



Nitrate concentrations and fluxes in the River Thames, London UK 1868 to 2008: exploratory analysis of the world's longest water quality time series

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Abstract

This paper presents analyses of the world's longest water quality record: 140 years of monthly-average nitrate concentrations (1868 to 2008) and fluxes (1883 to 2008) for the River Thames north of London. We show how short- and long- term patterns in these time series are influenced by both climatic and anthropogenic pressures, in the case of the latter, particularly land use and land management practices. Climate change does not play a significant role in controlling annual average concentrations or fluxes, rather large-scale land conversions from permanent grassland to arable farming have caused sustained (almost four-fold) increases in concentrations and fluxes that persist for many decades after the initial changes.

Our analyses of this unique time series highlight four areas of particular interest:

- (1) Despite several layers of regulation and source control, fluvial concentrations and fluxes remain intractably high – no decrease has been observed since the early 1970s;
- (2) Catchment response to changing nitrogen inputs from land use and land management is subject to considerable lag: present conditions in the river reflect land practices from some years ago;
- (3) Following (2), we suggest that current changes to land use and land management practices will not be reflected in river water quality for some time to come;
- (4) Overall, the long-term view afforded by this record questions the derivation of “baseline conditions” that are formulated from records that do not reflect the massive changes in land use and land management in the mid-20th century.

Overall, a better understanding of the links, and time delays, between cause (i.e. changing land use / land management) and fluvial response (i.e. concentration increase/decrease) will improve our ability both to predict changes in the coming decades, and inform management decision making now, to ensure the appropriate balance between agricultural development and security of freshwater resources for the future.