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THE JOURNAL

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

CHANGING NATURE OF FARM CONSULTANCY IN NEW ZEALAND ESSENTIAL FRESHWATER PACKAGE
FARMING AND LAND USE ZERO CARBON ACT UPDATE **OVERSEAS INVESTMENT REGIME**

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NZ Institute of Primary Industry Management

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Photo courtesy of Nico Mouton and James Allen

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Contents

STEPHEN MACAULAY CEO

Human health and the economic impact of coronavirus

Coronavirus disease 2019 (COVID-19) was first detected in Wuhan, China in December 2019. With the global spread of the disease, the World Health Organisation (WHO) declared COVID-19 a pandemic on 11 March 2020. At the time of writing, coronavirus had been found in at least 110 countries, with reports that the disease had killed more than 4,600 people globally.

As many countries battle to control the disease to protect the health of their people, we are also seeing the impact on global trade as the Chinese government applies various forms of travel restrictions to nearly half of its population in a race to contain the spread of COVID-19.

Like many global commodity producers, New Zealand is heavily reliant on China's demand for our food and fibre products. With 31% of all our primary exports by value now going to China we have become economically dependent on this market. There will be a growing concern among our exporters and producers about the impact of the virus on our exports as 51% of forestry products (by value) go to China, followed by seafood (35%), meat and wool (33%) and dairy products (31%) [Source: MPI's Situation and Outlook for Primary Industries, December 2019]. Recent reports of more than 1,000 logging contractors being laid off as the economic impact of the virus begins to bite further demonstrates the challenges faced by some sectors of the primary industry.

We are also beginning to see major disruptions occurring to manufacturing sectors worldwide. In the pursuit to reduce supply chain costs, many companies outsourced at least some parts of their production to China, and many industries are now heavily dependent on them to supply parts to their assembly and manufacturing facilities. China is now the world's manufacturing hub and has become an integral part of many companies' business operations. In a rare investor update from Apple, they note that COVID-19 will have a material impact on the company's bottom line with the worldwide iPhone supply being temporarily constrained due to Chinese manufacturing slowdown. Store closures and reduced retail traffic in China are also expected to have a significant impact on revenues for Apple.

The human health and economic impact of the COVID-19 virus should not be underestimated as countries across the world fight to contain the virus.

Preventing the spread of coronavirus

Globally, countries are moving to restrict international travel. In an effort to slow down the spread of the COVID-19, the Government announced on 14 March that every person entering New Zealand, including returning New Zealand citizens and residents, will be required to enter self-isolation for 14 days.

The symptoms of COVID-19 appears to start with a fever, followed by a dry cough. Other symptoms can include headache, muscle pain, high temperature and fatigue. According to WHO, symptoms may only start showing up to 14 days after a person is exposed to the virus. Based on the latest estimates, WHO have reported that globally the mortality rate of COVID-19 is about 3.4%.

The COVID-19 virus is transmitted between people through close contact and droplets, not by airborne transmission. The people most at risk of infection are those who are in close contact with a COVID-19 patient or who care for them. Preventive measures recommended by WHO include:

- Performing hand hygiene frequently with an alcohol-based hand rub if your hands are not visibly dirty or with soap and water if hands are dirty
- Be mindful of avoiding touching your eyes, nose and mouth
- Practising respiratory hygiene by coughing or sneezing into a bent elbow or tissue and then immediately disposing of the tissue
- Wearing a medical mask if you have respiratory symptoms to reduce the spread of infection to other people and performing hand hygiene after disposing of the mask
- Maintaining social distance (a minimum of 1 metre) from individuals with respiratory symptoms.

As rural professionals our work involves a lot of direct interaction with clients. If you are meeting with clients it is recommended that you take on board the preventive measures described in the above points and remain wary of the symptoms of the COVID-19 virus (coughing, high temperature, etc).

Should cases of COVID-19 escalate, you may also wish to consider various approaches to reduce the spread of the virus, including whether face-to-face meetings are needed, look at alternative channels in communicating with your clients and team members, carrying alcohol-based hand sanitisers and tissues in your vehicles, and being honest if you think you have the flu and seek medical advice. I encourage members to remain conscious of all the factors that may spread COVID-19 when interacting with your clients and colleagues.

Take care.
Stephen

NICO MOUTON AND JAMES ALLEN

THE CHANGING NATURE OF FARM CONSULTANCY IN NEW ZEALAND

Farm consultancy is facing a challenging future with an increasing skillset requirement needed by the farming client, the corporate client and the regulators. This article looks at the history of the farm management consultancy profession, issues facing provision of farm management advice, and some thoughts on the future of the profession.

Increasing demand for advice

There will be an increasing demand for qualified and consistent advice from the farming community to sift through the many options and issues facing a farming business. This will place increased demand on the variety of skillsets offered by farm management consultants, ranging beyond the normal agricultural production systems to more complex areas of environmental management, managing diverse landscapes, more detailed farm financial planning, and a range of governance issues. This will likely be managed through greater collaboration between rural professional organisations, and the larger consultancy firms using a range of personnel to meet these diverse demands.

The pipeline of tertiary trained agricultural students coming from the two main New Zealand universities offering agricultural education are steady in number, and there is an improvement in the number of students interested in agriculture through the recently developed agribusiness curriculum that is now being delivered in secondary schools. The challenge is improving the pipeline into the consultancy profession itself, as the number of new consultants being trained has historically been low.

History of farm advisory services

The New Zealand Department of Agriculture was formed in 1892, out of which formal agricultural extension services were developed. The Advisory Services Division

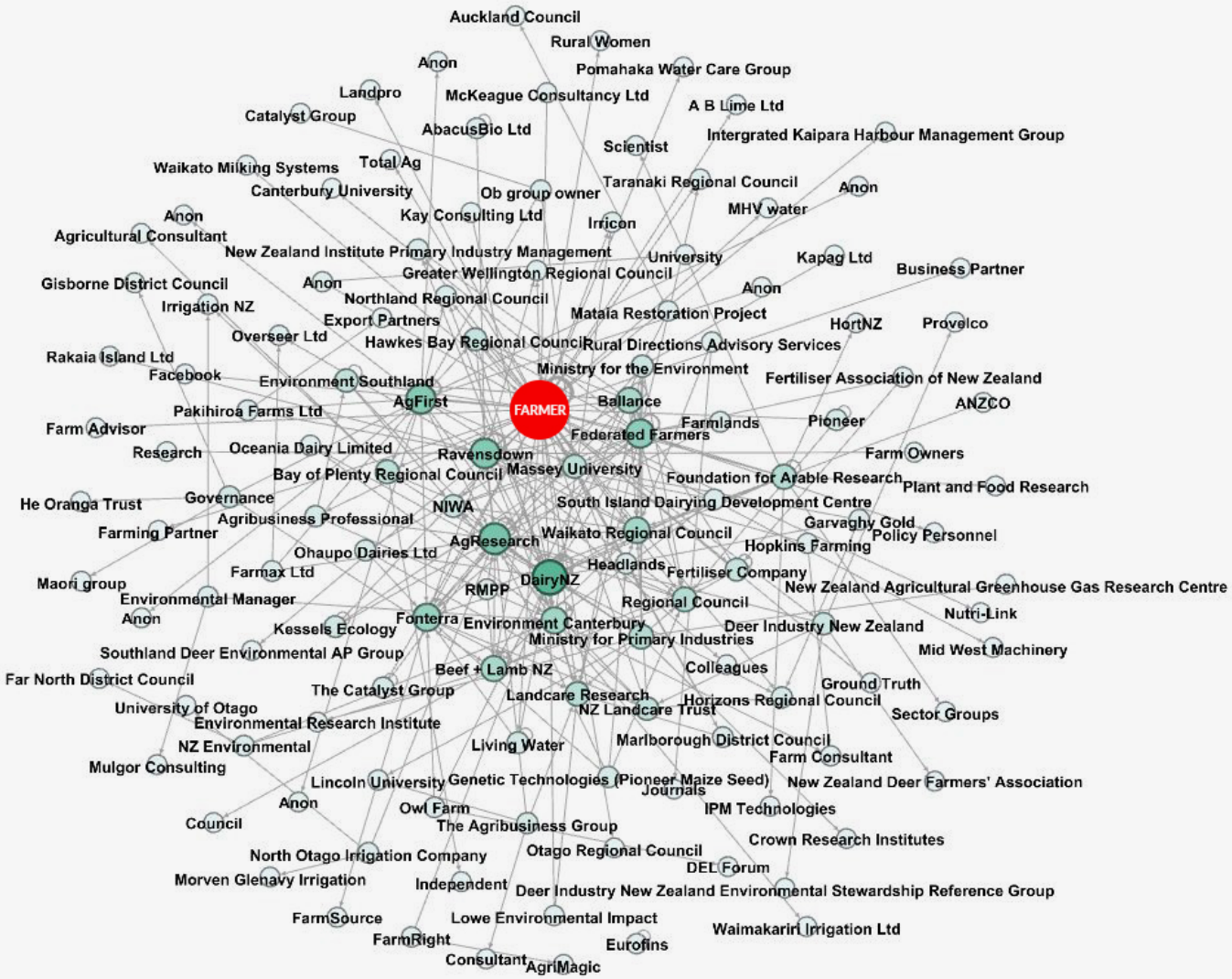

Figure 1: Parties (organisations or groups) talking about environmental farm practices. The larger and darker the circle, the greater the number and diversity of the conversations. The labels used in this map were verbatim from participants so vary in their specificity (e.g. some participants are 'council' vs a specific regional council)

was formed in 1972. At its peak the division consisted of some 670 staff, half of whom were graduates in agricultural and horticultural science.

In 1984, the Advisory Services were commercialised and finally privatised in February 1995. In 1973, there were approximately 600 full-time agricultural or horticultural extension personnel. By 1996, this number had reduced to approximately 425. However, a number of extension staff moved from the government extension services to setting up their own private consultancy businesses.

In parallel to the formal extension services, farm improvement clubs were formed in the early (1880s) development of New Zealand pastoral farming, whereby farmers employed a farm consultant under a membership system. These farm improvement clubs have now in the main ceased to exist, having been replaced by industry good extension staff or private consultants.

Producer boards maintained extension services, which have now evolved into the likes of DairyNZ and Beef + Lamb New Zealand, performing the roles of extension, research and development, and advocacy.

In 1969, the Farm Management Society was formed to establish a separate recognition of the skillset and profession of the farm management consultant. A membership criteria was established and a registration system put in place to recognise suitably qualified consultants as registered consultants.

In 1999, the Farm Management Society was renamed as the New Zealand Institute of Primary Industry Management (NZIPIM) to further enhance the profession of farm management, which now extends to a membership of 1,100 members. Within this membership there are approximately 350 farm consultants.

Figure 1, first published in the June 2019 edition of *The Journal* (authors H. Percy and P. Payne), shows sources of information for farmers when discussing environmental practices on-farm. The farm consultancy profession plays an important role and is highly regarded as a trusted advisor, but naturally is only one of many sources of information. This was also found to be the case in the Red Meat Profit Partnership (RMPP) research, which highlighted the importance of farmers learning from farmers, with

A pipeline of qualified agricultural students is required to service the extension industry. The recently developed agribusiness curriculum that is being taught in secondary schools is one of the first stages in this pipeline.

the consultant having a role in being the facilitator of knowledge transfer or a subject matter expert.

The increasing scale of New Zealand agricultural units has also given the opportunity for individual farm consultants to be working on a one-to-one basis (one large client only) with larger corporate style agricultural units, e.g. managing multiple farms under one ownership structure.

The pipleline of consultants

A pipeline of qualified agricultural students is required to service the extension industry. The recently developed agribusiness curriculum that is being taught in secondary schools is one of the first stages in this pipeline. Initially developed by St Paul's Collegiate, there are now over 1,000 secondary school students studying agribusiness throughout New Zealand. At the tertiary level there are approximately 300–400 students graduating with an agricultural or horticultural qualification each year.

Given there are approximately 350 consultants in the industry, in theory the pipeline should be sufficient. However, this does not account for the significant number of graduates who move directly into farming careers, other rural professional occupations, or even other careers. In addition, there is a significant increase in capacity required in order to manage the environmental workloads such as Farm Environment Plans.

After tertiary training has been completed, it takes on average three to five years to train a farm consultant to be 'industry ready' at either their own cost or that of the consultancy firm they work for. It is at this stage that there appears to be a blockage in the pipeline, with only a small number of graduates entering into the consultancy profession each year. This demand for new consultants is partially fulfilled by experienced rural professionals entering consultancy from a related field of work.

The Ministry for Primary Industries (MPI) has a work stream called the Primary Industry Advisory (PIA) Services, which is partnering with producers, primary industry advisors (PIAs), industry and relevant organisations to support and strengthen the advisory services system so it is better placed to respond to current and future challenges. The critical outcomes of this programme are strengthening the PIA system through increasing the capability, capacity and demographic diversity of advisors in New Zealand. This work will be rolled out in 2020.

The future farm consultant

The primary industry continues to evolve both nationally and internationally. Consistent themes that keep emerging regarding future trends include increasing farm scale, more use of technology, increased environmental and animal welfare scrutiny and compliance, and more diverse land use and landscapes. All of which leads to more complex farming systems and increasing demands on farmers and farm consultants alike.

The average dairy farm today is around 130 ha in size, and the average sheep and beef farm is 400 ha. The average size farm continues to increase each year, partly as a consequence of the consistent cost price squeeze which arises when producing commodity products. What these statistics in farm size don't tell us is the average size of the farm business, i.e. there are many farming businesses that own multiple properties, whether this is a family farming business that has grown, a corporate operation or a Māori agribusiness with scale.

This rapid change in scale of farm organisations in the last 20 years has seen the emergence of operations managers and general managers at the farm level. These roles traditionally would have been filled through the external use of consultancy support, but logically with scale comes the need to internalise this resource. While the operations manager and general manager roles are not the image of the traditional farm consultant, it needs to be recognised that the skillset and workloads are often similar, and they are a significant part of the profession today and for the future.

A farm with a large-scale diversified landscape, containing mixed-use enterprises with significant environmental compliance requirements and using a range of technology to run their business, requires a diverse set of skills by a farm consultant if they are to add value.

The base skillset will need to include technical competence and a high degree of familiarity with a range of Information and Communication Technology (ICT) tools to help run the business. This will need to be underpinned by the most important skillset of all, which is the ability to relate to the client and all stakeholders in the business, and an ability to listen, to encourage, to support and to facilitate on-farm change.

The role of social media in farming knowledge and extension cannot be ignored. Currently Facebook and Twitter are a ready and valuable source of information and the sharing of ideas for farmers. Some of this technical knowledge would have traditionally been gathered via word of mouth from other farmers or consultants – social media allows this process to be sped up. An awareness of the role of social media in consultancy needs to be part of the toolbox for a good consultant.

When looking at the increasingly diverse set of skills that a high-performing consultant may require in the not-so-distant future, there are associated challenges for the consultant and the consulting firm in their ability to deliver such a wide range of complex services. Increasingly, we believe there will be a trend towards specialisation. Whilst a good consultant *must* have a fundamental grasp of holistic farm management systems, specialisation may occur in the areas of environmental management, human resources, and nutrition or financial management, amongst others.

A good consultant therefore needs to decide which areas they might specialise in, whether their consulting firm can cover all of these areas, or whether external collaboration is required. Regardless of the size of any firm, increasingly collaboration between various rural professionals, (e.g. consultant, accountant, bank manager, vet) is seen as a crucial part of running a high-performing farm business.

The increased diversity of skills that are required raises the challenge of certification for a farm consultant. Current possible areas of certification include dairy farm systems, nutrient management, greenhouse gases, body condition score, effluent management, irrigation and human resources, with farm environment planning on the way. Clearly it is unrealistic for any one person to obtain and maintain certification and competence in all of these areas, hence the need to consider collaboration and specialisation. Once again, it has to be kept in mind that the scale and complexity of farms has changed and will continue to do so.

Knowledge management

The days when a consultant earned a living by transferring knowledge using a top-down approach are gone. Rapidly increasing data collection at the farm level, the evolving use of data analytics, and the interconnectedness of software make it quite conceivable that many of the operational decisions made by a farm manager or a farm consultant will become semi or fully automated. For example, within the very near future we could be able to link remote monitoring of pasture growth and pasture covers with animal feeding levels and production, along with remote shifting of livestock. This will allow animals to be automatically allocated a new break once certain grazing residuals and production levels have been achieved. This is only touching on what is imminently available, let alone what could become available within the next 10–15 years.

