

Source attribution and environmental fate and effects of Microplastics, an emerging pervasive and persistent environmental contaminant

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Project description: This PhD will undertake lab and field work in aquatic and terrestrial ecotoxicology to assess the so far un-researched exposure potential and possible effects of plastic fragments in these ecosystems. Such “microplastics” comprise small pieces of plastic debris (<1mm) that are derived from anthropogenic sources. These include particles deliberately added to products for their abrasive properties and also pieces released from larger items during weathering. There are a number of concerns about the possible environmental impacts of microplastics. These centre on their persistence (slow degradation times); potential for uptake by organisms and capacity to transfer surface adsorbed and intrinsic chemical contaminants into organisms when they are taken up.

To date the majority of research into microplastic “pollution” has focussed on marine systems; however, recent studies have indicated that up to 90% of the plastic in the seas originates from terrestrial and freshwater sources. Currently the processes that govern the fate and transport of microplastic in these terrestrial and freshwater environments are not well known. Further, given that microplastics are likely to be common in rivers and soils, information on the role of these materials as vectors for important pollutants such as metals, industrial organic chemicals and pesticides into the organisms living in these environments is notably lacking.

The aim of this PhD will be to quantify these transport routes and to investigate potential consequences for species exposed to these materials and associated chemicals using a range of approaches.

- Field work will assess the transport mechanisms of microplastics in different river catchment situations around the UK, as well as in soil columns.
- *In-situ* mesocosm study will study the detailed mechanisms of microplastic persistence in waters, sediments and soils.
- Laboratory studies will establish rate of microplastic uptake by species with different ecological and physiological characteristics and the resulting exposure to relevant pollutants that may co-occur with these plastics in the environment.

Together, these studies will help to develop a picture of the environmental distribution and transport of microplastics, their biological availability and the potential ecotoxicological consequences for key aquatic and terrestrial organisms. Communication of study results at International meetings will become a key aspect of this novel work.

Rillig, MC (2012). Microplastic in Terrestrial Ecosystems and the Soil? *Environ. Sci. Technol.*, 46, 6453–6454.

Wright S, Thompson RC, Galloway TS (2013) Microplastic ingestion decreases energy reserves in marine worms. *Current Biology*.