

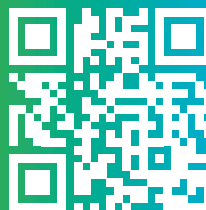


BIOREMEDIATION SYSTEMS EXPLOITING SYNERGIES FOR IMPROVED
REMOVAL OF MIXED POLLUTANTS



NEWSLETTER

ISSUE 5, FEBRUARY 2025



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1. INTERVIEWS WITH THE ICCRAM TEAM



UNIVERSIDAD
DE BURGOS



ICCRAM
INTEGRATED RESEARCH CENTER IN ARTIFICIAL MEDIA
FOR ENVIRONMENTAL REMEDIATION TECHNOLOGIES

BIOSYSMO INTERVIEW

**Dr. ROCÍO
BARROS**



The curriculum vitae of Dr. Rocío Barros García highlights her academic and professional career in the field of environmental research, especially in ecotoxicology, bioremediation, and sustainability. She is currently the Scientific Director of ICCRAM - University of Burgos and leads a group focused on integrated systems for environmental remediation, biosystem-surface interactions, and safe and sustainable design approaches. Throughout her career, she has held key roles in both academic and industrial research, gaining experience in projects ranging from soil and water monitoring to the application of environmental technologies in the

infrastructure sector. In the past five years, she has led the acquisition of 22 funded European projects, serving as the principal investigator in nine of them, managing a total budget of approximately 6.5 million euros.

Her academic output includes supervising four PhD candidates and publishing 45 works, 36 of which were in the last five years, with a strong focus on bioremediation and industry collaboration. She has also been the scientific coordinator of major European projects, such as GREENER, and recently of the new project BIOREM. She has played a central role in organising scientific events and coordinating technology transfer activities, contributing to the creation of innovation hubs in colloid biology.

In addition to her research work, Dr. Barros has received positive evaluations for her teaching and research activities from the National Agency for Quality Assessment and Accreditation of Spain (ANECA). She actively participates in science outreach through international events and workshops, demonstrating her commitment to the academic community and industry.



1. INTERVIEWS WITH THE ICCRAM TEAM

**Dr. BLANCA
VELASCO**



Blanca Velasco's scientific career began in 2011 at the "Center for Plant Biotechnology and Genomics" (CBGP), where she completed her doctoral thesis (FPI grant from MINECO, 2013-2016). She participated in numerous national and international conferences, was part of a Network of Excellence on redox metabolism, taught in two university degree programs over four academic years, organised and led research and scientific outreach activities, and contributed to national project applications. During her predoctoral stage, she completed two short international stays: at the University of Leeds (focused on

redox metabolism, UK, 2015) and INFIVE (researching vesicles associated with senescence, Argentina, 2016).

These experiences enhanced her resilience in the face of challenges and, above all, taught her to adapt to different work rhythms, organisational methods, and resource management on a day-to-day basis. She received the highest distinction, Sobresaliente Cum Laude, on her doctoral thesis, with an International Doctorate Mention and an Extraordinary Award.

After a year as a Postdoctoral Researcher at CBGP, she pursued R&D management training, completing the GESTIDI Program and a Secondary Education teaching course in 2018. She then joined the University of Burgos (UBU) for research in plant biotechnology while also teaching. She later worked at UBU's OTRI, drafting European project proposals. In 2020, she joined ICCRAM as a researcher and coordinator, balancing projects, teaching, and outreach. Since 2022, she has been an Assistant Professor (Profesora Ayudante Doctora), co-leading the BIOSYSMO project and securing funding for research.

UBU'S ROLE IN THE PROJECT

ICCRAM, representing UBU in this project, brings significant expertise in sustainability research with a multidisciplinary approach. Within BIOSYSMO, the primary focus is optimising resource efficiency to support the development of Circular Economy initiatives and sustainable solutions. This includes the development, optimisation, and application of biosystems, making a special emphasis in the associated microbial communities

of each technology under study. UBU is specifically working with: (i) 1 groundwater site contaminated with metal(loid)s to advance in phytoremediation, either as a technology alone and integrated with BES; ii. 3 soil sites contaminated with organic compounds, specifically a pesticide, an insecticide, and polyaromatic hydrocarbons (PAHs), to advance in biostimulation and bioaugmentation strategies.

IMPORTANCE OF THESE TECHNOLOGIES IN GENERAL

These technologies, also investigated by and in close collaboration with other BIOSYSMO partners, represent bio-based remediation technologies crucial for addressing

environmental challenges in a sustainable, cost-effective way. Unlike traditional methods that often involve harmful chemicals or energy-intensive processes, these

1. INTERVIEWS WITH THE ICCRAM TEAM

technologies harness natural organisms like plants, fungi, and beneficial bacteria to clean up contaminated soil and water. This makes them eco-friendly, reducing the need for intrusive methods, and minimising environmental damage. Additionally, these technologies can save money by cutting down on the use of chemicals and energy, while offering

the potential to recover valuable resources like metals. They also contribute to public health by removing toxic substances that can contaminate water sources, reducing long-term healthcare costs. Overall, bio-based solutions represent a more adaptable and sustainable approach to environmental clean-up.

