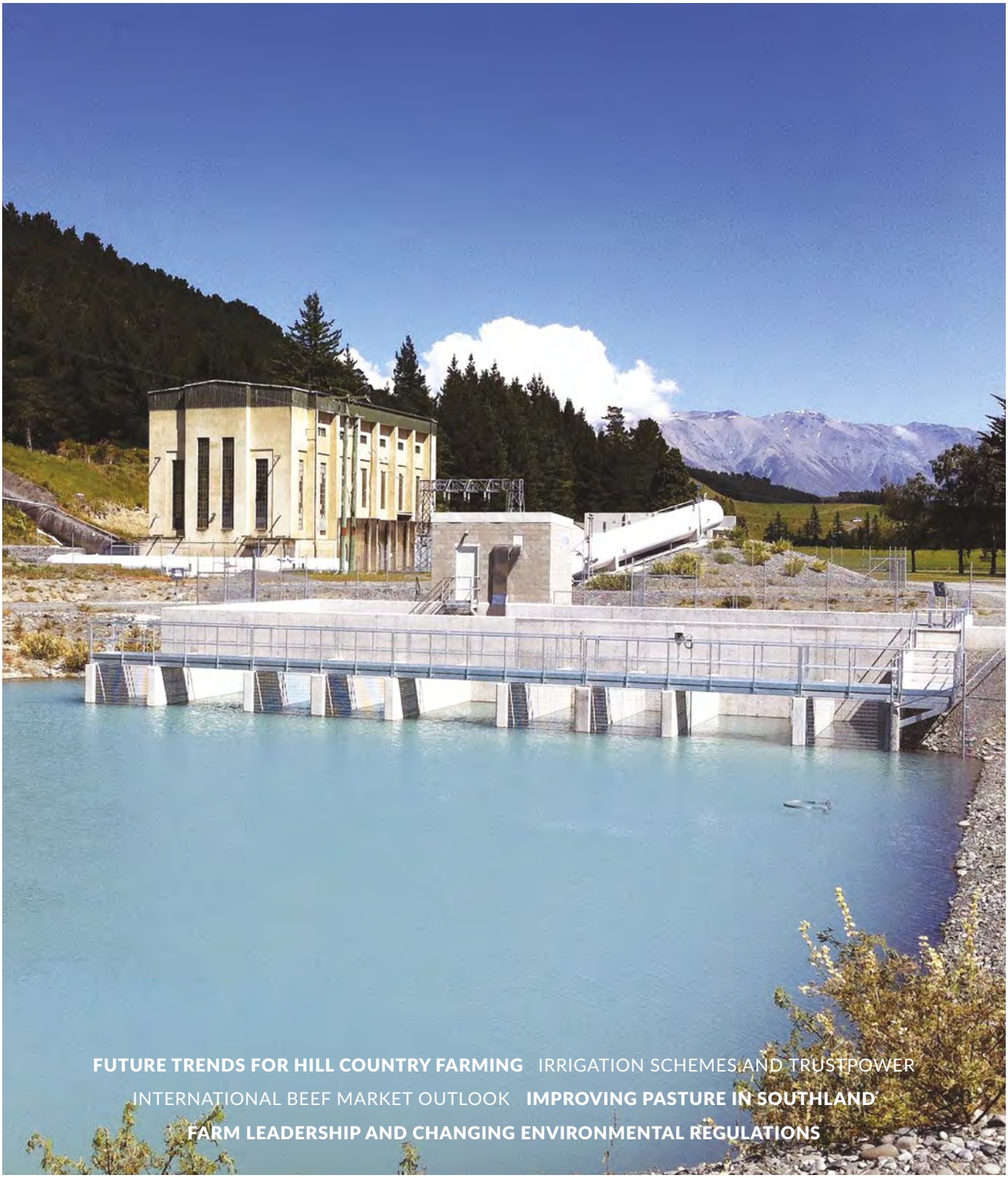
THE JOURNAL

Vol 20
No 4
December 2016
ISSN 1174-524X

The Official Publication of The New Zealand Institute of Primary Industry Management Incorporated



FUTURE TRENDS FOR HILL COUNTRY FARMING IRRIGATION SCHEMES AND TRUSTPOWER
INTERNATIONAL BEEF MARKET OUTLOOK **IMPROVING PASTURE IN SOUTHLAND**
FARM LEADERSHIP AND CHANGING ENVIRONMENTAL REGULATIONS

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STEPHEN MACAULAY CEO

CEO's comment

Irresistible forces of shifting landscapes and geopolitical change

When I reflect upon 2016, and to coin an overused term at the moment, it has been a year of disruption.

On 14 November, Kaikoura experienced a 7.8 magnitude earthquake, causing widespread damage and disruption in the immediate area and making its presence felt in Wellington and other regions north of the epicentre.

The farming community in the immediate area is now dealing with the aftermath of the earthquake as they work to get their farming operations and services up and running. Road and rail links on State Highway 1 north of Kaikoura to Picton have been severely damaged, affecting transport routes and causing delays in the transportation of goods and supplies at the top of the South Island.

Whilst the situation looks bleak at the moment, it's incredibly inspiring to see the resilience and strength of the people impacted by the earthquake just get on with the job at hand and restore services.

In addition to 'yet another' seismic event in New Zealand, to which a round of negative consequences for tourism and mobility is inevitable, there has also been a major geopolitical shift in both the United States and Britain during the year.

Events in both countries have caught many pundits by surprise, especially those committed to the progressive approach to socio-economic reform. What I have found interesting is the shift in supposedly mainstream thinking espoused and nurtured by international and domestic media, leaders and self-styled celebrities, which is effectively maintaining the status quo.

Despite heavy biases supporting one person over another, US voters have elected Donald Trump as their President, whilst the British people have ushered in Brexit and will be leaving the European Union. The argument then goes that these outcomes represent a vote against the establishment, but to put it more simply voters in the United States and Britain have lodged their ballots on the basis of what they believe is in their and their nations' interests.

So what does this mean for New Zealand and the export of our primary products?

It is probably too early to assess the likely impact for New Zealand of these two events, but peeling back the rhetoric there would be a reasonable expectation that the United States and Britain will become more inward looking rather than opening up market access opportunities.

In describing his first 100 days in office, Donald Trump issued notification of his intention to withdraw from the Trans-Pacific Partnership in his first day as President. His government would look to negotiate bilateral trade deals that would bring jobs and industry back to American shores, which doesn't bode well for a small exporting nation like New Zealand. Furthermore, Japan's Prime Minister, Shinzo Abe, has been reported as saying that the TPP trade deal would be 'meaningless' without the United States and that all but ends any hopes for TPP.

In describing Brexit, a NZIER report noted that the only certainty with Brexit is uncertainty, and this uncertainty is unlikely to be in New Zealand's interests. Whilst the longer term effect of Brexit on New Zealand exports of primary products is largely unknown, we are seeing a more immediate impact on New Zealand lamb. A sharp depreciation of the Sterling against the Euro has made British lamb more competitive in continental Europe against New Zealand lamb. Similarly, the depreciation of the Euro against the Kiwi makes European agricultural exports more competitive across the globe.

We have been through a period of reasonable stability over recent times, but as this year has shown significant change can occur, and do so very quickly. It would be unfortunate if we were to simply accept that the events such as those described above are our lot and just try to carry on. The question for me is how do we move beyond a business as usual approach and start to shape the discussion in exploring and rolling out high value market opportunities for our primary products where external influences are minimised, if not taken off the table entirely.

I hope that you have enjoyed reading *The Journal* this year. The Editorial Committee continue to have healthy debate and discussion in identifying topics that we hope you find interesting and relevant to the rural profession and the wider primary industry. The Editorial Committee is always open to readers' feedback on future articles. J

DEREK DANIELL

Reflections on New Zealand hill country farming

This article looks at trends in hill country farming, as well as other related issues such as where product prices are heading for different land uses on this type of farm.

Defining hill country

It was less than 200 years ago that our forebears set about cutting down the forest on all the hills that could be grazed with sheep. Over time part of that land area has reverted to second growth native vegetation, another part has been planted in the dark green of *Pinus radiata*, around 70% has remained in pasture, and a fourth part has been developed and redeveloped several times.

This latter area was the target of the government's Land Development Encouragement Loan (LDEL) scheme in the late 1970s. Most of that land reverted to mānuka, a failure for pastoral farming, but it played a big part recently in spawning the lucrative mānuka honey industry. The LDEL can now be considered a far-sighted government policy.

There is a huge range in the 37% of the New Zealand landscape which is defined as below 1,000m in altitude and above 15° in slope. Around half of this hill country is in plantation forestry, indigenous forest, scrub or tussock grassland. The other half, 18% of New Zealand's land area, is farmed with sheep, cattle or deer. Within this category there are large differences in rainfall, latitude, altitude, soil type, state of development, weed problems, plant and animal genetics, climate volatility and management skill. Export income from this resource is estimated to be just under $3 billion so it is a valuable resource.

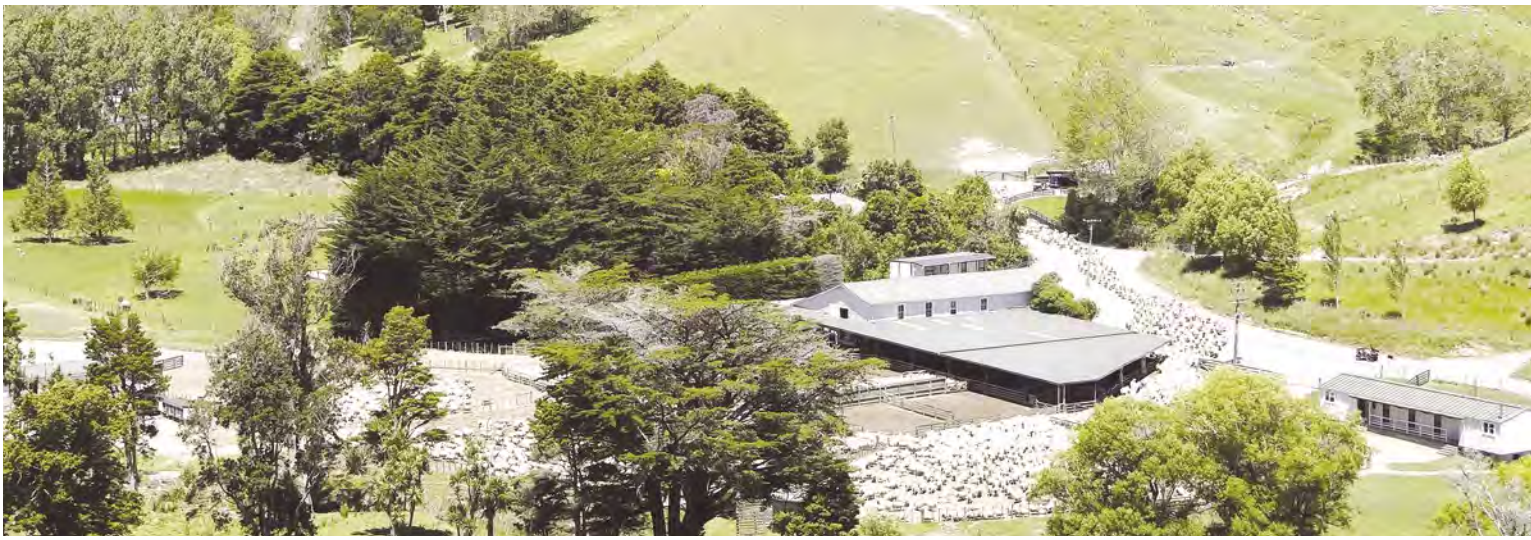
Why is the hill country farmer feeling like the poor cousin of New Zealand farming? Because over the past 40 years substantial areas of hill country which used to run livestock have been taken over for plantation forestry, dairy support, or quietly reverted to native shrubs and trees. Most hill country is growing pasture that was sown after the original bush was burned 50 to 160 years ago. It is a matter of luck as to the productivity of the brown top cultivar sown after the bush burn, as some cultivars are quite productive and others would be a perfect lawn grass. It is difficult to wipe out these species and replace them with more productive forage.

Why is the hill country farmer feeling like the poor cousin of New Zealand farming? Because over the past 40 years substantial areas of hill country which used to run livestock have been taken over for plantation forestry, dairy support, or quietly reverted to native shrubs and trees.

General trends

Across hill country farming in recent years there has been a trend to cut the stocking rate and to lift per head performance. The period 2000 to 2005 offered good returns to this type of farming due to a low exchange rate and favourable climatic conditions. Fertiliser inputs have also reduced dramatically since this period as low product prices and frequent droughts have taken their toll on farm income and expenditure. Sheep numbers dropped from 40 to 28 million between 2005 and 2016, with only some of that decline due to other land uses.

Despite less overall fertiliser use, nitrogen fertiliser is being increasingly used, either for small areas and a specific class of stock or over the whole farm. Given that the cost of owning or leasing hill country (plus fixed and variable costs) is now 15-20 cents/kg/DM, nitrogen grown pasture is usually cheaper. My father started using di-ammonium phosphate (DAP) over all of Wairere near Masterton in 1974. That practice has been continued at an annual rate of around 30 kg/ha/year. It is particularly valuable in prompting early winter pasture growth after a drought and extreme conditions can force the use of it both in the autumn and early spring. Normal application time at Wairere is mid to late winter to boost early spring growth in a cold, windswept climate where soils can get waterlogged. There has also been some capital spent around New Zealand on changing airstrips to all weather surfaces, which allows strategic application during the winter months.



Our pastures are reliant on regular dressings of phosphate, much of which travels along a 145 km conveyor belt in the politically unstable area of Northern Africa, then gets shipped around the world. It is a reminder that we rely on cheap energy and political stability for both our farm inputs and outputs.

A big picture trend is towards more finishing of home-bred stock using various tools to achieve in-house independence from the store market. In many situations however it is better to sell most surplus lambs at weaning, as well as beef weaners. Some hill farms have also been fenced into small paddocks, averaging 5 to 10 ha, which allows a move away from breeding cows and into finishing cattle and means a significant reduction in maintenance feed requirements. Laneways and satellite yards have also reduced labour requirements and the need for large dog teams.

Predictive tools that are being developed using satellite or drone measurement of DM/ha and feed quality, plus soil fertility, are now tied into helicopters or planes with control over variable rates of fertiliser application. These tools will aid fine-tuning around timing, are cost saving and will become the distinguishing feature of elite performing farmers. Analytical tools such as those developed by Farmax are also improving decision-making around the timing of mating, weaning, selling and classes of stock to run. Financial analysis, such as that provided by BakerAg and FAB, provides benchmarking on both income and expenditure. Farmer of the Year competitions, MRDC Monitor Farms and other comparisons of other farm businesses have all played a big part in extension.

Crops

The range of crops being used by dry stock hill country farmers has expanded over time.

Fodder beet

Virtues include high tonnage per hectare, resilience in a dry season (yields of 10-15 tonne/ha achieved in the long-running North Canterbury drought), high weight gain on cattle through the winter, and retention of quality until November in the second spring. Keeping cattle on beet allows more feed for lambing ewes.

Lucerne

This crop is growing in popularity where soil conditions suit. The high metabolisable energy (ME) outcome allows optimum growth rate in lambs and it generates its own nitrogen. Lucerne thrives in dry conditions, even in pure sand on the Wairarapa coast.

Red clover

This crop is proving increasingly popular for finishing stock. Stands last three to four years, whereas lucerne under grazing may last seven to 10. Like lucerne, it is necessary to spell it through the winter so alternative wintering pasture is required.

Plantain and white clover

This combination has had a burst of popularity. Like lucerne and red clover they can be used for ewes with triplets or lambing hoggets. As with these other high-octane specialist forages above, they can also allow earlier weaning (at 50-60 days and 15-20 kg weaning weight) without any problems in lamb growth rate. Then ewes can be sold early or relegated to maintenance feed.

Renewing farm pasture

There are tractors now which can traverse slopes steeper than 15° and direct drill new species into chemically-killed pasture. This practice works well on smooth slopes, but not on broken terrain. Statistics reveal that only 2.3% of the sheep and beef farm area is renewed each year, compared to 8% for dairy pasture. These crops allow fine-tuning improvements to both kg of product per hectare and the value of those kg. However farmers must be aware of being absorbed by what is happening with crops on a small percentage of the farm at the expense of optimising the economic outcome on 100% of the grazeable area.

The 'spray and pray' method is used by hill country farmers, where a helicopter or plane sprays out pasture to kill the existing sward, then seeds and fertilises it, while we just hope it works. This has been used successfully where the potential carrying capacity can be lifted from 1-2 stock units per hectare to 8-10. However where permanent pasture is already performing at a high level it is difficult to justify this method.

Many hill country farms have 5-20% flats or easy rolling country that is cultivable. It is on these areas, not technically 'hills', that a lot of pasture development has been occurring.

Animal genetics

Animal genetics have played a big part in the increase in kg of product from both sheep and cattle. It is estimated that there has been an 85% increase in sheep meat per ewe from 40% more feed, with some of that improvement is also due to improved management and feeding. Cattle are finished at a younger age than was the case 25 years ago. At a guess, average age at slaughter has reduced from 30 months to 22 since 1991. There has been a lot extension activity around the monitoring of body condition scoring (BCS) since Sheep for Profit (now Stockcare) introduced the concept 15 years ago. Case studies prove the merits of this approach, with significant rewards in net income.

Genetics from the dairy industry have accelerated that change, as has the greater proportion of bulls to steers. It is intriguing that the Friesian breed grows as fast as beef breed crosses, a tribute to objective breeding focused on the most efficient conversion of feed to the target product milk, rather than meat.

Dollars per kg of product

In simple terms, pastoral farm income can be formulated as: kg of product produced per hectare x dollars per kg of product less cost of production (COP) per hectare. The range of kg of product per hectare would start below 20 kg/ha for extensive semi-alpine tussock country to 300 kg/ha for some favoured North Island hill country.

Many hill country farms have 5-20% flats or easy rolling country that is cultivable. It is on these areas, not technically 'hills', that a lot of pasture development has been occurring. Productivity figures higher than 300 kg can be achieved on farms where a reasonable percentage of land is flat or rolling, allowing a system where feed crops add quantity and quality to the baseline hill country permanent pasture. There are some districts where a generous rainfall spread throughout the year allows optimal pasture growth. There are also other areas where soil types allow all trading cattle to be stocked, with no feed required to maintain breeding ewes or cows.

Over the past 25 years there has been significant improvement in farm gate prices for sheep and beef farmers. In 1991, a 16 kg lamb was making $1.90/kg (53 pence/kg) at the farm gate when the New Zealand dollar was buying just 28 pence. Experts commented that the lamb industry was going to fade away as lamb carcasses were too small and inefficient to handle. Today the New Zealand dollar is strong, buying 56 pence, but the same lamb is making $5/kg (£2 and 80 pence at our farm gate, over five times as much to the British consumer). Processors have made huge progress in enhancing the value of sheep meat and co-products, but get little recognition for it.

Over the same 25-year period, the farm gate price of wheat for the UK farmer has risen and then drifted down to the same, or even lower, than it was in 1991 at £100-£105/tonne. Wool has been a sad story, with a huge loss in real value since synthetic competition began to dominate the fibre sector, but the nominal price of wool is around the same as it was in 1991. The demise of wool has been the main reason for the decline in sheep farming.

The average farm gate price for all classes of beef was $2.91/kg in 1991, actually higher than the price of milk solids that year. It took until 2014 for the farm gate price of beef to once again surpass the price of milk solids. It has been a good two-year run for cattle farmers, but that has been contrary to other agricultural commodities and the farm gate beef price is about to fall more into line with the price of other farm outputs. Across dry stock farming, with the exception of deer, the immediate outlook is for lower farm gate profit, back to that 'sinking lid' feeling about the future of hill country. The average dollars per kg earned from sheep and beef farming has varied between $4.00 to $5.50 in recent years.

