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THE JOURNAL

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

REGENERATIVE AGRICULTURE – DIFFERENT PERSPECTIVES REDUCING GHG EMISSIONS ON-FARM
ECONOMICS OF FERTILISER USE INTEGRATING MIGRANT DAIRY WORKERS INTO NZ **FARMER MENTAL HEALTH**

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NZ Institute of Primary Industry Management

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COVER PHOTO
Highly diverse fodder crop including sunflowers.
Photo courtesy Jono Frew

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STEPHEN MACAULAY CEO

Regenerative agriculture debate – where tribalism trumps pragmatism

It is with some trepidation that I dip my toe into the murky waters of the regenerative agriculture debate. As an interested observer from the sidelines, I have found the debate to be polarising and highly emotive, reducing our ability to rigorously interrogate regenerative agriculture practices to the extent that we should be.

Unfortunately, the diverging views around regenerative agriculture has manifested itself into those who support such practices and those who question its authenticity, with no quarter given between. Worryingly, this form of tribalism does represent an increasing trend in today's society where individuals seek to simplify things into easy binary terms of right or wrong, which limits their appetite to actively seek out and engage with more diverse perspectives.

This is further exacerbated through the influence of social media, unlimited access to information from the internet and sophisticated algorithms to direct news and media intake, and provides a platform for like-minded users to frame-up and reinforce a shared narrative within echo chambers. Unfortunately, this leads to a level of distrust of anybody operating outside of that chamber and a general reluctance to discuss other points of view.

There is no shortage of engaging and thought-provoking Youtube clips, media articles and information sources available on farmers applying regenerative agriculture practices within their farm systems. These are mostly internationally-based stories, and I can see how certain Youtube clips showing the transformation of farms in arid climates into productive fields is appealing. If this were a viral media campaign, I would say the advocates for regenerative agriculture have been phenomenally successful in promoting their farming practices and principles compared to more conventional-based farming systems.

As a relative newcomer to regenerative agriculture compared to the US and Australia, our farmers and others are trying to work out which practices work, and don't work, in New Zealand's temperate climate. This also needs to extend to determining what regenerative agriculture actually means within a New Zealand context. The muddling and varied interpretation of what regenerative agriculture practices looks like on-farm has no doubt confused our ability to have reasonable broad-based discussions on the subject. This is further compounded by the rhetoric that regenerative agriculture is a continually evolving set of principles.

Even under the Primary Sector Council's *Fit for a Better World Strategy*, a different tack has been taken with regenerative agriculture being referred to as something we have always done. The Council notes that New Zealand has a 'long tradition of regenerative practices and principles including of enriching soil health, holistic management, balance, diversity, respect and connection with past and future generations.'

I expect there are large numbers of farmers who might already consider their farming practices to be regenerative, but don't choose to label these as such. Some of the outcomes being sought under regenerative agriculture practices (e.g. better soil health, increased macroinvertebrates, higher water retention, etc) would be the same types of outcomes that other farmers would also strive for. In fact, conventional-based farming enterprises may be closer to some of the principles of regenerative agriculture than is generally portrayed in the media and by various commentators on the subject.

A positive thing to come from the debate is the desire to test some purported benefits of regenerative agriculture practices on-farm. Currently, the Ministry for Primary Industries is calling for proposals for research projects to investigate regenerative farming practices in relation to New Zealand soils, climates and farming systems.

To help better inform and equip rural professionals when discussing regenerative agriculture practices with their farming clients, we have brought together a range of articles in this issue of *The Journal* to assess different standpoints on the subject. I encourage you to approach the subject with an open mind and actively interrogate the facts and claims being made. It is also important to analyse how you inform yourself in developing more diverse perspectives on regenerative agriculture practices, or for that matter any other new and developing areas within the primary industry in expanding your understanding and knowledge base to have more informed discussions with your clients on regenerative agriculture and its many parts. J

OPINION PIECE
BENJAMIN SCOTT

REGENERATIVE AGRICULTURE
A FARMER PERSPECTIVE

After pursuing a professional career as a civil engineer Benjamin Scott returned to the family farm five years ago. Two years ago he was keen to try a different farming system, so decided to learn more about and apply regenerative agriculture principles to the farming operation. In this article, he provides his perspective on regenerative agriculture, his motivations for using it, and the implementation of processes on-farm. He also discusses the results so far, as well as providing insights to those who are thinking of applying it on-farm.

What is regen ag?

Regenerative agriculture (regen ag) at its core seeks to improve or revive a farm's resource base (soil) by enhancing natural landscape functions that can improve water quality, increase farm resilience to climactic variability, raise productivity, improve water-holding capacity and infiltration, and fix large amounts of atmospheric carbon long term into the soil profile. Natural landscape function can be broadly grouped into four categories:

- Water cycle
- Mineral cycle
- Community dynamics
- Solar cycle.

They are all inherently linked and interrelated (i.e. one cannot be altered without affecting the other three). It is this focus that sets apart regen ag from conventional agriculture.

Conventional agriculture (a product of the green revolution) is typically characterised by large-scale monoculture farming, with a heavy reliance on synthetic fertilisers, agri-chemicals and tillage. These practices are stitched into the fabric of the modern farmer and deemed necessary to produce enough food and fibre to support the global population, even though they are the main reason 12 million ha of productive land is lost every year due to soil degradation (as reported by the United Nations https://www.unccd.int/actions/united-nations-decade-deserts-2010-2020-and-fight-against-desertification).

This is because these practices have proven to cause unintended consquences (such as water quality decline, soil erosion, soil carbon loss, increased pest pressure and lowering farm resilience to climatic shock events).

Enter regen ag, the farmer-led innovation that believes working with nature (instead of against it) can mitigate or reverse these problems. I first heard about regen ag when my sister mentioned an Australian farmer who was growing topsoil through a process called 'regenerative agriculture' and was earning carbon credits under their emissions trading scheme. As I researched into what it was, I began to tick the check boxes against the threats that are raised later in this article. It was liberating to learn that agriculture, one of the leading causes of climate change and environmental degradation, could possibly also be the solution by simply changing management processes.

In theory it made sense – to support the natural process that nature has already figured out to produce forage. Regen ag is a low cost, low input system which could appeal to consumers due to its environmental benefits. It is a new approach to farming that requires a significant investment in knowledge, but a smart approach is required if we want to see meat and milk produced under a natural production compete against alternative protein products. It is also a system proven to increase farm resilience and have a net decrease in carbon emissions through carbon sequestration.

Arguably, most farm owners have a sense of stewardship over their land and wish to pass it on to the next generation in a better condition. This is at least reflected in my family farm, where I am fortunate enough to have the opportunity to one day take over a property that has been meticulously farmed and where an extraordinary amount of time and money has been reinvested by my parents over the decades. With much conservation work having already been done, I am merely playing around with the end product.

Motivations for moving to regen ag

My motivation to shift to regen ag is also based on stewardship, not only environmentally but commercially. I wish to see our farm build on the hard work that has come before, and I hope the decisions I make today have a profound and positive effect on the future success of the business, the environment and future generations.

Above all, what excites me about regen ag is the feeling that you are part of the solution and not the problem. Farming (especially dairy) has become a dirty word in New Zealand, and although regen ag will not change consumer opinion overnight, I believe the proof will be in the pudding. It also gives you an excuse to experiment on-farm and not necessarily remain indoctrinated to the conventional system.

I had made the decision to come back and work on the family farm in 2016 after studying and working as a civil engineer in Auckland. The apparent mechanical nature of farming was appealing, where production outputs could be measured and forecast based on various inputs. However, I quickly learned that a farming operation is much more complex. Throw in weather, animals, pasture, staff, crops, soil, budgets, etc, and everything becomes a trade-off.

In a futile attempt to manage what was a complex array of interrelated systems the only thing I was succeeding at was working ever longer days. During drought years I found myself spending upwards of nine hours a day just feeding out bought-in supplementary feed and paying the bank for the pleasure. To me this did not seem sustainable. My initial thoughts were that more mechanical interventions were required (such as feed pads, in-shed feeders, automation and so on).

It was my Masters in Business Administration studies that helped me make sense of the situation. It forced me to take a discerning view of the agricultural industry. Four key factors therefore influenced my decision to shift to a regen ag system: the law of diminishing returns, changing consumer preferences, alternative protein products and climate change.

Law of diminishing returns

Agriculture is particularly subject to the law of diminishing returns as a commodity producer. This law states that as we add more inputs to increase production the marginal return from each additional unit of output gained decreases. The trend can be reset/altered by a material capital investment or management process that can significantly increase production efficiency. With farming, in particular, large capital investments are generally coupled with higher input costs (such as extra plant, labour or supplementary feed) to utilise the new investment. These investments are usually debt financed, adding more overhead cost.

Significant capital expenditure in pursuit of production gains will lead to a faster rate of diminishing returns until the next capital investment is made. Moreover, on-farm costs are steadily rising and at a faster rate than commodity prices for meat and milk. This strategy also increases the risk profile of the business, especially in a volatile market. Therefore, a low input, low cost farming structure looking for operational efficiencies through changes in management processes will (in the long run) likely be more profitable than a high input, high cost structure system.

Changing consumer preferences

It is also now the widely accepted narrative that conventional agricultural is impacting negatively on climate change and that the consumption of too much red meat is not good for your health. In developed countries there has been a growth in the number of vegetarians, vegans and flexitarians (those with a semi-vegetarian diet). There is also a category of consumers who still identify as meat eaters, but have significantly reduced their consumption and only seek out high quality products.

In developing countries (the main contributors to global population growth) there is demand for more protein and

Multi-species crop

red meat, but it is unsure which path they will take regarding consumer needs, behaviours and expectations. Demand for clean, pure and unprocessed foods is accelerating, and food that is closer to the farm (often referred to as organic, natural, sustainably grown, free-range or grass-fed) will appeal to premium food markets worldwide.

Alternative protein products

Consumers are also choosing to make what they feel is an ideological decision to eat alternative protein, which is linked to the backlash against broken food systems (such as factory farming). The lesson here is that we need to start listening to the consumer and adapt our processes to be more in line with their preferences, or risk losing them altogether.

Biotech start-ups (such as Impossible Foods Ltd) have developed a plant-based patty that bleeds like real meat and contains an iron molecule extracted from the roots of soy plants. Impossible Foods Ltd received funding from Google Ventures and Bill Gates raising over $250 million. There is increasing media coverage highlighting alternative protein products in lieu of real meat or dairy. One of the latest examples was Air New Zealand being the first airline in the world to serve the 'Impossible Burger' to business premier passengers.

Another alternative protein innovation is cultured meat or synthetic meat (marketed as 'clean meat'), which is derived from stem cells and produced in a laboratory environment. The first marketable cultured meat produced by MOSA Meat Ltd in 2013 attracted the attention of Google's Sergey Brin who invested heavily in the company. It also attracted the attention and imagination of many ethically concerned scientists who are actively researching protein biosynthesis, resulting in many more start-up companies producing alternative protein products globally.

This industry uses similar technology to genetically modified organisms (GMOs). Therefore, using GMO technology in agriculture will only legitimise this production process and make it harder to include the word 'natural' in our value proposition. Investors in alternative protein products are wealthy and experienced in creating and marketing consumer packaged goods, and they are raising the game for the historically niche vegan/vegetarian category. Primary producers of meat and dairy need to work smarter, not harder, otherwise we will most certainly be disrupted.

Climate change

Conventional agriculture is heavily dependent on inputs (such as superphosphate fertiliser, agri-chemicals, heavy machinery and tillage), which has been linked to global environmental degradation (such as soil erosion and desertification) and is a key driver influencing climate change. Despite being the leading driver for climate change, it is ironically the most vulnerable to its effects, with models showing that growing conditions will become increasingly challenging due to drier, hotter and variable conditions. In persisting to operate using our current production techniques, it means we are essentially doing ourselves out of the job.

Implementing regen ag on-farm

Regen ag farming practices are wide and varied, but are all trying to achieve the same goal, which is enhancing natural landscape function. We opted for a staged approach in our transition. First, we sought to stop or buffer the farming practices that harm soil health. This included changing our fertiliser programme to more biologically-friendly products (such as guano instead of superphosphate, sulfate of potash instead of muriate of potash, incorporating biological enhancers like humic acid and seaweed, and discontinuing the use of nitrogen fertiliser).

The goal here was to stop killing the microbes in the soil, address mineral imbalances to discourage weed succession, promote mycorrhizal fungi growth, and fix more nitrogen naturally. We are also experimenting with multi-species crops *(see first photo)* and pastures

Multi-species pasture

(see second photo), holistic grazing practices, no-tillage cropping, and introducing more biodiversity into our existing pastures. As our soil becomes more functional the fertiliser can be decreased, with future applications used to address only those factors that are limiting for plant growth.

To determine whether soils are becoming more functional, close observation of nutrient cycling and soil food web testing is required. The soil food web is a concept about the organisms living in the soil and the interaction between plants, animals and the environment (see www.soilfoodweb.co.nz who do soil biology reports analysing how functional this web is). A sign of poor soil function can be the slow decomposition of surface materials such as cow dung and thatch. Comprehensive testing of microbial activity in the soil can help quantify how active they are. The more active the microbial life is the more nutrients that will become available to the plant (i.e. improving the efficacy of how your soil functions reduces the amount of fertiliser required to sustain productive forage growth).

Results and measurements

We have only been transitioning to a regen ag system for 18 months but are starting to see the benefits already. Multi-species pastures are producing more quality summer forage than general rye clover pastures. There has also been a significant increase in earthworms in the soil. Despite stopping nitrogen fertiliser, herbage test results show that nitrogen levels are nevertheless at desired levels as legumes are fixing nitrogen into the soil. Their nodules are blood red inside *(see third photo)*, a phenomenon that simply does not happen if you frequently apply nitrogen fertiliser and/or pasture spray agri-chemicals.

A reliable measure for monitoring whether all landscape functions are effective is the infiltration test. We have only collected benchmark data to date and will track the trends over time. Interestingly the dry stock block, which typically has higher post-grazing residuals, has on average better infiltration rates then the dairy block, which usually gets grazed down lower each round.

Financial impact of regen ag

One financial benefit has been through lowering cropping costs by using a no-tillage approach, no synthetic fertiliser (effluent solids only), and no herbicides or insecticides. The broad range of plant species means they develop natural bio controls for pests, and with so much competition from desired plant species weeds struggle to germinate. It also requires fewer tractor passes, saving in labour and diesel. This season (not including contracting), direct costs were 29% less than using a clean crop turnip system. There was also a significant decrease in contracting cost of 62% as no cultivation and spray application was required, only direct drilling. Long-term environmental cost savings include no loss of carbon into the atmosphere as the soil surface remains undisturbed, plus the topsoil is not lost to wind and erosion post-grazing because the soil remains covered compared to a turnip crop.

There has also been a production spike in milk solids since starting the crop. As we are staging our soil nutrient requirements the fertiliser costs are the same. There has also been an overall decrease in agri-chemical use, no nitrogen fertiliser applied and no imported PKE (while still maintaining production). The stopping of PKE was more of an ethical decision as opposed to financial as regen ag prompts you to consider the consequences of your decisions beyond the farm gate.

Stocking rates and animal performance levels

Many of regen ag practices mentioned above are low risk and are merely substitutes for conventional practices. It is the regenerative grazing practice known as 'holistic management' that poses the biggest risk financially for animal performance.


Inside clover nodule

This is because it is not yet completely understood how to adapt grazing techniques that were developed in arid to semi-arid climates to temperate climates like New Zealand.

The practice promotes high-density grazing utilising only the top third of the plant with significant trampling effect. The short duration grazing means more frequent shifts are required and long round lengths to let pasture fully recover. This method of grazing helps farms become more tolerant to drought, restores soil function, and improves water infiltration and animal health. This is currently a topic of research for my Masters study, with the goal of answering the following questions:

- How have New Zealand farmers implemented holistic management to better optimise their environment?
- What are the barriers and facilitators for farming in the transition phase?
- What can be learnt about the transition process that may benefit future holistic management adoptees?
- How can the transition from conventional farm management to a holistic management be optimised?

Once fully understood I want to focus more on the grazing aspect of regen ag.

Advice to farmers moving to regen ag

With learning any new trade, it takes time to develop the knowledge base and it can be overwhelming hearing about the different farming techniques used by regen ag farmers. I found it easier to get a good understanding of the fundamentals first (namely, the four landscape functions mentioned above) and then to figure out what works best for your operation.

