ravensdown

INSIGHT AND ACTION FOR AGRICULTURAL SUCCESS

# ground EFFECT

Spring 2019
EDITION 9


"We don't want to be throwing stuff where it doesn't need to be."

**Dean Rabbidge, Rabbidge Farms Ltd**

## How "fixed" is your P?

Dr Ants Roberts, disproves the myth

## Kiwi farms leave smaller carbon footprint

Dr Stewart Ledgard explains the Life Cycle Assessment of NZ's produce

# WELCOME TO THE NINTH EDITION OF GROUND EFFECT® FROM RAVENSDOWN

**Do you skim, scan or scour every page of Ground Effect? Whichever way you read it, the vast majority of readers flick through their paper copy rather than click on an electronic version.**

Ground Effect is designed to be picked up, passed around and perhaps even kept. For this reason, this publication has been printed and posted since it started four years ago.

The paper it's printed on is from responsible sources and can be recycled.

NZ Post insist on wrapping publications such as these. From this edition, Ground Effect will be protected by a cornstarch-based material that is totally compostable. It's just one little step, but if everyone gives this wrapping a go, the impact will be massive.

With water quality being such an important issue, there's no surprise that many of the articles are connected to that topic in some way.

First up, Professor Rich McDowell looks at phosphorus losses and lists some mitigations. Then Dr Martha Trodahl outlines the potential for some modelling software that points out the nutrient hotpots so those mitigations can be more targeted in areas that matter most.

Another modelling tool in the news is Overseer®. The government has agreed with stakeholders like Ravensdown who state the case for a serious investment in more peer reviews and datasets. In the June budget, $43 million was committed to the tool which is a great endorsement of the approach outlined by the Overseer team on page 40.

It's always interesting seeing a perspective from overseas. Sometimes we are too close to the challenges to appreciate all the good work being done. So it's great to see the viewpoints from Ireland on page 33.

Over in the northern hemisphere, the idea of "food miles" is sometimes used to cast NZ produce in a negative light as if the freight is the only stage in the product lifecycle that has a carbon footprint. But Dr Stewart Ledgard shows how a more holistic view casts "Blighty-bought" NZ lamb in a much more favourable light.

Perhaps one of the reasons is farming's efficiency. Jana Hocken writes about how the car industry's approach to "lean" management can help the agsector. The potential for mapping and ordering tools to reduce errors and double ups is covered on page 28. Essential inputs such as lime, potassium and clover seeds are also assessed.

I hope you enjoy reading this edition and that the earthworms enjoy eating the wrapping!

Best regards
**Greg Campbell**
Ravensdown Chief Executive

CEO@RAVENSDOWN.CO.NZ

# Ground Effect® Spring 2019

# This edition


**10** **Getting ahead of compliance**
Wyndham farmers, Dean and Sarah Rabbidge collaborate with Ravensdown to navigate environmental compliance early

**24** **Improving your farm engine**
Applying Lean management to your dairy farm

**28** **Automated technology leads to greater farm efficiencies**
HawkEye helps Craig Minson spend more time on farm

**29** **Targeted approach to pasture management**
New Zealand Dairy Industry Award winners run a low input system

**33** **From the Emerald Isle to the Land of the Long White Cloud**
Irish Dairy farmer Denis Finnegan says we have a lot to learn

**40** **Overseer Agile and insightful**
A new approach for continuous improvement


## Thought leaders


**6** **Farmer actions improving water quality**
By Professor Rich McDowell, Chief Scientist for Our Land and Water National Science Challenge

**14** **Reflection on the Irish connection – and our water future**
Dr Vera Power, Fertiliser Association of New Zealand Chief Executive

**38** **Farm planning for a sustainable future**
Insights, tools and learnings from Nuffield Scholar Turi McFarlane


## Science and advice


**9** **The myth of "fixed" P**
By Dr Ants Roberts

**15** **The pasture worm burden**
Findings from trials on Scott McLean's Southland farm

**18** **LUCI-Ag mitigation solutions**
LUCI-Ag tool explained by Dr Martha Trodahl

**20** **Visualising nutrient loads**
Valuable insights

**22** **White clover**
By Jeremy Klingender

**27** **Evenly spreading soil conditioner**
Lime spreading trials worthwhile

**30** **Kiwi farms carbon footprint**
By Dr Stewart Ledgard

**34** **Playing catch up on sediment loss**
Catch crop technology

**36** **Potassium on sedimentary soils**
By Sonya Perkin

**37** **Potassium on North Island ash soils**
By James Livingston

**42** **Source Code**
Cited articles and sources




# BEHIND THE SCENES

**Ravensdown is enabling smarter farming for a better New Zealand**

## Three awards for ClearTech

Professors Keith Cameron and Hong Di of Lincoln University have celebrated winning three different awards for their research into the ClearTech® dairy effluent system. After winning two innovation awards at the South Island field days and at the national Fieldays®, the duo were presented with the Science & Research Award at the Primary Industries Awards in Wellington. The pair have tested the theories that the coagulant-clarified water would be able to be safely reused as yard wash and that the effluent and water would be safe to irrigate or apply to pasture. The results[1] showed significant reductions in leaching losses of total phosphorus, dissolved reactive phosphate (DRP) and *E. coli* from ClearTech-treated farm dairy effluent.

## Overseer gets backing

The government has given a very public endorsement of the Overseer nutrient modelling system by announcing a $43m boost in the June budget.

## Farmer of the year

James Robertson, a business graduate at Fonterra, is the youngest to ever take FMG Young Farmer of the year. He is the only entrant to also have won the TeenAg Grand Final (in 2013).

## Hugh Williams Scholarship Awarded

Congratulations to this year's recipient of the Hugh Williams Memorial Scholarship, Tom Wilson. Tom is studying for his Bachelor of Agricultural Science at Massey University. He is actively involved in the agricultural sector and presented his research on the feasibility of an updated Spreadmark test at the annual Fertiliser and Lime Research Centre conference this year.

## Primary Industry gong goes to CEO

CEO Greg Campbell was named Chief Executive of the Year at the inaugural Primary Industry Awards. Judges commented on Greg's ability to demonstrate the important skills of partnership and relationship building as well as leading the transformation at Ravensdown. The award was seen as a team effort by Greg who thanked all those involved with smarter farming.


## NZDIA SFOTY winners

Congratulations to the 2019 New Zealand Dairy Industry Awards Share Farmers of the Year, Colin and Isabella Beazley. They are also the deserving winners of the coveted Ravensdown Pasture Performance Award, which includes a $5000 prize pack. That, combined with our Share Farmer of the Year prize of $7000, will make a nice contribution to their pasture for 2019.

(1) see Source Code page 42

## Thought Leader: Rich McDowell

# FARMER ACTIONS IMPROVING WATER QUALITY

**By Professor Rich McDowell, Chief Scientist for Our Land and Water National Science Challenge**

PROFESSOR RICH MCDOWELL, CHIEF SCIENTIST FOR OUR LAND AND WATER NATIONAL SCIENCE CHALLENGE

**Phosphorus has decreased at 60% of measured sites since 2004. On-farm actions, to mitigate phosphorus loss from land are likely to have led to this improvement, along with policy instruments and industry guidelines.**

To celebrate the discovery of phosphorus 350 years ago by Hennig Brand, I thought I'd offer my thoughts to what could be argued as the element that drove productive agriculture in New Zealand – but whose judicious management now plays a role in protecting our waterways.

I've been working on phosphorus (P), nationally and internationally, for about 25 years. When I started, I used to have hair. What hair remains is now grey. Although people (chiefly my nine-year-old daughter) tell me I'm not that old, I am experienced enough to reflect on how the issue of P in water arose, has been assessed and what progress has been made.

Within the Our Freshwater 2017[1] report by the Ministry for the Environment was some interesting data. Analysis showed that from 1994–2013, 41% of routinely monitored streams and rivers showed decreasing concentrations of total P, and from 2004–2013 this increased to 65%.

I've met a lot of farmers who've just got on and done something about reducing contaminant loss from their land. Perhaps the efforts of these farmers are being rewarded?

To explain these decreasing concentrations of P, a few colleagues and I examined national datasets, such as changing land use, P fertiliser use, soil Olsen P concentrations and the use of policy and actions. We analysed the data to come up with a semi-quantitative estimate of the likelihood of nine potential reasons to explain these improvements[2].

We found the three most probable causes for improvements were:

1. On-farm strategies were mitigating phosphorus loss from land.
2. Industry guidelines were directing where to best use strategies (for example, in Critical Source Areas).
3. Phosphorus was being mentioned more (and acted upon) in policy instruments.

Although the data was less clear, other contributing factors to the decrease in P concentrations included changes in land use decreasing erosion, more nitrogen fertiliser use was (inadvertently) assimilating P in the soil, and a greater public understanding and awareness of phosphorus as an environmental issue.

> **"I've been working on phosphorus (P), nationally and internationally, for about 25 years. When I started, I used to have hair."**

Finally, our research found little evidence that decreasing P concentrations were caused by a decrease in soil Olsen P concentrations, fertiliser use or imported feed, or change in fertiliser form. However, this doesn't mean these practices won't help – more likely, it's because these practices aren't yet widely adopted across whole catchments. Using low-water-soluble-P fertilisers in Critical Source Areas (CSAs) remains one of more than 40 mitigations recommended to decrease nutrient losses.

Let's think about this a little bit further. Phosphorus losses are complex, being episodic and originating from some areas more than others. We've been calling these areas CSAs for some time.

Research has shown that targeting mitigation actions to CSAs is (on average) six to seven times more cost-effective than an untargeted approach[3,4]. We also know that as of April 2018, CSAs were mentioned in 159 documents in New Zealand (47 were

### Cost effectiveness of P mitigation

| Speed of treatment | Slow | Med | Fast |
|---|---|---|---|
| Score | 1 | 2 | 3 |

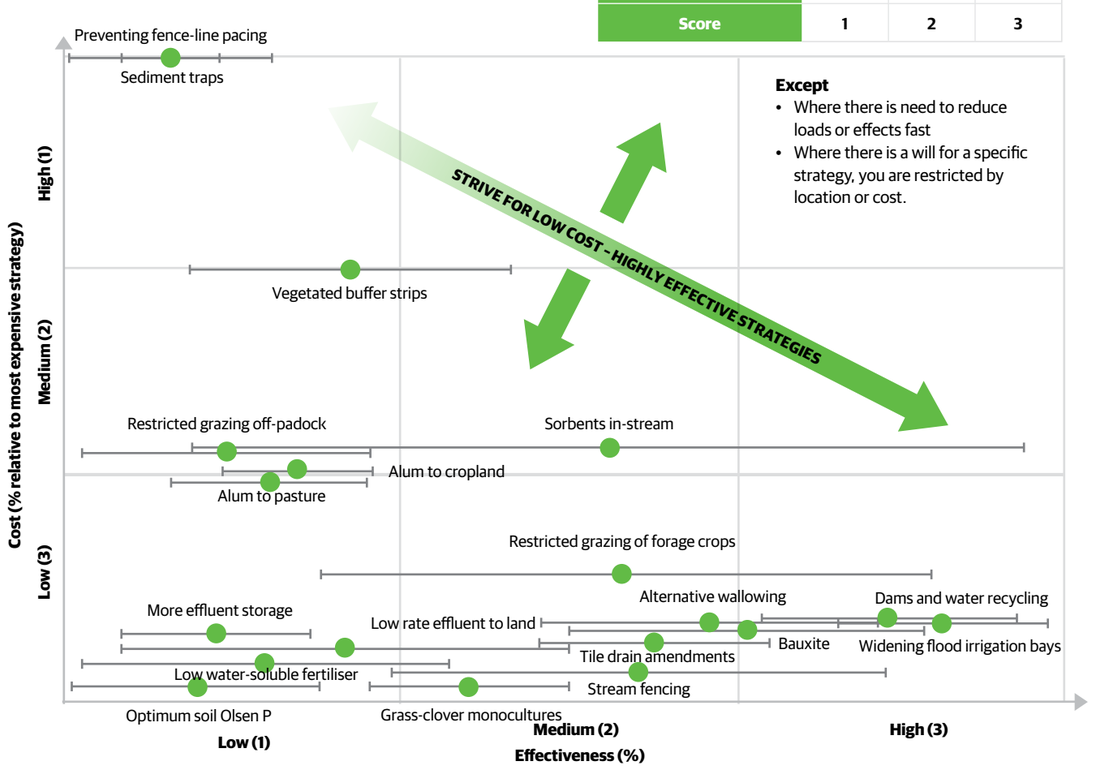



FIGURE 1: The relationship between mean cost and effectiveness of actions along with the likely speed of treatment. The numbers refer to a system for ranking similar actions based on cost, effectiveness and speed of treatment relative to the receiving environment.

**Ravensdown Mitigation Technologies**

LUCI AG — LAND UTILISATION & CAPABILITY INDICATOR

**Step 1:** Identify Critical Source Areas (CSAs)
**Tool:** LUCI-Ag

IntelliSpread

**Step 2:** Avoid CSA and sensitive areas
**Tool:** Precision placement technology such as IntelliSpread

(1,2,3,4) see Source Code page 42

academic papers, 75 were from policy, 30 were from industry, while 14 were from non-governmental organisations). Prior to 2014 this number was less than 30.

But how do we know what areas are CSAs? Or how much of my farm P loss is the CSA contributing and how do I manage it? Without muddying the waters (pun intended), Overseer can describe P losses from CSAs, but only when set up correctly. Often this means having blocks that are different to those used for nitrogen (N). I know Overseer is not 100% accurate, but it captures the performance of most farming enterprises most of the time, and certainly enough to inform users about farm P losses. When set up correctly, the difference between measured and predicted P losses is less than 30%.

**"I've met a lot of farmers who've just got on and done something about reducing contaminant loss from their land. Perhaps the efforts of these farmers are being rewarded? "**

However, depending on the diversity of soils, landforms and climate in your property, setting up different blocks for P compared to N could result in too many blocks to contemplate, let alone map and manage. Enter the Farm Environment Plan (FEP). The fertiliser industry has now developed software and systems to capture CSAs, thereby using the best available knowledge to map where problems are occurring and plan how to decrease them.

When applying mitigations, such actions should only be done after accounting for their suitability to your system, their cost, effectiveness and speed. If not, you could be doing things that are costly, ineffectual or take too long to have the desired effect.

Our Land and Water research has produced guidelines for mitigating P, N, sediment and *E. coli*. These guidelines aim to group and rank actions to present the least cost, most effective and quickest actions that will bring about change in the receiving waterbody. An example is given in Figure 1, while the full text can be found in 'A strategy for optimising catchment management actions to stressor-response relationships in freshwaters' (Ecosphere, 2018)[4].

Some of these guidelines have been implemented in the software and systems that drive FEPs, but others haven't. This implies that further mitigations are possible, particularly targeted to CSAs, reducing contaminant losses and improving water quality at a cheaper and faster rate than at present. ■

## What's the issue with phosphorus?

Algae grows when it's warm and sunny and streamflow is stable (storms flush algae away) - usually late spring to mid-autumn. The National Policy Statement for Freshwater Management requires regional authorities to reduce algal biomass (periphyton) to < 200mg chlorophyll-a m-2 (which is like having 30% of the stream bed covered in algae).

