# Croplands Research Group

GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

## What is the Global Research Alliance?

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

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

The main work of the GRA occurs in its four research groups. These are focused on key agricultural subsectors (Paddy Rice, Croplands, and Livestock) and issues common to those sub-sectors managed by the Integrative Research Group.

## What is the Croplands Research Group?

The GRA's Croplands Research Group (CRG) is focused on reducing greenhouse gas intensity and improving the overall production efficiency of cropland systems. Scientists from CRG-member countries work together to find ways to limit losses to the atmosphere of valuable carbon and nitrogen from crops and soils, and to transfer that knowledge and associated technologies to croplands farmers, land managers and policy makers around the world.

The CRG has interest in a wide range of topics, including crop selection, tillage management, crop rotations, and fertilizer management, as well as the fundamental processes underlying greenhouse gas emissions from crops and soils. The CRG's vision is 'to develop widely available decision-support tools that enable reduced greenhouse gas emissions intensity from climate-resilient croplands, producing sustained or increased yields; and identify management practices that improve soil carbon sequestration in croplands'.

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

# Key areas of work

## 1. Understanding the current research landscape

The CRG began with three work-streams: (1) quantifying greenhouse gas emissions from cropping systems, (2) managing peatlands and agricultural wetlands, and (3) modelling carbon and nitrogen. Each work stream provided a platform for members to share data, research outcomes, and identify knowledge gaps and capability building and training needs. The work streams were the foundation of the CRG work plan and regular communication among CRG members and the wider science community using mechanisms like Facebook (https://www.facebook.com/GRAcroplands) and the GRAMP (http://gramp.org.uk/) ensured targeting of efforts and value was added to annual meeting decisions. Moving forward, the CRG decided to revise its structure to additional research networks of key importance (see section 3 below).

## 2. Building capability

Building the capability of students and young scientists is a priority for the CRG and while each member country or work stream organises its own technical workshops, the Group has identified two activities that it will collectively support.

- **Fellowships and awards schemes**
  Borlaug fellowships (USA): The US Department of Agriculture (USDA), in cooperation with the US Agency for International Development (USAID), has established a research fellowship scheme to support scientists in developing countries obtain skills needed to engage more fully in the GRA. Competitively selected research fellows work side-by-side with U.S. scientists on climate change mitigation in targeted research areas for up to 3 months. http://www.fas.usda.gov/programs/borlaug-fellowship-program.

  LABEX scientist exchanges (Brazil): Embrapa Brazil provide opportunities for research collaboration through the LABEX exchange programme. The exchange encourages research collaboration between Brazilian scientists and other countries under several specific priority topics – including climate change and specifically funds early career scientists.

- **Technical capability building through workshops and webinars**
  Technical workshops (USA): A series of soil nitrous oxide measurement workshops were held in conjunction with the American Society of Agronomy. These workshops had international participation and scholarships for young researchers were awarded. In addition, a series of webinars is being proposed by the CRG, with invited guest speakers from partner organisations. Webinars would be held through the GRAMP.

## 3. Research networks and databases

The CRG recently established research networks based on successes during its first phase and new areas of emphasis. These networks will become the heart of the CRG and will enable scientists to work together across boundaries to advance collective knowledge. Each network will develop a work plan and lead the development of future research activities. One of the first activities planned is production of a Greenhouse Gas Mitigation Summary for each particular emphasis area. Leading experts will be assembled to assess available information into a short synthesis of what is known and what remains to be discovered in the near term. Summaries of mitigation options will be available on the GRA website.

### Example of a database

The CRG has an open access literature database housed and supported by Kansas State University Library- http://www.lib.k-state.edu/gracroplands/. The Database provides citation information, an abstract, and a link to journal articles that relate to research on agricultural greenhouse gas emissions research in croplands and is searchable by crop, climate and country so that similar research activities and results can be easily found.

## Agroforestry systems

Defining how systems in different ecoregions can sequester soil organic carbon, mitigate greenhouse gas emissions, enhance soil quality, and improve agricultural resiliency.

## Conservation agriculture

Assessing the ecological limits of conservation management to sequester soil organic carbon, mitigate greenhouse gas emissions, enhance soil quality, and improve agricultural resiliency.