Be critical about any advice you receive and experiment on a small area first. Also, when experts question your decision keep in mind that there are two schools of thought: reductionism and holism.

Primary producers of meat and dairy need to work smarter, not harder, otherwise we will most certainly be disrupted.

Reductionism

This is where variables of complex phenomena are isolated and a hypothesis is developed and tested against a control to obtain a causal outcome. Its successes have been in the mechanical world of technology. Reductionism nevertheless governs agricultural practice, which is a complex natural system.

Holism

This is a systems thinking approach and is a proven and widely-used problem-solving technique for managing complex phenomenon where a causal response is extremely difficult to achieve due to many interrelated variables. For example, civil engineers are trained in systems thinking and it is always applied to large infrastructure projects where many stakeholders are involved.

Engineering uses the most advanced technology (that the budget allows), but how it is applied is governed by a holistic decision-making process assessing all possible outcomes and 'what if' statements. The result is a 'best fit' outcome and not necessarily the most technologically advanced solution prevails. It is a classic example of holism and reductionism working together to achieve the best result.

Regen ag is effectively the same scenario. It is a holistic approach that guides decision-making but uses mechanical innovations as a tool-kit for implementation. Regen ag is not discounting the work done in the field of agricultural science, but recognises the fact that it should not be used to govern decision-making that could lead to unintended consequences.

Conclusion

The journey into regen ag has been very rewarding so far. What I first considered to be a bleak outlook for the agricultural industry now has real potential to enact positive change economically, environmentally, and socially on our farm. It can do this by mitigating some of the key threats mentioned above. We have only seen positive outcomes so far. However, I believe the biggest gains can be made in the grazing management of stock. This potentially poses the largest risk in terms of animal performance during the transition phase as the system is being tuned and mistakes are made, but equally there are large gains such as drought mitigation, soil restoration and animal health.

Benjamin Scott is a dairy & beef farmer in Te Kuiti. He is also undertaking a Masters in Business and Administration through Waikato University with his research project on the topic of regenerative agriculture. Email: scott.bw@outlook.com

CHARLES MERFIELD

AN INTRODUCTION TO AND ANALYSIS OF REGENERATIVE AGRICULTURE

Regenerative agriculture (regen ag) is a set of farming practices and a social movement that has been increasingly taken up by farmers in New Zealand over the last decade. Over the last four years it has now gained considerable national visibility and traction, such that MPI has launched a dedicated regen ag research fund in December 2020. The relative novelty of regen ag and diversity of influences means that its origins and exactly what it is about are unclear for many and some have expressed scepticism or even dismissed it. This article provides some background as to its origins and key components.

Highly diverse fodder crop including sunflowers. All photos in this article courtesy of Jono Frew

What's in a name?

While many would like a clear and concise definition, currently this is not possible. First, the name 'regenerative agriculture' is one of a number of names used to describe the same general farming approach, including biological farming, holistic grazing, natural farming, humus/carbon farming, amongst others. In New Zealand, starting in the early 2000s, carbon farming morphed first into biological farming, which then morphed again into regen ag. This means that regen ag is therefore not just one thing.

The use of the term 'regenerative', however, is a very deliberate reaction against the term 'sustainable' because regen ag proponents consider that 'sustaining' (i.e. keeping the same) is not good enough and that it is also possible to sustain something in a sub-optimal (even degraded) state. Using the term 'regenerative' is therefore considered something of a line in the sand, in that regenerative farmers are by definition improving their farms and reducing their environmental impacts.

There are also a range of other farming practices and systems seen as being more distantly related to regen ag (such as organic agriculture, agroforestry, permaculture, no-till, cover cropping, agroecology etc). These can be grouped together as the 'alternative agricultures' (alt-ags) because they are all alternatives to mainstream/intensive agriculture. There is a considerable cross-over of ideas and practices between the alt-ags.

Regen ag is still evolving globally, especially in New Zealand as the overseas versions of it are adapted to our farming conditions. Regen ag also has no governing body, only a set of associations and networks that often have no formal linkages with each other. So, unlike organics, which has a single international body in the International Federation of Organic Agricultural Movements (IFOAM) and formal definitions, principles and rules, regen ag is still quite fluid.

The origin of the term and concept of 'regenerative agriculture' is also not unambiguously known. It was first used in the academic literature in the late 1970s and early 1980s, but there are no clear linkages between those early uses of the term and current regen ag (i.e. it is likely the term and practices have been reinvented multiple times).

A major point of confusion is the term 'regenerative organic agriculture' coined by Robert (Bob) D. Rodale in 1983, the son of Jerome I. Rodale who founded the Rodale Institute in 1947, the leading organic agriculture research

Tillage raddish

Regen ag is still evolving globally, especially in New Zealand as the overseas versions of it are adapted to our farming conditions.

organisation in the US. In 2017, this was formalised by the creation of 'Regenerative Organic Certified' (ROC). However, ROC is an extension to certified organic production with a focus on soil health, and animal and worker rights, and therefore is quite different to mainstream regen ag. For example, most regen ag farmers are not certified organic, so would be unable to obtain ROC, and organic farmers could not implement some aspects of regen ag (such as no-till which is currently difficult or impossible without systemic broad-spectrum herbicides that are prohibited under organic certification). ROC is therefore related to regen ag by name only.

As a formally agreed definition of regen ag does not currently exist, it is more helpful to look at its objectives and practices to understand it.

Key objectives and practices

In keeping with the fluid nature of regen ag and lack of agreed definition, there are also no formally or universally agreed set of regen ag objectives and practices. There are, however, a growing number of organisations dedicated to regen ag, most of which outline the key objectives and practices as they view them. Some of the main organisations/associations are:

- Terra Genesis International (terra-genesis.com and regenerativeagriculturedefinition.com)
- The Regenerative Agriculture Alliance (regenagalliance.org)
- Regeneration International (regenerationinternational.org)
- Regenerative Agriculture Foundation (regenerativeagriculturefoundation.org)
- The Carbon Underground (thecarbonunderground.org and thecarbonunderground.org/our-initiative/definition).

Most regen ag associations are based in and originate from North America, with Australia being second in the level of activity. The dominant regen ag farming systems in both regions are extensive livestock and lower intensity arable/row-cropping, and particularly mixed farming systems with both arable crops and livestock. These are often situated in lower rainfall areas represented by temperate grasslands, savannas and shrubland biomes.

It is suggested that the objectives and farming practices of RA have been shaped by the biophysical constraints of these biomes, in a similar way to how organic agriculture has been shaped by the climate, soils and farming systems of Northern Europe (UK, Germany, Denmark etc) where

Improving soil health is considered to be the core objective and focus of regen ag. Soil health is viewed holistically (e.g. it includes biodiversity but the main aim is building soil carbon/organic matter and thus improving soil biology).

it originated. From the above sources and scientific publications key regen ag 'practices' have been distilled:

- Minimising or eliminating tillage (i.e. no-till)
- Avoiding bare soil/keeping the soil covered at all times with living plants or residues – 'soil armour'
- Increasing plant biodiversity (both pasture and crops)
- Integrating livestock and cropping (mixed/rotational farming).

Then there are further practices that are listed by three or less sources:

- Maintaining living plants and their roots year round
- Increasing soil fertility through biological means.

In the New Zealand regen ag group 'Quorum Sense' (QS) – named after 'quorum sensing' which is the ability of microbes to detect and respond to cell population density by gene regulation – there is also a keen interest in reducing the amounts of soluble/mineral fertilisers. There is a strong belief that nitrogen fertilisers, in particular, are detrimental and the aim is to replace them as much as possible with biologically-fixed nitrogen via legumes and free-living diazotrophs.

Some in QS also express the view that they have been over-fertilising with phosphorus and other nutrients and are aiming to utilise existing soil P by increasing the biological activity of the soil, especially via mycorrhizal fungi. There is also considerable interest in the base-cation saturation ratio (BCSR) soil nutrient testing approach, also called the Albrecht-Kinsey system, even though mainstream soil scientists widely consider the approach to be unsubstantiated at best.

Likewise for the pesticides (herbicides, fungicides and insecticides), there is a view among QS that they have negative effects, particularly on soil biology, and should therefore be avoided. As many of the QS farmers have been using agrichemicals extensively for many years (even decades) before their move to regen ag, they have good knowledge of the different types of chemicals and rate them as to how bad their negative effects are. Some are considered particularly harmful such as neonicotinoids ('neonics'), and are completely avoided, while others are considered less harmful and/or they are difficult to substitute (e.g. glyphosate) so are used sparingly. This view is not unique to QS. Gabe Brown (brownsranch.us) in his first principle of soil health states, 'Synthetic fertilizers, herbicides, pesticides, and fungicides all have negative impacts on life in the soil as well.'

The same as for on-farm practices, the 'objectives' of regen ag have also not been systematically agreed as different sources have different perspectives. However, like the practices, there are common themes that have been distilled from multiples sources.

Improving soil health is considered to be the core objective and focus of regen ag. Soil health is viewed holistically (e.g. it includes biodiversity but the main aim is building soil carbon/organic matter and thus improving soil biology). The next objective is considered to be mitigating climate heating through sequestering atmospheric CO_2 as soil organic matter, which is synergistically linked to the core objective of soil health (an example of a win-win scenario for climate heating). Adapting to climate heating as the next objective is clearly linked to the mitigation objective, as the solution to both is rooted in building soil organic matter because that makes soil more resilient and better able to deal with climate extremes (such as floods and drought).

Further building on the climate heating adaptation there are objectives around improving ecosystem services, although these are rarely couched using the term ecosystem services, rather more practical outcomes (e.g. not polluting waterways with soil, nitrogen and phosphorous). There are also multiple objectives around improving the health and vitality of farming communities, a clear difference with farming systems such as no-till and Conservation Agriculture (CO), which are purely focused on technical in-field issues.

The objectives therefore stretch from the highly specific (e.g. building soil organic matter) to the high level (e.g. the vitality of farming communities) within a holistic approach/view. So, while regen ag can be viewed as 'just' a collection of existing on-farm techniques, it has become something larger. Some regen ag advocates are claiming that it has moved into higher levels, such as system redesign and reconceptualisation of the farm, viewing the farmer as an actor in their farm environment, and regen ag being as much about a change in mindset as changing on-farm practices (e.g. some see it as a framework for self-assessment and collective aspiration). Regen ag should therefore not just be viewed as a set of practices and objectives, but rather as a fundamental re-evaluation of the farmer's relationship with the farm. Also, how their farming impacts on the quality (healthfulness) of the food they produce, the effect this has on the health of their customers who consume that food, and finally on the health of the wider biosphere and planetary systems.

Improving soil health is considered to be the core objective and focus of regen ag.

Regen ag and science

Most of the practices listed above (e.g. no-till, cover cropping) are not unique to regen ag, with many of them being part and parcel of other alt-ags. For example, the aims of minimising/eliminating tillage and keeping soil covered are 'borrowed' directly from minimum/no-till and CA, respectively, and some farmers have come to regen ag through previously practising these farming systems. Therefore, while regen ag as a whole is novel, it mostly consists of well-proven practices (e.g. residue retention) and farm systems (e.g. no-till).

The main novel regen ag practice is considered to be the focus on highly diverse multi-plant species rather than monocultures or simple mixtures of a few species. There is considerable scientific supporting evidence from ecological studies that it both increases yield and also improves other ecosystem services, for example, from Tamburini and colleagues in 2020 (see https://advances.sciencemag.org/content/advances/6/45/eaba1715.full.pdf DOI:10.1126/sciadv.aba1715).

Break feeding diverse pasture mixture

The lack of research into regen ag as a system cannot be blamed on the farmers, as they are farmers (not scientists) so lack the resources and expertise to undertake it.

Therefore, the charge that regen ag lacks scientific validity and evidence is contrary to a large amount of scientific evidence on its component parts. Where there is a lack of research is on regen ag as a whole system. This is partly due to it being relatively new, so there hasn't been sufficient time to undertake research, especially as regen ag is a whole of system approach so it requires farm systems research, which needs considerable resources and time. In addition, regen ag has been almost entirely developed by farmers (not scientists) so there has been little communication between the two camps.

The lack of research into regen ag as a system cannot be blamed on the farmers, as they are farmers (not scientists) so lack the resources and expertise to undertake it. Also, farmers undertake 'informal' and 'natural' experiments all the time: they modify and adapt their practices and note the results, and keenly observe the effects of changes outside of their control (such as the weather). While these 'experiments' do not meet the scientific gold standard of random, replicated experiments, they are also not worthless. Agriculture has existed for some 10,000 years and agricultural science some two to three hundred, so farmers have developed agriculture, including the domestication of all farmed species. without the benefit of science. The reliability of farmers' experiments is therefore sufficient for their needs and to answer their questions. Therefore, if scientific evidence is desired it is up to scientists to undertake it, not farmers.

Regen ag as a social movement for change

Regen ag farmers are wanting to change their farming systems to address local to global issues (such as climate heating, biodiversity loss, nitrogen and phosphorus pollution, food quality, rural life etc), which means they are actively trying to address some of the biggest social and environmental issues of our times. This is perhaps the most important aspect of regen ag that is being lost in academic arguments about the pros and cons of particular farm practices and the level of scientific 'proof' (i.e. that regen ag farmers are actively engaged in solving the massive global challenges that humanity faces).

In New Zealand, and many other countries, the farming sector (or at least its political organisations) have long argued that issues like climate heating do not exist. Then when such positions have become untenable, they have argued against agriculture's role in the issue and the need for change. It should therefore be warmly welcomed by wider society that regen ag farmers are actively engaged in these issues, acknowledge that farming is responsible, and that they are changing their farming practices to try to address the issues.

Conclusions

Regen ag is not straightforward to understand as it is a complex and whole of system approach. There is general agreement among proponents as to what practices and objectives are core to regen ag or are not. The practices that appear to be universal are the minimisation or elimination of tillage (soil disturbance), having a high diversity of plant species (both pasture and crops), avoiding bare soil, and the integration of livestock and cropping (mixed farming). The objectives are improving soil health, especially increasing/maximising soil organic matter (soil carbon) and soil biology, particularly microbiology.

However, regen ag is also much bigger than a mere collection of farm practices, as it is also a social movement, a value system and a philosophy, with the objectives to change the industrial/intensive farming paradigm, and to repair the damage done to planetary systems by mainstream agriculture on the farm, at the planetary level, and in the social sphere.

Finally, considering the intransigence of the agricultural sectors over several decades (both in New Zealand and globally) to engage with wider society and politics to address the multitude of global and environmental issues that face civilisation, it should be warmly welcomed that a network of farmers is actively acknowledging that agriculture is part of these problems. They are changing their farm systems, to the best of their abilities and knowledge, based on science and within economic constraints to mitigate and adapt to these issues, and are therefore worthy of support.

Further reading

This article is based on a more detailed report published by the BHU Future Farming Centre. See: www.bhu.org.nz/future-farming-centre/ffc/information/misc/an-analysis-and-overview-of-regenerative-agriculture-2019-ffc-merfield.pdf

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JOHN FRANCIS

REGENERATIVE AGRICULTURE
AN AUSTRALIAN FARM ADVISOR'S PERSPECTIVE

This article looks at the division of opinion, the principles and the growth in awareness of regenerative agriculture in Australia. It offers an approach for assessing the financial consequences of changing systems and for dealing with unconscious bias.

A polarising topic

Regenerative agriculture is a polarising and controversial topic, with critics and proponents equally vehement in their views. The internet is littered with compelling articles, opinion pieces and evidence supporting the case for and against it. The depth of choice allows for the biases of the reader to be fuelled, thereby further reinforcing their views and increasing the chasm between opinions, often without proponents even knowing that they are doing so.

Rather than adding to the already long list of information supporting my own bias, this article will outline the growth in awareness of regenerative agriculture and why this may be occurring. It will also attempt to use my own layman's interpretation of the social psychology surrounding this, to assist in understanding why there is such polarity in opinion about regenerative agriculture, and how a change in approach may help in changing views on each side of the debate.

I have found social psychology ground-breaking in my role as a farm consultant because it explains why people (including myself) act as irrationally as we do, even when we think we are being objective and unbiased. It also arms me with new ways of approaching old problems. In the interests of clarity, I value science and economics and I try to take an evidence-based approach to the delivery of my recommendations. I am an advocate of what I believe to be productive, profitable and environmentally sustainable agricultural systems. I am not opposed to most of the principles of regenerative agriculture. In fact, I consider many of them to be productive conventional practices and reasonable means of delivering improved productivity and desirable environmental outcomes.

