

Croplands Research Group Meeting

Online

9 -10 December 2020

Meeting Report

OVERVIEW

The twelfth meeting of the Croplands Research Group (CRG) of the Global Research Alliance on Agricultural Greenhouse Gases (GRA) was held 9-10 December 2020. The GRA meeting was chaired by USA (Dr Mark Liebig, USDA-ARS), Spain (Prof. Rosa Mosquera-Losada, University of Santiago de Compostela) and Brazil (Dr Ladislau Martin, Embrapa) as Co-Chairs of the Group.

This report is a summary of the key discussions and outcomes of the online meeting. Presentations pre-recorded for this meeting may be viewed in the resource library on the Global Research Alliance website. (<https://globalresearchalliance.org/library/croplands-research-group-annual-meeting-presentations/>)

PARTICIPANTS

The meeting was attended by 36 participants, representing 19 GRA member countries, and invited experts.

- **GRA Members attending:** Argentina, Australia, Benin, Brazil, Canada, China, Denmark, Finland, Germany, Indonesia, Italy, Japan, New Zealand, Poland, Republic of Korea, Senegal, Spain, UK, USA
- **GRA Partners Attending:** CABI

MEETING OUTCOMES

The meeting achieved the following outcomes:

- Identified new research interests among attending members included zero emissions agriculture recommendations for cropping systems, the use of artificial intelligence and digital technology for the measurement of GHG emissions and/or soil carbon stocks, coordinating research activities on biochar, and the inclusion of soil inorganic carbon dynamics data in soil carbon measurements.
- Indonesia agreed to act as a new co-lead for the Peatlands Network.
- Agreement to retire the Integrated Nutrient Management Network and incorporate activities into other CRG Networks.

- Continuation of the CRG webinar series for 2021.
- Undertake a survey of needs for the Croplands Literature Database in the first half of 2021, for possible integration with the JournalMap database.
- Undertake capability activities, including making use of CLIFF-GRADS and other scholarship funds as well as share experiences on living labs and climate hubs across members.
- Reinitiate a review paper exploring the biophysical opportunities, constraints, and caveats related to the application of GHG mitigation practices for cropland systems.

SUMMARY OF DISCUSSIONS

GROUP OVERVIEW

1. The Croplands Research Group Co-Chairs provided an overview of the Group and its activities as well as future directions for discussion during the two day meeting. Following the 2019 CRG meeting in San Antonio, Texas the group's Networks were reviewed reducing the number of Networks to six, moving activities under the Irrigation Network to other Networks. Leadership of the Integrated Systems Network was taken on by Alberto Bernardi, Embrapa. The CRG Webpage was also updated.
2. Recent developments include journal special issues related to activities of the Group:
 - Soil Science Society of America journal, submissions due 15 December 2020, the role of conservation agricultural practices on reducing GHG emissions and enhancing carbon sequestration.
 - Frontiers in Ecology and Evolution, submissions due 30 January 2021, Can the trees save the crops? Predicting the services and provided by traditional and novel agroforests in changing Mediterranean landscapes.
 - Atmosphere, submissions due 30 June 2021, Climate change impacts, mitigation and adaptation in croplands.
3. The CRG held two webinars in 2020, led and organized by the University of Santiago de Compostela, and would like to continue running this series in 2021. Additional activities have been shared through the CRG Newsletter, Facebook and Twitter accounts, thereby building an online community.
4. A discussion on future research priorities for the Group included identifying best management practices for farmers to increase soil carbon storage, including no-till practices, integrated crop-livestock systems agroforestry, pasture management and biochar. Other activities could include reviewing new tools and methods to measure changes in soil carbon stocks.

SECRETARIAT UPDATE

5. The GRA Secretariat provided an update to the Group on activities of the GRA since the 2019 CRG meeting, including new Members and Partners. The GRA has 64 Member Countries, with Bangladesh, Samoa, Turkey and Zambia joining recently. The GRA now works with 23 Partner organisations, the Greenhouse Gas Management Institute (GHGMI) joining as a new partner. Achievements from across the GRA this year include:
 - Regional Secretariat support provided by Uruguay and Germany.
 - The **2021-25 Strategic Plan** has been developed by a working group of representatives from Australia, Canada, China, Germany, Indonesia, Netherlands, New Zealand, Tunisia and Zimbabwe, and reviewed by the Council for finalisation at the 2021 GRA Council meeting.

