

# A methodological protocol to extract microplastics from river sediments (bed, bank and floodplain)

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## 1. Introduction

### Background of this work

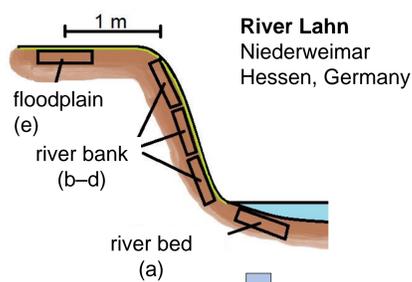
- While microplastic pollution has been proven at many spots worldwide, an accurate knowledge of sources, transport pathways and sinks is still missing.
- Research has focused on marine habitats [1] and large streams so far and the role of small-scale river systems, often adjacent to potential sources as agricultural areas and waste water treatment plants, is yet to be investigated.
- At the same time, the microplastic research community is challenged to develop reliable and efficient identification and quantification methods which are standardized enough to allow for inter-study comparisons.

### Aims of this work

- To gain first insights in microplastic abundance, small-scale distribution and composition in river Lahn
- To establish a method for microplastic analysis in river sediments in our University's microplastic laboratory

## 2. Methods

### 1. Sampling



### 3. Polymer identification



Identification via ATR-FTIR spectroscopy [Tensor 37, Bruker]

### 2. Sample preparation

Density separation via MPSS [2]  
[Hydro-Bios Apparatebau GmbH; separation liquid: NaCl dissolved in water ( $\rho = 1,2 \text{ g ml}^{-1}$ )]



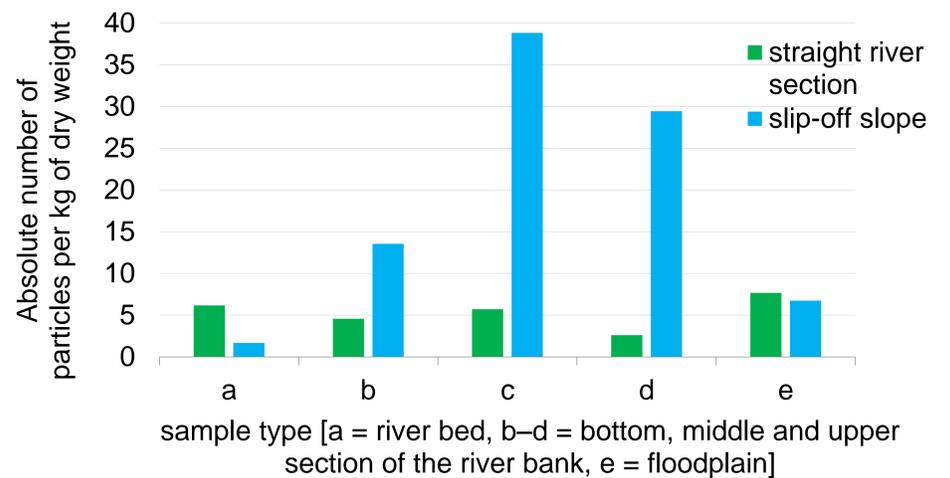
Size fractionation by sieving [2500  $\mu\text{m}$ , 500  $\mu\text{m}$ , 315  $\mu\text{m}$ ]

Detection via Nile red-based photoluminescence [3]  
[20  $\mu\text{g/ml}$ ; solvents: acetone and ethanol (50:50); excitation with 450 nm]

