

# THE JOURNAL

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**REASSESSING GREENHOUSE GAS EMISSIONS** FAMILY SUCCESSION AND INTEGRATION INTO THE  
FARMING BUSINESS **FUTURE CHALLENGES TO THE GLOBAL TRADING SYSTEM**  
WHERE MIGHT FOREST CARBON FIT **FARMER ADVISORY NETWORKS**



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# Environment top of mind for rural professionals

In July 2018, NZIPIM undertook a survey of members and other rural professionals. Within the survey we asked participants to provide their thoughts on what they saw as the biggest challenges faced by the primary industry sectors over the next three to five years. Of the 259 respondents who provided feedback to this open-ended question, 41% identified the environment (including such areas as regulations, sustainability, nutrient limits etc) as the biggest challenge in the future. The next biggest challenge identified by 37% of respondents was the increasing level of compliance faced by farmers and growers.

We also asked respondents about what they saw as the largest gaps in farmers' and growers' knowledge and understanding based on their dealings in working with their clients and other stakeholders. Unsurprisingly, the environment once again featured highly, with 55% identifying productivity within limits as the biggest knowledge gap within their client base.

Feedback provided in the survey shows that respondents have a high level of uncertainty over environmental matters, whether in a farm context or at a national policy level, particularly in areas that impact on farming business practices in the future.

I don't believe that there is a lack of willingness by farmers and their rural professionals in wanting to improve water quality and sustain natural ecosystems. However, given the fluid nature of the debate and diverse expectations across society, industry and government around managing environmental outcomes, we are seeing an elevated level of uncertainty on-farm. Worse still, we are seeing a sense of powerlessness over how to effectively respond to the myriad of challenges while building sustainable and profitable businesses.

Within the survey we also asked respondents to identify their top research priorities that should make the most significant positive difference to the future of the primary industry sectors. Farm systems was ranked as the highest research priority by respondents, with the best use of land being a constant theme within this category. Closely aligned with this, the next highest ranked research priority was the environment, particularly in the design of systems to reduce nutrient losses.

In looking at the survey data, respondents believe that farm system change should be a research priority. They feel that even with what research does occur, there is limited extension of such research to key user groups. This is in contrast to how rural professionals

view the level of investment into researching the impacts and implications of climate change and in reducing greenhouse gas (GHG) emissions.

So while considerable research efforts are being made to mitigate GHG emissions in the agricultural sector, the level of investment in farm systems research that can pick up this research and integrate research findings into current or future farm systems has been low. Questions remain over the ability to apply affordable and practical on-farm solutions at scale to achieve the types of environmental outcomes being sought by so many parties.

Instead, it is with disconcerting familiarity that we hear of big bang approaches for New Zealand to dutifully meet its commitment to the Paris Agreement through changing land use scenarios. Even the New Zealand Productivity Commission's recently released report on the country becoming a low-emissions economy recommends a substantial lift in afforestation (up to 2.8 million ha), and expansion into horticulture and cropping, as shifts that 'must happen for New Zealand to achieve its low emission goals.'

What this report and others rarely explore in any great depth is the market analysis and economic impact assessment of land use change at the scale often talked about, a point not lost on respondents to the survey.

Within the survey we asked participants to outline what they believed to be the biggest opportunities for the primary industry sectors over the next three to five years. Forty-three percent of respondents identified the market as the biggest opportunity, with a large proportion citing opportunities through increasing the value of New Zealand's agri-food and fibre products, and in focusing on our competitive advantage. Farm systems was also seen as an important area for further development, with 31% of respondents identifying big opportunities in exploring alternative farm systems and through the implementation of better traceability systems. Twenty-two percent of respondents believed big opportunities existed in technology, particularly in improving productivity and sustainable outcomes, while reducing costs. Unfortunately the breadth of discussion that openly explores how these types of opportunities can work toward the sort of environmental outcomes that we are all seeking represents a significant challenge that we must overcome.

More information from the survey will be made available to members soon. I would like to thank those who participated in the survey, and also wish to acknowledge the Ministry for Primary Industries and the Red Meat Profit Partnership programme in funding this project. **1**

# GREENHOUSE GASES – A MORE REALISTIC VIEW

The contributions of water vapour (H<sub>2</sub>O), carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O) to the warming of the atmosphere are reviewed. Water vapour and clouds are responsible for 80-90% or more of the greenhouse gas (GHG) effect. CO<sub>2</sub> has a finite influence. However, contrary to the common assertions, the contribution of methane and N<sub>2</sub>O to world’s total emissions is negligible. We therefore conclude that expensive attempts to reduce human emissions can have negligible effects only on regional and world temperature.

Therefore, the generally accepted effects of CH<sub>4</sub> and N<sub>2</sub>O as infrared-absorbing GHGs, causing about 50% of the total New Zealand emissions, must therefore be urgently reassessed, and to a lesser extent the quantitative role of CO<sub>2</sub>. It is therefore suggested that CH<sub>4</sub> and N<sub>2</sub>O be removed from New Zealand’s Greenhouse Gas Inventory, and that the supporting case for such treatment be prepared for negotiation with our international partners towards eventual withdrawal from the Paris 2015 Climate Agreement.

## Introduction

The rotating planet earth is warmed by incoming sunlight in the daytime and cooled by outgoing infrared radiation at night (Figure 1A).

The planet never actually reaches equilibrium. The real atmosphere contains a varying percentage of water vapour (dry air is an idealised concept found only in the laboratory). The principal atmospheric gases N<sub>2</sub> and O<sub>2</sub> have no role in cooling.

The black body curves shown in Figure 1B are displaced in wavelength (shifted horizontally), depending on temperature. Molecules radiating from different altitudes will do so at corresponding temperatures.

The cooling process involves multiple steps: heat from the surface is radiated back, absorbed by the various GHGs (mainly water vapour), and transported upward by the convection of moist air to the upper troposphere, where clouds form. Throughout this journey from the surface molecular collisions, emission and re-absorption of radiation continues. The

‘greenhouse effect’ is attributed to gases that absorb and emit solar electromagnetic energy in a particular part of the electromagnetic spectrum – ultraviolet (UV), visible, infrared light. The final cooling step (emission to space) takes place via infrared radiation leaving the upper troposphere and stratosphere.

The downgoing radiation from the sun is in the UV and visible light part of the spectrum (0.1 to 1.2 microns wavelength), and here there is some interception of energy by clouds and a little by water vapour. There is virtually no effect of the GHGs, CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O at the wavelength of the incoming radiation from the sun.

All of the upgoing thermal radiation is in the 3 to 70 micron range of the spectrum, where the GHGs have some effect in absorbing the up-radiated heat from the earth’s surface. This will be discussed in greater detail later.

Computer models used by the Intergovernmental Panel on Climate Change (IPCC) and many climate scientists attempt to account for all these mechanisms, and make future predictions about planetary conditions, especially temperature.

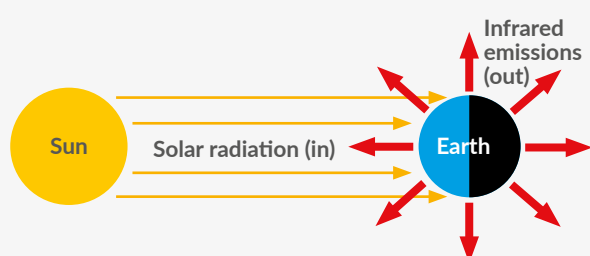


Figure 1A : Incoming solar radiation (energy) in and infrared emissions out

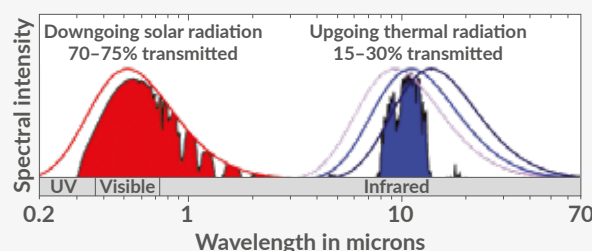


Figure 1B : Incoming solar radiation (energy) at 0.2 to 3 microns and outgoing thermal radiation at 3 to 70 microns



**The IPCC concentrates mainly on anthropogenic (human) emissions, and ignores natural contributions of the GHGs from the planet and the ubiquitous water vapour, both of which also must be included in any sensible consideration of the effects on world temperature.**

GHGs and their contribution to global warming (aka climate change and more recently 'climate disruption') are of national interest in view of the 2015 Paris Climate Agreement, and the commitments New Zealand has made to reduce emissions of these gases in the future. In addition to the known GHGs, ozone is recognised for its protective effect against UV radiation from space and will not be discussed further. CH<sub>4</sub> and N<sub>2</sub>O make up almost half of New Zealand's assessed GHG emissions, but are insignificant in comparison with CO<sub>2</sub>.

Mistakenly, water vapour is not included in any assessments of GHG effects by the IPCC, a crucial omission. The IPCC concentrates mainly on anthropogenic (human) emissions, and ignores natural contributions of the GHGs from the planet and the ubiquitous water vapour, both of which also must be included in any sensible consideration of the effects on world temperature.

The potential effectiveness of GHGs in influencing temperature depends essentially on five factors:

1. The capability of individual molecules to absorb or radiate heat.
2. Their relative concentration in the atmosphere.
3. Whether each can actually absorb effectively (as heat is radiated to and from the earth) depends on both the location of their spectral bands and the energy distribution of the earth's outgoing radiation.
4. Competition for absorption by and between other gases.
5. Phase change of water, evaporation, condensation and precipitation.

These factors will be discussed in turn.

**Capability of individual molecules**

In the 1860s, John Tyndall demonstrated that some atmospheric and other gases absorbed heat from black body radiation. He reported that CH<sub>4</sub> and N<sub>2</sub>O both absorbed about four times as much heat as carbonic acid, the original name for CO<sub>2</sub>. While his observations were not truly quantitative, this estimated value is many times less than indicated by the adopted Global Warming Potential (GWP) figures from the (IPCC) – see values in [Table 1](#).

GWP is a calculated ratio that the IPCC uses to estimate how much heat a GHG absorbs in the atmosphere (IPCC AR5, pp. 210-216). It compares the amount of heat trapped by a very small amount of the gas in question to the same additional very small amount of the comparator gas, CO<sub>2</sub> in this instance. This value for 'radiative forcing' is supposed to estimate the relative capability of a GHG molecule to have an effect on warming in comparison with one molecule of CO<sub>2</sub>. GWP is a concept promulgated by the IPCC and is accepted (by governments) as the basis for the calculation of their country GHG inventories. More of that later.

The individual molecules of CO<sub>2</sub>, H<sub>2</sub>O and N<sub>2</sub>O are similar in structure. Their relative concentrations in the atmosphere are in [Table 1](#) – CO<sub>2</sub> is now 410 ppm.

The GWP values are from the 2007 IPCC AR4 report. In 2013, the IPCC adjusted the GWP for CH<sub>4</sub> up to 28 and for N<sub>2</sub>O downwards to 265. Effectively these values are almost certainly wrong because of the faulty conceptual approach embedded in the very definition of GWP. Recent reports also emphasise that the treatment of reputedly

**Table 1: Atmospheric parameters of GHGs**

	WATER	CARBON DIOXIDE	METHANE	NITROUS OXIDE
Atmospheric concentration	0.01–4%*	385 ppm	1797 ppb	322 ppb
Rate of increase	N/A	1.5 ppm/yr	7.0 ppb/yr	0.8 ppb/yr
Atmospheric lifetime	Very short 1–5 days	Variable 5–200 yr	12 yr	120 yr
Global Warming Potential (GWP)	N/A†	1	21	310

\*The amount of water vapour in the air varies according to temperature and density of air (usually ~1–3% of troposphere)

† Water vapor levels vary strongly according to region, so rates of change and warming potential cannot be assessed

long-lived gases such as CO<sub>2</sub> in the same way as short-lived gases (such as CH<sub>4</sub>, 12 years) is not environmentally credible (Allen et al., 2018). This same approach must also be considered for N<sub>2</sub>O because the half life of this gas in the atmosphere is about half that for CO<sub>2</sub>. Allen et al.'s (2018) approach if adopted may reduce CH<sub>4</sub>'s assessed effect by about three-quarters, or New Zealand's calculated emissions by about 30%. Quite evidently, the 'official' GWP numbers asserted by the IPCC are unreliable and controversial.

Recent calculations (Happer & van Wijngaarden, unpublished data) clearly show that the absorptive capability of individual molecules of the GHGs is not as widely different as the GWP values might suggest (Table 2).

**Table 2: Calculated heat absorptive capability of individual GHG molecules relative to CO<sub>2</sub> with a concentration change of zero to one ppb, at the tropopause (11 km) or the top of the atmosphere**

CAPABILITY TO ABSORB HEAT IN COMPARISON WITH CO <sub>2</sub> = 1		
Gas	Top of atmosphere	Tropopause
CO <sub>2</sub>	1	1
CH <sub>4</sub>	0.19	0.22
N <sub>2</sub> O	0.54	0.66
H <sub>2</sub> O	0.084	0.14

Table 2 shows that the capability of the individual molecules to absorb heat (radiative forcing) is of the same order of magnitude. This seems reasonable since the molecular structure of the four molecules is not enormously different. Also, the absorptive value differences between the molecules is very similar to what Tyndall found in the 1860s.

This refutes the popular notion and the IPCC's claim that CH<sub>4</sub> and N<sub>2</sub>O are much more powerful GHGs than CO<sub>2</sub>. The reason for this is that the assumed radiative forcing for CO<sub>2</sub> is much more strongly saturated than the other gases (Figure 2).

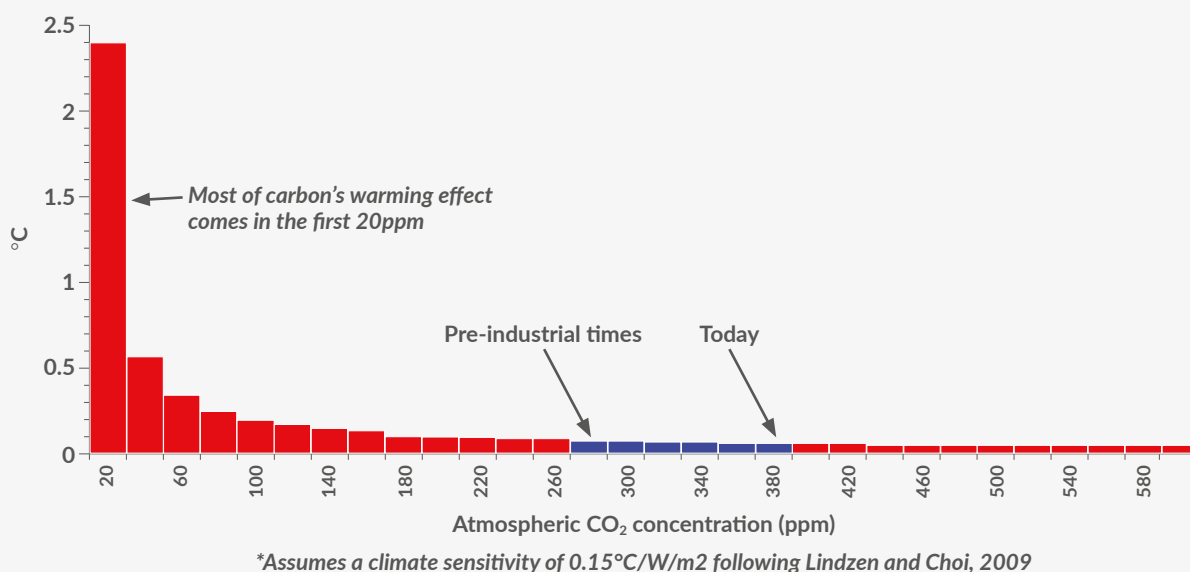
Because of this saturation additional CO<sub>2</sub> above 400 ppm has a miniscule effect on warming in comparison with additions to the very low unsaturated concentrations for N<sub>2</sub>O and CH<sub>4</sub>. However, the comparative effects of CH<sub>4</sub> and N<sub>2</sub>O on warming are derived with no cognisance of any competitive effects of water vapour throughout the atmosphere, or the fact that there is very little energy transfer from the earth at the frequency on the electromagnetic spectrum at which these trace gases might have an effect. More of this later.

#### Relative concentration of GHGs in the atmosphere

Omitting water vapour, the major gas components of a 'dry' atmosphere are nitrogen (N<sub>2</sub>), oxygen (O<sub>2</sub>) and argon (Ar), at 78.1%, 20.9% and 0.92% by volume, respectively, all of which do not absorb heat. This leaves 0.1% by volume for the remaining gases. CO<sub>2</sub> at 400 ppm is the largest of the trace gases. CH<sub>4</sub> and N<sub>2</sub>O are very small, just traces in effect, 1.7 and 0.3 ppm, respectively (Table 1).