The addition of P to water can stimulate algal growth when conditions are ripe and when P is limiting. There is a balancing act between nitrogen (N) and P in water, and the term limitation refers to the nutrient that is in shortest supply. When limited, algal biomass will correlate to the concentration of the limiting nutrient.

Across New Zealand, P limitation of algae is common, but so too is N-limitation. We therefore focus on reducing both N and P losses from land.



# HOW "FIXED" IS YOUR P?

**By Dr Ants Roberts, Ravensdown Chief Scientific Officer**

**DR ANTS ROBERTS**
**RAVENSDOWN CHIEF SCIENTIFIC OFFICER**

**One question I hear very often revolves around the "locking up" of phosphate (P) fertiliser in soils. The locking up or fixation of P implies that this P is no longer available to be used by the pasture for growth, so is this true?**

Your pasture plants take up P from the soil solution (water in the soil micropores). The amount of P in soil solution at any one time is very small. This is just as well because if there was a large amount of P in soil solution it would be able to be leached out and could cause surface water quality issues.

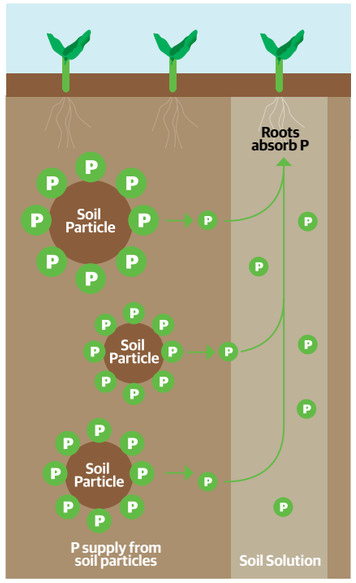
However, the P in soil solution is in balance (dynamic equilibrium) with the P stuck on the surfaces of soil particles (retained P). As plants remove P from the soil solution, some of the retained P comes off the soil and goes into solution for the plants to take up. Rather than seeing the P-retention nature of many New Zealand soils as a liability, this soil property is an asset because it means your soil acts as a store for P. This store, built up from one or two fertiliser applications a year over several years, releases P continuously into soil solution to replace P used by plants over the rest of the year.

Different soils retain more P than others. The P retention test, or anion storage capacity (ASC), measures the ability of soils to retain P. This, in turn, gives an indication of how much P fertiliser needs to be applied. For example, Taranaki volcanic ash soils generally have ASCs of 90% plus, whereas Canterbury sedimentary soils typically have ASCs of 30-50%. This means more P fertiliser will be required to overcome a P deficiency or maintain P levels on Taranaki soils than on Canterbury soils. It doesn't mean that on a soil with an ASC of 90%, that 90% of the P fertiliser applied will become locked up and totally unavailable to plants!

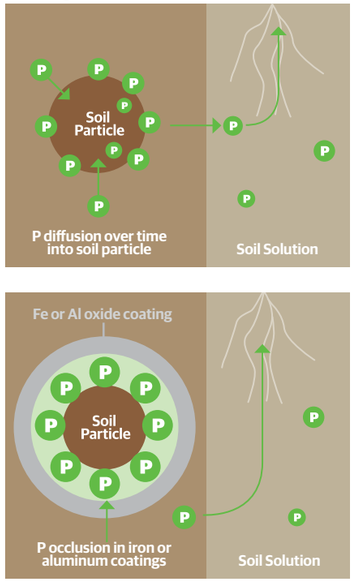
This isn't the whole story either. There is some P added to soils that becomes lost to plant uptake forever. This P moves into the structure of some clay minerals (diffusion), or sometimes gets trapped (occluded) in iron or aluminium coatings around soil particles. This is 'fixed' P and is generally the proportion of P that is truly locked up and not available to plants. Soils with high ASCs will often have a greater amount of fixed P than soils with low ASC. The processes of retention, diffusion and occlusion are all factored into the P recommendations for your soils. For example, on average, it will take about 10kg P/ha to shift the Olsen P test one unit on a Taranaki ash soil and only 5kg P/ha on a Canterbury sedimentary soil, and maintenance P fertiliser levels are 5-10kg P/ha lower on sedimentary soils.

On balance, P retention is an advantage rather than a drawback. Although the fertiliser P bill will be higher on farms with high ASC soils, these soils also hold onto sulphate-sulphur better and generally have a lower S requirement than low ASC soils. ■

**Positives of P retention**




**How P gets fixed**




**P STORAGE AND FIXING MECHANISMS ADAPTION FROM MCLAREN AND CAMERON[1]**

(1) see Source Code page 42

# GETTING AHEAD OF COMPLIANCE

By Victoria O'Sullivan

NATIVE BUSH MAKES UP 40HA OF THE PROPERTY

**Navigating the waters of environmental compliance can be tricky, especially as many regional policies remain in a state of limbo. With the Southland Water and Land Plan looming, Wyndham farmers and Ravensdown shareholders Dean and Sarah Rabbidge have taken the proverbial bull by the horns and set themselves up for compliance early.**

To help them navigate the path forward for their dairy, sheep and beef business, they've called on both their Agri Manager Sally Knowles and Senior Farm Environmental Consultant Mark Crawford for support in completing their environmental compliance. This includes nutrient budgets across all three properties as well as their lease block.

The 298ha Rabbidge family farm at Glenham sees 130 years of ownership in 2019, with Dean being fifth generation. Dean and Sarah's children Ted (4) and Ida (2) take a keen interest in all things farming, so a sixth generation is likely.

Dean came home to oversee the conversion of their 72ha, 190-cow dairy farm after graduating from Lincoln University and working as a technical field representative. Sarah comes from town but loves the environment it provides for Ted and Ida growing up.

It's been a constant state of flux for their business since they went through succession with Dean's parents, Stephen and Bev. They have recently leased an adjoining 165ha to the home farm and run a 108ha support block near Mataura Island. The home and lease block together will carry 4,400 ewes and winter 100 calves.

"You can talk to people and they want a status quo budget," says Dean, "but we've always had a fundamental change each year. Nothing too radical, just expansion and growth, which has been pretty cool."

## An unusual challenge

Dean says the key challenge they face on the farm is trying to get everything interlocking with matching stock to feed supply across properties.

"Our biggest challenge here is that we can't grow any grass here for 100 days from May 1, making it a long winter. We set up for spring – lambing, calving – from January. We aren't like the rest of the country where the biggest limitation is carrying capacity over the summer - it's what we can carry in the winter," he says.

That comes with a whole additional set of environmental challenges.

"We've got intensive winter crops and break fencing and all that sort of carry on, which is quite challenging at the moment."

Facing a sobering reality on the way they manage their winter grazing has prompted Dean and Sarah to act.

With the Southland Water and Land Plan rules, cultivating a slope over 20 degrees is going to require a resource consent.

"Twenty degrees is quite steep, but I have a feeling that the Ministry [for Primary Industries] is going to come in and override that and make it 15 degrees, which is most of our property," Dean says.

"Even though we're using no till and other measures the reality is it could make it pretty hard to farm. If we can't carry the stock we need through the summer for the winter, then this is going to force us to be a trading property, and if everybody else is trying to trade too then it's going to be a disaster."

## Proactive solutions

Dean has been actively engaging with Environment Southland (ES) to complete Farm Focus Plans. They have even hosted a

DEAN AND SARAH WITH CHILDREN TED (4) AND IDA (2)

busload of Environment Southland policy staff on farm to talk about the Plan.

Ravensdown's Sally Knowles says she has been impressed by Dean and Sarah's proactiveness.

"Dean approached me to see if we could get some nutrient budget work underway, both to be proactive and to ensure that what they're doing on farm is going to work under the new rules-based system, when the Southland Water and Land Plan comes into place," Sally says.

Sally visited Dean with colleague Mark Crawford to formulate a plan around creating nutrient budgets. They each decided on specific roles for the process – Sally as the conductor, Dean on data entry, while Mark will take on the role of internal auditor/sense-checker.

"The synergies of involving both the agri manager and the environmental consultant are beneficial for the farmer," Sally says.

"By having me involved with the planning it helps ensure all of the information is correct, and I'm able to provide some of the detail to save time and money for Dean and Sarah."

Overseer nutrient budgets are the first step needed in the process, because the budget identifies the risks for the Farm Environmental Plan (FEP).

Mark says Overseer is about inputting accurate data in an organised format for information on the farm's environmental risk.

"The Farm Environmental Plan (FEP) is about those risks and the Good Management Practices (GMP) Dean is using to mitigate them. From this comes an outstanding action list."

The alignment of the fertiliser plan with the FEP follows the completion of the nutrient budget and subsequent review by a Certified Nutrient Management Advisor (CNMA).

"There's no way the fertiliser plan can be aligned unless you have all three [Overseer, FEP and nutrient budget] in sync," says Mark.

GIS files will be downloaded to Ravensdown's farm mapping software HawkEye®, so the map Sally uses to do the fertiliser plan will be the same map that Dean enters all his data for Overseer.

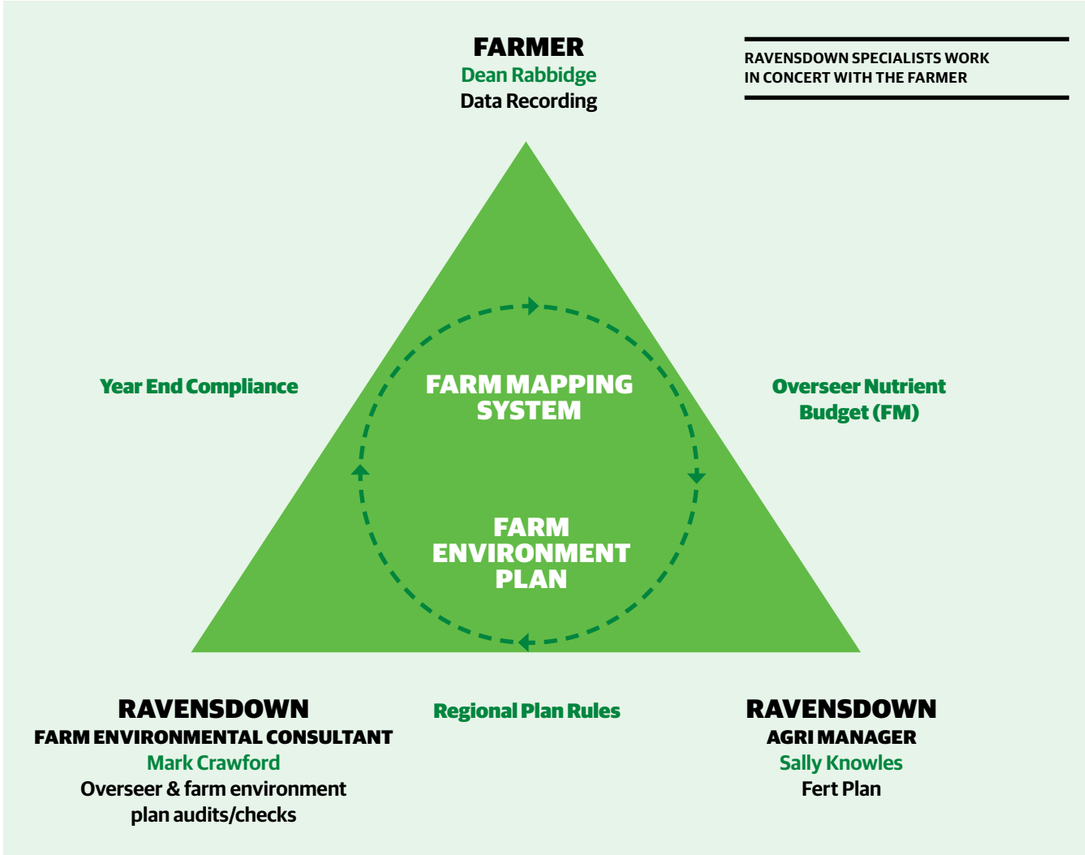
Mark says the key will be ensuring the nutrient budget is "honest and robust".

"It's all about trying to tie everybody in together so we're all working off the same page, and to help Dean to summarise all of the above into a single-action-list, which will be something that can be adjusted easily and reviewed annually. The next step is putting the action plan into place such as the Good Management Practice, mitigations, and the low-hanging fruit if you like."

"It's about minimising financial inputs as well," Dean says. "Making the most out of the bottom line. We don't want to be throwing stuff where it doesn't need to be - we want to be prioritising our actions."

When it comes to nutrient use, the Rabbidges have been


DEAN AND SENIOR ENVIRONMENTAL CONSULTANT MARK CRAWFORD DISCUSS MITIGATION MEASURES




diligent in understanding their soil needs.

Dean has been working with Sally on Whole Farm Soil Testing (WFST) for about eight years, beginning on the dairy farm and moving to the sheep and beef property about six years ago.

Their policy is to do one of their three separate properties each year.

"It's amazing how things have changed," Dean says. "When we first did Whole Farm Soil Testing, we were probably a bulky driver's nightmare. But now on the likes of the home-farm, fertiliser will probably be one blanket application next year - the same brew, the same rate - because everything has either come up or come down appropriately to the same level."

He says the dairy farm is close to this stage too, while the run-off block will take slightly longer.

"Whole Farm Soil Testing is a wee bit of a cost up front, but we're really seeing the benefits of it now - we've reduced our fertiliser bill dramatically, and the amount we've been putting on quite considerably."

Dean says they are vigilant about planning and selecting crop paddocks, testing one to two years in advance to ensure nutrient levels are right.

"We put a fair bit of work into ensuring we get good winter crops. You don't have to increase here by much to make it cheap by cents per kilogram of dry matter. Last year we did swedes for 7-8c/kgDM and fodder beet for 14c/kg DM, which is about the equivalent of grass."

"It makes it quite worthwhile, good bang for buck," Dean says.

They are very targeted in their N fertiliser use, which means they have lower leaching.

"We use a below-average amount on the dairy farm and a bit to establish our winter crops, which is all calculated usage."

Dean says the only other time they use WFST is to cover for seasonal feed pinches, like coming out of a dry season or when they have carried more stock for expansion purposes. Clover is valuable in their pastures, but lately has taken a hiding from clover root weevil.

He says they are proactively working to control phosphate and sediment loss with mitigation measures.

"Given the contour and slope of the property, P loss is something we're trying to mitigate. We do this with plantings, tactical grazing, only putting stock in our more free draining paddocks when it's wet and by trying to maintain higher covers in certain paddocks."

One of the big tasks they are undertaking is putting in a stock water-scheme and fencing to protect the waterways.

"We've got running water in every paddock so that's a big challenge for us."

"It's not a quick or a cheap fix. It's a big undertaking, but we're going to start off by getting the total stock exclusion area done so it's big enough to handle all the cattle on the home farm, so all the cattle are out of the creeks, and then start growing out from there."

