GLOBAL RESEARCH ALLIANCE

ON AGRICULTURAL GREENHOUSE GASES

Country report : Spain

Alberto Sanz-Cobeña, Jorge Alvaro-Fuentes,
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Presentation to IRG Annual Meeting
Wageningen, 3 March 2020

National and international projects contributing to IRG's topics

GLOBAL RESEARCH ALLIANCE ON AGRICULTURAL GREENHOUSE GASES

- **International initiatives**: (e.g.) **FAO-IAEA** research group on **N_2O mitigation and C sequestration** in cropping systems
- **ILTER (International Long Term Ecological Research Network). Build-up a world-wide N_2O database fluxes** and their temporal variation **across different climates and ecosystem types.**
- **National research projects** on N and C management towards sustainable cropping systems (e.g. Agrisost, Disosmed).
- **Zootecnic documents** for Spanish Ministry of Agriculture, Fisheries and Food
- **National research networks**: **REMEDIA** (GHG mitigation in agroforestry), **RED NUEVA** (to develop/improve) national GHG EF in croplands and livestock systems: 2nd Workshop (Elche, Spain. April 2020).

National networks contributing to IRG's topics

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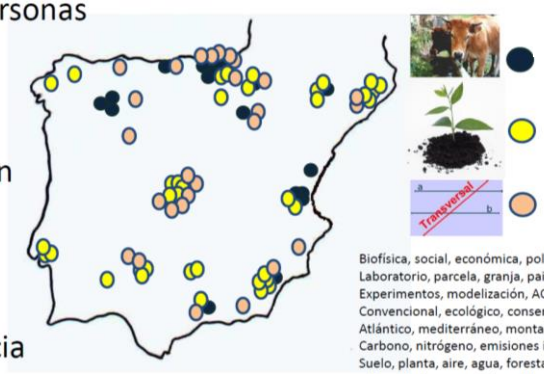
Workshops

Since 2012

Aprox.
400 -500 personas

Red de investigación

transferencia



Biofísica, social, económica, políticas
Laboratorio, parcela, granja, paisaje, regional
Experimentos, modelización, ACV, inventarios
Convencional, ecológico, conservación,
Atlántico, mediterráneo, montaña,
Carbono, nitrógeno, emisiones indirectas
Suelo, planta, aire, agua, forestal, animal,
subproductos, compost, residuos,
Mecanísticos, empíricos, estadísticos, holísticos,
Determinístico

remedia
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Res. papers

Blogs & Social Networks


remedia
RED CIENTÍFICA DE MITIGACIÓN DE EMISIONES DE GASES DE EFECTO INVERNADERO EN EL SECTOR AGROFORESTAL

10 OCTUBRE, 2017 DE MLCAYUELA

Web específica para contenidos de la Global Research Alliance (GRA) dentro del portal de Investigación Agroalimentaria y Forestal AGRIPA

El INIA ha desarrollado una página web dentro del portal de Investigación Agroalimentaria y Forestal AGRIPA (www.agripa.org) específica para los contenidos relativos a la GRA, (http://gra.agripa.org/), y en particular para información de presentaciones e informes de reuniones con el fin de que puedan estar disponibles como información compartida.

La página ha sido diseñada con una estructura básica que puede ser ampliada con las sugerencias que consideréis. La intención del INIA es mantener esta página directamente

Courses

& more…

REMEDIA: Links with (New) Circular Food Systems network

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viii remedia workshop

VIII REMEDIA NETWORK WORKSHOP (21-22 April, 2020. Elche, Spain):

'Circular economy to boost environmental sustainability in the Spanish agricultural sector'

UNIVERSITAS Miguel Hernández

remedia
RED CIENTÍFICA DE MITIGACIÓN DE EMISIONES DE GASES DE EFECTO INVERNADERO EN EL SECTOR AGROFORESTAL

frontiers | Crop Biology and Sustainability

Research Topic

Route Map for a More Sustainable Agriculture in Mediterranean Countries Using Circular Economy and GHG Mitigation as Driving Forces

National networks contributing to IRG's topics

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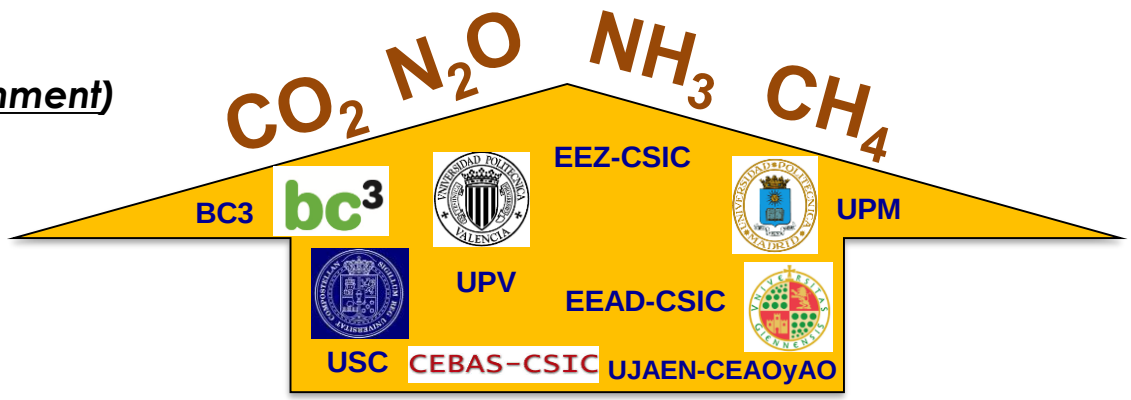
Network for **U**pdating **E**mission **V**alues in spanish **A**griculture

rednueva
network for updating emission values in spanish agriculture

'Assessment of GHG EFs in the Spanish agricultural sector'

