

Activity Report

ICRA - CERCA

Research institute affiliated
to the University of Girona

2025

ICRA
Institut Català
de Recerca de l'Aigua

CERCA
Centres de Recerca
de Catalunya

Contents

01. **Message from the Director**

Message from the Director 03

Roadmap to 2029 04

02. **2025 in numbers**

Contributions 07

Publications 08

Projects 10

KTT 10

Unique Research Infrastructures 11

Human Resources 15

Impact 17

Communication 17

Outreach 19

PhD theses 20

ICRA Frontier School 21

03. **About ICRA**

Mission and vision 24

Strategic priorities 25

Values 25

Organisational structure 26

Governance 27

04. **Research lines**

L1. Hydrological processes and water resources 32

L2. Functioning and biogeochemistry of aquatic ecosystems 34

L3. Biodiversity of aquatic ecosystems 36

L4. Contaminants in the aquatic environment 38

L5. Contaminants in water treatment 40

L6. Microbial diversity and water quality 42

L7. Ecology of the aquatic resistome in natural and urban waters 44

L8. Nature-based solutions 46

L9. Conventional and alternative water supply 48

L10. Transport, treatment and management of wastewater 50

L11. Next-generation technologies for water treatment and resource recovery 52

L12. Modelling, evaluation and decision support for the sustainability and resilience of the urban water cycle 54

L13. Contaminants: a One Health approach - New line 56

L14. Sewer networks for the observation of human and environmental health 58

L15. Water-related ecosystem services 60

L16. Impact and mitigation of extreme droughts - New line 62





01
Message from the Director

2025 was the starting point of an ICRA committed to leading, through science and innovation, the solutions to the great challenges facing water.



Vicenç Acuña
Director

For ICRA, 2025 was the first year of a new chapter. At a time when water has become established as one of the great challenges of our age, we have continued to strengthen our mission: to generate scientific knowledge of excellence and turn it into useful answers for society. It was a particularly significant year, marked by the final stretch of a severe drought that made clear the need for rigorous research, the capacity to anticipate and the tools to support decision-making.

> *"In this context, ICRA has reaffirmed its role as a benchmark centre in the study of water, its quality, water scarcity and adaptation to climate change."*

Throughout 2025, the Institute has continued working to connect its research more effectively with the challenges facing the region, public administrations and the sectors that use water. This commitment has translated into a clearer focus on scientific cross-disciplinarity, on knowledge transfer and on closer institutional collaboration, particularly with our trustees and with the key players in the water ecosystem.

2025 confirmed that our direction is clear and that we have begun to move decisively towards the new ICRA we want to build. This process is neither immediate nor free of difficulties. Transforming a research centre means reviewing structures, updating regulations, strengthening alliances, creating new spaces for governance and building the conditions for scientific excellence to translate into usefulness, impact and service to the country.

Along this path, our goal is clear: to become a benchmark on water issues and, above all, on everything related to drought and the adaptation of the water cycle to new climate conditions. We want to be that benchmark in Catalonia, and also in southern Europe and across the Mediterranean, where these challenges are already a shared reality. This will only be possible through scientific rigour, collaboration and perseverance.

We will keep working to make ICRA an ever stronger centre, more open and more connected to the real needs of society. We are in the middle of a transition, yes, but it is precisely at moments of change that the projects with the greatest future are defined.

ROADMAP TO 2029

This roadmap sets out the main objectives that will guide ICRA's development up to 2029. For each year it establishes a vision, which sets the centre's strategic direction, and a set of milestones, which turn that vision into actions and projects.











2025

Vision:
A new cycle begins. We start a new chapter to strengthen research, governance and transfer in the face of the country's major water challenges.

Milestones:
- Strategic Plan approved
- Action Plan approved

2026

Vision:
Better prepared for drought. We are sharpening the focus of our research and innovation on water scarcity, climate adaptation and the resilience of water systems.

Milestones:
- Launch of the GRAPHEC spin-off.
- Approval of ICRA's new statutes.
- Start of the programme contract with the Government of Catalonia.
- Start of works to renovate ICRA's surroundings.

2027

Vision:
We connect knowledge and decision-making. We want to do a better job of turning science into useful tools for managers, public administrations and the sectors that use water.

Milestones:
- Construction begins on the ICRA innovation hub
- Knowledge Regions actions begin

2028

Vision:
Innovation for resilience. We drive solutions in reuse, sanitation, water quality and integrated management in a context of climate change.

2029

Vision:
Mediterranean leadership in water. We are working to become a scientific and institutional benchmark in drought, water scarcity and adaptation across southern Europe.

Horizon 2029

Vision:
Research that is useful for transformation. We are building an ICRA capable of generating scientific excellence and, at the same time, real impact on policy, management and society.



02
2025 in numbers

This section brings together the main indicators linked to ICRA's programme contract and offers an overall view of the centre's activity during 2025.

Contributions

Income in 2025 was equivalent to 2024, consolidating an annual volume of around €6M over the last four years. The ratio between competitive income, KTT and other income also holds steady at around 50% of the total. Transfer income rose considerably compared with 2024, returning to figures equivalent to previous years.

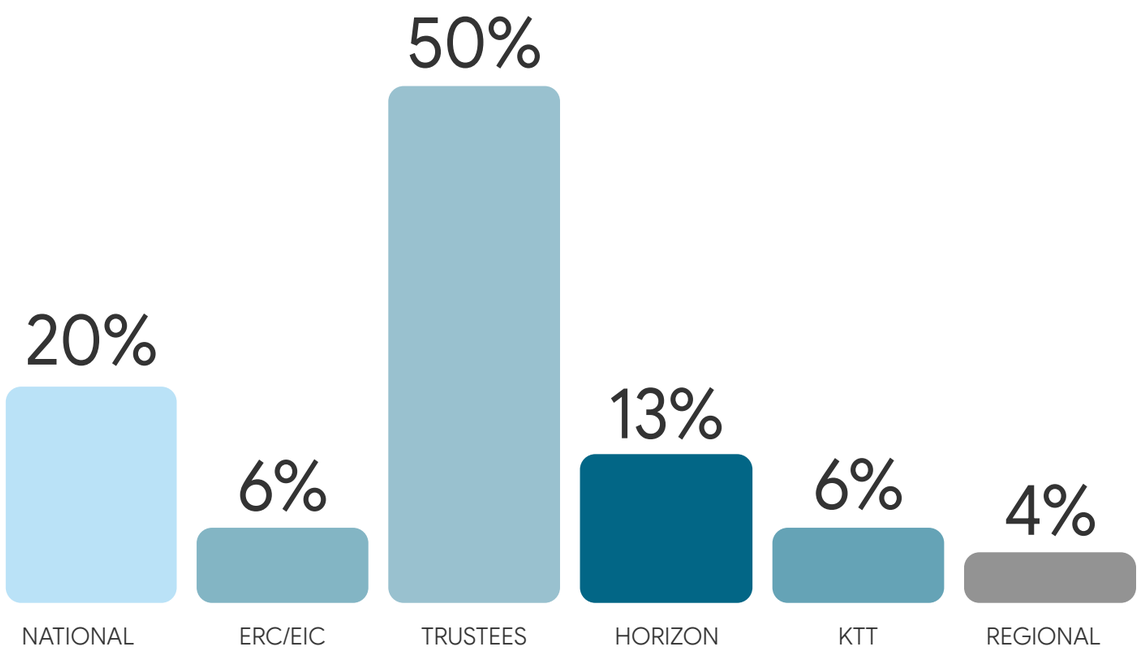
KEY FIGURES 2025

BUDGET EXECUTED
€5.8M

COMPETITIVE PROJECTS
42%

KTT
6%

% SHARE OF FINANCIAL CONTRIBUTIONS 2025



Publications

In 2025 the institution produced 77 publications, including 69 peer-reviewed articles. A notable 86% were published in Q1 journals and 55% in D1. Among the Q1 articles, 47% were led by ICRA researchers (24% women and 39% men). Q2 publications accounted for 14%.

KEY FIGURES 2025

TOTAL NUMBER OF ARTICLES
75

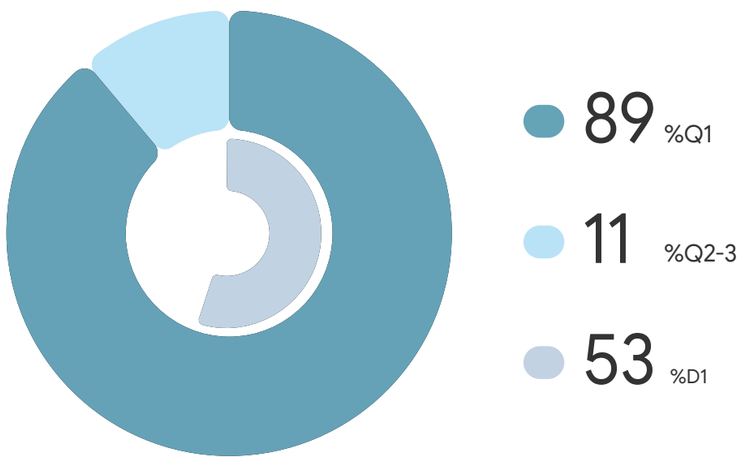
Q1
67

%Q1 IN A LEAD ROLE
54%
♂ 39%
♀ 24%

D1
40

%D1 IN A LEAD ROLE
50%

% SHARE OF Q1, Q2, Q3 AND D1 IN 2025 ARTICLES



TOP 10 ARTICLES

Chemical Engineering Journal
Volume 508, 15 March 2025, 160940

Electrochemical removal of contaminants of emerging concern with manganese oxide-functionalized graphene sponge electrode

https://doi.org/10.1016/j.cej.2025.160940

Ecological Indicators
Volume 173, April 2025, 113409

Patterns of nutrients and algal biomass in an intermittent Mediterranean river under intense human activity

https://doi.org/10.1016/j.ecolind.2025.113409

Water Research
Volume 282, 15 August 2025, 123720

Multidimensional tolerance landscapes reveal antibiotic-environment interactions affecting population dynamics of wastewater bacteria

https://doi.org/10.1016/j.watres.2025.123720

Environmental Pollution
Volume 366, 1 February 2025, 125524

Identification of emerging contaminants in greywater emitted from ships by a comprehensive LC-HRMS target and suspect screening approach ☆

https://doi.org/10.1016/j.envpol.2024.125524

Ecosystem Services
Volume 72, April 2025, 101702

Using georeferenced text from social media to map the cultural ecosystem services of freshwater ecosystems

https://doi.org/10.1016/j.ecoser.2025.101702

Water Research X
Volume 29, 1 December 2025, 100418

Mobility data for reduced uncertainties in model-based WWTP design

https://doi.org/10.1016/j.wroa.2025.100418

Journal of Environmental Management
Volume 394, November 2025, 127667

Modelling cultural ecosystem services of river landscapes in the Iberian Peninsula with deep learning and social media images

https://doi.org/10.1016/j.jenvman.2025.127667

Water Research
Volume 287, Part A, 1 December 2025, 124300

Irreversible inactivation of multidrug-resistant Gram-positive bacteria using S-functionalized graphene sponge anode

https://doi.org/10.1016/j.watres.2025.124300

iMeta
RESEARCH ARTICLE | Open Access

Phage-mediated horizontal transfer of *Salmonella enterica* virulence genes with regulatory feedback from the host

https://doi.org/10.1002/imt2.70042

Environmental Chemistry and Ecotoxicology
Volume 7, 2025, Pages 2133-2141

Comprehensive characterization of microcontaminants in urban runoff: Unveiling chemical signatures using wide-scope target screening by LC-HRMS

https://doi.org/10.1016/j.enceco.2025.09.009

Projects

In 2025 two projects were awarded under the European Horizon Europe programme: an MSCA Postdoctoral Fellowship and the PFAROS project, “Driving Sustainable Innovation to Minimise PFAS in European Healthcare”.

KEY FIGURES 2025

BUDGET
€2.4M

NATIONAL PROJECTS
56%

INTERNATIONAL PROJECTS
44%

KTT

Knowledge and technology transfer activities grew during 2025. The number of patents and spin-offs remains stable, consolidating the results achieved in 2024. Although the number of projects carried out has not changed significantly, the associated budget has doubled to €347,114, equivalent to 12% of competitive projects, reflecting the greater weight and scope of the projects developed. In parallel, collaboration with companies and public administrations has been strengthened through joint publications, training activities and the start of two industrial doctorates focused on drinking water and sanitation networks.

