Novel protocol helps to quantify catchment-scale nitrate yield and fluvial export dynamics

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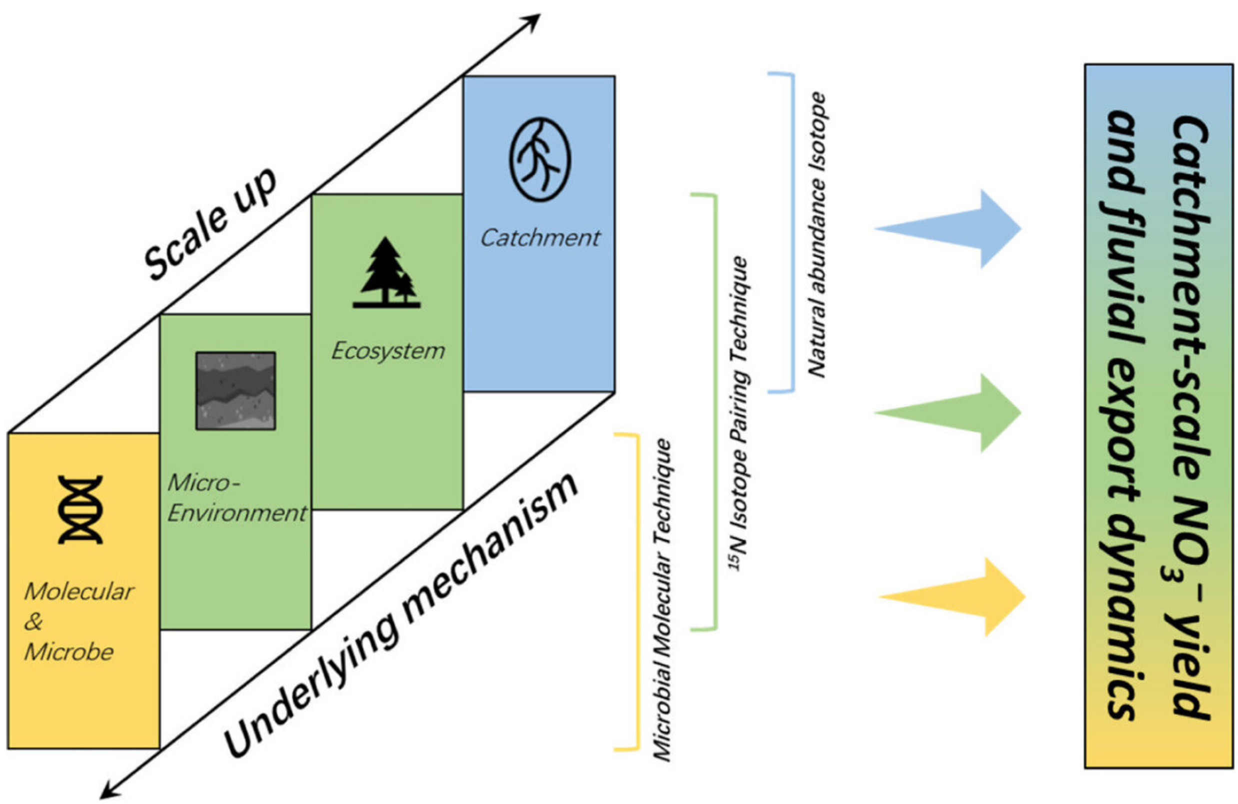

Coupling geochemical and molecular techniques for catchment-scale NO_3^- dynamics. a. Natural abundance isotopes of river waters contain composite information of multiple NO_3^- sources and various NO_3^- cycling processes at the catchment scale; b. Coupling potentials of natural abundance isotopes, microbial molecular techniques, and ^{15}N pairing techniques for revealing catchment-scale NO_3^- dynamics. Credit: WBG

Anthropogenic production of reactive nitrogen (N) is increasing rapidly due to the growing demand for food production. Rivers are the receptors of N, especially nitrate (NO_3^-), produced in their drainage catchments, therefore, quantifying catchment-scale NO_3^- sources and transformations is vital for understanding the global biogeochemical cycles of N and for remediating river NO_3^- pollution.

Historically, natural abundance isotopic compositions of NO_3^- ($\delta^{15}N/\delta^{18}O-NO_3^-$) in a river have been used to reveal catchment-scale NO_3^- sources and removal, and molecular techniques and ^{15}N pairing experiments can quantify NO_3^- related processes and their regulators in microenvironments. However, there is a long-standing gap between these techniques because they focus on different aspects of a catchment.

Dr. Jiang Hao, Prof. Zhang Quanfa, and their colleagues from the Wuhan Botanical Garden of the Chinese Academy of Sciences proposed a novel protocol that comprehensively applies natural abundance isotope tracing, ^{15}N pairing and molecular techniques to investigate the NO_3^- cycling processes and the regulating mechanisms at catchment scales. Their study was published in *Science of the Total Environment*

By applying the protocol in two catchments on the Qinghai-Tibet Plateau representing varying environmental conditions, the researchers explicitly described the NO_3^- production and removal processes and their abiotic and biotic driving factors in the catchments. In addition, the spatial variations in the NO_3^- yield rates and fluvial NO_3^- export rates were well explained.

The results successfully demonstrated the effectiveness of the protocol in revealing catchment-scale NO_3^- yield and fluvial NO_3^- export dynamics.

More information: Hao Jiang et al, Coupling geochemical and

microbial molecular techniques to reveal catchment-scale nitrate yield and fluvial export dynamics, *Science of The Total Environment* (2023).
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