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THE JOURNAL

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

GLOBAL THINKING FORESTRY ON FARMS FOR GHG OFFSETTING **PLANT-BASED ANIMAL PRODUCT ALTERNATIVES**
GREAT FUTURES IN DAIRYING PLAN AND A RESILIENT WORKFORCE **UPDATE ON NEW WINTERING RULES**
BIGGER LAMBS OR MORE LAMBS? TREES ON FARMS FOR LAND PROTECTION AND PROFIT

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Contents

Mitigation vs adaptation – lessons learned from Cyclone Gabrielle

Climate change mitigation remains critical and requires an ongoing focus as our primary sector struggles to commercialise technologies at pace to meet methane reduction targets. However, the devastation that Cyclone Gabrielle has inflicted across North Island regions over recent weeks brings home that adaptation is equally important, including the need to urgently build resilient communities.

Our hearts go out to communities in Northland, Tairāwhiti, Hawke's Bay and numerous other impacted communities across the greater Waikato and Auckland regions. I felt my friend's pain as she shared with me her personal account of standing barefoot in the torrential rain, watching a landslide wipe out her home, having just had her life spared by her teenagers as they'd dragged her from her home office moments before. Many will be telling similar, traumatic and heart-breaking stories, and many of us will be walking the journey with whānau, friends and farming clients.

It has been an incredibly challenging period for all the communities impacted, and the nationwide response has been significant and heartening. The wellbeing of our farming families, staff, rural professionals and wider communities is of highest priority to us. New Zealand farmers are known for their resilience, but these times will be incredibly testing and for many the recovery process will take months and, for some, years. Even those not immediately impacted by the cyclone will likely be feeling the pressure and impacts of the long periods of wet weather we have seen in the north. It will be an important time to prioritise our own wellbeing and to show understanding to those who have experienced the worst impacts.

Cyclone Gabrielle has significantly impacted farmers and growers, with some having lost orchards, others vast tracts of pastoral land and feed, business infrastructure and employee accommodation, and yet others their own family homes. In the horticulture sector, contamination poses a serious risk to orchards and crops affected by flood waters.

The number of insurance claims related to Cyclone Gabrielle and the Auckland floods in late January has reached 70,000, with the Earthquake Commission noting that it has close to 4,000 claims relating to land damage. The Government's commitment to $25 million to kick-start the primary sector's recovery goes a small way to assisting with the rebuild. Cyclone-affected farmers, impacted communities and rural professionals need to continue to look out for each other's wellbeing over the coming months.

As we progress with the recovery, a new kind of dialogue around climate is beginning to emerge. Some are arguing that it's potentially too late to mitigate climate change and that we just have to get on with adapting to it. We're currently experiencing around 1.2°C of warming above pre-industrial times. Under current policy pathways, the world will struggle to hold warming well below 2°C as had been pledged in the Paris Agreement.

Cyclone Gabrielle has now been officially confirmed by NIWA as being the strongest cyclone to ever hit Aotearoa New Zealand. It was more devastating than Cyclone Bola in 1988 and more impactful than Giselle in 1968. It also had the lowest pressure and the most rain, in part due to Gabrielle picking up intensity as it crossed an ocean undergoing a marine heatwave.

It's become clear that New Zealand needs to invest in both mitigation and adaptation. A low-carbon society should remain our aim, albeit that it will result in some restructuring of our economy. It's not an either/or situation. We need both. It's going to be hard to get to the recommended warming limit of 1.5°C and it's going to come at a considerable price. But the cost of not mitigating and instead adapting to a 2°C or above world will be massive.

Funding the cost of adaptation, and the aftermath of severe weather events as we've just experienced, has been on the radar of the developing world for many years. Adaptation is now on our radar in Aotearoa New Zealand. What has become known over recent weeks is that it's not optional. Building resilient communities to withstand future weather events is as critical as developing technologies and implementing greenhouse gas plans to meet methane reduction targets. We must prioritise both mitigation and adaptation J

CHRIS PARSONS

THOUGHT LEADERSHIP

THINKING GLOBAL

Food and fibre leaders need to re-learn how to trade in a less benign world. The stability we took for granted has gone. If the sector is to thrive in an era of change we need leaders who can think globally and act strategically.

Rapid and sustained change

In an era of rapid and sustained change, being able to think and act strategically is critical. This is especially so for practitioners, professionals and policy-makers in New Zealand's food and fibre sector because we are primarily an exporting sector. This point is not a small one. In the aftermath of COVID-19, food and fibre exports represent 82% of this country's merchandising exports. We are keeping New Zealand solvent.

Even when tourism and export education come back on-stream, New Zealand's economy will remain unique compared to most developed economies in that it is centred on primary industries. Despite the jingoism of the Rogernomics era, we are not, and never have been, a sunset industry. Food and fibre are as much part of our future as they have been the mainstay of our history.

However, the *Pax Americana* that has underwritten New Zealand's ability to send our goods across the world's oceans to far-away markets with historic ease is not something we should take for granted. No longer do we live on the far bank of an American lake. The world is returning to a realist phase where raw power is challenging liberal ideals. The unique moment where the US was the sole superpower is now in the rear-view mirror.

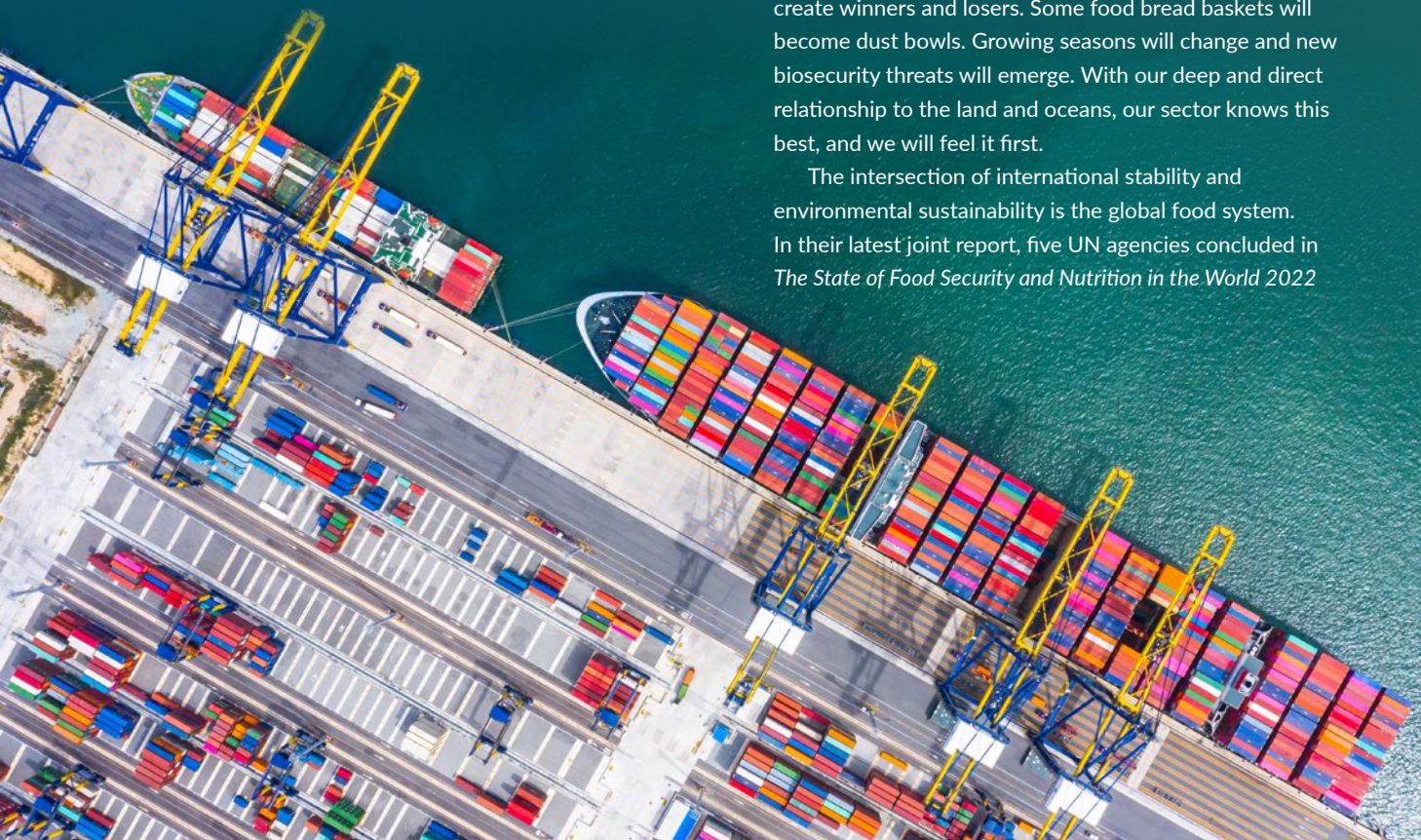
Today the world is returning to its norm: a multipolar world where the great powers jockey for competitive advantage. As a result, it is likely that we have reached the high-water mark of the integrated globalised system. The stability we have enjoyed since 1945 has given way to an era where global rules and prevailing values and systems are in transition. Food and fibre leaders will need to re-learn how to trade in a less benign world.

Climate change

The planet is also in transition, which makes our time different from those that have gone before. Climate change is fundamentally altering the grand bargain we have with the planet. Not only do we need to navigate political volatility, but we also need to manage climate volatility.

Climate change will impact where food can grow; it will create winners and losers. Some food bread baskets will become dust bowls. Growing seasons will change and new biosecurity threats will emerge. With our deep and direct relationship to the land and oceans, our sector knows this best, and we will feel it first.

The intersection of international stability and environmental sustainability is the global food system. In their latest joint report, five UN agencies concluded in *The State of Food Security and Nutrition in the World 2022*



that because of the triple header of climate, conflict and COVID, 'the world is moving backwards in its efforts to end hunger, food insecurity and malnutrition in all its forms.' If the world fails in this, the downside is food price inflation, mass migration, conflict and pain. So, if we are to thrive in an increasingly complex international environment we need to understand it.

For the sake of brevity, this article will paint with broad brush strokes. The aim is to touch on three areas that give a glimpse into a broad, deep and dynamic topic using the three lenses of politics, geography and demographics. Of these, geography is the constant, demography changes slowly, and while politics can change fast, over the long run there are discernible patterns that form the grand arc of history. Let's start with politics.

Climate change is fundamentally altering the grand bargain we have with the planet.

Politics

'History never repeats itself, but it does often rhyme.'
– Mark Twain

Mark Twain, and more recently Ray Dalio in his book *Principles for Dealing With the Changing World Order*, both talk about the great arc of history. There is a pattern in international relations that repeats, and which is cyclic. Political orders rise for a time and then fade (often violently); when they do, the international rules-based system that was optimised for that order is re-ordered too. According to Dalio, we are in the late stage of the current world order.

The long peace post-World War II is fading. Our whole system for prosperity has been optimised for the world order that followed the war, and on the back of plentiful labour (and consumers) born during the Baby Boomer generation. Looking historically, we can see the pattern of ideological shifts.

World War II was a contest between fascism, communism and democracy, where fascism lost. The Cold War was a contest between communism and democracy, where communism went bankrupt. Since 1991, we thought that democracy had won. Francis Fukuyama wrote his book *The End of History*, we cashed in the peace dividend, and we forgot some old maxims. Today we see the rise of strong men like Putin, Xi, and Erdoğan in Turkey, and others across Europe, the Middle East, South America and Africa. According to the Democracy Index 2022, democracy reached a high point in 2015, but has been in decline since.

Today the Chinese, among others, are asserting a different vision from the liberal democratic model. Concurrently, US politics and trade policy are swinging

According to the Democracy Index 2022, democracy reached a high point in 2015, but has been in decline since.

back to a more nationalist phase, seemingly weary of subsidising world security so others might prosper. It is not a foregone conclusion that China will surpass the US in economic and military power, but even if the US remains the leading country in the world, the future will be different from the system that has served us so well since the end of World War II.

For example, the US is exacting a higher price for those security guarantees that remain within its national interest, as the South Koreans and Europeans have found out. At the same time, the US is re-shoring key industries, semi-conductor manufacturing being one of the critical ones. We are moving into a multipolar world where once again different governance systems are competing to shape the global order.

It is highly possible that our future will see a contest between democracy and autocracy; at the very least it will be painted this way. This will create a dilemma for New Zealand. In the past our security and trade interests were aligned with the West. However, with the advent of the Chinese Free Trade Agreement our interests have increasingly been split — trade with China and the East versus security with the US and the West.

It will become harder and harder to walk that fine line. We will increasingly be asked to choose between our interests and our values. While this is nothing new in the art of diplomacy, New Zealand has long asserted a values-based foreign policy. In reality, the best foreign policy serves both our interests and our values, and one of the underlying drivers of our foreign and trade policy is our geography.

Geography

'If you know a country's geography, you can understand and predict its foreign policy.' – Napoleon Bonaparte

Geography has directed the affairs of people since the invention of politics. To highlight this, we will look at the Malacca Straits, the US, China and New Zealand. Each of these geographies is relevant to New Zealand's food and fibre sector.

The Malacca Straits is one of the world's most strategic choke points (**Figure 1**). The Straits have shaped Singapore's destiny, for good and bad. About 20% of global maritime trade passes the Port of Singapore and is a boon for its economy, but the need to control the Straits was also the cause of its most traumatic chapter during the Japanese occupation in World War II.

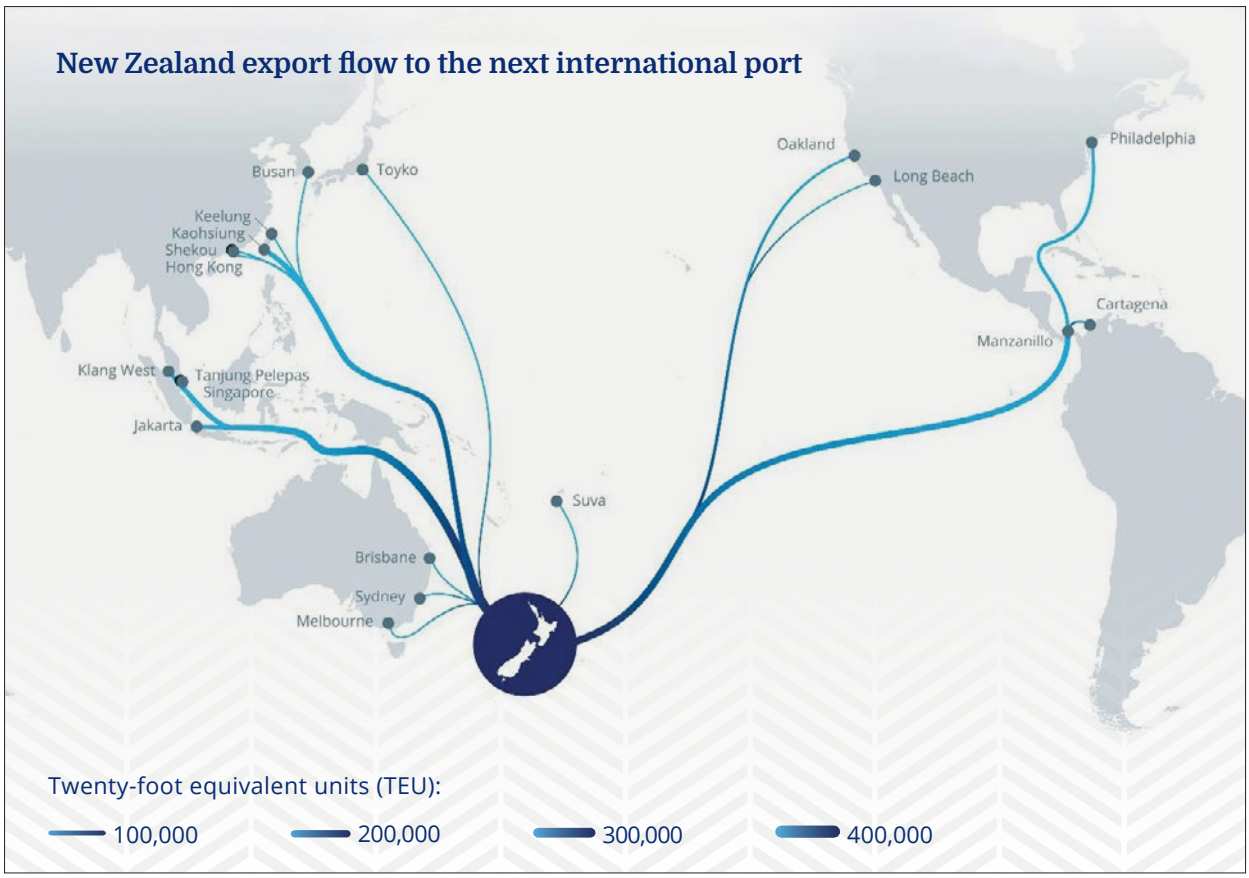


Figure 1: New Zealand export flow to the next international port. Source: Ministry of Transport

The Straits are also key to New Zealand's prosperity and security. Eighteen percent of our exports and 23% of our imports go through or to the Port of Singapore. Any disruption would have an impact on our prosperity. It is no coincidence that New Zealand is a member of the Five Powers Defence Arrangements, which provides assurances to the sovereignty of Malaysia and Singapore.

Further afield, the US's host of navigable rivers, an abundance of natural resources, and access to two oceans has allowed it to become one of the most productive and wealthy nations in world history. Given its moat and that its immediate neighbours are friendly and (under NAFTA) its biggest trade partners, the US is also one of the most secure states on earth.