## Integrated crop-livestock systems

Ascertaining better fundamental knowledge of how crop and livestock interactions can sequester soil organic carbon, mitigate greenhouse gas emissions, enhance soil quality, and improve agricultural resiliency.

## Integrated nutrient management

Specifiying how fertilizer source, rate, timing, and placement affect greenhouse gas emissions, both on farm in the form of nitrous oxide emission and in the production cycle in the form of energy investment.

## Irrigation efficiency

Addressing issues of agricultural sustainability under irrigated agricultural conditions based on assessment of greenhouse gas emissions intensity, soil and water quality evaluation, resource-use efficiency, and food security.

## Landscape management of agricultural systems

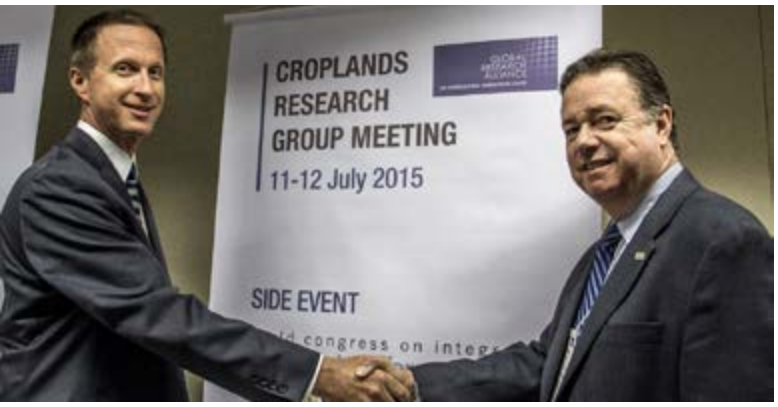
Delineating a knowledge framework for understanding the spatial and temporal aspects of soil carbon sequestration and greenhouse gas emissions in diverse agricultural landscapes.

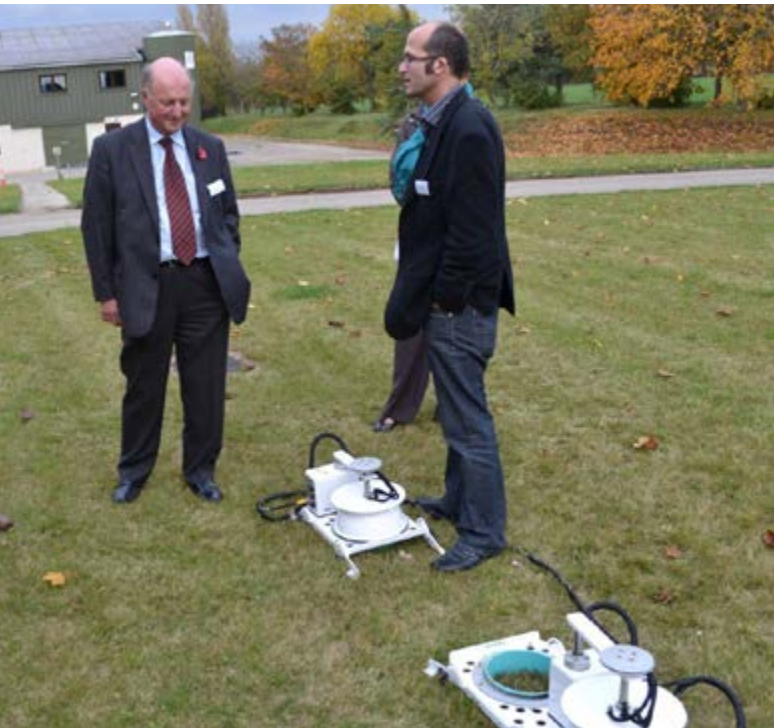
## Peatland management

Interpreting available data and developing strategies to limit peatland soil organic carbon loss and reduce greenhouse gas emissions in peatlands and agricultural wetlands in boreal, temperate, and tropical regions.

## 4. Collaborative research

Collaborative research projects enable scientists to achieve collectively what would have been impossible in isolation. This is particularly true for the CRG, which concentrates its collective efforts to collate scientific knowledge that exists in each member country across work streams. Central repositories hold data, provide open access to metadata from experimental sites, literature, and key findings. The CRG translates this knowledge in a way that can be best used by farmer organizations, policy makers and other scientists.



