the systems which have got us this far will not be the systems that serve us in the future, the methods and attitudes we use to transition will be a source of fascination for a generation.



Gillian Mangin

Effects on farming in the aftermath of the Hawke's Bay coastal weather bomb

There was intense rainfall of over 450 mm in 24 hours, and more than 600 mm in 48 hours on the two days 26 and 27 April 2011. It caused extensive slips and flooding damage to a coastal strip from Blackhead Point to Cape Kidnappers and north of Wairoa to Nuhaka and Mahia Peninsula. More generally, coastal areas in Hawke's Bay had between 250 and 400 mm of rain over the two days, the equivalent of a quarter to a third of their annual rainfall. Approximately 110 farms were estimated to be affected to a significant degree.



The worst affected area was north of Porangahau Beach centred on an area around Aramoana, Pouterere, Kairakau and Waimarama. Landcorp's Te Apiti Station of 2,000 hectares, just south of Waimarama Beach, was among the properties most severely affected by erosion of steeper hill country. The torrential water flows formed incised gullies on the property. Beach settlements along the coast were inundated with flood waters and silt, along with slip debris as the rain sluiced hillsides behind them.

Worse than Bola

Locals indicated that the effect of the event in this area was worse than Cyclone Bola in 1988. However that was a much wider disaster affecting more than 1,700 farms in Gisborne and Hawke's Bay. While Bola's total rainfall in the hardest hit areas exceeded that of the April storm, the intensity of the rainfall was similar. Bola's heaviest fall in 24 hours was 417 mm, which was on par with the 432 mm rain recorded at the Waipoapoa meteorological station just west of Te Apiti Station.

Along the central Hawke's Bay and Hastings coast this was rated as well over a one-in-100-year event. At Waipoapoa

the rainfall was almost 50 per cent higher than the 24 and 48-hour rainfall values for a 100-year event.

Much of the damage resulted from a doubling of the rainfall intensity on the night of 26 April. This was due to a low-level south-easterly flow combined with warmer high humidity air coming from the north. These low-level rain clouds escaped the rain radar system. The air movement was stalled for a time as the large high-pressure system to the south was blocked by low-pressure systems to the north.

The MetService has looked into the conditions that led to the high rainfall right at the coast. They determined that there was an unusual barrier jet flow that the south-easterly had to climb over acting like a virtual range of hills east of the coastline. This made the storm unusual and hard to predict for the central Hawke's Bay coast compared with northern Hawke's Bay.

And an earthquake

Locals are also adamant that the 4.6 magnitude earthquake on 26 April during the storm, at a depth of 24.5 km and just



off the coast at Pourerere, contributed to the massive slips on some of the steepest hillsides. It had been preceded by 5.2 and 3.6 magnitude quakes near Porangahau on 11 and 14 April. The area is well known for being seismically active due to tectonic plate movements, and is particularly susceptible to erosion due to the underlying soft rock geology.

Land slippage and flooding caused significant problems on coastal farms in three districts, affecting about 50 farms in Wairoa and 60 in Hastings and central Hawke's Bay. Farms at the centre of the rain bomb lost upwards of 40 per cent of their pastures in steeper paddocks, and access to much of the remaining pasture will be hampered by slips.

Slips and flooding also damaged fences, access tracks, yards and water supplies, and cut power. Restoring boundary fences in the worst affected areas was the first priority for the recovery effort, followed by fixing internal access and fencing. Many farms were left with only a few very large paddocks which remained stock-proof.

The adverse events framework

In terms of the government's adverse events framework, this storm was rated somewhere between a small to medium-scale event. This terminology relates to the regional effect and the community's capacity to cope, rather than the severity of

effect on particular farms. Farms in three districts suffered damage and resulted in the Minister declaring a medium-scale event in terms of MAF's matrix used for estimating severity. The medium-scale event declaration also provided MAF funding for the East Coast Rural Support Trust to appoint additional recovery facilitators to make contact with farmers, to assess the nature of damage and to coordinate recovery work.

The response

The East Coast Rural Support Trust responded as soon as the significance of the damage became apparent. Digital photographs and You Tube clips enabled a lot of people to gauge the severity of the effects quite quickly. In addition, GIS capabilities and FarmsOnLine data about landholdings allowed MAF to assess the number of farms likely to be affected, as well as the land area and numbers of stock. Facilitators and Hawke's Bay Regional Council staff contacted all affected landowners within a couple of days and offered assistance.

MAF's adverse event funding also contributed towards the costs of a seminar which was put on within two weeks of the event. This provided technical advice, for example about the costs and benefits of reseeding slips, and sharing



the experiences of farmers who had gone through Cyclone Bola. One farmer recently commented that a main message he had received was that the disaster created an opportunity to make changes that would leave a farm in better shape than before the storm. In planning his recovery programme he had taken that advice and moved fencelines and gates, and he now believes that the farm will be more workable in the future.

Complex programme

Work and Income staff helped with the preparation of an application for Enhanced Task Force Green. This had to be coordinated between three district councils and the Hawke's Bay council. The latter assumed the role of employer and paymaster for five teams in Hastings and central Hawke's Bay, while Wairoa District Council undertook those roles for three teams in the north.

The programme was costed at \$500,000. A larger scheme would have required Cabinet approval and would have taken longer to put in place. The programme provided for eight teams of six workers to be employed for 12 weeks on the clean-up. The budget included kitting out workers in appropriate gear and providing equipment and rental vans for transport.

The biggest task in Hawke's Bay was coordinating assistance both via scheme workers and groups of volunteers. A range of donations were received, both in-kind and in cash from individuals and organisations, including \$10,000 from each of the Hastings and Central Hawke's Bay District Councils. These were targeted towards fencing materials and resources such as small diggers to help clear stock-yards and fencelines of debris, speeding up the amount of work the teams could do in the clean-up. It was expected that much of the work would be clearing fencelines and erecting temporary waratahs and netting fences.

Although this has occurred, the farmer volunteers and the gradually upskilled Enhanced Task Force Green teams have been able to re-use fencing materials and make more permanent fence repairs in many places where the land is not continuing to move. The training that the workers received on the job has seen a number being placed in work.

Farmers have also been pleasantly surprised by the quality of the workers and have been encouraged to work alongside and get to know the teams on their farms. One farmer commented that he believed working alongside the teams had definitely increased their productivity. Having other people helping the farmers repair damage had also contributed to the morale of farmers.

Encouraging response

The community response to this event was particularly encouraging. Farm supply companies arranged for material to be donated by non-affected farmers and some also supplied items such as seed at cost. Banks and other firms with rural connections organised for teams of their staff to volunteer in the clean-up, as did local schools and the

Smedley farm cadets. Farmers from other districts also arrived to help.

Much of the area was particularly badly affected by droughts in 2007 to 2010, but up until this event the region had been enjoying a very good autumn. The rest of Hawke's Bay welcomed the steady but much lower rainfall, which ensured a record autumn pasture growth for many. This enabled farmers from other areas to offer help to those worst affected with labour, supplementary feed and grazing of capital stock.

Despite the event having worsened significantly and unexpectedly overnight on 26 April, catching many farmers unprepared in terms of the threat to stock, surprisingly few animals were lost. Those that were lost were mostly swept to sea. Following the storm, affected farmers reacted quickly, in view of the approaching winter, to move a proportion of remaining capital stock off to grazing, sell trading stock early at good prices, or halt plans to bring in replacement stock for wintering. Closed roads meant that some of the stock had to be moved some distance over land. Excellent weather in the three months following the storm limited stock losses in slips, but farmers commented that stock were quite spooked and took several weeks to settle down.

Building future resilience

The sort of rainfall received in the relatively confined area is beyond the capacity of even natural systems to cope with, as evidenced by the damage to native bush on some of the steep hillsides. Lone, mature cabbage trees also succumbed in places. While native or exotic trees can make slopes more stable, they cannot provide total protection. In general, the evidence in this area is that land in either mature pine trees or space-planted willows and poplars suffered much less damage than neighbouring pasture land.

However, the event has focused farmers further on the need to create more resilient farming systems and do what they can to protect the land. Possibly around a dozen of the affected farms have significant areas of severely damaged farmland which would benefit from concerted tree-planting, either as forests on steeper country or space-planted trees in pasture with vulnerable gully systems.



More forest planting

It is understood that forests, totalling 600 hectares and 150 hectares respectively, will soon be planted on two of the farms badly affected in this event. Te Apiti Station was already planning to retire some 300 hectares into radiata pine and is understood to have doubled the area to be planted. It is also considering hydro-seeding manuka in some areas. Forestry and carbon investing firms are also understood to be looking for opportunities to plant trees on some of the farms.

In most cases, access is too difficult and conditions are too wet for planting this year and there is a shortage of pine seedlings. Hawkes Bay Regional Council has also exhausted its supplies of poles for soil conservation plantings this winter. There is likely to be a rethinking of land use in the area, similar to that which followed Cyclone Bola.

In the longer term, it is expected that these farms will tend to move to lower stock carrying capacities and towards a greater mixture of pasture and trees. The stretch of land 5 km wide from Porangahau to Cape Kidnappers contains around 65,000 hectares of land, estimated to farm 340,000 sheep and 35,000 head of cattle, or around half a million stock units. The worst damage in terms of erosion is probably in the area within a couple of kilometres from the coast, and if 20 per cent of that was retired, then around 35,000 stock units might be displaced.

Reducing future losses

The farms in this area are generally large and extensively farmed. This makes it easier for them to adapt in the sense

that they have more scope to manage change within their wider operations. Putting more resources in terms of fencing and fertiliser into the land more suited to livestock might enable them to minimise the reduction in stock units and production from retiring the steepest and most eroding hill country. At the same time it will reduce future losses on other land downstream. In addition, the potential to earn carbon credits or access the Afforestation Grants Scheme, or something similar, to cover the costs of planting trees makes forestry more attractive on this marginal country.

A number of farms in the area already have pockets of forestry and spaced poplar plantings. With recent droughts, establishing poles has been difficult. Research shows that spaced poplars take around seven years to become sufficiently established to make a major contribution to slope stability. It is also apparent that in severe events such as this, newly established forestry blocks younger than around three years are at great risk. This is possibly because the excess pasture growth allows the soil to hold a lot more moisture. Similarly, newly harvested forest land is at risk of erosion, and in this storm forestry blocks contributed a lot of slash to the floodwaters, exacerbating downstream issues.

In at least one instance, harvested logs waiting to be removed were swept away, causing significant damage to bridges. Bridges were also affected by other large trees near waterways falling over.

Managing large poplars planted many years ago for soil conservation purposes has become an issue for the region and some farmers have begun to pollard them for stock fodder



in droughts. However, such pollarding is probably better started when the trees are much younger as it is relatively risky cutting old poplars for fodder. Care also needs to be taken not to cause the tree to lose its effectiveness in reducing erosion by cutting it too often or at a height that allows cattle to eat regrowth.

Sustainable land management

Following the major North Island flooding in 2004, the government directed MAF to lead the development of a long-term programme with local government in order to promote sustainable land management. This decision recognised that the resources required to adapt management practices on vulnerable land were, in many cases, beyond the capability of regional councils. The compounding effects of erosion on-farm and downstream have a significant financial and environmental cost for communities.

This initiative led to the establishment of the Sustainable Land Management (Hill Country Erosion) Programme, a partnership between central and local government to target erosion-prone catchments. The objective of the programme has been to produce a long-term shift in management practices within vulnerable catchments. Regional councils, working with landowners, can apply to the programme for financial support for mitigation initiatives.

The programme is a targeted intervention, which requires matching contributions from councils and landowners. The programme incorporates the concept of total catchment management. Changes in the upper part of a catchment to prevent erosion can improve the environmental results in the lower reaches, such as reduced flooding and siltation.

The programme is currently helping five regional councils to modify land management practices in erosion-prone catchments. It also supports the national poplar and willow breeding programme's research into the development and release of new versatile poplar and willow cultivars for protecting erosion prone soils.

Two initiatives

The Sustainable Land Management Hill Country Erosion Fund is currently helping with two initiatives in Wairoa

designed to identify and promote best land-use including minimising erosion. The Wairoa sediment reduction initiative targets the development of erosion control plans and the planting of poles for soil conservation on 400 hectares of land, along with retiring around 100 hectares of land including native areas and through using the Afforestation Grants Scheme.

A catchment help project involves contacting farmers in the Whakaki, Nuhaka, Kopuawhara and Ruakituri catchments and setting up groups to establish what they could do. A number of trials and demonstrations have been undertaken by these groups, including controlling the growth of older trees and species trials on slip scars.

The need for new and more innovative ways to manage New Zealand's physical resources in the face of climate change is recognised in the government's plan of action for 'Sustainable Land Management and Climate Change'. The initiatives within the plan are to understand and tackle the effects of climate change, adapting to those changes, reducing emissions and enhancing forestry carbon sinks.

The government is working with sectors under the plan of action on –

- An adaptation programme to help the land-based sectors to address the risks and opportunities arising from climate change
- A range of measures to complement the Emissions Trading Scheme
- Strategic research to underpin the plan of action.

The plan will help landowners with management tools, improved technical resources, and help to better manage the effects of climate change. This includes taking advantage of emerging opportunities.

The apparent increasing frequency of adverse events like this recent storm suggests that more may need to be done to encourage farmers to consider how resilient their farming systems are to both intense rainfall and drought. Recent increases in tree planting are likely to have been encouraged by improved profitability of sheep and beef farming, as well as farmers considering their options for forestry in the Emissions Trading Scheme.

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Andrew Newman

Ruataniwha water storage scheme

At the opposite end of the scale of floods is the need to manage water during dry periods

This article outlines the plans for storing water in the droughts experienced in Hawke's Bay between the floods.

At the national scale, fresh water is seen as both one of New Zealand's substantive economic opportunities, and as an area of competition between competing uses and values. At the risk of generalising, the opportunity for new irrigation, and therefore intensive and highly productive agribusiness, is on the dry east coast regions of New Zealand. The challenge in these areas from a water consumption perspective is one of seasonal constraints in some locations.

In general there is a lot of water around, but there is a substantial management challenge in accessing it in a way that protects and improves the lot of everyone involved. Water storage of winter water for use in the summer dry periods, is seen as the big intervention which can bring major gains. The following article outlines where things are in Hawke's Bay for both freshwater management and water storage.

Hawke's Bay water

The Hawke's Bay region, particularly south of Napier, is considered dry by New Zealand standards. The geology and geomorphology of the major central and southern Hawke's Bay river catchments, including the Ngaruroro and Tukituki catchments, consists of ranges in the west bounded by alluvial

outwash plains in two areas, the Heretaunga plain to the north, and the inland Ruataniwha plain to the south.

Both these plains and the river systems running through them have been heavily modified over many years. The predecessor of the Hawke's Bay Regional Council, the Hawke's Bay Catchment Board, constructed flood protection and drainage schemes in both areas. This infrastructure has enabled the development of significant intensive agricultural, horticultural and viticultural activity, as well as protecting an urban population of around 120,000.

Approximately 30,000 hectares of land is currently irrigated in Hawke's Bay, mainly for intensive arable, horticultural and viticulture purposes. These sectors currently consume 80 per cent of the total consumption of freshwater, with industrial and urban consuming around 10 per cent each.

Infrastructural development in Hawke's Bay has focused on dealing with too much water. With regard to too little water in Hawke's Bay for irrigation, this is an issue of seasonal constraints in some very specific locations. These include the Ruataniwha Basin, the margins of the Heretaunga plain and the middle reach of the Ngaruroro river catchment.



Freshwater management

Freshwater management, including aspects of water allocation and management of freshwater quality, has over the past decade or so emerged as arguably New Zealand's foremost environmental concern. The debate as it evolves feels a little like the debate around native forest logging of some 20 years ago. Water management issues in Canterbury have often been the lightning rod for the national discussion, but there are intense regional debates in most other regions including Hawke's Bay.

Overwhelming demand

A problem with water allocation has been that new irrigation demand in some regions has overwhelmed the statutory plan framework which allocates the public fresh water for private use. In many areas this framework relied on an assumption that there is plenty to go around. However over the last decade, with the implementation of the Resource Management Act, there has been an increasing focus on determining limits. The first come, first served principle of water allocation works fine when there is plenty, but not so well when there are constraints.

The water management change process is also traditionally slow and litigious, with statutory plan change processes often taking between seven and 10 years from initiation to full notification. For water allocation in Hawke's Bay, things started to get quite contentious in the past three to four years as a significant consent renewal processes began and additional demand emerged. This period also coincided with a period of four consecutive droughts in the region running through into late autumn.

Four major block consent renewal processes have been run over that time including –

- Surface water takes within the Ruataniwha Basin
- Ground water takes in the upper Karamu area of the Heretaunga plain
- Surface water takes in the Ngaruroro river
- Ground water takes in the Twyford area, also on the margins of the Heretaunga plain.

