Advanced Course

GREENHOUSE GAS ASSESSMENT AND MITIGATION IN AGRICULTURE: CONCEPTS, METHODS AND SIMULATION TOOLS

Zaragoza (Spain), 30 March – 3 April 2020

1. Objective of the course

In the context of the Paris Agreement on climate change, all the economic sectors have to reduce GHG emissions. The agricultural sector is responsible for about 10-12% of anthropogenic GHG emissions worldwide. Many studies have shown that there is potential to reduce GHG emissions and enhance soil carbon sequestration in agriculture. However, emissions in the agricultural sector are mostly biogenic and driven by multiple and interacting processes, which hampers reliable/robust estimates. Moreover, bridging the gap between scientific knowledge in GHG mitigation, decision making and policy implementation remains challenging.

This course will provide knowledge on the processes underlying GHG emissions and soil C sinks, measuring methodologies and modelling tools in cropping systems. Methods for national GHG inventories and mitigation options analysis, including socio-economic assessment, will be presented. Practical work based on real case studies will also be organized.

At the end of the course participants will have:

- Better understanding of the sources and drivers controlling GHG emissions from cropping systems.
- Insights on GHG mitigation options and their socio-economic assessment.
- Criteria for designing and improving national inventories.
- An overview of state-of-the-art methods for measuring GHG emissions and soil C changes.
- Improved skills in the use of simulation models and tools for estimating GHG emissions and soil C changes at different scales.
- A holistic view of available tools to support informed decision making.

2. Organization

The course is jointly organized by the **International Centre for Advanced Mediterranean Agronomic Studies (CIHEAM)**, through the **Mediterranean Agronomic Institute of Zaragoza (IAMZ)**, the **Global Research Alliance on Agricultural Greenhouse Gases (GRA)**, the **Food and Agriculture Organization of the United Nations (FAO)**, the **Red REMEDIA (Scientific network for greenhouse gas mitigation in the agroforestry sector)** and the **4 per 1000 Initiative**. The course will take place at the Mediterranean Agronomic Institute of Zaragoza and will be given by well qualified lecturers from international organizations, and from universities and research centres in different countries.

The course will be held over a period of one week, from 30 March to 3 April 2020, in morning and afternoon sessions.

3. Admission

The course is designed for 25 professionals with a university degree, and is specially oriented towards public and private planners and decision makers, technical advisors, agronomists, environmentalists and R&D professionals involved in the management of the environmental effects of agriculture in a context of climate change.

Given the diverse nationalities of the lecturers, knowledge of English, French or Spanish will be valued in the selection of candidates, since they will be the working languages of the course. The Organization will provide simultaneous interpretation of the lectures in these three languages.

4. Registration

Candidates must apply online at the following address: http://www.admission.iamz.ciheam.org/en/

Applications must include the *curriculum vitae* and copy of the supporting documents most related to the subject of the course.

The deadline for the submission of applications is **13 January 2020**. The deadline may be extended for candidates not requiring a visa and not applying for a grant if there are free places available.

Applications from those candidates requiring authorization to attend the course, may be accepted provisionally.

Registration fees for the course amount to 500 euro. This sum covers tuition fees only.

5. Scholarships

Candidates from Mediterranean CIHEAM member countries, GRA member countries in Africa, Asia, Latin America and the

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See updated information at
www.iamz.ciheam.org

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Caribbean, and from FAO member countries, may apply for scholarships covering registration fees and for scholarships covering the cost of travel and full board accommodation in the Hall of Residence on the Aula Dei Campus.

Candidates from other countries who require financial support should apply directly to other national or international institutions.

6. Insurance

It is compulsory for participants to have medical insurance valid for Spain. Proof of insurance cover must be given at the beginning of the course. Those who so wish may participate in a collective insurance policy taken out by the Organization, upon payment of the stipulated sum.

7. Teaching organization

The course requires personal work and interaction among participants and with lecturers. The international characteristics of the course favour the exchange of experiences and points of view.

