ISOTOPE TRACERS IN NUTRIENT SOURCE TRACKING (NST) OF NITRATE, A DIFFERENT PERSPECTIVE OF SURFACE AND GROUNDWATER REMEDIATION

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Excess nitrogen as nitrate is an increasing problem worldwide. Anthropogenic activity continues to stress nutrient balance in shallow groundwater systems, estuaries and wetlands causing both short and long-term environmental consequences. Stormwater events mix and move massive amounts of water and nutrients into and out of urban and rural watersheds, this causes stormwater runoff to carry a mixture of several sources of nutrients making point source and nonpoint sources of contamination difficult to differentiate. Here we present and review some of the leading techniques in isotope tracers and their applications to Nutrient Source Tracking (NST) with a focus on nitrate fingerprinting. By incorporating isotopic data into hydrological studies, isotope tracers can be used to suggest the type (e.g. agricultural, septic, precipitation) of nitrate contamination and its origin. Continuous monitoring of stable isotopic values are used to determine nutrient cycling, also referred to as the fate of nitrate. The fate of nitrate in a system can vary from attenuation to nitrification depending on environmental conditions and can change as a result of restoration activities. Isotope tracer techniques have been applied to watershed studies on both large regional and small local scales in order to determine major and minor contaminant sources where agricultural and land use is extensive. This talk will review a case study from Lake Superior, where isotopic values were used as evidence for in-lake nitrate production. A century long increase in nitrate concentrations was hypothesized to be due to external inputs; Isotopic values were used to delineate stream and river, precipitation, and deep-water lake sources. It was found that in-lake nitrification was the major source of nitrate. Outside of lacustrine applications, isotopic measurements have been applied to urban areas to determine septic infiltration as well test resiliency projects.