Transforming Food Waste into Sustainable Soil Improvers for Enhanced Soil Health and Food System Resilience- A Living Lab approach

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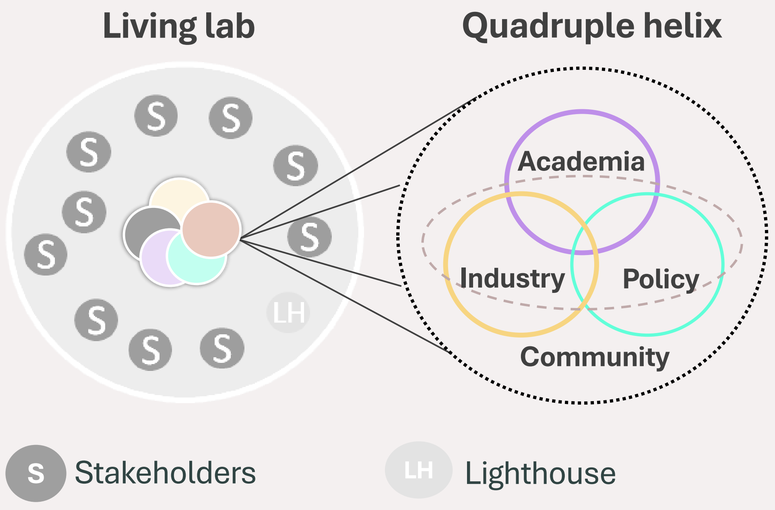
INTRODUCTION

Food waste encompasses various materials, including **food-processing residues** (FPR), by-products, resulting from food industry processes. **Anaerobic digestion** plants transform organic materials such as FPRs, into biogas and digestate. **Digestate** contains concentrated **nutrients**. Recognizing the potential environmental and economic benefits, there is a growing interest in developing technologies for nutrient recovery from digestate. These recovered nutrients can be repurposed as valuable fertilizers, offering a **closed-loop solution**.



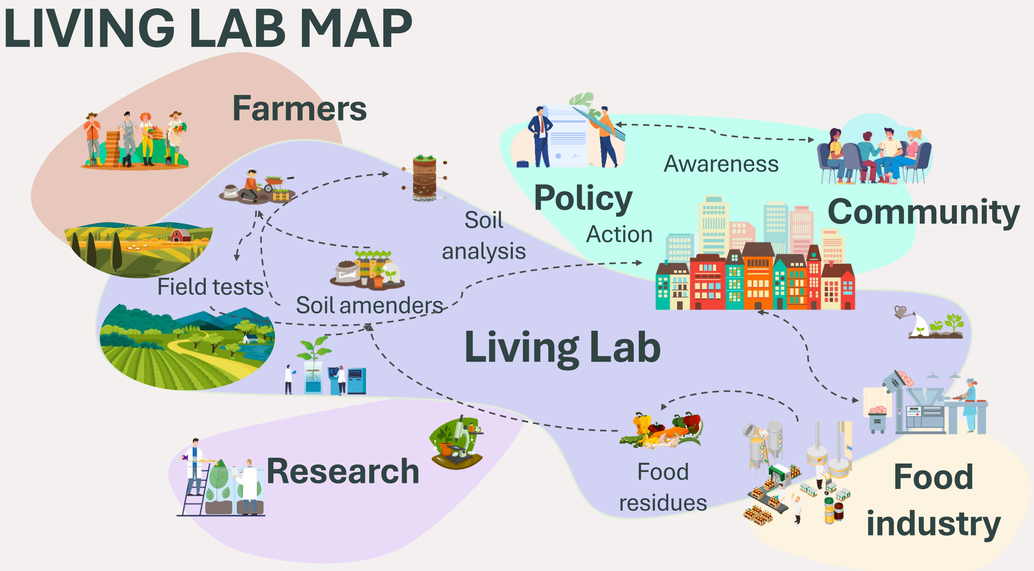
OBJECTIVE

- Development of applicable **recycling technical pathways** to transform **FPR into soil improvers** through anaerobic digestion and selective electrodialysis processing.
- **Engagement** of all relevant **stakeholders** in the food chain and closing specific loops, including nutrients, organic matter, and water.