Most of these renewal processes have been framed within a debate around the limits on current and future water allocation. In three out of the four cases, consents have only been allocated for a five-year period.

Concurrent with the consenting processes, the Hawke's Bay Regional Council determined that there was a compelling need to overhaul the water management system within the region. This was to ensure there were solutions for sustainable management of the freshwater resource over the decades to come. In essence, a system was needed that would provide wins for the irrigators, the economy, the environment, the rivers and the recreational users of those rivers.

Five initiatives

In 2008/09, the Hawke's Bay Regional Council launched five initiatives in parallel. The science budget was boosted by

\$900,000 a year from a base \$1.9 million to ensure that the detailed knowledge of the water resource, particularly in the constrained areas, was very robust. To date, our knowledge of water resources, especially ground water in the Ruataniwha system, has advanced dramatically. For example, we now know the ground water is old. It has been in the aquifer for between 40 and 200 years, and is replenished predominantly by rainfall and not streams and rivers.

Staffing was increased in the area of water use advice and this is focused on helping the irrigators establish water user groups. A number of joint Hawke's Bay Regional Council and MAF projects have been run involving water use efficiency, rationing and rostering within user groups. User groups are now established across the Ruataniwha, Ngaruroro and Twyford areas.

A water demand management strategy, involving water metering and telemetry, was established. The focus was to prioritise implementation of this technology on all water takes within the constrained catchments to underpin the efficient use of water within the user groups. Around 850 water takes out of 2,500 are now metered, and consent holders are being encouraged to provide more accurate and timely reporting by the provision of a web-entry system and telemetry.

This development, coupled with the creation of user groups, provides the framework for more efficient use of water, including transfers and potentially the aggregation of individual consents into group consents. Water use efficiency will allow plenty of water for all irrigators in many areas and will avoid the need for high capital cost infrastructure interventions.

Nearly there

Pre-feasibility and full feasibility studies on water storage were initiated in the Ruataniwha and Upper Tukituki and Ngaruroro catchments in 2009 and 2010. They were funded via the Hawke's Bay Regional Council's investment portfolio and MAF's Sustainable Farming Fund.

We are a few months away from completion of a full-feasibility assessment in the Ruataniwha basin, all going well, and we have just published a pre-feasibility assessment of the Ngaruroro catchment. The logic for progressing with storage assessments is that in some cases it is our view that water use efficiency improvements on their own will not bring the improvements needed in the water management system.

Development of a community regional water strategy began ahead of a revision of the statutory plan provisions for minimum flows and allocatable volumes. In the first symposium in November 2010, 79 per cent of the organisations identified that, with reservations, consensus management of the freshwater resource was possible. In addition 85 to 90 per cent agreed that water storage was seen as a critical component to potentially managing the overall system.

The changes to the water plan focused on reworking allocation, and water quality limits are due for notification from July 2012, starting with the Tukituki catchment. The



reason for running these initiatives in parallel has been to speed up the process, increase the learning from each initiative, and to produce an integrated and adaptable water management system which incorporates both supply and demand management.

The Ruataniwha feasibility project

Of all of the initiatives we are running, the most challenging so far has been feasibility studies on water storage. While simple in concept, the scale of these projects and the major changes they will involve if implemented, are very challenging.

To provide some context in the Ruataniwha case the main statistics include –

- The current irrigation footprint is approximately 6,000 hectares
- There is very limited security for the current consent holders based on short duration consents with many due for expiry in 2013
- The river catchment and its main river are very confined, with the result that the hydrology can be measured with a degree of certainty, and for recreational river users the effects of extractive uses within the river system are noticeable
- The potential future irrigation footprint within the basin is approximately an additional 19,000 hectares
- A further 5,000 hectares downstream and outside the Ruataniwha basin could also be irrigated if sufficient stored water were available
- Currently we are developing the feasibility project on the assumption that stored water will irrigate all 25,000 hectares of the basin which for Hawke's Bay would increase irrigation within the region by over 60 per cent

- To achieve this, the volume of stored water is projected at 75 million cubic metres, which is approximately five per cent of the total average annual hydrologic capacity within the Tukituki system.

Twenty sites down to one

So far the project has assessed 20 different storage sites and focused on two major sites within the Makaretu and Makaroro tributaries. Geological work has ruled out the Makaretu site leaving the focus on a single dam site on the Makaroro. In the process, upwards of 90 landowners have provided permission to assess sites and allow more detailed information where relevant.

In principle, in managing irrigation demand it could be considered desirable that all irrigation migrates to stored water and the river system effectively moves back to naturalised flows. A result of this might be security of supply for all irrigation at 95 per cent, and approximately 30 per cent more water in the river system through summer low flows.

A detailed on-farm economic assessment undertaken suggests that the land use change may result in a mosaic land use pattern, including mixed arable, horticultural and dairy. In addition, based on other similar schemes, the overall land use change footprint could expand to include a similar amount of land as that within the irrigated centre. This study suggests that returns on marginal capital – from the additional on-farm capital investment – are similar to data for a number of Canterbury based schemes.

Initial assessments indicate that the increased production associated with these changes could lead to significant





increases in regional GDP and employment. Our preliminary assessments also indicate that the additional investment, both on and off-farm associated with the scheme, could lead to substantial total increases in regional output. These economic effects will be mainly concentrated in the early years of the scheme when dam construction and the initial wave of on-farm investment are expected.

To date, the estimated costs of dams and pressure pipe water reticulation across the Ruataniwha plain is \$200 million. That figure precedes any on-farm conversion costs. However, a benefit is that the water would be brought to the farm gate.

What is clear is that when we apply our water management framework to assessment of options in the Tukituki catchment, the status quo is not an option. Irrigators and other recreational users have little certainty and there are no wins, only negative compromises. Most probably some form of winter water storage is the only way around this.

Where the project is now

The overall feasibility phase is designed to get the project to a point where it is clear that it is either possible or not possible. Assuming the answer is possible, then the next step is application for resource consents. Given that the Hawke's Bay Regional Council is the regulatory body which would normally deal with these issues, the current thinking is that any consent applications might be referred directly to the Environment Court. Ideally this decision might be made after June 2012.

In the meantime, the project itself contains three major work aspects –

- Geotechnical and engineering design work
- Environment effects, covering issues such as stream ecology and potential land use intensification effects and mitigating measures.
- Economic and financial assessment and optimisation, including business modelling, investment analysis and price modelling, supply chain assessment and marketing.

Within these major projects there are 118 individual tasks being managed, all with a very high degree of inter-

connectivity. The complete project, as noted earlier, is being jointly funded by the Hawke's Bay Regional Council and MAF. To govern the project, and ensure there is a community involvement, two main groups were formed and have been operating for approximately 18 months. One is leadership group chaired by Sam Robinson and the other a stakeholder group chaired by Debbie Hewitt.

The leadership group is focused on the work associated with the project economics and potential commercial and investment arrangements. The stakeholder group is focused on the community from an environmental, social and community context. These groups provide the foundations for validation, amendment and refinement of the overall direction and approach.

At this point while the challenges of making this project work seem endless, the main issues appear to be as follows –

- **Building infrastructure at an affordable level** The Ruataniwha area is very complex and active tectonically so the consulting engineers, Tonkin and Taylor, are focused on an innovative approach to the design phase
- **Ensuring uptake of the water** This means there is now an increasing focus on the value of water security to the irrigator, but also certainty of price. This marketing process and refinement will probably continue, both through the balance of the feasibility study and the consenting phase if that is entered into over the next two years.
- **Managing the environmental effects.** In particular, while there is a very strong element of this project focused on improving summer low flows, there is also a real need to ensure land use intensification occurs in a manner that leaves the river water in good condition. So far this issue, like elsewhere in New Zealand, is among the most challenging.

Investment needed

There appears to be no rule book for funding these projects, and from an institutional investor perspective they are not the norm. At this point we are focusing explicitly on potential investment models, investment values and financial modelling. Assuming we can create a compelling on-farm financial proposition, then that will help create a foundation for investment. However there will be problems of lag, development financing requirements and significant risk assessment. These issues might, however, be considered within a context of the rising value of water and food security.

To sum up, freshwater management is undergoing substantial reform in Hawke's Bay, and although water storage is potentially a real solution in some cases, it is quite complex. We are part of the way through the change process, and the major gains for all river users and stakeholders are yet to be produced. This indicates that, as for other parts of New Zealand, fresh water management is a very challenging business, but if we can get it right there will be real gains for all.

Andrew Newman is the Chief Executive of Hawke's Bay Regional Council

Profile

Hawke's Bay farmers and award winners Sam and Hannah Morrah

Sam and Hannah Morrah, both aged 34, farm at Ohineumeri situated about 30 km south-east of Waipukurau in a district called Wallingford. They have three young children. Their enterprise involves sheep breeding and finishing, and cattle trading and finishing. There is also a full-time staff member on the property. In 2010 Sam and Hannah won the Marks and Spencer Overseas Future of Farming Award.

The farm is 755 hectares fenced into 97 paddocks. It has rolling to steep hill country with about 200 hectares of cultivatable land. It was established in 1937 by Sam's grandfather, and was also farmed by his father, so is now a third generation farm. Sam took over the management of the property in 2001 at which stage there were 23 paddocks covering only 488 hectares. Land was purchased on the

boundary in 2003, and again in 2006, taking the farm to its current size.

Sam and Hannah have carried out a significant fencing programme with the average paddock size now 7.5 hectares – ranging from 2.5 hectares to 15 hectares – and invested in new water systems and re-grassing. The bulk of this was carried out between 2001 and 2005.



Five year plan

We aim to lift our production parameters such as lambing percentage by improved genetics and better feeding. Our five-year goal is 150 per cent survival to sale. Our lamb carcass weights, from genetics, cropping and regrassing, land planning and reduction in grazing competition at key times are currently 18.5 kg carcass weight to Marks and Spencer, with an ambition to hit a 19 kg average. This will achieve our goal of 90 per cent or more lambs to Marks and Spencer specification.

We hope cattle weights and prices will improve from a greater understanding of our sheep system and its requirements, and the meat industry in general. With the increase in productivity we hope will come enhanced profitability. If we are making consistent profits on a regular basis then we can combine that with our social responsibilities. We will be ensuring the continuation of this operation into the future for our children and beyond.

Consistent maintenance

Other on-farm goals within the five year plan are debt consolidation, cash surpluses towards farm development, and maintenance of on-farm buildings. These include an employee's cottage which is to begin this year, the homestead, woolshed and the construction of a new shed for housing farm machinery. We believe in consistent attention to maintenance to ease cash flow pressures from year-to-year.

Sustainability will be achieved from profitability and the ability to continue developing a successful dry land farming unit. If we can profitably farm through droughts by having different options within our business, then we are half-way there. We need to consider the land around us and the environment to put these in place.

Careful land use

The use of the land and environment plan will be crucial in identifying different land classes and their most productive use. That may be minimal grazing, fencing-off of waterways and wetlands or complete retirement from livestock farming in some cases. These are only examples of what can be done. If we protect our asset then it will be there for generations to come. We are merely guardians of the land. Hopefully our actions will result in the continuation of the property being a sustainable asset for the future generations.

Off-farm we must continue to up-skill ourselves. Attendance at relevant discussion days, forums and seminars allows us to remain up-to-date with what is happening in our industry and provide us with the tools to make changes to our farming operations if required.

Consistent supply

Our involvement in the Marks and Spencer suppliers working group is important for us to continue learning about all areas of the meat industry, as well as the goal

of a more efficient and profitable programme than we currently have. If we can achieve this then we are signalling to the farming community, particularly in New Zealand, that a fully integrated supply chain with a focus on genetics and consistent supply can work.

Vision to 2020

Our vision of New Zealand farming in 2020? If I had said in 2000 that we would have three consecutive years of drought, coupled with poor prices and a global recession, I would not have had much to look forward to. During the next 10 years it would be realistic to say that we will experience some tough times both climatically and financially. We will be faced with drought and cold, and interest rates will rise again.

As farmers we must collectively listen to what the global consumer is asking for and adapt. More food will be needed in the future and we are the ones who will be required to produce it. If we embrace further development and new technologies then this demand can be met with financial gains. Our customers are always right. If they do not like what we are exporting to the likes of Marks and Spencer or anybody else then they simply will not buy and will look for an alternative.

Move with the times

We need to produce to the required specifications, but do it in the most cost-efficient way. Everybody must make money otherwise we are unsustainable. If farmers understand how farm gate prices are derived aside from the exchange rate, then this could be a significant step to transforming our on-farm practices.

Farming in 2020 in New Zealand will be strong if we move with the times. There are people within the industry that do not see the importance in this change of policy. I believe we will see a changing in the guard of those who hold key positions to younger more adaptable leaders who will ensure that as an industry we make the changes needed to keep the global consumer happy.

The farmer who decides it is not for them will continue farming, but I believe they will slowly fall away financially as their business will become unsustainable. They will sell and leave the productive sector. The more aggressive farmers who have changed and are succeeding will purchase these farms and implement their policies and do what they have been doing on a larger scale.

The role of Marks and Spencer in this will depend on their level of involvement with New Zealand products. At present they have a huge opportunity to help change New Zealand farmers' current way of thinking. By offering fixed price contracts for set periods they are providing opportunities. Fixed prices may not be the best answer for everybody but it is about choosing what is the best option for your business.

Sam completed his BComAg with a farm management major from Lincoln. Hannah undertook her masters in business in Otago. She worked for Ezibuy, and then established Footloose Shoes in Napier and owned the Wellington equivalent as well. That business was sold in 2007 when she became a full-time mother. Sam is a member of several farming-related bodies and is deputy Chairman of the Central Hawke's Bay Farmers Veterinarian Club and a trustee for the Te Matau a Maui Health Trust.

Farm policy changes

The most vigorous policy changes have been in the last three years. This has included traditional Romney breeding ewes changed to a Highlander ewe flock using Primera rams, and buying in two-tooth ewes every January at a contracted price and to a set specification. This system has a guaranteed minimum and average weight, which allows them to finish all the lambs, and adds flexibility through the winter with no replacements to grow out if feed is tight.

There is also the potential to carry more trading stock if conditions are good. Winter numbers in 2011 have been 3,200 breeding ewes, 2,000 winter trading lambs, 205 weaner heifers and 50 rising two-year bulls.

All lambs are finished to 18 kg or more carcass weight. They are supplied according to specification to Marks and Spencer in the UK via Silver Fern Farms. Two-tooths are bought in, as are 80 cows with calves in spring for pasture management. Weaners are kept and cows sold in-calf in late autumn. The best heifers are killed, and the balance sold depending on the season. Bulls are wintered on crops and killed during the summer.

Ewe numbers have been reduced to ensure better body weights and lamb survivability. Better matches of stock to land class are sought, with more winter lambs carried to add flexibility and use the best land. Cattle numbers have been reduced to take the pressure off winter heavy land. This policy is in line with their decision to 'do what we do best, but try and do it better.'

The seasons from 2006 to 2010 were basically all droughts with some periods of growth. There was virtually

no autumn growth to set up for winter, a late or poor spring, and when added to a dry summer it made it very difficult to farm. Changes came about because of this. They needed to adapt their system to suit their climate.

Award winners and five-year plan

In 2010 the Sam and Hannah became winners of Marks and Spencer Overseas Future of Farming Award. Lambs are supplied to Marks and Spencer and specifications and criteria must be met on-farm with respect to climate change, biodiversity, waste, water, animal welfare and fair trade. They won the award for playing an active part in the community, and using good knowledge and flexibility to predict and overcome problems.

In July 2010, Sam and Hannah travelled to the UK to receive their award and visit Marks and Spencer to learn exactly what happens to their lamb once in the country. In February 2011, the couple also hosted a field-day on the farm for representatives from Marks and Spencer and their suppliers as well as the farm's own main service providers. Part of the award application involved developing a five year plan and the one they provided was focused in and around productivity, profitability and sustainability.

Tips for new entrants to farming

Sam's advice for anyone entering farming is to gain an understanding of land classes, and what their strengths, weaknesses and limitations are. Establish what the best class of stock is to be running on that country and in the environment where you farm. Farm your property to suit the environment, your strengths, and your interests, and this will help ensure that the next generation can do it as well.

Do not waste energy worrying about things that you cannot control such as weather, the exchange rate and meat plant schedules. Instead, focus on running the system so that risks associated with significant shifts in any of these factors can be minimised. Always remember that the first leg of sustainability is profitability. If we are not profitable then we are not sustainable.



Automatic milking – is it an option for small-to-medium herds in New Zealand?

There are 5,658 herds in New Zealand which have 300 or fewer cows. The majority are milked in ageing herringbone dairies by experienced owner operators who have been farming for more than 20 years. Many of these sheds will require replacement in the coming decade and owners will also consider their future in dairying. Is automatic milking an option?