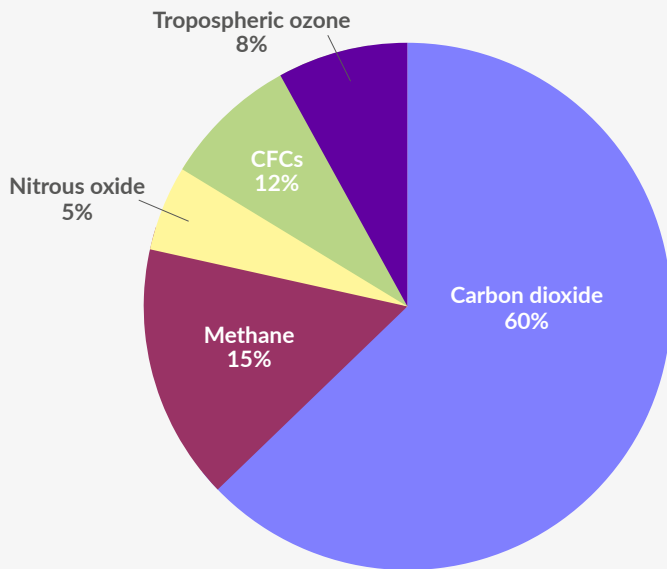
But the real atmosphere is not dry. Water vapour is widely variable: a very low percentage at the poles, but up to 4% in the tropics. For the purposes of comparisons and discussion in this article, we have assumed it is 1.5% or 15,000 ppm. Of course, any amount of atmospheric water vapour will proportionately reduce the percentage of all the other gases.

Further the amount of anthropogenic CO<sub>2</sub> (human induced) produced each year is less than 5% of the total CO<sub>2</sub> entering the atmosphere. Now, how are these gases supposed to cause all of the warming the world has experienced since the Little Ice Age (LIA)? In the teaching and scientific literature the estimates vary.

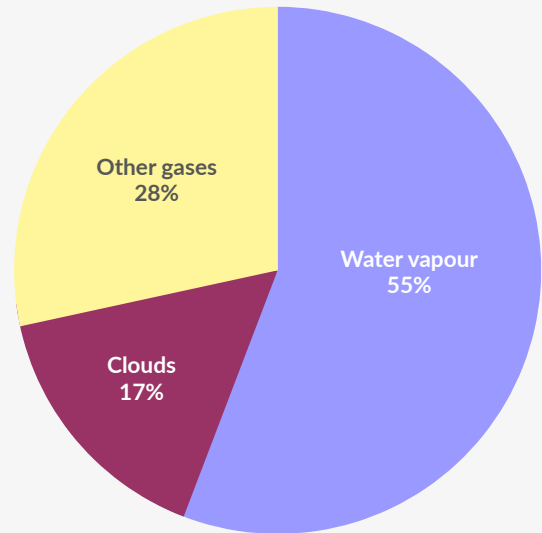


**Figure 2: Increasing levels of CO<sub>2</sub> cause less and less warming effect**

Source: Adapted from Lindzen & Choi (2009). This relationship is the basis of the MODTRAN atmospheric model, University of Chicago.



**Figure 3: Putative global warming effects of selected GHGs**  
 Source: [http://eesc.columbia.edu/courses/ees/slides/climate/g\\_effect.gif](http://eesc.columbia.edu/courses/ees/slides/climate/g_effect.gif)



**Figure 4: Breakdown of the 'natural' greenhouse effect by contributing gas. As halocarbons are industrial gases they are not represented here**  
 Source: IPCC Report (1992)

**Of all the CO<sub>2</sub> going into the atmosphere each year, 5% or less is anthropogenic, in comparison with CH<sub>4</sub>, about 40% of which is from natural sources, and similarly estimates of naturally occurring N<sub>2</sub>O are about 60%.**

The estimates in **Figure 3** above suffice for the discussion. CO<sub>2</sub> is generally regarded as causing about 60% of the warming from GHGs, CH<sub>4</sub> 15%, and N<sub>2</sub>O about 5%. Clearly the 'agricultural gases', although at very minor concentrations in the atmosphere, are estimated as being major causes of the total warming effect on the world from GHGs.

A common representation of the effect of the relative effects of the GHGs is in **Figure 3**, which 'conveniently' eliminates the dominant effect of water vapour.

The 2013 IPCC Report, AR5 (Physical Science Basis, Chapter 8, p. 666) states: 'Water vapour is the primary GHG in the earth's atmosphere. The contribution of water vapour to the natural greenhouse effect relative to that of CO<sub>2</sub> depends on the accounting method, but can be considered to be approximately two to three times greater.' Further, the IPCC's 1992 report indicates that water vapour accounts for 55% of the total GHG effect, and that clouds account for a further 17% (**Figure 4**).

Many scientific assessments consider that the total effect of water vapour is more like 90%, much more than the 72% suggested by the IPCC. Even at a value of 72% for water vapour, the proportion of the GHG effect on the world temperature, which international governments are ambitiously seeking to diminish through the reduction of the GHGs going into the atmosphere, is far less than conveyed in communications to the general public through official channels or the media.

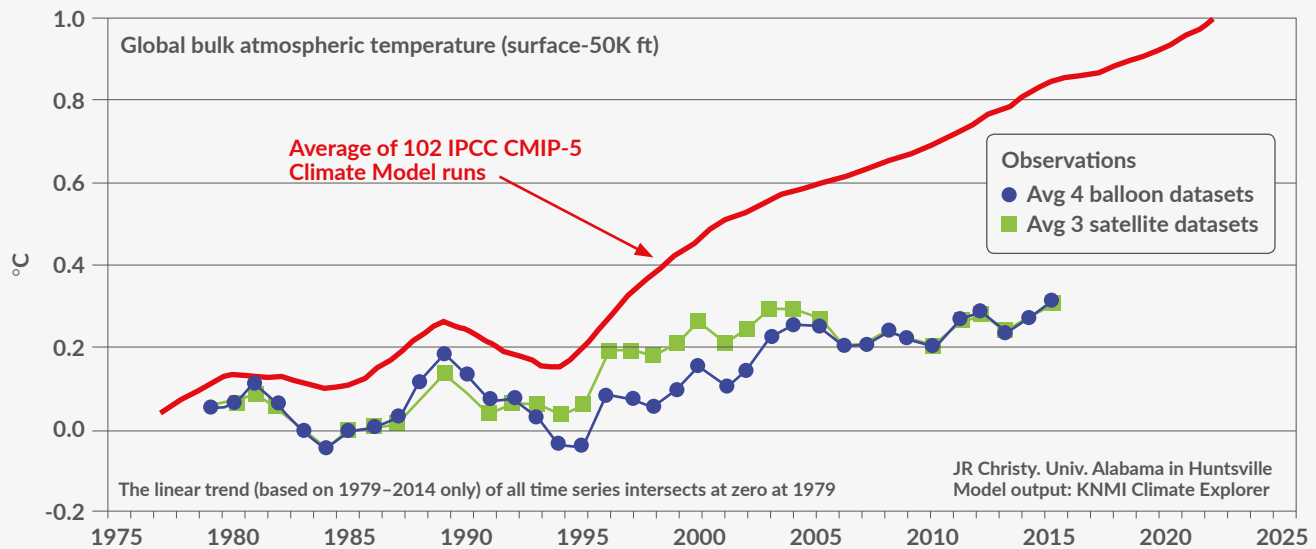
Of all the CO<sub>2</sub> going into the atmosphere each year, 5% or less is anthropogenic, in comparison with CH<sub>4</sub>, about 40% of which is from natural sources, and similarly

estimates of naturally occurring N<sub>2</sub>O are about 60%. It is frequently claimed that without the anthropogenic contribution of CO<sub>2</sub> the amount of natural CO<sub>2</sub> being released into the atmosphere would equal the amount of CO<sub>2</sub> being absorbed each year by the biosphere, and mankind is blamed for the absence of the balance.

Governments rely heavily on the IPCC's reports and claims about GHGs causing or threatening to cause dangerous warming. As shown above, however, the IPCC's reports fail to provide the complete picture, especially about water vapour. The IPCC relies on General Circulation Models (GCMs) to predict future temperatures, and when run with and without GHGs, to estimate mankind's contribution to warming. Because water vapour added to the atmosphere is present there for only a few days it is not incorporated into the models. Instead, the assumptions in the GCMs are that water vapour operates as a 'positive feedback', which amplifies the effects of the GHGs by two to three times.

This indicates an assumption that H<sub>2</sub>O does not operate in a direct way as do other GHG molecules in the atmosphere. This contention is made in spite of the fact that water vapour molecules are always present. All of the GHG molecules are well mixed throughout the atmosphere, albeit with water vapour at differing percentages (i.e. humidity). In this situation, all GHG molecules absorb, lose and re-absorb photons of energy. Thus, some radiant heat from the earth's surface is reflected back.





**Figure 5: Climate models predicted temperature compared to actual**

Source: Christy et al. (2016)

## There has been no significant increase in the world's temperature in the last couple of decades, the well-known and accepted 'pause'

There is no logic for the removal of water vapour molecules from consideration in the dynamic situation where all of the GHGs participate in exchanging photons of energy radiating outward from earth. This is particularly relevant in a situation where there is such a high concentration of water vapour in comparison with the other GHGs. As noted previously, many scientific assessments specify that water vapour is the most important GHG and is responsible for 80% to 90% of the greenhouse effect.

The IPCC dismisses any possible role of variations in solar output, such as the solar wind interacting with the earth's magnetic field or variations in sunspot activity.

### Temperature

The fact is that the world's temperature is not increasing at anything like the rate projected from the GCMs of the IPCC. The 'feedback' from water vapour amplifying the actual temperature effect of CO<sub>2</sub> by two to three times, as expected in the IPCC models, is not evident at least for the last two decades. Clearly the climate models are running hot, which is shown in [Figure 5](#).

The data are lower stratosphere measurements from satellites (green) and radiosondes on balloons (blue). These are the most accurate temperature data available, covering most of the world (including the oceans) not suffering from the Urban Heat Island (UHI) effects, from poor siting of climate stations in urban areas, or allowances for the heat build up, particularly at night from asphalt, shelter and other heat stores. Adjustments of past surface temperature records have also often resulted in apparent amplification of recent warming.

There has been no significant increase in the world's temperature in the last couple of decades, the well-known and accepted 'pause'. Over this short time there has been about one-third of all human GHG emissions ever, and the concentration of atmospheric CO<sub>2</sub> has increased more than 10%. Apart from some variation up and down, the mean temperature has not shifted much, certainly not at the rate suggested by the IPCC models. This is good evidence that CO<sub>2</sub> is not the main driver of the world's temperature and/or does not have a major effect on the world's temperature.

### Heat absorption activity range of GHGs over the total electromagnetic spectrum

The ability of the GHGs to absorb and emit radiation has been investigated extensively. In the daytime incoming radiation from the sun spans wavelengths from 0.2 to 3 microns. CO<sub>2</sub> has a small absorption band centred at 2.8 microns, which can absorb some incoming radiation. At this same wavelength water vapour is 100% saturated, so its 15,000 ppm versus 400 ppm substantially diminishes any minor effect CO<sub>2</sub> might have on incoming heat. We conclude therefore that there is little effective absorption of incoming radiation by CO<sub>2</sub>. Far more important is that the central stratosphere (~50 km) is warmer than the tropopause because ozone absorbs UV energy.

Water vapour does have two significant absorption peaks and some smaller ones in the 0.2 to 3 micron range of the spectrum which will be responsible for some absorption of incoming radiation. The outgoing radiation of heat from the earth is in the 4 to 70 micron range of

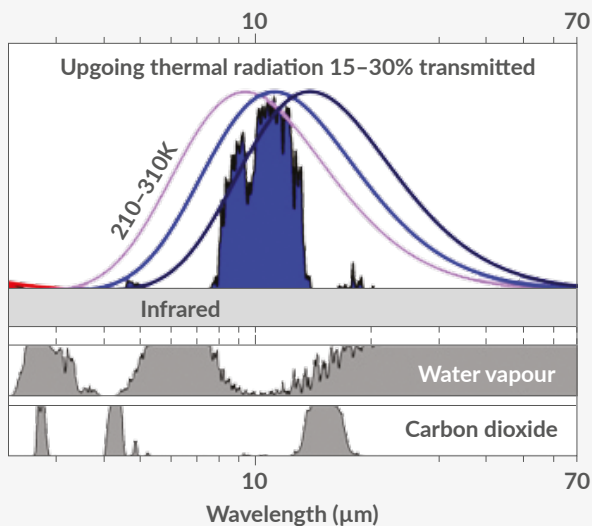


Figure 6A: Upper: Absorption of outgoing radiation from the earth's surface in the 2 to 70 micron range of the spectrum. Lower: Two panels show the absorption-saturation by H<sub>2</sub>O and CO<sub>2</sub> in various spectral regions

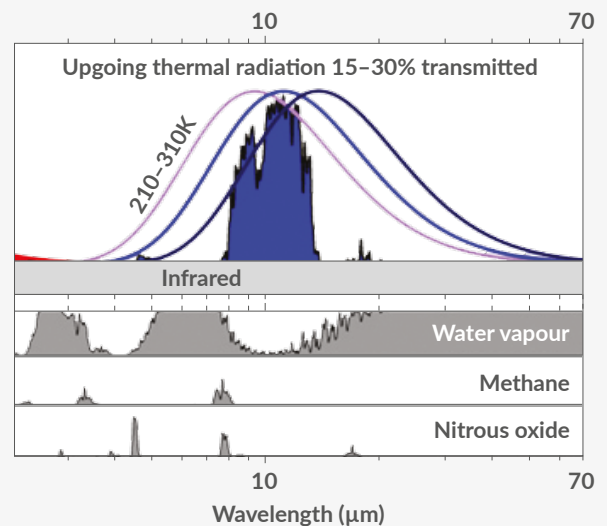


Figure 6B: Upper same as 6A. Lower bands: Absorption peaks for H<sub>2</sub>O, CH<sub>4</sub> and N<sub>2</sub>O across the infrared. The absorption bands of CH<sub>4</sub> and N<sub>2</sub>O are quite narrow

the electromagnetic spectrum (peaking around 10-15 microns), as shown in [Figures 6A](#) and [6B](#). Absorption bands for CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O are indicated. The water vapour bands are dominant. Note that CO<sub>2</sub> does not compete with CH<sub>4</sub> and N<sub>2</sub>O for heat radiated back from the earth, at any specific wavelength, only water vapour. Their roles are completely independent of each other.

One very important point that stands out in [Figures 6A](#) and [6B](#) is that water vapour absorbs over a very broad region of the spectrum. In contrast, CH<sub>4</sub> and N<sub>2</sub>O absorb only in narrow bands. This means that H<sub>2</sub>O captures much, much more of the radiant energy.

CO<sub>2</sub> has three main bands of infrared absorption: 1.8 to 2 microns, 4 to 5 microns and 12 to 18 microns. At the position of the first two bands where CO<sub>2</sub> is able to absorb there is hardly any energy being radiated by the earth anyway ([Figure 1A](#)), and thus CO<sub>2</sub> is not effective as a GHG in those bands. The 12 to 18 micron band is the main place where CO<sub>2</sub> absorbs outgoing radiation. Absorption and emission from this band of CO<sub>2</sub> remains a major factor even up into the high stratosphere – above 50 km.

For CH<sub>4</sub> and N<sub>2</sub>O, [Figure 6B](#) shows narrow absorption peaks in the 7 to 8 micron range; these are their only relevant bands. At the other minor absorption peaks for these gases there is very little energy emitted by earth into that spectral region.

In this discussion 15,000 ppm is taken for the atmospheric concentration of water vapour. This is 38 times the concentration of CO<sub>2</sub>, and a much bigger concentration difference in comparison with those of CH<sub>4</sub> and N<sub>2</sub>O. We know the individual capability of the GHG molecules is of the same order of magnitude ([Table 2](#)). We also know the projected warming is not happening, ([Figure 5](#)) and that the GWP metrics presently used by the

IPCC to classify the various GHGs as to their respective effects on warming are defective. The suggested treatment of a new way for CH<sub>4</sub> to get an environmentally credible metric (Allen et al., 2018) is a case in point.

Further, Sheahen (2018) has pointed out the mathematical illogicality of using the slope of a saturated gas (CO<sub>2</sub>) as the divisor of the numerator (the top number in a fraction). If any number is divided by another number (the divisor), which is close to zero, then the quotient (the result) becomes a large number itself. This is the simple situation in the calculation of the GWP. A normal numerator (the number related to the absorption by CH<sub>4</sub> or N<sub>2</sub>O) is divided by the very low number, the slope of the CO<sub>2</sub> absorption curve. This ridiculous situation produces a huge quotient (purported value for GWP).

CH<sub>4</sub> and N<sub>2</sub>O at their tiny concentrations in the atmosphere absorb radiated heat at the earth's surface and in the troposphere – in small, narrow bands. While this happens, water vapour (a GHG of similar absorptive capacity) is at concentrations thousands of ppm higher than these GHGs. The sequence of absorption, collisions (with N<sub>2</sub> and O<sub>2</sub>), emissions and more collisions combines to carry energy away, and that process is dominated by H<sub>2</sub>O and CO<sub>2</sub>. That mechanism completely truncates the effectiveness of CH<sub>4</sub> and N<sub>2</sub>O as GHGs.

Further, Ollila (2014) suggested that the present assessment of the effectiveness of the various GHGs was badly flawed, referring to an analysis from the Harvard-Smithsonian Centre for Astrophysics (2014), which noted that the total contributions of GHGs up to 120 km in altitude were H<sub>2</sub>O 82.2%, CO<sub>2</sub> 11%, O<sub>3</sub> 5.2%, CH<sub>4</sub> 0.8% and N<sub>2</sub>O 0.8%. This assessment agrees with many other estimates in the scientific literature that suggest that water vapour is the main GHG,

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## Increasing the concentration of CO<sub>2</sub> in the atmosphere is not such a potential warming problem for the world as frequently promoted in the scientific literature, by governments and the media.

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and 82% being higher than the IPCC's estimate of 72% mentioned above. Clearly, the main GHG is water vapour and there is not a great deal that can be done about the control of this gas.

