

Livestock Research Group

GLOBAL RESEARCH ALLIANCE

ON AGRICULTURAL GREENHOUSE GASES

What is the Global Research Alliance?

Agriculture has a vital role to play in the coming decades with the world's population estimated to reach 9.6 billion by 2050. With more mouths to feed but limited natural resources to draw on, the sector must find ways to produce more food and fibre more sustainably, while also contributing to broader development goals.

The Global Research Alliance (GRA) seeks to increase cooperation and investment in research activities to help reduce the emissions intensity of agricultural production systems and increase their potential for soil carbon sequestration, and improve their efficiency, productivity, resilience, and adaptive capacity. This contributes in a sustainable way to overall mitigation efforts but also helps meet food security objectives.

The main work of the GRA occurs in its five research groups. These are focused on key agricultural sub-sectors (Paddy Rice, Croplands, Livestock) and issues common to those sub-sectors (Soil Carbon & Nitrogen Cycling, and Inventory & Monitoring).

What is the Livestock Research Group?

The GRA's Livestock Research Group (LRG) is focused on reducing the emissions intensity of livestock production systems and increasing the quantity of carbon stored in soils supporting those systems. The LRG works with scientists, farmers and farm advisors, industry and policy makers to research mitigation options, share knowledge and experiences and help strengthen the resilience of livestock farming.

Members collaborate to advance global research on livestock emissions intensity at the same time as supporting countries to achieve their own agriculture and climate change priorities. In this way, the GRA enables progress to be achieved on challenges that any country would struggle to approach on their own.

The LRG is composed of official representatives from GRA member countries, mostly from scientific and government organisations. The LRG also partners with relevant international organisations. New member countries and organisations are always welcome.

The LRG's work plan spans six areas of activity as shown in the diagram. This brochure provides details on each of these work areas.



Key areas of work

1. Understanding the current research landscape

Advancing research collaboration between countries relies on a collective understanding of individual countries' current research priorities and activities. The LRG routinely carries out 'stocktakes' to identify knowledge gaps, capability building needs and opportunities for joint research. Information from countries on who is doing what helps ensure that the LRG's efforts are appropriately targeted and add value, and also helps internal coordination within countries.

2. Building capability

Building the capabilities of researchers and technicians to measure, predict and report on greenhouse gas (GHG) emissions from livestock systems is a critical area of work for the LRG. Activities take place in several ways:

- **Technical capability building/training workshops:** bringing scientists from a region together with world-leading experts to work on regionally appropriate ways to measure and mitigate livestock GHG emissions intensity.
- **Capability-building projects:** often set up in response to particular issues identified at regional workshops.
- **Fellowships and awards schemes:** enabling scientists and technicians to undertake 'on-the-job' training and help seed new collaborative ideas.

The LRG actively partners with other projects that are building capability, including other GRA Research Groups and relevant organisations, to deliver on shared objectives.



Examples of building capability

Technical training to build research capabilities in Africa

Delivering regional technical training courses for developing countries is a key element of capability building. In September 2014, the LRG held a two-week training course at the University of Pretoria in South Africa to increase research capabilities in methane and nitrous oxide measurement for scientists from across Africa. Participants received hands-on training in measuring GHG emissions from pastoral livestock farming, taught by a collaboration of international experts. Similar workshops were also held in Ghana and Kenya in 2012, and future events are planned in South and South East Asia.

Joint livestock mitigation project in Latin America and the Caribbean

Latin America is a key region for livestock development and the identification of regionally appropriate mitigation options. Since 2011, countries in Latin America and the Caribbean have been working together with the support of the Inter-American Development Bank and the New Zealand Government to improve their national GHG inventories and develop mitigation options adapted to their particular livestock farming systems. Key research goals include improved and standardised measurement of enteric methane and nitrous oxide emissions from different farm systems, and the identification of regionally appropriate mitigation options consistent with farming practices and development goals.

