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A catchment-integrated approach to determine the importance of secondary sources of contaminated sediment

Jose Andres Lopez-Tarazon (1,2,3), Patrick Byrne (1), Donal Mullan (4), and Hugh Smith (5)

(1) School of Natural Sciences and Psychology, Liverpool John Moores University, Liverpool, UK, (2) Institute of Earth and Environmental Science, University of Potsdam, Potsdam, Germany, (3) Department of Environment and Soil Sciences, University of Lleida, Lleida, Spain, (4) School of Geography, Archaeology and Palaeoecology, Queen's University, Belfast, UK, (5) School of Environmental Sciences, University of Liverpool, Liverpool, UK

Water pollution has been identified as one of the most important environmental challenges of the early 21st Century. The Water Framework Directive (WFD) (2008/105/EC) explicitly recognises the risk to water resources posed by sediment-associated contaminants in European river basins. The potential impacts on water supply and the biodiversity of aquatic ecosystems from sediment and associated contaminants may be further exacerbated by climate change pressures on water resources, as highlighted in the 2009 EU White Paper "Adapting to climate change: Towards a European framework for action" (SEC(2009) 386, 387, 388). Despite these concerns, the role of floodplains and other storage areas as secondary sources of contaminated sediment (i.e. metals) in river basins affected by historic industrial or mining pollution has been largely overlooked. Thereby, besides the sediment which is transported by the river, secondary sources of contaminants represent a credible threat to achieving EU water quality targets set by the WFD. This project addresses this issue by developing a catchment-based approach looking at metal geochemistry from source to sink (i.e. from sediment generation at slopes, passing through sediment transported by the river system, to sediment deposition at the storage areas to the outlet) and develop a geochemical model to predict the chemical aspects of metals transport and transformation. This approach will allow us to quantify (i) the sediment fluxes and associated contaminants flowing through the river, (ii) the storage areas contributions to downstream contaminated sediment fluxes, (ii) the timescales for the storage and removal of contaminated sediment in the sinks, and (iv) the transformation and bioavailability of the pollutants (i.e. metals) along the basin. Both physical and chemical aspects of metal transport will be considered by looking at metal geochemistry, mobility and bioavailability, hence producing information on chemical metal transport and transformation from source to sink. Different metal species rather than bulk metals will be investigated providing information on potential metal mobility (and what environmental processes might force mobility) and bioavailability. Biological work (i.e. macroinvertebrates samplings, PCA and CCA techniques) will also carried out to apply contaminant-ecosystem models and determine the affectation of pollutants over the biology/ecology. Finally, catchment-based hydro-sedimentological models will be applied to study how different global-change scenarios could alter sediment (and hence) metals transport. This way, present work will generate better understanding of the environmental risk derived from sediment mobility in contaminated systems, a critical information which will provide river basin managers with the means to assess the potential impact of the secondary sources of water pollution in European rivers.