The New Zealand dairy industry has experienced remarkable growth in the past 20 years, particularly in the South Island, with rapidly expanding herds and a strong trend towards large rotary sheds and increasing automation. However, nearly half of all herds have 300 cows or fewer, producing 25 per cent of the industry's total milk production – or 343 million kg milk solids.

A 2008 DairyNZ survey on milking practices and technology use on New Zealand farms indicated that the majority of these herds are milked in sheds which are 20 years or older, mainly herringbones, although some are the very early small rotaries. Farmers in this group are generally owner operators, who have been farming for at least 20 years, and who are either regularly or always in the shed. Although around 40 per cent of these sheds have had a significant upgrade in the last 10 years, a third of farmers indicated that if they were in the position to make changes they would like to build a completely new shed within the next few years.

Ageing dairy farmers

Building a new milking facility is something most farmers consider only once in a lifetime. Because of the age profile of a significant number of farmers of small-to-medium herds, a third are 50 years old, for many this decision will coincide with the larger questions of – ‘do I still want to be in the shed’ and ‘what is my long-term future in dairying’? Recently a small number of farmers within this demographic have considered these problems and chosen to invest in automatic milking technology and remain dairying on the farm.

Automatic milking is a relatively new technology for New Zealand dairy farmers. However it is well established in other countries as an alternative to conventional manual milking methods, particularly western Europe. According to the 2011 European Dairy Federation Agri-benchmarking survey of 2,600 farms from 20 countries, more than 40 per cent of all new milking system investments are going into

robots. By 2016, robotic milking systems will be milking 18 per cent of cows in Europe, doubling the current number.

In New Zealand, systems have been operating since 2001 when the first machines were installed on a research farm in the Waikato. In 2008, the first two commercial farms commissioned machines and in 2011 there are five farms using the technology. Yet many farmers and rural professionals are unfamiliar with the technology, know little about how it works, and more importantly how it could be integrated within New Zealand farming systems. In this article the development of automatic milking technology is outlined, barriers to adoption on New Zealand farms are considered, and an early adopting farm is profiled.

What is an automatic milking system?

An automatic milking system is a generic term used to refer to automated systems that complete the whole milking process without the direct assistance of milking staff. Automatic milking systems are often referred to as robotic or voluntary milking systems. They generally consist of a milking stall or crate with a robotic arm which attaches the teat cups to each cow without human intervention, an electronic identification system, and a milking machine. The terms are defined as –

- Robotic which refers to the robotic arm that performs main functions of the system such as cup
- Voluntary is used because cows can choose when they want to be milked.

Because of the hands-off nature of this technology, sensors that monitor cow health and milk quality are in place as well as facilities to manage cow movements remotely. These include separating cows for later inspection or treatment and drafting gates that direct cows to different areas on the farm. All systems have the ability to present feed while the cow is milking, usually grains or pellets, but liquid feeds such as molasses are an option. The systems are designed to operate 24 hours a day, so an essential component of the technology

is remote monitoring which sends alerts to cellphones when there is a technical or cow problem.

Technology advances

There is continuing development of automation technology to meet the needs of a broader range of herds and management systems. The most common automatic milking system design is a single stall which milks one cow at a time. However recently there has been a re-emergence of multi-box designs in which a single robotic arm services more than one cow at a time, either in stalls which are adjacent or in series.

Lately technology developers have focused on systems for larger herds and grazing cows. The AMR, which uses multiple robotic arms to clean teats, attaches cups and applies a teat sanitiser while cows are on an internal rotary, was unveiled in 2010. However, there has been more focus on streamlining the production and design of single stall automatic milking systems to reduce capital costs, making the systems more affordable.

Production has moved outside Europe for the first time. The first mobile systems – an automatic milking system with all support services self-contained and which move with the herd – is being tested in three countries in Europe. As yet there are no technologies that can achieve the throughput rates achieved by batch-milked herds in conventional systems. All systems are based on the concept of distributing milking over 24 hours.

Barriers to adoption

Recent workshops held by DairyNZ identified that the awareness of automatic milking is low among rural professionals. There are pockets of interest from farmers, although many are sceptical of the technology and believe it is not yet suited for New Zealand dairy systems. Questions relate to the ability to manage pasture, changes to farm infrastructure and capital investment. Other perceived barriers to adoption of robotic milking systems relate to the apparent contradiction between some of the fundamental principles which have made New Zealand dairying so successful and the systems for which robotic milking has been developed.

New Zealand dairy systems are built on a foundation of high use of grazed pasture, low-cost capital infrastructure, seasonal milk production, efficient use of labour and scale. Importantly, milking has evolved to be a batch process where herringbones and rotaries are sized to enable the maximum number of cows to be milked in the shortest possible time.

Robotic milking systems, on the other hand, need milking to be distributed throughout 24 hours and they have been developed for use in housed systems. They are capital-intensive, best suited to year-round milk supply due to the fixed capacity of the technology, and are most commonly used by farms with fewer than 150 cows. There is no doubt that the automatic milking system is a disruptive technology which requires hard thinking about how the advantages of automating a fundamental task, such as milking, can be

achieved while maintaining profitable dairying.

Managing pasture

Most New Zealand dairy farms remain reliant on grazed pasture as the feed source and will do so for the foreseeable future. For automated milking systems to be successful, it is critical that high standards of pasture management and pasture quality can be maintained when cows are milked voluntarily. In trials conducted at the Greenfield Farm in the 2008/09 season, 13.2 tonnes per hectare of dry matter was harvested in a self-contained near-grass-only system. A total of 116 kg of grain per cow was fed annually in the automatic milking system during milking, producing 1,166 kg of milk solids per hectare and 365 kg milk solids per cow.

The results of the trials demonstrated that minimal levels of concentrate supplement were necessary to encourage voluntary movement, and that traditional low input systems could be successfully combined with automated milking system technology. There were several features of the farm operation that enabled the system to be successful.

One of these was three-way grazing, now widely practised by early adopters in both Australia and New Zealand. Three daily allocations of pasture are offered to the herd, in separate sections of the farm, creating a more even flow of cows through the automated milking system. This was mainly in generally quieter periods after midnight and ensured access to fresh pasture for all individuals, regardless of the time they are milked.

Another feature was a drafting system which sorts cows before they enter the automated milking system. This ensured that only cows due for milking were allowed entry to the machines and others were given direct access to new pasture. The system also smoothed cow traffic flows and ensured cows have equal opportunity to access fresh feed. In addition, close monitoring of pasture covers and the feed budget from weekly farm walks and careful allocation of daily grazing ensured target residuals were met and surpluses were identified early.

Farm layout and infrastructure

Experience to date suggests that walking distances of up to a kilometre present few problems for cows. By centrally locating the automated milking system, most of the small-to-medium sized farms with herds of 300 cows or less would fit within this limit. It is not necessary for cows to be able to see the dairy from all paddocks, although the farms using automated milking systems in New Zealand are generally relatively flat. As the land becomes steeper it is probable that more intervention will be required. The main consideration is positioning laneways which allow cows to access three different areas on the farm. This is to help with three-way grazing.

Existing dairy infrastructure may be able to be re-used. Herringbone dairies have the potential to be ideal for refurbishing by filling in the pit and positioning two to four automated milking systems along the rows. Then

using the existing yard as a pre-automated milking system waiting area and with a three-way drafting gate positioned at the exit, cows could be separated for later inspection or treatment and sent back to the waiting yard if the milking was unsuccessful or on to a new paddock. It is not necessary to use split laneways, as farms can use standard five metre wide races with cows walking in both directions to and from the same paddock.

A common question is how many automated milking systems do you need to milk your herd? This number will depend on how often you want the cows to be milked, the peak yield of the herd and what level of use of the milking stations can be achieved. Typical numbers of cows for an automated milking system are 60 to 90, with milking frequency reducing as cow numbers for each automated milking system increase. Each milking has a fixed set-up

Profile of an early adopter John Fisher's story

John Fisher owns the 82 hectare family farm near Cambridge in the Waikato. Farm production is among the higher performing farms in the Waikato at 1,382 milk solids per hectare and 355 kg milk solids per cow. He also owns an adjacent 109 hectare dairy farm, 63 hectares of which are leased, and has a part-share in a dry stock block where young stock and some dry cows are grazed.

He first looked at robotic milking when the DairyNZ Greenfield project started in 2001. From the beginning he thought his home farm was suited to an automated milking system as it was flat and rectangular. He became more serious about considering this system when thinking about the longer-term future of the farm and the need to upgrade the existing milking facility.

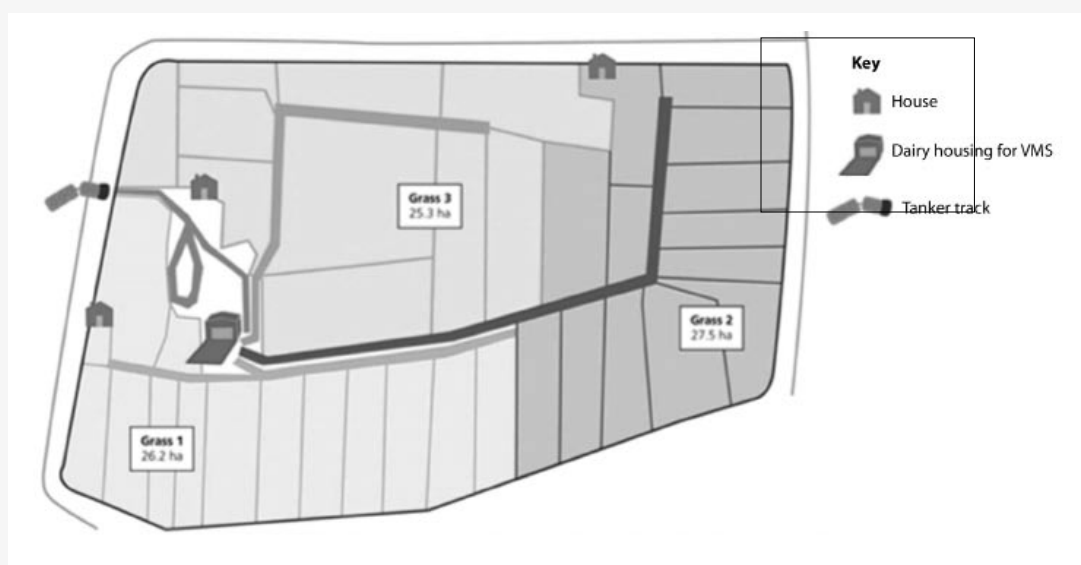
Although the system he worked was not broken, he was looking for a different challenge. Options were to upgrade the 30-year-old, 24-aside herringbone, build a new large rotary to service both farms and install an underpass, or convert to an automated milking system. He thought that 300 cows was an awkward number for staffing as it is difficult for one person to manage when having to milk, but not necessary to have two people full-time.

Having spent a lot of time off-farm with other commitments, going back into the shed and milking convinced him that manual milking was not a long-term

solution. He had been keeping an eye on the technology by studying reports from other farms and seeing first-hand the robots in operation at Greenfields and around the world when visiting farms in Japan and Australia.

| Farm facts | |
|--|--|
| Herd size | 280 cows with a target of 320 cows |
| Number of automatic milking systems | Four DeLaval voluntary milking systems |
| Calving pattern | Seasonal, spring only production before the automatic milking system was 1,382 kg milk solids per hectare, 355 kg milk solids per cow |
| Commissioning date | March 2011 |
| Labour | Farm manager |
| Technical support | Professional farm services |
| Features | Grass focus, System 3, half farm under sown in annuals every year, 35 hectares effluent irrigated, supplements fed to fill feed gaps are Nutrilig, PKE and maize |

Following the decision to move to robotic milking, the farm was divided into three grazing areas and changes were made to a section of laneway to make these areas accessible. The new dairy was built alongside the old herringbone while still in use, which is now used for animal treatment and as a post-milking separation yard. Four voluntary milking system units were commissioned in March 2011 to milk 280 cows.



time, so the aim is to increase the yield at each milking by increasing the milking interval, but not to the extent that cow production is compromised.

Economic considerations

Apart from capital there are operating costs to consider. In the first year, milk production may drop up to 15 per cent, depending on what stage of lactation the herd is when trained and the success of the commissioning phase. Once established, milk production is not expected to remain lower if no other changes are made to the farm system with no extra feed input, change in milking frequency or days in milk. Maintenance costs will increase considerably because of the need for 24 hour on-call support contracts, as will electricity costs. A decrease in lameness levels should be expected.

The research results and practical experiences of early adopting farmers suggests that the operational barriers to automatic milking can be overcome. However, in economic terms, automated milking systems remain a challenge when compared to conventional milking alternatives. This is mainly due to the capital investment required and higher operating costs.

A significant number of farms in New Zealand with herds of 300 cows or fewer face decisions regarding re-investment in milking equipment as well as their future in dairying. It is important for farmers and advisors to be aware of the developments in milking technology. The recent adoption of automatic milking systems by farmers with herds of around 300 cows provides the opportunity for others to see the technology in practice and consider its merits for their specific situation.

Animals: Automated Milking Systems (AMS)

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Find out more about Automated Milking Systems, including their history and FAQs... [More](#)
- Making the Decision**
Help determine if Automated Milking Systems are right for your farm and your business, and if they will suit you... [More](#)
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The information available on the DairyNZ website

Information resource for farmers and advisors

It is important that advisors are aware of developments in automatic milking and able to help farmers. Information is now assembled in one place on the DairyNZ website www.dairynz.co.nz which is accessible to farmers and rural professionals. The site has information on what an automated milking system is, including its history and frequently asked questions such as how is mastitis detected and how do I manage heat detection?

When considering the suitability of an automated milking system the farm, the business and the people must all be considered. Nine years of results from the Greenfield Project have been compiled, as well as a section describing the latest developments from around the world. Each of the five farms using automatic milking systems in New Zealand have been profiled in case studies, including farm layouts and dairy designs. There are also links to technology providers and extension staff experienced with automatic milking.

Jenny Jago is a Senior Research Scientist for DairyNZ in Hamilton



Almost as much milk from cows on once-a-day milking

This article first appeared in the Dominion Post a few weeks ago and it seemed worthwhile getting permission to republish it for those members who were not able to see the original article

Colin Holmes is reading the autobiography of legendary motor racer Stirling Moss. ‘He had an innate, almost subconscious ability to drive at top speed, commanding and self-assured, reading every corner perfectly and seeing any danger well before it happened. Leo farms like that.’

Leo Vollebregt looks bemused at that comment. Perhaps he is imagining feeding out from a 1959 Cooper-Climax at 140 mph. Dr Holmes parks that metaphor and tries again. ‘Good dairy farming is as much an art as it is a skill. Leo is an example of that.’

Mr Vollebregt feels happier with this. ‘It’s better than being called lazy.’ Lazy, cranks, not real farmers – once-a-day milkers have heard it all. But Mr Vollebregt, a former Wairarapa sharemilker of the year and New Zealand young farmer of the year, has the credentials and the milk production performance to crush such insults.

Lower costs and more income

His last season of milking 580 cows twice-a-day returned the highly creditable production figures of 1,295 kg of milksolids a hectare. Last year, his third season of milking once-a-day, the same number of cows gave 1,250 kg a hectare. ‘My costs have dropped and I’m making more money. I’m happy and my staff are happy.’

He is a top performer in a discussion group of about 20 farmers who have decided to milk their cows just once-a-day. Dr Holmes, retired professor of dairy production at Massey University, and DairyNZ consultant Leo Hendrikse are the group’s convenors.

These farmers are at the forefront of a challenge to mainstream dairying that Dr Holmes rates as momentous as the advent of the herringbone milking shed or the abandonment of teat washing and stimulation in the 1960s and 1970s.

Fonterra is wary of the move, possibly fearing its influence could put a brake on the drive to increase production. But Dr Holmes says that need not happen. Farmers like Mr Vollebregt show that once-a-day milking does not permanently reduce milk output and it can open

up new dairying country – hilly or awkward-shaped farms where some paddocks are a long walk from the cowshed.

‘It is not for everyone,’ Dr Holmes says. ‘But it needs a fair hearing as a realistic option.’ The biggest disincentive is an initial dip in production, as some cows see the absence of a milking session as a signal to dry off.

For Mr Vollebregt this lasted two years as he weeded these cows out of his herd, and farmers carrying high debt would have to be wary. However, research to identify the genetics of cows that comfortably make the transition would resolve this. DairyNZ and Livestock Improvement have projects in mind.

We can do that

Mr Vollebregt, who with wife Rebecca farms on irrigated land near Martinborough, decided to make the move after he and herd manager Cory Wildman visited Canterbury to see the irrigated once-a-day 3,000 cow farm run by brothers Doug and Dave Turner on Rakaia Island.

‘We thought we could do that. They were doing 1,350 kg a hectare which was pretty reasonable. And it looked like it would make life simpler, and I was all for that.’

