Microplastics in soils:

Sink or source?

Wiebke Mareile Heinze, Denise Mitrano, Elma Lahive, John Koestel, Zacharias Steinmetz, Geert Cornelis

“Sink or source?” has regulatory relevance

	”Soil is a sink”		”Soil is a source”
Implications for Exposure	• Concentrations increase indefinitely • Transport processes of limited relevance	OR	• Concentrations tend to some steady state value • Transport from soil should be considered
Implications for Hazards	• Topsoil most critically at risk • Plastic entry in soil does not affect other environmental compartments		• Groundwater also at risk • Plastic entry in soil affects other environmental compartments

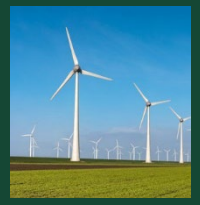
Plastics in the environment


Wastewater treatment


Composting

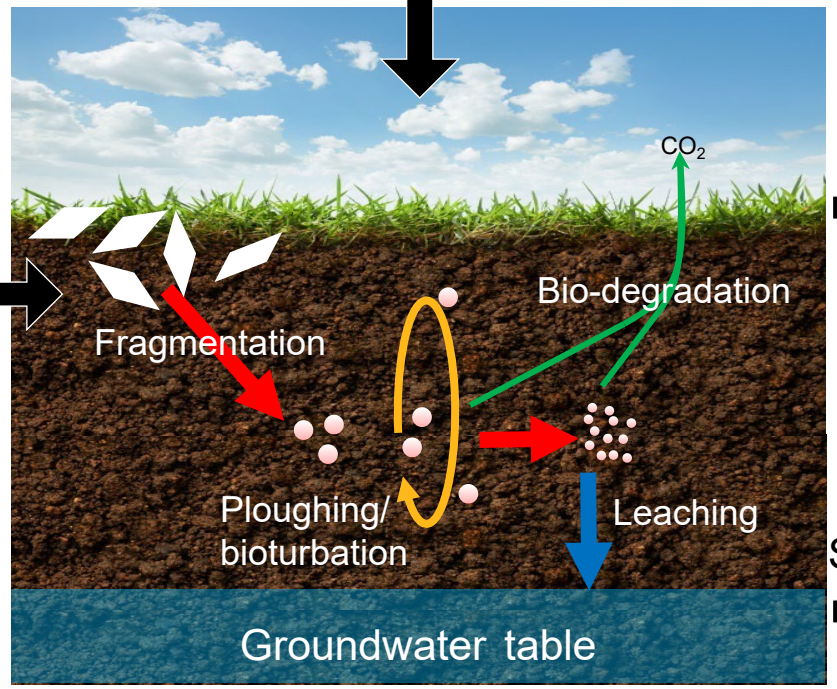
Littering

Construction



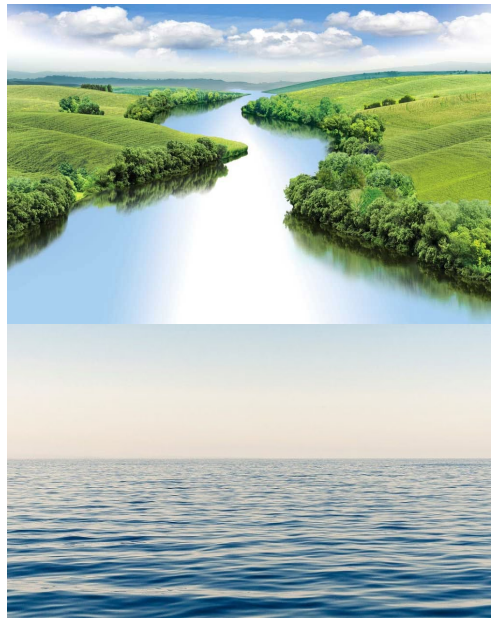

Traffic

Agricultural
plastics

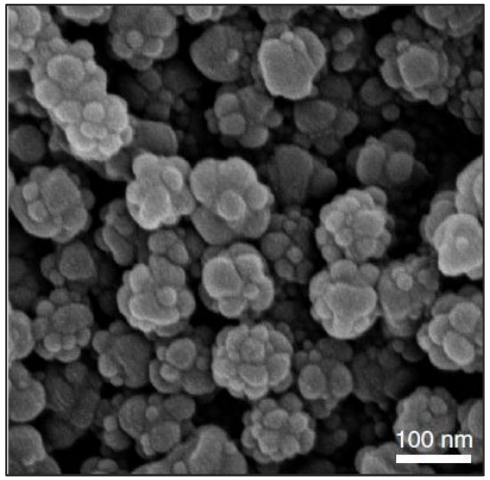


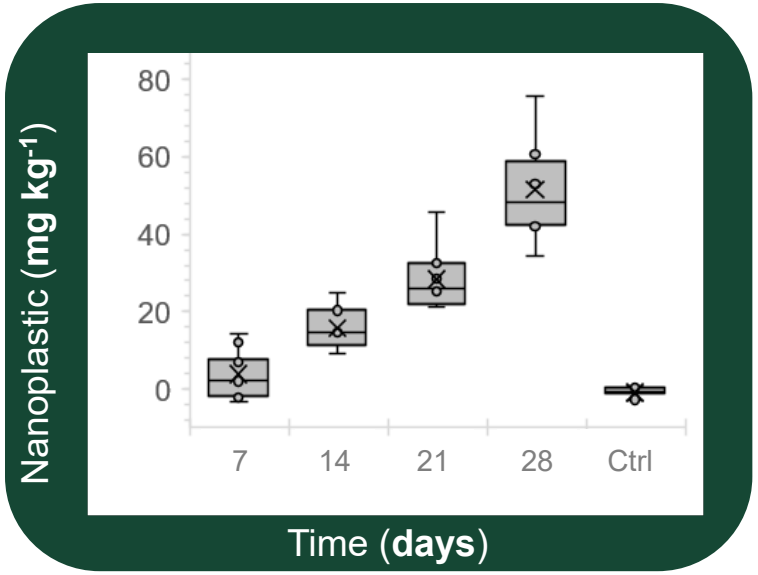
Run-off

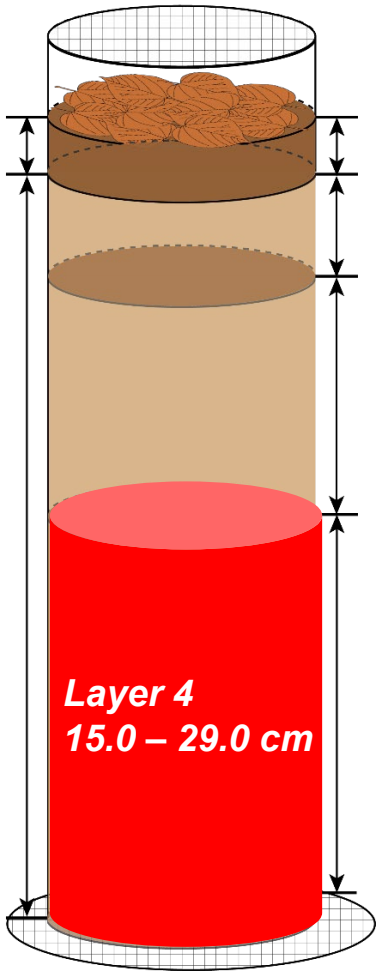
Subsurface flow