Defining regenerative agriculture

The lack of a clear definition of regenerative agriculture makes any assessment of the philosophy difficult. Some proponents argue that it cannot be defined, while others define it by delivering their interpretation of the philosophy. The same could be said of conventional agriculture where there are interpretations of broad definitions,

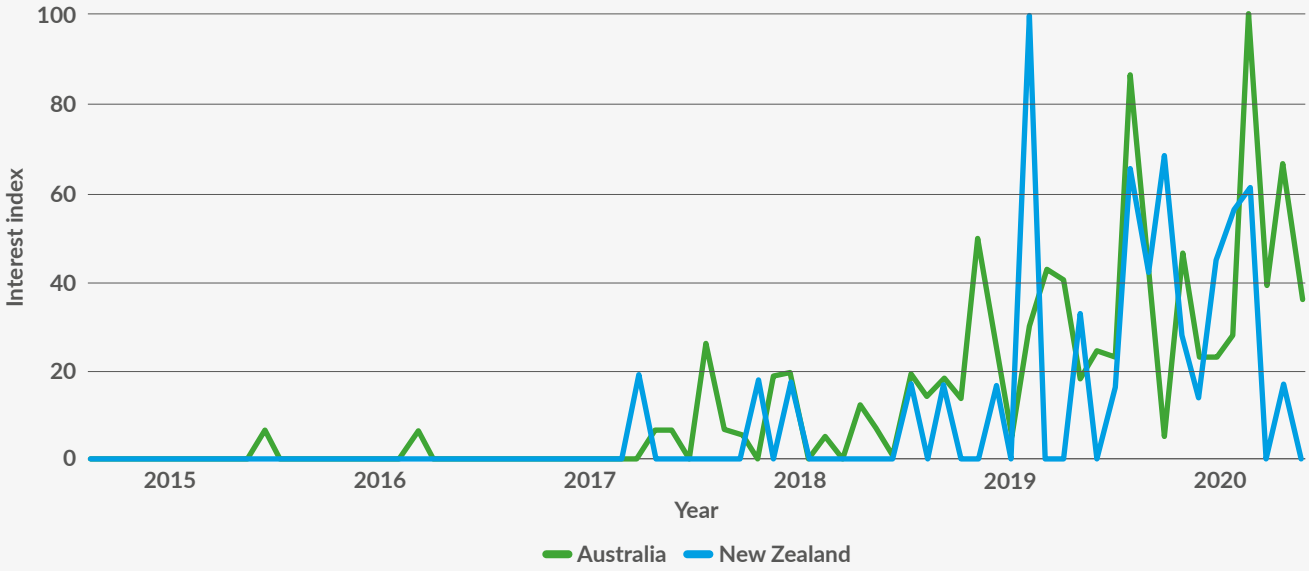

Figure 1: Google trends interest in the term 'regenerative agriculture' for Australia and New Zealand
Source: Google trends

many highlighting the inclusion of synthetic chemicals for managing pests and soil fertility. Conventional agriculture encompasses so much more than the use of synthetic chemicals, but as this is often a key point of differentiation it is the one that receives the most attention.

A study by Schreefel and colleagues in 2020, 'Regenerative Agriculture – The Soil is the Base', found that regenerative agriculture lacked a clear scientific definition relating to different perceptions of the practice. They found that regenerative agriculture focuses specifically on environmental issues, in particular soil issues. Based on their findings, they proposed a provisional definition of regenerative agriculture as an approach to farming that uses soil conservation as the entry point to regenerate and contribute to multiple ecosystem services.

Most of the objectives of regenerative agriculture identified in this article, which some proponents call principles, are consistent with the objectives of farm managers practising more mainstream conventional agriculture. Many conventional farmers are conducting regenerative practices, but are either unaware or unwilling to affiliate these with the broader philosophy.

This unwillingness to affiliate appears to come from their view that champions of the regenerative cause have denigrated them for what they consider to be the broadscale environmental damage caused by their farming approach. It is entirely plausible that the motivation of managers practising more mainstream methods to adopt activities that improve soil and ecological health are the same as those who align themselves closely with regenerative agriculture.

Patrick Francis, in his Moffits farm article (www.moffittsfarm.com.au), suggests that ideology is the reason for the divisions over regenerative agriculture. He writes:

> *The adoption of RA amongst mainstream professional farmers over time might have been a fairly straightforward process if not for one barrier, the associated ideology promoted by its champions that conventional farming methods and the agricultural scientists and technologists involved with its research and extension are responsible for land and water degradation and for producing food which is less healthy, possibly toxic, and is responsible for the decline in human health around the world. As a consequence, instead of being a methodology for positive change it has become a cause of division amongst farmers.*

Cognitive dissonance is a theory discovered by Leon Festinger that recognises our motivation to maintain harmony and avoid disharmony in our beliefs and attitudes. Dissonance, or disharmony, occurs in our minds when confronted with a situation that conflicts with our beliefs or attitudes so the tendency is to reduce the discomfort. One way of reducing the discomfort when presented with evidence that challenges beliefs is to refute it. The more time and energy invested in the beliefs, the harder it can be to accept the evidence, so the more forthright one becomes in them. This may explain what is now a great chasm between the proponents of regenerative agriculture and those refuting its claims.

Regenerative agriculture in Australia

The Australian Bureau of Statistics does not appear to capture data categorising farm businesses by farming philosophy or farming system. Using objective data to quantify the number of farmers in Australia affiliating them with the philosophy is therefore difficult. Based on the increased number of media and internet articles publicising the practice it would seem logical that there are more farmers now involved than in the past, but the reality is that this is no more than the availability heuristic at play.

Google trends can be used to track interest in regenerative agriculture in Australia over time ***(see Figure 1)***. The numbers represent internet search interest relative

On average, the costs of regenerative producers were reduced by 33%.

to the highest point on the chart for the given region and time. A value of 100 is the peak popularity for the term and a value of 50 means that the term is half as popular. A score of zero means that there was not enough data.

Interest peaked in Australia in the week of the 27 September to 3 October 2020, while it peaked in August 2019 in New Zealand. In Australia this was related to the airing of an ABC Australian story on Charles Massy, an advocate of regenerative agriculture who has been criticised by the scientific community for the lack of evidence supporting claims. The story did much to advance the regenerative cause, but little to add to the weight of evidence supporting some of the claims. Storytelling trumps facts in the race for audience attention, and an alternative method to food production without reliance on synthetic chemicals that heals the earth is absolute TV gold.

Most farmers who do not identify with any particular farming brand, but who have made significant advances in improving soil health, groundcover, water use, knowledge, skills and profitability, go unrecognised as they are not as newsworthy.

Financial consequences of moving to regenerative agricultural system

While every farm business manager is entitled to farm in a way that suits their own beliefs and achieves their own goals, provided they are morally and legally defensible, they are also entitled to facts and evidence upon which to base their judgements. Facts and evidence are different to case studies and anecdotes and, while they may do little to change beliefs, it is important that they are presented. Business management and finance is one area where the facts are particularly important because erroneous assumptions can mean the difference between being in business or not.

The following are seven key practices to encourage farm advisors, when dealing with clients who are interested in regenerative agriculture, to reflect on how their own and their client's beliefs are derived and to encourage deeper thought on the subject:

1. Qualify the financial position of proponents
2. Quantify the business case
3. Become financially literate and understand the numbers
4. Accept the change – the problem might be your beliefs
5. Educate yourself
6. Continue to challenge clients with questions
7. Measure client beliefs and profile client attitudes and capabilities.

1. Qualify the financial position of proponents

One observation of some high-profile proponents of regenerative agricultural systems in Australia is that their farming businesses appear to represent a small proportion of their total business interests. These people typically have access to capital that most farm businesses don't, which means these businesses may be more insulated from failure. Quantification of the extent to which externally generated capital is funding the farming operations of these proponents would be useful so that those without the same luxury do not get a false sense of financial security.

2. Quantify the business case

The difficulty in quantifying a business case is that there is little production and financial data to draw on for comparative financial analyses. The typical analytical approach to assessing a business case when making a change in system is to conduct a partial budget. This requires an assessment of the changes in production, expenditure and income from the system change relative to the existing business performance. The challenge is locating detailed production and financial data quantifying the changes over time.

The internet is awash with case studies and motherhood statements about components of production that change after moving to regenerative agriculture, but sadly it is devoid of the higher-level quantitative financial and production data necessary to conduct a partial budget.

The two most quoted studies with real comparative financial data of regenerative versus non-regenerative systems appear to be those of LaCanne and Lundgren in 2018 and Ogilvy and colleagues in the same year. The former is a US study comparing production and profitability of corn producers, while the latter is a comparative study of Australian livestock farmers.

The LaCanne study (10 farms of each) found the pooled average results of the regenerative farmers generated 78% more profit when compared to the non-regenerative farmers from 29% less yield, due to significantly higher prices and livestock income from grazing cover crops during the fallow period. The higher prices were related to organic premiums or to the sale of grain directly to consumers as seed or feed, but the extent to which each method contributed to the price increase is unknown.

An interesting point about this study was that four of the nine regenerative producers with financial data received average corn prices of $439/tonne, while the remaining five received an average price of $122/tonne. This compares with average prices received of conventional farmers in the same study of $126/tonne.

This suggests that four of the nine regenerative producers increased the average profit of that cohort considerably. The four regenerative producers who received a price premium generated average profits of $2,550/ha. This compares with the five regenerative producers who did not receive a price premium who achieved average profits of $886/ha and nine conventional producers who achieved profits of $910/ha. On average, the costs of regenerative producers were reduced by 33%.

The Ogilvy study presented financial metrics of a relatively small sample size, but showed limited comparative financial data with no production metrics. This was a lost opportunity to produce highly valuable comparative data between regenerative and non-regenerative farms.

A rational approach

The following is an approach that may be of value in the absence of the depth of data. The analysis considers the economic outcome when moving from a conventional livestock system running 10,000 dry sheep equivalents (DSE) to a regenerative system.

A DSE represents the energy required to maintain a two-year-old, 45 kg dry merino wether. The production (assuming a beef system for simplicity) and the financial performance (assuming land values of $850/DSE and livestock values of $150/DSE) are shown in ***Table 1***. Column 1 of this table shows the conventional system, while Column 2 shows the partial budget with a change to regenerative agriculture. Columns 3 and 4 show the financial outcome for an assumed regenerative system with and without price premiums.

The regenerative system metrics have been projected assuming a 30% production loss due to lower pasture growth due to the loss of fertiliser from the system. This figure is consistent with the LaCanne study. Expenses are assumed to be 37% lower than the conventional system due to less fertiliser and other expenses. Regenerative systems claim far lower costs compared with conventional systems, but any analysis conducted by a consultant with a producer should quantify the extent to which the reduction in costs is likely.

Higher prices?

Where prices are not different between systems (Column 3), profits decline in the regenerative system by approximately $100,000 and profitability (assessed as return on assets managed) declines by 24% to 2.65% when compared to the conventional system. Prices need to exceed $4.40/kg received for profitability to exceed the conventional system. This represents an increase of 20% over the price received in the conventional system. If there is no evidence for the extent of this price premium then it should be omitted from the analysis.

The LaCanne study showed that four of nine regenerative corn farming businesses with price data achieved a large price premium. It is advisable for clients to seek evidence that the proposed market is differentially pricing products from regenerative systems.

What is often not stated about differentially priced

Table 1: Methodology for comparative farm financial and production metrics

	1	2	3	4
	Conventional	Change from conventional	Regenerative without price premium	Regenerative with price premium
Production units – scale (DSE)	10,000	-3,000	7,000	7,000
Value of assets under management	$10,500,000	-$450,000	$10,050,000	$10,050,000
Gross profit ($/DSE)	$73.50	$0.00	$73.50	$87.96
Enterprise expenses ($/DSE)	$12.86	-$1.29	$11.58	$11.58
Overhead expenses ($/DSE)	$23.89	$0.00	$23.89	$23.89
EBIT ($/DSE)	$36.75	$1.29	$38.04	$52.50
Gross profit	$735,000	-$220,500	$514,500	$615,746
Overhead expenses	$238,875	-$71,663	$167,213	$167,213
Enterprise expenses	$128,625	-$47,591	$81,034	$81,034
EBIT/Profit	**$367,500**	**-$101,246**	**$266,254**	**$367,500**
Return on assets managed	**3.5%**	**-0.9%**	**2.6%**	**3.7%**
Production (kg/DSE)	20	0	20	20
Production (kg lwt)	200,000	-60,000	140,000	140,000
Cost of production ($/kg lwt)	$1.84	-$0.06	$1.77	$1.77
Price received ($/kg lwt)	$3.68	$0.00	$3.68	$4.40

Prices need to exceed $4.40/kg received for profitability to exceed the conventional system. This represents an increase of 20% over the price received in the conventional system.

livestock produce is that it may require a system change to receive the market premium. Typically, this means moving away from a low-cost system (with a single confined joining period) to a production system (with a time of trading animal turn-off suited to an area-specific feed supply curve). Any change that requires weight gain during a period when feed supply or feed quality is limited, or multiple joining times during the year, will typically result in far higher cost per kilogram produced.

Farm businesses that achieve price premium typically invest an inordinate amount of time and effort in building relationships that are necessary to secure and retain a premium. This may be time well spent where the premium is of an adequate magnitude relative to the base price, but the marginal cost of time is not always recovered. A business model that requires constant nurturing of end user relationships to maintain a price premium is not for everyone. It is therefore important to know whether the business has the personnel, time and skills required to achieve this objective prior to a change in farming systems approach.

Fifteen years of farm benchmarking analysis shows that the higher profit businesses usually have a combination of low cost of production with good levels of production, which means they maintain reasonable margins even when prices are low. A system dependent on high prices for success in commodity-based agriculture may face greater volatility and this should be factored into budget scenarios.

Column 2 of *Table 1* shows that it is possible to make a change to generate a lower cost of production but not deliver a higher operating return. While there is a higher margin on every kilogram produced, there were far less kilograms produced so profits are lower. The key message is that a low cost of production with low production generates low profit.

Table 2 shows the comparative debt and farm financing for the same scenarios between conventional and regenerative systems with and without price premiums in a reasonably heavily leveraged business ($4 million in debt). The analysis shows that interest costs decline by approximately $20,000 in the regenerative system due to reduced liabilities after the liquidation of 3,000 DSE at $150/DSE and lower operating costs. Capital expenditure is assumed to be $50,000 regardless of system, leaving $109,250 in the conventional system for debt repayment and personal expenses, while this is reduced to $52,324 in the regenerative system where no price premium is achieved.

Finance or interest coverage ratio, which is a measure of the ability to service debt and measured as EBIT divided by annual interest costs, falls from 2.6 times in the conventional scenario to 2.2 times in the regenerative scenario without a price premium. While the finance coverage ratio of 2.2 may still be within the realms of bank safety, one large question is whether the personal financial goals of the manager and their family are still being achieved. If not, then alternative options such as trialing the system on a portion of the property may be a useful progressive action.

It is possible that the client is willing to wear the financial consequences of a system with lower production

Table 2: Comparative liabilities and below the profit line expenses

	1	2	3	4
	Conventional	Change from conventional	Regenerative without price premium	Regenerative with price premium
Liabilities	$4,000,000	-$569,254	$3,430,746	$3,430,746
Net equity	62%	4%	66%	66%
Interest rate	3.5%	0.0%	3.5%	3.5%
Interest cost	$140,000	-$19,924	$120,076	$120,076
Tax @ 30%	$68,250	-$24,397	$43,853	$74,227
Net profit after tax	$159,250	-$56,926	$102,324	$173,197
Capital expenses	$50,000	$0	$50,000	$50,000
Debt repayment/personal	$109,250	-$56,926	$52,324	$123,197
Finance coverage ratio	2.6	-0.4	2.2	3.1

Table 3: The same profit per DSE with poor resource efficiency delivers low profitability

SYSTEM	A	B
Stocking rate (DSE/ha)	7.5	15
Profit ($/DSE)	$35	$35
Profit ($/ha)	$263	$525
Land capital ($/ha)	$12,750	$12,750
Livestock capital ($/ha)	$1,125	$2,250
Total investment ($/ha)	$12,875	$15,000
Return on assets managed	1.9%	3.5%

Source: www.farminstitute.org.au/publication/occasional-paper-may-2020-regenerative-agriculture-quantifying-the-cost-2/

It can be hard for a farm advisor to accept a client's choice to take action that may be contrary to the advice provided or to the beliefs of the advisor.

because the system meets other higher priority goals. This is entirely appropriate given that it is their choice. The process of quantifying the value may, however, assist them in adjusting the order of priority.

