



Assessing spatial and temporal variability in the carbon-13 signature of very long-chain fatty acid biomarkers to evaluate their potential as a sediment tracer in an agricultural watershed

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Determining sediment provenance in watersheds allows for the development of management practices that reduce sediment loads. Large volumes of sediment are an indication of erosion issues and lead to a decrease in water quality. Furthermore, sediment acts as a vector for the transport of pollutants, as well as nitrogen and phosphorus from agricultural activities, resulting in the eutrophication of lakes.

Tracers have been successfully used to follow the movement of sediment throughout watersheds; these include geochemical signatures and fallout radionuclides. One of the tools that has been in recent development involves using compound-specific stable isotopes (CSSIs) of plant origin, particularly the use of carbon-13 (^{13}C) signatures found in very long chain fatty acids (VLCFAs). The CSSI method differs from other methods in that it is land use-specific, with the possibility of further refining the origin of sediment. In order for VLCFA tracing to be effective, the signature for a particular land use must be unique.

One of the expected advantages of using CSSIs as a tracer is the lack of continual monitoring of sediment fluxes. It is well known that spatial variability exists in terms of organic carbon within cultivated and non-cultivated fields. Additionally, the literature provides multiple examples of ^{13}C variability in crops throughout the growing season and between seasons due to varying environmental conditions. Considering the potential sources of variability, the dynamics of VLCFA signatures were investigated in the South Tobacco Creek Watershed in Manitoba, Canada, for a range of crop types, at different times in the growing season, over a number of years. The objective was to elucidate the frequency and location of sampling required, and possible limitations and/or considerations in applying CSSI tracers as a sediment transport monitoring tool.