## Taking a leadership role

Dean is not afraid to speak out on issues for farmers as an advocate for New Zealand's primary industries. He has twice been a grand finalist in the FMG Young Farmer of the Year competition, representing Otago/Southland, and he's been the contest chairman and a board member for New Zealand Young Farmers.

He believes it is important that farmers stand up and tell their stories to help counteract negativity in the media.

"There's a lot of noise out there - but much of it is targeted at five percent of operators. The majority are doing a really good job and are making really conscious efforts," Dean says.

"Whether we're going to have to do more, and how we actually do more, I don't know. We're just going to have to be smarter." ■

## Thought Leader: Dr Vera Power

# REFLECTION ON THE IRISH CONNECTION - AND OUR WATER FUTURE

**By Dr Vera Power, Chief Executive, The Fertiliser Association of New Zealand (FANZ)**

DR VERA POWER CHIEF EXECUTIVE, THE FERTILISER ASSOCIATION OF NEW ZEALAND

**When thinking about farming in New Zealand, I automatically compare New Zealand with Ireland. This is partly because of the similarity of pasture-based agriculture, but also because of my whakapapa, having been raised in Dublin.**

Ireland is going through a significant dairy boom, which will likely increase its environmental footprint. Limited tools are available to manage the environmental impacts of dairying in Ireland. While national targets for water quality can be set, local government doesn't have real powers to regulate for the environmental impact of diffuse nutrient losses. The Irish approach is built around financial incentives to the farmer, demonstration of good practice and community engagement to encourage improvements to water quality.

In Ireland, as in other parts of Europe, many farmers receive financial incentives to manage nutrient losses through payments to reduce stocking rates or control nutrient inputs. There is also support for infrastructure development such as effluent storage facilities.

In contrast, New Zealand is a bit more about stick than carrot. New Zealand's unique resource management system encompasses the management of diffuse losses and their impact on the environment. Farmers and growers are expected to make significant changes to manage nutrient losses, facing the full cost of the transition that is required.

Differences in approach possibly reflect the different drivers. In Ireland, concerns about water quality come from Europe rather than being community driven.

Good farm and nutrient plans are increasingly part of New Zealand's transition. According to the last agricultural census, almost 40% of New Zealand farms now have some formal nutrient planning document in place. These plans are beginning to address the improvements in farm practice that are needed to meet our aspirations for water quality.

In New Zealand, we expect to be able to swim in and gather food from our waterways. This isn't a common goal across Europe, where managing sites for swimming tends to be the exception rather than the rule. If you look at Ireland, only a couple of freshwater sites are managed for swimming, mainly sites on lakes.

New Zealand's unique environment sets an additional challenge. Having clear rivers and warm summer temperatures creates a breeding ground for algae when excess nutrients become available. Managing nutrient inputs to control algae growth is a tight balancing act.

Most New Zealand councils are well underway with setting limits, so we're starting to get a picture of what is going to be required to achieve the water quality that our communities desire.

Regional councils have done a great job of making data on water quality available on their LAWA website. The site tells an interesting story of water quality around the country, with a bird's eye view of water quality measures for each region. In Canterbury, nitrogen is an issue. Auckland, Southland and Waikato, while having lower concentrations than Canterbury, are still pretty elevated.

If you look at the river water quality in terms of phosphate you get a different story, with higher concentrations of sediment-bound phosphate in Gisborne and Horizons regions. This demonstrates the challenge of managing easily erodible soils.

In terms of 'bugs', Auckland has much higher average concentrations than other regions. This is of course a 'high level' view - in fact this average will be made up by some rivers of pristine quality and some rivers that are a lot worse than any average value.

**"Differences in approach possibly reflect the different drivers. In Ireland, concerns about water quality come from Europe rather than being community driven."**

The recent report 'Environment Aotearoa 2019' sets a gloomy picture on the current state of water quality. However, it does emphasise that it will take a community approach if we are to solve the issue and deliver the sort of water quality that all New Zealanders aspire to.

Changes are always painful for all involved. Water quality improvements will be gradual and will likely be achieved stream by stream. But the improvements that have already happened give us reason to be optimistic about the future. ■



# THE TRUE COST OF A PASTURE WORM BURDEN

**They're small but they pack a punch. The third instalment of our series 'controlling the worm burden on pasture' looks at the impact a serious pasture parasite contamination can have on farm financial performance.**

High pasture contamination of worm larvae is not easy to detect, but it can severely impact the performance of your stock - something Southland farmer Scott McLean has come to know first hand. He estimates the underperformance of his ewes cost him at least $52,000 in lost production in one year.

Worm drench practice on New Zealand sheep farms mirrors the way traditional sheep breeds develop immunity to worms as they age. A critical, but often overlooked part of worm control has been the important role adult ewes play in controlling and reducing the pasture contamination of worms on pasture, where ewes effectively 'mop up' infective larvae present on the pasture, without the need for regular drenching.

In 2018 Dr Julie Wagner, Ravensdown Animal Health Product Manager, undertook a farm investigation on Scott's Thornbury property for suspected triple drench resistance, working in collaboration with veterinary parasitologist Dr Mark Vickers. Scott's composite ewes and lambs (Romney x Polled Dorset x Texel) were underperforming, despite being on good pasture and nutrition. But further testing revealed the problem was not drench resistance as first suspected - instead the ewes appeared not as resistant to parasites as would be normally expected. They were acting as the major worm contaminators of the pasture, a role usually associated with immature youngstock.

Fast forward almost a year, and the performance of Scott's ewe

SOUTHLAND FARMER SCOTT MCLEAN

flock has improved markedly following a Ravensdown trial.

"The farm has turned around, as far as animal performance, health and body condition. The ewes went into lambing in great condition as a result of using Centramax capsules," Scott says.

"Our lambs were born heavier and continued through to weaning. The weaning draft was excellent, with 540 ram lambs sent away at 18kg compared to last year, when we sent 280 away at 17kg. The better ewe condition has made farming easier on our property – we haven't had to build light ewes up all summer, whereas last year we had 500."

In April 2019, they had 330 lambs left on farm, a stark contrast to 2018's 1150 headcount, or in 2017 when they were forced to sell store lambs for the first time. The hidden costs of drenching and feeding lambs for longer, and the loss of land for other stock or purposes, has not been calculated.

## Trial and treatment

The Ravensdown trials undertaken showed that drenching lambs at 28-day intervals with Ravensdown Trio Sheep drench was highly effective. It identified straight away that the lambs were not the cause of the high pasture contamination on Scott's farm.

Instead, the problem was found to be with the mixed-age ewes, who maintained stubbornly high faecal egg counts through the summer and into early autumn. The average mixed-age ewe egg count was 370 eggs per gram (epg) and it stayed that way from January to April 2018. All ewes sampled over this period, at five different time points, had positive egg counts, which meant they were continually contaminating the pasture with worm eggs and infective worm larvae. This resulted in the poor performance observed both in ewes and lambs.

The Centramax capsule was used to break this cycle as it delivers two drenches (abamectin and albendazole) continuously for 100 days, killing both the incoming worm larvae from pasture and the adult worms in the sheep that produce eggs over this period. It also delivers cobalt and selenium, which can also help boost an animal's performance. By late March 2019, the mixed-age ewes had an average faecal egg count of 70epg – many with zero counts, which is the normal expected pattern in older ewes.

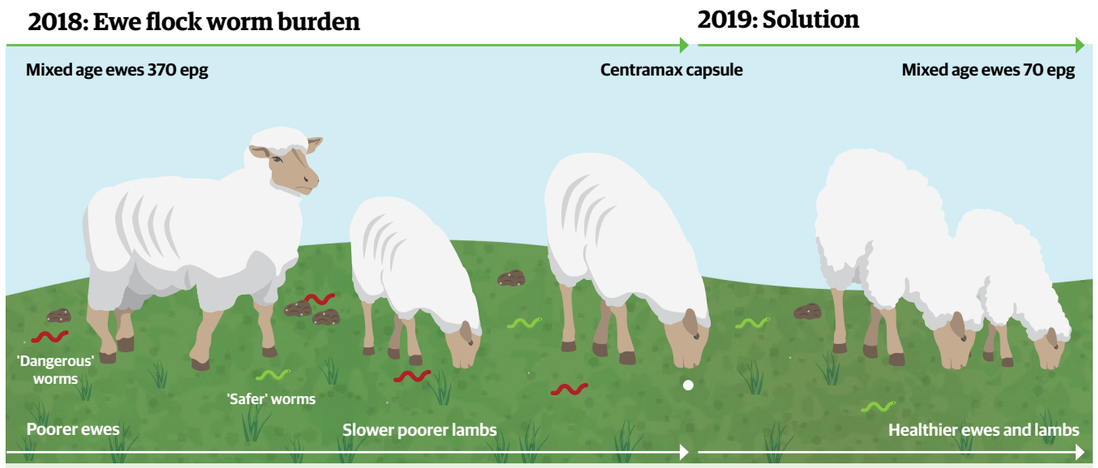
Since March/April 2018, Scott's ewes have gained around 8kg, weighing in at an average of 73.8kg just prior to tupping.

"It's still not known what triggered the mixed-aged ewes to behave in this way," Mark says. "It may be a vicious cycle – the result of a sudden seasonal build-up of high worm larval challenge on pasture, which in turn has reduced the ewes' immunity. This results in the production of more worm eggs, which then hatch into the pasture larvae that keeps the cycle going, and it's one the ewes find hard to break."

He says a situation like this could potentially happen on any farm.

"It's a timely reminder to all farmers not to forget about your adult stock. Check they're alright. Look and check that their egg counts are low, and not out of control. Adult sheep play an important role in mopping up worm larvae pasture contamination and also in shifting the worm population towards less damaging 'dangerous' worm types. A small number of faecal samples to determine the egg counts in your ewes, as in Scott's farm, may be money well spent."

Julie agrees. "It's important to keep an open mind. The mantra of 'do not drench adult ewes' isn't always correct. We recommend undertaking testing to help form a real picture of what's happening with worms on your farm – never just presume drenches are working well and your ewes are alright." ■




Last year, Scott's flock of ewes had a large number of 'tail enders or poor doers' (low body condition scores) resulting in lambs taking longer to reach their target weights and be sent off to market. These 'slower' lambs needed more drenches and ate more pasture that could have been fed to other stock. This resulted in increased cost of goods sold and translated into less profit. These 'tail enders or poor doers' ewes continued to contaminate pasture.

By eliminating the poorer ewes and lambs, income from sheep was increased by $52,000.

### What does this mean for you?

- Do not always assume that your ewes are the good ewes with safe worms.
- Test to know and ask for advice.
- Use the drenches responsibly.
- Use the immune sheep to leave the safe worms on the pasture.
- Breed for more immune sheep.

## Myth busting worms

**Myth** – Ewes do not need drenching.
**Busted** – Yes, they do when they lose their immunity and carry a high level of 'dangerous' worms as a result.

**Myth** – Scouring sheep have worms.
**Busted** – This is sometimes correct but there are many other causes of scouring in sheep such as gut infection or various toxins.

# LUCI-AG – IDENTIFYING HOTSPOTS AND OFFERING MITIGATION SOLUTIONS

**By Dr Martha Trodahl, Ravensdown Senior Technical Specialist**

**LUCI-Ag is a decision support tool that investigates current on-farm phosphorus (P) and nitrogen (N) losses. Developed for Ravensdown by researchers at Victoria University of Wellington, LUCI-Ag identifies nutrient hotspots and pathways on spatially detailed maps, which allows for targeted mitigation investigation to determine the best approach for in-stream water quality. This enables mitigations specific to a farm's management and biophysical environment to be explored and ranked according to effectiveness, prior to taking action and financial outlay.**

## How does LUCI-Ag work?

LUCI-Ag is based on geographic software (ArcGIS) that uses readily available national data, supplemented by your on-farm management data and knowledge. It uses this to develop spatially detailed maps and analyses specific to the property so you can see the nutrient hotspots on the farm map.

## Who is LUCI-Ag for?

In particular, LUCI-Ag works well on properties with rolling to steep topography, where there is a need to manage P losses. However, LUCI-Ag can be applied throughout New Zealand and is of potential interest to any farmers who want spatially detailed information about nutrient hotpots and pathways on their farms and who are interested in investigating the comparative effectiveness of a variety of mitigations prior to taking action.

## Water Quality Tools

Water quality tools within LUCI-Ag calculate P and N losses (or loads) at fine scale (≤ 15mx15m) over an entire farm. P and N loss estimates consider site-specific climate, soil, topographic, land-cover and land management variables. Actual farm management data is linked to LUCI-Ag via the farm Overseer file.

P and N losses are then cascaded, with water, through the farm according to topography. The tools spatially identify nutrient sources and hotspots, nutrient pathways, and potential 'sinks' where nutrients can be intercepted, avoiding loss into streams.

## Mitigation Tools

LUCI-Ag mitigation tools allow exploration of a variety of P and N mitigation strategies, targeted to the identified hotspots and pathways. Mitigations can be investigated individually and in combination to determine their likely effect on in-stream water quality. Mitigations available for exploration include:

- Modified fertiliser use
- Riparian planting
- Stream fencing
- Sediment traps
- Targeted planting, etc.

## Maps and Data

Maps and data summarising the results of the water quality and mitigation tools are generated by LUCI-Ag. These assist you to spatially identify and understand where your specific farm-nutrient hotspots and pathways are located, and assist with interpretation of both the current and mitigation scenarios.

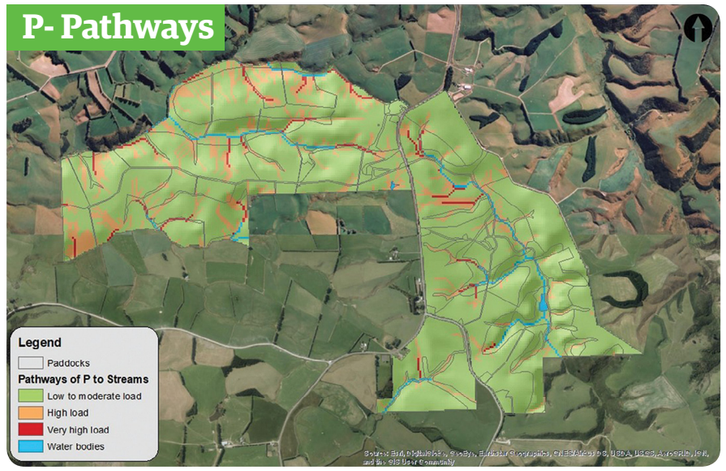
## How is LUCI-Ag different to OVERSEER?