COLLABORATION WITH OTHER PARTNERS

UBU closely collaborates with all the BIOSYSMO partners. From a technical point of view, concerning phytoremediation, ICCRAM initially collaborated with CIIMAR to improve techniques on isolation of endophytic and epiphytic microorganisms from an aquatic plant focus of interest for the project, i.e. *Phragmites australis*; likewise, with a view to the application of the selected microorganisms in bioaugmentation strategies to decontaminate metals in the corresponding water sample, ICCRAM steadily collaborates with the JSI in search of solutions in the form of optimised carriers. Strikingly, in April 2024, the EC Innovation Radar awarded UBU with a Prize in recognition of a bioremediation technology developed under the umbrella of the GREENER project. Thus, the involved partners (UBU and LEITAT) have a motivation to continue their research in the hybrid

system that combines plants and bioelectrochemistry. With regards on soil research, the main collaboration relies again with JSI, either for isolation, sequencing, and application of microbes methodologies' improvement; and a tight collaboration is established with the UK partner, ICL, with whom improved bacteria strains targeting organic contaminants are being enquired. Apart from this, UBU and LEITAT work together, also in collaboration with IDENER, for the ecotoxicology task. Last but not least, a key collaboration is established with IDENER since all the generated data in terms of strains, genomes, metabolic pathways, etc. need to be interchanged in order to acquire the objectives of this project. Together, these partnerships ensure that the project's innovations are reaching their maximum potential, scientifically and economically.

INTERESTING RESULTS ALREADY ACHIEVED

Grounding on previous successful results obtained during GREENER, among other achievements and in a very summarised way, UBU has already achieved useful milestones in BIOSYSMO. For instance, UBU has isolated, identified and characterised a community of microorganisms, some of them exhibiting PGPRs traits, from the aquatic candidate plant *P. australis*, exhibiting features either to tolerate and/or improve plant resilience facing toxic metal stress in water. Interestingly, they have

successfully achieved the growth of this macrophyte in vitro, paving the way for future research. Besides, UBU has advanced in terms of molecular mechanisms driving metal' tolerance in the studied plants used in phytoremediation. Moreover, they have isolated, tested and compared several methodologies for the obtention of consortia/strains from those soils contaminated with organics, and successfully characterised them towards future steps.

1. INTERVIEWS WITH THE ICCRAM TEAM

FUTURE STEPS

Among the future steps for BIOSYSMO from UBU's role, they are intended to continue with the application of the obtained biosystem plant-microbes (PGPR and other) in the context of WP4, with the aim of testing the efficiency at a mesocosms scale, and with a special focus in the hybrid BES-phytoremediation system in a mid-term. This target concerns in particular water.

Focusing on soils, UBU's main focus relies on testing the obtained consortia/strains to study the effects of tailored-bioaugmentation/ biostimulation strategies during new microcosms assays. Their priority now is also to deliver data to IDENER with the purpose of establishing a win-to-win flow of work which can help UBU in the design of specific phytoremediation/bioremediation strategies.



BIOSYSMO PROGRESS UPDATE

IDENER

Over the past 18 months, IDENER has advanced computational methodologies for biosystems design, environmental risk assessment, and project management within BIOSYSMO. By refining and expanding computational tools, IDENER has contributed to both the project's scientific and operational success.

A key achievement has been the development of a triple verification approach for classifying degradative enzymes, integrating sequence alignments, Hidden Markov Model (HMM) alignments, and cross-comparisons to improve genome screenings. These advancements have been applied to genomic data from CIIMAR (16S rRNA) and extended to complete fungal genomes from UBFC.

In metabolic modeling, IDENER has analysed six fungal genome-scale models (GEMs) from UMLP, focusing on metal resistance and plant-growth-promoting traits, with BIOSYSMO playing a key role. Additionally, the atrazine degradation pathway has been integrated into *Pseudomonas putida*'s optimised GEM, generating estimations for growth rate and degradation efficiency, now set for experimental validation.

A major milestone has been the integration of these advancements into Deliverable 2.1 – Initial Report on Model-Driven Biosystems Design, submitted in M24. This report consolidates key findings and methodologies and will be made public in the next reporting period.

In parallel, IDENER is preparing the BIOSYSMO database for ZENODO, ensuring functional inference



results and annotated genomic data are accessible to the scientific community.

On process modeling, IDENER has developed preliminary models for estuarine soil and sediment phytoremediation, as well as bioelectrochemical reactors (BES) for metal treatment. These models are continuously updated with new data and partner insights. Additionally, hybrid system models are being defined, particularly focusing on water-phytoremediation integration.

Beyond technical contributions, IDENER manages BIOSYSMO efficiently, successfully achieving RP1/RM submission, supporting the M30 GA, and coordinating the BIOSYSMO-MIBIREM Joint Consortium Meeting (March 2025, TAUW). Key agreements, including the BIOSYSMO/MIBIREM and Bioremediation Cluster Agreements, were finalised to strengthen research collaboration. IDENER is also working with MIBIREM partner UNIPi to enhance data-driven integration, expand knowledge, and improve computational tools.