- A new Circular Food Systems Network has been created under the IRG, coordinated by the Netherlands.
 - Webinars and online training activities organised by the GRA have been held in place of in-person activities this year including Progressing Partnerships webinars for new Members, CLIFF-GRADS science collaboration series and Research Groups webinars (IRG and CRG).
6. The next GRA Council meeting will be held 23-25 March 2021 in a virtual event, hosted by Australia as the incoming Council Chair.

NETWORK UPDATES

7. The Networks provided an update of activities to the Group ahead of the meeting and responded to questions during the live session. The Peatlands Network was unable to provide a report of their activities ahead of this meeting.

Landscape Management of Agricultural Systems - Xunhua Zheng, CAAS

8. The Network has 14 Members from five countries contributing to activities. The main activity is a project developing the CNMM-DNDC model. The updated version of the model includes soil pH changes and modifications for regions with seasonal or permanently frozen soils. This project has been presented as university seminars and a keynote speech at a conference in China. Several publications have been published or submitted.

9. Future research priorities for the Network would be to validate the model updates using field observations, updating the model to include soil erosion processes, complex cropping and agroforestry systems, and developing international research cooperation with other CRG members.

Integrated Crop-Livestock Systems – Alberto Benardi, Embrapa

10. The Network does not include any members at this stage, but a CRG webinar was held on 14 July to share Brazil's research efforts on agricultural sustainable intensification through integrated production systems. This same topic was presented at a recent conference in Brazil (November 2020).

11. Research Priorities include the evaluation of long-term experiments managing integrated systems and developing a better understanding of soil carbon stocks and stability in integrated systems.

12. Brazil is hosting a [world congress on integrated crop-livestock-forestry systems](#), 3-6 May 2021 and will plan future webinars and training opportunities on this topic.

Conservation Agriculture Network - Craig Drury, Agriculture and Agri-food Canada

13. The Network has completed a meta-analysis of selected management options to reduce N₂O emissions identifying practices from 90 peer reviewed studies from 19 countries. The Network is also contributing publications to the special issue for the Soil Science Society of America Journal: *The role of conservation agricultural practices on reducing GHG emissions and enhancing carbon sequestration*. Members of the CRG (Jane Johnson, Chuck Rice and Craig Drury) are editors for the special issue and will focus on publications to identify and promote practices to reduce GHG emissions. Over 20 submissions have been received from researchers from seven countries.

Agroforestry Network – Rosa Mosquera-Losada, University of Santiago de Compostela

14. The Agroforestry Network includes members of the [European AFINET](#), involving 9 countries across Europe. The main achievement of AFINET was the final meeting held at the European Parliament on 9 December 2019 and the final project conference held on 10 December 2019 with farmers and other stakeholders.

15. The Networks outcomes were presented at the 3rd international conference on sustainable agriculture, held online with over 100 attendees participating. AFINET also produced a handbook and established an online platform for knowledge sharing.

16. Future priorities include linking with EU projects focussed on sustainable land use and technologies and involving countries from South America, Africa and Europe ([UNDERTREES](#)). Additionally, projects on agroecology, bioeconomy, climate change, and knowledge sharing platform developments are also being considered.

Integrated Nutrient Management- Michel Cavigelli, USDA-ARS

17. The Network includes 22 Members from 11 Countries currently. A factsheet initiated in 2017 has yet to be finalised for publication. Michel Cavigelli is stepping down as leader of this group. Attending CRG members agreed that the focus of this Network can be easily assimilated into other existing Network activities.

ACTIVITY UPDATES

18. A summary of the updates of CRG activities that were provided ahead of the meeting and discussions from the meeting sessions is provided below.

MAGGnet

19. Mark Liebig presented the updates to MAGGnet, a network that compiles meta-data from research sites across the world. The sites included are mainly croplands production systems although some grasslands experimental sites are included. The database was initiated February 2012 and now includes 380 experiments located in 23 countries.

