



# UK Agri-Science & Innovation

Supporting international  
actions to mitigate  
agricultural GHG emissions

Issue 1

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## Welcome

to the first newsletter communicating information on UK participation in the Global Research Alliance (GRA) on Agricultural Greenhouse Gases. In 2011 the UK stepped up technical and scientific engagement and participation in GRA activities, including involvement in key actions identified by the GRA Croplands and Livestock Research Groups and the Inventories & Measurements Cross-Cutting Group.

This international activity builds upon the UK Government's current investment in the UK Agricultural Greenhouse Gas (GHG) Research Platform [www.ghgplatform.org.uk](http://www.ghgplatform.org.uk), and aims to promote and enhance UK research into GHG mitigation. The aim of the newsletter is to communicate UK activities which support the GRA and other international initiatives, including details of events and meetings attended by UK delegates and updates on actions being led by the UK.

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## ABOUT THE GLOBAL RESEARCH ALLIANCE

The GRA was established to help reduce the emissions intensity of agricultural production and increase its potential for soil carbon sequestration. Minimising GHG emissions from agriculture while increasing food security is a global issue and many countries have research underway to measure and mitigate losses from cropland and livestock systems.

The GRA aims to link up these research efforts to achieve faster progress towards the solutions needed for improving agricultural productivity and reducing its contribution to climate change. It aims to help improve the ways that agricultural GHG research is conducted and to enhance participating countries' scientific capacity via active exchange of data and research, development and extension of technologies and practices, and identifying research gaps and potential opportunities for new cross-national research collaborations.

Activities are progressed within three research groups (Livestock, Croplands and Paddy Rice) and two cross-cutting groups (Inventories & Measurements and Carbon & Nitrogen Cycling) and there are currently 33 member countries including the UK. For further information visit [www.globalresearchalliance.org](http://www.globalresearchalliance.org).

## GRA ACTIVITIES LED BY THE UK

### Animal Health and Greenhouse Gas Emissions Intensity

**The UK is leading the GRA activity on investigating links and synergies between efforts to reduce the burden of disease on livestock and reducing GHG emissions intensity.**

There is a broad consensus among experts and stakeholders that GHG emissions intensity from livestock farming could be reduced through efficiency and production gains resulting from improved livestock health. Whilst there is a long history of research in the field of animal health, the conceptual link between animal health and GHG emissions is novel and so there is a real opportunity for interested researchers to collaborate and for research funders to coordinate their efforts.

At the GRA Livestock Research Group meeting in Amsterdam in November 2011, attendees recognised the potential to further this area of work within the GRA. The UK, led by the Department for Environment, Food and Rural Affairs (Defra) and the Animal Health and Veterinary Laboratories Agency (AHVLA), agreed to develop a proposal and suggested the creation of a formal network.

A workshop was held in Bangkok, Thailand, on 20 June 2012 to bring interested scientists from member countries together to exchange knowledge regarding the extent of ongoing and planned activities in animal health and GHG emissions intensity; to scope options to promote and advance this work area; and to discuss desired actions for this GRA activity. The workshop was held directly after the STAR-IDAZ (Global Strategic Alliances for the Coordination of Research on the Major Infectious Diseases of Animals and Zoonoses) meeting.



Presentations were delivered by John Elliott (ADAS, UK), Jos Houdijk (SRUC, UK), Tim Robinson (Animal Production and Health Division, Food and Agriculture Organisation of the UN (FAO)) and Philip Mowles (Ministry of Science and Innovation, New Zealand).

There was great support for developing a network to initially act as an information sharing structure with potential to provide additional benefits as it matures. Outputs from the discussions were collated to form a proposal which was presented and approved at the Livestock Research Group meeting in Uruguay in November 2012. A paper on the science and background of animal health and GHG emissions intensity is

currently being produced, drawing on work already underway in the UK and abroad.

The GRA provides an excellent platform in which to develop this network as it contains motivated member countries already working together. The GRA can link animal health and disease communities with GHG research communities so that evidence gaps can be identified by the experts.

The presentations from the workshop in Bangkok can be downloaded [here](#). If you would like further information on this new network and wish to consider participating, please contact [Adele.Hulin@adas.co.uk](mailto:Adele.Hulin@adas.co.uk).