It is therefore possible to compare hill country returns with other modes of farming:

- Poor hill country – 100 kg @ $4.50/kg, $450/ha, COP $400, EFS* $50
- Average hill country – 200 kg @ $4.50/kg, $900/ha, COP $600, EFS $300
- Best hill country – 300 kg @ $4.50/kg, $1,350/ha, COP $650, EFS $700
- Best flat land sheep farm – 550 kg @ $4.50/kg, $2,500/ha
- Average dairying – 800 kgMS @ 5.50/kg, $4,400/ha
- Better dairying – 1,500 kgMS @ $5.50 kg, $8,250/ha
- Goat milking – 1,800 kgMS @ $17/kg, $31,000/ha (housed 24/7, feed cut or purchased)
- Pine trees – 20,000-25,000 kg @ $0.03 to $0.05/kg, $500 to $1,000/ha net, but have to wait 30 years and this takes no account of the time cost of money, and costs of establishment and maintenance
- Mānuka honey – 15-30 kg @ $20-$60/kg, $300-$1800/ha.

* *EFS = Economic Farm Surplus*

Where are product prices headed?

Trees

It is very difficult to predict where prices are headed for different land uses. *Pinus radiata* is a 30-year crop so how it is possible to judge the demand for a crop in 30 years' time given rapid technological change? Five years ago, the forward sale of carbon credits opened a window for immediate returns from trees, but that window closed when the value of carbon credits fell to low levels. Rising values may open that window again, but the landowner may then be trapped forever in a land use that discourages logging or conversion to another land use (and the income from carbon credits gradually falls away). Being such a long-term crop, most hill country farmers can afford only a small area in woodlots.

Mānuka honey

Having been involved in the mānuka honey industry since 2004 and seen the price of honey go up and up, I believe that this product has staying power. It has the opportunity for further price premiums, plus productivity improvements on the land. Mānuka honey extracted into a 200 litre drum spans values from $20 to $90/kg. At one hive/ha, and a yield of 20 kg, gross revenue per hectare could range from $400 for a natural stand to $1,800 and possibly more for a high-yielding plantation. If the annual cost of running a hive is $250, it is easy to do the sums. Mānuka honey has the potential to be a more profitable land use than livestock, even on a share-farming basis. However mānuka prefers acidic soils, and not high-producing pasture country, so plantations will be confined to lower pH soils or natural forests.

Sheep meat

There has been a substantial lift in the farm gate price of both lamb and mutton over the past 25 years and there is more to come. However the pressure will be on to continually lift our game across product development, consistency of taste and partnering with channels direct to the consumer. The substitutes are many and varied. Also some competitors are expanding, for instance, Australian lamb exports are increasing as fast as ours are declining and their cost of production is lower.

Wool

Wool is down to 1.5% of the global fibre market. The farm gate price has sunk so low that many sheep farmers give it little consideration. The best opportunity to move the farm gate price is to change the form from fibre to powder, which will open the door to higher value uses. This is where wool is transformed to a powder and can be used for high protein sports drinks, cosmetics, and even extruded as wool at 5 or 10 microns, which is finer than Merino and consistent.

Beef

New Zealand supply is only 1% of world annual tonnage. Over 50% of our kill is commodity lean beef for North American hamburgers. We have low cost competitors, such as South American countries, who will gradually open access to more of our markets. It is concerning to find that only 28% of New Zealand's prime beef is passing Silver Fem Farms' EQ standards for tenderness and other desirable traits. There is a significant premium to be had if our grass-fed product could be guaranteed tender but we have a long way to go, even with lamb, which rates only a 70% 'highly favourable' response with taste panels.

Through the inflation in asset values, hill country farmers have become multi-millionaires, enjoying a bigger shift in wealth than homeowners in Auckland.

Two tooth rams

It is during times of climatic and financial stress that top-performing farmers often get a chance to expand. To reduce the cost of production, the simplest way is to improve productivity. Lower-performing land will gradually be bought by those with the capital to develop potential.

Rising costs vs increases in equity

The trend has been to reduce inputs leading to reduced stocking rate. Generally farmers have chased per head production rather than per hectare. There has been a gradual depreciation of infrastructure on a lot of hill country – fences, buildings, water supply.

There are two aspects to costs – the cost of capital tied up in land, stock and plant, and then the fixed and variable costs with running a hill country farm. However land values have risen hugely since 1991, around six-fold on hill farms and up to 16-fold on flat land. This capital gain has been the biggest reward for landowners over the past 25 years.

Through the inflation in asset values, hill country farmers have become multi-millionaires, enjoying a bigger shift in wealth than homeowners in Auckland. It has been possible to leverage off improved equity ratios without selling the farm, through borrowing to buy more farmland, or invest off-farm. This has been a wonderful ride for all farmers, regardless of farming ability, and needs to be remembered alongside the perennial complaints about low net income. How many other assets can be sold for a capital gain after poor performance for 25 years?

The large lift in the market value of hill country farmland creates a cost factor of around 7 cents/kg/DM, assuming a 5% return on capital. Add in the fixed and variable running costs for another 10 cents/kg. All up, the cost of owning and running a hill country farm is around 17 cents/kg, plus or minus, depending on location and a host of other variables.

Extensive changes needed in future

Our pastures need a massive overhaul. Virtually no improvement has occurred in our permanent pastures over the past 40 years, but there have been huge increases in crop yields. These crops feed the animals that compete with our sheep, cattle, deer, chicken, pigs and farmed fish. For those industries the cost of feed has hardly changed, despite inflation. For us the cost of feed has multiplied with the cost of land – 600% over the past 25 years.

The exciting years of hill country pasture development are 30-60 years behind us. Most plant breeding now is geared to land that can be cultivated, with a focus on dairying. However it is difficult to transform pasture composition on uncultivable hills. Indeed even on flat land, with the advantage of cultivation, trial work has shown that pastures have reverted to 95% of the original residential species after just five years.

Genetically modified agriculture is happening on a massive and growing scale around the world, with 18 million farmers working over 100 million ha in 28 countries. The main genetically modified crops are soybean, cotton, maize, sugar beet and alfalfa, but a vast range of other crops and animal stock has been (or is being) modified so what are we waiting for?

Meantime, farmers around the world are being exhorted to grow more food to feed the ever-growing global population. This call to produce more comes despite many farmers struggling to make a profit. Those farming practices that are profitable have become more and more like factories, as the most efficient way to farm animals is to house them in controlled environments. Indeed it is a gain in efficiency to house humans in feedlots, called cities.

Conclusion

The immediate outlook for pastoral farming on hill country is for slow change – there is no magic wand. Large areas have been farmed with low inputs for some years, and it will be difficult for those landowners to find the working capital to produce more product per hectare. As for dollars per kg, product prices are either subdued or about to decline in the short term, apart from the small categories of venison and velvet. However product prices can change around quickly.

Recent climatic events have also impacted to cause lower per hectare production and reduced profit. However it is during times of climatic and financial stress that top-performing farmers often get a chance to expand. To reduce the cost of production, the simplest way is to improve productivity. Lower-performing land will gradually be bought by those with the capital to develop potential.

In sheep and beef farming there is no easy circuit breaker from super high-value products.

However the top operators in hill country farming will continue incremental improvements across a broad front. Their good return on investment over the past 25 years has vindicated their skills and tenacity.

DEREK DANIELL is the owner of Wairere, a sheep genetics company near Masterton. He was also one of the two foundation shareholders in the mānuka honey company, Watson and Son, which won the Deloitte Fast 50 in 2008 and has recently sold 50% of its shareholding to Ngai Tahu. Email: derek@wairererams.co.nz

ROB DAVISON AND ANDREW BURTT

THE INTERNATIONAL BEEF MARKET OUTLOOK

This article looks at the international beef market outlook and New Zealand's place within it.

Global beef production and NZ's place

Global beef production data includes cattle and buffalo meat. For instance, in the top 10 beef-producing countries, India (which ranked fifth) and Pakistan (which ranked ninth) include buffalo, which respectively makes up 62% and 50% of their beef production. Even with this qualification, the United States is the largest beef producer accounting for 16% of global production followed closely by Brazil with 15% and China with 10%. Argentina, India and Australia each contribute 4% of global beef production. Within this, 62% of India's production is from buffalo (FAO, 2013).

New Zealand ranks as the 20th largest beef producer, with 0.9% of global beef production. When it comes to beef exports, New Zealand ranks fifth largest after the United States at fourth. The recent drought-induced high slaughter in Australia helped make this country the largest exporter of beef for the calendar year 2015, followed by India and Brazil.

Figure 1 shows how much of the beef production in seven countries is exported and how much is consumed domestically. New Zealand is unique in that it consistently exports around 85% of its production followed by Paraguay, which is seventh largest, with 83% of its production exported. Following a couple of seasons of high slaughter and exports, which were boosted by drought conditions, Australia exports around 63% of its production. Brazil and the United States export around 16% and 10% of their production, respectively. India exports 70% of its production to Asia, mainly Vietnam and Malaysia, and to the Middle East.

Cattle prices in New Zealand are dominated by performance in export markets and the exchange rate. This is a major contrast to most beef-producing countries that have large domestic markets.

Figure 2 shows per capita beef consumption for the top six countries and New Zealand, expressed as retail weight. The official OECD/FAO figure for New Zealand is 14.5 kg per capita, but this has been updated to 18.8 kg using Beef + Lamb New Zealand Economic Service data, which shows that imports from Australia are equivalent to 2.1 kg per capita. New Zealand imports beef from Australia for domestic consumption because export prices are higher than the local market would pay, and lower priced beef from Australia meets New Zealand consumer needs.

New Zealand ranks as the 20th largest beef producer, with 0.9% of global beef production.

All markets are not equal

New Zealand's beef export markets are not equal and this country's beef faces a regime of quotas and tariffs for access to markets. This brief analysis covers New Zealand's top six markets that accounted for 83% of beef shipments and 87% of export value for the year ended 30 June 2016.

United States:

Exports to New Zealand's largest beef market (49%) are subject to a tariff rate quota (TRQ) of 213,402 tonnes product weight at an in-quota tariff rate of US4.4 cents/kg. This quota is on a calendar year and was 99.7% utilised in 2015 due to the high dairy cull cow slaughter. Quota allocations are made to qualifying exporters by the New Zealand Meat Board. For the nine months to mid-September 2016, the quota utilisation was at 79%, three percentage points down on the same period in 2015. This indicates the quota utilisation will again be high in calendar year 2016. Beef shipped to the United States outside the TRQ faces a tariff rate of 26.4%. The in-quota tariff rate will be eliminated once the Trans-Pacific Partnership (TPP) agreement enters into force and the out of quota tariff rate will be eliminated over a five year period.

China:

New Zealand's second largest beef market by volume (18%) and value operates under a free trade agreement (FTA) that eliminated tariffs on all red meat exports in 2016.

Taiwan:

New Zealand's third largest beef market by volume (6%) operates under a bilateral Economic Cooperation Agreement that eliminated beef tariffs in 2015.

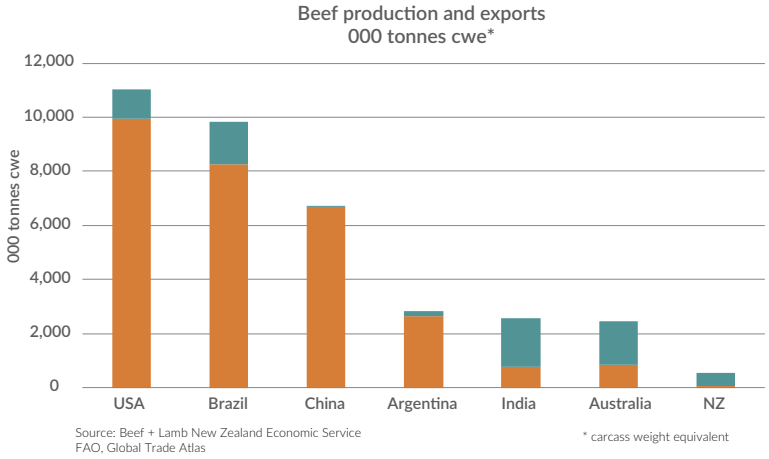


Figure 1: Beef production and exports

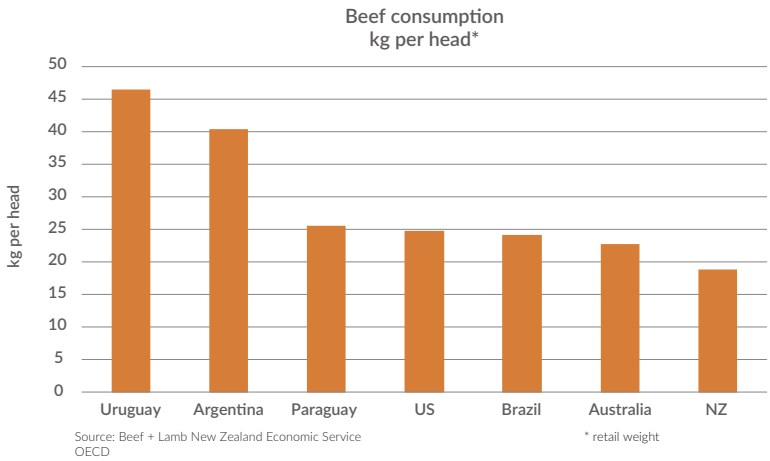


Figure 2: Beef consumption

Canada:

The fourth largest beef market (5%) is subject to a TRQ of 29,600 tonnes on a calendar year basis. Quota is allocated to Canadian importers. For the nine months to September 2016, the quota utilisation was at 49%, 10 percentage points up on the same period last year. Beef shipped to Canada outside the TRQ faces a tariff rate of 26.5%.

South Korea:

The fifth largest beef market (5%) for New Zealand operates under an FTA, which entered into force in December 2015 with a transition from a 40% tariff to duty free by 2029. For 2017, a 32% tariff applies to beef with a so-called 'safeguard' 40% tariff for shipments above 38,495 tonnes. Australia negotiated an FTA with South Korea that came into force from December 2014, with the beef tariff of 40% to be phased out by 2028. The United States has had an FTA with South Korea since March 2012 and Canada has had one since 2015. The New Zealand-Korea FTA will eventually bring this country's meat exports onto a level playing field with exports from Korea's other FTA partners, which should allow New Zealand to maintain a position in Korea. This is a position that was under real threat in the absence of an FTA, despite a long trading history and considerable investment in that market.

Japan:

New Zealand's sixth largest beef market (3%) is subject to a tariff rate of 38.5%. When the TPP agreement is implemented, the tariff will reduce to 9% over 16 years providing safeguard levels are not exceeded. This equates to a 77% reduction in Japan's tariff for beef, which is the lowest beef tariff Japan has agreed to in any trade agreement. The TPP agreement will ensure that New Zealand is on a level playing field with other TPP exporters, such as Australia, which is Japan's largest beef supplier, and also with the United States, Canada and Mexico.

Australia:

It currently enjoys a tariff advantage under the Japan-Australian Economic Partnership Agreement (JAEPA), which has considerably lowered the tariffs charged on Australia's beef exports to Japan. Australian frozen beef exports to Japan currently face a tariff of just 27.5% – a tariff advantage of 11 percentage points over New Zealand's beef exports. Imports of chilled beef have a slightly lower margin of difference of eight percentage points. The JAEPA will provide Australian frozen beef with a tariff reduction from 38.5% to 19.5% over 18 years and for chilled beef a reduction from 38.5% to 23.5% over 15 years.

EU:

While the EU is the eighth largest beef market by volume (2%), it is the fifth equal with Japan in terms of value. New Zealand has a high-quality beef quota of 1,300 tonnes product weight that has a concessional in-quota tariff of 20% ad valorem. Exporters from many countries, including New Zealand, are able to compete for access to the EU via two of the EU's most favoured nations (MFN) quotas, which are allocated on a first come first served basis. These are:

- The frozen beef in quota of 53,000 tonnes (1 July to 30 June) with an in-quota tariff rate of 20%
- The processing beef quota of 63,703 tonnes (1 July to 30 June) with an in-quota rate of 20% to 20% + 994.5 EUR/tonne to 2,138.4 EUR/tonne, depending on the product.

The United States and China have a key influence on beef price expectations because combined they account for two-thirds of beef exports from New Zealand.

New Zealand also has access to the 48,200 tonnes grain fed high-quality beef quota promulgated as a result of the settlement of the dispute between the United States and the EU over hormone growth promotants (HGPs). Other countries that have access to this quota are the United States, Canada, Australia, Uruguay and Argentina.

The United Kingdom's decision to leave the EU (Brexit) has created uncertainty for New Zealand's red meat exports. However due to World Trade Organization (WTO) rules it is expected that there will be no erosion in New Zealand's overall sheepmeat and beef access into the EU 27 and United Kingdom as a result of Brexit.

Market outlook

The prime concern of any market outlook is where prices will trend along with insight into the drivers of the trend. The United States and China have a key influence on beef price expectations because combined they account for two-thirds of beef exports from New Zealand.

United States:

As at 1 January 2016, the United States beef herd was in its second year of re-building, which was one of the reasons that limited their domestic production in 2015. In calendar year 2015, high beef prices were underwritten by tight supplies of cattle, high feed grain prices and the impact of highly pathogenic avian influenza (HPAI) in poultry that led to reduced poultry and egg supplies.

In 2016, the number of beef cattle placed in and marketed from feedlots returned to more normal patterns for both sales and weights. Increased weights of fed cattle were underwritten by increased feed grain supplies and weaker feed grain prices.

Beef prices have been volatile in 2016, with increased supplies noticeable in July and August. The USDA forecast is for beef production to be up 4.8% for calendar year 2016 and up 1.5% in 2017, followed by increases of 1.5% to 2.1% over the following three years including 2020. Given this increasing supply, prices are expected to soften to 2020, with indicator steer prices easing back 11% over five years.

In August 2016, the United States announced it had reached agreement with Brazil to allow imports of chilled and frozen beef for the first time since 2003. As a result, imports of Brazilian beef are expected to occur in the latter half of 2016. Brazilian beef imports will compete with other countries for a share of a first come first served quota of 64,805 tonnes product weight, with any volume above that subject to a 26.4% tariff.

Softer prices flow through to per capita beef consumption increasing 1.9% to 2020 and absorbing around 70% of the increased supply. However 30% of the increase in production (227,000 tonnes) is forecast to be exported lifting Unites States beef exports 21% from 2016 to 2020. The outlook for imports is for these to remain almost static from 2016 to 2020. Underpinning this outlook is the forecast that the United States cattle herd will increase from 92.9 million head at 1 January 2016 to 96.6 million head at 1 January 2020 (+4%) and the beef cow herd within this to increase 6%.

United States summary to 2020: Beef production increases 7%, prices soften 11%, exports increase 21% and imports remain static, but Brazil now has access to the United States market.

China:

China is a large complex market. The domestic cattle herd is 101 million (cattle at 30 June, GIRA estimate), of which 15.3 million are dairy cows and 50.8 million are beef cows. Total beef production (USDA estimate) is estimated at 6.8 million tonnes for 2016, up 1.3% on 2015. The average cattle carcass weight is estimated at 138.3 kg for 2016 and has ranged from 138 kg to 144 kg in recent years. Adding 2015 domestic production of 6.7 million tonnes and imports of 781,000 tonnes carcass weight equivalent or cwe (imports totalled 585,685 tonnes shipped weight), and deducting beef exports of 16,300 tonnes cwe (exports totalled 12,200 tonnes shipped weight), gives a total 7,465,000 tonnes of beef for consumption. On this basis, beef imports currently make up 10% of beef consumption. In addition to these data, there is a component of unofficial or 'grey trade' beef imports.

Figure 3 shows the beef import trend for the last three years. Brazil gained access to China in the year to 30 June 2016 and accounted for 26% of beef imports, with Australia and Uruguay following closely with 25% and 23% of imports, respectively. The emergence of Brazilian beef in the official statistics may not indicate increased imports because this beef may have previously been imported in the grey trade.

New Zealand contributed 13% to beef imports for the year ended 30 June 2016 with shipments at 77,500 tonnes, up 58% on the previous year. For the year ending 30 June 2016, China's beef imports were up from each of the supplying countries. In total, beef imports were up 80% (260,300 tonnes) to 585,700 tonnes.