There are two things that could challenge US impregnability: advanced technological innovations that defy geographic boundaries (e.g. cyber-threats, hypersonic missiles and a return to nuclear proliferation), and internal fragmentation fuelled by populist leaders who encourage outrage rather than galvanise the incredible creativity of the US's free society.

Eighteen percent of our exports and 23% of our imports go through or to the Port of Singapore. Any disruption would have an impact on our prosperity.

China's geography is tricky. It faces water scarcity, and lacks sufficient natural resources and arable land to feed its population and keep its economy growing. Hence, it imports significant amounts of food and fibre, including from New Zealand.

Trade with the Eurasian continent requires transportation networks to traverse borders, rivers, mountains and deserts. Their Belt and Road Initiative is a marvel and attempts to do this, but it is far more expensive to build and maintain than plying the world's oceanic trade routes.

To be a truly global superpower, China needs unfettered access to the global oceans, which raises the Taiwan question. There is a 'great maritime wall' (or 'first island chain' running from Japan and its outer islands to Taiwan, the Philippines and Malaysia), which bounds the South China Sea and constrains China's freedom of action. This is a core reason for President Xi's public and repeated statements that Taiwan will be reunified with China, by force if necessary.

The South China Sea should be of deep interest to New Zealand food and fibre leaders. This country is highly exposed to tensions there and any resulting friction to trade. According to the Ministry for Primary Industries *Situation and Outlook for Primary Industries* (December 2022), four of our

Figure 2: Japan's population 1950, 2005, 2055. Source: National Institute of Population and Social Security research (Japan)

top 10 export destinations (60% of top 10 revenue) are with countries adjacent to the South China Sea. If Malaysia were included this would be five destinations comprising 62% of top 10 revenue. We should not forget that our prosperity is based on the freedom of the high seas.

Ninety-nine percent of New Zealand's trade, by weight, goes by sea (**Figure 1**). Most of that trade plies the Pacific Ocean. We also claim the fourth largest exclusive economic zone in the world. Given our modest naval capabilities, we are reliant on a functioning rules-based system and a network of security partners to underwrite our prosperity. This also implies that we would do well to invest in it.

Beyond the Government's obvious requirement to make substantive contributions to the rules-based system and our international relationships through the Ministry of Foreign Affairs and Trade and the New Zealand Defence Force, food and fibre leaders can also contribute.

The more we engage with global food and fibre organisations and have a voice in creating policies and systems that suit our interests and values, the better. That said, regardless of how politics or demographics might change, our geographic reality will not. We will always be a long way from global markets, and we will still rely on the sea. The clue is in our name, as Zealand literally means 'sea land'.

Demographics

'Demography is destiny.' – Auguste Comte

If the 21st century is an Asia-Pacific century, the next is an Indo-African one. This is not a wild prediction; the future is baked in already. Just as livestock leaders understand flocks and herds, demographers can predict much about humanity's future.

At a basic level, there are three 'herd' shapes:

- **A growing population** has more young people than old, and when you chart this, it looks like a triangle with the young forming a wide base and a numerically smaller aged population at the top. Typically, the number of boys and men are shown on the left and the numbers of girls and women are represented on the right. If the numbers of each are evenly distributed a growing and balanced population forms an equilateral triangle.
- **A static population** has similar numbers of youth as it does elderly, and when charted it looks like a rectangle.
- **An ageing population** with more old people than young looks like an inverted triangle.

These three basic shapes can tell you a lot about a country's future. For instance, what a country's productive capacity is, what their consumer base will be in the future, and much more. **Figure 2** illustrates Japan's transition from a growing population in 1950 to the most aged country in the world today.

Turning to China, its demographics look like an inverted triangle. The Chinese economic miracle has been largely based on a demographic wave that has now passed. China is now the fastest ageing population in the world (e.g. it reduced by 850,000 people in 2022). Some time between 2050 and 2100, its population will be less than 700 million.

By contrast, India is, or soon will be, the most populous country in the world. Looking further ahead, the only continent with a growing population base is Africa. These factors should give New Zealand's food and fibre leaders pause for thought when we consider the location of our future consumers.

When coupled with the geopolitical factors above, there is an argument for New Zealand to focus on markets in the Indian Ocean, not just the Pacific Ocean. As **Figure 3** shows, there are several gateway countries on the Indian Ocean Rim

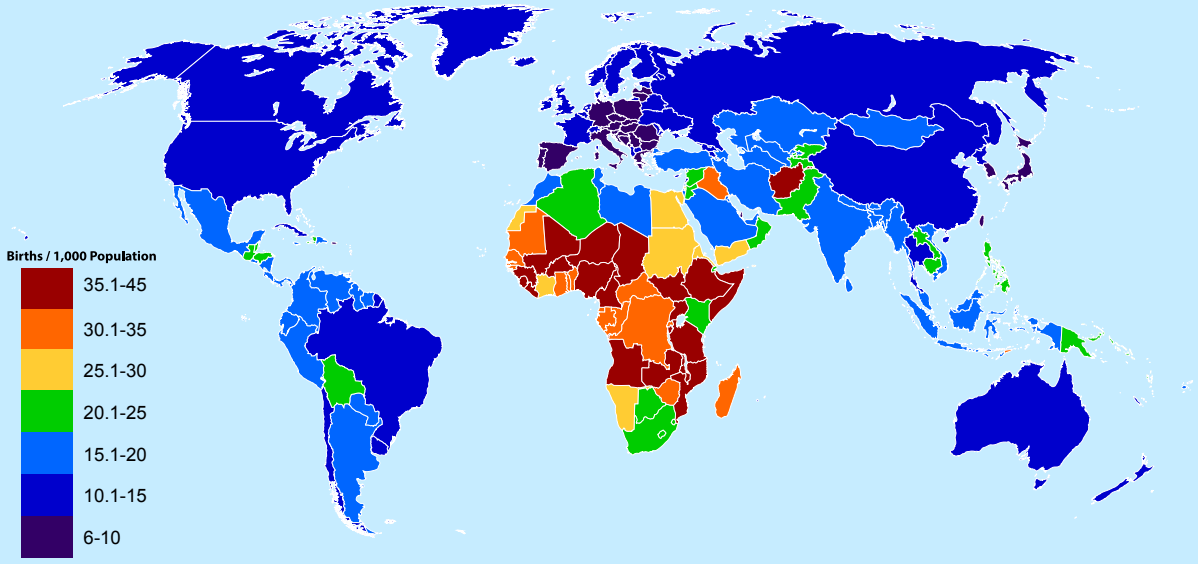


Figure 3: Countries by birth rate in 2017. Source: Wikimedia Commons

that have better demographic prospects than our established markets in Asia-Pacific, and (as a bonus) the shipping routes avoid the South China Sea.

We should be considering how to improve our trading relations with Indonesia, India, the gateway countries in the Middle East and the east coast of Africa. However, in all these markets, trade agreements will only eventuate if we have taken the time to forge deep relationships. The food and fibre sector needs to think about how we get to know our Indian Ocean neighbours. We need to post fast-track professionals into the 'market' and build their cultural understanding. This is a long game, and with all long games the earlier we start the better.

New Zealand has demographic challenges too, but they are not as acute as some other nations. We have been successful at offsetting our demographic decline with immigration. However, sensible immigration policy can only occur at a speed that infrastructure and cultural integration can support.

Until recently, New Zealand's immigration has arguably occurred at the faster end of the spectrum. Besides the obvious creaking noises coming from our national and housing infrastructure, the cultural shift has been rapid too, which has implications for food and fibre leaders.

According to Statistics NZ, by 2043, 50% of the food and fibre workforce will be Asian, Māori and Pacifica and by 2048 the average New Zealander will be 6.5 years older than today. Tomorrow's workforce will be more multicultural and older. To be effective, food and fibre leaders will need to lead from a bicultural foundation and in a multicultural context. They will also need to re-think work systems and incentives to cater to an older demographic.

Coupled with smaller generational cohorts (Y and Z) entering the workforce, global and local competition for talent will be sustained. The era of 'HR' is over: if food and fibre firms want to keep their talent they will need to treat them as 'people'. not 'HR'.

Conclusion

New Zealand has long enjoyed a stable trading environment, brought about through the sacrifice of the World War II generation. That world order is changing and changing fast, but so is the natural environment we rely on.

Our prosperity comes from working with the land, our sea trading routes that connect us to global markets, and an international rules-based order that puts us on an equal footing with larger and stronger countries. To maintain and enhance our security and prosperity, New Zealand's food and fibre sector needs to diversify its markets as we are overly-exposed to markets in the South China Sea.

Food and fibre leaders should play a more active role in supporting the rules-based system that underpins our prosperity. As a sector, we need to actively broaden and deepen our international relationships and understanding, so we can thrive in an era of rapid and sustained change.

However, there is a bigger point here too. Perhaps more than at any time in its history, the world needs practical, progressive and entrepreneurial leaders who can find sustainable ways of providing food, warmth and shelter to the many millions who need it. New Zealand has its part to play. If we are truly a leading food and fibre-producing nation, the part we play is more than just exporting produce. We have the potential to export our ideas, innovation and talent as well.

Whether the future is failing or flourishing, the difference is leadership.

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PHIL JOURNEAUX

FORESTRY ON FARMS FOR GHG OFFSETTING – SOME IMPLICATIONS

This article summarises a recent report 'Forestry on Farms: Implications for Farm Sustainability and Regional Impact' investigating the integration of forestry on farms versus the blanket planting of whole farms, and the implications of this for the wider regional economy.

Key objectives

The aim of the analysis in the report was to understand the opportunity to farm better class farmland more productively while planting forestry on poorer class farmland, with blanket forestry planting as a comparison. The key objectives were:

- Analysis of the economic impact at the on-farm level of planting areas into forest, looking at overall business profitability and changes in production, including the value of carbon and the proposed farm-level levy
- Assessment of the wider macro-economic impacts of such land-use changes
- Analysis based on targeted sensible land-use changes within the regions (e.g. areas of steeper sheep and beef hill country land transitioning into production forestry or natives)
- Assessment of the impact of blanket planting (i.e. whole farms) into forestry for carbon/timber.

This was done by analysing the impact on statistically 'average' farms for Northland and Hawke's Bay, and involved planting either 10%, 30% or 100% of the farms in three forest types:

- *Pinus radiata*
- Cypress, as an example of a special purpose species for timber, or
- Indigenous.

The impacts of this were then assessed at both the farm and regional level.

The aim of the analysis was to understand the opportunity to farm better class farmland more productively while planting forestry on poorer class farmland.

On-farm impact

The farms were set up within Farmax, based on Beef + Lamb NZ Economic Service data, with each one differentiated by slope and pasture productivity (**Table 1**). This allowed for the forestry planting to be concentrated on the poorer areas initially, spreading onto the more productive areas as the proportion planted increased.

The P*inus radiata* forestry regime was a 28-year farming regime, while for the other exotic (cypress) it was a 35-year clearwood regime. The natives were planted as a permanent carbon forest. The forestry analysis was based over a 56-year period (i.e. 2 x rotation for radiata).

As could be expected, as increasing areas of lesser-productive land were planted into forestry, the pastoral

Table 1: Land type, portion and area planted in forestry for Northland and Hawke's Bay model farms

Region	Typography	Scenario		
		10% of farm	30% of farm	100% of farm
Northland	Steep (ha >20°)	34 ha	45 ha	45 ha
	Rolling (ha 8° to 20°)		58 ha	206 ha
	Flat (ha 0° to 8°)			92 ha
	Total new forest area	34 ha	103 ha	343 ha
Hawke's Bay	Steep (ha >20°)	65 ha	196 ha	248 ha
	Rolling (ha 8° to 20°)			339 ha
	Flat (ha 0° to 8°)			66 ha
	Total new forest area	65 ha	196 ha	653 ha

Table 2: Comparative EBITDA returns – with and without a carbon value

Northland	Total EBITDA no carbon	Net EBITDA after accounting for carbon*
Base	$76,832	$71,424
10% pines	$74,328	$106,963
30% pines	$64,668	$174,822
100% pines	$64,985	$446,009
10% SPS	$66,780	$85,192
30% SPS	$38,324	$105,391
100% SPS	-$35,759	$201,777
10% natives	$45,326	$59,421
30% natives	-$29,869	$24,123
100% natives	-$275,295	-$81,298
Mixed**	$21,082	$98,153
Pines/Periodic harvest***	$50,431	$110,748

Hawke's Bay	Total EBITDA no carbon	Net EBITDA after accounting for carbon*
Base	$342,825	$334,194
10% pines	$337,045	$401,079
30% pines	$350,904	$512,185
100% pines	$173,275	$898,664
10% SPS	$317,342	$354,184
30% SPS	$241,308	$370,109
100% SPS	-$76,442	$375,777
10% natives	$276,522	$305,114
30% natives	$117,346	$221,267
100% natives	-$524,104	-$154,775
Mixed	$219,207	$376,561
Pines/Periodic harvest	$276,813	$396,299

*Includes carbon levy on the farm (5% of agricultural emissions) + carbon credits for forestry
**This scenario was based on planting 30% of the farm into 10% of each of *Pinus radiata*, cypress and natives
***This scenario was based on a periodic establishment of radiata, to give a periodic harvesting regime

Table 3: Value of sequestered carbon as an offset (10% planting level)

Northland	Area in pasture (ha)	Area in forest (ha)	2025 carbon levy ($)	Forestry credit	Net levy	EBITDA/ha post-levy
Base	343	0	$5,408		-$5,408	$208
10% pines	309	34	$5,135	$71,672	$66,537	$406
10% SPS	309	34	$5,135	$37,281	$32,146	$305
10% natives	309	34	$5,135	$18,785	$13,650	$252
Hawke's Bay	**Area in pasture (ha)**	**Area in forest (ha)**	**2025 carbon levy ($)**	**Forestry credit**	**Net levy**	**EBITDA/ha post-levy**
Base	653	0	$8,631		-$8,631	$512
10% pines	588	65	$8,172	$137,020	$128,848	$701
10% SPS	588	65	$8,172	$71,273	$63,101	$600
10% natives	588	65	$8,172	$35,913	$27,741	$546

operation intensified on the more productive land. This resulted in an increase in Earnings Before Interest, Tax, Depreciation and Amortisation (EBITDA), meat and wool production, and greenhouse gas (GHG) emissions on a per grazed hectare basis, but a decrease in total farm output across all three (**Table 2**).

In the absence of any carbon value, the addition of 10% of *Pinus radiata* resulted in very similar total EBITDA returns relative to the 100% pastoral operation. A higher proportion of radiata, and all levels of planting of either special purpose species (SPS, cypress) or natives, resulted in a much lower total EBITDA.

The addition of a carbon value ($85/NZU) resulted in all exotic forest scenarios lifting total farm EBITDA well above the base level of profitability, with the most profitable option being 100% planting in *Pinus radiata* followed by 100% planting in cypress. All indigenous forest plantings resulted in a much lower EBITDA relative to the pastoral (base) operation.

This also illustrates the value of carbon in offsetting the proposed carbon levy, at both the 10% and 30% planting levels. This is shown in **Table 3** and also indicates the value of pines compared to both the other exotic softwood and indigenous.

A point to note is that if the forestry credits generated by the pines were used solely to pay the carbon levy, then the credits generated within the 16 years under the averaging scheme would cover the levy for 30+ years.

Regional impact

For the regional impact analysis, a Multi-Regional Input-Output Model (MRIO) was developed incorporating approximately 100 industries covering the two regions and the rest of New Zealand. This captured the inter-regional trade exchanges between these economies and ensures that the economic impacts are assessed at both the regional level and for New Zealand as a whole.

As increasing areas of lesser-productive land were planted into forestry, the pastoral operation intensified on the more productive land.

The two key metrics used in the analysis were value-add (GDP) and employment:

- Value-add is measured in NZ$ millions (based on 2022Q2)
- Employment impacts are measured in job-year equivalents using Modified Employee Counts (MECs) – equivalent to a full-time equivalent (FTE) employee.

In general, the value-add analysis (**Table 4**) shows a reduction in economic activity in Year 1; the reduction in farm income is not offset by the expenditure on forestry establishment. This negative impact continues through to the year of harvest, when there is a massive improvement in economic returns (for pines, less so for cypress and nil for natives) due to the harvesting and processing of the wood. A somewhat similar pattern was followed for employment, although there was a positive response in Year 1 when the surplus livestock was slaughtered.

