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RELEASE



NEW ZEALAND
AGRICULTURAL GREENHOUSE GAS
Research Centre

The newsletter of the New Zealand Agricultural Greenhouse Gas Research Centre

Director's Update



Welcome to the fourth issue of the NZAGRC newsletter. I'm glad to see the days getting longer and summer rapidly approaching.

During the university summer break we are proud to be supporting six promising young students to work alongside some of our Senior Scientists. The students are participating in a range of research projects and it is great to see how motivated they are to get started.

Here at the Centre, we submitted our Annual Report to MAF at the end of August and this is now available on our website, along with a shorter and more colourful "Highlights" document. We have been working with a local company here in Palmerston North to redesign our website over the past few months and we'll keep you updated on the relaunch (www.nzagrc.org.nz). The LEARN website has also undergone a facelift (www.livestockemissions.net) and will shortly be completely redesigned.

We are busy preparing for our second annual conference and workshops at the start of 2012. On the 31st January, we will be holding an open public conference at which key international and New Zealand scientists will present. This will be followed

by two days of science and stakeholder workshops which will involve all scientists who participate in the NZAGRC science programme, the Centre's International Science Advisory Group and the Centre's Stakeholder Advisory Group

The Global Research Alliance goes from strength to strength with the opening of Round 1 of the New Zealand Fund for Global Partnerships in Livestock Emissions Research (NZ\$16 million) and the advertising of a series of targeted RfP's. NZAGRC staff have been busy providing technical support to MAF during the development and implementation of these two new funding initiatives.

Enjoy reading

Dr Harry Clark



Staff News



Centre staff enjoyed having Dr Kirsty Hammond work with us in the NZAGRC building during August and September. Kirsty did a great job of collating and summarising recent research in the agricultural greenhouse gas mitigation space for use in a number of future reports. In her time at the Centre, Kirsty was awarded

her well deserved PhD. Though she was a little nervous, we weren't at all surprised when she received glowing reviews of her thesis from her examiners. Kirsty has recently started post-doctoral research at Reading University in the UK with Professor Chris Reynolds. We wish her all the best for her time overseas and look forward to hearing all about her adventures in Europe. We'll miss her enthusiasm and her fantastic baking!



Dr Victoria Bradley has reverted to using her maiden name (Hatton) for work purposes, so don't be confused by her new email address. To ensure that all messages get through, email addresses with both surnames will continue to be active for the next few months. victoria.hatton@nzagrc.org.nz



Livestock Research Group advances its work plan



The Livestock Research Group of the Global Research Alliance continues to make great strides towards its goal of increasing global collaboration in research to lower the emissions intensity of livestock systems. Delegates met on 4-5 November in Amsterdam to review current key projects and consider critical areas for future action.

Projects currently being delivered by the group include best practice guidelines and a technical manual for various greenhouse gas measurement methodologies. These outputs are produced by international teams led by New Zealand experts and aim to increase the robustness and comparability of emissions measurements globally. The past half year also saw the establishment of two global research networks, one focusing on opportunities to select low-emitting animals through genetics and genomics, and the other on increasing our knowledge and building up a database of the diversity of rumen microbes.

These networks have already identified opportunities for collaborative projects that could not be achieved by any single country but rely on the pooling of expertise and research capacity across countries. New Zealand scientists will be actively involved in coordinating the further development of

these research networks and will lead two projects in animal selection and analysis of the diversity of the rumen microbial community. Funding for New Zealand's inputs is provided by the Ministry of Agriculture and Forestry, with contracts to be negotiated and managed by NZAGRC.

The Livestock Research Group also agreed to establish a third network on feed and nutrition, to be led by Switzerland with support from several other countries. Delegates also agreed to plan a set of regional workshops to assist capacity building in developing countries. New Zealand was asked and agreed, through the NZAGRC, to scope and coordinate these workshops, building on its success in initiating collaborative research across five countries in Latin America.

A significant further boost to joint international research is expected from the

New Zealand Fund for Global Partnerships in Livestock Emissions Research. This fund aims to invest \$25 million over the next four years in international collaborations. It was launched at the Ministerial Summit of the Alliance in June this year, and the first round of Expressions of Interest closed on 7 November. More than 25 eligible proposals have been received from New Zealand institutions and teams led by Alliance member countries. These will now be evaluated by an international technical advisory panel. A subset of proposals will be invited to submit full applications, with successful teams identified and proceeding to contracting by the middle of 2012. The fund requires all proposals to demonstrate strong international teams and co-funding but also significant New Zealand participation, ensuring that New Zealand science can both contribute to and benefit from globally available expertise and resources.



