GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

2022 GRA Research Group Report

Livestock Research Group

RESEARCH GROUP OVERVIEW

- **Group Leadership:**
  - **Co- Chairs:** Sinéad Waters (Teagasc, Ireland), Richard Dewhurst (Scotland's Rural College, SRUC), Harry Clark (New Zealand Agricultural Greenhouse Gas Research Centre, NZAGRC)
  - **Support Team:** Sinead Leahy (NZAGRC), Jessica Somerton (NZAGRC)
- **Group Members:** ***at the time of writing it is assumed that all 65 GRA members are also members of the LRG, although this is yet to be confirmed by some of the newest members:***

  Argentina, Australia, Bangladesh, Belgium, Benin, Bolivia, Brazil, Cameroon, Canada, Chile, China, Colombia, Costa Rica, Cote d'Ivoire, Cuba, Democratic Republic of Congo, Denmark, Dominican Republic, Ecuador, Egypt, Eswatini, Ethiopia, Finland, France, Germany, Ghana, Honduras, Indonesia, Ireland, Italy, Japan, Lithuania, Malaysia, Malawi, Mexico, Mongolia, Namibia, the Netherlands, New Zealand, Nicaragua, Nigeria, Norway, Panama, Paraguay, Peru, Philippines, Poland, Samoa, Senegal, South Africa, South Korea, Spain, Sri Lanka, Sweden, Switzerland, Thailand, Tunisia, Turkey, Uganda, United Kingdom, United States of America, Uruguay, Viet Nam, Zambia, Zimbabwe
- **Most recent Group meeting:**
  - The 13th annual meeting of the Livestock Research Group (LRG) of the Global Research Alliance on Agricultural Greenhouse Gases (GRA) was held virtually, given the current travel restrictions imposed by the COVID-19 pandemic. The meeting took place over two days and was chaired by Harry Clark and Jon Tanner, New Zealand; Sinead Waters, Ireland; and Richard Dewhurst, United Kingdom (co-Chairs of the LRG).
  - In addition to presentations from networks and partners, the meeting discussed ideas for future flagship project activities, as well as issues related to promoting 'science into practice'. Some presentations were recorded in advance of the meeting and made available online (https://www.lrg2021.com/). Other presentations, panel discussions and decision-making sessions were live streamed on each of the two meeting days.

- Attended by Alliance member countries: Argentina, Australia, Bangladesh, Brazil, Cameroon, Canada, Chile, Colombia, Costa Rica, Cote D'Ivoire, Denmark, Dominican Republic, Eswatini, France, Germany, Ghana, Ireland, Italy, Japan, Kenya, Lithuania, Malaysia, Mexico, Namibia, Netherlands, New Zealand, Nigeria, Norway, Panama, Poland, Senegal, South Africa, Spain, Switzerland, Thailand, Tunisia, Turkey, United Kingdom, United States of America, Uruguay, Viet Nam, Zambia and Zimbabwe.
- Participating partner organisations: Climate and Clean Air Coalition (CCAC), Agriculture and Food Security (CCAFS), European Commission, United Nations Food and Agriculture Organization (FAO).

- **Next Group meeting:**
  - Initial planning to hold 2022 LRG annual meeting alongside the GGAA meeting in Florida. Given the on-going travel restrictions, this is likely to be held virtually.
- **Group coordination and communications:**
  - Regular teleconferences between the Co-chairs (e.g. every 1-3 weeks, depending on need), regular email correspondence with network coordinators, LRG partners and other project leaders on an as needs basis.
  - LRG members receive email updates whenever there is something to notify them about (e.g. opportunities to register as an IPCC reviewer, employment opportunities in partner organisations etc). The LRG web page is also kept updated.
  - LRG Newsletter is published approximately twice each year.
  - Social media presence: various LRG members regularly tweet about relevant activities.
- **Resourcing**
  - The New Zealand Government provides financial support for countries to attend meetings of the LRG, as well as financing most LRG activities and a number of GRA flagship research projects.
  - Teagasc, the Irish Agriculture and Food Development Authority, (which is funded by the Irish Government) supports the travel and related LRG activities of the Irish co-chair and her team up to €30,000 per annum.
  - DEFRA (UK Department for Environment, Food and Rural Affairs) is supporting Richard Dewhurst's role as LRG Co-Chair at £240,000 from January 2020 to June 2023.
- **Website Promotion**
  - MMN webinar to be held on Wed 16 Feb, currently 224 registrations (14 Feb).

