



## **Impact of land use change on dissolved organic carbon in the River Thames (UK) over a 130 year time period**

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This study presents an analysis of land use in the UK's River Thames basin between 1867 and 2010, to estimate the potential transfer of soil organic carbon to the atmosphere (as CO<sub>2</sub>), deeper soils and groundwater, or to the river (as dissolved organic carbon - DOC). We use a modelling approach to combine two elements: an estimate of carbon available for export due to land use and land use change; and, an algorithm to route this carbon through to surface runoff, subsoil or loss as CO<sub>2</sub> emissions to the atmosphere.

Estimates of annual carbon loading use parish land use data, held in the UK's National Archives; National Inventories of Woodland and Trees; and Land Cover Maps for the last 25 years. Soil organic carbon (SOC) stocks for each year are calculated from a large database of typical SOC concentrations for land uses present in the Thames basin, and are combined with literature values of transition times for SOC to adjust to a new concentration after land use change occurs. Soil carbon fluxes are calculated as the inter-annual change in SOC, and then apportioned between losses to the atmosphere as CO<sub>2</sub>, DOC losses to surface waters or carbon leached into deeper soil layers. We use a 130 year record of DOC in the Thames, and parameters from previous long-term nitrate modelling, to constrain estimates of fluvial DOC rises caused by SOC losses.

Our results show there are many small inter-annual variations, but the major change in both estimated SOC storage and fluvial DOC, occurred during the 1940s due to massive large-scale changes in land use, the effect of which continues to date.