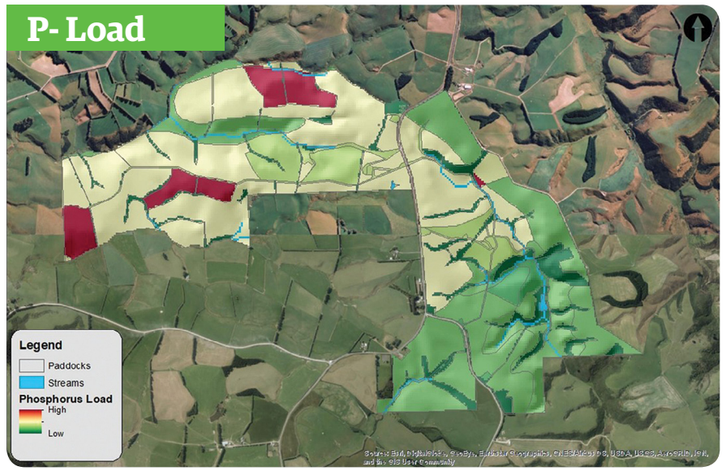
LUCI-Ag's spatial detail, identification of nutrient pathways and ability to explore mitigations are what differentiate it from other water quality and nutrient budgeting models.

Overseer quantifies nutrient loads by block (usually field to multiple field scale), but has no spatial component. Some organisations map block scale N and P loads to visualise loads across the farm and more recently, OverseerFM has also been developed with this capability. However, mapping of block scale nutrient loads neither considers within-block spatial variability, nor nutrient pathways to streams within the block or around the farm.

In contrast, LUCI-Ag identifies P and N load variability and nutrient pathways to streams within each block. In addition, LUCI-Ag can explore a variety of mitigations, both individually and in combination, to determine their likely effect on in-stream N and P.

It should be noted though that LUCI-Ag does link to Overseer to obtain actual and detailed farm management data.




## Inputs

LUCI-Ag N and P inputs:

- Digital Elevation Model - which provides a 3D representation of the farm's terrain
- Stream networks
- Regional rainfall
- Regional evapotranspiration
- Farm system data via Overseer® xml files
- Water extractions and additions to the catchment area
- Land cover
- Soil cover.

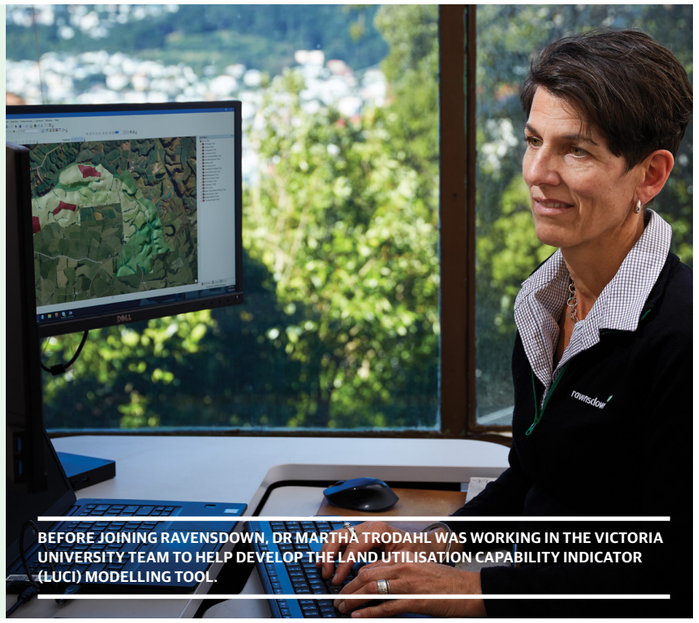
## Mitigation models & scenario exploration

LUCI-Ag features eight mitigation models, which allow exploration of mitigation scenarios and comparison against the current management system baseline. These include:

- Exploring mitigations via modified Overseer® file
- Modifying fertiliser use
- Modifying Olsen P levels
- Install sediment traps
- Riparian planting
- Stream fencing
- Targeting exclusion zones
- Targeting planting.

## Benefits of using LUCI-Ag

- Allows detailed investigation of CSAs within the field or block.
- Provides spatial detail (at 15m x 15m or less) on locations of high N and P loads and pathways to the stream network for accurate targeting of mitigations.
- Assists with decision making through exploration of a variety of mitigation scenarios and comparison to the current baseline scenario.
- Enables farm to catchment scale modelling - useful for individual farmers and catchment groups.
- It can embed actual farm data into wider catchment modelling.
- Allows for individual consultant advice, ground-truthing and data checking during the farm visit.



BEFORE JOINING RAVENSDOWN, DR MARTHA TRODAHL WAS WORKING IN THE VICTORIA UNIVERSITY TEAM TO HELP DEVELOP THE LAND UTILISATION CAPABILITY INDICATOR (LUCI) MODELLING TOOL.

# VISUALISING NUTRIENT LOADS AT CATCHMENT AND FARM LEVEL

THE WAIITI CATCHMENT WHERE STEVE HORGAN FARMS HAD A CATCHMENT GROUP FORMED TO PILOT LUCI-AG

## VALUABLE INSIGHTS FROM CATCHMENT PROJECT

**A catchment-level pilot project, undertaken to help farmers understand Ravensdown and Victoria University's environmental decision-support tool LUCI-Ag, has yielded beneficial information for those involved.**

*"Using Catchment Engagement and the Land Use Capability Indicator (LUCI) to Improve Environmental Management on Farms"* is a programme that was undertaken to inform Beef + Lamb New Zealand of the potential for LUCI-Ag to support their environmental extension programmes.

LUCI-Ag generates maps and data that allow geographical exploration of nitrogen (N) and phosphorus (P) sources, their pathways, and nutrient accumulation points. This leads to the identification of sites where nutrients can be intercepted and managed before they enter stream networks.

LUCI-Ag can help direct farmers to prioritise Critical Source Areas or 'hotspots', where mitigation measures can be applied, making it useful for planning actions in the Farm Environment Plan (FEP).

### The project

Led by Ravensdown's environmental consultancy and supported by LUCI developers, farmer groups from two different catchments were selected to participate. The Waiiti, a sub-catchment of the Tūtaekurī River in Hawke's Bay, was newly formed, while in Southland, the well-established Pourakino group was chosen for the pilot.

Catchment meetings were held in the two areas at the start and the end of the project to demonstrate the catchment modelling of LUCI-Ag and to gauge the value of hydrological modelling for farmers.

Eleven farms were modelled across the two catchments (five in Waiiti and six in Pourakino), and the data collected was used as an input to the catchment modelling. Individual farm reports were provided to the farmers, and feedback was collated on the process and their reaction to the reports.

Kate Ody, Ravensdown Senior Farm Environmental Consultant and Project Manager, says the project allowed farmers to consider their decision making when looking at mitigation measures.

"In many cases, the farmers involved in the project had a better understanding of their farm environment and nutrient pathways after the modelling. What they found really valuable was the one on one discussion and the farm visits. Some also found value in the LUCI-Ag tool to reinforce the actions they had already undertaken on farm to mitigate against N and P loss."

Kate says the specific feedback gained from farmers was invaluable to Ravensdown, allowing them to adjust the farm reports to provide increased value to the farmer.

"Catchment modelling provides an opportunity for catchment groups to understand their farm environments more thoroughly by demonstrating relationships between soil type, slope, land use and the impact these factors have on nutrient pathways," she says.

"Farmers liked seeing how different mitigations could impact on the nutrient loads at catchment and farm level. The maps allowed them to visualise where exactly issues could occur on their properties, so it was much easier to think about solutions."

One of the areas they have identified for further work is on the knowledge transfer of nutrient management to farmer groups.

"It's about preparing the group first, as different groups will be at different stages of implementation for action," Kate says.

"A new group may need more time on explaining the catchment baseline and understanding nutrient cycles before bringing in the farm-level assessment."

Alice Bradley, Beef + Lamb Environmental Projects Manager, says it has been great to road test the tool on real farms.

"We hear a lot about these complicated geospatial models but until we see them applied it can be difficult to understand their usefulness for farmers," she says.

"LUCI-Ag definitely has lots of potential to help individual farmers and catchment community groups to make good decisions around prioritising environmental management."

*LUCI is a GIS-based hydro-geological and ecosystem services model developed by Victoria University of Wellington. LUCI-Ag is a bespoke version of LUCI developed for Ravensdown and focused on farm impacts on water quality and potential mitigations.*

**"The maps allowed them to visualise where exactly issues could occur on their properties, so it was much easier to think about solutions."**

## LEARNING FROM THE LANDSCAPE

**Hawke's Bay farmer Steve Horgan says he's gained a greater awareness and understanding of the environment he farms in from taking part in the Land Use Capability Indicator (LUCI) Catchment pilot project, run by Waiiti Beef + Lamb NZ.**

Steve runs bulls and steers on 300ha of medium hill country with sandy loam soils and 1100-1200mm of rainfall annually. Around 20% of the property is in native or regenerative native bush, as well as pines. Two-thirds of the property is suitable for cultivation or regrassing and, like many hill country farmers, one of his main environmental challenges is managing sediment and phosphorus (P) loss.

Steve says his involvement with the LUCI catchment project has meant he has been able to form a clearer picture of the issues he faces on farm. He is also a member of the Hawke's Bay TANK farmer reference group (an acronym formed to represent four Hawke's Bay rivers – the Tūtaekurī, Ahuriri, Ngaruroro and Karamū catchments).

Part of the challenge around the project has been understanding some of the complexities behind the science and modelling. However, he found the best way to overcome this was to get out on the land with the farm maps and study them in situ.

"LUCI is all part of growing an awareness about how the landscape works," Steve says. "As a farmer, I like to be amongst things. If you take the maps out and sit on the hill and then start to read the landscape and see the catchments, then you can make sense of it – and that's what leads you to think, how can I do this differently?"

He says a couple of his blocks stood out in the LUCI-Ag report as having soils with high water-holding capacity, leading him to alter management of those areas.

"I didn't realise we had such a big variation in soil types, which made me think a lot more about where we did what. We're actually putting cattle on different blocks now. These blocks now have the lightest animals and the lightest stocking rate – I haven't always done that because it's the flattest land we have. We're also thinking about where we put the cattle for winter. It has led us to think more carefully about where we put what and why."

Steve says he has been really impressed to see the local buy-in around understanding and becoming proactive in the farm environmental space.

"Everybody is keen. They're all talking and thinking about it," he says.

"The one thing that really impressed me when we were asked to do the catchment group was that nearly everyone was more than happy to engage.

"Some farmers will be a bit bamboozled [with the technicalities of catchment management] but as time goes on, they'll start to learn and keep coming back and referencing the report."

Colin Tyler, Ravensdown's Environmental Principal Consultant, agrees.

"Farmers are busy people with a lot on the go," he says. "Because environmental management is often new and scary for people, and because there is so much information that gets thrown at them, with much of it being recent technology, people can get quite overwhelmed by it all. Often you just need a way to explain 'it's a risk here' and why, and then discuss mitigation options, but then again other people like to understand it all in detail."

Colin says, where beneficial, Ravensdown Environmental will look to include LUCI-Ag reports as part of the farm-planning process in the future.


RAVENSDOWN PRINCIPAL ENVIRONMENTAL CONSULTANT COLIN TYLER AND STEVE HORGAN DISCUSS THE LUCI-AG REPORT.

# WHITE CLOVER – THE PASTURE ALL-STAR FOR FIXING N

**By Jeremy Klingender, Ravensdown Product Manager Seed**

JEREMY KLINGENDER ,
RAVENSDOWN PRODUCT MANAGER SEED

**"All plants are nitrogen (N) deficient all of the time – except those that fix N." This is a statement from one of New Zealand's leading agricultural academics, Derrick Moot.[1] We hear statements like this often, but the practical 'how to' questions around increasing the prevalence of white clover in our pastures are more of a challenge.**

The importance of white clover in New Zealand pastoral agriculture cannot be overstated. It is the major source of biological nitrogen fixation, which typically ranges between 30-150kg N/ha/yr. Its presence improves pasture quality and balances seasonal growth of grass species, especially ryegrass.[2]

The fixation of atmospheric N into plant-available N forms occurs in the nodules formed on the white clover roots, after their infection by the bacterium *Rhizobium trifolii*. The host plant supplies energy and nutrients for the Rhizobia, which then in turn benefits from the N fixed by the Rhizobia. This successful symbiosis underpins the N economy and productivity of pastures in New Zealand.

It's been documented many times that an effective way to increase pasture production is to increase the legume content – specifically white clover. The classical pasture improvement sequence addresses the N limitation by first improving other important soil attributes, such as soil pH, phosphorus (P), sulphur (S) and potassium (K) supply to create a soil-nutrient environment that is favourable for legume growth.[3]

The increase in clover in the pasture sward then enhances N supply, which enters the plant and animal nutrient cycling processes. From this, a cascade of responses ensues, improved soil N availability, improved competitive ability and hence presence in the sward of 'more productive' grass species and higher pasture production.

Providing N increases animal production from high-quality feed and enhanced soil quality. These are key features white clover offers in well managed, mixed-sward pastures throughout temperate grasslands of New Zealand.

For both dairy and meat production, the proportion of white clover in the diet is a major determinant of performance and, given free choice between white clover and perennial ryegrass[4], ruminants will consume 70% of their diet as white clover, with related benefits to production.

White clover in New Zealand has a profound economic benefit to pastoral farming running into the billions.[5] However, despite being perennial, the seedling tap root may not persist for more than two years under dry conditions. Under New Zealand hill country conditions, less than 10% of stolons (runners) may not survive for longer than 12 months, emphasising the need for continual renewal of the stolon mass and adequate nodal root survival if white clover is to persist under grazing.

## Adapting across environments

Over the last 25 years, breeders have worked to improve persistence in conditions that stress plants so that farmers can now more confidently use white clover over a greater range of environments.

The success of this approach is demonstrated by the breakthrough development of 'Demand', a cultivar bred for use in southern regions of New Zealand under intensive sheep grazing. To achieve this breakthrough, hybrids were developed between persistent ecotypes collected from old Southland pastures and large-leaved Mediterranean European-based germplasm. Here at Ravensdown, we supply coated Demand clover to be mixed with superphosphate and applied to pastures and see good results. The coating is made up of lime and has Rhizobia and molybdenum added to it.

Many areas in New Zealand can have significant limitations in the growth of white clover due to summer dry conditions. Other contributing factors, including soil fertility, grazing and temperature, can make it difficult in summer dry areas to maintain the traditional white clover-based pasture. Therefore, these areas require different types of legumes to provide appropriate feed for grazing animals. Subterranean clovers are better suited to withstand this environment as they are more winter active. They bury their seeds in early summer before the parent plant dies away over the dry, hot summer period. Autumn rains will promote germination of some of the newly planted seeds.

Establishment, survival and growth are governed predominantly by temperature, moisture, soil fertility and plant management.[6] This includes lack of competition at germination, which can happen either by drought conditions, pasture removal at specific times or by applying herbicides to help control or kill resident pasture weeds.

JEREMY CHECKING OUT AN IMPRESSIVE SINGLE SUB CLOVER PLANT IN GISBORNE - SHOWING THE EXTENT OF HOW MUCH DM SUB CLOVER CAN GROW.

