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Tramline wheelings as diffuse pollution sources: integrating across spatial scales

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Identifying the sources of diffuse pollution, characterising transport pathways, and understanding the factors controlling delivery to water bodies, are generic challenges faced by scientists and policymakers supporting the implementation of the EU Water Framework Directive and other water quality legislation. Land management is intrinsically field scale, which is the scale at which much fieldwork is focused. However, processes identified at plot or field scale may not be significant in terms of water quality at catchment scale, which poses the problem of how best to upscale relevant field-scale characterisations. A consistent framework is urgently needed which is capable of bringing together experimental techniques at these disparate spatial scales (plot, field and river catchment scale), to provide high resolution evidence to support catchment characterisations (which identify "hot spots") and the spatial targeting of mitigation measures aimed at diffuse pollution control. In the absence of such frameworks, comparing existing data from disparate projects represents a starting point for assessing scaling issues.

The emerging evidence base is increasingly underscoring the importance of tramline wheelings as sources and pathways for diffuse pollution loss to the edge of cereal fields. Recent UK research has demonstrated that these compacted, unvegetated areas (which are used as markers in spraying operations) can account for over 80% of surface losses of runoff, sediment and phosphorus to edge-of-field. Current government and industry-funded projects are now exploring a range of novel practical land management techniques to minimise these field-scale losses. However, given the mitigating role of field headlands and boundaries, and riparian buffer strips in limiting connectivity and delivery to water bodies, it has not been clear whether such losses represent an important element of the net pollutant load reaching catchment outlets. Such scaling issues represent an important problem in modelling studies. New research evidence, however, has recently been assembled using a novel, conventional tracing - magnetic tracer framework, with results supporting the importance of tramline wheelings as pollutant pathways controlling surface losses from cereal fields at catchment scale. The implications of a comparison of the findings of this research with the results of independent field scale investigations are discussed. Fully coupled approaches across spatial scales continue to be unusual, but are required to link field-scale evaluation of sources, pathways and processes with corroborating evidence of the associated impact on loads in receiving waters.