Investigating the scope for increasing soil carbon levels in New Zealand

Can we increase agricultural soil carbon stocks in New Zealand? This is one of the key questions that the NZAGRC core soil carbon programme is seeking to answer. When looking at the whole farm system, increases in carbon stored in the soil could help to offset the emissions from other agricultural activities.

In order to define the scope for raising soil carbon levels, we first need to understand (i) how much soil carbon we currently have, and (ii) how much carbon our soils are capable of storing. Two science teams, led by Drs Allan Hewitt (Landcare Research) and Mike Beare (Plant & Food Research), are working alongside each other to determine

these current and potential levels of carbon storage. Their combined results are aimed at defining the “gap” in soil carbon that could be filled. Other projects in the NZAGRC programme are investigating the management practices that can be used to fill this “gap”.





Quantifying current agricultural soil carbon stocks by “joining the dots”

Dr Allan Hewitt (Landcare Research) is leading the team that is quantifying current NZ agricultural soil carbon levels. This team includes Drs Stephen McNeill (Landcare Research) and Andrew Manderson (AgResearch). Their approach is based on selecting the best available data at specific points across the country and then using sophisticated modelling techniques to approximate the soil carbon levels between the points (called “covariate layers”). It’s a more complex version of a “join the dots” puzzle that builds up to show the New Zealand soil carbon landscape.

Dr Hewitt points out that New Zealand’s current levels of soil carbon are actually quite high compared to many other countries. “This may be due to our predominant history of pastoral farming”, Allan says, “we haven’t been too savage to our soil”. “Some arable areas, for example places in the American corn belt which have been continuously cropped for long periods of time, have recorded depressed levels of soil carbon”.

A wide variety of spatial maps of NZ data that show correlation with soil carbon levels currently exist. These include geological

information, slope, altitude, longitude and rainfall. The team is using these to build up new covariate layers, that is, estimates of soil carbon in areas for which no point data is available. One interesting approach that the team is taking is to use historical information about land cover that may prove to be a dominant predictive covariate layer in their modelling. Soil carbon has a long residence time and what was happening in a particular area one hundred years ago may turn out to have more impact than more recent farming practices. In order to investigate this, the modellers have access to the Land Environments of

New Zealand data (LENZ) which estimates pre-European vegetation across the country. Additionally, the team are looking at how they can build covariate layers that reflect carbon turnover rates.

“The key to this project is in selecting the right point data and the right covariate layers” summarises Allan. The final maps produced by this team will be an important component to determining how and where technologies to increase soil carbon levels could be successfully deployed in New Zealand.

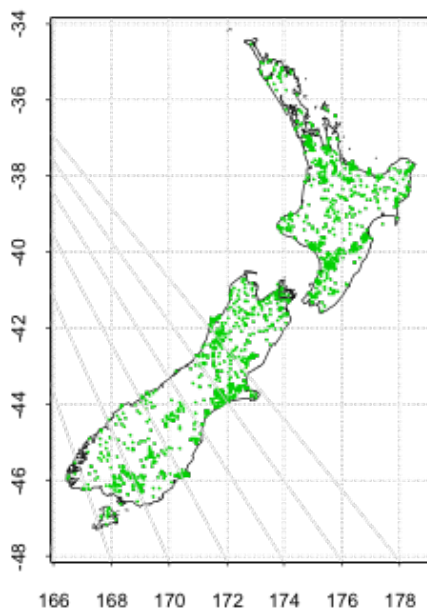


Fig 1: Locations of soil plot data used for analysis of soil carbon. Over 2000 plots are used from all over New Zealand, although the primary interest is in soil carbon for agricultural regions.

