NZ GRASSLAND ASSOCIATION
Fuelled by Science, Tempered by Experience

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Research with an Agribusiness focus

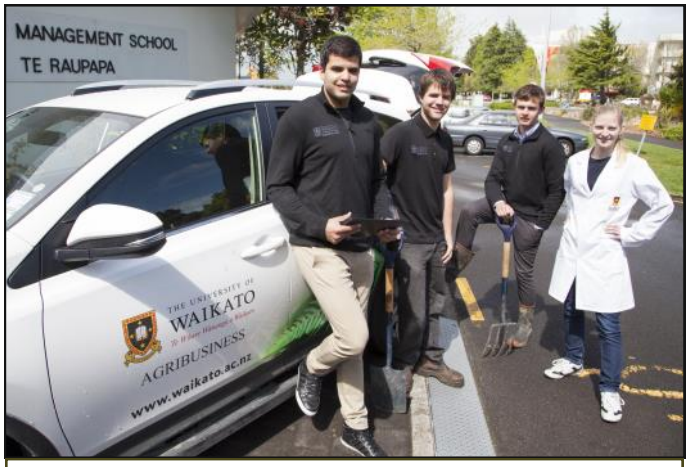
The following articles have been submitted by Agribusiness students from Waikato University. At last year's conference in Tauranga we had a successful agribusiness session that presented the research results from four of the Waikato Agribusiness students research. It provided a perspective that differs from the Association's more traditional pastoral science or 'kicking the grass'. In addition attending the conference gave the students a wider view of the industry they in which they intend to develop their careers and 'make a difference' - an inside view of science, research and its links with the farmers.

A greater proportion of graduates are now employed by agribusiness rather than research - be it banking, regional councils, rural retail, seed, fertiliser or the processing industries. NZGA recognises that we need to engage across all sectors to ensure practices continue to be based on the best science available.

Alex Tressler is a senior student in the Bachelor of Management Studies degree at the University of Waikato. His background is peripherally agriculture with family members involved in rearing dairy calves and agricultural finance. His future is in Agribusiness – not on farm or in science, but making a difference through applying analytical processes to business problems. The article presented in this newsletter was part of a Summer Research project funded by the New Zealand Agricultural Gas Research Centre; the aim of the latter was to build capability and knowledge.

Thomas Macdonald (with spade below) is completing a Masters of Management Studies in Agribusiness but has also been full time as a business analyst (dairy) with LandCorp since May. His background is dairy in Gordonton with 2 summers harvesting grain in Australia, as well as fitting in a summer research project (Macdonald et al. 2013 NZGA).

There are an increasing number of students like Alex who want to make a difference to the industry, but who are not going to do so through the traditional routes. The New Zealand Grassland Association is ideally placed to encourage these students as it bridges industry, policy, practitioners, science and academics.



University of Waikato open for Business – Agribusiness… driving the economy…

Soil Carbon Policy: A New Zealand Agricultural Context

Alex Tressler and Jacqueline Rowarth, Agribusiness, Waikato Management School, The University of Waikato

Background

Ongoing discussion about New Zealand's greenhouse gas production and the high proportion contributed by agriculture emissions have implications for whether or not soil carbon is included in any sort of mitigation policy. The debate is fuelled each time information appears from overseas.

In mid-August, headlines from Australia and the US covered soil carbon. "Optimizing fertility in 'fragile' soil" referred to a development under the Soil Biology Initiative II enabling testing of soil composition and fertility in Australia. The research had been jointly-funded by the Australian Government, research organisations and the grains industry. Comment number one was that soil organic carbon was typically less than 1%, compared to 5% elsewhere in the world.

In the US "We can do more to mitigate soil carbon loss" featured an interview with a soil scientist with the USDA.

The interview explained that it is challenging to measure soil carbon sequestration because (1) it is slow, (2) changes are small and measurement techniques aren't sensitive, and (3) spatial and temporal changes in total soil carbon can contribute to errors in measuring sequestered carbon. Current recommendations from the USDA to increase soil carbon include moving from fallow to more frequent planting, including no-till techniques.

The potential for increasing carbon is what causes interest in terms of carbon trading.

