Nutrient dynamics in streams

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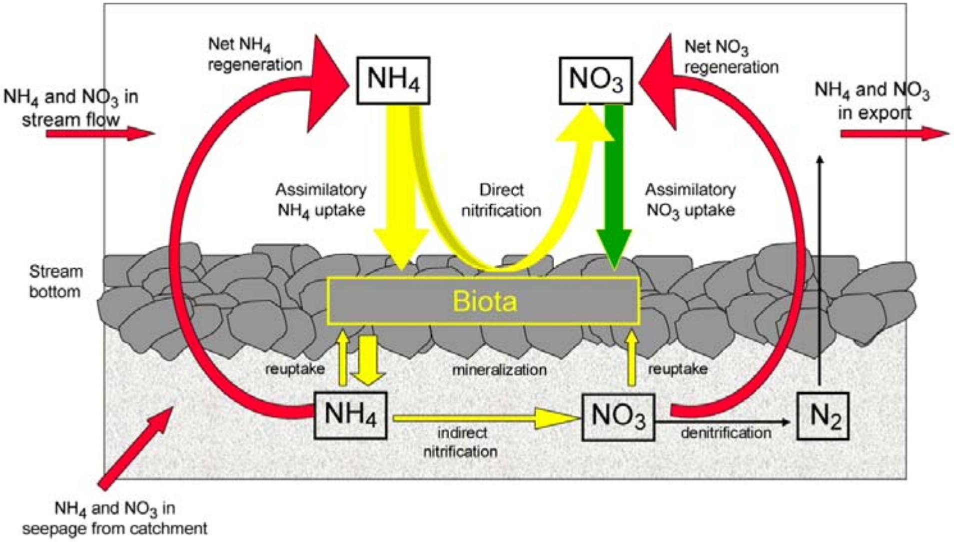
- Early studies of nutrient cycling in streams demonstrated: 1) nutrient limitations, 2) a downstream decrease in nutrient concentrations, and 3) the importance of radioisotope and budget studies as tools for determining cycling rates and controls.
- Important advances in our understanding of nutrient cycling in streams over the past 20 years includes the role of microbial communities, stream sediments, adjacent terrestrial biota, and spawning fish in the modification of nutrient concentrations and exports from catchments
- Field ^{15}N-addition experiments demonstrated high rates of nitrogen uptake, nitrification, and denitrification in streams, even for those in higher impact agricultural and urban areas.
- Improved understanding of rates and controls on nutrient cycling in streams have led to better models of nutrient transport, transformation, and export from large river basins.
- To better characterize landscape scale biogeochemical cycles additional research will be needed to resolve: 1) the residence time and ultimate fate of N taken up in streams, 2) the rates and controls on nutrient uptake in large rivers, and 3) effects of climate change on streams and rivers.



Stream Nitrogen
Cycle as Revealed Through
Mechanistic Research

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Nutrient dynamics in streams has been an important topic of research since the 1960s. Here we review this topic and the significant role played by *J-NABS* in its development. We limit this review almost exclusively to studies of N and P because these elements have been shown to limit productivity in streams. We use the expression *nutrient dynamics* for studies that included some measures of biological processes occurring within streams. Prior to the 1970s, instream biological processes were little studied, but through 1985 conceptual advances were made and 4 types of studies made important contributions to our understanding of instream processes: 1) evidence of increased plant production and decomposition in response to nutrient addition, 2) studies showing a downstream decrease in nutrient concentrations, 3) studies using radioisotopes, and 4) budget studies. Beginning with the first paper printed in its first issue, *J-NABS* has been the outlet for key papers advancing our understanding of rates and controls of nutrient dynamics in streams. In the first few years, an important review and a conceptual model for conducting experiments to study nutrient dynamics in streams were published in *J-NABS*. In the 1990s, *J-NABS* published a number of papers on nutrient recycling within algal communities, the role of the hyporheic zone, the role of spawning fish, and the coupling of data from field 15N additions and a N-cycling model to provide a synoptic view of N dynamics in streams. Since 2000, *J-NABS* has published influential studies on nutrient criteria for streams, rates of and controls on nitrification and denitrification, uptake of stream nutrients by riparian vegetation, and nutrient dynamics in urban streams. Nutrient dynamics will certainly continue to be an important topic in *J-NABS*. Topics needing further study include techniques for studying nutrient dynamics, nutrient dynamics in larger streams and rivers, the ultimate fate of nutrients taken up by plants and microbes in streams, ecological stoichiometry, the effects of climate change, and the role of streams and rivers in nutrient transformation and retention at the landscape scale.

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