Lectures are complemented by applied examples, practical work and debates. Practical sessions will be devoted to improving the skills of participants in the use of process-based models and the interpretation of their outputs. Furthermore, during the course participants will work in groups to discuss and apply the methodology for national inventories of GHG emissions based on case studies.

Participants will be invited to provide a brief report about GHG mitigation initiatives in the cropping systems of their specific regions. These reports will be distributed to all participants and lecturers.

8. Programme

1. **Context (1 hour)**
   - 1.1. Status of Climate Change and potential role of agriculture to meet Paris Agreement expectations
   - 1.2. Meeting sustainable intensification with Nationally Determined Contribution targets
2. **Sources and drivers controlling GHG emissions at different scales: from the soil aggregate to the agri-food system (2 hours)**
   - 2.1. Main processes underlying emissions of CO2, N2O, CH4
   - 2.2. The soil-plant-atmosphere system and its relationship with the C-N cycle components
   - 2.3. Basic concepts for estimating GHG emission and removals from agriculture and from land use
3. **Mitigation options for cropping systems. Examples (4 hours)**
   - 3.1. Main factors controlling emissions and effect of agricultural management practices
   - 3.2. Options for reducing non-CO2 GHG emissions
   - 3.3. Options for reducing non-biogenic GHG emissions
   - 3.4. Options for reducing indirect GHG emissions (NO3- leaching, NH3 and NOx)
   - 3.5. Enhancing CO2 removals
4. **Reporting National GHG Inventories (7 hours)**
   - 4.1. The importance of the National Inventories
   - 4.2. IPCC-based methods
   - 4.3. New 2019 IPCC inventory guidelines
   - 4.4. Overcoming drawbacks, limitations and uncertainties in different national conditions
   - 4.5. Improving national inventories – an introduction
   - 4.6. Practical work based on a case study
5. **Improving GHG estimations and National GHG Inventories (13 hours)**
   - 5.1. Measuring agricultural GHG emissions and SOC changes at field scale
     - 5.1.1. Methodological challenges: spatial/temporal variability, sampling issues, etc.
     - 5.1.2. Overview of field and laboratory methods: limitations and opportunities
     - 5.1.3. Low cost procedures and new developments
   - 5.2. Process-based modelling approaches: overview, data requirement, limitations and opportunities, applications
     - 5.2.1. Field-scale models for GHG estimation
     - 5.2.2. Life cycle analysis (LCA)
     - 5.2.3. Regional and global models
     - 5.2.4. Challenges of scaling up (or down) in the models
     - 5.2.5. Practical work
       - 5.2.5.1. Field-scale process-based models
       - 5.2.5.2. LCA
6. **Socio-economic assessment of GHG mitigation (4 hours)**
   - 6.1. The marginal abatement cost curve methodology (MACC)
     - 6.1.1. Key steps of the process
     - 6.1.2. Examples from different countries
   - 6.2. Barriers for mitigation implementation
   - 6.3. Debate on how MACC can help decision making
7. **Decision-making oriented tools (2 hours)**
   - 7.1. Decision support systems
   - 7.2. User-friendly tools
   - 7.3. Open-access databases
8. **Round table discussion (2 hours)**
   - 8.1. Priorities on GHG research
   - 8.2. How to incentivize the implementation of mitigation measures

GUEST LECTURERS

J. ÁLVARO-FUENTES, EEAD-CSIC, Zaragoza (Spain)
K. BUTTERBACH-BAHL, ILRI and IMK-IFU, Garmisch-Partenkirchen (Germany)
L. CÁRDENAS, Rothamsted Research, Devon (United Kingdom)
A. FERRARA, FAO, Roma (Italy)
L. LASSALETTA, CEIGRAM-UPM, Madrid (Spain)
E. MILNE, CSU, Fort Collins (USA)
S. PELLERIN, INRA, Bordeaux (France)
A. del PRADO, BC3, Leioa (Spain)
A. SANZ-COBEÑA, CEIGRAM-UPM, Madrid (Spain)
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GLOBAL RESEARCH ALLIANCE ON AGRICULTURAL GREENHOUSE GASES
Food and Agriculture Organization of the United Nations
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