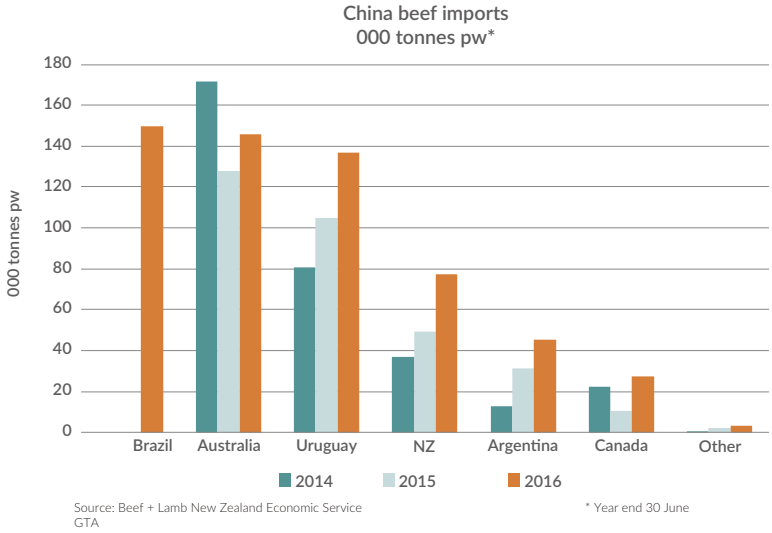


Figure 3: China – beef imports by volume

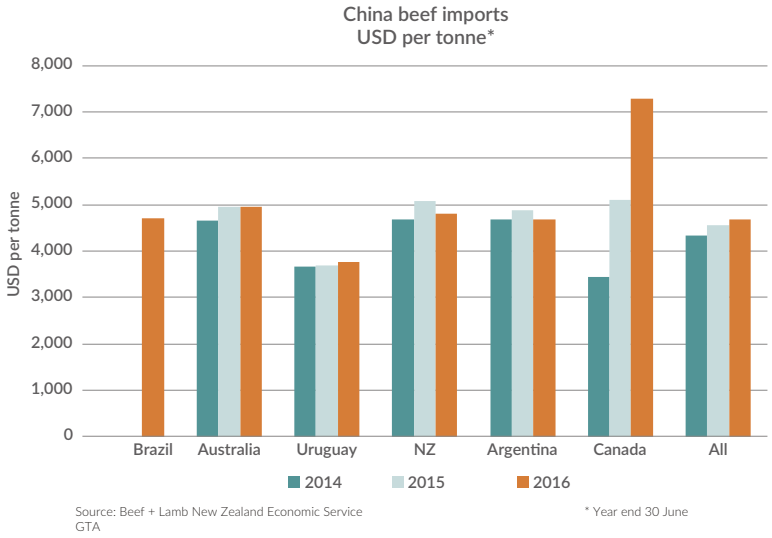


Figure 4: China – beef imports by average value

Figure 4 shows that the average value of imported beef in 2016 was generally similar to 2015. The high average value of beef imported from Canada is linked to small tonnages (see Figure 3) of high-value beef products. Overall, the imported beef value per tonne for 2016 was up 2.6% on 2015.

China summary: This country has a large demand for beef which is expected to carry on, but it will be dependent on economic growth continuing.

Outlook for the value of NZ beef exports

The average values of beef exports to New Zealand's main markets for the past three June ending years are summarised in ***Figure 5***, along with the 'all markets' receipts per tonne and its outlook for 2016-17. From the previous discussion, the outlook for 2016-17 will be largely influenced by market performance in the United States and the volumes shipped to China.

Australia is in a herd re-building phase following two years of high slaughter in response to drought conditions in major cattle raising areas. Estimates are that Australian beef exports will be down 12% (-142,000 tonnes) for 2016-17 (ABARES Agricultural Commodity Report, September 2016). An unknown offset to this reduction is Brazil's new access into the United States and its level of shipments to China in 2016-17.

In terms of 2016-17 supply from New Zealand, export volumes are forecast to be similar (+0.9%) to 2015-16. Should the September 2016 value of the NZD against the USD of around 73 cents prevail for all of 2016-17, then this would be a 7% appreciation on 2015-16.

Currently a 1.0 cent change in the value of NZD translates into a 5.3 cent change in the beef schedule, other things being equal. A 10 cent weaker NZD against the USD (i.e. NZD:USD is 63 cents) would be equivalent to a 73 cent per kg increase in the beef schedule as the relationship is not linear. In practice, the currency management policy of processor exporters dampens the impact of immediate currency swings. Nevertheless the exchange rate has a significant influence on the export schedule price for beef and sheepmeat.

The average value of beef exported to 'all markets' is forecast to decrease 3% on 2015-16, which translates to a 6% fall of the export beef schedule compared with 201516. While this provides an indication of the price outlook, where the exchange rates lies between November 2016 and June 2017 (the main production period) will be a key determinant of overall beef production profitability. The longer-term outlook is that competing country supplies will likely underwrite a softening global price beef price trend to 2020 outside the lens of the NZD exchange rate.

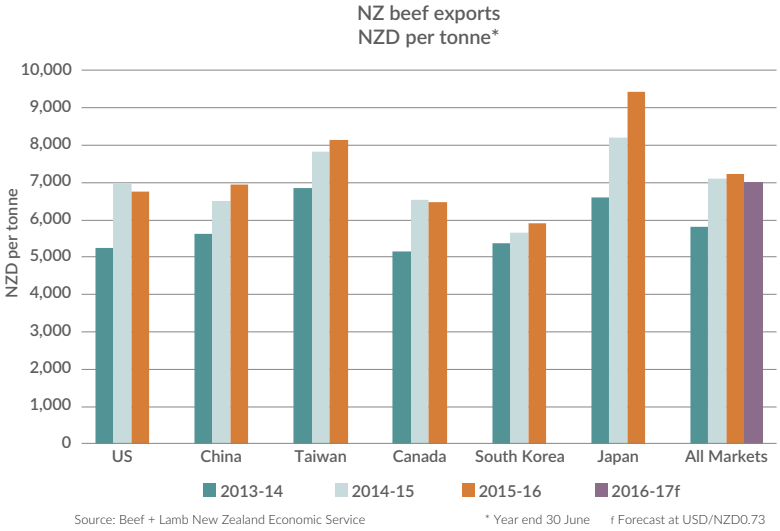


Figure 5: Average value of NZ beef exports

Given the competition in world beef markets it will become increasingly important to identify New Zealand beef with our story about the uniqueness of our grass-fed beef, our farms, our food safety standards and our commitment to farming the land for the future.

Table 1: Export beef $/tonne and all grades beef schedule % changes

	2014-15	2015-16	2016-17f
Export $ per tonne	+22%	+1%	-3%
All grades schedule	+29%	+3%	-6%

Source: Beef + Lamb New Zealand Economic Service

In ***Figure 5***, the right-hand 'all markets' shows the beef export value per tonne trend that underpins the export schedule price per kg that farmers receive. What is not shown in this analysis is the co-product trend for hides and offal which are also a component of the schedule price.

While the average values of New Zealand's beef exports to the United States and Canada have shown slight declines for the year ended 30 June 2016, other main markets have shown small increases. Japan stands out for its high level of export receipts per tonne relative to other markets. This reflects the product mix shipped to Japan, which is high-value beef, including 36% of shipments being chilled product. Likewise, Taiwan, which has the next highest export receipts per tonne, included 11% high-value chilled product. Shipments to other countries shown in Figure 5 all have less than 3% chilled product and China none.

Table 1 summarises the percentage change trend in export beef value per tonne with the all grades weighted average beef schedule.

The percentage change differences between the value per export tonne and the all grades beef schedule is largely explained by co-product price trends, but also the added-value component from farm to export being relatively fixed within a year so that export receipt changes competitively flow through to the schedule payments. For example, if the schedule is $5/kg carcass weight, and added-value from farm to export is $2/kg carcass weight, this gives an export value of $7/kg carcass weight equivalent.

If the exchange rate and/or export market price increase the export value 10 cents then the export price lifts 70 cents to $7.70 carcass weight equivalent. With the added-value component fixed, and other things being equal, the 70 cents increase flows back to the farm schedule increasing this 14% to $5.70/kg carcass weight. The forecast annual schedule price shown in Table 1 includes an element of softer co-product prices and seasonal factors.

As a final comment, given the competition in world beef markets it will become increasingly important to identify New Zealand beef with our story about the uniqueness of our grass-fed beef, our farms, our food safety standards and our commitment to farming the land for the future.

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ALEX HUNTER

Southland case study
Improving pasture to increase on-farm profitability

'Never let a good crisis go to waste' – *Winston Churchill*

The recent period of low dairy payouts has caused many dairy farmers and their advisers to analyse the dairy farm system. What lessons can we learn from this, and how can we use it to make our dairy farming businesses more resilient in a world of volatile milk payouts?

Pasture grown and utilised

Over recent years there has been much debate around low versus high input systems and the rising cost of production of New Zealand dairy farmers. One common theme that is agreed by most is that no matter what the farm system, the first step is to maximise the amount of pasture grown and utilised. This country has a clear comparative advantage when it comes to the ability to grow pasture, and obtaining high rates of pasture utilisation forms a solid foundation for a resilient dairy farm business.

All other things being equal, growing and utilising more pasture on-farm will lead to more profit. In ***Figure 1***, DairyBase data shows there is a reasonable relationship between operating profit per hectare (EBIT) and pasture eaten per hectare.

This article will explain the simple steps I use as a Southland-based dairy farm systems consultant to review the physical component of a dairy farm system using a three-year case study at Waihopai as an example.

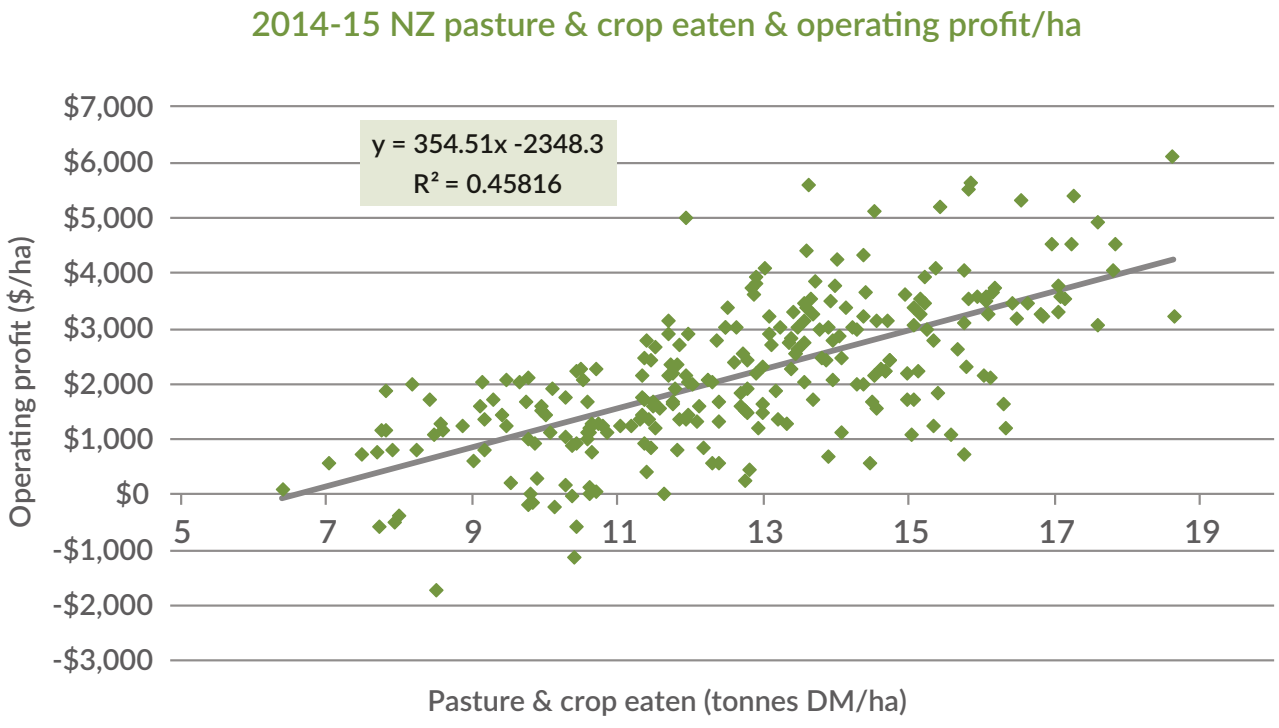

Figure 1: Relationship between operating profit/ha ($/ha) and pasture and crop eaten (t DM/ha) – 2014-15.

Source: DairyNZ Economics Group

Case study
Waihopai Pastoral, Woodlands, Southland

Waihopai Pastoral is an equity partnership employing a variable order sharemilker. The farm is a 240 ha dairy unit farmed mainly as a milking platform for last three seasons (see Table 1 for the farm physical data for these seasons). The approach shown in Figure 2 was introduced at the beginning of the 2014-15 season (between years 1 and 2). A new variable order sharemilker was also employed at this time, so it is fair to assume that there could also be an impact from the change in day-to-day farm management. The approach involved four steps as follows.

STEP 1:
CALCULATE PASTURE UTILISED AND GROWN AND DEVELOP PASTURE IMPROVEMENT PLAN

The current pasture utilised, and assumed grown, was calculated using a backwards calculation based on historical milk production. Ideally it would be good to compare this with accumulated pasture growth rates from weekly farm walks. As this identified that pasture species required improvement, a re-grassing plan was put in place expecting to take a minimum of 10% of the farm out per year. An emphasis was put on moving away from going from a perennial ryegrass 'grass-to-grass' renovation policy to using crops and short rotation ryegrass options as a 'break'. The use of at least two sprays of glyphosate assists with controlling grasses such as browntop, Yorkshire fog and couch.

The previous policy of grass-to-grass renovation showed reversion back to its old state quickly due to less desirable species coming back into the pasture sward. The selection of perennial ryegrass cultivars should be carefully considered for each paddock. Weekly paddock accumulated growth rate information totalled at the end of each season is used to continually review the pasture renovation plan by ensuring the lowest-producing paddocks are those specifically targeted.

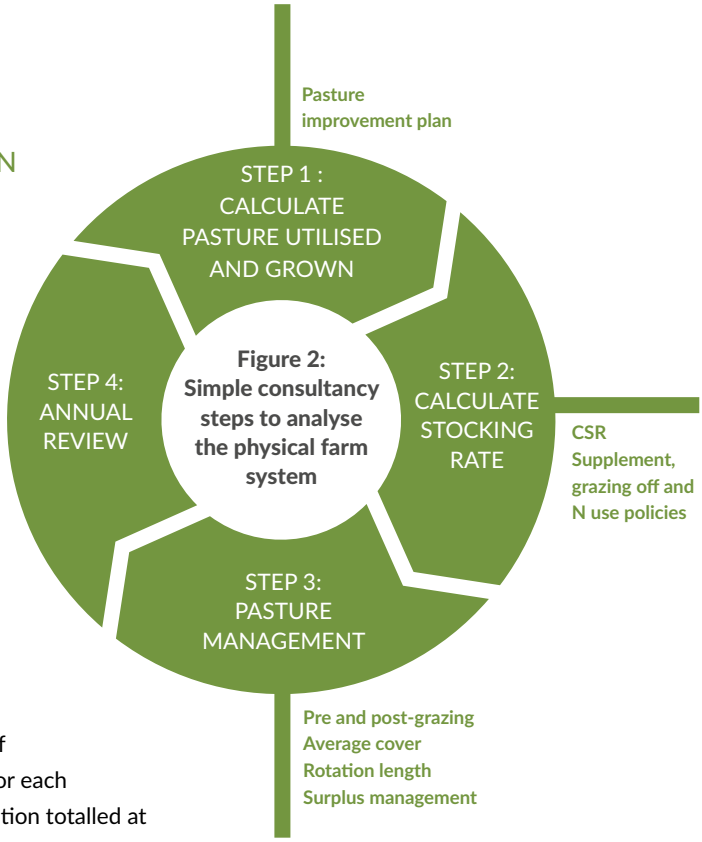

Figure 2: Simple consultancy steps to analyse the physical farm system

STEP 2:
CALCULATE STOCKING RATE, USE OF SUPPLEMENT AND NITROGEN

The correct stocking rate is calculated using a comparative stocking rate (CSR) to achieve this. CSR provides an alternative to the traditional simple measure of cows/ha. As some farms can import significant amounts of supplements, cows/ha is an inadequate measure and can be misleading when comparing farms, which vary in the amount of purchased feed/ha or have different breeds and cow liveweights (e.g. Friesian versus Jersey). CSR improves the estimation of the balance between annual total feed supply and feed demand. CSR is calculated as follows:

$$\frac{\text{average LW (kg/cow) x no. cows/ha}}{\text{total feed = pasture grown and bought-in feed (t DM/ha)}}$$

1) From my client database, CSRs in the low 70s are generally producing the best overall results for each farm's physical data.
2) Decision rules to ascertain when, and when not, to feed supplement are developed. The main rule on Waihopai is that supplement use is driven by the farm's current pasture covers (to fill a deficit).
3) Decide on the correct supplement to use, mainly based on cost – cents/MJ ME consumed.
4) Maximise the growth response of nitrogen use by having nitrogen available on-farm (normally in silo) with the correct timing so that the period between application and grazing is maximised.

Table 1: Annual farm review (feed) – Waihopai

ANNUAL FARM REVIEW (Physical) *Client: Waihopai*	2016	2015	2014
Farm			
Final production (kg MS)	287,359	270,482	265,337
Effective milking area (ha)	237.5	242	242
Production / peak cow	420	401	382
Production / eff ha	1,210	1,118	1,096
Physical data			
Cows wintered 1st June	718	720	720
Cows milking at peak	685	675	695
Breed (F, JxF, J)	Jxf	Jxf	Jxf
S R wintered	3.02	2.98	2.98
S R at peak	2.88	2.79	2.87
June 1st cow liveweight	490	490	490
LW / ha	1,413	1,367	1,407
Kg MS / kg LW	0.86	0.82	0.78
Feed – forage			
Silage fed less made on farm DM / cow	102	352	576
Silage fed less made on farm DM / ha	293	983	1,653
Cow winter grazing			
Winter grazing days (average / peak cow)	70	70	61
Concentrates purchased			
Total concentrates fed (kg DM)	185,050	196,200	192,050
Concentrate fed per cow (kg)	270	291	276
Concentrates per ha	779	811	794
Purchased feed summary			
Total supplementary feed purchased / ha	1,073	1,793	2,446
Total supplemetary feed purchased / cow	372	643	852
Nitrogen			
Nitrogen applied (kg / eff ha)	201	202	165
Feed calculations			
Total feed demand per cow:			
As per demand calculator (kg DM / cow)	5,243	5,112	4,980
Total feed demand per ha:			
As per demand calculator (kg DM / ha)	15,122	14,258	14,301
Feed / ha from bought in feed			
Less feed provided from silage DM / ha	-293	-983	-1,653
Less feed provided from concentrates DM / ha	-779	-811	-794
Less feed provided from wintering DM / ha	-2,423	-2,343	-2,102
Leaves pasture utilised per ha (including N response)	**11,626**	**10,121**	**9,752**
Utilised at 75% = pasture grown / ha including N	15,502	13,495	13,003
Less pasture from N (response @ 10:1)	2,010	2,020	1,650
Pasture grown / ha before N	13,492	11,475	11,353
Total feed offered pasture grown + bought in feed	18,997	17,632	17,551
Kg LWT / t DM offered (CSR)	74	78	80

Table 2: Woodlands rate of pasture growth (no N)

	2016	2015	2014	Long-term average
Woodlands rate of pasture growth				
Total kg DM/ha grown June to May (no N)	12,664	11,532	15,267	13,401
Waihopai calculated pasture growth				
Total kg DM/ha grown June to May (before NN)	13,478	11,475	11,353	–

Source: Chris Smith, AgResearch, Woodlands. Waihopai calculated pasture growth (before N) – last three years

STEP 3: PASTURE MANAGEMENT

1) Run the correct rotation length for the time of the season (plan with targeted rotation length), and control pre- and post-grazing covers (and therefore average pasture covers).
2) Balance the aim to maximise pasture growth potential with maximising pasture quality (MJ ME/kg pasture DM) by controlling correct pasture residuals. Feeding supplement in periods of pasture feed deficit, or the use of mowing and/or taking baleage in periods of pasture feed surplus, are tools used to assist with this.

