TERRA-MED PhD PROGRAM - Marie Skłodowska-Curie Actions

Context on the program

TERRA-MED is an interregional doctoral program funded under the Marie Skłodowska-Curie COFUND Actions that will recruit and train a new generation of researchers to address the sustainability and resource stress (Water–Land–Energy nexus) in Mediterranean territories.



The Euroregion Pyrenees–Mediterranean, coordinator of the program, brings together the Regions of Occitanie (France), Catalonia and the Balearic Islands (Spain) forming a cross-border research ecosystem. Through this collaboration, TERRA-MED connects world-class universities, research centers and socio-economic actors committed to advancing resilience in the face of climate change. With more than 22,000 scientists across 10 universities and 2 research centers, encompassing 1000 research units, TERRA-MED provides a rich, interdisciplinary environment where doctoral candidates can excel and launch their research careers.

33 PhD positions will be offered to early-stage researchers with a unique interregional, interdisciplinary and intersectoral environment.

Fellows will benefit from having two supervisors (a principal supervisor and a co-supervisor) from two different regions and having a non-academic mentor. The fellows will undertake mandatory cross-border or international stays to the co-institution, as well as a secondment in a non-academic entity.

Moreover, doctoral candidates will receive a specifically designed training program related to their research topics, alongside modules on innovation, entrepreneurship, project management, ethics, open science, etc.

Benefits of TERRA-MED PhD program

- Top-tier PhD education and research training
- Access to world-class laboratories
- Interregional double supervision
- Double PhD degree (France / Spain) where applicable
- Interdisciplinary and cross-sector research experience
- Unique TERRA-MED's excellence training program on resources stress and climate change. See here
- Attractive salary in the frame of MSCA standards
- Extensive network of academic and non-academic partners
- 2 secondments: 1 in the co-supervisor's institution (9 to 12 months); 1 in a non-academic organization to gain extra academic experience and skills (3 to 6 months)

<table>
<tr><td>Reference of the thesis project:
UT6</td><td colspan="2">Title of the thesis project
Predictive Modelling of Pathogen Removal in Treatment Wetlands and Post-Treatment Storage Systems for Safe Wastewater Reuse</td></tr>
<tr><td colspan="2">Host institution:
University of Toulouse (UT)</td><td>Co-supervision / co-host institution:
University of Girona (UdG)</td></tr>
<tr><td colspan="2">Country :France</td><td>Country : Spain</td></tr>
<tr><td colspan="2">Host Research Unit:
CRBE – Centre de Recherche sur la Biodiversité et l'Environnement (UMR 5300, Université de Toulouse / CNRS / IRD / Toulouse INP) and LGC – Laboratoire de Génie Chimique (UMR 5503, Université de Toulouse / CNRS / Toulouse INP) jointly bring together expertises in microbial ecology, ecological engineering and environmental/process engineering. Over the past decade, both teams have built a strong collaboration on nature-based water treatment and reuse – covering biofilm dynamics, trophic interactions and microbial community functioning in treatment ecosystems, together with hydrodynamic modelling, wastewater treatment engineering and pathogen monitoring for public-health protection. The teams manage several experimental platforms in Toulouse and Ariège, including filtrOCampus and the new Caumont demonstration sites.</td><td>Co-host Research Unit:
LEQUIA (Laboratory of Chemical and Environmental Engineering, University of Girona) and ICRA (Catalan Institute for Water Research) are internationally recognised leaders in the development, optimisation and implementation of nature-based solutions for wastewater treatment, greywater reclamation and circular water management. Their expertise spans system design, performance assessment, environmental modelling and multicriteria decision-support tools, including the co-development of Nat4Wat (nat4wat.icra.cat), a decision-support platform for selecting and designing nature-based solutions. The teams manage several long-term operational demonstration sites in Catalonia, including the Empuriabrava treatment wetland, the La Vinyeta winery treatment system, and the ICRA and Sant Quirze del Vallès green-wall facilities.</td></tr>
<tr><td colspan="2">Name of the first co-supervisor
Magali Gerino (CRBE, Université de Toulouse)
Ludovic Pilloux (LGC, Université de Toulouse)
Email contact: magali.gerino@utoulouse.fr ; ludovic.pilloux@utoulouse.fr</td><td>Name of the second co-supervisor
Joaquim Comas Matas (LEQUIA, University of Girona)
Gianluigi Buttiglieri (ICRA)
Email contact:joaquim.comas@udg.edu</td></tr>
<tr><td colspan="2">Doctoral School:
SDU2E – Sciences de l'Univers, de l'Environnement et de l'Espace (Université de Toulouse)</td><td>Doctoral School:
University of Girona Doctoral School – Water Science and Technology Doctoral Programme</td></tr>
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Research field(s)