These analyses did not include a value for carbon as that is essentially a wealth transfer and does not add to value-add. These analyses also assume that all establishment and subsequent operations occur at the same time across the region. In reality, these activities will be spread over time

Table 4: Direct and indirect net value-added and employment impacts with 10% *Pinus radiata*

Northland														
Year	0	5	10	15	20	25	28	30	35	40	45	50	55	56
$ million	-58.4	-13.3	-13.3	-13.3	-13.3	-13.3	2,007	-13.3	-13.3	-13.3	-13.3	-13.3	-13.3	2,007
MECs	100	-101	-101	-101	-101	-101	17,568	-101	-101	-101	-101	-101	-101	17,568
Hawke's Bay														
Year	0	5	10	15	20	25	28	30	35	40	45	50	55	56
$ million	-93.5	-20.2	-20.2	-20.2	-20.2	-20.2	4,298	-20.2	-20.2	-20.2	-20.2	-20.2	-20.2	4,298
MECs	194	-78	-78	-78	-78	-78	48,575	-78	-78	-78	-78	-78	-78	48,575

Table 5: Net present value (NPV) of impacts

Scenario	Direct and indirect value-added impacts 2022-78 NZ$2022Q2m	Direct, indirect and induced value-added impacts 2022-78 NZ$2022Q2m
Northland region		
1 Baseline vs sheep and beef farming with 10% *Pinus radiata* forest[1]	$430	$990
2 Baseline vs sheep and beef farming with 30% *Pinus radiata* forest[1]	$930	$2,310
3 Baseline vs 100% *Pinus radiata* forest[1]	$1,910	$3,980
4 Baseline vs sheep and beef farming with 10% SPS forest[2]	$70	$330
5 Baseline vs sheep and beef farming with 30% SPS forest[2]	-$190	$300
6 Baseline vs 100% SPS forest[2]	-$1,980	-$1,800
7 Baseline vs sheep and beef farming with 10% native forest[3]	-$610	$200
8 Baseline vs sheep and beef farming with 30% native forest[3]	-$2,320	-$2,970
9 Baseline vs 100% native forest[3]	-$9,180	-$12,750
Hawke's Bay region		
1 Baseline vs sheep and beef farming with 10% *Pinus radiata* forest[1]	$1,080	$2,350
2 Baseline vs sheep and beef farming with 30% *Pinus radiata* forest[1]	$2,270	$5,700
3 Baseline vs 100% *Pinus radiata* forest[1]	$3,600	$11,760
4 Baseline vs sheep and beef farming with 10% SPS forest[2]	$200	$720
5 Baseline vs sheep and beef farming with 30% SPS forest[2]	-$390	$780
6 Baseline vs 100% SPS forest[2]	-$5,720	-$4,810
7 Baseline vs sheep and beef farming with 10% native forest[3]	-$930	-$1,060
8 Baseline vs sheep and beef farming with 30% native forest[3]	-$3,800	-$4,580
9 Baseline vs 100% native forest[3]	-$17,410	-$22,770

Notes: [1]Includes two rotations [2]Includes one rotation [3]No harvests

The negative cashflow through to harvest is offset by the significant returns obtained at harvest.

Special purpose timber trees integrated into the farm system. Photo courtesy of Groundtruth Ltd

creating a long-term situation of mixed forest establishment, management and harvesting activities. This requires further analysis, but will give a clearer picture of long-term macro-economic impact.

These impacts increase with the increasing proportion of forestry planted on farms. Note the impacts are net of the base (pastoral) situation.

The picture is different when considered from an investment analysis viewpoint, where the net present value (NPV) for *Pinus radiata* is very positive, and also positive for the 10% cypress scenario (**Table 5**). Essentially, the negative cashflow through to harvest is offset by the significant returns obtained at harvest.

The NPV returns for the native forests are negative throughout, a reflection of the high cost of establishing native forests, coupled with the slow (albeit long) carbon sequestration regime associated with natives. It is also interesting to note that the greatest NPV returns are from planting 100% of the farms in *Pinus radiata*.

Essentially, while the financial returns for *Pinus radiata* and 10% of cypress are positive, the region is negatively impacted from planting through to harvesting, for both value-add and employment.

Discussion

At the farm level, there are a number of nuances with the addition of 'woodlot' forestry:

- At 10% in *Pinus radiata*, farm profitability was much the same as 100% pastoral in the absence of a carbon value
- With the inclusion of a carbon value, the addition of forestry greatly increased farm profitability, to the point where 100% of the farm in forestry was the most profitable
- A range of scenarios of integrating forestry into the farm operation gave increased profitability (post-levy EBITDA). This included integration of special purpose species forest and a mixture of forest areas of radiata, SPS and native
- Planting 10% of the farm in forestry gave significant coverage for carbon offsetting for the remainder of the pastoral operation and could do so for many years
- Farmers who have carried out forestry plantings on lower-productive land have experienced a positive impact on farm profitability due to an increase in per head livestock performance and a decrease in the running costs for weed control, infrastructure

maintenance and labour associated with managing a reduced land area. As such, an integrated land-use approach offers the opportunity for greater economic and environmental resilience.

The exception to all this was planting in indigenous species. Many farmers would prefer to plant natives, but the high establishment cost is off-putting. Future reductions in establishment costs and increased carbon price could make it profitable to establish native forest on-farm.

The key issue is that exotics, especially *Pinus radiata*, are many times more profitable. In talking with farmers, it is pointed out that they will not make money on planting a native forest, but their kids, grandkids, great-grandkids etc will. It is (pleasantly) surprising how many accept this proposition – they are prepared to bite the bullet on establishment costs knowing their descendants will benefit.

The other aspect, since we are on the topic, is that biodiversity credits (very likely to be a commercial reality in New Zealand in the not-too-distant future) will greatly assist the economics of forest planting, especially for natives.

A key aspect of the forestry modelling is the incorporation of *Pinus radiata*. The main reason is that for both carbon and timber it is usually the most profitable regime, plus there is significant information around on sequestration levels and the economics of growing pines. But they are not necessarily the best species in all situations, hence the inclusion of cypress and natives in this analysis. At the individual farm level, the mantra 'right tree/right place' certainly holds, which is what individual farmers need to work through.

A scenario briefly examined in this project was the establishment of 30% of the farm in forest, but with this forest as 10% each of *Pinus radiata*, SPS and native. This increased farm profitability from the base level, although significantly less than for radiata alone. This mixed scenario reflects the 'right tree/right place' approach. It would amount to:

- Planting difficult and erosion-prone areas that need to remain in permanent forest in native species, possibly identifying areas of good forest sites with harvest access where attractive SPS stands could be managed with selective harvesting
- Planting areas where traditional radiata clearfell harvest could occur with low impact on the farm and wider landscape.

Approaches such as this could give increased profitability, while also providing long-term environmental benefits, business resilience and flexibility in income.

At the regional level, again there are nuances. The large-scale conversion to forestry resulted in a negative value-add (i.e. there was a reduction in economic activity within the region) up to the point of harvest, when there was a significant spike in value-add as a result of the harvest. For employment the pattern was the same, although there was a positive lift in Year 1, followed by a decline through to harvest, when again there was a positive spike.

From a financial investment viewpoint, the investment into *Pinus radiata* and 10% cypress was positive, while for the remaining cypress and all native scenarios it was negative. This does give rise to the issue of whether there will be sufficient labour available, especially harvesting and processing capacity, at time of harvest. From an employment perspective, there is a need for planting and harvesting to be phased and sequenced to maintain a sufficiently skilled labour force for harvest.

Mixed forest types as part of a profitable, resilient and attractive farm landscape. Photo courtesy of Groundtruth Ltd

Alternative exotic species just pruned

In some ways, the pattern of a long period of negative followed by a large positive spike at harvest was an artifact of the modelling, where the planting took place in Year 1 followed by a hiatus through to harvest.

A scenario was modelled where 30% of the farms were planted in *Pinus radiata* on a periodic basis, with the idea to both stagger the conversion and the harvest. The pattern of the impact on value-add and employment was similar, with a negative impact from planting through to harvest and with a positive spike at harvest. The overall NPV was negative.

The addition of a value for carbon provides no net gain in value-add. The impact of a value for carbon is essentially an internal wealth transfer, with no overall net benefit at a national level. There could well be a benefit via additional sequestration/carbon credits being available over time, as this would then enable other economic activity to occur (such as the development of on-farm infrastructure resulting in a gain to value-add). If the forests are owned by overseas investors, then there is a net transfer of wealth out of New Zealand.

Overall, at current policy settings the blanket planting of pines is the most profitable activity at farm-scale compared to 'woodlot forests' integrated into the farm. However, this may well not be in the national interest. The answer for profitability, climate change, water quality protection and biodiversity improvement would appear to be 'trees on farms' rather than 'farms into trees'.

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The full report can be found at: www.fertiliser.org.nz/Site/research/projects/forestry-pn-farms.aspx or www.agfirst.co.nz/projects/forestry-on-farms

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GEOFF TAYLOR, JANE MUIR AND LEE ASTRIDGE

BUILDING A RESILIENT WORKFORCE THROUGH THE GREAT FUTURES IN DAIRYING PLAN

Driven by COVID-fuelled workforce shortages and the toll this has taken on farming families, the Great Futures in Dairy Plan sets an ambitious agenda for building the resilience of the on-farm workforce. This article provides an overview of the Plan co-developed with farmers, industry and government.

A perfect storm

The war for talent is real and it is playing out in our very own backyard. COVID-19 certainly caused its own problems, but also served to amplify and exacerbate the employment challenges already facing the sector. Low unemployment, a seasonal and inelastic demand for staff, a government rethinking immigration policy, and a wider set of locked-in demographic pressures have all contributed to the need for the sector to put the spotlight on people's wellbeing. It has also meant thinking differently about how we resource our businesses with the people and skills they need.

This perfect storm has seen estimates of staff shortages in spring 2021 of up to 6,000 people, or 17% of the total peak workforce. DairyNZ's 2021 'View from the Cowshed'

Figure 1: An overview of the Great Futures in Dairy Plan

DairyNZ's 2021 'View from the Cowshed' survey told us that 67% of employers were finding it challenging to get staff, with 62% reporting they were short staffed.

survey told us that 67% of employers were finding it challenging to get staff, with 62% reporting they were short staffed, and this was causing them and their team stress. Alarmingly that stress is contributing to a wellbeing crisis, with 55% of respondents telling us that they, or someone in their team, had suffered a mental health issue in the last 12 months.

While staffing is not the only factor affecting wellbeing, it is contributing to a general level of unease in the sector despite record milk prices. The 'View from the Cowshed' found 32% of respondents were expecting the immediate future for dairy farming to worsen, which was almost double the number of farmers (17%) who were expecting an improvement. This negative sentiment also extended to their local community, with 40% (64% in 2020) of farmers telling us they feel pessimistic about the future of the rural community they live in.

On the other hand, 30% of farmers report having no problem attracting the staff they need. This group had fewer concerns and were more positive about the future. What is it they are doing? What can we learn? Can it be replicated? How can the sector work collaboratively to create more resilient staffing structures for the future? These are the questions that prompted DairyNZ's investment in the Great Futures in Dairy Plan (the Plan) – see dairynz.co.nz/people/the-great-futures-in-dairying-plan

At a high level the Plan provides a vision for the sector: 'Great Futures in Dairying: Great people, great jobs, great workplaces'. Developed with farmers, the Plan is based on an analysis of the current workforce and workplace drivers and consolidates this into three key issues and focus areas as illustrated in **Figure 1**.

The Plan then goes on to outline a more detailed set of initiatives for implementation that will better position dairy farm employers in this highly competitive labour market:

- The first priority identified is to *Shape up* and better look after the capable and skilled workforce we already have, with the goal of significantly improving workforce retention. Through retention of our existing capability, we will build the productivity of our people and businesses.

- *Look in new places* aims to attract new talent to the sector by broadening its appeal to non-traditional participants. This relies on new approaches to attraction, workplace design and employment practice. It is recognised that the most effective investment we can make in attraction is through initiatives to retain our current workforce. This will in turn build the value proposition for others to join the sector.

- The desire to *Change the job* recognises some of the structural issues in the sector and the need for new thinking to assist in retention, productivity and attraction goals.

Developing the Plan

At its heart the Plan is deliberately simple. Despite its simplicity we have confidence it represents a whole-of-dairy approach, which we believe is critical if there is any hope that it will have impact. During the development of the Plan we engaged extensively with farmers, dairy companies, agribusiness, education and government stakeholders – taking a 'human design centred' approach. To ensure some clean thinking the process was facilitated by an external research firm.

The initial problem identification process included 47 in-depth interviews with farmers, farm team members and other sector stakeholders. These findings were then triangulated across a whole-of-sector engagement process, including:

- Further quantitative surveys of employers and employees
- Experiences from the past and from other sectors
- Data from the Integrated Data Infrastructure (IDI), which provides a view of the dairy workforce based on data collected across government agencies.

The problem statements developed led to design challenges put back to stakeholders in ideation workshops run throughout the country. The aim of these was to draw on the collective wisdom of farmers, farm staff and other interested parties to develop solutions to some of these problems. These workshops generated 85 different ideas ranging from the expected (just fix the sharemilking system) through to the more wonderful (like placing QR codes on milk bottles to link the public, our potential workforce, to the farm).

Finally, the draft plan was refined and re-circulated to farmers and other stakeholders who had participated in earlier stages of the process for feedback. This was a powerful part of the process and resulted in some significant revisions, most notably the prioritisation of *Shape up* above the other focus areas based on farmer feedback.

Understanding the context

There are four major pieces of context it is worth reflecting on to understand where the Plan has come from:

International workers and the immigration system

The development of the Plan was carried out in the context of a sector that has been struggling to attract Kiwis to farming roles for many years. As a result, dairy farmers have become more reliant on international workers who have been an invaluable part of farm teams, helping to address the workforce shortage. Workers on temporary work visas reached 25% of paid employees in 2020, and 40% of all new recruits to the sector. Then COVID-19 hit, with accompanying border closures slowing the entry of this important source of new staff.

Concerted advocacy by DairyNZ in partnership with Federated Farmers has led to the importance of international workers to our industry being recognised, but has not negated the fact that immigration is a matter of political whim. Policy can change suddenly, placing business continuity at risk. During this advocacy work we were continually asked how that future risk could be managed, adding further impetus to the development of the Plan.

As a sector, we can no longer rely on international workers to solve the systemic issues affecting our ability to attract and retain domestic workers.

Access for international workers has since opened up. With the dairy sector being placed on the 'Green List' we also have what are perhaps the most permissive immigration settings we have seen in the last 30 years – provided an employer is willing to pay the median wage. While we believe an international workforce will always be part of dairy's future, it would be a mistake to think the risk presented by political whim has evaporated. As a sector, we can no longer rely on international workers to solve the systemic issues affecting our ability to attract and retain domestic workers.

As a side note, the recent transition of some long-term international workers to resident visas has helped to provide certainty for those people. However, anecdotally we are starting to see newly-minted residents leaving the sector in large numbers to take up jobs elsewhere as they have suddenly become more mobile in a highly competitive employment environment. This reinforces the need for a focus on retention.

Domestic labour market and demographics

The obvious response to a squeeze in the supply of international workers has meant farmers have attempted to hire more domestic staff and found this is easier said than done. Domestic staff are in high demand across all sectors. A recent study, yet to be released by the Ministry for Primary Industries (MPI), suggests that up to 50,000 additional workers are needed between now and 2030 in the food and fibre sector alone if it is to achieve the transformation goals set out in *Fit for a Better World*. Other sectors like aged care, construction and hospitality have similar (if not greater) demand. It is likely that competition will only get more intense.

Despite COVID-19 supplying the biggest economic shock in a generation, low unemployment rates have persisted, and every region in the country (bar Northland) has under 4% unemployed, with the majority hovering round 3.3%. Workforce participation rates are also historically high meaning there is no pool of under-utilised people available to step into work.

Locked-in demographic trends, such as an ageing population and declining birth rates (**Figure 2**), are also

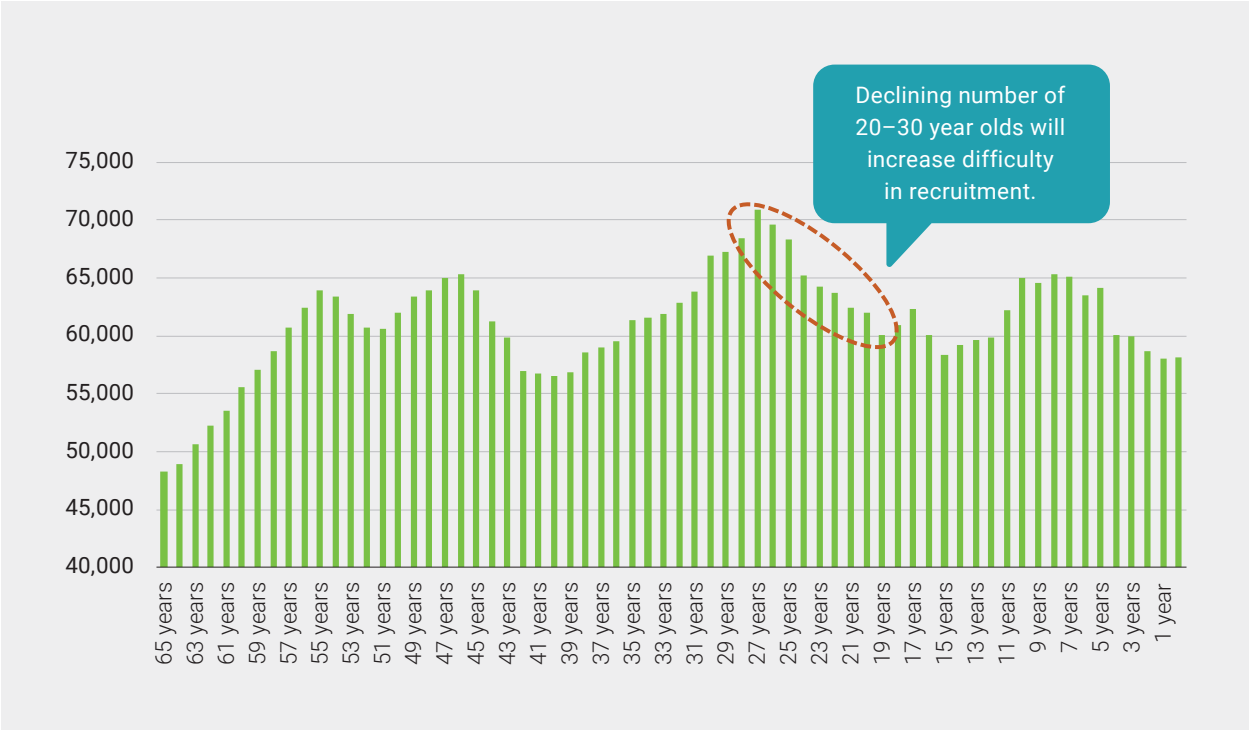

Figure 2: New Zealand population by age as at 2018 census. Source: Statistics NZ

factors impacting the workforce. The average age of the population will increase by 6.4 years out to 2048. Farm owners are part of this group, and although we have no substantive data, anecdotally we know a large number are looking to exit the industry within the next 10 years. This is most likely to happen through the consolidation of farms under fewer owners, further increasing demand for staff to replace those owners.