He had just bought a neighbouring farm and its herd of jersey cows, and was milking them twice-a-day through his 30-a-side herringbone shed, along with his original herd of friesians. He was also experiencing problems with cow fertility, with as many as 19 per cent failing to get pregnant, meaning considerable extra cost in buying in pregnant cows. Most farmers cull their herds on milk production, but with such a high wastage because of infertility he could not do that and it was difficult to make progress.

More relaxed

That has now changed. In fact, because they are under less stress the cows’ fertility has improved so much that he has more heifers than he needs and is selling 45 to 50 a year as rising two-year-olds. That is a big change – going from having to buy 10 to 20 cows at \$1,100 each to selling 45 for the same price.

Costs have also dropped, with the biggest gains being made from needing two less full-time staff. And everyone is happier. 'It doesn't mean we have oodles of spare time, but the atmosphere has changed. When you have a big team, with more work and more relationships, it takes a fair bit of managing. Now, in the afternoons we're more relaxed.'

Cow numbers were increased to 630 in the first year to take account of an expected fall in feed demand because of an anticipated lower milk yield. But numbers have now returned to 580 as yields have lifted.

With the extra feed, and under less stress than they had been when milked twice-a-day, the cows come out of winter in good condition. Dr Holmes says a normal twice-a-day herd has to put on about one condition point over winter to reach an ideal calving condition score of five by spring. This means feeding each cow 200 kg extra of dry matter. But Mr Vollebregt's cows finish their lactation and begin the winter at 4.7, so they need only 50 to 60 kg of extra feed over winter.

With udders staying full of milk for longer, some increase in mastitis has been experienced but it is not a serious problem. Mr Vollebregt talks of mastitis peppering through the year and says the average somatic cell count – an early warning of mastitis – at 150,000 is well within safety margins. Udder condition is now important in deciding which cows to keep and which to sell. Strong ligaments to hold the udders on to the body are needed.

Feed availability

Most important of all under the once-a-day milking regime is the feeding. This is where the combination of art and skill comes in. Dr Holmes makes his Stirling Moss comparison to highlight the importance of anticipation – anticipating the future pasture growth and cows' needs and keeping them in balance.

Leo Vollebregt and Cory Wildman work hard to ensure the cows have an enticing quantity of quality feed in front of them. Timing is everything, and they are ready to move the cows on as soon as pasture levels are chewed down until there is 1,500 kg of dry matter a hectare left. That leaves the grass enough time to recover for the next rotation.

They are ready with grass silage to smooth out the blips in pasture growth and in this year's wet and sunless spring, with the grass lacking energy, used palm kernel as well. In readiness for hot dry summers, 10 per cent of the farm is planted in a turnip crop.

Mr Vollebregt's way of describing it is 'The difference between milking twice-a-day and once-a-day is with twice

you are forcing the milk to come, but with once you are persuading it' However, there is no mystique to this. 'Leo is a conventional farmer, albeit a very good one, he just doesn't milk in the afternoons,' Dr Holmes says.

He hopes that when farmers learn of Mr Vollebregt's production figures they ask themselves a simple question – Why am I milking my cows in the afternoon as well as in the morning?

Discussion groups

Dr Holmes retired from his post at Massey in 2007, but could not resist a recall to arms when it came last year. At a barbecue he met Sherryn Marshall, who with her husband Dale milks 600 cows once-a-day on a hilly farm near Eketahuna. When he learned that their production was as high as 1,000 kg of milk solids a hectare, he asked her if she was part of a once-a-day discussion group. 'She said no, so I asked if she wanted one. She said yes, and we agreed to start one up.'

With funding from DairyNZ, they put out a call for others to join and now farmers from as far afield as Piopio, Galatea, Taranaki, Manawatu, Horowhenua and Wairarapa meet every second month to talk about their operations. Last week, at Mr Vollebregt's farm, a Tasmanian visitor, George Rigney, added his experience of once-a-day milking. He plans for production of more than 1,400 kg of milk solids a hectare from irrigated pastures this season.

Dr Holmes says once-a-day is not for everyone, and certainly not for bad twice-a-day farmers. 'The skills needed are similar for both systems. The people probably best suited are those on a low-cost grazing system, and those whose cows have long distances to walk to the milking shed and who have a low level of mastitis.'

He can see numbers rising when genetically predisposed cows are identified and the transition is made easier. That is when once-a-day will be taken seriously, when you see once-a-day farmers who are confident enough to buy other farms and change them to this system.

For Mr Vollebregt, there are limits. He thinks that as his herd settles down to once-a-day milking and the performance level rises, he could lift his production by another 200 kg a hectare over the next five years – but that is it.

'We could have a stand-off pad and feed more supplements but that is too complicated. When Rebecca and I started out, our original vision was to have a productive, profitable and attractive farm where everyone enjoys their work. We started to drift away from that when we bought the other farm and lifted cow numbers, but now we are back on track.'



Tony Rhodes

Emissions Trading Scheme – some reflections

As a recent traveller through Western Europe, it is impossible to miss the range of initiatives which nations, communities and individuals have taken as they try to reduce their energy-based emissions of greenhouse gases. In the process they are becoming more 'green' and reducing the effect on their environment.

Throughout Italy photovoltaic panels adorn the roofs of industrial buildings and dwellings. In Germany biogas digester numbers have increased substantially from 850 in 2000 to 5,905 in 2010, and are expected to reach 7,000 by the end of 2011. In Spain wind turbines scattered among the countryside meet in excess of 10 per cent of Spanish energy needs.

New Zealand's response to meeting its international obligations under the Kyoto Protocol are shaped by the Climate Change Response Act 2002. For agriculture, in particular, a taste of the mechanisms that are planned to apply are laid out in the Climate Change (Agriculture Sector) Regulations 2010.

However, there are a large number of influences which can apply between now and January 2015 when liability for emissions from livestock emissions is due to start being paid. These influences include –

- A review currently in progress
- Further reviews scheduled through to 2014
- We have two elections in this period
- There is as yet no international agreement beyond the first reporting period ending 31 December 2012
- Agriculture is a uniquely New Zealand component of our Emissions Trading Scheme (ETS) design.

ETS and related issues

The implications of the New Zealand ETS for farming are significant. First, it is easy to see this as just another cost of doing business. That cost, particularly in meeting liability for livestock emissions, is likely to represent a significant chunk of net discretionary income. Unfortunately, if farmers and their advisors continue to view the ETS as just another cost, businesses and the sector will miss opportunities for both short-term and long-term improvement in resource use, resource management and business management.

Secondly, we should not consider the ETS as an isolated imposition which is uniquely challenging New Zealand farming. In reality, the ETS is just one of a series

of problems we must confront. The others include nutrient loss and sustainable soil management, water quality, water use efficiency and water consumption. We must make demonstrable progress on these issues if we are to be credible marketers of high quality, high value nutritional and life products to discerning customers. The point is that each of these problems is inter-related, and experience to date indicates that progress on one is likely to provide co-benefits in others.

Some benefits

So although arguing for agriculture to be omitted from the ETS could be justified from the perspective that no other country has yet done the same, are there any benefits from having an ETS? Yes, sort of. There is the fact that it is consistent with the issues noted above. Importantly, by imposing a cost around the use of energy, it should focus attention on opportunities to improve energy efficiency particularly in energy consumption intensive farming industries.

Each sector within agriculture has diversely different levels and patterns of energy consumption, such as forestry, vineyards and wineries, dairy farming, arable farming and indoor crop production. They also each have unique opportunities both to reduce energy use and integrate alternative sources of energy into the business operation.

The result can be new opportunities for businesses to achieve improved energy and resource use efficiency, and potentially reduce greenhouse emissions. Would that occur without the ETS? Probably, but the rate of adoption would probably be a lot slower.

In pastoral livestock farming, achieving high efficiency and minimising wastage of resources will generally result in more profitable, sustainable and low greenhouse gas emission intensity business. However, in this context the energy source which is really important is the amount of pasture that can be grown each year. On the average sheep and beef, and dairy farm, this is roughly 40 million MJME and 18 million

MJME respectively, dwarfing consumptive use of electricity, petrol and diesel on these types of farm.

Case study on a Taumarunui farm

In 2008, MAF implemented a plan of action intended to develop understanding around on-farm implications of greenhouse gas emissions and climate change. As part of this programme, case studies were undertaken on farms grazing sheep and beef, deer and dairy stock across the country. One of the hill country study farms is located in the Waimiha district north of Taumarunui. Grazing 700 hectares with 140 hectares in a mix of radiata pine, QE II covenanted bush and manuka regeneration, the farm is carrying 8,800 stock units.

Livestock policies on the farm have been developed to use the mix of land classes, soil structure and drainage characteristics and pasture development, and provide a range of options to achieve high performance in a generally favourable summer climate. Animal numbers and performance reflect medium-term trends. No fertiliser nitrogen is routinely applied in the production system analysed, although nitrogen may be applied to boost recovery from adverse conditions. The policies for sheep and cattle are –

- **Sheep policy** A high performance breeding flock of 3,200 ewes, retaining 800 replacements, finishing a high proportion of the lambs, all sold by the end of April.
- **Cattle policy** A dairy cross breeding herd of 120 cows, purchasing replacements and finishing all progeny by 18 months. A total of 380 Friesian bulls, purchased as 100 kg weaners and finished by 18 to 20 months of age, a spring trading cattle policy with 100 yearling steers purchased in July and sold by March, and 70 two-year steers purchased in August and sold in January.

In the 2009 season, production was 340 kg of carcass weight equivalents per hectare. The figures are shown in the table. Note that meat and fibre production is expressed as carcass weight equivalents. All sheep meat and beef production is converted to carcass weight units. Scoured wool weight is converted to carcass weight on a one-to-one basis.

Production indices for Taumarunui farm baseline 2009

| | |
|--|-------|
| Average sale lamb carcass weight kg | 15.4 |
| Meat and fibre production kg per hectare | 340 |
| Estimated annual feed demand kg dry matter per hectare | 6,916 |
| Stock unit equivalents per hectare | 12.6 |

Farm livestock greenhouse gases

Using Overseer the livestock policies and animal performance applying in 2009, the level and components of greenhouse gas emissions resulting from livestock farming were estimated. The figures were 3,485 tonnes of carbon dioxide equivalent.

For this analysis, only direct livestock emissions have been considered. Estimates of carbon dioxide emissions due to fuel and energy consumption, nitrogen fertiliser

manufacture and capital infrastructure have been omitted. This is because under the New Zealand ETS Amendment Act 2008, liability for these emissions will result at the time these goods and services are purchased.

Greenhouse gas components and emissions from livestock farming

| | Methane | Nitrous oxide | Combined livestock greenhouse emissions |
|--|---------|---------------|---|
| Whole-farm emissions from 700 hectares tonnes carbon dioxide equivalent | 2,504 | 981 | 3,485 |
| Per hectare emissions tonnes carbon dioxide equivalent per hectare | 3.6 | 1.4 | 4.98 |
| Emission intensity kg carbon dioxide equivalent per kg of meat and fibre | 10.5 | 4.1 | 14.6 |

Mitigation of livestock greenhouse gases

Several options that may affect greenhouse gas emissions were examined –

- Increasing the sheep to cattle ratio
- Changing flock age structure
- Replacing the breeding herd with additional two-year-old cattle
- Replacing all cattle with a once-bred heifer policy
- Replacing the yearling cattle policy with deer breeding and finishing
- Adopting a programme of summer fallowing 10 per cent of the pastoral land each year and adjusting stock numbers.

Greenhouse gas emissions

The effect of various scenarios on the level and intensity of emissions have been compared with the baseline as shown in the table. Intensity of emissions can be expressed as kilograms of carbon dioxide equivalent emitted per kilogram of meat and fibre carcass weight equivalents produced from the farm.

Overall, the opportunity for changing the livestock greenhouse gas emission profile for the farm using alternative livestock policies is limited. In general, the level of difference in emissions is small, and the effect on farm total emissions and intensity of emissions per unit of production may differ. In addition, the effect of policy change on farm system risk and profitability is much greater than any benefit derived from reducing the level of emissions and emission liability.

- **Increasing sheep numbers and decreasing cattle numbers** Changing sheep and cattle ratio from 53:47 to 62:38 would result in only a small annual animal production and productivity, emissions intensity minus two per cent, and total greenhouse gas emissions from the

Effect of scenario on farm livestock emissions

| | Whole-farm livestock emissions tonnes carbon dioxide equivalent | Per hectare emissions tonnes carbon dioxide equivalent per hectare | Farm production kilograms of meat and fibre per hectare | Emission intensity kilograms carbon dioxide equivalent per kilogram of meat and fibre | Farm profitability economic farm surplus |
|-----------------------------------|---|--|---|---|--|
| Baseline | 3,485 | 4.98 | 340 | 14.6 | \$219,404 |
| Increasing sheep and cattle ratio | 3,439 | 4.91 | 342 | 14.4 | \$237,300 |
| Changing flock age structure | 3,410 | 4.87 | 337 | 14.5 | \$178,253 |
| Replacing the breeding herd | 3,731 | 5.33 | 367 | 14.5 | \$260,882 |
| Once-bred heifers | 2,968 | 4.24 | 255 | 16.6 | \$144,535 |
| Deer breeding and finishing | 3,247 | 4.64 | 262 | 17.7 | \$240,990 |
| Summer fallow 10 per cent | 3,085 | 4.41 | 341 | 12.9 | \$157,342 |
| Year 1990 performance | 3,977 | 5.68 | 319 | 17.8 | |

farm also minus two per cent, but it will have significant effect on profitability.

- **Replacing older ewes with a higher proportion of lambing ewe hoggets** This can be expected to increase flock reproductive efficiency. However, because additional feed is required to meet increased animal energy needs, the effect on total livestock emissions was negligible, and intensity of emissions was marginally greater.
- **Replacing the 120 cow breeding herd and heifer replacements** Along with an additional 280 head of two-year steers purchased in September for finishing, selling in January and February, is expected to result in increased total livestock greenhouse gas emissions of seven per cent. The reason for this increase is that breeding herd numbers are limited by later winter feed supply. The replacement trading steer policy does not have this constraint and is better placed to more fully use spring surplus feed. Although total feed consumption is greater livestock, this is offset by higher meat production with no change in intensity of livestock greenhouse gas emissions.
- **Purchase of 675 in-calf heifers** Buying in July and selling them and their calves at weaning in April targets, achieving high production over a short period, is intended to address some of the inefficiencies associated with a breeding herd. While not providing the management flexibility of aged beef cattle, this policy has the intention of improving spring-summer feed use. This achieves a reduction in total greenhouse gas emissions of 15 per cent, but the emission intensity increased 14 per cent.
- **Gains in animal performance and productivity since 1990** Today the farm has 14 per cent lower total livestock greenhouse gas emissions. At the same time, improvements in animal growth rate and lambing performance have increased productivity to the extent that livestock greenhouse gas emissions per kilogram of meat and fibre are now 21 per cent lower than in 1990.

The New Zealand ETS puts a price on the emission of greenhouse and is intended to provide incentives to encourage sectors to lower their emissions. It recognises

emissions removed from the atmosphere from carbon forestry sequestration activities. It also establishes January 2015 as the date on which agriculture joins the ETS.

ETS liability

The primary unit of trade in the New Zealand ETS is the New Zealand Unit (NZU). One NZU represents one tonne of carbon dioxide equivalent emissions, either released to the atmosphere as emissions or removed from the atmosphere. As agriculture is a trade exposed industry, the legislation, which comes into effect in 2015, provides for an initial free allocation of units equivalent to 90 per cent of a yet to be determined level of emissions.

The Climate Change (Agriculture Sector) Regulations 2010 establish the methods by which liability for emissions from agriculture will be assessed when animal products are processed. The liability the sheep and beef farmer will face for emissions from livestock farming will be assessed based on emission factors for the number and carcass weight of animals processed through the meat industry.

If you apply these emission factors to the 2009 base line production on the case study farm farm, the assessed level of whole farm livestock emissions is 4,804 tonnes of carbon dioxide equivalent. This is 38 per cent greater than the Overseer derived estimate of 3,485 tonnes carbon dioxide equivalent. Any process of regulation which is based on average emissions for animal classes will result in winners and losers. However, current policy design does appear to create some big variability which has financial consequences for the farm business. To be fair, there is still opportunity for further review of the regulations, and the basis for free allocation of units has yet to be advised.

The basis for the 90 per cent free allocation of units is yet to be determined. Therefore it has been assumed that liability for livestock greenhouse gas emissions in 2015 will be 480 units which, at \$20 an NZU, will amount to \$9,600. If changing livestock policies and practices are unable to have significant effect on ETS liability, what other options do farmers have to manage the risks they face?