To be able to realise the potential of these advances in technology there is still a vital role for a consultant in the analysing and interpretation of the data available at the farm level, and assisting the farm team in making timely decisions.

The tertiary institutions will need to be challenged to continually adapt their courses to allow for students to be 'industry ready' in a fast-changing agricultural environment. Whilst the need for strong interpersonal skills will always remain, ensuring graduates can tackle both production and environmental challenges, whilst utilising the latest technology to add value, will require regular revision of any training programme offering.

Summary

Any environment abhors a vacuum. As the complexity and scale and diversity of farming changes in the next decade, the role of a farm consultant will also need to rapidly evolve and change. Those who choose not to change will eventually fade into insignificance because they are not adding value to the farm business. For those willing to embrace change, challenge their own ways of doing business and embrace technology there will continue to be plenty of opportunities.

Nico Mouton and James Allen are Directors of AgFirst Waikato. Corresponding author: nico.mouton@agfirst.co.nz.

ASLAN WRIGHT-STOW

Community volunteers help plant indigenous vegetation alongside a stream on a Canterbury dairy farm as part of a planting day organised by Te Ara Kakariki. Riparian planting helps improve water quality in a number of ways

THE ESSENTIALS OF THE ESSENTIAL FRESHWATER PACKAGE DOWN ON THE FARM

DairyNZ Environment Manager Aslan Wright-Stow provides an overview of the Government's Essential Freshwater Package, what aspects of the proposals have been causing controversy, and how the package could affect farming in the future.

Two significant government policy proposals dominated the rural media last year. The first was the Zero Carbon Bill which drew around 12,000 public submissions from Kiwis from all walks of life. The other consultation which drew a major response was the Government's Essential Freshwater Package. Around 18,000 submissions were received on this consultation.

Thousands of farmers turned out at meetings across the country. Many farmers also penned submissions expressing concern at the significant on-farm and community impacts the package would have. So, why did the package prompt farmers to pack small community halls over a busy spring calving and lambing season and create such a flurry of submission writing down on the farm? And how will the changes affect farmers on the ground?

Updated National Policy Statement for Freshwater Management (NPS-FM)

The Government says that the main objectives of the package are to:

- Stop further degradation of waterways and start making immediate improvements so that water quality is improving within five years
- Reverse past damage and bring waterways and ecosystems back to a healthy state within a generation.

The newly proposed national bottom lines for in-stream nitrogen and phosphorus have been the most controversial part of the Essential Freshwater Package.

These are both goals that most Kiwis, including farmers, would agree with. However, the consultation has sparked debate amongst farmers, researchers and the public about whether the proposals will achieve the goals they aim to, and whether we can improve water quality in alternative ways at a lower community and economic cost.

As part of the package, the Government consulted on an updated National Policy Statement for Freshwater Management (NPS-FM). This strengthens an existing requirement in freshwater management for Te Mana o te Wai – putting the health of the water first when making freshwater decisions, with the needs of people and communities second.

The changes to the NPS-FM propose updated and new requirements. A number of new National Environmental Standards (NES) are proposed. Regional councils have the responsibility for implementing the NPS-FM through regional plans and would be required to give effect to these by 2025. NES are national rules and would come into effect from mid-2020.

Raising the bar on ecosystem health

The draft NPS-FM proposes changes to ecosystem health indicators. It introduces five compulsory components of ecosystem health:

1. Aquatic life
2. Habitat
3. Water quality
4. Water quantity
5. Ecological processes.

As currently occurs, regional councils would be required to set objectives for each attribute to ensure its state is maintained or improved. National bottom lines would be set for measures associated with most of these components. Also there are a number of other values that must be considered (e.g. Mahinga Kai and potable water supply) in council decision-making.

New bottom lines for nitrogen and phosphorus cause controversy

The newly proposed national bottom lines for in-stream nitrogen and phosphorus have been the most controversial part of the Essential Freshwater Package. Dissolved inorganic nitrogen (DIN) is comprised of nitrate plus nitrite and ammonium. Dissolved reactive phosphorus (DRP) is a measure of the dissolved (soluble) phosphorus compounds readily available for use by plants and algae. Under the right conditions, excess DIN and DRP can cause proliferations of aquatic plant and algae growth, which impacts habitat and aquatic life.

The Science and Technical Advisory Group, which provided advice to the Ministry for the Environment on the package, proposed that to protect ecosystem health a national bottom line of 1 mg/L for DIN and 0.018 mg/L of DRP be set.

The effects of the proposed bottom lines would be that some catchments in rural South Auckland, Waikato, Taranaki, Manawatu and Southland may have to reduce their nitrogen losses by up to 50% over a generation to meet these limits. In parts of Canterbury, farmers may have to reduce their nitrogen losses by up to 90%.

Understandably, communities in these areas have been vocal in their concerns about the future viability of their farming operations, as well as the potential for significant social and economic impacts on communities. Submitters have also questioned whether the new nutrient bottom lines are sufficiently robust, as many scientists have found that there isn't a clear relationship between ecosystem health and nutrients.

Local Government New Zealand's submission states that, 'our experience from our own data sets is that there is a poor correlation between nutrient concentrations and macroinvertebrate scores which reflects the complex nature of ecosystem health.'

DairyNZ's scientists analysed Land and Water Aotearoa's (LAWA) national water quality dataset (from regional council monitoring) and found that of the sites ranked as having the lowest DIN levels, only 10% ranked as having the best macroinvertebrate community index (MCI) scores. The MCI is commonly used as a general indicator of water quality by assessing the sensitivity of macroinvertebrates to habitat condition and organic pollution. In contrast, one-third of the LAWA sites ranked worst for macroinvertebrate health had the lowest (best) DIN levels. These results highlight the poor relationship between nitrogen and ecosystem health, as noted by LGNZ and many other peer-reviewed scientific studies.

DairyNZ also commissioned independent modelling which indicated that New Zealand's GDP could be reduced by $6 billion a year by 2050, and by $80 billion over 30 years, under the proposed changes. Most of this impact was due to the national bottom lines for in-stream nitrogen.

New requirements on-farm under the Essential Freshwater Package

On the ground, some of the proposals in the package will be familiar to farmers in one form or another, while other requirements are new.

New fencing rules, including 5 m setback requirements, have been a contentious proposal in the Government's Essential Freshwater Package

All farmers and growers would need to have a Farm Environment Plan (FEP) with a freshwater module in place by 2025. The plans would need to be certified by an approved Farm Environment Planner with ongoing audits every two to three years.

All farms to have Farm Environment Plans

All farmers and growers would need to have a Farm Environment Plan (FEP) with a freshwater module in place by 2025. Many farmers already have a plan, and primary sector organisations have committed to all farms having an FEP within five years.

FEP requirements currently vary by region. The proposed requirements are similar to the plans required for dairy farms in Canterbury and proposed in parts of Waikato. However, additional maps and risk assessment may be required. Under the proposal, the new freshwater module would integrate existing farm planning tools, resource consents and regional plan rules. Information on risks to threatened plant and wildlife species, and how these are addressed, may also be needed.

The plans would need to be certified by an approved Farm Environment Planner with ongoing audits every two to three years. Currently there isn't a national system to certify Farm Environment Planners and regional councils are concerned that enough planners cannot be trained and certified in time to meet these requirements.

Wetland protection and fish passage

From June 2020, new standards are proposed restricting activities that could affect wetlands. These activities include: drainage, damming, diversion, water takes, reclamation, disturbing river beds and clearing indigenous vegetation.

Regional councils would be required to identify all existing natural wetlands, monitor them and set policies to protect them, as well as encouraging wetland restoration. Land owners may need to contribute to these monitoring costs.

Rules providing for fish passage through weirs, culverts, gates, dams and fords are also proposed.

New fencing and stock crossing rules

New national rules are also proposed requiring that larger waterways be fenced off, while farm plans would specify how stock would be excluded from smaller waterways.

The Government has proposed that for waterways and wetlands more than 1 m wide, fences should have a 5 m setback. This setback is an average distance from

125 farms are involved in a seven-year DairyNZ project in Tararua to test the benefits of plantain as a tool to reduce nitrogen losses

waterways calculated across a farm. The expense of carrying out new fencing or re-fencing work was one of the main concerns farmers shared at consultation meetings on the package. Dairy farmers have already voluntarily fenced off over 24,000 km of waterways – 98% of dairy waterways that meet the Government's proposed size criteria of over 1 m wide.

For waterways on low slope* land greater than 1 m wide:

- Fencing would be required by 2021 for dairy and pigs, and any cattle or deer feeding on fodder
- Existing fences would be required to achieve a 5 m average setback by 2025. However, existing fences which have a minimum setback of 2 m would not be required to achieve the 5 m average setback until 2035.

For waterways on non-low slope* land greater than 1 m wide:

- Fencing would be required by 2021 for dairy cattle and pigs
- Fencing would be required by 2023 for beef cattle, dairy support and deer where land has a carrying capacity of 14 stocking units per hectare at the farm scale, or 18 stocking units at the paddock scale
- Fencing would be required where any cattle or deer are feeding on fodder, break feeding, or feeding on irrigated pasture by 2021.

**The Government sought feedback on the definition of low slope and non-low slope land during consultation and this is yet to be confirmed.*

Another change is that pigs, and dairy and beef cows, are only allowed to cross waterways at culverted or bridged crossings, unless crossings occur twice a month or less.

Winter grazing and stockholding areas

The Government is consulting on two options for winter grazing. One is to introduce new national standards requiring farmers to get a resource consent if winter grazing more than a certain land area. The other option is to require that farmers use current industry good practice standards for wintering.

For proposed wintering standards, the Government sought feedback on:

- The slope of land where winter grazing is permitted
- The setback required from the grazing area and waterways
- The depth of pugging allowed
- The direction of grazing, stock exclusion from critical source areas, and the re-sowing of grazed areas.

These new standards are expected to be introduced six months after freshwater legislation is passed.

With changes proposed to fencing setback rules, it would be sensible for farmers to hold off carrying out any significant new fencing or re-fencing work on larger streams until the requirements are clearer, other than required maintenance work.

Restricting intensification

New interim rules would be introduced from June 2020 restricting development in catchments where limit setting processes have not been implemented. The rules would apply to farms planning to:

- Expand their irrigated area by more than 10 ha, or
- Convert more than 10 ha of land to dairy support (unless the land is already used for dairying) to dairy, or from forestry or bush to pastoral farming, or
- Increase their forage cropping area by more than 10 ha.

A consent could still be granted if the change does not increase nitrogen, phosphorus, sediment or microbial pathogen discharges above the property's 2013–2018 baseline average. However, measuring the latter two is likely to be challenging.

Immediate action to reduce nitrogen losses in specific catchments

The Government also proposed new measures to reduce nitrogen losses in a number of catchments (identified in Schedule 1 to the NES) which do not have regional rules in place. New requirements would apply until updated regional plans take effect.

Three options were put forward for consultation:

- Setting a catchment nitrogen cap requiring farms with higher nitrogen losses to reduce to achieve the cap
- Setting a national nitrogen fertiliser cap
- Requiring farmers to show in their farm plan how they will rapidly reduce nitrogen leaching and auditing their progress.

The Government sought feedback on the appropriateness of these areas as Schedule 1 catchments:

- Northland: Waipao Stream (Wairoa River catchment)
- Bay of Plenty: Upper Rangitaiki River (upstream of Otangimoana River confluence)
- Waikato region: Piako and Waihou River catchments
- Hawke's Bay: Taharua River (Mohaka River catchment)
- Taranaki: Waingongoro River
- Wellington: Parkvale Stream (Ruamahanga River catchment)
- Tasman region: Motupipi River
- Southland: Mataura, Oreti, Aparima and Waihopai River catchments, and Waimatuku Stream.

The Government may also introduce further restrictions in other catchments with high nitrogen loads if these do not reduce within five years.

Next steps for the Government

An Independent Advisory Panel is reviewing submissions on the package and will provide recommendations to ministers. The Government has previously said that it expects to make decisions on the new freshwater regulations in the first half of 2020, and is aiming to have regulations in place by mid-2020. The large number of submissions received may make it challenging to meet these timeframes.

Government ministers and the Prime Minister have already indicated there will be changes to the original package. As discussed, the new in-stream nitrogen bottom line and fencing requirements have been controversial, and the farming community will be closely following future announcements to see if changes are announced to these proposals.

While I have outlined that some of the new requirements would be introduced in the near future, other rules would be introduced through regional plans which must be in place by 2025 and have differing timeframes.

Farming with change on the horizon

With significant changes proposed by the Government, what advice can rural professionals offer farmers on how to steer a sensible path in 2020? First, it is helpful to look at those changes included in the package which would be introduced soon and make preparations to meet any new rules. New wintering standards are some of the first changes proposed, with indications that they will be introduced six months after legislation is passed. DairyNZ has already been working with other sectors, rural professionals and farmers to develop resources and training on good wintering practice. Our resources are largely consistent with the new standards the Government is proposing (see dairynz.co.nz/wintering for information).

With changes proposed to fencing setback rules, it would be sensible for farmers to hold off carrying out any significant new fencing or re-fencing work on larger streams until the requirements are clearer, other than required maintenance work. Farmers can, and should, continue work to exclude stock from smaller waterways less than 1 m wide.

Farms operating in catchments where new rules may be introduced to manage nitrogen losses in the near future can get ahead of the game by starting to consider which changes would be the most practical and affordable.

Dairy farmers across the country have already made significant strides by undertaking fencing and riparian management work (2,200 dairy farmers have created a riparian plan).

In catchments with high DIN or DRP, farmers will be waiting for the Government's decision on in-stream nitrogen bottom lines, and the timeframe these must be achieved by. If there are already regional rules in place (e.g. in Canterbury) requiring farmers to reduce their nitrogen losses, they will need to keep working to meet these goals.

Advice on a range of options to reduce nitrogen losses is available from farm advisors and DairyNZ Consulting Officers. DairyNZ also has a guide looking at different options (see dairynz.co.nz/publications/environment). Some of the changes that can be made, such as more targeted and well-timed use of fertiliser, can save money on-farm without affecting productivity. However, these strategies alone will not achieve the level of reductions needed to meet proposed DIN limits in many catchments with high levels of nitrogen.

Primary sector organisations and dairy processors are already supporting all farms to develop an FEP by 2025. If farmers do not have a plan, it is a good idea to discuss what an FEP covers, and how having a plan helps improve environmental outcomes. Other than identifying risk and actions to mitigate these, FEPs are also a great way to record important information about the farm and its management to ensure consistent practices when staff change. Milk companies, industry good bodies, environmental advisors and regional councils can offer information and advice on developing farm plans.

What works on-farm to improve water quality?

A wide range of views have come through at consultation meetings on the best way to improve water quality. Regulating change is the approach the Government has largely proposed. However, we are already seeing many positive steps being taken on-farm, and interest has been growing amongst farmers about what else can be done.

Thousands of farmers already have FEPs in place which set out the actions they will take on-farm. They allow for environmental risks, and opportunities for environmental improvement, to be identified. Farmers list the management steps they will take to make improvements and timeframes to complete these. In many cases, auditing is used to check progress against actions.

Dairy farmers across the country have already made significant strides by undertaking fencing and riparian management work (2,200 dairy farmers have created a riparian plan). Good riparian management is a key strategy that helps improve water quality. This includes stock exclusion, vegetation cover, planting riverbanks, weed control and erosion management.

Numerous studies have shown that stock exclusion and riparian planting improves water quality. Stock exclusion from waterways on Southland farms was linked to a 20% reduction in *E. coli* and a 40% reduction in phosphorus losses. Many studies show riparian vegetation stabilises river banks, filters and removes contaminants, and shades waterways which benefits ecosystems. Even grass has considerable benefits. A study in the Bay of Plenty found that having 3 m rank grass buffers reduced nitrogen, phosphorus and sediment loads by 35–87%.

