Post-flood macroplastic deposition in riparian vegetation and on floodplains

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Why?

- Flood events mobilize and deposit potentially large amounts of macrolitter in rivers.
- Factors determining the deposition of macrolitter along rivers remain largely unresolved.
- We sampled riverbanks and floodplains following two flood events along the Meuse (> 100 year return period) and IJssel (3 year return period) in the Netherlands.
- We investigated the specific location on the floodplain, and the element, e.g. debris or type of land cover, in which each macrolitter item was found.

Where?

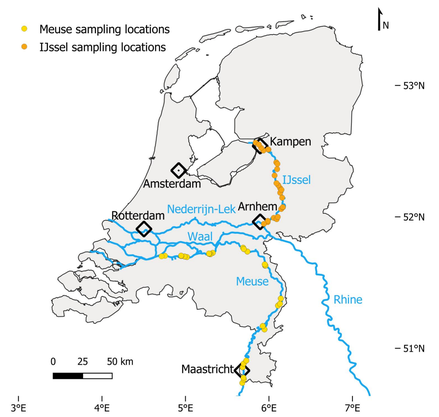

Figure 1: The Netherlands in grey with the main Dutch rivers. The Meuse and IJssel rivers with their respective measurement locations sampled in this study. We sampled 25 floodplains along the Meuse in July and August 2021, and 25 floodplains along the IJssel in January and February 2024.

How?

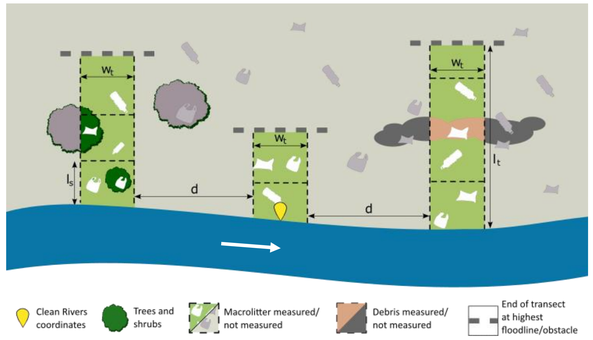

Figure 2: Overview of the sampling approach. Riverbanks were sampled in three transects from the waterline towards the highest floodline. Transects width w_t was 2 m, distance d between transects was usually 40 m. Each transect was sampled in multiple sections with section length l_s.

Figure 3: Example of macrolitter deposited as suspended material in riparian vegetation along the Meuse river (a) and distinct debris along the IJssel river (b). For all macrolitter items we detected in the measured transects we recorded the landcover type (e.g. grass, shrubs, trees) they were deposited in and whether they were deposited off the ground 'in suspension' or on the ground/in ground covering vegetation. Further, we categorized each item based on the River-OSPAR litter classification.

Mass and length of each item was determined based on de Lange et al., 2023.

Results

Macrolitter in riparian vegetation

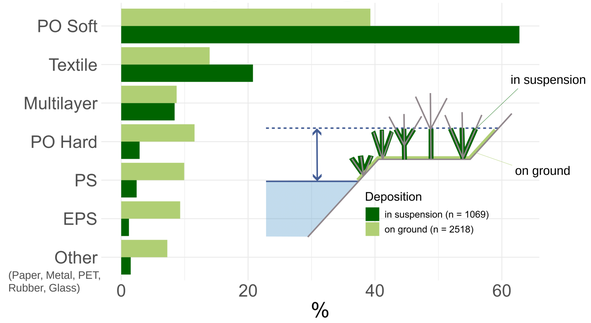

Figure 4: Macrolitter items sampled following the 2021 summer flood along the Meuse river, which were deposited in suspension (i.e. in inundated riparian vegetation, off the ground) in dark green, and on the ground (i.e. on the ground and in ground covering vegetation) in light green. The light and dark green bars respectively add up to 100%.