(1,2,3,4,5,6) see Source Code page 42

JANA HOCKEN, DAIRY FARMER, AUTHOR, DIRECTOR AND LEAN CONSULTANT

# IMPROVING YOUR FARM ENGINE

By Cheyenne Nicholson

**On the surface, farming and vehicle manufacturing don't have a lot in common. Or do they? Manawatu dairy farmer and consultant Jana Hocken says they do. She should know, she spent her formative career working for manufacturing giant Toyota.**

"I first started with them [Toyota] in their graduate programme. After a few years I went to work at their headquarters in Belgium, working as a Senior engineer and Toyota production system specialist," says Jana.

There, she learnt the ins and out of 'lean', a management philosophy born out of Toyota that is based on a business culture of continuous improvement, which Jana has adapted to work for dairy farmers in her book 'The Lean Dairy Farm'. The idea being you seek perfection and drive improvement to achieve that.

"You're never going to be perfect due to the forever-changing landscape, but it helps you to envision what "perfect" looks like in your business, and this drives you to improve to get there."

The way to continuously improve is to constantly look at all the waste in your processes and eliminate it.

"More and more, customers are focused on ethical farming practices that don't damage our environment. We need processes that deliver this. Lean will help you look at all these elements of your business and this will make your businesses much more sustainable."

Since leaving Toyota, Jana has been consulting and dabbling in a variety of industries. In 2013, she and husband Mat returned to his family farm in Colyton in the Manawatu.

"When we came back to the farm, I immediately saw so many opportunities to apply 'lean' management to farming, because at the end of the day, it's all processes."

Over the past two years, Jana and Mat have focused on implementing 'lean' into the farm.

"Continuous Improvement is holistic and it covers all elements of your farm; not just productivity or cost. It is our quality, production, people, animal welfare and, of course, our environmental and social impact."

As part of their strategy, the couple has three key themes:

1. Being great farmers
2. Making the community proud
3. Building a legacy

They have been working with Ravensdown, looking at holistic business management with their Integrated Reporting process. Integrated Reporting looks beyond financial records to incorporate the economy, environment and society into your performance– something Jana says is very aligned to the way they think about their business.

"This has been very forward thinking and a good partnership for us. On a more practical basis, as we're trying to improve our environmental impact, waste is a big issue for us. Ravensdown has been working with us to help reduce our waste through improved recycling and re-use of packaging. We contacted them to discuss it and we know now that we can take back all the fertiliser bags and recycle them."

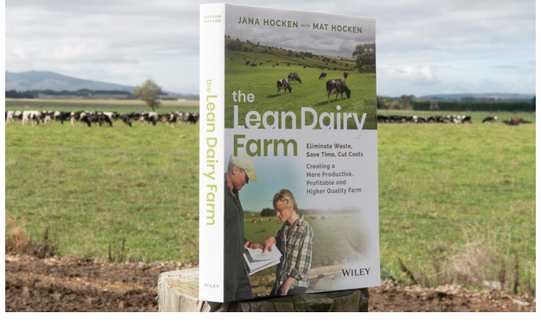
Other 'lean' practices on farm are focused around visualisation: getting information out of your head and making it visual so everyone knows what's happening right now; standardisation – having a clearly defined process for everything and the '5S' methodology (sort, set, shine, standardise, sustain).

"We're doing a lot around visualisation. The biggest thing we've done that's made a significant difference is our visual management boards (VMB). Each shed has one and the team tracks the status on farm."

Mat says an important element of lean is using facts and real data to make decisions and improvements.

"Ravensdown provides us with soil tests and subsequent fertiliser plans, which gives us data we need to make better, more accurate assessments of fertiliser requirements; including quantity, type and where it's needed. This makes our fertiliser use as efficient as possible and minimises our impact to the environment, rather than second guessing," he says.

"Creating a well-organised farm is a bit like having a

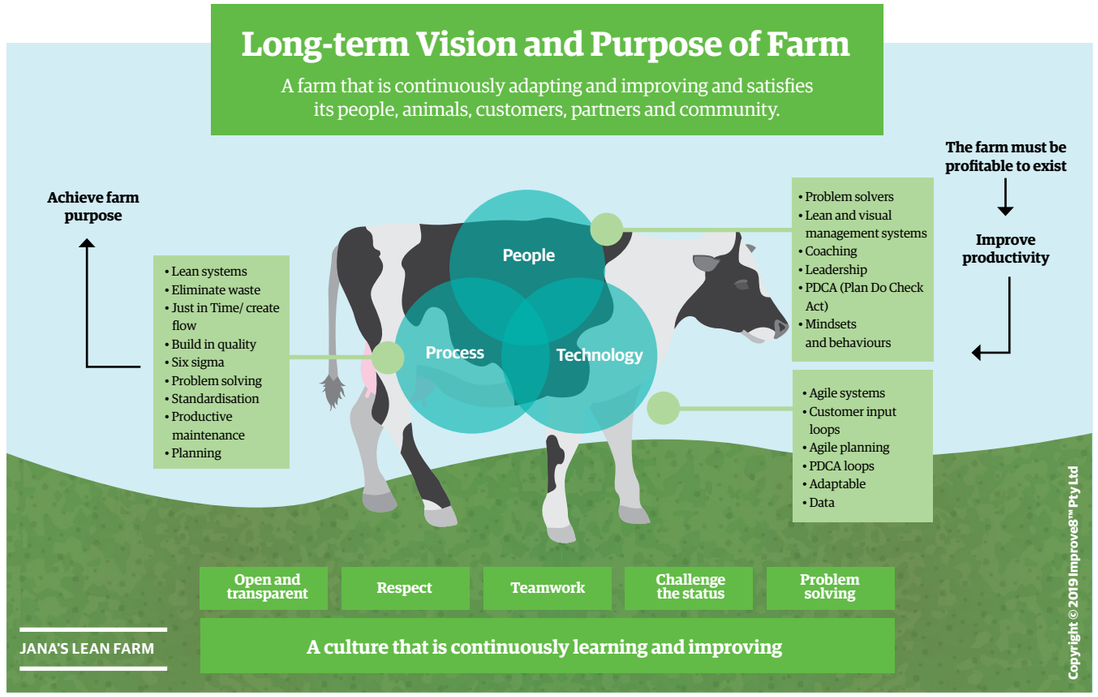



JANA HAS TAKEN SOME OF THE LEAN PRINCIPLES USED IN THE CORPORATE WORLD AND PUT THEM INTO A NEW ZEALAND DAIRYING CONTEXT IN HER NEW BOOK, THE LEAN DAIRY FARM.

## Benefits of lean

- **Team culture:** getting the team involved helps engage and empower them.
- **Communication:** more efficient so actions and decision making is more effective.
- **Cost savings:** less wasted product, lower maintenance costs, lower running costs.
- **Sustainable farming practices:** targeted and specific use of fertiliser, lowering over-production therefore lowering impact on the land.
- **Animal health:** data tracking means issues can be picked up earlier and problems dealt with fast.

**"I immediately saw so many opportunities to apply lean management to farming, because at the end of the day, it's all processes."**



well-organised kitchen. It makes the process of farming much smoother and has been an on going project," says Jana.

Recently, as a team, they have gone through and figured out where all on-farm vehicles should be parked for maximum efficiency.

"It's not about making things pretty. It means you know where everything is and don't end up with an extra few containers of chemical you didn't actually need because you already had some, but they were hidden under piles of other stuff," she says.

Like any business change, there are challenges to get it going. As with everything else on farm the biggest hurdle can be getting the team to buy in and sustain it.

"The key way to overcome this is to make sure the team are involved in everything and are engaged. A big part is empowering your team and trusting in them that they know what they're doing. People are the most important element of lean."

Change is hard and accepting that your business has waste and that your current way of doing things might not be best can be a hard pill for farmers to swallow.

"It's a bit confronting but if you're open to improvement, then you'll reap the rewards," Jana says.

Sustainable practice and nutrient use are under increasing scrutiny with the idea of a 'social licence to farm' and lean has a large capacity to help farmers in the changing global food production sector.

"If you can introduce the right systems into your business, standardise processes, use visualisation, so everyone knows what's going on, and you're tracking key metrics and priorities, then your farm will have much less of an environmental footprint and be more sustainable, because you know what you need to improve to reduce waste and can make the necessary changes."

## What are the 8 wastes of Lean?

Waste is defined as the opposite of adding value. Ideally, all processes are value adding in the eyes of the consumer.

- **D** - Defect
- **O** - Overproduction
- **W** - Waiting
- **N** - Non-utilised resources and people
- **T** - Transport
- **I** - Inventory
- **M** - Motion
- **E** - Extra processing

"A big part is empowering your team and trusting in them that they know what they're doing. People are the most important element of lean."



# EVENLY SPREADING SOIL CONDITIONER

**Recent research trials, commissioned by the Foundation of Arable Research (FAR) and Ravensdown, looks at getting one of New Zealand soil's most vital inputs, lime, spread accurately.**

Lime can be a significant investment for farmers, so ensuring it is spread accurately is important. There is a strong correlation between crop yields and optimal soil pH, therefore accuracy of application of lime is important. Lime is pivotal in reversing the natural process of acidification and helping pastures and crops produce at their optimum. Approximately 1.5 million tonnes is spread in New Zealand each year, making it the most widely used soil conditioner.

The recent trial work looked into the accuracy of lime spreading over a range of application rates on "Spreadmark"-certified spreading trucks to ensure this natural resource is used efficiently and effectively.

Lime can be a challenging material to spread, mainly due to its fine particle size and its non-uniform size distribution, often resulting in poor ballistic properties. Furthermore, lime has adhesive properties that cause it to come off the conveyer belt in chunks or cakes rather than a smooth continuous granular flow.

The work targeted varying rates of applied lime on arable land, at a target coefficient of variation (CV) of 10%, in order to define the optimal bout width of the spreading machines.

Ravensdown Technology Innovation Manager Dr Rob Murray says the results indicated the spreading width required to achieve a target of 10% CV would need to be halved.

"Lime is typically applied at a 10 to 12 metre bout width; however, the results of this work suggest a bout width of five metres is required to spread at 10% CV and be confident across a range of application rates. This would also help to reduce the influence of lime spreading variability on arable cropping yields."

"The results indicated the spreading width required to achieve a target of 10% CV would need to be halved."

## The trial

Dr Scott Post of Lincoln Agritech led the field testing of five different spreading trucks, with ranging application rates and driving speeds.

- Application rates ranged from 500 to 5,000 kg/ha.
- Driving speeds of 15km/h as well as 10 km/h and 20 km/h.
- Spread patterns measured across three tray lines for each test condition, then CV calculated as a function of bout width for each line.
- Measurements made of the particle size distribution for the lime used (Kakahu lime quarry) with videos taken of the lime motion from the spreader discs.

The spreaders were tested in the "as presented" condition. Scott says optimising the disc speed, gate height, belt/chain speed, and forward speed for each desired flow rate may result in higher bout widths at a CV of 10%.

"There would likely be a different combination of settings that gives the best spread pattern at low (500 kg/ha) and high (5,000 kg/ha) spread rates. In practice, this would require creating a "map" of spreader settings to be used at each flow-rate for a given model of spreader that could be put into the computer controller," Scott says.

"A Spreadmark test for a granulated material like urea does not necessarily tell how a spreader will spread a fine powder like lime. Getting a Spreadmark test on lime, particularly the lime that the operator will most commonly use, is needed to ensure the spreader will give a good result. It's also recommended to use dry lime to avoid caking issues as it comes off the belt. Ultimately, achieving more uniform application of lime will require investment, whether that's on better equipment, time spent optimising that equipment, more passes at a narrower bout width, or in a lime product that has better ballistics."

COLLECTING THE LIME FROM EACH TRAY AS PART OF THE SPREADMARK TESTING PROTOCOL.

## What is the coefficient of variation (CV)?

Is a measure of the variability of (in this case) lime disbursement. In the case of lime spreading, the higher the CV number (ie 25%) the more variability is to be expected relative to the average.

# AUTOMATED TECH LEADS TO GREATER FARM EFFICIENCIES

**For many farmers, the goal is to be out farming the land, not stuck in the office surrounded by paperwork.**

Since switching to using HawkEye® in August 2018, Canterbury contract milker Craig Minson has really noticed efficiencies gained across the business, Craufurd Dairy Farm, near Burnham.

HawkEye is a map-based farm tool that farmers can use to make quicker, more informed decisions about their nutrient inputs. It allows farmers to order online directly from their farm map, ensuring accurate spreading and the avoidance of high-risk areas.

Proof of placement shows where nutrients have gone for compliance purposes and so assists on-farm decision making.

Craig says the ability to order fertiliser from his farm map and have the order automatically communicated to all parties involved has made life much simpler for his whole team.

"When I order the fertiliser through HawkEye, the job is automatically sent to Ravensdown and the spreader via an email with the farm map of where it needs to go. I pasture walk and order fertiliser twice a week, so user-efficiency means a lot to me, especially when it allows me to have more time on the farm."

After spreading, a proof of placement map showing all the nutrient information and quantities applied appears in HawkEye, provided a Ravensdown Joint Venture (JV) or opted-in TracMap spreader is being used.

Craig says that the time efficiency comes from having all the information in one place to make agronomy decisions.

"All the info is there so you can make decisions fast. If you want to see what you've done in the past, you can just click on the paddock and look at its history," he says.

"The time I spend on this task is so much less now. I have more time to get out on farm - which is what I enjoy doing."

With his wife Toni and a team of four staff, Craig says it's not only the time benefits that have been noticeable.

"It helps us stick to budget and identify areas where we can improve and make better management decisions, such as improving nutrient efficiencies. The automation of HawkEye means that everything just happens. Everyone who needs to know is communicated with, including our farmer shareholders," he says. "Communication is key to ensure everyone knows what's going on, removing any risk of errors."

HawkEye specialist Rangi Holland says HawkEye's ease of use and information-sharing capabilities mean the farmer's agri manager and other consultants have access to the right information.

"I could see the benefits to the farmer right back when I started on this project as an agri manager," says Rangi. "The whole development has been farmer led so I know it will add value on farm.

"Anything that makes it easier for farmers gives me a huge sense of accomplishment because we are all part of the farming family, part of the farmer's team."