STEP 4: ANNUAL PHYSICAL REVIEW

The annual review is used to check if the farm is physically performing as expected. After the review, introduce any changes proposed to be made.

RESULTS – WAIHOPAI

Pasture grown

The AgResearch Woodlands Research Station is located about 1 km down the road from the Waihopai farm, and pasture grown information has been available now since mid-1977 so it is a robust set of data. The AgResearch information is a useful 'control', as pasture there is cut on a fortnightly basis from under cages. The data is indicative of actual pasture growth rates in the district without influence from other effects such as nitrogen application and round length (see ***Table 2***). Waihopai developed a three-year pasture improvement plan that included identifying the poorest-growing paddocks, addressing fertility, pH, drainage and weed incidence and then re-grassing. The Waihopai results show an improving trend in pasture grown for the last three years.

Growing and utilising more pasture can lead to reducing a farm's cost structure ($/kg MS), which in turn will lead to improving profit.

A conclusion to be drawn from this, when comparing results to the Woodlands AgResearch data, is that the application of the strategies above are producing results that indicate the farm is setting itself up well. The plan is to continue to increase pasture grown per hectare, assuming an 'average' growing season, by continuing to improve the amount of pasture grown mainly through targeted renovation and efficient use of nitrogen.

Stocking rate and use of supplement and nitrogen

The CSR reduced over the three years to be in the low 70s at 74 by 2016 (see ***Table 3***). Supplementary feed purchased per cow reduced from 852 kg DM/cow in 2014 to 372 kg DM/cow in 2016. Growing more pasture on-farm facilitated the ability to do this.

There was an emphasis on a large reduction in the use of bought-in pasture silage from 576 kg DM/cow in 2014 to 102 kg DM/cow in 2016. This was a conscious decision made, as pasture silage can see high wastage rates through the system, with bought-in DM paid for in the stack after trucking increasing the actual cost of DM consumed mainly through in-stack fermentation losses and feeding-out losses. However a limited amount of fodder-based feed on hand, such as silage or baleage, can be a useful feed input into the system at certain times of the season due to its good 'gut-fill' properties. Nitrogen use at 200 kg N/ha is the annual target.

Pasture management using Annual Farm Management Guide

The Annual Farm Management Guide is a one-page table used to outline decision rules at certain times of the season regarding pre- and post-grazing levels, average cover, rotation length and surplus management/mowing. The lower order sharemilker has an intensive farm monitoring regime, carrying out a weekly farm walk to determine average pasture cover, weekly pasture growth rates and produce the feed wedge.

Table 3: Comparative stocking rate (CSR) Waihopai – last three years

Waihopai *(from Table 1)*	Year 3 2016	Year 2 2015	Year 1 2014
kg liveweight/ha	1,413	1,367	1,407
t DM/ha offered (pasture grown + bought-in feed)	18.997	17.632	17.551
CSR (kg/LW/ha / t DM/ha offered)	74	78	80

Table 4: Waihopai financial results – last three years. DairyBase analysis has been used to analyse the three financial years (owner with variable order/contract milker)

Financial year	Operating profit *($/ha) based on net milk sales (milk price and Fonterra dividend) fixed @ $6.50/kg MS*	Total farm working expenses *($/kg MS)*	Supplement expenses *($/kg MS)*
2015/16	$1,876	$3.49	$0.59
2014/15	$1,401	$3.76	$0.64
2013/14	$1,449	$4.05	$1.18

Review

Completing an annual physical review (as per Table 1) is the starting point to identify areas for improvement/change in the physical farming system going forward. Any revision to the plan for next season is developed and provided to the Waihopai Board for their approval. The management team (sharemilker and farm consultant) have had full support from the farm's governance board. Having all stakeholders' input and everyone being on the same page was critical to success.

Financial results

Table 4 gives the Waihopai case study financial results for last three years. It indicates that when indexing net milk sales (milk price and dividend) at $6.50/kg MS, operating profit ($/ha) over the last three years has improved, with total farm working expenses ($/kg MS) declining. As noted in previous articles on this subject, there is a very strong relationship between declining farm expenditure and increasing profit. Also over this period, there was a 50% decline in expenditure on supplement purchased per kg MS.

Conclusion

The dairy farm system is complex, with many inter-linked components. There are many facets for a farm systems consultant to address when reviewing the total farm system. In my experience, the amount of pasture utilised and grown per hectare is an important focal point when aiming to improve overall farm performance. As illustrated in this case study, growing and utilising more pasture can lead to reducing a farm's cost structure ($/kg MS), which in turn will lead to improving profit.

Acknowledgement

Many thanks to the Waihopai Pastoral Ltd Partnership Board and management for providing permission to use their property as the basis for the case study outlined in this article.

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JOLENE GERMANN

Farmer leadership needed in times of changing environmental regulations

Environment Southland is mid-way through its Water and Land 2020 and Beyond (WL2020) Project, which consists of three stages and is the council's response to the government's National Policy Statement for Freshwater Management. The project aims to prevent any further decline in water quality and to help the Southland community achieve its goals for water.

Dairy farming in Southland

Dairy farming has increased significantly in Southland over the last 20 years and is now a substantial contributor to the local economy. With this intensification has come water quality pressures. The changing environmental regulations of the WL2020 project will impact Southland dairy farmers, as well as the local community.

Although the region has had an established dairy industry since the 1880s, prior to the 1990s the predominant agriculture was sheep, deer and beef farming, with only 25,000 dairy cows in the region. The late 1980s and early 1990s saw the Southland 'dairy boom' where the size of the dairy industry expanded exponentially, signalling a significant land use change in the region. This was catalysed by depressed returns for meat and wool, the increased presence of corporate farming and a campaign run to attract North Islanders to move to the province where land was relatively cheap.

Southland now contains 11.4% of the national dairy herd and the average herd size is 40% larger than the New Zealand average. The Southland dairy industry has continued to grow as can be seen in ***Figure 1***.

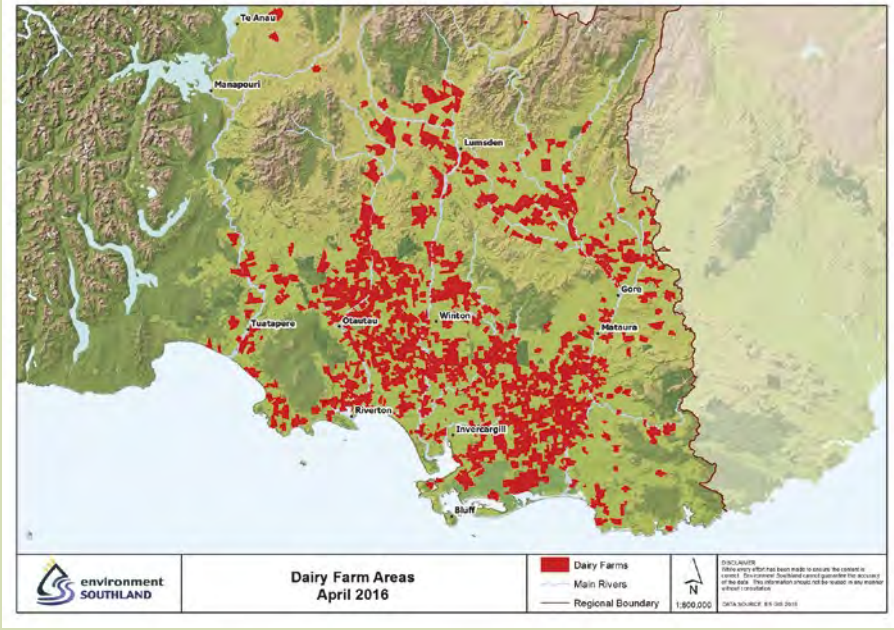


Figure 1: The increase in dairy farm areas from January 2000 to April 2016 in Southland.
Source: Environment Southland

Water quality pressures

There is concern about the water quality in Southland as increased intensity of agriculture, coupled with the poor flushing characteristics of estuaries, has led to a decline in the quality of some bodies of water. Since 2010, there has been an increasing focus on the region's water quality in response to well-documented regional (Environment Southland's State of the Environment Report 2010) and localised (Waituna lagoon) declines in freshwater quality.

Environment Southland monitors 76 water quality sites in Southland and this data is available on the Land, Air, Water Aotearoa (LAWA) website. The state of the region is represented by the median concentration for the parameter across all sites within Southland, which then compares that value to the quartiles for all monitored sites (945 sites) within New Zealand. LAWA's recently updated 10-year analysis gives the following results for Southland:

- Total nitrogen (organic and inorganic) is in the worst 25% of sites in the country with an indeterminate trend
- Total oxidised nitrogen (nitrite and nitrate) is in the worst 50% of sites and has an indeterminate trend
- Ammoniacal nitrogen (ammonia and ammonium) is in the best 25% of sites and has meaningful improvement
- Total phosphorus (dissolved and particulate, organic and inorganic) is in the worst 50% of sites with an indeterminate trend
- Dissolved reactive phosphorus (soluble phosphorus) is in the worst 50% of sites and has significant degradation
- Sediment levels and *E. coli* are amongst the worst 25% or 50% of sites, respectively, with an indeterminate trend.

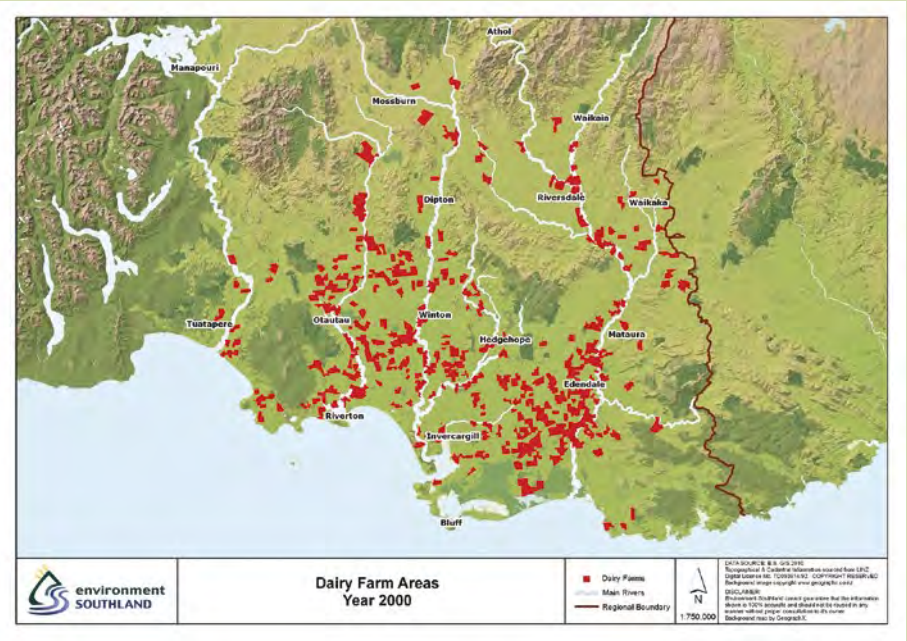
There is concern about the water quality in Southland as increased intensity of agriculture, coupled with the poor flushing characteristics of estuaries, has led to a decline in the quality of some bodies of water.

Water and Land 2020 and Beyond

The WL2020 project involves three stages. First, 'focus activities' for good management practices which were promoted through field days and publications. Second, the forming of the new Water and Land Plan, which will replace the existing Regional Water Plan for Southland. Third, the limit setting process for Southland's catchments. Ngai Tahu ki Murihiku is Environment Southland's lead partner for this project, as well as a regional forum of other stakeholders. Currently the Southland community is approximately mid-way through the WL2020 process with the plan notified on 3 June 2016. Submissions closed on 1 August 2016, with about 1,000 received from the Southland community. A summary of these submissions will be publicly available in October 2016 when further submissions from those who have already submitted will be called for. Hearings are due to start in mid-2017.

Aim of project

The aim was to investigate how Southland dairy farmers have been involved with the WL2020 process already and to find ways as to how this involvement could be improved. The best possible outcome for the WL2020 project was also investigated. The methodology involved interviewing Southland dairy farmers and dairy industry members who had actively been involved with the project as well as reviewing existing literature.



Findings

Understanding the current level of engagement of Southland dairy farmers in the WL2020 process was critical to this project, because to improve this level it is first necessary to understand what it was beforehand. In this project, engagement was defined as the farmers having had something to do with the process in an active way, e.g. attended a meeting (Environment Southland or industry), spoke to an advisor, gave feedback or prepared a submission.

The number of Southland dairy farmers engaged in the process was estimated to be between 10% and 20% by most interviewees. Some commented that this was similar to most other processes in life, and likened it to the Rogers's bell curve. The engaged dairy farmers were seen as being comparable to the innovators and early adopters. They were the part of the population who were easy to get engaged and were likely to be the leaders.

Questions were then asked about how to improve the proportion of engagement. A key theme of how this could be improved going forward was that more one-on-one meetings or small group 'woolshed' meetings were needed. Dairy farmers had to understand and accept that there was a water quality problem before they could be engaged. Farmers listened to other farmers more than anyone else, so key farmers needed to be identified who could directly contact others who were not engaged.

Other suggestions were that the information had to be made specific for individual farmers so they could relate the big picture to their own circumstances. However it was discussed that the 'bell curve would not change, just the axis would move', i.e. there would always be a significant proportion of the population less engaged than others. It was also commented that for topics such as environmental issues the bell curve was likely to start shifting slightly towards the left hand or less engaged side, and this is why regulation would always be needed to change the behaviour of the slower adopters.

The importance of leadership was seen as vital. As members of the Southland community, dairy farmers have the responsibility to 'stand up and lead'. The learnings from the Waituna Lagoon process had found that while DairyNZ and other industry support was important, working as a team with your community and taking leadership was as well. One comment was, 'Define who your community is. Make sure that everyone is represented from an early stage.' Community members had to understand their fellow community members. It was seen as important that everyone was invited to their catchment group meetings and that these invites were personal.

The description of the best possible outcome for the WL2020 process provided the most unanimous responses of the whole survey from the interviewees. Amongst the best outcomes described there were a number of themes:

- Environmental sustainability was not surprisingly a popular issue. Interviewees wanted to see actual improvements in water quality that were quantified by science and were visible
- The importance of handing the land to the next generation in a better state was also spoken about. It was felt that most farmers want to pass their farm on to their children in a better condition than they received it
- Economic sustainability was also a key message – a prosperous and productive Southland community is necessary if the aim to have 10,000 more people living in the region by 2025 is to be reached

A prosperous and productive Southland community is necessary if the aim to have 10,000 more people living in the region by 2025 is to be reached.

Water quality issues, and the community's response to them, involves both science and social science.

- There were comments around the effect that the current dairy downturn is having on the region's economy, both directly and indirectly. This was seen as an example of what it might be like if there were significant constraints on the productivity of dairy farming because of the WL2020 process
- From a social perspective, a united community was important instead of an 'us' versus 'them' mentality. It was hoped that all parties would have a better understanding of each other's views, and that a truly collaborative approach with everyone starting with an open book was used for the limit setting process
- One of the most significant messages from all of the interviewees was something that was not said by any of them. No-one argued against something needing to be done. All of the interviewees had been engaged in the WL2020 process and they all realised that something needed to be done to improve water quality in Southland.

Recommendations

Water quality issues, and the community's response to them, involves both science and social science. It is not as simple as providing the scientific proof to dairy farmers and assuming this will lead to improvements in water quality. It is also complex because dairy farmers are part of the wider community. For them to adapt to changing regulations, the communities that they are part of must also adapt. Five broad recommendations were made by the author as a result of this work.

1. Water quality is also a social issue

Southland dairy farmers must first understand what the water quality issue is, accept that there is an issue, and understand how their actions affect it before they can adapt to any changes in regulation. More one-on-one work and small group work with dairy farmers is necessary. The issue must be personalised to their own farms, rather than just talking in general terms. Dairy farmers are practical people and need practical solutions. They need to be able to give feedback to the scientists and 'rule setters' so that an information exchange occurs rather than an information transfer.

2. DairyNZ should build on what it is doing in Southland

DairyNZ has contributed significantly to the progress that the Southland dairy farmers and the local community have made in the WL2020 process, but this can be built on. Science and communicating this science in a way that dairy farmers and the rest of the community understands was seen as important. One-on-one work with dairy farmers was still very necessary and tools that personalised the issues have great potential. Greater use of technology is also needed to reach more dairy farmers and to spread good news stories about dairy farming.

3. Engagement is the first step

If dairy farmers are not engaged in the WL2020 process they will not have knowledge of the proposed changes and rules, and the impacts of these, or be prepared for them. Again, more one-on-one and small group meetings are needed and personalising the problems at a farmer level is seen as the best way to get dairy farmers engaged. Dairy farmers are seen as the best people to contact dairy farmers and peer pressure is important. By focusing on engagement, the 'axis would be shifted'. This will lead to a higher proportions of Southland dairy farmers being involved in the WL2020 process, having knowledge of the proposed rules and changes and their impacts, and being prepared for them. Ultimately, this will help more Southland dairy farmers adapt to the changing regulations.

4. Farm Environmental Plans effective but need follow-up

Farm Environmental Plans, including DairyNZ Sustainable Milk Plans, are effective at both increasing the knowledge of the proposed rules and changes and helping dairy farmers prepare for these. These plans gave a one-on-one meeting with these farmers, which was important for both engagement and understanding water quality issues. However a follow-up visit and some sort of 'industry audited, self-managed' system is needed. It is important that these plans do not simply become a box ticking exercise, but add real value to dairy farmers.

5. Relationships and leadership are key

Southland dairy farmers are part of the Southland community. It is important that dairy farmers themselves ensure all members of the community are engaged in the WL2020 process. They need to talk to their neighbours and form relationships that will be vital for the whole process, but particularly for the limit setting process. Dairy farmers themselves need to be responsible for forming these relationships.

Conclusion

Coming from a pure science background I had mistakenly considered the water quality issue and the WL2020 process as primarily a science issue. If there is good science then dairy farmers will see this and make the required changes. However throughout this project it has become very clear that this is far from the case. Social science plays a very important role, but this is as much a people issue as it is a water issue. The Southland community is mid-way through the WL2020 process. At this stage parts of this process are unknown. Significant changes are still ahead, and there is no doubt that there will be further challenges to come for the local community.

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LINDY NELSON

Agri-sector governance

What has changed in our thinking around governance in the last five years? What are the attributes of good farm governance and what are the future expectations of individuals taking on governance roles?

Recent changes

In the last five years much has changed in what we think about governance in our agri-sector. We now expect more from our elected directors, gender diversity in our boardrooms is better understood, governance structures within farming businesses are emerging and governance development is a hot topic.

Many factors are influencing this change of thinking. Changes are growing organically as we look to implement more robust business practices to respond to an increasingly volatile and rapidly changing environment. They are also growing artificially as universities and organisations, such as the Institute of Directors, see the sector and its needs as a market for governance development. As this growth is occurring one thing is certain – the governance landscape and what we think about it is evolving.

Director evaluation screening

We have changed the way we think about governance and the expectations of our directors. There is more information available now to make better informed decisions about who we are electing onto our agri-business boards as we move towards director evaluation screening. This helps shape our thinking on defining what competencies a candidate has and helps to educate us about what competencies directors need.

The current evaluation processes are not perfect systems, or without their critics, but they are a good start to changing how we vote. Eight years ago when I was researching governance and leadership in the sector there was a lot of anecdotal evidence about directors being elected on personality, on their farming practices/competencies, for being 'known' or for standing on a platform. That doesn't cut the mustard any longer. Our sector is growing up and is looking for highly competent directors with proven track records. Candidate screening has helped provide the transparency around competencies that directors both have and need.

Director competencies

These competencies fall into four major categories, the first being behavioural. How does a director's personality and leadership play out in the boardroom? What is their ability to utilise their skills and knowledge within a board environment, to be part of a strong decision-making team and interact well with all stakeholders? To understand, and then accept, the board acts as one?