### Other energy transfer mechanisms that must be examined simultaneously

There is an important factor that is often overlooked with one of these GHGs, namely water, which has the additional ability to change phase (evaporate, condense, and precipitate) which the others cannot. These properties also act to provide cooling mechanisms for the earth.

If the planet heats up for any reason, the oceans (which are 70.9% of the earth's surface) will heat up slightly, water will evaporate, and the atmosphere will increase in humidity. Then convection carries the moist air to the cooler upper troposphere, where water changes phase back again, deposits its heat at high altitudes and forms clouds. More clouds reflect heat back to the earth. Further, in the daytime clouds will reflect back or absorb about 30% of the incoming sunlight. This is a built-in cooling effect, a 'negative' feedback. Again, this casts doubt on the IPCC contention that water vapour provides strong positive feedback that amplifies the warming effect of CO<sub>2</sub>.

Increasing the concentration of CO<sub>2</sub> in the atmosphere is not such a potential warming problem for the world as frequently promoted in the scientific literature, by governments and the media. Clearly water vapour is the dominant GHG. CO<sub>2</sub> becomes less and less effective (at a logarithmic rate) as its atmospheric concentration increases. Thus, there is limited opportunity for additional CO<sub>2</sub> to cause heating, as previously illustrated in [Figure 2](#).

There is agreement that increasing CO<sub>2</sub> in the atmosphere causes some warming; the relevant discussion is about how much? There is also general agreement that doubling the CO<sub>2</sub> levels in the atmosphere from 'pre-industrial' levels of about 280 ppm might increase global temperatures by up to 1°C. Just how much of the temperature rise is due to expected warming as the earth comes out of the Little Ice Age (LIA), i.e. natural variation, and how much is due to an increase in CO<sub>2</sub> levels is impossible to determine.

### High altitude absorption

The observed temperature and GHG concentration data are pertinent close to the earth's surface and through

much of the troposphere where water is the dominant GHG. At higher altitudes water is largely frozen out and the dominant absorber becomes CO<sub>2</sub>. At higher stratospheric altitudes water vapour is in the few ppm range, with CO<sub>2</sub> and CH<sub>4</sub> still at their lower tropospheric values. In the lower stratosphere the oxidation of CH<sub>4</sub> to H<sub>2</sub>O and CO<sub>2</sub> begins to occur. Consequently, CH<sub>4</sub> always remains less than half the concentration of water vapour.

In the stratosphere the ambient temperature is below minus 30°C, and so the energy peak of outgoing radiation has shifted further out into the infrared, leaving even less energy in the 7 micron zone. Again, CH<sub>4</sub> has no significant role as an absorber of infrared energy. Ultimately, the cooling of the planet takes place from the stratosphere and upper troposphere as gases emit radiation into space.

CO<sub>2</sub> participates in this process, but CH<sub>4</sub> does not. CO<sub>2</sub> does not compete with CH<sub>4</sub> or N<sub>2</sub>O to absorb radiation from the earth; CO<sub>2</sub> absorbs at different frequencies. Nevertheless, the effect of water vapour in the atmosphere overwhelms the role of CO<sub>2</sub>; H<sub>2</sub>O is known to provide about 33°C worth of greenhouse effect warming (IPCC, AR4 & AR5). That suggests that reducing atmospheric CO<sub>2</sub> by reducing human emissions has little potential to reduce temperature, much less to control climate. Presently, anthropogenic CO<sub>2</sub> is less than 5% of all the CO<sub>2</sub> going into the atmosphere, and as the temperature increases (as it has in the last millennium) the ocean will heat up and 'outgas' CO<sub>2</sub>. Of course, this will also contribute to the atmospheric concentration.

### Benefits of CO<sub>2</sub>

There is a huge scientific literature about the benefits of additional CO<sub>2</sub> in the atmosphere; it is in fact the gas of life. The fact that many refer to this gas and the increasing levels in the atmosphere, even the adding any of it to the atmosphere, however small, as 'carbon pollution' is illustrative of a misinformed and alarmist media and a misinformed general public.

Already the increase in atmospheric CO<sub>2</sub> from 280 to 400+ ppm from 1850 to 2018 is responsible for probably more than a 15% increase in plant growth, and the 'greening' of the earth is well recognised. Adding additional CO<sub>2</sub> to the atmosphere will increase crop, pasture and forest growth. In fact a doubling of the level of CO<sub>2</sub> in the atmosphere would most likely result in about 30% increase in plant growth, a result which would be a terrific boon towards food production for an increasing world population.

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#### **Are the present IPCC estimates of GWP for the various GHGs realistic?**

It is clear that the warming effect of CH<sub>4</sub> and N<sub>2</sub>O is limited due to their molecular structure, their concentration in the atmosphere, and the minor amount of energy falling within their very narrow absorption bands. They are ineffective GHGs.

There are four serious discrepancies regarding our present political assessment of the effectiveness of CH<sub>4</sub> and N<sub>2</sub>O as GHGs:

1. The similar molecular structure to CO<sub>2</sub> and H<sub>2</sub>O, N<sub>2</sub>O and CH<sub>4</sub> result in their individual capability to absorb radiating heat from the earth of a similar order of magnitude.
2. There are very tiny amounts of CH<sub>4</sub> and N<sub>2</sub>O in the atmosphere.
3. The earth emits very little energy in the energy band where both CH<sub>4</sub> and N<sub>2</sub>O can absorb radiation.
4. The absorption bands of CH<sub>4</sub> and N<sub>2</sub>O are narrow and small, thus these molecules are unable to materially contribute to the dominant role of water vapour in the heat transfer process.

These factors drive the potential impact of these gases down to vanishingly small values. Based on the information presented we conclude that the GWP value of 25 (and rising) for CH<sub>4</sub>, and between 265 and 310 for N<sub>2</sub>O, is incorrect. Such an error, if followed through to financial commitment according to the United Nations Framework Convention on Climate Change (UNFCCC) and the 2015 Paris Agreement will have very serious negative effects on the New Zealand economy, not to mention all other countries. All of this would be promulgated with an indiscernible effect on temperature or climate. Thus, the generally accepted GHG effects of CH<sub>4</sub> and N<sub>2</sub>O, almost 50% of the total New Zealand emissions, must be seriously questioned, and to a lesser extent the quantitative role of CO<sub>2</sub>. Water vapour is the dominant GHG.

We assert therefore that the GWP values of both CH<sub>4</sub> and N<sub>2</sub>O are vastly overstated by the IPCC, and therefore by member governments of the UNFCCC. Consequently, it is suggested that these gases be removed from New Zealand's Greenhouse Gas Inventory, and that the supporting case for such treatment be prepared for negotiation with our international partners.

Further, there is a much bigger prize at stake. CO<sub>2</sub> has such a small part to play in global warming/climate change, with no more than 20% of the total greenhouse (heating of the earth) effect and probably a lot less than that, and the effects of CH<sub>4</sub> and N<sub>2</sub>O are trivial. This means that there is

an urgent need to stop all this expensive concentration on 'climate change' and be rid of the naivety of assuming that human beings can control and/or stabilise the climate.

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- Further reading**
- For those who wish to read further on the topic of global warming we recommend a small (and free) book available on Google, *Why Scientists Disagree About Global Warming: The NIPCC Report on the Consensus* (2<sup>nd</sup> Edn).
- Dr Jock Allison, ONZM, FNZIPIM is a partly retired sheep breeder, scientist and consultant, who was previously Director of Agricultural Research for the Southern South Island for the Ministry of Agriculture and Forestry (MAF). Email: jock.allison85@gmail.com.*
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JOHN-PAUL PRAAT

# WHERE MIGHT FOREST CARBON FIT GIVEN THE FUTURE OF THE ETS, CARBON MARKETS AND TRADING – WHOSE GOT A CRYSTAL BALL?

At prices north of \$20/NZU, and if agriculture comes into the ETS, it may be worthwhile for livestock farmers to investigate forestry options to minimise their costs or in fact to diversify into new products.



Logs and carbon could be new farm products





*Trees provide shelter and shade for livestock*

### The big picture

Interest in forest carbon has renewed in line with a rise in the price of carbon and a cacophony of calls for more tree planting. As was the case in 2009 when the emissions trading scheme (ETS) was established as part of the Climate Change Response Act 2002, a reasonable price for carbon could finance a change in land use from pasture to forestry. This could be especially valuable to landowners where the long-term returns are better from forestry as compared with grazing. The link or drive for more tree planting is partly related to offsetting New Zealand greenhouse gas (GHG) emissions, which have risen by 20% (gross) since 1990 (agriculture by 12%) in the face of international agreements to reduce emissions.

How does that work? It works in two ways. First, at a national level New Zealand accounts for emissions and removals of GHGs using an inventory, which includes forestry, a net sink and energy, industry, waste and pastoral agriculture, all of which are net emitters. So what happens annually and over time in these sectors impacts on the balance. For example, conversions of forest to pasture and increases in energy use will increase New Zealand emissions, while the reverse is also true. The national inventory takes your land use decisions, productivity, energy use and waste production into account whether you like it or not. The 'what happens' is driven mostly by economics, which is why the ETS was introduced and is the second aspect.

### The ETS

The ETS is a government market-based approach to controlling pollution by establishing a price on pollutants, in this case GHGs. In economic speak the pollutants

(GHGs) are described as an externality which is a cost or benefit that affects a party who did not choose to incur that cost or benefit. Air pollution from motor vehicles is an example of a negative externality (cost). The costs of the air pollution for the rest of society are not compensated for by either the producers or users of motorised transport.

Emissions trading provides economic incentives for achieving reductions in emissions of pollutants and to influence what happens. Under the ETS, GHG emitters such as the energy, industry and waste sectors are required to purchase carbon credits to offset the liabilities associated with their emissions. While there has been a honeymoon period, carbon credit requirements for these sectors are ramping up from 50% in December 2016 to 100% by January 2019. That has increased demand for carbon credits in New Zealand, hence the recent increase in price. If agriculture is brought into the scheme demand will further increase.

### Forestry and carbon accumulation

Activities such as forestry generate carbon credits, which can be entered into the ETS and used to offset emissions or traded for cash. This is possible because trees use the sun's energy to convert carbon dioxide (CO<sub>2</sub>) into organic compounds using photosynthesis and store carbon for between 70 and 500 years. While pasture also uses this process, carbon is cycled a lot quicker (days rather than years).

Carbon, along with hydrogen and oxygen, is stored in the stem wood of a tree. At harvest, when a log is removed approximately one tonne of CO<sub>2</sub> equivalents (CO<sub>2</sub>-e) is also removed in a cubic metre of stem wood. This equates to

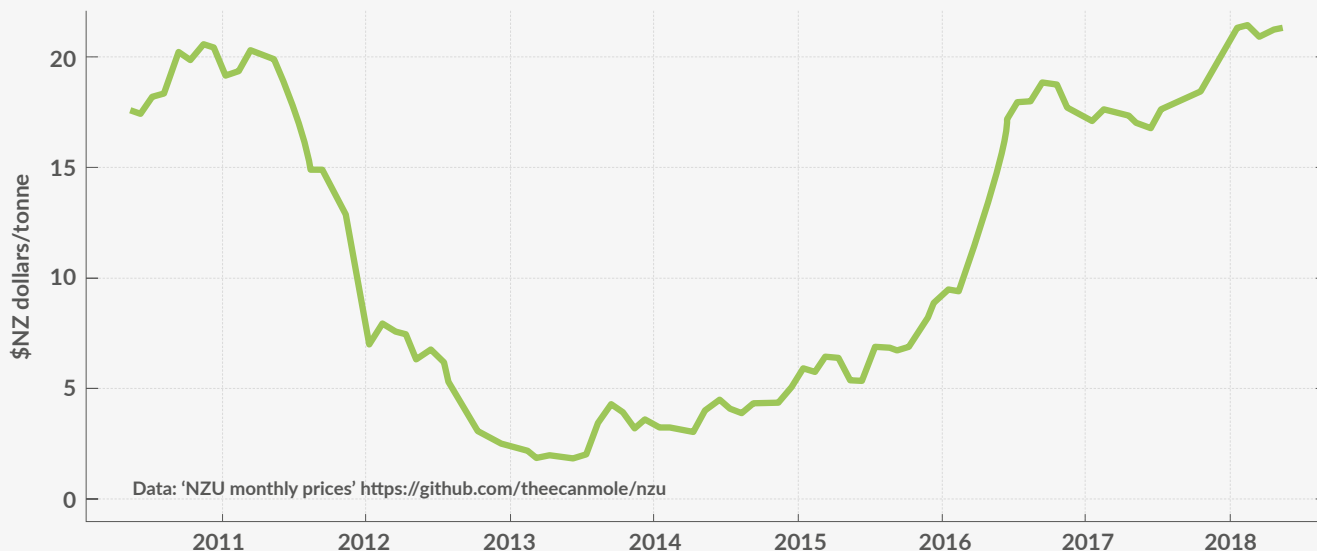


Figure 1: Variation in NZU prices – 2010-2018

**It is highly probable that the government will recommend agriculture be brought into the ETS, initially at 5%, but with this proportion to increase over time.**

a 'New Zealand Unit' or NZU. The quantity of carbon or NZUs stored by a forest is a function of growth rate. Annual growth rates have been standardised for the purposes of the ETS in 'look-up tables' produced by the Ministry for Primary Industries (MPI). The tables cover radiata pine, exotic hardwoods (eucalyptus species) and softwoods (cypresses and redwoods), Douglas Fir and natives. For example, the tables show that by 25 years, radiata pine in Gisborne would have accumulated 722 NZU/ha, whereas eucalyptus, redwoods, Douglas fir and natives would have accumulated 618, 330, 409 and 215 NZU/ha, respectively.

Forest and landowners can decide to measure their ETS forests using the Forest Measurement Approach (FMA) to develop their own look-up tables. This is mandatory for areas larger than 100 ha and must be done every five years. It will cost about \$20,000 for an area of 600 ha. Specialised advice should be sought about these decisions. The MPI Climate Change helpline is a good place to start at 0800 254 628.

**Carbon pricing**

NZUs are traded on a New Zealand market, which is highly linked to international carbon markets. The price is volatile (see Figure 1) and subject to New Zealand and international regulations, which is the main risk of this market as governments change unpredictably. A further risk is that of financial depression like the recent global financial crisis (GFC), which took the focus away from longer-term investment. These aspects limit the attraction for landowners to engage in the carbon market.

The NZU traded as low as \$2 in 2013 when the government allowed emitters to use dubious Kyoto carbon credits to offset emissions liabilities and so

there was no interest in carbon in New Zealand. Once this allowance was removed interest increased, which is reflected in the current NZU price of around \$22/ NZU (www.comtrade.co.nz/). Since then, under the Paris Agreement New Zealand has agreed to target GHG emissions 5% below our 1990 level by 2020, a further agreed target of 11% below 1990 levels by 2030, and 50% below 1990 levels by 2050.

At present we are on track to meet the 2020 target courtesy of the trees planted on pastoral land in the 1990s, known as post-1989 forestry, which are regarded as an offset to GHG emissions acting as a carbon sink. While this serendipity has been our get out jail card until now, meeting future targets will be more difficult as that will require real reductions in emissions, not just offsets to emissions. The government is focusing on tree planting on pastoral land as that is the most cost-effective carbon management tool available at around \$20 to \$30/NZU or tonne of CO<sub>2</sub>-e. Potentially this price can significantly improve the return on a forestry investment for landowners as it provides cash to overcome the traditional upfront investment road block. Prices above \$30/NZU are likely to encourage outside investors to become land and forestry owners, competing with sheep, beef and dairy support operators.

The current price of carbon or NZU will not change consumer behaviour, which is the goal of the ETS. A price of \$25/NZU translates to around 6 cents/litre of fuel or 0.5 cents/kilowatt hour (kWhr), which equates to daily levels of fluctuations in New Zealand, so is not game changing. The Productivity Commission's draft report on transitioning to a low-emissions economy predicts that a carbon cost of \$250 a tonne, 10 times today's price, may be required to reach carbon neutrality by 2050.



*Radiata planted on Manawatu river terrace – 23 years old*

Back in 2007 the Intergovernmental Panel on Climate Change (IPCC) indicated that a price of \$125/tonne CO<sub>2</sub>-e was required to begin to reduce GHGs. This equates to around 30 cents/litre of fuel. So how high could the cost of carbon go? One benchmark may be carbon capture technology. While trees do this naturally, we cannot keep planting new areas indefinitely. Technology to reduce CO<sub>2</sub> concentrations in the atmosphere has been put at around \$250/tonne CO<sub>2</sub>-e, so maybe that is the upper limit to the price.

### **Agriculture in the ETS**

In April this year the government set up an interim committee (prior to setting up a permanent Climate Change Commission due mid-2019), to investigate how best to incorporate agriculture into the ETS. It is highly probable that the government will recommend agriculture be brought into the ETS, initially at 5%, but with this proportion to increase over time. You could argue this is unfair, but it will be unavoidable albeit the extent of liability will be low initially given the arguments about fairness.

How might this play out? For an average sheep and beef farm of 5,000 stock units, annual emissions are calculated to be around 1,875 tonnes. Initial liability may be set at 10%. Actual liability will depend on carcass sales as processors will be asked to pay the cost of emissions and will pass this on to suppliers. So back to our 'average' farm, 10% amounts to 188 NZUs, which the meat processor will

pay or purchase NZUs on behalf of the farmer:

- At \$25/NZU this will amount to a levy of about \$9/head of cattle and \$1/head of sheep at slaughter or 4 cents/kg of carcass weight
- A 689 cow dairy farm will produce similar overall emissions and the cost will amount to about 1.5 cents/kg milk solids and around \$7/cow culled.