3. Become financially literate and understand the numbers

Regardless of what role the farm advisor has in the business there is value in becoming financially literate. Agronomists, livestock production advisors, bankers and agricultural chemical salespeople are all in the business of giving variants of investment advice, so understanding and articulating the returns generated on the investments made is important.

Financial literacy is a skill which means that it requires repetition to improve. Appropriate course attendance is a useful starting point, but it is the application of the information in real world circumstances that cements the principles. Too often the learning stops after the attendance of the course as no application was made beyond the first step.

Financial literacy allows for the identification of some of the critical analysis approaches, which can be important when delivering financial results. For example, a recent study compared profit per DSE as its key financial metric for comparison of systems in the absence of stocking rate or production data. This measure, in the absence of other important information, provides limited information about livestock business performance and efficiency. The same level of profit per DSE between businesses can deliver very different levels of whole farm profit and profitability due largely to differences in production per hectare.

Profit is an absolute dollar figure, while profitability is a measure of resource efficiency. At a whole farm level, profitability (otherwise known as operating return or return on assets managed) measures profit relative to the value of all of the assets employed to generate that profit. In a business like broadacre agriculture, where approximately 80% of the capital employed is related to the value of the land, resource efficiency matters.

At the same level of profit per DSE, but two very different levels of feed utilisation, profitability will be considerably different. For example, ***Table 3*** shows two systems (A and B), each with the same profit per DSE. Due to efficient levels of feed utilisation, System B allows for a higher stocking rate of 15 DSE per hectare compared to System A where high levels of feed wastage occur.

The investment in land capital is the same, regardless of whether the 15 or 7.5 DSE per hectare stocking rate is managed, but the livestock investment is lower per hectare in System A where the stocking rate is lower. Irrespective of having the same profit per DSE, the profitability (3.5%) of System B is 1.8 times higher than the profitability (1.9%) of System A.

This example demonstrating the importance of financial literacy was examined in detail in an occasional paper (May 2020) published by the Australian Farm Institute, which also compared operating returns of managers using regenerative and non-regenerative farming systems.

4. Accept the change – the problem might be your beliefs

It can be hard for a farm advisor to accept a client's choice to take action that may be contrary to the advice provided or to the beliefs of the advisor. The advisor will question their own self-worth and sense of self-importance. The view from the advisor's perspective may be, 'I'm a smart person, I have good skills and technical expertise and I deliver trustworthy recommendations and now, by not taking my advice, you are telling me that I am bad and

In the absence of an instrument for measuring beliefs, a starting point for farm advisors is to spend time understanding what the client believes and why they do.

untrustworthy.' In short, the farm advisor sees the client decision as an attack on their identity, or as a shortcoming in their ability to communicate and articulate a clear message with proven outcomes.

This is a problem that exists in the mind of the farm advisor and not in the mind of the client. Rocket scientist Ozan Varol suggests that when beliefs are entwined with identity (as they typically are), changing your mind means changing your identity and that is difficult. Varol suggests that a potential solution is a mental shift separating you from your products. He gives an example of how a subtle shift in his language tricks the mind into separating the arguments from the person, which allows the arguments to be viewed with a greater degree of objectivity. In an advisory role an example might be a move from, 'In my report, I recommend …' to 'This report recommends …'. A disagreement in beliefs moves from being personal to a hypothesis proven wrong.

Further comfort for the farm advisor can be gained from an improved understanding of confirmation bias, which is our tendency to overvalue evidence that confirms existing beliefs and undervalue evidence that contradicts them. This may also be discomforting to the farm advisor, as it will now be evident that they themselves are biased. This reality requires self-reflection and assessment to establish the extent to which their own biases drive recommendations.

The understanding of confirmation bias has been personally ground-breaking to me, as it explains why the presentation of evidence and facts has been proven to be an ineffective strategy in the changing of minds, regardless of how apparently compelling they may be. The mind is not good at following facts and scrutinising evidence due to our beliefs and the discomfort we feel when they are challenged. This has been a confronting finding for me as I view myself as a rational and objective thinker who takes an evidence-based approach. The reality now confronting me is that I am biased.

Even when conducting the research for this article I demonstrated my bias with Google searches. I read in detail the articles that appeared to take an evidence-based approach to the topic and skimmed the sites that appeared not to support my belief.

5. Educate yourself

My university education is in the technical sciences of agronomy and livestock production. This training taught me how to think, how to review literature, seek evidence, analyse and evaluate data. As my career progressed, I learnt that maximum production was different to economic optimum, so I invested in learning about farm business management. My latest informal learning is about social psychology. I have found this area of science to be illuminating in providing me with an understanding of why people (including myself) behave the way they do, in most cases defying what I consider to be logical. My ability to influence, engage and improve client outcomes is dependent on my ability to implement components of each of these fields.

6. Continue to challenge clients with questions

Many beliefs form from the personal and emotional influences of family, culture and surroundings. The mantra of critical thinking is to form beliefs on the basis of the evidence. The problem with this approach is that the sense of disharmony, known as dissonance, that we experience subconsciously when we learn that we have made a mistake causes us to take a biased approach to the evidence we seek. This results in the use of data to support or reinforce our belief regardless of the truth of that belief.

Peter Boghassian, Assistant Professor of philosophy at Portland State University, suggests that rather than telling people to form beliefs on evidence they should be encouraged to seek information that could undermine their confidence in a particular belief. For example, consider a client who has formed the view that regenerative agriculture will deliver superior soil health, better environmental resource efficiency and improved economic prosperity relative to their existing conventional approach. Boghassian's approach might be to ask on a scale of 1–10 how confident that client is in those beliefs. Once the number is articulated ask what evidence would be required to undermine their confidence in that score. That is, if the answer was 9, ask what it would take to reduce confidence to 5, then invite the client to seek out the information that would reduce that confidence.

This approach isn't just one that applies to advocates of regenerative agriculture; it is equally important that proponents of conventional agricultural systems apply this approach to their own beliefs. For example, my personal view is that farm managers of sensible conventional broadacre livestock systems in southeastern Australia can deliver equivalent or superior soil health benefits with superior farm profitability when compared with managers adopting regenerative agricultural systems in the same environment.

On a scale of 1 to 10 how confident am I in this belief? My score is a 7, indicating that I am reasonably (but not totally) confident. What evidence would be required for

Table 4: Client profiling can lead to better tailoring of advice

PROFILING ASSESSMENT CRITERIA	SCALE		
Ability to critically appraise information	Poor	Moderate	Good
Propensity to accept being challenged	Low	Medium	High
Likelihood of implementing changes	Low	Medium	High
Technical ability to implement recommended changes	Low	Medium	High
Balance sheet strength (net equity)	Low	Medium	High
Operating performance	Poor	Moderate	Good
Ability to understand complex systems-based issues	Poor	Moderate	Good
Stage of the business cycle	Start-up	Consolidation	Retirement

Financial literacy is an important skill when advising on any systems change.

me to change my belief? Comprehensive independent soil chemical analysis, soil structural assessment and soil biological assessment comparing a pool of highly productive commercial scale conventional systems with a pool of commercial scale regenerative systems, preferably by year over a five-year period. For the comparative farm financial performance, I would require comprehensive comparative farm financial and production (benchmarking) data using consistent methodology over at least five years.

Daniel Kahneman in 'Thinking Fast and Slow' divides the mind into two systems. System 1 is the quick fire part of the brain that uses certain rules to allow us to respond quickly, intuitively and efficiently. System 2 is slower, more analytical and better at reasoning. Kahneman suggests that the initial attempt to believe something is an automatic operation of System 1. The problem is that System 1 is gullible and biased to believe, while System 2 oversees doubting. The beauty of Boghassian's approach is that the challenge requires thought. This progresses thinking from System 1 to System 2 where doubting is more likely. Each question is an opportunity to revise beliefs and to seek evidence that disconfirms.

7. Measure client beliefs and profile client attitudes and capability

The medical sciences have demonstrated the value of the development of instruments for measuring beliefs and attitudes and values. By identifying the strength and significance of beliefs, educational interventions have occurred to change the approach to treatment and rehabilitation from certain diseases. The same approach would be useful in agriculture.

In the absence of an instrument for measuring beliefs, a starting point for farm advisors is to spend time understanding what the client believes and why they do. Try to understand how entrenched the belief is in their life and how much emotional energy has been invested.

Another approach that may be useful is client profiling. It is probable that farm advisors already do some sort of client profiling, but it will typically occur subconsciously and undocumented. Their advice will change depending on profile outputs. Documenting the process can be useful as it sets out the deficiencies and highlights areas of strength and weakness.

Table 4 is an example of client profiling. The highlighted cells correspond with the advisor response for each criteria of client profile assessment. The client in this example has a high propensity to accept change, but the deficiency appears to be in balance sheet strength and technical ability to implement changes. Better suitability and adaptation of advice is the key benefit of profiling.

Conclusion

Depending on their interpretation, there are sound principles underpinning the regenerative agriculture philosophy. Many of the practices that deliver on the principles are already being implemented in conventional farming systems. The pursuit and delivery of facts and evidence to refute or support claims is an important scientific approach but beliefs, which are not necessarily evidence-based, rule the mind. Finding a way to beat the easily-led belief system requires a new approach that engages the deeper thinking part of the mind.

Financial literacy is an important skill when advising on any systems change. It allows for a deeper understanding of the issues and delivers the ability to assess the financial impact of the changes to the client. The client can then make an informed decision about the value of the change.

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NICK TAIT

REDUCING GREENHOUSE GAS EMISSIONS ON-FARM

LESSONS FROM DAIRYNZ'S GHG PARTNERSHIP FARMS PROJECT

Recent research conducted by DairyNZ through our partnership farms project looks at ways to reduce greenhouse gas emissions on-farm and the key lessons from these, including the role of rural professionals in these changes.

Agricultural partnership

A significant focus for the many New Zealand farming businesses in the coming years will be examining and identifying how they can understand, manage and reduce their greenhouse gas (GHG) emissions.

Under *the Primary Sector Climate Change Partnership – He Waka Eke Noa*, the Government, iwi/Māori and the agricultural sector have committed to helping farmers with the information, tools and support they need to reduce emissions and build resilience to climate change. As part of this, dairy farmers will need to have a report on their emissions by 2022 and a farm environment plan (FEP), which includes guidance on how to manage and reduce on-farm emissions by 2025.

At the start of 2021, over 90% of dairy farmers will have received an annual report on their on-farm emissions, and many farms already have an FEP which guides on-farm activities and includes good management practices. In a number of catchments throughout the country, regional councils are also requiring FEPs to limit nitrate, phosphate and sediment losses and improve water quality.

Recent science has shown that New Zealand's dairy farmers are able to produce dairy products with lower emissions per unit of fat and protein corrected milk than other countries. However, we know that globally, other dairy producers are focused on improving efficiency and reducing their environmental footprint. To stay a step ahead of competitors, and play our part to reduce absolute emissions, our dairy farmers need to continue to innovate and adapt practices (along with improving nutrient loss to water to reduce environmental footprint), while maintaining viable businesses.

Tararua Plantain Rollout project

Establishment of partner farms and modelling

In 2017, the Dairy Action for Climate Change was established. As part of this programme, 12 partnership dairy farms were established covering a range of farm systems across New Zealand. The aim was to model how changes to reduce GHG emissions and nitrogen (N) leaching affect farm profitability and productivity.

To look into the farms' existing performance, a whole farm assessment (WFA) was completed, assessing all aspects of these businesses. Baseline modelling of N loss and emissions were established for the farms using Overseer^{FM}.

Suitable solutions for each farm were then discussed with a community of interest (COI), which included farmers, local consultants, scientists and DairyNZ. At the COI group a WFA report, Overseer^{FM} baseline modelling, gaps, opportunities and mitigation options were presented for discussion. Both the farmers and the COI provided advice to help identify suitable mitigation options.

Mitigation scenarios were then modelled by consultants using Farmax and Overseer^{FM}. These were reviewed by DairyNZ and the findings, including effects on profit, were presented back to the farmers and COI group. The partner farms could then select the mitigations they preferred to reduce their environmental footprint, while examining the effect on profitability and productivity.

Mitigation principles

The programme adopted some guiding principles to identify mitigation options, drawing on current research. The key mitigation principles included:

- **Pastoral 21 principles**, which involved lowering N inputs, reducing stocking rates, and increasing production per cow. These changes resulted in reduced dry matter intake per hectare (and therefore less methane produced) and lower nitrous oxide emissions due to less N eaten per hectare
- **Forages for reduced nitrate leaching (FRNL) principles** that involved using: low N forages or crops to reduce N intake and therefore N surplus; catch crops to reduce the time land is fallow and therefore reduce the risk of surplus N being leached; and plantain to lower the N load in the urine patch. These mitigations reduce both nitrous oxide emissions and N loss to water
- **Reducing whole farm N surplus** by reducing N fertiliser, using effluent as an N fertiliser, reducing or using lower N supplements and using lower N crops
- **Improved irrigation efficiency** through better soil moisture monitoring and/or investment in more efficient irrigation infrastructure and practices, to reduce drainage and therefore N loss to water

Mitigations need to be farm-specific, as some are not relevant or do not align with the farmer's goals.

- **Reducing autumn dry matter intake** by culling and drying off cows early
- **Reducing supplement use and/or N fertiliser use** by reducing numbers and therefore dry matter intake per hectare of non-lactating stock in the farm system. This included replacement rates, carry-over cows or non-dairy animals
- **Examining the use of off-paddock facilities** to lower N loss and manage effluent during autumn and winter
- **Offsetting emissions** by planting trees in lower productive areas of the farm.

Mitigation options

Mitigation options modelled on the partnership farms fell into three categories: farm management changes to the current farm system, infrastructure investment and changes, and retiring lower productive areas of the farm and planting in trees.

Reductions in methane came from reducing dry matter intake per hectare, as this is the driver of methane in Overseer^{FM}. Reduction in nitrous oxide emissions mainly came from reducing N surplus (as calculated by Overseer^{FM}), as this is highly correlated to nitrous oxide emissions.

The future

From here, DairyNZ will continue to work closely with the farmers involved in the partnership farms to identify how successfully the options have been implemented, and to identify further opportunities to reduce their environmental footprint, while maintaining or increasing profit. DairyNZ projects include Step Change, and co-development projects Sustainable Future (Hinds and Selwyn) and the Tararua Plantain Rollout project.

DairyNZ's Step Change programme is helping dairy farmers understand their GHG emissions footprint, and how to reduce emissions, while contributing to better water quality and improving profitability.

The findings from partner farms confirm that for *the Primary Sector Climate Change Partnershp – He Waka Eke Noa*, we need to build a system that incentivises farm system efficiency and encourages action by farmers who can make the greatest reduction in environmental footprint, while maintaining profitability and production.

Early adopters and farmers who are already running N efficient businesses and implementing the latest research and technologies should be recognised for their initiative in leading the way forward. Farmers also need to continue to adopt these initiatives and technologies to continue producing dairy products with lower emissions than other countries. These countries are focused on improving efficiency and reducing their environmental footprint. To stay a step ahead, we need to continue to be innovative and adapt, while maintaining viable businesses.

Further reading

More information can be found at:
dairynz.co.nz/climatechange

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LEARNINGS FROM THE PROJECT

The key lessons from the project about how to reduce environmental footprint, while examining the effect on profitability and productivity, included:

1. The importance of understanding the farm system and farmer's goals at the start and involving the farm's key rural professionals.
2. Having good data, which allows modelling farm system options to reduce both N loss from the root zone and GHG emissions, is complex. Good information is required to accurately represent the farm system.
3. Rural professionals must have capability with digital tools, Overseer[FM] and or/Farmax in order to undertake modelling that is relevant and practical for the individual farms.
4. Mitigations need to be farm-specific and are often difficult to present to the farmer individually, as they are generally bundled due to the farm system interactions.
5. Opportunities are currently available on some farms to improve both profit and reduce emissions through good management practices. However, there is no 'one-size-fits-all' package of mitigations that every farmer can implement. Mitigations need to be farm-specific, as some are not relevant or do not align with the farmer's goals.
6. There is also a high correlation between reducing N loss and nitrous oxide emissions. To reduce both, there needs to be a focus on reducing N surplus. Currently, options to reduce methane are limited to reducing the farm's total dry matter intake.
7. Some mitigations resulted in conflicting environmental outcomes. These included investing in new infrastructure to stand cows off-paddock to reduce N loss from the root zone, by managing the collection and timing of effluent applications. Unfortunately, these systems resulted in increased nitrous oxide emissions and often higher dry matter intake, and therefore more methane emissions.
8. Every farm has something they can do, but the magnitude of reductions depends on the starting point. There are those that had significant opportunities to reduce their environmental footprint and improve profitability through farm system change. There were farms who had already taken steps to reduce their environmental footprint and were very efficient, so had less opportunity to make further gains without a significant effect on profitability. This highlights that mitigation options need to be farm-specific. The farm's starting position will also determine the magnitude of any reductions.