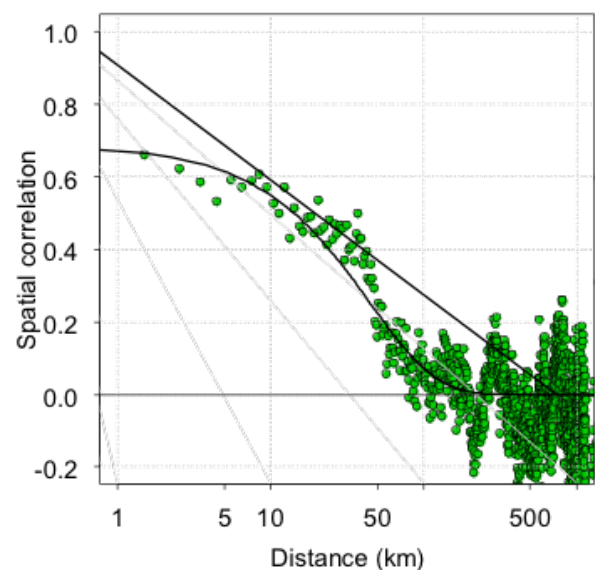


Fig 2: Plot of the spatial correlation of pairs of 0–30 cm soil carbon data measurements (solid points) as a function of distance between the two points, along with a model for the correlation shown as a solid line. The soil carbon spatial correlation at zero distance is equal to one (i.e. measurements at the same point have the same level of soil carbon), but the correlation at other distances is less than unity due to natural variability at a local scale, and diminishing correlation effect with increasing distance.



Calculating upper limits of soil carbon storage

Dr Mike Beare (Plant & Food Research) is leading the team that is focussed on quantifying the upper limits of soil carbon storage. Team members include Drs Roger Parfitt (Landcare Research), Mike Dodd (AgResearch), Haydon Jones (Scion) Stephen McNeill (Landcare Research) and Joanna Sharp (Plant & Food Research). The idea that soils have an upper limit of carbon is based on the concept of soil carbon stabilisation.

While overseas research suggests that the stabilisation of soil carbon is primarily dependent on the amount of fine mineral particles (i.e. fine silts and clay), recent research in New Zealand has indicated that other factors such as aluminium, allophone and Fe-oxide contents are much more important. These results suggest that chemical stabilisation of organic matter is the key process controlling carbon stabilisation in our soils but this theory has not been independently verified. In addition to verifying this concept, the research team is also focussed on developing a new model

that will predict the upper limits of carbon storage from a soil's chemical properties.

The "Upper limits" research team is also working with Dr Hewitt's team to use their statistical modelling approach to estimate the soil carbon storage potential. In this case, we will remove the land use data layer from their model to give us a first approximation of the upper limits of soil carbon based on soil carbon stocks prior to agricultural development.



Mike Beare and Joanna Sharp discuss approaches to modelling the upper limits of soil carbon stocks



Chris Dunlop demonstrates some recent improvements in a soil coring method to measure soil carbon stocks

Capability Development Fund

Funding capability development in the GHG emissions mitigation research arena is a key activity for the NZAGRC. In addition to funding PhD and post-doctoral positions within the core science programmes, the undergraduate and graduate Pipeline Scholarship scheme, administered by Massey and Lincoln Universities, is now in its second year.



Emilie Ollion



James Wang with Dr David Pacheco



Glen Treweek

A NZAGRC integrated farm systems core programme led by Dr David Pacheco (AgResearch) is benefiting from the additional brain power of two young minds. The students, Emilie Ollion and James Wang, are contributing to the development of improved models of methane production in the rumen which reflect the NZ forage based situation more accurately.

Emilie Ollion

Emilie received funding from the NZAGRC to conduct her Masters project with Dr Pacheco at Grasslands in Palmerston North. As a French citizen, studying at Wageningen University in the Netherlands, Emilie enjoyed the opportunity to learn about yet another country's agricultural system whilst carrying out her research in NZ. In addition to her scientific research, she also upgraded her rugby skills whilst in the southern hemisphere by playing for the Massey University women's team.

Emilie's project has cemented the relationship between the NZ team and her Wageningen co-supervisors Drs Ad van Vuuren and Jan Dijkstra. There are already plans to collaborate and build on her work in the near future.

James Wang

James has a Masters degree in statistics from Canterbury University and has recently moved to Palmerston North to start his PhD at Massey University. He is supervised by Drs Bruce van Brunt and Tammy Lynch (Massey University), and Dr Pacheco. James was attracted to the NZAGRC funded project by the chance to apply his mathematical knowledge to "something new", especially given the importance of agriculture to the NZ economy. He is also taking advantage of the sporting opportunities at Massey and enjoys playing badminton, dodgeball and swimming.

Glen Treweek has recently moved to Lincoln University to begin his NZAGRC funded PhD, working with supervisors Professors Hong Di and Keith Cameron.

Glen Treweek

Glen grew up in the Waikato where he first became interested in dairy farming and appreciated the importance of the industry to NZ. He has a passion for ensuring that as a country we are farming in the most responsible way possible. To that end, he completed his BSc and MSc at Waikato University, with a focus on environmental and soil science.