In employee ranks, dairy's typical employment pool in the 18-to-30 year-old age group is declining as a proportion of the population. In some areas, such as Southland, this cohort is also predicted to fall in absolute terms. The sector therefore needs to think carefully about how it broadens its appeal to attract and retain people in a more competitive environment.

Ongoing urban growth is also a threat, soaking up rural people. Current population predictions have New Zealand growing by one million people out to 2048, but almost all of this (94%) is urban-based growth. Not only do we have to lure people away from other sectors, but we have to entice them away from the amenities they expect and that are more available as part of urban living.

Employer competitiveness

What this boils down to is that domestic workers have choice. If we are going to be competitive and secure the staff we need for our businesses, we need to look outside our industry and consider what employees want from work in the widest sense.

Consideration of competitiveness always starts with remuneration and hours of work. The complexity of gathering comparable information within our sector and across different sectors means it is hard to be certain. Publicly available information (**Figure 3**) suggests dairy employers are competitive on a remuneration basis, but, without accurate hours data comparability it is hard to judge. For example, if average hours per week in other sectors are 40, and dairy staff are working 50 hours, that equates to dairy farm workers being paid roughly $5.50 per hour less than those working in other sectors. This uncertainty is compounded by the provision and treatment of accommodation within the total remuneration for many on-farm dairy roles and the use of salaries, which make hourly rates harder to determine.

Methods to enhance job competitiveness need to be explored in more depth at a farm business level. Options may include changes to roster structure, training provided, responsibility levels, assistance with career growth, profit share, or flexibility to meet the employee's work-life balance. The answer will be different for each farm and employee.

Existing retention rates

For every 100 people who start dairy farming in any given season, there will only be 23 remaining in the sector after three years (**Figure 4**). Turning that round, 77% have left the sector after three years, and a staggering 58% of them left within the first 12 months. Improving this retention rate is the most direct path dairy farmers have to secure their future workforce.

Part of the reason for this level of churn out of the sector is the seasonal nature of the work within the industry. On a seasonal basis the workforce fluctuates by at least 4,000 people annually (11% of the workforce), from a peak in September to a low point the following May. Of those 4,000

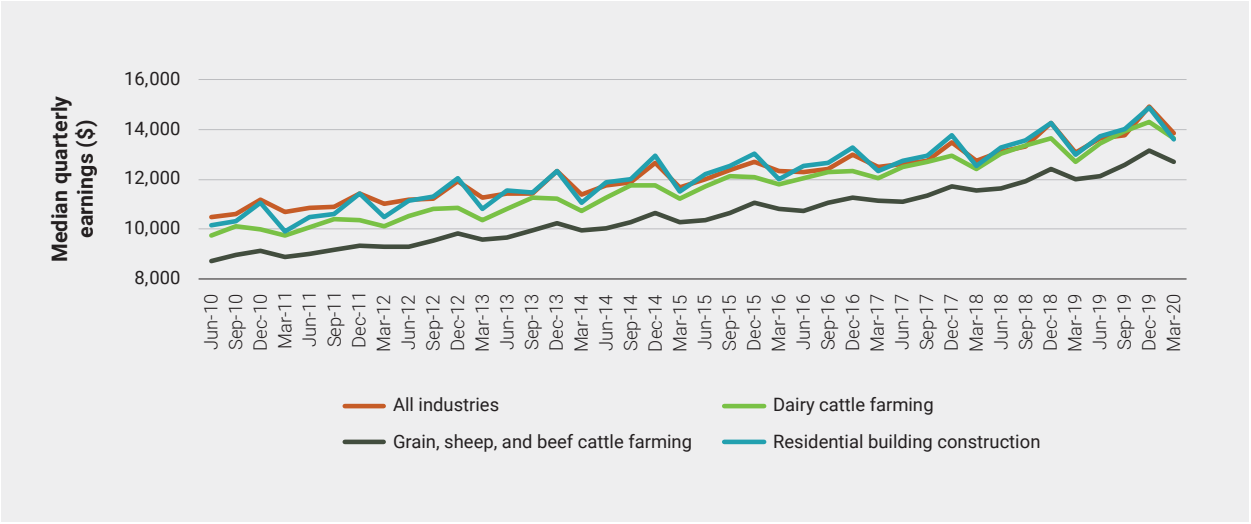

Figure 3: Comparative earning between competitor industries. Source: Statistics NZ LEED Database

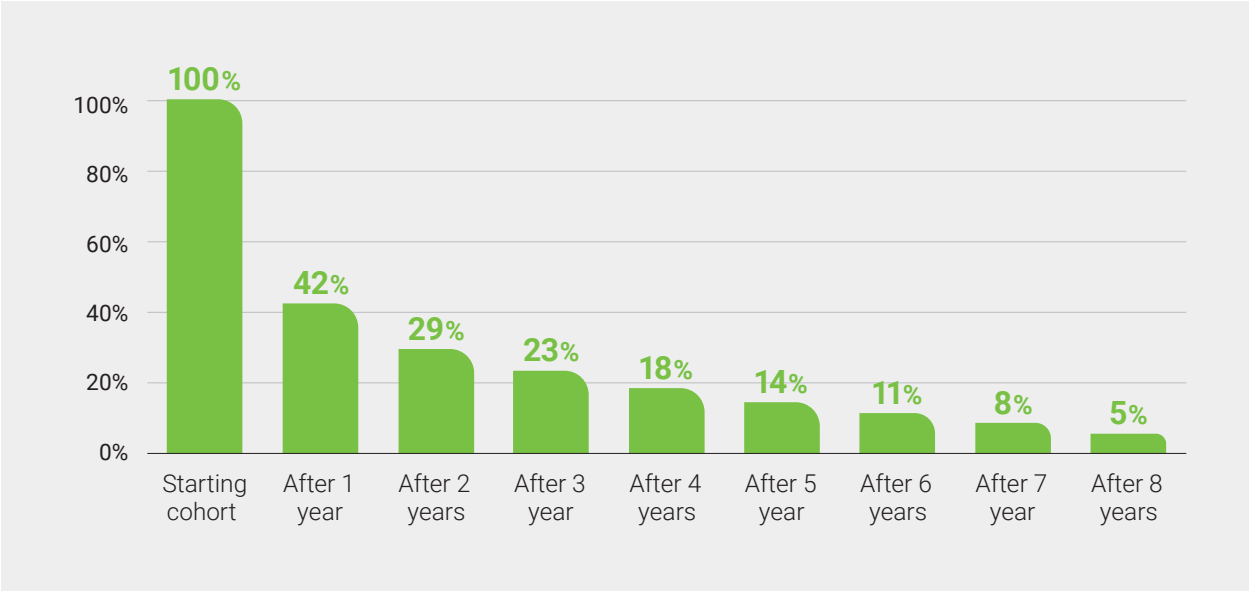

Figure 4: Retention in the dairy sector over time: Source: Statistics NZ IDI

people, 50% are employed for nine months of the year. A creative approach to reducing seasonality and providing year-round employment would certainly enhance retention given job security is a key driver for employees.

Of equal, if not more, concern is the turnover in permanent roles created because of the industry's persistence in taking a seasonal approach to employment. **Figure 5** shows this as a spike in turnover for the September quarter. For the balance of the year the dairy sector is comparable to the 'All industry' average until roughly one-third of all staff change employer around the end of the season. This may be for a range of valid reasons, but in the absence of such a reason it creates needless churn between farms and out of the sector.

By continuing this seasonal approach to employment, we impact an employee's sense of job security. Whenever the possibility of a change or break in employment is raised it creates concern for the employee and drives them to consider their career and employment choices, and they have plenty in a competitive employment environment. Retaining people in jobs is the only way we will lift retention in the sector.

For every 100 people who start dairy farming in any given season, there will only be 23 remaining in the sector after three years.

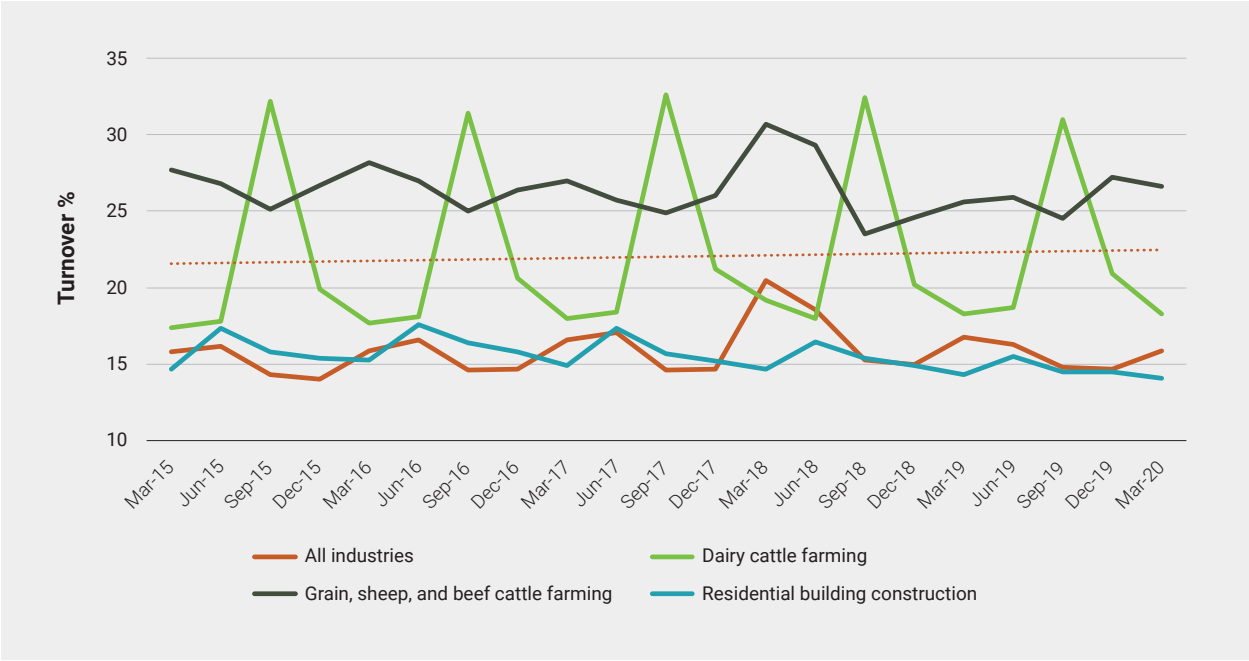

Figure 5: Quarterly turnover in the dairy sector. Source: Statistics NZ LEED Database

More detail on the Plan

The Plan's three focus areas may not appear to be new, but in the detail there is a significant shift in emphasis enabled by the extensive engagement through the design process (Figures 6-8).

Shape up

This focus area challenges the sector to be competitive so we can retain and grow our people. This is where we really see a novel approach taking shape, enabled by farmers calling each other out. The farmers consulted during plan development believe their performance as employers, both individually and collectively, will be the main determinant of success in securing a capable workforce in the short to mid-term. As we sought wider feedback from farmers and other stakeholders, 67% agreed this should be the number one priority.

Shape up has a focus on successfully transitioning people into the sector and retaining them through a focus on providing competitive jobs, creating worthwhile careers for everyone, and well-led workplaces. Farmers and their advisors must think about what it takes to be competitive outside the narrow demographic currently attracted to working on-farm. What will it take to attract a new person to the sector and keep them? It's clear that what we are doing currently is not working well enough. Hours, pay, rosters, milking frequency, accommodation standards and personal development opportunities must all be on the table for discussion.

The need for access to international workers is recognised as we build our domestic workforce and advocacy for the sector is an important part of the work. However, as already noted, access to this important pool of workers is subject to political whim. To maintain access, we need to have our on-farm employment 'house' in order and demonstrate we are responsible employers.

Change the job

This focus area challenges us to think about how we provide modern, productive and safe workplaces, which enable us to retain and grow our people as well as helping attract a broader group of potential new entrants. That means fundamentally redesigning work and employment models to create more attractive and competitive job opportunities, as well as considering how we might reduce reliance on people if we had to. This is a research-led area of work looking to bridge the gap to the future through helping both farmers and tech manufacturers understand the opportunities and the value proposition for investment.

Look in new places

The demographic story tells us it will be critical to attract a larger and more diverse talent pool as competition from other sectors intensifies in the future. Broadening the talent pool includes creating even more opportunities for women, Māori and Pacific peoples to participate in the sector, as well as designing jobs that shift the perception of what it means to work on-farm.

For the sector to be successful in hunting out new talent, farmers told us they realise it is their responsibility to *Shape up*, so that our current staff are selling the sector to their friends and family and a positive workplace experience for new staff encourages them to stay. This will take time and must be augmented by collective attraction initiatives. As a sector, we will continue to work with schools, school leavers and the public through Go Dairy to build a positive image of the sector as a genuine and competitive career opportunity for all.

Farmers and their advisors must think about what it takes to be competitive outside the narrow demographic currently attracted to working on-farm.

Shape up

- Support farmers to make workplaces competitive in the wider job market
- Invest in careers for our people
- Facilitate access to international workers while we work towards a resilient dairy workforce

Figure 6: Work areas in the Shape up focus area

Change the job

- Support farmers to evaluate and adopt time-saving technology, including changes to milking frequency
- Support farmers to test alternative and productive business processes and employment models

Figure 7: Work areas in the Change the job focus area

Look in new places

- Support farmers to improve recruitment, on-boarding and employment practices
- Develop targeted approaches to talent attraction where there is the highest likelihood of success
- Diversify and broaden the pools of talent that the industry draws on

Figure 8: Work areas in the Look in new places focus area

Success factors

We believe there are four success factors we need to get right:

1. **Farmer ownership of the need for change –** The development phase of the Plan has demonstrated there is strong farmer acknowledgement of the need for change among the engaged. However, it is not clear that the 'why' is widely understood by the farming populace.

2. **Farmer leadership –** There are no pressing regulatory drivers for change, yet if change does not occur dairy farming businesses stand to lose. DairyNZ, even with its influential partners, cannot force the change needed. Farmer leadership at a local level will be critical and it is our job to stand with and support our farmer business owners and leaders. This will primarily be done through 'Regional Farmer Groups' where local farmers will determine and work on initiatives that are relevant to their region.

3. **Creation of options will be critical to success –** There is not going to be a silver bullet that solves workforce challenges for us. Multiple options, stemming from research and farmer experimentation, will be required. Having options will allow businesses to structure themselves, either individually or as collectives, to address the challenges in a way that makes sense to them.

4. **Working together –** As DairyNZ worked hard to help farmers meet their staffing needs over COVID-19, the degree of misalignment among wider government and sector partners became quite apparent. We realised this had to be a whole-of-sector strategy and have established a Partnership Group to help increase the level of cooperation across the sector.

The reality of dairy farming and the lifestyle implied through attraction activity don't always line up

The Plan recognises that in a rapidly changing environment incremental steps will not be enough to position dairy farming in a highly competitive labour market. It is time for transformational change.

Conclusion

The Plan recognises that in a rapidly changing environment incremental steps will not be enough to position dairy farming in a highly competitive labour market. It is time for transformational change, which means we must be creative, bold and committed. As mentioned, there is no silver bullet to solve our workforce issues – it will take a range of initiatives, some big and some small, to make the changes required. Above all, it will require us to work together. Farmers hold the key to their future workforce.

Re-imagining the way we design and carry out work, and the way we engage, manage and reward people, will be critical to retaining and attracting a wider pool of talent, building resilience and avoiding the acute pain experienced on-farm over recent years.

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Portable trough

JUSTIN KITTO

HELPING DAIRY FARMERS PREPARE FOR THE WINTER SEASON AHEAD – UPDATE ON NEW WINTERING RULES

This article looks at the new wintering rules as they affect dairy farms, including the development of a wintering plan.

Building on momentum

By now winter crops will be established, growing well and farmers will have made the initial decisions to help them winter well and minimise impacts on waterways.

Over the past two years farmers have improved wintering practices on-farm to protect the environment and look after their animals, with regional councils and the Ministry for Primary Industries having acknowledged their efforts.

Farmers have focused on supporting good animal health and welfare, while caring for the environment. Some of the great work has included:

- Maintaining buffers near waterways
- Leaving critical source areas in grass and keeping stock out
- Avoiding cows calving in crop paddocks
- Moving cows to sheltered areas during adverse weather.

Now, we need to support farmers to continue to build on that momentum this season.

Rural professionals have played a key role in helping farmers improve wintering practices, and your support will be vital for continual improvement this winter as they navigate the new regulations. For farmers to do well this winter, there are a few things they need to consider.

National wintering rules

The new regulations have now taken effect. If farmers are unable to meet the permitted activity requirements for wintering on crop, resource consent can be applied for any time before 1 May 2023.

The new rules require that:

- The intensive winter grazing area is no larger than 50 ha or 10% of a farm (whichever is greater). The farm also cannot use a larger area for winter grazing than it used in the 2014-2019 period.
- The slope of the paddock must be less than 10°
- Livestock need to be at least 5 m away from any river, lake, wetland or drain and this buffer needs to be vegetated.
- Critical source areas need to be excluded from grazing, and vegetation maintained in these areas to provide land cover.

