LIVESTOCK RESEARCH GROUP

newsletter

GLOBAL RESEARCH ALLIANCE ON AGRICULTURAL GREENHOUSE GASES

Update from the Co-Chairs

You might be wondering why the cover of this October 2015 edition of the Livestock Research Group (LRG) newsletter features a giraffe...

We are delighted to bring you the groundbreaking results of the LRG's flagship 'Global Rumen Census' project, published recently in *Scientific Reports*. After two years of truly global collaboration initiated by the Rumen Microbial Genomics Network, the project has found that the microbes that cause methane emissions in ruminants are highly similar across diverse animal species and feeds around the world. This means that new technologies that seek to reduce methane emissions by influencing rumen microbes should have global application – a significant discovery that would not have been possible without the Global Research Alliance (GRA). Led by New Zealand, 140 scientists from 73 organisations around the world contributed to this study with samples collected from sheep, cattle, deer, goats and even giraffes and buffalo.

The newsletter also brings you coverage of the recent Council meeting. The Council is the body that oversees the GRA's activities and partnerships. Every member country has a seat and it meets annually to discuss matters of strategic importance, including receiving progress reports from the Research Groups. As well as providing a summary of the main discussions at this year's Council meeting, this newsletter also includes an interview we gave on how the outcomes of the Council meeting relate to the work of the LRG.

We also provide an update on France's '4 per mille: soils for food security and climate' initiative. This has been launched ahead of the major UNFCCC climate change conference 'COP21' in Paris in late November this year and there are some clear opportunities for the GRA and LRG.

Finally, we update you on progress in the joint LRG/FAO collaboration on global agricultural mitigation potential, 'Reducing enteric methane for improving food security and livelihoods', with regional workshops held recently in Ethiopia and Sri Lanka.

Enjoy this edition and, as always, our thanks for your ongoing support for the LRG.

Harry and Martin

Next LRG meeting: February 2016

The next meeting of the LRG will be held in Melbourne, Australia, 19-20 February 2016, immediately following the sixth international Greenhouse Gas & Animal Agriculture (GGAA) conference (14-18 February). Several LRG research networks are planning their internal meetings in the days before the conference. Please book this into your diary now - further information will be included in the December newsletter. Registration details for the GGAA can be found online: www.ggaa2016.org.

Global Rumen Census project delivers groundbreaking results

Global solutions to reduce methane emissions from ruminant animals are feasible, because the microbes causing the emissions are similar around the world.

A flagship collaborative LRG project led by New Zealand, the "Global Rumen Census", analysed the microbes responsible for methane emissions from a wide range of ruminant animals around the world. The project found similar bacteria and methanogens dominate in nearly all rumens across a wide variety of species and animal diets. This means that new technologies that seek to reduce methane emissions by influencing rumen microbes should have global applications.

The results of the Global Rumen Census were released on 9 October 2015 in the open-access journal ***Scientific Reports***.