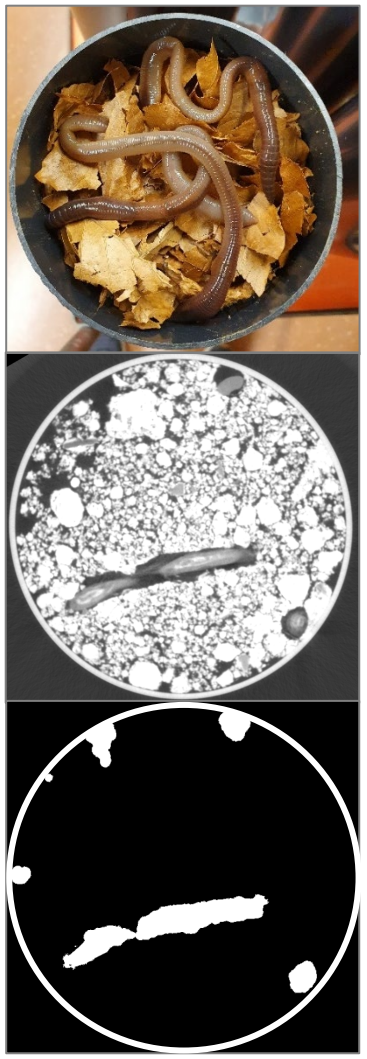


Vertical transfer of microplastics in microcosms due to bioturbation









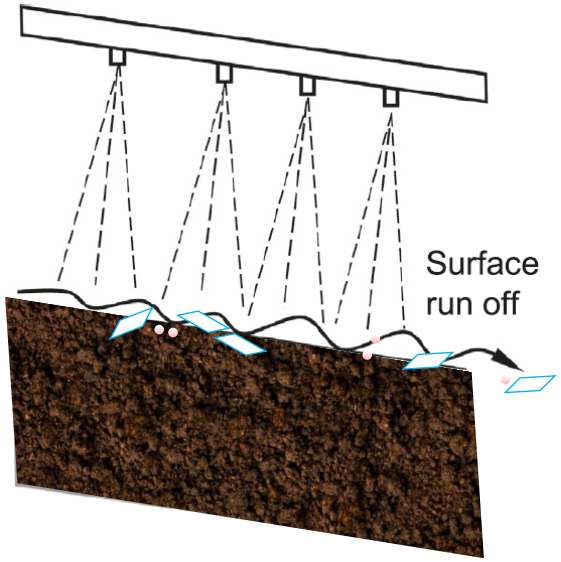
Lab process studies

- ✓ Earthworms transport micro(nano)plastics
- ✓ Over short timespans, micro(nano)plastics can be transported into the subsoil
- ? Applicability to the field

Heinze et al. ES&T. 55, 24, 16423-16433

Horizontal transfers: Run-off

- MP can erode preferentially (i.e. more than the soil itself) during rainwater events if their density < water
- Coarse MPs are removed more than relatively fine MPs or NPs



Rehm et al. Sci. Total. Environ. 2021 148774

Preliminary conclusions

- Removal and transport in soil is significant and **soils should not be modelled and regulated as true sinks**

  →*Vertical transport* of MPs and NPs, most likely predominantly via bioturbation

  →*Horizontal transport* of MPs with run-off from soils

- Groundwater and nearby environments can be contaminated by soil containing MPs/NPs, remains to be seen which is more mobile