Wetlands also play a key role in filtering nutrients and improving water and groundwater quality. A NIWA review of New Zealand scientific studies found that wetlands can reduce nitrate losses by 75–98%. Most wetlands in cities and the countryside have been drained over the past 200 years. This presents us with an opportunity to re-establish former wetlands on farms. Seepage wetlands can be re-established by excluding stock, and then planting species like native wetland rushes, or maintaining rank grass cover. Constructed wetlands also offer a fantastic opportunity to reduce nutrients and bacteria, and improve biodiversity.

Farmers involved in DairyNZ projects in Canterbury and Manawatu have been using a range of strategies to reduce nitrogen losses. These include using catch crops, plantain, changing the way they irrigate or upgrading irrigation systems, and changing fertiliser application.

Careful management of critical source areas can also significantly reduce nutrient losses. Good management includes avoiding cultivation of these areas, excluding stock through fencing, and maintaining rank grass to help filter contaminants.

Final thoughts

As we wait for announcements on the rules that will apply on-farm, farmers and many in the primary sector are encouraging the Government to ensure that changes are based on robust science. This will provide confidence that the changes made on-farm will achieve the environmental and water quality outcomes being sought. The rules should balance the need to feed an increasing population, support rural communities, and achieve improvements to water quality.

Whatever the final rules are, we are likely to see continued change on-farm to meet new environmental requirements, some of which will come into effect over the next few years. It is likely to be challenging time. Farmers will need clear and consistent information on rules from national and local government, and the support of primary sector professionals to help achieve change on-farm.

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NICK PRINCE

BATTLE OF THE GREENFIELDS

FINDING COMMON GROUND TO ADDRESS SOCIAL CONCERNS ABOUT FARMING AND LAND USE

Using examples from England, this article argues that multifunctional agriculture promotes a collaborative approach to help address social concerns relating to intensive production. It offers suggestions for how such an approach could improve the social perception of New Zealand agriculture.

Same problems, different regulatory approaches

Arriving from England in 2019, I immediately found familiarity with the main issues facing the agricultural sector in New Zealand. Concerns relating to carbon, water quality, tree planting and the environmental impact of red meat are creating social debate in both countries. These commonalities arise despite the very different regulatory approaches adopted by the respective states. Through the de-regulated neoliberal approach adopted in New Zealand, farmers are allowed the regulatory freedom to satisfy the demands of the market. This was facilitated by the historic removal of subsidy support, and currently there appears to be a preference for a 'stick' approach to encourage environmental compliance.

In contrast, the UK operates under the EU model of 'multifunctional agriculture', which prefers to dangle the 'carrot' of support payments to encourage compliance. This article argues this multifunctional approach adopted in England has fostered an improved social awareness of land management and a wider social appreciation of the benefits to be derived from it. To support this assertion, the following section outlines the main regulatory aspects of agricultural policy in England. It then draws upon personal experiences to demonstrate how collaborative working appears to increase the public perception of agricultural land management. It closes with a discussion on how these approaches could be applied in New Zealand to the benefit of the whole economy.

Regulation of multifunctional agriculture in England

Two main support payment mechanisms are available to farmers in England: the Basic Payment Scheme (BPS); and various agri-environment schemes focusing on biodiversity enhancement. The BPS offers three tiers of payment based on land quality to all land owners who adhere to basic land and livestock husbandry standards. Official figures suggest that in 2018 the average farm business in England received a BPS payment of NZ$54,600 (all conversion rates calculated as £1 = NZ$2). Agri-environment schemes were introduced in the 1980s, offering 'income forgone' payments to offset production losses to those choosing to follow environmental land management prescriptions.

Originally these schemes contained national objectives and were open to all farmers within specific regions. The success of early schemes in delivery biodiversity benefits is questionable, so modern schemes are more targeted and often competitive. They retain national objectives, but allow a focus on locally important species and habitats. Farmers have more choice as to their level of engagement, with payments increasing with greater involvement. Full participation seriously reduces productive capacity. On top of this, the complexity of administration and the restrictive nature of the management prescriptions means many farmers are disengaging with the programme as and when their existing scheme ends.

Waiting for milking time in mid-Canterbury – cattle tracks are promoted as having a positive environmental impact in England as they reduce compaction, run-off and diffuse pollution.

Agri-environment schemes in upland areas of Northern England – such schemes have encouraged the return of native cattle, but done nothing for soil quality or productivity

Agri-environment schemes are administered under the Countryside Stewardship (CS) programme, which offers additional environmental funding opportunities. These opportunities extend the environmental focus of the CS programme beyond biodiversity to include:

- Reducing water and air pollution under a Catchment Sensitive Farming approach
- Woodland management and tree planting through Woodland Support schemes
- Bringing farmers and land managers together to enhance the environment through 'facilitation' funding.

These grants generally provide some level of funding for capital works undertaken to meet scheme objectives. In most cases, farmers have to provide some level of match funding. These schemes (and some additional funding streams) focus on reducing diffuse pollution from agriculture, including nitrates, phosphates, ammonia and soil. Numerous capital items and works are fundable to reduce pollution risk including: roofing over yards and slurry/manure stores; installation of cattle tracks to reduce soil compaction and run-off; and the purchase of precision injection systems for direct slurry incorporation to reduce ammonia emissions.

These schemes tend to be competitive and are generally priority area focused. In the financial year 2018/19, the cost of all agriculture support payments in England (including additional rural development schemes not discussed here) was around NZ$4 billion. No figures have been put on future funding payments, other than they will be significantly lower.

Post-Brexit agricultural policy in England

Despite the uncertainty of the Brexit process, proposals for the reform of agricultural policy have been clearly defined. While the finer details are yet to be determined, a timeframe of reform will be implemented following the UK's withdrawal from the European Union on 31 January 2020. A new Agriculture Bill is to be debated in Parliament, which will herald the end of BPS payments by 2027. This will commence with stepped reductions in payments starting in 2021.

Farmers with existing agri-environment scheme agreements will have these honoured, but there is less clarity for the prospect of new agreements before 2027. However, it is expected that a new Environmental Land Management (ELM) programme will be launched at some point to replace the current incarnation. A significant part of this programme will focus on 'soil quality' as a public good due to its role in carbon storage, reducing diffuse pollution through run-off, enabling habitats and species to develop, and increasing productive capacity.

The specific structure of the new programme is yet to be defined, but a series of tests and trials are currently being undertaken to determine what may be included. One trial gaining favourable feedback is the 'payments by results' scheme. This policy identifies locally significant species and habitats and allows farmers to manage land to enhance the provision of these. A baseline survey is undertaken at the start of the scheme and farmers receive tiered payments based on the level of success they achieve.

There are a few issues with this scheme to iron out, such as what happens to payment levels if off-farm influences impact on performance. However, the scheme appears popular amongst farmers as it applies no management constraints. This allows them the freedom to manage the land as they see fit to achieve the desired results. It is also likely that landscape-scale projects involving multi-actor collaborators will also form a central part of the new ELM programme.

The proposed time-scale for phasing out the BPS between 2021 and 2027 has no doubt been influenced by New Zealand's experiences in the 1980s. A significant proportion

of existing farming businesses in the UK could not cope with the overnight removal of subsidy support. In 2018, the average farm income in England was NZ$100,800 (£50,400). This varied across different farm types, with general cropping farms returning an average NZ$212,800 (£106,400), dairy farms NZ$159,400 (£79,700) and LFA Grazing Livestock (unimproved hill country) farms NZ$31,000 (£15,500) – remember, the average farm business in England received a BPS payment of NZ$54,600.

Thus, production accounts for less than half of total income across all farm types, with production activities on the average LFA Grazing Livestock farm resulting in a loss of NZ$42,000! BPS and agri-environment payments contribute an average of 62% of total income across all farm types, but again this varies by farm type *(see Table 1)*.

Benefits of a multifunctional approach

The EU model of multifunctional agriculture has done little to improve farm business efficiencies and has maintained the industry's reliance on support payments, but it has been successful in cultivating an acceptance that we can derive additional benefits from land management beyond the production of food and fibre. Terminology such as 'ecosystem services', 'natural capital' and 'public goods' is commonly used to value contributions to resource management, biodiversity, landscape and socio-economic development. This in turn has increased the incidence of collaborative working between farmers, land owners and other interested parties through a variety of funding sources.

Before leaving England, I set up a management plan to create over 20 ha of native woodland across our 170 ha family farm. The scheme was planned through the Woodland Creation Grant that provides one-off infrastructure payments and annual maintenance payments for the first 10 years following establishment. Working alongside the local National Park Authority, I managed to secure additional funding to cover the full costs of implementation. Even though the project was for native, not commercial, forestry it still benefited all parties. It offered us the ability to renew boundaries and exclude stock from problem areas and waterways.

It also allowed the National Park Authority to meet strategic targets at the landscape level, thereby improving the biodiversity and social enjoyment of the area. Finally, it contributed to the Government's pledge to bolster tree planting rates in the fight against greenhouse gases (GHGs) and climate change. Unfortunately, a delay in processing the paperwork meant we ran out of time to implement the project before our move to New Zealand. The point of recounting this tale is that it was a seamless process and would have been regarded a success by all had it gone ahead. This appears to be in stark contrast to the One Billion Trees Programme in New Zealand.

Rivers Trust

Another example can be demonstrated from my employment as an environmental consultant promoting land management strategies to improve water quality and biodiversity. The organisation I worked for was one of the 60 local charity groups who operate across England and Wales under the umbrella of the Rivers Trust. The concept has evolved from small groups of anglers who were concerned with the quality of rivers and waterways. In many areas this is caused by historic industries and sewage issues, but agriculture is a contributory factor (nitrates, phosphates and sediments).

One of the strengths of the Rivers Trust is that it attracts funding from private business, public sources such as the National Lottery, and private subscribers. This process is beneficial to the agricultural industry in two ways. First, it raises the social profile of land beyond being a cause of pollution to a vital resource in the mitigation of pollution and increasingly flood risk. Secondly, it extends the responsibility of this mitigation beyond the farm gate, providing farmers with access to expert guidance, financial assistance and even labour to facilitate good practice. Again, this should have some relevance to New Zealand, particularly given the interests of environmental bodies, such as Fish & Game, in the condition of waterways.

Adopting multifunctional land management

I am not suggesting that England should be seen as the perfect example of how the agricultural industry should operate. It is far from it. However, the two examples given have shown how use of the 'carrot' can encourage improved environmental performance within the agricultural sector

Table 1: Breakdown of farm business income by farm type and cost centre in England in 2018
Source: Defra, 2019

		% OF TOTAL FARM INCOME FROM			
Farm type	Total farm income	Production	Diversification	BPS	Agri-environment
All farms	NZ$ 100,800	12%	26%	54%	8%
General cropping	NZ$ 100,800	37%	17%	42%	4%
Dairy	NZ$ 100,800	45%	12%	39%	4%
LFA grazing livestock	NZ$ 100,800	-138%	17%	155%	66%

and develop a wider social understanding of this. To promote this approach, the Government needs to mediate between the needs of the economy and the concerns of society. Unfortunately, the current New Zealand Government is not mediating these relationships for the wider benefits of the economy. It continues to demand the industry rights it wrongs and improves its environmental credentials.

However, the Government cannot absolve responsibility as the dependency on the industrial agricultural process has evolved over the past 60 years or so. Initially this was facilitated by direct policy intervention and more recently it has been allowed to continue unchecked through de-regulation. Even when regulation has been implemented, it appears to have failed to prevent development in areas where there have been significant environmental concerns. Central and regional government appear to be culpable through inaction. However, it is unlikely that they are going to change their current stance, so the industry needs to take more proactive steps to facilitate change.

Going forward, it would be appropriate for New Zealand to adopt a multifunctional land use approach. It is accepted that this suggestion can be challenged academically, not least due to the strong association between multifunctional land use and subsidy support payments. Such support will not be politically acceptable, although some grant payments are available to land owners through the One Billion Trees Fund. Further to this, in 2017 McWilliam et al. reasoned that the voluntary approach to conservation within the neoliberal political environment was insufficient to promote a multifunctional dairy industry.

The additional benefits that can be achieved through multifunctional land use are increasingly demonstrated by the industry (see for example the following websites: Dairy NZ – Environment section; and the Beef & Lamb New Zealand Community Catchment Projects North Otago). However, the agricultural sector needs to learn from other industries how to market the environmental benefits achieved through land management. Air New Zealand, for example, have a significant part of their website devoted to sustainability. It doing so, they openly address social concerns, providing customers with the opportunity to pay for remedial action through a 'carbon offsetting' programme.

Social concerns for climate change and GHG emissions are facing both sectors, so there should be scope for collaborative working. One such way could be to develop an alternative native tree planting scheme to the One Billion Trees Programme. This scheme is particularly unpopular with many farmers, but the concept of planting is socially accepted as a beneficial activity. An industry-led alternative, carried out in conjunction with Air New Zealand, could encourage greater participation. Both industries can then promote it and demonstrate how they are trying to address social concerns on a country-wide scale.

A collaborative approach between farmers and other industries, along with conservation and community groups, would also allow access to alternative funding sources, such as Lotto New Zealand. This approach would be a significant step forward as it would extend the focus beyond land management activities to include improving social networks and cohesion in rural areas. The outputs would have real benefits for well-being, mental health, farmer retirement, and maintaining employment and skills within rural communities at a time when such issues are of genuine concern. Such activities could demonstrate to the Government that the industry can be entrusted to address social concerns and encourage greater inclusion in the development of policy going forward.

The agricultural sector needs to collaborate with others to challenge the perception of a production-based industry towards one that delivers many benefits through multifunctional land use. The industry needs to lead on this quickly, as New Zealand is in a bizarre situation where it continues to promote its clean and green image to its global market, but is seemingly losing the battle to prove its environmental credentials at the national level. The potential implications of this are significant, not only to agriculture, but the wider New Zealand economy.

It is not just agriculture's role in relation to these issues that society is questioning. Climate change issues, for example, are not going away and will place significant pressure on a New Zealand economy that relies more than most on the social perception of its land. It is argued these challenges are set to pose a much greater threat to the New Zealand economy than the current issues that focus primarily on the agricultural sector. By promoting understanding and collaboration at this stage, the industry can facilitate a joint effort towards the current problems and prepare the economy for the more significant battles to come.

Further reading

Defra. 2019. *Farm Business Income by Type of Farm in England, 2018/19*. Available online: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/847722/fbs-businessincome-statsnotice-21nov19.pdf. [16/01/2020].