At this rate, as for fuels, there will be no change in behaviour on the farm, nor any incentive to change unless on-farm practices are taken into account by the processor.

Changes in the carbon price will have a direct impact on the final costs of any scheme. Given the market price for carbon will vary continuously like other commodities, it may be worth livestock farmers considering an investment in a post-1989 forest to provide credits at the farm. Access to these credits reduces exposure to future increases in carbon price, significantly reducing business risk.

### **Income diversity**

For current forest owners, the ETS offers another product to sell in addition to timber. Timber value should always be the first consideration of planting and management, while carbon should be a second consideration given the regulatory risks alluded to earlier. Wood fibre has a strong future in our economy – take the emergence of bio-plastics and laminated lumber construction as examples. Over the past couple





Pruning trees increases market value

## For current forest owners, the ETS offers another product to sell in addition to timber.

of years some forest farmers have cashed in NZUs to cover the recent shortfall in the dairy payout and to buy additional land. Effectively, they have used the carbon account as a bank. There are risks associated with that because NZUs will have to be repaid at harvest, but if you have mixed-age forestry you can manage that or alternatively hedge against harvest risk as you can forward buy NZUs.

At the current price for an NZU the income from a 20-year-old radiata pine plantation is good at around \$600/ha/year, but what if an NZU is \$50 when you look to harvest in eight years' time? Well you are unlikely to be worried about that as you are now getting \$1,400/ha/year and there is no harvest to manage, no risk of soil/waterway damage, biodiversity is likely improving, and you can still harvest in another eight years if that is economic. The relative returns from timber and carbon will dictate the economics of harvest. You could become a carbon farmer, harvesting carbon rather than timber, if the price of carbon is high and the price of timber has not kept pace with that.

The MPI tables for carbon accumulation go up to 50 years, by which time forest management will not be your problem. While storm events and fires are a risk, by the

time another 30 years have elapsed the ETS should have done its job, our economy should be bio-based (including wood fibre) and not carbon-based, and the price of carbon may have receded again. At that stage, the accumulated carbon will likely have to be maintained and the forest will naturally revert to native in the long term anyway.

### Riparian planting

It has been suggested carbon income could offset the cost of riparian planting of natives. While it is true in theory as there is an ETS mechanism for counting the carbon from natives, it is not practical due the cost of registration into the ETS (\$500 to \$1,000), the annual reporting or claim fee (\$90), and the low initial rate of growth (about one-quarter that of radiata pine). Also riparian margins need to be over 30 m wide and more than 1 ha to be registered in the ETS.

Not many pastoral farmers would be willing to retire a 30 m width along a waterway and if they did they would need to plant around 1 km of waterway to get 3 ha of eligible planting. The cost of the project might be \$60,000 (\$20,000/ha for fencing, planting and weed control). However, the net carbon return on that in the first 10 years at \$20/NZU would be around \$1,000 once ETS costs have been paid.

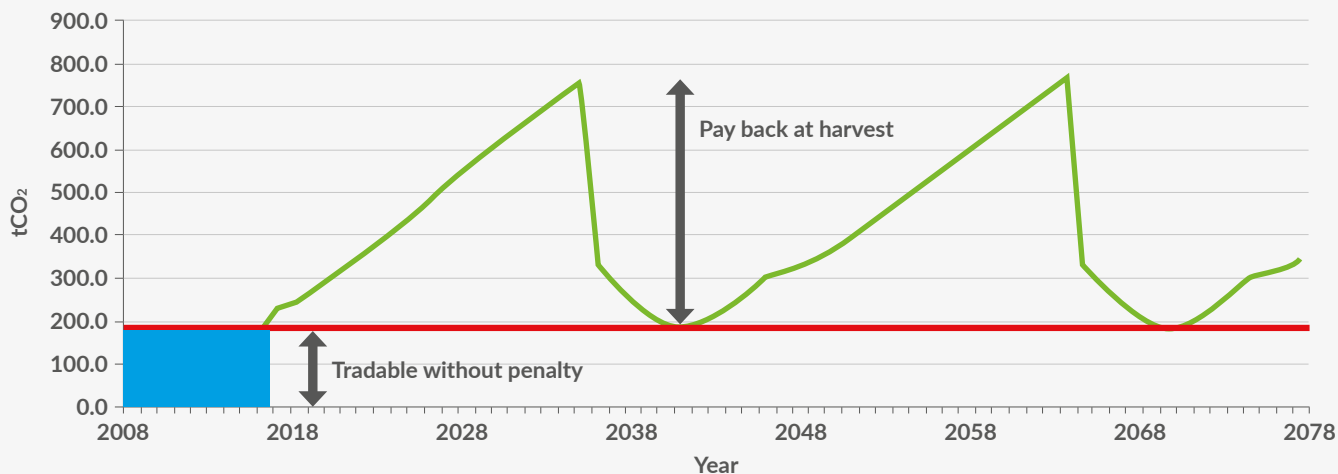


Figure 2: Carbon forest management. Tradeable without penalty equates to 'safe to trade' from [www.carbonfarming.org.nz/wp-content/uploads/InfoSheet\\_12\\_10-06-09web.pdf](http://www.carbonfarming.org.nz/wp-content/uploads/InfoSheet_12_10-06-09web.pdf)

## The ETS provides an economic mechanism to manage the risk of increased GHG emissions charges. New Zealand businesses have some experience now in how it works and can plan strategies to mitigate risk in this space.

### Risk management

An average radiata forest absorbs approximately 800 tonnes CO<sub>2</sub>/ha over a 30-year rotation, which is equivalent to approximately 2.5 tonnes/tree. Under the current rules of the ETS, timber removed at harvest creates a carbon deficit and must be 'paid back'. This is demonstrated in [Figure 2](#). The black line represents accumulated carbon within an even-aged stand. After the first harvest not all of the carbon volume is removed: stumps, branches and roots remain on-site, slowly break down, and are replaced by the new growing forest. This is why the black line does not drop back to zero at harvest.

In the example shown, the first crop retains around 185 tonnes of CO<sub>2</sub>-e/ha (tCO<sub>2</sub>). Under this regime, 185 tonnes/ha would be tradable without the requirement to pay credits back at the point of harvest. This may also be termed 'safe to trade' as stored carbon is a one-off, and once this is claimed and sold it cannot be sold again, but will not have to be repaid while the land remains under forest.

While planting new pine forest on pasture can offset the cost of emission charges and protect against high charge rates, it is most likely a stop-gap solution. For our livestock farmer example who wanted to be carbon neutral by selling only the safe to trade portion of carbon in their forest, they would need to plant a new 258 ha of radiata forest every 30 years to offset their 1,550 tonnes annual emissions.

However, if the pine forest was not harvested then 58 ha would be required to be carbon neutral, although if long-term forests are planned radiata pine is not the most suitable species. Landowners could increase the quantity of safe to trade carbon per hectare by developing a mixed-age forest where forests are planted and harvested on

an annual ongoing basis. In this case up to 400 tonnes of carbon (NZU)/ha would be safe to trade, but only in the first rotation. That would suit the gradual increase in liability for the agricultural sector.

### Summary

The ETS provides an economic mechanism to manage the risk of increased GHG emissions charges. New Zealand businesses have some experience now in how it works and can plan strategies to mitigate risk in this space. However, a strong and consistent market for carbon will be needed to change planting decisions that favour carbon accumulation such as moving to longer rotation species like redwoods, cypresses and natives instead of radiata pine. Perhaps where carbon accumulation is the primary focus it will skew traditional pine management to high planting density without pruning or thinning.

At prices north of \$20/NZU, and if agriculture comes into the ETS, it may be worthwhile for livestock farmers with suitable land to establish new forest blocks on existing pastoral land as an alternative income and a hedge against high carbon prices. At prices above \$30/NZU and evidence of a stable market the options for being a carbon farmer could well worth considering, especially when you factor in other external benefits such as reducing nitrogen, phosphate and soil losses, increasing biodiversity, and improving landscape aesthetics. At this stage, it is suggested that carbon is still a speculative part of forest investment, not the main focus, as the regulatory risk is always there.

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# CHALLENGES TO THE GLOBAL TRADING SYSTEM – IMPLICATIONS FOR NEW ZEALAND

The title of Bob Dylan's 1967 hit tune seems as prophetic today as it was 50 years ago. Dylan was drawing attention to the sources of domestic unrest in the US such as poverty, racism and anti-Vietnam war protests. However, his lyrics that warned Congressmen there was 'a battle outside, it is ragin and will rattle your walls' could equally be applied to many aspects of today's turbulent geo-political and geo-economic world.

## Disruptive forces identified

In its recent 2018 Strategic Defence Policy Statement, the government identified a number of 'compounding challenges' to the international rules-based order on which New Zealand's security and economic well-being have been so heavily dependent. The Statement highlighted threats to open societies and liberal values, to long-established multilateral institutions, and the undeniable downside impacts of climate change. These 'disruptive forces' are at play in New Zealand's near neighbourhood, the Asia-Pacific, as well as further afield as far as western Europe. They create an uncertain environment, regionally and globally, for the country's trade and export community.

## Global factors

If we are tempted to think that things could only get better from this point, best 'buckle up'. The reality is that the world as we had come to know it has changed and is in the process of changing further, in fundamental ways and forever. Since taking office the Trump administration has been faithful to the campaign rhetoric that it would not be bound by established rules and ways of doing things, or accept uncritically the institutional architecture that has buttressed the post-war economic order.

The new President's first executive action was to pull the US from the Trans-Pacific Partnership (TPP). Renegotiation of the North American Free Trade Agreement (NAFTA) agreement is underway. Talk of a trade deal with Europe is on hold. US opposition to appointments to the World Trade Organization (WTO) appellate body – its Court of Appeal – is preventing the WTO from carrying out one of its core functions, the conduct of a number of trade dispute cases, some initiated by the US itself. The imposition by the US of punitive tariffs against several major trade partners (China in particular), and the retaliatory reaction, has raised the spectre of an all-out global 'trade war' that prompts worrisome memories for some of similar

disastrous actions in the 1930s.

If President Trump was to leave the White House after a single four-year term that would not promise a return to the seemingly untroubled and predictable state of world affairs before 2016. Not all of the blame for the current turmoil can be placed at Washington's door. That would be an over-simplification. For one thing, the world is still feeling the lingering effects of the global financial crisis a decade ago and the structural economic devastation it unleashed.

Moreover, consider the question: Whither the European Union? The political contortions around Brexit provide abundant material for daily headlines, and by 2020 Britain may have left the EU; perhaps triumphant, possibly traumatised. There are other threats as well to the 'European Dream'; they reflect a surge of nationalist fervour that appears to defy what many of us believed was the march of history.

The Brexit decision and Donald Trump's campaign success were not isolated events. They were manifestations of deeper currents flowing in many societies and New Zealand is not immune to them. They include scepticism about the benefits advanced in favour of globalisation and open markets. There is no doubt that economic reform at the global, regional and national levels has lifted millions out of poverty. But the process has been uneven and papered over a lot of scars. Not all sectors of society have enjoyed the benefits. Many feel disenfranchised and left behind. In New Zealand's case the government's new 'trade for all' agenda launched in August 2018 has promised a more inclusive and transparent approach to trade issues.

To this volatile mix can be added a sluggish world economy and rampant protectionist behaviour shown in layer upon layer of trade-distorting non-tariff measures. The ambitions of a rising China also create some tensions, already the world's second largest economy and determined to assert its regional and global interests. Japan and Russia



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**The imposition by the US of punitive tariffs against several major trade partners (China in particular), and the retaliatory reaction, has raised the spectre of an all-out global ‘trade war’ that prompts worrisome memories for some of similar disastrous actions in the 1930s.**

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could be described as ‘resurgent nations’, looking to reclaim former status and recognition as global heavyweights. A further group of middle powers are also making their presence felt beyond their shores, namely, countries such as Argentina, Brazil, Indonesia, Mexico, Nigeria, the Scandinavian states, South Africa and South Korea.

**New Zealand’s portfolio of options**

Where does all this leave New Zealand, the only country in the OECD to fit the description, ‘Small, developed and distant’? Or to borrow Kipling’s description after his visit here, ‘Last, loneliest and loveliest.’ The temptation to use apocalyptic language must be resisted. The planet and the global economy are not at breaking point. But given that change of epic proportions may already be in motion, it would not be acceptable for the country’s political leaders, the policy community and export businesses to passively say, ‘Let’s just go along for the ride and see what turns up.’ Stressful times call not for national or regional hand-wringing, but calm analysis and a measured response. Careful consideration, that is, of what could be called a portfolio of options.

New Zealand is no stranger to that type of exercise in gritty defence of vital national interests. We undertook such a campaign in the 1960s and 1970s after it became clear that Britain saw, at least at that time, its long-term future being within Europe’s embrace. Skilful negotiation produced for this country in 1994 a result from the

Uruguay Round better than any other developed economy achieved. We were ahead of most others in anticipating China’s return to centre stage and all that could mean for the global economy, and for Beijing’s bilateral trading partners if they moved smartly to position themselves. As New Zealand did in 2008 in the first free trade agreement China signed with any developed economy.

What strengths does this country have going for it? For two decades the economy has consistently been in good if not great heart. Even if productivity per capita has not leapt ahead, very few other countries could claim a growth record of that duration. We enjoy a temperate climate, a long if twisted coastline, a significant resource of renewable energy, and a vast extended economic zone that could comfortably house continental Europe or the Indian sub-continent.

In scope and rigour the public sector regulatory regimes and instruments of border control have few peers elsewhere. New Zealand has built a reputation for independent thought and deed and a willingness to do more than its share of meeting global and regional commitments. The export community is known abroad for its readiness to play by the agreed rules, for keeping its word, and for being tough but fair negotiators driven by a steely resolve to succeed.

I found it intensely interesting to be in Lima, Peru in November 2016 for the meeting of Asia-Pacific Economic Cooperation (APEC) leaders. It was held in the aftermath of the Brexit decision and barely a week following the upset in the US presidential election. Those participants whose countries were in especially close ties with the US, such as Australia, Canada, Japan and Mexico, felt their known world had rocked on its axis. Some others like China could see only opportunities coming their way in what appeared to be an emerging power vacuum. New Zealand was among a third group that included Association of South East Asian Nations (ASEAN) members like Malaysia and Singapore, and others such as Chile and Peru.

Those last economies, while also surprised by the dramatic political shifts in London and Washington, took the stance that even if 'times were a-changin', the rest of the world couldn't simply wait on the sidelines while new power managers made up their minds where their priorities lay. New Zealand and others argued in Lima that there was no point in sitting idly by and hoping that, when rhetoric eventually came up against reality, all the unwanted disruption would collapse and go away. It was heady stuff to observe a New Zealand Prime Minister being interviewed and quoted in support of that positive thinking, on the same day, by the BBC and CNN, the *New York Times* and the *Wall Street Journal*.

In facing up to this unfamiliar and uncertain setting there has been little to distinguish in any substantive way between the policy responses of the Key/English administrations and in 2018 that of the Ardern government. The political leadership focus has continued to be on developing and pursuing for New Zealand a trade strategy that is agile, alert, practical and pragmatic. There has been no stepping back from the past three decades of commitment to the view that it is in New Zealand's best interests long term to be a party to liberalised trade deals.

That approach was fully on display in the speed and vigour with which New Zealand joined countries like Australia, Chile and Japan in seeking an alternative to the TPP that the remaining 11 members were comfortable with after the US withdrew. The successful outcome was the Comprehensive and Progressive Trans-Pacific Partnership (CPTPP), which retained almost all the high-quality trade and investment liberalisation elements that were a feature of the TPP. The CPTPP is expected to become effective later this year after it has been ratified by at least six of the 11 members. It will give New Zealand a trade agreement with four new partners – Canada, Japan, Mexico and Peru.

#### **Trade policy approach and regional links**

Three core components can be identified in New Zealand's trade policy approach. The first is to give staunch backing to the role and activities of the WTO as a bulwark of the multilateral rules-based system. That is not to maintain the WTO is a perfect instrument for managing world trade. It was not, for instance, able to bring the Doha Round to fruition. It has also struggled to address government-inspired market distortions and ongoing subsidy regimes.

There is certainly scope for WTO reform, but in today's world no other entity can match its contribution to a stable trading order. From New Zealand's standpoint, the WTO is invaluable as the custodian of enforceable rules on agricultural trade, which did not exist before the Uruguay Round. New Zealand has never lost in its appeals to the WTO Appellate body, including against some much larger economies, and not least the successful campaign in the late 1990s to compel the US to lift tariffs the Clinton administration had imposed on lamb imports.

At the regional level New Zealand has been a long-time member of organisations that undertake activities 'for the common good'. The most prominent of these is APEC, formed in 1989. Unlike the WTO, APEC is not a decision-making body or a negotiating forum. It proceeds by consensus and recommendations are non-binding. Nevertheless, APEC is generally considered to be the premier agency for promoting regional growth and integration. Its 21 member economies account for 40% of the world's population and 60% of global production.

APEC countries have promoted the concept of a free trade area for the entire Asia-Pacific (FTAAP). Seven of New Zealand's top 10 markets are APEC members. APEC will be 30 in 2019 and attention is focused on its future purpose, objectives and priorities, of which FTAAP will be near the top. The Pacific Economic Cooperation Council (PECC) has been asked for input to that exercise and its contribution is being jointly led by the PECC Committees of Malaysia and New Zealand. APEC's Business Advisory Council is engaged in a similar project.