Understanding emissions trends and research needs in South East Asia

A pilot project focused on understanding livestock systems in the region and their changes over time, and associated emissions trends in South East Asia emerged from a regional capability-building workshop in Thailand in 2012. The project developed a fuller understanding of the diversity of livestock systems in the region and used analysis of existing data and measurements to identify priority areas for improving the quantification and mitigation of agricultural GHG emissions. Follow-on projects have focused on ways to improve livestock emissions inventories to better reflect regional systems and practices, and reductions in emissions intensity resulting from productivity gains. Results from this work are being used to identify country-specific training and development needs and link mitigation research and inventory development with national and regional development plans.

3. Research networks and databases

Much of the LRG's work relies on experts working together across boundaries to advance collective knowledge. To support this goal, the LRG has established six global networks on specific aspects of livestock emissions research.

These networks are the 'engine room' of the LRG, linking researchers up to address critical knowledge

gaps, analyse and improve data, standardise modelling assumptions, develop common protocols for measurement and find new ways of working together to advance shared priorities.

The level of participation is very high with many hundreds of people now connected to at least one of the six networks. Anyone with relevant expertise and interest in a network can join; participation is not limited to researchers from GRA member countries but includes experts from industry and farm practice around the world.



Feed and Nutrition Network

Exploring the impacts of feeds and nutrition on GHG emissions from ruminant livestock and animal productivity. Participants are analysing existing data, developing measurement protocols and mitigation options based on nutritional means.



Animal Selection, Genetics and Genomics Network

Sharing information and data relating to breeding low-emitting animals, including defining common traits and developing common measurement protocols, and connecting with industry partners to facilitate adoption by farmers.



Rumen Microbial Genomics Network

Improving the taxonomy of methane-generating microbes, 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.



Animal Health and Greenhouse Gas Emissions Intensity Network

Exploring the interactions between efforts to improve animal health and reducing GHG emissions per unit of product. This is a win-win situation where animal health improvements may lead to reductions in environmental impact. The approach offers strong synergies with broader development goals and food security, and also links with efforts to adapt to a changing climate while improving the resilience of livestock systems.



Manure Management Network

Identifying management practices to reduce methane and nitrous oxide emissions from livestock manure and improve the efficiency of nutrient use, and ensuring available information is shared and adapted to national circumstances and diverse livestock systems.



Grasslands Network

Identifying good practices to maintain and increase carbon storage and to reduce GHG emissions per unit product in managed grassland and rangeland systems, and enhancing the recognition and value of grasslands as a key source of nutrition for ruminant livestock. The network's scope includes the identification of mitigation and adaptation strategies for grassland management under a changing climate.

For more information visit:

<http://globalresearchalliance.org/research/livestock/>



4. Collaborative research

Collaborative research projects are at the heart of the LRG's work. They allow scientists to achieve results that would have been impossible working in isolation, for example by sharing data sets, harmonising measurements and methodologies, and pooling resources for analysing large numbers of samples or model inter-comparisons. Specific projects may be identified within research networks or at annual meetings of the LRG, with participating countries then collaborating to source funding for the work. A significant number of projects are underway at present – some highlights are presented below.

Global Rumen Census

Understanding how much the rumen microbial population differs between animals and their feeds is critical to determining the success of the various mitigation technologies being developed (inhibitors, vaccines, etc). This project surveyed the diversity of microbes present in rumen samples from 34 countries and a range of farm systems around the world and has developed a dataset to illustrate the global diversity in rumen microbial communities. An exciting finding was that the key rumen microbial groups are highly conserved across very different feed and farming systems, indicating that rumen microbial interventions have potential to be effective globally. The project covered a wide range of ruminant species, breeds, feeds and locations globally and was a collaboration of the [Rumen Microbial Genomics Network](#).

Global Network project

Nutrition-related strategies are an important component in mitigating methane and nitrous oxide emissions from ruminant livestock but there are gaps in the current knowledge base and a need for expert recommendations as to research priorities, methodologies and science-based mitigation solutions. The LRG's [Feed and Nutrition Network](#) has a four-year project funded through a collaboration between some GRA countries and countries belonging to Joint Programming Initiative on Agriculture, Food Security and Climate Change (FACCE-JPI) to address these issues. Central to this is the collection of individual ruminant data related to diet, intake, emissions and animal performance. These data are evaluated, resulting in novel and sound enteric methane prediction equations from feed and nutrition information. In addition, a database of treatment means from literature is also being developed allowing recommendations for effective and feasible mitigation practices. Reviews on methods used in in vivo and in vitro experiments measuring feed and nutrition effects on methane emissions will complement these activities by forming the basis for standard operating procedures.