BIOSYSMO PROGRESS UPDATE

ICCRAM UNIVERSIDAD DE BURGOS

The University of Burgos has made significant progress in its tasks within the BIOSYSMO project over the last year. Methodologies for extraction and quantification of hydrocarbons and Lindane have been optimised. Progress towards in vitro toxicology has been achieved in close collaboration with Leitat, meeting the planned objectives. Regarding the interaction with WP2, regular meetings with IDENER have been held to share experimental and sequencing data related to isolated bacterial consortia from contaminated soils, and PGPR isolated from *P. Australis*. Collaboration with the MIBIREM project has been consolidated in the analysis of real data, especially Lindane. Likewise, the characterisation of PGPR has been completed, and important progress has been made in their sequencing. It is worthy to mention the research stay held by a PhD student at JSI in order to advance

and compare isolation, aggregation and sequencing techniques related with the obtained PGPR. In the context of WP4, significant progress has been achieved: the design of an integrated system combining Leitat's BES and UBU's phytoremediation has been completed, with technical meetings and collection of material for its implementation at the beginning of 2025. Progress has also been made in the isolation of multiple bacterial consortia in relation to the different targeted organic pollutants in soils (hydrocarbons and pesticides) with different methodologies. In relation with the latter, there has been a steady collaboration with JSI (including a short research stay of a PostDoc), and with IRNAS-CSIC to perform biodegradation assays with isolated consortia on the side of organics, this last exhibiting promising results.

JOZEF STEFAN INSTITUTE

Jožef Stefan Institute continued with the characterisation of venlafaxine using liquid chromatography mass spectrometry (LC-MS) technique. Calibration curves were developed, and the method was established for further characterisations of venlafaxine degradation experiments.

A number of different bacterial consortia were isolated from the provided environmental samples. A total of 282 bacterial consortia were acquired using the μ LUME and iACME isolation techniques developed at

JSI. The collection of different consortia is constructed to degrade venlafaxine, pyrene, benzo(a)pyrene and atrazine in combinations with copper, nickel and mercury as additional selection factors. The consortia were characterised based on the efficiency of substrate utilisation. Further characterisation was conducted for the purpose of community characterisation using DNA sequencing, resulting in the DNA isolations of 30 consortia isolates.

JSI started the development of the electrogenic bacteria

BIOSYSMO PROGRESS UPDATE

JOZEF STEFAN INSTITUTE

attachment on graphite electrodes by optimizing the attachment by the deposition of polymers on the electrode surface. Optimal conditions for polymer and bacteria deposition were tested and a bioreactor set up was developed by constructing a custom-made and 3D printed reactor with inserted electrodes with deposited bacterial biomass.

Protocol for the hydrophobic hydrogel coating on the plant roots was developed to be executed with UPM for

the degradation of the pyrene and benzo(a)pyrene in the polluted substrate.

Joined experimental work resulted in two visits at JSI, one of a PhD student from ICCRAM for the joint development of optimal PGPR bacterial consortia and a PhD student from CIIMAR for the purpose to outselect the best bacterial candidates for the degradation of venlafaxine and to prepare the protocol of bacterial deposition and attachment to the plant roots.

LEITAT

Leitat continued with the development of different strategies for the functional growth of electroactive biofilms exploring easily scalable approaches. The collaboration with JSI has continued and samples of the biofilms produced with Leitat approaches have been sent to be characterised in JSI. Moreover, the experimental development of four different bioelectrochemical systems (BES) to treat polluted groundwaters with hydrocarbons (TPHs and BTEX), chlorinated ethenes and metals have started and are being optimised. Significant progress has been made in BES-HC technology aiming to degrade hydrocarbons. Its development has overcome the first lab phase in H-type reactors where the cathode configuration was selected. New flat plate reactors have been designed based on the scalability of their components and they are under optimisation phase. Also, important progress has been achieved in the development of BES towards

the degradation of chlorinated ethenes in BES reactors and key performance parameters are being optimised. The integration of electro-bioremediation in BES with phytoremediation in Microcosm floating systems (MFS) to remove metals from groundwater has been defined together with UBU. Currently the systems are being prepared to start working together in the following months. To assess the impact of BIOSYSMO bioremediation technologies on toxicity and ecotoxicity risks in polluted sites, a comprehensive ecotoxicological toolset is being deployed to evaluate these risks both before and after bioremediation. An initial strategy has been defined and outlined for the development of a comprehensive human toxicity and environmental toxicity assessment for the BIOSYSMO project. This assessment includes experimental in vitro and in vivo tests as well as in silico models. The experimental (eco)toxicity assessment

BIOSYSMO PROGRESS UPDATE

LEITAT

strategy has been adapted, including targets, endpoints and tests, taking into account the information on the characteristics of the real polluted samples collected during the first period of the project. Throughout the year polluted samples before the application of the bioremediation technologies are being evaluated by using

experimental in vitro and in vivo models. The data is being used, alongside the physicochemical characterisations and the data collection from ecotoxicological databases, to feed the in silico models generated for each group of pollutants (hydrocarbons, metals, pharmaceuticals, organochlorides and lindane).

UNIVERSITE MARIE & LOUIS PASTEUR

Over the past 12 months, UMLP (formerly UFBC) has completed work on isolation (WP1), genome sequencing and annotation (WP2), and functional characterisation (WP3) for bacteria and fungi isolated from the three French case studies. Collaboration with IDENER has highlighted the specificities of the isolated strains in terms of genomic potential compared to reference genomes. For instance, one fungal strain exhibited unique arsenic-related genes, which aligns well with the presence of arsenic in the soil from which this fungus was isolated. Twelve fungal genome sequences have been delivered and deposited in the NCBI and Zenodo repositories. Additionally, another set of four fungal genomes has been sequenced de novo and fully analyzed by IDENER. The various microbes have been

tested for their tolerance to metals present in the case study sites, primarily Hg, Pb, Cd, and Zn. RNA-seq-based transcriptomic studies have been conducted, and the data are currently being analysed. UMLP has also worked on the production of microbial inocula and studied the behavior of each isolate within the consortium. Optimised growth conditions were selected to enhance spore production for future inoculation of selected poplars. A first consortium comprising nine fungal strains has been tested and shipped to UPM and JSI for further studies on the poplar/soil biosystems. Another consortium has been selected for the inoculation of poplars in Hg-enriched soils (CS2). These steps will facilitate testing of the biosystem concept in a field environment, as planned in WP5.