KEY FIGURES 2025

PATENTS AND TRADE SECRETS
3

SPIN-OFF OR START UP
2

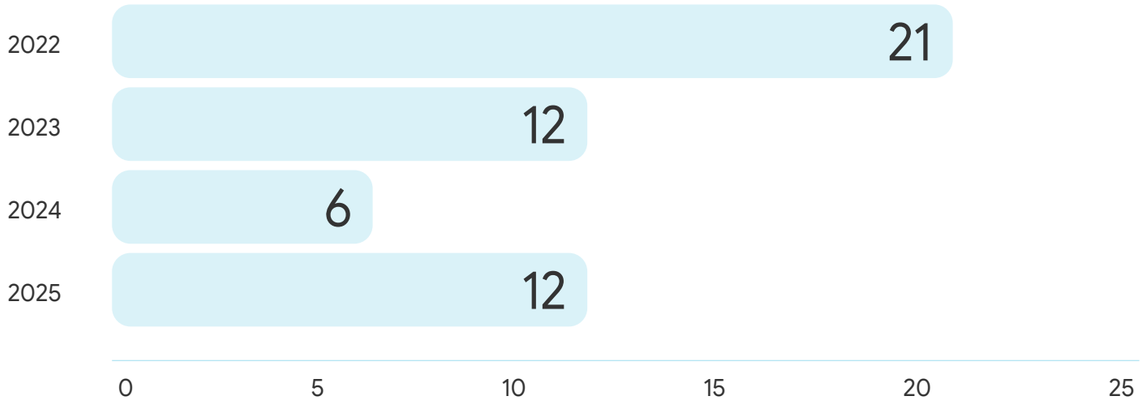
FINANCIAL CONTRIBUTION
€347K

%KTT FINANCIAL CONTRIBUTION RELATIVE TO COMPETITIVE PROJECTS
12%

% ARTICLES WITH BUSINESS AND PUBLIC SECTOR PARTNERS
17%

TRAINING FOR BUSINESS / PUBLIC ADMINISTRATION
4

% KTT FINANCIAL CONTRIBUTION RELATIVE TO COMPETITIVE PROJECTS (2022- 2025)



Unique Research Infrastructures (URI)

SCIENTIFIC AND TECHNICAL SERVICES (SCT)

The activity of the Scientific and Technical Services (SCT) over the course of 2025 involved the analysis of more than 10,000 samples across 437 service provisions linked to 23 ICRA research projects and 37 collaborations with external bodies. In terms of infrastructure, three pieces of scientific equipment were installed and brought into operation during the year: an ion chromatograph with multiple detection — High-Resolution Mass Spectrometry (HRMS), Conductivity (CD) and Ultraviolet-Visible (UV/VIS) — an ultra-high-performance liquid chromatograph coupled to a hybrid triple quadrupole linear ion trap mass spectrometer, and a cytometer.



437 EXPERIMENTS CARRIED OUT

23 SERVICES PROVIDED TO ICRA PROJECTS

37 EXTERNAL SERVICES

7 COLLABORATION WITH BUSINESS/PUBLIC ADMINISTRATION

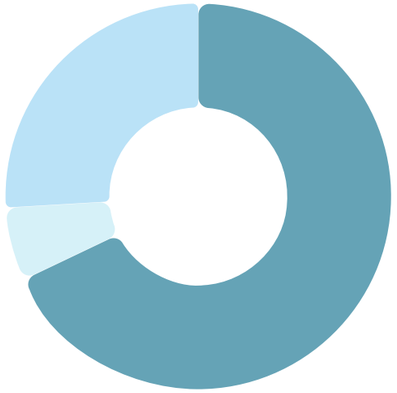
SCT SERVICES PROVIDED IN 2025 BY UNIT

UAQ 36%

UTBM 35%

UEM 29%

TOTAL SCT INCOME 2025



68% RESEARCH PROJECTS

26% EXTERNAL SERVICES

6% TRANSFER

DISTRIBUTION OF SCT INCOME BY SOURCE OF RESEARCH PROJECT FUNDING 2025



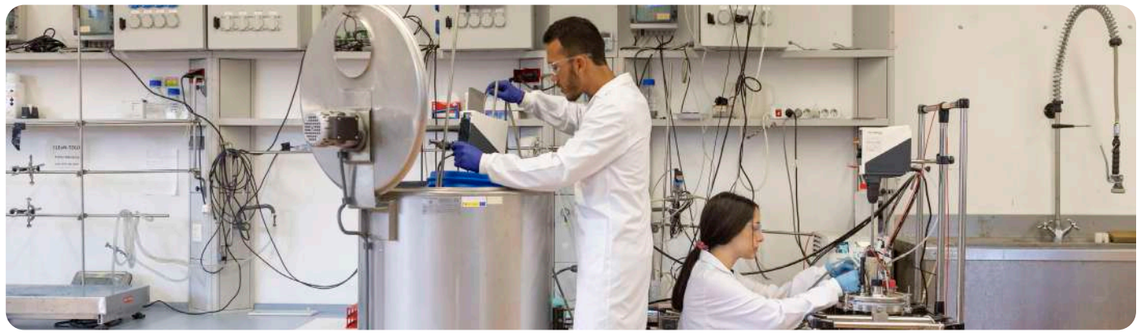
66% NATIONAL

27% INTERNATIONAL

7% REGIONAL

PILOT PLANTS AND BIOPROCESSES LABORATORY

In 2025 the Pilot Plants and Bioprocesses Laboratory supported 6 ICRA projects, contributing to 3 scientific publications. Three technologies were tested there, consolidating the facility as key infrastructure for applied experimentation and the development of innovative water treatment solutions.



6 ICRA PROJECTS USING THE LABORATORY

3 RESULTING SCIENTIFIC PUBLICATIONS

3 TECHNOLOGIES TESTED

GREEN WALL

ICRA's experimental green wall facility is an innovative technology for treating urban greywater (from kitchens and sinks) that replicates natural processes such as adsorption, precipitation, plant uptake and biodegradation through a modular structure combining vertical and horizontal flows. In 2025 the system was brought into operation and an experiment was launched to assess treatment efficiency with 5 plant species. Overall, it has contributed to 5 projects (ReUseMP3, MULTISOURCE, NEWater, GGsolutions and AWARE) and 2 ongoing doctoral theses, and has a theoretical treatment capacity of around 10,400 L/year.



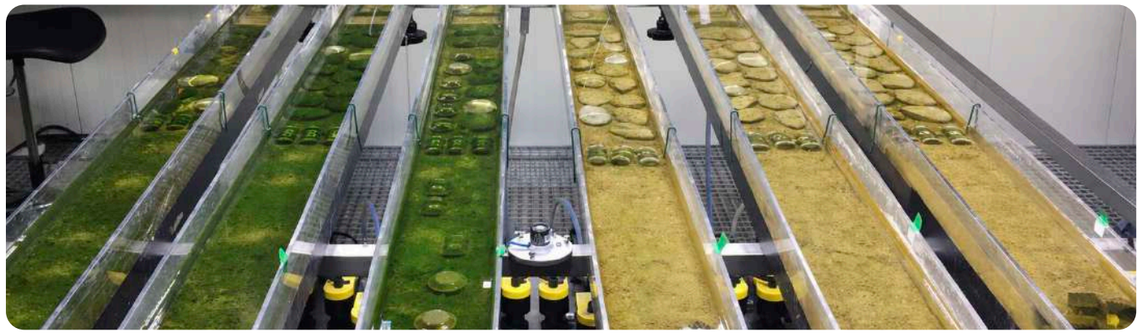
5 PLANT SPECIES

6 INTERNATIONAL CONFERENCES

7 STUDENTS TRAINED

EXPERIMENTAL STREAM FACILITY (ESF)

During 2025 the facility received more than 22 visits and was used for 3 different experiments. In May, some channels were used to colonise artificial substrates with microbial biofilms for ecotoxicology experiments as part of the Citypoll project. In July, the circular mesocosms were used to study the effect of sunscreen on aquatic snails, in an experiment carried out by a secondary school student with the support of the Càtedra de l'Aigua, Natura i Benestar. In September, one channel was used to study the behaviour of an in-house turbine design and its capacity to convert the energy of moving water into electricity.



3 EXPERIMENTS CARRIED OUT

1 ICRA PROJECT USING THE FACILITY

22 VISITS TO THE FACILITY

HYDROPONICS

ICRA is investigating the use of hydroponic systems for the treatment and reuse of greywater and wastewater within several research projects. To date, this line has contributed to 4 projects (ReUseMP3, NePMTune, NEWater and GGsolutions), 4 doctoral theses and 9 scientific publications, published or in preparation. During 2025, studies focused on the treatment and possible reuse of greywater, wastewater and runoff, as well as on the accumulation of emerging contaminants in edible and phytoremediation plants.



11 PLANT SPECIES

5 WATER TYPES TESTED

4 ICRA PROJECTS USING THE FACILITY

Human Resources

In 2025 ICRA had 107 professionals, with a clear research focus (60% of FTE). The research team shows gender balance (39 women and 40 men). The centre maintains a strong international profile, with staff of 23 nationalities.

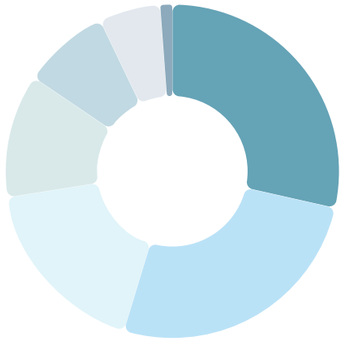
KEY FIGURES 2025

EMPLOYED AND AFFILIATED STAFF
107

RESEARCH STAFF
79

% WOMEN IN RESEARCH
49%

RESEARCH STAFF DURING 2025



24 SPECIALISED SUPPORT TECHNICIAN

22 POSTDOCTORAL RESEARCHER

15 PREDOCTORAL RESEARCHER

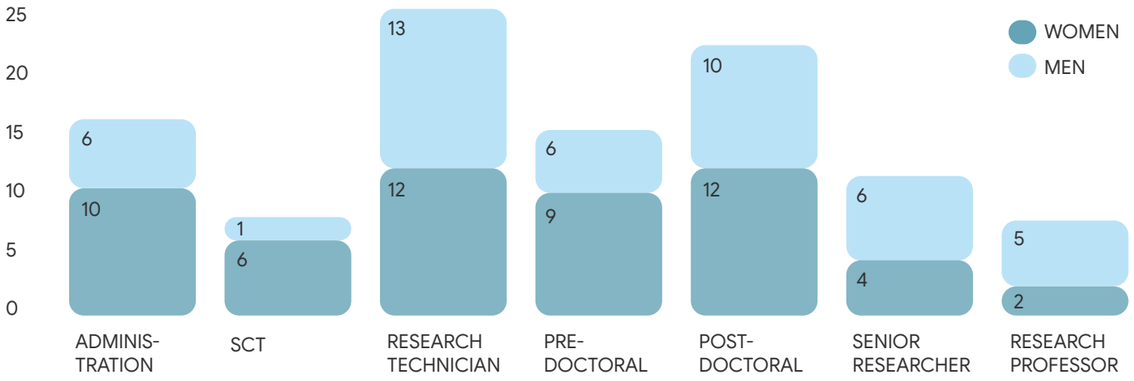
10 SENIOR RESEARCHER

7 RESEARCH PROFESSOR

5 SSR

1 RESEARCH SUPPORT TECHNICIAN

% GENDER DISTRIBUTION BY PROFESSIONAL CATEGORY 2025



MAP OF ICRA STAFF 2025



EUROPE

Austria: 2
Germany: 2
Belgium: 1
Croatia: 2
Spain: 70
Finland: 1
France: 3
Greece: 1
Italy: 4
Russia: 1
Serbia: 3

AMERICAS

Argentina: 3
Bolivia: 1
Colombia: 3
Mexico: 1
Peru: 1

ASIA

India: 2
Iran: 1
Philippines: 1
China: 2

AFRICA

Morocco: 1
South Africa: 1



Impact

In 2025 ICRA recorded 25 legislative citations, took part in 11 expert committees and received 5 awards (4 regional/national and 1 international). Over the last three years it has earned 9 distinctions. Two impact narratives were graded A in the CERCA Research Impact Assessment 2024, accounting for 50% of the top grades awarded by the STEM panel.

