SOIL SCIENCE COLLOQUIUM

Guest speaker

Tuesday 28th Sept 2021, 4.15 pm – 5.15 pm

Small(er) plastics, big(ger) problems? Fate, transport and impacts of nano- and microplastics in the environment

Prof. Denise M. Mitrano
ETH Zurich – Department of Environmental Systems Science

ABSTRACT. Numerous studies have made the ubiquitous presence of plastic in the environment undeniable, and thus it no longer comes as a surprise when scientists measure the accumulation of macroplastic litter and microplastic fragments in both urban and remote sites. Ultimately, the different physical and chemical characteristics of the different size classes of plastic pollution (macroplastic, microplastic and nanoplastic) will result in divergent fate and hazards. Quantitative data are still limited due to analytical difficulties to detect nanoplastics in complex matrices, and thus mechanistic studies to understand the fate, transport and biological interactions of these materials are limited. While progress is still ongoing to develop protocols to measure particulate plastic in field studies, researchers who study these processes in bench top or pilot scale studies can take advantage of an entirely different approach. In the last years, we have synthesized a variety of particulate plastics with an embedded inorganic fingerprint which can be used as a proxy to detect plastic by common analytical techniques for trace metals analysis. In practice, this affords for quicker and more accurate sampling and subsequently allows us to investigate the basic processes and pathways which control particulate plastic fate and impacts. To highlight the utility of this approach, we have used these materials in a number of different test systems including, 1) mass balance and flux of plastic through pilot-scale wastewater and drinking water treatment plants, 2) application of sewage sludge in agriculture and plastic mobility through porous media and 3) the interaction and uptake of nanoplastics with plants and organism. As environmental nanoscientists, we try to place nanoplastic in the context of global plastic pollution by

assessing its source and risk, but also by assessing commonalities nanoplastics may share with other nano-sized objects in environmental systems, such as engineered nanomaterials and natural colloids. The presence of plastic in the environment has sparked considerable discussion amongst scientists, regulators and the general public as to how industrialization and consumerism is shaping our world. Restrictions on the intentional use of primary microplastics are under discussion globally, despite uncertain microplastic hazards and prioritization amongst options for action. Regulations should have a precise focus and must be enforceable by measurements. Policy must carefully evaluate under which contexts microplastic use may be warranted and where incentives to replace certain microplastics can stimulate innovation of new, more competitive, and environmentally conscious materials. Collectively, our research aims to understand the implications of (nano- and micro-) plastics in the environment and provide information to make more sound and sustainable choices in relation to plastic use and waste management.

BIO. Denise M. Mitrano is an Assistant Professor at ETH Zurich in the Environmental Systems Science Department. As an environmental analytical chemist, her research focuses on the distribution and impacts of anthropogenic materials in technical and environmental systems. She is particularly interested in developing analytical tools to systematically understand the mechanisms and processes driving the fate, transport and biological interactions of particles, such as engineered nanomaterials and nano- and microplastics. In this context, her research group uses these results to assess risks of anthropogenic materials. An interest in a "safer by design" approach for both nanomaterials and plastics is exemplified by working on the boundaries of environmental science, materials science and policy to promote sustainability and environmental health and safety of new materials.

You are welcome to attend in person in Hallerstrasse 12, seminar room 002 or virtually in the Zoom seminar room.

The presentation will be followed by a talk by Alexandra Foetisch, doctoral candidate from the Soil Science Group, on the topic: "Study of plastic aging using STXM."