Selecting naturally low-emitting animals

Animals vary naturally in the amount of methane they produce. Selective breeding of animals with low methane emissions per unit of feed consumed could result in a permanent methane reduction of up to about 10%, with no negative impacts on productivity recorded so far.



Faster progress will be made in this important area of research if countries coordinate their efforts and also use the same metrics. This project is focused on optimising genetic, genomic and phenotype measurement parameters in cattle and sheep through international collaboration to share data and develop common measurement protocols. It is a collaboration of the [Animal Selection, Genetics and Genomics Network](#).

Models and management options to reduce nitrous oxide emissions from grazed pastures

Emissions of nitrous oxide from grazing animals are hard to monitor by measurements alone, due to their great spatial and temporal variability. Models are therefore crucial to understand the long-term effect of mitigation options and the influence of grazing management practices – but no model is perfect, and some may be calibrated to a particular set of circumstances but perform poorly in other situations. Two projects, combining efforts of the LRG and the GRA's Soil Carbon and Nitrogen Cycling Group, are seeking to test and improve a range of commonly used models through large-scale inter-comparisons that pool modelling resources, expertise and datasets across participating countries. These help to better understand areas of agreement and disagreement between models, and increase their reliability to predict nitrous oxide emissions and the effectiveness of mitigation options.

Funding for joint projects

The GRA is a voluntary organisation and currently has no central fund. This means that turning research and capability building opportunities into viable projects has had to rely on flexible and creative approaches to funding from individual member countries and other partners and institutions. For example:

- Individual countries making dedicated funding available to support international collaborative projects in areas of their particular domestic interest, e.g. the New Zealand Fund for Global Partnerships in Livestock Emissions Research.
- Multi-country collaborations, e.g. the Inter American Development Bank's support for Latin American livestock mitigation research, and also FACCE-JPI.

But dedicated new funding is not always necessary to allow collaborative research to proceed. Almost all GRA member countries have domestic funding mechanisms that include agricultural productivity, efficiency and GHG implications within their goals. Aligning the priorities of such funds with collaborative opportunities presented through the GRA allows countries to combine domestic priorities with expertise and resources located in other countries to work towards common goals.



5. Providing policy support and links to international initiatives

The LRG has forged links with other international and regional initiatives to reach farmers and improve farming systems on the ground. Partnerships with other organisations that directly work with farmers, industry and policy are vital to achieve this goal and turn research into practical solutions.

The LRG works closely with several of the GRA's formal partners including the FAO, the World Bank, and the CGIAR, in particular its Climate Change, Agriculture and Food Security (CCAFS) programme. The LRG has also built strategic relationships with other organisations working in similar areas for example the International Dairy Federation, Sustainable Agriculture Initiative, European Commission Directorate-General of Research and Innovation, and the Global Agenda for Sustainable Livestock. These organisations share many of the objectives pursued by the LRG – working to reduce the emissions intensity of livestock products while promoting food security and farmer livelihoods. Some significant advances are being made through these important relationships.

A flagship collaboration has emerged from the LRG's partnership with the FAO and UNEP's Climate and Clean Air Coalition (CCAC). The CCAC promotes and supports actions to reduce emissions of short-lived climate forcers, including methane from agriculture. The LRG's scientific expertise and ability to mobilise scientists in different world regions, coupled with FAO's focus on practical application and the CCAC's ability to mobilise resources have enabled two significant projects.

The **Manure Management Kiosk** is a project aimed at identifying practical ways to integrate manure management best practice into livestock systems by removing barriers to action at regional, national and local levels. The focus is on

capturing methane as an energy source, reducing air and water pollution and optimising nutrient utilisation for crop production. An online 'knowledge platform' (the Kiosk) will link to three regional reference centres and bring together a subject library, global overview of lessons learned, entry point for the Livestock Geo-wiki, and an e-marketplace for relevant services and assistance including a roster of experts providing assistance to key stakeholders. This exciting new approach will deliver expert knowledge directly to farmers, policymakers and other practitioners, with a focus on livestock systems in developing countries in Latin America, Africa and Asia. This project was a collaboration of the [Manure Management Network](#).