KEY FIGURES 2025

CITATIONS IN LEGISLATION
25

EXPERT COMMITTEES
11

AWARDS AND DISTINCTIONS
5

Communication

2025 was a key year for consolidating communication at ICRA, with the drafting of the 2025-2029 Communication Plan and the development of the Corporate Identity Manual, which lay the foundations for more strategic and coherent communication. In terms of activity, the year stands out for a solid digital presence, with 18,000 website visits and significant growth of the community, with 1.937 followers, as well as a steady output of content. As for press coverage, official data are still awaited to confirm exact figures, although estimates point to a significant presence in national and international media.

KEY FIGURES 2025

FOLLOWERS
1.937

DISSEMINATION EVENTS
46

PRESS COVERAGE
74

SHARES
848

IMPRESSIONS
660

NATIONAL PRESS
61

WEBSITE VISITS
18K

WEB NEWS ITEMS
91

INTERNATIONAL PRESS
13

SELECTED NEWS HIGHLIGHTS OF 2025



THE CONVERSATION

Antibióticos en el agua subterránea: cómo frenar este contaminante emergente

https://theconversation.com/antibioticos-en-el-agua-subterranea-como-frenar-este-contaminante-emergente-265497



THE CONVERSATION

La plastisfera: una amenaza emergente para el medioambiente y la salud pública

https://theconversation.com/la-plastisfera-una-amenaza-emergente-para-el-medioambiente-y-la-salud-publica-250465



THE CONVERSATION

¿Tendremos que vivir con menos agua?

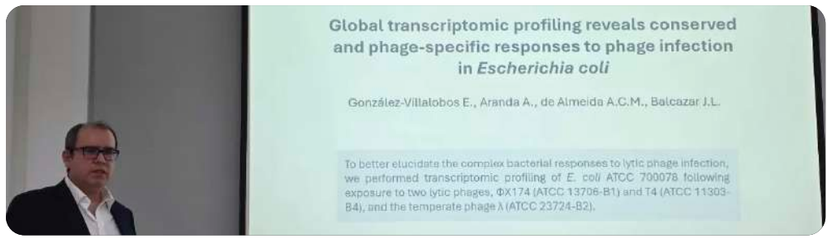
https://theconversation.com/tendremos-que-vivir-con-menos-agua-255335



Diari de Girona

Girona acull per primer cop la trobada anual del Moviment Europeu de l'Aigua

https://www.diaridegirona.cat/girona/2025/12/01/girona-acull-per-primer-cop-124317828.html



RETEMA
REVISTA TÉCNICA DE MEDIO AMBIENTE

El Dr. José Luis Balcázar (ICRA), galardonado con el Premio John Snow a la Innovación en Salud Pública

https://www.retema.es/actualidad/el-dr-jose-luis-balcazar-icra-galardonado-con-el-premio-john-snow-la-innovacion-en-salud

Outreach

During 2025 a range of outreach activities and workshops were held to share the research carried out at ICRA. Talks were organised in primary and secondary schools, and the centre took part in public events such as World Water Day, Girona Temps de Flors and Research Week, reaching both students and the general public, with hundreds of participants in total.

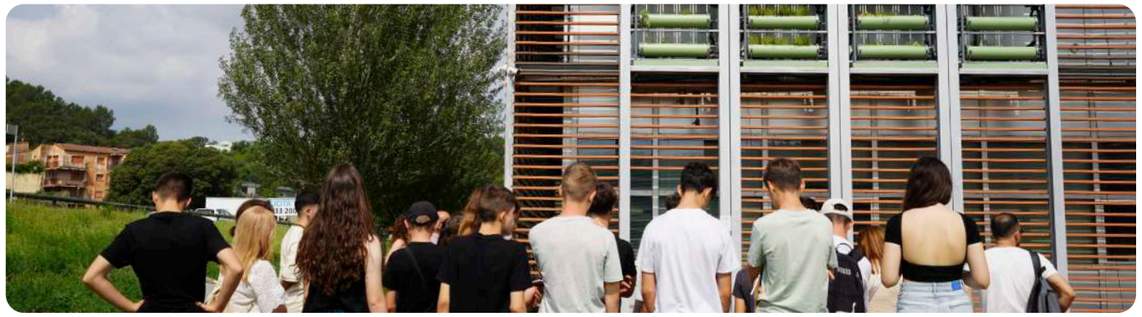
KEY FIGURES 2025

OUTREACH EVENTS
25

SCHOOL VISITS
8

No. OF ATTENDEES
850

STUDENTS HOSTED
6







PhD theses

In 2025, 6 doctoral theses were defended at ICRA, giving rise to 12 resulting scientific publications and demonstrating the strength and impact of the research carried out. A new industrial doctorate also began during the year, bringing the number of active industrial doctorates to 2 and reinforcing the connection between academic research and business and public administration.

KEY FIGURES 2025

DOCTORAL THESES DEFENDED
6

RESULTING PUBLICATIONS
12*

ACTIVE INDUSTRIAL DOCTORATES
2

DOCTORAL THESIS TITLE	DOCTORAL CANDIDATE	SUPERVISION
Nanoparticle-Enhanced Hybrid Ozone-Membrane Process for Micropollutant Abatement	Ms. Nikoletta Tsiarta	Dr. Wolfgang Gernjak Dr. Lidija Ćurković
Evaluación de contaminantes orgánicos en los vertidos generados por el transporte marítimo	Ms. Elisa García Gómez	Dr. Mira Petrović Dr. Meritxell Gros
Electrochemical Removal of Antibiotics and Multidrug-Resistant Bacteria using Graphene-Sponge Electrodes	Ms. Natalia Ormeño	Dr. Jelena Radjenovic
Scale-Dependent Patterns of Hydrological, Chemical, and Ecological Descriptors in an Intensively Managed Mediterranean River	Ms. Gabriela Córdoba - Ariza	Dr. Josep Mas Pla Dr. Sergi Sabater Dr. Ramon J. Batalla
Pharmaceuticals in Water Reclamation: Prioritisation and Monitoring for Sustainable Irrigation Practices in Mediterranean Regions	Mr. Marc Castaño Trias	Dr. Gianluigi Buttiglieri Dr. Sara Rodríguez
Understanding transformation of organic micropollutants during plasma treatment and its ecotoxicological implications	Ms. Barbara Topolovec	Dr. Mira Petrovic

ICRA Frontier School

2025 saw the first edition of the ICRA Frontier School: Tackling Water Pollution through Innovation and Technology, an initiative led by ICRA and aimed at early-career researchers interested in addressing the global challenges of water pollution. This summer school offered an immersive experience with presentations by leading scientists, spaces for debate and interactive sessions designed to encourage participation and critical thinking. This first edition brought together 17 students from 10 research centres around the world, representing 10 different nationalities, creating a highly enriching international and interdisciplinary environment.

KEY FIGURES 2025

STUDENTS
17

RESEARCH CENTRES
10

NATIONALITIES
10











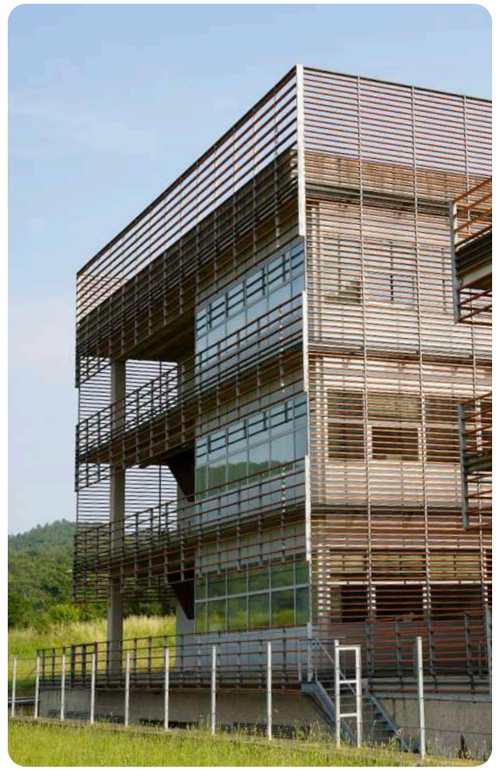
03

About ICRA

This section presents an overview of ICRA, its mission, vision, organisational structure and governance model, including the activity of its governing bodies during 2025.

The Government of Catalonia created the Catalan Institute for Water Research (ICRA) on 26 October 2006, within the Research Centres of Catalonia (CERCA) Programme. The Government of Catalonia participates in ICRA through the Department of Business and Knowledge. CERCA centres, ICRA among them, form part of the Research and Innovation Plan of Catalonia, approved by the Government of Catalonia.

ICRA is a multidisciplinary water research centre covering the complete water cycle. Research at the Institute addresses a range of topics, including the availability of water resources, the importance and role of freshwater biodiversity, the full assessment of water quality (chemical, microbiological, ecological and so on) and the development and evaluation of treatment technologies, as well as the transfer of that knowledge to society, industry and the business community.



ICRA is based in the H2O building at the Science and Technology Park of the University of Girona, opened on 7 October 2009. The H2O building is equipped with state-of-the-art facilities and technologies used to carry out national and international research projects. This building of more than 5,000 m^2 has facilities suited to supporting the research of its technical staff, and enables interaction with other research centres, universities and companies, the training of technicians and the transfer of knowledge to industry and society at large.

ICRA is also supported by the Catalan Water Agency (ACA) and the University of Girona (UdG). The UdG holds a recognised position as a benchmark research and teaching centre at national and international level and promotes the integration of its researchers into its Sectoral Campuses. ICRA is now a research institute affiliated to the UdG, strengthening its relationship with the university since 2018 (Decree of the Government of Catalonia of 6 July 2018). The Catalan Water Agency (ACA), for its part, is a public law body attached to the Department of the Environment and Housing, founded in 1998. As the Hydraulic Administration of Catalonia, it exercises the authority of the Government of Catalonia on water matters, working towards the objectives set out in the Water Framework Directive, in line with the principles of environmental, economic and social sustainability, unity of management and integrated treatment.

ICRA is part of the Research Centres of Catalonia (CERCA) network. CERCA centres are autonomous bodies with their own legal personality, in which the Government of Catalonia participates, whose main purpose is scientific research of excellence. They apply a private management model with maximum flexibility and maximum self-demand, and their legal regime is defined in Chapter IV of Law 7/2011 of 27 July on Fiscal and Financial Measures. ICRA is currently a member of ACER, the Catalan Association of Research Centres, which aims to help define research priorities and policies for its members.

MISSION

ICRA’s mission is to generate and share knowledge to help society understand, protect and restore water systems.

We study hydrological processes, freshwater ecosystems and chemical and microbial contaminants in contexts of scarcity and environmental stress. We develop innovative technologies for water treatment, resource recovery and reuse to ensure that scientific knowledge translates into practical, scalable and sustainable solutions.

VISION

ICRA’s vision is to contribute to a future in which water is the foundation of sustainability, equity, resilience and security. We aim to be an international benchmark in water research and innovation, inspiring and driving solutions that transform society’s relationship with water resources and freshwater ecosystems.

STRATEGIC PRIORITIES

Excellence in research:

Carrying out high-quality, innovative research with international reach.

Research with impact:

Carrying out research that addresses global challenges and contributes to the development of legislation.

Innovation and knowledge and technology transfer:

Bringing innovative solutions generated by research to society.