In New Zealand GHG emissions are currently addressed through allocation of national units under the Emissions Trading Scheme. These units are allocated by production intensity, with extra credits over allocation needing to be purchased to cover emissions and credits awarded for certain mitigations. The industries covered in the scheme include our largest emitters such as energy and forestry but does not include pastoral agriculture which accounts for 47% of New Zealand's GHG emissions.

Next year the new government will be reviewing the inclusion of pastoral agriculture in the New Zealand Emissions Trading Scheme (ETS), as a means of placing liability of emissions onto farmers, at production level. This is an attempt to reduce GHG emissions and meet targets established on 1990 base levels and our new voluntary commitments under the United Nations Framework Convention on Climate Change (UNFCCC). The new elected government will be faced with the task of deciding on the inclusion, with a Labour/Green party more than likely to implement agriculture into the scheme and a National Government more likely to exclude agriculture until fiscal neutrality is proven.

America: Effort and Interest

The United States of America 'supported' but has not made a binding declaration that it will reduce emissions. This stance is thought to reflect a desire for freedom in actions, whilst maintaining a climate-friendly image. America has, however, continued funding research on GHG mitigation and soil carbon sequestration practices, e.g. by the Dow Sustainability Program and The Carbon Coalition. These institutes have the primary function of improving the adaptability of sequestration practices and practicability of incentives.

Since the 1950s soil carbon has decreased by up to 50%. A leading cause of the decreased fertility of soils in the US is intensive tillage, but the deterioration has been masked through nitrogen and fertiliser inputs resulting in an improved yield. The masking of changes in fertility and soil carbon from increased fertiliser use has caused a delayed reaction to the issue and America is now hot on researching mitigation initiatives.

The Americans thus far have not implemented any enforced policy in regards to soil carbon sequestration or penalties for decreasing soil carbon stocks. They have however researched the opportunities to improve their carbon stocks and prevent further damage as offsets to GHG emissions through sequestration. A large focus area for the US has been the change of on-farm management practices as highlighted earlier. The changes in land management that enhance soil carbon storage and thus provide an offset to GHG emissions include options such as: reducing tillage intensity and frequency, eliminating tillage, changing crop cycles and covers, eliminating summer fallow, fertiliser management, adjusting irrigation methods, improving feed practices, conservation of riparian zones.

Due to the current lack of economic evidence for measuring sequestration, the suggestion has been made that rather than focusing on separate measurement and management schemes to tax carbon or subsidize for sequestration, the incorporation of practices promoting sequestration be included in current land conservation policies. The idea here is that existing land conservation policy aiming to prevent damage to the environment, could incorporate practices which protect the environment in multiple functions, including improved carbon sequestration, without the cost associated with measurement for credit/tax systems and the like. This means that America could offset their emissions with decreased economic burden and unpredictability.

Australia: Innovations, Complications and Revocations

Australia has made attempts at policy obligations and has a strong network examining alternatives for mitigation of GHG. The most recent attempt by Australia at policy surrounding agriculture and soil carbon sequestration is the carbon credits (carbon farming initiative) act 2011. The act is part of the plan to reduce Australia's GHG emissions and is the world's first initiative nationally backed as a carbon offset market for the land sector, awarding credits for eligible offset projects which can be sold to select entities wishing to offset their liabilities.

Thus far the voluntary initiative has given few methodologies approval. Many projects submitted under the act have been sent back to their proposers by the Domestic Offset Integrity Committee due to insufficient information. The initiative has approved some methodologies such as manure management in piggeries and establishment of environmental plantings, however there are issues around the permanence of sequestration from plants. The sequestration must be permanent in order to maintain credits, with mandatory obligation to surrender credits back the sequestration is reversed, say by deforestation, even if this is done by a later owner. Soil carbon has not been successful in meeting criteria.

The future of the Carbon Farming Initiative is uncertain with the changing directions of the coalition government and the relinquishment of the Australian Carbon Tax. With the country repealing the carbon tax in July 2014, associated programs such as the Carbon Farming Futures program, which provided research on technologies for reducing emissions, and the Conservative Tillage Tax refund, which provided a tax refund of 15% for those who used specific

machinery for tillage, will now also be repealed. These will be replaced and covered through the new Emissions Reduction Fund. The policy reached green paper stage in December 2013 and states future action under the CFI will remain voluntary.

