LIVESTOCK RESEARCH GROUP
newsletter
GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

March 2016

Update from the Co-Chairs

"Livestock greenhouse gas emissions are likely to become of greater significance in global mitigation efforts in the future" – Professor Richard Eckard, University of Melbourne and Chair of GGAA 2016.

This was a key conclusion of the recent Greenhouse Gas & Animal Agriculture (GGAA) conference in Melbourne, Australia – a global showcase of the collective state of knowledge on greenhouse gas emissions from animal agriculture. It was also a very relevant point for the Livestock Research Group (LRG) to reflect on during our eighth meeting, immediately following the GGAA on 19-20 February 2016.

We were delighted to welcome nearly 50 participants to our meeting, which was generously hosted by the Government of Australia and which also encompassed a half-day joint meeting with the Global Research Alliance's (GRA) newly formed 'Integrative Research Group'.

Our meeting made good progress on several opportunities for the LRG during 2016, including helping the LRG's networks advance their ideas for collaborative research and funding sources; focusing LRG capability building activities on supporting countries to move towards Tier 2 GHG inventories for livestock emissions and the technical skills and policy links this requires; and deepening our existing partnerships with CCAFS (CGIAR's Research Program on Climate Change, Agriculture and Food Security), the World Bank and the FAO. You can read more about the main outcomes from our meeting on pages 2-3, along with next steps for the Integrative Research Group.

Several of the LRG's research networks also met during the week of GGAA. We attended as many of these meetings as we could and were very impressed with the level of engagement and the calibre of the work programmes underway. You can read more about network activities and the outcomes of their meetings on pages 4-6 of this newsletter.

Several of the networks have plans to submit bids to the current European funding round 'ERA-GAS', including a joint proposal from the Feed & Nutrition Network and the Manure Management Network exploring feed-nutrition-manure-soil carbon and nitrogen emissions relationships. It is this type of activity that truly epitomises the GRA's unique approach to collaboration: countries simply wouldn't have been able to achieve this working in isolation. We hope to see a number of successful GRA projects as a result of ERA-GAS and are excited about the prospect of the GRA working toward its own funding mechanism this year.

Some of the highlights from the GGAA are presented on pages 7-8. We noticed a central theme emerging around the importance of taking an integrated approach to mitigation – building research programmes that acknowledge and embrace the complex dynamics and trade-offs inherent in livestock farming systems. We were proud to see so many contributions in conference papers and posters from LRG colleagues, including right across the research networks, indicating that the GRA is providing new research insights to the GGAA domain.

We are also pleased to showcase a new feature in our newsletter – highlights from key LRG partners (see page 9). This quarter's 'Partner Update' comes from CCAFS. Their flagship area on low emissions agriculture provides farmers, technical advisors and policy makers with science-based evidence and information on ways to introduce climate-smart land use practices. The LRG and CCAFS have been working together for over five years and it's great to be able to raise awareness of their work more broadly throughout the GRA community.

We hope you enjoy this edition, and as always are grateful for your ongoing interest and support for the Livestock Research Group.

Harry and Martin

Outcomes from the meetings of the Livestock Research Group and Integrative Research Group

The LRG meeting at the Pullman Albert Hotel in Melbourne, Australia, 19-20 February 2016

Over fifty people attended the meeting of the Livestock Research Group in Melbourne, Australia recently. This was the eighth meeting for the group, held 19-20 February 2016 immediately following the international Greenhouse Gas & Animal Agriculture (GGAA) conference. It also encompassed a joint meeting with the GRA's newly formed Integrative Research Group (IRG).

Representation spanned the globe, including two new observers from Tanzania and Uganda and several key LRG partners – CCAFS, FAO and the World Bank. The meeting traversed the full range of the LRG's work plan.

Main outcomes

Current research landscape

Countries were interested in learning more about each other's domestic research in support of the GRA's ambitions, and also about existing capability building projects, programmes and funding mechanisms, including where GHG emissions may not be the primary focus but where this could be added as a component (e.g. livestock productivity and sustainable development). A good reference point for this information is the country-specific web pages available in the community section of the GRA website – countries were encouraged to update their pages via the Secretariat.

Building capability

Continuing with capability building, the meeting agreed a central theme for the LRG's efforts in this area during 2016 and beyond: Helping countries move towards Tier 2 GHG inventories and designing improved measurement, reporting and verification (MRV) systems for livestock GHGs.

As the year unfolds, the LRG will look to its partnerships with other key organisations working in this area to prioritise and develop a programme of activity in this growing area of interest for a number of countries. Opportunities exist for the LRG to work together with CCAFS and the World Bank to strengthen tools, training and processes for countries to measure, report and verify their livestock GHG emissions and to improve how national GHG inventories capture information on gains in livestock productivity. The LRG will also work with CCAFS to compile existing capability building materials on livestock GHG research into an open access information platform.

The LRG's flagship capability building project (partnering with FAO and drawing on funding from the Climate & Clean Air Coalition and the New Zealand Government), 'Reducing enteric methane for improving food security and livelihoods' was discussed as stage 1 of this initiative is scheduled to come to an end during 2016. Stage 1 has focused on identifying and prioritising areas of high potential for mitigation in ruminant livestock production systems in various regions, seeking to design cost-effective, technical 'intervention packages' that can deliver multiple benefits on farms. The meeting agreed the importance of pursuing a second stage for the project, which would see the intervention packages tested on farms and scaled up for widespread implementation.

Collaborative research / Research networks and databases

A core focus of the LRG's meeting agenda was the work of the research networks, with a dynamic breakout group session to discuss their recent achievements and hear their ideas for priority collaborative research during 2016 and beyond, along with identifying possible funding mechanisms to support this future work (including ERA-GAS – see page 3). The networks' ideas and the outcomes of this meeting are covered in more detail in the research networks section of the newsletter; please see pages 4-6.