Leader in water research in Catalonia and southern Europe:

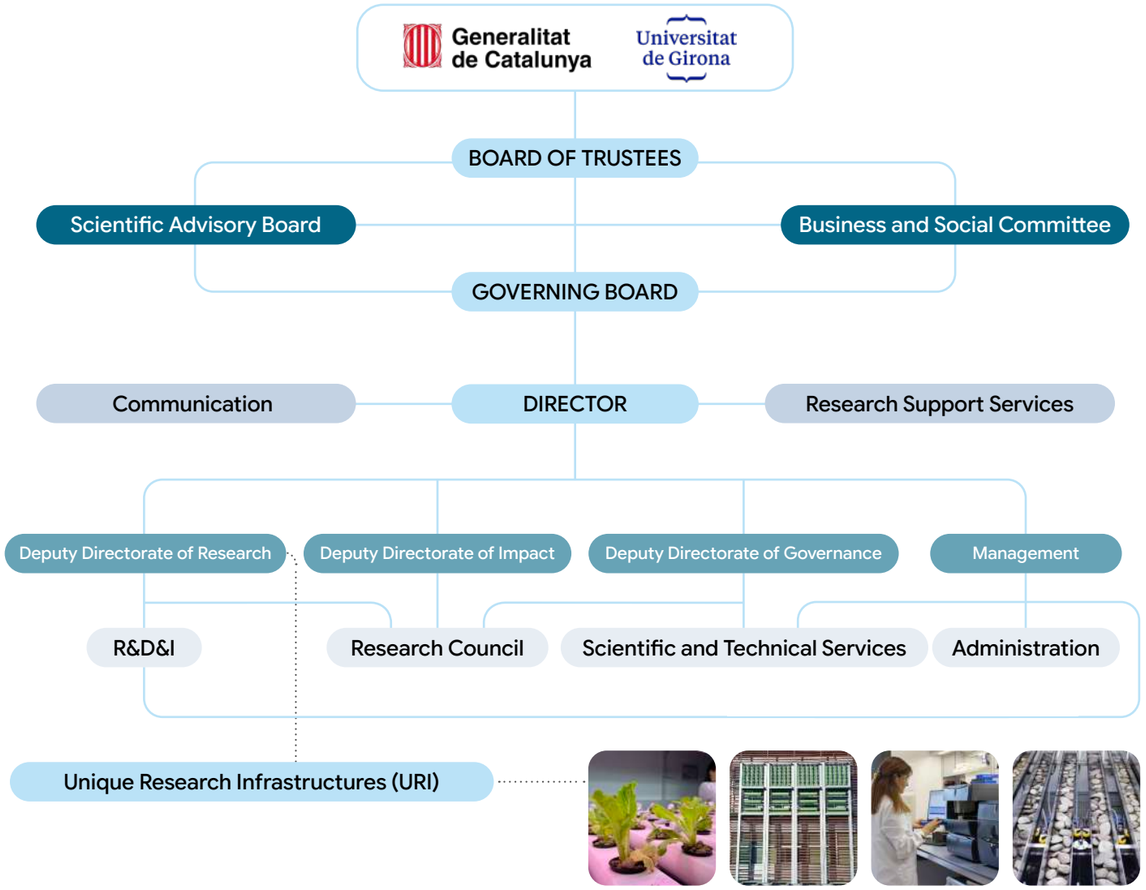
ICRA as a benchmark in integrated water management at regional and international level.

VALUES

Multidisciplinarity	Going beyond disciplinary boundaries.
People	Respect, honesty and camaraderie.
Commitment	Focusing on solutions to current and emerging water challenges.
Inclusion	Ensuring an inclusive institute with gender balance.
Excellence and Impact	Pursuing excellence in research to generate transformative impact.
Teamwork	Collaboration within ICRA and with external partners.

ORGANISATIONAL STRUCTURE

ICRA's organisational chart is structured to ensure efficient coordination and optimal management of research. It comprises three deputy directorates with clearly defined functions and reporting lines, which contribute to the centre's strategic alignment. In addition, the Research Council, made up of the Principal Investigators (PIs), acts as a key space for fostering coordination, collaboration and scientific exchange.



GOVERNANCE

Board of Trustees

The Board of Trustees is ICRA's highest governing body. Its trustees are the Department of Research and Universities of the Government of Catalonia (DREU) and the University of Girona (UdG). During 2025, ICRA's Board of Trustees met in ordinary session on 2 June and twice in extraordinary session, on 24 January and 19 November. Key resolutions: amendment of the Institution's Statutes; a new agreement with the University of Girona regulating ICRA's affiliation as a UdG-affiliated Research Institute; Programme Contract 2026-2029

MEMBER	POSITION
Núria Montserrat Pulido Chair	Minister for Research and Universities, Government of Catalonia
Joaquim Salvi Vice-Chair	Rector of the University of Girona
Teresa Sanchís Member	Director General for Research, DREU, Government of Catalonia
Javier Selva Sánchez Member	Director General for Transfer and the Knowledge Society, DREU, Government of Catalonia
Anna Albar Member	Director General of the Science and Technology Park of the University of Girona
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Josep M. Sangrà Franci Member	Head of the Tax Assessment Department, Catalan Water Agency
Laia Pellejà Board Secretary	Director of CERCA, Government of Catalonia
Josep M. Alcoberro Pericay Deputy Secretary, non-trustee	Legal Adviser to CERCA, Government of Catalonia



Scientific Advisory Board

The Scientific Advisory Board is appointed by the Board of Trustees and includes an unspecified number of scientists of recognised standing and expertise in the field of water and all other related areas of science. During 2025, ICRA strengthened its Scientific Advisory Board (SAB) with two new members: Núria Catalán (CEAB - CSIC) and Maite Martínez Eixarch (IRTA). With these additions, the SAB is made up of 10 members, reinforcing the scientific expertise and interdisciplinary outlook that support ICRA's research strategy and institutional development.

MEMBER	POSITION
Paola Verlicchi Chair	Associate Professor of Environmental and Sanitary Engineering, Department of Engineering, University of Ferrara (Italy)
Peter Vanrolleghem	Research Chair in Water Quality Modelling, Université Laval (Canada)
Susan Richardson	Professor of Chemistry, University of South Carolina (United States)
Celia Manaia	Associate Professor, School of Biotechnology, Catholic University of Portugal (Portugal)
Lars Hein	Professor of Ecosystem Services and Environmental Change and Deputy Head of the Environmental Systems Analysis Group, Wageningen University (Netherlands)
Paul Westerhoff	Regents Professor and Fulton Chair of Environmental Engineering, Arizona State University (United States)
Christoph Ort	Head of the Urban Water Management Department, Eawag, Swiss Federal Institute of Aquatic Science and Technology (Dübendorf, Switzerland)
Katie Meehan	Professor of Environment and Society, Department of Geography, King's College London (United Kingdom)
Núria Catalán	Scientific Researcher, Centre for Advanced Studies of Blanes CEAB-CSIC (Spain)
Maite Martínez	Scientific Researcher, Inland Waters Department, IRTA (Spain)



Business and Social Committee

The Business and Social Committee is the body through which the business sector takes part in the Foundation. It may be consulted by the Board of Trustees and by the Director, and may issue recommendations of an advisory nature. During 2025, ICRA launched a new phase of the Business and Social Committee with two in-person working sessions (5 and 6 May 2025) that brought together companies, public administration and researchers. Strategic challenges facing the water sector were debated and working tables were organised to connect the sector's needs with scientific capabilities and generate new opportunities for collaboration and innovation.

MEMBER	POSITION
Alejandra Puig Infante Chair	Deputy Director General for Hydrological Planning, Directorate General for Water (Ministry for the Ecological Transition and the Demographic Challenge)
Xavier Amores Vice-Chair	Director of the Catalan Water Partnership - CWP
Albert Testart	Manager, Cicle de l'Aigua del Ter S.A. (CATSA)
Albert Solà	Manager, Consorci Besòs Tordera
Belen Benito	Operations Director, Canal Isabel II
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Fernando Valero	Head of R&D&I, Aigües Ter – Llobregat – ATL
Jorge Molinero	Managing Director of Amphos21
Ana Jiménez	Head of Innovation Management, ACCIONA
Guillermo Berlanga	Head of the R&D and Continuous Improvement Department / Innovation Manager, Grup Gimeno
Marián Serrano	Innovation Director, Global Omnium
Miriam Pardos	Water Commissioner, Confederación Hidrográfica del Ebro (CHE)
Frank Rogalla	Director of Innovation and Technology, AQUALIA
Antoni Munné	Head of the Environmental Management Area, Catalan Water Agency - ACA
Josep M. Sangrà	Head of the Tax Assessment Department, Catalan Water Agency - ACA
Clara Muñoz	Segment Leader Coordinator (ACO Ibérica)
Lluís Sala	Head of Water Supply and Reclamation Services and acting Manager of CACBGI
Marina Arnaldos	Director, CETAQUA - VEOLIA ESPAÑA
Maria Josep de Ribot	Head of the Technical Office, General Secretariat, Department of Agriculture, Livestock, Fisheries and Food (Government of Catalonia)

04

Research lines

This section brings together the main achievements of ICRA's research lines, organised into five knowledge areas: environment, contamination, treatment, water and health, and governance.

L1.
Hydrological processes and water resources

ENVIRONMENT

L2.
Functioning and biogeochemistry of aquatic ecosystems

ENVIRONMENT

L3.
Biodiversity of aquatic ecosystems

ENVIRONMENT

L4.
Contaminants in the aquatic environment

CONTAMINATION

L5.
Contaminants in water treatment

CONTAMINATION

L6.
Microbial diversity and water quality

CONTAMINATION

L7.
Ecology of the aquatic resistome in natural and urban waters

CONTAMINATION

L8.
Nature-based solutions

TREATMENT

L9.
Conventional and alternative water supply

TREATMENT

L10.
Transport, treatment and management of wastewater

TREATMENT

L11.
Next-generation technologies for water treatment and resource recovery

TREATMENT

L12.
Modelling, evaluation and decision support for the sustainability and resilience of the urban water cycle

WATER AND HEALTH

L13.
Contaminants: a One Health approach - New line

WATER AND HEALTH

L14.
Sewer networks for the observation of human and environmental health

WATER AND HEALTH

L15.
Water-related ecosystem services

GOVERNANCE

L16.
Impact and mitigation of extreme droughts - New line

GOVERNANCE

L1.

Hydrological processes and water resources

The availability and quality of water resources are increasingly shaped by climate change, recurrent drought episodes and pollution pressures associated with agricultural and urban activity. In this context, L1 carries out interdisciplinary research that combines hydrogeological analysis, field monitoring and the application of advanced analytical techniques to explore these challenges in depth, improve understanding of hydrological processes and of contaminant transport and transformation mechanisms, and generate scientific evidence, data and analytical tools that support decision-making and the sustainable management of water resources.

LINE COORDINATOR: Prof. Josep Mas-Pla

CONTRIBUTORS: Dr. Warren Meredith, Dr. Gabriela Córdoba-Ariza, Dr. Rafaa Trigui and Mr. Federico Franco



Main achievements in 2025

PROJECTS

01. Research on the presence of emerging contaminants, particularly pharmaceuticals and antibiotics, in different hydrogeological settings in Catalonia and in the Mar Menor area (projects REMÉDIATE - TED2021 - 131005B - C33 and EC - FATE - PID2022 - 139911OB - C42), focusing on the reactive processes of these contaminants in the subsurface and their potential risk to human and environmental health.

02. Research on the relationship between groundwater resource availability and droughts, based on standardised indices, to determine the resilience of aquifers to a lack of rainfall (**TREASURE project** - PCI2024 - 153494), with the aim of understanding the role of groundwater as an alternative resource during periods of water scarcity.

03. Study on the determination and control of emerging contaminants in groundwater. “Analysis of emerging contaminants in groundwater in Catalonia, 2022 - 2024”, funded by the ACA (CTN2200303; PI: M. Gros, M. Petrovic), presenting for the first time results on pharmaceuticals and PFAS at Catalan level, interpreted in the appropriate hydrogeological context.

04. Study on mitigating diffuse nitrate pollution of agricultural origin through the recovery of ecological functions, funded by the ACA (CTN 2400669), with a subcontract for the joint venture of ENEO3 Andrena and MN Consultors, with the aim of establishing criteria to identify areas with denitrifying potential based on fieldwork and the interpretation of hydrogeological, hydrochemical and isotopic data.

PUBLICATIONS

Córdoba Ariza, G. (2025). Scale - Dependent Patterns of Hydrological, Chemical, and Ecological Descriptors in an Intensively Managed Mediterranean River. Doctoral thesis, University of Girona. Supervised by J. Mas-Pla (ICRA - UdG), S. Sabater (ICRA-UdG) and R.L. Batalla (UdL-ICRA).