DOUG EDMEADES AND ROBERT MCBRIDE

THE ECONOMICS OF FERTILISER USE

Fertiliser is the major item of discretionary expenditure on most farms, but despite this our approach when offering advice to farmers is ad hoc. The science of soil fertility and pasture nutrition is well developed in New Zealand, but much of this knowledge is not being used. This article discusses the latest available information and technology.

In the last issue of *The Journal* it was concluded that there is considerable opportunity to increase the productivity of pastoral farming in New Zealand. To capture this we need to update our current knowledge of soil fertility and pasture nutrition, and develop more objective and robust processes to apply this knowledge and technology, when planning farm-specific fertiliser policies and plans.

What is new?

Between 2003 and 2010 major reviews by Doug Edmeades have been formally published on the nutrient requirements – phosphorus (P), potassium (K), sulphur (S), magnesium (Mg), calcium (Ca) and sodium (Na) – of clover-based pastures in New Zealand. These reviews have resulted in some changes in the relationships between pasture production and soil nutrient levels (the pasture production functions), and also indicate that some changes are required in the interpretation of some soil tests, particularly in relation to K and S.

Fertiliser recommendations in the past have been ad hoc, often based on repeating or modifying last year's policy, doing what the salesperson recommends, or following the latest fad. Given that fertiliser is typically the largest item of discretionary expenditure on most

Production over the long term is of greater value than the expense of properly applying fertiliser

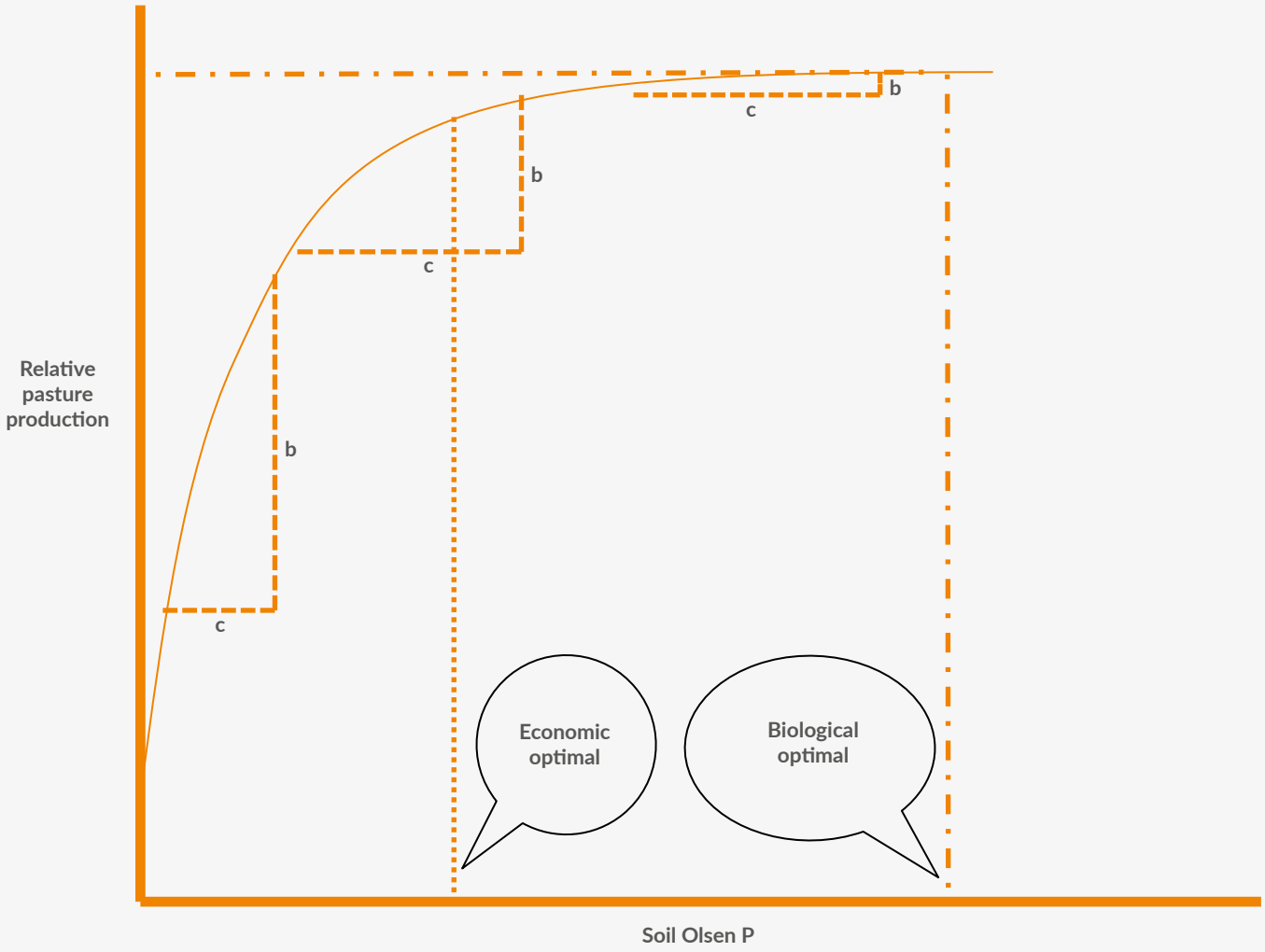

Figure 1: Schematic of the relationship between pasture production and Olsen P showing the economic optimal Olsen P when the financial benefits (b) of applying fertiliser P are equal to the costs (c) of applying fertiliser

farms, a more robust and objective approach is needed when developing and formulating fertiliser policies and plans. We suggest that fertiliser inputs should be based on economic considerations.

Economic vs biological nutrient levels

The cost of the major nutrients required on New Zealand pastoral soils, based on current ex-works prices, are P ($2.62/kg P), K ($1.38/kg K) and S ($0.61/kg S). P is therefore not only a major driver of the pasture production in our clover-based pastoral systems, it is also the most expensive nutrient.

One approach to rationalising fertiliser inputs is to bring all the other soil nutrients (in particular K and S, but also magnesium (Mg) and the trace element molybdenum (Mo) in some cases) to their 'biological optimum levels' (the levels required to achieve maximum production) and then optimise the soil P level (Olsen P) for maximum economic return (profit) in the long term (five to 10 years). This is known as the' economic optimal level', applying the logic of why should we limit the expression of the most expensive nutrient by limiting the inputs of the less expensive nutrients?

Economic Olsen P levels

The process of determining the economic optimal Olsen P can be understood with reference to *Figure 1*, which shows schematically the production function relating plant available P (Olsen P) to the relative pasture production. The economic optimal is defined where the cost (c) of applying fertiliser equals the financial benefit (b) accruing from the additional pasture grown (i.e. benefits (b) = costs (c) in *Figure 1*). There is no point in farming above the economic optimal because that increases the environmental footprint (i.e. P run-off) for no financial return. Similarly, operating below the economic optimal will limit the profitability of the operation.

The major factor affecting the economic optimal Olsen P is the biological efficiency of the farm ($ generated/kg DM produced). A good measure of this internal efficiency is the gross margin (GM) defined as the gross income minus the variable costs (the costs that are related to the number of animals), which includes animal health, supplements and electricity.

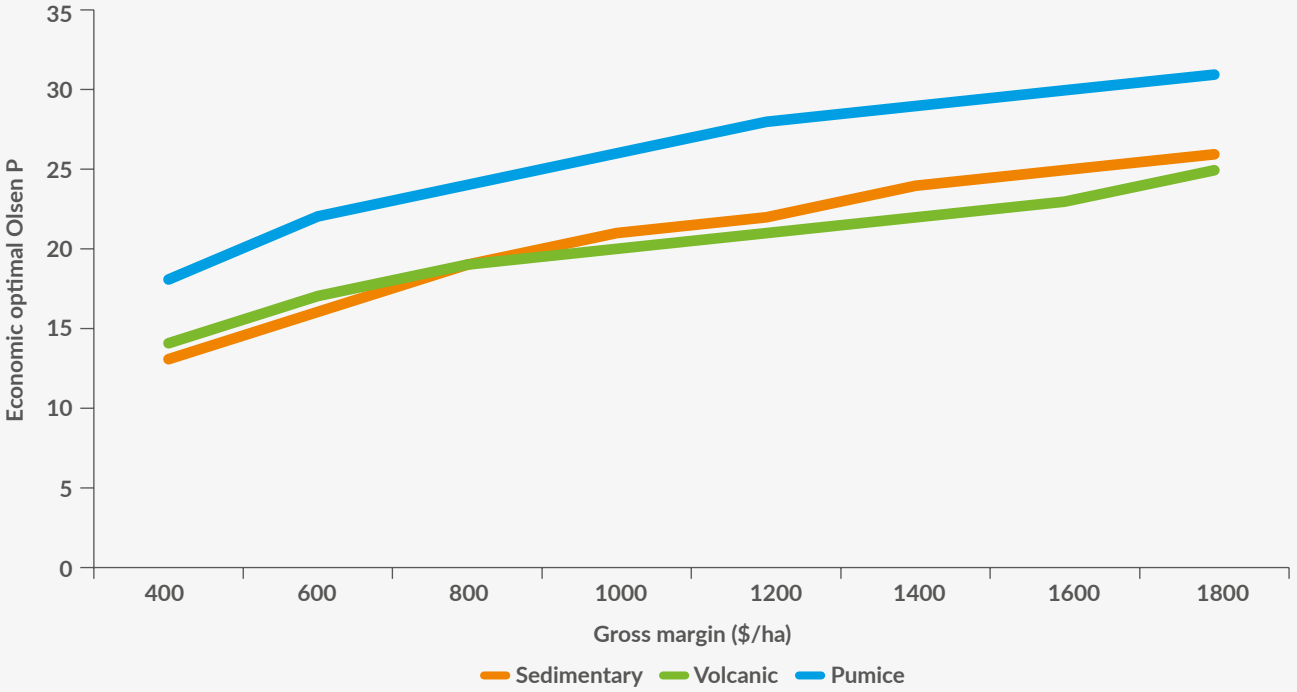

Figure 2: Relationship between gross margin ($/ha) and the economic optimal Olsen P for the three most important soil groups. (Assumptions: topography, easy hill country; soil K = 7 MAF Quick Test units; extractable organic sulphur = 10; gross margin = $100/su; cost of P, K and S as above; transport and spreading = $100/t.)
Source: Derived from Overseer 3 econometric model

The economic optimal Olsen P increases as the gross margin increases *(see Figure 2)*, and is also affected by soil group because the production functions relating Olsen P to relative pasture yields are slightly different for the different groups.

Sheep & beef

The generic relationships between the economic optimal Olsen P and farm GM ($/ha) for the three major soil groups (for a given set of input parameters for dry stock farms) are shown in *Figure 2*, derived using the econometric model Overseer 3.

The GM/ha on most sheep & beef farms, and hence the economic optimal Olsen P, can cover a wide range depending on the farm enterprise. Intensive fattening operations may have a GM/ha of $1,600/ha to $1,800 /ha, and at the other extreme the GM on extensive high country in the South Island may be less than $400/ha. Hence, it is sensible when developing fertiliser plans to divide the farm into blocks based on their actual, or planned or potential productivity, taking into account the soil group, the long-term farm goals, trends in future gross margins and any proposed changes in stock policies. For this purpose, a farm consultant may deploy other tools such as Farmax as part of the decision-making process.

Dairy

The situation is considerably different for dairy farms because they typically have a GM/ha above $3,000. This is, of course, the reason why the economic optimal Olsen P levels on most dairy farms are close to the biological optimum (i.e. at the top end of the Olsen P pasture production function). Pragmatically, the economic optimal ranges could be adjusted depending on the MS production *(Table 1)*.

Biological optimal soil nutrient levels

Potassium

A 2010 review by Doug Edmeades of all the K trials on New Zealand pastures showed that the biological optimal K

Table 1: Indicative ranges for the economic Olsen P on dairy farms

SOIL GROUP	INDICATIVE ECONOMIC OLSEN P	
	LOW PRODUCTION (<900 KG MS/HA)	HIGH PRODUCTION (>1000 KG MS/HA)
Sedimentary	30–35	35–40
Volcanic	30–35	35–40
Pumice	35–40	40–45
Peat	35–40	40–45

Source: Derived from Overseer 3 econometric model

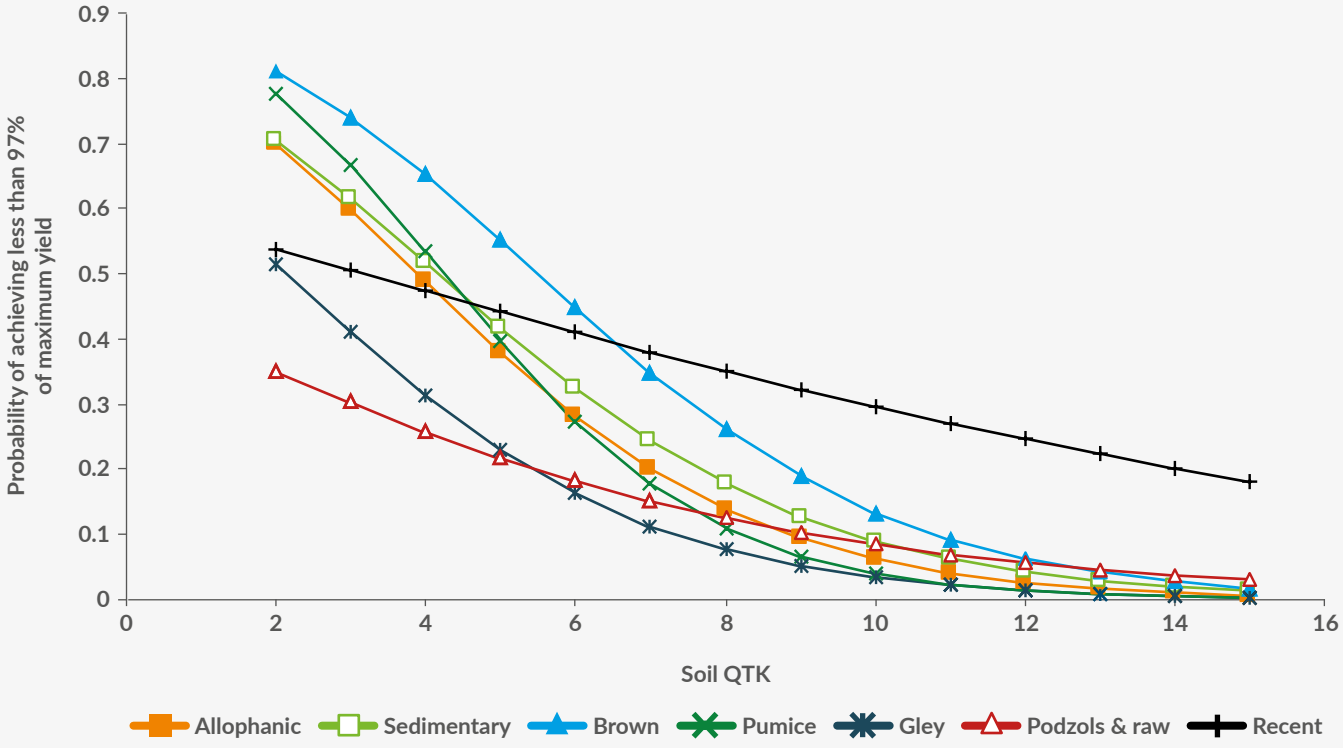

Figure 3: The relationship between soil Quick Test (QTK) and the probability of getting a response to fertiliser potassium

It is sensible when developing fertiliser plans to divide the farm into blocks based on their actual, or planned or potential productivity, taking into account the soil group, the long-term farm goals, trends in future gross margins and any proposed changes in stock policies.

levels for all soil groups, including the sedimentary soils, was in the range 7–10 Quick Test units (QTK). This represents a significant change in the diagnosis of soil K deficiency on sedimentary soils. It was believed that they contained agronomically significant amounts of what was called Reserve K (normally measured by the TBK test), and hence did not require such high QTK levels to achieve maximum production. However, it was found in reviewing the data that the ability of soil QTK to predict relative pasture production was not enhanced by including a measure of Reserve K, even on sedimentary soils. This test therefore has little value for determining the ability of soil to provide plant available K.