In addition, the meeting received an update on the development of a regional network for Mediterranean countries, led by Italy. This will focus initially on a multidisciplinary approach to water resources and quality, mycotoxins in feed, heat stress tolerances and vector borne diseases. Countries interested in being involved should contact its Italian coordinator, Giacomo Pirlo (giacomo.pirlo@entecra.it).

Good practice guidance & methodologies

The LRG's Manure Management Network indicated that it would like to review the existing N_2O Chamber Methodology Guidelines and update and expand them as necessary.

The next meeting of the LRG will be held in Washington DC, USA in April 2017. More details will be sent towards the end of this year.

Policy support and links to international initiatives

Interest was expressed in translating the very popular joint LRG and SAI-Platform industry publication, 'Reducing GHG emissions from livestock: best practice and emerging options', into other languages. We are hoping that this may soon be available in French, Spanish and possibly Thai. The LRG will also work with the SAI-Platform to hold a joint seminar to extend on that publication, showcasing industry and science partnerships that are already reducing the emissions intensity of livestock production.

An opportunity was identified for the LRG to contribute to the World Bank's development of a programme to guide investors to large-scale implementation of sustainable livestock production, including addressing emissions intensity.

Opportunities for increased engagement with the FAO were also identified, including via the Global Agenda on Sustainable Livestock (GASL) and the Livestock Environmental Assessment and Performance Partnership. The meeting also received a demonstration of the new FAO tool to support countries tackling climate change through livestock production, GLEAM-i, which enables governments, industry, producers and others to calculate emissions and emissions reductions from various interventions using Tier 2 inventory methods.

Joint discussions with the Integrative Research Group

A core part of this year's LRG meeting was a joint meeting with the GRA's newly formed IRG. This group was agreed at the 2015 GRA Council meeting as a merger of the previous two cross-cutting groups on soil C and N cycling, and inventories and monitoring issues. The joint meeting was co-chaired by Australia, Canada and France as the Co-chairs of the IRG.

The IRG Co-chairs outlined the scope of the new group as being focused on the estimation, monitoring and projection of GHG emissions within and across agricultural systems. Its activities will centre on a series of networks on different integrative issues across the GRA:

- Grasslands network: transfers and builds on the existing LRG network
- Soil carbon sequestration network: new but builds on work started across the GRA
- Field scale modelling network: builds on existing work from the former Soil C & N Cross-Cutting Group
- Farm scale and regional modelling network: new but builds on work started across the GRA
- GHG inventories network: builds on existing work from the former Inventories & Monitoring Cross-Cutting Group

The joint meeting identified possible short and longer-term activities for these networks, including a potential connection with the French '4‰ Initiative' on soil carbon for food security and climate change. The IRG Co-chairs underscored the importance of identifying key audiences and end users for the group's work and of packaging their outputs appropriately. This point was picked up throughout the wider LRG meeting as well.

Discussions underway at the eighth LRG meeting

ERA-GAS call opens

ERA-GAS is a European Commission co-funded call for research into the 'Monitoring and Mitigation of Greenhouse Gases from Agri- and Silviculture'. ERA-GAS aims to strengthen the transnational coordination of research activities and provide added value to research and innovation on GHG mitigation.

ERA-GAS is valued at around €13.9 million for projects up to three years in duration and is part of Horizon2020, the European Union Framework Programme for Research and Innovation. Funding is provided by participating countries (European members and New Zealand), plus a contribution from the European Commission that will be available for European members.

The scientific scope of the co-fund addresses collaborative projects from multi-country and multi-party consortia in four thematic areas:

- Theme 1: Improving national GHG inventories and monitoring, reporting and verification of emissions
- Theme 2: Refining and facilitating the implementation of GHG mitigation technologies
- Theme 3: State of the art production systems that are profitable and improve food and forest biomass production while reducing GHG emissions
- Theme 4: Assessment of policy and economic measures to support emissions reductions across the farm-to-fork and forest-to consumer chain.

Only an ERA-GAS partner country can lead a bid, and there are minimum and maximum requirements for the number of ERA-GAS partners in a consortium, but any country can participate provided they can bring their own funding (including in-kind), or funding from third parties. The deadline for submission of pre-proposals is 3 May 2016, 14:00 CET. For more information, including to download the Call Announcement, which contains the rules for developing and submitting pre-proposals, please see the ERA-GAS website.

Updates from the Research Networks

LRG delegates in breakout groups with the network coordinators, discussing research priorities for 2016 and beyond.

The LRG's five research networks have been busy since their last progress update in the August 2015 newsletter. The LRG meeting in Melbourne was a chance to hear of recent achievements within the networks and to discuss their ideas for collaborative research in 2016 and beyond, including potential bids to ERA-GAS (see page 3).

Joint meeting of the Research Networks

When the opportunity arises, the LRG's research networks meet jointly to discuss common areas of interest, key issues and shared opportunities and challenges. A joint meeting took place in the margins of the GGAA on 16 February, with fifty people attending from across the LRG's five networks.

The meeting was a mix of plenary presentations on the work of the networks as well as breakout groups to discuss possible synergies and collaborations and ways to promote participation in the networks. Greater visibility for the networks online and in wider GRA communications was identified as critical for increasing international participation and helping the network communities stay connected. The networks also agreed on the importance of their work promoting an integrated, holistic approach to mitigation management in livestock farming and the idea for a white paper identifying knowledge gaps in this area was conceived. The outputs of this meeting fed into the subsequent network discussions during the LRG meeting later that week.

Manure Management Network

The Manure Management Network (MMN) is a global forum for scientists focused on reducing GHG emissions from livestock through improvement of manure management.

The network is currently working on a compilation of mitigation methods and strategies, on metadata reporting requirements for different GHG sources, and on harmonising protocols for GHG measurements from the different stages of the manure management chain.