NETWORKS		
Network name	Network coordinators *(names and institutions)*	Network Update *(e.g. communications, meetings, workshops, funding applications, participation in Flagships or other GRA activities etc.)*
Animal Health & GHG Emissions Intensity Network (AHN)	Nick Wheelhouse, Edinburgh Napier University, UK and Seyda Ozkan, FAO, Italy	Dirk von Soosten (FLI, Germany) has now stood down as network lead and been replaced by co-leads Nick Wheelhouse and Seyda Ozkan. Webinar on June 22, 2021 attended by ~30 participants. Webpage updated and Twitter account (@AHN_GRA) reinvigorated in January 2022.
Animal Selection, Genetics and Genomics Network (ASGGN)	Suzanne Rowe, AgResearch, New Zealand	Webinar/workshop on methane proxies held 2 June 2021, well attended. Produced a technical report on methane proxies. Activities of the group shared on social media (Twitter - @ASGGN_GRA and http://www.asggn.org/)
Rumen Microbial Genomics Network (RMG)	Sharon Huws, Queen University Belfast, UK	Continue to provide leadership to new journal 'Animal Microbiome' Network leader and members contributed chapters to book 'Improving Rumen Function'. Funded collaborative projects – RumenPredict, and MASTER and HoloRuminant (Horizon 2020) Publication of a review article covering the past, present and future of the rumen microbiome has been well cited. Proposing a new flagship 'culturomics'. Held annual workshop for all members as part of INRA-Rowett meeting (15th October, 2021)
Feed and Nutrition Network (FNN)	Andre Bannink, Wageningen UK, Netherlands (supported by co-coordinators Alex Hristov, USA and David Yáñez-Ruiz, Spain)	Two major review papers published in Animal Feed Science & Technology on *in vitro* and *in vivo* techniques for assessing nutritional strategies to reduce methane emissions. A symposium review has been published in Journal of Dairy Science on 'Uncertainties in enteric methane inventories, measurement techniques and prediction models.

		The Network activities have been well-funded by Projects such as: Global Network and Capturing Effects of Diet on Emissions from Ruminant Systems (CEDERS). Two enteric methane mitigation databases have been also developed. Developing a flagship proposal on feed additives. Recent funding calls have helped LMIC collaboration (ERA-net call on circularity). Webinar held on November 23 2021 titled "Mitigating enteric methane - the Global Network & the Methane Flagship projects". 205 registrations and 114 attendees. Recording here.
Manure Management Network (MMN)	Tony van der Weerden (AgResearch, New Zealand) and Hongmin Dong, Chinese Academy of Agricultural Sciences	DataMan: GRA Nitrogen flagship project (2018-2021). DataMan GHG Database is publicly available and contains over 5600 emission factors; from 184 studies conducted in 25 countries https://globalresearchalliance.org/research/livestock/collaborative-activities/dataman/ Network webinar 2nd February 2021 History of establishing the Network, the scope, deliverables, and relationship with international projects (e.g. DataMan, MELS) and future priorities.

RESEARCH GROUP Activities					
Activity Name	Outcomes	Members involved	Partners/others involved (if relevant)	Existing funding is provided through (e.g. name of international fund/name country research funding/name of Partner funding or collaboration), including use of any fellowships /exchanges programmes	Please categorise output as one more of following: Capability Building (CB), Research (R), Guidance (G), Policy Support (PS)
<u>There are two FLAGSHIP PROJECTS within LRG:</u> Enteric Fermentation Flagship [Animal Selection Genetics and Genomics Network] DATAMAN Flagship [Manure Management Network]	Bring together of global data on bovine microbiomes with measured GHG emissions, feed intake and feed efficiency. DataMan GHG Database (N emissions) is publicly available and contains over 5600 emission factors; from 184 studies conducted in 25 countries.	Open to all GRA/LRG members Open to all GRA/LRG members		GRA supported GRA supported – linked to EU funded project (MELS)	R, PS R, PS
<u>NETWORK WORKSHOPS</u> Each network holds annual workshops – these were usually aligned to major conferences; but are held virtually during covid-19 restrictions (e.g. Manure	Project concepts; consortium building; funded projects.	Many GRA/LRG members are involved in the different networks	Funding agencies. DATAMAN/MELS has GRA and EU funding. EU and ERA-GAS		R

Management Network virtual workshop 2 February 2021 looked at existing and new opportunities for international project linkage. Networks put ideas into major international funding programmes. RMG Network had a workshop as part of the INRA-Rowett conference on October 15th. One planned for November 23rd for FNN.					
DATABASES Management of major international databases – such as: 'Hungate 1000' rumen microbial genomes (Rumen Microbial Genomics Network) DATAMAN manure emissions (Manure Management Network) Two enteric methane mitigation databases (Feed and Nutrition Network): which summarise and recommend science-based enteric methane mitigation options and support the development of robust enteric methane emission prediction models.	Major 'go-to' databases internationally	Many GRA/LRG members are involved in the different networks			R, G, PS

COLLABORATIVE PROJECTS Networks have central roles in major international collaborative projects, such as (Feed & Nutrition Network) Global Network and Capturing Effects of Diet on Emissions from Ruminant Systems (CEDERS) and a new project INTEGRITY (ERA-GAS) and Rumen Microbial Genomics Network (HoloRuminant, MASTER)	Major global research projects	CEDERS: UK, France, Denmark, Sweden, Germany, Ireland, Finland, New Zealand HoloRuminant: France, Denmark, New Zealand, UK, Israel, Spain, Australia, Finland, Lithuania, Norway, Ireland, Canada, Belgium, Germany, Netherlands		FNN associated project: Global Network and Capturing Effects of Diet on Emissions from Ruminant Systems (CEDERS). New EU Horizon 2020 project with strong RMN involvement: HOLORUMINANT: Understanding microbiomes of the ruminant holobiont.	R
REVIEW PAPERS Feed & Nutrition Network: Two major review papers published in Animal Feed Science & Technology on in vitro and in vivo techniques for assessing nutritional strategies to reduce methane emissions. A symposium review published in the Journal of Dairy Science 'Uncertainties in enteric methane inventories, measurement techniques and prediction models. Animal Health network also produced a review about the associations between dairy cow health and GHG.	Keystone papers for the field.	USA, Brazil, UK, Switzerland, Australia, Ireland, Canada, Belgium, Finland, Netherlands, Spain, South Korea Germany		Range of funding to support different authors (including member support for co-chairs).	R, G, PS

