PROJECT TITLE: Tackling the Plastic Waste Problem: Quantifying Polymer Contamination of the Terrestrial Environment
DTP Research Theme(s): Living World, Changing Planet
Lead Institution: University of Bristol
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Project partners: Dr Anish Warrier, Centre for Climate Studies, Manipal Academy of Higher Education, India; Prof. Rahul Mohan, National Centre for Antarctic and Ocean Research (NCAOR), India.
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Project keywords: plastic, polymer, pollution, environment, sediment, organic chemistry, Antarctica, India

Project Background
Plastic pollution is a global issue receiving ever increasing levels of public attention. More than 80% (150 million tonnes) of all ocean pollution is plastic. As a petroleum-based product, plastic (polymer) ingestion is harmful to wildlife, human well-being and global-national economies. By 2050, ocean plastic is expected to weigh more than fish, unless costly and ongoing clean-up operations are put in place urgently. Most ocean plastic 'litter' originates on land with major rivers providing important source-to-sink pathways into the ocean. How effectively the problem of plastic pollution in the ocean can be resolved is dependent on establishing effective methods for surveying, quantifying and modelling pollution pathways on land and examining how these can vary through time. A key area in need of further research is developing long-term strategies to reduce the amount of plastic pollution reaching the ocean from the terrestrial environment.

Project Aims and Methods
- Develop novel methods to characterise the distribution of plastic waste in sediments of major river systems in temperate (UK), sub-tropical to tropical (India), and polar regions (Figure 1).
- Model source-to-sink litter pathways inland from major coastal river systems.
- Provide quantitative spatial and temporal pollution datasets for effective remediation strategies.

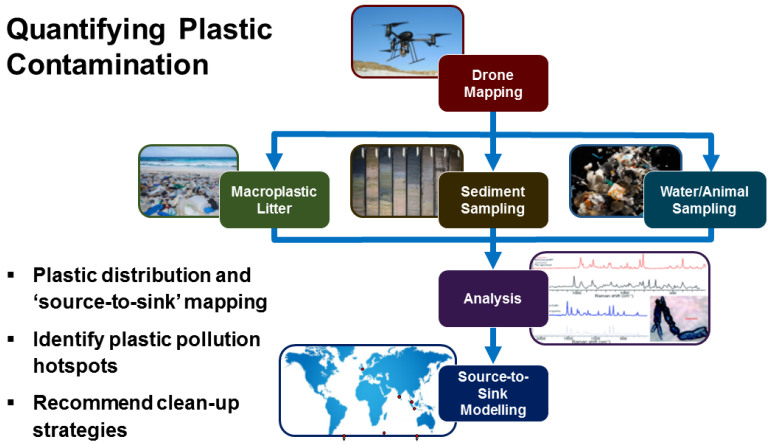

Figure 1 Developing a holistic approach to quantifying terrestrial plastics

Work packages
The project will primarily involve the acquisition and statistical evaluation of Py-GC/MS data (a new analytical system for evaluating plastics in the environment) and Py-GC-Q/TOFMS data (pre-existing instrumentation) as a means of rapidly quantifying micro/nanoplastic contamination of terrestrial sediments, soils and products generated by the waste and water treatment industries. Key tasks include:

1. Develop pollution/effluent pathway sampling and monitoring strategies and assess seasonal changes in plastic contamination for two major river catchments in SW England (Avon and Severn).
2. Develop microplastic and nanoplastic analytical protocols using state-of-the-art techniques (Py-GC/MS and Py-GC-Q/TOMS) and a novel targeted 'omics-based approach.
3. Working with project partners from India, assess plastics source-to-sink pathways environments for two major river systems in Karnataka, SW India, the Netravathi and Sharavati rivers, to build a more quantitative picture of micro/nano-scale plastic contamination and improve remediation practices.
4. Trace plastic contamination of sediments and soils from industrial, urban and globally 'pristine' environments (including Antarctica, the Arctic).

Candidate Requirements: This project would suit someone with good laboratory/data analytical skills and a willingness to learn new techniques. A background in analytical Chemistry, Environmental or Earth Sciences is desirable, as is an aptitude for statistical analysis and an interest in pollution monitoring and remediation. There will be opportunities to develop aspects of the project around on your own interests and strengths.

Training: You will be fully-trained in organic geochemistry analytical techniques at the OGU at Bristol University, one of the oldest and most successful organic geochemistry groups in the world. You will join a vibrant Plastics Research Group at BAS, with regular opportunities to meet with key industry and government stakeholders and the newly-formed Cambridge Centre for Circular Economy of Plastics. There will be regular web-based meetings with Indian partners and opportunities to develop field-sampling strategies *via* Indian/UK student government exchange schemes. You will have access to optional NERC training courses and take part in the GW4+ /BAS student training program.

Background reading list

Fischer, M. and Scholz-Böttcher, B.M. (2017) Simultaneous Trace Identification and Quantification of Common Types of Microplastics in Environmental Samples by Pyrolysis-Gas Chromatography−Mass Spectrometry. *Environmental Science and Technology* **51**, 5052−5060.

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