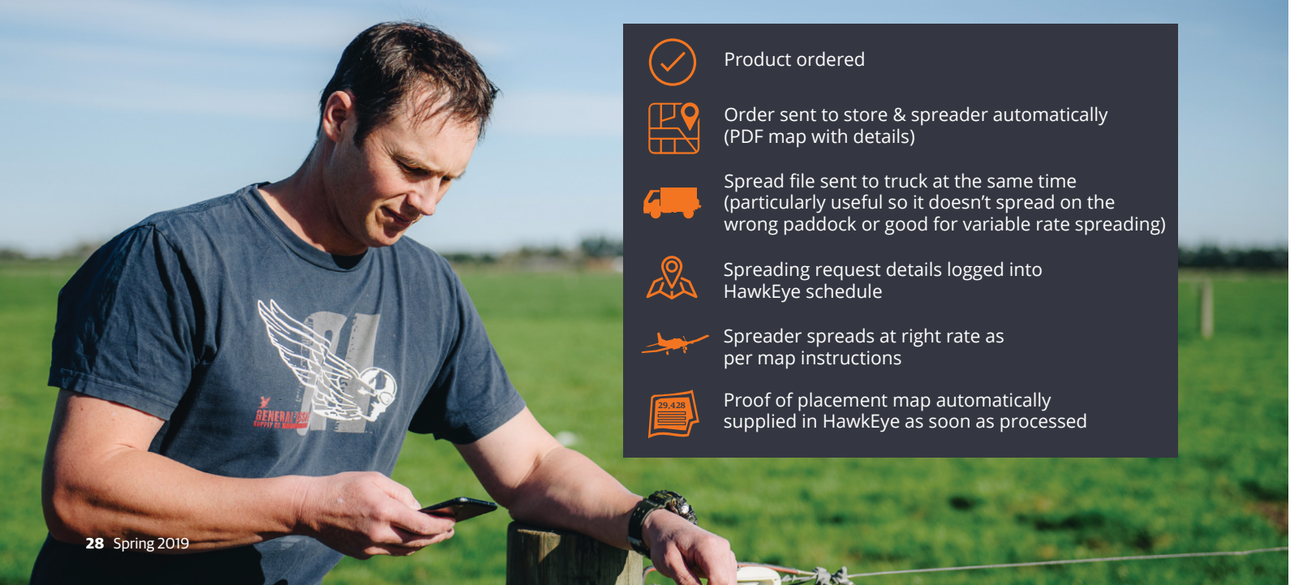
HawkEye is integrated with TracMap, C-Dax and Ravensdown JV spreaders, reducing the margins for error in nutrient application.

"Farming today is about having access to good data, and for farmers to have that, we need to be collaborating with other businesses to give them something that isn't piecemeal so they can make better decisions," she says.

"Having the ability to access one source of the truth means we can problem solve and provide solutions and plans more efficiently."

With HawkEye's new smartphone app HawkEye Mobile, farmers can now order product and spreading from their phone, making life simpler still.

"I'm really looking forward to using the app so I can get back to doing what I love, farming," says Craig. ■







RAVENSDOWN CHAIRMAN JOHN HENDERSON WITH NZDIA SHARE FARMER AND RAVENSDOWN PASTURE PERFORMANCE WINNERS COLIN AND ISABELLA BEAZLEY.

# TARGETED APPROACH TO PASTURE MANAGEMENT

By Cheyenne Nicholson

**It is easy to see why New Zealand Dairy Industry Awards Share Farmers of the Year, Colin and Isabella Beazley, are deserving winners of the Ravensdown Pasture Performance Award.**

Their Wellsford farm provides plenty of challenge to grow quality pasture, thanks to the Kikuyu grass they are simultaneously trying to work with and eliminate. But armed with a decent plan and a little experimentation, Colin says they are coming out on top.

"One of our owners prefers high metabolisable energy (ME) ryegrasses. Kikuyu is a pest, but the cows can still graze it, so we work with it and just keep chipping away at getting rid of it before it takes over entire paddocks."

Their combat measures are spraying it out and regrassing with high ME grasses. They admit they still have not found the silver bullet when it comes to cultivar of grass, but are trialling new ones all the time.

"We've had the best success with Asset Italian Ryegrass but we're still looking for the perfect fit for our conditions," Colin says.

The dry Northland climate combined with limestone-based soil means it can be a struggle to grow grass, but they have a battle plan for that too.

Colin says fertiliser is key for their grass growth, and in recent times they have changed their approach to their fertiliser programme.

"We used to do one or two soil tests a year and a big fertiliser rotation. Now we've shifted to a more personalised and targeted plan."

This includes more soil tests in multiple areas of the farm to allow targeted fertiliser application and a more mindful approach to their nutrient management.

"If an area doesn't need potassium (K) then we don't do it. Previously we just put everything on all parts of the farm. We've found that our fertiliser spend has decreased."

Their low-input system includes a fair amount of cropping to combat the summer dry and with the Kikuyu renovation they are doing a lot of no-till work to avoid disturbing the soil as much.

"Combined with being smarter about our fertiliser and not overloading the soil with nutrients, we're getting the outcome we need from our grass without increasing leaching issues," says Colin.

As part of their continuous improvement in the pasture space on farm, the Beazleys have recently started using Ravensdown HawkEye® technology, which integrates the three perspectives of pasture production (farm mapping, nutrient input and pasture quantity on the ground).

"Ravensdown have been great to work with and are really onboard with what we're trying achieve on farm in terms of doing more soil tests, strategic fertilising and offering up different options to help us get the outcome we need, which is ultimately growing as much grass as we can."

The introduction of a drone to daily farm life has meant increased efficiency when it comes to monitoring stock and checking pasture covers and fertiliser distributions.

"When staff are putting seed on, they can see where their lines are and if they've got their spacings right," Colin says. "It's a big help when the cows are grazing chicory, we can really keep on top of moving the break to make sure we don't over-graze. It's a time saver and a health and safety benefit for us, particularly when checking pastures and stock on the steeper parts of the farm." ■

# KIWI FARMS LEAVE SMALLER CARBON FOOTPRINT

DR STEWART LEDGARD, AGRESEARCH PRINCIPAL SCIENTIST

**The science world loves a new phrase or term. And a few years ago, Life Cycle Assessment (LCA) appeared to be the latest that would prove equally impenetrable and fleeting. However, LCA has endured. Why has it done so and how is this good news for New Zealand farmers?**

For the answers to that, we journey to a New Zealand Crown Research Institute, where scientists from AgResearch's Environmental Research Team are leading the way in evaluating New Zealand's environmental efficiency in agricultural systems and products along the whole supply chain.

## How can a Life Cycle Assessment help farmers and producers?

LCA is the measurement of total resource use, or the total environmental emissions of a product, from cradle to grave, such as lamb or beef.

1. Resources
2. Processing
3. Manufacturing
4. Distribution
5. Use
6. End of life

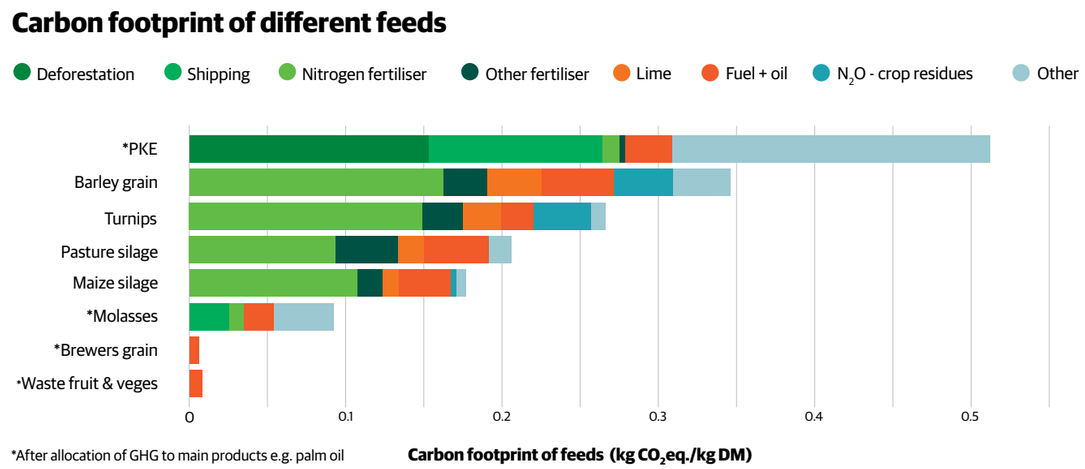



FIGURE 1: CARBON FOOTPRINT OF DIFFERENT FEEDS (SOURCE DR S LEDGARD)

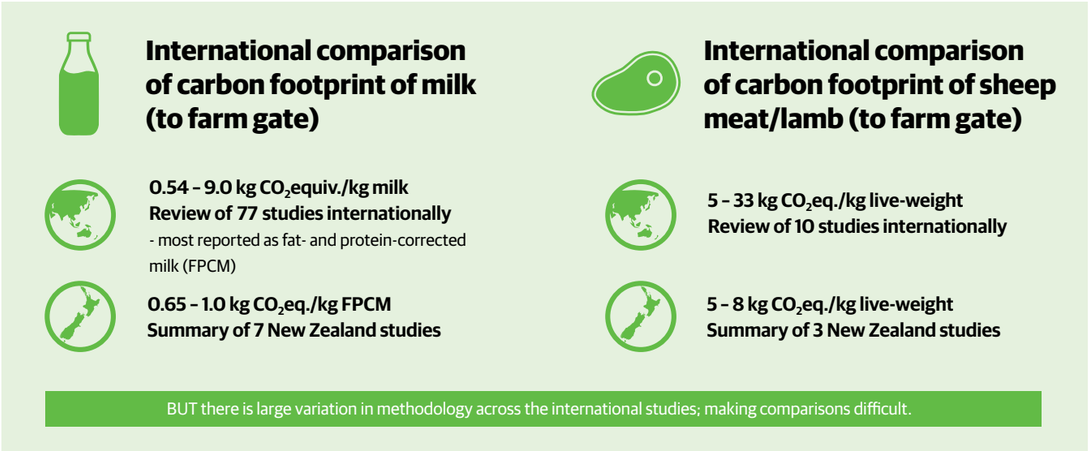



FIGURE 2: CARBON FOOTPRINT OF MILK TO FARM GATE INTERNATIONAL VS NZ

FIGURE 3: CARBON FOOTPRINT OF SHEEP-MEAT/LAMB TO FARM GATE INTERNATIONAL VS NZ

The application of LCA to agricultural products is most evident with carbon footprinting but is rapidly evolving to include wider environmental impacts.

A key benefit is the ability to evaluate potential impacts of products on resources and environmental indicators, enabling optimisation. However, for it to be fair and effective, it requires standard methodologies that reflect differing agricultural systems around the world. This has not always been the case, due to requirements originating in Europe.

## Why use LCA in New Zealand?

AgResearch Principal Scientist Dr Stewart Ledgard says LCA is relevant to New Zealand because it can be used to measure market drivers for environmental information. Measures include commonly used eco-labels, such as food miles and carbon footprints for overseas supermarkets.

"It's important to ensure New Zealand food products have fair and equal access to overseas markets," Stewart says, "which is why the Environmental Research Team has worked with the European Commission to investigate the potential implementation of a universal European food-labelling scheme that'll allow consumers to see first-hand the impact that the product has had on the environment. These include environmental effects that can potentially affect human health as well as other eco-system indicators such as water quality."

This is the latest step in research spanning more than a decade. It follows the food miles debate that was the catalyst for ongoing research on quantifying the environmental footprint of our goods aimed at European markets. There has been a lot of work done in New Zealand on the life cycle assessment since then "There was a need to understand the relative contributions of all the stages. From extraction of the raw material through the farm processing - through the entire life cycle of a product," Stewart says.

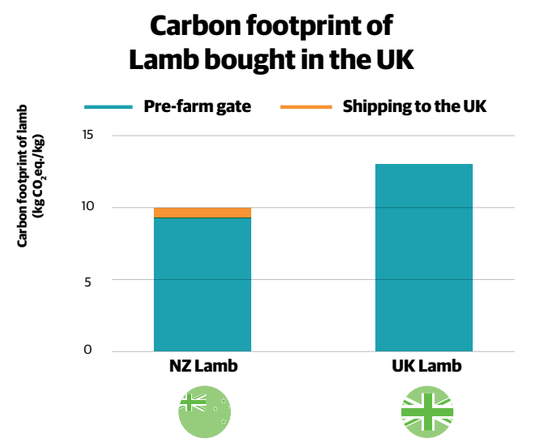



FIGURE 4: NZ LAMB BOUGHT IN THE UK HAS A LOWER FOOTPRINT THAN THE UK LAMB (WILLIAMS ET AL. 2008)

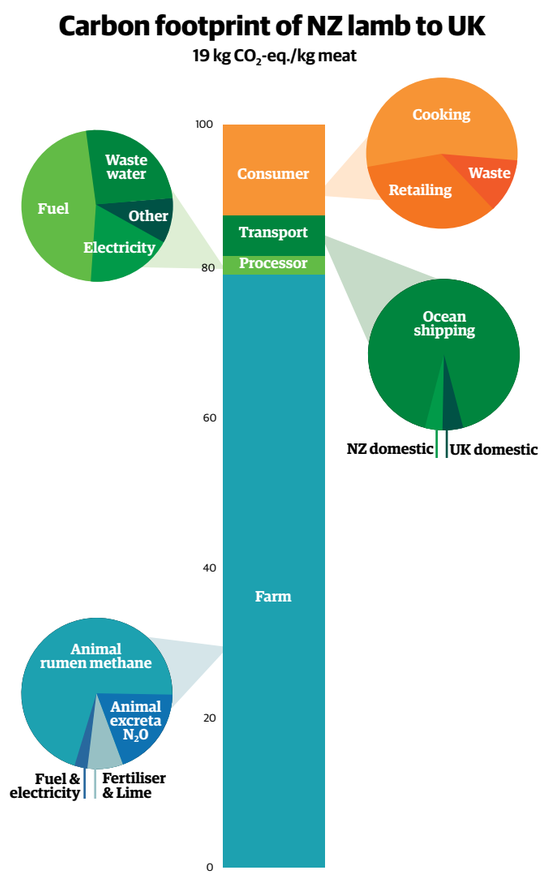



FIGURE 5: CARBON FOOTPRINT OF NZ LAMB TO UK (SOURCE DR S LEDGARD, LEDGARD ET AL 2011)

## Carbon footprinting New Zealand's produce

Stewart worked with the dairy industry to develop methods looking at New Zealand produced milk, which focused on the farm, processing and shipping overseas.

He also calculated a detailed measure of the carbon footprint of various feeds, from maize silage to palm kernel expeller (Figure 1).

Stewart followed this with a detailed analysis of the sheep industry, looking at lamb and mutton (the total emissions per kilogram of meat). He considered the entire life cycle, including the consumer in the United Kingdom (Figure 4 and 5).

They found that the carbon footprint of New Zealand lamb in the United Kingdom (Figure 4) compared favourably to that produced in the UK and France. Ocean shipping made up 5% of the final product's carbon footprint, avoiding the commonly held belief that meat produced on this side of the world is environmentally unsustainable (Figure 5).

Current New Zealand overseas merchandise trade values for dairy, beef and sheep, and deer products annually aggregate to some $26 billion as free-on-board (FOB) export value. There were notable proportions of higher value lamb, wool and venison exports to Europe, and beef and milk products to Asia.

Consumer awareness about environmental sustainability, including carbon footprinting, is high among a discerning consumer base. This is especially true of Europeans, who consume much of New Zealand's high value lamb and venison market products. Taking New Zealand chilled lamb exports to Europe as an example, some $580 million FOB value annually would be a market segment underpinned in part by New Zealand environmental credentials.