The minimal success of the Carbon Farming initiative has not meant the research in Australia on carbon sequestration has halted. Australian scientists have experimented with several methods to incorporate sequestration into modern broad-acre farming. These include technical options such as liquid inoculant style fertiliser with deep rooted clover species, globulin producing fungi to encourage nutrient uptake and saprophytic fungi to trap organic carbon in loose soils.

These recommendations aimed to improve sequestration and create greater aggregate stability of soil, but have yet to achieve scientifically and economically-supported status. The Australian Department of Agriculture has allocated $1million towards exploring the effects on soil carbon using deep rooted foliage in crops during 2012-2015 (Australian Department of Agriculture, 2014).

The interest in soil carbon in Australia has also alerted academics to what we have seen in the USA: widely applied measurement and effectiveness are difficult to assess due to differing sequestration rates, and economic profitability must be significant to entice farmers.

Despite this, the Australian researchers have come to conclusions that practices such as the following all provide a level of sequestration or conservation of soil carbon:

- Conservation tillage
- Increased retention of crop residues or "stubble"
- Regrowth of native vegetation
- Reduced frequency of fallowing
- Conversion from annual to perennial crops or pasture
- Grazing and livestock management: for example, intensive rotational grazing
- Sowing improved grass species that produce more biomass.

New Zealand already has approximately 50% of land area under pasture, which produces more biomass (particularly under intensive management which includes irrigation and fertiliser) than possible in other countries; under the new Common Agricultural Policy 'Greening' theme this pasture would be eligible for environmental support subsidies.

Taxes and subsidies create unintended consequences, as do policies, hence this investigation.

Conclusions

Policies regarding sequestration have been proposed in other countries. No country has yet implemented a successful soil carbon policy, largely due to the lack of financial evidence on mitigation methods, the difficulty of measurements and the spatial variability of results inhibiting justified large scale actions and enforcements. Based on the evidence gathered, it is not recommended that New Zealand incorporate agricultural soil carbon into policy at this stage. The global economic and scientific evidence for the effectiveness of a policy is currently lacking. Filling the gaps in the research is essential before any enforced actions take place in order to protect New Zealand's competitive advantages for agriculture, the economy, our society and the environment.

NB The challenges of managing and measuring soil carbon were the focus on the NZGA conference paper: Managing Pasture for Animals and Soil Carbon (Parsons, Rowarth and Newton, 2009) http://www.grassland.org.nz/publications/nzgrassland_publication_70.pdf

Also the NZGA newsletter August 2012 (Is soil biology a can of worms? Rowarth, Parsons and Lissaman) http://grassland.org.nz/newsletter.php?year=2012

Measuring the comparative cost of environmental compliance for Waikato dairy farm systems

Thomas Macdonald, Jacqueline Rowarth & Frank Scrimgeour, Agribusiness, Waikato Management School, The University of Waikato

The Challenge

The New Zealand dairy industry has grown significantly over the past decade, particularly in new areas such as Canterbury, Southland and the Central Plateau, but the Waikato region still has New Zealand's highest concentration of dairy cows (and 24.6 % of the national herd).

In common with other regions, dairy farm systems in the Waikato have intensified principally through the use of supplement feeding. In the traditional dairying region of Matamata-Piako, stocking rate has decreased in the last five years (from 3.22 to 3.13), but production of milk solids per cow has increased by 16%. In South Waikato, stocking rate has also decreased marginally (from 2.98 to 2.97) but area has increased 18% due to conversions around Tokoroa. Cow numbers have increased 20% and production of milk solids per cow has increased 18%. The increase per cow throughout the Waikato reflects better feeding, and resilience through periods of low pasture growth; the last five years has covered three significant droughts and uncharacteristically cold periods.

The growth and changes in dairy production has intensified reaction from the public, particularly around the environment. In response, government at both a central and regional level has implemented regulation aimed at limiting and reducing the negative effects of dairy on the environment. The new regulatory framework requires farmers to 'farm within the limits' with regards to both water quality and quantity.