A review paper on 'sustainable livestock futures' for Global Change Biology is under final revision: "Livestock and sustainable agri-food system futures".	Publication demonstrating the multi-faceted roles of livestock in different regions.	New Zealand, UK, Kenya, Austria, Australia, Netherlands, Italy, Ireland	FAO; CGIAR; ACIAR; CSIRO; UoA; AgMip; IIASA; Teagasc; SRUC; WUR; JHU; QUT; ANU	New Zealand Government, in-kind contributions from participating organizations and partners.	
Short-term projects with SRUC researchers (supported from DEFRA co-chair funding) working with networks to collate date and scope potential projects – first one on livestock disease and GHG emissions with AHN and a second one contributed to the ASGGN review of methane proxies.	Project concepts and preliminary data	United Kingdom	Linking with networks	DEFRA funding for co-chair activity	R

FUTURE RESEARCH GROUP ACTIVITIES					
Activity	Expected Outcomes	Members involved	Partners/others involved (if relevant)	Funding to be sought from – (e.g. name of international fund/name country research funding/name of Partner funding or collaboration)	Please categorise expected output as one more of following: Capability Building (CB), Research (R), Guidance (G), Policy Support (PS)
Identification of science priorities, barriers to adoption of practice changes and funding mechanisms. Areas include: carbon sequestration and land use, adoption of technologies, data collection for inventories. [Led by networks; we will also ask member countries to provide input on priorities and opportunities]	New collaborative R&D and Knowledge Exchange activities	Networks		Networks to identify opportunities; member governments and funding agencies to explore opportunities for joint programming.	R, G
Prioritisation of science capability needs across LRG and by regions. Contribute to capability development – in conjunction with CCAC, CCAFS, FAO, World Bank and GRA Integrative Research Group (IRG).	Members sharing expertise in mitigation, measurement and inventory development.	Co-chairs with country representatives and partner organisations.			CB

Contribute to global initiatives developing roadmaps to net zero livestock production. This has established and will continue to work on a roadmap for a new international initiative on 'Net Zero Carbon Dairying'.	Roadmaps to net zero livestock emissions for different regions/systems	All stakeholders	Global Dairy Platform (GDP)	GDP will support a scoping study to be based at FAO, NZAGRC and SRUC.	G
Contribute to a European Working Group looking at Product Environmental Footprinting Category Rules (PEFCR) for feed raw materials (emissions related to feed digestion and manure management).	Internationally agreed standards on footprints	LRG network members representing FNN and MMN	EU		G, PS
Exploring opportunities/ funding to develop projects with LMICS in areas such as: (i) measurement technologies; (ii) animal health and GHGs; and (iii) feed resources and feed evaluation.	New inclusive and collaborative R&D and Knowledge Exchange activities	Co-chairs Networks	National governments and funding agencies – explore co-funding opportunities	NZAGRC has funds for collaborative projects developing measurements in Africa.	R
Development of new Flagship Projects in 1. Rumen culturomics (RMN) and 2. Feed additives to reduce methane emissions (FNN)	New inclusive and collaborative R&D and Knowledge Exchange activities	Co-chairs Networks		Funding sought from GRA members	R

Note any issues to be addressed at 2022 GRA Council meeting

Points from LRG annual meeting 2021:

- Work with networks to refine and seek support for Flagship Project proposals
- Encourage networks to organise webinars and workshops linking research, KE and policy – also to think about activity that could affect behavioural change and KE
- Promote collaborative activity between networks – examples mentioned included FNN/MMN (linking CEDERS and DATAMAN/MELS) and RMG/FNN/ASGGN (microbial genomes underpinning work on additive mechanisms and methane proxies)
- Encourage networks to look for opportunities to involve LMICs more – including exploring new funding opportunities like the recent ERA-NET calls (needs more funders; e.g. Council could pursue wider EU support across GRA areas?)
- Work with Council to publicise resources that we have available within networks (e.g. CEDERS and DATAMAN/MELS databases) to policy and industry in particular
- Work with Council to develop 'country' pages on GRA website – e.g. case studies presented at Annual Meeting would be good content.

GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

2022 GRA Research Group Report

Paddy Rice Research Group

RESEARCH GROUP OVERVIEW

- **Group Leadership:**
  - **Co- Chairs:** Yasukazu Hosen (NARO, Japan), Álvaro Roel (INIA, Uruguay), and Ghislain Kanfany (ISRA, Senegal)
  - **Support Team:** *N/A*
- **Group Members:** Argentina, Bangladesh, Belgium, Bolivia, Brazil, Chile, China, Colombia, Ecuador, Egypt, France, Ghana, Honduras, Indonesia, Italy, Japan, Malaysia, Mexico, Netherlands, Nicaragua, Pakistan, Panama, Paraguay, Peru, Philippines, Republic of Korea, Senegal, Spain, Sri Lanka, Thailand, Tunisia, United Kingdom, United States, Uruguay, Vietnam, Zimbabwe.
- **Most recent Group meeting:** Africa Sub-Group Meeting
  - Meeting date and location: 10 and 17 March 2021 on the web
  - Attended by Alliance member countries: Cameroun, France, Ghana, Japan, New Zealand, Nigeria, Senegal (non-member countries: Liberia, Madagascar, Mozambique)
  - Participating partner organisations: CGIAR (AfricaRice) (non-partner organisations: CIRAD, JIRCAS, RUFORUM; and CLIFF-GRADS Awardees)
- **Next Group meeting:** Americas Sub-Group Meeting
  - Meeting date and location: 12 July 2022 (TBD) at the Delta Water Management Research Unit, USDA-ARS, Jonesboro, Arkansas, USA (with web)
- **Group coordination and communications:**
  - Regular teleconferences -

