Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.14741

Embracing ecosystem complexity to understand the full impacts of microplastics pollution

PROF. DENISE M. MITRANO

ETH Zurich

Presenting Author: denise.mitrano@usys.ethz.ch

Microplastics (MPs) pollution is frequently framed as an exercise in enumerating particle burdens through monitoring studies, assessing transport between environmental compartments or as an (eco)toxicological issue. However, fewer studies address the complexities of how the presence of MPs impact natural systems and biogeochemical cycles in a holistic way. In this context, two examples will be presented where MPs have indirect effects on aqueous and terrestrial environments. First, understanding how MPs and freshwater snow (FWS) interact and influence their respective settling rates through the water column supports both MPs fate modelling and their ecological impacts with respect to FWS deposition and nutrient cycling. We used a laser-illuminated plexiglass column equipped with a stereoscopic camera system to track the settling velocities of particles in three tests: 1)MPs of various size, density and morphology, 2)FWS flocks and 3)MPs-FWS heteroaggregates. Typical equations describing particle settling dynamics (e.g., Stokes law) could not predict MPs velocities when the morphology deviated from perfectly spherical particles. When MPs were incorporated into FWS, the faster settling velocities of these heteroaggregates may impact biogeochemical cycles by changing the flux of carbon, nitrogen, and phosphorus contained in FWS to the sediment, potentially having implications on productivity throughout the water column. In a second example, we explored responses of soil ecosystems to the presence of plastics and their impact on soil structure, nutrient cycling, and greenhouse gas emissions. Currently, the effects of MPs in soils are uncertain due to uncertainties in how MPs drives changes in soil structure and the subsequent linkages between soil structure and microbial activity. Here, the presence of MPs affected soil structure and pore connectivity, leading to higher or lower O_2 availability and consequently higher or lower soil respiration. The magnitude and direction of these effects were dependent on soil texture and MPs morphology. Framing the presence of MPs in soil in this way can help elucidate the impacts MPs have on soil functioning. Understanding the consequence of MPs presence in natural systems will be more complete by increasing the scope of current experimental designs to advance plastics research and policy within the context of global environmental change.