#### **Buffering our isolation – building more ties**

New Zealand learned a sobering lesson in the early 1970s when the country began to forge a new direction for itself. An immutable fact of life for small powers is that acting purely on their own they can rarely achieve a great deal. The message for New Zealand was clear: find common cause with others of limited means, but with broadly similar ambitions, and work in harmony with them. The aim being to become an embedded part of the emerging regional economic architecture. Hence, the second core component of the trade strategy is to cultivate close links with small and medium-sized countries with shared interests, especially in Asia and South America.

A worthy effort in the early 2000s was the creation of the 'P4' economic grouping alongside Brunei, Chile and Singapore. That ground-breaking initiative attracted wide interest and the group grew progressively to evolve into the 12 member TPP. In 2009, a trade deal came into effect that Australia and New Zealand had jointly concluded with the 10 members of ASEAN. New Zealand has individual bilateral trade agreements with Singapore, Malaysia, South Korea and Thailand, and liberalised trade arrangements with Hong Kong and Taiwan.

More recently, there has been a strong emphasis on building ties with Latin America, and notably with the four-member Pacific Alliance of Colombia, Chile, Mexico and Peru. New Zealand has a formal strategic





economic partnership with the Alliance and the intent is to achieve membership of the group. Negotiations to that end have begun. To become a full member of the Alliance would add credibility to New Zealand's aspirations to be seen and accepted as a country with genuine trans-Pacific credentials.

With the CPTPP on the cusp of being put in place, the remaining 'mega-regional' trade deal still under negotiation, since 2013, is the Regional Comprehensive Economic Partnership (RCEP). The 16 countries involved are those in ASEAN plus Australia, China, India, Japan, South Korea and New Zealand. Collectively, these potential partners take two-thirds of New Zealand's goods and services exports. For comparison the CPTPP cluster, without the US, take around 30%. An important aspect of both the CPTPP and RCEP is the provision for future accession by other countries, provided they accept the terms and conditions of the original agreement.

This 'open plurilateralism' would allow for the US to return to the CPTPP if there was a change of attitude in Washington by the present or a subsequent administration. Meantime, to offset any impression that all is doom and gloom on the US front, it is worth noting that since August 2018 New Zealand businesses have obtained easier visa access to that market and talks have resumed with Washington on a Trade and Investment Framework Agreement (TIFA).

#### **Post-Brexit implications for New Zealand**

Beyond the Asia-Pacific, New Zealand's primary focus is upon the consequences for the trading relationship with Europe likely to emerge after Britain's scheduled withdrawal in 2019, post-Brexit, from the EU. To a generation of New Zealand exporters and trade negotiators who spent many character-building years helping to mitigate the worst impacts of Britain's entry to the Common Market in the 1970s, it must seem barely conceivable that country is now contemplating turning its back on Europe, which is what Brexit appears to imply.

The Brexit decision does not present an insuperable dilemma for New Zealand but another 'call to arms'. There has been a marked acceleration in contacts with officialdom in Brussels and London since the Brexit vote in June 2016. In the first half of 2018 four senior EU Commissioners have visited New Zealand. A first round of negotiations towards a New Zealand-EU free trade agreement was held in Brussels in July 2018. British ministers have been in New Zealand.

In the UK public consultations have been launched for opening bilateral trade negotiations for an agreement with New Zealand as soon as the UK is in a position to do so. Each of the three parties involved in these dual sets of negotiations has its own suite of incentives for approaching them in a positive manner. But no-one should anticipate other than tough bargaining when details have to be worked through, such as devising a new formula for dealing with New Zealand's current EU-wide quota access arrangements for meat and dairy products.

#### **Reinforcing our independence**

There are at least two ways of depicting how New Zealand should respond to its current trade challenges. One is to portray the country as facing the plight of Coleridge's *Ancient Mariner*, 'Alone, all all alone, adrift in a wide, wide sea.' The one I prefer is drawn from Patricia Grace's mihi in *Tangata Whenua* (2014), 'May this fine waka (meaning the book) launch heartily. May it sail in ever-widening circles to find its place.' That strikes me as an apt metaphor for New Zealand's approach; sailing in widening circles to establish and deepen important regional and global economic connections to safeguard and reinforce its independent place in the world.

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JULIAN RAINE

# ON THE ROAD TO DIVERSIFICATION AND VALUE ADD – NELSON DAIRY OPERATION

This article looks at how a long-standing Nelson farming family that owns Raine Farms Ltd has diversified and added value by developing two new brands – Oaklands Milk and Aunt Jean’s Dairy – with products now marketed in the South Island, Auckland and Wellington.



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Oaklands milk trucks delivering milk in the Nelson region to cafes and restaurants seven days a week





Cathy and Tom Raine (mother and son) sampling milk to customers at the Auckland Food Show this year



Aunt Jean's milk ready for sale at Food Shows

### Nelson farming history

My family has had a long history in farming, with our original Oaklands property purchased in 1844. The early settlers who arrived in Nelson were certainly pioneers and a diverse bunch. John Waring Saxton, my great, great grandfather, was not a farmer but a well-educated man who could speak and write four languages, play a number of musical instruments and paint exceptional landscape scenes. His painting skills were used by the New Zealand Company to assist with the promotion of this country to potential emigrants. It also supplemented his income, as surviving early New Zealand was by no means easy. With no services, little money, few resources and harsh conditions it took a great deal of hard work to establish the farm we see today. The family name changed with my grandfather (Raine) marrying my grandmother (Saxton).

The farm once very rural is now part of Nelson city and occupies nearly 1.5% of the city's area. With neighbours on three sides the constant gaze on the farming activities are 24/7. Saxton Field, a major sporting and recreation complex, was part of the farm until the Depression in the 1930s. The land was partly sold to satisfy death duties and also to establish the Nelson Freezing Company in 1918.

Sheep farming was the main income earner during the 1800s. Dairying has been part of the farm's diverse scene since the 1920s and the farm's records show it also grew hops, apples and cereals. So over the years the farm has adapted to changing times and market forces. Horses gave way to tractors and 4x4s are now the main form of transport.

Today the farm is the home of Oaklands Milk and Aunt Jean's Dairy - two start-up brands that have been born out of necessity. Perhaps rekindling the pioneering spirit of my forebears, the family took on the challenge of moving the direction of the business in the face of changing times. We resolved to steer a new course for it and to re-connect

with our community commercially. Nelson is definitely not known as a dairying area, and much of the farm is suited to sheep and cattle rather than milking cows, but this was seen as just another challenge to overcome. The current milking platform occupies just 90 ha of our 450 ha, with the balance in dairy support, beef production, conservation plantings and commercial forestry.

### Oaklands Milk

I was the last chairman of Nelson Milk and that business was sold to Kiwi Dairies in 1998. Nelson Milk was the local supplier of white and flavoured milk to the Nelson region. The company had been established in the 1940s by my grandfather Dick Raine. The formation of Nelson Milk had brought together a number of small local milk treatment stations to establish one integrated unit into a farmer-owned co-operative. As part of the sale process to Kiwi Dairies winter milking contracts were established for those suppliers who wished to remain supplying 365 days of the year.

Within two years of the sale, the three-way amalgamation of the NZ Dairy Group, NZ Dairy Board and Kiwi Dairies to form Fonterra occurred. The winter contracts were transferred and life continued on until Fonterra gave notice in 2012 that it would not be renewing the winter contract to those left in the Nelson region. The winter contract (and premium associated with it) was a significant part of making dairying profitable for my family.

Milking 220 cows all year round was marginal, but without all of the income it was terminal. As a family we asked ourselves how do we adapt to the changing circumstances? I had seen milk vending machines in Europe, especially in Italy and France, and wondered if they could work in Nelson. Over the next 12 months the issues were researched, consents were gained, money was spent and Oaklands Milk was born.

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The first two vending machine outlets started in May 2013. A new rotary milking shed was built, complete with a public viewing window and processing facilities. Two more vending machines soon followed that were placed at a cafe and another at a fruit and vegetable shop. The local community loved the concept and we were being supported and encouraged to do more. The journey had started.

More machines were then added, all in fruit and vegetable shops. Shortly after opening the first vending machines cafes started to come out to Oaklands Milk to fill up bottles. Within weeks we started a cafe and restaurant delivery service that today delivers to over 80 of these establishments in the Nelson region. Home delivery started about two-and-a-half years ago, and we now also supply Bidfood, which provides wider distribution around the Top of the South region.

Hand-in-hand with the birth of Oaklands Milk, the humble glass bottle was reintroduced into the system. Today it is one of the main reasons why people support the company. I believe that in the last 12 months we have prevented over 500,000 plastic bottles being used and thrown away, which has to be good for the environment.

### Aunt Jean's Dairy

About two years ago a second brand was added to complement the original Oaklands Milk brand. Many people had experienced their milk while on holiday in the Nelson area and asked how they could get the same milk in their home town or city. The milk had reminded them of how milk use to taste and the experience felt real from a bygone era. Again the family was challenged and came up with the concept of Aunt Jean's Dairy ([www.auntjeans.co.nz](http://www.auntjeans.co.nz)). This brand is being rolled out to supermarkets in Christchurch, Wellington and Auckland. The main difference is that it is more expensive because of freight and additional margin, and the glass bottles are recycled rather than washed, sterilised and re-used.

The two brands do things slightly differently Oaklands does vending, home delivery, cafes and restaurants and all bottles come back to the factory and are washed, sterilised and refilled. Aunt Jean's is for supermarket demand and the bottles are one way to the recycle bin.

### Changed farming practices

Farming practices have also changed since both brands have been launched. With constant feedback from customers this has challenged and shaped what we do on the land. I take all the customer calls through our 0800 number. Some things have worked and other things have not. For instance, the feeding of palm kernel extract (PKE) was quickly stopped. Also, all calves are now reared and either sold to lifestyle block owners or grown on as

dairy beef. We are fortunate that we have the land area to do this and we have integrated this feature into our farming practice.

There are many groups that come onto the farm. We host a wide variety from kindergartens to aged care, students to special interest groups to international delegations, so there is a real mixture and all are welcomed with enthusiasm. I enjoy the experience and a chance to interact with urban dwellers and fellow farmers from all over New Zealand and other parts of the globe. Along with my staff I have observed how disconnected the general public has become from farming in general. There are a lot of questions and a thirst for information as to what really happens behind the farm gate.

The milk from both farms is processed at the Stoke property and the facility has expanded each year as demand continues to grow. The milk is pasteurised but non-homogenised. All cows only have the double A2 gene and this breeding process took some time. Initially all cows were tested to determine if they were A2 or not and all A2 cows were put in a single herd. Any calves born that were not A2 were sold. A small number of A2 cows were purchased to speed up the process and the last of the A1 herd was sold last autumn. The road to find the right solution has been a long one and the family's tenacity to make it work has produced a very good result.

### Lessons learned

One of the biggest lessons we have learned is that you don't know what you don't know. There was no-one who could guide us about what to do and the new ventures evolved as they were being developed. We were not raw milk producers or trying to be a 'cottage' producer, so the rules apply to us as if we were a major dairy manufacturer like Fonterra. We are audited four times a year and need to be audit ready every day, which is a significant cost and overhead. A food technologist helped us initially and wrote our manuals. Once the rules were understood and were practised regularly it became second nature and it is now automatic for everyone involved.

On the farm changing practices was probably just as difficult. Bad habits had to be broken and new thinking adopted. All staff now need to think like food handlers. Strict hygiene standards and systems to record what is done have also become second nature. In some respects it is like adopting the new Health & Safety law – it has to be seen as instinctive and there for a purpose, not a compliance issue that is a barrier to operations. Once you get over the change in thinking it definitely becomes easier.



Oaklands and Aunt Jean's milk factory

**We have lost the economy of scale that supplying a company like Fonterra gave us. The cool wind of reality in dealing with thousands of consuming customers and the tough trading conditions of small to medium-sized businesses prevails.**

We have also found it very difficult to manage supply and demand. To do this we try and estimate demand 12 months out and respond with calving the right number of cows but still have a surplus. Currently, the surplus from our second farm goes to Fonterra and probably always will as it's impossible to get it exactly right.

**Cost to date, investment and succession**

The financial cost is significant, but for me I ask myself – what is the cost of doing nothing? If you are not prepared to invest in the future you will be going backwards and there is no future for the family and for succession. The family to date has had a successful succession plan, but more by accident than design. I am in the early stages of handing over the business to the next generation as my son Tom has stepped up and is running the value add part of the business. He is responsible from vat to consumer. It has been a steep learning curve for everyone in the family, but they are all relishing the challenges it brings and new skills and knowledge have been gained.

It has been fortunate for our family that there have had assets to draw on to make the changes as it has been in the millions of dollars that have been invested. As part of the change in philosophy the family has changed how we invest. Traditionally, farms invest in their productive capacity and are forced in a number of cases to buy shares in processing and/or a marketing company that they supply. So it looks like 90+% of their investment is in land, buildings and farming equipment with the balance in shares. The Raine family has adopted a 1/3, 1/3, 1/3 philosophy. This means that we will not increase our exposure to productive assets (the first 1/3 of our investment), but we will invest in our own processing and distribution as our second 1/3, and the final 1/3 will be investment in brands and intellectual property (IP).

This philosophy gives us a vertically integrated business and we believe better market signals and a quicker response time to changing trends and customer demands. We have lost the economy of scale that supplying a company like Fonterra gave us. The cool wind of reality in dealing with thousands of consuming customers and the tough trading conditions of small to medium-sized businesses prevails. Belonging to a bigger business means you get paid on the 20<sup>th</sup> and there is a buyer created invoice to cover it. For us now there are over 100 monthly bills to be raised and debts to collect and unfortunately people do not always pay on time.

**Has it all been worth it?**

The short answer is that it is too soon to say. Some days are tough and supermarket buyers drive hard deals. Trying to explain to the bank and some family members about brand development, IP investment, supply chains, the continuous requirement for tastings, and the need to invest in non-bricks and mortar has been difficult. Keeping positive through these days is very important, while the good days are both exciting and extremely rewarding, especially the public feedback. Turning into a food company is a major challenge and is not for the faint-hearted. We feel we have invested in ourselves and in our future, and building two brands from nothing has been a challenge that we have definitely enjoyed.

The journey down the road of diversification and value add has therefore been long and windy, with the eye on the prize a constant focus.

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ANNABEL CRAW

# JOINING THE FAMILY - ATTRIBUTES TO SUPPORT SUCCESSFUL INTEGRATION INTO A FAMILY FARM BUSINESS

Family farming businesses contribute to a large proportion of the total number of agricultural businesses in New Zealand. But given the level of their significance very little focus is put on how these businesses function to remain harmonious, strengthen and grow. Through the Kellogg Rural Leaders Programme Annabel Crow looked at the family farming business from a different angle – of a new family member joining one as a daughter or son-in-law – to understand what factors ensure successful integration into it.

## Common themes

Are there common themes which emerge amongst families around the way they welcome, transition and involve new family members in the farming business to ensure the family, business and individuals flourish? If so, what are these traits and can others adopt them whatever their situation?

As a daughter growing up in a farming family, a daughter in-law involved in a multi-generational family business and a mother, I have experienced first-hand the balancing act required to navigate through understanding how your skills and aspirations can interweave with those of your own family, the wider family and the farming business. All family farming businesses have a common thread in that they are made up of a diverse range of people and it is they who will determine the ease of the pathway on which these businesses travel.

To gain a first-hand understanding of experiences and insights about integrating into a family farming business a range of farming family members were interviewed, along with professionals specialising in family coaching, succession and facilitation. A literature review of families and businesses was also conducted, common themes were fleshed out, and eight attributes were identified and represented visually.

The attributes of joining a family business are aimed at supporting those assuming the daughter or son-in-law role, but to achieve a truly harmonious integration into a family business it takes commitment from all the family members. Therefore, many if not all of these attributes are worthy of attention by all those involved.



Figure 1: Attributes of harmonious integration into a family business

### 1. Stay values-driven

Staying true to yourself and what you believe is important to the way you live. Values determine your priorities and are the measures you use to tell if your life is turning out the way you want it to. When life is going well, you are likely to be acting in a way that matches your values; when life doesn't align that creates unhappiness.

Understanding your values and living to them is critically important. By doing so you can then clearly articulate them to others and be truly understood. It is also important to recognise the differences in what matters to you compared to that of the wider family, acknowledge that a gap may or may not exist, and give time to understanding how this may impact on your integration into the family and business.

This was summed up well by one professional: 'By understanding and sharing your core values you are allowing insight into what you are thinking and what is important to you.' Staying values-driven gives you a greater chance of keeping on track and getting it right. As one participant put it: 'If your intentions are well thought through and from the right place, you are probably not going to go wrong.'

### 2. Strong and connected partner relationship

The main reason a person is in the position of integrating into a family farming business is because they are in a relationship with someone who is involved in it. Second only to staying true to your values is maintaining a strong and connected partner relationship, for if that no longer exists then there is no longer a foundation for involvement in the family business.

## Create a safe place and give everyone a voice, and have regular, planned and structured time with an external advisor or facilitator if required.

Strong farming couples have very open, aligned and supportive relationships with their partners, and by doing so gain respect and present a united front when working through challenges within the family business. Investing in your relationship with your partner is the equivalent of building resilience for getting through the tough times. It means developing the skills to talk through the tough stuff, respecting each other, and spending time together doing things you enjoy.