The MMN met in the margins of the GGAA on 14 February. The members present agreed to continue refining the compilation of metadata initially via a discussion document. Theun Vellinga (Wageningen UR) will lead a new action on manure management mapping. Initial discussions were held regarding ERA-GAS submissions and it is likely that members of the network will be involved in two or three consortia submitting bids to the fund. A compilation of research topics of interest will also be undertaken.

Several ideas for future research collaboration were identified during discussions at the LRG meeting, including working with the FNN on a joint ERA-GAS bid (see FNN section). The MMN is also considering the development of a database of emissions factors, methods and guidelines, and exploring a system to permanently archive such a resource. Members raised the need to review the LRG's existing N_2O chamber measurement guidelines and update/expand as necessary and appropriate.

For more information on the MMN, please contact the network coordinator Dr Jonathan Levin, INRA (levin@supagro.inra.fr).

Animal Selection, Genetics and Genomics Network

Sharing information and data, and fostering discussions on issues relating to breeding for low-emitting animals is the primary purpose of the Animal Selection, Genetics and Genomics Network (ASGGN). These issues include common protocols for measurement and for collection and storage of data, proxies and criteria for data sharing, combining and analysis.

The network had a very busy 2015 with joint scientific and white papers published on 'genetic selection as a mitigation strategy' (published; doi:10.1017/S1751731115000968), 'phenotypes to genetically reduce GHGs' (submitted), and 'breeding for adaptability, resilience and ability to cope with changing climates' (in progress). An international ICAR Feed & Gas Working Group was established to set up and validate protocols, and a first attempt was made to compare and combine direct measurements performed with different equipment. Data combining initiatives are also underway on methane measurements in different countries and on proxies (e.g. taken from milk composition, feed intake, faeces, rumen etc).

The ASGGN held its annual meeting in the margins of the GGAA conference in Melbourne on 14 February 2016. This saw the leadership baton pass from Yvette de Haas (the Netherlands) to Jan Lassen (Denmark), with a resounding thanks expressed to Yvette for her extensive contribution to the network's success. Potential areas of focus for 2016 were identified, including:

ASGGN members meet in Melbourne on 14 February 2016

- Economic values, including a potential study on breeding goals and how they differ globally
- Adaptation, including finishing the white paper on the role of genetics in adaptation and identifying knowledge gaps for further research
- Better biological understanding of heritability, for example where is heritability referring to and what is changing in the animal with genetic improvement?

These activities were endorsed at the subsequent LRG meeting. The ASGGN will also assist the LRG deliver a practice brief with CCAFS and the Global Alliance on Climate Smart Agriculture (GACSA) on the role of genetics as a mitigation strategy.

For more information on the ASGGN, please see www.asggn.org or contact the network coordinator Dr Jan Lassen, Aarhus University (jan.lassen@mbg.au.dk).

Rumen Microbial Genomics Network

The Rumen Microbial Genomics Network (RMG) is focused on improving the taxonomy of methane-generating microbes, and undertaking experiments and genomic analysis to develop a comprehensive database on the diversity and characteristics of the rumen microbial community. This information is critical to inform strategies to reduce methane emissions by directly targeting rumen microbes.

The RMG concluded two major projects during 2015: (i) the Hungate 1000, a catalogue of reference genomes from the rumen microbiome; and (ii) the Global Rumen Census, ground-breaking research that found that the microbes causing emissions in ruminant animals are similar across a wide variety of species and animal diets.

These two projects have provided a hugely valuable data resource to the research community that would not be available without the RMG or the wider GRA. It is key that this resource is now fully exploited to enable further advances in understanding the role that rumen microbes play in GHG emissions and animal nutrient use efficiency.

The recent LRG meeting identified the need for an RMG white paper on research priorities, along with potential development of a meta-database along with guidelines and tools for data interrogation, and the possibility of a reference manual on culturing techniques. These suggestions will be taken up on 20 June 2016 at the annual network meeting, this year in Clermont-Ferrand, France in the margins of the INRA-Rowett gut microbiology conference.

For more information on the RMG including to attend its upcoming workshop, please see www.rmgnetwork.org.nz or contact its coordinator Dr Sharon Huws, Aberystwyth (hnh@aber.ac.uk).

Feed and Nutrition Network

Measuring enteric methane emissions in US dairy cows

The Feed and Nutrition Network (FNN) explores the impacts of feed and nutrition on GHG emissions from ruminant livestock and animal productivity.

In 2015, the FNN submitted two review papers to Animal Feed Science & Technology: (i) design, implementation and interpretation of in vitro batch culture experiments as a method to investigate nutritional strategies to mitigate enteric methane emissions from ruminants, and (ii) a review of current in vivo measurement techniques for quantifying enteric methane emissions from ruminants.

The FNN also assembled a database of individual animal data, including over 6,000 observations provided by investigators around the world. This database will be used to develop robust enteric methane emission prediction models. The development of a separate treatment means database was also completed.

The FNN held its annual meeting in the margins of the GGAA on 18 February. Delegates discussed progress with the Animal Feed Science & Technology manuscripts, the two mitigation databases and collaborative proposals with other LRG networks, and outlined priorities for FNN in the next year. It was decided that FNN will submit a proposal to the upcoming ERA-GAS call and will seek collaboration with the Manure Management Network.

A number of ideas for the potential joint ERA-GAS proposal were put forward, including exploring feed-nutrition-manure-soil carbon and nitrogen emissions relationships. Other discussion points included nutritional and manure management practices in relation to GHG emissions, current accounting of these components and modelling to improve their integration, sequestration of soil carbon from manure, and development of 'functional' meta-analyses of databases. Other research ideas included improving mitigation estimates (e.g. with rumen, manure and soil emission inhibitors), as well as evaluating inventory methodologies related to the fate of feed, excreta and manure carbon and nitrogen, and exploring the benefits and costs and farm-level trade-offs of implementing mitigation practices.