If a buffer of at least 5 m has not been left between the crop and waterways (including drains) before stock start grazing the crop, farmers can install a temporary fence at least 5 m from the waterway and maintain this throughout the season.

Regulations also state that vegetation cover in critical source areas must be maintained between 1 May and 31 September each year. Ideally, best practice would be to not establish crops in critical source areas, but if this has already been done, temporary fencing is a good alternative measure to keep stock excluded until after 31 September.

Ground conditions closest to the feed face are the driest and in the best condition for cows to lie down on.

Regional councils may have other localised wintering rules that farmers need to comply with. We recommend checking with the local regional council to see if any other rules apply.

Setting up paddocks

Once farmers have a clear understanding of the wintering rules, paddock set up needs to be considered. Getting farmers to set up paddocks early while the soil is drier will help save time and reduce the loss and movement of sediment in winter.

Portable troughs

Access to fresh, clean water is essential for good animal welfare. The Code of Welfare states dairy cattle must have access to a daily supply of drinking water that is sufficient for their needs. Cows drink approximately 45 litres each every day over the winter period. Portable troughs are recommended as they can be moved with the animals every day or two, minimising stock movement. This reduces excess pugging and mud, while less walking for cows reduces their energy output.

Winter crop

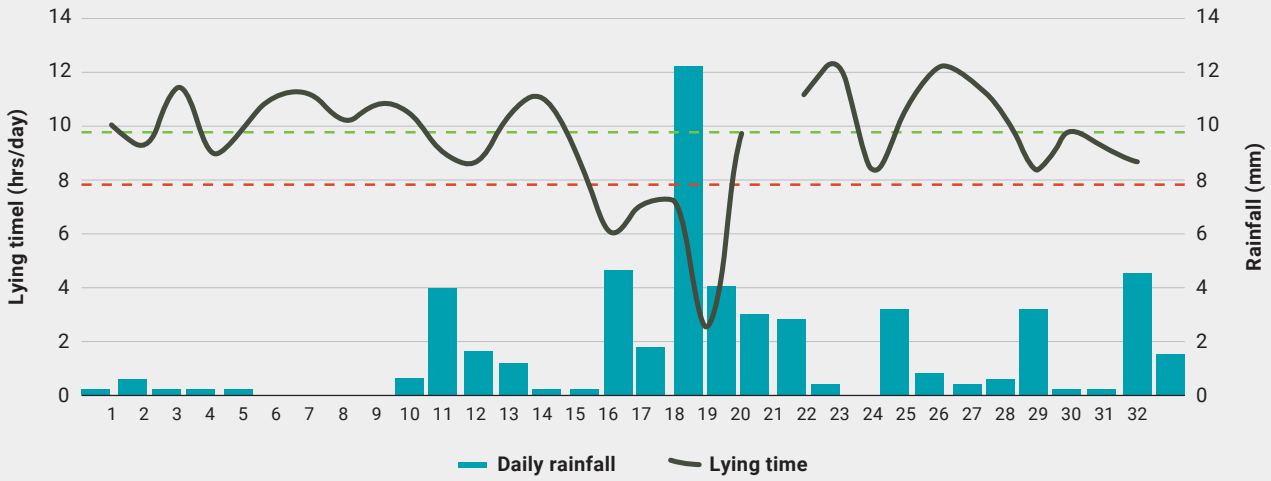

Figure 1: As shown in a trial completed at the Southern Dairy Hub in 2020, cow lying time is negatively impacted by rainfall events.

Back fences

Generally, ground conditions closest to the feed face are the driest and in the best condition for cows to lie down on. By using back fences, stock movement through the paddock is minimised. This reduces soil damage and minimises surface water pooling, which reduces mud and improves cow lying time. Technological solutions such as Halter can be a viable alternative to back fencing.

Grazing direction

Strategically choosing grazing direction is important for two reasons: reducing run-off and drier areas for animals. First, by grazing towards a waterway, good soil conditions can be maintained closer to the waterway for longer. This allows more rainfall to be soaked up, reducing the amount of run-off compared to a paddock that has been pugged. Secondly, you can protect the area closest to the feeding face by grazing animals into prevailing weather conditions, which provides more suitable conditions for cows to lie down.

Ensuring cow welfare

Caring for cows is at the heart of what farmers do. Cows with good body condition will have a better experience during winter as they are able to better withstand the cold because the fat layer beneath the skin acts as an insulating layer.

If farmers are drying-off all at once, we encourage splitting the dry cows into herds based on condition and expected calving date. This allows for preferential feeding to get all cows to target body score condition, and it can help protect younger cows from competition from older, dominant cows.

Good animal welfare includes avoiding calving in muddy conditions. Cows should be split by calving date, and then moved to a suitable birthing area at least 14 days (but ideally longer) before their expected calving date.

Some farmers may initially split their herd into mobs based on condition, then redraft them into calving date mobs a month before calving starts.

Cow lying time

Lying down is an important behavioural need for cows as it allows rest and rumination, which is necessary for feed utilisation. Cows will lie down for 10-12 hours each day if they have a comfortable lying surface. They prefer soft, dry and clean surfaces, and are reluctant to lie on hard, wet/muddy and/or slippery surfaces.

Evidence from the Southern Dairy Hub has shown that even 10 mm to 30 mm of rain is enough to result in cows not getting enough lying time, as surface water pooling (more so than pugging depth) is the critical factor that reduces cow lying time.

In areas with free-draining soils, which are less susceptible to pugging, surface water pooling still occurs after rain and they can become muddy. This can reduce cow lying time and means that even paddocks with minimal pugging can still be unsuitable for wintering in, especially during periods of high or prolonged rainfall. The key is to use different farm management strategies to ensure cows get sufficient lying time.

Management strategies to improve lying times

- Shifting cows to a drier, lower-risk paddock or to shelter
- Having specific crops to graze in poor weather, which are in a lower risk and sheltered area
- Strategically grazing paddocks to avoid wet areas
- Using feed-pads, stand-off pads or grass strips in crop paddocks to shift cows off crop
- Rolling out straw for cows to lie on

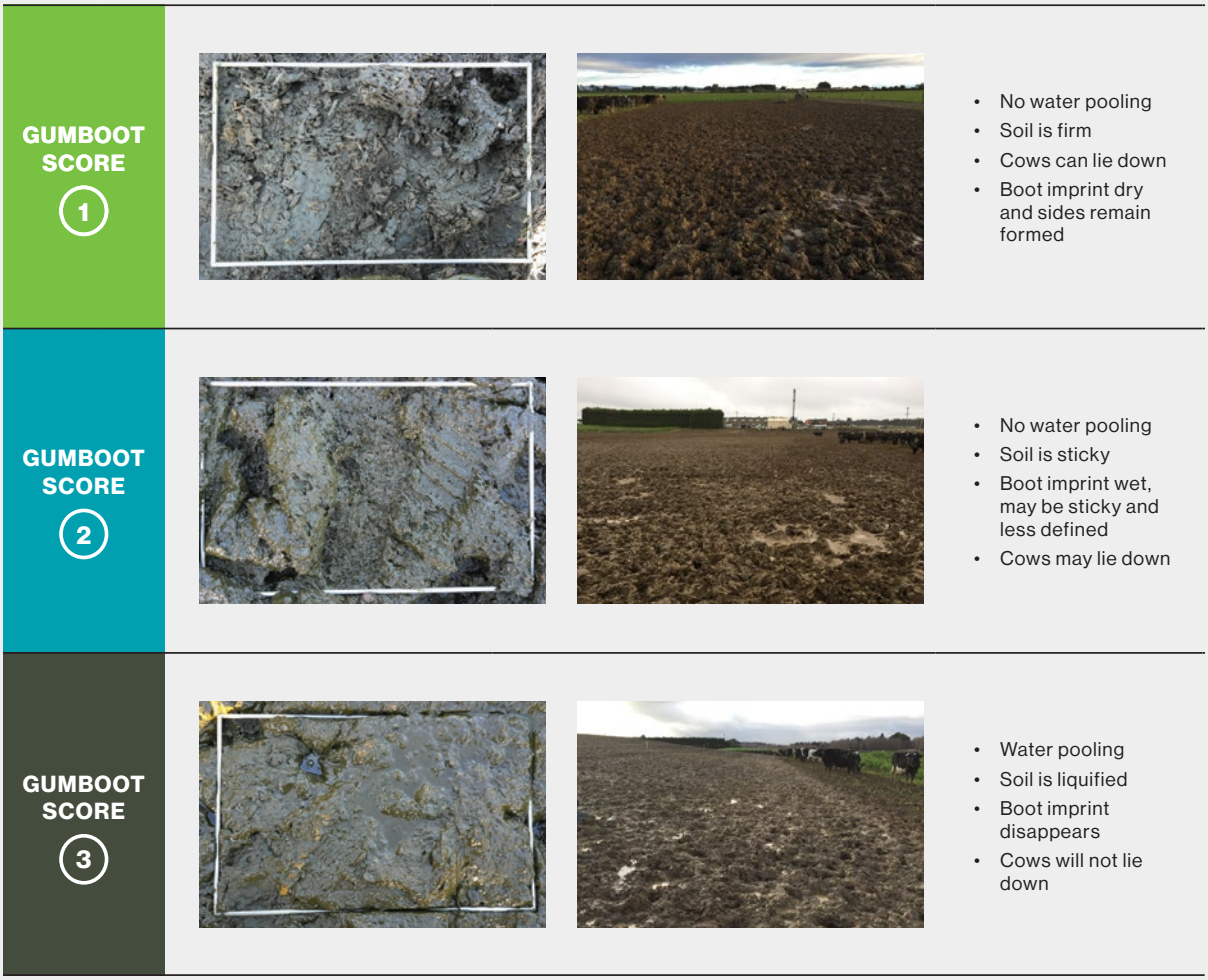

Figure 2: Good practice guide to deciding when to stand off stock

- Increasing the feeding area by giving cows another break. Where possible, feed cows crop continuously during adverse weather. If the herd is off crop for over 24 hours you may need to re-transition them back onto it, particularly with fodder beet
- Providing cows with access to the area behind the back fence (if suitable for lying on)
- Keeping supplementary feed and water troughs near the feeding area (and not in swales or hollows) to reduce mud
- Ensuring care for some animals is prioritised, such as certain classes of stock that may be more affected by poor weather (younger, lighter, earlier calvers)
- Budgeting to have 10% extra feed for wintering. Meeting the nutritional needs of cows over winter needs careful consideration, and we recommend that farmers discuss their strategy with their vet.

Figure 1 shows the impacts of rainfall events on lying times. To help farmers assess if a paddock is suitable for lying, DairyNZ has developed a gumboot test which is a quick and easy in-paddock test (see **Figure 2**).

Developing a wintering plan

Having a written wintering plan is a helpful tool for farmers to understand and manage the inherent risks in their wintering paddocks. Sharing the plan with farm teams and contractors helps ensure clear expectations and information on expected farm practice, including animal care, crop establishment and spraying.

It is also important the plan outlines strategies for animal care during persistent rain, so that cows can achieve minimum lying times. Having these contingency plans documented enables farm teams to quickly respond during poor weather, which is especially important when farm staff are responsible for day-to-day management. Wintering plans are also becoming an expectation from regulators.

Wintering resources

DairyNZ has a range of wintering resources online (dairynz.co.nz/wintering), including:

- A wintering plan template to help plan for next winter
- The gumboot test in Figure 2 to assess if the ground is suitable for cows to lie on
- Information on the wintering regulations.

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ANNA HIGGINSON

NES WINTERING RULES
A SNAPSHOT FOR ALL LAND USES

This article looks at the NES wintering rules as they affect all land uses, including information on Freshwater Farm Plans.

Need for Freshwater Farm Plan

The National Environmental Standards for Freshwater (NES-FW) require farms comprising:

- 5 ha or more of horticulture land use, or
- 20 ha or more of pastoral or arable land use, or
- 20 ha or more of a combination of any of these land uses,

and that graze any livestock (of any type or class) on an annual forage crop between 1 May and 30 September to assess their wintering activities against the intensive winter grazing regulations introduced within the NES-FW.

An annual forage crop is a crop, excluding pasture, that is grazed in the place that it is grown. The definition does not include annual ryegrass, as that is defined as a pasture, nor does it include crops that are lifted instead of being grazed where they are grown.

Those that do not meet a range of permitted activity criteria (outlined below) are required to either gain a certified Freshwater Farm Plan (FWFP) that applies to the intensive winter grazing, or to apply for a resource consent from 1 November 2022. The Ministry for the Environment has proposed a region-by-region roll out of FWFPs. This means that for some regions the option to obtain an FWFP and have it certified (in the context of intensive winter grazing) will not be available. Within those regions a resource consent will need to be applied for. Resource consent applications will need to be lodged with the respective regional council by 1 May 2023.

The regulations are applied at the farm or landholding level. A farm is a landholding whose activities include agriculture. A landholding is defined as an area of one or more parcels of land (whether or not they are contiguous) that are managed as a single operation. Areas of intensive winter grazing can be managed within a landholding. The management of the winter grazing will, however, have paddock specific considerations that will need to be considered when assessing if consent (or a certified FWFP) is required or not.

Permitted activity criteria

Intensive winter grazing can only be considered as a permitted activity (no consent required) if you can answer 'yes' to *all* of the following questions:

- Was land on the farm (within the landholding) used for intensive winter grazing at any stage between 1 July 2014 and 30 June 2019?

Wintering foothill

- Is the total area used for intensive winter grazing less than or equal to the maximum area used across the same landholding between 1 July 2014 to 30 June 2019?
- Is the total area of intensive winter grazing less than 50 ha or 10% of the property area (whichever is the greater)?
- Is the slope of land under intensive winter grazing less than 10° measured over any 20 m distance?
- Are all livestock (when intensive winter grazing) at least 5 m away from the edge of the bed of any river, lake, wetland or drain (regardless of whether there is any water in it at the time)?
- Are all critical source areas that are within or adjacent to any areas of land used for intensive winter grazing protected?
  - Are they ungrazed between 1 May to 30 September?
  - Do they have vegetation (groundcover) maintained over the whole critical source area that does not include the cultivation or harvest of annual forage crops?

In addition to these conditions there are two standards: a pugging standard and a ground cover standard. While these standards do not specifically trigger the requirement for consent, it is expected that anyone undertaking intensive winter grazing as a permitted activity will take all reasonably practicable steps to minimise any adverse effects of pugging and extended periods of bare ground.

The standards are enforceable by a regional council enforcement officer who can request any information reasonably required for the purpose of monitoring compliance against the standards. The two standards require any person using land on-farm for intensive winter grazing as a permitted activity to:

- Take all reasonably practicable steps to minimise the adverse effects on freshwater of any pugging that occurs on that land, and
- Ensure that vegetation is established as ground cover over the whole area of land as soon as practicable after stock have finished grazing the land.

The use of land for intensive winter grazing that cannot comply with the permitted activity rules would require either a certified FWFP (if available within their region) or a resource consent. Those farmers looking to increase their wintering areas beyond the maximum area used between 1 July 2014 and 30 June 2019 would also require consent. In some regions there may be regional regulations related to winter grazing that also need to be complied with.

In all cases it is important for farmers and their teams to be well prepared and informed. A winter grazing plan is a good place to start to help identify and manage the risks from intensive winter grazing.

In all cases it is important for farmers and their teams to be well prepared and informed.

KEY DEFINITIONS

Annual forage crop:
Means a crop that is grazed in the place where it is grown, but does not include—

(a) pasture; or

(b) a crop that is grown for arable land use or horticultural land use (as those terms are defined in section 217B of the Act).

For clarity, if a paddock is sown into a mix of pasture and crop varieties it will be considered as pasture if the pasture component makes up more than 50% of the mix. If you grow cereal crops for grazing over winter, and then allow them to re-grow again for harvesting or further grazing without re-sowing, they will not be considered annual forage crops

Critical source area:
Means a landscape feature such as a gully, swale, or depression that—

(a) accumulates run-off from adjacent land; and

(b) delivers, or has the potential to deliver, one or more contaminants to one or more rivers, lakes, wetlands, or drains or their beds (regardless of whether there is any water in them at the time).

Intensive winter grazing:

(a) means the grazing of livestock on an annual forage crop at any time in the period that begins on 1 May and ends with the close of 30 September of the same year; and

(b) for the purpose of determining whether and how section 20A(2) of the Act applies to any requirement to obtain a resource consent under sub-part 3 of Part 2 of these regulations, includes activities on a farm that support intensive winter grazing and may occur year-round, such as the preparation and sowing of land for grazing and the cultivation of annual forage crops.

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ALAN RENWICK, ROBERT RADICS AND JULIO BOTERO

Plant-based milks a contested space

PLANT-BASED ANIMAL PRODUCT ALTERNATIVES AND GLUTEN-FREE MARKETS –

opportunities and challenges for New Zealand

This article, based on a project undertaken for Takahuri Whenua (the NZ Agricultural Greenhouse Gas Research Centre Programme), considers emerging opportunities in New Zealand in the plant-based animal product alternative and gluten-free markets. Three exemplar products are considered – peas (could also be fava beans) for protein, oats for oat milk and chestnuts for chestnut flour.

Peas, oats and chestnuts

New Zealand currently produces oats and peas for domestic markets and export and a small quantity of chestnuts. Studies have identified significant areas within the country that are suitable for expanding the production of these crops, but they currently struggle against competing land uses. However, they offer non-economic benefits for growers and wider society because they are relatively low carbon compared to our mainly livestock systems, which makes them potentially sustainable crop options.