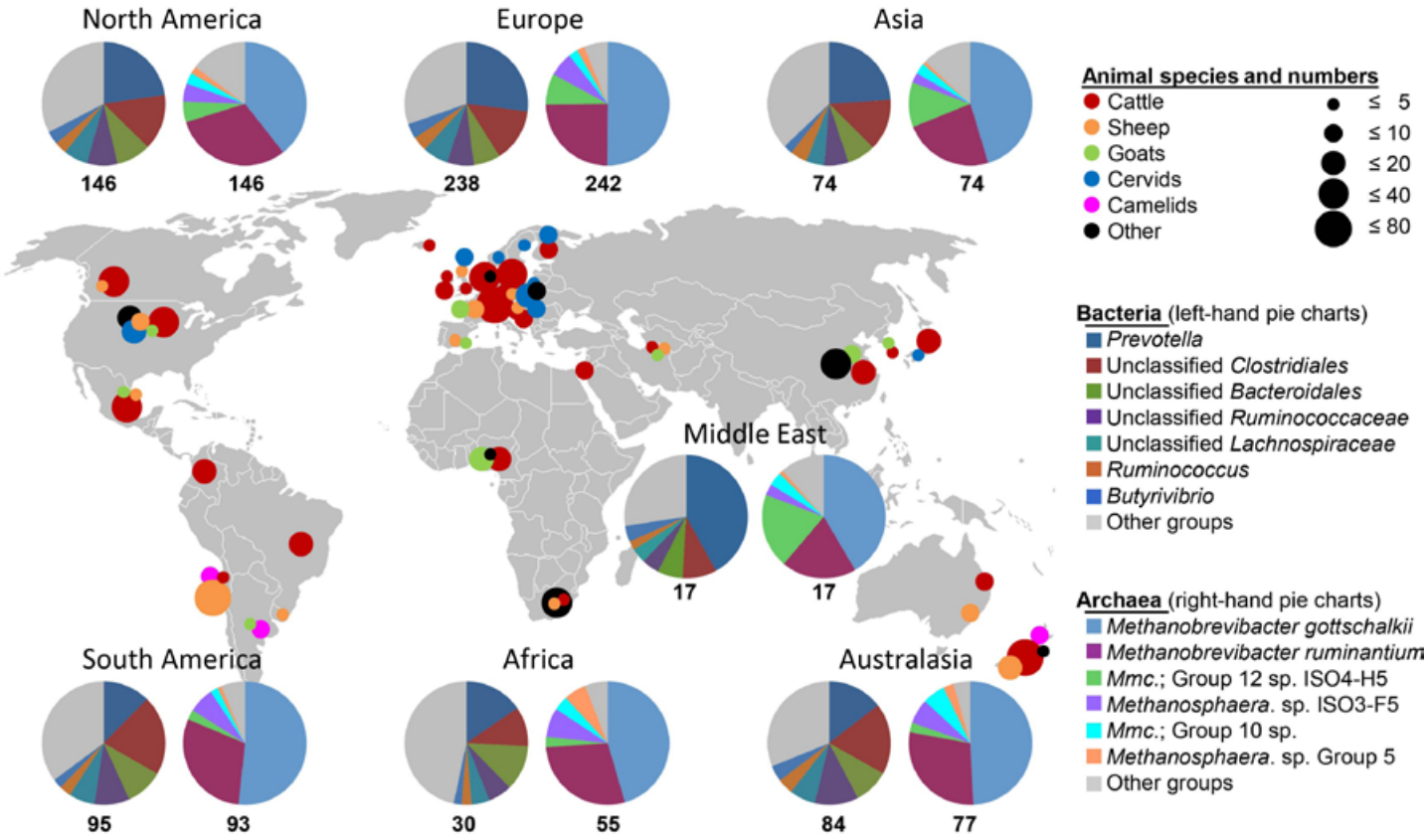
Gemma Henderson and Peter Janssen of AgResearch, New Zealand's largest Crown Research Institute, led the project with 140 scientists from 73 organisations around the world contributing microbial samples over two years.

"We initially thought it would attract about 200 samples but the international interest was immediate and quite large. The sample pool grew to over 900 and we selected 742 of those samples to include in the project," says Henderson.

"It was an honour to be involved with such a successful global collaboration. One of the most exciting things for me was the enthusiasm generated internationally with so many people being interested in what we were doing and wanting to contribute. That was very rewarding."

The strength of the study lies in the diversity of samples collected, with animals from the Slovenian mountains to remote islands off the Chilean coast. As well as the expected samples from sheep, cattle, deer and goats, there were also some from buffalo and giraffes.

Rumen sample: A view of rumen contents through a fluorescence microscope. The small blue cells, identified by Peter, are methanogens.



Origins of samples and their bacterial and archaeal community compositions in different regions.

Numbers below pie charts represent the number of samples for which data were obtained.The most abundant bacteria and archaea are named in clockwise order starting at the top of the pie chart.

Brazilian goat

Cattle in the Sichuan province of China

The rumen is the modified foregut of these animals. Microbes ferment food in the rumen, allowing the animal to extract energy from feed such as grasses that otherwise could not be digested. These microbes are therefore essential for ruminant productivity. Unfortunately, one of the by-products of this fermentation is the greenhouse gas, methane. This is produced by microbes called methanogens. The microbial survey extracted DNA from all samples and sequenced diagnostic marker genes that allowed the identification of different bacteria and methanogens. Once the data had been explored, the findings were checked back with census collaborators around the world.