20. Since November 2019 one site has been added and one request for meta-data has been received – relating to a meta-analysis of soil carbon stocks in Mollisols. Dr. Marta Camps is conducting the meta-analysis and is looking to include experimental sites that have data comparing rotational cropping systems involving shallow and deep-rooted crop species.

Literature Database

21. A presentation from Livia Olsen (Kansas State University) identified an opportunity for the Cropland Literature database to combine with JournalMap. Journal Map provides location-based searches for publications and data. Accordingly, JournalMap is an ideal collaboration for the Literature Database which includes publications from a variety of cropping systems around the world. Both the Literature Database and Journal Map are databases that need to be regularly updated to ensure they remain relevant.

22. In the first half of 2021 a survey will be sent out to CRG members to better understand the Group's needs for future updates of the Literature Database and to assess if combining with Journal Map would help to meet such needs.

Education and Outreach

23. Ayaka Kishimoto-Mo (NARO) and Javier Rodriguez-Rigueiro (USC) provided the update on CRG outreach activities. Two webinars were held in 2020:

- *Agricultural Sustainable Intensification: Integrated Production Systems Achievements and Challenges* presented by Dr Alberto Bernardi.
- *Soil Carbon Sequestration through Biochar Amendments in Farmland in Japan* presented by Dr Ayaka Kishimoto-Mo.

24. The [Facebook group](#) has grown over the last year and a new Twitter account (Croplands Research Group [@GroupGra](#)) has been established for members to follow. Future webinars, Newsletter and other CRG as well as relevant GRA activities will be publicised through these channels.

GRAMP

25. Jagadeesh Yeluripati (James Hutton Institute) provided the Global Research Alliance Model Platform (GRAMP) update. Alongside the DNDC model the BASFOR model family is now available on the website.

26. New funding has been received for a follow-on project – Dynamic Monitoring, Reporting and Verification for Implementing Negative Emissions Strategies in Managed Ecosystems (RETINA). This two-year project explores the possibility of using near real-time monitoring for farm level forecasting of soil carbon stock changes.

CLIFF-GRADS

27. The benefits of participating in the Climate Food and Farming – GRA Development Scholarship (CLIFF-GRADS) programme was shared through a set of pre-recorded presentations and written responses from both host researchers and student awardees. The CLIFF-GRADS programme provides short term research visits (up to 6 months) for developing country students undertaking a PhD to travel to a research institute of a GRA Member or Partner organisation. The group is encouraged to take advantage of this programme when developing future research activities. Written responses or video presentations are available on the meeting webpage, provided by:

- Hosts
 - Dr. Michel Cavigelli, USDA-ARS, Beltsville, MD, USA
 - Prof. David Chadwick, Bangor University, UK
 - Dr. Upendra Sainju, USDA-ARS, Sidney, MT, USA
- Students
 - Lucélia de C. R. de Brito, Federal University of Piauí, Brazil
 - Gabriela Perez, PhD student, University of Buenos Aires, Argentina
 - Sikiru Yusuf Alasinrin, Federal University of Agriculture, Abeokuta, Nigeria

COUNTRY ACTIVITIES

28. Countries provided an update on national research activities prior to the meeting, either as a pre-recorded presentation or slides. These updates can be viewed on the [meeting webpage](#), and a short summary is provided below.

Argentina

29. Marcelo Beltran (INTA) noted that Argentina had participated in several webinars organised by the GRA. Topics of most relevance included climate change effects on the agricultural sector and contributions of national projects and activities toward GHG mitigation goals.

30. Research opportunities include the participation in the 4/100 and climate soil community of practice, and related collaborations on soil carbon sequestration in agricultural soils. Argentina is involved in a Fontagro project on the sustainable intensification of livestock systems by including legumes in pasture, which has a component of capability building. Other projects are measuring GHG emissions from nitrogen fertilisers and mapping the national potential for soil carbon sequestration.