- To define EFs evaluation criteria/review existing methodologies
- To explore GHG measurement approaches
- To identify 'gaps of knowledge'
- To promote internationalization and communication with policymakers and stakeholders

(Funded by the Spanish Government)



1st workshop: April, 2019 (Lugo, Spain)
2nd workshop: April, 2020 (Elche, Spain)

→ **Aiming to imrpove National Inventories in the agro-food sector**

National research initiative to improve N_2O EF in Spanish cropping systems (inventories network)

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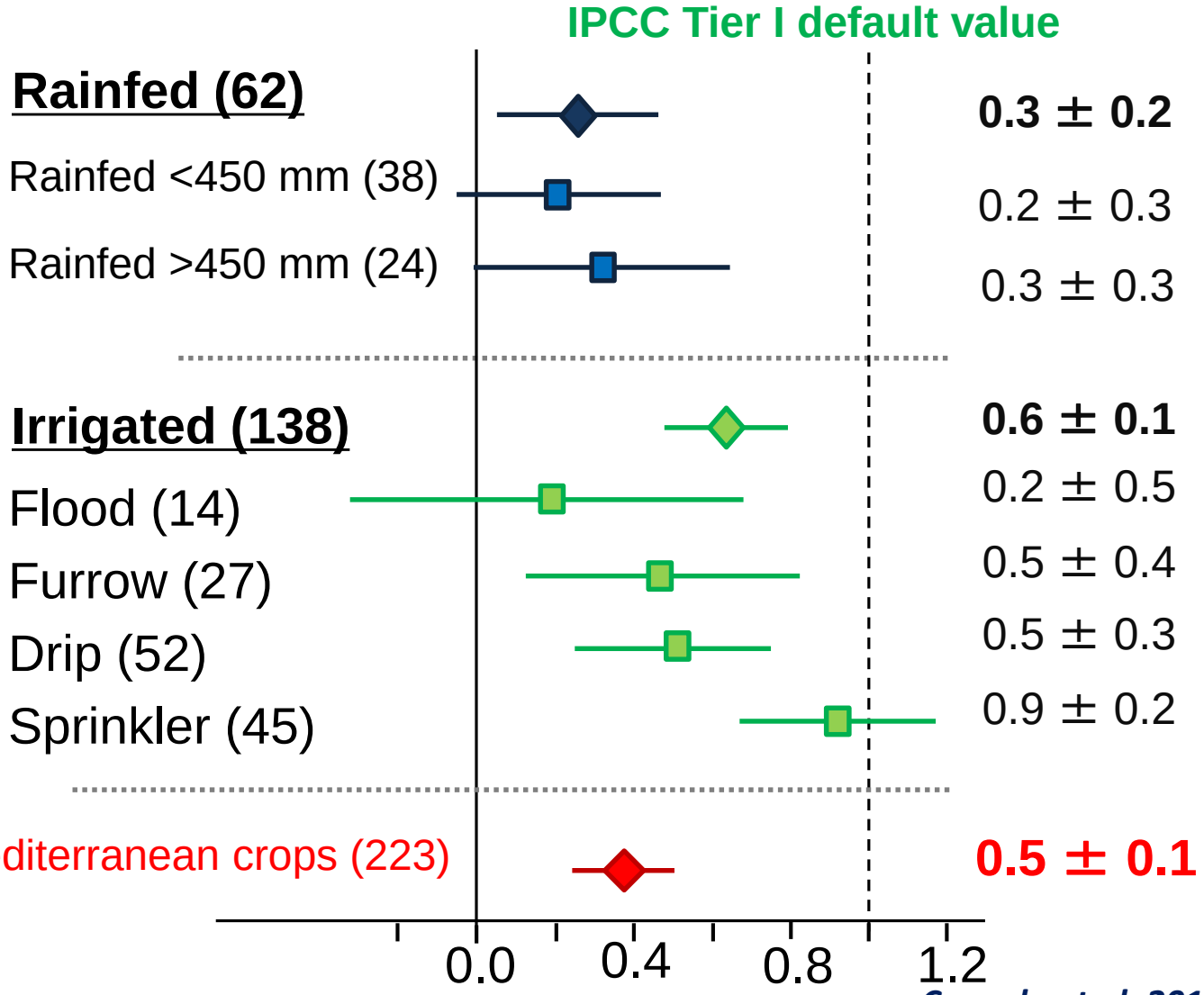
Lower N_2O emission factors than temperate systems



Cayuela et al. 2017 (AGEE)

The importance of a Tier-2 transition in the national inventories

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factors (N application rate per fertiliser type; fertiliser type, liquid or solid form of organic fertiliser; irrigation and type of crop with differences between legumes, non-leguminous arable crops, and grass) (e.g. Cayuela et al. 2017, Chadwick et al. 2018, Rochette et al. 2018, Wagner-Riddle et al. 2017).