It is accepted, however, that there is a lot of 'noise' in soil QTK vs pasture production function, but this can be clarified by looking at the relationship between soil QTK and the likelihood (probability) of getting a pasture response to fertiliser K *(Figure 3)*. The optimal range of QTK 7–10 corresponds to a low probability of responsiveness in all soil groups.

Sulphur

A new understanding of the meaning and hence the importance of the two soil tests for plant available S emerged from the S review carried out by Doug Edmeades in 2005. Sulphate S makes up a very small part of the plant available S pool (<5%). It is also extremely variable, mainly as a result of leaching events. For these reasons, it has very little value as the basis for determining the S status of soils. The mineralisable organic S pool (referred to as the Organic S test) contributes about 95% of the available S in the soil. It is not subject to leaching and is therefore a more robust measure of the soil S status. The biological optimal range is 10–12. However, some soils – those under low rainfall (<1000 mm) – cannot accumulate sufficient organic matter under pasture so the organic S levels can reach or exceed 10–12. Such soils will always need external additions of fertiliser S.

Other macro-nutrients

The other macro-nutrients that need to be considered in relation to New Zealand pastoral soils are calcium (Ca), magnesium (Mg) and sodium (Na). The critical level for Ca is very low in relation to typical soil Mg (QTMg) levels. It is for this reason that Ca deficiency does not occur in New Zealand soils. Two ranges are required for Mg:

- A range of 8–10 QTMg is required to eliminate the possibility of Mg deficiency in plants
- Levels of greater than 25–30 QTMg are required to achieve mixed-pasture Mg levels >0.25% in the spring, and hence minimise the possibility of animal health problems (hypomagnesemia).

Obvious production differences between a P, K and S test plot (left) in a Southland hayfield

Sodium is not one of the 16 essential nutrients, but levels above 3–4 QTNa are required to achieve Na concentrations of >0.1% in mixed-pasture for animal health.

The full set of biological optimal soil nutrients ranges for most New Zealand soils is given in *Table 2*.

Table 2: Biological optimal soil nutrient ranges for New Zealand clover-based pastures

NUTRIENT	RANGES
Potassium	7–10
Sulphate S	10–12
Organic S	10–12
Magnesium	8–10 (25–30 for animal health)
Calcium	>1
Sodium	Not required for plants (3–4 for animal health)

Clover-only samples

Clover is the canary in the mine when it comes to soil fertility because it has a higher requirement for all nutrients relative to grasses. Clover-only samples should be seen as complementary to soil test data and are a handy tool for corroborating soil macro-nutrient nutrient deficiencies.

Most micro-nutrients are abundant in New Zealand soils and are not required to be added to the fertiliser. However, there are three – molybdenum (Mo), boron (B) and copper (Cu) – that are required on some soils and because there is no calibrated soil test for these nutrients the only way to monitor them is via clover-only tests. A list of the critical nutrient levels for both macro and micro-nutrients is given in *Table 3*.

Table 3: Critical levels of the main macro and micro-nutrients below which clover growth will be limited

NUTRIENT	CRITICAL LEVEL
Phosphorous	<0.30%
Sulphur	<0.25%
Potassium	<2.0%
Magnesium	<0.15%
Calcium	<0.2%
Molybdenum	<0.10 ppm
Boron	<13 ppm
Copper	<5 ppm

Soil pH

Lime may be required and this can also be determined based on the likely economic benefit. Given current costs and prices it is always economic (when ground spreading lime on clover-based pastures) to increase the soil pH to the biological optimal range 5.8–6.0, but note that high-optimal pH levels are required for some specialist legumes such as lucerne.

However, most pastoral soils in New Zealand to which lime can be ground spread have pH levels of >5.5. Pasture responses to liming to the biological optimal pH for clover-based pastures (5.8–6.0) in such cases are small (0–5%) relative to correcting nutrient deficiencies, so liming is only considered when all the optimal nutrient levels have been achieved.

The situation is different when the aerial application of liming is necessary, as is the case in most hill country. Because of the greater on-ground costs, the economic optimal soil pH for the aerial application of lime on clover pastures is currently about 5.5–5.6. If soil pH levels are significantly below 5.5–5.6 (say <5.3) then liming is essential, together with nutrient inputs to optimise pasture production.

New tools

The calculations of the economic Olsen P ranges used above are based on Overseer 3, which was developed in the early 1990s prior to the various nutrient reviews. This software is now owned by the fertiliser industry and is being updated, and it is assumed to take into account the key findings from the recent reviews. The upgraded software will only be available to industry personnel (A.H.C. Roberts, Ravensdown Fertiliser Cooperative Ltd, Personal communication).

agKnowledge Ltd, with mathematical input from Massey University (Albany Campus) and financial support from agMardt, has developed and is currently testing new dynamical models (as distinct from mechanistic models) for P, K and S. These will allow farm consultants to examine economic outcomes (net present value and internal rate of return) from any given fertiliser policy. This is based on the predicted changes in pasture and hence animal production. This modelling approach requires fewer input variables than required to run mechanistic models. It also allows the user to readily determine the most profitable combination of nutrients (P, K and S) to optimise the long-term farm profitability based on the goals on a given farm.

It is an annualised model and takes a long-term perspective (10–20 years). It is designed as an expert system and typically the farm consultant (expert) would run the model initially to set-up the farm fertiliser plan, based on the farm's potential and the farmer's production and economic goals. Updates could follow if there were major changes to the farm's policies or economic circumstances.

One of the important outputs from the model is the predicted changes in pasture production (increases or decreases over time (years) for a given fertiliser program). This output could be used to develop or refine stock policies using the farm management software Farmax.

Further reading

To access the author's research papers mentioned in this article see: wwwdougedmeades.com

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The quality of pasture directly correlates to livestock production

JACOB KAMBUTA

INTEGRATING MIGRANT DAIRY WORKERS INTO NEW ZEALAND

The intensification of dairying in New Zealand and the changing structure of dairy farms (from small, traditionally family-run farms to larger and often corporate-owned farms) has created an ever-growing demand for staff and, subsequently, recruitment and retention problems. Pre-COVID-19, farm owners who were unable to fill vacancies domestically turned to migrant dairy workers to meet their labour demands. Although the current pandemic makes it much more difficult to source migrant workers, it provides us with an opportunity to reflect upon issues associated with migrant labour.

Demand for migrant labour

The increasing dependence on migrant labour has created significant challenges for employers, rural communities, the Government and farmer employers. The Canterbury region, which has undergone rapid expansion in the dairy industry, has the highest concentration of foreign-born dairy workers. Given the current border restrictions, the question of how we can integrate these migrant dairy workers – both on the farm and into rural communities – becomes even more important.

Migration in New Zealand

New Zealand, like many migrant-receiving countries around the world, has turned to the international labour market when domestic labour shortages develop. Migrants, both temporary and long term, have been arriving in this country since the mid-1800s. Although the early agricultural labour migrants were from less developed countries, they are increasingly coming from other developed countries.

Migration is expected to increase in New Zealand and in other developed countries in the near future due to ageing populations and declining birth rates. New Zealand, like many host countries, uses a skill-based immigration system to control the influx of migrants. This system favours migrants with tertiary qualifications. Most migrants who move countries for a better life or economic opportunities work in urban areas. Dairy farm workers, who are considered voluntary economic migrants, represent a distinct group as they live and work in rural areas.

Migrant dairy workers represent a growing share of the New Zealand rural agricultural labour supply. The Government's response to skill shortages in the rural sector, where jobs are typically seen as low-skilled, has been very different from its response to high-skill industry/urban shortages. Here migrant dairy workers who obtain an Essential Skills Visa (ESV) receive longer-term (one to three-year) visas and work permits than migrants in other categories, such as the Recognised Employer Scheme (RSE). They can also bring their partners and children. Both of these factors, combined with the current border restrictions, means that retaining and integrating dairy workers into the country is even more important today.

Integration of migrant dairy workers

Integration is typically considered a 'two-way process', where both the minority and majority must adjust to one another and develop shared norms. At an individual level, integration also depends on an individual's social participation, as well as the economic and cultural roles he or she plays in their new setting. At a community and government level, it means creating a welcoming environment, providing opportunities for participation, and ensuring that migrants' voices are heard and their needs are met.

While there is considerable research on the economic benefits of labour migration schemes, we know very little about migrants' day-to-day experiences of living and working on New Zealand dairy farms or how they attempt to integrate into local communities. What is clear is that integration is a complex process that involves many interrelated domains.

It is therefore necessary to develop a better understanding of migrants' perspectives on working in the New Zealand dairy industry. This is true not only because migrants contribute to the national economy, but also because they are often socially and physically constrained due to their work permit conditions, the physical isolation they experience while living on remote dairy farms, and their limited knowledge of local employment practices.

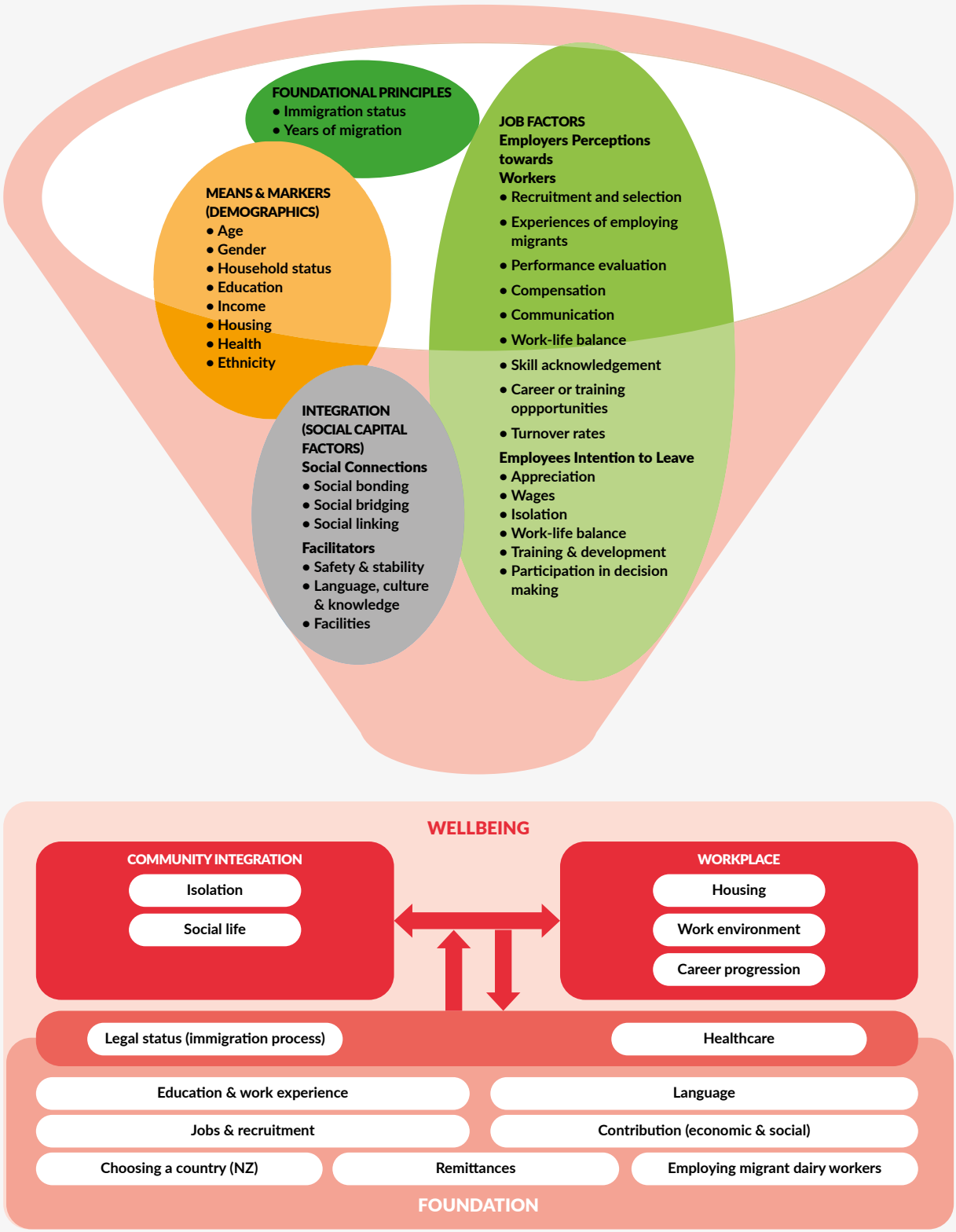

Figure 1: Model of integration for migrant workers

Migrant dairy workers are changing the face of rural New Zealand communities. Increased ethnic diversity means that rural communities must consider how best to integrate migrants. Surprisingly, very little attention has been devoted to the integration of migrant dairy workers, despite the fact that a large share of New Zealand dairy farms hire them.

Although migrants working on dairy farms in Canterbury are an extremely diverse group, they face many of the same challenges in their attempts to integrate successfully into the New Zealand way of life. The analysis of data gathered through a series of interviews and semi-structured questionnaires helps us to understand the complex process of integration in a more structured way *(Figure 1)*.

The difficult psychosocial process of integration for migrant dairy farm workers begins even before they enter the country. Migrant dairy workers must provide evidence of a job offer, information about their prior education and relevant skills, and satisfactory medical and police certificates. On arriving in New Zealand, most employers help migrants to settle in by introducing them to members of the local community and helping them with various tasks, such as setting up bank accounts and purchasing vehicles. Fellow migrants also play a central role in helping them to 'find their feet,' often providing advice around employment, where to buy clothes and goods and introducing them to other migrants.

Challenges faced by migrants as they attempt to settle in include the high cost of living in New Zealand, issues with long work hours, social isolation, and language and cultural barriers. They also reported feeling dissatisfied with the work visa renewal process and constantly changing immigration policies, which lead to uncertainty around their futures. These findings point to a disconnect between what the migrants envisage life in New Zealand will be like and the reality of living here. *Table 1* provides a list of factors that affect migrant dairy workers' length of stay on the farm and in the country and those which hinder integration into the community.

While most migrant dairy workers try their best to integrate into their local communities, some noted that they were not able to fully participate in activities due to the nature of dairy work (in particular the long work hours, variable rosters and distance from the farm to the community). Many also emphasised that the financial and emotional costs of renewing their work permits, and difficulties associated with obtaining residency, were major barriers to their integration.

As migrant dairy workers undertake essential work on New Zealand dairy farms, it is crucial to recognise their flexibility and adaptability, as well as the strengths and talents that exist within this community. Migrant dairy farm workers have strong social bonding capabilities. Many come to New Zealand and acquire subsequent positions through family and friends.

Table 1: Factors negatively impacting on length of stay on the farm and in the country and integration into the community

LENGTH OF STAY ON THE FARM	LENGTH OF STAY IN THE COUNTRY	INTEGRATION INTO THE COMMUNITY
Distance from the nearest town	Issues with prior education not being recognised	Lack of resources (time, money and transport) needed to socialise with fellow migrants and members of the local community
Inadequate housing	Poor access to social services (in particular, the high cost of healthcare and dental treatment)	A lack of relevant language skills and cultural knowledge
Challenging workplace characteristics, conflict with co-workers and line managers, unsustainable work rosters	Current visa policies and concerns about whether work permits will be renewed	
Short-term nature of most dairy contracts	More favourable visa policies in other countries like Australia	

Table 2: Factors supporting length of stay on the farm and in the country and integration into the community

LENGTH OF STAY ON THE FARM	LENGTH OF STAY IN THE COUNTRY	INTEGRATION INTO THE COMMUNITY
Good working relationships with employers who appreciate their staff, pay them fairly, provide good accommodation, decent rosters, adequate time off and support ongoing learning	Obtaining local qualifications – Industry Training Organisation (ITO) courses	Attendance at various community events
Employers who help their staff settle in	Favourable immigration policies	Children's school events provide a good space for integration
Employers who support their staff members' visa applications		Knowledge of culture and language skills

Photo courtesy of Mitchell Adair, Lincoln University

Employers face significant challenges in managing and retaining foreign workers as a result of more favourable immigration policies in other countries.