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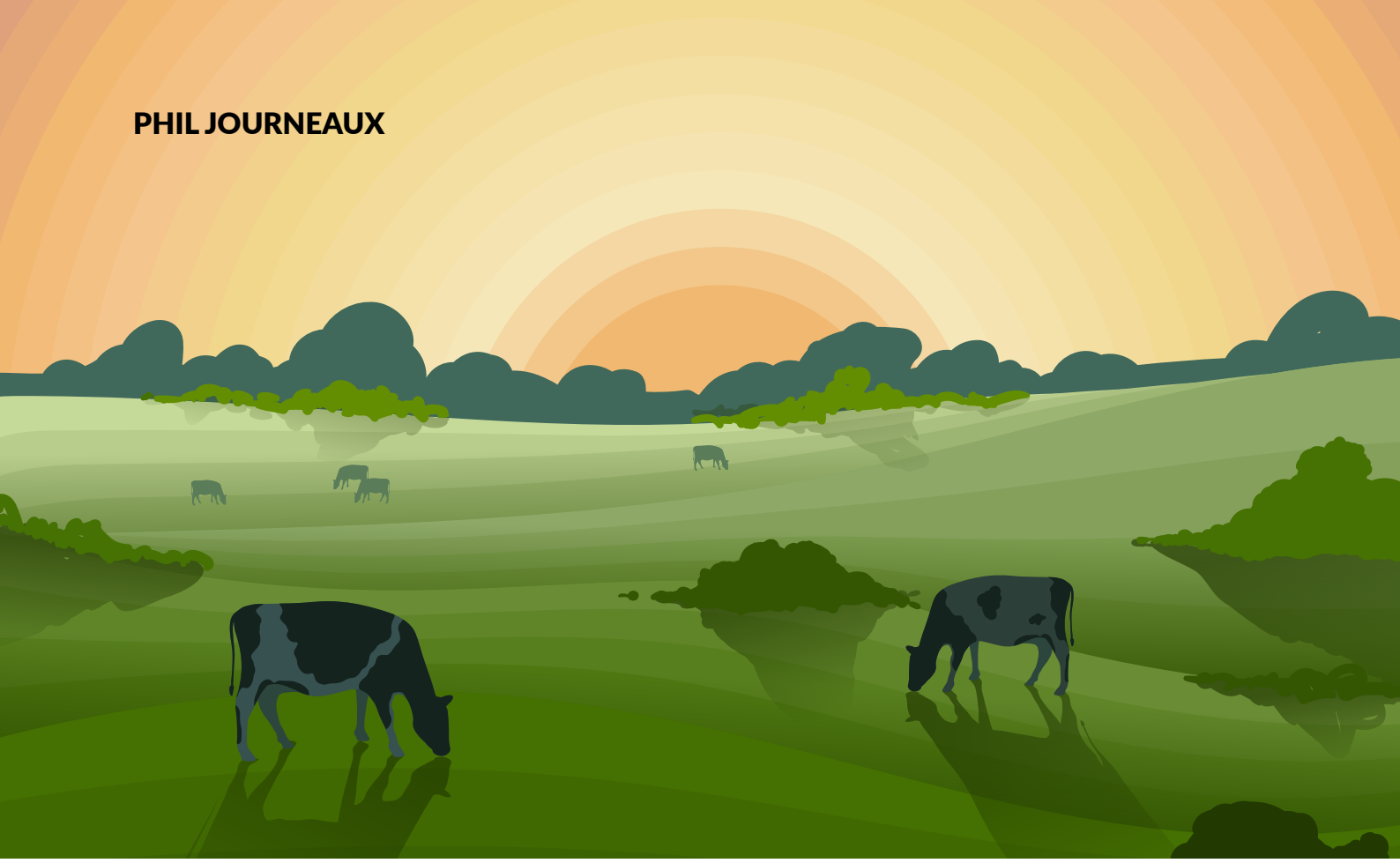
PHIL JOURNEAUX



KEY SIGNALS AND ACTIONS UNDER THE ZERO CARBON ACT

This article follows on from The Journal's December 2020 issue where CEO Stephen Macaulay's editorial talks about the need for rural professionals to discern amongst all the 'noise' on various issues the real information or situation likely to impact on their clients' farm businesses and advise them accordingly.

As a case in point Stephen briefly touches on the Zero Carbon Act (ZCA), and the amount of noise and confusing messaging occurring about what farmers may or may not need to do to reduce their greenhouse gas (GHG) emissions. In helping to separate the signals from all the noise in the area, this article is an attempt to provide further clarity on targets and possible actions that farmers will need to consider under the ZCA.

GHG targets

Readers may be aware of the targets set by the ZCA, namely:

- A 10% reduction in biogenic methane levels by 2030, and a 24–47% reduction by 2050, relative to a 2017 base
- Net nitrous oxide emissions to be zero by 2050. 'Net' means that actual emissions may not need to be zero, as long as they are offset presumably by forestry. The trajectory of the reduction is not set, and given there are 30 years to 2050 (and assuming a linear trajectory), this would mean a 33% reduction by 2030.

It would appear that these targets are reasonably set in stone, apart from the 24–47% methane reduction, which is to be reviewed by the newly appointed Climate Change Commission.

The key thing to remember is that these targets are *national* ones, and inasmuch as agriculture makes up the vast bulk of methane and nitrous oxide emissions, they could be thought of as primary sector targets. So what happens at a sector level will very much determine what individual farmers may have to do on-farm to reduce their GHG emissions, and there are some indications that this may be naturally happening already.

A recent NZX report on the New Zealand dairy industry contained a projection of a 500,000 cow reduction by 2025, which is 10% of the national herd.

For example:

- A recent NZX report on the New Zealand dairy industry contained a projection of a 500,000 cow reduction by 2025, which is 10% of the national herd. Contributing to this will be reduced stocking rates on individual farms and some land use change out of dairying. The end result will be a reduction in GHG emissions from the dairying sector even if per cow production levels increase. At the very least there will be a reduction in the 'maintenance' emissions due to the lesser number of cows, and very probably an efficiency gain at the margin in dry matter eaten relative to milk solid production
- There is a trend for sheep and beef farms to be converted to forestry. In the last six months of 2019 approximately 63,000 ha was sold for conversion into forestry (~34,000 ha to overseas investors and ~29,000 ha to domestic investors). This is likely to continue, and despite the economic and social disruption it will mean a reduction in GHG emissions at a sector level. It will also result in a significant amount of carbon credits via sequestration, although it is very probable that these will be used as an offset at a national level rather than for agriculture or at an individual farm level.

The end result is that at a *sector* level GHG emissions will reduce to some degree, which means that reductions at an individual farm level will not necessarily need to equate directly to the ZCA targets.

The methane reductions are relative to the 2017 base year. Given the target is a national one, the government will reference the 2017 base year as calculated by the New Zealand Greenhouse Gas Inventory. This means it is currently uncertain how much referencing to 2017 will be required at an individual farm level.

Please note that I have not considered the availability of new technologies within this article (e.g. vaccines, methane/nitrogen inhibitors), which are currently under research. If (or when) they become available, then the situation will change.

Government and industry agreement to reduce emissions

Another factor here is the government-industry agreement to reduce primary sector emissions under *He Waka Eke Noa – Our Future in Our Hands* announced in November last year. Key aspects of the agreement are:

- The industry sectors will, in collaboration with government, develop practical and cost-effective ways to measure and price emissions at the farm level by 2025
- In 2022, the Climate Change Commission will check in on the progress made and, if commitments are not being met, the Government can bring the sector into the Emission Trading Scheme (ETS) at a processor level before 2025
- If the pricing scheme is not ready for implementation by 2025, then agriculture will come into the ETS with the point of obligation at the processor level.

A key aspect of the above is the development of a 'carbon-at-the-farm-level' price. How this is to be established and how it works remains to be seen but it needs to be done by 2025. Currently, the 'ETS price' is $25/tonne CO_2e (or per NZU), which is fixed through to 2022. One would assume there will be a close relationship between these two prices, otherwise the opportunity for arbitrage arises. What happens to the ETS price post-2022 also remains to be seen.

As part of this government-industry agreement a range of five-year initiatives will be developed with government assistance, including:

- Improved tools for estimating and benchmarking emissions on-farm
- Integrated farm plans that include a climate module incorporating GHG mitigations/offsetting at the farm level
- Investment in research, development and the commercialisation of any technologies developed
- Increased farm advisory capacity and capability
- Incentives for early adopters
- Recognition of on-farm GHG mitigation such as small plantings, riparian areas and natural cover.

What all this means, and will result in, remains to be seen as work is only just starting under this agreement. Perhaps the main factor to consider is that farmers will not face a direct GHG cost until 2025, unless the Government considers industry commitments are not being met and agriculture is brought into the ETS earlier.

Water regulations

The other key issue which intertwines with GHG mitigations involves policy settings under the 2019 Essential Freshwater Package, particularly how any on-farm GHG mitigation actions impact on the environmental risk to waterways, and vice versa.

While GHG emissions will be controlled by central government, water quality plans are/will be promulgated by regional councils, and going by precedents seen to date these will be very on-farm orientated. The danger we need to be mindful of is that the two issues are not coordinated, meaning that GHG and on-farm water quality actions could become disjointed and counterproductive, resulting in wasting time and money for the farmer, especially if separate water and GHG plans are produced.

WHAT TYPES OF DISCUSSIONS SHOULD YOU BE HAVING WITH YOUR CLIENTS?

For my 10 cents worth, I would recommend that rural professionals consider the following in advising their clients on why agricultural GHG emissions are important and assisting them with on-farm mitigation strategies:

- The need for both rural professionals and farmers to understand the targets set by the ZCA
- Encourage farmers to find out their current farm GHG emissions for methane and nitrous oxide. This will (a) give them a reference number, and (b) help spark their interest in GHGs. Farmers should at least be prepared to act quickly should sector-wide strategies or the Government require these metrics
- Be better prepared in helping farmers understand the basics of what drives methane and nitrous oxide emissions – as a precursor to the next point
- Build your knowledge base (or connect with experts in your referral network) to help develop your clients' understanding of:
  - Farm system mitigation strategies to reduce on-farm GHG emissions
  - Land use change options
  - Implications for business profitability
- Understand the basics of forestry as an offset – that it is not a permanent solution and is a long-term exercise. It is recommended that expert advice on forestry be sought
- Know what is happening in the wider sector under the government-industry agreement around meeting GHG reduction targets
- Understand what your clients need to do under their farm environmental plans in mitigating risks to waterways, and whether this could impact on their ability to reduce GHG emissions. Look for a coordinated approach to GHG and water quality mitigations.

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CHRISTINA LEFEVER

OVERSEAS INVESTMENT REGIME – IMPLICATIONS FOR RURAL LAND TRANSACTIONS

New Zealand's overseas investment regime impacts on the ability of overseas investors to purchase or invest in rural land sector. This article explores the regime and how different land uses might influence the potential for overseas investment within the sector.

Overseas investment regime

New Zealand's overseas investment regime requires overseas persons to obtain consent before investing in 'sensitive' New Zealand assets, and applies to all rural land over 5 ha. The regime is governed by the Overseas Investment Act 2005 (the Act) and the Overseas Investment Regulations 2005 (the Regulations). The regulatory body responsible for the administration of the Act is the Overseas Investment Office (the OIO) under the oversight of the Minister for Land Information and the Minister for Finance. The Ministers can issue guidance to the OIO as to how certain aspects of the Act are to be applied, so the regime is prone to influence from government policy.

Since the new Labour-New Zealand First coalition Government was formed in late 2017, there has been a marked change in government policy surrounding New Zealand's overseas investment regime. Investments in rural land generally have become much more difficult. However, forestry investment (whether existing or new) has been encouraged by the introduction of streamlined tests and assessment processes.

The severity of the overseas investment regime can have significant impacts on the rural land market. Where overseas buyers are unlikely to satisfy the criteria necessary to obtain OIO consent, this will limit the pool of potential buyers for a property. This may impact

property values, particularly where the size and scale of the property puts it beyond the reach of most local buyers, and for properties where overseas buyers are more likely to offer significant 'amenity value' premiums (such as high country stations). Excluding overseas buyers from the market in turn has impacts on market liquidity, restricting current land owners from realising their investment and potentially investing in other opportunities. Vendors of significant properties may need to consider options (such as subdivision) to improve saleability.

The requirement for an overseas person to obtain OIO consent will also impact on vendor decision-making if they are presented with an offer from an overseas person. If a purchaser will require OIO consent, any offer or agreement must be conditional on OIO consent being obtained, and vendor and purchaser expectations must be carefully managed.

The OIO has no statutory obligation to assess applications within a specified time. Over the last year, the average assessment timeframe for rural land applications has been approximately six months, but some applications take more than a year. As such, an agreement that is conditional on OIO consent may remain conditional for over 12 months. The timeframes, process and potential uncertainty need to be considered by vendors before accepting offers from overseas persons, and balanced against the increased purchase price that may be being offered by them.

In the current OIO environment, a vendor may wish to request information from the potential purchaser about their OIO strategy and take their own advice as to the likelihood of success. The long conditional period in an agreement subject to OIO consent also means that thought has to be given to an appropriate settlement date and/or transitional arrangements, where the land use is subject to seasonal considerations.

Transactions that require OIO consent

The Act and Regulations apply to all overseas investments in 'sensitive land' in New Zealand. The Act also governs investments in 'significant business assets', which are generally business investments with a value of over $100 million, and fishing quota, but this article is focused on the sensitive land matters. Sensitive land includes all non-urban land exceeding 5 ha, as well as smaller land parcels where the land has other sensitive features (such as including or adjoining reserves, conservation land, historic places, lakes or the foreshore). It also now includes all residential land, which covers lifestyle properties.

Land investments that require OIO consent include land purchases, leases (of at least three years including renewals), forestry rights and other rights to take resources from land, investments in companies that already own land, and security interests (such as mortgages over land). Where an overseas person already owns shares in a company that holds sensitive land, minor shareholding changes can also trigger the provisions of the Act.

By far the most difficult aspect of an OIO application is satisfying the OIO and the Ministers that an investment will bring substantial and identifiable benefit to New Zealand.

An 'overseas person' includes individuals who are neither New Zealand citizens nor holders of New Zealand residence visas who have (among other things) lived in this country for the last 12 months. Any company incorporated outside New Zealand is automatically an overseas person, regardless of its shareholders. A New Zealand company will be an overseas person if overseas persons hold 25% or more of the ownership, voting or governance rights (e.g. at least 25% of the shares). The tests for partnerships, trusts and other entities are similar.

OIO consent criteria

Unless the overseas person holds a New Zealand residence visa and intends to live in New Zealand indefinitely, which will need to be demonstrated, to obtain OIO consent for rural land investments they must show that the overseas investment is likely to benefit New Zealand. If the relevant land is non-urban land over 5 ha they must show that the benefit is likely to be substantial and identifiable.

Any land used for agricultural, horticultural or pastoral purposes must have been publically advertised in New Zealand before being sold to an overseas person. All overseas investors must also satisfy an 'investor test', which considers their business experience, financial positon and character.

By far the most difficult aspect of an OIO application is satisfying the OIO and the Ministers that an investment will bring substantial and identifiable benefit to New Zealand.

Benefit to New Zealand

When the OIO is assessing whether an investment will benefit New Zealand, and if that benefit meets the 'substantial and identifiable' threshold, the OIO has regard to:

- A list of factors contained in the Act and the Regulations, which include (among other things) economic factors, environmental factors, consideration of government policy and international relations, and the degree of ongoing ownership or control by New Zealanders

It is currently difficult to satisfy the OIO consent criteria for the purchase of an existing horticulture property with no proposed change in land use.

- Any policy directives issued by the responsible Ministers about which factors are of most significance for various types of application
- The level of benefits that have been claimed in the context of the investment as a whole – the higher the value of the assets being acquired, the greater the level of benefit that will be required to meet the benefit test
- The 'counterfactual (i.e. what is likely to happen if the overseas person does not acquire the land) – the overseas person *cannot* rely on benefits that are likely to occur regardless of whether it acquires the land.

When making an application for OIO consent, the applicant must provide detail (quantified where possible) about how the investment will, or is likely to, provide the relevant benefits. Benefits must also be assessed against what is likely to occur without the overseas person's investment. Unless the overseas person can satisfy the OIO otherwise, this generally involves considering what an 'adequately funded' New Zealand purchaser would do on the land.

This counterfactual analysis can result in scenarios where the certainty of an overseas purchaser's investment is being assessed against an unknown hypothetical purchaser (i.e. where no alternate purchasers have been identified as part of the marketing process). The hypothetical purchaser could be credited with certain intentions, but may not in fact exist to provide the vendor with a realistic alternate purchaser if OIO consent is not granted. Considerations as to the likely counterfactual(s) and their impact on the benefits being claimed can be key to the success or otherwise of an application.

Current policy directive

Following the change in Government in late 2017, a Ministerial Directive was issued to the OIO by the Minister of Finance. This Ministerial Directive introduced a 'rural land' directive that applies to *all* acquisitions of non-urban land over 5 ha, other than land already used principally for forestry. It requires the OIO to give high relative importance to five factors:

- Increased export receipts
- Increased jobs
- Increased processing of primary products
- Introduction of new technology or business skills
- The degree of New Zealand oversight or participation.

Rural land investments that do not satisfy at least one of these factors now have a much reduced chance of satisfying the 'benefit to New Zealand' test.

The combination of the current Ministerial Directives and the counterfactual presumption of an adequately funded alternate purchaser have recently made it much more difficult to satisfy the benefit to New Zealand test for rural land investments. ***Table 1*** shows the number of OIO approvals granted for rural land in 2018 and 2019 broken down into proposed land use.

Table 1: OIO approvals granted for rural land (2018 and 2019) by land use

RURAL LAND CONSENTS (>5 HA)	2018	2019 (JAN–SEPT)
Farming	3	1
Horticulture	2	6
Viticulture	4	5
Forestry	10	30
Manufacturing/processing facilities	9	5
Residential development	3	1
Other	4	3
Total	**35**	**51**

Farming

There have now been over 55 OIO consents issued for rural land over 5 ha under the new Ministerial Directive, excluding consents issued under the streamlined forestry tests, but only four of those have been issued for a proposed farming use (e.g. dairy or grazing). Continued use of properties for grazing purposes will present significant challenges if the purchaser requires OIO approval. The introduction of more efficient farm systems and processes (or nominal levels of capital improvements) are unlikely to meet the tests under the new rural land directive for small parcels of rural land, let alone significant high country stations.