Changing farm systems, infrastructure and management techniques are all options for achieving 'compliance', but

the economic benefits are not always apparent. Research published this year involving AgResearch soil scientist Dr Stewart Ledgard, working with consultants, farmers and researchers in the Bay of Plenty concluded that it was very difficult to reduce nitrogen to meet a nitrogen discharge allowance when there were few 'low hanging fruit' mitigation options (Park, Kingi, Morrell, Matheson & Ledgard, 2014).

Compliance spending for dairy farm systems requires high levels of capital investment, which can necessitate debt financing. This has resulted in the fear that becoming environmentally compliant is mutually exclusive to being economically viable. However, through modelling farm systems it is evident that by optimising system intensity, management regime and farm infrastructure the modern dairy farm can maximise economic returns and mitigate environmental degradation.

In this research, analysis of farm systems was performed using financial, physical and environmental models to determine the comparative profitability and environmental performance of Waikato farming systems of varying intensity, infrastructure and management technique. Data from DairyBase were used to obtain the physical and financial characteristics of the average Waikato farm systems at low, medium and high input for the 2011/12 season. A corresponding nutrient budget in Overseer v6 provided the environmental analysis.

Results

For the average Waikato farm system, N leaching (a measure for environmental performance) was 31 kg per hectare for the low input system, 29 kg per hectare for the medium input system and 34 kg per hectare for the high input system.

Operating profit per hectare was $2,551, $2,533 and $3,152 for the low medium and high input farm, respectively. Two further measures of N use included operating profit per kg N leached and nitrogen leaching efficiency (NLE), that is the kg of N leached per hectare divided by the kg of milksolids produced per hectare. Analysis of the Waikato farm systems showed operating profit per kg of N leached increased uniformly from $82 to $92 between the low and high input systems. This indicates higher profitability for each kg of N leached under the high input systems. This is a reflection of higher NLE, greater milk solids produced per kg of N leached (Table 1).

A targeted survey to Waikato dairy farmers of varied scale and system intensity has provided valuable insight into the realised economic cost of compliance. Of the 20 farmers surveyed so far, every farm had incurred a cost associated with environmental compliance in the past four years. The investment made for compliance varied as a function of scale with a range between $25,000 and $500,000 spent on improving the environmental performance of the farm system.

Types of environmental compliance measures adopted include building lined storage ponds, riparian fencing of waterways and cow housing systems. Across all farmers surveyed the average environmental compliance cost was $1.00 per kgMS, $1428 per hectare and $385 per cow. This represents the one off capital investment to adapt farming system through management or, most commonly, farm infrastructure. Of the compliance systems adopted, cow housing has been shown to be a significantly high one off capital cost, however the benefits to the farm system- including feed conversion efficiency, increased pasture production and the ability to capture and control the application of farm dairy effluent- provide an increase in farm operating profit over future years (Macdonald, Rowarth, & Scrimgeour, 2014).

Table 1. Average Waikato Farm System – Financial and Environmental Indicators Survey of compliance cost

		Low	Medium	High
N leaching	kg/ha	31.00	29.00	34.00
Operating Profit	$/kgMS	$2.82	$2.48	$2.39
Operating Profit	$/ha	$2,551	$2,533	$3,153
Operating Profit	$/cow	$991.	$913	$1,026
OP/N leaching	$/kgMS	$82.29	$87.34	$92.74
NLE	kgMS ha/kg N leached ha	34.5	39.5	41.5

Table 2. Initial Results from Compliance Cost Survey

	Average	Low	Medium	High
$/kgMS	1.00	0.51	1.50	0.99
$/Ha	1428	489	1841	1954
$/cow	385	178	572	407

There is general consensus within the survey responses which suggests environmental compliance is a top priority for Waikato dairy farms. However, by nature of the regulatory framework there is a lack of understanding as to what exactly is required for environmental compliance and by whom the requirements are set.

Many Waikato farmers indicated within their responses

that they experience a good working relationship with the regional council with regard to farm audits and compliance checks. However, despite their investment in environmental farming practices, they were still unsure whether the farm met all of the guidelines under current or proposed regulation.