Low environmental impacts, including a low carbon footprint, are laudable goals for efficient food production systems globally, with whole LCA for New Zealand pastoral livestock systems illuminating efficiencies and 'hot spots' along the product value chain (Figure 5). The carbon footprint of New Zealand's products versus their international counterparts are amongst the lowest globally for dairy and sheep, and traditional beef production is towards the lower end of the range, considering variations between farms and farm management systems, along with the type of feed inputs used (Figures 2 and 3).

## Opportunities on farm

Improved animal productivity has been a key driver of a 22% reduction in GHG emissions in the lamb sector since 1990. This was attributed to improved lambing percentages and lamb performance. Also, farm-scale dairy system modelling in Southland has shown a 13% reduction, associated with a 3% increase in profitability for farms adopting mitigation strategies. ■

*Dr Stewart Ledgard is a Principal Scientist with AgResearch and an Adjunct Professor of the Life Cycle Management Centre at Massey University in New Zealand. His research focus is the management of resource use and environmental impacts of pastoral farming systems. During the past decade this has involved the application of Life Cycle Assessment across a range of New Zealand agricultural systems and products.*

# FROM THE EMERALD ISLE TO THE LAND OF THE LONG WHITE CLOUD

DENIS FINNEGAN IRISH DAIRY FARMER AND IDEAS COMMITTEE MEMBER FOR THE PASTURE SUMMIT IRISH/NEW ZEALAND INITIATIVE

**Irish dairy farmer Denis Finnegan says we have a lot to learn from each other when it comes to ensuring our grass-fed dairy farming systems are the most sustainable in the world.**

Denis farms 700 cows across four farms near Cork in the southwest of Ireland. He took part in the ideas committee for the Irish/New Zealand Pasture Summit initiative (held in November 2018 in Hamilton and Ashburton) and believes it's important for Irish and New Zealand farmers and researchers to keep up the dialogue with one another.

"Only 5% of the world's milk comes from grass and 95% comes from indoor systems," Denis says. "Maize has a budget of $5 billion a year to research the crop, with yield growing three percent a year. That means, in time, even though grassland systems are the most efficient and profitable systems to produce milk, maize can compete. Pasture Summit was formed to share our technologies, our information and bring all that intellectual property together to create something better."

Just like in New Zealand, environmental regulation and best practice are vital to Irish pasture-based dairy farming.

Ireland's traditional small-holding land-use means farms often border villages, therefore there is an onus on the farmer to ensure environmentally sustainable practices are undertaken on farm. In the past, many of these dwellings would have housed tenant families or farm workers, however these days many dwelling owners connected to farms have no relation to the farm or its farmers whatsoever.

Ireland also has strict guidelines on the amount of nutrients that can be spread and when. Phosphorus (P) application is regulated based on stocking rates. Urea can only be applied at the start of the year, in February/March, which is the equivalent of New Zealand's Late August/September. Denis says these rules are contributing to successful outcomes.

> **"If we want sustainable grass-fed systems to be economic and environmentally sustainable into the future, we'll have to work together."**

"We're farming on the river, we're more intense than ever with more grass utilisation and application of fertiliser at the right times of the year and water quality is improving."

He says the Irish dairy industry is going through major change following the removal of milk quotas in 2015. Thirty years ago, New Zealand and Ireland's milk production was on par. But when Ireland joined the European Union, their production was capped at seven billion litres of milk, while New Zealand production grew to 21 billion litres - all in response to global demand for dairy products.

Denis expects the next decade to hold a wealth of change and opportunity for Irish dairy farmers to expand and refine their farm systems.

"Ireland, now, is like New Zealand in the early nineties," he says. "We want to see what New Zealand has done right over the past 20 years - we want to see the successes, but we want to see the mistakes too."

When visiting for Pasture Summit, Denis and several other Irish farmers also took a three-week tour of New Zealand's top dairy farms.

"New Zealand dairy farmers are the all-stars of grassland dairy farming around the world - they're the ones we want to emulate," he says, "and if we want sustainable grass-fed systems to be economic and environmentally sustainable into the future, we'll have to work together." ■

# PLAYING CATCH UP ON SEDIMENT LOSS

**Minimising sediment loss in hill country grazing situations is an ongoing challenge for many farmers, but a Sustainable Farming Fund (SFF) project being run in the Hawke's Bay is looking to help refine best-practice techniques using catch crop technology.**

Run by the Catch Crop Sediment Mitigation Group, the project aims to show under what conditions the use of catch crop technology can help reduce sediment loss, and to what extent. Specifically it is focused on post-winter grazing of hill country forage crops.

Historically, winter forage crops have been grazed off by livestock and left fallow until spring, increasing the risk of nutrient loss, predominantly phosphorus associated with sediment loss.

The use of a catch crop offers an alternative management technique, whereby soil nutrients, and in the case of this study, sediments, can be held in the soil rather than being lost as run-off. This is achieved by planting a short-term crop that is established before, during or after a winter crop is first grazed off, and before the next crop or new pasture is established. In hill country situations, ideally the catch crop will be progressively sown to cover each break following livestock grazing – covering up bare ground.

Other catch crop projects, run through the SFF programme, have had a focus on flatter terrain and reducing the amount of soil nitrogen susceptible to leaching, using cereal crops, such as oats, to mop up excess soil nitrogen (N). This new project will be based on the same principles but will have a stronger focus on sediment loss within hill country.

Ravensdown's Technical Development Manager Mike White has been working on the project with Programme Manager Lochie MacGillivray of AgFirst and Science Team Lead Dr Brendon Malcolm of Plant and Food Research. With the first year underway, Mike says they aim to determine how well the catch crops establish and quantify reductions in soil losses and associated nutrients following the grazing of winter crops, which includes kale at the main experimental site. The project will also look at the economic outcomes and productivity benefits to farmers, including further grazing opportunities for livestock on the catch crops in late winter to early spring.

## Project method

Many of the detailed measurements will take place at the main trial site in Poukawa, Hawke's Bay, but there will also be two satellite sites in Hawke's Bay and Manawatu on farms involved with the mitigation group. The sites have been selected, and experimental protocols including catch crop selection and establishment have been finalised for the first year. The learnings from the first year will flow through to a second year of work with in-depth farmer involvement along the way. This will ultimately aim to provide practical information for the third year on best practices, suitable sites and benefits for adopting this approach on farm.

The project will evaluate a range of catch crop species, initially ryegrass and oats, followed by plantain and clover, with a focus on establishment techniques and barriers to uptake. Improvements in sediment losses will be measured across different soil types as well as the evaluation of economic benefits of a range of catch crops.

While the project will take place in Hawke's Bay and the Horizons region's hill country, the outcomes are expected to apply and be of benefit to all hill country farming regions.

*The Sustainable Farming Fund (SFF) supports applied research and projects led by farmers, growers and foresters. The project is led by the Catch Crop Sediment Mitigation Group and the science team includes Plant and Food Research, AgFirst Pastoral, Massey University and On-Farm Research. Project co-funders include Hawke's Bay Regional Council, Horizons Regional Council, Beef+Lamb, Ravensdown, Ministry for Primary Industries, Foundation for Arable Research, Farmlands and DairyNZ. Follow project progress at catchcrop.nz*

# PERFECTING POTASSIUM USE ON SEDIMENTARY SOILS

**By Sonya Perkin, Senior Agri Manager**

SONYA PERKIN, SENIOR AGRI MANAGER

**Growing productive and nutritious grass and legume pastures requires about 16 nutrients in sufficient quantities. Potassium (K) is one of these essential elements, for plant and animal production and health.**

Some Canterbury sedimentary soils generally have adequate soil reserves of K, with quick test K levels of 5-8 being adequate for pasture growth. These soils can be identified by measuring the reserve K status with a TBK soil test.

But for most sedimentary soils, because K is removed from the farm when milk, animals, wool and crops leave the property, annual maintenance applications of K in fertiliser ensure that deficiencies do not hinder farm productivity. Potassium is important in photosynthesis, enabling the synthesis of proteins and sugar, increasing vegetative growth of plants, carbohydrate and nitrogen accumulation and regulating the transfer of water and organic substances that are required for plant growth.

Even sedimentary soils with reserve K can benefit from K fertiliser application. For example, trials conducted on high-reserve K sedimentary soils in North Canterbury showed the application of 50kg K/ha on dairy pastures resulted in the increase of dry matter during the milking season by 16%. This is because during periods of rapid pasture growth, soil K reserves may not always match plant requirements from weathering of clay minerals, even when soil test results showed adequate soil reserve K levels. Applying K to meet plant requirements, and not just relying on soil reserves, helps ensure K deficiencies do not impede pasture growth.

On free-draining soils, where K can leach in wet conditions, it can be particularly difficult to keep levels in the optimum range. It may be better to replace K used by pasture rather than aiming for the optimum soil-test range. Potassium can be applied in autumn or spring and split applications are recommended, to minimise risk, if you need to apply more than 50kg K/ha, have low cation-exchange capacity (CEC) soils or get over 1500mm of rain a year.

Herbage testing is a good way to obtain information on K and magnesium (Mg) levels in the pasture, when pasture is growing rapidly.

Deficiencies of K, (seen in clover as speckling around the leaf margins) results in reduced plant growth and development, reduction in yields and decline of quality. However, in New Zealand, the K requirement for optimal plant growth far exceeds the requirement of K for the grazing animal.

Perennial grasses are better than clover at extracting K from the soil. As a result, when soil levels are low, grasses can out-compete clovers, leaving clovers prone to K deficiency and poor growth. Ensuring adequate K nutrition will help improve the clover content of pastures and increase overall pasture production.

Potassium deficiency can also cause a loss of appetite in animals, liver and kidney dysfunction, hyper nervousness and reduced levels of potassium in blood and milk. However, surplus K can result in a luxury uptake by pasture and interfere with the uptake of Mg and calcium (Ca), both in plants and animals. The main metabolic disorders that are associated with high K-induced low dietary intake of Ca and/or Mg are milk fever (*hypocalcaemia*) and grass staggers (*hypomagnesaemia*).

**"Perennial grasses are better than clover at extracting K from the soil. As a result, when soil levels are low, grasses can out-compete clovers."**

This risk can be reduced by avoiding applying K to pasture three months prior and post calving or lambing and ensuring there is an effective animal Mg supplementation programme in place. ■

# UNDERSTANDING POTASSIUM ON NORTH ISLAND ASH SOILS

**By James Livingston, Senior Agri Manager**

JAMES LIVINGSTON, SENIOR AGRI MANAGER

**Taranaki soils, usually derived from volcanic ash, have good physical characteristics but very little natural potassium, commonly referred to as potash by farmers.**

The soils of the Taranaki ring plain are comparatively young. Some are derived from undisturbed ash layers and some from mud flows (lahars), which hold K poorly especially under high rainfall. By contrast, a few kilometres away, ash soils under lower rainfalls may accumulate potassium quite easily, with high Quick Tests (QTK) being common.

Mount Taranaki's position in the middle of the volcanic ring plain adds complexity to potassium recommendations by influencing the weather and the soils. For example, rainfall may be 1000mm at the coast and 3000mm a few kilometres away at the bush edge, so considering that potassium is soluble and susceptible to leaching under high rainfall, possible loss of K from the soil is an issue in the region.

The two most common ways Ravensdown's agri managers assess potassium levels are via the QTK and via herbage sampling. Being a mobile nutrient, it is often best to use these tests in conjunction and make recommendations using both sources of information.

Farmers often spread potassium twice a year, but Norman Thomson, formerly scientist in charge of the MAF Taranaki Agricultural Research Station, carried out trials across different rainfall areas. He found split applications made no difference to annual pasture production so long as the same total amount of potassium was applied - even on soils with QTK levels of two to three and 3000mm of rainfall.

Using Overseer to model all farm inputs of potassium can lead to significant savings. The cost associated with buying potassium is about $1.40/kg at present - so when farmers are applying 80 to 100kg K/ha each year, any savings are welcome.

Effluent contains significant amounts of potassium so it is important to use Overseer modelling to maximise the benefit farmers can get from spreading their effluent to apply maintenance potassium over as large an area as possible. Some imported feeds, such as grass and maize silage bring useful quantities onto the farm and these can also influence the amount of K fertiliser required.

In Taranaki, it is sometimes more important to select effluent area sizes based on the amount of potassium being applied rather than nitrogen inputs to make the best use of potassium and to help prevent animal health issues. Excess intakes of potassium in animal diets have been linked to metabolic issues (see previous article). By matching potassium inputs to current soil levels and demand and by applying it at the correct time, we aim to minimise the chance of any animal health issues occurring.

Whole Farm Soil Testing (WFST) is a useful tool to help get potassium inputs right. With many years of using potassium fertilisers on dairy farms in Taranaki, and adding process by-products like Proliq, QTK levels, over the optimum range of 7-10 and into the 20s are not uncommon. WFST enables Ravensdown's agri managers to look at the potassium levels across the whole property and suggest ways to more effectively use this nutrient. ■

## Thought Leader: Turi McFarlane

# FARM PLANNING FOR A SUSTAINABLE FUTURE

**Turi McFarlane, 2018 Nuffield scholar and Ravensdown Senior Farm Environmental Consultant**

**Being immersed in a Nuffield Scholarship for 18 months has without a doubt been one of the most rewarding and challenging experiences of my life.**

The final version of my research report is titled Farm Planning for a Sustainable Future – which is the culmination of roughly four months of international travel and study throughout 2018 as part of the scholarship. My research looks at aspects of Farm Environmental Planning and land use optimisation – exploring the international setting and considering learnings as they might be applied to the New Zealand farming context.

Right now, New Zealand farmers are being confronted by the need to improve multiple environmental outcomes, while still returning a profit. How the primary sector continues to evolve to deliver sustainable returns, in the face of increasing environmental pressures, is one of the defining challenges of our time.

## International learnings

My recent studies took me from vast arable fields in Eastern Europe and subsistence farming in Eastern Africa, through to highly developed and subsidised agricultural businesses in North America and the UK. While every country (and every farm) was unique, with its own specific points of difference, there were invariably huge similarities and learnings that might be applied in our New Zealand farming context.

KENYAN DAIRY - HAND MILKING 235 BORANX FRIESIAN COWS TWICE A DAY

(1) see Source Code page 42

Much of my personal travel involved visits and discussions with individuals and organisations that were promoting learning support as well as extension tools and services to help improve sustainable agricultural outcomes. I looked at a number of international examples of farm environment planning, including the Alberta Environmental Farm Plan in Canada, the New York State Whole Farm Plan in the US and Farm Plan21 in Victoria, Australia, as well as a range of 'Best Management Practice' programmes.

The Whole Farm Planning programme I looked at in New York State was particularly fascinating and involved a catchment of farmers who played a key role to ensure drinking water quality was maintained for the downstream residents of New York City. A huge amount of financial and technical support had resulted in greater than 90% farmer uptake of this voluntary farm planning programme, in the watershed visited.

As a Nuffield scholar, I also attended the 24th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP24), in Katowice, Poland. While there I learnt more about the concept of Climate Smart Agriculture, which I found a useful way to consider aspects around climate change and agriculture – not just focusing on emissions but rather the 'triple win' of increasing productivity, enhancing resilience as well as reducing greenhouse gas emissions.