An overseas person will likely have to demonstrate a significant change in current land use or operations to satisfy the OIO and the Ministers that the investment is likely to result in a sufficient level of benefit.

However, a conversion from grazing to dairy is now much less likely to satisfy the 'substantial and identifiable benefit' test. This is due to the counterfactual test, and the presumption that if there is commercial benefit in undertaking a conversion, a potential New Zealand purchaser would be likely to undertake a similar conversion and be able to obtain the required finance.

Recent changes to the Act introduced streamlined approval paths for forestry investments, reflecting government policies supporting quality overseas investment in forestry and 'One Billion Trees' by 2027. Under these new approval pathways, the threshold for obtaining OIO approval has been significantly reduced.

Horticulture

It is also currently difficult to satisfy the OIO consent criteria for the purchase of an existing horticulture property with no proposed change in land use.

New greenfields horticulture developments have the advantage of involving a change of land use, which makes demonstration of a benefit under the Ministerial Directive more straightforward (subject to counterfactual considerations), as these developments will generally involve significant capital investment, new job creation, and the growth of new produce for export. However, consideration does need to be given to the area being developed relative to the total area of land being acquired.

Viticulture

From an overseas investment perspective, viticulture has the advantage of its product not being exported under an export licensing system. Produce exported under these systems will be exported to the same markets, regardless of who owns the land, whereas vineyard owners have more influence over the export of the final product. As such, an overseas person may be able to obtain consent to purchase an existing vineyard/winery asset if they can demonstrate that their investment is likely to result in more of the final product being exported (e.g. if they are able to open up other export markets and/or market the wine under an existing label with an established reputation overseas).

There is also often potential for ancillary development (such as restaurants and cellar doors and associated export earnings through tourism). However, the latter may often be discounted against the counterfactual.

Forestry

Recent changes to the Act introduced streamlined approval paths for forestry investments, reflecting government policies supporting quality overseas investment in forestry and 'One Billion Trees' by 2027. Under these new approval pathways, the threshold for obtaining OIO approval has been significantly reduced.

The new pathways apply where the land is likely to be used exclusively (or nearly exclusively) for forestry activities, and can be used regardless of the nature of the forestry investment (e.g. bare land purchase, purchase of existing forest, lease, forestry right or investment in a forestry business). However, they only apply where trees are planted with the intention of harvest, not for permanent carbon sink forests.

Under the most advantageous new test, which has already been successfully applied in 28 OIO applications, if all the relevant criteria are satisfied the overseas person is not required to show any 'benefit to New Zealand' resulting directly from their investment. Essentially, it is enough that the land will not 'go backwards' under the overseas person's ownership.

Overseas forestry investors can also now apply for 'standing consents', allowing them to buy land without making further OIO applications for each purchase. This will enable those investors to be more competitive in the market, as any offers will not need to be subject to OIO consent.

Lifestyle blocks

Lifestyle blocks over 5 ha have always fallen within the scope of the Act. All lifestyle blocks, regardless of size, are now 'sensitive land' following changes to the Act in October 2018 that brought all residential land within the regime.

To get OIO consent to acquire lifestyle land, an overseas person will generally need to show that they hold a residence visa and intend to live in the property being purchased, or that they are increasing housing, or using the land for a commercial purpose.

For lifestyle blocks over 5 ha, an overseas person will also have to satisfy the 'substantial and identifiable benefit to New Zealand' test, unless they hold a residence visa and intend to use the property as a principal residence. Under the new Ministerial Directive, this is a threshold that will be difficult to satisfy for lifestyle properties. Investments that are most likely to meet the OIO consent criteria would be those involving a change in land use, or the development of housing on bare land (with an on-sale requirement after completion).

Potential for further change

The Treasury is currently developing its advice to the Government on further proposals to reform the Act. Further change to the overseas investment regime is very likely, with draft legislation expected in early 2020.

Disclaimer

The content of this article is general in nature and not intended as a substitute for specific professional advice on any matter and should not be relied upon for that purpose.

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MARK PAINE

PEOPLE MANAGEMENT IN THE FOOD AND FIBRE SECTOR

This article discusses the employment and skills situation in the New Zealand food and fibre sector. A new strategy for the sector is introduced that aims to coordinate initiatives across our industries and improve the way we attract, educate and employ people.

People – the problem and the solution

Maori wisdom has never been more pertinent, as expressed in the proverb, 'He aha te mea nui o te ao. He tāngata, he tāngata, he tāngata' (What is the most important thing in the world? It is people, it is people, it is people.) This article discusses the challenges and opportunities associated with people working in our rural industries. A new 'industry-led – government-enabled' strategy is introduced as a mechanism for improving our international competitiveness through better people management.

The year 2020 is significant in New Zealand history. We will exceed five million people at a time when global population is approaching eight billion (estimated 2024). This relentless growth is placing ever more pressure on national and global ecosystems. It is also creating greater demand for our food and fibre. The strategy for our food and fibre industries must navigate between the shoals of environmental degradation and international food security if our nation is to continue to enjoy the prosperity we have experienced in recent years. Our ability to navigate this course depends on our people and their access to technology.

Employment practice in New Zealand

New Zealand food and fibre industries currently employ 350,000 people, including the processing and service sectors, generating over $46 billion in export returns. Most growth is occurring in the horticultural industries, particularly kiwifruit and pipfruit, with pastoral farming stable or declining in the numbers employed. People employed in food and fibre production is relatively stable, but exceptional growth is forecast in support services

Cut + carry

Cropping

out to 2025 (see www.mpi.govt.nz/dmsdocument/3893-future-capability-needs-for-the-primary-industries-in-new-zealand). Service sector growth will occur as businesses build resilience, while complying with more stringent demands for food safety and reducing their environmental footprint.

Are food and fibre businesses adequately informed about good employment practice? Each industry provides their farmers and growers with frameworks and action plans consistent with their industry strategic priorities. These resources typically address the legal responsibilities that employers have to their employees, and outline ways they can move from good to great employment practice.

The challenge is that generic industry strategies do not always translate into common practice across all businesses. Most industries have thousands of employers who are making independent decisions about employment practice. Stories about everyday practice in the field vary, but they can be broadly categorised as tales of two communities – the negative and the positive experiences in rural communities.

Employers' negative experiences are reported about the following issues:

- A labour market that is never providing enough of the 'right' type of person for the job
- Too much compliance imposed by government agencies
- Immigration rules that are continually changing, making planning difficult
- Increasing problems from drug and alcohol abuse in the workforce.

These issues leave employers unwilling to invest in training because they believe that when staff leave it is other employers who will gain the benefit.

Each of these negative experiences have a positive counterpoint, with leading employers telling their stories at events like award ceremonies that celebrate excellence in employment practice, e.g. Ben and Nicky Allomes who won the 2019 Primary Industries Good Employer award. The experiences of these types of employers will typically refer to:

- The good reputation of their business spreading quickly in the labour market, giving access to the best and brightest
- Developing long-term supply solutions by employing locally
- Good systems and routines giving them peace of mind
- Developing team cultures so that employees look after each other
- Providing career pathways that are planned and agreed with their employees.

Employees can also be categorised in terms of negative and positive experiences. On the negative side employees refer to:

- Long hours of work with no recognition from their employer
- A sense of isolation without effective internet connection
- No rewards for doing a good job
- Poor communication from the boss – what is the plan for the week, what is the business trying to achieve?
- There is no chance of owning their own farm.

Robotic milking

Employees with positive experiences and dispositions report a different worldview:

- An enjoyment of their outdoor work environment
- Strong rural community support and active participation in Young Farmers Clubs
- Clear targets and incentive schemes from the employer
- A sense of value and clarity about their role in the business
- Numerous options opening up for business ownership.

Each industry is taking responsibility for improving the collective performance of their businesses. There is high awareness of the consequences of poor performance for businesses, such as loss of labour market competitiveness and increasing costs arising from failure to comply with regulations.

The rest of this article will focus on the future. For example, what people challenges and opportunities will our food and fibre businesses encounter?

Trends impacting on the labour market

Several trends are anticipated to impact on the labour market. First, competition in the labour market is likely to intensify in coming years. Employment in the construction, tourism and information technology (IT) sectors has grown consistently over the past three years, while the food and fibre sector has remained largely unchanged. For instance, the Statistics NZ household labour survey comparing the June quarter to June quarter 2016–2018 noted that employment in the construction sector increased 12% and employment in IT increased 21%, while the primary industries remained unchanged (see www.stats.govt.nz/information-releases/labour-market-statistics-june-2018-quarter).

However, over the past three years, the food and fibre industries increased its contribution to export revenue by 16% (see www.mpi.govt.nz/dmsdocument/37074-situation-and-outlook-for-primary-industries-sopi-september-2019). Of the $58.3 billion exports to June 2019, $46.4 billion was from our food and fibre sector. Clearly the strength of the New Zealand economy continues to depend on the international competitiveness of this sector. If food and fibre businesses are to successfully compete for the best and brightest in the labour market three things will need to happen:

- An accurate information base must support the prioritisation and planning by government agencies and industries
- Confidence in the food and fibre sector must bring in current and future generations of New Zealanders, and confusion about the sector must be eliminated
- Food and the environment are attractive to the next generation – a positive association between our industries and the 'food-environment nexus' in the minds of future generations must be achieved.

The second trend characterising future labour markets is a move to more flexible workforces. People are

Alternative pastures

expected to move more frequently and with greater ease across industries and regions. The use of social media is accelerating the sharing of information about employment opportunities. The virtual nature of this information also removes geographic barriers to information exchange. For example, a person in Auckland can discover employment opportunities in Hastings that have a good fit with their CV.

New employment opportunities will also be created through emerging industries, like medicinal grade manuka honey, which will require some adaptation of existing professions and the development of new ones. These employment opportunities will emerge along the full value chain from farm to consumer.

A third trend will see greater upskilling of the workforce. A 2014 report predicted people employed in the food and fibre sector will increase by 50,000 (2012–2025), but qualified people over the same period will rise by over 92,000. Automation and IT will become more prevalent, and with this change will come a corresponding demand for technical expertise to support the use of new technologies.

A fourth trend is likely to see greater pressure on community groups and non-profit organisations. Organisations like NZ Young Farmers depend on donations, fundraising campaigns and significant voluntary contributions to balance the books year to year. Time demands on members of these types of organisations will intensify in the coming years. Such pressure threatens the social cohesion in rural communities.

The final challenge is to manage a shift in culture. After decades of competition between industries, the future will require industries to find their strengths in a coordinated food and fibre sector strategy. Allocation of funding and public sector resources to the industries has operated on a contestable basis since the mid-1980s, the assumption being that competition between them ensures the market selects for the most fit-for-purpose solution.

The risk with this approach is that problems can be framed at the wrong scale. In the case of people and employment, the labour market needs to be framed at both the regional and national levels, and at both the industry and sector levels. What has been lacking is an integrated plan for the food and fibre sector that complements the individual plans of each industry.

A new strategy – Action Plan

Several industries worked with the Ministry for Primary Industries (MPI) between February and September 2019 to develop a Food and Fibre Skills Action Plan. A mix of pastoral and horticultural industries participated in the development of the plan. Production and processing industries were also members of the working group. A key operating principle for the plan was to be 'industry-led – government-enabled'. This meant any initiatives proposed in the plan had to align with industry strategic priorities and support government aspirations signalled in the Wellbeing Budget.

The plan is a first for the food and fibre sector. Its launch is well timed to capitalise on other reforms underway, particularly the review of vocational education and training.

More young people will elect to have careers in food and fibre because an integrated school-tertiary-employment pathway will facilitate a seamless transition.

Working group focus areas

After reviewing the current rural workforce operating environment, the working group proposed four interdependent focus areas. Each focus area cannot be treated in isolation, as actions taken in one part of the plan will impact on the performance of other areas. This section provides a brief overview of each focus area before discussing how the plan will be implemented. The full report is available at: www.agriculture.govt.nz/dmsdocument/37751/direct.

Knowledge

Knowledge is the first focus area as information and knowledge underpins effective decisions across the plan. Work in this area will collect, analyse and report data in a consistent manner. Understanding the root cause of issues, and forecasting future trends using integrated information systems, will provide a better assessment of food and fibre workforce initiatives.

Attraction

Attraction will build on the many initiatives that individual industries are using to attract new entrants to their industries. Increasing the scale and scope of initiatives to reach graduates and career changers will be achieved using a pan-industry approach to the investment, evaluation and delivery of programmes in partnership with government agencies.

Education

Education will build on the Review of Vocational Education and Training and extend industry participation in secondary and tertiary initiatives. As a result, the education and training system will produce sufficient learners with the skills required to meet food and fibre workforce needs.

Employment

Employment will focus on improving workplace employment practices. Better practices will provide the credibility needed by the sector to attract, develop and retain a skilled workforce. Retention is critically important for businesses to secure the return from their investment in upskilling their staff. This focus area will also support improved networking to better match employers and employees.

How the plan will operate

The plan maps out several actions in each focus area out to 2022. An establishment group, with membership from primary industry organisations, is overseeing the implementation of the plan in partnership with MPI and other government agencies, e.g. the Tertiary Education Commission, the Ministry for Business, Innovation and Employment and the Ministry of Education.

How will an 'industry-led – government-enabled' plan operate? The answer to this question is part of the task confronting the establishment group. A process that has worked effectively in recent years to improve employment and animal welfare practices uses the VADE framework. Practice change under this framework spans 'Voluntary' change by leading farmers and growers who are pursuing best practice.

At the other extreme, poor practices by recalcitrant (and sometimes recidivist) offenders can result in a legal requirement to change practices under 'Enforcement' from a government agency. 'Assist' and 'Direct' initiatives span the gap between Voluntary and Enforced change, involving combined support from industry and government. The VADE framework supports innovation from leading farmers and ensures regulations are targeted at those businesses that are undermining the reputation of the food and fibre sector.

Where will we see change?

Successful implementation of the Food and Fibre Skills Action Plan between now and 2022 will see change across several dimensions of the labour market. Expect to see a change in sector confidence, with businesses targeting people as a core investment. This cultural shift will evidence an associated improvement in the metrics tracking reduced health and safety incidents, as well as reduced non-compliance notices from Labour Inspectorate checks.

New collaborative solutions (pan-industry) will result in the sector being more successful in the labour market, and regional workforces will fulfil the demands of the industries. More young people will elect to have careers in food and fibre because an integrated school-tertiary-employment pathway will facilitate a seamless transition. A series of high-impact industry-government programmes will increase the speed and scale of benefits captured by businesses due to early adoption, or from adaptation to new policies.

Finally, rural professionals will give more thought to people issues when developing business plans for clients. These plans will better equip businesses with the information and services that professional food and fibre businesses will require in the future.

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NAZANIN MANSOURI

AUTOMATIC MILKING SYSTEMS – BENEFITS AND IMPLICATIONS FOR DAIRY LABOUR REQUIREMENTS

The uptake of automatic milking systems on dairy farms is assumed to reduce labour requirements, but in reality this may not be the case. This article explores AMS, its adoption history globally, and the implications of this for New Zealand dairy systems.

Development of robotic agricultural technology

In an increasingly globalised world, there are multiple, simultaneous and interconnected economic, social and ecological pressures that farmers are exposed to. Hence, the activities and decisions that occur within the agricultural sector are diverse in nature and continually evolving. In response to these and ongoing changes, the agricultural sector has seen many advances in the technology available to it. This occurs across both the livestock and cropping sectors in a number of forms, encompassing biotechnological, automotive and robotic, monitoring and data systems.

The reasons for their use are numerous and include the following: to improve productive capacity and achieve efficiency gains, to reduce labour costs and improve working conditions, to monitor production and support decision-making, to determine animal behaviour to improve animal health and welfare, and to create greater overall resilience within the farming system. These technologies, which may be designed to address a particular need, may also realise other benefits but also have unintended consequences.