    MIRSA-3 Annual Project Meeting on 18 November

GRA Co-Chairs of Research Groups that were held on 15 June, 14 October 2021 and 26 January 2022

- On-demand email communication with Members, Project Leaders, government officials, and GRA Secretariat
- Social media presence: N/A
- Participation in other Research Groups and Networks: N/A

- **Resourcing**
  - Travel support to attend meetings*: (if this is offered to participants or has been offered previously, list the funding source and meetings provided)*

    No travel (planned travels were cancelled)
  - Funding for activities*: (if not otherwise listed in activities of Networks or the Research Group)*

    The Japanese Government for MIRSA-3 Project (FY2021: JPY 15,284,000)

    FONTAGRO for "More rice with less emissions and less water use" Project and "More productive and sustainable rice for Latin America" Project
- **Website Promotion**
  - Asian Long-Term Experimental Network for Agriculture (ALTENA), Rota Wagai (NARO, Japan; altena@ml.affrc.go.jp)

NETWORKS

Network name	Network coordinators *(names and institutions)*	Network Update *(e.g. communications, meetings, workshops, funding applications, participation in Flagships or other GRA activities etc.)*
Asia Sub-Group	Yasukazu Hosen (NARO, Japan)	● MIRSA-3 project (27 November 2018 – 31 March 2023) in progress ● Annual Project Meeting (web) on 18 November 2021
Americas Sub-Group	Álvaro Roel (INIA, Uruguay)	● Capacity building and research activities in progress

Africa Sub-Group	Ghislain Kanfany (ISRA, Senegal)	● Sub-Group Meeting (web) on 10 and 17 March 2021 with participants from 7 member countries (3 non-member countries) and CGIAR (AfricaRice) as partner organisation (3 non-partner organisations and CLIFF-GRADS Awardees)

RESEARCH GROUP Activities

Activity Name	Outcomes	Members involved	Partners/others involved (if relevant)	Existing funding is provided through (e.g. name of international fund/name country research funding/name of Partner funding or collaboration), including use of any fellowships /exchanges programmes	Please categorise output as one more of following: Capability Building (CB), Research (R), Guidance (G), Policy Support (PS)
Webinar "New tools for monitoring, reporting, and verification of GHG mitigation in rice" (April 28 and May 18, 2021, Vietnam time)	Promoting the application of new MRV tools in rice production for planning and implementing cost-effective mitigation programs, contributing to achieving countries' NDC targets	Attendee list, not prepared	CGIAR (IRRI)	CGIAR (IRRI)	G, PS
MIRSA-3 Project (the Greenhouse Gas Mitigation in Irrigated Rice Paddies in Southeast Asia 3)	Providing evidential information of the mitigation option in the region	Indonesia, Japan, Philippines, Vietnam	CGIAR (IRRI); Indonesian Agricultural Environment Research Institute (IAERI); National Agriculture and Food Research Organization (NARO);	Ministry of Agriculture, Forestry and Fisheries, Japan	R

			Philippine Rice Research Institute (PhilRice); University of Agriculture and Forestry, Hue University (HUAF)		
More rice with less emissions and less water consumption (Mas arroz con menos agua)	Providing evidential information of the mitigation option in the region, working with small-scale farmers	Colombia, Peru, Chile	Fedearroz, Univsersidad Nacional Agraria La Molina, INIA Chile, FLAR, CGIAR (CIAT)	FONTAGRO	CB, R
More productive and sustainable rice for Latin America	Providing evidential information of the mitigation option in the region, working with small-scale farmers	Chile, Panama, Argentina		FONTAGRO	CB, R
Use of safe alternate wetting and drying irrigation reduced yield-scaled global warming potentials in Arkansas commercial rice fields	Providing evidential information of the mitigation option in the region	USA		ARS USDA Arkansas	R
Contribution of winter cover crop on GHG emissions in furrow irrigated rice systems	Providing evidential information of the mitigation option in the region	USA		ARS USDA Arkansas	R

Assessing seasonal GHG emissions of rice selections under alternate wetting and drying and constant water management practice	Providing evidential information of the mitigation option in the region	USA		ARS USDA Arkansas	R
Single mid-season drain and how that can reduce GHG emissions	Providing evidential information of the mitigation option in the region	USA		UC Davis	R
GHG emissions under different rotation systems	Providing evidential information of the mitigation option in the region	Uruguay	FAGRO	INIA Uruguay - ANII	R

FUTURE RESEARCH GROUP ACTIVITIES

Activity	Expected Outcomes	Members involved	Partners/others involved (if relevant)	Funding to be sought from – (e.g. name of international fund/name country research funding/name of Partner funding or collaboration)	Please categorise expected output as one more of following: Capability Building (CB), Research (R), Guidance (G), Policy Support (PS)
MARDI-NARO collaboration program on agricultural greenhouse gas (GHG) inventory	Development of local emission factors in Malaysia	Japan, Malaysia		Malaysian Agricultural Research and Development Institute (MARDI), Ministry of Agriculture and Food Industry, Malaysia	CB, PS
U.S.-Japan Research Collaboration on Climate Change	Providing evidential information of the CH_4 mitigation option	Japan, USA		Ministry of Agriculture, Forestry and Fisheries, Japan USDA	R

Note any issues to be addressed at 2022 GRA Council meeting: None at this time.

GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

2022 GRA Research Group Report

Croplands Research Group

RESEARCH GROUP OVERVIEW

- **Group Leadership:**
  - **Co- Chairs:** Ladislau Martin-Neto, Embrapa, Brazil; María Rosa Mosquera-Losada, University of Santiago de Compostela, Spain; Mark Liebig, USDA-ARS, USA.
  - **Support Team:** Nuria Ferreiro-Domínguez, Javier Rodríguez-Rigueiro, University of Santiago de Compostela, Spain.
- **Group Members:**

  Argentina, Australia, Belgium, Benin, Bolivia, Brazil, Cameroon, Canada, China, Colombia, Costa Rica, Denmark, DR Congo, Ecuador, Egypt, Finland, France, Germany, Ghana, Indonesia, Ireland, Italy, Japan, Lithuania, Malaysia, Mexico, Mongolia, Namibia, Netherlands, New Zealand, Nicaragua, Norway, Panama, Paraguay, Peru, Philippines, Poland, Republic of Korea, Sénégal, South Africa, Spain, Sri Lanka, Sweden, Switzerland, Thailand, Tunisia, United Kingdom, Uruguay, United States, Viet Nam, Zambia, Zimbabwe
- **Most recent Group meeting:**
  - Meeting date and location: 19 January 2022, online.
  - Attended by Alliance member countries: Argentina, Brazil, Canada, China, Denmark, Indonesia, Ireland, Japan, New Zealand, Poland, Republic of Korea, Sénégal, Spain, United Kingdom, United States
  - Participating partner organisations: CABI
- **Next Group meeting:**
  - Meeting date and location: To be confirmed

- **Group coordination and communications:**
  - Regular teleconference: Teleconferences among co-chairs occurred on 18 February 2021, 28 April 2021, 30 September 2021, 11 November 2021.
  - Email updates / Newsletter: The GRA Croplands Research Group Newsletter was released in March and June, 2021. Led by Rosa Mosquera, the newsletter provides brief updates on relevant mitigation and adaptation initiatives relevant to GRA members.
    - Webinars: Three CRG webinars were held during period: 8 March 2021 - Soil C Sequestration, Dr. Marcelo Beltrán (Argentina), 12 May 2021 - "Full inversion tillage in mixed crop/pasture systems to sequester soil C and reduce the risk of N_2O emissions", Dr. Mike Beare (New Zealand) and 7 December 2021 - "Mediterranean agroforestry and climate change", Dr Anastasia Pantera (Greece)
  - Social media presence: *Facebook* - https://www.facebook.com/GRAcroplands/; *Twitter* - GRA Croplands Research Group, @GroupGRA.
- **Resourcing**
  - Travel support to attend meetings: N/A

NETWORKS

Network name	Network coordinators *(names and institutions)*	Network Update *(e.g. communications, meetings, workshops, funding applications, participation in Flagships or other GRA activities etc.)*
Agroforestry	*María Rosa Mosquera-Losada, University of Santiago de Compostela*	Network activities aligned with projects coordinated within AFINET throughout 2020. Briefly, project outcomes were presented at the 3rd International Conference on Sustainable Agriculture, held online with over 100 scientists attending. AFINET also produced a practitioner's handbook and established an online platform for knowledge sharing in 2020. Activities for 2021 include efforts linking with EU projects focused on sustainable land use and technologies, with the aim of engaging representatives from countries in South America, Africa, and Europe within the scope of the UNDERTREES effort. Additionally, projects on agroecology (AE4EU), bioeconomy (GO-GRASS), climate change, and knowledge sharing platform developments (EUREKA, EURAKNOS) are also being considered as activities in 2021.

Conservation Agriculture	*Craig Drury, Agriculture and Agri-Food Canada*	Update: A special section on the role of conservation agriculture on mitigating N_2O emissions and enhancing carbon sequestration was published in the September issue of the Soil Science Society of America Journal. There were 10 papers published including manuscripts on 7 field studies, two modelling studies as well as a meta-analysis which reported data from 121 field sites in 19 countries. The Guest Editors for these papers included Craig Drury, Jane Johnson and Chuck Rice. This special section was featured in *CSA News* in December 2021. The meta-analysis paper on the impact of conservation agriculture practices including conservation tillage, crop rotation, cover crops, irrigation and residue management on mitigating N_2O emissions is underway
Integrated Systems	*Alberto Carlos de Campos Bernardi, Embrapa, Brazil*	In 2020, the Network led a webinar reviewing research on sustainable intensification practices in Brazil, with particular focus on integrated systems. In 2021, the Network will evaluate how integrated systems affect soil carbon stocks and stability through a meta-analysis of applicable treatments in long-term experiments. Preliminary outcomes will be shared at the II World Congress on Crop-Livestock-Forest Integration Systems (4-5 May 2021).
Landscape Management	*Xunhua Zheng, Chinese Academy of Sciences*	Update: 1. The network leader, Xunhua Zheng, was invited by the IPCC Task Force on National Greenhouse Gas Inventories (TFI) to the Joint 1st and 2nd Expert Meeting on Short-Lived Climate Forcers (virtual sessions in October, 2021) to prepare for the Methodology Report on the Agriculture, Forestry and Other Land Use (AFOLU) Sector, and took the Associate Editor position for the Agriculture, Ecosystem & Environment journal. 2. A five-year NSFC-UNEP joint project "Optimizing Decision-Making of Agricultural Management Practices to Mitigate N_2O Emissions from Upland Farming Systems in China and Kenya" was granted by the National Natural Science Foundation of China (NSFC). 3. The hydro-biogeochemical model CNMM-DNDC was applied in catchment ecosystem simulation to predict sub-daily inflow fluxes of carbon, nitrogen, phosphorous and soil particles into a lake, while the validation and application of this model in seasonally frozen catchment/region were published in the Agriculture, Ecosystem & Environment and Biogeosciences journals.