LS9_7 Environmental biotechnology and bioengineering • LS8_12 Microbial ecology and evolution • LS8_15 Modelling in environmental biology, ecology and evolution • PE8_11 Environmental engineering (water treatment, recycling, regeneration) • PE6_13 Bioinformatics and bio-inspired computing • PE10_9 Biogeochemistry and environmental chemistry • LS7_11 Environmental health, occupational medicine

Keywords

Water reuse, constructed and treatment wetlands, nature-based solutions, pathogens, predictive modelling, machine learning, water storage, climate resilience

Description of the research project

Context and Rationale

Water scarcity is reshaping how the Mediterranean region secures its food and water supply. Reusing treated wastewater for irrigation offers one of the most promising responses to this challenge. Water provisioning and its microbiological safety should be guaranteed but these 2 aspects are the main difficulties to coper with so far. This project addresses that challenge directly, aiming to establish low-cost, nature-based systems such as treatment wetlands as a safe and reliable pillar of sustainable water reuse.

Scientific Context

Treatment wetlands represent the most sustainable option for decentralised water reuse, owing to their low cost, low energy demand and adaptability to local contexts. However, current regulations still require costly and energy-intensive disinfection to control pathogens, which continues to limit their wider adoption — a limitation this project seeks to help overcome.

Research Gap

The mechanisms governing pathogen removal, survival and potential regrowth within these systems remain insufficiently understood, particularly during post-treatment storage. Addressing this gap is essential to develop the first reliable tools capable of predicting microbiological water quality across the entire treatment-to-reuse chain.

Relevance to the Water-Land-Energy Nexus

The project stands at the intersection of water and food security, with a strong contribution to climate resilience: safer, decentralised water reuse reduces pressure on freshwater resources and supports climate-adapted irrigation in a Mediterranean region increasingly exposed to drought.

Objectives

This doctoral project will pursue the following objectives:

- To elucidate the mechanisms of pathogen removal in treatment wetlands — including filtration, predation and biofilm dynamics — and how these evolve.
- To develop a novel hybrid mechanistic/machine-learning model simulating pathogen transport, persistence and regrowth, from treatment to storage;
- To validate this framework against long-term operational datasets from demonstration sites in France and Spain;
- To translate these findings into an operational decision-support tool, by integrating the produced models into Nat4Wat, a platform already used by practitioners and public authorities.

Expected Results

This project is expected to deliver:

- A validated hybrid predictive framework for pathogen dynamics in nature-based water reuse systems;
- New pathogen-risk modules integrated into the Nat4Wat platform, extending its capacity to jointly assess treatment performance, ecosystem services and microbiological safety;
- Concrete recommendations for the safe design and management of treatment wetlands and storage systems, supporting compliance with EU water-reuse regulations and the development of decentralised reuse strategies across the Mediterranean area.

Required Skills and Competences:

– Background in environmental engineering, microbiology/microbial ecology, water sciences or a related field, with a strong interest in wastewater treatment and reuse;

– Aptitude for quantitative and modelling approaches (mechanistic and/or data-driven / machine-learning), ideally with programming skills (R, Python or similar);

– Experience with laboratory and/or field experimental work (microbiology, water quality analysis) is an asset;

– Strong motivation for interdisciplinary, international research, autonomy, and good written and oral communication skills in English (B2 minimum).