The initial hypothesis was that rumen microbes would be similar to some extent across the world, but that diets or other factors would make a difference. Peter Janssen, who leads part of New Zealand's methane mitigation research, says the rumen microbes ended up being more similar than they had expected. Mostly they were the same in all samples, but some microbes were more strongly associated with certain hosts and some with certain diets.

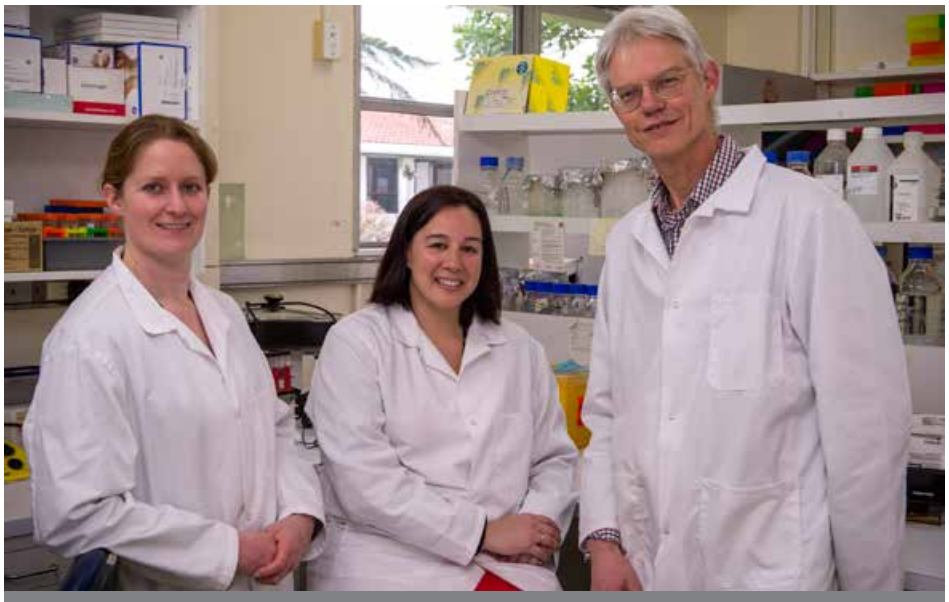
"The rumen methanogens turned out to be highly similar species in all rumens across the world. Only a few species appear to be responsible for the methane produced by ruminants everywhere. This means mitigation strategies can be developed to target the few dominant methanogens, and a technology that's developed in one place should be applicable everywhere," says Janssen.

Harry Clark, Director of the New Zealand Agricultural Greenhouse Gas Research Centre and co-chair of the LRG, says this study shows the real power of international research collaboration possible through the GRA, with the study identified by the LRG's Rumen Microbial Genomics Network as a flagship initiative when the network first came together in 2011.

"This study has provided knowledge that no country could have delivered on its own, and the benefits are also international. The Global Rumen Census shows that new mitigation technologies that tackle the microbes responsible for methane production in ruminants can make a real difference at the global scale. Modifying the rumen is an enormous challenge, but collectively we have a chance to get there."

The Global Rumen Census complements New Zealand's large domestic research programme focused on methane-mitigation technology, particularly vaccines or inhibitors to suppress methanogens. The New Zealand Government's Ministry for Primary Industries funded the main part of the study as part of its support for the GRA.

For more information, please contact peter.janssen@agresearch.co.nz or gemma.henderson@agresearch.co.nz.



New Zealand researchers leading the project: from left to right Gemma Henderson, lead researcher; Faith Cox, research associate; and Peter Janssen, lead researcher.

The 2015 Council meeting at the World Food Prize Hall of Laureates, Des Moines, Iowa, USA

Fifth meeting of the Global Research Alliance Council

GLOBAL RESEARCH ALLIANCE ON AGRICULTURAL GREENHOUSE GASES

A wide range of issues was traversed in the recent GRA Council meeting in Des Moines, Iowa and the coming year is shaping up to be a busy one.

