

Modelling past and future sediment transfer in catchment-lake systems using integrated records of environmental change

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Agricultural change has caused significant environmental impacts with the onset of modern practices and intensification over the past century. In response, many current policy and management initiatives aim to reduce soil erosion and river pollution by fine sediment. However, there is a lack of detailed, longer-term baseline information extending beyond the instrumental record against which to measure the success or otherwise of such efforts. Furthermore, future reductions in the magnitude of impacts on soil erosion achievable under a changing climate remain unclear. Here, we provide an overview of an integrated approach for reconstructing impacts from past agricultural change based on social and environmental records coupled with multi-model simulations of catchment erosion and lake sediment dating. We aim to model soil erosion and sediment transfer responses to climatic variability and land use changes spanning the last ca. 100 years using variants of the RUSLE and Morgan-Morgan-Finney models. The study focuses on six lake catchments in Britain which cover a range of agricultural environments from intensively-farmed lowlands to upland catchments subject to lower-intensity livestock grazing. Land use reconstructions are based on historic aerial photography (1940s-2000s) and satellite-derived land cover maps (1990-2007) in combination with annual parish-level agricultural census data (1890s-1970s) and farmer interviews. Radionuclide dating of lake sediments coupled with pollen analysis provides independent data on decadal sedimentation rates and vegetation cover for comparison with model outputs and land use reconstructions. This combination of social and environmental records, soil erosion modelling and dating of lake sedimentary archives forms a powerful platform from which to project impacts from future agricultural scenarios under a changing climate.