In the livestock sector, there has been widespread adoption of technology in animal genetics, tracking and traceability systems, feeding systems and nutrition, and livestock handling. Robots, more commonly associated with glasshouse and field cropping systems, are also in use in the livestock sector. A primary function is in the automation of slow, repetitive and/or dull tasks, releasing farm workers to concentrate their time and effort in other areas. Automatic milking systems (AMS) and milking robots are one of the more successful applications of robotics in the dairy industry, particularly in housed systems.

1. Milk receiver can 2. Quarter milk tubes 3. Robotic arm 4. Teat cleaning brushes 5. Scanning laser 6. Milk sensor
7. Feed dispenser (hidden) 8. Milk meter 9. AMS control panel 10. Robotic arm control panel

Figure 1: Example of an automatic milking system
Source: DairyNZ (2019)

Automatic milking systems

An AMS removes the herd movement and milking process currently undertaken in conventional milking systems by farm staff. To achieve this, it has two key elements (robotic and voluntary), creating changes in the milking event itself but also requiring changes in the entire farm system.

The robotic element relates to the milking robot, which primarily consists of six components: the milking stall; a teat detection system; a teat cleaning system; the robotic arm attaching the cups to the cow's teats; the milking machine including sensor, a meter and milk receiver can; and an automated monitoring and recording system *(see Figure 1)*. This is the single box system. The alternative is the multi-box system, where one robotic arm operates for up to five stalls. Developments that are more recent have focused on automatic milking rotaries.

An AMS is not only the use of a robot for milking dairy cows, but also a new system of running a dairy farm, which is the voluntary element. It allows and requires dairy cows to freely and voluntarily milk themselves. The voluntary movement aspect indicates that cows will bring themselves from the pasture or barn to the milking shed and robot, with the opportunity for cows to have 24-hour access (referred to as 'distributed milking'), although 24-hour access may not always be the case. Compared to conventional systems, voluntary milking systems offer better flexibility of the milking event for both timing and frequency.

An AMS reduces the labour requirement during the milking process, potentially reducing the manual workload and unsociable hours, freeing up time for other tasks such as reproduction, feeding and pasture management, and herd health. Although an AMS is suitable for various herd sizes and dairy farming systems, it is more common on dairy farms with small herd sizes in barn-based systems. With the introduction of multi-box and automatic milking rotaries the technology has also been successfully introduced to farms with larger herd sizes.

History of AMS adoption

The Netherlands, Europe and North America and barn-based systems

Research and testing of prototypes for milking cows without human intervention dates back to the 1970s and 1980s, respectively. The first commercial dairy cow milking with robots without human involvement was in The Netherlands in 1992. A milking system manufactured by a Dutch company, Prolion, was installed on an experimental farm in The Netherlands and then on a commercial dairy farm. More manufacturers and companies then participated in the development of milking robots.

By 2003, there were approximately 2,200 dairy farmers across the world using an AMS, with the largest operation at that time located in California. By 2010, the adoption of AMS stood at more than 10,000 dairy farms globally *(see Figure 2)*. More than 80% of these were located in

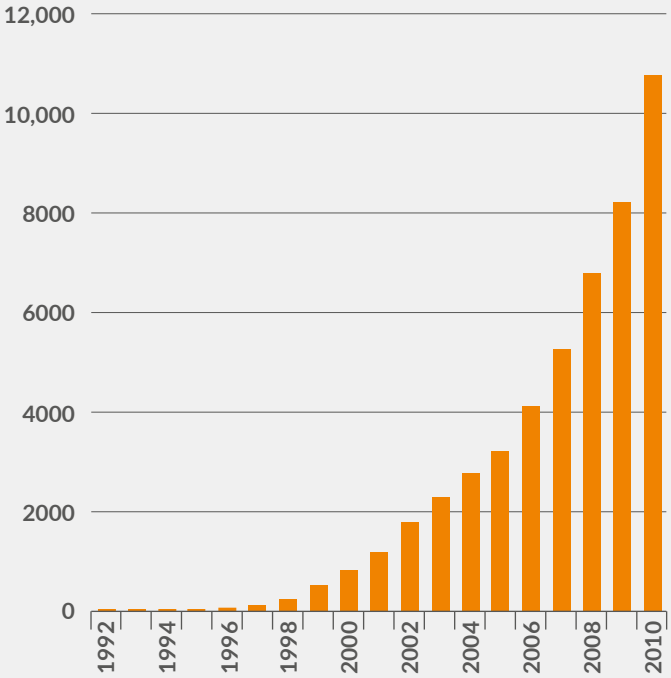

Figure 2: Robotic worldwide adoption of automatic milking systems
Source: De Koning & Rodenburg (2004)

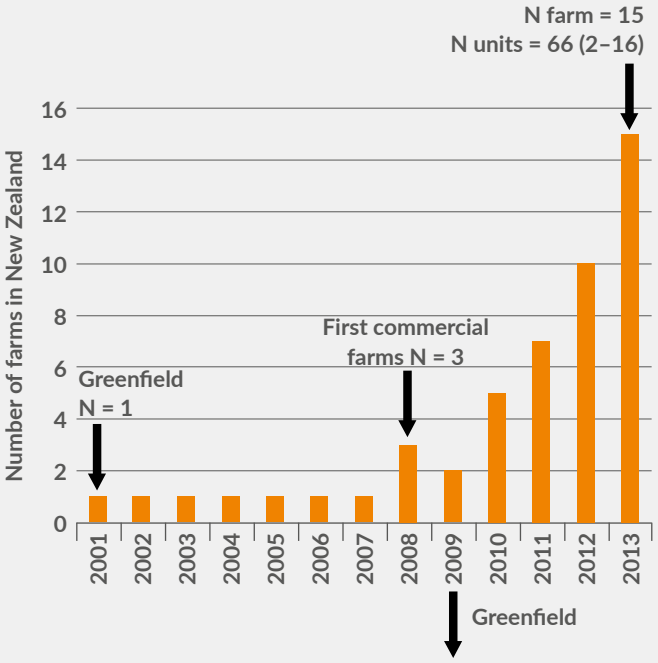

Figure 3: Adoption rate of AMS in New Zealand
Source: DairyNZ Farmer's Forum available at: www.dairynz.co.nz/media/621418/automatic_milking_technology.pdf

There are currently about 27 dairy farms in New Zealand operating AMS. Adopters are a combination of pastoral-based, barn-based and hybrid dairy systems.

north-western Europe, with the greatest number in The Netherlands and then Scandinavian countries, with just under 10% in Canada.

The adoption and installation of AMS is largely in indoor barn-based systems, with cows inside during lactation and fed a mixed-ration feed. In most European countries, grazing does take place during the summer months, but the combination of grazing and AMS itself is less common. In Europe, the dairy farms that have AMS are family businesses where herd size is small (with around 100 to 250 cows), the labour cost is high, and the farming system is relatively intensive.

In North America, the climate favours a diet that includes silage, more easily fed from storage, which also favours their barn-based systems. The first commercial installation of robotic milkers in Canada was in Ontario in 1999. There are currently over 500 farms with robotic milking in Canada, and as with European adopters these are family farms with small herd sizes where the pasture grazing opportunity is limited and labour is expensive. The typical dairy herd for early adopters was around 60 cows. In contrast, dairy farms in the US tend to be larger and thus adoption has been slower. The farms that have adopted AMS tend to milk herd sizes between 200 to 500 cows. Adoption is partially driven by the difficulty in finding a reliable workforce. The development of automatic milking rotaries more suited to larger herd sizes has seen increased adoption on farms with up to 1,000 cows.

New Zealand, Australia and Ireland and pastoral-based systems

The adoption of AMS has also occurred in pastoral-based dairy systems, most notably in Australia, New Zealand and Ireland. In these three countries, grazing is critical to low-cost milk production.

The adoption of the first AMS in New Zealand was in 2001 by the Greenfield Project in Hamilton, which examined the viability of the technology in a pastoral system. It then took until 2008 for two commercial farms to adopt the technology. *Figure 3* shows that between 2001 and 2013 there was a gradual growth in the adoption rate of AMS in New Zealand, with most of the growth occurring in the latter four years of that period, culminating in 15 dairy farms milking their cows using AMS. From 2013 to 2018, more dairy farmers introduced AMS on their farms. There are currently about 27 dairy farms in New Zealand operating AMS. Adopters are a combination of pastoral-based, barn-based and hybrid dairy systems. Herd sizes range from less than 200 up to about 400, although there was one farm milking around 1,500 cows.

In Australia, the first commercial Australian AMS began operation in 2001, and as with New Zealand there were no new commercial installations until 2008. Currently, there are 45 dairy farms operating AMS, most with just under 300 cows. *Figure 4* depicts AMS adoption growth in Australian dairy farms. AMS occurs in various farming systems, including barn-based systems (10%) and corral systems (6%), i.e. grazing with variable levels of supplementation.

Similarly, in Ireland it is estimated that there could be up to 500 dairy farms with AMS, primarily in indoor systems (Personal communication, Bernadette O'Brien, Teagasc). Adoption is successful in herd sizes between 70 and 140 cows. In 2013, a European project was established to look at an AMS that maintained the use of pasture in the milk production system. Teagasc in Ireland led this, with partners in The Netherlands, Denmark, Sweden, France and Belgium also participating. As a result, the number of farms adopting AMS in these countries was expected to increase, with expectations that this would reach nearer to 100 farms in Ireland.

The challenge in pastoral systems is the voluntary movement of cows from pasture to milking shed. With medium-to-large herd size, i.e. more than 300 dairy cows, there can be some distance between the two.

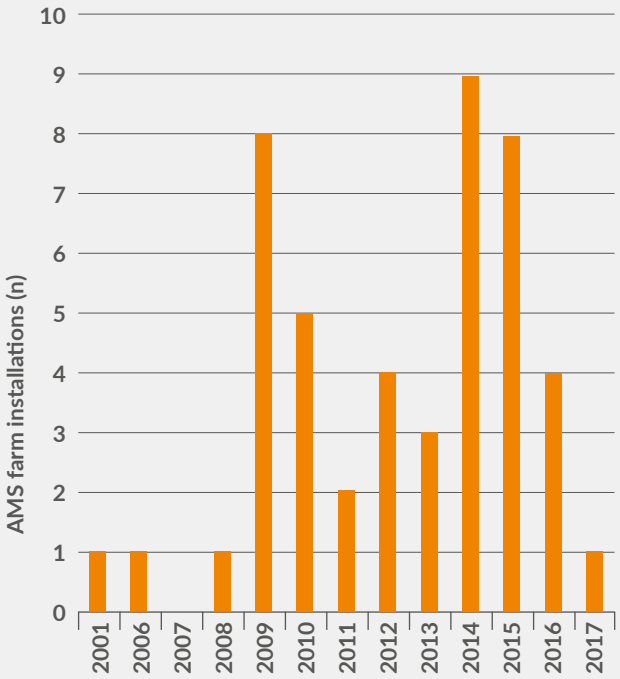

Figure 4: Adoption rate of AMS in Australia
Source: Personal communication, Nicolas Lyons, NSW Department of Primary Industries

Reasons for adoption

The reasons for adopting AMS vary in accordance with the dairy farmer's needs and expectations. The main adoption factors have been about:

- Experiencing new technology
- Lifestyle, workload and labour costs
- Improved profitability through reduced labour input.

A number of farmers have adopted AMS because of their interest in technology and automation systems, and the opportunity to experience a new and different system. Alongside this is the notion of the enjoyment of the type of work that this allows.

A better lifestyle is one of the significant contributing factors in adopting AMS because it potentially provides the opportunity to reduce workload. At one end of the age spectrum are those farmers considering semi-retirement, seeing AMS as a way to stay in the dairy industry without a daily commitment to spending long hours milking cows twice a day. At the other end of spectrum are the younger dairy farmers who want to spend more quality time with their family or away from the day-to-day activities of the farm itself.

Better managing the physical nature of dairy tasks is also of concern to dairy farmers. Milking dairy cows requires intensive physical ability and it is time-consuming. The vast majority of older dairy farmers have worked on their farms for many years. As they get older, they not only face physical difficulties, but also lose their incentive to milk cows. An AMS reduces both physical activity, with the potential to reduce associated health problems, and the time commitment required.

These reasons are frequently associated with smaller family farming businesses, but are also relevant to larger business where additional labour is required. The perception of an industry requiring long hours of manual work means it can be challenging to find and keep a reliable workforce. The flexibility of hours that are more sociable, shorter working days, and less physically demanding work may thus be more appealing for some. For the farm owner, reducing labour hours and the associated cost, with the resultant potential to improve profitability, is another factor driving adoption.

Implications for dairy farmers of AMS installation

The AMS reduces the labour requirement during the milking process, which allows (but also requires) work to be undertaken elsewhere. This is because there is less interaction between the dairy farmer and the herd, resulting in reduced and regular observation of the herd and individual cows, particularly where the herd size is large. It is therefore essential for dairy farmers to find other ways of facilitating appropriate cow management.

One benefit of the milking robot is the wide range of information available on each individual cow, including the number of milking events, milk yield and composition. It is important to monitor and act upon the information and reports provided. The detailed and comprehensive information available for each cow can assist the dairy farmer to make informed operational and management

One benefit of the milking robot is the wide range of information available on each individual cow, including the number of milking events, milk yield and composition.

decisions more easily, with the advantage that the milking robot potentially provides the additional time to do this. This does, however, require the need for some level of computer skill and understanding of the technology.

Furthermore, it is not only about making use of the data from the milking robot, but also understanding the need for a change in the overall farm system. Changing the farm system may entail altering the farm layout, the cow traffic system and grazing rotation, with the use of automatic gates to facilitate cow movement, from pasture to milking robot and return to pasture. This will require additional capital investment beyond that of the individual milking robot, as well as any associated ongoing maintenance. There are advantages, however, when systems change. One system advantage that may not be immediately evident is that before AMS installation dairy farmers needed to identify and separate the dry cows from the milking cows. The milking robot, however, has the ability to identify the dry cow, and although they may still move through the system milking will not take place.

A further advantage of the technology is that the management of operations can be conducted remotely using a smartphone. Having access to this information via a smartphone has made it possible for farmers to keep an eye on the farm's operation from anywhere, even off-farm. This does require some form of internet connection, so it might be challenging for farms in remote places.

In changing to AMS there will also be a need for cow training when first installed. Some cows will adapt easily, but for others this will not be the case. For an individual

What is evident from the adoption of an AMS is that it changes the nature of the work. This may lead to a reduction in hours, but it may not.

cow, the milking robot may simply just not be appropriate due to cow size, udder and/or teat placement.

There is also the need for the dairy farmer and employees to be flexible about work hours. As the AMS works on a 24-hour basis, there is a need for someone to be on-call for when things go wrong. It is possible to receive alarms at any time of the day or night. Through managing the frequency and timing of cow movement from pasture to shed, and thus the number of potential milking events, this can (in part) be alleviated. Further, depending on the severity of the issue, it might be possible for the dairy farmer or farm staff to solve it remotely. However, in severe cases, the help of a properly trained technician from the robot's supplier through the phone or in person may be needed. The data monitoring facility that milking robots have can aid this process with the data transferred to the robot supplier technician. This also means there is the potential for a technician to fix the problem even before the farmer is alerted. The concern for a farmer is the potential loss of privacy of information that occurs as part of this process.

The provision of information that the milking robot provides, if used, can lead to improvements in operations and management and consequently productivity. This includes improvements in both milk quantity produced and milk quality.

Even without the analysis of data, the AMS (in providing a voluntary milking system for the cows with more flexibility in access to the milking shed) means they are milked when needed. This results in less pressure on the udder, which in turn has a positive effect on their health. Some dairy farmers have also experienced less clinical cases of mastitis. Related to this is the ability of the milking robot to identify changes in the cow's details and detect potential problems such as mastitis, which can then be managed and treated. Reductions in lameness may also occur with cows moving on their own freely from the paddock to the milking shed, rather than being forced along. Overall, after the installation of AMS, farmers have found that cows appear heathier and more visibly contented.

Reducing the workload hours associated with the milking process, the manual and repetitive physical work, and introducing the use of the technology also lends itself to attracting and maintaining the workforce, appealing to both the older and younger generation.

Conclusions

Automatic milking systems remove the need for someone to be present during the milking process. This leads to the belief that this can reduce the on-farm workload, and thus the labour required and associated costs. Reducing costs can also mean there is opportunity for improved profitability. In reality, this may or may not be the case.