The Council is the representative body of all member countries and oversees the work of the GRA's five Research Groups and the relationships with key partner organisations. Twenty-one of the GRA's 46 member countries attended this year's meeting from 8-11 September; along with the co-chairs of the Research Groups and several GRA partners (CGIAR-CCAFS, FAO, World Bank) and other invited organisations (European Commission, Global Alliance on Climate Smart Agriculture, CABI, Global Open Data for Agriculture & Nutrition (GODAN), the World Agricultural Forum (WAF)).

The Netherlands as outgoing Council Chair handed over to the US as incoming Chair, and Mexico was confirmed as the new Vice Chair. The Council acknowledged the volume of work accomplished in the last few years by the Research Groups and saw the Groups as unique in the work they did in bringing the science community together and the results that were being achieved.

A number of key issues critical to the work of the Research Groups were discussed including a proposal to merge the two Cross-Cutting Groups into one 'Integrative Research Group', ways to engage with the French 4 per mille soil carbon initiative (refer also to page 9), a proposal to explore the development of an 'International Research Call' with the European Commission, and proposals to develop a five-year strategic plan for the GR and agree on an enhanced role for the Secretariat. Council decisions regarding these issues, and others, are now in the process of being endorsed by all GRA member countries prior to them being implemented.

Main discussions

Research Group issues

The co-chairs of the Research Groups held a pre-meeting on 8 September to discuss group-wide issues and to identify key areas where Council action is needed in order to fulfill the Groups' potential. These were jointly presented to the Council on 9 September and reflected many of the issues flagged in the LRG's paper to the Council on 'Maximising the Effectiveness of the LRG', e.g. more active GRA leadership and greater promotion, including stronger links with partners and industry; increased resourcing; and better science-policy links and information from member countries on domestic GRA activities.

In an interesting development, the co-chairs proposed merging the two existing Cross-Cutting Groups to create a new 'Integrative Research Group'. The rationale

for this was that cross-cutting issues were not restricted to the activities covered by the current Cross-Cutting Groups. These existing activities would become networks within the new Group, which would also take over the leadership of some of the networks developed within existing Research Groups, e.g. the LRG's Grasslands Network. Co-chairs would be drawn from the countries currently co-chairing the two Cross-Cutting Groups. Council members viewed this proposal very favourably, seeing it as a rational and effective realignment that would provide greater flexibility and increase the efficiency and coherency of work across all the groups.

Resourcing issues were discussed and the co-chairs sought Council endorsement to develop a joint funding mechanism to encourage resource collaboration between countries. This would be based on the European Commission's 'International Research Consortia' model that was presented at the June LRG meeting (and is similar to what has been achieved through FACCE-JPI). The Secretariat is going to follow up with the Commission to establish how this could work in practice and report back to the Council.

The Council also discussed several other matters relating to the Research Groups including:

- The need for the Research Groups to conduct periodic reviews of their co-chairing arrangements, building on the requirements of the Charter.
- The need for increased information flow from individual member countries in terms of domestic GRA activities to help inform the work plans of the Research Groups, for example by way of annual reports from countries.
- The prospect of a GRA science conference in 2017 as an opportunity to further cement global interest in reducing the emissions intensity of agricultural production and to showcase the achievements of the GRA. This could include a Council meeting, meetings of the Research Groups and, potentially, a high-level Ministerial segment.
- A GRA presence at the agriculture side event being organized for the UNFCCC COP21 in Paris in December, as well as potential GRA involvement in the French 4 per mille soil carbon initiative via the Research Groups.

Development of a five-year strategic plan

The Secretariat proposed the development of a strategic plan for the GRA – a concept that was met with enthusiasm by the Council. This would sit between the Charter and the Research Groups' annual work plans and would identify specific objectives and achievements for 2015-2020. It would address matters such as open access to data, research and publications; promotion and awareness-raising of the GRA's work; enhancing participation by members, partners and potentially the private sector; resourcing constraints; and improving the science/policy interface. This will be developed by a working group of member countries, with input from the Research Groups, over the next six months and sent to the full Council for final approval.

