Position Paper for the

European Commission's Bioeconomy Strategy Consultation

Harnessing Environmental Biotechnology for a Resilient and Sustainable Bioeconomy

ALL4BIOREM
Alliance for Environmental Bioremediation

Funded by the European Union

Position Paper for the European Commission's Bioeconomy Strategy Consultation

Title: *Harnessing Environmental Biotechnology for a Resilient and Sustainable Bioeconomy*

Submitted by: Member projects of the EU Bioremediation Cluster

Date: June 2025

1. Executive Summary

Environmental biotechnology is now a mature scientific domain offering critical tools to address systemic environmental and health challenges across the EU. Bioremediation, in particular, demonstrates how biological processes can directly support climate resilience, ecosystem recovery, and public health protection. This paper calls for the integration of environmental biotechnology into the core of the European Bioeconomy Strategy. To overlook its role would be to ignore one of the most effective, science-based tools we have to remediate, regenerate, and future-proof our our ecosystems and their services.

2. Strategic Imperative for the Bioeconomy

The European Green Deal, the Zero Pollution Action Plan, and the Bioeconomy Strategy all aim for a sustainable, circular, and resilient Europe. Environmental biotechnology aligns directly with these goals:

- **Remediation of pollutants:** Remediation should always be deployed in the context of sustainable and risk-based land management. Biological systems have already proven their capability in degrading persistent organic pollutants and heavy metals, thus restoring ecological function.
- **Sustainable soil and water management:** Bioremediation contributes to reversing land degradation and water systems—key priorities in European sustainability agendas. Many bioremediation systems are aligned with the concept of nature based solutions.
- **Strategies exploiting bio**-based solutions create opportunities for sites where the economic case for remediation is marginal or negative by also delivering wider benefits such as (but not limited to) biofeedstock production, public amenity, carbon storage, or compensatory biodiversity schemes
- **Public health benefits:** Through a One Health lens, environmental biotechnology addresses pollution-related disease drivers and helps curb diffuse contamination that transcends borders.
- **Industrial and urban symbiosis:** Environmental biotech enables cleaner industrial processes and responsible urban development by mitigating environmental externalities.

These synergies make environmental biotechnology a cornerstone of a modern bioeconomy that goes beyond production to include **environmental regeneration**.

Funded by the European Union

3. Scientific Readiness and Innovation Capacity

Environmental biotechnology has undergone a transformation, powered by advances in genomics, systems biology, synthetic biology, and nanotechnology. Europe now hosts leading research consortia and infrastructure in:

- Microbial pathway engineering
- Biocatalyst discovery
- Integrated multi-contaminant degradation systems
- Predictive environmental modelling

However, the next leap forward requires more than scientific excellence—it demands **systemic integration**. Interoperable platforms for data, modelling, and knowledge-sharing are needed to bridge disciplines and scale real-world applications. Europe is uniquely positioned to lead this integration globally.

Furthermore, in recent years, a new perspective on biotechnology has emerged—one that views biological systems through the lens of *bona fide* engineering. Unlike earlier approaches, where „engineering" was more metaphor than method, synthetic biology now offers a true engineering framework for designing new-to-nature biological functions. This paradigm shift allows us to move beyond the catalytic capabilities found in nature and begin addressing the degradation and bioremediation of compounds that have long been considered completely recalcitrant.

However, the full potential of these new technologies can only be realized by revisiting current regulations, which often restrict—or outright prohibit—the environmental use of genetically programmed microorganisms. To usher in a new era of bioremediation, we must integrate naturally occurring biological agents with those enhanced by advanced molecular techniques and erase the largely ficticious barriers between the two categories of environmental remedies.

Indeed, developing effective strategies for this integration should become one of the most ambitious research priorities of the coming years. In many cases, the health and resilience of our ecosystems—in particular those well beyond a tipping point— will depend on the success of this effort

4. Call for Policy Alignment, Not Just Support

This position paper advocates for **strategic alignment**, not simply more funding. Environmental biotechnology deserves formal recognition in EU bioeconomy and innovation strategies, alongside biomanufacturing and agri-bio sectors. Despite its transformative potential, innovation bottlenecks—such as technical and deployment challenges, inconsistent national regulations, and the lack of certified testing or demonstration sites—continue to hinder progress and delay market adoption. Overcoming these requires not only regulatory alignment but also early and sustained engagement with non-scientific stakeholders, including landowners, local communities, and SMEs. Co-creation with end-users, as well as SME participation in technology transfer and product development, should be integral to innovation strategies.

Funded by the European Union

Specifically, we recommend:

- **Prioritising environmental biotechnology in Horizon Europe successor frameworks**, including in Cluster 6 and the Missions program, with dedicated calls or cross-sector synergies.
- **Embedding bioremediation within regulatory and innovation roadmaps**, including the Chemicals Strategy for Sustainability and the Soil Health Mission.
- **Creating interoperable data systems and predictive models** to support decision-makers in both environmental management and innovation scaling.
- **Engaging with citizens and stakeholders** through transparency and education around microbial solutions, countering misinformation and promoting acceptance of DNA-based and GMO-related technologies.

These measures will ensure the field contributes not just isolated breakthroughs, but broad **systemic innovation**.

5. Environmental Justice and Global Competitiveness

Environmental degradation disproportionately affects vulnerable populations. Environmental biotechnology offers a science-based path to address this inequity by restoring contaminated environments and preventing future harm. In parallel, clean technologies built on bioremediation offer a **competitive edge** in the global green economy.

Failure to act decisively risks:

- **Losing scientific talent** to better-supported fields or regions
- **Ceding leadership in emerging biotech markets**
- **Facing increased social and economic costs** from unmanaged pollution

6. Conclusion: Environmental Biotechnology Must Be a Pillar of the Bioeconomy

The EU has already laid the groundwork. It now faces a clear decision: continue to nurture this strategically vital sector or risk stagnation and missed opportunities. Environmental biotechnology is no longer emerging—it is ready. It supports resilience, competitiveness, and long-term sustainability across policy domains.

We urge the European Commission to recognize environmental biotechnology not as an adjunct to the bioeconomy, but as **one of its essential foundations**.

Endorsed by EU Bioremediation Cluster Projects:

MIBIREM – https://www.mibirem.eu/

EDAPHOS – https://edaphos.eu/

BIOSYSMO – https://www.biosysmo.eu/

SYMBIOREM – https://symbiorem.eu/
NYMPHE – https://www.nympheproject.eu/
BIOREM – https://www.bioremproject.eu/
pHYBi – https://www.phybi.eu/
IASIS – https://www.iasis-soil.eu/
LIFE MySOIL – https://lifemysoil.eu/
ISLANDR – https://islandr-project.eu/

Disclaimer: This position reflects the views of the undersigned projects and not necessarily those of the European Commission or granting authorities

Funded by the European Union