The second CCAC project on **Enteric Methane** seeks to develop interventions to increase productivity and reduce the emissions intensity of enteric methane in particular livestock systems. This project uses the FAO's Global Livestock Environmental Assessment Model (GLEAM) to identify regionally appropriate low emission pathways for the livestock sector, and harnesses expertise in participating countries as well as [LRG research networks](#) to ensure data and mitigation options are robust and reflect reality in focus regions. The project has five key components:

- 1 Identifying and prioritising opportunities for mitigation using a comprehensive life cycle analysis model and locally-sourced data.
- 2 Mobilising resources for testing and demonstrating key technology and policy actions.
- 3 Evaluating the success of the applied interventions against social, economic and environmental goals.
- 4 Identifying barriers to adoption and building capacity to aid implementation.
- 5 Harnessing stakeholder support for wider adoption, knowledge generation and transfer.

Initial focus regions are South Asia, Sub-Saharan East Africa and South America.



Examples of international linkages

Engaging with industry

The LRG and the Sustainable Agriculture Initiative (SAI) Platform have jointly published a guide for farmers and industry leaders on reducing the emissions intensity of livestock production: *'Reducing greenhouse gas emissions from livestock: Best practice and emerging options'*. It covers animal feed and nutrition, genetics and breeding, rumen modification, animal health, manure and grassland management and was reviewed by experts from the [LRG research networks](#). The guide highlights positive environmental impacts as well as the financial implications of implementing the various options. It underlines the importance of GHG reduction efforts in supporting a sustainability approach to farming.

"The practical options provided in this resource allow farmers to make informed decisions about greenhouse gas reduction activities and efficiencies benefitting their farms. It is based on the latest science, demonstrating that proper cooperation between research and industry can be very rewarding" – **Keith Kenny, Head of Sustainability and CSR, McDonald's Europe and chair of the SAI Platform Beef Working Group.**

World Farmers' Organisation

Grassroots support for the GRA is just as important as support from international organisations. The World Farmers' Organisation is a formal GRA partner, helping take the GRA's efforts out to farmers, including the work of the LRG. A two-week international study tour programme has been initiated for pastoral livestock farmers to expose them to a range of technologies and management practices to help improve on-farm productivity while reducing greenhouse gas emissions. Farmers have travelled to New Zealand and this year will also travel to Argentina.

Demonstrating country experiences in reducing emissions intensity

A new project is compiling experiences from countries in reducing the emissions intensity of their livestock systems, and making these case studies available through a central portal. This project will enable mutual learning between countries and cover experiences from local to national level. Parallel work is also underway to document the benefits of improved emissions inventories to monitor and report the reductions in emissions intensity that result from increasing the productivity and efficiency of livestock systems. Together, these projects help countries showcase and celebrate the achievements they have made in meeting environmental as well as food security goals, while enabling them to move further along this pathway consistent with their national development priorities.



6. Good practice guidance and technical methodologies

Scientists in the LRG have worked together to produce good practice guidelines and technical manuals on key areas of livestock emissions research including:

- Good practice guidelines on soil chambers for measuring nitrous oxide emissions, and the sulphur hexafluoride (SF₆) tracer technique for measuring enteric methane emissions.
- A technical manual on respiration chamber designs from around the world to help new groups developing their own chambers.
- An evaluation of the GreenFeed system for daily measuring of methane emissions from freely ranging cattle.

Sharing information in this way means that new research teams can quickly adopt and tailor research techniques so that they meet their individual needs, while still being consistent with international best practice. This also helps enhance comparability of results and makes it easier for teams to collaborate in future projects. The LRG uses these publications in its capability-building activities.

Further Information

For more information and contact details for the LRG Co-Chairs and research network coordinators, please visit the LRG's area of the GRA website:

www.globalresearchalliance.org/research/livestock



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