31. Argentina will host 3 CLIFF-GRADS students in the next year, once international travel resumes.

Australia

32. Australia's update from Lee Nelson (ACIAR) Peter Grace (QUT) covered the recently released Technical investment roadmap, which includes soil carbon sequestration opportunities and carbon capture and storage technology development. A National soils strategy is due to be released in 2021, followed by the development of an implementation plan. In partnership with industry, Rural Research and Development Corporations have been established, including with Grains Research and Development and CSIRO investment to better understand agricultural GHG emissions and mitigation options.

33. Australia will host the next GRA Council meeting, online in March 2021 and take on the role of GRA Council Chair at this meeting. Priorities for Australia's term as Chair will be to increase GRA participation and research capabilities of countries in the Pacific, focussing on conservation agriculture and sustainable intensification practices.

34. Research activities of relevance to the include several projects to understand GHG emissions from soils cropped to sugarcane – including soil carbon, nitrogen use and reduced N₂O emissions. Additional activities include improved modelling of N₂O emissions and nitrogen processes for cereal crops, and N₂O emissions from tropical crops, dryland cereals, irrigated cotton and intensive horticulture (see the presentation for more detail on projects).

35. Through ACIAR Australia is also supporting projects in Fiji and Vietnam to help meet Nationally Determined Contributions (NDC) under the UNFCCC, GHG mitigation in farm systems of Asia-Pacific and East Africa, and preserving soil carbon in cleared lands of Asia - Pacific.

Brazil

36. Ladislau Martin-Neto (Embrapa) presented the achievements of the first 10-year period for the Brazilian Agricultural Low Carbon Plan, encouraging farmers to undertake 6 identified low carbon practices. Planning for the second 10-year period is underway, involving a greater number of participants and including additional low carbon practices.

37. Research activities related to climate change within Embrapa considers adaptation, mitigation and future impacts, including a project in cooperation with Bayer involving 500 farms monitoring the effect of management practices on soil carbon sequestration to inform a national carbon credit programme.

38. The Climate Change Program Strategic Plan 2020-2030 has been finalised and includes opportunities for international cooperation on themes of mutual interest. Research priorities include adaptation and resilience projects, the establishment of a platform to monitor carbon and nitrogen stocks in soil, as well as GHG emissions from agricultural production systems.

Canada

39. Craig Drury (Agriculture and Agri-Food Canada) presented on the need to build a common understanding of issues and solutions to reduce agricultural GHGs. Canada's primary interests are to reduce fertiliser-associated emissions, enhance carbon sequestration and develop predictive models at global and regional scales.

40. Canada contributed to the GRA Progressing Partnerships webinar series to enhance awareness of GRA objectives and activities and also an AGMIP workshop on modelling and adaptation co-benefits. Canada has been involved in the working group drafting the next GRA strategic Plan 2021-2025.

41. National research funding calls in Canada have identified linkages to GRA objectives as a priority, 21 new and ongoing projects aligned to GRA projects have been funded under these calls.

42. Opportunities for collaboration that have been identified include the Agroecosystems living labs which have topics on farm soil health, reduced environmental impacts and enhanced yield. Other topics of interest are adaptation of farming systems to climate variability by improving soil health.

Germany

43. Heinz Flessa (Thuenen Institute of Climate-Smart Agriculture) mentioned that Germany's new climate protection law includes a reduction target for agriculture to be monitored each year. Germany's national soil inventory programme was published in 2020, with re-sampling of sites to take place in 2023 and 2028.

44. Germany is contributing to the European Joint Programme (EJP) on soils, a funding programme involving 24 countries that supports projects of up to 4 years. Topics for this call will include soil carbon sequestration and trade-offs with GHGs. Opportunities for capability building include the SPACES II science partnerships, series of 12 online courses held in 2021 supporting capacity building in southern Africa.

Indonesia

45. Fahmuddin Agus (Indonesian Agency for Agricultural Research and Development) presented on the circumstances in Indonesia where adaptation is the entry point and mitigation is a co-benefit. Indonesia has a strategic plan for climate change research and development in agriculture sector, funding is available ongoing inventory activities and circular agriculture is a new funding topic. Other research activities funded include sustainable peatlands management, fertiliser management, organic matter and irrigation improvement. The national guidelines for GHG inventory and measurement were published recently.