# Examples of Collaborative Research

### Managing Agricultural Greenhouse Gases network (MAGGnet)

MAGGnet represents a coordinated, multi-national approach for inventory and analysis of published soil carbon sequestration and greenhouse gas emissions research. The project has some funding from the Joint Programming Initiative on Agriculture, Food Security and Climate Change (FACCE JPI) and is being led by the USDA-Agricultural Research Service. MAGGnet is an international database that shares knowledge on agricultural management practices and provides the basis for understanding how management practices influence greenhouse gas emissions. It is a network of experimental sites and research expertise. The database holds basic metadata (e.g. climate, soil, crop, and management) from 20 countries and 315 experimental sites and provides a link to the research outcomes that have been published in peer reviewed literature.

### Agricultural Peatlands and Wetlands

Coordinated by Finland and Norway, this collaboration involves 13 countries focused on understanding how to mitigate greenhouse gas emissions from agricultural peatlands. Peatlands are an important agricultural land base for many member countries of the CRG, from tropical climates to the Nordic region. The group has published a paper in the journal Climate Policy "GHG mitigation of agricultural peatlands requires coherent policies" and is planning for a workshop to share mitigation options to reduce emissions from agricultural peatlands.

### Global Research Alliance Modelling Platform (GRAMP)

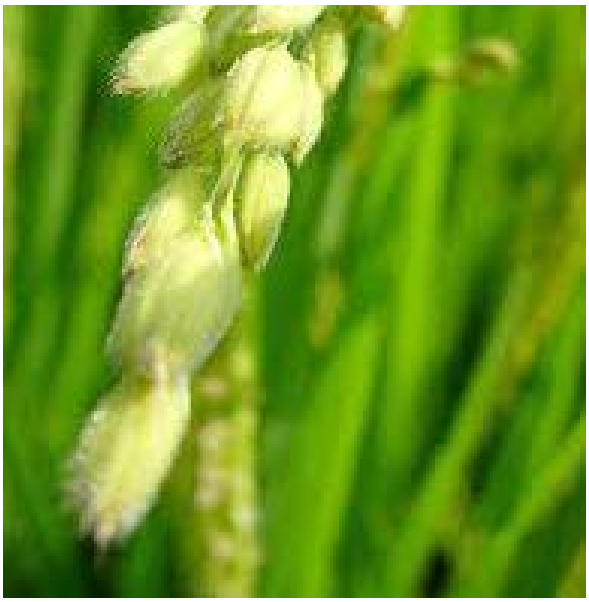
GRAMP is an open source web platform for modelling greenhouse gas emissions from crops. GRAMP brings together a number of models to explore biogeochemical processes and predict changes in soil carbon and nitrogen cycling in the context of climate change and management practices. The platform documents all aspects of the modelling process, including version changes and parameters used when running experiments. GRAMP has four components;

- Data storage and records;
- Model trees documenting the evolution and versions of the models;
- Applications database which will test all models against benchmark sites (in collaboration with AgMIP) and record the ability of models to perform under different conditions; and
- Training and education, including the ability to host webinars. A schedule of monthly webinars will be circulated in the near future.

## 5. Providing policy support and links to international initiatives

Linkages with a small number of other international organisations and initiatives are being forged in areas where there are synergies with the work of the CRG. The Centre for Agriculture and Bioscience International (CABI) has specialty in translating science into information for farmers across 48 countries – some of which are the world's poorest and most food insecure. The CRG is working with CABI to develop a communications strategy for publishing a set of management approach to mitigate greenhouse gas emissions. These will be disseminated as a series of fact sheets.

The CRG also works closely with the Consultative Group for International Agricultural Research (CGIAR), in particular the Climate Change, Agriculture and Food Security (CCAFS) which is one of the GRA's formal partners. The CRG recently contributed to a CCAFS workshop on reduced-cost GHG estimations in agriculture, as well as a workshop on management of agricultural peatlands. Other strategic relationships are being pursued by the CRG with the International Fertilizer Industry Association (IFIA) and Field-to-Market. The Group also organizes and contributes to international workshops and symposia to support the objectives of the CRG and partners.

