



Advanced Course

Integrating the Water-Energy-Food-Ecosystem (WEFE) nexus approach in Mediterranean irrigated agriculture

Zaragoza (Spain) • 6-11 November 2023



Objective

Mediterranean irrigated areas are at the crossroads of the Water-Energy-Food-Ecosystem (WEFE) nexus. Irrigation continues to be the largest water consumer in the region, but makes a very strong contribution to food security. The region offers great scope for the generation of renewable energy, given the intensity of solar radiation, wind speed and water flows. Renewable energies can moderate the cost of alternative water sources (i.e. desalination and wastewater treatment), however, pressurized irrigation is leading to sharp increases in energy demand. One paradigmatic example is modernization from surface to sprinkler/micro irrigation. Whilst major investments have targeted improving water efficiency, irrigation control and automation, modernization has led to a much greater dependence on energy, with significant implications for rural development, economic growth and sustainability. Regarding the environment, irrigation modernization has shown great potential for the alleviation of nitrate pollution. However, animal farming, the application of chemicals in excess of requirements and poorly treated wastewater continue to threaten environmental sustainability. In addition, climate change may increase water scarcity and modify the cropping pattern, introducing changes in water supply and demand.

Innovative solutions in both technology and policy are needed to ensure future water, energy and food security and a protected environment. Renewable energies, irrigation techniques and alternative sources of water offer new opportunities for tackling the trade-offs of the WEFE nexus in Mediterranean agriculture. The Sustainable Development Goals have marked a path for simultaneous development and respect for natural resources. Decarbonization, resilience and adaptation to a changing environment are additional requirements. The challenging interdependency between water, energy, food and ecosystems requires new skills and analytical capacities.

This course will critically review a broad spectrum of WEFE nexus issues, including technical solutions and policy/governance approaches, tools to support decision-making, sustainability assessment methodologies and serious games to explore trade-offs in a series of case studies. The course will disseminate some of the outcomes of the WEFE nexus projects financed by PRIMA (the Partnership for Research and Innovation in the Mediterranean Area) since 2019.

The course will enable participants to:

- gain deep insights into the complex challenges surrounding the WEFE nexus in Mediterranean irrigated agriculture, and its implications for food security and nature preservation;

- understand the nature and complexities of the trade-offs between WEFE components in a changing environment;
- analyse the energy implications of changes in water use in irrigated agriculture, and apply sustainability criteria to optimize water and energy requirements in irrigation system design and management;
- know how to optimize the use of grid energy and renewable sources for irrigation pumping requirements;
- develop policy and governance approaches for the WEFE nexus, leading to sustainable, resilient solutions, pursuing Sustainable Development Goals and promoting early stakeholder involvement;
- apply sustainability assessments and WEFE nexus simulations, considering a wide array of technical, economic, policy and environmental issues;
- improve their skills in the use of modelling tools and benefit from experiences gained through case studies, interaction with lecturers and course participants, and a technical field visit.

Organization

The course is jointly organized by the International Centre for Advanced Mediterranean Agronomic Studies (CIHEAM), through the Mediterranean Agronomic Institute of Zaragoza (CIHEAM Zaragoza), the PRIMA Foundation and the International Center for Agricultural Research in the Dry Areas (ICARDA). It will be held with face-to-face participation and online live training transmitted from the Mediterranean Agronomic Institute of Zaragoza, in morning and afternoon sessions, for one week from 6 to 11 November 2023, and given by well qualified lecturers from research centres, universities, associations, ONG's and a consultancy firm in different countries. The programme will be delivered in English and Spanish with simultaneous interpretation in these two languages. The Organization will provide interpretation into French if needed. The international characteristics of the course favour the exchange of experiences and points of view.

The course requires personal work and interaction among participants and with lecturers. Formal lectures are illustrated by applied examples, real case studies in various Mediterranean contexts and a round table discussion. Practical sessions will be devoted to implementing the nexus for the optimization of energy and fertilizers; modelling tools for decision support; and life cycle analysis for resilient Mediterranean irrigated agriculture.

Participants will be invited to provide a brief report about the WEFE nexus in their specific regions/countries. These reports will be distributed to all participants and lecturers.