Córdoba - Ariza, G., Muñoz - Mas, R., Batalla, R.J., Mas - Pla, J. Sabater, S. (2025b). Patterns of nutrients and algal biomass in an intermittent Mediterranean river under intense human activity. Ecological Indicators , 173: 113409. DOI: 10.1016/j.ecolind.2025.113409

Córdoba - Ariza, G., Batalla, R., Gutiérrez, C., Sabater, S., Mas - Pla, J. (2025c). Streamflow Generation Processes and Stream Intermittency in a Mediterranean Basin: Insights from End-Member Mixing Analysis. Hydrological Processes . DOI: 10.1002/hyp.70164.

L2.

Functioning and biogeochemistry of aquatic ecosystems

Freshwater ecosystems are among the most threatened on the planet, owing to the combined impact of climate change and multiple human pressures such as reduced flow and water pollution. These factors alter key processes, including organic matter processing and nutrient dynamics, and affect the biodiversity of rivers and streams. L2 addresses these challenges by combining experimental laboratory studies with fieldwork in river ecosystems to analyse how these pressures affect ecosystem structure and functioning, and to generate scientific knowledge that is useful for their management, restoration and conservation.

LINE COORDINATOR: Dr. Anna Freixa

CONTRIBUTORS: Dr. Sergi Sabater, Dr. Josep Pueyo - Ros, Dr. Vicenç Acuña, Dr. Xavier Garcia-Acosta, Ms. Neus Besolí, Mr. Javier Ortiz, Ms. Victoria Dàvila (intern), Ms. Blanca Tabarner (research project student)



Main achievements in 2025

PROJECTS

01. Completion of the **technical assistance project** for the Catalan Water Agency (ACA): Study on the extent of recreational activities in rivers and reservoirs in Catalonia's internal basins and their potential impacts on river ecosystems. The project made it possible to identify pressures associated with uses such as swimming and canyoning in the aquatic ecosystems of Catalonia's internal basins. Licitacio_ACA_CTN2400442.

02. Completion of the **CityPoll research project**: Through laboratory experiments and field studies, the project analysed the effects of contaminants from urban runoff on river biofilm communities, assessing changes in biodiversity, ecosystem functioning and ecological status. TED2021_CityPoll.

03. Launch of the **BIOVERA project**: A project aimed at encouraging citizen participation in the collection of environmental data to improve understanding of the ecosystem services associated with green infrastructure, combining citizen science platforms and awareness-raising activities. FundBiodiv2024_BIOVERA.

ACTIVITIES AND CONFERENCES

- Science outreach and environmental education activities: Participation in initiatives such as the FCRI #Científiques programme and the AUMENTA project (FECYT FCT-23-19570), with activities on the climate emergency and water carried out in primary and secondary schools.
- Invited lecture at the Recreation Ecology Symposium (REC, December 2025): Oral presentation by researcher Anna Freixa on the impacts of canyoning and swimming on river ecosystems and possible management measures.

PUBLICATIONS

- Besolí-Mestres, N., Freixa, A., Cojoc, L., Cadena - Aizaga, M. I., Petrovic, M., & Sabater, S. (2025). Impacts of urban runoff pollutants on biofilm communities. Environmental Chemistry and Ecotoxicology.
- Sepp, M., Abbasi, M., Döll, P., Freixa, A., Marcé, R., & Sabater, S. (2025). Impacts of climate change on the dilution capacity of perennial and non-perennial European rivers. Water Research, 124499.

L3.

Biodiversity of aquatic ecosystems

The effects of climate and global change on the biodiversity and functioning of aquatic ecosystems, and river systems in particular, have direct implications for their conservation and for water security. L3 addresses these challenges by combining experimental and field studies with predictive tools to understand the effects of multiple stressors, such as flow intermittency, rising temperatures, excess nutrients and the presence of contaminants, on biological communities. This approach makes it possible to identify drivers of change and to develop models and risk analyses that anticipate the impacts of global change and contribute to the management and conservation of aquatic systems.

LINE COORDINATOR: Sergi Sabater

CONTRIBUTORS: Dr. Anna Freixa, Ms. Neus Besolí, Mr. Javier Ortiz, Dr. Paula Gabriela Córdoba, Ms. Ariadna Gabarda, Mr. Àlex Gou, Prof. Josep Mas-Pla, Prof. Mira Petrovic, Dr. Josep Pueyo, Prof. Joaquim Comas, Dr. Oriol Gutiérrez



Main achievements in 2025

PROJECTS

01. As part of the **CityPoll project** we have produced an 11-minute documentary for the general public on the potential impact of urban runoff. The documentary won the MasOrange Sustainability award.

02. **The CityPoll project** has put forward a set of management recommendations (https://citypoll.eu/download-category/congress-presentations/). These include the need to implement integrated urban wastewater management plans, prioritise nature-based solutions and improve the monitoring of emerging contaminants, as well as to ensure tertiary and quaternary treatment in sensitive areas in order to protect aquatic ecosystems.

03. The **RIVHS project** (Hydrosedimentary Disequilibrium, Biophysical Responses, and Recovery Potential in Mediterranean Rivers), coordinated by ICRA with the University of Lleida and the University of Barcelona as partners, will study the impacts of anomalous hydrosedimentary dynamics on biological communities and the functioning of river systems.

04. The **RIVSTRESS project** has defined the effect of some of the most frequent stressors in Mediterranean watercourses through a combination of field and laboratory approaches, forming the basis of Javier Ortiz's doctoral thesis.

PUBLICATIONS

A first output of the **H2OSEG project** is the publication of the article "Water scarcity challenges water security: a case for Spain's freshwater ecosystems" in Environmental Research Letters 20 (2025) 091008. The article underlines that the overexploitation of water resources is causing severe impacts on aquatic ecosystems, some of which are on the verge of collapse.

One of the final outputs of the **Dryver project** has been the publication in Water Research of the article "Impacts of climate change on the dilution capacity of perennial and non-perennial European rivers", by Sepp et al. (https://doi.org/10.1016/j.watres.2025.124499).

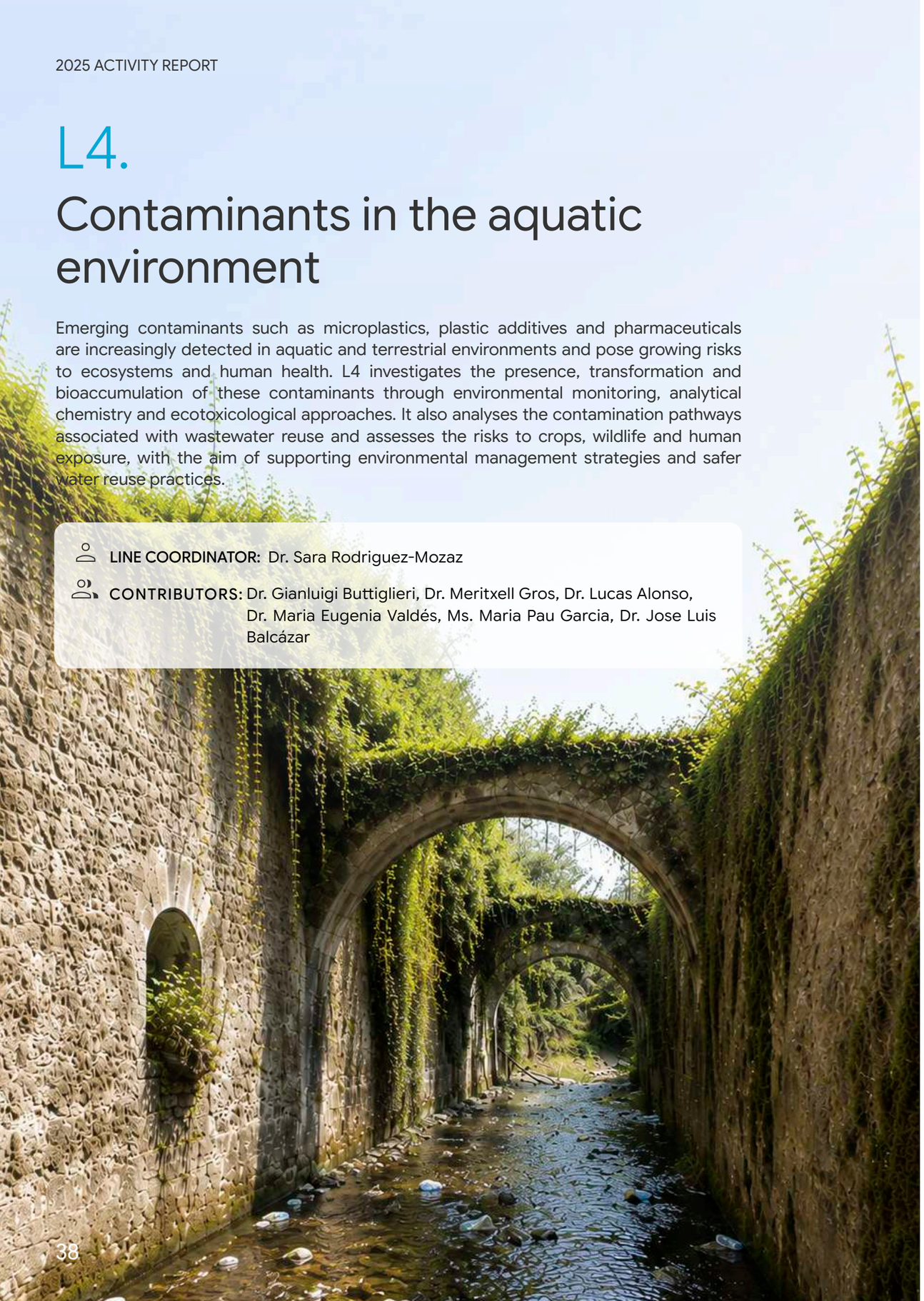
L4.

Contaminants in the aquatic environment

Emerging contaminants such as microplastics, plastic additives and pharmaceuticals are increasingly detected in aquatic and terrestrial environments and pose growing risks to ecosystems and human health. L4 investigates the presence, transformation and bioaccumulation of these contaminants through environmental monitoring, analytical chemistry and ecotoxicological approaches. It also analyses the contamination pathways associated with wastewater reuse and assesses the risks to crops, wildlife and human exposure, with the aim of supporting environmental management strategies and safer water reuse practices.

LINE COORDINATOR: Dr. Sara Rodriguez-Mozaz

CONTRIBUTORS: Dr. Gianluigi Buttiglieri, Dr. Meritxell Gros, Dr. Lucas Alonso, Dr. Maria Eugenia Valdés, Ms. Maria Pau Garcia, Dr. Jose Luis Balcázar



Main achievements in 2025

PUBLICATIONS

01. Sustainable solutions for water treatment: Demonstration of the effectiveness of nature-based wastewater treatment systems and non-conventional technologies in removing pharmaceuticals and other emerging contaminants, contributing to safer water reuse in water-scarce regions and to more sustainable management of water resources. DOI: https://doi.org/10.1039/D4EW01085J https://doi.org/10.1016/j.jhazmat.2025.139310

02. Risks of chemical pollution in aquatic ecosystems: Identification of the presence, persistence and ecological risks of pesticides and tyre-derived compounds in aquatic environments, revealing long-term sources of pollution and their implications for ecosystem health and restoration strategies. DOI: https://doi.org/10.1007/s11356-024-35778-2 ; https://doi.org/10.3390/environments12100356

03. Impacts of contaminants on terrestrial ecosystems: showing how irrigation with wastewater and antibiotic pollution affect soil–plant interactions, plant metabolism and crop development, improving understanding of contaminant transfer in agroecosystems. DOI: https://doi.org/10.1016/j.greeac.2024.100203 ; https://doi.org/10.1007/s00244-024-01104-7

04. Assessment of food safety risks and human exposure: Key insights have been gained into the uptake of pharmaceuticals by edible plants and the possible risks associated with contaminated soils, helping to improve risk assessment and to promote safer agricultural practices. DOI: https://doi.org/10.1007/s10311-025-01878-9

ACTIVITIES AND CONFERENCES

Participation in the **ICCE conference** in Belgrade (June 2025), where three members of the group presented two oral communications and a poster on the ReuseMP3 and Phageland projects.