TABLE 11.1 (UPDATED)
DEFAULT EMISSION FACTORS TO ESTIMATE DIRECT N_2O EMISSIONS FROM MANAGED SOILS

Emission factor	Aggregated		Disaggregated		
	Default value	Uncertainty range	Disaggregation[4]	Default value	Uncertainty range
EF_1 for N additions from synthetic fertilisers, organic amendments and crop residues, and N mineralised from mineral soil as a result of loss of soil carbon[1] [kg N_2O–N (kg N)$^{-1}$]	0.010	0.001 – 0.018	Synthetic fertiliser inputs[5] in wet climates	0.016	0.013 – 0.019
			Other N inputs[6] in wet climates	0.006	0.001 – 0.011
			All N inputs in dry climates	0.005	0.000 – 0.011
EF_{1FR} for flooded rice fields[2,7] [kg N_2O–N (kg N)$^{-1}$]	0.004	0.000 – 0.029	Continuous flooding	0.003	0.000 – 0.010
			Single and multiple drainage	0.005	0.000 – 0.016
$EF_{3PRP, CPP}$ for cattle (dairy, non-dairy and buffalo), poultry and pigs[3] [kg N_2O–N (kg N)$^{-1}$]	0.004	0.000– 0.014	Wet climates	0.006	0.000 – 0.026
			Dry climates	0.002	0.000 – 0.006
$EF_{3PRP, SO}$ for sheep and 'other animals'[3] [kg N_2O–N (kg N)$^{-1}$]	0.003	0.000 – 0.010	-	-	-

Sources:

[1] Stehfest & Bouwman 2006; van Lent et al. 2015; Grace et al. 2016; van der Weerden et al. 2016; Albanito et al. 2017; Cayuela et al. 2017; Liu et al. 2017; Rochette et al. 2018.

[2] Akiyama et al. 2005; Albanito et al. 2017; Cayuela et al. 2017.

IPCC, 2020

Indirect GHG emissions

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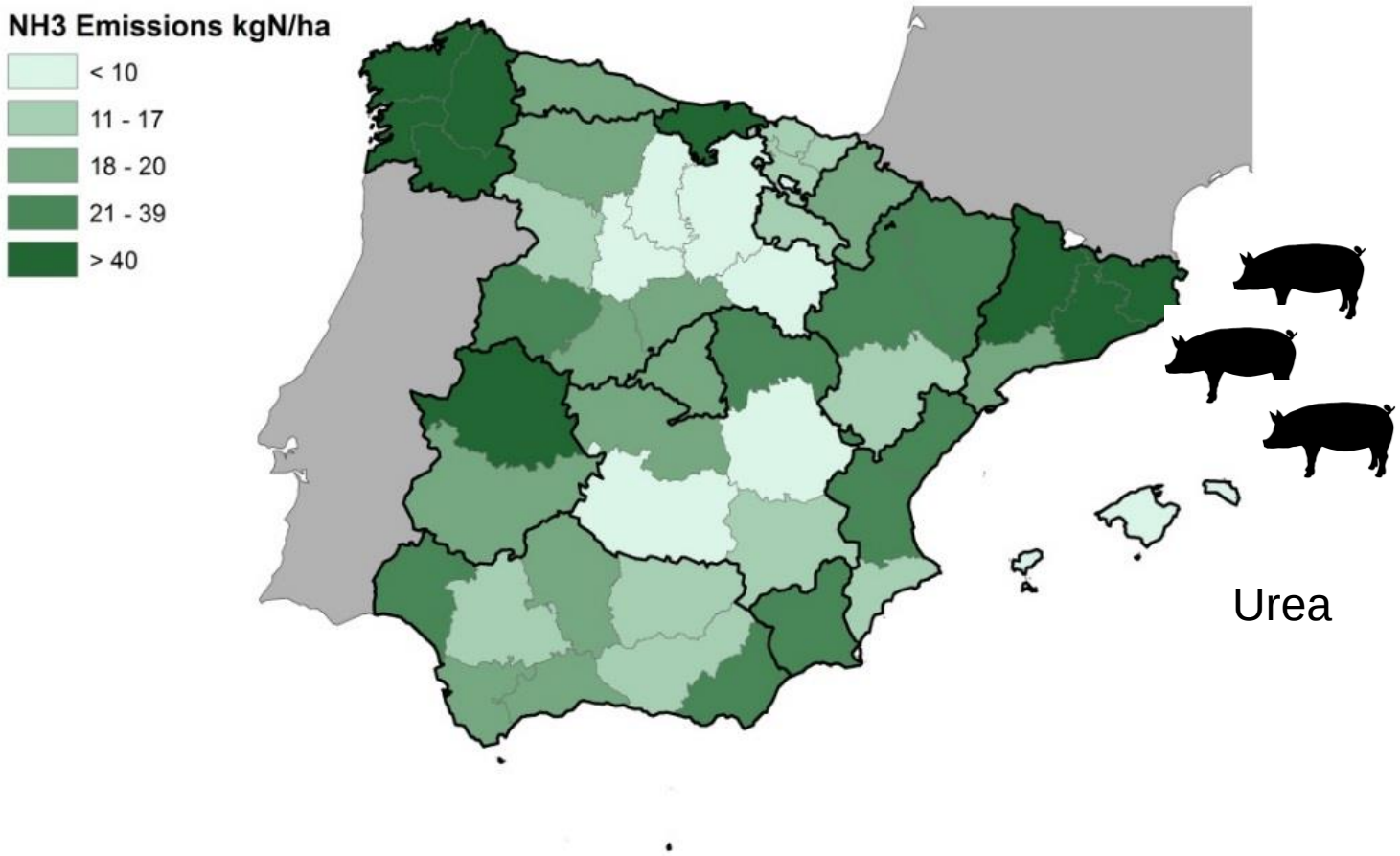