## Tools for sustainability

My study explores a number of tools, techniques and approaches designed to facilitate and enable sustainable outcomes in the New Zealand agricultural sector – to set farmers up to succeed in the long term, build farmer confidence and inform farmer investments and farm management decision-making.

Some of the key recommendations to come from this study include:

1. Farm environmental planning should be prioritised, appropriately resourced and supported as a primary means to drive sustainable outcomes in New Zealand agriculture.
2. Sustainable Management Practices (SMPs) should be promoted and supported to help provide farmers with clarity regarding on-farm management.
3. Climate Smart Agriculture should be socialised by the New Zealand agricultural industry as a valuable component of farm environmental planning – prioritising the 'triple win' of increasing productivity, enhancing resilience to the effects of climate, as well as reducing greenhouse gas emissions.
4. New Zealand farmers should be supported by relevant industry groups to have access to appropriate farm system modelling tools and specialist support to inform land use and land management decision-making.
5. Effective farmer extension at both farm and catchment scale to enhance farm sustainability and ensure effective uptake of relevant technologies should be prioritised by the New Zealand government.

The future of New Zealand farming is laced with both challenge and opportunity; however, sustainable agriculture is not some far-off, unattainable goal. To truly optimise farm systems in New Zealand, we should take a holistic approach and utilise a range of enabling tools to help farmers make informed decisions regarding both land use and management practice.

No doubt there are some significant challenges ahead for our agricultural sector in the environmental space, but I am excited by the opportunities that exist for us to show real leadership to improve sustainable outcomes on farm.

**"The future of New Zealand farming is laced with both challenge and opportunity; however, sustainable agriculture is not some far-off, unattainable goal."**

In my role as Senior Farm Environmental Consultant with Ravensdown, it is always a privilege to work with so many hard working and passionate New Zealand farmers. I look forward to incorporating more of these learnings into my work to help grow the success and resilience of our agricultural sector.

Many thanks to Ravensdown for supporting me on this scholarship as well as Nuffield New Zealand and partners.

BLACK SOILS OF UKRAINE - THE BREADBASKET OF EUROPE

DELAWARE COUNTY - NEW YORK STATE: BARN TO WINTER BEEF CATTLE, CONSTRUCTED WITH FUNDING TIED TO WHOLE FARM PLAN

# OVERSEER AGILE AND INSIGHTFUL

By Tim Cronshaw

**Overseer Limited plans to steadily introduce more software improvements in the future, rather than carry out the "big bang" launches that were previously made for upgrades. Further improvements will be made as they are ready to be released.**

"In the past we used to have these upgrade launches every six months or once a year when a new model upgrade would happen," says Antony Williams, Overseer Limited Product Manager. "We're trying to get into more regular continuous improvement of the model and software together, rather than waiting a year for something to happen."

Much of the groundwork has already been carried out after Overseer Ltd's overhaul of the software service's user interface. This was released as OverseerFM – FM stands for farm modelling – nearly a year ago for users to more easily input their farm data to track, map and work towards reducing their farms' nutrient losses.

The cloud-based OverseerFM software replaces legacy OVERSEER® Nutrient Budgets, which was retired on 30 June 2019.

Overseer Ltd's Chief Executive Caroline Read says the main change is that the software has become far more user-friendly, but not at the expense of taking into consideration the scientific complexities of farming.

When Overseer was first introduced in the 1990s, it had been developed by scientists for consultants, but now software programmers have refashioned the interface so it is much more intuitive and easier to use for both consultants and farmers.

Antony says the software had progressed from its initial science development background to being picked up by regulatory bodies and that had expanded the user base and the needs of its users.

"There are few farming software services with Overseer's reach. It is the main software tool for consultants and farmers to predict the long-term loss of nitrogen in particular, as well as phosphorus from pastoral farming systems," Antony says.

"In the name of sustainable farming, Overseer has also become essential for setting nutrient limits and complying with regional council plans, or for sending compliance information, for example, to dairy companies and irrigation schemes."

The Overseer team is trying to provide software and a helpdesk service to engage consultants and farmers more in the process so they can see what Overseer is doing. It is about getting a better understanding of their farms and being able to have conversations with their consultants about the sort of improvements they want to make.

"Busy farmers have been shying away from running Overseer in favour of engaging experienced qualified consultants in order to fulfil their agreed-on farm mitigations."

## Getting a clearer view

Antony explains that OverseerFM operates under the same principle as its predecessor with the same data feeding into the model, however it has been reorganised to make it more presentable, allowing for a single view of a farm.

Access is now structured around a farm account instead of a user account. The information is more visible than it was before, allowing consultants and farmers to see where the hotspots are and build a better understanding of the ebb and flow of nutrients on their properties based on the analysis.

They can then compare them with other blocks on their farms, looking at soil types, fertiliser use, irrigation and different farming management practices to get a better view of their farm environment. In addition, scenario tools will eventually help users predict what would happen if they make changes, such as focussing fertiliser where it is needed most or changing stocking rates to control effluent loads.

"Consultants and farmers will be able to track nutrient loss variances over time as they make changes to their farms. Or, high performing farmers might see less change because they are already doing a good job," Antony says.

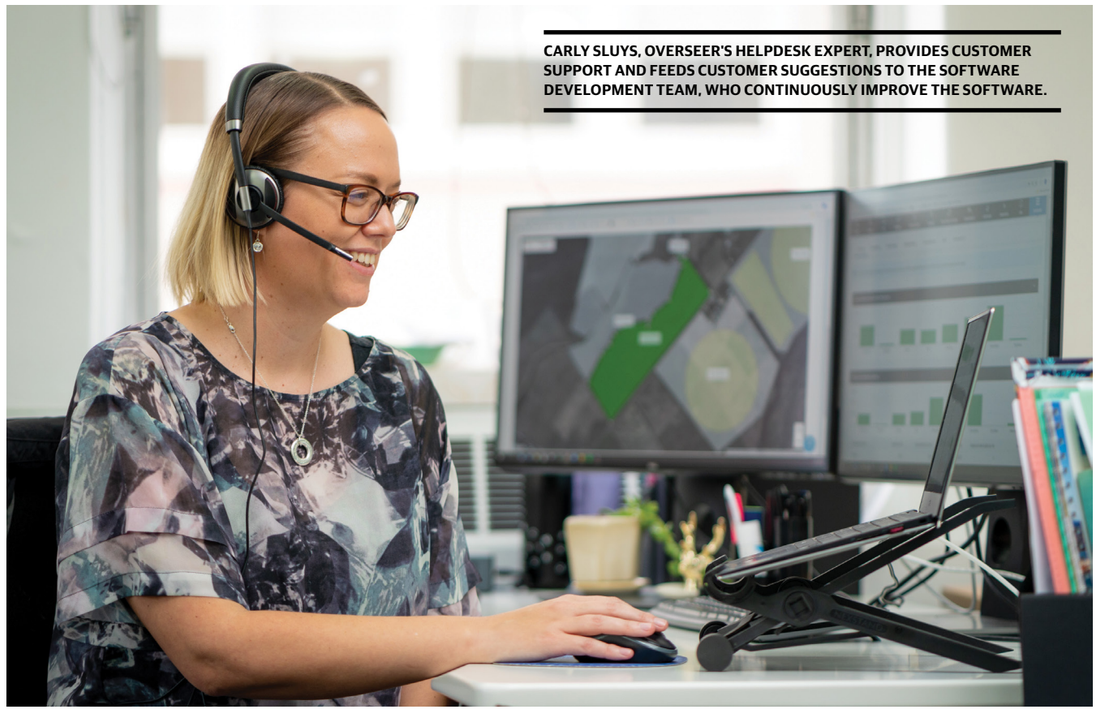
Overseer can also be used to analyse data across several farms to get insights into both nutrient losses and greenhouse gases, and to see where they sit compared with other farmers for benchmarking purposes. More farmers are needed to create a larger national database on top of the 4,000-plus farms modelled in the system, and Overseer Ltd hopes this next-level tool will encourage them to subscribe.

"Farmers can expect more improvements ahead," Antony says. "And Overseer Ltd will continue to work with research teams to add new scientific data to the modelling.

"Going forward, it is going to be about being able to invest in that science. Overseer also recognises that if new science is added to mitigate nutrient losses then this can also help drive behaviour change around its usage. If consultants and farmers are getting rewarded for these mitigations from councils, because they can show it in Overseer, they will be more likely to pick it up."

"So it's definitely a focus for us to create an IT development environment, where we can bring scientific knowledge into that and work with our developers to keep improving the model and to have everyone working collaboratively to make this constant improvement to the model." ■

*Overseer Ltd was set up in 2016 by the software owners, which include the Ministry for Primary Industries, AgResearch and the Fertiliser Association of New Zealand. The company is responsible for supporting and developing the software tool and building a financially viable, subscription-based service. Under a new funding model, an OverseerFM farm account subscription is $200 + GST per year. The farm owner can choose who has access to their paid farm account, for example their consultant.*



CARLY SLUYS, OVERSEER'S HELPDESK EXPERT, PROVIDES CUSTOMER SUPPORT AND FEEDS CUSTOMER SUGGESTIONS TO THE SOFTWARE DEVELOPMENT TEAM, WHO CONTINUOUSLY IMPROVE THE SOFTWARE.


In case you would like to learn more, we have collated this list of sources cited in our articles. Most of these are available online. If you'd like more information, or you'd like to discuss an article written in Ground Effect®, give the Customer Centre a call on 0800 100 123 to have a chat. We'd love to hear from you!


**REFERENCES**

**PAGE 5**

**BEHIND THE SCENES**

1 Cameron and Di: Journal of Soils and Sediments, January 3, 2019: doi.org/10.1007/s11368-018-02227-w.

**PAGE 6**

**FARMER ACTIONS IMPROVING WATER QUALITY**

1 Ministry for the Environment, Statistics New Zealand. 2017. Our fresh water 2017: Data to 2016. Wellington, New Zealand: Ministry for the Environment and Statistics New Zealand.
2 R.W. McDowell, M.J. Hedley, P. Pletnyakov, C. Rissmann, W. Catto, W. Patrick. Why are median phosphorus concentrations improving in New Zealand streams and rivers? J R Soc N Z.1-28. (https://www.tandfonline.com/doi/full/10.1080/03036758.2019.1576213)
3 R.W. McDowell. 2014. Estimating the mitigation of anthropogenic loss of phosphorus in New Zealand grassland catchments. Sci Total Environ. 468-469:1178-1186.
4 R.W. McDowell, M. Schallenberg, S. Larned. 2018. A strategy for optimizing catchment management actions to stressor–response relationships in freshwaters. Ecosphere. 9(10):e02482. (https://esajournals.onlinelibrary.wiley.com/doi/10.1002/ecs2.2482)

**PAGE 9**

**HOW "FIXED" IS YOUR P?**

1 R.G. McLaren, K.C. Cameron. Soil Science, (1990), pg 211-212.

**PAGE 22-23**

**WHITE CLOVER - THE PASTURE ALL-STAR FOR FIXING N**

1 Dr D. Moot. "The Journal" The official publication of the NZ Institute of Primary Industry Management Inc, vol 23. March 2019.
2 J.L. Brock, J.R. Caradus and M.J.M. Hay. Fifty years of white clover research in New Zealand. Proceedings of the New Zealand Grassland Association 50: 25-39 (1989)
3 D.F. Chapman, A.D. Mackay, B.P. Devantier, D.A. Costall and P.J. Budding. The relative strengths of phosphate fertiliser application and white clover cultivar introduction for hill pasture improvement. Journal of New Zealand Grasslands 79: 15-18 (2017).
4 K.H. Widdup and B.A. Barrett. Achieving persistence and productivity in white clover. AgResearch and Grasslands.
5 D.R. Woodfield and J.R. Caradus. Factors affecting white clover persistence in New Zealand pastures. Proceedings of the New Zealand Grassland Association 58: 229–235 (1996).
6 K.N. Tozer and G.B. Douglas. Pasture establishment on non-cultivable hill country: a review of the New Zealand literature. Hill Country – Grassland Research and Practice Series 16: 213-224 (2016).

**PAGE 38**

**FARM PLANNING FOR A SUSTAINABLE FUTURE**

1 Global insights: Farm optimisation for sustainable productivity within environmental constraints, September 2018, https://ruralleaders.co.nz/turi-mcfarlane-2018-nuffield-scholar-global-insights-farm-optimisation-for-sustainable-productivity-within-environmental-constraints/


## The Last Word

We hope you enjoyed the ninth edition of Ravensdown's Ground Effect®, which is all about putting insight into action.

Got an idea? This publication is only as valuable as the value you get from it so if you want to see more or less of particular topics or issues please do get in touch via the details below.

Tel: 0800 100 123
Email: newsletter@ravensdown.co.nz
Twitter: @RavensdownNZ
Facebook: www.facebook.com/Ravensdown
Instagram: @ravensdown

On behalf of Ravensdown, we'd like to thank you for your valuable contribution to New Zealand and our food and fibre industry. We continue to invest in and develop our agri-science, technology and innovations for the good of your business and the country. Keep up the good work of smarter farming for a better New Zealand.

## Contributors


Ravensdown wishes to thank the following who provided a wealth of actionable insights to help us all farm smarter.

Professor Richard McDowell, Dr Vera Power, Denis Finnegan and Dr Stewart Ledgard for sharing their thoughts and expertise as industry leaders.

Ravensdown farmer shareholders: Dean and Sarah Rabbidge (Wyndham); Jana Hocken (Manawatu); Steve Horgan (Hawke's Bay); Craig Minson (Burnham); Scott McLean (Southland); and Colin and Isabella Beazley (Wellsford) for sharing their stories and giving up their time for us.

We would also like thank this edition's external contributors: Alice Bradley (Beef + Lamb NZ), Dr Mark Vickers (Veterinary parasitologist), Cheyenne Nicholson, and Tim Cronshaw.

A big thank you goes to the Ravensdown team of Dr Ants Roberts, Dr Rob Murray, Kate Ody, Mark Crawford, Colin Tyler, Dr Martha Trodahl, Jeremy Klingender, Julie Wagner, Mike White, Sonya Perkin, James Livingston, Rangi Holland, Turi McFarlane and Mark Fitzpatrick, for their contributions to Ground Effect 9.

Finally, a special thanks to our design team Libby and Ashleigh from Libby & Ben Ltd, who have designed and laid out Ground Effect to such a high standard.

Editors
Penny Clark-Hall and Victoria O'Sullivan


## Ground Effect®

Ground Effect is available free to all Ravensdown shareholders and customers. If you would like to learn more about Ravensdown, or become a shareholder, call our dedicated Customer Centre on 0800 100 123 or visit us online at www.ravensdown.co.nz.

If you would like more copies of Ground Effect, or do not wish to receive further copies in future, call the Customer Centre on 0800 100 123. The views of external contributors are not necessarily those of Ravensdown.