For more information on the FNN, please contact the network coordinator Professor Alex Hristov, Pennsylvania State University (anh13@psu.edu).

Animal Health & GHG Emissions Intensity Network

Improved animal health contributes to greater gains in efficiency and productivity, which in turn helps reduce the GHG emissions intensity of livestock farming. The Animal Health Network (AHN) brings together researchers from across the world to investigate the connections between animal diseases and GHG emissions intensity, and possible GHG mitigation opportunities through disease control.

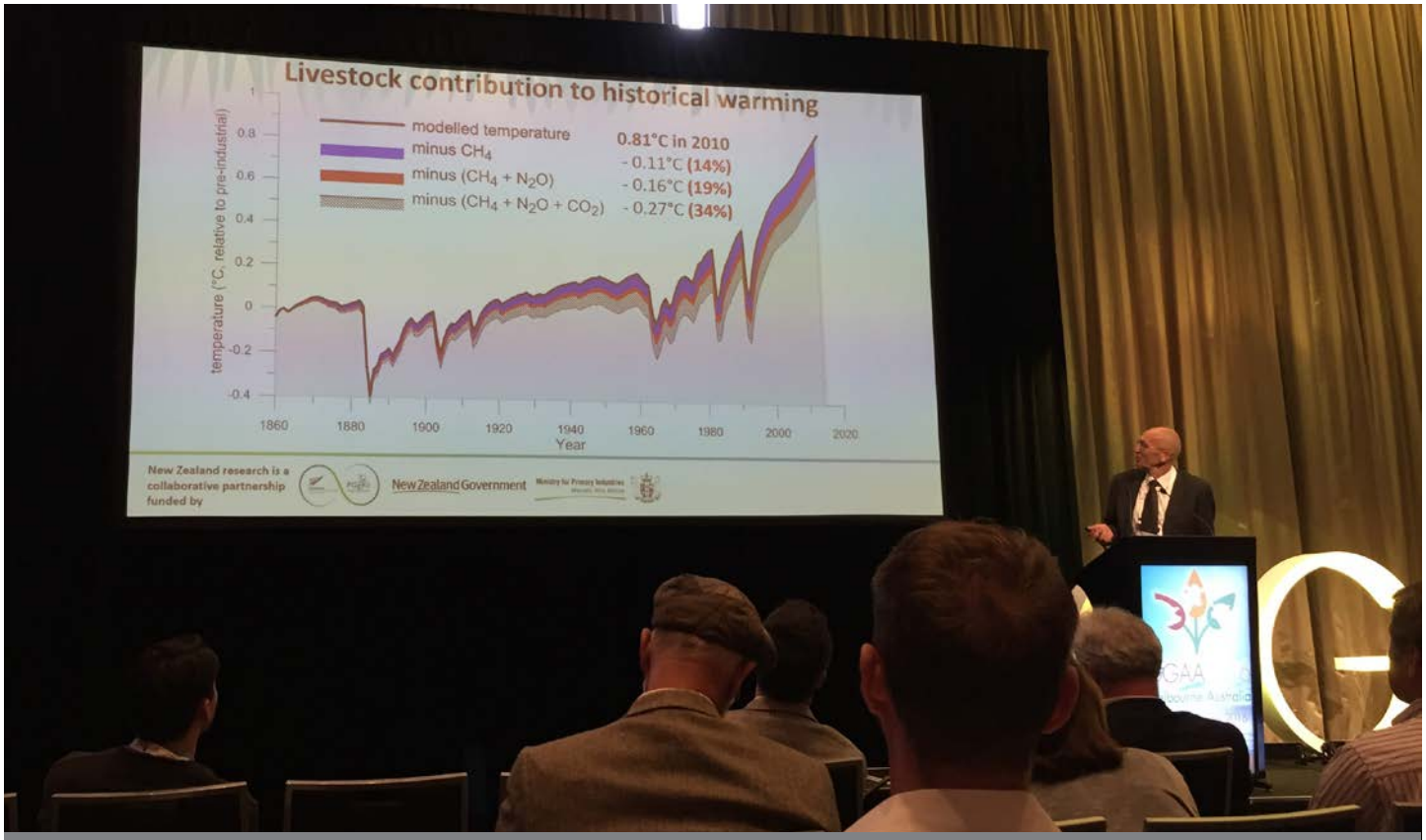
The AHN held several meetings and workshops in 2015 and has looked at increasing participation regionally including via the Latin American Animal Science Association (ALPA) and Europe's MACSUR community (Modelling European Agriculture with Climate Change for Food Security).

The third annual AHN workshop was recently held in the margins of SVEPM (Helsingor, Denmark). Attended by 21 researchers from 9 countries, the workshop was an opportunity to share new research and discuss research priorities and opportunities for collaboration. Presentations on current research linking animal disease with GHG emissions set the scene for a discussion on research priorities and knowledge gaps. Priorities include estimating both aggregate and individual regional disease burden, gathering good quality surveillance data, and disseminating and correctly targeting the message. The Network has developed links with a number of related initiatives and pursued these further through presentations from NEAT, STAR-IDAZ, FACCE-JPI and MACSUR. A discussion session followed the presentations and gave members and representatives freedom to discuss collaboration opportunities. The basis of future collaboration is dependent upon two linked factors: identifying tangible research needs through a gap analysis and procuring adequate funding.

An initiative that would benefit from a collaborative approach was identified as creating an inventory of models and data sources relative to animal health and disease data. This would be valuable for testing existing and new models as experimental data is often difficult to get hold of. The first step in achieving this is for all Network members to send the Secretariat details of their research and published papers to be hosted on the Network webpages and accessed through the Member's Share Area.

Funding options for collaborative projects were identified as; ERA-GAS, SusAn, Bill and Melinda Gates Foundation and COST Action. A few members have taken on the action point of further exploring the funding streams. Funding opportunities for the future coordination of the AHN are also being pursued. GRA member countries interested in taking over leadership of the Network are encouraged to contact animalhealthnetwork@adas.co.uk.