Sanz-Cobena et al. 2014 (Env. Res. Lett.)

Indirect GHG emissions

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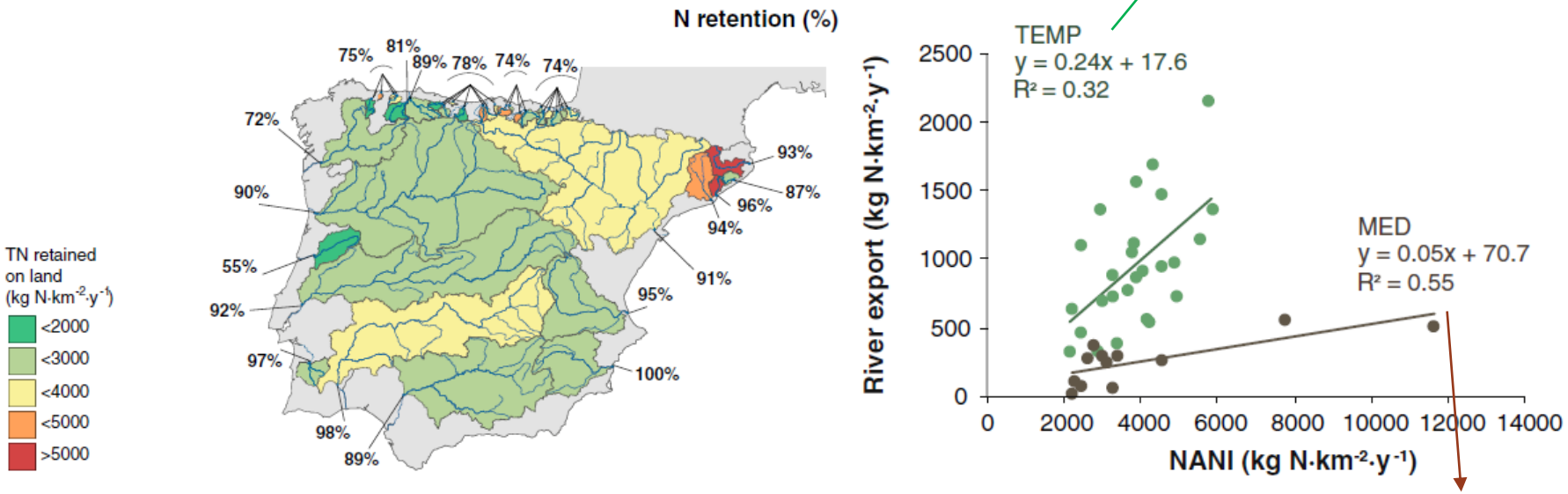
Retention 76 % in temperate catchments