We have changed the way we think about governance and the expectations of our directors. There is more information available now to make better informed decisions about who we are electing onto our agri-business boards as we move towards director evaluation screening.

The next competency is their governance knowledge, experience, appropriate training and a commitment to their ongoing development. Directors need strong financial acumen, the ability to think and act strategically, and to be able to identify both opportunity and risk.

Directors should also bring an area of technical skill or expertise to their board role. This does not mean they should be an accountant or lawyer, but they should provide specific expertise to aid the business and a skill that it needs.

Finally, they need industry knowledge. Do they really understand the business they are governing, the environment that it operates in (both nationally and globally) and the challenges it faces?

Passion and vision not enough

When we start to understand competencies, we start to realise why sometimes the boards we have inadvertently elected will not deliver the results we need. The red meat sector has some fine examples of boards who have directors endorsed by ginger groups, who intentionally aim to change an organisation or industry's strategic direction and have industry reform on their minds. They endorse candidates who have a passion for change fuelled by frustration about the industry – fine people, but with a passion and a vision that isn't enough.

AWDT Founder and Executive Director Lindy Nelson co-facilitates one of the Trust's programmes that develop leadership, governance and business skills and the confidence of women in agriculture

Directors have to do due diligence, they have to truly understand international markets, and to understand this they must act in the best interests of the company and to realise this may be at odds with the best interests of the industry. It is not acceptable any more to stand on a platform or single issue. We need, deserve and should expect more from our directors and we have to keep thinking about who those people should be.

Gender diversity

Our thinking has also changed around gender diversity and the value this adds, with more women contributing in our sector. Yes, commentators may say we need more, but what pleases me most is women are not standing on the 'gender card' but on what they bring to the board table. They are accessing programmes like the Agri-Women's Development Trust's (AWDT) Escalator Programme to ensure they have the skills and competencies needed and to find alignment with those skills in the right leadership role or direction.

I have seen women in our agri-sector women creating tangible changes:

- Traci Houpapa leading Landcorp
- Mavis Mullins (AWDT's patron) chairing Atihau, Poutama and Taratahi
- Escalator Programme graduates like Dawn Sangster (Alliance) whose work around due diligence won national recognition and who is making a real difference to how women stakeholders engage with and understand their cooperative
- Kirsten Bryant, a Beef + Lamb NZ director who gained huge industry respect for her work within the land and water forum.

These are only a few outstanding agri-women directors who are working differently on their boards and shaping our future.

New initiatives

Our thinking around governance and why it is important has changed in many practical ways in the last five years. More organisations and education providers are developing specific programmes and offerings to meet our governance development needs. Banks are starting to insist that farming businesses have a governance structure in place. As a sector we are trying to figure out its importance, how it fits within our organisations (maybe our businesses), and perhaps starting to think about our own personal aspirations to become a director.

Tertiary institutions such as Massey University, Agri One and Waikato University all offer various governance development programmes aimed at either developing rural professionals to work with clients or developing individual's governance skills. Our industry organisations

We need to help farming businesses think about what governance actually means, what it delivers, and assist them develop a fit-for-service solution.

are offering development opportunities as well – Fonterra, Dairy NZ, Beef + Lamb NZ through the AWDT Farmer Council training, Silver Fern Farms-Burnside Hart cooperative training and the ADWT's Escalator Programme. So depending on what a person wants to be or do, there is an offering which varies from being totally free, highly subsidised or completely user pays.

The Institute of Directors have recently spotted a market opportunity and have released their Rural Governance Essentials Programme aimed at helping farmers understand succession planning, farm safety, risk management and whether or not they should have an independent director. Simon Arcus, CEO of the Institute, stated in a recent media release that 'the agri-sector is starting to wake up to the value of good governance.'

What good governance looks like

There is now a greater awareness about the need for good governance. We are recognising that we are operating in an increasingly volatile environment, our risk profile is changing and as directors, as business and farm owners we have increased responsibilities around health and safety. However we have a long way to go in helping people understand what better governance looks like and then in assisting them to find an easy system for its implementation, especially within our farming businesses.

Currently we run the risk of potential disaster by confusing farming businesses about what good governance actually looks like. We need to dispel some myths that it equals a board and independent directors. There is increasing awareness that most farming businesses need improved governance, a push from the financiers of those businesses to ensure better governance, and a pull from some governance development providers offering training. We need to help farming businesses think about what governance actually means, what it delivers, and assist them develop a fit-for-service solution.

The Organization for Economic Cooperation and Development (OECD) states that governance is 'the system by which (business) organisations are directed and controlled.' The Institute of Directors definition is: 'governance means thinking about strategic issues, rather than operational day to day running of the business.' Dairy NZ's Mark and Measure describes governance as 'a process of leading, controlling and directing a business so that it delivers a desired set of outcomes for the owners.'

Farm business governance

Most farmers' understanding of governance is that it is a formal board, usually with an independent director. This leads them to believe they are not ready for this step and they can worry that governance means they will lose control of the business and feel they cannot afford it. They often have a real fear that implementing a governance structure will mean they will be found lacking as a business person and put under scrutiny. It is a valid reaction given the stresses many of our farming business are under – often carrying too much debt, not dealing adequately with it, lacking robust business and strategic planning, and having poor financial literacy. Combine this with the drivers for increased governance and a farming business can feel like change is being forced on them.

We need to help farming families see the benefits of governance and understand that it is a system that separates the strategic direction, risk and policy-making part of the business and determines what it is here to do and why. The management is delivering the operational part of the business – the how. Governance is about accountability and adding value – management is the doing.

Journey analogy

We need to demystify governance and simplify what it does. When working with reluctant farmers I often explain it like a car or tractor going on a journey. Governance is the windscreen. Side and rear mirrors monitor where you have got to on your journey. We plot our strategic direction into the GPS, then look forward through the windscreen at the future and where we are heading, looking for both risk and opportunity. The side mirrors help us understand and adapt to what is currently happening around us and the rear window monitors what has happened and ensures we travel the road we set out to.

The management of a business is more concerned with how we are actually operating the car or tractor to get to the destination. As managers we are in the driving seat, and using governance we are checking the GPS mapping system to see how we are going, as well as putting the vehicle into four wheel drive in hazardous terrain and/or shifting and changing gears and braking when required. As the driver, we know when the terrain is changing and can adjust and alter direction to ensure we achieve our destination. In this way farming businesses can see governance not as separate from the business, but integral to it.

Regardless of where the governance journey starts, as farm businesses face the future they will be operating in increasingly more challenged and volatile environments.

Adding value

Farming businesses need to see that governance is a system for achieving and adding value to the shareholders of the business, which could be the farmer/equity investors/family. It does not need to be a formal board and it can be achieved and implemented in a stepped process to suit business aspirations and growth. The attributes of a good farm governance system are those that support the farmer and the business achieve goals, is fit-for-purpose, adds value and will be implemented.

As professionals advising farming families who have no current governance systems it is necessary to help them become comfortable with governance, demystify it, design with them something that suits them, develop an annual work plan and support them through the implementation phase.

Development days are crucial where farmers can be taken through a process, and hear case studies from peers on the value and impact an implemented governance system has created for their business. We need to let farmers make their own minds up about the value. It aligns well with Mark Elliot's research for the Red Meat Profit Partnership about how the sector can help farmers adapt to change. His key findings included that farmers need to own the idea, implementation needs to be easier and the process needs to be smoother – listening and then tailoring. Key to this was the need to work with the farming partner (often women) and provide an environment where farmers can see success in action (other farmers).

Role of rural professionals

Rural professionals can be pivotal in helping farming business make the transition to good governance, but will need to think carefully around their own role in this. Professionals will be increasingly approached and will need to clarify both for themselves and the client what that involvement looks like. How much accountability are they prepared to take – balancing the client's needs, their professional role, and their own personal aspirations around their own governance career?

Ready for future challenges

This leads me to the last question – what are the future expectations of individuals taking on governance roles? Regardless of where the governance journey starts, as farm businesses face the future they will be operating in increasingly more challenged and volatile environments. Potential directors will need to ensure they are also armed to meet these challenges. Farming family businesses will face intergenerational challenges as business models change and they transition through ownership succession. Businesses will face increasing environmental compliance, water issues, and licence to farm and health and safety requirements. Directors will need to balance all of these issues while working to the current shareholders' aspirations and needs.

There will invariably be the balancing of management versus governance, and professionals may often feel their value-add will be in their expert topic knowledge, yet they will need to think and act as directors. They will need all the general competencies required of directors, as well as strong communication and sector skills and experience. Directors will need to recognise the motivations of stakeholders and investors and be able to coach, persuade and influence around the board table – working with competing needs and interests. They will need to increase their cultural competencies and understand the rapidly changing and growing Maori agri-business sector. Finally, they will need to understand where the business they govern sits, not only within the national landscape, but how it stacks up in a global setting.

Growing good governance systems

Our agri-sector's understanding of governance is changing, the need for better governance will keep growing in demand, and the quality of people to nurture and support this will need constant investment. If we can grow good governance systems then we can grow a sustainable and thriving sector.

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JOHANNES WELSCH AND BRADLEY CASE

Shelterbelts – a farm-friendly way to improve carbon sequestration in New Zealand's agricultural sector

New Zealand needs to adapt to a changing climate and growing consumer concern around the environmental footprint of its farming. New insights into on-farm carbon sequestration and ecological benefits of shelterbelts could be part of the solution to sustainable management and improved environmental credentials for our agriculture.

Climate change

Few now doubt the reality of climate change or the contribution our increasing use of fossil fuels and other greenhouse gasses are making to atmospheric warming. New Zealand's net greenhouse gas emissions increased 54% between 1990 and 2014. Agriculture is responsible for almost half of all our domestic greenhouse gas emissions (approximately 49%). Climate change is an issue that New Zealand farmers cannot ignore. It already has a profound impact on our farming methods and the impacts will only intensify.

Agriculture in New Zealand is at risk from the effects of climate change. The drought of the late 1990s cost the New Zealand economy $1 billion. According to the Ministry of Agriculture and Forestry, the 2009 drought in the Waikato cost the farming sector over $1.24 billion, with Fonterra estimating the cost for dairy farmers at over $500 million. Primary industries generate the bulk of the country's export earnings and have a reputation for quality products and reliable supply. This image, along with the sector's economic sustainability and environmental resilience from climatic events, is under threat from climate change.

The general population in New Zealand and in key overseas markets are becoming more concerned with where their food comes from and the environmental impact of its production. The agricultural sector should be motivated to get out in front of a new wave of opportunity to show consumers that the potential impact of climate change and the environmental footprint of farming are being sustainably managed. Planting more shelter trees can be part of that strategy.

Native shelterbelt on Canterbury farm

NZ agricultural land as a carbon 'sink'?

New Zealand is a signatory to the Kyoto Protocol. Under the Protocol, this country committed to limit emissions to 1990 levels. The New Zealand Government introduced an emissions trading scheme (ETS) to manage its Kyoto commitments, which essentially puts a price on the emission of greenhouse gases. Forestry was the first sector to enter the ETS in 2008. New Zealand's exotic plantation forests are estimated to sequester 25 million tonnes of carbon dioxide from the atmosphere each year, making an important contribution towards meeting our Kyoto commitments. The New Zealand Government excluded agriculture from ETS obligations.

The most recent climate change agreement (finalised in Paris in December 2015) commits New Zealand to reducing its greenhouse gas emissions to 30% below 2005 levels by 2030. Agriculture is currently not part of the mitigation strategy, despite growing research evidence indicating how the farming sector could contribute by increasing carbon storage and decreasing its overall greenhouse gas footprint. What role could shelter trees on farms play in New Zealand's contribution towards greenhouse gas mitigation?

Shelterbelts – more than just wind?

Climate change predictions suggest that the east coast of New Zealand will get warmer, windier and drier with an increased frequency of droughts and storms. If these changes occur, increased efficiency of water use and general farming practices will be necessary to maintain and/or increase production. Wind is a dominant feature of the Canterbury landscape and one of the few weather elements over which a farmer can exert some control with the use of shelterbelts.

However over the past three decades many shelterbelts in Canterbury have been lost due to changes in farm layout to facilitate the use of irrigation equipment and productivity. A case study by Tait and Cullen (2006) on area of shelterbelt loss (m/ha) in central Canterbury revealed a reduction of 46% between 1984 and 2004 as a result of dairy conversions and intensification. Aside from wind protection what else is being lost? Are we sacrificing opportunities to sequester carbon dioxide, provide habitats for indigenous biodiversity, and gain wider environmental benefits across farms both in Canterbury and New Zealand?

Shelterbelts as mini-ecosystems and carbon reservoirs

Carbon is gained in a system through the sequestering of carbon dioxide during photosynthesis. It ends up stored as biomass in the components of the shelterbelt, as well as in the soils beneath the shelterbelt. Gains in shelterbelt carbon stocks through growth and sequestration will reach a maximum when the trees reach maturity. At that point the break down and release of carbon dioxide equals the gain and sequestered amount through photosynthesis.

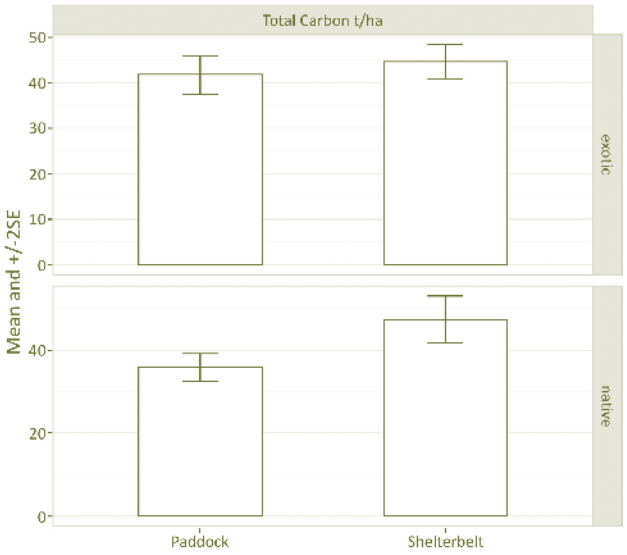

Figure 1: Comparison of total soil carbon stocks (mean tonnes per hectare $^{-1}$ ± 2 standard errors) between native and exotic shelterbelts and the adjacent paddock

Over the last three years the authors have quantified the amount of carbon stored in exotic and native shelterbelts and investigated the effects shelterbelts have on their local soil ecosystem. The research was conducted on farms across Canterbury ranging from the foothills to the sea. It also included investigating whether different farming types (sheep, beef, dairy and arable) were inherently different in the quantities of carbon contained within their respective shelterbelts.

To determine the total carbon sequestered in a shelterbelt at any given time it is necessary to work out how much carbon is stored in different ecosystem components:

- Above-ground live biomass, including the stem, branches and leaves or needles
- Below-ground live biomass, comprising the root system of the tree – once the tree is harvested this component typically decays slowly
- Coarse woody debris, including all larger woody material that has fallen from the trees or is left on the ground after pruning – this component decays over a number of years
- Fine litter, which is composed of decaying leaves or needles and small branches and twigs – this component usually increases slowly over time until a balance between average annual litter inputs and decay is reached
- Herbaceous biomass, which is composed of any grasses or small plants
- Soil organic matter – the soil below shelterbelts is already a significant store of carbon and there is potential for this to increase further over time.

Shelterbelts also create their own ecosystem conditions that differ from adjacent farmland. This is because

shelterbelt trees create a micro-climate beneath their canopies, provide inputs of nutrients and carbon in the form of falling litter and woody material, and cycle nutrients, water and carbon via their roots. This all happens over a relatively long period, commonly 20 to 40 years in the case of shelterbelts. To get a picture of what was happening within the shelterbelt ecosystem we quantified a range of indicative ecosystem processes, including decomposition rates of leaf litter, and soil invertebrate and microbial activity.

Decomposition is the break down of leafs, twigs and needles, with the help of invertebrates (among others) into smaller pieces so that micro-organisms can access them and break them down further and turn them into carbon dioxide, water and plant-available nutrients.

Research results

Our research showed that total carbon stocks in exotic and native shelterbelts, including all components, averaged 152.68 ± 44.94 and 110.88 ± 52.58 tonnes of carbon per hectare (t C/ha), respectively (mean ± 2 standard errors). For all sampled shelterbelts, the above-ground and below-ground carbon values showed a high level of variability. Soils comprised the next largest carbon stock compartment, with no obvious differences between exotic and native shelterbelts (43.40 ± 5.12 and 41.72 ± 7.21 t C/ha, respectively). Coarse-woody debris (0.39 ± 0.14 0.69 ± 0.23 t C/ha, respectively) and litter (4.20 ± 0.58 and 6.09 ± 1.48 t C/ha, respectively) contributed small quantities to the total shelterbelt carbon with negligible differences between shelterbelt types. The exception was the herbaceous biomass carbon stock under natives, which was almost 10 times higher (on average) than the herbaceous carbon stocks under exotic shelterbelts (0.03 ± 0.05 and 0.30 ± 0.06 t C/ha, respectively).

The studied shelterbelts differed in age, with the exotics being 27 years old and natives 16 years old on average. The exotics had greater tree biomass than the natives and in the root systems but soil carbon under each was similar. This finding might indicate the potential for further increases in both soil carbon and carbon in the native shelter tree biomass.

In contrast, the adjacent agricultural land was found to have approximately 40 t C/ha (***Figure 1***). Paddocks adjacent to exotic shelterbelts had on average 42.48 ± 4.73 t C/ha and 38.62 ± 3.94 t C/ha next to native shelterbelts. There was no significant difference in the carbon content between production land and soil under shelterbelts. However soil under trees has a relatively stable level of carbon stocks compared to land used for agriculture and therefore contributes to greenhouse gas mitigation as a true carbon sink.

While the current value of $10 per tonne of carbon is very low and a disincentive to act, it is expected to increase to $25 in the mid term. The Ministry for the Environment has quoted estimates ranging between $35 and $57 per tonne by 2030. This puts the findings into perspective and shows the potential value of carbon in the future.

Results also showed that the decomposition of native leaf litter was considerably quicker than that of exotic leaf litter. This was supported by the finding that invertebrate and microbial activity was over twice as high under native shelterbelts compared to exotics. This higher activity and break down may improve the nutrient status, quality and fertility of soil under the native shelterbelt.

Our expectations were that farming practices, such as irrigation, fertilisation and herbicide applications as well as stock run-off, might have spill-over effects within adjacent shelterbelts for nutrient and carbon cycling processes. Interestingly both carbon stocks and ecosystem processes were found to be relatively insensitive to adjacent land use effects across our study farms in Canterbury. The farming systems across all study sites have been in place for at

least 20 years, so the intensity of the farming operation or the type of stock run on adjacent paddocks does not appear to have any major effect.

What does it mean for everyday farming?

The protection of existing native vegetation and the planting of shelterbelts can provide a multitude of productivity and biodiversity benefits for farming industries. Strategic placement and species selection with clear objectives has numerous potential benefits for farm productivity and profitability. The value of shelterbelts in raising agricultural productivity has been demonstrated in many countries, suggesting potential improvements in crop yields (25%), pasture yields (20-30%) and dairy milk production (10-20%).

There has been concern in New Zealand that the large-scale use of potentially fertile agricultural land for shelterbelt forest or permanent forest sinks will result in 'food and production displacement'. However most new shelterbelts will typically be planted around property boundaries, roadsides, on marginal land or in riparian areas and these areas have commonly been fenced off already. Given the overall lack of native vegetation across the Canterbury Plains, there is an ongoing debate about the need for increasing the use of native species in re-vegetation activities.

New planting with native or exotic species not only provides shade, shelter or reduces run-off, it also increases the storage of carbon on the farm. That would be a win-win for both the farmer and New Zealand as a whole. The average Canterbury dairy farm size is 232 ha and 1% under agricultural use could sequester around 93 tonnes of carbon, whereas the same area under native or exotic shelterbelts could store around 260 or 355 tonnes of carbon, respectively.

