

MSc thesis at FiBL – Soil Science Group (in collaboration with Aquatic Biogeochemistry Group, Uni Basel)

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| Topic | Tracing sources of nitrate leaching using the natural abundance of ^{18}O and ^{15}N |
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| Background | <p>Nitrogen (N) is an essential plant nutrient and has to be applied as mineral or organic fertilizer to sustain crop production. However, considerable amounts of N are lost from the soil/plant system by nitrate leaching and threaten groundwater resources. In the region Gäu-Olten, Canton Solothurn, groundwater nitrate concentrations are clearly increased, with concentrations above the quality threshold of 25 mg/l.</p> <p>In the joint research project “NitroGäu” of the Research Institute of Organic Agriculture (FiBL), the University of Neuchâtel and ETH Zurich we aim at investigating sources and processes leading to these elevated nitrate concentrations and at developing strategies to reduce nitrate leaching from agricultural land.</p> <p>One approach to investigate sources of nitrate such as organic or mineral fertilizers, N-deposition, or mineralization of organic soil N, is to use the isotopic signature of ^{18}O and ^{15}N in nitrate in aqueous samples. Samples will originate from so-called Self-integrating accumulators (SIAs), adsorber resins buried underneath the agricultural fields, which will collect all nitrate leached during a certain period and thus measure nitrate leaching directly underneath the cultivated land.</p> <p>The main objectives of this MSc. thesis are i) to identify the main source(s) of nitrate leaching under agricultural fields and ii) to investigate whether different farming approaches (e.g. organic vs. conventional, different crops, etc.) differ in the source of leached nitrate.</p> |
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| Methods | <ul style="list-style-type: none">• Analyse the natural abundance of $^{18}\text{O}/^{15}\text{N}$ in nitrate of SIA samples with the denitrifier method (Casciotti et al., 2002, Sigman et al., 2001)• Modelling for source identification (e.g. Stable isotope analysis in R package (SIAR))• Field work (depending on interest) |
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| Start | July 2019 or spring 2020 the latest |
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| Literature | <p>Casciotti, K. L., Sigman, D. M., Galanter Hastings, M., Böhlke, J. K. & Hilkert, A. 2002. Measurement of the oxygen isotopic composition of nitrate in seawater and freshwater using the denitrifier method. <i>Anal. Chem</i>, 74, 4905-4912.</p> <p>Sigman, D. M., Casciotti, K. L., Andreani, M., Barford, C., Galanter, M. & Böhlke, J. K. 2001. A bacterial method for the nitrogen isotopic analysis of nitrate in seawater and freshwater. <i>Analytical chemistry</i>, 73, 4145-4153.</p> |
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