Migrants reported involvement in the local community via sports teams, cultural events, children's school events and voluntary activities *(Table 2)*. They are well educated and are utilising their skills. Most are involved in on-the-job training through studying for vocational qualifications in their current jobs. With access to information and services, migrant dairy workers are able to find ways to deal with day-to-day tasks to enhance their lives in New Zealand.

Most of the interviewed migrants want to remain in New Zealand on a long-term basis and dream of progressing in the dairy industry. This points to a disconnect between migrants' aspirations to stay in the country and the temporary nature of the ESV programme many came into the country under, which may spell ongoing labour problems for the dairy industry.

Employers face significant challenges in managing and retaining foreign workers as a result of more favourable immigration policies in other countries. A recent policy change in Australia, which makes it easier for migrants with limited English proficiency to gain residency, is an example. Interviews with New Zealand employers suggest that they want to retain their migrant workers, but often struggle to keep them as a result of variable immigration policies, as exemplified by the transition from the ESV scheme to the new temporary work visa programme.

Benefits and barriers to integration

Integration is crucial for migrant dairy workers' mental wellbeing, even for those on temporary programmes like the ESV or in the more recent immigration categories. They reported high levels of anxiety about their futures in New Zealand. Greater certainty about their visa status, or eligibility to apply for residency or citizenship, will provide them with a higher degree of wellbeing and potentially increase their productivity.

The integration of migrant dairy workers also benefits this country. They not only help to meet local labour needs, but they also contribute to the growing global demand for New Zealand milk products. They increase the country's human capital through their skills and qualifications, and contribute to rural communities through their employment in areas where there is

Despite the Government's ongoing efforts, the New Zealand dairy sector still faces serious challenges attracting and retaining dairy farm workers, both locals and migrants.

high demand. Their spending in rural communities and the presence of their children in local schools ensure that these small rural communities remain viable. The sociocultural impacts of integrating and retaining migrant dairy workers in New Zealand are equally significant. At the very least, migrants provide locals with an opportunity to engage with members from different parts of the world.

A failure to integrate migrant dairy workers has wide-ranging and negative flow-on effects for all stakeholders. Migrants lose the time and money they have spent moving to New Zealand and gaining local skills and qualifications. They are passionate about progressing in the industry and are willing to work hard to achieve their career goals. Employers lose their investment in these migrants and must spend more money recruiting and retraining new farm workers.

Recent changes to immigration policy, which mean that migrants must leave New Zealand for a year once their three-year work permit has expired, will harm businesses due to the cost of recruiting and retraining new individuals. The loss of migrant families from rural communities also means that schools and social services may have to close. Reductions in migrant populations may even mean less funding for rural infrastructure (roading, transport, postal services) and council amenities such as community swimming pools, libraries, parks and sports fields.

Migrant dairy workers (Filipinos in particular) have high levels of social bonding (close bonds with members of their own communities). Despite the limitations identified (time, distance, transport, and financial resources), they also have remarkably good levels of social bridging (relationships with the local community) and social linking (links with the local government). While many have accomplished remarkable levels of integration, the success stories tend to be the outcome of individual resources and resourcefulness, rather than community or government-wide efforts. Moreover, there is still a danger that while migrants may find strength in a group, as individuals they may be vulnerable, particularly in their immigration status.

Migrant dairy workers have shown they are willing to integrate, but integration requires more than just the efforts of migrants. To achieve their successful integration, employers, local communities and the Government all have an important role to play. The following are some suggestions about how this can be achieved:

- As migrant dairy workers spend most of their time on the farm, employers must ensure they provide a positive and supportive workplace
- Language proficiency plays a crucial role in integration, so local councils should offer English courses at times and in locations that are convenient for them. These courses could also be offered through the ITO scheme
- Dairy NZ, along with the Ministry for Business, Innovation and Employment (MBIE), could consider developing an app that provides information about working on New Zealand dairy farms in the dominant languages, along with links to relevant services
- Recognition of migrants' prior qualifications by the New Zealand Qualifications Authority (NZQA), along with continued local education through ITO opportunities on New Zealand dairy farms, would contribute greatly to their integration
- The Government must consider revising the current visa system and providing a clearer pathway to residency
- The Government should also establish an integration working group to determine how many migrants there are in the country, what their specific needs are, and what services are currently provided.

Conclusion

At the time of completion of this article, the Government had expanded its efforts to grow the New Zealand economy using a regional immigration category. In short, recent policy focuses on attracting migrant workers at the regional level. Given the requirements to leave, these new policies will have an adverse effect on a dairy sector already struggling to fill its labour demands.

Despite the Government's ongoing efforts, the New Zealand dairy sector still faces serious challenges attracting and retaining dairy farm workers, both locals and migrants. This need is even more pressing given the current border restrictions, which are likely to remain in place for the near future.

Acknowledgements

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SARAH DONALDSON

FARMER MENTAL HEALTH – GUIDANCE FOR RURAL PROFESSIONALS

Rural professionals are often the people who are the eyes and ears of rural communities. They are up farm driveways, sitting at kitchen tables and frequently privy to a client's business or personal situations. This may mean they are in a valued position to spot the signs if things are amiss, where someone is showing signs of stress or mental unwellness, and therefore have the ability to ask how they are. This article looks at non-invasive ways of doing this, as well as common signs of mental distress, and discusses other channels of support.

Starting the conversation

More people are willing to step in to support others if they recognise they are stressed or unwell. However, this is still a challenging situation and one of the main questions I always get asked is, 'How do I bring this up with someone?' Usually this is because they are worried they will say it wrong or that the other person might react negatively. But you don't need to be a mental health professional to check in on someone. It is better to ask or invite a conversation than not. There is no right way to do this as long as you are genuine, respectful and non-judgemental.

First, just start chatting about everyday or neutral topics, basically anything just to engage that person and also to show you are taking an interest in them and are happy to listen. This alone might be enough to get them talking about where things are at for them. Otherwise you can direct the conversation to your current concerns. Asking an open question generates further discussion. For example, 'So how are you feeling about how things are going on the farm at the moment?'

Feed back to them that it is a positive move that they have opened up, that you recognise it is really tough right now, and by doing this they have taken the biggest step. Remember, even just listening can be a game changer.

Second, normalising it can make it less threatening. For example, 'Lots of people at the moment are finding it hard going, so how are things going for you?' Also being genuine and upfront about why you are there or reflecting about changes in behaviours you have observed is another lead-in. For instance, 'I wanted to catch up today because I've been a bit concerned about you lately. You haven't been following up with stuff or returning phone calls and you seem a bit down compared to normal. So I wanted to talk to you and ask what's up?'

Try not to use the phrase 'Are you okay?' because typically many people will automatically say 'Yes, I'm fine', whereas an open question can get them talking. If someone dismisses your question or minimises your concerns at least they know the invitation is there and that you have made it known that you are supportive should they want or need to later open up. It may mean they go away and reflect more about their situation and this might increase their self-awareness.

If the person is your manager or an older client this can potentially feel more intimidating. If you feel like you have a reasonably open relationship with them, you can still check in as one person genuinely caring about another, regardless of rank. If you feel like this may inflame the situation it could be an option to talk to their partner or another senior person in the team to share your concerns and observations. Or the other option is to talk to one of the support services given in this article to ask for guidance about how to manage the situation. They often support people indirectly through supporting those who already have a relationship to the person.

Three approaches

Generally speaking, in my experience rural people are more likely to be comfortable about talking if we can do three things:

- Initially use everyday language that they can relate to and isn't too confronting. Try terms such as 'feeling overloaded', 'being under the pump', 'body and brain have hit a wall', 'wound up' or 'run out of coping space'. Or we can compare it to stock condition scores or sport performance
- One of the main barriers to people getting help if they are experiencing mental distress is they may worry that others will perceive them in a negative manner if they disclose that they are struggling. Many people still perceive illnesses such as depression and anxiety to be some kind of personal flaw and we have to address this (and also on a bigger scale with community education). The easiest way is to explain that we all have mental health, just as we have physical health, and it is on a continuum from 'really well' to 'really unwell'. When we are feeling more unwell or 'overloaded' there are common symptoms our body and brain display that will reduce as we make a plan and take steps to move back up the continuum to wellness
- This leads to the third point which is normalising what they are experiencing (e.g. explaining that if they have been under sustained stress for months it is only natural that their body hits the wall and shows up with some signs). Don't confuse normalising with minimising. It's a big thing to acknowledge or disclose if you are struggling and they may not be able to see the wood for the trees. So feed back to them that it is a positive move that they have opened up, that you recognise it is really tough right now, and by doing this they have taken the biggest step. Remember, even just listening can be a game changer. When we feel overwhelmed and our mind is full of negative thoughts, just talking to someone about these can reduce the internal pressure. Knowing you have support and people who care counts and reduces that sense of isolation.

'Five Ways to Wellbeing'

Offer hope and let them know you and others are there to support them to move forward with a plan. Also let them know there are some key proven actions that keep people mentally well and healthy and encourage them to inject these elements back into their routine. These are called the 'Five Ways to Wellbeing':

- Being connected to others
- Staying active
- Giving to others
- New learning or experiences
- Taking notice.

These actions not only keep us well, but also help restore us when we are under pressure. I recently heard a term from an Australian fellow psychologist who referred to 'pleasure and leisure' as the anecdote to stress, which is a great simple way to think about how to calm and recharge our body.

Common signs of mental distress

Signs and symptoms of mental illness can vary from person to person. These symptoms can affect emotions, thoughts and behaviours. The following are some generic warning signs that may alert you that someone may be becoming unwell or is already unwell:

The Rural Support Trust is a valuable support option for farmers and rural professionals. They are often able to come to the farm to meet with people, something which many other support services do not offer.

- Withdrawal – increased isolation and social withdrawal
- Mood changes – feeling flat, down or negative, or having mood swings that are extreme or out of character
- Drop in functioning – an unusual drop in participation and performance at work and/or in social activities
- Inability to cope with daily problems or stress
- Problems thinking – difficulty with concentration, memory or logical thinking, and making decisions, or being impulsive with decisions
- Apathy – loss of initiative or motivation to participate in any activity
- Sleep or appetite changes – changes in sleep or appetite or decline in personal care
- Loss of interest – in previously enjoyed activities and interests
- Enduring fatigue/tiredness – low energy
- Excessive fears or worries, or extreme feelings of guilt
- Increase in alcohol or drug use
- Excessive irritability and low tolerance – may express extreme frustration, anger or show aggressive behaviour
- Intrusive thoughts – repetitive or sped up thoughts that are preoccupying
- Self-harming or risk-taking behaviours
- Suicidal thinking or gestures – talking about or thinking about death or ending their life, feelings of hopelessness, helplessness or worthlessness, putting affairs in order, making plans to end life.

Sometimes symptoms of a mental health disorder appear as physical problems, such as stomach pain, back pain, headache, or other unexplained aches and pains. However, this needs to be assessed by a health professional to consider the presence of other possible physical conditions.

Farmstrong have very good wellbeing resources. See this handy checklist that can be ordered or looked up to use together with someone to gauge if they are showing signs of stress: https://farmstrong.co.nz/wp-content/uploads/2019/03/FS_DL_UnderPump-FINAL.pdf

Other channels of support

When it seems (even after talking) that the other person still seems to be preoccupied, obviously low or highly anxious/agitated, or you are worried about their safety, it is best to call in others to access further professional help for support or to action next steps.

GP support

Making an appointment with their GP is a good place to seek help and advice when symptoms are ongoing, getting worse or affecting their everyday life. They also can screen for other physical issues, or do blood tests for iron, thyroid or vitamin B levels in case these are impacting on wellbeing. This kind of check can be a good way to 'sell' a review with a GP too. At times medication is a valuable and usually temporary option to provide

If things are feeling intense, you feel drained or consumed by the situation, or the person is overly reliant on you, it is time to step back and get someone else's perspective and help.

some relief from symptoms, just as with any other illness. A GP may also be able to look at options to refer to the DHB Mental Health Services or to a psychologist or counsellor experienced in this area who can help with strategies to manage stress or depression.

Rural Support Trust

The Rural Support Trust is a valuable support option for farmers and rural professionals. They provide direct and free support for practical or emotional health issues for rural people facing adversity. They understand the culture and pressures of rural life but can also help direct or navigate to other channels of support of aid. They are often able to come to the farm to meet with people, something which many other support services do not offer. They can also provide support to rural professionals who are supporting clients or community members.

SUMMARY OF ENGAGEMENT STRATEGIES

- Initiate general conversation
- Show the enquiry comes from genuine concern
- Normalise the pressures and impact
- Ask open questions
- Feed back specific changes you have seen
- Use terms that are non-confronting – worn out, fatigue, under the pump, body/mind hitting a wall, overloaded
- Destigmatise – we all have mental health
- Support the Five Ways to Wellbeing

Depression website

John Kirwin's website now has a specific rural section and includes useful resources, tools and stories. It can be helpful to increase insight for people to see videos of people they can relate to telling of their similar challenges and learn what helped them to get well. See https://depression.org.nz/get-better/your-identity/rural/

Rural support channels

Suggest that your client contacts one of these organisations, as applicable:

- Farmstrong – wellbeing information for farmers
- Rural Support Trust – a free and confidential service for people and families in rural communities
- Dairy Women's Network – for women working in the dairy industry
- Rural Women – network for people working in rural communities
- Federated Farmers – farmer advocacy.

Urgent help

If you are concerned about someone it pays as a precaution to check if there are firearms on the property and arrange to store any guns off-site in the interim period until they are well again. If your concern about someone's mental health is urgent contact your local DHB's Mental Health Crisis Assessment Team (24 hours) or call 1737 to talk to a trained mental health professional. A further option can be to arrange for the person (accompanied by someone) to go to the Emergency Department of your local hospital to request further assessment and support.

What about you?

We definitely need our rural community supporting each other and leaning in to help when life gets challenging. But we need to be mindful of not compromising our own wellbeing or safety in the process. Remember the oxygen rule: oxygen to self before helping others. In essence, we need to be okay in order to be helpful to others.

Know and check your boundaries in the situation and ask, 'What is my role/responsibility and what are my limits?' This obviously depends on the relationship with the person. If it is a client, your role at times might be spotting that things aren't right and supporting that person to access other channels of help. Or there may be an ongoing role in your professional capacity, but do not feel like you have to shoulder that responsibility alone. If someone is particularly unwell they may need a small team of people around them to support the track back to wellness.

Also, if you are concerned about someone's safety, confidentiality can be breached in order to protect potential harm from occurring. If things are feeling intense, you feel drained or consumed by the situation, or the person is overly reliant on you, it is time to step back and get someone else's perspective and help. Recognise the limits of what you can offer alongside pritorising recovery time and your own wellbeing needs. Remember the 'pleasure and leisure' rule to mitigate stress.

Sarah Donaldson is a Clinical Psychologist who specialises in rural mental health. She is the Wellness Coordinator for the Wairarapa and Tararua RST and a Director of Tea Health & Wellbeing Consultants Ltd. Email: sarah.donaldson@xtra.co.nz.

ISABELLE SMITH

THE SUSTAINABLE AGRICULTURE FINANCE INITIATIVE (SAFI)

FINANCING A SUSTAINABLE FUTURE

SAFI is developing a standard for sustainable agriculture that aligns with emerging international frameworks, as well as existing sustainability standards used by New Zealand farmers and growers. This article looks at how the SAFI Standard will be used by the finance sector in considering agricultural lending and investment to improve the flow of sustainable finance to New Zealand's agriculture sector.

Origins

SAFI was established in early 2020 by a Steering Group made up of the major banks in New Zealand – ASB, ANZ, Westpac, BNZ and Rabobank – working in collaboration with The Aotearoa Circle and the Ministry for Primary Industries, with secretariat services provided by Ernst & Young (EY). The purpose of SAFI is to accelerate further investment and support for sustainable agriculture in New Zealand. The Aotearoa Circle is a partnership of public and private sector leaders whose priority workstream is sustainable finance.

Drivers

SAFI aims to create a bridge between the range of sustainable agriculture (in many cases consumer-focused) standards currently used by New Zealand farmers and growers, and emerging international frameworks for sustainable agriculture finance.

