EXPLORING ENVIRONMENTAL BIOTECHNOLOGY AS A FIELD

Executive summary

A project of the Environmental Biotechnology Network Social Sciences Working Group

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Executive Summary

This small study set out to explore the past, present and future of environmental biotechnology as a field. Drawing on documentary evidence, bibliometric analysis and 12 interviews, it provides an initial mapping of definitions and clusters within the field, and presents tentative conclusions regarding its future directions, following discussions at an EBNet workshop convened on 4th November, 2024.

The study did not identify a single universally recognised definition of "environmental biotechnology", but that the ways different groups define the field diverge across various dimensions (types of organisms, methods applied, areas of application, and focus on prevention or mitigation).

The bibliometric study drew upon a corpus that went beyond using the single search term "environmental biotechnology" by developing a group of terms corpus that were more representative of the scientific field. The corpus was crafted to include topics related to search terms provided by an initial round of consultations and drew from publications in the last 50 years (1973-2022). The analysis shows that:

- Environmental biotechnology is a growing field, relative to the whole of science (Figure 5).
- Five different clusters are identifiable from the bibliometric mapping (see Figure 10), loosely characterised as: General Bioremediation; Contaminants & Phytoremediation; Biochar; Anaerobic Digestion and Nitrogen & Phosphorous Waste.
- As the field has developed over the last fifty years, more publishing activity has taken place in the biochar and anaerobic digestion fields (Figure 12), with biochar, biochar-anaerobic digestion and electron transport chain work in particular taking place in the most recent decade.
- Patterns of publishing activity across the world are severely skewed (Figure 14). Different countries show specialisation in different clusters (Figure 15), and also differences in their levels of international collaboration (as indicated by co-authorship) (Table 10).
- The contribution of India and China has increased dramatically in the last two decades, and China now publishes by far the greatest number of papers of any individual country (in our corpus).
- The term "environmental biotechnology" was used by a surprisingly small proportion of the papers in the corpus (881/200,963). This compares with 89 papers that used the term "industrial biotechnology", 275 that used "environmental engineering", 89 that used "synthetic biology" and 2 that used the more recent term "engineering biology" (Table 7).

Current dynamics show that more traditional approaches to environmental biotechnology (e.g. microbial ecology) are merging with different engineering disciplines as well as artificial intelligence and synthetic biology. The field is therefore evolving in ways that present opportunities for current application areas (e.g. wastewater management) focussing at localised scales, but also potentially extending to more large-scale/ global challenges (e.g. circular economy, climate change). Further work is required to explore these potential use cases and their social and environmental implications, to support associated policy-making across a range of areas.