		4. The model development group is applying the CNMM-DNDC in catchments or regions of different climate zones to widely test its functional performances in simultaneously simulating ecosystem productivity, emission fluxes of greenhouse gases (CO_2, CH_4, N_2O), gaseous nitrogen pollutants (NO, NH_3), and leaching/runoff carbon, nitrogen and phosphorous with high spatial and temporal resolutions.
Peatlands Management	*Hanna Silvennoinen, NIBIO Norway; Fahmuddin Agus, Indonesian Agency for Agricultural Research and Development*	Update: In collaboration with the World Agroforestry Center (ICRAF), IAARD has been starting an almost-two-year- delay (due to COVID-19) site selection, for research on improvement of inventory methodology of GHG emissions due to peat decomposition and peat fire. We aim at finishing instalment of measurement devices at two provinces; in South Sumatra and West Kalimantan.

RESEARCH GROUP Activities

Activity Name	Outcomes	Members involved	Partners/others involved (if relevant)	Existing funding is provided through (e.g. name of international fund/name country research funding/name of Partner funding or collaboration), including use of any fellowships /exchanges programmes	Please categorise output as one more of following: Capability Building (CB), Research (R), Guidance (G), Policy Support (PS)
Literature Database: https://www.lib.k-state.edu/gracroplands/	Completed work on IMLS grant (Institute of Museum and Library Services) in August 2021.	L. Olsen, C. Rice, Kansas State University		In-kind from Kansas State University Libraries	CB, R

Global Research Alliance Modelling Platform (GRAMP): http://www.gramp.org.uk/)	Improved access of process-based models for GHG mitigation estimation.	J. Yeluripati, James Hutton Institute, UK		In-kind James Hutton Institute, UK	R
Managing Agricultural Greenhouse Gases Network (MAGGnet): https://globalresearchalliance.org/research/croplands/collaborative-activities/maggnet/	Improved access to experimental site metadata for modelling activities and meta-analyses.	M. Liebig, USDA-ARS, MAGGnet metadata providers	Jennifer Carter, USDA-ARS	In-kind contribution from USDA-ARS	R
AFINET organization of the Parliamentary session	Increased dissemination of project outcomes	Rosa Mosquera, University of Santiago de Compostela	Anastasia Pantera	European Union Funding	R, PS
Agroforestry Innovation Networks	Social media dynamization	Rosa Mosquera, University of Santiago de Compostela	Nuria Ferreiro, Javier Rogriguez	European Union funding and network contribution	R, G
REGENERATE	EU project to implement (IA) climate smart agriculture through food systems in Europe	Rosa Mosquera and Ladislau Nieto	Nuria Ferreiro, Javier Rodríguez	Several funds to support the project	

FUTURE RESEARCH GROUP ACTIVITIES					
Activity	Expected Outcomes	Members involved	Partners/others involved (if relevant)	Funding to be sought from – (e.g. name of international fund/name country research funding/name of Partner funding or collaboration)	Please categorise expected output as one more of following: Capability Building (CB), Research (R), Guidance (G), Policy Support (PS)
Literature Database: https://www.lib.k-state.edu/gracroplands/	If approved to submit a full application, will develop proposal for three-year grant to improve database.	All CRG members	Kansas State University	Institute of Museum and Library Services, National Leadership Planning Grant	R, CB
AFINET	Increase sharing and uploading documents in collaboration with EUREKA, EURAKNOS, UNDERTREES and AE4EU	All CRG members	University of Santiago de Compostela	USC and European Commission	CB, G, PS
European Green week	Workshop	CRG members	University of Santiago de Compostela	In kind support from University of Santiago de Compostela	PS

Managing Agricultural Greenhouse Gases Network (MAGGnet) – Expansion of experimental sites included in network.	10% increase in the number of experimental sites included in compiled metadata spreadsheet.	MAGGnet metadata providers		In-kind contribution from USDA-ARS	R
Continuation of CRG education and outreach activities	Well attended webinars on topics relevant to CRG members (e.g., zero emissions agriculture, use of artificial intelligence for GHG mitigation, biochar, soil inorganic C, etc.). Engagement of CRG membership through increased newsletter contributions and social media use.	CRG members		In-kind support from University of Santiago de Compostela (Spain) and National Agriculture and Food Research Organization (Japan)	CB
Note any issues to be addressed at 2022 GRA Council meeting: None at this time.					

GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

2022 GRA Research Group Report

Integrative Research Group

RESEARCH GROUP OVERVIEW

- **Group Leadership:**
  - **Co- Chairs:** *Jean-François Soussana (INRAE, France), Pamela Joosse (AAFC/AAC, Canada), retiring Lee Nelson (ACIAR, Australia), incoming Matthew Bartlett (AWE, Australia)*
  - **Support Team:** *None currently*
- **Group Members:**

  Argentina, Australia, Bangladesh, Belgium, , Bolivia, Brazil, Cameroon, Canada, Chile, China, Colombia, Costa Rica, Cote d'Ivoire, Democratic Republic of Congo, Denmark, Ecuador, Egypt, , Finland, France, Germany, Ghana, , Indonesia, Ireland, Italy, Japan, Kenya, Lithuania, Malaysia, Malawi, Mexico, Morocco, the Netherlands, New Zealand, Nicaragua, Nigeria, Norway, Panama, Paraguay, Peru, Philippines, Senegal, South Africa, South Korea, Spain, Sri Lanka, Sweden, Switzerland, Thailand, Tunisia, United Kingdom, United States of America, Uruguay, Viet Nam, Zambia, Zimbabwe
- **Most recent Group meeting:**
  - Meeting date and location: *IRG 5th Annual Meeting. Four virtual sessions over June 24 and 25, 2021.* https://globalresearchalliance.org/library/integrative-research-group-meeting-june-2021/
  - Attended by Alliance member countries: *Argentina, Australia, Bangladesh, Canada, Costa Rica, Cote d'Ivoire, Denmark, France, Germany, Japan, Netherlands, New Zealand, Norway, Senegal, South Africa, Spain, Switzerland, United Kingdom, USA, Uruguay*
  - Participating partner organisations: *AgMIP, CIAT, GHGMI, ILRI, World Bank*
- **Next Group meeting:**
  - Meeting date and location: *Most likely to occur virtually. Investigating opportunities and welcome suggestions from members and partners*

- **Group coordination and communications:**
    - Regular teleconference: *Quarterly, as much as possible, teleconference call with Co-chairs and network coordinators + ad-hoc teleconferences on specific projects*
    - Email updates/ Newsletters: *Networks have newsletters but there is no research group newsletter.*
    - Social media presence *(provide a link to account e.g. facebook, linked in, twitter)*
    - *INDC Network invited Low Carbon Livestock Research Network (LCL-RN) of Livestock Research Group to present at meeting.*
- **Resourcing**
    - Travel support to attend meetings*: The IRG provides no funding of this type.*
    - Funding for activities*: Limited resources have been mobilized from other initiatives, like the CIRCASA project, in the past to support annual meeting in particular. See the Soil Carbon Sequestration network activities to seek new funding.*
- **Website Promotion**
    - See webinar and project websites/links from networks below.

NETWORKS

Network name	Network coordinators *(names and institutions)*	Network Update *(e.g. communications, meetings, workshops, funding applications, participation in Flagships or other GRA activities etc.)*
Soil Carbon Sequestration	*Jean-François Soussana (INRAE, France)* *Pete Smith (University of Aberdeen)*	New paper on inter-model comparison submitted: *Sandor, R. et al. Residual correlation and ensemble modelling to improve crop and grassland models.* A new international project, ORCASA ('Operationalising the International Research Cooperation on Soil Carbon') has been successfully evaluated and has been invited to start negotiations for a grant agreement. ORCASA brings together partners from 10 GRA countries that will work together to prepare and launch an International Research Consortium (IRC) on soil carbon governed by research, private sector and public sector members. It will form the backbone of the Soil Carbon Sequestration Network and will expand to non-agricultural land uses the strategic research and innovation agenda adopted by CIRCASA.

		In addition, soil carbon farming was addressed through an innovation project with private sector in 4 countries of the GRA: France, Switzerland, Netherlands and Sweden. https://www.climate-kic.org/innovation-spotlight/carbon-farming-is-innovating-land-use/ This has resulted in a new network of soil carbon farming initiatives with projects across Europe and Africa. This SCARF network will contribute to the IRC on soil carbon and has potential to expand across world regions to share best practices, monitoring methods and business models. https://www.climate-kic.org/innovation-spotlight/carbon-farming-is-innovating-land-use/
Farm to Regional Scale Integration	*Nina Grassnick, Claus Deblitz, Yelto Zimmer (Thuenen Institute)*	***Webinars*** *Economic analysis of climate change - marginal abatement costs (29.10.2021)* Gary Lanigan (Teagasc), Titis Apdini (Wageningen University and Research), John Antle (Oregon State University) *Carbon farming with no-tillage and straw incorporation - a reality check (16.11.2021)* Axel Don (Thuenen Institute for Climate Smart Agriculture), Mark Liebig (USDA) *Silvopastoral systems (15.12.2021)* Maria de Belem (Algarve University, Portugal), Julián Chará (Centre for Research on Sustainable Agricultural Production Systems, Colombia), Ernesto Reyes (*agri benchmark* Beef and Sheep Network) **Website** Update planned after Council Meeting **LinkedIn** Group: https://www.linkedin.com/groups/12544692/ *A **flagship project** was initiated and will be presented at the council meeting:* *"GHG mitigation in cattle farming – how much is possible where and what are the economic implications on-farm?"*
Circular Food Systems Network	*Karin Andeweg, Flavia Casu, Henk van der Mheen (Wageningen University & Research)*	*In 2021, the Circular Food Systems (CFS) network started as part of the Integrative Research Group of the Global Research Alliance on agricultural greenhouse gases. This is a summary of the network's activities in 2021.* *- On June 22-23, 2021 the network organised an online kick-off workshop. Through presentations from across the world and interactive working sessions, almost 60*