Severe winds

Farmers will most likely look for slower-growing shelterbelt species with less wind-catching foliage as replacements for the tall lines that took a hammering on Canterbury farms during the most recent extreme windstorm in 2013. Corsican pines and Leyland Cyprus clones might be a good exotic species as they are slower growing and/or withstand trimming, and native species could play a larger role on the Canterbury Plains in the future. There is a range of hardier native shrub species that can be used for shelter, while also allowing centre pivot irrigators to pass over them. Using natives more commonly across lowland Canterbury would represent a great practical opportunity to bring native plants back into these highly-modified productive landscapes which are bereft of biodiversity.

Mixtures of both native and exotic species can give optimal benefits of shelter, permeability, low maintenance, wildlife habitat and resistance to drought, frost and snow. We now know that natives can hold their own in locking carbon in compared to the more common exotics, and can also provide a number of 'free benefits' to the soil and ultimately the farmer. Such native shelters can be aesthetically pleasing, ideal as a stock shelter under spray irrigation systems, and require less maintenance once established because of slower growth. In addition, these natives play a role in increasing property values.

Native shelterbelts and carbon sequestration – is it worth it?

A large number of countries have taxes for greenhouse gas emissions and emitters can offset their taxes if they put measures in place for reducing or offsetting them. While New Zealand agriculture does not have these taxes or offsets, one could argue that it is only a matter of time before it happens.

So why would farmers not plant new shelterbelts on the farm when the benefits include free carbon storage, increasing organic matter which improves water-holding capacity and the amount of available plant nutrients in the soil, with associated productivity gains in the mid to long term?

A well-considered whole environment farm plan can have objectives including landscape integrity, biodiversity, agriculture and forestry activities. Farm planning allows the evaluation of the efficiency and impact of current land use and agricultural operations. It is important to specifically design the shelterbelt to suit the required purposes/benefits. The location and species in a shelterbelt are influenced by site features including property infrastructure, prevailing and problem winds, soil types, erosion and salinity, remnant vegetation, the use of non-arable areas and other on-site specific features.

Well-designed, established and maintained shelterbelts support ecologically sustainable agriculture and enhance productivity, biodiversity, and property and landscape values. Sustainable whole-farm planning incorporating shelterbelts and biodiversity values can increase the 'environmental credentials' of a farm and the produce sold from the property.

Shelterbelts are not a short-term panacea to mitigate climate change and greenhouse gas emissions, but a mid to long-term proposition that requires a flexible approach and site-specific solutions. They contribute to the well-being of future generations, help position farmers for a 'lower-carbon' future and enable adaptation to a changing climate.

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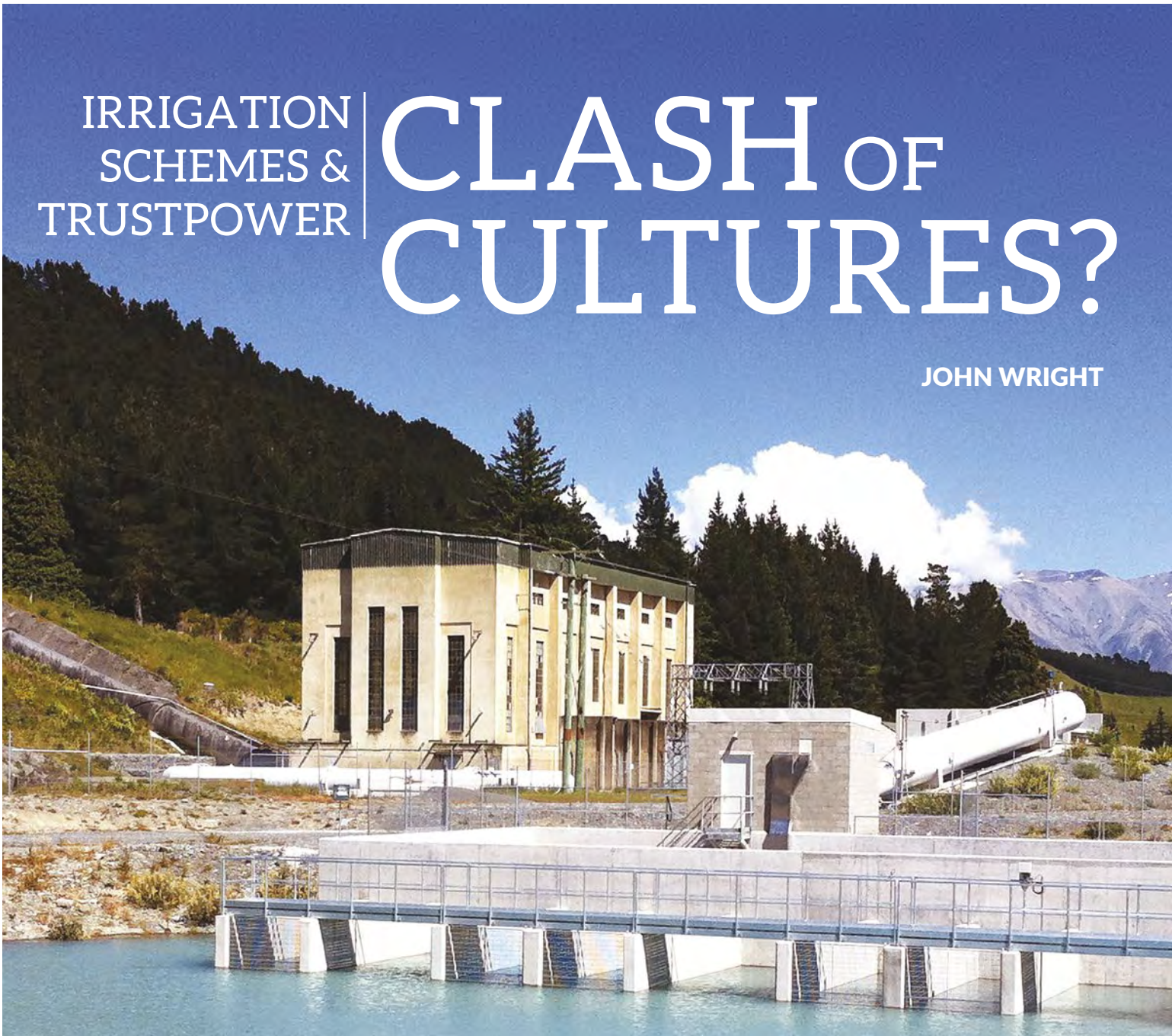
IRRIGATION SCHEMES & TRUSTPOWER

CLASH OF CULTURES?

JOHN WRIGHT



It is clear that mid-Canterbury's prosperity has developed on the back of water. Together with some reasonable land, useful climate and smart adaptive people, the district has been at the forefront of intensive agriculture for many decades. But who else has derived value from water in mid-Canterbury? This article follows on from Bob Engelbrecht's contribution on irrigation in the September 2016 issue of The Journal.

Highbank Power Station with the addition of pump station for BCI

The foresight

The irrigation journey in the Ashburton district began in the late 19th century with the consideration of various options to utilise the obvious resource available in the large alpine-fed rivers to the north and south. The depression in the 1930s was the catalyst for the government to invest to create employment and mitigate the effects of drought in the region. In the mid-1940s construction of the Rangitata Diversion Race (RDR) was completed and irrigation water was then made available to three irrigation schemes – Mayfield Hinds, Valetta and Ashburton Lyndhurst.

The RDR took around 31,000 litres per second (l/s) of water from the Rangitata River and, if not used by the irrigation schemes, conveyed most of the volume 67 km to release it to the Rakaia River via the Highbank Power Station. This station was commissioned in the mid-1940s and operated by the New Zealand Electricity Department for its early life and was (and still is) a highly efficient piece of infrastructure that fully utilises its consented resource.

The reform period

Roll forward to the late 1980s. The RDR schemes had used their allocated water resource as farmers in the scheme catchments fully irrigated their properties and the groundwater resource in the district was being utilised in areas closer to the coast. The Ministry of Works, whose negotiating skills obviously didn't match those of the local farmers, was losing money on most of their irrigation schemes around the South Island and the Crown had decided to divest their interest in them.

The Irrigation Schemes Act 1990 paved the way for dozens of irrigation schemes to be passed on to their beneficiaries on the basis that those irrigators were best placed to operate them efficiently and cost-effectively. Other than some debate around the future potential use of the RDR, the three mid-Canterbury irrigation schemes and the RDR were privatised as a result of that legislation. The corporate structure developed for the RDR reflected the use of the canal by the three irrigation schemes, the generator and Ashburton District Council for stock water use. The generator was allocated two seats on the governance board, the other parties one each, to reflect that the generator was meeting in excess of 50% of the operating costs on a volumetric basis.

The next phase was electricity reform. In 1987, the New Zealand Electricity Department was corporatised and a plethora of complex reform ensued. In 1995, the decision was made to sell the Crown's interest in a number of smaller and less strategically important generation assets, including Highbank and the Lake Coleridge Power Station in the upper Rakaia River. The Electricity Industry Reform Act 1998 required ownership separation of distribution (lines) businesses from supply (retail and generation) businesses to prevent cross-subsidisation.

The first decade of the 21st century could be seen as a protectionist phase. The benefits of irrigation were obvious and irrigators were looking to protect their access to the resource into the future.

Since 1923, the Ashburton Electric Power Board had operated the electricity lines network in the Ashburton District and in 1982 had built, and since operated, the Montalto Power Station on the RDR, a low-head, high-volume station with modest output. The Reform Act 1998, ironically under the control of Prime Minister Jenny Shipley who was MP for Ashburton at the time, forced the now local co-operative Electricity Ashburton to divest the Montalto Power Station, but more importantly denied it the right to purchase the Highbank Power Station when it was subsequently sold.

Roll up Trustpower. The relatively unknown corporate, in Cantabrian terms, had been generating electricity in Tauranga since 1915. The Tauranga Electric Power Board gradually increased its generation assets in the Bay of Plenty approaching the industry reform in the 1980s and continued to operate the distribution network. In 1994, it listed on the New Zealand Stock Exchange becoming Trustpower, with Infratil as a major shareholder, and rapidly expanded its generation assets in the central North Island. In response to the 1998 Reform Act, Trustpower chose to sell the distribution network and focus on the generation and retail of energy. It soon became New Zealand's fourth largest generator and energy retailer.

When the Highbank Power Station was offered for sale in 1999 Trustpower purchased the assets, as well as Lake Coleridge and Montalto Power Stations.

The volume period

The first decade of the 21st century could be seen as a protectionist phase. The benefits of irrigation were obvious and irrigators were looking to protect their access to the resource into the future. For RDR and its shareholders this was accentuated by a consent renewal through this period that was seen to challenge the volume of water available to the irrigators and the generator. The parties threw significant resources at the renewal and were rewarded with continued access to the consented take.

At the same time, a number of parties had been exploring accessing Rakaia River water for large-scale developments on the north and south banks of the river. Early in the decade Barrhill Chertsey Irrigation Ltd (BCI)

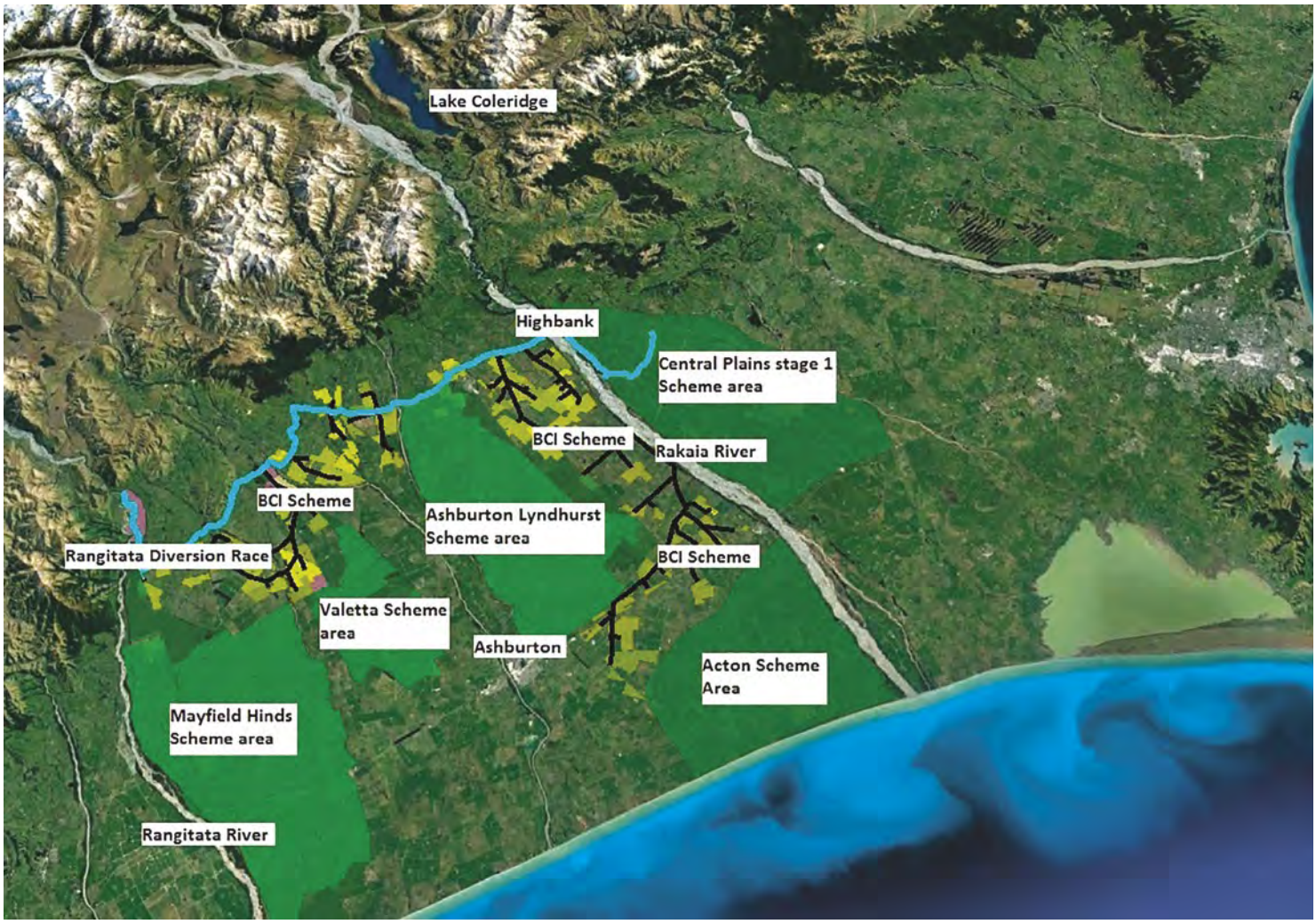


Figure 1: Proud supporters of mid-Canterbury's cooperative water vision

was awarded a 17,000 l/s consent to irrigate 40,000 ha in mid-Canterbury, the development of which was stymied by poor reliability, open access to alternative groundwater and cost.

Intensive farming in the region was obtaining water rights where they could for dairy conversion on the lighter soils, and arable and vegetable production on the heavier soils. The groundwater resource was coming under pressure and any move to vary consents or extend consent lapsing periods on surface water takes was challenged by competing users and interested parties.

Later in the decade Central Plains Water began its arduous journey in consenting a 60,000 ha scheme in Central Canterbury, north of the Rakaia River. Although initially seeking some water from the Waimakariri River to the north, they were ultimately forced to largely rely on water from the Rakaia River to develop their scheme. Attempts to consent foothills water storage were met with significant challenges and the scheme was threatened by poor reliability.

Amidst this backdrop BCI was determined to satisfy the demand for water from its shareholders, most of whom had no access to RDR scheme water or groundwater. Following two disappointing attempts to develop larger schemes, BCI found a workable business case and developed a 3,000 l/s scheme in 2010. Enter most of the other parties previously discussed.

The BCI solution involved forming a 50:50 joint venture with Electricity Ashburton, contracting Trustpower to pump the required water 104 m up from the Rakaia River to the RDR, and contracting RDR to deliver water to the BCI pipe networks across mid-Canterbury through a water swap arrangement. BCI also licensed a further 3,000 l/s of water to the Acton scheme near Rakaia and Rooney Earthmoving enlarged the existing stock water network to deliver irrigation water to the area, later selling the scheme to the irrigator users. The Acton scheme gave effect to the BCI consent a day before the consent lapsed in 2010.

Although Trustpower had worked closely with the RDR irrigators for a decade, this was their entrée into the ownership of joint use assets in Canterbury.

The master stroke

Entering the current decade there was a realisation that, at least in the mid-Canterbury district, there was an abundance of water available for local irrigators. Much of the driver for this was the continual irrigation efficiency improvement on farms, pushed largely by the conversion of flood irrigation to centre pivot application and also the piping of some of the RDR scheme delivery networks. Trustpower was a significant beneficiary of the efficiency

Rakaia River intake downstream from Highbank

improvements as they 'mopped up' surplus summer water at Highbank Power Station. At the same time, BCI was 'filling in gaps' in the district, which took pressure off the RDR schemes to expand outside their catchments.

The master stroke was delivered by Trustpower. As BCI was concocting the various scheme solutions it became obvious to Trustpower that the key to providing reliability to the new irrigation schemes lay in the use of Lake Coleridge as a storage facility. In conjunction with this realisation, the Highbank Power Station and influential interest in the RDR was strategically important in the future development of irrigation infrastructure in the region. The Canterbury Water Management Strategy Infrastructure Group highlighted the Highbank assets as a critical 'node' to meet the region's future water needs.

Trustpower sought a variation to the Water Conservation Order (Rakaia River) 1988. This was the Order protecting the braided river from over-abstraction and governing the minimum flows for various consent holders, which would allow the storage and release of consented irrigation water not taken by the consent holders from their Lake Coleridge asset. The outcome of this variation would provide BCI to the south of the Rakaia River, Central Plains Water to the north of the Rakaia River, and other Rakaia River consent holders with a reliability solution that was as close to 100% as they chose to pay for.

The key learning from the interaction in the last few decades between the farmer co-operative irrigation schemes and the corporate partner is that these schemes should demand the same corporate disciplines, strong management leadership and sound governance that corporates demand.

Although not universally supported in the community, the 'non-invasive' storage solution was seen to be the lesser of any evils considered and the variation was approved in early 2013. The result gave BCI greatly improved reliability and an immediate boost in demand for new connections and Central Plains Water the impetus to develop.

The contemplative period

As the various participants contemplated their successes, and the degree of collaboration in the local industry was reaching new heights, there was a new and somewhat naively unanticipated threat in the water space. The National Policy Statement on Freshwater Management, the Canterbury Water Management Strategy and collective implementation by Environment Canterbury suddenly restricted the irrigation schemes' ability to expand as they had intended. The contemplative period was quite short.

The quality period

The implementation of Environment Canterbury's Land and Water Regional Plan (LWRP) gave irrigation schemes the opportunity to develop audited self-management (ASM) systems to manage the environmental impact of their irrigating shareholders. It would be fair to say not all schemes viewed it as an opportunity. However without an approved land use or discharge consent, with appropriate constraints on nutrient losses from farms using irrigation water, schemes were now unable to expand. The pragmatic response from most schemes was to develop ASM systems including Farm Environment Plans for all irrigators, restrictions on changes in land use that resulted in increased nutrient losses, and independent audits of these plans establishing confidence levels in the irrigator's ability to meet the targets under the LWRP.

As an example, the BCI scheme has now grown to deliver 9,000 l/s of water through 200 km of buried pipe, plus the 3,000 l/s under licence to the Acton scheme, and has more resource committed to its environmental programme than it does to its in-field operations team. There is no universal acceptance amongst irrigators that there is value in the ASM system, particularly in the older schemes, and care will need to be taken that goodwill toward the schemes is not eroded through poor communication.

The pressure to prove environmental stewardship will not wane. Those who embrace the opportunity to improve their on-farm environmental performance will be rewarded with more certainty in their future 'licence to farm'.

Square peg… round hole?

Irrigation schemes have generally had limited management structures and governance is provided by elected farmer directors. Farmers like to 'make stuff happen' and sometimes drift into the realm of management quite easily. Some schemes are in fact operated by their elected directors.

