# Unraveling the Impact of Microplastics on Bioturbation: Insights from Microcosm Experiments across Diverse Ecosystems

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**Résumé**

Ecosystem engineers play a key role in shaping the structure and function of ecosystems. They actively create or modify habitats, both for themselves and other species, through direct alterations to the landscape or by indirectly influencing microbial communities and associated biogeochemical processes. This manipulation provides shelter and affects resource availability for various species within the ecosystem. The physical manipulation and restructuring of soil or sediment matrices by these engineers are collectively referred to as bioturbation. Because it involves various organisms and behaviors, bioturbation can serve as a crucial indicator of ecosystem functioning. Nowadays, the widespread presence of plastic debris, especially microplastics measuring less than 5 mm in size, is a significant and harmful environmental hazard potentially affecting bioturbating species. Nevertheless, a low number of studies assessed the influence of these microplastic particles on the bioturbation process.

To fill this gap, three microcosm laboratory experiments were conducted across three distinct ecosystems: terrestrial soil, freshwater sediment, and marine sediment. These ecosystems were exposed to a mixture of microplastics containing polystyrene fragments, polyamide fragments and fibers, ranging from 10 to 1000 $\mu$m in size, and displaying red and white coloration. Three model ecosystem engineers-*Aporrectodea caliginosa* (terrestrial), *Tubifex tubifex* (freshwater), and *Hediste diversicolor* (marine)-were studied under controlled conditions, both with and without microplastic contamination.

Fluorescent inert particulate tracers (i.e., luminophores) were then employed to monitor particle reworking activity, the solid transport component of bioturbation. After 21 days under the controlled conditions representative of each ecosystem, the vertical distribution of luminophores was measured with or without microplastics for each species, and different

*Intervenant

reworking coefficients and proxies were calculated.
Our preliminary results revealed diverse effects on reworking activities, with *A. caliginosa* showing a 9% increase, while *T. tubifex* and *H. diversicolor* experienced reductions of 78% and 28%, respectively. These findings offer valuable insights into the impacts of microplastics on soil and sediment species. This underscores the urgency for additional research in this field to comprehensively understand and mitigate the adverse effects of microplastic pollution on ecosystems.

**Mots-Clés:** Ecosystem engineers, Contaminationm Freshwater, Marine, Terrestrial, Sediment, Soil