		participants from 36 different countries discussed what circularity in their food system entails, how this may differ between regions and context and on what knowledge gaps future collaborations could focus. *For the workshop, a call for abstract was send out to get an overview of what CFS means in different parts of the world. This resulted in 49 abstracts on circularity in different food systems worldwide. 11 abstracts were invited for a short communication of 2500 words and a video presentation of their research.* Workshop report (with links to video's) Blogpost Presentations *- During the kick-off workshop, new global collaborations have been established that will further explore the opportunities of circularity in food systems in a specific region. The case studies have received funding from the CFS network. In total 12 organisations have received funding to strengthen collaboration on circularity research. Case study results are expected in 2022.* *- Webinar 'Providing integrated data for the monitoring and analysis of agriculture, greenhouse gas emissions and circular food systems, 29 Oct. 2021* *- 2 newsletters, send to 300 persons,* Circular Food Systems Network Newsletters, 2021 – Present | Global Research Alliance *- Outlook to 2022* • *White paper ' Circular Food Systems across the world'.* • *Results of case studies + publications & conference presentations* • *Align research results with ERA-net projects* • *Session at Circular@WUR conference* • *Thematic discussion groups (indicators for circularity; role of insects)*

Greenhouse Gas Inventories and Nationally Determined Contributions network	*Hazelle Tomlin (Ministry for Primary Industries, New Zealand)* *Ngonidzashe Chirinda (Mohammed VI Polytechnic University (UM6P))* *Richard Eckard (University of Melbourne) retiring* *Natalie Doran Brown (University of Melbourne) incoming* *Mai Van Trinh (Vietnam) incoming*	• *Two new co-leads have joined INDC Leadership* • *A new email address has been set up to facilitate network communications and safeguard the longevity of the Network through leadership shifts and as have increasing member engagement – indc.gra@gmail.com* • *2022 Newsletters are planned for February, May, August and November* ***INDC Network Research Collaboration Meeting*** *held June 2 and 3 2021* • *the two meetings were attended in total by nearly 60 participants from Africa, Europe, North American, ASEAN and LAC countries with diverse backgrounds in Inventory development and agriculture mitigation policy.* • *Presentations from IPCC, US EPA, NZAGRC, LCL Research Network, GHGMI, ACIAR and the FAO ETF Network.* • *Discussed importance of inventory frameworks and clear inventory structures, collaboration to avoid duplication of work and, identifying and addressing inventory capacity gaps for partners and regional institutions.* ***Agricultural Compilers Meeting*** *held 17 Jan 2022* • ***Participation****: 35 countries were represented from Africa, Europe, LAC and Asia, North America and Oceania.* • ***Pre-survey data:*** *INDC co-leads received 45 responses from national agriculture inventory compilers prior to the meeting which have provided very useful information to inform INDC direction and activities (webinar topics, workshop etc). In general agriculture inventory compilers globally struggle with i) data, ii) financial constraints, iii) emission factors, iv) expertise and v) inventory relationships.* • ***Discussion****: Three discussion rooms were hosted based on pre-survey feedback we received; i) livestock emission calculation, ii) agricultural soils emission calculation and iii) an open forum including rice emission calculation where we also discussed IPCC guidance and the political dimension of inventories.*

		INDC Direction + Activities *Two focus areas emerged in the Agriculture Compilers Meeting as useful for our network and the wider GRA and research community;* *1. a resource summarizing ag. sector methods of emission calculation (NIR is too lengthy and cannot keyword search across multiple countries' methods for one area of development), and* *2. a resource / set of guidelines on capturing mitigations in national level inventories, for proper validation of emission reductions and potential for Governments to formally issue carbon credits.*

RESEARCH GROUP Activities					
Activity Name	Outcomes	Members involved	Partners/others involved (if relevant)	Existing funding is provided through (e.g. name of international fund/name country research funding/name of Partner funding or collaboration), including use of any fellowships /exchanges programmes	Please categorise output as one more of following: Capability Building (CB), Research (R), Guidance (G), Policy Support (PS)
AgMIP/GRA Mitigation and Adaptation Co-Benefits modelling (MAC-B) project AgMIP Teams Forum June 10, 2021 Panel 3 – Regional Aspects presentation on MAC-B	Special issue in CABI Agriculture and Bioscience "Co-Benefits and Tradeoffs to Food Security form Mitigation and Adaptation in Agriculture"	France Australia Bangladesh	AgMIP	Australian Centre for International Agricultural Research provided 250,000 AUD funding for MAC-B initial pilot study in Bangladesh	PS, G, CB and R

	Development of MAC-B Flagship proposal				
FUTURE RESEARCH GROUP ACTIVITIES					
Activity	Expected Outcomes	Members involved	Partners/others involved (if relevant)	Funding to be sought from – (e.g. name of international fund/name country research funding/name of Partner funding or collaboration)	Please categorise expected output as one more of following: Capability Building (CB), Research (R), Guidance (G), Policy Support (PS)
TBC					
Note any issues to be addressed at 2022 GRA Council meeting: None at this time					