Sara Rodriguez - Mozaz and M. Eugenia Valdés took part in the **EU-JAMRAI 2 workshop** on the environmental dimension of antimicrobial resistance, held in Madrid (13–15 October). The event brought together 50 experts from 15 countries to align approaches and priorities for action on antimicrobial resistance.

Defence of the **doctoral thesis** of Marc Castaño (19/09/2025), entitled Pharmaceuticals in water reclamation: prioritisation and monitoring for sustainable irrigation practices in Mediterranean regions http://hdl.handle.net/10803/695764 , supervised by Sara Rodriguez-Mozaz and Gianluigi Buttiglieri.

L5.

Contaminants in water treatment

The presence of emerging contaminants in the urban water cycle, including wastewater, groundwater and greywater, poses a growing challenge for the sustainable management of water resources. L5 addresses this challenge by developing and applying advanced analytical methodologies, based mainly on LC-MS/MS and LC-HRMS, for the detection, identification and quantification of emerging contaminants in different environmental matrices. These studies are combined with assessments of treatment system performance and risk assessments in order to guide water management strategies, including the safe reuse of wastewater and the protection of groundwater.

LINE COORDINATOR: Prof. Mira Petrovic

CONTRIBUTORS: Dr. Meritxell Gros, Dr. Mira Celic



Main achievements in 2025

PROJECTS

01. First large-scale monitoring campaign within the **European ProCleanLakes project**: A campaign to assess the state of pollution in six European lakes (Greece, Romania, Norway, Croatia, Czech Republic), generating baseline data on urban, agricultural and industrial emerging contaminants. ProCleanLakes aims to study the combined impact of disruptive factors on lake ecosystems and to facilitate the assessment of unregulated emerging contaminants and nutrient enrichment.

02. Completion of the Catalan Water Agency (ACA) contract on emerging contaminants in groundwater: Determination and control of priority, preferential and emerging substances in surface water and groundwater in Catalonia (2022 - 2024). Results presented at a workshop and final report delivered: Determina

03. Award of the contract with the Junta Central d'Usuaris d'Aigua del Baix Ter: A study to assess the potential for reusing treated wastewater from several WWTPs for agricultural irrigation, urban uses, the natural environment and aquifer recharge, with analysis of emerging contaminants and assessment of their removal. It includes technical advice with risk assessment to guide decisions on treatment options, costs and environmental impact, with the aim of developing a future water reuse master plan.

04. Launch of the **Iron - SEWER project (AEI)** : The project studies how iron dosing can influence the dynamics of microcontaminants and the reliability of the biomarkers used in wastewater-based epidemiology (WBE) studies, an emerging field with great potential for environmental and public health surveillance. As part of the project, a comprehensive study of emerging contaminants was carried out in the sewer network of Roses, on the Costa Brava, generating baseline data on the presence and behaviour of these compounds in real urban systems.

PUBLICATIONS

E. García-Gómez, R. Gil-Solsona, E. Mikkolainen, M. Hytti, E. Ytreberg, P. Gago-Ferrero, M. Petrović, M. Gros. Identification of emerging contaminants in greywater emitted from ships by a comprehensive LC - HRMS target and suspect screening approach. Environmental Pollution, 366, 125524 (2025).

Cadena-Aizaga, M.I., García-Gómez, E., Gago-Ferrero, P., Sabater, S., Petrovic, M., Comprehensive characterization of microcontaminants in urban runoff: Unveiling chemical signatures using wide - scope target screening by LC - HRMS, Environmental Chemistry and Ecotoxicology, 7, 2025, 2133–2141.

L6.

Microbial diversity and water quality

The presence and activity of microorganisms affect water quality and can compromise water security, particularly in the case of pathogens, including antibiotic-resistant phenotypes, and of certain microbial groups that produce metabolic intermediates or toxins. L6 applies culture-based techniques and cutting-edge molecular techniques to characterise microbial communities in urban and natural systems, with the aim of identifying the potential risks associated with the use of water as a resource, under the One Health approach that brings together human, animal and environmental health.

LINE COORDINATOR: Prof. Carles Borrego

CONTRIBUTORS: Dr. José Luís Balcázar, Dr. Alexandre Sánchez, Dr. Eugenia Valdés, Dr. Sara Rodríguez-Mozaz, Dr. Eugenia Valdés, Dr. Lluís Corominas, Dr. Mireia Fillol, Dr. Meritxell Gros, Dr. Marie Rescan, Ms. Anna Pico Tomàs, Ms. Pamela Jael Colman



Main achievements in 2025

IMPACT

Participation in the Eionet working group carrying out the “Pilot study on the monitoring of antimicrobial resistance in European surface waters” (European Environment Information and Observation Network – Eionet and European Environment Agency – EEA). https://www.eea.europa.eu/en/analysis/publications/antimicrobial-resistance-in-european-surface-waters-a-developing-area

ACTIVITIES AND CONFERENCES

Invited talk at the JPIAMR final conference presenting the results of the PhageLand project. C.M. Borrego on behalf of the consortium. Stockholm, 7 - 8 May 2025.

KNOWLEDGE TRANSFER AND INNOVATION

Award of a public tender on the “Surveillance of antibiotic resistance indicators in wastewater in Catalonia”, within the Xarxa Catalana de Vigilància d’Indicadors de Salut en Aigües Residuals.

Co-inventors of patent T811/CTTW/2025 (Polish Patent Office – UPRP, 11/10/2025), application no. P.453472 (“Passive system for the treatment of municipal wastewater and associated method”). Authors: Wołącewicz M., Ł. Dziewit, M. Iwan, M. Stanowski, C.M. Borrego, S. Rodríguez Mozaz, M.E. Valdés.

PUBLICATIONS

Publication of an article describing how interactions between antibiotics, temperature and salinity affect the dynamics of wastewater bacteria and their tolerance to macrolides: Rescan , M., M. Gros and C.M. Borrego (2025) Multidimensional tolerance landscapes reveal antibiotic - environment interactions affecting population dynamics of wastewater bacteria. Water Research 282: 123720. https://doi.org/10.1016/j.watres.2025.123720

Study on differences in the composition of microbial communities and the resistome across age groups through wastewater sampling at local scale, providing evidence to strengthen AMR surveillance and intervention strategies in urban settings: Pico, A., A. Sanchís, C. Mejías - Molina, M. Comas - Cufí, J.L. Balcázar, S. Bofill - Mas, H. Torrell, N. Canela, C.M. Borrego and L. Corominas (2025) Tracking Age - Linked Antibiotic Resistance Patterns through Building - Level Wastewater Analysis. ACS ES&T Water 5 : 7141–7151 https://doi.org/10.1021/acsestwater.5c00349

L7.

Ecology of the aquatic resistome in natural and urban waters

Antimicrobial resistance (AMR) is a growing global challenge for environmental and public health, in which aquatic ecosystems play a key role in its spread. L7 investigates the factors that influence AMR in aquatic environments by integrating genomics, metagenomics, bioinformatics and wastewater-based surveillance. These approaches make it possible to characterise the aquatic resistome and to generate data for understanding exposure to contaminants and resistant microorganisms, supporting evidence-based strategies for public health and environmental management within the One Health framework.

LINE COORDINATOR: Dr. José Luis Balcázar

CONTRIBUTORS: Ms. Pamela Jael Colman Vega, Dr. Carlos Omar Lomeli Ortega, Dr. Zhi Mei, Prof. Carles Borrego, Dr. Lluís Corominas Tabares, Ms. Anna Pico Tomàs



Main achievements in 2025

PROJECTS

01. Implementation of the **EXPOWASTE project**: The EXPOWASTE project, funded by the AEI, combines human biomonitoring and wastewater-based surveillance to assess the population's exposure to chemical contaminants and antimicrobial resistance determinants.

PUBLICATIONS

- Perspective article on AMR surveillance in wastewater: an article in mBio on the role of wastewater-based surveillance in strengthening the monitoring of antimicrobial resistance within the One Health framework. https://doi.org/10.1128/mbio.02778-25

- Phage-mediated gene transfer in Salmonella: Co-authorship of an article in iMeta on phage-mediated horizontal transfer of virulence genes in Salmonella enterica and its implications for pathogen evolution and transmission. https://doi.org/10.1002/imt2.70042

- STREAMS guidelines for microbiome research: Co-authorship of a consensus article in Nature Microbiology presenting the STREAMS guidelines for the standardised reporting of environmental and host-associated microbiome studies.
https://doi.org/10.1038/s41564-025-02186-2

ACTIVITIES AND CONFERENCES

- Scientific dissemination at international congresses of results on environmental antimicrobial resistance and wastewater-based epidemiology at the 1st ISME Asia Forum (China) and in invited seminars at several Chinese universities.

AWARDS

- **John Snow Public Health Innovation Prize**: Recognition with AMI's John Snow Public Health Innovation Prize for contributions to research on antimicrobial resistance and its implications for environmental public health.
https://appliedmicrobiology.org/advocacy-policy/horizon-awards/horizon-award-winners-2025.html

L8.

Nature-based solutions

Water scarcity, pollution and climate change are increasing the pressure on water resources, particularly in the Mediterranean region, and call for safe and efficient solutions for reusing water. L8 promotes nature-based solutions (NBS) for circular and resilient water management, investigating treatment wetlands, hydroponic channels and green walls for the decentralised treatment of greywater and its safe reuse. This approach provides evidence on the performance and safety of these technologies and supports their implementation in Mediterranean and water-scarce regions.

LINE COORDINATOR: Dr. Gianluigi Buttiglieri

CONTRIBUTORS: Prof. Joaquim Comas, Dr. Sara Rodriguez-Mozaz, Dr. Meritxell Gros, Dr. Josep Pueyo, Dr. Esther Mendoza, Dr. Lucas Alonso, Dr. Sofia Semitsoglou-Tsiapou, Dr. Henry Beral, Dr. Josephine Vosse, Ms. Maria Pau Garcia Moll, Dr. Marc Castaño-Trias, Mr. Èric Herran, Mr. Massimiliano Riva



Main achievements in 2025

PROJECTS

01. Implementation of an **experimental green wall facility at ICRA**: Completion and commissioning of a pilot-scale NBS system for greywater treatment within the MULTISOURCE, ReUseMP3, NEWater and GGsolutions projects, enabling controlled performance studies and risk assessment.

02. Progress on a **hydroponic laboratory platform**: a new hydroponic system to investigate contaminant fate, plant uptake and transformation mechanisms under reproducible experimental conditions.

03. Strategic participation in **European and Mediterranean projects**. Active participation in NEWater (Water4All), SAFE (PRIMA) and AquaLoops4Med (Interreg i3), reinforcing ICRA's leadership in the innovative implementation of NBS and in evidence-based safe reuse practices in Mediterranean agriculture.

ACTIVITIES AND CONFERENCES

- Doctoral thesis defence by Marc Castaño-Trias (2025): This thesis provides a comprehensive assessment of pharmaceutical pollution in Mediterranean water systems and shows how NBS can contribute to safe wastewater treatment and sustainable water reuse.

- Dissemination and public outreach. ICRA hosted the NEWater project workshop (September 2025), along with outreach activities (NBS flash seminar, secondary school work placements at ICRA and school visits) to communicate the role of NBS in sustainable water management.

IMPACT

- International collaboration and capacity building: Stronger collaboration with Politecnico di Milano, Aegean University, Agricultural University of Athens and Aachen University, and training of visiting and Erasmus students, with knowledge exchange on plant growth, contaminant uptake and NBS-related activities.

PUBLICATIONS

- Publications advancing understanding of contaminant dynamics in water reuse systems, assessing innovative treatment technologies (https://doi.org/10.1016/j.seppur.2025.134347), the removal of pharmaceuticals in NBS, and the uptake and metabolic responses of plants exposed to contaminated irrigation water. https://doi.org/10.1016/j.jes.2025.02.00 ; https://doi.org/10.1016/j.greeac.2024.100203 ; https://doi.org/10.1007/s10311-025-01878-9).

L9.

Conventional and alternative water supply

Guaranteeing access to clean and safe water is a growing challenge in a context of climate change, water scarcity and declining water quality. The presence of emerging contaminants and disinfection by-products affects ecosystems and human health and calls for innovative treatment technologies. L9 develops and applies advanced treatment processes, such as chemical oxidation and reduction and membrane separation technologies, combining experimental studies with modelling tools to improve water reuse, support more proactive management of water resources and strengthen water resilience.

