

A reconnaissance survey of channel bank particulate phosphorus concentrations, controls and estimated contributions to riverine loads across England

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March 28, 2022

Abstract

Channel banks can contribute a significant proportion of fine-grained ($<63 \mu\text{m}$) sediment to rivers, thereby also contributing to riverine total particulate phosphorus loads. Improving water quality through better agricultural practices alone can be difficult since the contributions from non-agricultural sources, including channel banks, can generate a 'spatial mismatch' between the efficacy of best management applied on farms and the likelihood of meeting environmental objectives. Our study undertook a reconnaissance survey ($n=76$ sites each with 3 profiles sampled) to determine the total phosphorus (TP) concentrations of channel banks across England and to determine if TP content can be predicted using readily accessible secondary data. TP concentrations adjacent field topsoils and local soil soil type/texture and geological parent material were examined as potential predictors of bank TP. Carbon and nitrogen content were also analysed to explore the impacts of organic matter content on measured TP concentrations. The results suggest that channel bank TP concentrations are primarily controlled by parent material rather than adjacent topsoils, but significant local variability in concentrations prevents the prediction of bank TP content using mapped soil type or geology. A median TP concentration of 873 mg kg^{-1} was calculated for the middle section of the sampled channel bank profiles, with a 25th percentile of 675 mg kg^{-1} , and 75th percentile of 1159 mg kg^{-1} . Using these concentrations and, in comparison with previously published estimates, the estimated number of inland WFD waterbodies in England for which channel bank erosion contributes $>20\%$ of the riverine total PP load increased from 15 to 25 (corresponding range of 17 to 35 using the 25th and 75th percentiles of measured TP concentrations). Collectively, these 25 waterbodies account for 0.2% of the total inland WFD waterbody area comprising England.

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