### 3. Prioritise understanding time

In one of the interviews a participant used the term 'understanding time' to develop deeper relationships with her parent in-laws. This term stuck with me because it not only described the action of stepping into another person's shoes, it also made it feel like a conscious activity that one put effort into and took a strategic approach to. It is easy to say or think we understand but do we really? Has time been taken to peel the layers and get to the core of people's drivers, their values, their story, their dreams, their fears and ultimately how they see you? I have also included 'prioritise' in the attribute because a proactive approach needs to be taken and people need to go out of their way to make it happen.

Understanding time requires the skill of asking the right questions and empathic listening. This is the highest form of listening and enables you to really get inside another person's frame of reference. Even if you are emotionally involved in an exchange with someone you are able to step outside the emotion, not take a position yourself, and reflect back in new words what they said to you. It is listening with you heart, eyes and ears.

The professional facilitators interviewed provided examples of situations where in family meetings progress had stalled through emotion. In these instances they asked, 'Tell me about the tears', 'What was it like for you?' or 'What did you have to put up with?' These can be powerful questions to find out why patterns of behaviour may have emerged.

Understanding time is also relevant to the business aspect as well as the personal. The depth of understanding of the business will depend on the role played in the family business, but you need to feel that the farm is sustainable and going in a direction you are comfortable with.





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## **New members who join a family business bring with them new energy and insight. Everything is seen through a different lens and from a new perspective.**

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### **4. Develop conversational confidence**

Conversational confidence is the essence of how we want to communicate as a family. We want each member to have the strength and courage to talk openly and honestly to each another and feel safe in doing so. Words are well crafted, judgement is reserved and new ideas are welcomed.

How a family enables that conversational confidence to be established will vary, but do not leave this to chance. Create a safe place and give everyone a voice, and have regular, planned and structured time with an external advisor or facilitator if required. For one family this was very helpful as they noted, 'The advisor could deliver the message, it preserved the family harmony. When dad died it added emotional stress and it was important that we had someone independent to provide an objective view.'

### **5. Remain agile**

Families are constantly undergoing change and one of the most important characteristics needed of them is being 'rapidly adaptable', not being bound to fixed rules, and having the freedom to create new rules and decentralise power. Acknowledging that power has shifted from the exclusive domain of fathers to include mothers and

children is also important. This is not about disrespect of parents, but using the insight that younger generations can bring to work through solutions. This bears a similarity to how the family business is evolving; no longer are decisions made solely by one member of the older generation, but a more collaborative approach is used to solve problems and refine how things are done.

Comments from another family member included, 'Everything is very fluid and ongoing, we are always open to discussion and ideas as a family.' A family coach noted, 'I really encourage families to see generational transition and succession as a process that never ends.'

### **6. Practice self-care**

This attribute is not about self-centredness; it is about nurturing yourself to enable you to be happy so both you and your family can flourish. Aside from all the aspects of self-care such as sleep, food and exercise it is important to focus on the mental aspect, which encompasses feeding the brain and the importance of continued learning or professional development. Investing in one's knowledge regardless of the topic or area was observed to be a significant factor which supported in-laws in their journey and involvement in a family business.

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**Joining a family farming business has its own set of intricacies. Being an in-law, one is confronted with the balancing act of operating a business, maintaining family relationships, creating your own family culture, and meeting your personal needs and aspirations. It is a journey that lasts for a lifetime.**

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One participant said, 'Working off-farm is not necessarily about the job, but a skillset I am developing along with the different situations I am being exposed to. It has provided me with the confidence to bring a different point of view to the business.' Another participant said, 'I lost a lot of confidence while farming with my husband's family and doing a personal development course ignited it again.'

Everyone's pathway for self-care will be different but the key is to do things that put you outside of your comfort zone, challenge your thinking, or expose you to new experiences or insights. In turn, this will also provide new networks and connections, and social and intellectual stimulation. Building your resilience for when the pressure comes, when you are confronted with a challenge or something new, you can then approach it as an opportunity to grow and learn. You have a toolbox of skills and thinking to give it your best shot.

#### **7. Be fun and creative**

Create the fun. Being involved in a family business is complicated, and it can be all-consuming and emotionally exhausting at times. Farming is the same and seriousness can take hold of both the business and the family very easily. Families need to have fun because it is what creates memories, builds culture and makes people happy, whether it be annual holidays, wider family activities, adventures or creating traditions.

As one family said, 'When we are out on the farm as a family we make it fun – we make it an adventure. Families need to spend time together building trust and relationships.'

Be creative. New members who join a family business bring with them new energy and insight. Everything is seen through a different lens and from a new perspective. Harness this and experiment with bringing creative ideas, opportunities and approaches to the family and the business for discussion. Families must take the time to understand and acknowledge skills and seek to embrace those beneficial to the business.

One participant noted, 'The family acknowledged that my skillset was beneficial to the business and formalised a role for me. My skills were embraced by the family and not seen as a threat.' One father said, 'I accept the talents and personalities of my children and their partners and make use of them.'

#### **8. Change can start with you**

Joining a family business will be a totally different experience for each person. For some they may start at a fairly low power base, feel the need to prove themselves,

are daunted by the existing culture and personalities, or have little interest or understanding of the industry which the business operates in. For others, it will be an exciting and seamless transition where their skills are quickly valued and used and they just click with the family and naturally find their place.

Whatever situation, achieving success and happiness within a family business is a matter of choice and the best way to make it is to start with the little things. There is a commitment to making incremental changes and accumulating 'small wins'.

#### **Recommendations and discussion questions for family farm businesses**

Being involved in a family farming business is not a straightforward road to travel, with unexpected bumps and deviations along the way. Whether you are gliding along nicely or weathering a storm the opportunity for reflection is always valuable. The questions and discussion points for the eight attributes identified in the boxed section will provide some impetus around ensuring you thrive when integrating into a family farming business.

#### **Making the commitment**

Joining a family farming business has its own set of intricacies. Being an in-law, one is confronted with the balancing act of operating a business, maintaining family relationships, creating your own family culture, and meeting your personal needs and aspirations. It is a journey that lasts for a lifetime. What happens in the first days, weeks, months and year does set the foundations, but becoming part of a family and business is a constant evolution and involves continual learning and application. For that reason, the attributes that have been identified are timeless and can be adopted at any stage of the journey.

No two families are the same in the unique set of challenges they face, whether related to the business, the family or both. Each family will make their own decisions based on what is right for them and situations which they are presented with. However, what strong and connected families do have in common is their clarity of direction and commitment to the things that build resilience within their family. By doing so they develop the capacity to rebound from adversity stronger and more resourceful, and transform and grow, ensuring they thrive as a family farming business.

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# QUESTIONS AND DISCUSSION POINTS FOR THE EIGHT ATTRIBUTES

## STAY VALUES-DRIVEN

Understanding what is important to you and living a life aligned to what matters is fundamental to achieving a happy life:

- How much clarity do you have around your values or what guides you in your decision-making?
- Are you living your life in a way that truly makes you happy?
- Can you articulate what is important to the people closest to you?

## STRONG AND CONNECTED PARTNER RELATIONSHIP

Investing in your relationship with your partner is the equivalent of building resilience for getting through the tough times:

- Do you prioritise time and energy for your relationship on a regular basis?
- Have you developed a constructive way of talking through the tough stuff and big issues?
- Are you able to approach situations as a united partnership?

## PRIORITISE UNDERSTANDING TIME

Building strong relationships requires one to see the world through the other person's eyes and to understand their perspective:

- How well do you truly understand the members of your family, their history, their journey, their fears and dreams?
- Are you asking the right questions and being an empathic listener?

## DEVELOP CONVERSATIONAL CONFIDENCE

Every family should strive to create an environment where each member has the skills and courage to talk openly and honestly to one another and feel safe in doing so:

- Does your family have regular, planned and structured meetings to ensure open and safe communication?
- Each family will differ depending on their size, structure and who is involved. Identify an approach that works for everyone.  
Can you recognise when the need exists for an independent person to support and manage the emotions and challenging issues?
- How do you manage your emotions so that when the hard stuff is talked about they do not get in the way?

## REMAIN AGILE

The only constant is change, so families who adapt, evolve and try new ways of doing things will build resilience and stimulate progress:

- What is working and not working for you, your family and your business?
- What framework could be established to constantly and constructively review what is working and what is not working and adapt it appropriately?

## PRACTICE SELF-CARE

Looking after yourself is like refueling and it ensures you bounce back when things are tough or stressful. Recognise what you need to remain balanced, healthy and energised:

- In what ways are you challenging your mind, stepping outside your comfort zone and seeking new experiences, big or small?

## HAVE FUN AND BE CREATIVE

Have the confidence to be a breath of fresh air and bring fresh insight and ideas to the family business:

- Do you work hard to be understood and acknowledged for the skills and capabilities that you have while respecting the experience and roles of the wider family?
- Do you seek opportunities to bring fun, humour and enjoyment to the family and create traditions, plan holidays or make the small things memorable?

## CHANGE CAN START WITH YOU

Do not underestimate the impact and influence your actions or inactions can have on the wider family.

Start with the right mindset and a commitment to try:

- Do you focus on your circle of influence and are you patient as it grows? Do not trouble yourself with things outside of your control.
- What strategies can you develop that ensure you hit the 'pause' button and stop when stressful or challenging things happen to enable you to choose your own response?





JEREMY SAVAGE

# A PROFESSIONAL TEAM APPROACH TO FAMILY BUSINESS SUCCESSION

The development and implementation of a family business succession plan is often a complex and time-consuming task requiring a broad range of skills. This article explores the skills required from a team of rural professionals to support families through this process.



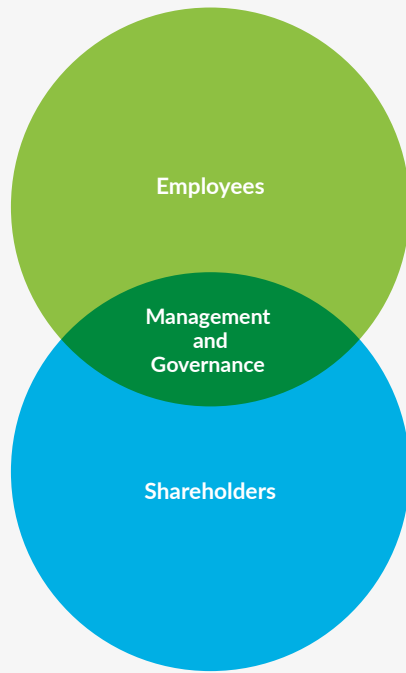


Figure 1: Traditional company structure

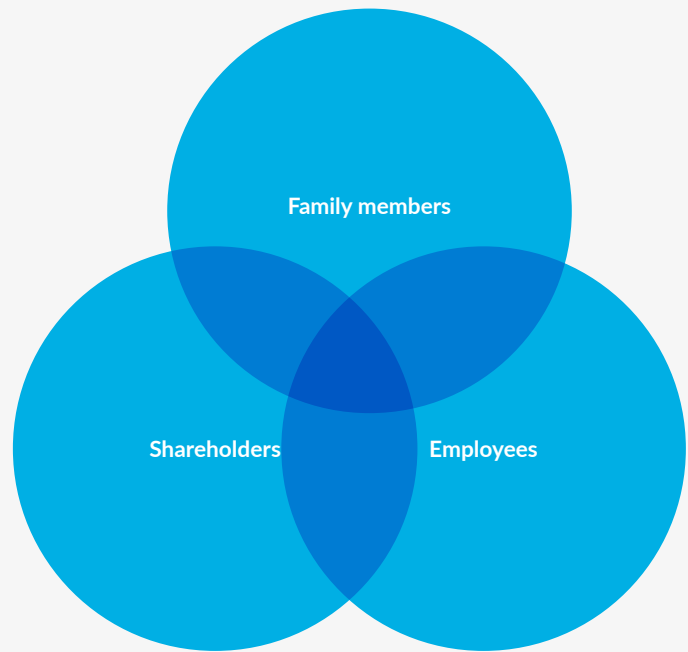


Figure 2: Family business structure

Compared to the traditional company, a family business has a number of layers of complexity which exponentially increases the number of roles, relationships and conflicts in the business.

#### Traditional company structure

Due to the complexity of the family business, the skill set required to successfully navigate a family business is far more challenging and complex than dealing with a traditional commercial company structure. This skill set is greater than one person. In our experience a team of professionals with complementary skills will have a far greater chance of success in guiding a family through business succession.

The traditional company ownership and management structure has been in existence since 1602 (see [Figure 1](#)). The first instance was the Dutch East India Trading Company, which operated on the same principles as companies do today. In this model there are three main groups:

- Shareholders
- Employees
- Management and governance.

The traditional company structure is well serviced by New Zealand company law and the rights of the employees are well protected. The obligations of the management and governance are well documented and supported. Should there be an overlap of any of these roles

(e.g. employees who are shareholders), then company law is quite clear about how these conflicts are to be dealt with.

As professionals, when advising strategy, direction and the management of these companies, the key principle is to focus on the best interests of the shareholders. The focus is simple and well understood in the professional arena of New Zealand agriculture.

#### Family business structure

Compared to the traditional company, a family business has a number of layers of complexity which exponentially increases the number of roles, relationships and conflicts in the business. This creates another layer of complexity for professionals advising these businesses. Participants in a family business can have one or more of the following roles:

- *Family members*: These participants do not have a stake or role in the family business. However, they do have a role to play and can exert a major influence on the values and standards of the business.
- *Family members with ownership*: In a normal business they are treated and communicated to as shareholders. However, in a family business their 'stake' and role tends to be far more influential than a standard shareholder.





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## It takes a special skill set to listen, challenge and encourage family members to participate in difficult conversations.

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- **Family members who are employees:** These participants are a challenge for any professional to deal with. On the one hand they can be competent, dedicated and willing, but sometimes they can be incompetent. They are covered by employment law. How as rural professionals do we draw the line between their role performance and role as a family member?
- **Family members who are in management:** These individuals need a lot of support, especially if they are dealing with family members who are in employment who are not up to the task or are quick to criticise the hierarchy. This group is often the key to the success of implementing the plan and they need plenty of support and guidance.
- **Family members who are in governance:** Coaching for this group is essential. What does good governance look like? The industry offers plenty of training, literature and support. However, these members need to understand their limitations and where they can get help from.
- **Non-related employees:** Easy to deal with, but they are often the engine room to the success of the family business and must be treated with respect.
- **Non-related shareholders in a family business:** A delicate position to be in as your rights as a normal shareholder are upheld by law, but the values of the family in internal relationships can disrupt the performance and direction of the business.
- **Independent governors:** Essential for any large-scale family business that is dealing with multiple roles as described above. A good independent governor needs to be a good coach, showing the ropes on how to govern well to the family directors. They also need to provide a clear pathway for the family to follow along the disciplines of good business, while being sympathetic to the various roles of all of the members of the family business.



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## The strategists are typically the farm consultant, accountant and bank manager.

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### Key roles in a family business model

To successfully navigate a family business, we suggest the key roles that need to be filled are:

#### The facilitator

The first job to be completed in farm succession is to understand the family. The values, roles, strengths and weaknesses of the family members, and the family unit. This can be a demanding and time-consuming role. It takes a special skill set to listen, challenge and encourage family members to participate in difficult conversations.

Establishing the individual goals of the family members, as well as the goals of the family, is essential. This is often an uncomfortable space for family members as they may have rarely sat down and worked through this process themselves. This part of the process often takes a couple of meetings. The facilitator may be a long-standing rural professional who has these unique skills.

A number of professional facilitators are also practising in New Zealand. A rural professional who has a long-term relationship with the family can do this job well if they have good facilitator skills. They may already know which closets hold the secrets. However, a fresh face can often help give confidence to the new members of the family as they might see the pre-existing relationship getting in the way of the process.

#### The strategists

The strategists and facilitator need to be communicating well. What are the values of the family? What are the goals of the family – are they clearly defined and SMART? The family goals also need to be challenged respectfully. What is the family business capable of? How well is it operating, what resources are available, and how can we make the business better?

In working with helping families to think outside the square strategists need to ask other questions. Are their goals audacious enough? Are there other approaches, and ownership and management structures, that they should consider? A strategist who is open-minded and experienced is essential.

Families really respond to examples. For a number of families we have facilitated a road trip for them to meet with other businesses to learn from their successes and mistakes. When the family goals are defined, how are we going to get there? What are the risks and distractions along the way, and how are we going to deal with them while holding the true course of the family business in the direction it needs to be going to achieve the goals?

The key to any strategy is that the business needs to have a positive and strong cash flow. The business

needs to be performing above average. The greater the performance, the quicker the family will achieve the goals. The strategists are typically the farm consultant, accountant and bank manager.

#### The watch dogs

This role is essential to minimise the risks along the way, to ensure that there is the flexibility in the family company structure to achieve the goals, while minimising the potential risks. The watch dogs are typically the family business solicitor and accountant. They need to be advising with the family business interests at heart, but must also be open to peer review and suggestions from other professionals who may be supporting individuals within it. The watch dogs need to work with the strategists to ensure that they do not restrict the business in the future, which may hamper the execution of the plan.


#### The implementers

When the plan is in place, the implementers get on with the job. They assist management to execute the plan as fast and as safely as possible, with steering and guidance from those in governance. As the key professionals to help implement the plan, they need to clearly understand it, and the end goal, so they can work with management to monitor progress. The farm consultant and bank manager have an important role to play to assist in implementing the plan. Accountants are essential to monitor their performance.