#### **Objectives of the animal health and GHG emissions intensity network**

- ▶ Share information on current and planned research
- ▶ Improve understanding of the links between animal health and GHG emissions intensity and productivity
- ▶ Maintain and enhance capacity in this area of research
- ▶ Encourage and facilitate a joined-up approach from fundamental science to strategic and applied research and research-into-use
- ▶ Avoid duplication and identify research gaps and opportunities for collaboration
- ▶ Establish common agreement on priority issues and explore funding opportunities to address them



### The UK is leading the GRA action to create a DNDC modelling network

DNDC (de-nitrification de-composition) is a model that simulates carbon (C) and nitrogen (N) biogeochemistry in agro-ecosystems. The model predicts nitrous oxide, carbon dioxide and methane emissions and can be used to evaluate mitigation options. Scientists across the world use DNDC as well as other C and N process-based models (such as DayCent, RothC, Holos, APSIM) for scenario analysis and aiding the interpretation of measurements in order to report on GHG emissions from agriculture. There is great scope to learn from different countries' experience in using and applying the model and the GRA provides a unique opportunity to facilitate interaction between specialists with a common interest in modelling C and N cycling in relation to GHG emissions.

The UK is setting up a network within the GRA Croplands Research Group to stimulate communication between model users, model developers and specialist researchers. The network aims to bring researchers together to share data and experiences in model use, gather metadata on model adaptations, improve comparability of outputs via benchmark parameters and databases and look more strategically at model use and development.

The proposal for the network was developed via discussions with UK scientists and model users at the University of Aberdeen, SRUC, Rothamsted Research and Rothamsted North Wyke and presented at the Joint Croplands Research Group and Carbon and Nitrogen Cycling Cross-Cutting Group meeting in Bari, Italy, in July 2012. The idea received a positive reception with eight other GRA member countries expressing interest. Attendees agreed that this should be a collaborative network of lectures and events with an interactive website.

It is expected that the network will be expanded in the future to include other C and N process-based models. This project aims to create links and avoid overlaps with the [Global DNDC Network](#) based in New Zealand.

### Objectives of the DNDC modelling network

- ▶ Establish a vibrant collaborative network
- ▶ Create an interactive website
- ▶ Encourage interaction between model users and model developers
- ▶ Create an evolutionary tree of model versions
- ▶ Synthesise problem areas in application and validation of models
- ▶ Build capacity and train the next generation of model users



## Scoping the Feasibility of Earth Observation to Provide Activity Data for Inventory Compilation

### Supporting the Inventories and Measurements Cross-Cutting Group

The availability of activity data to drive inventory estimates of GHG emissions from agriculture has been identified as a critical barrier to developing inventories for all members of the GRA. Earth observation technologies offer an interesting opportunity to replace or augment statistical surveys as a cost effective and spatially exhaustive option for activity data collection.

On the 12th July 2012 the UK Space Agency and Defra welcomed delegates to a workshop to discuss the possibilities of satellite remote sensing and how it may contribute to the improvement of the UK agricultural GHG inventory. The objectives of this workshop were to facilitate the exchange of knowledge between GHG policy makers and the remote sensing community. The meeting aimed to identify potential contributions remote sensing could make to improve the evidence on which inventories are based. Presentations given on the day covered topics such as direct measurements using satellite data; integration of terrestrial and satellite direct measurement methods; optical methods of obtaining crop and non crop land cover; and the use of radar data to improve crop cover identification and assessment especially in situations where cloud cover acts as a barrier to optical data use.



Image source: Chelys

After the speaker sessions, discussion aimed to draft concept notes and agree the next steps. The UK has since developed a proposal to further this work after positive discussions at the Inventories and Measurements Cross-Cutting Group meeting in Ghana, November 2012.



## UK GHG Workshop

### UK hosted workshop on agricultural greenhouse gas measurement methodologies and techniques to support the work of the Global Research Alliance



Delegates at the workshop session on measuring GHG's from soils and manures



The UK GHG workshop was held at the University of Reading's Centre for Dairy Research (CEDAR) on 31st October 2011 directly before the Livestock Research Group meeting in Amsterdam. This was initiated by Defra to support the GRA goals to increase international cooperation and enhance participating countries scientific capability.