BIOSYSMO PROGRESS UPDATE

BLUE SYNERGY

Blue Synergy is involved in sustainability assessments from environmental, economic, and social perspectives. To achieve this, they have gathered data related to the treatments developed in the project at the laboratory scale for sustainability modelling using Life Cycle Assessment, Life Cycle Costing, and Social Life Cycle Assessment. Later, all assessments will be conducted at higher TRLs in accordance with the demonstrators resulting from BIOSYSMO execution. In parallel, Blue Synergy has been performing the same sustainability

assessments for alternative remediation treatments as appropriate benchmarks for BIOSYSMO. For instance, solidification-stabilisation technology has been studied due to its significant use in soil remediation. In this connection, concrete consumption has been identified as a critical environmental impact and cost driver. Additionally, Blue Synergy is paying special attention to the potential damage to biodiversity from the remediation scenarios to ensure full alignment with biodiversity protection efforts.



CIIMAR

At CIIMAR, we are developing microbial-assisted phytoremediation systems for the removal of mixed pollution in estuarine sediments. For this, we are exploring microbial diversity to find candidates for symbiotic associations with salt marsh plants towards the degradation of pharmaceutical compounds (ketoprofen, venlafaxine, paroxetine, bezafibrate), enhancement of plant growth, and promotion of metal (Cu, Cd) uptake from estuarine sediments. Over the past year, our team has characterised sediments and plants from sites 4 (Douro estuary, Portugal) and 5 (Lima estuary, Portugal), assessing contamination levels and microbial diversity (bacteria and fungi). Additionally, we have identified and characterised more than 100 bacterial strains isolated from enrichment cultures exposed to the target pollutants (metals and pharmaceuticals), using estuarine sediments as inoculum. These strains were evaluated for their ability to utilise different carbon sources, degrade pharmaceuticals, tolerate metals, and promote plant growth. The best-performing strains from these tests

are now being used to construct novel microbial consortia for microcosm and mesocosm experiments. In parallel, we performed preliminary microcosm and mesocosm experiments to evaluate the natural capacities of salt-marsh plant-microbe associations in degrading target pharmaceuticals and uptaking target metals. Moreover, in partnership with JSI (Josef Stefan Institute), we utilised iACME (interspecies, Aggregation, Combinatorics, Microfluidics, and Entrapment) selection tools to select and characterise isolated microorganisms, creating new consortia. Various inoculation techniques (root coating and suspension) are being tested to deliver the selected microbial consortia to salt-marsh plant roots, enhancing microbial-assisted phytoremediation. With the data from these experiments, CIIMAR plans to conduct future microcosm and mesocosm experiments using optimised microbial consortia combined with salt marsh plants to fully assess the efficiency of this nature-based solution in removing mixed pollutants from the estuarine environment.

BIOSYSMO PROGRESS UPDATE

UNIVERSIDAD POLITECNICA DE MADRID

Over the past year, the Universidad Politécnica de Madrid (UPM) has successfully identified and characterised two distinct poplar genotypes in response to the trace metals Zinc and Cadmium, both major soil contaminants. These genotypes exhibit remarkable tolerance and resilience to environments with high concentrations of these metals, making them highly promising for phytoremediation efforts. Building on these findings, UPM has focused on an in-depth transcriptomic characterisation of one of these genotypes to fully understand the intricate regulatory networks governing the plant's response to these

pollutants. This research lays a solid foundation for future applications of poplar in the field of phytoremediation. The team is currently working on a scientific publication that will unveil these results throughout the year. Additionally, in collaboration with other project partners, UPM has begun exploring ways to further enhance the poplar's phytoremediation capacity by associating it with different microorganisms isolated from BIOSYSMO study sites. This plant-microbe synergy aims to improve the tree's ability to extract contaminants from the soil even more effectively.

AXIA INNOVATION

AXIA, which focuses on the exploitation activities, has made significant progress in their relevant tasks over the last year. AXIA successfully delivered the mid-term Plan for the Exploitation of Dissemination of Results. New Key Exploitable Results (KER) have been identified during this period, and the ownership expected per each KER has been revised and aligned to the progress of the technical work following the partners' feedback.

Regarding the exploitation routes, different options are planned per each KER, but mainly scientific and market-

oriented exploitation routes are expected. AXIA drafted the individual exploitation plans per each partner, and it developed the value proposition, unique selling points and CANVAS business model for the commercial partners.

AXIA has also gathered the expected Intellectual Property (IP) protection per each KER, as the IP protection of the results is essential for the successful exploration of the results. On the other hand, AXIA has been focusing on the competitor analysis over the last few months, for a better understanding of the current bioremediation market.