Enhanced Secretariat

New Zealand presented a proposal on the future of the Secretariat, which it currently hosts. Council approval was sought to widen the Secretariat's role so that it could more actively work to raise the profile of the GRA internationally, improve relationships with partners and better support the membership. The proposal included the concept of a GRA 'representative', which was positively received by the Council. Such a role could be established as a two-year trial to work closely with the Chair and Vice Chair, representing the GRA at relevant events and working to broaden links with existing and potential partners, NGOs, the agricultural sector and philanthropics. Such a person could also help member countries raise the profile of the GRA domestically, including highlighting the value of the Research Groups' work. This proposal was agreed subject to agreeing a Terms of Reference and Council approval of the 'representative'. The Council also agreed that New Zealand should continue hosting the Secretariat until 2019.

Partnerships and strategic relationships

On the back of the very strong relationship being developed between the Climate and Clean Air Coalition (CCAC) and the LRG, the Council agreed that a new partnership with the CCAC would be highly beneficial. The Council also agreed new partnerships with WAF and CABI, a not-for-profit scientific research publishing and international development organisation. Both the WAF and CABI are focused on finding ways to put sustainable agricultural research to use and offer valuable conduits for promoting the GRA's achievements to a wider audience. The relationship with the Global Alliance on Climate Smart Agriculture was also discussed although the Council felt this would be best developed at the Research Group level at this stage.

For more information on the Council meeting, please contact the GRA Secretariat (secretariat@globalresearchalliance.org)

Q&A with the LRG co-chairs following the Council meeting

Martin Scholten and Harry Clark, the Dutch and New Zealand co-chairs of the LRG discuss the recent Global Research Alliance Council meeting and how its outcomes will impact on the LRG in the coming months.

Q. How were the LRG's activities received?

A. The Council was impressed by the scope and quantum of the LRG's work – we received a lot of praise for the various communication documents that we shared with the Council (the case studies of success, the LRG's review on participation, the new brochure). Council members described these as incredibly valuable, for example in briefing Ministers on GRA progress and achievements. The Council was also very appreciative of the efforts to build capability. A copy of our presentation to the Council can be found in the members area of the GRA website.

Q. What effect will the proposed new Integrative Research Group have on the LRG?

A. Before we talk about impacts, we need to be clear about why this new Research Group has been proposed. The GRA Charter's mandate for the Cross-Cutting Groups isn't particularly flexible and doesn't allow them to easily take on new activities. The idea for the new Group was seen as a way to overcome this inflexibility and have a Group that could address a number of cross-cutting issues rather than the two that were identified when the GRA was first formed. This new 'Integrative Research Group' would form research networks to address a range of cross-cutting issues. One immediate impact on the LRG would be that the cross-cutting issue of grasslands, of interest to the LRG, the Croplands Group and the Soil Carbon and Nitrogen Cycling Group, would migrate to the new Group.

Research Group co-chairs attending the Council meeting

Q. How will the changes to the Secretariat help the LRG?

A. The proposal for a strengthened Secretariat, particularly the GRA 'representative', is a really positive outcome from the Council meeting. This has the potential to be a big help in terms of raising the profile of the GRA internationally and within countries, which will undoubtedly have a flow-on effect to the LRG and its work. All of the Research Groups highlighted resourcing issues – the new 'representative' would have a key role in making more of the GRA's formal partnerships and in brokering new relationships, especially with philanthropics and industry. Member countries also need to be more active and public in their support for the GRA, especially the Research Groups, and we see the GRA representative as being critical in helping achieve this.

Q. How did the Council view the relationship with the Global Alliance on Climate Smart Agriculture (GACSA)?

A. The Council could see complementarity between the GRA and GACSA agendas, and also that there is potential for the GACSA – particularly its Knowledge Action Group – to be an avenue for getting GRA research information out to a broad audience, especially policy makers. We talked to the Council about how the LRG is liaising with the GACSA, exploring the potential for how we could work together in the future. They were comfortable with this approach and didn't see a need to make the GACSA a formal GRA partner at this stage. We will maintain our regular contact with the GACSA (we met with them in Europe recently) and will look to invite them to attend the next LRG meeting.