The working title of his PhD project is: Nitrous oxide emissions from a winter dairy forage system - effects of animal trampling and soil physical properties. Away from his studies, Glen enjoys cooking, gardening, building things and playing with old cars. He is relishing the opportunity to enjoy all the things that Canterbury has to offer over the next three years.

We are proud to introduce the six recipients of the NZAGRC Pipeline Scholarships for 2011/12. Typically November is when many students are winding down for the long summer break, however these scholars are enthusiastically preparing for a summer, an Honours year, or both, spent with their sleeves rolled up getting involved in cutting edge research.

Lincoln University Scholars



Roshean Fitzgerald

Roshean is currently in the third year of her Bachelor of Science Degree and intends to do Honours next

year. Her scholarship research will investigate the potential of selected New Zealand native plants to mitigate N₂O emissions from soil under the supervision of Dr Brett Robinson. She has a keen interest in environmental sciences and aims to apply her knowledge gained at university to the dairy industry after she graduates.



Alice Keir

Alice grew up on an arable and dairy grazing farm in the Mid Canterbury district and has a huge passion for the farming

industry. She is currently studying towards a Bachelor of Agricultural Science degree and will be conducting research into quantifying ruminant urine induced carbon leaching under the supervision of Professor Tim Clough this summer. She can foresee potential benefits for future farming from the outcomes of this soil science research.



Peter West

Peter is a third year Bachelor of Agricultural Science student. His NZAGRC scholarship will fund his Honours project

investigating variability in soil carbon storage under grazed pastures supervised by Professor Frank Kelliher. From an agricultural background, Peter is interested in how we can mitigate the potential negative environmental impacts of pastoral agriculture, while maintaining farm productivity and profitability. He is keen to contribute knowledge and understanding to the agricultural community and find a suitable role in the industry after graduation.

Massey University Scholars



Calvin Ball

Calvin is a third year Bachelor of AgriScience student intending to do Honours next year. He has recently been crowned 2011

Massey Agriculture Student of the Year and has a passion for the NZ farming industry. He previously spent a summer working for a fertiliser company and his NZAGRC funded research continues his interest in this area. Calvin's project will investigate whether the same amounts of dry matter can be produced with reduced nitrogen content. He will be supervised by Professor Tony Parsons (Massey) and Dr Susanne Rasmussen (AgResearch).



Chelsea Hirst

Chelsea is in her second year of a Bachelor of Science degree studying both agricultural and animal sciences. She is looking

forward to her project, supervised by Drs David Pacheco and Peter Janssen (AgResearch), which involves investigating colonisation of the early rumen. Chelsea chose this research area as she is interested in seeing how animal trials are run in the field, rather than the university teaching laboratory. She will be engaged in experimental work which examines the effects of manipulating the rumens of young lambs versus their twins as controls.



Priya Saini

Priya has a BSc in Biotechnology from India and came to New Zealand to study for a graduate certificate in Science and

Technology. Her NZAGRC funded summer research will place her in Dr Graeme Attwood's laboratory at AgResearch in Palmerston North. Her objective is to investigate the relationships that occur between methanogens and bacteria in the rumen environment through gene expression studies.

Moving towards solutions

NZAGRC 2nd Annual Conference

WHEN: 31 January 2012

WHERE: AgHort Lecture Theatre, Massey University, Palmerston North



The NZAGRC conference will be an exciting opportunity for a wide range of representatives from the science community, New Zealand government bodies, industry bodies, farmers and businesses to come together.

The day will be an open public conference at which key international and New Zealand scientists will present on the current state of affairs in some key areas of agricultural greenhouse gas emissions mitigation and how these may collectively lead to on-farm solutions for the future.

Attendance is free, but delegates must register to attend the conference.

Call for posters

The NZAGRC conference is an excellent opportunity for all scientists working in the agricultural GHG emission mitigation arena to showcase their latest results.

Abstracts (max 150 words) must be submitted via the NZAGRC website by 1st December 2011.

Successful applicants will be notified by 9th December and poster guidelines will be supplied.

Science & Stakeholder Workshops

1-2 February 2012

Two days of workshops will follow on from the conference. These will include a NZAGRC science review and an opportunity for stakeholders to discuss the science direction and content. Invitations to this event will be issued separately.

Register at www.nzagrc.org.nz



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Livestock Emissions &
Abatement Research Network

GLOBAL
RESEARCH
ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

LEARN is a collaborative, international network to facilitate the development of practical and cost effective agricultural greenhouse gas mitigation solutions.

Check out the new look LEARN website (anticipated launch date 1 December) at www.livestockemissions.net to find out about:

- Funding opportunities
- Joining this growing international network



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