Macrolitter in debris

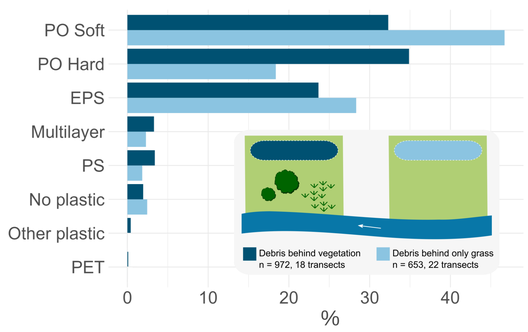

Figure 5: Macrolitter items sampled in debris piles following the 2024 winter flood along the IJssel. Difference in macrolitter composition between items in debris behind only grass in light blue, and macrolitter in debris behind vegetation (such as herbaceous and shrubs) in dark blue. The light and dark blue bars respectively add up to 100%.

Sampled areas, mass, and item count

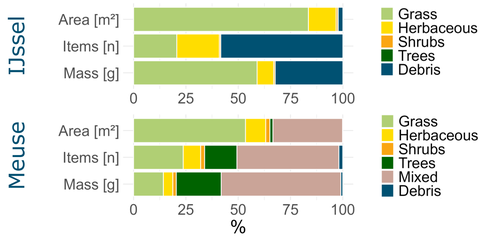

Figure 6: Proportion of measured land cover and debris area in comparison with the macrolitter count and mass proportion we detected in each land cover class, item mass is based on *de Lange et al., 2023*.

Macrolitter size and mass comparison

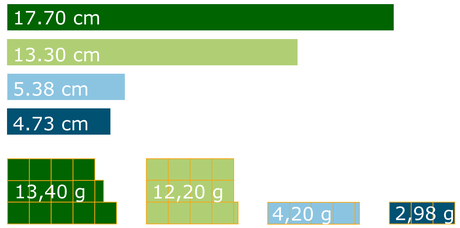

Figure 7: Comparison of average item length and mass for macrolitter suspended above the ground (dark green) and on the ground (light green), as well as macrolitter deposited in debris behind only grass (light blue) and debris behind vegetation (dark blue). Macrolitter length and mass is based on *de Lange et al., 2023*.

Take away

- Riparian vegetation acts as a filter for macrolitter, especially soft items
- Along the IJssel, debris piles constituted 2% of sampled area but accumulated 32% of macrolitter mass and 58% of macrolitter items by count
- Macrolitter in debris behind vegetation were significantly smaller and of lower mass than in debris behind only grass
- Inundated trees along the Meuse constituted 1.4% of sampled area but accumulated 21% of macrolitter mass and 15% of macrolitter items by count
- Macrolitter items deposited suspended above the ground were significantly larger and of higher mass than macrolitter deposited on the ground
- Macrolitter density was lowest in grass with 0.13 items/m² (Meuse) and 0.12 items/m² (IJssel)
- Regular and event specific sampling should cover all land cover elements in the area, since mass and count density of macrolitter varies between elements

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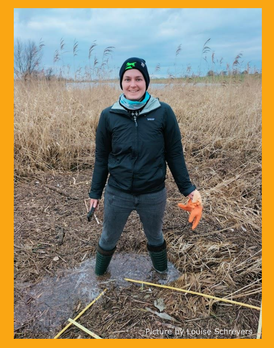

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References and further reading

de Lange, S. I., Mellink, Y., Vriend, P., Tasseron, P. F., Begemann, F., Hauk, R., ... & van Emmerik, T. H. (2023). Sample size requirements for riverbank macrolitter characterization. Frontiers in Water, 4,

Hauk, R., van Emmerik, T. H., van der Ploeg, M., De Winter, W., Boonstra, M., Löhr, A. J., & Teuling, A. J. (2023). Macroplastic deposition and flushing in the Meuse river following the July 2021 European floods. *Environmental Research Letters*, *18*(12), 124025.

Hauk, R., van der Ploeg, M., Teuling, A. J., de Winter, W., & van Emmerik, T. H. (2024). Flood-induced buttertub spill reveals riverine macroplastic transport dynamics. *Environmental Sciences Europe*, *36*(1), 149.

van Emmerik, T. H., Frings, R. M., Schreyers, L. J., Hauk, R., de Lange, S. I., & Mellink, Y. A. (2023). River plastic transport and deposition amplified by extreme flood. *Nature Water*, *1*(6), 514-522.

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