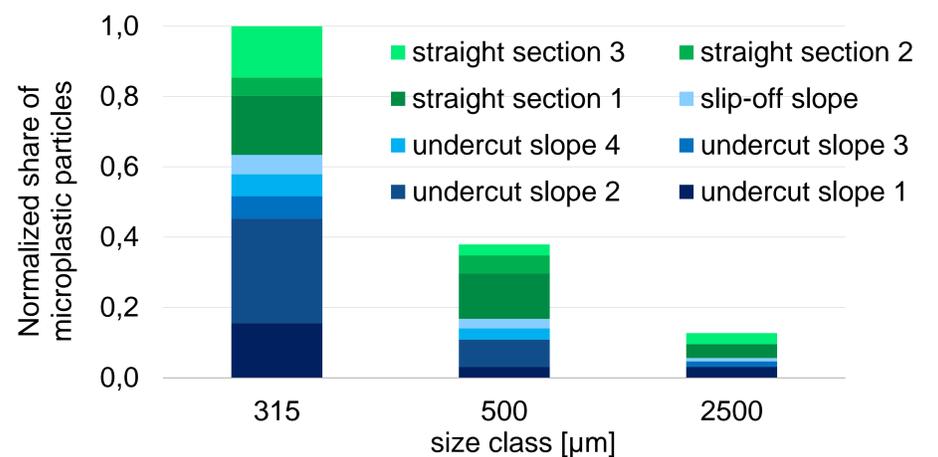


## 3. Results

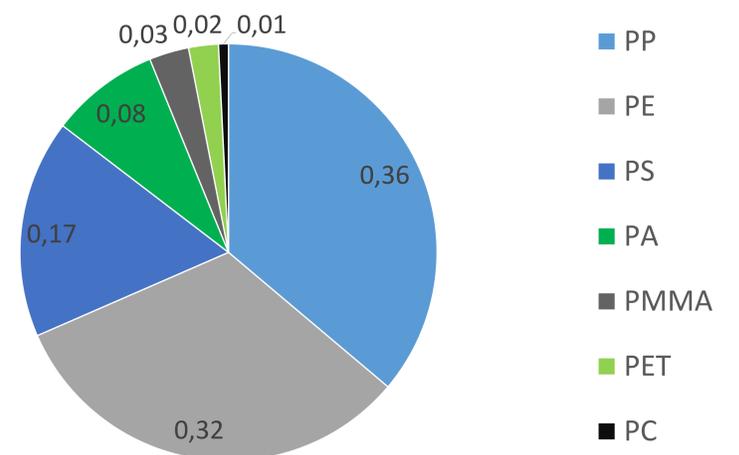
### Comparison of two river bank types



### Particle size distribution (river bed)



### Polymer types (river bed)



## References

- [1] L. Nizzetto, G. Bussi, M. N. Futter, D. Butterfield and P. G. Whitehead, „A theoretical assessment of microplastic transport in river catchments and their retention by soils and river sediments,“ In: *Environmental Science: Processes & Impacts* 18, pp. 1050–1059, 2016.
- [2] H. K. Imhof, J. Schmid, R. Niessner, N. P. Ivleva and C. Laforsch, „A novel, highly efficient method for the separation and quantification of plastic particles in sediments of aquatic environments,“ In: *Limnology and Oceanography: Methods* 10, pp. 524–537, 2012.
- [3] W. J. Shim, Y. K. Song, S. H. Hong and M. Jang, „Identification and quantification of microplastics using Nile Red staining,“ In: *Marine Pollution Bulletin* 113, pp. 469–476, 2016.
- [4] C. Lorenz, L. Roscher, M. S. Meyer, L. Hildebrandt, J. Prume, M. G. J. Löder, S. Primpke and G. Gerdtz, „Spatial distribution of microplastics in sediments and surface waters of the southern North Sea,“ In: *Environmental Pollution* 252, pp. 1719–1729, 2019.

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## 4. Conclusions

- First data on microplastic pollution in the Hessian river Lahn are shown. Microplastics were not only found in the river bed, but also in the river bank and the floodplain. Highest concentrations were found in the river bank of the slip-off slope – probably due to a lower flow velocity compared to the straight river section. Microplastic particle number increases with decreasing particle size as reported elsewhere [4]. Main polymer types were PP, PE and PS. Further investigations at other locations in river Lahn are planned.
- The presented approach – MPSS, sieving, Nile red, FTIR-spectroscopy – was successfully applied to analyse microplastics in river sediments. A digestion of sample matrix could be avoided by using Nile red. Validation and enhancements of the presented methodology are ongoing.