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Over 50 years promoting cooperation and development across the Mediterranean in agriculture, fisheries, food, environment and the rural world

Programme

0. Opening session and presentation of the course (1 hour)
1. Framing the WEFE nexus in Mediterranean irrigated agriculture (5 hours)
 - 1.1. The challenging interdependency between Water, Energy, Food and the Ecosystem (WEFE) in the light of the Sustainable Development Goals
 - 1.2. WEFE nexus implementation under climate change: from silo thinking to cross-sectoral risk & benefit sharing
 - 1.3. Discussion of the situation of the WEFE nexus in participant's countries
 - 1.4. Case study – Irrigated agriculture under severe stress: the views of an environmental NGO
 - 1.5. Case study – Irrigated agriculture under severe stress: view of a scientist's and a practitioner's country
2. Deploying innovative technological solutions (10 hours)
 - 2.1. Regulated deficit and low-pressure irrigation to reduce the water and energy dependence of Mediterranean irrigated agriculture
 - 2.2. Alternative water resources for Mediterranean agriculture: quality and energy requirements
 - 2.3. Software, modelling and decision-making tools for building and managing nexus-ready irrigation systems
 - 2.4. Making the most of renewable and grid energy for irrigation pumping requirements
 - 2.5. Optimizing nitrogen input and using monitoring networks to reduce nitrate water pollution in irrigated areas
 - 2.6. Exploratory solutions and trade-offs for the complex relationship between wetlands and irrigated agriculture
 - 2.7. Case study – Implementing transdisciplinary WEFE nexus and stakeholder engagement for sustainable resource allocation in the Val di Cornia, Italy
 - 2.8. Case study – “Piano Laghetti”: interconnected small nature based solutions providing ecosystem services, water storage and energy generation
 - 2.9. Practical session: Implementing the nexus in a solid-set irrigated farm using electricity for pumping in a vulnerable area for nitrate pollution
3. Developing policy and governance approaches (9 hours)
 - 3.1. The nexus policy framework: EU and non-EU policies and strategies, institutional coordination challenges and barriers, and a nexus approach to coordinated WEFE policy development
 - 3.2. Innovative nexus governance approaches: institutional aspects illustrated by case studies in the Mediterranean
 - 3.3. Case study – The North-Western Sahara Aquifer System: options for nexus policies in a transboundary situation
 - 3.4. Case study – River contracts in Italy: a policy instrument implemented by water users associations to control nitrate pollution
 - 3.5. Practical session – Nexus game: exploring the nexus solutions tool for optimizing multi-scale energy-water-land system transformations
4. Performing sustainability assessments and nexus trade-off analyses (8 hours)
 - 4.1. Assessing WEFE trade-offs across different scales; translating findings into decision support
 - 4.2. Sustainability assessment: ecological footprinting and life cycle analysis (LCA)
 - 4.3. Ecosystem services accounting
 - 4.4. Practical session – Nexus modelling of irrigated agriculture in Greece based on systems thinking and dynamics
 - 4.5. Case study – Application of the Q-Nexus Web Tool for resilient Mediterranean irrigated agriculture
 - 4.6. Practical session – LCA for resilient Mediterranean irrigated agriculture
5. Round table (2 hours): “Implementing the WEFE nexus in Mediterranean Water Users Associations: constraints, challenges and expected benefits”
6. Technical visit to the Monegros area (6 hours): irrigated area of 125,000 ha using water resources from reservoirs in the Pyrenees mountains.



Guest lecturers

Almulla, Youssef - KTH, Stockholm (Sweden)
Battilani, Adriano - ANBI, Bologna (Italy)
Bidoglio, Giovanni - JRC, Ispra (Italy)
Castañeda, Carmen - EEAD-CSIC, Zaragoza (Spain)
Fernandez, Alberto - WWF, Madrid (Spain)
Isidoro, Daniel - UNIZAR, Teruel (Spain)
La Jeunesse, Isabelle - UFR, Tours (France)
Karnib, Ali - Lebanese University, Beirut (Lebanon)
Lago, Manuel - Ecologic Institute EU, Berlin (Germany)
López Günn, Elena - ICATALIST, Madrid (Spain)
Moreno, Miguel Ángel - UCLM, Albacete (Spain)
Nardi, Fernando - Univ. Perugia (Italy)
Playan, Enrique - EEAD-CSIC, Zaragoza (Spain)
Rhouma, Ali - PRIMA Foundation, Barcelona (Spain)
Zapata, Nery - EEAD-CSIC, Zaragoza (Spain)

Admission

The course is designed for participants with a university degree and is aimed at professionals from public or private organizations, such as decision-makers, technical advisors, agronomists, environmentalists, engineers and R&D specialists, dealing with or interested in the WEFE nexus challenges as applied to Mediterranean irrigation planning and management.

- 25 places will be available for face-to-face participation (lectures, practical work, debate and technical visit);
- 25 places will be available for online participation (lectures and debate).

Knowledge of English, Spanish and French will be valued in the selection of candidates.

Registration

- Candidates may apply online at the following address: <http://www.admission.iamz.ciheam.org/en/>
- Applications must include the *curriculum vitae* and a copy of the supporting documents most related to the subject of the course.
- The deadline for the submission of applications is 31st August 2023. The deadline may be extended if places are available.
- Applications from candidates requiring authorization 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 and from ICARDA Middle East and North Africa partners, 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 Organization, upon payment of the stipulated sum.

Contact:

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<https://edu.iamz.ciheam.org/NexusIrrigatedAgriculture/en/>