For more information on the AHN, please also see the network's website.



Dr Harry Clark, LRG Co-chair and Director of the New Zealand Agricultural Greenhouse Gas Research Centre, presenting on livestock's contribution to climate change

Highlights from the sixth Greenhouse Gas & Animal Agriculture conference

14-18 February 2016, Melbourne Australia

GGAA opened with global perspectives on the dual challenge of achieving food security and climate change mitigation in livestock production systems; a point that was returned to throughout the conference. Pierre Gerber (FAO and World Bank) discussed the need to rethink livestock systems for food security and mitigation, focusing on (i) improving natural resource use efficiency in livestock systems, i.e. reducing the amount of natural resource used per unit of product; (ii) managing feed crops, pastures and rangelands to maintain/increase carbon stocks; and (iii) reducing food waste and modifying diets to manage demand for animal products.

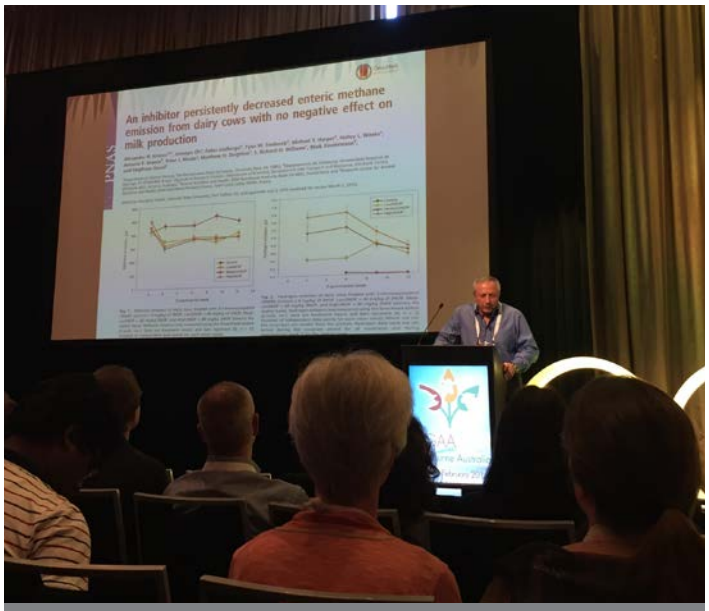
While technological breakthroughs in mitigation could radically change the landscape, most of the policy levers and private sector interventions for addressing (i)-(iii) are already known. The challenge resides in their cost-effective combination, minimising trade-offs and maximizing co-benefits.

Pierre noted that work to reduce livestock emissions still isn't well connected to climate mitigation finance, which is overwhelmingly focused on reducing CO_2 emissions, although eighty countries have included agriculture in their UNFCCC Nationally Determined Contributions (and of those, 54 mention livestock). He wrapped up by emphasizing the importance of four key factors: the narrative, clearly conveying the key role of the livestock sector in supporting sustainability and development goals; indicators and methods for progress; technical packages; and institutional and financial setups for inclusive participation.

Martin Scholten (LRG Co-chair, Wageningen UR) took stock of the range of international initiatives underway in support of agricultural GHG mitigation and 'climate smart agriculture' since the FAO's seminal 'Livestock's Long Shadow' report in 2007. The GRA's efforts were covered, including the identification of a reduction potential of than 40% by adopting an 'integrated' approach to mitigation, encompassing improved animal genotypes, feed quality and digestibility, animal health and husbandry, soil carbon sequestration, manure management and precision livestock farming.

This need for an integrated approach was a point made by other presenters. Ben Henderson (CSIRO, Australia) discussed an alternative approach to modeling the linkages between soil, forage and animals to assess the net mitigation potential of carbon sequestration in grazing lands around the world (usually this is expressed by extrapolating from a small number of field studies). The study modeled three different mitigation practices – improved grazing management, legume sowing and N fertilization – and found that the estimated potential for increasing soil C stocks in grazing lands is actually lower than earlier worldwide estimates. More work is needed to understand the impact that the different management practices had on all emissions, for example the additional ruminant GHG emissions associated with higher forage output are likely to substantially reduce the mitigation potential of these practices, but could contribute to more GHG-efficient livestock production.

New Zealand booth at the GGAA



Prof Alex Hristov, coordinator of the LRG Feed & Nutrition Network presenting on the effect of 3-NOP on enteric methane emissions from dairy cows

Harry Clark (LRG Co-chair, NZAGRC) explored how much actual warming is due to GHG emissions from livestock and how important this is in the context of the newly agreed UNFCCC 2° target. Agriculture directly contributes about 10-12% of current global GHG emissions. However, this is based on 100-year Global Warming Potentials (GWPs) and as such does not express the actual warming caused by livestock, which would need to take into account changes in emissions and concentrations and the much shorter life of methane in the atmosphere compared to N_2O or CO_2. Historical emissions and a range of future emissions scenarios were used to infer how much of the historical warming is due to livestock and how large a contribution livestock might make to future warming. The study found that while the absolute amount of warming caused by livestock is not large (a few tenths of a degree), the future warming due to livestock could constitute a significant and increasing fraction of total warming if the world makes major efforts to reduce total GHGs (especially CO_2) in other sectors, given that livestock emissions are considered harder to mitigate than emissions from many other sectors. Realising and expanding the mitigation potential of livestock GHGs could, therefore, make a significant contribution to the global 2° target.