A higher price could encourage the expansion of these crops with a range of potential benefits, including diversification of land use, rotational benefits (for peas and oats) and alternative income streams for farmers. However, traditional markets for these crops (both in terms of human consumption and animal feeds) do not appear to offer opportunities for a significant shift in profitability and areas grown.

Globally, there has been strong growth in demand for alternative proteins and gluten-free products. Four main drivers strengthening the overall demand for plant-based products have been identified:

- Consumer preferences (driven by health and lifestyle factors)
- Environmental awareness
- Product research, development and innovation
- Government initiatives.

Table 1 briefly outlines the processes by which these products are produced, some of their properties and examples of end uses.

Projected demand

More specifically, strong global growth was found in demand for pea proteins and oat milk, with market research companies generally predicting double-digit compound growth rates over the next five to 10 years. The chestnut sector appears to be less dynamic than the oat and pea sectors, but reasonable growth is still forecasted.

Table 1: Process, properties and uses

	Pea protein	Oat milk	Chestnut flour
Process	Derived from whole peas through a 'dry' or 'wet' process. Dry extraction is much cheaper and produces 65% protein that is suitable for meat analogues. Wet extraction produces a soluble protein isolate (85% protein), more suitable for dietary supplements and beverages. Three types of pea protein: textured, concentrated and isolated.	Derived from whole oat grains by extracting the plant material with water (often in an enzymatic process)	Chestnuts are slowly dehydrated. When dry, the outer brown shell is removed in a shelling machine. The shelled nuts still have a pellicle around the embryo. To remove this further drying is necessary, which makes the pellicle brittle. When atmospheric conditions are dry, a crushing operation will then shatter the pellicle off. The broken pieces of pellicle, which are very light, are removed by ventilation. Two stages of grinding then follow.
Properties	Pea protein is a rich source of branched-chain amino acids, especially arginine, which improve blood flow and aid in muscle growth. It is easily digestible, vegan, hypoallergenic and can be well absorbed in a variety of diets. Fava beans are higher in protein and also branched-chain amino acids.	Oat milk is vegan, lactose and soy and nut-free. It is 100% wholegrain and can be gluten-free. It is often fortified with B vitamins and minerals. ß-glucan content may lower blood cholesterol, and is also good for bone health. Can reach up to 36% of the daily recommended calcium intake.	The nutritional profile of chestnuts is unique among nuts. Chestnut flour contains high-quality proteins with essential amino acids (4–7%), a relatively high amount of sugar (20–32%), starch (50–60%), dietary fibre (4–10%) and a low amount of fat (2–4%). It also contains vitamin E, the vitamin B group, potassium, phosphorus and magnesium. It is gluten-free.
Used for	Currently used for dietary supplements (68%), bakery products (17%), meat substitutes (9%) and beverages (4%).	Generally, can be used as a substitute for dairy milk in a range of products. Manufactured in various flavours (e.g. sweetened and unsweetened, vanilla or chocolate).	Generally, can be used as a substitute for wheat flour (in sourdough bread, quick bread, cookies, extruded snacks, gel and cake). Further refinement and additional uses can be developed by chemically, enzymatically and physically modifying chestnut starch to obtain the desired properties. The high sugar content and corresponding sweetness of chestnut flour can be used to create sweet foods without having to add sugar.

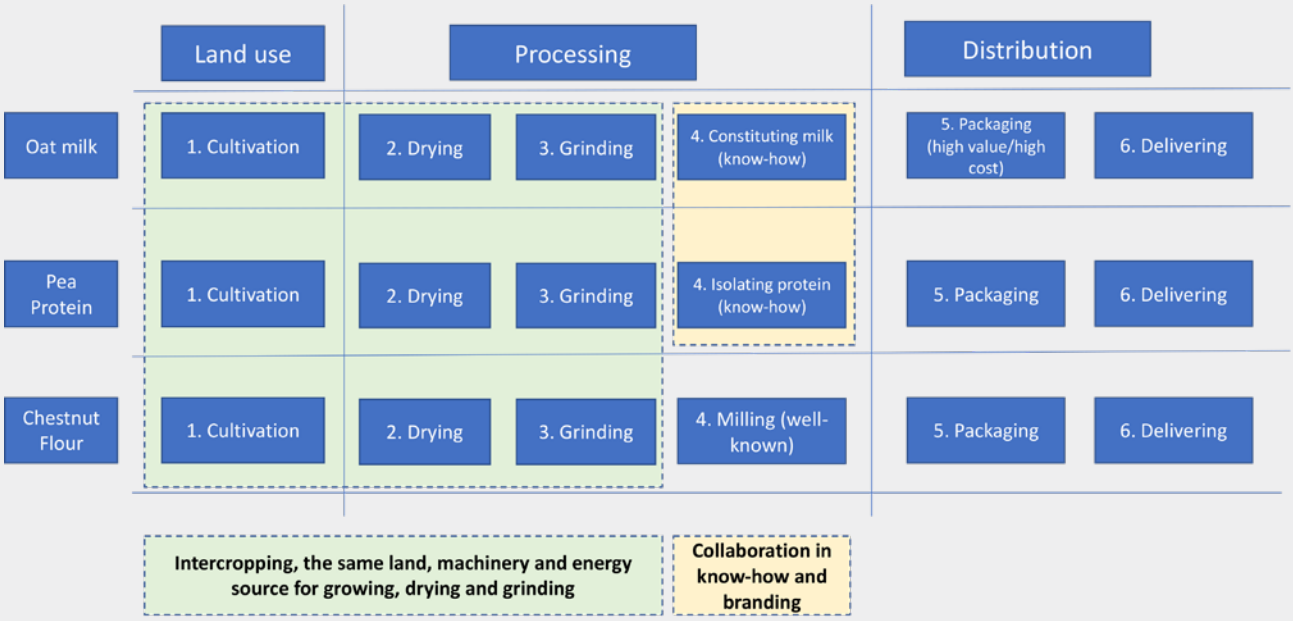

Figure 1: Abstraction of the production and distribution process

While overall demand for the alternative protein products is strong, market growth for alternative meat products has currently stalled. High food price inflation (leading to a reluctance to pay a premium for alternative products), and increased questioning by consumers of the claimed health and environmental benefits of alternative meat products, have been cited as possible reasons. There is disagreement about the extent that the plateauing of demand represents a fundamental shift for the sector or whether it is just a short-term blip on an otherwise upward trajectory.

Unsurprisingly, the generally strong market signals have attracted interest globally from not only the private sector, but also government agencies and departments tasked with regional and national development. However, when compared to more established agrifood value chains, competition in global markets is relatively fragmented at present, but plant-based protein and milk markets are becoming increasingly contested with many local and international players entering the market.

The international players are also significantly increasing their scale of production. For example, Roquefort's new facility in Canada is estimated to be able to produce 125,000 tonnes of pea protein a year, while Oatly's newest factory in the UK will initially produce 300 million litres of oat milk a year (with a planned expansion to 450 million a year).

Even in the face of strong demand, this scaling may lead to the 'commodification' of both alternative milk products and protein extracts, which may constrain developments in New Zealand. The situation is rather different with chestnut flour, although the overall international supply of the raw product is dominated by China.

Where are we in New Zealand?

Domestically, New Zealand has a number of emerging oat milk brands. Due to a current lack of processing capacity, with the exception of one brand oat milk is processed offshore. Whether or not New Zealand oats are used also varies across the brands. New Zealand products compete with a range of imported oat milk products, as well as a wide range of alternative milk products.

A small number of New Zealand firms are using imported protein to manufacture diet supplement products and a few more are currently manufacturing plant-based foods. These include Nothing Naughty, Sunfed, Plan't Foods, Off-Piste and Let's Eat. They make an array of products containing plant protein as the main ingredient, including plant-based nuggets, burger patties, 'chicken-free' chicken, jerky and other meat analogues. There appears to be no commercial chestnut flour production in New Zealand and little evidence of its use in domestic food manufacturing.

Figure 1 provides an abstraction of the production requirements from farm-to-customer. For infrastructure, we produce the raw materials and have the facilities to dry and grind the products (e.g. Harraways' Southland factory for oats). There are also facilities for packaging the final products and well-developed logistics.

While overall demand for the alternative protein products is strong, market growth for alternative meat products has currently stalled.

There is no current commercial-scale plant protein extraction occurring in New Zealand and progress in developing a facility has not got beyond the scoping stage.

The main infrastructural gap lies in the facilities to isolate the proteins and produce oat milk on a commercial scale. For chestnut flour, existing milling infrastructure could (in theory) be used. The situation is about to change for oat milk with the planned opening of the New Zealand Functional Foods (NZFF) factory in Southland, which has an initial stated capacity of 60 million litres per year. Given that this far exceeds the current market size in New Zealand, it does fundamentally alter the viability of other processing plants in this country. There would need to be significant export opportunities to make additional large-scale processing facilities viable.

There is no current commercial-scale plant protein extraction occurring in New Zealand and progress in developing a facility has not got beyond the scoping stage. However, a recent study by PwC did suggest that under certain assumptions a national-scale facility processing 15,000 tonnes a year could be viable. Regarding land use, around 1,800 ha of oats would be required to supply the 60 million litre NZFF factory, and about 4,300 ha of peas would be needed to supply a 15,000 tonne pea protein plant.

Opportunities for traditional protein suppliers?

At first glance it may seem that the development of alternatives to livestock products presents a direct threat to the companies operating in these areas. However, there has been increasing interest in alternative proteins from the traditional dairy and meat sectors as they have witnessed the market grow.

The move into alternative proteins by firms in these sectors is occurring in three main ways:

1. Developing their own plant-based products (e.g. Wunda Pea drink by Nestlé)
2. Engaging in joint ventures with other companies, or
3. Investing in start-ups (e.g. Tyson Food's investment in Beyond Meat).

It is also not necessarily a case of either animal or plant proteins, as a number of companies are developing 'hybrid' products.

Within New Zealand, Fonterra has taken steps into non-dairy products (e.g. in 2019 it took a stake in Motif Ingredients, a US-based food ingredients company developing plant-based or cell-grown animal products, including milk). More recently it has announced that it is investing in a start-up company with Royal DSM to develop non-dairy proteins using precision fermentation. This approach from Fonterra may well bring value to their farmer shareholders, but it will not lead to opportunities for New Zealand farmers as suppliers.

In 2021, it was reported that Silver Fern Farms, the country's largest meat company, was in the early stages of exploring meat-plant hybrids as it looked to respond to customer demand. Although they recognise the potential dangers of confusing their offering to customers, Silver Fern's strategy opens opportunities for the domestic supply of plant-based protein into these supply chains.

As with international companies, New Zealand companies have established sophisticated post-farmgate supply chains for animal products (both in the dairy and meat sectors), which could also be utilised for plant proteins. Also like their international counterparts, these New Zealand companies could also benefit from the lower environmental footprint for alternative proteins to help reduce their overall emissions profile and improve their social license to operate.

Opportunities for growers – the three ceilings

Establishment of new processing facilities (such as the new NZFF factory), either by specialist plant product producers or through diversification by mainstream livestock product companies, can provide opportunities for New Zealand farmers and growers in the alternative protein space by increasing demand. However, there is still the fundamental question about the extent that this will generate enhanced returns to producers.

This relates to the extent that processors would be willing and able to pay a premium for New Zealand-grown ingredients as opposed to those available in international markets. In turn, this depends upon the extent that provenance is important for these companies (i.e. the extent to which they can monetarise it), and the ability of New Zealand processors to be competitive.

Ceiling 1

At the most basic level, there could be opportunities for farmers to collaborate with each other to supply processing facilities with raw materials. The collaboration could take a range of forms from loose agreements to more formal business structures. Firms are likely to be keen to secure supply, and if grower groups are able to commit to certain levels of supply over time then this may attract a premium. This premium, however, is likely to be limited by the availability of other supplies (both domestically and internationally) – (Ceiling 1).

The more specialist the supply (i.e. the more skills that are required to grow the product) then the higher the premium is likely to be. The issue is whether the premium will be enough to encourage a sufficient number of growers (or sufficient area) to move into the crops.

AbacusBio highlight the stark reality of the returns to farmers of simply supplying oats, noting:

> *Oat supply is only a small part of the oats value chain that farmers represent currently (7 cents out of a retail price of $4.50), in part due to the large investment required in manufacturing. This highlights the need from a farmer returns perspective to have a larger investment in the value chain rather than remaining a supplier.*

Given the general lack of existing processing capacity identified for the crops under consideration, there would potentially be opportunities for growers to move down the supply chain by becoming involved at the processing stage. Again, this may take a number of forms, either collectively across growers or through some form of joint venture with international or national firms wishing to move into the area. Given the wider perceived benefits of creating strong alternative protein production systems in New Zealand, there may also be the opportunity for public-private initiatives.

Ceiling 2

While there is likely to be a margin in processing in addition to that in growing, access to this margin will likely require investment by growers, leading to increased risks. A key challenge is that manufacturers are unlikely to pay significantly above international market rates for New Zealand ingredients – (Ceiling 2). Also, if domestic processing cannot attain the same economies of scale as elsewhere there is a real danger it will not be competitive.

With models that involve simply growing or growing/processing, the key weakness is the inability to capture the margin that may be associated with a branded alternative protein product. AbacusBio have also noted that a generic brand could be expected to operate at a relatively slim gross margin of 10-20%. They argue that to elevate products above the commodity level requires either a:

- Strong (brand) story (about the product, its attributes and its provenance), or
- High levels of innovation (in novel products and uses), or
- The development of value-added products using the products as base ingredients.

Ceiling 3

However, again the value that can be attained from these final products will be constrained by the availability of competitor products in the market – (Ceiling 3). Even with strong branding, Oatly has had difficulty in achieving margins as high as 10-20% over the last year and are struggling for overall profitability.

The fundamental challenge though is returning sufficient value back through the chain to generate returns to growers that stimulate production, as well as compensate for the potential risks associated with investment further down the chain. These challenges are of course not unique to the products considered in this article, but are fundamental to any attempts to diversify away from our livestock orientated agrifood sector.

International examples

If value cannot be extracted from existing companies for growers, then it is important to consider the alternative options. There are international examples of models where, through their own initiative, farmers have been able to capture the value added in plant-based products.

An example of creating a unique selling point in the increasingly competitive alternative plant-based sector is that of Glebe Farm Foods in the UK. They have focused on producing and developing a market for gluten-free oats made from their own oats. As well as producing their own oat milk product, they also sell their oats to food manufacturers across the world on the basis of its gluten-free status. Through investing in knowledge and on-site facilities, the farmer has become a grower-producer and is able to derive greater margins from their products.

It is likely that New Zealand will struggle to compete with the main competitors in global markets who are taking advantage of economies of scale throughout the supply chain. Differentiation, product innovation and (nation) branding when positioning possible products from New Zealand are crucially important if these alternatives are to be viable.

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Pea protein at scale – Roquette's 125,000 tonne/year facility in Canada

ADAM MOLONEY, PETER TOZER, PAUL KENYON AND STEVE MORRIS

BIGGER LAMBS OR MORE LAMBS?

THAT IS THE QUESTION

Farmers are better off focusing on increasing pre-weaning lamb growth rates rather than flock lambing percentage, especially when these percentages are already well above average, to increase sheep enterprise profitability. In this study, a 1% increase in pre-weaning lamb growth rates increased farm cash operating surplus (COS) by 1.7% compared to a 1.16% increase in COS following a 1% increase in lambing percentage.

Improving sheep performance and profitability

Sheep producers are always looking to improve enterprise performance and profitability, with the main methods being an increase in the number of lambs sold or in the individual weight of those sold. Increasing a farm's lambing percentage or pre-weaning growth rates are the two most utilised methods to increase lamb number and weight, respectively, with farmers often being unsure which of these is the best option to increase profitability.

While this decision is often subjective and varies between farm and region, a systems dynamic bio-economic model was created using industry data and calibrated to produce outputs directly reflective of any given year. This calibrated model was then used to run scenarios with differing lambing percentages and/or pre-weaning lamb growth rates, using the results to examine which variable has the biggest impact on enterprise profitability.

What we did

An 'average' Class 4 sheep enterprise in the Western North Island (WNI) of New Zealand was modelled using Beef + Lamb New Zealand data. The farm modelled is 478 ha effective and has a self-replacing flock of 2,203 autumn-mated Romney-breed ewes, lambing at 133.5%. Birth rank determines sale type, with all singles sold for slaughter and surplus multiples sold as store for others to finish. Ewes were all mated to a maternal ram and maiden ewes were not mated.

It was assumed that the sheep flock consumed 60% of the total feed available on-farm (11.815 million MJ ME), with cattle consuming the remaining 40%. Pasture growth rates and quality were determined by the relevant literature for the region. Ewes are retained until six years old then culled for age. A culling rate of 20% was used for the breeding flock, along with a death rate of 5.2%. A pre-weaning death rate of 15% was used for lambs.

Eight scenarios were run:

- Scenario 1 was the status quo, assuming an industry-average lambing percentage of 133.5% and lamb weaning weights of 30 kg and 25 kg for single and multiple born lambs, respectively (**Table 1**).
- Scenarios 2, 3 and 4 used status quo lamb weaning weights, but had lambing percentages of 140%, 150% and 160%, respectively.
- Scenarios 5, 6 and 7 used the status quo lambing percentage of 133.5%, but had improved lamb weaning weights of 10%, 20%, and 30% above the average, respectively.
- Scenario 8 reflected a slight increase to lambing percentage (140%) and weaning weight (10%), and was utilised to examine the impact of a slight change to both variables.