Q. How far is the Council prepared to go in terms of facilitating a joint research call for the GRA?

A. The Council did not manage to have a focused discussion on sources of new funding to support GRA activities, however it was clear that members could see that resourcing is a critical issue for the GRA. We were really pleased that the European Commission was able to attend and present its 'International Research Consortia' model – this offers a low-risk opportunity for countries in that it works on a research alignment model rather than new funding having to be found and deposited into a central pool. We will be staying in close contact with the Secretariat as they explore what might be possible. There are some great lessons to be learned from the success of the LRG's multi-country call conducted in collaboration with some countries of the EU FACCE-JPI programme.

Q. What involvement will the Research Groups have in the French 4 per mille soil carbon initiative?

A. The GRA's work on soil carbon fits in well with what the French are proposing including the plans for an international research programme (see page 9 for more details). Jean-Francois Soussana of France's INRA, who is co-chair of the GRA's Soil Carbon & Nitrogen Cycling Cross-Cutting Group (SCNC), is heavily involved in the development of the 4 per mille initiative and sees a clear role for the GRA in hosting the research programme, working alongside other organisations such as the FAO, AGMIP, UNEP and the CGIAR soil carbon partnership. The Secretariat is working with the French Government on the details as this will all feed into the plans for the GRA's presence during the Agriculture Day planned for COP21, where we expect the French initiative will be formally launched.

Q. What will a strategic plan for the GRA actually deliver for the Research Groups?

A. The Council sees a strategic plan as a means for bringing the GRA's activities into a coherent whole and placing them in the context of delivering on the key goals set out in the Charter. A group of member countries is expected to be set up to develop a first draft and it will be interesting to see how this process unfolds.

Q. Is there news on a formal GRA partnership with the SAI Platform?

A. The Council was impressed at how productive the LRG's relationship with the SAI Platform is, with the joint publication of the guide for industry leaders on current best practice and emerging options for mitigating livestock greenhouse gas emissions. The Council asked the Research Groups to intensify their work with SAI Platform and we were pleased to hear that the Paddy Rice Group intends to follow our approach.

Collaborating on global agricultural mitigation potential: an update on progress

Participants at the Sub-Saharan Africa workshop in Addis Ababa

Participants at the South Asia workshop in Colombo

In an ongoing series for the LRG newsletter, we bring you another update on progress with the LRG's flagship collaborative capability building project with the FAO and CCAC, 'Reducing enteric methane for improving food security and livelihoods'.

The project team recently held regional workshops in South Asia and Sub-Saharan Africa. These were an opportunity to bring together policy, science, industry and livestock extension organisations to discuss key regional production systems, interventions which are available or near to market, constraints affecting the uptake of such interventions and the economic cost to farmers.

Twenty-five participants from Sri Lanka and Bangladesh attended the South Asia regional workshop, hosted by the National Science Foundation in Colombo, Sri Lanka, 27-28 August 2015. (It was not possible for participants from India to attend but they will be contributing data). Significant numbers of the world's cattle, buffalo and small ruminant populations are found in South Asia – 20%, 78% and 23% respectively. Twelve percent of global milk production comes from the region and 92% of buffalo milk, along with 23% of global edible protein from small ruminants.

Thirty-two participants from Ethiopia, Kenya, Tanzania, Uganda, Benin, Senegal, Mali, Niger and Burkino Faso travelled to Addis Ababa for the Sub-Saharan Africa workshop from 31 August – 2 September. Over 200 million people rely on livestock for income in the region, which is home to 17% of the global cattle population and 23% of small ruminants. Ruminants in the region are fed diets mainly based on highly fibrous material and usually show only a marginal level of productivity; the region producing only 4% of the global protein from cattle and 12% from small ruminants.