LINE COORDINATOR: Prof. Wolfgang Gernjak

CONTRIBUTORS: Dr. Nikolaus Klamerth, Prof. Mira Petrovic, Dr. Sofia Semitsoglou Tsiapou, Ms. Saida Marti García, Mr. Francisco Antonio Zafra, Ms. Atefeh Tizchang, Ms. Ángela Pedregal, Mr. Tomas Lock, Mr. Luca Sbardella, Dr. Nikoletta Tsiarta, Dr. Yicheng Wang



Main achievements in 2025

PROJECTS

01. Presentation of results at international congresses: The **RECREATE project** presented its results at events such as the 12th International Conference on Urban Climate (ICUC12), showcasing frameworks for resilient water management based on alternative resources.

02. Implementation of a pilot water treatment system: The **AIGUANEIX project** implemented and operated a pilot system at the Roses WWTP to produce high-quality reclaimed water for aquifer recharge and to improve drought resilience on the Costa Brava.

03. Completion of a pilot for industrial wastewater recovery: The **iWAYS project** successfully completed a system at Tubacex combining dissolved air flotation (DAF) and membrane distillation (MD) to recover water from industrial effluents.

04. Implementation of monitoring systems in drinking water networks: The **intoDBP project** deployed UV-Vis and fluorescence sensors in the Limassol network to monitor and predict the formation of disinfection by-products under real conditions.

05. Development of the DECIDEIX tool for potable reuse: The project extended the SUGGEREIX tool by adding new contaminants, treatment options and interface improvements to support decision-making on direct potable reuse.

ACTIVITIES AND CONFERENCES

Doctoral thesis defence and international recognition: Nikoletta Tsiarta defended her thesis on hybrid ozone–membrane processes for micropollutant removal, awarded the Gold Medal at INOVA 2025 (Zagreb).

L10.

Transport, treatment and management of wastewater

Improving the management of sewer systems and optimising treatment at wastewater treatment plants are two key challenges for urban wastewater systems. L10 develops scientific knowledge and innovative technologies to understand the physico-chemical and biological processes that take place during wastewater transport, reduce odour emissions and understand the behaviour of emerging contaminants. In parallel, it drives biotechnological processes to turn waste water and gas streams into high value-added bioproducts and to help transform treatment plants into urban biorefineries within a circular economy model.

LINE COORDINATOR: Dr. Maite Pijuan

CONTRIBUTORS: Dr. Oriol Gutierrez, Mr. David Primo, Ms. Milagros Peña, Mr. Massimiliano Riva, Dr. Oriol Casavella



Main achievements in 2025

PROJECTS

01. Launch of the **VALORBIO project**: The VALORBIO project began in December 2025, funded by the Water4All Joint Call 2024, with a budget of €1.3M and coordinated by M. Pijuan. The project brings together six research groups from five European countries to develop a circular platform that turns wastewater from the agri-food sector into biodegradable bioplastics for food packaging.

02. Completion of the **CH4BIOPOL project** which launched research into the transformation of methane into high value-added products in 2023. The project, awarded under the “Proyectos Estratégicos Orientados a la Transición Ecológica y a la Transformación Digital” call, marked a paradigm shift by introducing waste gas streams as a raw material for producing high-value products such as biopolymers. Although this line of research began in 2023, the results have been published in 2 scientific articles (https://doi.org/10.1016/j.jece.2026.121526 ; https://doi.org/10.1128/mra.00952-24) and presented at the 7th IWA International Congress on Ecotechnologies for Wastewater Treatment.

03. Completion of the **4SM project**: The 4SM project, Spread Sewer Sensing for Sustainable Management, has been successfully completed and marks a decisive step forward in the digital and sustainable transformation of urban sanitation networks. Within 4SM, a set of innovative technologies has been developed to monitor, manage and optimise sanitation systems through data-driven solutions, renewable energy and advanced sensor technology. The project was funded under the PLEC2021 programme and delivered by a consortium of ICRA, FACSA and EURECAT.

EDITORIAL ROLES

- Notable editorial roles: M. Pijuan has been appointed editor-in-chief of Water Science and Technology, a leading IWA journal. She also continues to serve as executive editor of Water Research, one of the most prestigious scientific journals in the field of water research.

ACTIVITIES AND CONFERENCES

- Participation in expert committees: Participation as a member of the expert committee of the Observatori per la Transició Hídrica of the Barcelona Chamber of Commerce, an initiative bringing together specialists from academia, institutions and business to analyse the challenges of water management and promote strategies and recommendations for a more resilient and sustainable water management model in Catalonia.

- International mobility: From February to June, two researchers from the line carried out a research stay at the Australian Centre for Water and Environmental Biotechnology (ACWEB) at the University of Queensland (Australia), supported by the researcher mobility programme of the Ministry of Science, Innovation and Universities. This stay has strengthened the existing collaboration between ICRA and ACWEB and has opened up new opportunities for future joint projects.

L11.

Next-generation technologies for water treatment and resource recovery

Per- and polyfluoroalkyl substances (PFAS), known as “forever chemicals”, are one of the main challenges facing the water sector because of their high persistence in the environment. At the same time, recovering critical raw materials such as lithium (Li), cobalt (Co) and nickel (Ni) is essential for the energy transition. L11 develops new electrochemical systems for water and wastewater treatment and for resource recovery. Graphene-based electrochemical systems are used to drive the degradation of PFAS and other organic contaminants, while new nanostructured monolithic electrodes make it possible to extract critical raw materials electrochemically from complex waste streams.

LINE COORDINATOR: Prof. Jelena Radjenovic

CONTRIBUTORS: Dr. Nick Duinslaeger, Dr. Elisabeth Cuervo Lumbaque, Dr. Chosel Lawagon, Dr. Tom Ducrocq, Dr. S. Nova, Ms. Anastasya Kravtchenko, Ms. Anna Segues Codina, Dr. Natalia Ormeño Cano, Mr. Johan Andres Pasos, Ms. Lidiya Yudina, Mr. Aditya Anand, Mr. Filip Zivkovic, Dr. Oriol Casabella Font



Main achievements in 2025

PROJECTS

01. Launch of the **GENESIS project** (HORIZON-JU-Chips): The GENESIS project (Generate in Europe a Sustainable Industry for Semiconductor) began in May 2025 and runs until April 2028, with a budget of more than €46M. Coordinated by CEA Leti (France), the ICRA team leads the small-scale trials of the electrochemical treatment of PFAS-containing waste streams from the semiconductor sector.

02. Launch of the **FOREVER WATER project** (EIC Transition Grant): The project began in September 2025 with a budget of €2.5M, coordinated by ICRA (J. Radjenovic), with the participation of Fraunhofer IKTS, CEA Leti and Amphos 21. The project will validate the electrochemical destruction of PFAS with graphene up to TRL 6 and drive its commercialisation through the spin-off GRAPHEC.

PUBLICATIONS

- Publication on the biotransformation of carbamazepine: Publication of an article in Environmental Pollution on the anaerobic biotransformation of carbamazepine catalysed by graphene oxide: Casabella-Font, O. et al. (2025) Anaerobic biotransformation of carbamazepine during graphene oxide biological reduction. Environmental Pollution, 379, 126538.

- Publications on graphene-based electrochemical treatment: Publication of two articles in Water Research and Chemical Engineering Journal on the irreversible inactivation of multidrug-resistant bacteria and the removal of emerging contaminants using graphene-based electrochemical systems.

ACTIVITIES AND CONFERENCES

- Participation in the European Commission panel on water resilience: on 12 November 2025, Jelena Radjenovic took part as an invited expert in the event “From Science to Policy: Shaping a Sustainable and Competitive Europe”, organised by STOA and the ERC in Brussels.

DOCTORAL THESES

- Doctoral thesis defence by Natalia Ormeño Cano: On 28 October 2025, Natalia Ormeño Cano defended her thesis on the electrochemical removal of antibiotics and multidrug-resistant bacteria using graphene electrodes, obtaining the grade of cum laude from the University of Girona.

L12.

Modelling, evaluation and decision support for the sustainability and resilience of the urban water cycle

Urban water systems are under growing pressure from climate change, urbanisation, water scarcity and the presence of emerging contaminants. Meeting these challenges requires integrated approaches that consider the whole urban water cycle, together with advanced modelling tools and decision support systems. L12 develops modelling tools, digital platforms and decision support systems that combine systems modelling, environmental assessment and digital technologies to optimise wastewater and stormwater systems, evaluate scenarios and environmental impacts, and contribute to more resilient, sustainable and efficient water management.

LINE COORDINATOR: Prof. Joaquim Comas

CONTRIBUTORS: Dr. Gianluigi Buttiglieri, Dr. Lluís Corominas, Dr. Henry Beral, Dr. Anna Freixa, Dr. Oriol Gutiérrez, Mr. Èric Herrán, Mr. Oliu Llorente, Dr. Esther Mendoza, Dr. Josep Pueyo, Mr. Massimiliano Riva, Dr. Sara Rodríguez-Mozaz, Ms. Josephine Vosse



Main achievements in 2025

PROJECTS

01. Launch of the **AWARE and OPRA projects** on the life cycle assessment of nature-based solutions and the biodiversity impacts of combined sewer overflows: AWARE began assessing the environmental performance of nature-based water treatment solutions, while OPRA was launched to develop an integrated urban water model to evaluate the ecological impacts of combined sewer overflows.

DIGITAL TOOLS AND DECISION SUPPORT SYSTEMS

- Launch of the Nat4Wat platform within the MULTISOURCE project: ICRA led the development and launch of Nat4Wat, an open-source decision support platform for water treatment and stormwater management, in close collaboration with L08.
- Development of modelling and decision support tools for conventional contaminants and micropollutants: New modelling approaches and decision support tools were developed for the transport and removal of micropollutants in urban water systems within the ReUseMP3, GGSolutions and NePMTune projects, and work began on the H2OSEG decision support system.
- The DECIDEIX project was launched to extend the SUGGEREIX decision support system, helping municipalities identify and prioritise water reuse opportunities. Within the RECREATE HEU project, the system will be extended to allow its application at European scale and interoperability with other digital tools. Tools were also developed for the design of water reuse networks, the optimal placement of sensors and early warning systems (AGUARics).
- Modelling of sustainable urban drainage systems: the Girona case study (GiroNat): Work continued on modelling Girona's urban drainage system to assess the effectiveness of sustainable urban drainage systems (SUDS) and nature-based solutions for stormwater management.

PUBLICATIONS

- Pueyo-Ros et al. (2025). Knowledge base dataset on nature-based solutions for wastewater treatment and stormwater management. Data in Brief, 60, 111469. 10.1016/j.dib.2025.111469
- Pueyo-Ros et al. (2026). Nat4Wat: a co-developed decision-support system for resilient urban water management with nature-based solutions. Environmental Modelling and Software, 196, 106797.10.1016/j.envsoft.2025.106797.

SCIENTIFIC NETWORKS

- Contribution to the IWA working group on MBR modelling and control: Participation continued in the International Water Association working group on membrane bioreactor modelling and control.

ACTIVITIES AND CONFERENCES

- Participation in the plenary session Eco-social transition in cities at REPENSEM Girona (the second Professional and Citizen Forum on Urban Transformation, 21/11/2025).
- Plenary lecture at the AI4Science conference: Joaquim Comas was a plenary speaker presenting "Integrating AI in Urban Water Management: Intelligent Decision Support Systems for the Twin Transition", 22–25 September 2025, Ljubljana, Slovenia.

L13.

Contaminants: A One Health approach (NEW LINE)

The Contaminants-One Health concept recognises that chemical contaminants connect environmental quality, ecosystem integrity and human and animal health. Within the anthroposphere, contaminants and their degradation products can spread between species and habitats, producing cumulative and often indirect effects on health. Within the One Health framework, identifying, monitoring and managing contaminants therefore requires integration across disciplines and is, by definition, interdisciplinary. This systems-based perspective prioritises prevention at source, understanding exposure pathways and reducing risks to humans, wildlife and microbiomes. Ultimately, it reframes pollution as an interconnected planetary health challenge rather than a local contamination problem.