Master's degree(s) required or equivalent(s):

Master's degree in environmental engineering, Water Sciences and Technology, Microbial Ecology / Microbiology, Environmental or Public Health, Biotechnology, or an equivalent degree with a strong environmental / life-sciences component.

Co-supervision partnership framework

Cotutelle (double degree) between University of Toulouse (UT3) and the University of Girona (UdG), with academic mobility to LEQUIA-UdG / ICRA and a non-academic secondment with a water-reuse technology partner.

Co-supervision (2 supervisors): Yes
Double degree PhD (France / Spain) where applicable and approved by the relevant institutions: Yes
Hosting institution: 18 or 24 months (Université of Toulouse – UT)
Co-hosting institution secondment: 9 to 12 months (University of Girona – LEQUIA / ICRA)
Non-Academic secondment: 3 to 6 months (potential partners under discussion: EPURAQUA, France; WETCON, Spain)

Work conditions

Duration: 36 months
Indicative start date: September/ October 2027
Indicative gross salary: 2450-2550€ /month including Mobility allowance. 29.400-30.600€/ year.
If eligible (fellow with 1 or more dependent child), Family allowance: additional 100€ / month

Trainings:

- TERRA-MED joint training program (scientific, transferable-skills and career-development modules)
- Mandatory doctoral school training program
- Ethics and Scientific Integrity
- Awareness session on gender-based and sexual violence

Mobility required: yes

Non-academic secondment: yes

Double degree / Cotutelle possible: yes

Doctoral tuition fees and Visa fees: fully covered by TERRA-MED program

Social security: Full employer contributions covered by the recruiting entity.

Host institution	Co-host institution
The University of Toulouse places its doctoral researchers at the heart of a dynamic scientific ecosystem in southern France. The successful candidate will join the CRBE and LGC laboratories, with direct access to state-of-the-art experimental platforms — including filtrOCampus and the new Caumont demonstration site — and to neOCampus, a unique living laboratory for ecological transition on campus. Beyond the laboratory, Toulouse offers an outstanding	On the Costa Brava, the University of Girona and ICRA form a leading centre of expertise in water science and nature-based solutions. Doctoral researchers hosted here will work alongside the team behind Nat4Wat, with hands-on access to ICRA's Experimental Green Wall Facility and to internationally recognised demonstration sites such as the Empuriabrava treatment wetland. Girona combines a vibrant, research-driven university city with the charm of the Catalan

quality of life, a rich cultural scene, and easy access to both the Pyrenees and the Mediterranean coast.	Mediterranean coast — all within easy reach of Barcelona.

Eligibility conditions

Academic Requirements **:** *By the call deadline, candidates* **must** *hold a master's degree or equivalent diploma; and do not hold a doctoral degree.*

***Horizon Europe MSCA Mobility Rule*:** Researchers must not have resided or carried out their main activity (work, studies, etc.) in the country of the host organization (France or Spain depending on the employing institution) for more than 12 months in the 36 months immediately before the recruitment date – unless as part of a compulsory national service or a procedure for obtaining refugee status under the Geneva Convention.

***Horizon Europe MSCA Eligibility Criteria*:** Applicants must be eligible for enrolment in a doctoral program at the employer institution and must not already hold a doctoral degree at the date of recruitment.

Applicants who do not fulfill the Mobility Rule and the Eligibility Criteria WILL NOT be considered for the research position.

***Language requirements*:** Applicants must demonstrate sufficient proficiency (B2) in English to successfully conduct doctoral research and participate in the TERRA-MED training program. Please provide any certificates that correspond to the level required that you have completed (TOEFL, TOEIC, IELTS, Cambridge certificates…).

For more information on this call for candidates see our website here :https://terra-med.euroregio.eu/

and the guide for applicants here: https://terra-med.euroregio.eu/how-to-apply

APPLY HERE BY Decembre 31st 2026

Administrative Contact

TERRA-MED Program Office (only for general administrative questions and redress demands. Any research-related question must be addressed to the supervisors by email, see second page)

Email: terramed@euroregio-epm.eu