Retention 95 % in Mediterranean catchments

Romero et al. (2016)
STOTEN

Complete budget of emissions under different strategies

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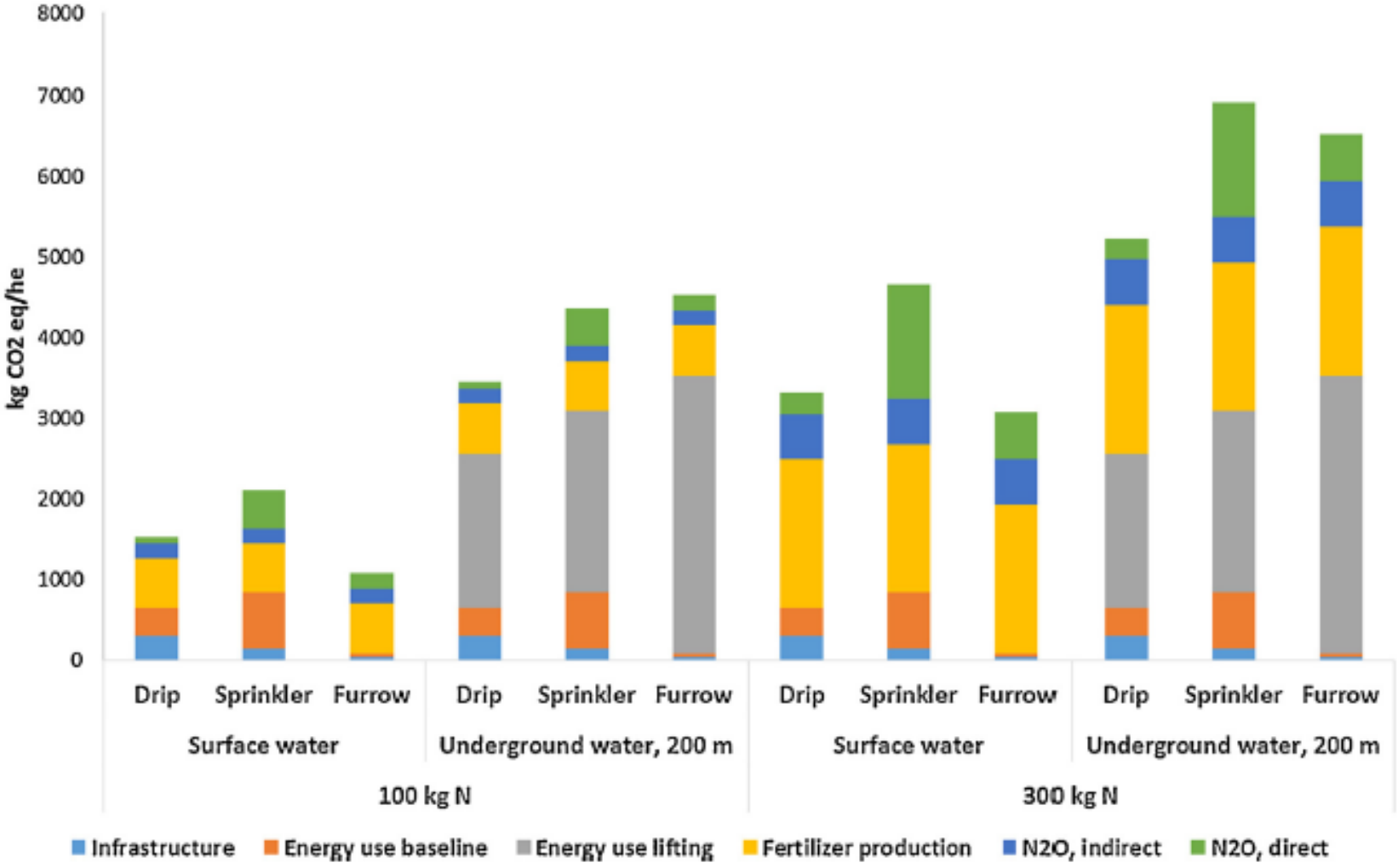

Sanz-Cobena et al. (2017) Agr. Ecosys. Environ.

Zootecnic documents for Spanish Ministry of Agriculture, Fisheries and Food

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Revised methodology for Spanish National Inventory of Livestock emissions (TIER II) based on IPCC guidelines(2006) and EMEP/EEA (2013) to calculate National NH_3, NO, NO_2, N_2O, CH_4, COVNM, PM2,5, PM10 and TSP emissions.

Transference and dissemination

GLOBAL RESEARCH ALLIANCE
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Round table: GHG mitigation in Mediterranean agricultural systems

TIME FOR ACTION
COP25
CHILE
MADRID 2019
UN CLIMATE CHANGE CONFERENCE

INIA
Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria

UNIVERSIDAD POLITÉCNICA DE MADRID
POLITÉCNICA

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Centro de Estudios e Investigación para la Gestión de Riesgos Agrarios y Medioambientales

Transference and dissemination

GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

CIHEAM IAM ZARAGOZA | ICARDA Science for Better Livelihoods in Dry Areas | remedia

Advanced Course

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

Zaragoza (Spain), 12-16 March 2018

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.

Programme

1. **Context (1 hour)**
   - 1.1. Agricultural sector and climate change with a focus in the Mediterranean area: feedback and feedforward interactions
   - 1.2. Potential role of agriculture to meet Paris Agreement expectations
   - 1.3. Sustainable intensification, how greenhouse gases (GHGs) fit in this definition
2. **Sources and drivers controlling GHG emissions at different scales: from the soil aggregate to the agri-food system (2 hours)**
   - 2.1. Basic processes underlying emissions of CO2, N2O, CH4
   - 5.2. Options for reducing non-biogenic GHG emissions
   - 5.3. Enhancing CO2 removals
   - 5.4. Options for reducing indirect GHG emissions (NO3- leaching, NH3 and NOx)
6. **National GHG Inventories (7 hours)**
   - 6.1. The importance of the IPCC National Inventories
   - 6.2. Existing IPCC-based methods
   - 6.3. Drawbacks, limitations and uncertainty
   - 6.4. Improving national inventories
   - 6.5. Practical work based on a case study
7. **Socio-economic assessment of GHG mitigation (5 hours)**
   - 7.1. The marginal abatement cost curve methodology (MACC)
     - 7.1.1. Key steps of the process
     - 7.1.2. Examples from different countries
   - 7.2. Barriers for mitigation implementation
   - 7.3. Debate on how MACC can help decision making
8. **Decision-making oriented tools (2 hours)**
   - 8.1. Decision support systems
   - 8.2. User-friendly tools
   - 8.3. Open-access databases
9. **Round table discussion (2 hours)**
   - 9.1. Priorities on GHG research
   - 9.2. How to incentivize the implementation of mitigation measures