There are a number of drivers for seeking international alignment including the need to keep ahead of developing financial and environmental regulations in overseas markets, safeguard access to future capital and meet evolving climate-related risk reporting requirements.

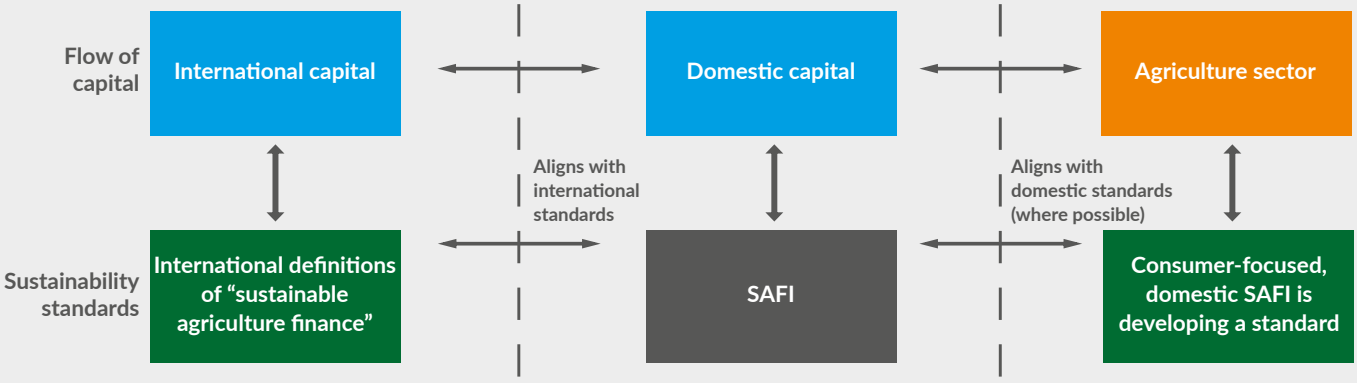
Internationally, the pace of development of green standards and labels, taxonomies of sustainable investments and corporate disclosures of environmental risks is increasing.

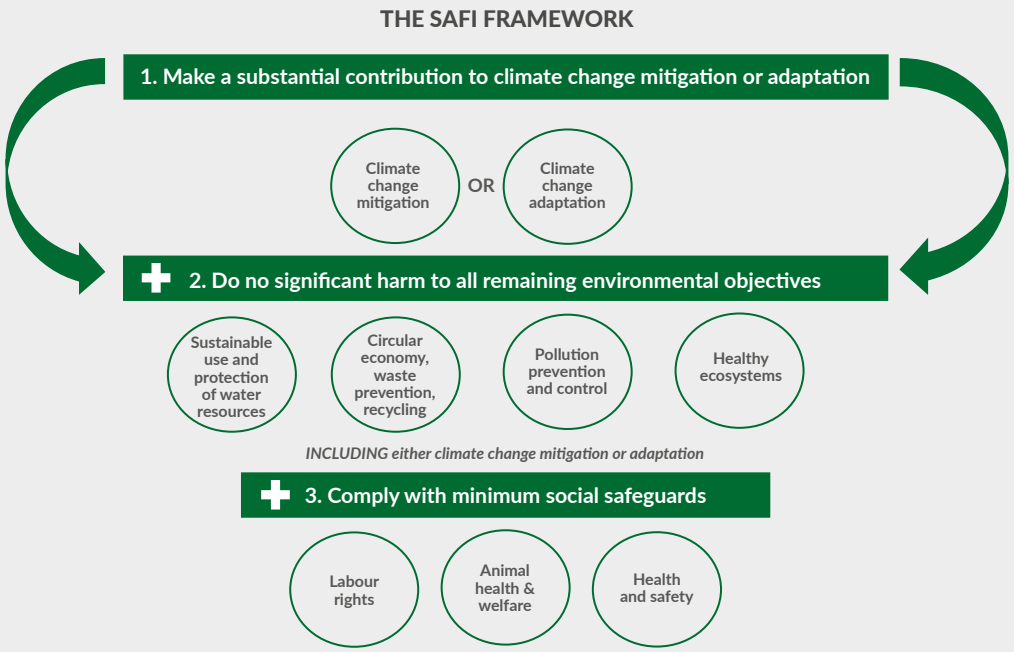
As a result, the SAFI Standard aligns to the EU 'taxonomy', a leading classification system which establishes a list of environmentally sustainable economic activities.

The EU taxonomy is supported by recent EU regulation, which sets the EU taxonomy as a key pillar of the EU's sustainable finance climate change agenda and the EU's Green Deal. The taxonomy regulation amends disclosure regulation in the EU to require financial market participants and large corporates to disclose information on how (and to what extent) their products, investments and businesses are aligned with the taxonomy.

Through the Ministry for the Environment, SAFI is engaged with the International Platform on Sustainable Finance, with the aim of achieving international recognition and equivalence of the SAFI Standard.

VISUALISING THE PROBLEM





The SAFI Standard and the finance sector

The development of the SAFI Standard allows the finance sector (capital providers) to understand and define sustainable agriculture practices in New Zealand as an element of sustainable finance, in a way that also aligns with international frameworks. Using this understanding, capital providers can make independent decisions on the manner and extent to which they integrate sustainable finance products and services into their business models.

For example, what Bank A in New Zealand recognises as sustainable environmental resource management can align with current and future domestic sustainability certifications received by some of their customers and with what Bank B in Europe considers sustainable environmental resource management. This will provide comparability between sustainable finance products and encourage sustainable capital into New Zealand, while improving the bank's understanding of its climate change risks.

What rural professionals and farmers need to know

For farmers and growers, this means that an understanding of (and ultimately alignment with) the SAFI Standard will support conversations with their banks about potential future access to sustainable finance and how they are addressing climate change risks.

Using the EU taxonomy framework, the SAFI Standard covers many of the same environmental objectives covered by domestic standards including:

- Climate change mitigation
- Climate change adaptation
- Water
- Circular economy/waste
- Pollution control
- Biodiversity.

Alignment through equivalency with existing standards and regulations

Importantly, the SAFI Standard seeks to align not only with international frameworks, such as the EU taxonomy, but also with existing domestic standards already used by large numbers of farmers and growers and relevant domestic legislation and regulation.

Through alignment, the SAFI Standard will allow a farmer or grower meeting an existing standard, that is deemed equivalent, to also meet the SAFI Standard.

This significantly minimises the administrative burden on farmers and growers seeking alignment with the SAFI Standard, as compliance with an existing 'equivalent' standard can meet the requirements of SAFI.

Next steps

Version one of the Draft SAFI Standard was published in December 2020 and the Steering Group are currently seeking further stakeholder feedback on this draft.

The key next step for the SAFI work programme is to align the Draft SAFI Standard with existing standards to find equivalence either in full or part.

By seeking equivalence, the SAFI Standard can bridge the gap between international and domestic standards for sustainable agriculture, give international recognition to farmers and growers and ideally drive new channels of sustainable capital into New Zealand.

What success looks like

The ultimate aim of SAFI is to encourage low-cost investment flows from the financial sector to farmers and growers engaged in or transitioning to more sustainable activities. In doing so, SAFI can support New Zealand's agriculture sector to reduce emissions, improve resiliency and deliver a sustainable future.

More information

For more information about the SAFI work programme please contact the Secretariat at the email address below.

Isabelle Smith is a Climate Change and Sustainability Consultant at EY and part of the SAFI Secretariat team based in Auckland. Email: safi.secretariat@nz.ey.com

JULIAN GAFFANEY

Ag background

Growing up on several farms in South Canterbury that his father managed through the 1980s gave Julian an early immersion in farming and farm life. He credits this lifestyle, along with a very diversified farming operation he was employed at from the ages of 14 to 21, as his farming foundation.

Completing high school at Pleasant Point, he worked before studying science and agriculture at Lincoln University and graduating with a Bachelor of Science in 2004. An integral part of building his confidence and platform for an ag sector career was membership of and competitions in Young Farmers Clubs, which saw him competing in the National Young Farmer of the Year contest finals in both 2003 and 2005.

On completing his degree, he worked for Pyne Gould Guinness (prior to its merger with Wrightsons) and was based at Ceres Farm outside Christchurch in a field agronomy role. This was broad-based, including procurement and full agronomic advice for a wide variety of seed crops, as well as trial and research work at both Ceres Farm and various trial sites. Julian recalls the invaluable knowledge gained during this period of his career. Working under seed and plant breeding industry experts such as Murray Kelly and Dr Alan Stewart helped build up his agronomy base, which is an important foundation for pasture-based consultancy.

Farm management consultancy

Following on from agronomy work, he worked initially in a technology transfer and then in a business management role with Donaghys Industries for two years before starting into farm management consultancy under Andy Macfarlane at Macfarlane Rural Business in Ashburton in 2008. Andy had long been a mentor after Julian worked for a client of his in the early 2000s, and they had kept in contact through his early post-university career. He credits Andy with stimulating his interest in consultancy because during one of his visits he asked him what he was planning to do after his degree and suggested it as a career. This was a real confidence boost for Julian who had not seen himself in the role prior to this.

Julian has been through the ups and downs of farming cycles with clients through his 13 years of consultancy, starting out in 2008 before the global financial crisis.

Starting out primarily in arable and mixed cropping systems-based consultancy, he took on a small amount of dairy work under Jeremy Savage and this gradually grew to the majority of his client base. Today, this has a strong dairy component as well as dairy support, mixed cropping and some larger-scale multi-enterprise businesses and corporate client work.

Julian has been through the ups and downs of farming cycles with clients through his 13 years of consultancy, starting out in 2008 before the global financial crisis. He says that new lending and overdraft extensions were a lot easier to come by back then, which turned around fairly quickly to focusing on cashflow and strengthening balance sheets after the global financial crisis. This was a great learning curve at the time and has helped him to guide clients through tough cycles since then, such as the dairy downturn mid-decade and coming into the uncertainty that the early COVID period brought.

One tool which is central to Julian's consultancy is Farmax. Having been schooled up in 'Udder' early career, the transition to Farmax was made through Macfarlane Rural Business and Dairy Systems Monitoring (DSM) several years ago, and he has been a keen contributor of feedback to assist the development and refinement of the software. He says they were able to set up and model, in particular irrigated farm systems, to a high level of certainty from a physical standpoint. The ability to run the farm financials underneath this allows farm systems to be well monitored and benchmarked, but also to run scenarios for system tweaks and changes that would otherwise be far more complex to validate.

He believes the concurrent running of Farmax models alongside Overseer nutrient budgeting models is a real strength for consultants who have invested time and effort into training in these software tools. While it is not core business for a farm management consultant to operate Overseer, Julian sees it as a necessary component to really understand the whole farming system's environmental impacts and aspects for change which are fundamental for farming in the future. Also, the new NPS and the NES regulations are creating the need to understand which levers of a farming system need to be pushed or pulled to drive environmental outcomes that meet the new era of compliance.

Professional development

Julian has always had a strong focus on continued professional development throughout his career. He sees professional development as being the key to growth as a consultant and also as a person, without which he feels he would not have been able to progress his career and knowledge to current levels.

He has continued to take opportunities including completing a Kellogg Rural Leadership Scholarship in 2006, the initial Massey University Greenhouse Gas course in 2012, and intermediate and advanced Sustainable Nutrient Management certificates in 2013 and 2014. More Young Farmer contest involvement followed when he organised the technical section for the 2016 Grand Final based at Raincliff Station in South Canterbury. In 2017, he attended the IFMA international congress in Edinburgh, Scotland. In 2018, he was awarded an AGMARDT Leadership Scholarship, which he used to apply for the Institute of Agricultural Management (IAgrM) Leadership Development Programme in the UK, and which has had some previous NZIPIM alumni including Andy Macfarlane and Richard Green.

His attitude has been that to grow and progress you need to make things happen for yourself in life and business, and that has been the driver for his continued focus on personal and professional development. The training and courses he has done in New Zealand have been important, but the extension into International learning in the ag sector has been fundamental. His view of the agri-food sector has now become more international, as has his appreciation and understanding of New Zealand's global position.

For him, the IAgrM Leadership Development Programme was a privilege to attend along with 12 fellow delegates who were all UK-based agri-professionals. While the course was UK/EU centric, he found the learnings he took away about leadership, agri-food sector markets, trading relations and future food production pressures invaluable. Some of the key take-home messages Julian learned included:

- Lobbying power for the ag sector in the UK/EU is far stronger than we have in New Zealand – cohesion and amalgamation of sector/industry organisational lobbying is a prerequisite for more influence for our sector
- New Zealand may de-competivise our food production by adding agricultural methane emissions to an ETS – the EU has agreement to leave this out until 2030 at the earliest
- Agrichemical options in New Zealand are far wider than in the UK/EU – they are currently operating under a much tighter regulatory environment and he feels we would be in major trouble if we lost the use of neo-

nicotinoid seed treatments, for example, to deal with our native grass grub. The future risk is not necessarily losing these agrichemical options but the potential use of this against us in equivalent trade standards (a lot of trade deals are currently being negotiated)

- The UK ag sector view is that the subsidy removal has driven New Zealand's international competitiveness, but this has been driven by intensification which has caused environmental damage (a message well promulgated by our media)
- Animal welfare is something we need to be hyper-aware of, our outdoor wintering systems are being scrutinised, and equivalance of animal welfare standards and outcomes will be part of trading access
- The anti-livestock movement and 'fake news' will not go away and these messages must be countered with factual science-based messages.

The use of mentors has also been an integral part of his professional development and he would strongly encourage developing agri-professionals to use one. He says to choose someone you respect in the industry who is a good communicator and just ask them if they are willing to be one. He believes that mentors get a lot out of the process as well, it is good to be challenged about what you are doing, and they can often help you see the broader picture of your career progression.

Agri-food sector

In his view, one of the weaknesses of our overall agri-food sector is that there is no overarching plan for primary food production in New Zealand. We are not alone with this, as he saw in the UK, although they are working on a united primary sector plan as part of the Brexit withdrawal from the EU. Without an overall plan for primary sector production, we are at risk of not being able to maintain our current competitive position and advantages as we go through what he believes is a global reset of food production systems.

This global reset has been underway for a few years already and is measuring food production against new climatic, social and environmental standards that are very challenging. We have a lot of resources going in across various industry bodies and sectors which, if better aligned and coordinated, could he says become a more powerful driving force to lead the whole primary industry sector forward. However, this needs to happen under an overall agri-food sector national plan.

Farming venture and TransformAgri

Julian spent his early life growing up on farms, working weekends and school holidays then full-time prior to university, and took some time out to work as an arable manager in between degree years. He has more recently farmed a smallholding at Kerrytown near Pleasant Point.

Converting from borderdyke irrigation to spray by K-lines was the first major project, as well as re-fencing the block. Breeding ewes were run for fat lamb production, as well as rearing Hereford/Friesian cross calves and taking them through to 18 months for store and prime sale.

He says it was important for he and his wife Kate to bring up their children Tristan and Neve in a farming environment for at least part of their lives, to let them understand the realities of animal and food production. They have since sold the property and moved into Timaru in 2020, where the children attend high school and the focus is able to be 100% on their consultancy business.

Julian was a partner in Macfarlane Rural Business for several years before deciding to take the leap in 2019 and set up the company TransformAgri Limited with Kate. He is currently the sole consultant, while she is the business administrator. With a wide range of farming clients (primarily dairy) across North Otago, and South and Mid-Canterbury, he also does work on the West Coast. The business vision is, 'to support farmers and farming systems through the spectrum of present challenges, whilst striving to drive, lead and facilitate transformational change to meet the needs of the future'.

NZIPIM and governance

Julian has been a member of the Institute since 2008 and has greatly appreciated and benefited from the support, networking and knowledge opportunities provided. He has been on the Canterbury committee for four years, is a foundational member of a new South Canterbury/North Otago branch that has started, and in 2020 became a national board member.

He enjoys being able to contribute and give back to the Institute and those who have contributed previously, while strengthening and growing the organisation for the future. Julian says that membership and engagement with the Institute allows rural professionals to leverage off each other for knowledge and growth and is vital to sustain our collective future. He is also a member of IAgrM and has served 18 months as an Associate Director of Opuha Irrigation Limited, which supplies around 16,000 ha of irrigation area in South Canterbury.

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Working for the good of the Rural Profession

www.nzipim.co.nz