#### Timeframes

In our experience, not one person has the skill set to meet the demands of all these roles well. We all have our strengths, but also weaknesses. A team with a balance of these skills is essential. The team needs to be respectful of each other's views. Having a balanced approach is key to a successful plan. If one of these roles takes precedent in the plan, then the potential is rarely achieved, for instance, an ownership structure that avoids tax but ties up access to liquidity.

Successful, long-standing farm succession plans take time. Time for family members to digest, reflect and in some cases regurgitate. From the first conversations on farm succession to signing off on a plan to achieving succession can typically take six months to five years. However, it may take another 10 years to successfully implement the plan.

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ALISON BAILEY

# ENHANCING THE ROLE OF FARMER ADVISORY NETWORKS - THE AGRICULTURAL KNOWLEDGE AND INFORMATION SYSTEM (AKIS) THEN AND NOW

Over time farmer advisory networks have moved from government to private provision, from free advice to that requiring payment. This has led to a complex and sometimes confusing system. This article explores the current situation, concluding with the key success factors for future provision.



### Top-down and bottom-up information flows

AKIS refers to the entire set of individuals and organisations that support and facilitate people engaged in agriculture to obtain information, solve their problems, and acquire skills and technologies to improve their livelihoods. AKIS has an important role to play in coordinating the flow of information between farmers and others.

Traditionally, agricultural advisory services were designed to bring new knowledge and techniques from public research organisations to farmers. Their main function was providing knowledge to improve agricultural productivity and to add value to a farmer's business. However, the role of agricultural advisory services has now evolved, with new functions such as promoting environmentally sustainable production techniques.

Furthermore, the flow of information is not systematically top-down any more, but also bottom-up, coming sometimes from the farmers to the scientists. This includes both the embedded knowledge that the farmer holds and also a statement of their actual needs. These interactions between scientists, consultants and farmers enable the industry to respond to current challenges, to provide a cost-effective and sustainable way to adapt productivity to the potential farming assets within the framework of the country-specific context.

### Complex set of interrelationships

Historically, knowledge exchange was led by government institutions, but their disengagement in terms of providing advice and informing farmers has resulted in a privatisation of these services, leading to a complex set of interrelationships. There are three main sectors that can be distinguished: public (state agency), private, and non-governmental but non-profit structures such as farmers organisations. Consequently, depending on a governance structure, some services are free, some are shared among stakeholders and some have a full cost.

This complex set of interrelationships increasingly impacts on the potential for advisors to accelerate the diffusion and adoption of ideas and innovations. There are a number of factors that can have a negative impact on the functioning of such systems including:

- Incoherence of institutional frameworks and systematic failure in terms of actors' interactions
- Inappropriate knowledge infrastructures
- Lack of specific capabilities and competence
- Inadequacies in market and incentive structures.

The plethora of alternative advisory mechanisms from free advice to paid consultants and extension networks is a core blocking mechanism in the New Zealand advisory and information system.

Although advisory services have a substantial role to play, farmers also have access to other sources of information that can help them in making their decisions. It is widely recognised that change at the farm level emphasises adaptation and co-learning as more realistic ways of conceptualising the process by which farmers acquire new knowledge and put it into practice.

'Learning by doing' is an essential component in this process. Social learning and farmer-to-farmer interactions can facilitate change and is the most widely used source of information. Farmers learn from their neighbours, but also from their family, by observation and dialogue. This way of getting knowledge is crucial for learning, and can lead to more likely adoption because of the experiential and observable nature of the information.

Research on the adoption and diffusion of innovations has consistently confirmed that one of farmers' most commonly cited sources of information and ideas is other farmers. Innovation is evaluated not on the basis of scientific research by experts, but through the subjective evaluation of near peers who have adopted the innovation, with these near peers serving as a role model such that innovative behaviour is then imitated by others in their social system.





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## The farmer cluster concept is the idea of enabling farmers to work more closely together, facilitated by a lead farmer.

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Notions of learning, i.e. acquiring knowledge, thus recognise that opportunities for observation, interaction and discussion play an important role in farmers' decisions, prompting interest in on-farm demonstration activity and workshops, field days, monitoring of farm businesses, and discussion groups as potentially effective knowledge transfer interventions.

Furthermore, in recognising the need to facilitate demand-driven knowledge exchange, the concept of learning and cluster farming groups has emerged. The farmer cluster concept is the idea of enabling farmers to work more closely together, facilitated by a lead farmer. The group decides their own needs, devise their own plans helped by advisors, sets their own targets and record progress, and are supported by their own funding, although they may have access to other funding sources.

Similar initiatives have been set up by processing companies across the different sectors, whereby staff from the company act as innovation intermediaries, providing opportunities for skills development and knowledge transfer for their supplier farmers. This involves engagement with both individual farmers and/or farmer groups facilitating access to information channels, including specialist experts and consultants as required.

### Sources of information and the role of trust

A number of studies have been undertaken in New Zealand on where farmers are sourcing information. These emphasise the role of demonstration and interaction. For example, farmers will adopt new technologies, new crops, or environmental management practices where they have seen successful demonstration and/or where they have been proved as commercially beneficial.

An important factor in adoption is cooperation. Learning from other farmers occurs where information is freely shared amongst individuals who are not competing with each other on a limited domestic market, and where there is cooperation in the market place and limited price competition. Cooperation then contributes to trust.

Cooperation in the dairy sector in New Zealand is a key factor engendering trust and facilitating information exchange. This could also hold for other livestock farmers as they and the dairy farmers are both price takers in export markets, and thus the sales of one domestic producer would have no impact on the prices obtained by another domestic producer. There may, however, be less cooperation in the sheep and beef sector, as there is evidence to suggest these farmers are less inclined to attend monitor farm days and discussion groups compared with their dairy counterparts.

Trust is thus an important factor in innovation adoption and plays an important role in determining whether information or advice is acted upon. Information and advice provision is thus most effective when delivered by trusted individuals. It is generally recognised that the most trusted individuals are other farmers, scientists and vets. The least trusted are regional councils. This has implications for the dissemination of information and advice about policy implementation.

An example of where collaboration between a regional council, a trusted intermediary organisation, consultants and farmers resulted in successful policy implementation is the One Plan initiative in the Manawatu-Wanganui region to control on-farm nutrient management and ensure environmental compliance. Mutual trust between government and farmers is critical in encouraging diffusion of new practices and technologies, particularly those associated with government policy.

The lack of mutual trust between government and the farming industry may be less of a concern where farmers have large cosmopolitan professional social networks, as these can be beneficial in the adoption of new practices and technologies. What is important to remember in this context is the need for these networks to be operating as small groups or subgroups. Small groups mean that discussions can take place, questions can be asked, and farmers themselves have control of the situation and the language used.

Use is also made of the farming press. It may be used as a complementary source to reinforce previous information, for keeping up-to-date or to trigger awareness. Many farmers will also have access to the internet, a particularly good source of technical information.

The rural professional is also a source of information and advice. Private consultancies take on two main roles: one operational, one more strategic. Consultants network with other farm management consultants and rural professionals to build their knowledge. They also build their networks through their client farmers and non-client farmers in discussion groups, farmer meetings and events. Farmers may also take the opportunity at such events for informal conversations with consultants. There are also accountants who have a role in financial compliance, and along with bank managers may have a role in strategic planning.

For these individuals, trust takes time to be earned. Interpersonal communication skills and an ability to think holistically about farming systems, as well as an analytical ability, are important attributes. It is also important for the



client that there is a focus on the practical implications and further sources of information. It is about exuding confidence, and demonstrating a level of service, reliability, impartiality and empathy.

Experience is also a factor. For individuals operating within established organisations the brand and history of that organisation can be of benefit. The industry good levy bodies are seen as a trusted organisation, in part because they are viewed as independent. Suppliers as part of an organisation are seen as less useful sources, although they and processors can play an important role in the provision of both technical and compliance information.

There have also been studies on how the demographics of farmers influence the sourcing of information. There are indications that as an individual becomes older they are less inclined to attend events, relying on their own knowledge and experience. Those early on in their career are more likely to attend events, suggesting they are at a stage of actively seeking information, and they would also make greater use of the internet, family, friends and neighbours.

For both younger and older farmers the reliance on their own knowledge and experience is aided by the use of management information systems, both informal on-farm data collection systems and more formal and readily available agricultural software tools. Most of these relate to production and financial systems and are primarily used for day-to-day operational decisions. Intuition is also a critical component of a farmer's decision-making ability.

### Types of information being sought

The information that farmers are seeking tends to focus on business performance and operational concerns and, where necessary, regulatory compliance. For the latter,

there are some concerns over the lack of access to useful information and continually changing requirements. Research transfer is also important to some individuals with the emphasis on recent innovations, the bringing of something new into use.

The information and advice being sought is also dependent on the time of year and immediate needs. There is an element of reassurance to reaffirm an individual's thinking encompassing both ongoing practice and/or trying something new. Rural professionals may be a crucial link in this process through sourcing and adapting research information to their clients' needs at the same time as translating the needs of the farmer to the research community.

The latter is less evident as it has been suggested that rural professionals may be undervalued by the research community. In addition to the lack of (or perceived lack of) individuals with the ability to act as translators in knowledge exchange, there is evidence to suggest there is a lack of strategic leadership and fragmentation across the diverse sectors of the agricultural industry.

It is relatively easy for farmers to find day-to-day shorter term farm management information, but long term and more strategic areas are more difficult to obtain information on. Furthermore, farmers will adopt innovations which best suit current practices and the farming system, with compatibility and profitability important factors. To do so in an incremental way can also be important. Non-adoption is also a considered decision.

The adoption itself, in any of these areas, is dependent on a farmer's goals, attitudes towards what is being considered and an evaluation of potential outcome, the influence of an individual's farming network including social pressures, and factors that exist to

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## The best way to facilitate the flow of information is through a farmer's existing professional and social networks.

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facilitate or inhibit adoption. Personal characteristics of the individual, including their information seeking characteristics, contextual characteristics of the situation, and the innovation characteristics also all have a role to play. For example, farmers who seek out information for financial benchmarking, rather than farming practice per se, are more likely to adopt change as they have a motivation to learn. Farm characteristics are also important, with farm size and productivity important factors in adoption. For example, with a less experienced manager and larger operation there is more likelihood of a consultant being used.

It is important to recognise that although the availability of information and advice may be well resourced, that stimulating demand (the information seeking process of individual farmers) may be just as important. There are a number of stages an individual goes through in the adoption process including:

- Awareness raising
- Engendering interest
- Comparison
- Decision-making
- Adoption and implementation, or
- Rejection.

There are also different categories of adopters such as innovators, early adopters, early majority, late majority or laggards. Innovators tend to have more years of education and engage in information seeking. Laggards are seen as traditional, sceptical, less intelligent, undertaking less social participation and having less contact with change agents. Laggards may therefore take longer to accumulate information. However, this is not always strictly true, as individuals may be seen as innovators/adopters for one thing, and then a laggard on another. It is about fit with systems.

### Factors for success

The more farmers are exposed to various sources of information, the more likely they are to adopt approaches and techniques that can improve their business. Farmers make decisions on the basis of a continuum of awareness creation through careful consideration and onto adoption/implementation. An example of possible steps taken is as follows:

- The decision may arise as a result of something read, heard or seen, but will necessarily involve some form of social interaction with others, depending on the nature of the decision

- It may be through using the internet to search for more information, going to individual family members or peers, and then other individuals or organisations as appropriate for further information
- It would tend to be the suppliers and processors for more technically-based information, with additional independent advice sought from the industry good levy bodies
- For the more strategic levels, information and advice would then be sought from consultants, who would also be used for day-to-day operational advice.

Whatever the context and from wherever the information or advice is sought, relationships are an important component for any information or advice to be acted upon. Those with the most influence are the trusted individuals who generally already have some form of business or social relationship with the decision-maker, and for most will always include their peers even if only as a sounding board. The best way to facilitate the flow of information is therefore through a farmer's existing professional and social networks.

There remains the question, however, of how to get greater uptake by others in the farming community outside of such networks. Pairing a lead farmer with the experts is a good technique for generating trust in the information or advice, because another farmer may be more likely to act upon the information or advice received.

In providing the information or advice, there should be a clear reason and objective for interaction. Subject matter should be relevant, tailored and of interest. Individuals involved, whether farmer, facilitator or expert, and the decisions made should be credible. In terms of information exchange, it is more important that an individual is credible in terms of the context of the situation, rather than who or what they are, whether a 'professional' extension officer, host farmer or consultant.

Location is also important for relevance and ease of access, whether for an event, individual meeting or online. Networking opportunities requiring greater distances to be travelled are less valuable than those in the immediate locality. Finally, at whatever stage in the process there needs to be a clear pathway to where further information or advice can be sought.

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# REPORT ON EUROPEAN STUDY TRIP

This article is based on a report compiled at the completion of a recent European study trip undertaken by Paul Martin, 2017 DairyNZ Dairy Rural Professional of the Year. The trip was funded by his prize from this competition.

In late May 2018, I travelled to The Netherlands and Northern Germany. My trip included visiting a range of research institutions, meeting with researchers and dairy farmers, visiting biogas plants and farm effluent processing facilities, and meeting with farm consultants, farm environmental advisors and an agricultural extension body. After driving more than 1200 km, I departed Amsterdam with more questions than necessarily concrete answers, but with a lot of ideas.

## De Marke research farm

My study trip began in The Netherlands by visiting the De Marke research farm. De Marke is one of two off-campus research facilities owned by Wageningen University. Located in the Eastern Netherlands, relatively close to the German border, De Marke conducts farm

systems research. Currently, De Marke is set up to demonstrate what might be possible under a Dutch dairy farming system which uses some cow pasture grazing to qualify for a milk company premium (120 days a year for six hours a day), has very low nutrient losses including leaching, run-off and gases, is carbon neutral, and makes limited to no use of chemical sprays.

I met with the research manager of De Marke, Zweir Van de Vegte. This was my first taste of Dutch dairy farming and, in what was to be repeated throughout the week, it was noticeable how much emphasis they place on minimising ammonia volatilisation. This focus includes how they apply effluent and store effluent, and how they crop paddocks and feed their cows. Key points of interest that I observed at De Marke were:



Grazing cows in Germany





Bedding trial

## Dairy farmers in the EU may only apply 170 kg N/ha per year from effluent, and due to their stocking rates many farms have far more effluent nitrogen than land to spread it on.

- They aim for a milk urea concentration of under 20 consistently to ensure they have optimised the use of feed protein and minimised urea excretion in the urine. The target crude protein level of the diet is 14.5-15.0%, which includes a measurement of the grass protein levels
- An injection of effluent slurry at 35 m<sup>3</sup>/ha, preferably (for less ammonia volatilisation) diluted 1:1 with water and injected at twice that rate
- A focus on measuring and using deep mineral N in the soil with maize crops, thus reducing the use of nitrogen fertiliser on maize. No solid fertiliser is placed in the first year, only injected slurry either side of the maize rows two days before planting. GPS is heavily used in The Netherlands
- Reliance on deep ploughing (20-25 cm) for weed control, and also to mineralise soil nutrients so that they are available for the plants in the absence of fertiliser
- An Italian ryegrass 'catch crop' is sown between the maize rows, with an air seeder, six weeks after the maize was planted
- An on-farm biogas plant selling biogas into the local grid was interesting, although not producing sufficient return on investment to make it a commercially viable project.

### Veenhuis machinery factory

Following De Marke, I visited the Veenhuis machinery factory. They make effluent equipment, in particular

slurry wagons and the associated application booms for either effluent injection or 'dribble bar' application. For a machinery sales company, they have carried out significant research into reducing ammonia volatilisation, as well as proof of placement technology. They have recently released a state-of-the-art attachment that can be fitted to their machines. This uses near-infrared spectroscopy (NIRS) to assess the nitrogen, ammonia, phosphorous, potassium and dry matter content of effluent slurry in real time, and to adjust application rates to apply nutrients at the precise level desired.

These are not small slurry wagons, most of them having 1.6 m diameter tyres, one to four axles, and holding up to 40,000 litres of slurry. The largest wagon requires a 350 HP tractor to tow it. Even the mid-size slurry wagons were priced at 130,000 Euro (NZD\$220,000), so while the technology would be valuable in New Zealand, I struggle to see a business case for that level of investment in machinery. It is also debatable how these machines would cope with anything more than the slightest slope or variable contour in a paddock. Use of slurry wagons with a spreader plate as we do in New Zealand is banned in The Netherlands and it is soon to be banned in Germany, hence their use of effluent injection and dribble bars.



### Dairy Campus

My next visit was to Dairy Campus, the second off-campus research facility of Wageningen University. Located in Northern Holland, this is an impressive applied research facility which was built two years ago. A variety of research trials are undertaken there, with many of them focusing on reducing greenhouse gas (GHG) and ammonia production (10% of the EU's GHG production is from agriculture).

I toured the facility with one of the university's researchers, Harm Wemmenhove. Key points of interest that I observed at Dairy Campus were:

- They are finding lower GHG emissions off deep litter wood chip floors compared to slatted, solid or straw covered floors
- Methane emissions have been shown to decrease when a lower fibre diet is fed to the cows, although predictably they ran into acidosis issues with this diet
- Pumping air into the slurry stored under the floor of the sheds decreases ammonia volatilisation (they are repeating this trial to clarify the results)
- I saw a very impressive artificial wetland system, which was being used to treat all run-off from cow yards (not the cow houses) and races. The water passed through two wetlands followed by a long shallow pond before being allowed to discharge into a waterway.