GUEST LECTURERS

J. ÁLVARO-FUENTES, EEAD-CSIC, Zaragoza (Spain)
M. BERNOUX, FAO, Roma (Italy)
K. BUTTERBACH-BAHL, IMK-IFU, KIT, Garmisch-Partenkirchen (Germany)
L. CÁRDENAS, Rothamsted Research, Devon (United Kingdom)
L. LASSALETTA, IMBE-CNRS, Aix-en-Provence (France)
E. MILNE, CSU, Fort Collins (USA)
S. PELLERIN, INRA, Bordeaux (France)
A. del PRADO, BC3, Leioa (Spain)
A. SANZ-COBEÑA, UPM, Madrid (Spain)
R. TEIXEIRA, MARETEC, IST-Univ. Lisboa (Portugal)

First edition (March 2018)

Tra nation

GLOBAL RESEARCH ALLIANCE ON AGRICULTURAL GREENHOUSE GASES

CIHEAM IAM ZARAGOZA | ICARDA | remedia

Advanced Course

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

Zaragoza (Spain), 12-16 March 2018

PARTICIPANTS

31 Participants (selected from >100 applications) from **10 countries**:

- Algeria
- Egypt
- Italy
- Morocco
- Malta
- Panama
- Portugal
- Spain
- Tunisia
- Turkey

Transference and dissemination

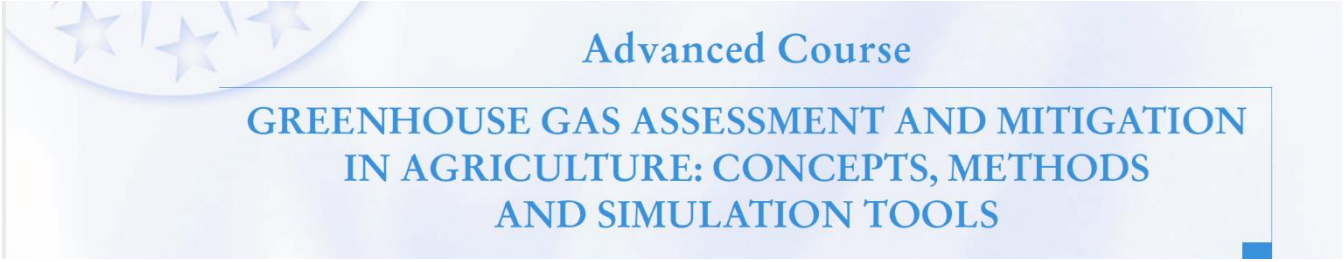
GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

Second edition (March 2020)

- This new edition is **supported by GRA** and 4per1000 initiative.
- 30 new students will attend this edition.

Transference and dissemination

GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES



Topics covered in the course:

– 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**.

Transference and dissemination

GLOBAL RESEARCH ALLIANCE
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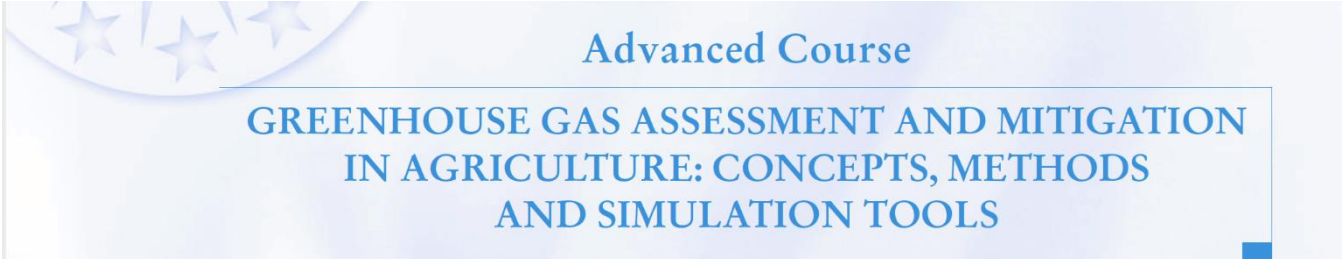


Lecturers:

J. ÁLVARO-FUENTES, EEAD-CSIC, Zaragoza (Spain)

K. BUTTERBACH-BAHL, IMK-IFU, Garmisch-Partenkirchen (Germany)

L. CÁRDENAS, Rothamsted Research, Devon (United Kingdom)

C. CARDOSO LISBOA, Rothamsted Research, Harpenden (United Kingdom)

R. FARINA, CREA, Rome (Italy)

A. FERRARA, FAO, Roma (Italy)

T. MORAIS, Universidade de Lisboa, Lisboa (Portugal)

S. PELLERIN, INRA, Bordeaux (France)

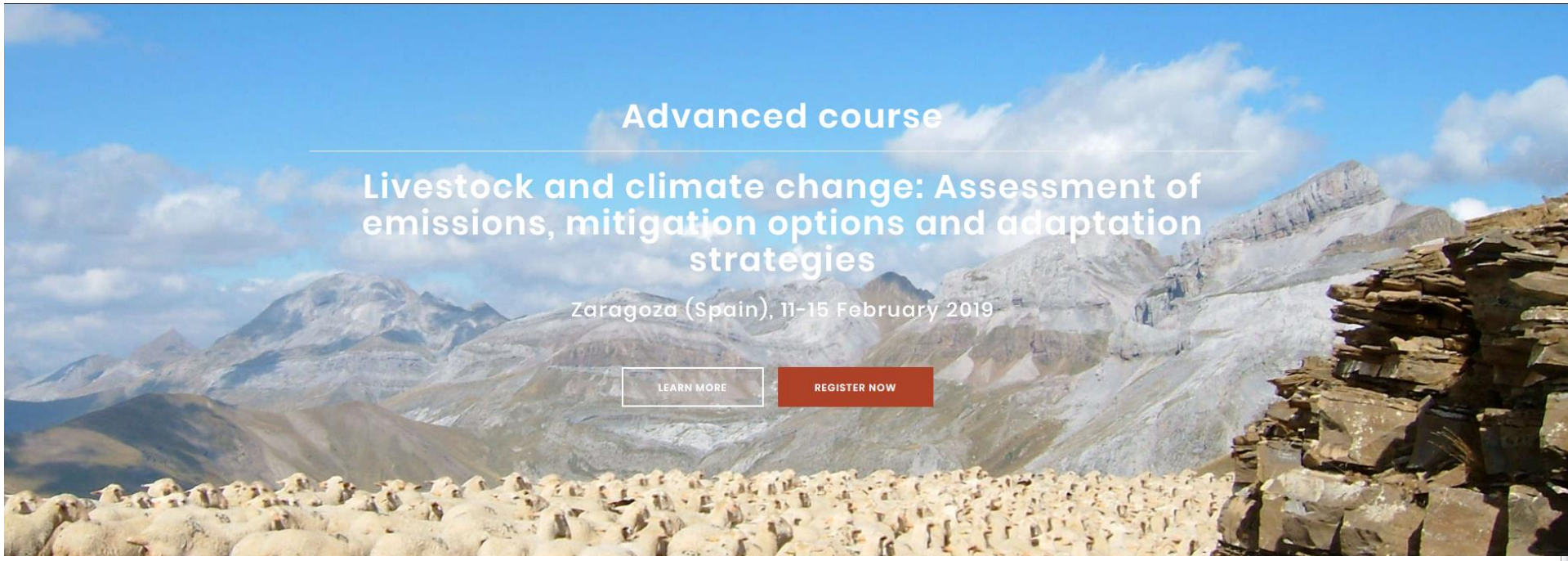
A. del PRADO, BC3, Leioa (Spain)

A. SANZ-COBEÑA, UPM, Madrid (Spain)

Transference and dissemination

GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

Strong support from GRA (NZ) with 10 grants for students in developing countries



Organisation

CIHEAM IAM ZARAGOZA

Food and Agriculture Organization of the United Nations

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ICARDA Science for resilient livelihoods in dry areas

remedia RED CIENTÍFICA DE MITIGACIÓN DE EMISIONES DE GASES DE EFECTO INVERNADERO EN EL SECTOR AGROFORESTAL

4 POUR 1000

Transference and dissemination

GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

5. Scholarships

Candidates from Mediterranean CIHEAM member countries, FAO member countries, institutions of GRA member countries in Africa, Latin America and the Caribbean, and ICARDA Middle East and North Africa partners may apply for scholarships covering registration fees and for scholarships covering the cost of travel and full board accommodation.

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 guidelines and models for GHG emission calculation, mitigation assessment and carbon sequestration (including for National Inventories). In a final round table discussion participants will have the opportunity to put forward policies and action plans for mitigation and adaptation in the Mediterranean region.

Participants will have to provide before the course a brief document about the situation, perspectives and challenges within their countries regarding mitigation and adaptation strategies for livestock systems. These reports will be distributed to all participants and lecturers and will be the basis for joint discussion.