BIOSYSMO PROGRESS UPDATE

CNRS

CNRS conducted extensive research on sediment samples from CIIMAR (sites 4 and 5). As part of this study, they quantified pharmaceutical compounds present in the samples, providing crucial data on environmental contamination. An initial large screening of contaminants, including pesticides and pharmaceuticals, was performed to assess the overall pollution levels in these sediments. Through this screening, CNRS identified 18 pharmaceuticals, pesticides and metabolites of interest. Additionally, CNRS is set to quantify atrazine and its metabolites in soil samples from Site 1. This quantification will be instrumental in understanding the contamination levels and their potential impact.

In parallel, CNRS is working towards the development and optimisation of a low-flow chromatography (μ LC-MS/MS) analytical method. This method aims to enhance the detection and quantification of contaminants with

greater sensitivity and precision, while reducing solvent consumption. The initial experiments have involved comparing conventional liquid chromatography (LC) with the newly developed μ LC to evaluate their performance. They also began the optimisation of MS parameters using analytical standards.

Preliminary results of this development were showcased in a poster at the 3rd European Sample Preparation (EuSP2024) and the 2nd Green and Sustainable Analytical Chemistry (GSAC2024). Meanwhile, they have thoroughly reviewed the various available tools for assessing the sustainability of analytical methods and sample preparation, which has led to the writing of a review that will be submitted very soon. This work contributes to improving the monitoring of emerging contaminants in sediments, supporting environmental protection efforts.



BIOSYSMO PROGRESS UPDATE

TAUW

TAUW has conducted additional sampling campaigns at project sites located in Belgium and Spain to provide Biosysmo partners with additional material (groundwater) for laboratory scale technology testing and development. The sampled sites are characterised by different types of contaminants including metal(oid)s, organochlorides and mixed hydrocarbons. For site 7 in NW Spain additional groundwater samples were also collected for ecotoxicity assessment by partners UBU and LEITAT. The data for site 7 showed that the inorganic fraction (salts) resulted in higher toxicity than the organic fraction (hydrocarbons) to the exposed water organisms. A thorough evaluation of physicochemical and biological sequencing data for site 7 was also performed and indicates the presence of a native hydrocarbon-degrading microbial community with potential for transformation of BTEX, alkylbenzenes and

PAHs. Samples from this site are being tested for BES (Bioelectrochemical Systems) technology by LEITAT. In addition, part of this work was presented at a workshop in Leipzig 25.-26.09.24 for professionals in the field of environmental remediation.

Key Performance Indicators (KPIs) for each technology have been defined together with all partners responsible for technology development and will be used to evaluate the progress of the different technologies in both WP3 (Development and optimisation of consortia and plant-microbe systems) and WP4 (Application and Optimisation of improved biotechnologies). Finally, an approach that integrates all KPIs for each technology will be used for decision-making about which technologies to test in WP5 (Field studies and validation) and at what scale.



BIOSYSMO PROGRESS UPDATE

EXELISIS

During this period, EXELISIS successfully carried out multiple dissemination and communication actions to enhance BIOSYSMO's outreach and collaboration. The project's website was updated with public deliverables and news, while social media platforms (LinkedIn & X) had weekly updates, reaching 1,300 followers. Key updates included the Plan for upcoming publications and the establishment of guidelines for sharing datasets on the BIOSYSMO Zenodo community. New publications were announced, and Horizon Results Booster services were finalised. The EU Bioremediation Cluster was rebranded as ALL4BIOREM, with a new name, logo, video, factsheet, PowerPoint template, and success stories.

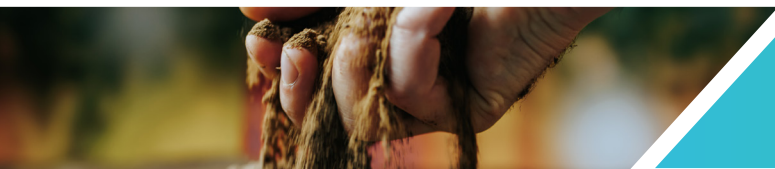
BIOSYSMO was actively represented at major events, including the Condegres Conference in Burgos, where BIOSYSMO participated in the dissemination corner providing materials (roll-up, poster, USB sticks).

Additionally, BIOSYSMO co-organised with the cluster the BioBio 2024 Cluster Workshop in Prague. The Mid-term PEDR (D7.4) was successfully submitted, and an agreement with MIBIREM was signed to strengthen collaboration and promote shared goals.

The Zenodo repository was updated with publications and public deliverables, while one newsletter was released, with another under preparation.

Future events are being organised, including a joint BIOSYSMO-MIBIREM event in March 2025 at TAUW. A common BIOSYSMO-MIBIREM poster was also developed for this event.

Moreover, a 3-day event co-organised by JSI, UBU, EXELISIS and IDENER is planned for May 2025, in Slovenia. Regular cluster meetings continued, and planning for the upcoming ALL4BIOREM cluster workshop in June 2025 is underway, at the EBC-IX 2025 in Chania, Greece.



IMPERIAL COLLEGE OF LONDON

Imperial has focused on engineering bacteria for the removal of lindane and atrazine. Biochemical pathways for the biodegradation of both pesticides were mined from the literature and genomic databases and synthesised as a long DNA fragment cloned into a mobilisable plasmid. The genetic constructs were transferred to the environmental workhorse bacterium *Pseudomonas putida* and were validated by DNA

sequencing. As an additional validation, Imperial is testing the appropriate expression of the recombinant enzymes. The ability of the engineered organisms to mineralise the pollutants is also being tested in culturing assays supported by analytical methods such as mass spectrometry at Imperial as well as on the surface of nanoparticles in collaboration with the Jozef Stefan Institute.