The dynamic model was run for 35 years to allow for stabilisation, with the output from the final year utilised for discussion. The model contained six key modules:

- Flock dynamics
- Feed supply
- Feed demand
- Feed balance
- Wool production
- Economics.

The feed supply limits the size and distribution of ewes within the breeding flock, while the increase in lambing percentage or lamb weaning weight determines the feed demand and distribution of total feed supplied to ewes or lambs.

Table 1: Proportion of lambs at each birth rank based on flock lambing percentage in scenarios where this percentage differed to average

Scenario	Lambing percentage* (%)	Lamb weaning weight (kg/hd) (single/multiple)
1	133.5	30.0 / 25.0
2	140.0	30.0 / 25.0
3	150.0	30.0 / 25.0
4	160.0	30.0 / 25.0
5	133.5	33.0 / 27.5
6	133.5	36.0 / 30.0
7	133.5	39.0 / 32.5
8	140.0	33.0 / 27.5

* Lambs weaned per ewe mated

Table 2: Number of lambs weaned production across the eight scenarios

Scenario	Lambs weaned					Lambs sold					Weight of lamb sold (kg CW/ha)
	MS	FS	MM	FM	Total	MS	FS	MM	FM	Total	
1	546	546	550	550	2192	546	535	531	0	1,612	93
2	491	491	654	654	2290	491	491	634	96	1,712	97
3	407	407	813	813	2440	407	407	792	258	1,864	102
4	329	329	952	952	2562	329	329	932	399	1,989	107
5	541	541	545	545	2172	541	531	526	0	1,598	100
6	537	537	541	541	2156	537	526	521	0	1,584	107
7	532	532	536	536	2136	532	521	516	0	1,569	113
8	487	487	649	649	2272	487	487	628	95	1,697	104

Note: MS = male single, MM = male multiple, FS = female single, FM = female multiple, store lamb liveweights were adjusted to kg of carcase weight (CW) equivalent

What we found

As lambing percentage increased from 133.5% in Scenario 1 to 160% in Scenario 4, the amount of energy required for gestation and lactation became the factor limiting ewe flock size, which in turn led to a decrease in the flock from 2,203 ewes to 2,172 ewes, respectively.

As pre-weaning lamb growth rates increase, flock size decreases from 2,203 ewes in Scenario 1 to 2,146 ewes in Scenario 7, with the energy required for ewe lactation and lamb pasture intakes becoming the limiting factor. The combination of increased gestational and lactational demand in Scenario 8 reduced ewe flock numbers to 2,178.

In Scenario 1, a total of 1,612 lambs were weaned, with 93 kg of lamb CW equivalent per effective hectare sold (**Table 2**). Greater numbers of lambs were weaned in Scenarios 2 to 4, leading to higher CW equivalent of lamb sold per hectare compared to Scenario 1. Fewer lambs were weaned in Scenarios 5 to 7, but due to the heavier weight per lamb, this led to a greater CW equivalent of lamb sold per hectare. In Scenario 7, 20 kg more of lamb CW equivalent per effective hectare was sold than in Scenario 1.

While feed supply was fixed at 11.815 MJ ME/yr, the distribution of this demand differed between the scenarios as seen in **Figure 1**. While ewe demand remained the greatest contributor to annual feed demand, it decreased from Scenarios 2 to 4, with lamb demand increasing. Ewe demand was higher in Scenarios 5 to 7 than in Scenario 1.

Ewe demand from Scenarios 5 to 7 remained relatively constant, with the decreasing ewe numbers compensating for the increase in individual ewe demand over lactation. Scenario 8 had a very similar distribution of energy demand to Scenario 1, with only a slight reduction and increase in ewe and lamb demand, respectively.

Sheep enterprise income for Scenario 1 was $280,000, with total expenses of $196,500, giving a cash operating surplus (COS) of $83,500 or $291/ha (**Figure 2**; **Table 3**). As lambing percentage increased from Scenarios 1 to 4, enterprise income increased from $280,000 to $305,400. Expenses also increased due to the greater number of lambs, increasing total animal health expenses due to activities such as drenching and shearing.

Figure 1: Distribution of energy demand by stock class, total MJ ME per stock class in each scenario

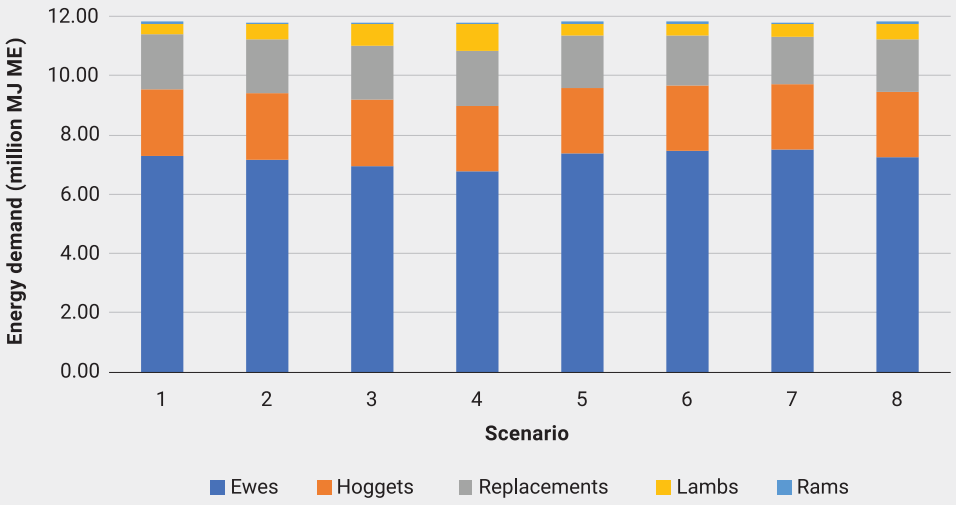

Figure 2: Total income and expenses (NZD) and cash operating surplus by effective hectare (NZD/ha)

Table 3: Lamb value for Scenarios 5 to 8 by sex and birth rank

Scenario	Male singles		Female singles		Male multiples		Female multiples	
	CW (kg)	Value ($)	CW (kg)	Value ($)	CW (kg)	Value ($)	CW (kg)	Value ($)
5	19.3	$137.0	19.3	$137.0	15.14	$100.5	14.36	$95.4
6	20.8	$147.7	20.8	$147.7	16.21	$107.6	16.51	$109.6
7	22.3	$158.3	22.3	$158.3	17.50	$116.2	17.80	$118.2
8	19.3	$137.0	19.3	$137.0	15.14	$100.5	15.44	$102

However, increases in income were greater than expenses, so overall COS increased from Scenarios 1 to 4. Enterprise COS increased to $105,400 in Scenario 4, $368/sheep/ha or $77/sheep ha more than Scenario 1. These results indicate that a 1% increase in lambing percentage increased COS by 1.16% from Scenarios 1 to 2, with the marginal return decreasing to 0.67% from Scenarios 3 to 4. This suggests that the impact of lambing percentage on COS follows the law of diminishing returns as lambing percentage increased above 140%.

As pre-weaning lamb growth rates increase from Scenarios 4 to 7, enterprise income increased from $293,000 to $318,700. Enterprise expenses declined from Scenarios 5 to 7 compared to Scenario 1, due to the smaller ewe flock and fewer lambs. As pre-weaning lamb growth increased from Scenarios 5 to 7, enterprise COS increased from $98,200 to $127,200. Scenario 7 had the highest COS of all eight scenarios, with a COS of $444/ha, $153/ha more than Scenario 1, and Scenario 8 had the fourth highest COS of $104,800 or $365/ha.

These results indicate that a 1% increase in pre-weaning lamb growth increased COS by 1.7%, comparing Scenarios 1 and 5, while the marginal benefit decreased to 1.3% between Scenarios 6 and 7. The results also indicate that the overall return from increased pre-weaning growth is higher than the returns from improved lambing percentages. If a farm's productivity is at the levels used in Scenario 1, any increase to lambing percentage and/or pre-weaning lamb growth rates will increase the farm's profitability (**Figure 2**).

Previous research in New Zealand supports our findings and show that farmers already achieving the mean lambing percentage were better off financially focusing on pre-weaning growth rather than increasing this percentage. However, if the farm's current lambing percentage is below the regional average of 133.5%, it would be more profitable to increase this percentage to at least 133.5%, but with 140% being more profitable. In contrast, if the farm is already achieving a lambing percentage of 140% or greater, it may be more profitable to increase pre-weaning lamb growth rates rather than lifting lambing percentage further.

Further considerations

This model relies on a feed supply which may be higher, lower, or distributed differently within any given year. While a feed surplus has less risk to total production, an annual deficit or deficit in a period of high requirement (such as lactation) will have major implications for the outcome of this model. It may change results unless supplement is provided, which is not a common occurrence on hill country farms.

At higher lambing percentages, a greater proportion of the lamb crop are born as multiples, with triplets being much more prone to pre-weaning mortality through starvation/exposure and dystocia. Unfavourable climatic conditions during lambing are much more likely to have negative impacts on lamb survival rates for the scenarios with higher lambing percentages, negating any benefit and impacting the model results.

The scenarios with high lambing percentages require high scanning rates if they are to be achieved. If coming out of a summer drought with light ewes, the required ovulation rates and subsequent scanning rates may not be attained, impacting lambing percentages.

This model uses birth rank to determine sale type, with all singles being sold prime and all multiples being sold store regardless of liveweight and estimated carcass weight. The model could be amended to ensure sale type is dictated by liveweight and the estimated dressing out percentage at time of sale. This would ensure a greater proportion of multiple born lambs are sold prime in the scenarios that have improved pre-weaning lamb growth rates, increasing farm COS further.

Conclusions

While lifting the lambing percentage of a sheep enterprise improved profitability, increasing the pre-weaning growth rates of the lambs led to the largest improvements to it. These results suggest that if a farmer has a lambing percentage of around the current average, or above, they are better off spending more of their limited feed supply on improving pre-weaning lamb performance rather than lambing percentages. These results are dependent on several factors (such as climatic conditions, ewe liveweight and pasture supply), with farmers potentially having limited ability to manipulate flock performance for any given year.

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MARK BELTON

Cyclone Gabrielle caused major damage to vineyards and orchards in Eskdale, Napier

OPINION PIECE

TREES ON FARMS FOR LAND PROTECTION AND PROFIT – A RESPONSE TO BOLA AND GABRIELLE

There is an urgent need to reduce risk and make the farming sector more resilient to major cyclones. In this article, Mark Belton suggests that the Government should partner with landowners and finance growing trees to reduce erosion and sequester carbon on high erosion risk land.

Cyclone Gabrielle and at-risk landtypes

The calamitous deluges being delivered across our country have one positive dimension – our most powerful political and economic constituencies, urban and rural, are forced to acknowledge the need for urgent climate action. The concept of 'trees on farms for land protection and profit' is not a new theme, but its time has come.

Our land-use sector is the most important for NZ Incorporated's collective economic well-being and requires urgent climate action to help safeguard its future. In my view, there should be no climate change deniers left. Just a 1.1°C increase in average global temperature is delivering storms of unprecedented intensity and frequency. With much worse to come, greenhouse gas (GHG) loadings are already sufficient to lock in global temperature increases to 1.5°C, and if current levels of emissions continue we are fast-tracking towards a 2.5°C–3.0°C increase.

The land-use sector underpins our country, and we need to work out what it can do to better survive, and better profit, going forward into this future. For a start we need to build greater resilience into our farming sector. In particular, we must build greater resilience across 800,000 ha of steep hill country pasture identified as being at high risk from landslip erosion. Across these 'at-risk' landtypes, rates of slip erosion under pastoral farming are amongst the highest in the world. The downstream consequences are catastrophic:

- Soil, rock and tree debris dumped across valuable flatlands, destroying fences, tracks, roads, railways, homes, factories and telecommunications, and sewage and stormwater infrastructure
- Scoured water channels
- In-stream ecosystems destroyed.

Effects of Cyclone Bola

The financial losses and distress caused to those directly impacted are indeed catastrophic. With each destructive storm event there is massive loss of valuable topsoils and the productive capacity of our land collapses further.

In 1988, Cyclone Bola delivered 900 mm of rainfall in 72 hours across the Gisborne-East Cape region. Bola provided irrefutable evidence of levels of landslip erosion on pasture compared to the same landtypes under protective forest cover. Across the region, the frequency of landslips per hectare was 16 times greater under pasture than under radiata forest older than eight years age, or under mature indigenous forest.

Across the Uawa catchment, the storm epicentre, the incidence of landslips was 28 times higher under pasture than under radiata forest older than eight years of age. This was analysed in work done by Mike Marden and colleagues in 1991 on declining soil loss with increasing age of forest post-Bola. The 101 lesson: forest root systems have remarkable erosion prevention capabilities. However, when radiata is clearfelled its roots rapidly die and rot, creating (according to Rebecca Macfie in a 2018 *Listener* article on the pine problem), a 'window of vulnerability, a six to eight-year period of heightened landslip erosion risk.' The combination of storms, landslips and harvest slash all too frequently causes devastating debris tsunamis.

The 101 lesson: forest root systems have remarkable erosion prevention capabilities.

Re-afforestation of high-risk areas

It is time to banish radiata clearfell forestry from riparian areas and high erosion risk hill country, which may affect up to 200,000 ha of forest. These areas need to be managed as permanent carbon-conservation forests, not clearfell timber plantations.

In addition to addressing high erosion risk areas, there are extensive areas of rural land that are economically marginal for other reasons, such as low stock-carrying capacity, scrub weed infestation, poor soils, drought and animal pests. Farmers can readily identify these problem areas that contribute little to their net farm income and effectively have very low land value. Problematic low-value land areas could total about 1.5 million ha, or 15% of rural land.

Logic and economics would suggest a change in land use of these marginal high-risk areas to permanent protective tree cover. It makes absolute sense to attack the source of the problem and re-afforest high erosion risk landtypes. Such an approach would reduce debris discharges to 1/16th of what would discharge from pastoral hill country in a Cyclone Gabrielle magnitude storm.

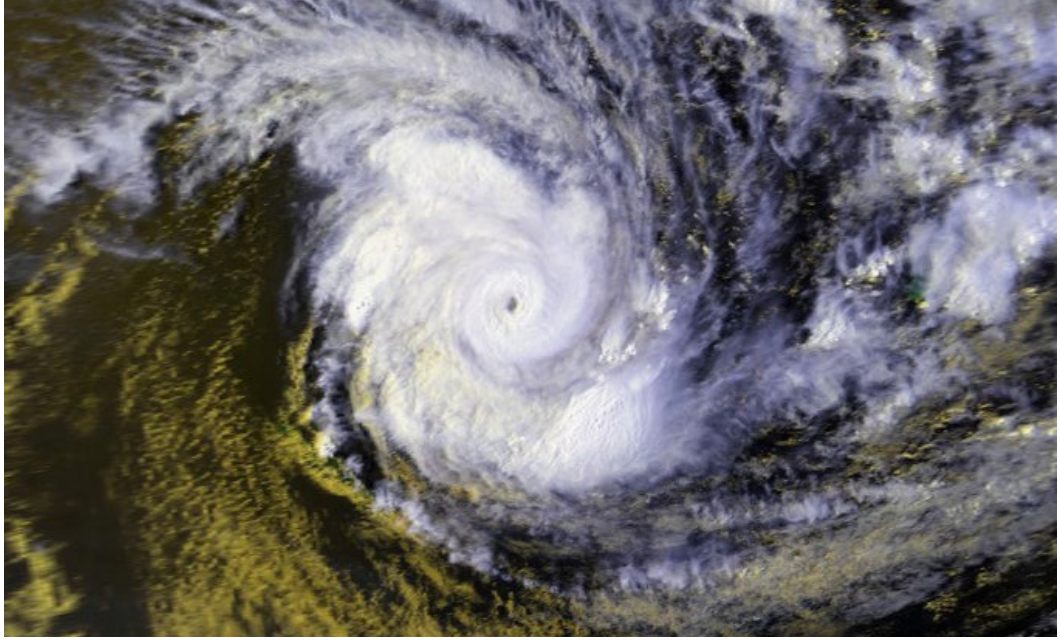
Using the NZETS to advantage

The good news is that afforestation of these problem areas within farms can be extremely profitable to landowners if their carbon sequestration potential is able to be captured, as indeed it can be, in the regulatory framework of the New Zealand Emissions Trading Scheme (NZETS).

High rates of return of around >15% internal rate of return (IRR) for low input cost radiata regimes have resulted in a surge in whole-farm conversions for timber carbon averaging regimes, which under the new regulations include a removal of contingent liabilities for carbon loss at time of harvest.

However, permanent carbon-conservation forests can sequester four times as much carbon by age 50 as short-lived timber forests, and last year the Government decided to exclude exotic forests as permanent forests. Following strenuous objections from industry, the Government has agreed to continue to include exotic forests within the permanent forest category.

A big dilemma for the Government is that hiking NZETS carbon prices to pressure emitters to transition to low carbon options inevitably causes land price escalation



Satellite image of Cyclone Bola near peak intensity

and whole-farm conversions to pine monocultures. It also unleashes fury and political backlash. A practical solution is to decouple the NZETS price for forest carbon credits from the NZETS price faced by emitters. Sound like an almighty mess? Yes, in my view the NZETS is a mess – a playing field for speculators while failing to deliver the economic behaviour change required to achieve a net zero economy.

Despite the current NZETS problems, forest carbon sequestration has a critical part to play in the transition to a net zero economy by offsetting intractable emissions and, more importantly, for the primary function of CO_2 removals.