Management of risk around ETS liability

Forestry and aforesatation are important features of many North Island hill country farms, adding to the mix of aesthetic, land stabilisation and preservation of indigenous objectives. There is scope for additional aforesatation to complement these objectives, and add an extra revenue stream from sequestration of carbon.

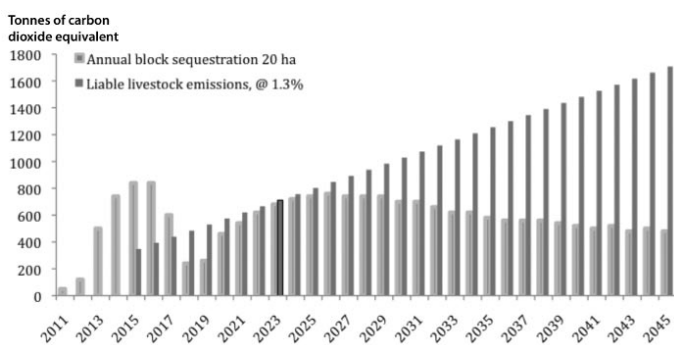
Carbon sequestration from aforesatation also offers the potential to manage the exposure of the pastoral farming enterprise to the liability for livestock emissions. Livestock farming faces two risks around liability for livestock greenhouse gas emissions under the ETS –

- Legislation currently prescribes that the level of free allocation of units abates at the rate of 1.3 per cent each year from the 90 per cent allocation in 2015
- The cost of NZUs that need to be purchased to meet the liability will be subject to market forces.

Becoming involved in a programme of carbon sequestration can enable liability for livestock emissions to be aligned and a natural hedge to be established, independent of variability in the market price for NZUs. One option on the case study farm is to plant an additional 20 hectares of steeper hill land in radiata pine, managed to 450 stems per hectare for clear wood and carbon credits.

Carbon sequestration is based on look-up tables. MAF have produced a guide to look-up tables for forestry in the ETS. The carbon sequestered annually by 20 hectares of forest planted in 2011 would match or exceed the increasing annual liability for livestock emissions until at least 2023.

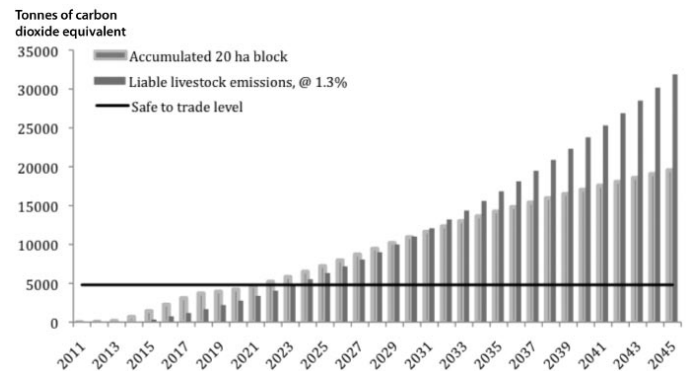
Livestock emission and carbon sequestration from aforesatation



Although livestock emissions are forecast to increase steadily, annual carbon sequestration can be more variable. This is due to pruning and thinning and any surplus between sequestration and liabilities can be stored and used to meet future liabilities. In this way, the 20 hectare forest planting would be able to offset total liable livestock emissions through to 2030.

However, there is a caution. By selling carbon sequestered beyond 2023 to offset liabilities, the 'safe to trade threshold' for the forest is exceeded. This threshold represents the minimum quantity of carbon residual in the forest following harvest and subsequent replanting. Selling

Cumulative livestock emissions and carbon sequestration from aforesatation



NZUs above this level will require units to be surrendered in the period after harvest, exposing the business to the risk if the price of units increases. One option to manage this risk would involve planting an additional 20 hectares of forest in 2022. Planting new forest and aligning liability for livestock emissions closely with carbon sequestration provides the livestock business opportunity to hedge against increases in the cost of carbon.

Conclusions

Hill country sheep and beef farmers have a very limited range of options by which they can influence the level of livestock greenhouse emissions from their business. In considering policy change you need to identify the desired result. Changing livestock policies in a way which increases the amount of animal production in preference to maintenance feeding of stock may reduce the intensity of greenhouse gas emissions. However, at the same time, total farm livestock emissions may actually increase, depending on the feed supply and demand balance.

There is evidence that the sheep and beef sector has, since 1990, successfully reduced the intensity of greenhouse gas emissions associated with producing each tonne of meat and fibre around 10 per cent. In this case study, there was significant disparity between the level of emissions calculated by applying the Climate Change Regulations emission factors and the Overseer derived estimate. It would appear that there is still a real need to develop policies which recognise and incentivise farm businesses towards production achieved with lower-than-average intensity of emissions.

Aforesatation can provide an opportunity to hedge against change in the cost of meeting liable livestock emissions, as well as providing woodlot, land stabilisation and amenity benefits. Consideration of the minimum level of post-harvest carbon in the forest and the 'safe to trade' quantity of NZUs is an important aspect of risk management.

Tony Rhodes is an agricultural consultant for PGG Wrightson Consulting in Dannevirke

John-Paul Praat

An update on the Emissions Trading Scheme

The Emissions Trading Scheme (ETS) has been operating and affecting all New Zealanders for just over a year now. There is a lot of detail available on the web about how the system operates, with some advisors now coming to grips with it. This article provides an overview about how it relates to landowners – your clients as rural professionals.

Early operation of the ETS

For the past year both sides of the carbon ledger emitters, mainly energy producers and suppliers, and sequesters, mainly forestry, started to account and trade in carbon. Before that only owners of land covered in exotic forest in 1990 and 2008 were directly affected. These forest owners had their land use options severely reduced due to international rules restricting deforestation.

The legislated activity of the ETS attracts higher prices for carbon compared with voluntary markets. The principle unit of trading is known as a New Zealand Unit and is equivalent to one tonne of carbon dioxide. The activity under the ETS is starting to give experience of its function and affect on land use.

Between 2005 and 2008 there was a net loss of around 8,000 hectares each year of exotic forest. That has now been reversed to give an average predicted net gain of around 5,000 hectares a year between 2009 and 2012. However most of this, over 12,000 hectares, was approved for funding from the Afforestation Grant Scheme which, at the time of writing, is defunct.

Losing all the hard work

New Zealand as a whole is currently carbon positive and we have had more carbon credits than emissions since 1990. However this could become unhinged as the forest harvest ramps up from 2020 onward. A response in readiness for this could be to increase the rate of new plantings. It has been stated that this will happen in the current environment, but the recent lows in the New Zealand price on carbon, down to around \$14 a unit, may come close to making deforestation to dairy conversion projects viable. This would potentially undo the carbon positive work over the last three years.

For example, the deforestation penalty for a 10-year-old stand of Bay of Plenty pine would be about \$2,340 a hectare at \$13.85 a unit, the price in August this year. In reality it is unlikely to happen at this time given that the true trading

value of NZUs, which has until recently been around \$20, is only established when trading volumes are significant. At present this is between April and May each year. New annual credits are issued in April for forests planted after 1989, and emitters must surrender their units or pay \$25 a unit to the government by the end of May each year.

Eye for the future

Carbon traders complain that foresters are being unrealistic in holding out for \$20 a unit. As a result, trading volume is low. However there is little downside for existing forest owners as the credits cost them little in the first place, so riding out the market lows is lost opportunity cost, not a cash cost.

The value of the NZU is tempered by internationally traded units. Real foresters, not those simply driven by carbon returns, always have an eye to the future. This looks positive as wood is a renewable resource with a wide range of uses. Wood is also likely to appreciate in value as the world becomes more conscious about the sustainability, or lack thereof, of current regimes based on fossil fuel.

For example, forestry has been identified as a more cost-effective carbon recapture technology than any industrial process. Recapture of carbon is anticipated to be a required part of the solution to the rise in global emissions and atmospheric carbon as current efforts to curb emissions have no real effect.

Some main points for rural professionals

This discussion highlights the volatility and immaturity of the carbon market which is based on government policy. However the biological fundamentals remain the same – conserving and maximising the efficiency of our carbon-based systems on the farm is a win for profitability and productivity, and we need our markets to value this as well. So we must operate as efficiently as possible in this environment. Given forestry and energy are in the ETS, we

need to understand the existing opportunities and threats for farmers. Four aspects can be highlighted

One-off allocation of credits for pre-1990 forest

Carbon credits are available for owners of land covered in exotic forest before 1990 as one-off compensation for loss of flexibility in determining how the land can be used. This is available under the forest allocation plan and could be worth over \$1,000 a hectare, but will only be available until 30 November 2011, by which time any claims need to have been processed.

Contact the MAF office in your region for details or go to the website www.maf.govt.nz. The help line 0800 00 83 33 is actually helpful so do not hesitate to use it.

Forestry consultants and some accountants are also familiar with the process, although some lawyers are not. Surprisingly, even some recent purchasers of land with pre-1990 forests were not made aware of a deforestation penalty. This could add more than \$10,000 to the cost of the planned conversion to dairy until after they had gone unconditional on the deal.

Credits for post-1989 forests and reversion

New forests planted after 1989, and areas on a farm which have reverted to indigenous forest since that time, are eligible for carbon credits on an annual basis. The average claim over the first 30 years of growth of pine forest is about 22 units per hectare per year. At \$20 a unit, average income could be \$440 a hectare. This could be very attractive for areas of low agricultural productivity on sheep and beef farms, especially in comparison to historical returns for wool and lamb.

As with any land-based business activity there are environmental and market risks. However these risks can be managed with planning and should not be an excuse for ignoring the opportunities. Since forestry joined the ETS in 2008, about 200,000 hectares of forest land, or just over 30 per cent of the eligible area, has been registered in the voluntary scheme. Annual carbon credit generation from this area would supply around 25 per cent of the predicted annual demand of 16 million NZUs.

Even if all post-1989 forests enter the scheme there will be a shortfall in supply which should result in a high price. However, there is currently an over-supply from a backlog of credits since the entry of forestry to the scheme and the provision of one-off compensatory credits for pre-1990 forests. This will take several years to work through. The market price is likely to feature spikes and troughs as the balance between supply and demand takes effect.

The ETS improves the economics of forestry

Traditional analysis of investment in forestry, where land is purchased and trees are planted, uses discounted cash flow analysis, due to the long time lag between investment and return. To maximise returns a short harvest rotation is used of around 27 to 30 years. The addition of an early annual income from carbon significantly improves the attractiveness

of investment in forestry and the amount an investor can afford to pay for land.

At \$20 a unit, the amount an investor could pay for land when establishing a radiata pine forest increases from \$500 a hectare up to \$4,000 a hectare to achieve an eight per cent return on the initial investment. At \$30 a unit, \$6,000 a hectare could be paid for land to achieve the same return. This would seriously compete with returns from agricultural livestock. Carbon has traded between \$13 and \$65 a tonne so this is not outside the bounds of the market. Such prices could see whole farms retired for carbon investments.

However, a much better outcome would be for farm operations to incorporate forestry investments and native reversion on appropriate low-pasture productivity areas. This would add additional carbon income and diversification to the farm business and support sustainable land management while maintaining New Zealand's production of high value foods to export markets. Farm businesses should look seriously at how they participate in potential carbon returns to diversify their production base which will make them less vulnerable to financial pressure.

Future liabilities for agriculture

The current regulation will see meat and milk processors having to provide the government with carbon credits equivalent to a portion of the methane and nitrous oxide emissions associated with the livestock products they receive from 2015 onwards. Initially this will equate to 10 per cent of emissions, but will then gradually increase to 36 per cent by 2040. As the point of obligation will be the processor, this is likely to result in some form of levy on farmers.

Establishment of investment in areas of forest is one way that farm businesses could consider insulating themselves from this cost. For a 4,500 stock unit sheep and beef farm the cost of this could be offset by the farmer for the next 30 years by establishing 26 hectares of pine forest without incurring a carbon penalty at harvest. While the emission costs are relatively low at \$25 a unit, an additional 90 cents a lamb, they could increase should the price of carbon increase.

Future developments

International speakers at recent carbon-related conferences currently consider that a global agreement of the same style as the Kyoto Protocol is unlikely to be in place after 2013. There is simply too much diversity among the players and not enough time for resolution before January 2013. What seems more probable is that linkages will develop between the ETS type of entities, such as those in the European Union, South Korea, California, New Zealand, Australia and China which either have, or plan to have, trading schemes in place from 2013 onward.

New Zealand could use this to customise solutions which suit our situation. For example there could be transferable offsets allowing the carbon lost by deforestation in one location to be offset by afforestation in another. Alternatively, in what seems like good logic, there could be recognition that all wood is not converted to carbon

dioxide at harvest and that a portion is sequestered for a period thereafter. In addition schemes which recognise any increase in biomass in our protected native forests may also gain more traction.

Farmer clients affected

The ETS has been reviewed and recommendations went to the government in June. However, there has been a delay in announcing any changes to allow the effect of the recently announced Australian Carbon Pricing Mechanism to be assessed. This is yet to be legislated, but is unlikely to have any effect on the ETS given that it is a carbon tax due to start in July 2012 and will have no carbon trading functions until 2015. By this time the ETS would have been through a further review due in 2014. The Australian tax will apply to most fossil fuel emissions, but not domestic fuel. Commercial forestry species and agricultural livestock emissions are specifically excluded.

An aspect which may have relevance is that up to five per cent of emissions could be offset by credits sourced from

Australia's carbon farming initiative. Credits will be available by removing carbon in growing a forest or reducing tillage on a farm. However, no details on when and how this might occur are available. Current projects vying for official recognition include increasing soil carbon and companion planting of low-growing eucalypts.

The current New Zealand government has made it clear that the ETS is not going away, and major opposition parties have made it clear they would ramp up responsibilities. As rural professionals you should take time to work out how it could affect your farmer clients. Some of you will have attended a MAF ETS workshop in the last 12 months focused on agriculture and or forestry. A further series of workshops are being planned at present. Please contact the author if you have specific requirements of these workshops in terms of location, timing and topics jp.praat@pahandford.co.nz.

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Anna Campbell

Global environmental opportunities for New Zealand agriculture

Recently I sat at a table with representatives from a leading UK supermarket and discussed the ETS. They asked the question, while shaking their heads – why would a country which relies on agricultural exports include agriculture in their emissions trading scheme? They were answered with a slightly bemused chuckle.

It seems that a proportion of people within the agricultural industry do not want agriculture to be part of the ETS. Right now we hope, probably in vain, that during the current review the government will see sense. There is an urban belief that the reason why the agricultural industry do not want to be part of the ETS is that they are non-believers in climate change and do not want to do their bit.

Farm sustainability

The reality is far different. The vast majority of farmers understand environmental balance as it directly affects their bottom line. It is quite simple – farm unsustainably and your farm will not continue to perform. That is not to say there is no room for improvements in the way we treat our environment. The deterioration of many of our waterways is a prime and justified attack point for the media.

But the ETS will do nothing to mitigate such problems, which is why, with its negative, tax-like approach and narrow focus on carbon, it lacks vision and leadership. These are the very attributes we need to demonstrate to rise above our

current OECD status. The issue I have with the current inclusion of agriculture in the ETS is that it does not do what it sets out to do – which is reward or incentivise behavioural change. Until it does that, the ETS is a glorified and bureaucratic tax on farmers and food export companies, which creates no commercial advantage for New Zealand products in the market.

So do we throw up our hands in despair and give up? No, what we need to do is to take the lead, lobby smarter and come up with a better vision for our industry. The two options I see are set out here. Personally, I favour the second, but more about that later.

Incentivisation of behavioural change via the ETS

The first option is to accept that agriculture will be part of the ETS. Lobby the government to ensure that farmers who can prove that they are part of environmental improvement schemes can be rewarded or incentivised as soon as possible.

The point of obligation, as set out currently in the ETS, is with processors of our meat and milk processors. Meat must calculate emissions from the number of livestock slaughtered and the tonnage of carcass weight processed. Dairy processors must calculate emissions from the quantity processed of milk solids from cows and goats, or milk fat from sheep.

Under this scheme, there are other options as suggested by my colleague Dr Peter Amer, which would be more effective in incentivising a reduction in greenhouse gas production –

- The levies could be directed more aggressively to cull slaughter animals on a per kilogram carcass weight basis
- The levies could be targeted at the highest value products such as prime lamb, beef, venison and milk

The first option would send a useful price signal to farmers by putting a proportionally higher levy on animals which produce a large proportion of farm methane emissions, such as adult breeding and milking animals. This would encourage efficiency, but the second option will be less noticeable and more politically acceptable.

Overall, these are tweaking a flawed scheme and, in terms of actually incentivising behavioural change, the best way is to place the point of obligation at the farm level. This will mean more bureaucracy, but farmers who can prove they have lower emissions than the industry average will be rewarded.