The event provided an opportunity for scientists and industry to come together to share knowledge about technologies which can be used to improve national inventories and develop mitigation strategies. The morning session included an introduction by Harry Clark (Livestock Research Group Co-chair) and two parallel sessions on measurement techniques; one on measuring GHG emissions from livestock and the other on GHG emissions from soils and manures.

The afternoon session was introduced by Defra's Minister of State for Agriculture and Food, and included demonstrations of the SF<sub>6</sub> tracer technique, the GreenFeed methane measurement system, calorimetry chambers, automated nitrous oxide chambers and a portable infrared laser spectrometer for field measurements of nitrous oxide and methane.



Francis Lively demonstrating the SF<sub>6</sub> tracer technique

This was a successful event with approximately 100 delegates from more than 15 different countries attending and benefiting from the knowledge and expertise on offer.



## UK PARTICIPATION IN GRA CAPABILITY BUILDING ACTIVITIES

### Measurement and mitigation of greenhouse gases in South East (SE) Asian livestock systems

Measurement and mitigation of GHG's in SE Asian livestock systems: building capacity to meet the challenge, was the theme of a workshop hosted by the Thailand and New Zealand Governments in Bangkok on 14-15th March 2012. This was part of an ongoing commitment of the Livestock Research Group to identify opportunities for capacity building and increasing scientific expertise in GHG measurements and mitigation.

Professor Dave Chadwick (Bangor University) provided expertise on nitrous oxide emissions from soils and manure management whilst other presentations reviewed how lessons learnt in practice from South American countries could be used to stimulate a funded project on GHG quantification and mitigation.

The workshop aimed to determine the range of livestock systems in SE Asia and the current capacity for GHG emission measurements, and to find out what mitigation methods were already being trialled. The workshop provided a good opportunity for SE Asian country representatives to outline the current state of their inventories and options for addressing critical gaps as well as identifying research opportunities and capabilities to improve emission factors and measurement protocols.



## Manure Management Network



Delegates at the first Manure Management Network meeting

### **Professor Dave Chadwick and Professor Brian Chambers present on manure management practices in the UK and implications for diffuse pollution**

Professor Dave Chadwick (Bangor University) and Professor Brian Chambers (ADAS) attended the first workshop of the Manure Management Network at the FAO headquarters in Rome on 3-5 September 2012.

The meeting had representatives from 12 member countries and two invited guests from FAO. The objective of the workshop was to share information about the state of research, policy and communication on manure management; to define a strategy for the GRA Manure Management Network and create an action plan; to introduce the Global Livestock Dialogue and Reduce Discharge agenda; and to introduce the Manure Management Improvement Programme and look for connections and support.

The workshop highlighted the importance of an integrated approach to measuring nitrous oxide emissions. For example, where practical, research studies

should include other nitrogen measurements (ammonia and nitrate) and where appropriate carbon (e.g. methane) emissions. The workshop demonstrated a strong international research focus on GHG emissions from manure storage which was in contrast to UK research where the focus is on GHG emissions following manure spreading to land. The workshop highlighted a variety of levels of 'priority' in pollution mitigation i.e. in some countries nitrate and phosphorus emissions to water were often a higher policy priority than GHG emission research.

Looking to the future, the Manure Management Network should complement the activities of the Livestock Research Group and focus on harmonisation of GHG measurement techniques, nitrogen and carbon cycles in farming systems, developing GHG mitigation methods and facilitating dialogue between scientists and policy makers.



### **Professor Chris Reynolds represented the UK at the inaugural Feed and Nutrition Network workshop in Zurich, Switzerland**

In November 2011 the Livestock Research Group launched a 'research networks and databases' activity addressing nutritional mitigation of methane emissions and excretion of nitrogen by ruminants. The network on Feed and Nutrition in relation to methane emissions (FNN) will enable increased international coordination and collaboration in the most intensive area of research for agricultural GHG mitigation. At present 23 of the 33 countries participating in the GRA have agreed to participate in the FNN. The first FNN workshop was held at ETH (Science and Technology University) Zurich, Switzerland on 1-3rd September 2012. Representatives from 14 countries attended including Professor Chris Reynolds from the UK.