What is evident from the adoption of an AMS is that it changes the nature of the work. This may lead to a reduction in hours, but it may not. The implementation of an AMS also requires changes beyond just that of replacing the equipment in the milking shed, which requires adjustment by both the cows and the staff. There is anecdotal evidence to suggest that the cows adjust more quickly than the staff!

Reducing the time that is required for the milking process does reduce the physical manual and repetitive load, and changes the timing of events, but it also removes the staff from regular contact with the herd and individual cows. The reduced interaction requires, in its place, the need for data monitoring. This then provides the opportunity to increase the level of decision-making autonomy and management input. This will appeal to those with an interest in the data produced and the opportunity for information analysis. An AMS may be less appealing to those staff who do not like separation from their livestock, and who may prefer some form of regular routine. The nature of the work with an AMS may also be less appealing to those who are not as comfortable with technology and data management.

Overall, however, an AMS will improve the working environment, being more flexible in nature and requiring less physical effort. It has the added advantage of providing the opportunity for time to be spent on greater management activity, with additional benefits for cow health and welfare because of both the overall flexibility in the system for individual cows and the opportunity to monitor the data produced by the milking robot. The combination of the opportunity provided in terms of management and the potential to benefit individual cows provides additional opportunities for improvements in productivity.

Further reading

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MAJEED SAFA, THOMAS MAXWELL
AND CRILE DOSCHER

DEVELOPING AN APP TO ESTIMATE PASTURE FERTILISER APPLICATION ON DAIRY FARMS

Estimating fertiliser application has always been one the main issues on-farm. Optimum fertiliser application depends on many factors, which makes it a time-consuming and expensive process. This article discusses a Lincoln University project that aims to estimate real-time nitrogen application with minimum field sampling and cost.

Managing nitrogen flow

New Zealand is a world leader in pasture-based dairy production, with its associated advantages and challenges. Due to environmental concerns, economic constraints and farm system efficiency expectations, managing nitrogen flow on dairy farms is critically important. Leaching of nitrate-nitrogen (NO_3^--N) is politically the most significant challenge facing the future viability (environmental and possibly economic) of grazed dairy farms. Also, imported nitrogen fertiliser costs New Zealand farmers around USD400 million per year. Dairy farmers in this country use around 63% of the total nitrogen fertiliser, which is about 271,000 tonnes.

Low cost app for farmers

There are a few apps in the market that estimate nitrogen application, but some of them are not accurate or they need farm sampling or lab results. The main objective of a recently developed app at Lincoln University is to estimate nitrogen application with minimum cost and farm sampling to reduce costs and environmental impacts. Using thermal images and artificial neural network modelling together can make a powerful tool to estimate nitrogen application in different conditions on-farm.

After conducting greenhouse and field studies over the last five years, an artificial neural network (ANN) model was developed to estimate the pasture nitrogen

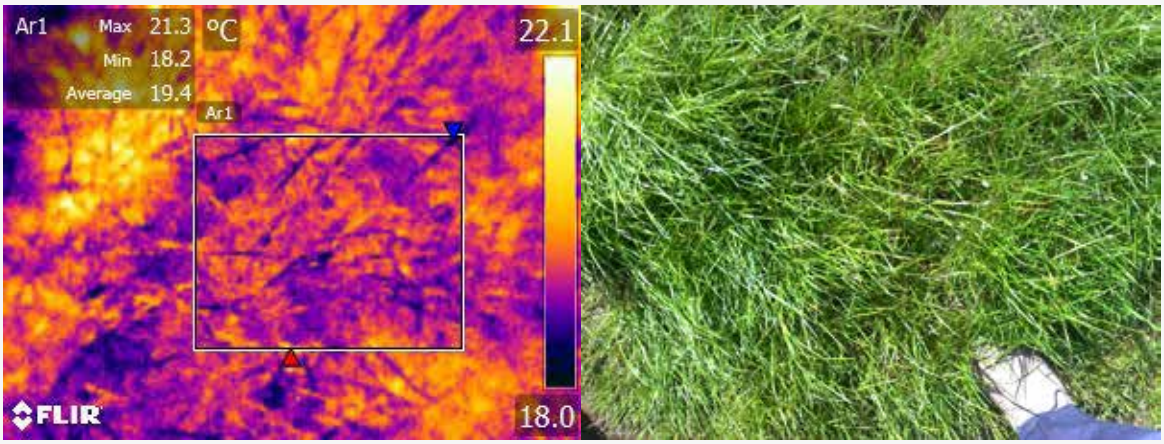

Figure 1: Thermal and digital photos of a spot

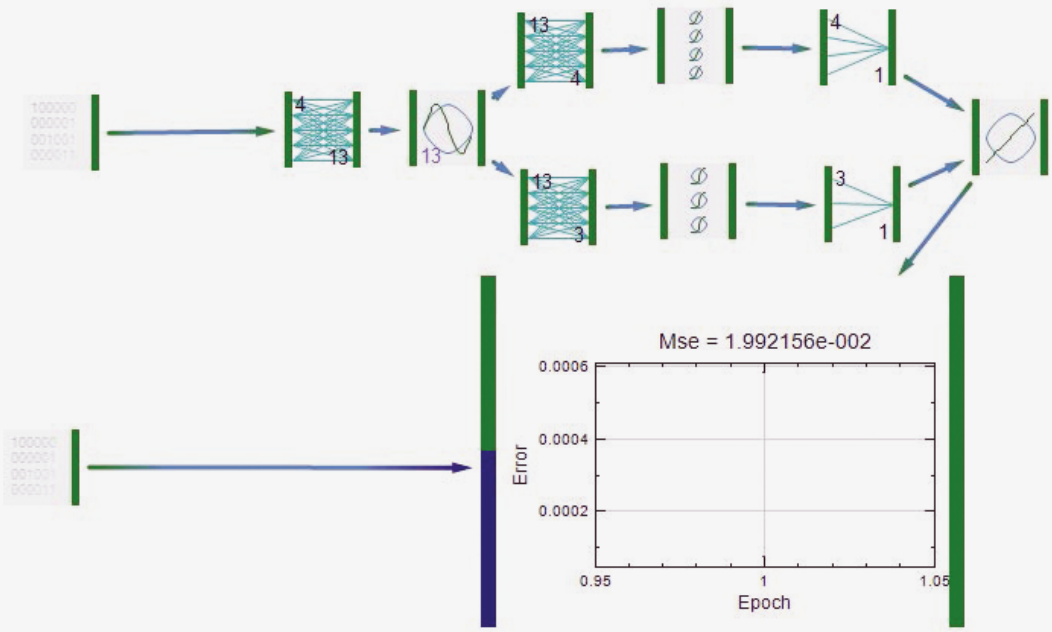

Figure 2: Structure of the ANN model

content using environmental factors and thermal imaging. The model has been designed to inform the fertiliser application of nitrogen, depending on a pasture's real-time temperature and other environmental parameters. The sensibility analysis shows plant temperature is the main independent variable in the developed ANN model.

The proposed app's ultimate purpose is to give farmers an accurate estimate of the optimum nitrogen application rate for their pasture. Farmers will choose a pasture area they want to apply fertiliser on in the dashboard app on their computer or mobile phones. The ANN model will estimate the nitrogen content of the selected pasture area using thermal images by Landsat8, with the final step being to recommend an optimum nitrogen application rate to the farmer. The current prototype uses Landsat8 thermal images with a resolution of 30 m x 30 m. For a 2 ha paddock, it is possible to take at least 23 thermal images. Existing apps can provide air temperature and LUX (solar illumination), but farmers should only need to measure soil moisture.

Development of app

An on-farm field study was developed to estimate the degree of correlation between leaf nitrogen content and the sward surface temperature of perennial ryegrass pasture (*Lolium perenne*) in 2017. A field experiment was also conducted to monitor different environmental factors and measure their sensitivities in the final model. A thermal imaging camera was used for periodic monitoring of the herbage surface temperatures (with a range between 7.5 and 13 µm). Simultaneously, some environmental parameters (including humidity, soil temperature, light intensity and air temperature) were measured in conjunction with herbage cuts to determine the dry matter (DM) yield and herbage nitrogen content (% of DM). The thermal images were investigated to find the

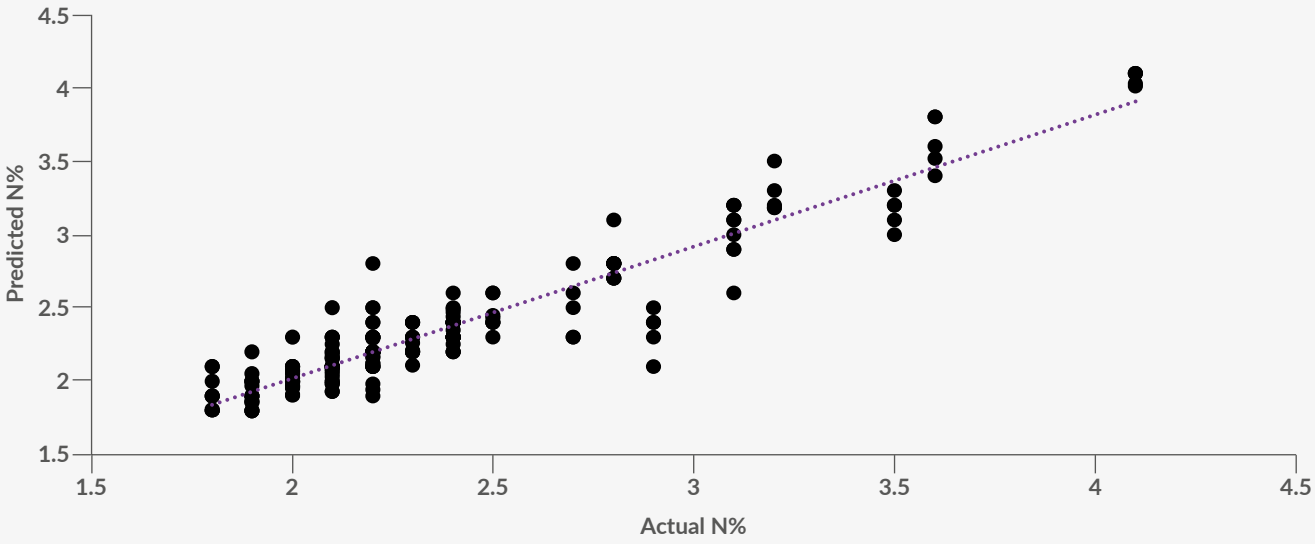

Figure 3: Relationships between actual and predicted pasture nitrogen content (% N) using the artificial neural networks model

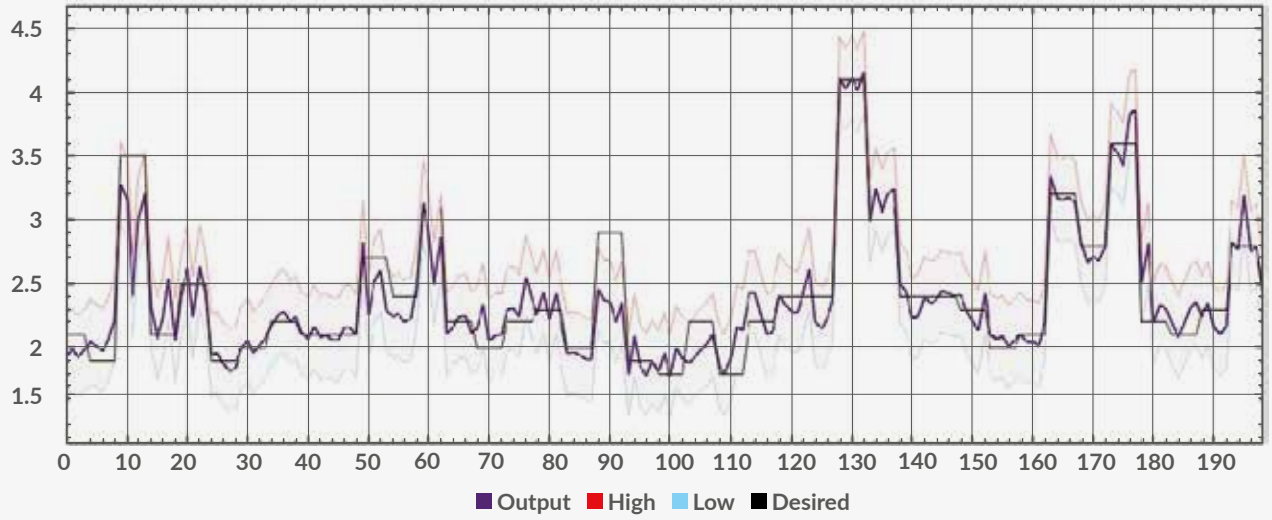

Figure 4: Predicted and actual data on the ANN model

average temperature of the grass leaves *(Figure 1)*.

After testing combinations of the different input variables in the various model structures, four inputs were selected: herbage surface temperature, soil moisture, illumination (LUX) and air temperature. Several model structures and transfer functions were investigated carefully to find a model with a minimum mean square error. These sub-tasks are trained independently using a different dataset from the input samples and their data outputs are summed in the last layer *(Figure 2)*.

The final ANN model reached the finest outcome with a scaled MSE= 1.99\ E-2 (inputs and outputs were scaled between -1 and +1 for the neural networks model). The root mean square errors (RMSE) of the final model were estimated to be 0.12 % N, which was the lowest RMSE between several models examined in this study. *Figure 3* shows the pasture nitrogen content estimated by the model accounted for 94% of the actual variability.

Figure 4 shows the final model estimated pasture nitrogen content (% N) using an error margin of ±0.32% N. To investigate the capability of the ANN model some data samples had been selected randomly as validation data. A comparison of the training and validation data revealed that the links between predicted and actual pasture nitrogen content in both the training and validation data were similar. However, it was recommended to investigate other input variables under different site conditions to minimise the error margin.

Several uncontrolled factors could change the final results, but the results of this study show that an ANN model can estimate pasture nitrogen content (%N) with an acceptably low error. These results could be used to develop a robotic platform to apply variable nitrogen applications based on pasture nitrogen content.

The sensitivity of the output to changes in each independent variable (sensitivity analysis) is estimated by

the Peltarion Synapse software. As shown in *Figure 5*, a sensitivity study of the final model showed that plant temperature (77%) is the most important factor contributing to the output, which was followed by air temperature (14%), LUX (6%) and soil moisture (2%). The sensitivity analysis shows the importance of thermal images to estimate the nitrogen content in pasture.

Suitability for farming conditions

The main challenge of the suggested app is accurate data collection under farming conditions. The sensitivity analysis shows plant temperature is the most significant input variable in the developed ANN model. We hope the satellite images can help us to collect plant temperatures. As already mentioned, existing apps in the market can provide air temperature and LUX, but farmers should only need to measure soil moisture.

As the first step, a UAV thermal image investigated the developed ANN model and the results show the model is capable of estimating the nitrogen content in a pasture *(Figure 6)*. The UAV thermal images can recognise the areas with a high concentration of urine patches, which can help farmers to manage nitrogen application. However, due to technical and financial limitations we started to focus on satellite thermal images.

The basic prototype based on thermal satellite images was developed during the New Zealand Aerospace challenge. The nitrogen content of physical samples in a few paddocks of the Lincoln University Dairy Farm was compared with the output of the developed prototype, which showed the results are very similar *(Figures 7 and 8)*. However, the prototype made it easier, faster and cheaper.

The thermal images were collected from Landsat 8 with a resolution of 30 m. If we can access thermal images from satellites with higher resolution, it would be possible to improve the accuracy of nitrogen application recommendations by having a better estimation of pasture nitrogen content of a farm paddock area. Most input variables required for our model and proposed app are either freely or inexpensively available, so the app operation would not be expensive for an end-user – the farmer. The satellite is passing New Zealand almost every week, so farmers can access the data and estimate optimum nitrogen fertiliser application weekly.

