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Sourcing sediment loss to watercourses at catchment scale using a novel tracing-tracking framework

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Although traditional sediment tracing approaches provide valuable information for characterising key generic sediment sources, Catchment Officers working as part of the England Catchment Sensitive Farming Delivery Initiative (ECSFDI) frequently require higher resolution evidence to assist better the targeting of mitigation options. Accordingly, a novel framework combining conventional sediment source fingerprinting and a dual signature tracking method has recently been used to improve the resolution of sediment source information for contrasting priority catchments. Conventional geochemical tracing incorporating revised mass balance modelling is used to provide information on the relative significance of generic sediment sources such as grassland or arable surface soils, damaged road verges and channel banks/subsurface sources and to provide a framework for the spatial extrapolation of tracking data. Particle tracking using fluorescent-magnetic grains is used to elucidate sediment loss from key components of the primary generic sources, characterised, for example, as poached gateways or cattle tracks and wider areas of general poaching damage in grass fields, wheeling or inter-wheeling areas in arable fields and poached or fluvial-eroded channel banks. The insertion of high-strength magnets in watercourses ensures that the tracking component links sediment loss from seeded areas to river channels as opposed to providing edge-of-field information. Uncertainty and prior information are explicitly recognised by the novel framework.
Key words: sediment sources; catchment scale; fingerprinting; tracking; uncertainty; prior information