3. ALL4BIOREM: OUR CLUSTER HAS A NEW BRAND IDENTITY



**Our cluster has
a new logo!**



ALL4BIOREM
Alliance for Environmental Bioremediation

ALL4BIOREM is here!

Our cluster, consisting of BIOSYSMO, SYMBIOREM, MIBIREM, ISLANDR, Nymphe, EDAPHOS, IASIS, pHYBi and MySoil, has a new name and logo, with the support of the Horizon Results Booster.

Marking our strong alliance as projects, we join our forces to advance research and practical applications for soil, seawater, and groundwater pollution remediation.

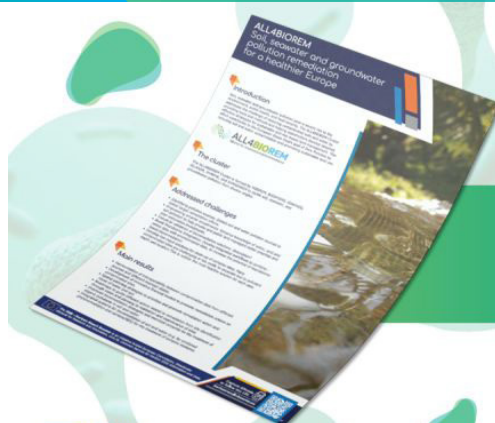
CHECK OUT OUR FACTSHEET



**ALL4BIOREM Cluster's
Factsheet is here!**

We are happy to present our new Cluster Factsheet, developed with the Horizon Results Booster. This resource highlights our collaborative efforts and innovative bioremediation solutions tackling soil and water pollution across Europe. Take a look at our goal, addressed challenges, and impactful results, as we work together for a healthier environment:

www.biosysmo.eu/wp-content/uploads/2024/10/All4Biorem-cluster-factsheet.pdf

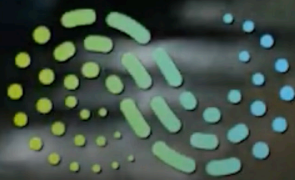


ALL4BIOREM
Alliance for Environmental Bioremediation



3. ALL4BIOREM: NEW CLUSTER VIDEO

Soil, seawater and groundwater pollution remediation for a healthier Europe



ALL4BIOREM
Alliance for Environmental Bioremediation



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the European Union

Take a look at our latest cluster video, developed in collaboration with the Horizon Results Booster. This video showcases groundbreaking advancements and

collaborative efforts within our research community. Watch the full video here:

www.youtube.com/watch?v=D5vBlwPeJ4A

ALL4BIOREM SUCCESS STORIES

The ALL4BIOREM Cluster is showcasing success stories in innovative bioremediation! Four case studies have been released so far, highlighting advancements in:



More success stories are on the way - stay tuned!

BIOSYSMO AND MIBIREM ARE CO-ORGANISING A WORKSHOP IN TAUW FACILITIES



 BIOSYSMO 

JOINT MEETING BETWEEN
**BIOSYSMO
& MIBIREM**

MARCH 19-20, 2025

 **TAUW** TAUW FACILITIES, DEVENTER, NETHERLANDS

 Funded by
the European Union

BIOSYSMO and MIBIREM are co-organising an exciting bioremediation workshop on March 19-20 March. The event will be hosted by at TAUW Netherlands. A key partner in both projects. This collaborative event will bring together experts, researchers, and stakeholders to discuss innovative biotechnological approaches for tackling soil and water contamination.

The workshop will feature:

- Presentations on key bioremediation strategies investigated by both projects
- Field studies: state of play in both projects
- Discussions on shared challenges & solutions
- A facility tour at TAUW

STAY TUNED FOR INSIGHTS AND OUTCOMES FROM THIS IMPACTFUL EVENT!

5. BIOSYSMO TEAM ATTENDING MAJOR EVENTS

XIII CONGRESS OF MICROBIOLOGISTS OF SERBIA

JSI participated at the XIII Congress of Microbiologists of Serbia: FROM BIOTECHNOLOGY TO HUMAN AND PLANETARY HEALTH. The event took place between 4-6 April 2024 in Belgrade, Serbia, where JSI participated with 3 oral presentations and 4 posters.

Find out more: <https://fems-microbiology.org/>



ISPTS-2024 CONFERENCE



Our partner Leitrat Technological Center represented BIOSYSMO at the ISPTS-2024 conference in Chania, Crete! Taking place from September 14-19, 2024, this event gathers experts to discuss sustainable remediation.

Leitrat, alongside ICCRAM UBU, showcased their work on ecotoxicological evaluations of remediation technologies. Explore the full program: https://lnkd.in/d/2u_2dRG

3RD EUROPEAN SAMPLE PREPARATION CONFERENCE (EUSP2024)

During 15-18 September 2024 CNRS participated at the 3rd European Sample Preparation Conference (EuSP2024) and the 2nd Green and Sustainable Analytical Chemistry Conference (GSAC2024).

Please check here: www.eusp-gsac2024.tuc.gr



RESEARCHER'S NIGHT IN ATHENS



EXELISIS IKE showcased the BIOSYSMO Project at Researcher's Night in Athens on September 27, 2024.