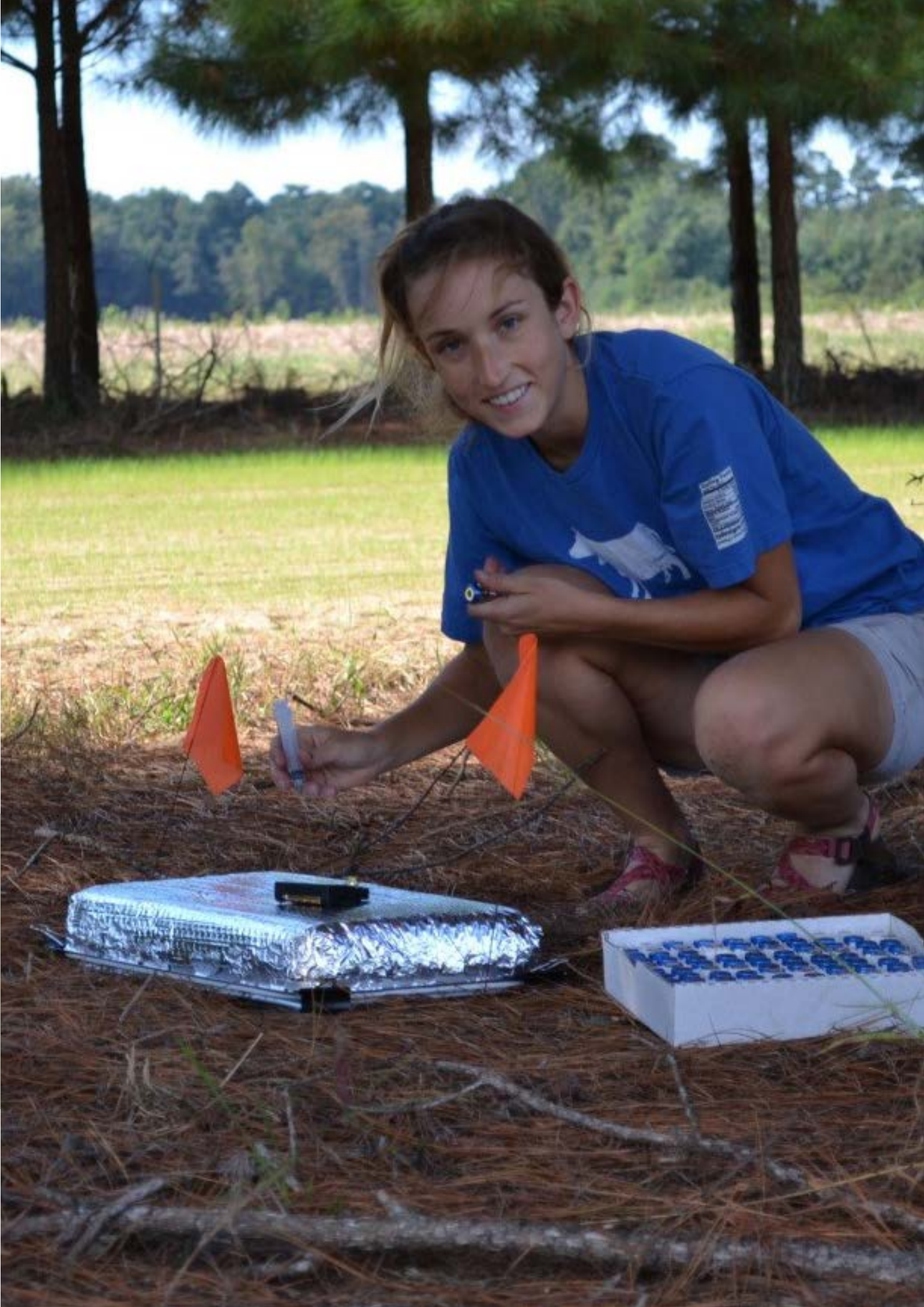


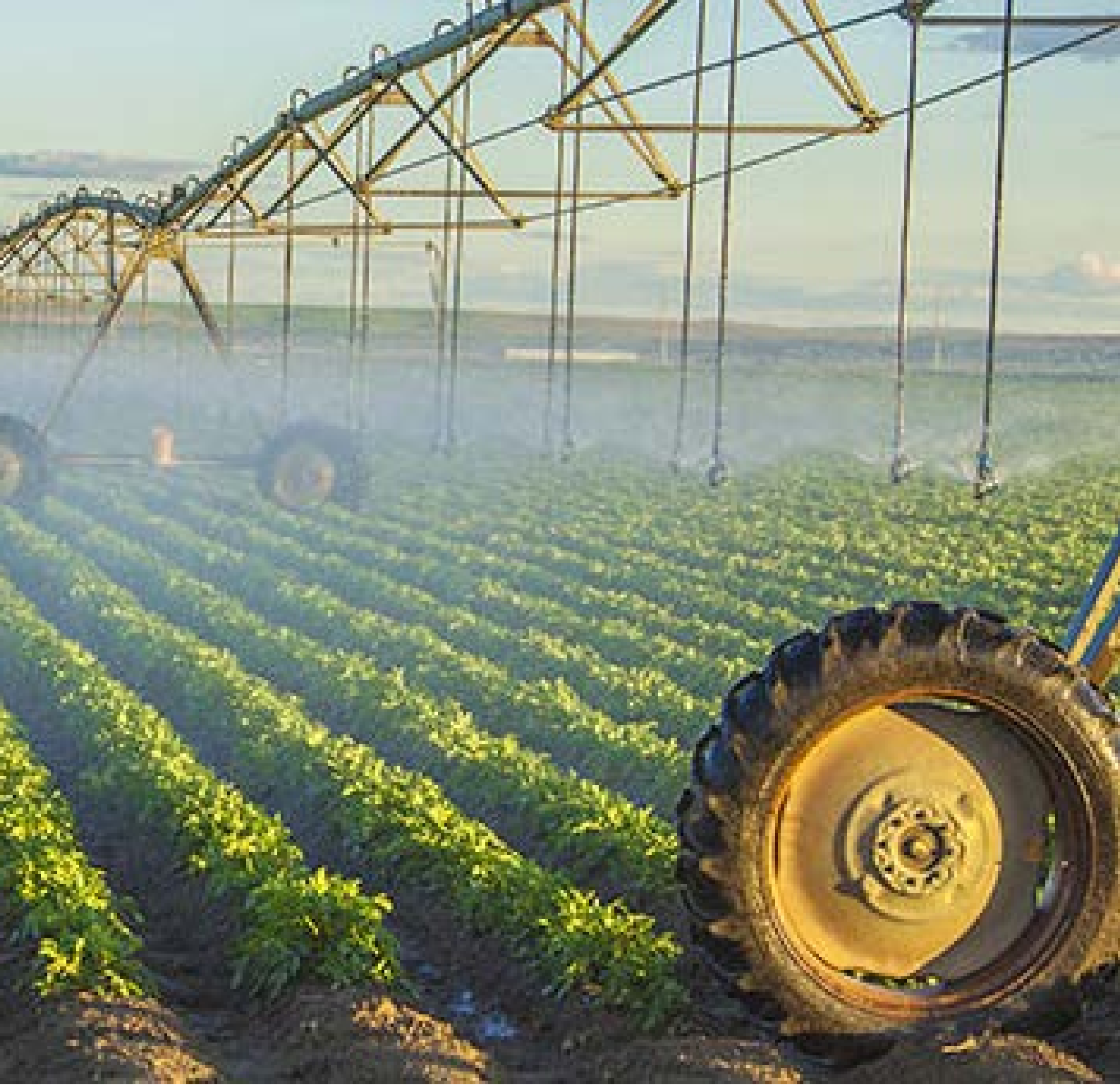
## 6. Good practice guidance and technical methodologies

Members from all network themes will be developing GHG Mitigation Summaries as part of their work plan. These documents will highlight best management practices to both mitigate greenhouse gases, as well as systems that offer climate adaptation strategies.

### Example of policy support

Agricultural peatlands could be used to help reach GHG mitigation goals in many countries, but the full potential of mitigation of peatlands is not used. Although peatland cultivation inevitably leads to loss of the whole peat layer and high emissions, there are few incentives or regulation to effectively minimize these losses. Members of the CRG recently published an article in the journal Climate Policy that discussed the possibilities to reduce GHG emissions from agricultural peat soils, with specific emphasis on the barriers of implementing mitigation measures nationally. Four selected case studies help illustrate lessons learned, and emphasize the role of all policy makers and their cooperation in planning coherent policies for achieving the goals determined by climate policies. It is hoped that this paper will contribute to the IPCC guidelines on peatlands which are currently being updated.





# Further Information

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

**http://globalresearchalliance.org/research/croplands/**

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