46. Indonesia is collaborating internationally on a number of projects including feed quality, GHG mitigation for sustainable farming, nutrient use, peatland management, mitigation in irrigated rice systems, crop-livestock integration and climate smart agriculture.

Japan

47. Ayaka Kishimoto-Mo (National Agriculture and Food Research Organization) presented a CRG [webinar on Biochar](#) amendments to crop and grasslands in Japan and schemes for inclusion as a mitigation practice. Opportunities for research would be for further collaboration on biochar activities.

48. Opportunities for capability include the [JSPS Postdoctoral Fellowships](#) and an upcoming conference organised by NARO-OECD Adaptations to Climate Change in the Food Systems: enhancing synergies and breaking trade-offs between adaptation, mitigation and ecosystem services.

USA

49. Mark Liebig (USDA-ARS) presented on the US contribution to the CRG, Co-Chair of the Research Group, leadership of Nutrient Management Network, hosting the literature database and MAGGnet.

50. ARS hosts a number of research networks related to agricultural greenhouse gases, for example [GRACEnet](#), and most recently has established a Long-Term Agroecosystem Research Network ([LTAR](#)) to share research on sustainable intensification including a working group on non-CO₂ gases, co-Chaired by Michel Cavigelli and Curtis Dell. Other useful activities are an agricultural research Database ([AgCROS](#)) and regional [Climate Hubs](#) providing research information for land managers covering both adaptation and mitigation options.

51. Priority Research Topics are the use of AI technologies to mitigate GHG emissions from crops and the quantification of GHG mitigation trade-offs with adoption of sustainable intensification practices.

52. Capability building opportunities are provided by the National Institute of Food and Agriculture (NIFA) through [global engagement programmes](#) and the US AID partnerships for enhanced engagement in research (PEER), which are international science research programmes

53. US researchers have supported 10 students across round 3 and 4 of the CLIFF-GRADS programme and can also use the Borlaug Fellowship programme to offer short term visits to international students.

Research Opportunities

54. The meeting provided opportunities for the group to identify and discuss future research activities and priority topics. Proposed topics are identified below along with initial suggestions for collaboration.

Zero Emissions Agriculture

- What is the role of the CRG in supporting countries to achieve zero-emissions agriculture or similar policy ambitions?
- Recommendations could be provided as a commentary; this may include life-cycle analysis and require involvement from other GRA Research Groups.

- There are current efforts in USA to develop position papers on this topic (e.g., NSF and USDA-ARS). When available, outcomes will be shared for consideration.
- CNMM-DNDC model has an aligned research effort focused on zero-emission agriculture.

Artificial Intelligence (AI) and Digital Technologies

- Many countries are interested in using AI and digital technologies to address GHG mitigation from croplands. There is an immediate need to identify problems that the technology can effectively address.
- The UK has a new two year project providing real time information to farmers to monitor soil carbon stock change.

Biochar

- Ayaka Kishimoto-Mo presented an overview of biochar research projects in Japan during the October 2020 CRG webinar.
- Other countries have research underway, or an interest in knowing more about this work.
- A survey of existing research efforts was proposed.

Peatlands

- There are many research opportunities related to peatland systems in southeast Asia (e.g., carbon accrual, nutrient-use efficiency, net GWP, residual impacts of burn footprints, etc.).
- Dr. Agus will be joining the Peatlands Management Network as co-lead with Hanna Silvennoinen.

Soil Inorganic Carbon Research

- Soil inorganic carbon dynamics data is lacking in most evaluations of soil carbon stocks in croplands, but is increasingly identified as an important topic (for example RECSOIL- Soil Recarbonization, June, 17th, 2020, organized by FAO, and pointed out in presentation of Prof. Rattan Lal).
- The group should consider greater focus on this topic – including in future Newsletters and a webinar topic.

Soil Health and Climate Change context

- Soil health is a topic of growing interest taking in account soil biology, including microbial activity and soil biodiversity, soil organic carbon, soil structure, with relevant impact in sustainability, gaseous emissions, and environmental services
- The Group should consider including this topic as a Research Network and a presentation for the CRG Newsletter and Webinar series.