Farm forestry options

The government has indicated that there will be a place whereby farmers, or groups of farmers, can apply for unique emissions factors. Regulations and details around this process are not yet available. There are also opportunities for farmers to obtain carbon credits via farm forestry within the ETS. Consultants at AbacusBio have modelled options around opportunities with farm forestry. They estimated that land with a carrying capacity of less than 5.5 stock units a hectare may benefit economically from farm forestry if the price of carbon dioxide equivalent is of \$25 a tonne.

Under such a scenario farm forestry opportunities will be taken up by farmers, but milk and meat products will remain vital for our country's growth. We need to ensure that they are both at the forefront of government decision-making.

Create a sustainability vision

This programme would go beyond greenhouse gas emissions to develop wider sustainability objectives to anchor New Zealand's environmental values. The programme would be associated with market development and branding, as well as incentivisation schemes for agriculturalists and penalty schemes where absolutely necessary.

We live in a time of unprecedented global connectedness, which means that what we do here in New Zealand is noticed by our overseas markets. The international exposure

seen last year when statistics around New Zealand dairy inductions were publicised was a case in point for anyone involved in the export of New Zealand products.

In terms of thinking about what a sustainability vision would entail, KPMG summed it up in their 2010 'Sustainability in the Agribusiness Sector' paper. They stated that a sustainable supply chain is a whole life-cycle approach. They listed the issues for New Zealand agriculture seen as fitting under the sustainability umbrella. These were wide ranging and included issues such as water use, food safety, animal welfare and product integrity.

Business strategy

Businesses are already exploring opportunities and investing time and money into this space. Behind the '100% initiative' is an impressive group of New Zealand business leaders including Geoff Ross of 42 Below, Phillip Mills of Les Mills, Rob Fyfe of Air New Zealand and Jeremy Moon of Icebreaker along with around 20 others in a privately funded steering group to champion sustainability as a business strategy for New Zealand.

In the agricultural space, and closer to home is the Alliance Group Hoofprint initiative by the Alliance Group together with AbacusBio. Hoofprint allows Alliance Group to communicate with key markets as to the current status of their producer farm footprints and how they might improve.

The Hoofprint programme is part of a commitment to reducing the carbon footprint of its whole supply chain. The company has already reduced its processing carbon dioxide emissions rate by 26 per cent since 2000. They are also investigating opportunities beyond greenhouse gas emissions.

Taking another perspective, there is a raft of 'cleantech' type companies which have started in New Zealand in the past 10 years. An excellent example is LanzaTech, who would also benefit from an internationally-marketed and recognised sustainability vision.

Pulling together

So how do we pull such leading business initiatives together? The government has just announced that a \$25 million fund is being set up, to be known as 'The New Zealand Fund for Global Partnerships in Livestock Emissions Research'. The government could add to this fund to create links among our exporters, both agricultural and non-agricultural, to develop and market a wider environmental vision.

In five years' time, I would like to be sitting around a table with international retailers who say that the New Zealand government has a great commitment to sustainability. It would be great to hear them say 'you have an amazing place to do business in, if only our politicians had such foresight'.

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A success story for Parininihi Ki Waitotara Incorporation

Parininihi Ki Waitotara (PKW) is a Maori incorporation, constituted under the Te Ture Whenua Maori (Maori Land) Act 1993, and it is located in Taranaki. Up until June 2010, PKW employed 12 independent contractor 50-50 sharemilkers and one variable order sharemilker, milking a total of 7,000 cows and producing 2.4 million kg milk solids. This made it the largest Fonterra supplier in Taranaki.

There are six farms with between 600 and 900 cows, five farms with 200 to 500 cows and two smaller cow units with less than 200 cows. PKW also has two dairy support units with the capability of contract grazing 600 dairy heifers.

PKW performance was recognised in 2006 for Maori dairy farming excellence with the award of the Ahu Whenua trophy. What follows is some of its history and the challenges it faces in today's competitive environment.

Original history

PKW traces its origins to the Crown's 1865 land confiscations, which took place in Taranaki following the first and second Taranaki wars of 1860 and 1863. The current West Coast leases form a residue of lands returned to Maori owners following the confiscations. A compensation court process was established to hear the claims of Taranaki Maori affected by the confiscations. As a result, 225,000 hectares were purchased from Maori and 104,000 hectares returned to Maori, leaving 187,000 hectares as the final area deemed by the Crown to be confiscated. Of the original 515,000 hectares confiscated only 20,000 hectares remain under the current administration of PKW.

The spark which set alight the Maori wars was the 1860 transaction known as the Waitara purchase, also known as the Pekapeka Block. The government decided to use military force to secure the purchase of the land from an individual who did not possess the right to sell it. Following the confiscations, the Confiscated Lands Enquiry Act and the Maori Prisoners Trial Act were passed which set up a commission to enquire into alleged promises and grievances in connection with the Taranaki confiscated territory.

The Fox and Bell Commission, also known as the West Coast Commission, came down with findings in 1880, resulting in the enactment of the West Coast Settlement (North Island) Act 1880. The broad effect of this was to confer power to effect final settlements of Taranaki Maori

claims and grievances. These hearings were followed by the enactment of the West Coast Settlement Reserves Act 1881. This was ultimately repealed by the 1892 Act initiating administration by the public trustee of the reserves arising out of the Fox and Bell Commission.

While the Act placed an obligation on the public trustee to consult the native beneficiaries and settlement of the lands, the promises to return the land to the rightful owners originally made in 1866 remained unfulfilled. The settlement question was finally settled by the West Coast Settlement Reserves Act 1892. The public trustee was empowered to allocate to Maori such land thought necessary for their occupation and to lease the rest to European settlers

Perpetual leases

The current Taranaki landscape is very different from what was physically taken up by the early settlers, including the original West Coast lessees as early as 1880. Tenure uncertainties discouraged long-term investment. The New Zealand Pioneer Society had ample developable freehold land in which to invest without risking capital in uncertain arrangements. The cultural background of the early settlers, particularly those from Ireland and Scotland where landlords were often oppressive and tenure problems were rife, made fee-simple tenure attractive. This probably led the Crown to change the original terminating leases to create a perpetual lease regime to encourage a climate of settler development.

The process set in place leases in perpetuity over the land PKW now owns and manages on behalf of its 8,500 shareholders, the vast majority of whom are descendants of the original Maori owners. Maori reserved land leases are a form of tenure that fall within the general categorisation known as Glasgow leases. These ground leases have been a subset of the New Zealand property market for 110 to 120 years. The leases differ from capital or market value leases in that lessees pay for and own all improvements to the land.

The interest being leased from the lease or owner of the land is the land in its unimproved state, and all improvements on and to the land being owned by the occupiers known as West Coast lessees.

Interim history

Taranaki Maori voiced numerous complaints about the extent of the power given to the public trustee. Several commissions of enquiry were set up, but owner calls for assistance for Maori to farm their own lands were not supported. Instead legislation was amended providing settlers more favourable terms and allowing the Crown to buy the land. In the 1920s there was considerable free-holding by lessees where the Maori owners wished to sell their interests and individual sections of the land.

The Meyers Commission was set up in 1948 to report on how the leasing laws operated. The Commission found that 'Maori had suffered grave injustices and the reduction of their rents since 1934' and recommended options for assessing future rentals. The Maori Reserved Land Act 1955 standardised the leases of Maori reserves across the country, and the purpose was to deal with rapidly fragmenting beneficial interests by fixing leases to perpetuity.

In 1963 all the West Coast Settlement Reserves were amalgamated into one large reserve known as Parininihi Ki Waitotara Reserve of 29,125 hectares. While the intent was to make things simpler, the move has been a source of disagreement, pain and confusion for owners ever since. It gave beneficial owners shares in the whole of the lands, rather than owning individual interests in just their whakapapa-related section. This process made land sale easy because the Maori trustee could aggregate individual sellers in order to sell blocks, even if the former owners of those blocks were opposed to the sale.

In 1975, a further commission of enquiry was established following continuing frustration about the effect of the 1955 Act. Despite recommendations for a move to five-yearly rent reviews away from 21-year rent reviews, most of the Commission's approvals were not implemented, apart from the one relating to setting up an incorporated body of owners to administer the reserve.

PKW was established in February 1976 to administer 22,313 hectares including the leases and the rents. This process was supported by the descendants of the original owners in an effort to halt further alienation of their ancestral lands.

Pivotal changes

Under the incorporation model, former landowners were allotted share interests in the incorporation, but not the land itself. At the time some owners viewed this as an interim step towards the goal of regaining direct ownership of their property, but the perpetual lease regime still denied owners any form of control over their own lands.

During the 1990s, the government appointed various consultants and commissions, including the Marshall and

Trapski reports, to continue to address the problem of inequities faced by Maori reserved land owners. In 1993 the Minister of Maori development from the Maori Reserved Land's Panel found that the leasing system had –

'... interfered with the natural and inherent rights of Maori landowners by removing Tino Rangatiratanga, the right to make their own decisions in respect of the land; the system has treated them like children or people under a disability and capable of making their own decisions, simply because they were Maori.'

The watershed for PKW development came out of the 1997 Maori Reserved Land Amendment Act. This was yet another attempt to balance competing owner and lessees interests. The main features of this Act included –

- Continuation of the perpetual leases.
- Three-year delay before moving to market rental.
- Moving rent reviews to every seven years, previously 21 years
- Giving landowners a 20-day first right of refusal under strict conditions.

While the Act did not terminate perpetual leasing, it did at least provide some mechanism for the incorporation to buy back leases as they became available. Despite a modest amount of compensation being made available, a fundamental flaw in the mechanism was, and remains, the incorporation's inability to find sufficient capital to buy back the leases.

Rent reviews

About 70 per cent of the 28,000 hectares of the Maori Reserved Land under perpetual lease in New Zealand is in the Taranaki or Waverley/Waitotara area. PKW inherited a peppercorn rent cash flow from the Maori trustee in 1976. The previous rent review had been completed in 1969 in a period of relatively low inflation and low values. This compared to the period of high inflation that took place over the period from 1969 through to 1990. PKW were locked in to a non-reviewable 21-year rental with no opportunity for review procedures.

The first rent review for PKW was notable for a number of special features. The statutory framework for the 1990 rent round was for the then Valuation Department to carry out the rent review assessments under the statutory framework with both owner and lessees having the right to object. Valuation assessments at that stage before the amending legislation, were limited to an assessment of the unimproved value, taking into account there was a prescribed rent rate of five per cent as set out under the legislation.

Objecting to the assessments

Both the lessee and the lessor objected to the assessments carried out by Valuation Department for a number of reasons. Because assessments had been carried out six months before the specified date, rising values between the previous six months and the specified date saw an unprecedented level of inflation and rising land values which were not captured in the assessments. In addition a number of leases captured

under one valuation assessment were valued in blocks rather than being treated as separate lease assessments. The result was that the valuers acting for the incorporation considered that the unimproved values did not represent the market.

Another reason for an objection was the issue of the treatment of native timber. The Malpas-Atihau case was revisited taking into account the then current value of native timber. Expert advice in respect of much of the land and the PKW portfolio identified that, in its unimproved state, there would have been extensive valuable native timber reserves in today's environment. This would have considerably enhanced the unimproved value depending on the results of the legal position.

Research into old valuation reports before the 1900s indicated some of the land previously valued as having an original cover status of bush were in fact made up of clearings. Maori owners had not been given due credit for clearing carried out by them before the inception of the leases.

Tribunal findings

The findings of the Tribunal were interesting.

First, in respect of the unimproved value that would form the rental value for the 21-year period. The Tribunal's finding was that, in spite of the rent review process starting six months before the specified date, the unimproved value must represent the true value at the specified date. In fact the test case process resulted in a large measure of agreement between the valuers acting for the lessee and lessor. These were substantially different from the valuations carried out by the Valuation Department resulting in some quite considerable increases.

In respect of the native timber issue, the Tribunal's finding followed a Court of Appeal decision. It was that the cutover bush principles as per Malpas-Atihau remained intact. The correct legal position for the valuer to adopt was to imagine the bush as being in its cutover state, excluding the value of any native timber.

In terms of native clearings based on a Court of Appeal finding, the date for assessing the unimproved value was at the commencement of the lease in 1892. Credit was to be given to the original Maori owners for improvements in respect of native clearings. Previous assessments carried out on the basis of a literal assessment of the unimproved value, as if no improvements had been made without considering any date, were replaced with a value assessment for improvements made by the original Maori owners pre-1892. Where in the past improvements made by Maori owners before 1892 had been mainly ignored in previous rent review processes, those clearing improvements now merged with the unimproved value becoming a lessor asset.

Another eight years

Following the 1990 rent review and eight years of protracted and expensive litigation and Tribunal hearings, PKW and the Lessees Association entered into discussion. This was with respect to the manner in which the rent review process would be carried out in future. PKW and the Lessees

Association resolved to adopt a collegial process where an attempt would be made by the valuers acting for both sides to agree on as much as possible relating to the rental value and the rental rate.

The 1990 rent round only required the assessment of the unimproved value because of the prescribed five per cent rate. However, the 2003 assessments following the amending 1997 legislation moved to the basis of the assessment of a fair annual rent. The valuers were able to agree on all the values required for the rent review process – 3,000 individual values for the 313 individual leases. Arbitration was required to settle the rental rate for the 2003 rent review, this being the first test of the new legislation relating to a fair annual rent. The 2011 rent review has been completed, with full agreement between the valuers acting for both PKW and the Lessees Association for both the rental value and a rental rate without any form of dispute resolution.

The agreement reached between both the incorporation and the lessees for the valuers in the agreement reached highlights the relationship that exists between the lessor and lessees as business partners in the relationship. The other main issue was the professional relationship which existed between the valuers involved. This allowed for a significant reduction in what could have been a protracted and expensive valuation hearing at considerable cost to both parties.

Farming operations

Regaining active control of its ancestral lands has always been a high priority. Before the amending legislation in 1997, PKW administered passive control over 343 ground leases on 20,000 hectares, apart from two parcels of fee-simple land that had been acquired as a result of cultural links to adjoining land.

Following the amending 1997 legislation, PKW completed its land management plan, the first significant comprehensive review of its land assets, regarding regaining active control of its land portfolio. That land management plan comprehensively reviewed all leases for physical and land use capabilities for how each individual parcel would factor into mega units employing economies of scale to optimise productivity and performance.

Into dairying

The strategic purpose of the land management plan was to identify key Class I and Class II leases with potential for aggregation. This would allow PKW to enter the dairy industry and farm its lands for the benefit of its shareholders, and with its own people farming its own land. From the outset the project was identified as a capital intensive due to the requirement for PKW to buy the interests of the lessees before any work could begin.

The process was made even more difficult by changes taking place to the New Zealand dairy industry restructure which in 1991. Unbundling started and new entrants were required to buy shares to gain the right to supply milk. Under the Fonterra constitution the definition of supplying shareholder was linked to the occupier on the land.

In the case of the PKW corpus land perpetual leases, the lessees were deemed to be the supplying shareholders and unbundling vested share capital to the occupier rather than the landowner. PKW has been significantly prejudiced with rental losses and having to acquire shareholding to progress the land management plan.

Since 1997, PKW has acquired 46 of the 343 leases and now farms 2,423 hectares with an effective area of 2,163 hectares. All acquisitions have been debt funded, apart from some of the early acquisitions being equity funded from past rental losses compensation arising out of the MRL Act 1997. The debt funding strategy, however, is limited by the incorporation's ability to generate cash flow. This leads to the perverse situation where land sale was a consideration to secure strategically important leases. Sale has now been ruled out by both the shareholders and the committee of management to protect the further diminution in ancestral land.

The challenge faced by PKW management and governance has been to carry out the land management plan against a steadily rising market for dairy farms. In addition was the Fonterra unbundling, and a legacy structure farming 50-50 sharemilking contracts representing a yield of 2.7 per cent compared to a cost of capital above five per cent.

The future

In order to improve operational performance and match or improve the cost of capital, PKW has made a structure change and is piloting two managed farms for the 2011/12 dairy season. The modelled yields, even in Taranaki which is one of the most expensive areas for dairy farm real estate, exceed five per cent. Management has been successful in retaining

key intellectual property with sharemilkers as managers and capital redeployment from stock into land ownership.

Moving to a managed farm structure in a corporate regime comes with high risk. PKW management are well aware of the risk, and to date have been able to mitigate that risk by retaining intellectual property. This is fundamental to the success of high performing high risk dairy ventures.

Five-year plan

PKW has recently completed its five-year business plan which identifies capital expenditure of \$65 million, based on \$36 million for land, \$20 million for livestock and approximate \$9 million for development. They are currently investigating a calf-rearing enterprise to mitigate the cost of acquiring livestock.

Despite overwhelming odds and challenges, PKW has developed itself into a significant enterprise within Taranaki. It has the potential to become a significant agribusiness player at the national level. Its land portfolio has a potential for dairying over 14,000 hectares, or approximately 42,000 cows producing 14 million kg of milk solids.