The FNN will focus on effects of feed and nutrition on enteric methane emissions and nitrogen excretion by ruminants and is committed to help researchers and funding organisations to identify key areas of research and avoid unnecessary duplication. Short and long term objectives will include providing evidence-based recommendations for nutritional mitigation in differing production systems and recommendations for best practices for in vitro and in vivo research on enteric methane emissions.



## Rumen Microbial Genomics Network

### **Professor John Wallace and Professor Jamie Newbold contribute to the Hungate 1000 project**

The GRA Rumen Microbial Genomics Network consists of a global network of researchers developing mitigation technologies using a microbial genomics approach. A network workshop held in New Zealand in February 2011 emphasised the need for a catalogue of reference genomes from the rumen microbiome. The Hungate 1000 project aims to sequence 1000 microbial genomes, supporting international efforts to develop methane mitigation and rumen adaptation technologies. UK scientists Professor John Wallace and Professor Jamie Newbold have sent a number of rumen bacterial cultures to New Zealand for genomic sequencing.

At the present time, genome sequencing information is few and far between, only being available for a small number of rumen bacteria and methanogenic archaea. This reference genome information will be used to support the interpretation of methanogenomic sequence datasets, which in turn can support testable hypothesis to gain a better understanding of rumen biology.

More information on the project can be found at [www.hungate1000.org.nz](http://www.hungate1000.org.nz).



## UK REPRESENTATION AT GRA MEETINGS

Cropland Research Group meeting (20 October 2011 in San Antonio, Texas, USA).

UK GHG Measurement methodologies and techniques workshop (31 October 2011 in Reading, UK).

Livestock Research Group meeting (4-5 November 2011 in Amsterdam, the Netherlands).

Inventory and Measurement Cross-Cutting Group meeting (8-10 November 2011 in Ottawa, Canada).

Workshop on measurement and mitigation of greenhouse gases in SE Asian livestock management systems: Challenges and opportunities (14-16 March 2012 in Bangkok, Thailand).

Animal Health and GHG Emissions Intensity workshop (20 June 2012 in Bangkok, Thailand).

Joint meeting of the Croplands Research Group and Soil Carbon and Nitrogen Cross-Cutting Group (3-7 July 2012 in Bari, Italy).

Start-up meeting for the Network on Feed and Nutrition in relation to GHG's (1-3 September 2012 in Zurich, Switzerland).

Start-up meeting of the Manure Management Network (3-5 September 2012 in Rome, Italy).

Workshop on measurement and mitigation of greenhouse gases in African livestock systems: building capability to meet the challenge (24-26 September 2012 in Nairobi, Kenya).

Livestock Research Group meeting (1-2 November 2012 in Punte del Este, Uruguay).

Inventories and Measurements Cross-Cutting Group meeting (22-23 November 2012 in Accra, Ghana).

## ADDITIONAL UK INVOLVEMENT AND FURTHER DETAILS

UK scientists are participating in a wide range of GRA activities and there are many opportunities for further involvement.

Additional to the activities captured in this newsletter, UK scientists are participating in the [Animal Selection, Genetics and Genomics Network](#); various activities assessing GHG emissions in agricultural peatlands and wetlands; and the Croplands GHG Network (led by USA). UK scientists have contributed towards the technical manual on respiration design (available to download [here](#)), the best practice guidance on methodologies for using chambers to measure nitrous oxide from soils, and are currently involved in developing best practice guidance on using the SF<sub>6</sub> tracer technique to measure methane. The University of Reading has purchased a GreenFeed Unit to measure methane emissions from free-ranging ruminants and is sharing experiences with scientists in Australia and New Zealand who are also trialling the kit.

Please contact ADAS for further information on UK participation in the GRA and other international initiatives such as the Joint Programming Initiative on Agriculture, Food Security and Climate Change (FACCE-JPI). Please send your email address to ADAS using the contact details below if you would like to receive regular updates on GRA activities, meeting reports, funding opportunities, publications and events.

### Contact details:

[Adele.Hulin@adas.co.uk](mailto:Adele.Hulin@adas.co.uk) or [gra@adas.co.uk](mailto:gra@adas.co.uk). Tel: 01902 271308