New Zealand's responsibility

New Zealand may well step up to our share of responsibility in the global efforts to achieve net zero by 2050. However, I believe that NZ Incorporated's efforts to date have been to duck and dive and shirk responsibility. For example, we met our Kyoto Protocol emission targets in large part thanks to dubious foreign carbon credits, primarily from Russia and the Ukraine. The Government is now planning to increase our Nationally Determined Contribution (NDC) under the United Nations Framework Convention on Climate Change (UNFCCC) from a 30% to 50% reduction in net emissions by 2030 by purchasing again dubious overseas forest offsets, costing billions, which do precisely nothing for reducing global CO_2.

How do we determine our level of responsibility? According to UNFCCC GHG metrics, our annual per capita GHG emissions at 17 tonnes CO_2 equivalent is the fifth highest in the developed world, and half of it comes from our livestock emissions.

Our historic emissions are immense as well. The first peoples to colonise New Zealand burnt about a third of the forest cover, mostly located in the drier eastern areas. More recently, and more relevant now, post-1850 colonisation saw the clearance of half of the remaining native forest for farming (this time mainly across wetter hill country areas), and extensive wetland areas were also drained. Together these land-use change emissions may have released 10 billion tonnes of CO_2. Our agriculture sector's development has therefore left a legacy of perhaps several billion tonnes of CO_2 in our atmosphere, a consequence of it being the longest-lived GHG.

Reductions, removals and adaptation

Effective climate action comes in three forms – reductions, removals and adaptation.

Reductions

Reductions of emissions is fundamental, and all credit to our Climate Change Commission for bringing this to the fore. We cannot offset our way out of this. Significant progress on reducing livestock emissions is proving elusive, but there are many positive possibilities which once delivered will help significantly.

There will always be intractable residual emissions to address, so offsetting will have a key role in transitioning to a low emissions future. Another consideration is access to premium primary sector export markets that increasingly require the delivery of net zero produce.

Removals

For the good of our global climate the bigger challenge remains removals. The world must not only achieve net zero, but the overshoot of GHG levels (especially long-lived CO_2) must be dealt to as well. Carbon Capture and Storage (CCS) technologies remain the great hope, but despite decades of effort no CCS capabilities of consequence have been delivered, and the projected costs of CCS systems are extremely high.

By contrast, the removals opportunity through re-establishing forests is huge and cost-effective. New Zealand has an exceptional opportunity to establish carbon-conservation forests that can also deliver wealth and environmental resilience for the benefit of our farming sector. Landowners are in the box seat to capture this opportunity. To achieve its full potential, landowners and the Government will need to work together. The support of land-use sector leaders, consultants and advisors will also be essential. The situation requires a NZ Incorporated private-public partnership programme (discussed later).

Table 1: Indicative economics of *Pinus radiata* across a range of land costs

Pinus radiata, Avg NZ model			Land Value Sensitivity Analysis – Carbon Price $60/NZU, DR 8%			
Land cost $/ha	1,000	4,000	10,000	15,000	25,000	50,000
IRR %	18.10	14.30	10.20	8.20	5.60	2.30
NPV $/ha	13,400	10,600	5,100	450	-8,900	-32,000
$/NZU-NPV	24.00	30.50	46.00	58.00	83.10	145.00

Notes: *Pinus radiata* seq model, Scion Calc v4, 300I 27, SI 30, scrub site, kill spray & burn, fencing, 10% amenity/native species, Yr 1 & 2 forest establishment costs $6,000/ha, Yr 8 thinning costs $1,000/ha, annual OH $150/ha, carbon price 60/NZU 0-50 yrs

Adaptation

Adaptation is about flood control and managed retreat. It is also about reducing debris discharges at their source and shifting to more resilient land uses such as protection forest.

Adaptation is about flood control and managed retreat. It is also about reducing debris discharges at their source.

Economics of forest carbon markets

The economics of forest carbon markets are speculative and spectacular and there is nothing comparable in the agriculture sector. Buying a livestock farm, one may hope for returns on invested capital to be in the order of a few percent. High returns from core farming businesses are rare. For many livestock farmers, servicing debt is the biggest challenge.

Carbon income from trees can radically change this situation. If we take a real-life example, one of our farmer clients purchased a 1,300 ha hill country farm a decade ago, 500 ha of which had been planted in radiata pine and Douglas fir around 2003. Cashflow from the sale of New Zealand units (NZUs) became the farm's major source of income, enabling debt retirement, investment in the farming operation and the purchase of a nearby farm.

The forest area was recently sold to a carbon farming investor for about $40,000/ha, enabling them to purchase another farm, thus providing for the next generation. The unimproved hill country where the forest is located previously supported about 3-4 stock units/ha and had net earnings of around $200/ha/p.a. Under carbon forest, it now generates above $2,000/ha/p.a.

Note that **Table 1** is illustrative only, and intentionally conservative, with an average radiata sequestration model, a $60/NZU flat carbon price, an 8% discount rate, and very high costs for forest establishment (Yr 1 & 2 $,6000/ha).

The Table 1 'sweet spot' for farmers might be the scenario with marginal land valued at $4,000/ha, which together with establishment costs at $6,000/ha allows for high fencing costs and the establishment of forest on difficult land with a range of species with superior soil conservation erosion prevention capabilities. These high establishment costs provide for an environmental best practice approach, which might well include a proportion of indigenous and amenity species plantings.

Table 1 also illustrates that high returns and a low cost per NZU carbon unit only occur with low-value marginal land. At high land costs, IRRs are low, net present value (NPV) of the project becomes negative, and sequestration has an exorbitant cost ($/NZU-NPV).

Growing permanent forests for carbon sequesters about four times as much carbon per hectare by 50 years as occurs under an averaging timber forest regime. Projected investment returns may be >15% IRR, or even higher. However, a word of caution – current permanent forest contingent liability for carbon loss still applies at a project level.

In my view, another caution is that carbon pricing under the NZETS is entirely an artifice of government regulatory settings, with all the hallmarks of political risk. Despite these risks, with confidence in rising carbon prices speculation on land acquisition for carbon forests is hot, and land prices and sales of farmland for carbon forestry will escalate accordingly. The threatened demise of farming, burgeoning sales to foreign buyers and expansion of radiata monocultures also present a big political risk.

The question becomes how does the Government change forestry regulatory settings in order to afforest marginal lands and maximise carbon capture for the benefit of NZ Incorporated? The challenges include:

- Enabling carbon prices to increase without escalating land prices
- Slowing conversions of farms to radiata monocultures
- Protecting high-quality landtypes for farming purposes
- Building more resilience into our rural lands
- Conserving soil and water
- Reducing flood risk
- Increasing forest species diversity
- Recovering more native forest.

We need to achieve these outcomes as cost-effectively as possible, and with broad electoral support, which is a big wish list.

The opportunity – a box of solutions

What is proposed is a public-private partnership programme between farmers and government focused on the afforestation of 1.5 million ha of marginal landtypes located within existing farms. The forests would primarily be permanent carbon-conservation forests, comprising a range of tree species (not just pine) – species that have rapid sequestration and maximum carbon storage capabilities.

The conservation dimension of the carbon-conservation forests would be stabilising erosion-prone land, reducing flooding, conserving topsoils, and protecting riparian habitat and water quality.

The optimal forest types for this purpose would comprise tree species that can rapidly develop permanent interlocking root systems and have strong root-grafting and coppicing capabilities. High-sequestration species include eucalypts, redwood, Douglas fir, radiata, hybrid pine and poplar. Radiata pine, and other *Pinus* species, do not have root-grafting and coppicing capabilities. Nor do most native tree species.

The carbon sequestration dimension also requires fast-growing and high-sequestration capable tree species. Re-afforestation of 1.5 million ha of environmentally problematic land could remove and store 2 billion tonnes of CO_2 emissions in 50 years. The New Zealand land-use sector is in the box seat to capture the extremely high monetary/economic value from the environmentally essential task of CO_2 removal and capture. The monetary value opportunity for the land-use sector requires that it captains and steers the ship, not 'sell up and run', and hand over to speculators and non-farming investor players.

The positives are more than just monetary as there are multiple co-benefit opportunities to be realised, the most important being to recover resilience and reduce risk across the weft and weave of New Zealand's productive lands. In a word it is about sustainability.

The 1.5 million ha can be accommodated without the use of any highly productive farmland whatsoever, with afforestation being restricted to environmentally problematic low land-use capability LUC classes. Establishment of the 1.5 million ha of forest could require around $15 billion invested, to cover a landowner land expectation value (LEV) up to $4,000/ha and forest development costs up to $,6000/ha.

Ideally the Government would be the key investor partner with landowners, de-risking by purchasing all sequestered carbon at a set price. This would provide surety and a very high return for participating landowners, and full capture of NZUs into our government carbon account at a very low cost of carbon.

The solution proposed in this article is actually a 'box of solutions' designed to resolve multiple challenges in the sphere of effective carbon action and environmental resilience. Delivery could be through the NZ Forest Service – Te Uru Rakau, but other government agencies would have critical roles in order to integrate and maximise co-benefit opportunities.

Key benefits

Climate adaptation/mitigation benefits

- Build environmental resilience across high erosion risk land, to achieve up to a 16 x reduction in landslip risk
- Reduced incidence and cost of catastrophic flooding/debris discharge, destructive of downstream land, roading, buildings and infrastructure

Environmental co-benefits

- Government and landowner control enables property-level planning for best practice carbon-conservation forestry outcomes
- Programme enables funding of best practice environmental farm plans, including Clean Rivers farm programme riparian protection

Political benefits

- 2.25 billion forest sequestration units into the Government's accounts, at very low cost (around $30/NZU) in 50 years, and 1.5 billion units into these accounts by 2050
- Huge cashflow and NPV value to farmers/landowners
- 1.5 million ha is marginal landtypes (LUC 6e15, 7e, 8e etc) so the proposed programme creates value for these problem land areas within farms
- Decouples forest carbon unit pricing from NZETS emitters carbon pricing, allowing emitters to face higher prices
- Stops whole-farm conversions to radiata monocultures
- A political positive – government partnership with landowners for the benefit of NZ Incorporated delivering effective climate action
- Enables New Zealand to achieve net zero by 2050, and its UNFCCC NDC targets through domestic actions, and avoids buying dubious overseas forestry units.

Conclusion

NZ Incorporated must make its land-based primary industries more resilient in the face of climate change and more extreme storm events by establishing permanent protection forests across at-risk landtypes. These forests have the potential to sequester vast amounts of carbon and create considerable wealth for the land-use sector. It also enables New Zealand to achieve net zero emissions, and to punch above our weight in the fight to combat global heating.

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NICO MOUTON

This profile looks at the life and work of Nico Mouton, former Editorial Committee Chairman of *The Journal*. He was also an important foundation member of NZIPIM, having facilitated its formation out of the NZ Society of Farm Management.

UK and US experience

Nico was born in London and moved to Holland for primary education, followed by secondary schooling in England. Between 1973 and 1976 he completed a Diploma in Farm Management and Advanced Farm Management at the Royal Agricultural University in Cirencester, England.

Following completion of the diploma course, he continued on for a further course in Advanced Farm Management. At the time it was the most advanced agricultural management training course available in the UK. There is an interesting connection between Lincoln College and Cirencester College. The initial foundation of Lincoln University/College in New Zealand is linked to the first principal of Lincoln University coming from Cirencester.

Cirencester College has since been upgraded to university status in the last 10 years. Nico's training consisted of all basic agricultural areas, specialising both in livestock arable farming and farm finance.

After completing his degree Nico moved to a large estate as trainee farm manager in Wiltshire, which specialised in sheep production, grass seed production and arable. From there he moved to Cambridge in the eastern UK, and was employed by a large real estate firm that managed land on behalf of farm owners under contract farming arrangements to avoid the agricultural tenancy restrictions. This gave Nico a large range of skillsets, including grain trading and large-scale arable production.

He then moved to an extensive dairy property south of London specialising in on-farm milk production from 600 Jerseys. This involved the production of high-quality ice cream and yoghurt, servicing the organic market in London and the south of England.

While there Nico became Chairman of the Farmers' Club in London for the under 30's group, which was the original farming club founded in 1840 as a precursor to farmer representative groups to government.

During his work at the agricultural estate in Surrey, Nico had the fortune of marrying a Kiwi who was on her OE. From there he moved to a large multiple cropping cattle estate near Birmingham consisting of approximately 10,000

Nico became Chairman of the Farmers' Club in London for the under 30's group, which was the original farming club founded in 1840 as a precursor to farmer representative groups to government.

acres with dairy units and an arable farming operation. At that time the UK agricultural industry was going through a transformative stage and a lot of the larger estates were changing their farming business to in-hand farming (i.e. rather than leasing the farm out the farm owners became farmers themselves).

To get around the tenancy issues, contract farming businesses were established that were similar to sharemilking in New Zealand. Farm owners took back control under a contract arrangement with a third party, therefore avoiding the tenancy issues.

An opportunity then developed in the US working for an investor in the area south of Washington DC, the Blue Ridge Mountains of Virginia, on an extensive farming operation that included beef Simental pedigree herds, arable farming and sheep farming. The sheep farming was part of a decision by the farm operation, with the support of the USDA, to develop more productive sheep in the eastern side of the US.

To achieve this, and to increase the lambing percentage, the farm operation was involved, with the assistance of the USDA, in the purchase of Romanov sheep from Canada. To improve the lambing % of their sheep flock the farm decided to import these sheep, which are a highly productive 400%-500% lambing breed from Eastern Europe, particularly from Bulgaria.

This then led into an extensive sheep multiplication project, including synchronisation, artificial insemination to improve the volume of lambs born, and for sale with the assistance of the Virginia polytechnic and USDA. A particular focus was developing the sheep industry on the eastern side of the US where a lot of ethnic demand was driving the sheep industry.

During Nico's time in Virginia he experienced a whole range of interesting farming challenges, including droughts, heavy snowfall incidents and, towards the end of his contract, the arrival of coyotes that were migrating from the western US to eastern US. Coyotes target sheep flocks as a ready source of nutrition and even now they put a lot of pressure on the sheep industry in the eastern US. To combat the issue farmers have introduced more housing to keep the flocks secure at night from coyote attack. They also use sheep herding dogs, such as Maremma from Italy, which are sheep guard dogs that are well established in Europe.

New Zealand farm consultancy

The opportunity arose to either stay in the US through the Green Card process or return to the UK and/or New Zealand. Nico and his wife agreed the best opportunity for both their skillsets and would be to come to New Zealand. Nico was particularly keen on no-subsidy farming, as both UK and US farming are heavily dependent on subsidisation to make a profit.

Nico moved to New Zealand in 1988, two months before Cyclone Bola hit the country. He set up in Hamilton as a Farm Management Consultant, initially with two colleagues, and introduced a computer-based financial programme for dairy farmers. He developed his private farm management practice further before joining AgFirst in 2005.

The business developed to a point where Nico saw the opportunity to join up with two other colleagues and formed the AgFirst Waikato branch in 2005.

Nico first joined the National Board of AgFirst as a Director. During this time working with clients he became involved as a professional trusteeship of farming businesses. He developed his private farm management practice on the back of the financial management system, which focused on good business practices, especially for dairy industry clients.

The business developed to a point where Nico saw the opportunity to join up with two other colleagues and formed the AgFirst Waikato branch in 2005. During this time, he also joined the National Board of AgFirst as a Director.

NZIPIM involvement

Soon after arriving in New Zealand, Nico joined the Waikato branch of the then NZ Society of Farm Management. He then joined the local committee and became Chairman of the Waikato branch, followed by being appointed Chairman of the NZ Society of Farm Management for a term. Within this term Nico was involved with the reorganisation of the Society, which was then established into an Institute with fellow board members following a strategic review. The result was the change of name to the NZ Institute of Primary Industry Management as it is known today.

The Journal

Following the name change, Nico and fellow board members undertook a review of the then Society magazine and established this as an authoritative quarterly journal. This was the forerunner of the current journal. Nico has been on *The Journal's* subcommittee for 20 years, many of these as Chairman. *The Journal* is now a well-established source of high-quality information for NZIPIM members and the wider industry.

Other interests – equestrian and ornithological

Nico and his wife have always been involved in the equestrian world. Shortly after arriving in the country, he got involved in the New Zealand Warmblood Horse Breeders Association and became its Chairman. Warmblood horses are essentially the European high-performance breeds for the use of show jumping and dressage, with the

Romanov cross-bred lambs

New Zealand thoroughbred fulfilling the demand of the three-day eventing style sport.

For the last 20 years, Nico has also become involved in the establishment of the Maungatautari Ecological Island Trust at Cambridge and lately as one of its trustees. This is the largest enclosed pest-proof sanctuary in the world extending to some 3,400 ha.

The establishment of the fence and excluding the pest pressure has resulted in the introduction of kiwi with a specific breeding programme. This has happened in conjunction with the development of other research and the introduction of further bird species, such as the takahe, and the building of an enclosed area for tuatara. A large education centre for school groups and scientific research will be completed shortly to further improve the whole visitor experience.

The Department of Conservation have approached the trust to become a site for the first release of kakapo onto the mainland of New Zealand since European settlement. The trust has further developed a fence to secure the kakapo as they are climbing parrots and would otherwise climb out of the enclosed area. The first introduction of the kakapo into the enclosure will be in the next six months.

Nico is about to park his Red Bands after a long and rewarding career in farm management.

More recently, Nico has become involved with the Wingspan Bird of Prey Trust as a sponsor and member. The trust is based in Rotorua for the promotion, study and protection of the New Zealand falcon, the kārearea.

Retirement

Nico is about to park his Red Bands after a long and rewarding career in farm management. For him, the best part has been working with a group of motivated farmer clients and always challenging the status quo.

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