University of Antwerp
Faculty of Science

ECOSPHERE

The ECOSPHERE research group aims to study aquatic and valley ecosystems that are continuously challenged by natural and anthropogenic stressors. The research focuses on acquiring fundamental and applied knowledge at different levels of structural and functional organisation in order to underpin environmental management decisions.

MASTER THESIS SUBJECT 2023-2024

Effect of plant characteristics on the bioaccumulation of PFAS in terrestrial plants – for phytoremediation purposes

Research group: ECOSPHERE

Hosting laboratory: CGB, CDE

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- **This topic mostly contains ☒ literature study, ☒ lab work, ☐ field work, ☒ experimental work, ☐ GIS, ☐ numerical modelling, ☐ other: ……**
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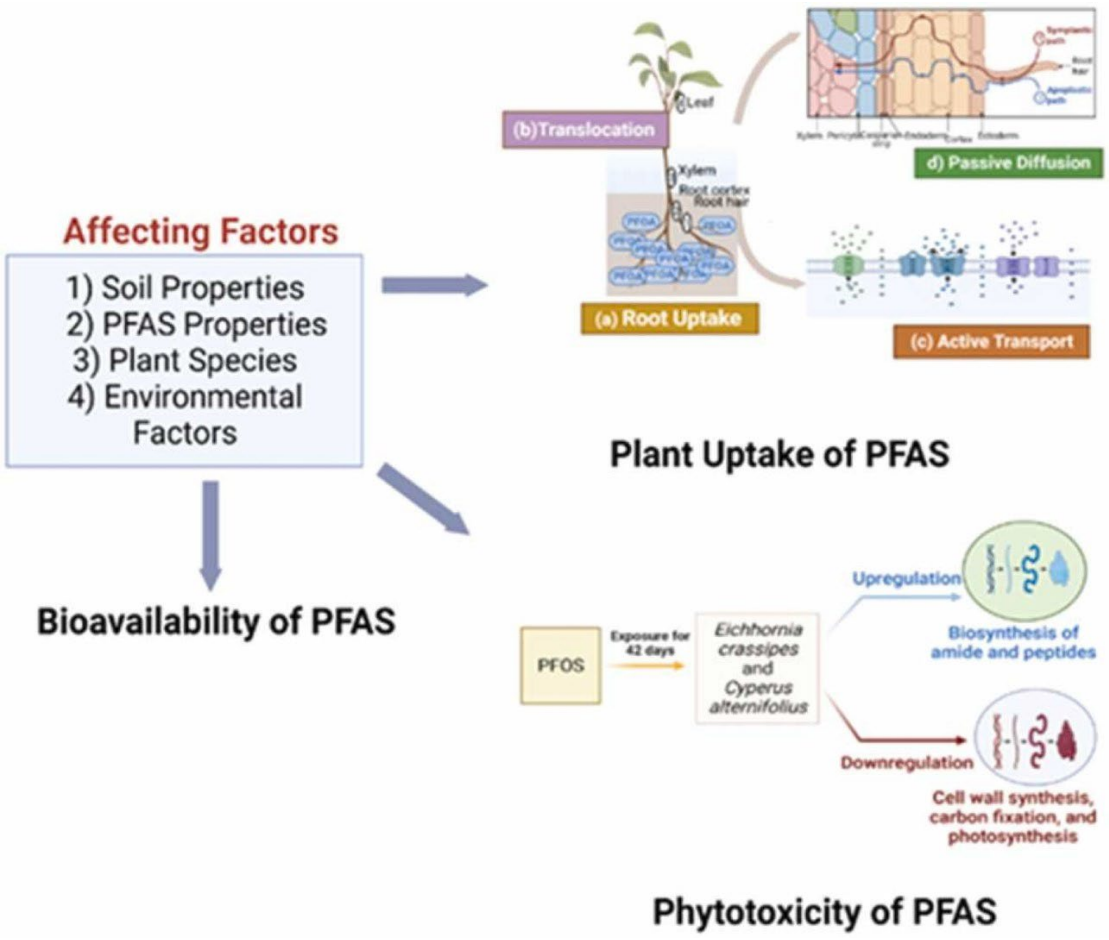

Figure 1: PFAS accumulation in plants (Adu et al., 2023)

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Summary

Per- and polyfluorinated substances (PFAS) have been used in many different applications and consumer products for many decades now. This has resulted in a widespread contamination of the environment. At this moment, not many solutions are developed to remediate contaminated soils from PFAS. The current strategy used in Flanders is not a real solution, since they excavate the first 70 cm of the soil and store it somewhere else, while the soil gets replaced by new clean soil. This comes with very high costs and is not environmentally friendly. In addition, the remediation of PFAS is extremely challenging due to their persistent character and the current strategies mainly focus on PFOS and PFOA, while there are many more PFAS present in the environment that need to be remediated.

A solution to replace the currently used and very expensive technique could be the implementation of phytoremediation to remediate the soil from PFAS. This is a technique wherein plants will bioaccumulate chemical compounds in order to remediate them from soils. For this, it is important to have a better understanding of the plant characteristics, that may help facilitate or even counter the uptake and translocation of PFAS and to evaluate the potential use of plants with such characteristics for phytoremediation as a cost-efficient, low-maintenance and sustainable green approach to remove PFAS from the soil-environment.

Therefore, in this study we will investigate the impact of several plant characteristics (e.g. root biomass) on the uptake and accumulation of PFAS in terrestrial plants. For this, a selection of a few species will be made harbouring the characteristics we aim to evaluate. Soils will be spiked with an aqueous PFAS mixture and plants will be grown within these spiked soils. By doing so, we can track the uptake and accumulation of PFAS within the plants and even determine the amount of PFAS that is remediated from the soil.

You will help with the spiking of the soil, the sewing of the plants, the harvesting and corresponding PFAS analyses on the samples taken. It will be a combination of both experimental work in the mesodrome (CDE) and lab-work to do the PFAS analysis. You will learn both protocols for PFAS extraction (abiotic/biotic samples) and learn about UPLC-MS/MS. In addition, it is possible to also look at toxicity of PFAS on these terrestrial plants.

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References

ADU, O., MA, X. & SHARMA, V. K. 2023. Bioavailability, phytotoxicity and plant uptake of per-and polyfluoroalkyl substances (PFAS): A review. *Journal of Hazardous Materials,* 447**,** 130805.

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