The entrée of corporate partners like Trustpower was met with some scepticism, mistrust or even fear. There were certainly some cultural differences experienced between the 'partners' in the BCI scheme, particularly in the commercial behaviour experienced on the realisation that the irrigator group had exhausted any leverage they may have once held. This created significant ill feeling in the community and amongst those who had spent a generation of volunteering towards a community project. With the passing of time, and success experienced, the fitting conclusion is 'welcome to the real world'.

The modern irrigation scheme looks a bit different. Boards are now supported by independent directors filling skill gaps and providing commercial experience. Management structures are developing and providing more commercial skills, leadership and succession. The Crown's tentative return to the irrigation scheme space, in the form of Crown Irrigation Investments Ltd (CIIL), may not have contributed significant capital to developing schemes at this stage, but it has been instrumental in forcing new schemes to meet a sufficiently commercial threshold to receive funding support. CIIL are all too aware of the performance of historical Crown investments in irrigation, but have a critical role to play in some regionally significant investments that have the ability to replicate the success of mid-Canterbury water in drought-prone regions like the Hawke's Bay.

Central Plains Water is a good example of the modern scheme. In 2015, the scheme commissioned their first stage, irrigating around 20,000 ha from the Rakaia River, and is likely to move to stage two development in the short term. Trustpower's Lake Coleridge project was a key component of the scheme and CIIL supported the development. These corporate relationships are critical to Central Plains Water.

BCI's more complex JV structure brought further discipline, which has allowed the scheme to lever off its line business partner in a number of areas. Both Electricity Ashburton and Trustpower also provided confidence to enter the power generation market with a recent installation of a hydro generation plant.

The older irrigation schemes who took over their schemes from the Crown a quarter of a century ago have experienced a different relationship with corporate entrants like Trustpower. The schemes' low-cost focus, which earlier ensured that the Crown lost money on their irrigation investments, is entrenched in the mindset of the shareholding irrigators and they have generally not developed significant management structures or moved from farmer-only elected boards. Without the need to rely on a corporate partner, these schemes have developed a

relationship based on tolerance and operational necessity. In the RDR structure this has manifested in a solid working relationship, but one where the corporate influence is significant and accentuated by the duplication of representation around the board table.

The key learning from the interaction in the last few decades between the farmer co-operative irrigation schemes and the corporate partner is that these schemes should demand the same corporate disciplines, strong management leadership and sound governance that corporates demand. These schemes are significant businesses in their own right and drive the economic prosperity of the region in which they operate. The schemes which adopt this approach will have no issues forming mutually beneficial relationships with corporates like Trustpower in the future. That said, farmers like to own infrastructure.

The consolidation period

The next period is when the crystal ball comes out, although the industry is just starting to see glimpses of this pathway. The realisation of the need for strong management and governance in irrigation schemes will be born from shareholding irrigators realising the significant value provided by irrigation schemes to their own farming businesses from leadership and support in the environmental, compliance and advocacy areas.

From that will flow a further realisation that this is best achieved through the consolidation of schemes into larger schemes, if not one 'mega irrigation scheme' where the cost impact is minimal compared to the value added by having industry leading people representing irrigator interests. The highly skilled management teams will easily transition into operating, maintaining and developing sophisticated water utility businesses incorporating irrigation, environmental restoration and hydro generation.

Farmers' intergenerational views of the cost structure associated with the delivery of water will drive the schemes to consider the best ownership model for water infrastructure and may lead to some changes to the current model. The learnings from the post-reform period will position the irrigators well to make sound investment decisions in the future.

Competing uses for capital will be an issue in this period, as they have always been. Most new irrigation schemes have been successful in minimising the share capital requirement and 'banking the scheme' through higher annual charges. Expanding older schemes have been able to extract much higher share capital contributions and bring new participants into the lower annual charge regime. Once participants in new schemes are reaping the benefits of more resilient irrigated systems on-farm they will begin to explore options of lowering the annual cost of the water, normally through the injection of new capital into the scheme. The BCI scheme is approaching that phase and shareholders generally understand that annual charge reductions will be achievable by providing more equity to the scheme. The successful timing of these moves can be challenging and in BCI's case generally coincides with recessions.

Irrigation schemes are facing, and will continue to face, increasing environmental and compliance challenges. The logical way to meet these challenges without imposing untenable costs is through the consolidation of schemes.

Conclusion

The reform of Crown-owned irrigation schemes and the electricity industry paved the way for Trustpower to secure a box seat in irrigation infrastructure in the wider Canterbury region. Their behaviour was suitably commercial and created a degree of mistrust, although they brought significant corporate discipline and innovation in water management which has benefited the whole region.Trustpower has derived substantial value from water infrastructure in mid-Canterbury and the wider Canterbury region, and perceived supernormal profits creating this value has underpinned a clash of cultures.

Through necessity some irrigation schemes are now developing strong management structures and sound governance teams. These schemes are providing significant value to irrigator shareholders and have resulted in the forming of strong commercial relationships with their corporate partners.

Irrigation schemes are facing, and will continue to face, increasing environmental and compliance challenges. The logical way to meet these challenges without imposing untenable costs is through the consolidation of schemes. A likely unintended consequence of this, and exposure to the corporate outsider, is that schemes may wish to ultimately own and operate all of the infrastructure required for the intergenerational delivery of water to their farming businesses.

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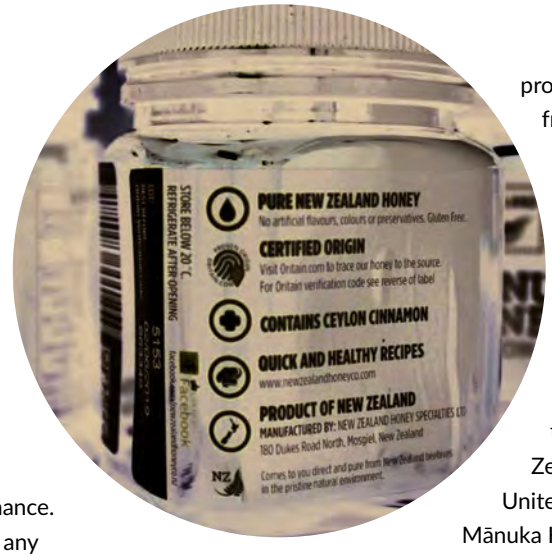
SAMUEL LIND

Adopting science to strengthen the integrity of supply chains

Since the domestication of agriculture supply chains have been in a state of flux – continually evolving in response to the development of technologies and changes in the marketplace. As price pressures continue to force increases in buy-sell nodes throughout the agribusiness sector, these changes manifest in an evermore complex structure of supply chains.



Food fraud

Likewise, and somewhat ironically, the globalisation of supply chains has coincided with an increasing consumer interest in the provenance of the foods they eat. Now food fraud has entered into the void created by price pressures, supply chain complexity and the greater value obtained for products with the desired provenance. Food fraud is a catch-all term for any misrepresentation of goods in the marketplace, whether through mislabelling, dilution, substitution or any other form of adulteration. It is estimated to cost the global food industry $US49 billion a year, not including intangible losses to brand damage.

New Zealand companies have not been immune to this global problem. The most costly and high-profile case was the 2008 Chinese milk scandal, where Fonterra alone lost $140 million as a result of its 43% owned Sanlu brand who were heavily involved in the incident. The reputational damage, both to Fonterra and to Brand NZ, is unquantifiable. As China continues to focus on heightened food security – in its own supply chain and in products imported globally – an ever-increasing light of scrutiny is being shone on premium products from New Zealand.

NZ mānuka honey in the spotlight

As with any product commanding a premium price over 'normal goods', mānuka honey has become a lucrative industry targeted by fraudsters. This honey is produced only in New Zealand from the nectar of the mānuka tree, and due to its origin and perceived health benefits it commands a premium price over most other honeys. As a result, and as is common in similar premium products, there is large scope for fraudulent practices within the industry. These practices are proliferating, with potentially damaging impacts on this lucrative export product.

According to international reports, there is more than 10 times as much mānuka honey bought by consumers than being produced by New Zealand. Recent articles in the United Kingdom detailing 'The Great Mānuka Honey Swindle' have not done our reputation any good. Much of the most recent supply chain fraud has related to the dilution of production lots of mānuka honey. With inferior honey of non-New Zealand origin now entering mainland China, and with a number of the major exporters looking to grow this market, this fraud issue will only increase.

At the same time, authentic mānuka exporters have a responsibility to protect the reputation of our industry. The Ministry for Primary Industries recently seized and recalled product from an Auckland-based producer who was found to be adulterating their product with a synthetic chemical used to boost the 'activity' of the honey for economic gain.

Food fraud has entered into the void created by price pressures, supply chain complexity and the greater value obtained for products with the desired provenance.

As consumers and retailers around the world become increasingly concerned about food safety, the demand for proof of authenticity is therefore also rising.

Brand NZ

Benjamin Franklin famously said that it takes many good deeds to build a good reputation, and only one bad one to lose it. Commercial brands are ruled by a similar edict – their welfare flourishes until, with one lie or mistake, it fails. A brand is a promise to the consumer that the product they purchase is authentic every time they buy it. If New Zealand brands are to deliver on their promises, fraudulent practice must be stopped at every point in the premium product supply chain.

New Zealand exports as a whole trade off the untainted image and good favour that the country inspires in companies and individual consumers. This confidence and trust equals value creation for producers as they try to obtain premium pricing. However it also makes them vulnerable to the extraordinary risks of scandals and fraudulent practices of New Zealand exporters as a whole, and therefore to reputational damage and incalculable financial losses.

As a result it is imperative that a high priority is placed on maintaining and improving the integrity of Brand NZ and the reputation of our premium producers because, as shown in the mānuka honey industry, no-one is immune to food fraud. As consumers and retailers around the world become increasingly concerned about food safety, the demand for proof of authenticity is therefore also rising.

Traceability

The concept of both traditional and new adapted methods of traceability is to document the transfer of production lots as they move through a supply chain. For primary products, such as apples, this is a relatively simple process as they are traced from the orchard, to the pack-house, to freight, to the wholesaler and then to retail. Tracing is monitored only at steps where lots are, for instance, either consolidated (several orchards into a pack-house) or broken down (wholesaler to retail).

Traceability of ingredients for manufactured goods requires significantly more bookwork, especially as production runs of a final product can incorporate dozens of different primary goods. These processes rely on a form of packaging to hold a unique identifier of the product, which can be as simple as a lot number or as complex as a QR code. They have the ability to accurately document every movement of those product lots and to form a point-to-point overview of an entire supply chain. Often these aspects are not sufficiently traced, especially in the latter stages of the supply chain, as goods will pass through several owners who hold no responsibility for the products once they have been shipped from their facilities.

The limitations of traceability became apparent during the European horse meat scandal (or 'Horsegate') of 2013. There is a global trade (trade being the buying and selling goods as they are financial products) of beef trim used in the production of mince and ground beef products. The trading players in this market essentially have no direct use for the product and very little responsibility for it as it moves through the supply chain. In this case, horse meat cuts were traded between various entities and at some point the product was relabelled as beef trim. The mislabelled product was purchased by a processor/manufacturer and it entered into markets for human consumption. There was a reliance on the veracity of invoicing documents by each step in the chain without anyone having an overall picture of the actual provenance of the product.

Chemical fingerprinting

In forensic science the term 'fingerprinting' is used to explain the concept of generating a unique identifier, with three major principles to adhere to:

1) A fingerprint has an individual characteristic.
2) A fingerprint will remain unchanged over time.
3) Fingerprints have unique characteristics which allow them to be classified.

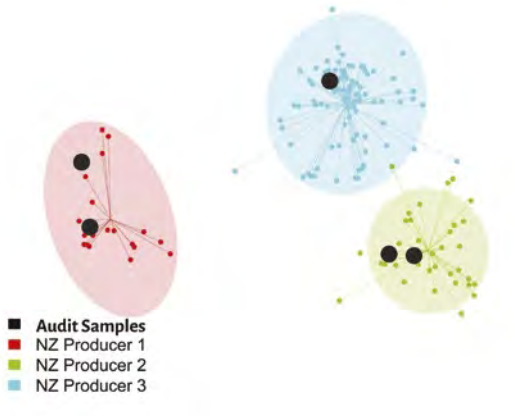
These principles can thus be adapted in many fields, with the major differences encountered with the third principle, i.e. the aspect you are looking to classify.

Chemical fingerprinting uses the same principles as applied above, except chemical parameters are the attributes measured instead of ridge lines on the skin of our fingertips.

The team at Oritain uses a similar approach, but the attributes needing to be classified relate to origin and provenance.

Within the limitations of traditional traceability described above, this is a method that can be used for proactively ensuring integrity throughout the supply chain and in-market. This type of fingerprinting measures what is in the product rather than what is written on the packaging.

The concept of chemical fingerprinting for provenance is simple, even if it is complex in practice. It relies on exploiting the measurements of a number of chemical specifications that are known to vary depending on the environment, geography and various production processes. Effectively, the values of these specifications depend on the product's origin.



Each cluster represents an origin fingerprint for producers of mānuka honey products, and each point within the cluster represents a sample of the product. If a sample falls inside of a cloud, it is deemed to be consistent with product from that producer.

By measuring a whole host of these specific chemical parameters, it is possible to develop a chemical fingerprint for a product from a particular origin. Suspect products can then be tested against this fingerprint to determine if it is genuinely from that origin. These parameters include the concentrations of multiple trace elements and stable isotope ratio, such as hydrogen, carbon, nitrogen and oxygen, which are passed from the soil and the atmosphere into plants and animals. The use of these for origin determination evolved from the forensic science field, where the techniques are used for numerous provenancing purposes. These have included identifying the origin of illicit goods, such as drugs, or determining the country, for instance, from which a murdered migrant originated to help to solve the crime.

Once a reference database of authentic samples has been created of the desired product and origin, a queried product can then be compared to this database to determine if it is an authentic product from that specific origin. However chemical fingerprinting is not a simple case of comparing numbers. It requires complex algorithmic and statistical modelling to combine these measured parameters, along with other considerations such as climatic and geological variables, to offer the most accurate and scientifically robust solution.

Chemical fingerprinting methods do not replace traditional traceability systems which track the movement of products – they are used alongside them to confirm the authenticity of products in the supply chain. Simply put, they audit the origin claim of products in the supply chain. A product can be taken at any point in the supply chain or in-market and compared, using chemical fingerprinting, to the reference database. This enables brands to check the integrity of their supply chain, lessening the risk of counterfeit and fraud, which in turn reduces the chance of brand damage and forced product recalls.

Reducing risk and adding value

All businesses and brands in the food supply chain are susceptible to fraud and the likelihood of this occurring increases day by day. It is the businesses that are proactive in accepting the risk and taking steps to manage it who will be more robust. The purpose of auditing and protecting the integrity of the supply chain is to provide all stakeholders with peace of mind that what they are dealing with is authentic. The impact of having a supply chain compromised is too great for a business to ignore.

With origin fingerprinting, from product creation through distribution to the end consumer, each supplier can be assured they are part of a process that aims to keep transparency and consumer interests at the core of it. This auditing process can:

- Reduce risk exposure for directors and demonstrate good governance
- Deter fraud within the supply chain
- Mitigate the risk for supply chain partners
- Help exonerate innocent parties in a food fraud event
- Signal to consumers that the supply chain is robust
- Send the message that the brand and its products are worth protecting.

Businesses in the agricultural and food services industry have never faced greater pressures than they do today. Rapid technological development, volatile economic landscapes and changes in the earth's climate which affect – and sometimes destroy – agricultural yields all force the continual evolution of supply chains. As agribusiness continues to globalise, and supply chains span throughout countries, over continents and across the world, these chains become more complex.

While globalisation brings people together and fuels economic growth, it is also the reason that businesses have never faced greater risk. The pressure to lower prices now coincides with the need to protect the value of premium products, and products like New Zealand's mānuka honey are ultimately the most vulnerable to food fraud. Consumers are concerned with the provenance of their food, and demand proof of origin labelling from the brands they want. When consumer trust is broken, brands suffer sometimes irreparable damage to their reputation.

In the case of mānuka honey such fraudulence has broader implications for Brand NZ, tarnishing the reputation of the producers at the source who are responsible for the product, whether or not it was them who adulterated it. That is why taking the necessary steps to guarantee the integrity of their products is more important than ever for food services and supply companies, and why adding science to the supply chain is the way forward.

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GRAEME J. DOOLE

Nitrogen and intensive agriculture – WHAT HAVE WE LEARNT?

Pastoral agriculture remains the backbone of regional and national economies, but losses of nitrogen from New Zealand pastoral farms are a key driver of the nutrient enrichment of freshwater bodies. There has been a concerted effort to understand the economic and environmental implications of different management strategies to reduce the environmental footprint of grazing systems in this country.

This body of research is now quite mature, with broad-scale understanding that meaningful reductions in nitrogen on-farm will likely decrease both production and profit. Industry-wide adjustments to existing farming systems that are capable of transforming economic and environmental bottom lines are deemed to be extremely rare. Yet current conditions provide a substantial incentive to explore these alternatives and evolve new systems that are better placed to meet the needs of farmers and society. It is also timely to reflect on what we have learnt from our national 'nitrogen fixation', and place greater emphasis on mitigating contaminants that arguably more directly impact societal values associated with freshwater.

Nitrogen loss from pastoral agriculture

Pastoral agriculture continues to play a central role in the economic and social fabric of New Zealand. In particular, it remains a key driver of economic activity in regional areas where alternative sources of income are less available and agricultural land is plentiful. The New Zealand economy is particularly vulnerable to shocks, being small and market-driven. The benefits of a strong dairy sector for both employment and income have been significant in recent times, especially throughout the aftermath of the global financial crisis. Market forces have played a major role in encouraging the development of highly productive dairy farms throughout New Zealand over the last quarter of a century. The amount of milk produced by the dairy industry has trebled over this time as a result of increases in both production intensity and farm area. Milk production per hectare improved by 63% over this period, while the area utilised for milk production increased by 70%.

Increases in farm intensity are a result of broad-scale improvement in farm management, genetics and the use of nitrogen fertiliser and supplements – both imported and grown within the farm system. Significant drivers are predicted to exist for intensification in the future too, especially once higher milk prices return. A key opportunity here is the improved management of irrigation water through the further development of central storage systems and/or the adoption of improved institutional arrangements (e.g. trading).

Other than land use change, a key driver of increased milk production in the national dairy industry has been the use of imported supplement, forage crops and/or nitrogen-fertiliser application. These inputs have increased the delivery of metabolisable energy to cows, thus increasing milk production and stimulating regional economies. Meanwhile there has been increasing recognition of the off-site impacts of nitrogen losses from intensive dairy production. Nitrogen is a key input to pastoral systems, with pastures requiring this nutrient in the largest quantity out of all of the essential nutrients. However the primary pasture types used in New Zealand are generally high in crude protein that, once digested, yields high amounts of nitrogen available to the grazing animal. Greater use of supplement and nitrogen fertiliser has further increased the ingestion of crude protein by cows, thereby driving more nitrogen intake. More than three-quarters of the nitrogen ingested by cows is excess to requirements, and is therefore deposited onto urine patches on pastures where it is easily lost over autumn/winter when plant requirements for nitrogen are low and water supply exceeds pasture needs. The dislocation of nitrogen to waterways can eventually impair its use for drinking and recreation and/or contribute to eutrophication.

A result of increased feed inputs has therefore been more milk production, but also greater nitrogen loss from dairy pastures throughout New Zealand. The dual components of energy and protein within feed yields, for a given dairy herd, an upward-sloping and approximately linear relationship between production and nitrogen leaching. This relationship highlights the central role that intensification has played in water quality decline in New Zealand. However it also demonstrates how decreasing nitrogen leaching typically has direct implications for the productivity, and likely profitability, of this country's dairy

farms and processing companies unless the process of rationalisation is well managed.

The first significant scientific recognition of high nitrogen losses arising from New Zealand dairy production, and its potential for off-site impacts, appears to be in a body of work led by Stewart Ledgard (AgResearch) in the late 1990s. This work was stimulated by increasing concern about the off-site impacts of dairy intensification, particularly through observations of large increases in nitrogen-fertiliser use and historical records indicating water quality degradation in traditional dairy areas.

