Can stable isotopes be used as indicators of nitrogen processing in wetlands?

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Many coastal waters are nitrogen limited and hence nitrogen loads entering these systems is a high management priority. In urban regions constructed wetlands treat nitrogen under base and, more importantly, event flow conditions via two key processes; assimilation (N-storage, $^{15}\varepsilon$ = 5-15‰) and benthic denitrification (N-removal, $^{15}\varepsilon$ = ~2‰). Inlet and outlet concentrations are often used to examine the effectiveness of these systems however these measurements provide little information on system function unless more time intensive process measurements are undertaken. We propose that stable isotopes of NO_3^-, NH_4^+, periphyton-N and sediment-N can provide useful qualitative information on wetland nitrogen pathways.

In two urban wetlands (Melbourne, Australia) preliminary results have shown an increase of ~2‰ in the $\delta^{15}N$ signature of the sediment from the inlet to the outlet indicating isotope fractionation occurs within the wetland as water passes through it. Further, transect sampling of $\delta^{15}N$ and $\delta^{18}O$-NO_3^- from the inlet to outlet throughout a rainfall event showed a dependence on wetland type. In a poorly vegetated-turbid wetland the NO_3^- decreased from inlet to outlet and there was minimal fractionation within the residual NO_3^- pool suggesting, as expected, benthic denitrification was the dominant N-removal pathway. Comparisons with isotope fractionation in vegetated wetlands will also be discussed.