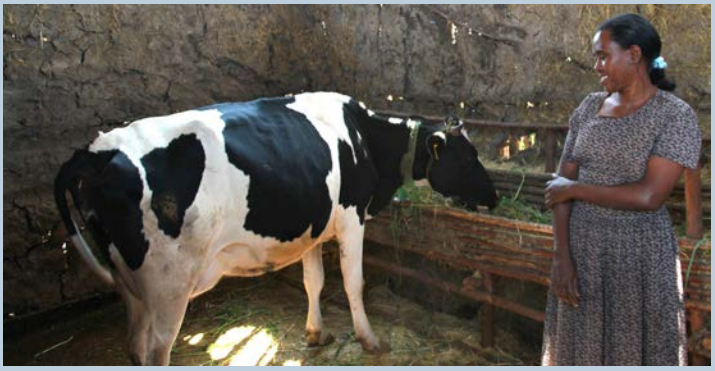
The outcomes from a number of LRG research collaborations were also presented, as well as findings from individual LRG member countries, for example the UK's work to build data on nitrification inhibitors and more broadly on understanding N_2O emissions from livestock dung and urine, and US research into the effect of different barnyard surfaces on GHG emissions from dairying. Presentations ranged from research at its most fundamental all the way to its application at the farm level, for example:

- Several studies showed promising early results from the development of a new inhibitor, 3-nitrooxypropanol (3-NOP), to reduce enteric methane in dairy and beef cattle. In addition, at the concentrations required to significantly reduce methane emissions, 3-NOP and its products were found not to be toxic to the animals.
- New Zealand has developed new methods to rapidly screen compound libraries in an effort to fast track the discovery of novel methanogen-specific inhibitors.
- A global study is underway, initiated by the GRA's Soil C&N Group, to assess and inter-compare the predictive ability of simulation models for agricultural GHGs and soil carbon stock changes. Early results with temperate grasslands have found that multi-model estimates are more robust for projections of GHG emissions and removals than those from single models.
- Modifications to the SF6 tracer technique, first developed in the early 1990s, have been shown to produce estimates of methane emissions that closely approximate those made by respiration chambers, greatly improving the accuracy of this technique.
- Australian grazing systems based on shrubs and pasture species selected for their nutritive value and anti-methanogenic bioactivity offer a practical means to reduce methane emissions and improve animal productivity during the annual 'feed gap' in the autumn months.

The three-yearly GGAA conference is the world's premier event on livestock emissions research, bringing together leading scientists and policy makers to review current knowledge and present significant new developments and advances in measurement, modeling and mitigation of greenhouse gas emissions from animal agriculture. The last GGAA was held in Ireland in 2013 and previous events have been held in Canada (2010), New Zealand, Switzerland and Japan. The next GGAA will take place in Brazil in 2019.

Partner Update:
Highlights from CCAFS

Demonstrating the depth of our collaboration around the world, the LRG newsletter will now regularly feature relevant news and activities from our partners. This quarter, our Partner Update comes from CCAFS, the CGIAR Research Program on Climate Change, Agriculture and Food Security. CCAFS involves over 200 scientists working in five regions of the developing world. CCAFS' research aims to transition to and scale up agricultural practices and policies that are adaptive to climate change, increase male and female farmers' resilience and decrease greenhouse gas emissions.



Highlights from CCAFS low-emissions agriculture work programme

SAMPLES is a global research programme led by CCAFS that supports tropical countries to measure GHGs from agriculture and improve GHG emissions data. The SAMPLES website offers a comprehensive array of information, including guidelines for conducting field measurements of agricultural GHGs in smallholder systems. SAMPLES also welcomes metadata on emission factors for specific agricultural practices. Experts from across the GRA have been involved in the development of the SAMPLES project.

The CCAFS Mitigation Option Tool (CCAFS-MOT), developed in partnership with the University of Aberdeen, estimates greenhouse gas emissions from crops and livestock production systems in different regions, helping provide policy-makers with reliable information to make decisions about emissions reductions in agriculture. The tool differs from other agricultural GHG calculators. Rather than estimating emissions from a given farm or practice, it suggests mitigation options that are well suited to the production system, soils and climatic conditions of the farm. The suggestions are based on empirical models and data from over a dozen different research studies. See more here.

A systematic review of highly cited climate-smart agricultural (CSA) practices and technologies is underway. This will evaluate the evidence base and identify knowledge gaps, highlighting the synergies and trade-offs of potential CSA practices as well as analysing the barriers to their uptake. This meta-analysis will eventually lead to a database to support farmers, extension agents and policy-makers to make decisions about which practices to scale up and how.

In a recent article published in Agricultural Systems (143:106-113), on 'Closing system-wide yield gaps to increase food production and mitigate GHGs among mixed crop-livestock smallholders in sub-Saharan Africa', CCAFS and partners used observed differences in technical efficiency among farms in seven sites in six countries (Kenya, Tanzania, Uganda, Ethiopia, Senegal and Burkina Faso) to better estimate yield gaps. Sizeable gaps were found in all sites. The researchers concluded that closing these gaps by improving the efficiency of production would generate marked benefits for smallholder incomes, food supply and environmental performance.