Nevertheless this work exhibited a strong tie to the scientific and policy focus placed on nitrogen losses from European dairy systems, which had occurred across much of the prior decade. Subsequent work reinforced that dairy farms typically yield the greatest load of nitrogen per hectare out of the main types of pastoral farms present across the country, a key factor drawn upon by Fish and Game New Zealand as part of its 'Dirty Dairying' campaign in the early 2000s. These efforts initiated a broad research agenda and concerted societal focus on the implications of dairy farming for water quality throughout New Zealand, one particularly focused on nitrogen and one that persists to this day.

Cost of reducing nitrogen losses

After 20 years of intensive research there now exists a strong understanding of the cost of nitrogen mitigation across New Zealand pastoral industries. Losses generally increase as the level of mitigation increases, although counter examples do exist (see below). This relationship between profit and mitigation is commonly known as a cost curve or a Neal curve (named after Mark Neal of DairyNZ who first used this formalism) (***Figure 1***).

The abatement-cost relationship that is described in the Neal curve is intuitive, given that it generally becomes more difficult (and therefore costlier) to reduce nitrogen losses as more mitigation is performed.

These curves vary broadly across different systems and different landscapes. An abatement-cost curve for sheep farms is typically steep and short, given their generally low nitrogen footprint and lack of options for reducing leaching. In comparison, one for a standard dairy farm is typically shallower but longer, which reflects their higher level of baseline leaching and the broader range of potential mitigation options available to these producers. More intensive dairy farms often have a shallower curve again, given their greater range of options to reduce nitrogen loss. Also the cost of mitigation is typically lower on a per unit of nitrogen basis for a more intensive farm, as each kilogram that is abated represents a smaller percentage change in the baseline load.

Shallow parts of the Neal curve (those near the vertical axis) for a dairy system typically reflect the utilisation of cheaper strategies of low to moderate efficacy (Figure 1). Examples are the use of stream fencing, improved effluent management and autumn applications of nitrogen fertiliser. Stream fencing is now broadly adopted on New Zealand dairy farms and generally achieves a 5-10% decrease in nitrogen leaching through the prevention of direct urinary deposition to waterways. Riparian vegetation may also be able to remove nitrogen as it flows through shallow groundwater on its way towards the stream. Decreasing autumn applications of nitrogen fertiliser is often more cost-effective as a mitigation relative to reducing spring applications, given the high susceptibility of nitrogen to leaching in autumn/winter and the high milk solids response achieved earlier in lactation.

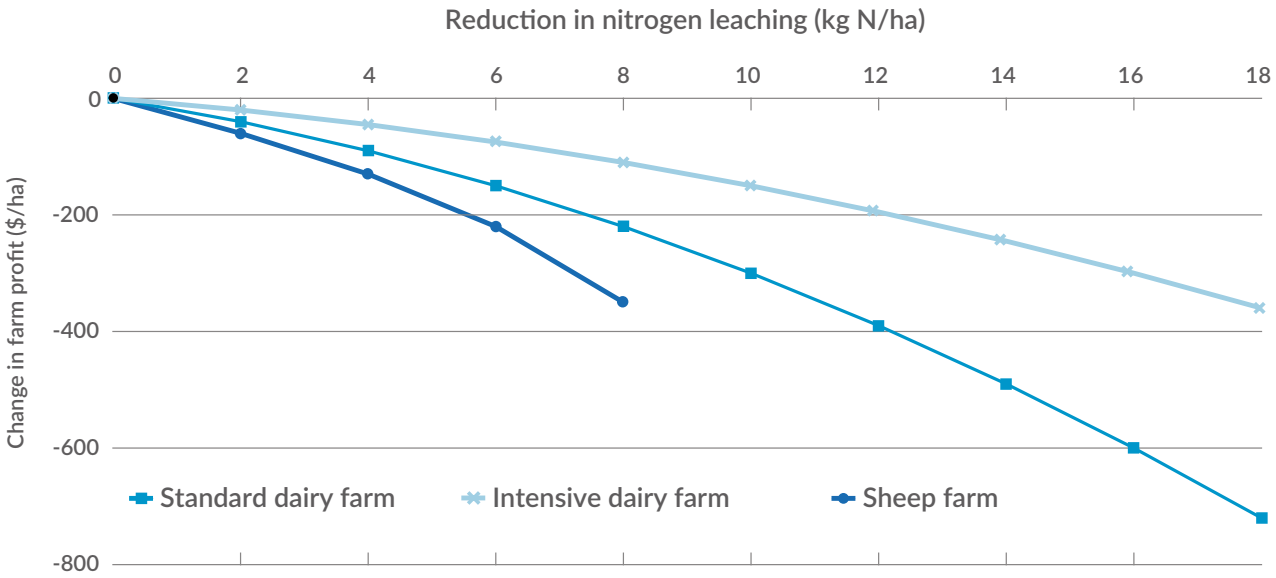

Figure 1: An example of cost curves (i.e. Neal curves) delineating the relationship between the abatement of nitrogen and the associated change in farm profit

Off-pasture facilities such as stand-off pads and wintering barns are effective strategies for reducing the loss of nitrogen, breaking the association between milk production and leaching that lies at the root of the nitrogen leaching problem in pastoral systems.

Higher levels of abatement are associated with strategies that also reduce milk production (e.g. through decreasing supplement use, crop use, pasture intake, stocking rates and lactation length). Lower stocking rates generally lead to higher levels of milk produced per cow, yet this is dominated by the loss in production per hectare associated with decreased pasture utilisation at higher levels of herbage allowance. Lower stocking rates also make the management of pasture quality more complicated, promoting the need for tactical silage conservation and mowing.

Even higher levels of abatement generally require significant changes to the farming system. Typical strategies involve the construction of edge-of-field assets, land use change and off-pasture facilities such as stand-off pads and wintering barns. The application of edge-of-field assets to target nitrogen loss from dairy farms mainly involves the use of wetlands to intercept and attenuate nitrogen, although riparian vegetation may serve a similar role. Edge-of-field strategies are costly to design and construct, yet they represent one of the most effective means to reduce nitrogen losses from intensive agriculture. Moreover, they may offset the need to change farm management, reducing the adjustment costs associated with learning new ways to farm.

Off-pasture facilities such as stand-off pads and wintering barns are effective strategies for reducing the loss of nitrogen, breaking the association between milk production and leaching that lies at the root of the nitrogen leaching problem in pastoral systems. Their cost in production terms can be low too if cows are managed to achieve high rates of intake from short periods of grazing. However their capital cost can be significant, often in excess of $1,000 per cow, and intensification to service the ensuing debt can offset any real environmental gains accruing to their use.

A movement towards lower leaching land uses allows arguably the most secure improvement in nutrient mitigation. One example is conversion from dairy to sheep production, while another is conversion from sheep to forest production. However when implemented at a large scale, land use change is associated with significant economic and social upheaval. Accordingly, it is perhaps best suited to partial adoption (e.g. through continued strategic retirement of low-producing land). There are also potential synergies between carbon and nitrogen policy, with substantial scope for reduced nitrogen loss if stable, elevated carbon payments can be earned for plantation forest.

The discussion of the Neal curve delineated in Figure 1 has focused on individual strategies, for simplicity, yet taking a farm system perspective to reducing nitrogen loss typically necessitates the use of multiple strategies. This is important for a number of reasons. First, reducing the environmental footprint of intensive dairy production requires the simultaneous assessment and control of each element of production, given the feedbacks present between them.

Second, a farm generally consists of several blocks each consisting, for example, of diverse soil types and slopes. Taking a systems perspective to environmental management requires that the relative strengths of each of these blocks or sub-catchments are exploited. Third, farms are highly diverse in terms of both management and biophysical assets so the most cost-effective mitigation strategy will generally vary across farms and consist of multiple practices. Last, the high cost of edge-of-field assets, cow housing and land use change suggests that cost-effective approaches to mitigation are more likely to constitute a bundle of cheaper, less-effective abatement strategies, rather than the use of a single more expensive, highly effective option.

Win-win strategies for reducing nitrogen losses

A number of New Zealand case studies hypothesise that reduced nitrogen loss can be achieved on our pastoral farms while simultaneously increasing financial returns. This is a key argument in the discussion of nitrogen mitigation in this country, as it suggests that we may achieve large environmental gains while also promoting economic activity and thus circumvent the economic-environmental trade-off that complicates the formulation of water quality policy. Such outcomes are often referred to colloquially as 'win-win' options.

Recent research highlights that most of these outcomes require producers to improve the efficiency with which feed (both pasture and supplement) is utilised, such that more profit is earned for a fixed level of nitrogen input, especially that related to the use of nitrogen fertiliser and imported supplement. Empirical evidence shows that win-win outcomes are present on most farms, but are ultimately limited in their scope to reduce nitrogen leaching across large tracts of agricultural land. Indeed various case studies conducted over hundreds of farms

show that reductions in leaching above 5-10% are likely to reduce farm income.

A number of pragmatic viewpoints also help to cast doubt on relying on win-win options to achieve secure environmental gains:

- It is costly to identify win-win outcomes for individual farms as it is highly likely that the most cost-effective mitigation strategy differs broadly across farms, given their inherent heterogeneity
- Even if these strategies are identified, the extent of their actual adoption remains unclear, due to barriers to uptake that are not considered during standard financial evaluations of mitigation strategies. Such barriers can be related to risk, uncertainty, adjustment costs, system impacts, incompatibility with lifestyle and values and complexity
- Some managers are unwilling to deviate from established management plans, given a strong drive to repeat learned actions even in the presence of new opportunities or constraints. Management options that constitute win-win solutions change annually, given that the most cost-effective means to mitigate nitrogen is highly sensitive to input and milk prices
- Win-win solutions can even end up exacerbating pollution. Improvements in efficiency are likely to stimulate further intensification as these improvements open up new opportunities for business growth.

Transformation of pastoral farming

The ultimate win-win option is a transformative farming system that is highly adoptable across heterogeneous farms and farmers, but also provides for economic and environmental outcomes. Rather than involving an adjustment of existing systems these are likely to involve a significant disruption to traditional ways of thinking. Substantial transformations have been observed in some nations due to the broad-scale adoption of win-win solutions. For example, erosion rates on cultivated land have been greatly reduced throughout Australia and South America due to the wide-scale diffusion of reduced cultivation practices that stimulate crop yield through water conservation. This example is indicative of a disruptive technology that can revolutionise an industry through offering extensive private benefits above those accruing to standard practice.

However such transformative practices are rare. Indeed there currently appears to be no transformative practices or systems available that have the potential for wide adoption, alongside being capable of greatly reducing the environmental footprint of pastoral farming in New Zealand.

Our existing farming systems are the result of many years of evolution, as knowledge of how best to produce meat, milk and fibre from pasture has developed in an environment characterised by climatic and price variability. The accumulated knowledge pertaining to our current system, much of which has arisen from learning by doing, continues to reduce production cost and promote our comparative advantage in commodity markets around the globe. These cost advantages pose a barrier to change in our current pastoral systems, given the inefficiency associated with moving producers and value chains towards a new paradigm. To overcome this inertia, it will be important to consider ways to protect emerging systems and encourage innovation, such that new ways of thinking have a chance to evolve to a place where they are more competitive with established ways of farming.

Conclusions

The loss of nitrogen from intensive pastoral farms around New Zealand remains an issue of significant societal interest. The focus on contaminant loss will only intensify as regional councils more broadly implement the National Policy Statement for Freshwater Management 2014. Some perceive this as the most significant legislative constraint placed on farming for a generation. Yet it really provides a timely opportunity for New Zealand agriculture to review its environmental footprint and think how best to evolve systems that are better placed to meet the requirements of both farmers and society. There are many positive examples of pastoral industries working with communities across the country to move towards improved environmental outcomes. This provides a foundation for further momentum, as well as helping communities better understand the trade-offs facing the pastoral sector.

The intensification of the dairy industry during the 1990s made it timely for New Zealand society to reflect on the off-site impacts of intensive agriculture. Yet a concerted focus on nitrogen meant that less attention was paid to contaminants, such as faecal microbes and sediment, which are arguably more likely to challenge the values that society draw from freshwater nationally. New Zealand has learnt a lot from this 'nitrogen fixation', but it is timely to place greater emphasis on the generation and mitigation of other contaminants. On these new frontiers it is necessary to learn from the nitrogen journey, especially by placing a greater focus on the drivers of practice change and how policy can better incentivise transition among a diverse farming population.

Acknowledgement

The work carried out as the background to this article was partly funded by the Ministry for the Environment. The Ministry does not necessarily endorse or support the content of this article.

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John Sweeney

John was born in Auckland in 1947, the eldest of six, his father having been a successful accountant and businessman following World War II service with the New Zealand Army in the Philippines. John's attraction to farming was enhanced by having a cousin on a dairy/sheep farm in Patumahoe. During the school holidays he learnt about lamb tailing, bareback horse riding and milking. A huge desire to pursue farming as a career had been fired up, and from there he progressed to a cadet scheme for young men and was placed on farms during the school holidays.

Role models and Lincoln College

While contemplating what university course to pursue John was reading about the exploits of Wilson Whineray who had captained the All Blacks, studied agriculture and completed the Valuation and Farm Management Diploma at Lincoln College during the 1960s. John felt to follow his role model and, along with others, booked a train to Wellington to sit an IQ test and interview for the Rural Field Cadet scheme. The New Zealand government was backing this scheme to train valuers and consultants through Lincoln College in the 1960s and 1970s.

Two-and-a-half years at Lincoln plus three years of practical farming on cropping, sheep and dairy farms in both the North and South Island fully equipped students in those days to interact with future farming clients in a positive way. He still maintains contact with those farmers and their families who he worked with, many of whom became life-long friends.

Catchment Board

The time after Lincoln saw John employed by the Manawatu Catchment Board based in Dannevirke as a soil conservationist drawing up farm plans, writing articles, organising helicopter drops and planting pines and poplars in remote and erosion-prone hill country near Wimbledon, west of the town. On one occasion a local farmer asked if John would drop a load of fence posts off on a certain hill to save time. An aerial photo was thrust into the helicopter, but he had trouble finding the exact spot. At $200 per hour the chopper pilot wanted to know where they were to go, so John said 'drop them now' and the posts ended up two gullies from where they should have been.

Europe and Africa

The lure of going to Europe on a working holiday saw John and others travel overseas in 1974, and after working on farms in Scotland and England he had more practical experience to fall back on if needed. After climbing Mt Kilimanjaro in Tanzania and travelling through East Africa he arrived in Rhodesia with very few dollars in his bank account. On proving his New Zealand agricultural qualification he was posted to Sinoia as an agricultural officer. He was supplied with a Landrover, an Uzi submachine and two local translators in uniform, then rapidly introduced to the local way of life and required to report to the district commissioner on a weekly basis.

The area he covered was massive and involved managing cattle, growing cotton and establishing forest trees for conservation planting in the Tribal Trustland of Chirau. He also played rugby for the Sinoia Country Club – 6,000 feet above sea level – and enjoyed golf or tennis on Sundays. John left Rhodesia before he was required to do military service on the Tanzanian border, but the main reason was to follow the All Blacks on their South African tour.

Rural Bank/NRM Feed and Farmers Fertiliser Co

Post-Europe and Africa, Rural Bank postings in Auckland and Kaitaia were great training grounds in the financial world for John relating to the purchase of farmland, stock and plant in these areas. Following a busy stint in the Kaitaia office doing land development encouragement loans and livestock incentive loans he was offered a position in Auckland with NRM Feed. This position gave him an in-depth look at the financial requirements of poultry farms, both north and south of Auckland, and was useful when assessing the value of broiler and egg farms in the Waikato in later years.

After marrying an Auckland nurse in 1980, John accepted a position in Morrinsville as farm adviser with the Farmers Fertiliser Company (now part of Ballance Agri Nutrients). This position was challenging and involved radio work, soil testing and presenting papers at various conferences, but above all a close relationship with some of the best soil scientists in New Zealand at Ruakura. The knowledge and personal assistance he gained from the late Mike O'Conner and John Scott he found immeasurable.

John was challenged by a local dairy farmer to have a go at farming himself, so with encouragement from his wife (and with their second child due) they decided they would try 50/50 sharemilking if they had a son. Daughter Angela arrived, but they still went farming and in 1982 spent a year on wages before accepting a 230 cow position on a 60 ha farm at Te Aroha. John maintains that the skills required to succeed in this venture are no different to those needed to run any business: surrounding oneself with reliable peers, setting realistic goals, having a conservative financial budget, punctuality, a good work ethic and a good partner, physical fitness and (above all) a positive outlook.

He was then offered a position as a valuer/consultant in Hamilton with Ashworth & Associates in 1989 and parted company with the cows, but not their replacements having purchased a 7.1 ha block of land at Matangi. At a farewell in Te Aroha, John's employer said he had 100 applicants for the position and that he would not usually employ a farm advisor type person or a Catholic but he did both! They still maintain a strong and respectful relationship with each other.

Waikato consultancy and valuation work

After a year on wages, John was offered a chance to purchase the business, which was one of the oldest in New Zealand having been set up by Vince Ashworth and others as an alternative to the old Department of Agriculture. So along with Ron Lockwood and Jim Ross the firm of Ashworth Lockwood Ltd was formed. The work was varied and interesting and another valuation practice was purchased, meaning more of the work was valuation-based, mainly within a 100 km radius of Hamilton. John has always maintained the importance of a group rather than a one-person business in today's environment.

Supervising several dairy farms in south Waikato for absentee owners and buying farms on behalf of clients who were domiciled overseas soon occupied a lot of his time, and the sharemilking days in Te Aroha were invaluable experiences to fall back on. John's farm consultancy has given way to more valuation-related work over the past few years following the sale of the Ashwood Lockwood Ltd to Russell Fergusson. Both he and Ron Lockwood have been re-employed as contractors back to the firm.

John has also been involved with compensation assessments concerning new high-voltage transmission lines through the Waikato, and valuations of dairy farms for purchase by an individual or family trust and of numerous lifestyle properties near Hamilton. He now owns two lifestyle blocks alongside each other with high-voltage transmission lines crossing them and is often bemused by the 'cancer' associated with such towers. He feels Transpower has bent over backwards to advise of their activities on the property, and for several years he has farmed around 80 dairy heifers (from 1 June to 31 May) plus bulls over the mating period for clients. He now farms beef and is enjoying the challenge of producing quality grass-fed meat at a lower stocking rate.

NZIPIM and other involvement

John believes there is a strong committee of focused and experienced people in the Waikato who will take our profession through the next decade or so. He has been a former chairman and involved with organising and sometimes presenting at various seminars over the years. He is still on the Fertmark Council and Executive involving the main fertiliser companies, Federated Farmers, spreader operators and others in the New Zealand agricultural industry. He recently resigned from the Waikato committee after about 35 years.

Any other spare time has seen John on three boards of trustees in Hamilton, as a board member of the Lochiel Golf Club, and actively involved with the local church and community. There is also golf, road cycling (he has twice completed the Lake Taupo 160 km event), sailing and fishing. He has also travelled extensively with family and friends around New Zealand including the Milford track, the Heaphy, the Routeburn, Lake Waikaremoana, Tongariro Crossing tramps, the Alps to Ocean and many other off-road cycling trips.

Farming challenges for New Zealand

A concern for John is an ageing population with a shortage of keen young New Zealanders to take over either the management or ownership of farmland. He also feels that too high a debt loading on capable young entrepreneurs and the subsequent stress is not good either. There are exciting challenges ahead and he is certain that those with a solid education and who are smart with technology will do well. On the world scene there is a new generation who do not use much dairy produce (instead sheep and goat milk), and not many can afford our lamb, so there is a real need to produce skilled men and women who can market our quality produce to reliable customers. John believes that regional councils, OSH and other regulators have an important part to play in our industry, but not at the demise of or unfair expense to our farmers.

In 1970, he says you would be hard pressed to see a dairy farm around Lincoln or as far south as Oamaru, but now we see many 500 plus herds on irrigated land. In his view, it will be the world market that will decide if they prefer goat and or sheep dairy products and the same goes for lamb. John sees many challenges ahead for an industry that has achieved much and he feels it has been a privilege to be a part of it.

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