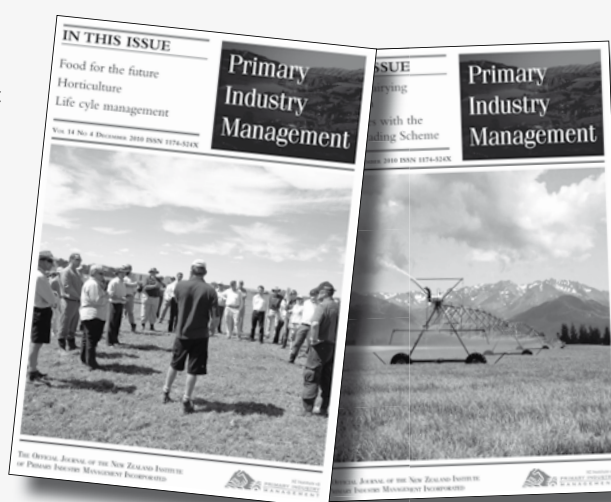
The challenges are to optimise operational performance to match or better the cost of capital to develop the land management plan, and attract key people. This is the recipe for successful agribusiness.

Ranald Gordon is a Registered Valuer, Registered Farm Management Consultant, Licensed Real Estate Agent, Qualified Arbitrator (FAMINZ) and an NZIPIM member. He was the General Manager of PKW Farms Ltd from 2006 until 2010 until taking up appointment as General Manager Land Assets.

In upcoming issues of Primary Industry Management

In the December 2011 issue we hope to feature the West Coast of the South Island along with another feature on governance. Looking ahead to March 2012 the feature will be on the Bay of Plenty and perhaps a bit more of a technology update.

We are always looking for more articles and keen to have contributions from NZIPIM members. If you would like to contribute on any of the subjects mentioned above, please get in touch with the editor, the details as usual are on the contents page.



Employment law for farmers – some case studies

An employment agreement provides both an employer and an employee with clarity as to their obligations. The best practice for an employer is to have a well-drafted employment agreement, and to combine this with regular constructive communication with staff.

Time and time again employers fail to get the essentials right. They wait too long to address problems and to seek assistance when problems arise. I use three case studies and each looks at the problem, the process and the result. These studies all highlight the importance of having a proper employment agreement in place, and the need to combine the agreement with advice to achieve the best possible outcome.

Case study one

This is about a farmer with several farms who employed a number of staff without mishap for many years. The employer could have been seen to be lucky that no employment issues had arisen in the past. However, the employer was guilty of adopting a rather lax approach to his employees and was fairly lenient in terms of their work ethic.

A problem arose with an assistant farm manager employed mid-season under a standard Federated Farmers individual employment agreement. Part of the employee's job description was to raise calves and at the interview the employee had confirmed he had calf-rearing experience.

Within a few months it became apparent to the employer that the employee was not as capable as had first been at the interview. The farmer raised several issues with the employee at a meeting including plant hygiene, calf-raising practices and his poor attitude and behaviour to other staff members. The employee did not accept the employer's criticism. From that point he became very difficult to manage, and his behaviour negatively affected other staff on the farm and the employment relationship with his boss.

Better management

The employer was not able to use the 90-day trial period provision contained in the employee's individual employment agreement to terminate his position as the employee had been working at the farm longer than 90 days. The employer had failed to document the previous meetings and warnings for poor performance and bad behaviour. As a result, he was unwilling to terminate the employment relationship for fear

of retribution.

From discussions with the employer's solicitors it was decided that better management of the employee would more effectively handle the problem. A performance management plan was implemented and the employee was placed on weekly reporting to manage his behaviour and workmanship.

The employee was also paired up with another more senior work colleague who was able to mentor and monitor him more effectively. This enabled the employer to ensure that the employee was carrying out his work to a standard that the employer was satisfied with, in addition to fulfilling his obligations in accordance with his employment agreement.

Improvements

Within one month of implementing this plan the employee's behaviour had improved dramatically. He was more receptive to constructive criticism, was more aware of his obligations in terms of his employment agreement, and had learned some very valuable skills by watching and working alongside his more senior colleague.

Although this may be seen as the best possible outcome, it happened because of proper management and advice. The employer was in the unique position that he was able to pair the employee up with a more senior colleague. However, this buddy system proved invaluable as the employee was able to gain some insight into the employer's expectations without the constant monitoring of daily reporting.

As a result both the employer and employee began to feel more confident in their respective roles. The employer was able to, with the assistance of his solicitor, to manage the employee to a point that he was offered a role the following season and stayed permanently for another three seasons.

This case study certainly highlighted a number of important points including –

- The need for proper reference checking
- Having the appropriate individual employment agreement

- The use of the 90-day trial period provision
- The need to communicate with staff to ascertain any problems at an early stage
- The use of buddy or pair system to mentor staff where appropriate.

Case study two

This second case study involved an employer who had employed a dairy farm hand. The employee had been provided with a rough job description. However no employment agreement had been shown to, or signed by, the employee. When questioned, the employer advised that he just 'had not got around to getting one sorted'. The 'she'll be right' mentality has in recent years seen many employers within the industry penalised by the Employment Relations Authority.

The employment relationship continued without mishap for around six months. However, the employee's behaviour slowly began deteriorating to a point where there would be periods of unexplained absence. The employer suspected the employee was taking drugs, and there were occasions that he had arrived at work intoxicated. The employment relationship continued to deteriorate to such a level that the employer would not know from one day to the next whether the employee would be at work the next day, and if he was, what state he would be in.

Relationship ends

Most comprehensive individual employment agreements contain provisions for drug testing, abandonment of employment, termination for serious misconduct, as well as drug and alcohol policies. However in this case the employer had nothing signed and so could not rely on any individual employment agreement to test the employee or terminate the employment relationship. Fortunately for the employer, the employee was arrested for possession of drugs and the absence brought an end to the employment relationship.

Had this not been the case, the employer potentially would have had to either follow a drawn-out and potentially risky termination procedure to minimise the possibility of a personal grievance being raised by the employer, or he could have dismissed the employee. However, he would have run the risk of being penalised by the Employment Relations Authority for not having an employment agreement in place. This was potentially a very unfair outcome for the employer, but reasonable for the employee given that the employer had disregarded his obligations.

Important points

Again, certain important points arise from this case study including –

- The importance of ensuring there is a signed individual employment agreement in place with each and every employee
- Recognition of the minimum statutory requirements for an employment agreement as in section 65 of the

Employment Relations Act 2000. This should include the names of the employee and employer concerned, a description of the work to be performed by the employee, an indication of where the employee is to perform the work, an indication of the arrangements relating to the times the employee is to work, the wages or salary payable, a plain language explanation of the services available for the resolution of employment relationship problems, including a reference to the period of 90 days in section 114 within which a personal grievance must be raised, and must not contain anything contrary to law or be inconsistent with the Act.

- Identifying the need for a clause providing for drug testing
- Inserting a provision for abandonment of employment, most commonly three consecutive days without contact, into the employment agreement
- Identifying in the employment agreement what defines serious misconduct and the process to be followed in the event that misconduct is suspected.
- The use and implementation of a comprehensive drug and alcohol policy.

Case study three

This final case study deals with an employment dispute which was successfully resolved because the employer had taken the time to ensure that his employment agreements were up-to-date and in line with the law. The employment agreement the employer had had drafted at the beginning of employment enabled both parties to successfully resolve the dispute without irreparably damaging the relationship.

The problem arose approximately a year into the employment and involved an employee being in a farm accident with a power take-off. Following the accident the employee did not complete the relevant accident report in accordance with her individual employment agreement – nor did she have anyone else complete the report on her behalf. Instead she left the farm and went directly to the doctor. As a result she was deemed as being unfit to return to work by the doctor and was placed on ACC for one month.

Poor communication

Following the doctor's appointment the employee did not advise the employer of the accident, that she had been to the doctor, nor that she was on ACC. From that point the employee's communication with the employer decreased significantly. The employee began screening her calls and only communicated with the employer using text message. She refused to confirm details about the accident and instead said she would let the employer know when she was able to return to work.

The employer was understandably extremely frustrated. He contacted the employee using a text message and then backed this message up by delivering a letter to the employee's farm accommodation. The letter required the employee to attend a meeting to discuss the injury and she was advised that she could bring a support person. The purpose of the

meeting at that point was to gather further information about her injury and was not a disciplinary meeting.

Poor understanding

The employee attended the meeting and she was asked to provide copies of her doctor's certificate and ACC information. She was questioned about the injury and why she had not completed the relevant accident report. The employee explained that the reason for her reticence was that she was embarrassed about the accident because at the time it occurred she was not following proper procedures. She thought she was going to lose her job and did not want the accident recorded for that reason.

The employer explained the purpose of accident reporting and how important it was that the employee communicated with him. The employer also reiterated the contents of the health and safety policy and how important it was that the employee followed those guidelines.

The employer's individual employment agreement included a comprehensive injury and illness clause that, in the event she was unable to return to work, her position would not necessarily be held open for her. She accepted this, and confirmed that she understood that it would mean that if she did not recover from her injury then her position could possibly be terminated.

Agreement is important

The employer accepted that the employee had suffered a genuine injury and was on ACC as a result. The employer liaised with the employee's case manager at ACC and between them a plan was implemented to allow the employee to stagger her return to full-time work. While she remained off work the employer encouraged her to provide him with regular updates of her progress and recovery. As a result of the accident the employer also reassessed his power take-off vehicle safety policy and arranged for some further workplace training for all of his staff.

This particular employer recognised the importance of good communication with staff and was committed to ensuring all his staff were properly trained and aware of their obligations. Because the employer had taken the time to ensure that he had a comprehensive individual employment

agreement, he would have been able to terminate the employee's position had she been unable to recommence work. This is something that many farming employer's tend to overlook.

More important points

This last case study identified some important points. There is a need for a comprehensive health and safety policy in individual employment agreements in the agriculture sector. Ensure that the employee is aware of the need for proper accident reporting in accordance with the Health and Safety in Employment Act 1992 which includes –

- The place of work
- The time and day of occurrence
- The nature of the occurrence
- The cause of the occurrence
- Any investigation carried out
- Any significant hazard involved
- In the case of injury to any person – the personal details, whether they were an employer or some other person, the person's occupation, duration of employment and the time between the person's arrival and the time of the accident, the treatment provided, a description of the injury, the nature of the injury, and the name and position of the person recording the details if not the one involved.
- Good communication with staff
- The importance of proper training for operating farm machinery
- Ensuring that all staff promptly provide all information related to their accident, including doctor's certificates and ACC details.

Ensuring that all employees have signed an employment agreement at the beginning of their employment should not be seen as a problem. These agreements are absolutely vital. With the inclusion of additional clauses over and above the minimum statutory requirements, employers are able to better provide for a wide range of situations to protect and preserve the employment relationship.

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James Lockhart

Observations on farm business governance in New Zealand

We know little about good governance. Nor do we know much about the relationship between good governance and subsequent business performance. The cause simply has not yet been established. However, where we find business failure we often find elements of what is increasingly regarded as poor governance. Business performance has become the responsibility of the organisation's governors. This article presents reflections on current governance practice in New Zealand's agricultural sector and how this may be improved.

Business schools' contribution to governance

Business schools and business researchers seldom venture behind the farm gate. In most developed nations the responsibility for the business education of farmers and the research of their enterprises lies mostly beyond the interests of business schools. There are some exceptions but rarely do business schools target rural audiences, especially the producers of raw commodities. The domain of business schools typically starts nearer the consumer.

On occasion, business school research and teaching are targeted at the management and governance of first stage processors. This may also encompass some of the attributes of supply chain management, but that is mostly downstream of agricultural producers. But in general, business schools rarely focus their limited resources on the food and agribusiness sector.

Inadequate preparation

Cynics may argue that this is part of the current global financial problem – the almost entirely abstract teaching of business concepts by a faculty remote from the community they supposedly seek to serve. The business school environment does not necessarily prepare graduates adequately for the community within which they are expected to contribute.

For example, the relationship between Arthur Anderson, Enron and Ivy League MBA graduates is well documented. In New Zealand a similar pattern has emerged over the last three decades. Domestic business schools have retained only latent capability or provide limited offerings to the sector while others ignore it completely. Their interests appear to lie mostly in generic business research and teaching conducted at the functional level of the firm.

Not much relevance

Despite that neglect, the emerging concerns among business schools surrounding governance, leadership and management, especially that relating to small business in terms of employee numbers, ought to be transportable across sectors. Business school knowledge should be of relevance to the farming community, assuming a thorough understanding of the context is sought and the knowledge is then appropriately applied.

The warning here is that much of what is written in the domain of corporate governance, leadership and management is likely to be of little immediate relevance to rural family businesses without adequate translation. The same argument could be said to apply to small family businesses elsewhere, especially when legal, compliance, reporting and human resource responsibilities are generally minor activities.

Until the late 1990s the source of much business success or otherwise was attributed to the CEO. In many nations especially the United States, the CEO was heralded as the corporate saviour. Lee Iacocca was the first CEO to promote his own success by way of an autobiography in 1988. In doing so he started a trend that continues unabated today. Despite much of this literature attracting considerable criticism – beach reading at best – it is avidly consumed and is expected to influence the practitioner community.

Corporate boards

The collapse of Enron in December 2001, however, shifted the direction of the lens through which much business success is now examined. Suddenly the corporate board had become important, although the recognition of governance as a source of wealth creation began emerging a decade earlier following publication of the *Cadbury Report* in 1992.

It is worth reflecting on the differences in composition of typical United States corporate boards and those found

elsewhere. These boards have always had a unitary structure, consisting of a mix of independent and executive directors. In addition, the positions of CEO and board chair were commonly held, and still are, by the same person. Therefore, much United States business research fails to recognise that the distinction between board and management activity. Arguably, much of it fails to recognise that the board exists for purposes other than compliance.

The same shift in attention is now occurring in the small to medium-sized enterprise and family business domains. Influential contributions to this understanding of business performance, benefiting from earlier United States corporate experiences and research, are now being firmly led by the Europeans, particularly the Germans and Scandinavians.

Limitations to our knowledge of governance

The limitations to our knowledge of effective governance are due to two phenomena. The first is to do with the respectability of research methods, and the second with access. Respectable research generally involves either large-scale data, searching for relationships with the hope of eventually identifying a link between variables, or the use of laboratory or near laboratory-like conditions in a simulation of the real environment.

Much governance research has reduced the reasons behind board and subsequent business performance to a pseudo-linear input-output model. Despite perceptions to the contrary, little of this research has been revealing. For example, there is as yet no systemic support for the view that independent directors add value. The second limitation is due to the difficulty of accessing the board room. Only in rare instances have researchers entered the boardroom or a proxy site for the boardroom. Therefore we have the mystique concerning what goes on.

Board value

Does a board really add value, and if so how? Some boards appear to add considerable value, while others are culpable of wealth destruction. Yet why that may be the case is not well understood. For example, current recommendations to have more women on boards are admirable. But we currently do not know if men are effective governors. In some cases they are demonstrably not. Whether or not this is a function of their sex, as opposed to some other attribute such competence is unknown and yet to be explored.

To date, there has been little research on the actual governance of small to medium-sized enterprises, but as noted above, contributions are starting to be made. Even less research has been completed on the governance of rural business that also happens to be both small to medium-sized enterprises, at least on a local level, and family firms. We therefore know little about what is happening, and little attention has been paid to the sector's needs.

Because of the limitations of research, recommendations

for boards are usually based on structure and form, including easy-to-measure externally recognisable attributes concerning directors. Therefore we see the near constant recommendation for independent directors – their incidence is measurable from the outside but their systemic contribution is largely unknown. Whether or not many of the recommendations of structure and form are optimum for providing effective governance for an organisation is debatable, for the time being anyway. There even appears to be an emerging perspective that strict adherence to best practice could, in some circumstances, be limiting performance.

Need competent directors

An emerging issue is the potential information asymmetry created between the board and management when the board consists of external directors, as is the case with most agribusiness cooperatives in New Zealand. In such circumstances it is reasonable to expect that both formal and informal processes are in place to ensure that directors are well informed of business performance and the reasons behind performance at the business unit as well as corporate level.

If good governance is to be achieved, when governance is defined as effective collective decision-making resulting in exemplary company performance, directors must be selected on the basis of how their competencies and behavioural characteristics complement each other. They also need to be selected on how they contribute to and enhance the strategies an organisation has for achieving its purpose, once that purpose has been determined.

This is a very different position from which to start effective conversations about governance than what has emerged as the dominant logic of best practice. It also has implications for the relationship between performance and compliance on one hand, and firmly shifts the responsibility for exemplary performance from management to the board.

