Geophysical Research Abstracts
Vol. 17, EGU2015-7398, 2015
EGU General Assembly 2015

Do weirs affect the physical and geochemical mobility of toxic metals in mining-impacted floodplain sediments?

Amelia Bulcock (1), Alexandra Coleman (1), Elizabeth Whitfield (1), Jose Andres Lopez-Tarazon (1,2,3), Patrick Byrne (1), and Greg Whitfield (4)

(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) Geomorphology Technical Advisor, Environment and Business, Environment Agency, UK

Weirs are common river structures designed to modify river channel hydraulics and hydrology for purposes of navigation, flood defence, irrigation and hydrometry. By design, weirs constrain natural flow processes and affect sediment flux and river channel forms leading to homogenous river habitats and reduced biodiversity. The recent movement towards catchment-wide river restoration, driven by the EU Water Framework Directive, has recognised weirs as a barrier to good ecological status. However, the removal of weirs to achieve more 'natural' river channels and flow processes is inevitably followed by a period of adjustment to the new flow regime and sediment flux. This period of adjustment can have knock-on effects that may increase flood risk, sedimentation and erosion until the river reaches a state of geomorphological equilibrium. Many catchments in the UK contain a legacy of toxic metals in floodplain sediments due to historic metal mining activities. The consequences of weir removal in these catchments may be to introduce 'stored' mine wastes into the river system with severe implications for water quality and biodiversity. The purpose of this study is to investigate the potential impact of a weir on the physical and geochemical mobilisation of mine wastes in the formerly mined River Twymyn catchment, Wales.

Our initial investigations have shown floodplain and riverbed sediments to be grossly contaminated (up to 15,500 mg/kg Pb) compared to soil from a pre-mining Holocene terrace (180 mg/kg Pb). Geomorphological investigations also suggest that weir removal will re-establish more dynamic river channel processes resulting in lateral migration of the channel and erosion of contaminated floodplain sediments. These data will be used as a baseline for more detailed investigations of the potential impact of weirs on the physical and geochemical mobilisation of contaminated sediments. We have two specific objectives. (1) Geomorphological assessments will use unmanned aerial vehicle (UAV) photographic surveys, historical aerial photographs, ground-based topographic surveys, surface and subsurface particle size determination, bed stability and sediment entrainment assessment, together with discharge and sediment (both suspended and bedload) monitoring to establish the effect of the weir on patterns of sediment flux and the physical transport of metal contaminants. 2D and 1D models (IBER, HEC-RAS) of the weir-affected reach will investigate sediment and metal flux following weir removal. (2) The physicochemical speciation and geochemical stability of contaminated floodplain sediments will be characterised using bulk chemistry, mineralogical (XRD, SEM) and speciation methods (sequential extractions, electron microprobe analysis).