We had an incredible evening discussing innovative bioremediation technologies and sharing our progress on tackling soil and water pollution.

5. BIOSYSMO TEAM ATTENDING MAJOR EVENTS

“DECONTAMINATION NINJAS” & “FITOSAMURAI AGAINST THE POLLUTION”

CIIMAR for one more year participated at the Science Communication activity called: “Decontamination Ninjas” and “FitoSamurais against the pollution” during the CIIMAR’s Open Day. The event took place on 22 September 2024.

On this day, participants were able to follow the work carried out by CIIMAR researchers, take part in scientific experiments, observe organisms under a microscope, explore coastal biodiversity aquariums and intertidal zones, and learn about CIIMAR’s mini-phytoremediation wastewater treatment system, among others.

Find out more: www.ciimar.up.



ROUND TABLE



JSI, participated at the “Round Table: Food, bioeconomy, natural resources, agriculture and environment in the HORIZON OF EUROPE”, which was organised by the National Institute of Biology in Slovenia on 25 September 2024.

Check out the agenda here: www.gov.si

ENCONTRO NACIONAL CIÊNCIA 2024

On 27 September 2024 CIIMAR participated at the Researchers Night initiative “ in the city of Porto, Portugal (NEI 2024). BIOSYSMO project was spotlighted in the science communication activity CIIMAR organised called: “Decontamination Ninjas” and “FitoSamurais against the pollution.

Check out the agenda here: <https://webstorage.cienciaviva.pt>



5. BIOSYSMO TEAM ATTENDING MAJOR EVENTS

EUROPEAN RESEARCHERS NIGHT

Our BIOSYSMO Project partner, ICCRAM UBU, celebrated the European Researchers Night as they organised two highly engaging workshops. The workshops provided young innovators with a hands-on opportunity to delve into soil science and environmental topics. Participants explored cutting-edge bioremediation techniques and learned about the latest advancements in tackling soil and water pollution.



EU MISSION SOIL WEEK



BIOSYSMO Project, along with PHYBi, EDAPHOS, and Nymphe projects attended Mission Soil Week 2024 in Brussels on November 12-13. This event was a fantastic opportunity to showcase our contributions to innovative solutions for soil health, sustainability, and environmental stewardship. Check out the team!

BLUEMISSIONMED NATIONAL EVENT

On January 16, IDENER took part in the BlueMissionMed National Events: HUBs4Innovation. This event serves as a platform to support and empower the innovation ecosystem of the Mediterranean Sea basin. Our coordinator, Dr. Sara Gil Guerrero presented their work on "Formulation and application of a computational model-driven framework for the design and improvement of synergetic biosystems for the removal of mixed contaminants from polluted soils, sediments, and (ground)water." Learn more about the event here: <https://lnkd.in/dSqqTuqV>



6. NEW BIOSYSMO PUBLICATION

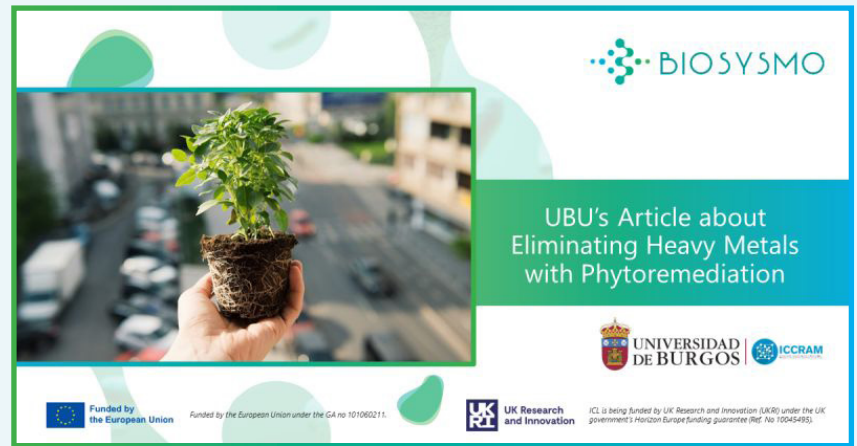
UBFC – Université Bourgogne-Franche-Comté has published in open access their work titled “Poplar as a woody model for the phytomanagement of trace element contaminated soils”

You may check it out here: <https://www.biosysmo.eu/wp-content/uploads/2024/11/Ciadamidaro-Blaudez-Chalot-ABR-Vol-109.pdf>



BLOG ARTICLES

Check out this interesting article from IC-CRAM University of Burgos, on developing phytoremediation methods, showing positive results in reducing heavy metal contamination in real-world scenarios: <https://ubuinvestiga.es/acabando-de-raiz-con-el-heavy-metal-fitorremediacion-de-metales-pesados/>



UPCOMING EVENTS



AquaConSoil 2025 will be held in Liège, Belgium. Hosted by the University of Liège, the next edition of this renowned conference will take place from 16 to 20 June 2025. AquaConSoil 2025 aims to explore innovative solutions for soil, sediment, and water resources. Celebrating its 40th anniversary, the event promises a dynamic program featuring insightful exchanges, site visits, and special celebrations.

