Ph.D. project: Wiebke Mareile Heinze

Occurrence and fate of plastics in agricultural soils in Sweden

The overall purpose of my PhD project is to contribute to our understanding of the distribution and occurrence of plastics in agricultural soils in Sweden, and their subsequent fate. While plastic consumption and emissions are steadily increasing, we know very little about the abundance and fate of plastics in terrestrial systems. Within my PhD project, I will investigate the abundancy of plastics in Swedish soils, but also try to explain their distribution by investigating different fate processes. A special focus will be on the smaller sized fractions of plastic debris, i.e. micro- and nanoplastics, due to the higher anticipated mobility and susceptibility to bio-uptake.

In particular, we hope to examine different potentially relevant transport processes in controlled process-studies in the laboratory. Microcosm tests will be performed to improve the understanding of biologically mediated transport, and results will be used to develop suitable transport models. Then, field samples from agricultural soils with a well-characterized management history will be analyzed for small plastics to firstly, understand sources of plastics in agriculturally managed systems, and secondly to validate and improve the developed transport model for in-field conditions.

By characterizing the spatiotemporal dynamics of these fate processes, it is possible to develop fate models for micro- and nanoplastics in the soil. The developed fate models will then be applied to simulate concentrations in soils under different management systems and input scenarios. For this purpose, a catchment-scale sampling campaign will be conducted to determine the current baseline of plastic pollution of agricultural soil in Sweden. Subsequent spatial analysis will allow delineating potentially vulnerable areas and the dominant factors affecting exposure levels and causing redistribution of small plastics in the field.

My supervisor team consists of:

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- Anke Herrmann (SLU, Department of Soil and Environment)
- Denise Mitrano (ETH Zürich, Department of Environmental Systems Science)
- Elma Lahive (UK Centre for Ecology and Hydrology)