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Dual signature tracer: A new tool for soil management and research.

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The significant detrimental effects that occur, both on and off site due to the transport of soil are well documented. Now more than ever, it is vital to understand the pathways, processes and fate of transported sediments, to underpin environmental strategy and develop robust forecast models. Researchers have employed a broad range of materials and techniques to trace the movement of soil through space and time. However, three primary challenges still remain: 1) to develop a tracer that has the same or similar hydraulic characteristics as soil: 2) to develop a tracer able to replicate the broad and variable particle size distribution of soils; and: 3) to develop a tracing methodology that increases the volume, and quality of data collected from the field.

This study approaches these challenges using a unique ‘dual signature’ tracer comprising natural mineral material directly coated with a fluorescent dye pigment and loaded during coating with a naturally occurring magnetic mineral oxide creating a tracer with both fluorescent properties and para-magnetic character. An assessment of the effectiveness of the tracer as a tracer of soil was conducted at the soil box and plot scale under controlled rainfall conditions, to: 1) examine the behaviour of the tracer, and: 2) to assess the efficiency of the different tools available to monitor the tracer post- deployment. At the plot scale, a unique site specific tracer was developed to match the hydraulic characteristics (particle size distribution and specific gravity), of the native soil enabling the source-sink relationship, transport pathways and transport rate through the environment to be investigated. Spatial mapping of the tracer distribution within each plot was also conducted using photography and Ultra Violet (UV) illumination. The results of this study provide the basis for the development of a unique soil tracing methodology, which can be applied to investigate soil transport processes, at a range of scales in a variety of settings.

Keywords: soil, processes, erosion, tracing, fluorescent, magnetic