LINE COORDINATOR: Dr. Michael Gonsior

The One Health concept is, by definition, an interdisciplinary approach that takes a holistic view of the current and future challenges facing our aquatic environments. This research line integrates Earth system science and aquatic biogeochemistry with environmental chemistry and engineering. This unusual combination is particularly powerful for better understanding the behaviour of contaminants in aquatic and urbanised environments. Processes within the anthroposphere are complex, and analytical chemistry acts as the key element in this integrative approach and in connecting disciplines. For example, the interactions between precursors in highly complex dissolved natural organic matter and their reaction with disinfectants such as free chlorine continue to pose a challenge for human and environmental health.

Multiple analytical approaches must also be combined to gain a fuller picture of the chemical world we live in and to identify the sources and fate of environmental stressors. A key aspect of tackling this complex challenge is the development of new organic tracers capable of identifying specific contamination events, processes or even ecosystem functioning.



L14.

Sewer networks for the observation of human and environmental health

Sewer networks concentrate valuable information about environmental pressures and human activity, but monitoring is carried out mainly at treatment plants, losing spatial resolution. L14 aims to turn sewer networks into intelligent observatories of urban health and environmental pressures. To do so, it develops analytical, digital and engineering methodologies to obtain and interpret data directly from sewer networks, combining modelling tools with environmental, territorial and socio-economic data. This approach makes it possible to develop indicators and decision support tools to improve environmental management and health surveillance.



LINE COORDINATOR: Dr. Lluís Corominas

CONTRIBUTORS: Prof. Carles Borrego, Dr. José Luis Balcázar, Dr. Mireia Fillol, Ms. Anna Pico, Ms. Sílvia Busquets, Ms. Pamela Colman, Dr. Josep Pueyo, Mr. Lluís Maria Bosch

Main achievements in 2025

PROJECTS

01. Scientific progress on the **EXPOWASTE project**. During 2025 the design of the sampling network and the data analysis for the EXPOWASTE project were completed. The project studies socio-economic inequalities in exposure to chemical and microbiological contaminants across different urban neighbourhoods. The first scientific article arising from the project is in the final stage of drafting.

04. Coordination of the **SARSAIGUA programme** of epidemiological surveillance in Catalonia. Under a public tender, the team has coordinated the SARSAIGUA programme for the surveillance of SARS-CoV-2 in wastewater. The network has monitored 24 treatment plants monthly, analysing genetic targets of the virus and carrying out sequencing to track variants of epidemiological interest.

SCIENTIFIC PUBLICATIONS

Publication in Nature Communications on untargeted metabolomics to study drug exposure. Participation in the article “A resource to empirically establish drug exposure records directly from untargeted metabolomics data”, published in Nature Communications, which presents a resource for identifying drug exposures from untargeted metabolomics. The ICRA team contributed by applying the method to wastewater samples. DOI: 10.1038/s41467-025-10600.

Critical review of the use of wastewater-based epidemiology to study human exposure to chemicals. Publication of the article “A critical review of wastewater-based epidemiology as a tool to evaluate the unintentional human exposure to potentially harmful chemicals”, which analyses the opportunities and limitations of WBE. DOI: 10.1007/s00216-024-05596-z.

Identification of age-related viral patterns through wastewater at building scale. The article “Wastewater-based epidemiology applied at the building-level reveals distinct virome profiles based on the age of the contributing individuals” shows that wastewater analysis can reveal differences in viral profiles according to the demographic characteristics of residents. DOI: 10.1186/s40246-024-00580-1

DOCTORAL THESES

Design of an intra-urban surveillance network for new psychoactive substances in Barcelona. Under an agreement with the Barcelona Public Health Agency and BCASA, Manuel Mazarío’s master’s thesis developed a method for sizing a sampling network to detect new psychoactive substances. The design combines sensor placement algorithms, graph theory and socio-economic data.

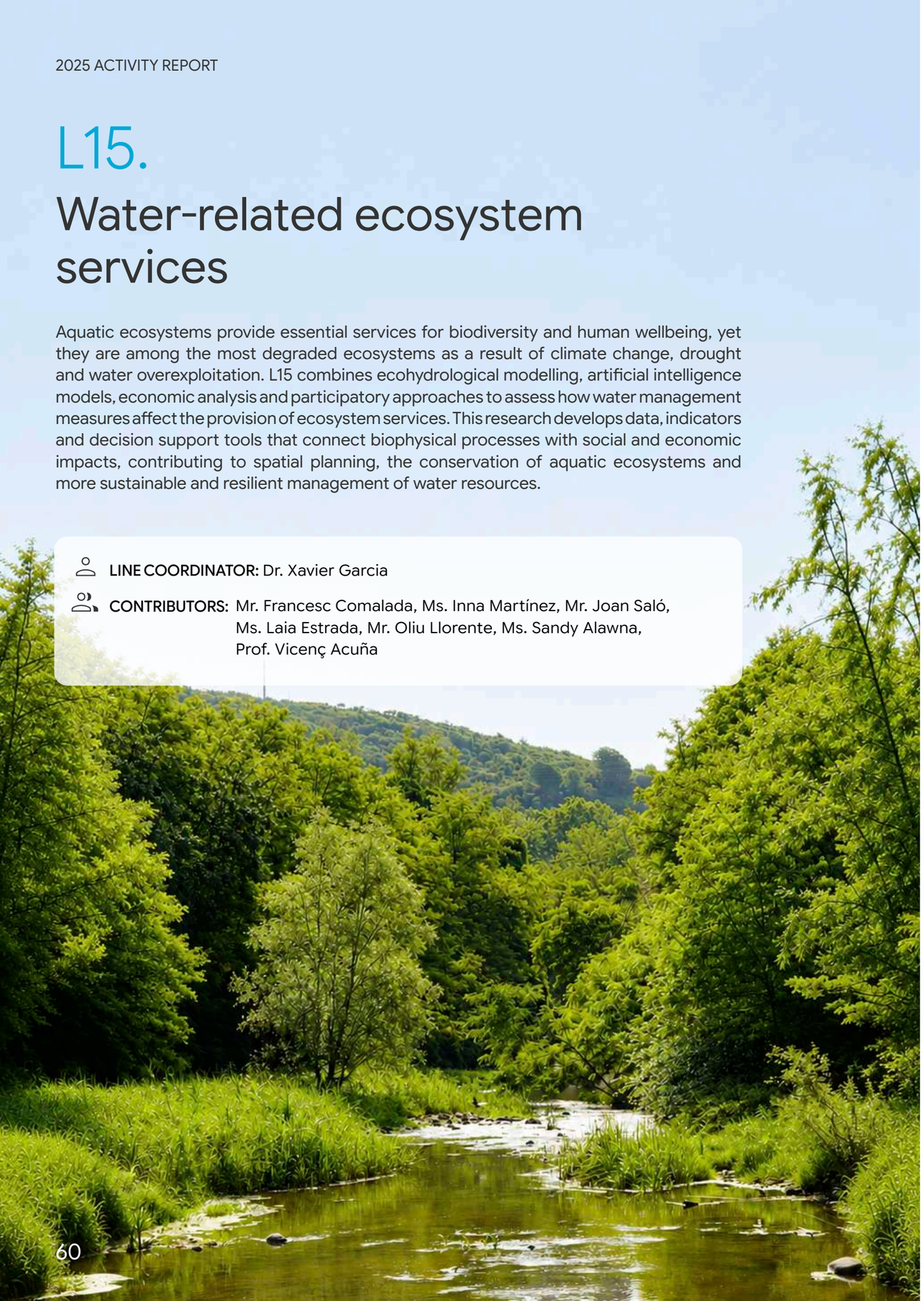
Development of algorithms for the automatic reconciliation of sewer networks. As part of Sílvia Busquets’s doctoral thesis, algorithms have been developed to automatically reconcile sewer network data and build consistent hydraulic models, which are essential for wastewater-based epidemiology at intra-urban scale. This work is being turned into a plug-in to make it easier for the scientific and technical community to use.

L15.
Water-related ecosystem services

Aquatic ecosystems provide essential services for biodiversity and human wellbeing, yet they are among the most degraded ecosystems as a result of climate change, drought and water overexploitation. L15 combines ecohydrological modelling, artificial intelligence models, economic analysis and participatory approaches to assess how water management measures affect the provision of ecosystem services. This research develops data, indicators and decision support tools that connect biophysical processes with social and economic impacts, contributing to spatial planning, the conservation of aquatic ecosystems and more sustainable and resilient management of water resources.

LINE COORDINATOR: Dr. Xavier Garcia

CONTRIBUTORS: Mr. Francesc Comalada, Ms. Inna Martínez, Mr. Joan Saló, Ms. Laia Estrada, Mr. Oliu Llorente, Ms. Sandy Alawna, Prof. Vicenç Acuña



Main achievements in 2025

PROJECTS

01. Launch of the **BIOVERA project**, in collaboration with Cetaqua and funded by the Fundación Biodiversidad. The project will develop innovative methods, including citizen science, to assess the environmental and social benefits of green infrastructure.

02. Contribution to the **European MERLIN project** (Mainstreaming Ecological Restoration of fresh water-related ecosystems in a Landscape context: INnovation, upscaling and transformation), through the development of a modelling framework to assess the biophysical and economic impact of restoring freshwater ecosystems at basin scale, applicable to different regions of Europe.

03. Active contribution to **research on climate and water resilience** in the West Bank (Palestine), providing spatial analysis of climate risk to strengthen the scientific basis for adaptation and sustainable planning in a highly vulnerable region.

PUBLICATIONS

Publication in the prestigious Journal of Environmental Management of a study that uses social media data and artificial intelligence models (Deep Learning and Machine Learning) to map and model, at the scale of the Iberian Peninsula, the value of the cultural ecosystem services associated with river landscapes.

IMPACT

In collaboration with the Xarxa per la Conservació de la Natura (XCN), we have made visible the socio-economic impact of the restoration and conservation work carried out under the river stewardship agreements signed between local organisations and the Catalan Water Agency (ACA).

ACTIVITIES AND CONFERENCES

Representation at the international IALE 2025 European Landscape Ecology Congress with an oral communication entitled “Mapping Cultural Ecosystem Services Of River Landscapes In The Iberian Peninsula Using Artificial Intelligence And Social Media” and a poster entitled “Policy Implications Of Cultural Ecosystem Services In Freshwater Ecosystems: A Systematic Review”. Taking part made it possible to establish new international collaborations and to share innovative methodologies for river planning and restoration.

L16.

Impact and mitigation of extreme droughts (NEW LINE)

Climate change is transforming drought dynamics in Mediterranean regions. Seasonal dry periods are increasingly giving way to more frequent, more intense and more persistent droughts, including supra-seasonal and multi-year episodes. This new hydrological context is altering landscapes, affecting aquatic ecosystems and water quality, and forcing us to rethink how we capture, distribute, manage and allocate water among competing uses. For ICRA, this is a central scientific and strategic challenge. The research line Impacts and mitigation of extreme droughts was formally created in 2025 to address drought and water scarcity as a key priority for the Institute. Conceived as a cross-cutting line, it aims to bring together researchers, ideas and projects from across ICRA around one of the great water challenges of our time, and to position this research as a spearhead within the centre's strategic vision.

This line is designed to connect the environmental and human dimensions of drought, integrating research on hydrology, water quality, ecosystem change and water management in a context of growing scarcity. During 2025, the priority was to define its scope and establish a common framework for future research and collaboration within the Institute. Although the first projects specifically linked to the line will formally begin in 2026, the line already builds on scientific work carried out during 2025. In particular, the research associated with Laia Estrada's doctoral thesis has provided a first scientific foundation for the line by analysing changes in the hydrological regime, identifying drought-related trends since the beginning of the twenty-first century and modelling the relationship between hydrological change and water quality. This work helps generate knowledge that is useful for defining mitigation and sanitation strategies for the competent authorities. In parallel, another strand of work on forest management scenarios has explored the balance between green water and blue water, opening up new perspectives towards innovative management approaches such as future water credit systems.

LINE COORDINATOR: Prof. Vicenç Acuña

CONTRIBUTORS: Ms. Laia Estrada



We work towards a more sustainable use of water.

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ICRA is an international benchmark centre in research on the integrated water cycle, studying water resources, water quality and treatment technologies, with a commitment to transferring knowledge to society and the productive sector.

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