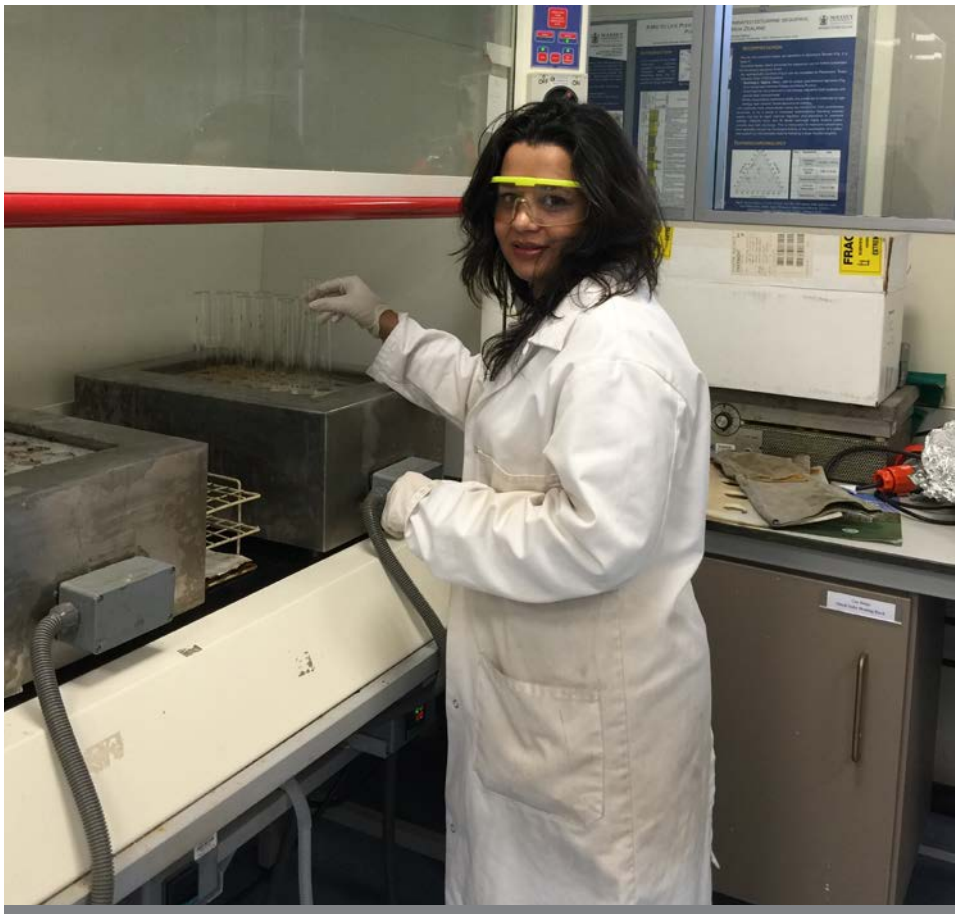
An article published in Agriculture, Ecosystems and Environment (220:164-174) addressed the question 'Does conservation agriculture deliver climate change mitigation through soil carbon sequestration in tropical agro-ecosystems'? Conservation agriculture is widely promoted for reducing soil degradation and improving agricultural sustainability and is also claimed to mitigate climate change through soil carbon sequestration. Researchers conducted a meta-analysis of soil organic carbon (SOC) stock changes under conservation agriculture practices in the Indo-Gangetic Plains and Sub-Saharan Africa to test these mitigation claims.

CCAFS has been active ahead of upcoming UNFCCC discussions on agriculture being held in Bonn in May 2016 and has compiled multiple synthesis papers, including 'Agricultural practices and technologies to enhance food security, resilience and productivity in a sustainable manner' and 'Adaptation measures in agricultural systems'. Both papers address livestock production and can be found here. An earlier CCAFS working paper on 'Climate-smart livestock sector development: the state of play in NAMA development' is also relevant to this work.

CCAFS and the LRG (and the wider GRA) have been working together for over five years on a range of capability building and collaborative research activities. Current efforts are focused on developing case studies and practice briefs on low emissions approaches to livestock management, guidelines for measuring, reporting and verifying livestock GHGs and improving national inventories, and compiling existing capability building materials on livestock GHG research into an online platform.

For more on CCAFS, see https://ccafs.cgiar.org

New Zealand and Pakistan collaborate in a LEARN Postdoctoral Fellowship on soil organic matter and its mitigation potential



Dr Ambreen Bhatti, LEARN Postdoctoral Fellow from the Arid Agriculture University, Pakistan

Dr Ambreen Bhatti has recently arrived in New Zealand from the Per Mehr Ali Shah Arid Agriculture University in Rawalpindi, Pakistan to undertake a LEARN Postdoctoral Fellowship with Associate Professor Marta Camps-Arbestain at the New Zealand Biochar Research Centre, Massey University. Dr Bhatti is a PhD graduate in 'Dynamics of nitrogen cycling in soils under permanent grasslands' from the University of York, UK.

Biogeochemical models generally identify three pools of soil organic matter (SOM) with different turnover times – active (0.5-1 year), slow (10-50 years) and resistant (1000-5000) – and different agronomic and environmental implications. Through her LEARN fellowship Dr Bhatti aims to understand the characteristics of SOM in these different pools, and how this relates to their mitigation potential for N_2O and CO_2 emissions from soils.

During the fellowship, Dr Bhatti will develop parameters for application in biogeochemical models that simulate GHG exchange and carbon cycling in terrestrial ecosystems. The expected advance in both her expertise and the knowledge on how SOM characteristics affect N_2O and CO_2 emissions is substantial, in particular understanding the subsurface denitrification, as this can potentially minimise the risk of nitrate leaching to both surface and groundwater. The data and general experience acquired over the two-year project will be applicable to different pedo-climatic conditions, therefore helping advance the level of understanding about SOM in Pakistan.

Dissolved organic carbon (a component of the active soil carbon pool)

Permanent pasture soils develop surface layers rich in SOM with high potential for denitrification when fertilized or when urine and dung are deposited during grazing. Denitrifiers require a readily available carbon source before reduction of nitrate can occur. Any process that influences the fraction of dissolved organic matter (DOM) in soil will have a major impact on the denitrification rate. Despite intensive research, knowledge of the formation and fate of DOM in soils and its response to changing environmental conditions is still fragmented and often inconsistent.

Dr Bhatti's fellowship will investigate the characteristics of native organic matter in 10 New Zealand dairy grazed soils, and how these relate to the contribution to DOM (along with key properties of soil solution such as pH, ionic strength among others). This builds strongly on New Zealand's current programme of research on grazed dairy soils where soil parameters and denitrifiers on N_2O and N2 emissions are being monitored but SOM has not yet been characterised at the molecular level. For this, techniques such as pyrolysis-GC/MS will be used.