The sharing of such information even at this early stage has provided a rich picture of dairy production in South Asia and Sub Saharan Africa. As with the regional workshop held in Argentina in June (reported in the July 2015 newsletter), the next steps are to work with country-nominated focal points to collect baseline data for their key production systems, interventions and constraints to input in to the FAO's Global Livestock Environmental Assessment Model (GLEAM). This will identify regionally appropriate intervention packages for testing and upscaling in the second phase of the project.

For further details of the project please contact the project coordinator, Victoria Hatton (victoria.hatton@fao.org).

This project is a collaboration between FAO (www.fao.org) and the LRG, led by the New Zealand Agricultural Greenhouse Gas Research Centre (www.nzagrc.org.nz). Funding is jointly provided by the Climate and Clean Air Coalition (www.ccacoalition.org) and the New Zealand Government, in support of the Global Research Alliance on Agricultural Greenhouse Gases (www.globalresearchalliance.org).

4 per mille: soils for food security and climate

Soil degradation poses a threat to more than 40% of the Earth's land surfaces. Climate change is accelerating this rate of degradation and threatening food security.

The French Government has launched a major international effort seeking to achieve a "4‰"(four thousandths or 4 per 1000) annual growth rate of the global soil carbon stock. According to a factsheet from the French Ministry of Agriculture, Agrifood and Forestry, this would absorb and store the equivalent of the world's annual CO_2 anthropogenic emissions, "making it possible to stop the present increase in atmospheric CO_2". This growth rate is not presented as a normative target for every country but is intended to show that even a small increase in the soil carbon stock (agricultural soils notably grasslands and pastures, and forest soils) could significantly alter agriculture's contribution to climate change while improving soil fertility and agricultural production.

The 4‰ Initiative aims to improve the organic matter content and promote carbon sequestration in soils through the application of agricultural practices adapted to local conditions both economically, environmentally and socially, such as agro-ecology, agroforestry, conservation agriculture and landscape management.

The initiative seeks a wide range of participation from governments, local authorities, companies, farmer organisations, NGOs and research institutes. A 'voluntary action plan' is envisaged where stakeholders commit to implement/support farming practices that maintain or enhance soil carbon stock on as many agricultural soils as possible and to preserve carbon-rich soils. This would be supported by an international research and scientific 'cooperation programme', focused on four complementary research themes:

- Study of mechanisms and assessment of the potential for carbon storage in soils across regions and systems
- Performance evaluation of best farming practices for soil carbon and their impact on other GHGs, on food security and on other regulation and production services
- Support of innovation and its promotion by appropriate policies
- Monitoring and estimating variations in soil carbon stock, especially at the farm level

As reported in the previous LRG newsletter in July 2015, the LRG and the GRA's Soil Carbon & Nitrogen Cycling Cross-Cutting Group held a joint workshop in late June to discuss the 4‰ Initiative, specifically as it relates to soil carbon in grassland systems. There was strong support by participants then to be a part of the international research programme. This interest carried over to the recent GRA Council meeting, where representatives requested that the Research Groups support the initiative (although it was noted that individual member countries are still considering their own positions). The LRG co-chairs will work actively with co-chairs of other Research Groups and the GRA Chair, Vice-Chair and Secretariat to define the ways in which the LRG could become involved in this initiative.

For more information, see
http://agriculture.gouv.fr/join-40-initiative-soils-food-security-and-climate-0

International fellowship opportunities

LEARN and GRASS Awards (sponsored by New Zealand)

Supporting Research in Agricultural Greenhouse Gases

Award types

LEARN Technician Award: provides funds for up to six months for a technician from a developing country to travel to a New Zealand organisation to receive training on equipment, tools or methods that when applied in their home organisation/country will improve the measurement of and understanding of greenhouse gas emissions from agriculture. To be eligible, you must have a bachelor's degree or equivalent tertiary qualification or be a technician with at least five years work experience.

LEARN Co-Funded PhD: provides a stipend for a PhD student from a developing country to benefit from having supervision from a researcher in a New Zealand institution. The scholarship is for a maximum of three years duration and the student must be enrolled in a PhD programme in their home country or at a New Zealand institution to receive the scholarship, and must have secured or be likely to secure co-funding.