Long-term field experiments, 'agroecosystems living labs' and Climate Hubs

- There are opportunities to learn from national-scale networks involved in on-farm research to more facilitate adoption of GHG mitigation practices on privately owned land.
- Share experiences from Canada (Agroecosystem Living Labs Initiative) and the USA (USDA Long-Term Agroecosystem Research Network and Climate Hubs) in the CRG Newsletter or as a webinar.

MEETING OUTCOMES

Action	By who
Journal Map and Croplands Literature Database survey circulated early 2021	Livia Olsen (KSU, US)
Nutrient Management Network retired, activities taken up by other Networks	CRG Networks
New co-lead for the Peatlands Network appointed - Fahmuddin Agus, IAARD Indonesia	Peatlands Network
Review Paper addressing biophysical opportunities, constraints and caveats of greenhouse gas mitigation options to be developed, as discussed at the 2019 meeting.	Mike Beare (Plant and Food Research, New Zealand)
CRG Webinars to continue, schedule of upcoming webinars to be developed.	Rosa Mosquera, Javier Rodriguez-Rigueiro (USC, Spain)
CRG Members to contribute to upcoming Journal Special Issues and consider future opportunities to bring together CRG research activities	All
Conduct a survey of existing biochar research projects to better understand this practice	Marta Camps (New Zealand)

APPENDIX 1: Participants list

Country	Attendees
GRA Member Countries	
Argentina	Dr Marcelo Javier Beltran, INTA (National Institute of Agropecuarian Technology)
Australia	Mr Lee Nelson, ACIAR Prof Peter Grace, QUT
Benin	Dr Annick Flore Arlette Dohoue Bossou, University of Abomey-Calavi
Brazil	Dr Ladislau Martin-Neto, Embrapa Dr Alberto Bernardi, Embrapa
Canada	Dr Craig Drury, Agriculture & Agri-Food Canada
China	Prof Xunhua Zheng, Instiute of Atmospheric Physics, Chinese Academy of Sciences
Denmark	Prof Lars Munkholm, Aarhus University
Finland	Prof Kristiina Regina, Natural Resources Institute
Germany	Prof Heinz Flessa, Thuenen Institute of Climate-Smart Agriculture
Indonesia	Dr Fahmuddin Agus, Indonesian Agency for Agricultural Research and Development Dr Asmartnsyah, Indonesian Agency for Agricultural Research and Development Dr Muhammad Prama Yufdy, Indonesian Center for Horticulture Research and Development
Italy	Dr Laura Trozzo, Polytechnic University of Marche Dr Paride D'Ottavio, Polytechnic University of Marche Dr Matteo Francioni, Institute for Agro-Environmental Sciences
Japan	Dr Ayaka Kishimoto-Mo, National Agriculture and Food Research Organaziation Dr Sadao Eguchi, National Agriculture and Food Research Organaziation
New Zealand	Prof Marta Camps, Massey University
Poland	Dr Jerzy Kozyra, Institute of Soil Science and Plant Cultivation
Republic of Korea	Dr Sun-II Lee, National Institute of Agricultural Sciences, Rural Development Administration
Senegal	Dr Bassirou Sine, CERAAS/ISRA
Spain	Prof Rosa Mosquera-Losada, University of Santiago de Compostela Dr Marisa Tello, INIA Javier Rodriguez-Rigueiro, University of Santiago de Compostela Dr Nuria Ferreiro-Domínguez, University of Santiago de Compostela
UK	Dr Jagadeesh Yeluripati, The James Hutton Institute
USA	Dr Mark Liebig, USDA-ARS Dr Jane Johnson, USDA-ARS Dr Chuck Rice, Kansas State University
Partners:	
CABI	Mr Jonathon Casey
Secretariat:	
Mr Hayden Montgomery, GRA Special Representative	
Ms Deborah Knox, GRA Secretariat	
Ms Nina Grassnick, GRA Secretariat – Thuenen Institute	
Ms Tiana Jakicevich, GRA Secretariat	