Active and slow organic carbon pools

Because of their size and their relatively short turnover times, active and slow soil organic carbon pools have strong agronomic (e.g. cycling of nutrients) and environmental (e.g. CO_2 emissions) implications. Dr Bhatti will investigate the characteristics of the fraction of SOM that has preserved two years after soil inversion and that which has decomposed, and the mechanisms by which SOM has been stabilised under different types of pasture species. This will help the research community to better forecast changes in soil carbon.

The resistant organic carbon fraction

Resistant organic carbon (ROC) is relatively inert material such as chemically resistant materials or organic remnants such as charcoal. It is likely that ROM is equivalent to, or correlated with the non-oxidizable fraction. Building on existing work, the post-doctoral fellowship will investigate the relationship more fully between ROM and non-oxidizable fractions, and identify the C fractions that resist dichromate oxidation in archive samples in which 14C have been already measured in at least two time points.

International fellowship opportunities

LEARN Awards (sponsored by the New Zealand Government)

Exchanges and training for agricultural greenhouse gas researchers

LEARN is an awards scheme sponsored by the New Zealand Government to build international capability in livestock emissions research. It is part of New Zealand's support for the Global Research Alliance on Agricultural Greenhouse Gases. The GRA seeks to increase cooperation and investment in research to help reduce the emissions intensity of agriculture and increase its potential for soil carbon sequestration.

LEARN is focused on:

- Supporting technical staff and scientists from developing countries and GRA member countries to work alongside New Zealand colleagues.
- Sharing knowledge on livestock GHG emissions measurement, modeling and mitigation practices to increase the level of scientific skills and technological capabilities internationally.
- Supporting strategic research and capability building activities that align with the priorities of the GRA as well as relevant New Zealand science priorities.
- Advancing common research interests between countries and building enduring relationships.

There are four LEARN awards offered:

- **Co-funded PhD Scholarship**
- **Postdoctoral Fellowship**
- **Technical Training Award**
- **Global Research Alliance Senior Scientist (GRASS) Award**

Application process

A two-stage process applies. Applicants can submit an Expression of Interest for any of the awards at any time during the year. If successful at this stage, you will be invited to submit a full application.

Full applications for the Co-funded PhD Scholarship and the Postdoctoral Fellowship awards are now assessed on an annual basis. **For 2016, full applications for these awards MUST be submitted by 30 June.**

Full applications for the Technical Training Award and the GRASS Award are assessed on a quarterly basis. For 2016, full applications for these awards MUST be submitted by 30 April, 30 June and 30 October.

All applications must be developed in close collaboration with a New Zealand research institution.

For more details, including how to download the Expression of Interest forms, visit the website at www.livestockemissions.net or email: awards@nzagrc.org.nz

Previous LEARN recipients

Dr Sven Sommer,
GRASS recipient from Denmark

Dr Jie Li,
LEARN Co-funded PhD recipient from China

Stephen Olinga,
LEARN technical training recipient from Uganda

Upcoming events

II SIGEE: Second International Symposium on Greenhouse Gases in Agriculture

The first SIGEE event was held in 2010. This second event will present updated information about GHG dynamics in different agricultural systems based on research carried out in Brazil by Embrapa and its partners, aiming to benchmark progress with trends in international agriculture. Among the presenters is LRG Co-chair Dr Martin Scholten, addressing mitigation strategies for enteric methane.

Date: 7-9 June 2016
Location: Campo Grande, Brazil
Website: http://cloud.cnpgc.embrapa.br/sigee2016-en/

MACSUR: Modelling grassland-livestock systems under climate change

Modellers and researchers from across the MACSUR knowledge hub are invited to present advances in modelling grassland-livestock production systems in the context of future food security and sustainable production, highlight challenges and research priorities for modelling, and share ideas, spread best practice and develop new collaborations. Registration closes 1 May 2016.

Date: 15-16 June 2016
Location: Potsdam, Germany
Website: https://www.pik-potsdam.de/research/climate-impacts-and-vulnerabilities/livem-2016-conference/workshop-macsur-livem

Rumen Microbial Genomics Network Workshop

The LRG's Rumen Microbial Genomics Network will hold an open workshop to update on developments in the field, provide networking opportunities, and to gather feedback on how the network can be improved. Registrations are due by 1 May 2016.

Date: 20 June 2016
Location: Clermont-Ferrand, France
Website: http://globalresearchalliance.org/e/rumen-microbial-genomics-network-workshop/

INRA-ROWETT 2016: Joint Symposium on Gut Microbiology

The 10th INRA-Rowett symposium will explore how understanding the complex gut microbial ecosystems can help to promote improved human and animal health, particularly through the interaction of gut microbiota with the host. It will also investigate how to manage the metabolism and activity of the animal digestive ecosystems towards less polluted and safer environments.

Date: 20-23 June 2016
Location: Clermont-Ferrand, France
Website: https://colloque.inra.fr/inra-rowett-2016/home/INRA-ROWETT-2016

International Rangeland Congress

The 10th International Rangeland Congress will explore the interchange of scientific and technical information on all aspects of rangelands and grass farming and management of wildlands. Aimed at ranchers, grass farmers, extension agrologists, range managers, land reclamation specialists, parks or wild land supervisors, researchers, modellers, remote sensing specialists and other people interested in the management of the world's grazing and wild lands.

Date: 17-22 July 2016
Location: Saskatoon, Canada
Website: www.irc2016canada.ca

International Seminar on Livestock Production & Veterinary Technology Production

The Indonesian Centre for Animal Research and Development (ICARD), under the Ministry of Agriculture, is holding an international seminar aimed at promoting livestock and veterinary technologies for sustainable rural livestock development. Note that the call for papers ends 15 April 2016.

Date: 10-12 August 2016
Location: Bali, Indonesia
Website: http://peternakan.litbang.pertanian.go.id/intsem

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GLOBAL RESEARCH ALLIANCE ON AGRICULTURAL GREENHOUSE GASES

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