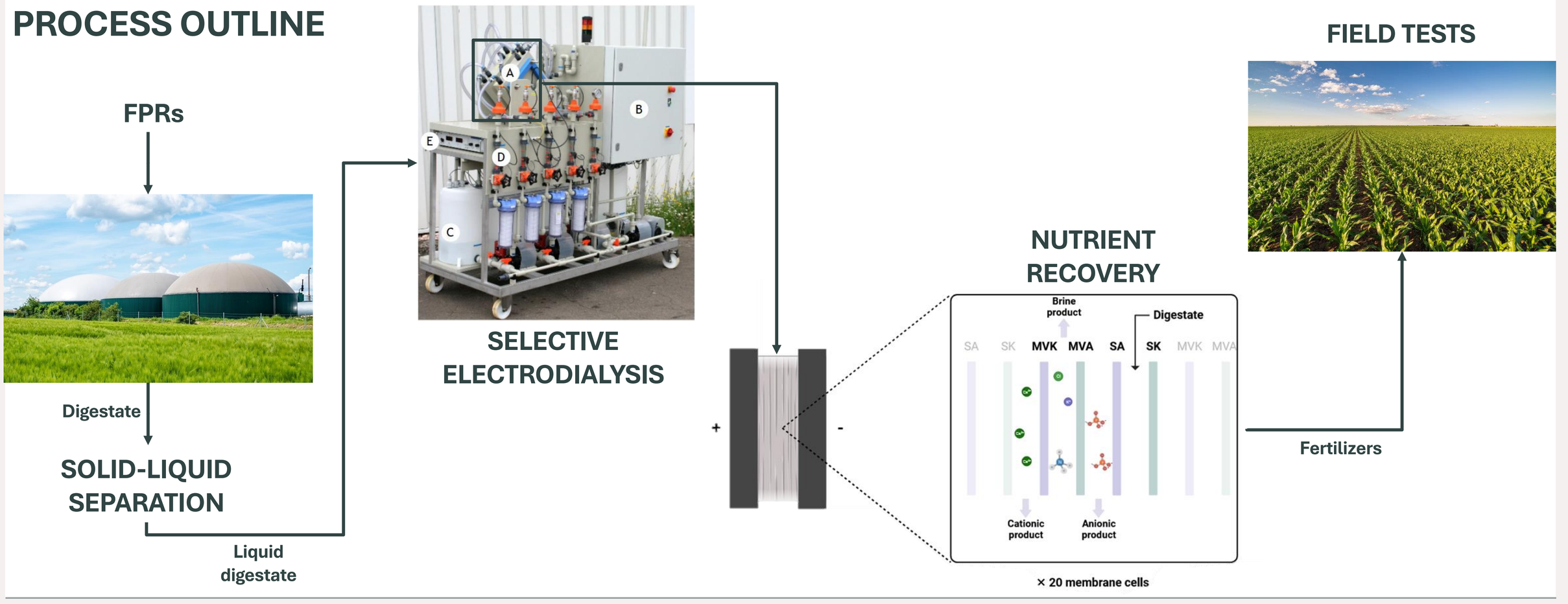
METHODOLOGY

- Investigation of technologies for processing FPRs through a **circular, systemic, and multi-actor approach** at the regional level and within the context of a **Living Lab**.
- The technologies investigated are **solid-liquid separation** and **nutrient recovery via electrodialysis**, which has emerged as a cutting-edge method with the potential to revolutionize nutrient management in various sectors, particularly in **agriculture**.
- **Electrodialysis** is an electrochemical process that utilizes **ion-selective** membranes to selectively transport ions, separating them based on their charge.

LIVING LAB MAP



PROCESS OUTLINE



CONCLUSIONS

- **Food waste hierarchy** suggests reusing **FPRs** before classifying them as waste, as they contain **valuable nutrients** like Nitrogen, Phosphorus, and Carbon.
- **Valorization** of liquid digestate derived from FPRs via **selective electrodialysis** could promote the production of tailored made **fertilizers such as struvite, hydroxyapatite and ammonium sulfate**.
- 98% of NH_4^+ and 92 % of K^+ of liquid digestate was recovered through **selective electrodialysis.**
- Electrodialysis shows promise for revolutionizing **nutrient management** in agriculture by **reducing environmental pollution** and **promoting circular economy principles**.
- Adopting a **Living-Lab approach accelerates the development of sustainable food systems** by optimizing practices and technologies for utilizing FPRs.

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CPERI Chemical Process and Energy Resources Institute

artemis Advanced Renewable Technologies & Environmental Materials in Integrated Systems

WASTE4SOIL

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