Conclusions

The increase in environmental regulation, and the subsequent need for compliant dairy farming systems, has several implications for New Zealand's dairy industry economically, culturally and environmentally. As a result of the increasing regulatory environment there is a need to optimize the way in which farm systems are employed and managed in order to maximize the profitability and environmental sustainability of farms at an individual level and as an industry. Investment in compliant farm systems has been a prominent project for dairy farmers across New Zealand. This is reflected in rural media, industry strategy documents as well as being confirmed through the farmer surveys in this research. While expansion and intensification of the industry is often cited as the cause for regulation, within the Waikato, farmers are achieving higher production from lower stocking rates driving productivity and lowering the impact on the environment. In turn these farm systems are generating the means with which to invest in farm management and farm infrastructure options to reduce environmental impact further. Achieving environmental compliance is a cost which increases exponentially the further the current farm system operates from the designated compliance target. Whatever the media suggestions to the contrary, change is not easy, but farmers are doing their best.

References

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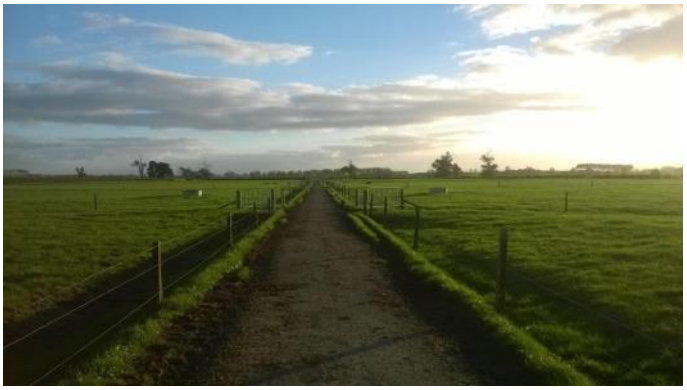


Thanks to Thomas for the Waikato images

Sound bites don't apply to science

Jacqueline Rowarth, publ. in NBR, Aug 8, 2014

Extrapolation is dangerous. It is a calculation of a value of a function outside the range of known values, or an extension of the application of a method or conclusion to an unknown situation by assuming that existing trends will continue or that similar methods will be applicable.

Scientists try to avoid it. Through the research qualification process, involving various degrees and at least four years beyond a basic undergraduate degree, scientists are encouraged (a) to interpret what the data indicate (not what they would like them to indicate) and (b) not to take the implications of the conclusions beyond the range from which the conclusions were formed.

This is not the case in other fields and the sound bite approach to reporting is exacerbating the problem.

Radio and television interviewers appear to be regarding cutting to a yes/no answer as a sign of success, but in doing so they are stopping the people being interviewed from completing answers to complex issue questions. Their interruptions mean that the audience does not hear the end of a counter-argument, nor the complexities and caveats on assumptions.

Curtailing of information is occurring during reports as well as in discussions.

Headlines indicating that 'Carbon tax hasn't harmed B.C. agriculture, study finds' is a case in point. The research came from the Pacific Institute for Climate Solutions and suggested that although the agricultural sector had claimed that having to pay a carbon tax would make it uncompetitive on the global market, there was no evidence that a change in exports or imports of agricultural products was attributable to the carbon tax.

The implication from the report was that New Zealand farmers are wrong to argue that they would be made uncompetitive if they had to pay a carbon tax. This is an extrapolation.

What was not highlighted in the media here was that the British Columbia carbon tax being investigated was a tax of $30 per tonne of carbon dioxide equivalent emissions on fossil fuel.