Figure 5: Contribution of different variables to the output of the ANN model app development

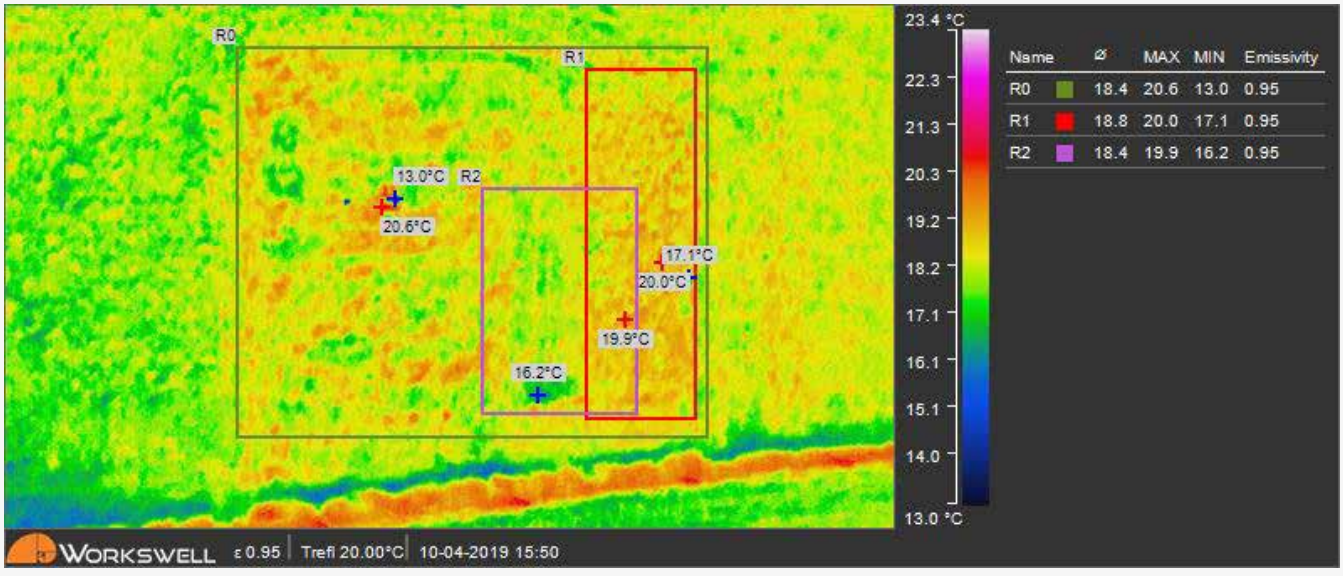

Figure 6: Thermal images from UAV

Projected plan

We hope to improve the app estimating the nitrogen content of perennial ryegrass pasture (*Lolium perenne*) based on the plant's temperatures and different environmental parameters. Based on estimated nitrogen content in the pasture and a few other parameters, we are confident it is possible to develop a professional app to estimate the optimum fertiliser application on dairy farms.

The app can be used by smartphones, laptops, tablets and desktops. It needs more investigation in different regions of New Zealand and the dashboard needs to be developed based on farmers' requirements. If the funds can be found it will be possible for dairy farmers to estimate optimum nitrogen application in a few minutes and almost for free. Also, a similar model could be developed to estimate nitrogen applications for other farm products.

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Figure 7: Thermal images by Landsat8 and the selected paddock in the prototype, which was investigated in this study to develop the prototype and validate the ANN model

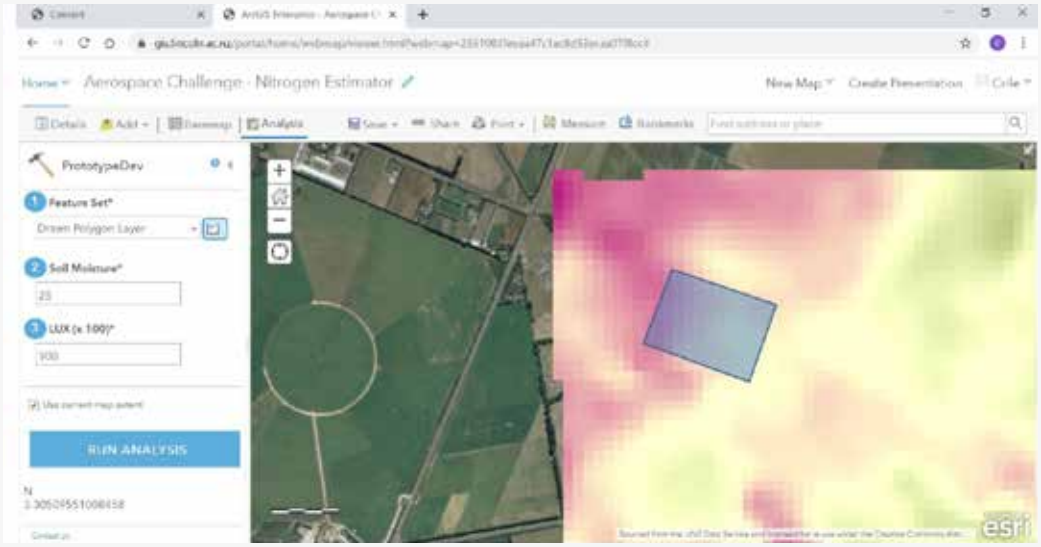

Figure 8: The prototype developed to estimate %N

EARL RATTRAY

Earl's career journey from freezing works labourer to senior dairy industry leadership roles was not deliberately planned. It gradually evolved over a long process of learning, seizing opportunities and building personal confidence, while developing a relentless optimism for New Zealand farming and its place in the global food chain. Looking back over the past 40 years, he notes that the individual steps in his career just happened independently, each one built on the last and combined to form a very satisfying career.

Earl's parents owned a small dairy farm at Honikiwi, a mainly sheep and beef farming district west of Otorohanga. His school holidays passed very quickly, with ceaseless local demand for summer haymaking, shearering rousies and relief milking labour. Listening to conversations and gaining a glimpse into the lives, businesses and thinking of a wide range of farmers, usually principled and hardworking people, fed his early curiosity about what shaped the big picture of farming and our agricultural economy. He recalls it always seemed to be that when the chat moved from the weather onto things like prices for lamb, wool, butterfat, or the merits of subsidies or tariffs, trade unions, co-ops and producer boards (and of course government policy), then the place would light up. These were the hot points which animated farmers.

The dark age of big government

The period between the mid-70s and mid-80s was the age of big government in New Zealand. Our primary industries were deeply influenced by state interventions on both the input and output sides of the value chain.

Earl notes that we often see commentators running with the hares and hunting with the hounds, placing too much emphasis on the headline in yesterday's paper and not separating the short-term noise from the underlying trend.

This country was coping with massive economic and social change in the decade spanning the mid-1970s to mid-1980s. Our agricultural export industries were heavily integrated into the UK market, which had recently joined the European Common Market, and they were under pressure as New Zealand's market access was gradually constrained. While dairy exports at the time were just one-fifth of today's volumes, 70% of that went to one market in just two product categories. Even a schoolboy could understand the risk in that.

At the same time, importing, manufacturing and exporting anything was heavily regulated and controlled through government licensing, essentially creating monopolies for favoured interests. This protectionist environment created a 'cost-plus' economy. Annual price inflation ran rampant, always in double digits and getting close to 20% in some years over the decade. Export industries got crunched in the grip between rapidly rising internal costs and gradually eroding export prices. Successive devaluations of the New Zealand dollar saw it fall from USD1.45 in 1972 to USD0.45 just over a decade later. New Zealand became a relatively poorer country. Deep state support for agriculture was then generously applied through an assortment of input subsidies, incentives and guaranteed minimum prices, all underwritten by the taxpayer.

Massey and the Economics Service

After leaving school Earl spent 1977 at the Finegand freezing plant at Balcultha, attracted by the big pay envelopes freezing workers received in those days. A series of strikes quickly diluted his enthusiasm. Around the same time, he happened upon a Massey University publication outlining a new Agricultural Economics degree course on offer. He hadn't studied economics or accounting at school, but the programme seemed to intersect with his curiosity about markets, exports, prices and policy which he had grown up hearing about. With nothing to lose he enrolled, finishing strongly and developing a passion for macro and quantitative economics, as well as the wonders of accounting.

After graduating in early 1981, Earl joined what was then the NZ Meat and Wool Boards' Economics Service. He believes it was his good fortune to join that organisation at that point in history. It was a nurturing environment to work in, and operated very much in the non-fiction world of managing big data, explaining the past and anticipating the future.

One of the key learnings from his Economics Service days, which he says has helped him enormously through his later career in the dairy industry, was understanding the simple truth when forecasting anything: 'The trend is your friend.' Earl notes that we often see commentators running with the hares and hunting with the hounds, placing too much emphasis on the headline in yesterday's paper and not separating the short-term noise from the underlying trend. He says he has lost count of the number of times price commentators have explained above-trend price spikes as the beginning of a 'new age' or a 'paradigm shift', or some other creative phrase suggesting a permanent shift in the market. In fact, prices were just doing what prices do – reflecting the current balance of supply and demand.

Farming years

The next pivotal step in his career came in 1986 when Earl and his wife Joanne made the call to go sharemilking. His parents were about to retire and asked the family if anyone was interested. In the mid-1980s farming had been up-ended by the dismantling of subsidies and price support. Even the Prime Minister, the most influential voice in the country, infamously said around that time that farming was a sunset industry, so the prevailing mood was very negative.

Against this background he faced the vexing choice about whether to stay in a stimulating role in Wellington or swim against the tide and go farming. Then, as now, banks were shrinking their exposure to farming, but cashed up they were able to buy the herd and plant. The following year his dairy farming career began. Strategically it was a massive bet, but with hindsight the timing was perfect. Earl reflects that making big decisions without perfect knowledge is always risky, but being captured by negativity is fatal.

Behind all the hyperbolic language of doom and gloom at the time there were less obvious, but very positive, developments emerging. First, few countries, if any, were more disadvantaged in world agricultural trade than New Zealand. Market access to wealthy consuming countries was very limited, while subsidised exports from those same closed markets were very damaging to world prices. The Uruguay round of trade talks, which were announced in 1986 and lasted eight years to eventually spawn the WTO, was a seminal event for New Zealand agriculture. Any trade liberalisation had to be good for our farmers. Secondly, New Zealand's dairy industry was advanced

Earl says that one of the biggest changes in the agricultural supply chain over the last 40 years has been the gradual shift in decision-making from farmers and their producer organisations to downstream customers and consumers who now call the shots.

in its tilt towards Asia. While wealthy markets were virtually closed, the poorer ones were open for business. Poor countries become richer over time and, as happens, demand for everything (especially food) increases.

Earl found those years of farming very energising. He says, 'I was living the dream. I would work until dark, and turn in early because I couldn't wait to jump out of bed the next morning.' Three years later the banking sentiment had changed, as it always does. He purchased the farm and subsequently added to it.

Dairy industry governance

Earl's interest in dairy co-op matters arose out of his curiosity about conflicting reports on the operating performance and financial position of local competing co-ops. Faced with having to decide on which one to supply milk to, he spent winter evenings picking apart company reports, and interviewing directors and executives to make sense of it. The investment in time paid off, as it helped build his confidence and understanding about how the industry worked and why dairy co-ops succeeded or failed.

By 1995, he was elected to the Board of the Hamilton-based NZ Dairy Group as a shareholder director, and was subsequently appointed by the Dairy Group onto the NZ Dairy Board. In 2001, Earl became one of the founding directors of Fonterra and was later instrumental in establishing the NZ Dairy Companies' Association of New Zealand, becoming its inaugural Chairman in 2003.

The dairy industry was in transition in the 1990s. Its structure was still a legacy of a time when dairy exports were largely generic commodities. At its centre was the NZ Dairy Board, a statutory body whose functions were prescribed in law. The structure was coming under increasing pressure, both internally and externally, as product mix evolved and increasing amounts of capital investment were needed to process the rapidly growing New Zealand milk supply, as well as in downstream market and brand development. The concept of operating a statutory monopoly exporter was also coming under greater scrutiny in trade liberalisation efforts.

Forming the mega co-op Fonterra by integrating the last two major co-ops with the Dairy Board, rather than trying to split its business between the two, was a major enabling step for the dairy industry. Critically, the integration provided full visibility into the entire value chain, eliminating the artificial separation of revenue captured by the Dairy Board, and the operating and capital costs incurred by the processing co-ops, unleashing significant opportunity for efficiency gains.

A key outcome of the integration was enabling the new company to derive an independent milk price, essentially what the company must pay for milk before it prints a profit. It took the introduction of the Global Dairy Trade auction (GDT) to fully bed down an externally verifiable milk price. This was a game-changing initiative, where the value of New Zealand milk is set by a transparent market involving hundreds of participants, rather than obscurely by a few internal traders who had an inherent conflict between maximising milk value and company value (profit).

Earl expects Fonterra's ownership structure will continue to evolve. He says the reality is that one size does not fit all, even in a co-op. Young farmers or aggressive growers often want a milk price business only and not be obliged to buy-in to value add investments. Others want the company's value-adding investments like brands and IP to do the work for them. All value-adding co-ops have to resolve this conundrum one way or other. While Fonterra has had some recent trauma, he believes the company is fundamentally very strong. Earl feels it is worth noting that in the past an investment write-down was simply lost in the milk price, but now there is nowhere to hide, it appears openly in accounting losses where it should reside.

Recent activities

After leaving Fonterra, and in the wake of the 2008 GFC, Earl served a three-year term as one of the independent advisors on the RBNZ Monetary Policy Committee. He says he couldn't have picked a more interesting time for that role, which saw the biggest interest rate cuts in recent history.

Today, Earl retains ownership of his original farm at Otorohanga and holds interests in several others in New Zealand and offshore, being especially active in India. He balances his time among governance roles and working for a Geneva-based strategic food consultancy, GIRA, where he focuses on insights and analysis of Oceania and Asian dairy markets.

Prospects for pastoral-based industries

Earl is enthusiastic about the prospects for New Zealand's pastoral-based industries. For dairy, demand

is rising every year in the markets which are open to us. Occasionally, supply gets ahead of that market growth and prices correct, then so does supply. The milk deficit in Asia will continue to grow, which will mean more dairy ingredient imports that will have to come from somewhere and prices will go up to ensure it does.

He feels that safe, affordable nutrition is still a principal driver of demand in many of New Zealand's agricultural export markets, but final consumer demand always evolves over time as disposable incomes grow. Manufacturing consistency, product safety and environmental integrity all favour the New Zealand provenance story, and these features are now well-established value-adding drivers.

Earl says that one of the biggest changes in the agricultural supply chain over the last 40 years has been the gradual shift in decision-making from farmers and their producer organisations to downstream customers and consumers who now call the shots. Running alongside this has been the globalisation of supply, brands and retailing and consolidation of small firms into large production/industrial units. He sees our current challenge is conducting farming in ways which speak to society of the virtues of pastoral farming, but he acknowledges that task becomes harder as farms get larger, consolidate, corporatise and intensify.

He says farmers and agriculture generally have taken a beating lately, and confidence has been unduly undermined. Certainly, it's no fun for any farmer feeling like you are public enemy number one when, by any measure, we operate the most environmentally benign farming system anywhere.

Earl said he is not aware of any other country which is proposing to include biological emissions in their Paris climate agreement commitments. He notes the New Zealand government has chosen to do that, it wasn't obliged to, but probably did so because it has very little else to turn to given agriculture remains such a big part of a small economy. He believes this, in itself, is a reflection of the success of agriculture in New Zealand.

He also notes that the sector hasn't declined into irrelevance, despite being written off, undermined and disparaged regularly over its history, while year after year it continues to underwrite the wealth and welfare of the entire nation. Earl believes we should celebrate that, but at the same time recognise our government has a problem and we should help them solve it. He is confident that emerging technologies and honest carbon accounting will help enormously in that task.

Earl believes you have to play the long game in agriculture. Commercial reality and scientific fact will always win out over politics, and eventually the market will decide what the truth is. For now, that market is hungry for the meat and dairy we produce here and appreciates the way we produce it.

Earl believes you have to play the long game in agriculture. Commercial reality and scientific fact will always win out over politics, and eventually the market will decide what the truth is. For now, that market is hungry for the meat and dairy we produce here and appreciates the way we produce it.

Earl also believes every generation in agriculture has inherited some problems it has had to solve, and that today's challenges are no more or no less formidable than what we have faced before.

Earl says well-resourced and well-led champions of agriculture will always be critical to leading adaptation. Our processors and exporters, together with industry support organisations and professional associations like the New Zealand Institute of Primary Industry Management and Federated Farmers will play a vital role in shaping our future.

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