Were this understanding of governance adopted anywhere else than in the small family business context, the queues of aspiring directors would probably decline. While there is much conversation among directors concerning their fiduciary responsibility, it seldom extends to one of 'owning' business performance. This progressive approach to governance then views compliance as a result of the pursuit of performance rather than a result in its own right.

Recent experiences among agricultural business owners

In 2010, a total of 18 day-long workshops were hosted throughout New Zealand by the National Bank of New Zealand. They were held from Invercargill to Whangarei, Greymouth to Tauranga, and Balclutha to Waitomo. During the course of this professional development activity the author met with some 700 agricultural business owners, representing about 450 businesses, and discussed with them the attributes of their business's governance. A technique

of enquiry learning was used to stimulate discussion among participants concerning the benefits, attributes and implementation of more formal governance processes.

Given the nature of participant selection there is the likelihood of bias. Relative to the broader agricultural business population this sample could be expected to be better informed, more receptive to change, more willing to learn, and more eager to contribute in a group setting than their peers. Any bias is therefore likely to favour the attributes of the respective business governance encountered over the larger population of New Zealand farm and agricultural business owners. A brief summary of some of the structural characteristics of these businesses follows.

Common model

Most of the businesses, 94 per cent, were held as companies, trusts or some combination of company and trust. The most common model was found to be one where the physical assets were held in a family trust, with a company responsible for trade – 72 per cent of participants.

The owner-operator as sole trader was often the exception among this group, represented by only six per cent of participants. On rare occasions third party equity capital was held by businesses, and equally rare were independent directors or other features of best practice governance including formal planning and reporting. Governance appointments external to family members as business owners, either directors or trustees, were most often bestowed on family accountants and family lawyers.

These results are far from surprising. The professionals within reach of most farm and agricultural business owners are the businesses and family's accountants and lawyers. Their appointment to positions of governance responsibility is therefore a natural consequence of the relationships that develop either quickly or over an extended period of time. The legal and compliance obligations of a family business are few in number, but very important.

Compliance

In New Zealand, like most other western jurisdictions, these are limited to an annual company return, election of directors, appointment of the auditor as required by the Companies Act, and taxation compliance. For the sake of this discussion the focus is on conventional compliance activity relating to fiduciary responsibility, assuming that good employment, production and environmental practices are in place.

In practice, annual returns were completed on line by either a company director and business owner-cum-manager or by the company's accountant. Only rarely was the election of directors found to occur among participants. Directors were almost always appointed at the time of the company's registration, except when multiple generations of family were involved.

Business owners, through their role as shareholders, were again rarely observed to appoint an auditor. The exception was a patrimonial dispute, with one reported incidence among the 450 businesses involved. The benefits

of more formally separating roles – not necessarily the people – of shareholders, directors, management and perhaps even labour therefore appear to be being lost.

Only rarely was a vision or statement of purpose written down, which occurred with around 10 per cent of the participants. Formal planning was limited, and typically included nothing more than an annual cashflow for 23 per cent of participants or a production forecast for 17 per cent. Formal evaluation of financial performance was also rarely undertaken. Changes in balance sheet position were noted from annual tax accounts and calculated from the value of land sales in close proximity. Debt positions were reported by the financier on a monthly or annual basis, leaving reasonably simple calculations to be undertaken by the business owners.

Emerging conflicts

The inherent conflicts of interest of having service providers in governance appointments were seldom recognised by the business owners in attendance at the workshops. Nor was enhanced formality of process necessarily perceived through such appointments. One of the main features to emerge from the recommendations for better governance is independence. Sadly, that independence is typically determined by way of ownership or employment relationship with the organisation, as opposed to capability for independent thought.

It is this independent thought, as opposed to capture, which appears to be a requisite for effective collective decision-making. Independence, therefore, needs to take two forms not one. First, it requires independence from the entity, which may or may not be bestowed by ownership or employment. Secondly, it requires independence from others contributing to the organisation's governance. It is expected that some family accountants and lawyers will have this capability – a willingness to sacrifice their service relationship with the client for the benefit of the entity they are required by law to serve.

Justification

Numerous reasons were provided by the workshop participants to justify the dominant business structure. Trusts were still considered to be an appropriate vehicle for asset protection and tax minimisation, while companies were seen as a more appropriate entity from which to limit risk from potential financial liability. Seldom did workshop participants express the view that the business's legal structure was adopted with the purpose of business growth.

However, whether trusts provide the form of asset protection that they may have once done, or provide tax minimisation among beneficiaries, is debatable. In addition New Zealand has by global standards, liberal matrimonial property law, and the beneficiary income of minors is now taxed at company rates. Trusts also have other limitations, including the inability through which to introduce third party equity capital.

Governance is much more about effective collective decision-making than it is about structure and form. New

Zealanders are notoriously poor at building great companies. Few of the iconic companies established in the 19th century remain. As a nation, business owners appear to spend considerable time and entrepreneurial effort getting to what could be described as being at first base – an entity with some \$4 million to \$8 million of equity, operational systems and processes, reasonable returns in cash and wealth creation, good employees and some form of local market presence.

In the case of rural entities the equity base is often higher – as evidenced in this study – and it is the global market being served through societal marketing boards or farmer-owned cooperatives. At the stage when the company should be changing from an entrepreneurial founder-led form to something more formal, with a formal governance structure, business owners appear to be increasingly willing to sell. The agricultural business and farming sector in New Zealand does not appear to provide an exception to this view.

What could better governance offer?

Much is to be learned from what formal governance has to offer small to medium-sized enterprises, and in this case those intimately concerning families and agriculture. For example, the discipline of planning and reporting on performance, such as quarterly, by directors to shareholders is suspected to be of benefit to most rural businesses. Such reporting of business direction and performance is also expected to be of value to debt providers. Considerable value could also be achieved by simply making the existing legal entities operate in the way they were intended.

This will include the recognition among many rural business owners that companies, not trusts, are the globe's preferred vehicle for growth. However, the roles and responsibilities of their shareholders, their directors, their managers, and their employees first need to be considerably better understood. Organising distinct shareholders' meetings, board meetings, and management meetings should not be an especially onerous task. Even recognising that these groups have different needs, expectations and responsibilities are expected to benefit many of the small to medium-sized enterprises involved.

The fear of losing control, by appointing non-family or non-shareholder directors to boards, was commonly expressed. Observations of the behaviour of some corporate directors appear to influence, mostly negatively, a shift to more formal structures through which alternative ideas for business growth and development should develop. Those same structures, namely, a more mature model of company governance, also moves the burden of decision-making and responsibility to a better defined group – the board. An important distinction is being made here between the minimal legal governance requirements of an incorporated company and something upon which shareholders and directors can bestow a true sense of purpose.

Parting thoughts on governance

The rural businesses represented in the workshops only rarely offered an alternative view, where the linkage between governance, asset ownership, management and succession planning was at the point of being openly and formally discussed or implemented. Rarely was more formal governance for the business's sake considered to be related to its sustained business growth and development.

We actually know little about governance. The relationship between good governance and subsequent business performance has not been established. Business failures, such as Ansett, followed by the government bailout of Air New Zealand in 2001, typically reveal governance failure.

Independent roles

Virtually all recommendations for company boards surround their structure and form. They could well be improved by addressing the need for effective collective decision-making and the responsibility for good company performance. However, such a change would require a far greater understanding of director competence, and arguably require some form of externally assessed and publicly available competency measure. A draconian stance better resembling the Stalin-era than the first world free enterprise democracy to which we uphold.

In most family owned small to medium-sized enterprises, family members hold multiple roles such as director, trustee, shareholder, beneficiary, general manager and labourer. Immediate improvements could be achieved by conducting these roles independently of each other and one at a time. Exemplary companies, both in New Zealand and abroad, regardless of scale have all adopted formal governance processes of planning and control.

Some benefits therefore appear to exist from the adoption of better governance. Business school research should now attempt to identify whether there is a link between exemplary companies and the adoption of more formal governance practices, or whether these observations are merely a matter of chance. An observation that, on a near daily basis, is looking increasingly unlikely.

The businesses responsible for New Zealand's economic engine room appear to be deficient in terms of many of the common attributes of business governance. While this may not be harmful to business performance in the short term, it raises the question of missed opportunities. Much could be done by business schools to better inform this community, and in so doing expectations of the entire sector's governance, could well be raised.

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John Scandrett

Dairy green – alternative dairy effluent application methods

A large increase in dairy farms and dairy cow numbers in Southland over the last 25 years has had a significant effect on the local environment. Traditional methods of dealing with dairy shed effluent needed to be updated to prevent pollution of surface and ground water. A project funded from MAF's Sustainable Farming Fund allowed studies to be carried out on dairy effluent irrigation.

Southland covers 31,600 square kilometres and 23 per cent of the land area is farmed. In 1981 there were nine million sheep and 20,000 dairy cows. By 2009 there were 4.5 million sheep and 418,000 dairy cows on 785 dairy farms.

Dairy shed effluent treatment

In the 1970s two-pond anaerobic aerobic treatment systems were used with discharges to waterways. With an expanding industry there was concern the discharges from an increasing number of dairy farms would affect water quality. By the mid-1990s a change had been made to land irrigation for effluent mainly using rotating boom travelling irrigators. Regional council monitoring and farmer experience was that the application of dairy shed effluent to land sometimes caused pollution to waterways.

It was subsequently found the irrigators being used had an application rate up to five times higher than the soils could cope with. Excess effluent from irrigation would sometimes run off the paddock or go into mole and tile drains and then into waterways. The recommendation was to set irrigators to the fastest speed and apply only small amounts of effluent. This was not always practical and some system designs would not achieve this.

The Dairy Green project

An application was made to the Sustainable Farming Fund administered by MAF for a project to study the issues related to dairy effluent irrigation and to find better, alternate application methods. The project was divided into three parts with a proposed timeline as follows –

- Starting in spring of 2002 a study of 10 farms looked at how dairy shed effluent is managed and what issues farmers face in their day-to-day management
- In 2003, develop and trial alternative effluent irrigation methods.
- Make public the research findings in 2004.

Project findings – year one

Dairy farmers face a range of problems in managing effluent systems. There is no standard system design. Inappropriate design of components creates management problems. For example, sand traps that cannot be easily cleaned, pumps that are hard to service and prone to wear, pumps that are undersized for the range of irrigator duties required and irrigators that were unreliable or performed poorly.

Design can happen by default – those who have products to sell create a design to use their product rather than considering the results required and designing accordingly. A main finding was that the travelling irrigators commonly used to apply effluent were not always the right tool for the job when considering soil conditions. The distribution pattern was usually very uneven and the application rate very high.

In Southland the milking season generally runs from August to May. Soil moisture levels can be at field capacity or close to it in August, September, April and May – and often for periods up to three weeks at any other time during the season. Soils at field capacity are prone to soil structure damage during grazing and a loss of infiltration rate. Measurements were taken on 10 farms to record the soil infiltration rates of paddocks that were being used to receive effluent.

Soil infiltration results

Infiltration measurements were taken in spring, summer and autumn on 10 farms. Ideally travelling irrigators should be set to apply a depth of 10 mm of effluent. Typically this means they would need to travel at a speed where they apply this in 20 minutes. By measuring the soil's infiltration ability for a 20 minute period, an indication can be gained about whether there will be ponding on the soil surface.

In reality, the average application depth was much greater than 10 mm and irrigators were taking longer than

Cumulative infiltration depth for clean water over 20 minutes

| Infiltration depth mm | Number of farms |
|-----------------------|-----------------|
| 0 to 10 mm | 4 |
| 10 to 20 mm | 2 |
| 20 to 50 mm | 2 |
| Over 50 mm | 2 |

20 minutes to pass any one point. Ponding was a significant problem on six farms. Two farms had infiltration rates of zero after 20 minutes, indicating serious surface soil structure problems. Infiltration rates improved during summer and deteriorated in autumn.

Irrigator performance

When the irrigator is stationary and distributing effluent the wetted pattern is a doughnut shape. When the irrigator moves forward this pattern is maintained. As a result the depth of application is quite variable. The application depth is much greater at the outside of the wetted width and less in the centre.

The depth of application can vary from 12 to 40 mm across the wetted pattern. The rate of application is also very high. Up to 40 mm depth could be applied in half an hour or less. For many farms this leads to ponding followed by overland flow, and in some situations preferential rapid flow down the soil profile to subsurface drains.

Nutrient loadings

During the season samples of the effluent were randomly collected from what was being irrigated on to pasture. Assuming 15 mm depth of application, or 150 cubic metres applied per hectare, the following table shows total nitrogen and phosphate loadings for a single irrigation event for eight farms. Often effluent was being applied several times during a season and at greater than 15 mm depth.

Nutrient loadings per hectare per 15 mm effluent application depth

| Farm | Total nitrogen kg | Total phosphate kg |
|------|-------------------|--------------------|
| 1 | 50 | 8 |
| 2 | 69 | 6 |
| 3 | 90 | 27 |
| 4 | 57 | 7 |
| 5 | 24 | 4 |
| 6 | 60 | 9 |
| 7 | 54 | 7 |
| 8 | 51 | 8 |

Implications from monitoring information

Soils receiving effluent need to be managed to maintain soil structure and balance nutrients from effluent and fertiliser. Effluent needs to be applied at a rate that matches soil infiltration rates, should be applied when there is a suitable soil moisture deficit and should be analysed for nutrient content so that a nutrient budget can be completed.

The travelling irrigators being used to apply effluent had too high an application rate for much of the milking season. A means of applying effluent at a lower rate was required. Speeding up the irrigators would reduce the depth of application, but not the rate that the soil received effluent. To reduce the application rate, the option of using smaller nozzles was looked at.

Trial work – year two

K-line for effluent application

To achieve a low application rate much smaller nozzles are required than those currently used on travelling irrigators, which typically range from 12 to 15 mm. We tested a range of nozzle types and sizes from 2.5 up to 7 mm in diameter. We found 4 mm nozzles to be a good compromise, giving a reasonable volume irrigated and reduced chance of blockage while still maintaining a low application rate. The effect of achieving a low application rate is very significant when soils are moist or very dry.

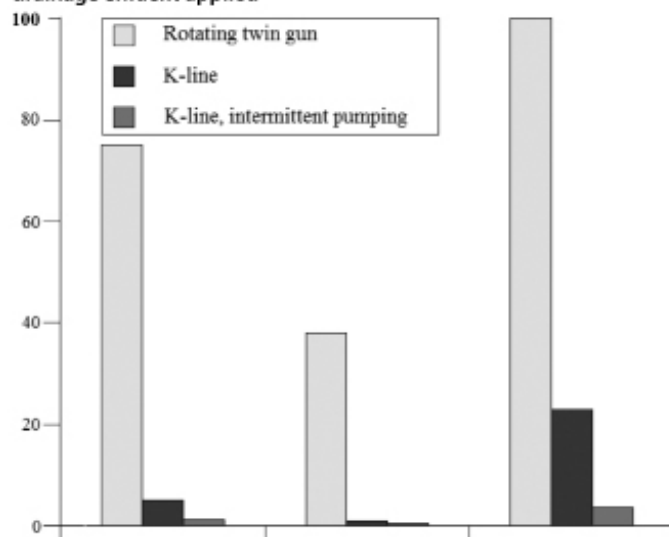
Trials were carried out applying effluent either by travelling irrigator or K-line on to silt loam soils when at field capacity. The soils had subsurface drainage installed to collect effluent that dropped below the root zone.

Filtration of effluent

This graph shows the results of a trial on mole-drained soils in West Otago. A total of 10 mm depth of effluent was applied either by irrigator or K-line and the concentration of phosphate, ammonia nitrogen and *E. coli* bacteria were measured in the drainage water.

To use 4 mm nozzles the solids need to be removed from the effluent. The use of clay-lined primary ponds,

Relative concentration of drainage effluent applied



called sludge beds, is one option for this and these are fitted with a filter wall, locally called a weeping wall. A weeping wall is a slatted timber wall which retains solids but allows liquid to pass.

Sludge beds are made eight metres wide, between one and two metres deep and up to 30 metres long. The liquid then goes to a storage pond. The filter wall needs to be properly designed as it acts as a retaining wall. Concrete is recommended beneath the line of the weeping wall to prevent scour of any clay lining.

Because the solids are removed from the effluent more efficient pumps can be used and these can be located on the pond bank. A filter is used in the pond and connected to the suction line of the pump. The filter ensures there are minimal blockages of the sprinkler nozzles. The pump usually supplies 24 nozzles and the total flow rate is 18,000 litres an hour. This

suits the 90 mm mainline usually used on most farms.

The benefits of the smaller nozzles are quite significant reduced nutrient loss, more palatable pasture, electricity savings, and no more time required to shift them than moving a travelling irrigator. The concept has been evaluated and accepted by regional councils who set the operating rules for the discharge of dairy effluent. Low rate irrigation has now been installed on more than a quarter of the dairy farms in Southland now.

A full list of references for this article can be obtained from the editor.