Check it out here: www.aquaconsoil.com



The **PlantACT! 2025 Conference** continues its mission by bringing together international experts to foster collaboration on climate-related challenges. This year's focus is on multidisciplinary synergies across key areas: soil ecosystems, plant microbiomes, molecular biology, and climate change impact. Discussions will explore soil-plant interactions, the role of microbiomes in resilience, and strategies to enhance crop productivity under environmental stress. The conference will also address the economic implications of climate change on agriculture and ecosystem services, promoting sustainable solutions.

Check it out: www.plantactconference2025.cbcp.upm.es

UPCOMING EVENTS



ECOMONDO
The green technology expo.

NOVEMBER
5 — 8,
2024

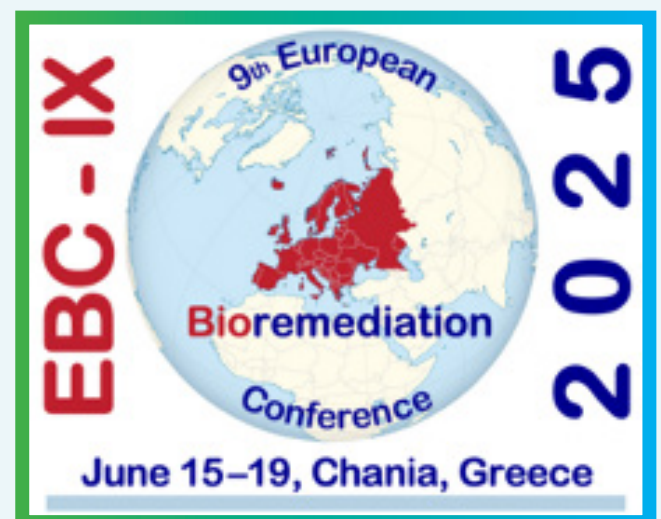
RIMINI
EXPO CENTRE
Italy

From November 4-7, 2025, the city of Rimini, Italy, will once again host ECOMONDO – The Green Technology Expo, a leading event driving innovation in the green and circular economy. Bringing together industrial leaders, policymakers, researchers, stakeholders, and local authorities, ECOMONDO serves as a hub for collaboration and knowledge exchange. The event provides a dynamic platform to explore cutting-edge technologies, best practices, and policy strategies that will shape the future of sustainable development and environmental management in the EU. Through exhibitions, discussions, and networking, ECOMONDO 2025 will play a key role in defining the next steps in Europe's environmental policy and circular economy transition.

Check it out: <https://en.ecomondo.com>

ALL4BIOREM CLUSTER WORKSHOP

The 9th European Bioremediation Conference (EBC-IX) will take place in Chania, Crete, from June 15-19, 2025, marking 24 years since the first edition. Co-organised by the Technical University of Crete and the University of Bologna, with support from EFB, WILEY, and ELSEVIER, EBC-IX will showcase innovations in bioremediation, contaminated site restoration, marine environment management, and resource recovery for a circular economy. The ALL4BIOREM Cluster will participate in the event to highlight the role of bioremediation in sustainable environmental solutions. A special session, titled “The Contribution of Environmental Bioremediation to the Clean Industrial Deal in Europe,” will take place on June 19, 2025. As part of this session, the ALL4BIOREM Cluster will present ten innovative EU projects and host a panel discussion with leading experts on advancing bioremediation for a cleaner, more sustainable future.



Find out more: www.ebc-ix.tuc.gr

7. FUN CORNER

Word Search: BIOSYSMO Edition

Find the following hidden words related to BIOSYSMO:

BIOREMEDIATION, MICROBES, POLLUTANTS, SEDIMENTS, GROUNDWATER, CONSORTIUM, ECOSYSTEM, BACTERIA, CONTAMINANTS, SUSTAINABILITY

Y	H	Z	L	O	Q	X	N	P	R	U	S	A	O	O
C	V	Z	H	R	J	L	Z	Q	U	T	G	T	Q	V
K	R	N	W	A	K	V	E	M	N	G	F	H	N	J
Q	X	W	J	P	Y	I	Q	A	R	B	V	K	F	N
P	C	Q	X	Z	A	C	N	O	P	W	W	C	I	O
J	F	I	R	O	C	I	U	Z	O	O	E	Y	G	T
Y	L	R	S	X	M	N	S	Z	T	L	L	A	I	S
V	C	T	F	A	D	E	R	R	R	T	W	L	I	E
Q	U	Y	T	W	H	D	E	P	M	J	D	R	U	B
K	U	N	A	D	G	B	B	Y	S	J	E	J	T	T
Y	O	T	R	H	W	M	M	L	Z	P	L	M	N	C
C	E	P	K	S	S	B	Q	N	G	C	M	K	M	D
R	R	Y	M	W	W	O	B	T	G	U	N	V	Z	J
Z	T	U	M	I	C	R	O	B	E	S	Q	U	S	H
V	S	U	S	T	A	I	N	A	B	I	L	I	T	Y

Riddle Me This!

I clean up the mess you can't see,
In soil and water, I work for free.
With bacteria and fungi, I team up tight,
Turning pollution into something right!

Who am I?

(Answer: Bioremediation)

Fun Fact Quiz

Which natural organisms are commonly used in bioremediation?

- A) Viruses
- B) Fungi & Bacteria
- C) Insects
- D) Algae

(Answer: B) Fungi & Bacteria)

8. MEET THE BIOSYSMO CONSORTIUM



 idener.ai



WWW.BIOSYSMO.EU | INFO@BIOSYSMO.EU



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