*Advanced Course*

# Greenhouse gas assessment and mitigation in agriculture: concepts, methods and simulation tools

Zaragoza (Spain) • 30 November – 4 December 2026

CIHEAM ZARAGOZA · CSIC · INIA Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria · remedia+



## Objectives

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 and robust estimates. Moreover, bridging the gap between scientific knowledge in GHG mitigation, decision-making, policy and incentive 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 will be presented and practical work will be organised based on real case studies.

At the end of the course participants will have:

- knowledge of the international reporting processes of GHG emissions and C removal from agriculture;
- better understanding of the sources and drivers controlling GHG emissions and carbon sequestration in cropping systems;
- an overview of state-of-the-art methods for measuring GHG emissions and soil C changes;
- insights on the technical aspects on direct and indirect GHG mitigation strategies;
- criteria for designing and improving national inventories;
- 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;
- a comprehensive vision of the challenges and opportunities of C farming.

## Organisation

The course is jointly organised by the International Centre for Advanced Mediterranean Agronomic Studies (CIHEAM), through the Mediterranean Agronomic Institute of Zaragoza (CIHEAM Zaragoza), the National Institute for Agricultural and Food Research and Technology of the Spanish National Research Council (INIA-CSIC), and the Red REMEDIA (Scientific network for greenhouse gas mitigation in the agroforestry sector), through the project REMEDIA+ funded by the AEI (RED2024-153949-E), and with technical assistance from the Food and Agriculture Organization of the United Nations (FAO).

It will be held with face-to-face participation and through online, live sessions transmitted from the Mediterranean Agronomic Institute of Zaragoza, in morning and afternoon sessions for one week, and will be given by well qualified lecturers from international organisations, and from universities and research centres in different countries. The programme will be delivered in English.

Lectures are complemented by applied examples, practical work and debates. Practical sessions will be devoted to improving skills in the use of process-based models and interpreting their outputs and conducting the Life Cycle Analysis (LCA) of a crop. Furthermore, participants will work in groups to discuss and apply the methodology for national inventories of GHG emissions based on case studies. 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.

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.

## Programme

**0. Opening (1 hour)**

**1. Context (2 hours)**

1.1. The role of agriculture in climate change

1.2. Main processes underlying emissions of CO2, N2O, CH4

1.3. The importance of the National GHG Inventories

**2. Measuring agricultural GHG emissions and soil carbon changes (2 hours)**

2.1. Methodological challenges: spatial/temporal variability, sampling issues, etc.

2.2. Overview of field and laboratory methods: limitations and opportunities

2.3. Low-cost procedures and new developments

**3. GHG mitigation options for cropping systems (4.5 hours)**

3.1. Direct and indirect GHG emissions: general concepts

3.2. Options for reducing direct N2O and CH4 emissions

3.3. Options for reducing indirect GHG emissions: N leaching and atmospheric reactive N.

3.4. Options for enhancing CO2 removal

3.5. Barriers and opportunities for GHG mitigation in agriculture

**4. National GHG inventories (6 hours)**

4.1. IPCC-based methods

4.2. Overcoming drawbacks, limitations and uncertainties in different national conditions

4.3. Practical work on GHG NI based on a case study

**5. GHG estimation tools (13.5 hours)**

5.1. Process-based models

5.1.1. Overview, data requirements, limitations and opportunities, applications

5.1.2. Field-scale models for GHG estimation

5.1.3. Regional and global models

5.1.4. Challenges of scaling up (or down)

5.2. Life cycle analysis (LCA)

5.3. Practical work (7.5 hours)

5.3.1. Field-scale process-based models

5.3.2. LCA

**6. Decision-making oriented tools (3 hours)**

6.1. Decision support systems

6.2. User-friendly tools

6.3. Open-access databases

**7. Round table discussion: Priorities on GHG research (2 hours)**

**8. Closing session (0.5 hours)**

## Guest lecturers

**Álvaro-Fuentes, Jorge** - EEAD-CSIC, Zaragoza (Spain)
**Jebari, Asma** – Rothamsted Research, Noth Wyke (United Kingdom)
**Klumpp, Katja** - INRAE, Clermont Ferrand, (France)
**Milne, Eleanor** - CSU, Fort Collins (USA)
**Oliveri, Ramiro** - MITECO, Madrid (Spain)
**Del Prado, Agustín** - BC3, Leioa (Spain)
**Sanz-Cobeña, Alberto** - CEIGRAM-UPM, Madrid (Spain)
**Schiettecatte, Laure-Sophie** - FAO, Rome (Italy)
**Viskari, Toni** - JRC, Ispra (Italy)

**With technical assistance from:**

Food and Agriculture Organization of the United Nations



## Admission

The course is designed for 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.

There are **25 places** for face-to-face participation and **30 places** for attendance online.

Knowledge of English will be valued in the selection of candidates since it will be the working language of the course.

## Registration

- Candidates may apply online at the following address: https://admission.iamz.ciheam.org/en/
- Applications must include the *curriculum vitae* and a copy of the support documents most related to the subject of the course.
- The general application deadline closed on 12 July 2026. If places remain available, applications may be accepted after this date only from candidates who do not require a visa.
- Applications from candidates requiring authorisation to attend the course may be accepted provisionally.
- Registration fees for the course amount to 500 euro for face-to-face participation and 350 euro for online participation. This sum covers tuition fees only.

## Scholarships

Candidates from Mediterranean CIHEAM member countries may apply during the registration process for scholarships covering registration fees and for scholarships covering the cost of travel and full board accommodation in Zaragoza.

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

## Insurance

It is compulsory for participants in face-to-face modality 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 Organisation, upon payment of the stipulated sum.

**Contact:**
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