River floods and plastics: Where did the litter go when the Meuse flooded?

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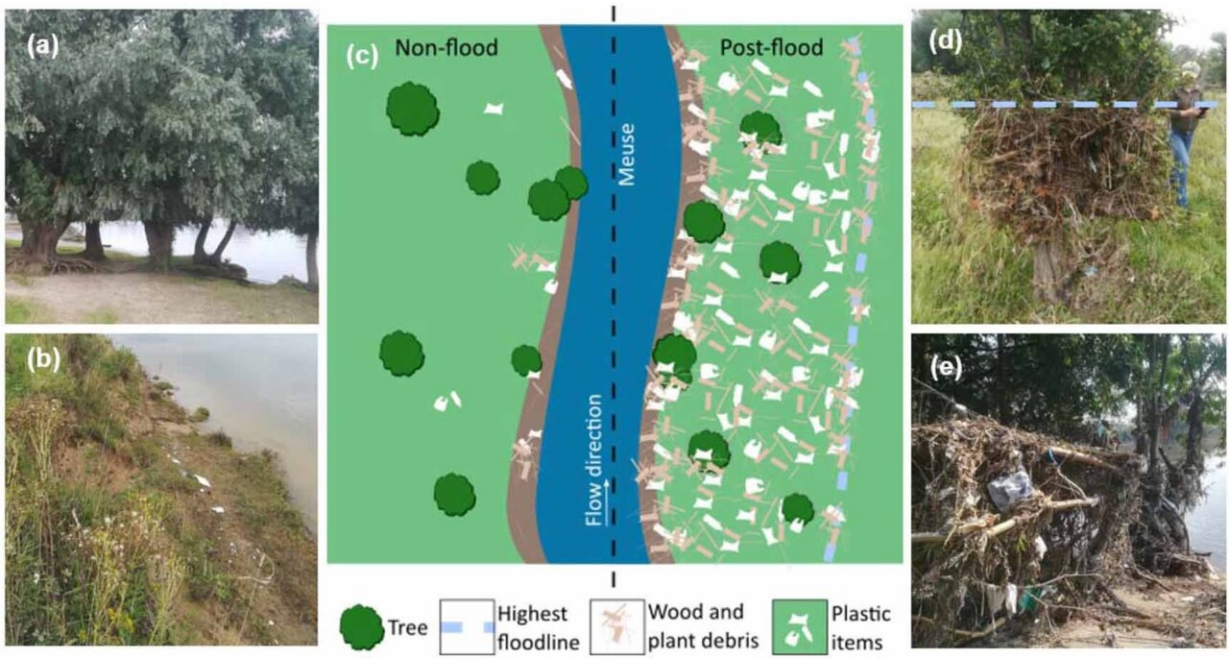

Concept of flooded riverbanks and riverbanks that were not flooded, which showed different litter and natural debris densities and modes of litter deposition (c). Location 11 (a) showed no litter deposition, even though the tree roots provided potential for entanglement. Location 9 (b) showed very low litter deposition, close to the waterline at the time of Q3 measurements. Location 2 (d) and location 1 (e) showed high deposition, especially in higher vegetation. The flood peak water level is clearly depicted by litter and plant debris deposition and entanglement in higher vegetation. Pictures by Rahel Hauk. Credit: *Environmental Research Letters* (2023). DOI: 10.1088/1748-9326/ad0768

Plastic pollution is a global problem and Dutch rivers are no exception. Anyone who has ever walked along their banks will know the sight of bottles, caps and food packaging. But some of that litter may originate from elsewhere. How much plastic waste is transported and deposited by rivers? And what happens during floods?

Researchers of Wageningen University & Research, Heerlen Open University and the North Sea Foundation investigated the deposition and flushing of macroplastics in the Dutch Meuse river after the flood in 2021. One of their findings was that even during an extreme flood event like this, not all plastic litter is transported from a river into the sea, but most of it is actually washed onto the riverbanks. The study was recently published in *Environmental Research Letters*.

"Our observations help to understand more of what happens to macroplastics in the environment," said Rahel Hauk, Ph.D. candidate and lead author of the study. "We recommend to include extreme events like floods in plastic litter monitoring, to see their impact on plastic transport and deposition. Understanding these dynamics better is important. It could contribute to better prevention of plastic pollution and finding ways to manage it."

Counting litter along the river Meuse

Macroplastics include all plastic waste larger than 0.5 cm. When they are released in the environment, rivers play an important role in their further distribution and deposition. Hauk states, "During floods the transport of floating macroplastics is known to increase. The floods in July 2021, which also affected the river Meuse, provided an unique opportunity for plastic pollution research."

Within three weeks after the severe flood in July 2021 the research team counted and categorized plastic litter on 16 riverbanks along the river

Meuse. They compared plastic accumulation and flushing during this period, to accumulation on the same riverbanks during normal discharge conditions between 2018 and 2021. The data from these years were available from Clean Rivers project (Dutch: Schone Rivieren), which has been monitoring litter along rivers since 2017.

Many macroplastics stay around after floods

Overall, there was more plastic litter found on the Meuse's banks than what would be expected for that time of year, as a result of the extreme flood. However, along the entire Dutch Meuse there was still less plastic litter than is being deposited during average Dutch winters.

The research team noticed a strong difference between plastic deposition upstream (at the Belgian–Dutch border, where the flood was most severe) and more downstream. Close to the border there were almost 200 times more plastic items deposited due to the flood than at the most downstream location, close to Raamsdonksveer. This indicates that even during extreme floods, much of the plastic litter is not transported into the sea, but stays in the rivers or ends up on their banks.

More soft plastics and wet tissues

The researchers saw that after the flood macroplastics smaller than 2.5 cm were flushed away from the riverbanks into the river, whereas soft plastic fragments up to 0.5 m and wet tissues were brought onto the banks. This suggests that how macroplastics move in rivers, and where they come from, can be different during floods compared to normal times. For example, the flood caused a significant sewer overflow, which may explain the increase in wet tissues.

More information: Rahel Hauk et al, Macroplastic deposition and

flushing in the Meuse river following the July 2021 European floods, *Environmental Research Letters* (2023). DOI: 10.1088/1748-9326/ad0768