8. Programme

1. **Context (3 hours)**
   - 1.1. Livestock and climate change with a focus on the Mediterranean area: sector trends, contribution to Greenhouse Gases (GHG) emissions and mitigation strategies
   - 1.2. Climate change scenarios, impacts on Mediterranean livestock and adaptation strategies
   - 1.3. Importance of IPCC National GHG Inventories and methodologies
   - 1.4. Potential role of livestock to meet Paris Agreement expectations under Nationally Determined Contributions (NDCs). Koronivia Joint Work on Agriculture (COP23 2017)
   - 1.5. Discussion based on the situation, perspectives and challenges in participants' countries
2. **Greenhouse gases from livestock systems (3 hours)**
   - 2.1. Livestock systems, components and interactions
   - 2.2. Emitting processes and reduction
     - 2.2.1. Animal level
     - 2.2.2. Manure level
     - 2.2.3. Feeding and feed production level
     - 2.2.4. Carbon sequestration
     - 2.2.5. Energy use
3. **Measuring and monitoring livestock GHG emissions and sinks (4 hours)**
   - 3.1. What should we measure and why?
   - 3.2. Methodological challenges: spatial/temporal variability, sampling issues, uncertainty, etc.
   - 3.3. Review of field and laboratory methods: limitations and opportunities. Low cost procedures and new developments
   - 3.4. Data collection, management, standardization and reporting
4. **Main strategies for mitigation (4 hours)**
   - 4.1. Productivity gains and efficiency
   - 4.2. Better integration of livestock in circular biocconomy
   - 4.3. Enhancing carbon sinks/offsets
   - 4.4. Practical work on the estimation of soil carbon sequestration
   - 4.5. Demand-side approaches
5. **Climate change adaptation strategies for livestock (3 hours)**
   - 5.1. Review of impact and existing adaptation strategies/options by regions and production systems
   - 5.2. How to include livestock in National Adaptation Plans?
   - 5.3. Case study on responses to drought (early warning systems, index based approach and feed emergency)
   - 5.4. The issue of establishing feed balances
   - 5.5. Discussion on climate change adaptation opportunities
6. **Modelling approaches for assessing GHG emissions and mitigation measures at different scales (11 hours)**
   - 6.1. What should we model and why?
   - 6.2. Types of models: overview, data requirement, limitations and opportunities, applications and outputs
   - 6.3. Life cycle assessment (LCA): products footprints
   - 6.4. Synergies and trade-offs between mitigation and adaptation measures. Examples of successful practices
   - 6.5. Practical work on modelling
     - 6.5.1. A simple field scale model for grassland systems: NCYCLE
     - 6.5.2. Livestock GHG National Inventories: basic calculation of Tier I emissions based on a country case
     - 6.5.3. Global to subnational scale and LCA approach: FAO Global Livestock Environmental Assessment Model interactive (GLEAM-i)
7. **Socio-economic assessments and policies (4 hours)**
   - 7.1. The marginal abatement cost curve methodology (MACC)
     - 7.1.1. Key steps of the process
     - 7.1.2. Examples from different countries
   - 7.2. Adaptation cost curves
   - 7.3. Accounting for multi-functionality
   - 7.4. Policy mechanisms available to address livestock and climate change issues
8. **Round table discussion (2 hours)**
   - 8.1. Priorities on knowledge for mitigation and adaptation
   - 8.2. Barriers for mitigation and adaptation implementation in Mediterranean countries
   - 8.3. How to incentivize the implementation of mitigation and adaptation measures

GUEST LECTURERS

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D. MORAN, SRUC, Edinburgh (United Kingdom)
A. MOTTET, FAO, Roma (Italy)
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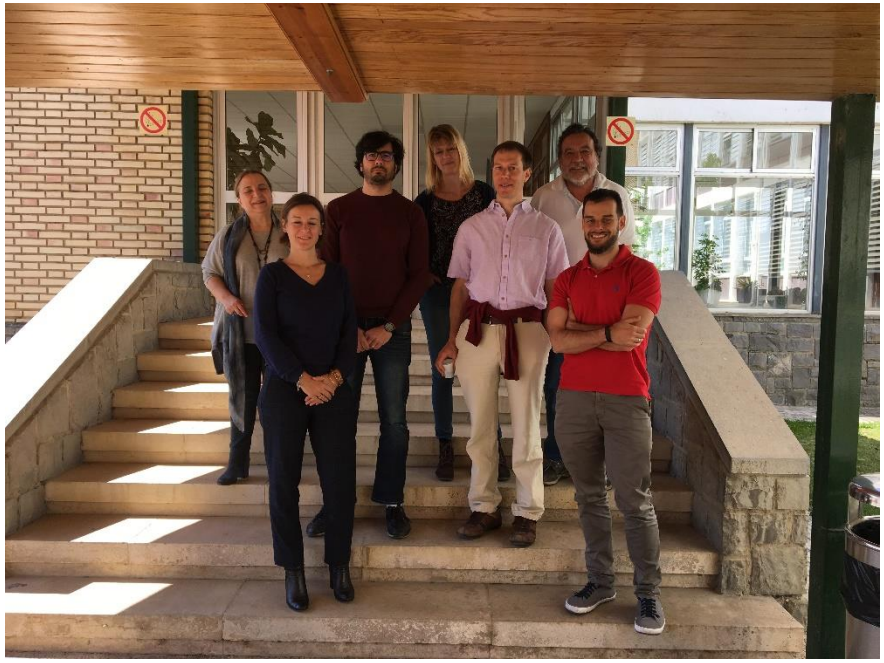
coordinators



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Thanks for your attention

rednueva
network for updating emission values in spanish agriculture

neiker tecnalia

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CSIC
Consejo Superior de Investigaciones Científicas

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BASQUE CENTRE FOR CLIMATE CHANGE
Klima Aldaketa Ikergai

UNIVERSITAT POLITÈCNICA DE VALÈNCIA