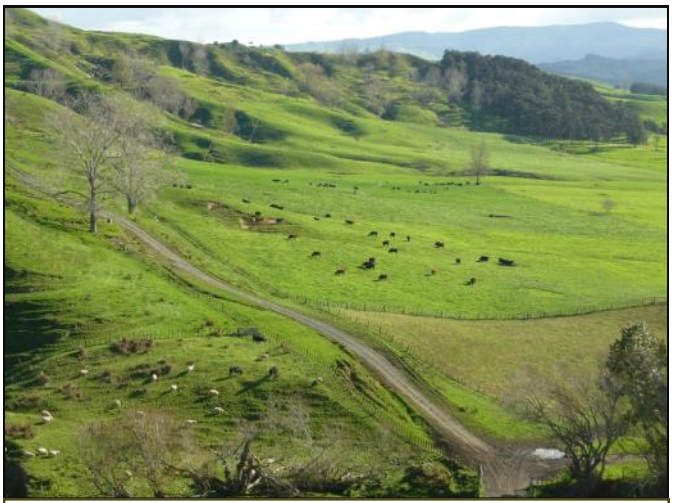
Farmers in British Columbia have adopted improved and efficient technologies which have enabled some of them to remain in business. Overall in B.C. fossil fuel consumption decreased nearly 19% whereas the rest of the country increased consumption by 3%. New Zealanders, including

farmers, already pay tax on fuel.

Farmers in New Zealand have already done what they can in achieving fuel efficiency. What they can't do, at least not easily, is change the biology of their animals. As a consequence, a carbon tax on agriculture involving animals would simply be an extra cost which would certainly detract from competitiveness.

Recent research by DairyNZ has highlighted the fact that the US farmers who are the largest and most profitable are now competing directly on cost of production with the less profitable New Zealand farmers. US farmers are subsidised for production and are not subject to a carbon tax. In addition, cost of labour per hour in US dairy systems is estimated (again by DairyNZ and using an 80c exchange rate against the USD) at $8-$10, in comparison with $14-$30 in New Zealand. Clearly New Zealand farmers are right to be concerned about anything that might make the costs of production greater here.

A different report, but still focussed on Greenhouse Gas and agriculture, stated that beef production is ten times more damaging to the environment than any other type of livestock. What wasn't considered in the New Zealand presentation is that 95% of beef production in the US, where the research was done, is in feedlot systems not free-range pasture. The calculations for New Zealand are different and should include 'is there a better use for the land'? Humans cannot obtain nutrition from plants growing on hill country without an animal intermediary.



Beef grazing in the hills in the King Country

For any of the energy and protein calculations that involve a comparison of different livestock categories, dairy cows star. But putting them on hill country during lactation decreases their efficiencies. Suggesting that crops should be grown for direct human consumption overlooks the physical constraints on cultivation (and the fact that cultivation burns off organic matter in the soil, thereby releasing carbon to the atmosphere), the climate in New Zealand which makes protein crops such as soybeans and lentils difficult to grow (at least at present) and the labour input for crops such as nuts.

A third extrapolation example is the notion that it is easy for farmers to improve their environmental footprint while maintaining economic viability. The concept involves a reduction in nitrogen use, which models indicate will result in a reduction in nitrogen loss to the environment. Although pasture growth is likely to be reduced because of the lower input of fertiliser, the fertiliser bill will also be reduced; fine tuning of feed will increase nitrogen use efficiency. The theory is that financial neutrality will be achieved and the environment benefits.

The theory has been shown to work for some operations, but 'some' is not 'all'. Results from models should always be interpreted with care as all models are subject to constraints and assumptions in their development.

Research published this year involving AgResearch soil scientist Dr Stewart Ledgard, working with consultants, farmers and researchers in the Bay of Plenty concluded that it was very difficult to reduce nitrogen to meet a nitrogen discharge allowance when there were few 'low hanging fruit' mitigation options.

DairyNZ experts suggest that if the nitrogen reduction target is greater than approximately 6kg per ha per year, the farm system will need to be changed. Changing farm system does not constitute 'low hanging fruit'.

Extrapolations are dangerous. They do not consider context and appropriateness which are vital in complex issues. Whether from one country to another, or from the particular to the general, extrapolation enables misinformation and misunderstanding. Sound bite interviewing and reporting should be saved for 'news'.

Alexandra Conference 2014

The registration for this year's conference is now open online and earlybird rates are available until the end of September.

Register via the link below.

grassland.org.nz/eventdetails.php?eventnum=20

The programme will be available online after next weeks Executive Meeting.

The AGM of the Society will be held at 5.30pm on the Thursday 6th November. Apologies can be emailed to eo@grassland.org.nz