LEARN Postdoctoral Fellow: provides funds for an emerging researcher from a developing country to work on a research project mentored by a New Zealand researcher while being based at an institution in New Zealand. To be eligible, you must have gained a PhD in the last five years and be employed in an area of research aligned with livestock GHG emissions mitigation in your home country. The fellowship is for up to two years with an expected minimum duration of 12 months.

GRASS (Global Research Alliance Senior Scientist) Award: provides funds for extended exchanges between New Zealand scientists and scientists from other Alliance member countries in accordance with the mission and objectives of LEARN and the Alliance. To be eligible, you must have a PhD or be a scientist with at least five years experience participating in/leading major projects and demonstrate impact and leadership in your professional field. Funding can be awarded for between 6 weeks and 6 months duration.

For more details refer to the LEARN website: http://www.livestockemissions.net/ or email the New Zealand Agricultural Greenhouse Gas Research Centre: enquiry@nzagrc.org.nz

Borlaug Fellowship Program (sponsored by the U.S.)

The Norman E. Borlaug International Agricultural Science and Technology Fellowship Program promotes food security and economic growth by providing training and collaborative research opportunities to fellows from developing and middle-income countries.

The U.S. Department of Agriculture is now accepting applications for the 2016 Borlaug Global Research Alliance Fellowships (deadline is 15 November 2015).

Borlaug fellows are generally scientists, researchers or policymakers who are in the early or middle stages of their careers. Fellows will work with a mentor at USDA's Agricultural Research Service or a U.S. university for up to 12 weeks on climate change mitigation research. The U.S. mentor will later visit the fellow's home institution to continue collaboration.

Objectives

- Provide early-to-midcareer agricultural research scientists, faculty, and policymakers with individual training opportunities in climate change mitigation research
- Provide practical experience and exposure to new perspectives and/or technologies that can be applied in their home institutions
- Foster increased collaboration and networking to improve agricultural productivity and trade
- Facilitate the transfer of new scientific and agricultural technologies to strengthen agricultural practices
- Address obstacles to the adoption of technology such as ineffectual policies and regulations

Eligible countries: Colombia, Costa Rica, Egypt, Ghana, Honduras, Indonesia, Malaysia, Nicaragua, Panama, Peru, Philippines, Thailand, Vietnam

For more information on the targeted research areas and to apply online, please see: http://www.fas.usda.gov/newsroom/accepting-applications-2016-borlaug-global-research-alliance-fellowships

Upcoming events

Expo Milano 2015

The theme for the 2015 Milan Universal Exposition is "Feeding the Planet, Energy for Life". This embraces technology, innovation, culture, traditions and creativity and how they relate to food and diet.

Date: 1 May to 31 October 2015
Location: Milan, Italy
Website: www.expo2015.org

ALPA 2015: 14th Congress of the Latin American Association of Animal Production

This congress brings together the industrial, productive and scientific sectors to discuss animal production research in Latin America, particularly focusing on the challenges of animal science to sustainably meet increasing food demand.

Date: 9-13 November 2015
Location: Puerto Varas, Chile
Website: www.alpa2015.com

3rd LRG technical training course on SF_6 measurement techniques for South and South East Asian countries

Invited participants will receive 'hands-on' training to develop skills in methane emission measurements from ruminants using the SF_6 tracer technique.

Date: 16 November – 4 December 2015
Location: Bangkok, Thailand
Email: victoria.hatton@nzagrc.org.nz

6th Greenhouse Gas & Animal Agriculture conference

Preeminent international conference for scientists and policymakers working on the measurement, modelling and mitigation of greenhouse gases from animal agriculture. The event reviews the current state of knowledge and presents significant new scientific developments.

Date: 14-18 February 2016
Location: Melbourne, Australia
Website: www.ggaa2016.org

LRG meeting

Eighth meeting of the Livestock Research Group, immediately following the GGAA conference.

Date: 19-20 February 2016
Location: Melbourne, Australia
Email: secretariat@globalresearchalliance.org

Contacts

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