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Characterization of sediment sources at seasonal and centennial scales using CSIA, biomarkers and connectivity modelling in the Baldegg Lake catchment (Switzerland)

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Land use changes and agricultural practices become a key factor of sediment dynamics by modifying the soils erosive risk and the catchments sediment connectivity. Restoration and management plans of water bodies can only be efficient if the sediment sources and their respective contributions, i.e. the proportion attributable to different land uses and agricultural practices, are identified.

To achieve this goal, we used for this study a mixed approach using compound-specific isotope (CSIA; here, long-chain fatty acids δ^{13}C) and biomarker analysis, connectivity modelling and biomarker modelling. We applied it to the Baldegg Lake catchment (Switzerland), which still suffers from a substantial eutrophication despite several restoration attempts during the last 40 years. Soils, suspended river sediments and lake sediments were investigated to assess the isotopic signature of the potential sources (soils), as well as the short-term (high-flow suspended river sediments) and long-term (130-yr-long lake sediment core) variations of sediment origin.

The isotopic signature of soils clearly discriminates between different land-uses (grasslands, mixed forests, agricultural land and orchards). Suspended river sediments results reveal discrepancies between the investigated rivers, as well as several per-mil seasonal variations. The coupling of CSIA, biomarkers analysis and connectivity map allows the identification of the supplying areas. The long-term evolution of the sediment origin observed in the lake core is explained with the landuse and agricultural practices history of the catchment.

The dynamic of sediment origin over space and time revealed through this integrated source-to-sink study could serve as a basis for future management options to reduce sediment inputs to the Baldegg Lake.