### Manure Tailored Project

From Northern Holland I travelled into Northern Germany and embarked on a very busy tour of a variety of dairy farms, as well as organisations and facilities connected with cutting edge nutrient management. Compared with The Netherlands, Germany seemed to have less focus on ammonia, but a significant focus on the full-farm nutrient cycle, largely due to stricter government regulations than in The Netherlands.

I met with members of the 'Mest op Maat' (Manure Tailored) Project, which is investigating ways of using effluent nutrients off-farm. This project has developed a system using either a centrifuge system on the back of a truck, or else a press sieve also on the back of a truck, to separate dairy effluent on-farm. These separators are operated by contractors and they arrive on-farm, suck effluent out of holding tanks on the property, take away the solid fraction and leave the liquid fraction for use on-farm.

The solid waste is trucked to a commercial biogas plant, which uses it as digesta in the generation process. Farmers pay for this service, largely due to the fact that under the nutrient rules they cannot apply all their effluent nutrients on their own farms. Dairy farmers in the EU may only apply 170 kg N/ha per year from effluent, and due to their stocking rates many farms have far more effluent nitrogen than land to spread it on.

### Commercial biogas plant

I subsequently visited a commercial biogas plant using dairy effluent solids to produce 400 kW/hour of electricity. This business was commercially viable, processing 20 tonnes/day of solid waste from dairy farms, which



Mest op Maart Project press sieve solids separator



Slurry wagon



On-farm screw press solids separator





Artificial wetland system for nutrient removal



Covered effluent pond

the dairy farms provided for free. In a continuous operation, the solid waste passes through two 1,000 m<sup>3</sup> digesters over a period of 60 days before the resulting slurry is stored and transported back to the dairy farms.

Currently, electricity is generated by burning off the methane produced by the biogas digester, but the business foresees that producing biogas for cars may be the best future path. There are 1,600 biogas plants in Lower Saxony, which is the region of Northern Germany that I was visiting. It was baffling to hear that 30% of all maize grown in Germany goes into biogas production – it was previously 50%.

#### Wider dairy farm operation learnings

In my tour of dairy farm operations in Germany, and meetings with rural professionals, I observed a number of approaches:

#### Effluent

The measured methane loss from an unroofed effluent pond was quoted as being 10%, reducing to 2% with a roof. Slurry tanks using a spreader plate, as in New Zealand, are quoted to have 80% ammonia loss from the slurry. If effluent is applied to a sprayed-out paddock, the paddock must be cultivated within one hour. The German government is moving towards full traceability of effluent from extraction to spreading. Soon effluent will not be able to be applied within 10 m of a waterway if the slope is greater than 10%. Denmark adds sulphuric acid to effluent, to lower the pH in an effort to increase ammonium, and thus decrease ammonia release.

#### Material flow balance sheet

The German government has advisors who visit every farm each year, and construct a 'material flow balance sheet' for the farm. This counts all nutrients in and out of the farm system, with the allowable nutrient surplus being 50 kg/ha P and 10 kg/ha N. From this balance sheet, they give each farm an annual fertiliser plan for each paddock separately.

#### Nitrogen and potassium

There are groundwater N targets of below 50 mg/litre. The groundwater in the areas I visited is currently well

in excess of 100 mg/litre. Minimum storage capacity for liquid manure is six months and two months for solids. No nitrogen is allowed on grassland for November, December, January (May, June, July our time), and it is also not allowed to be applied in October (April our time) for arable land. The German government is heading towards longer periods of restriction due to weather. Potassium is measured, but is not regulated with regard to nutrient losses.

#### Recycling

Silage wrap is all collected by truck and recycled in China. All feed bags are paper with a plastic liner. Both the paper bag and the plastic bag liner are recycled.

#### Annual Nutrient Cycling Assessment (ANCA) tool

Back in The Netherlands, I visited the main campus of Wageningen University. There I met with a soil scientist, Gert-Jan Noij. He talked me through a nutrient modelling program called the ANCA tool. In the same vein as Overseer, this model has been developed by the Dutch dairy industry. Interestingly, their motivation seemed to be more so that they could convince the EU that they could apply more nutrients on some farms. Key points of interest that I noted in my discussions at Wageningen University were:

- Dutch dairy farm soils average 5.0-5.5 pH
- The concern over ammonia volatilisation comes from acid rain concerns, as well as problems with eutrophication when the ammonia is taken up by soil and plants
- With high water tables, 50% of soil N surplus is leachable, while with lower water tables this is closer to 100% due to more aerobic conditions. Under anaerobic conditions, denitrification takes place. Interestingly, denitrification can leak nitrous oxide, which is an important concern as a GHG
- The ANCA model demonstrates that the biggest effector of farm nitrogen use efficiency is soil N use efficiency. Thus N applied when grass is most active is most efficiently used
- Minimal amounts of artificial N are used on maize crops in The Netherlands. Rather, effluent is applied at sowing at around 100-150 kgN/ha

- A Farm Water Index tool is being developed by the university researchers to produce an assessment of whole-farm nutrient cycling and efficiency down to the paddock level. This tool takes data from ANCA, combined with a soil type map, a water table map and information on: soil organic matter levels, contours and drainage, drain types, rainfall, topsoil condition and soil biodiversity. The tool is at the stage of Beta testing, but my assessment was that the use of the tool by farmers required a lot of time. However, it has the potential to identify areas for attention on-farm.

### Conclusions

Compared to European farmers, most New Zealand dairy farmers currently have little knowledge of the nutrient content of their effluent. We need to become more precise in our effluent application, to optimise nutrient usage and minimise losses. Knowing nutrient application rates based on the nutrient content of the effluent will help to allow farmers to defend continued effluent application to land into the future.

In New Zealand we do not focus on ammonia volatilisation from effluent, seeming to only worry about volatilisation from urea applications. Can we afford to ignore our gas losses from effluent, both during storage and application?

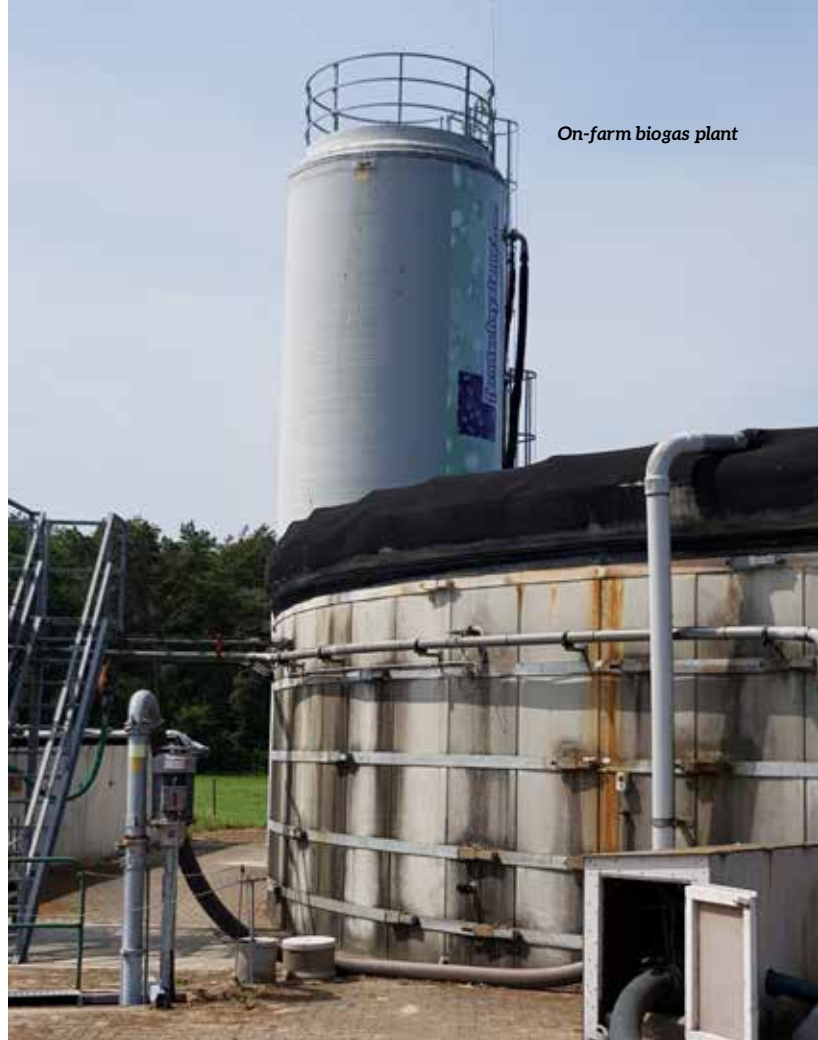
I cannot see how, long term, New Zealand dairy farms can continue to have uncovered effluent ponds. Can we still accept the gas losses from an effluent pond? Also rainfall capture is leading to a requirement for larger holding facilities than would otherwise be required.

It is inevitable that in the future farmers will need increased effluent storage capacity on New Zealand dairy farms, to reduce leaching from effluent irrigation onto saturated winter soils. This will make solids separation an attractive option to reduce the liquid storage capacity requirement.

More work needs to be done before on-farm biogas generation is economically viable, and only rising electricity prices is likely to drive more research and investment in this area. NIWA is currently doing some work on this option. We need to measure deep mineral N more frequently, and adjust our cropping fertiliser applications accordingly.

GPS technology on machinery needs to become the norm, and with some haste, because we are missing out on the gains that it allows farmers to make in precision nutrient placement and cropping. The uptake of GPS technology in New Zealand is patchy, with it already being very common in some areas, whilst almost non-existent in other areas.

Catch crops sown into maize prior to harvest attracted my attention and I want to investigate the feasibility of this under New Zealand cropping conditions. This could make maize cropping in particular more environmentally-friendly, although with our pre- and post-emergent herbicide sprays I suspect that this will not be an option.



On-farm biogas plant

We are already grass-fed in New Zealand, even with the average dairy farm feeding 10-20% of the diet as supplements. If 120 days a year for six hours a day qualifies for a grass-fed label overseas, then even New Zealand's most highly supplemented farm qualifies easily. Friesland Campina is paying approximately a 5% premium for grass-fed milk under the criteria mentioned above. Are our dairy companies doing enough to extract a premium for our milk? New Zealand dairy companies, and our industry, need to do a better job of advertising our grass-fed status on our products. We are already feeding our cows more grass than almost any other dairy exporting country, so we need to stop getting hung up on the finer points of what grass-fed means because no-one else is.

I believe we are taking our grazing management knowledge in New Zealand for granted, but it is so far in front of what I saw of European farming that we should pat ourselves on the back. We are doing really well in New Zealand dairy farming (that is not saying we cannot improve), and I certainly don't think we want to go down the housed cows route like Europe.

### Acknowledgements

I would like to extend my sincere thanks to all the sponsors of the DairyNZ Dairy Rural Professional of the Year competition: DairyNZ, NZIPIM, Farmax, MPI and Beef & Lamb. Without the generous support of these organisations this study trip would not have been possible.

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# BRENT GOLDSACK

The passion that Brent has for farming, farmers, cows, grass, profit, and the milk price in particular, is infectious. Even his children mock him about how much time he spends talking about cows and persuading anyone who will listen about the wonderful future of dairy and all it does for our communities.

## Taranaki start

Brent has not been in dairy all his life as he was born in Stratford and raised on a dairy farm in Inglewood. At the age of five his parents sold the farm to buy a larger one, but it was not to be. The price of land at the auctions went higher and higher so they leased the 120 cows out for the following season thinking they would buy a farm in the next season. But the prices went higher so the cows were sold and they lived on five acres just out of New Plymouth. He attended New Plymouth Boys' High and most Saturdays would head off to his friends' farms for a day of hard work.

## Russia, London and New York

After graduating with a BCA at Victoria University in Wellington in 1992, and three years 'doing tax' in the Wellington office of accountants Coopers & Lybrand, Brent was sent to Russia. He spent three years in Moscow with PwC. 'It was an amazing time. The capital markets were just developing so we were able to be creative, but in hindsight I am not sure whether we really added to the productivity of the country,' he says.

Russia was a huge learning curve for Brent. He worked with large banks and private equity funds that were investing billions into the Russian economy. 'I really enjoyed bringing a practical approach to resolving some tough regulatory, finance and tax issues. I guess I look at

most things positively, wanting to see the opportunity and to resolve it so that all parties are better off.'

After Moscow it was off to London. Working in the PwC Capital Markets International Tax team on synthetic financial products he feels that, 'although I learnt a huge amount, I'm not sure if we actually made a difference to anyone other than rich people.' One of Brent's Russian clients then hired him into their venture capital fund as the finance director working one week in London and one week in New York for 18 months.

It was during this time that Brent married Delwyn and they went on to have two daughters. After settling in New York for a while they returned home in 2003 to Auckland. Delwyn's parents were dairy farmers in the Waikato so this also fulfilled his desire to be closer to the land.

## Waikato first farm

During the 2008 global financial crisis they bought their first farm with Delwyn's parents at Ngarua (between Matamata and Morrinsville), with 80 ha and 320 Jersey cows. They took the farm from 67,000 kgMS to 116,000 kgMS over the next five years on System 2 with the help of farm consultant Peter Kane. Brent says, 'Peter has been absolutely awesome for us. He has taught me to respect science, value grass and to love the cow. He will often challenge our thinking and is always thinking about profit, people and the land. He is a great example of a farm consultant.'



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## In the US where Grasslands have 14 dairies it is excellent to see our staff join the business and progress to managers, contract milkers and then 50/50 sharemilkers. We often send our best US people to New Zealand for a season or two.

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During this period Brent would travel down from Auckland to help on the farm. Subsequently, over a period of five years they bought four more farms.

In 2014, Brent and Delwyn went into an equity partnership at Ballance with 660 cows on 300 ha. Also in 2014, they bought into the family farm of her parents, together with the 50/50 sharemilkers who had worked on it for five years. Brent is the first to admit that an equity partnership of three is very different to the original partnership with Delwyn's parents. 'We needed more formality, we had to draft the partnership agreement to protect against downside risk, people had their various accountants and advisors that they wanted the partnership to use, and it was just not as straightforward. But the learnings were very useful.'

In 2014, Brent, Delwyn and the girls moved to the Waikato. They needed to be closer to the cows and PwC has an excellent office in the Waikato. Brent lead the office and the PwC Agri Strategy for New Zealand. He says, 'I loved working with farmers, families and helping them to set and strive for goals.'

In 2015, they brought a further 45 ha at Ngarua and built a 40-a-side Waikato milking shed to milk 460 jersey cows there. In 2017, that equity partnership expanded to another Te Awamutu farm with 560 cows. For Brent it was a real stretch, and he notes that without the Fonterra flexible share up programme over six years they could never have bought it.

Brent and Delwyn also manage with another couple a 3,000 cow operation for two brothers and their families over five platforms. 'This has been an interesting experience. I have to report to a board, hiring and developing staff, and working with many competing priorities. There is a real responsibility when you are the custodian of the land and assets for others,' he says.

### Grasslands involvement

Then Delwyn said no more cows. So there were to be no more cows.

Nearly. In 2016 Brent went on the board of Canterbury Grasslands and they are 'very, very, very small' shareholders. He is also the chair of the Finance and Risk Committee. Grasslands have grown a lot and over the past three years, and they have expanded into Southland where they currently milk 7,000 cows. There are another 8,000 cows in Canterbury and 7,500 cows in Missouri, US. Brent feels it has been great to be part of a major dairy operation.

'We try to keep the family spirit. It is wonderful to see people grow and develop. In the US where Grasslands

have 14 dairies it is excellent to see our staff join the business and progress to managers, contract milkers and then 50/50 sharemilkers. We often send our best US people to New Zealand for a season or two. What is interesting is that as we have been brought up in a pasture system we understand what it can do and continue to push to improve. However, in the US the team have not seen what can be done, and therefore when they come to New Zealand their eyes are opened and they absolutely fly. It is wonderful to see', he says.

### Fonterra director

Last year he left PwC to become a director of Fonterra. Brent gets more serious when he is speaking about the co-op. He talks about the responsibility, the farmers, the communities, and the New Zealanders who rely on Fonterra doing its job to deliver a great milk price. He is passionate about the good things that Fonterra, its farmers and staff do every day around the world. But at the same time he is refreshingly honest about the challenges that lie ahead.

These challenges include issues around the Dairy Industry Restructuring Act 2001, winning the hearts and minds of not only New Zealanders but also farmers, and the challenge of trade in a world that is potentially becoming more localised. He is proud of a strong milk price, but is also open about the improved performance needed from a number of business units if Fonterra is able to pay a good dividend and have positive growth in its share price.

### NZ Fieldays Society

Brent has also been on the board of the NZ Fieldays Society, which he has enjoyed. For him, it has been great to see what a few farmers started 50 years ago has become an event that so many look forward to. He believes that the advancement of agriculture in New Zealand is very important and it is good to see Fieldays really investing in careers and health in the primary sector. For Brent, the hundreds of volunteers are the real heroes of Fieldays and it demonstrates what can be achieved with the cooperation and efforts of many individuals.

### Global responsibility

Brent is an example of how an industry can attract and motivate people. He has the last word: 'The dairy industry is so important and the role we have in feeding people in this country and globally is only going to become more important as time goes on. In particular, dairying in New Zealand is a real privilege which we should not take for granted. We have a role to produce the highest quality food in the most sustainable way.' **J**

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