Flood plain nutrient dynamics: patterns, controls and the influence of changing hydrology

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Abstract Dissolved nutrients are mobilised from flood plain surfaces during periods of inundation. These dissolved materials are an essential resource for the functioning of flood plain–river ecosystems. However, little is known of the dynamics of nutrient release during periods of flood plain inundation or the factors controlling their release. Patterns of total organic carbon (TOC), total nitrogen (TN) and total phosphorus (TP) released from flood plain sediments were investigated in this study. In a series of experiments conducted over a 72-h period, sediments collected from various flood plain surfaces were wetted in order to assess possible controls, spatial patterns, and the influence of changing hydrology on the release of dissolved nutrients. Top-down constraints, including the reach location, degree of confinement and elevation above the river bed, all had a significant impact on release rates for TOC, as well as release rates and concentrations of TN. Sediment texture was significantly associated with TP concentrations only; although sediment texture was associated with TN and TOC release rates over time. These results indicate that larger scale constraints, such as position in the broader riverine landscape, influence spatial patterns of nutrient release rates over time more than smaller scale influences such as sediment texture. Using the release data for the various flood plain surfaces, combined with long-term flow data for several flow scenarios, simple budgets for dissolved nutrients were calculated for the study reach over the 1922–2000 period. A 43% reduction in the potential supply of dissolved nutrients was demonstrated with changes in river hydrology over this 78-year period associated with water resource developments.

Key words flood plain–river exchanges; complex systems; water resource development