



Pooled Monitoring Initiative's Restoration Research Award Program

Project Title

Memories of the soils:
Evaluation of soil nitrogen stable isotope as a robust metric to assess floodplain restoration and nitrogen removal effectiveness

Lead Entity

Shreeram Inamdar & Joe Galella, University of Delaware

Partners

Sujay Kaushal, U. of Maryland

The Pooled Monitoring Initiative pools resources to support scientists who answer key restoration questions posed by the regulatory and practitioner communities. The research teams then provide the answers back to those who asked the questions for direct application. The goal of the program is to answer these key restoration questions that serve as a barrier to watershed restoration project implementation.

Questions? See cbtrust.org/grants/restoration-research/

Research question(s)

Can the soil bulk nitrogen isotope $\delta^{15}\text{N}$ be used as a robust metric to evaluate the long-term effectiveness of stream and floodplain restorations in removing nitrogen from runoff?

Issue addressed

- Assessing the long-term effectiveness of floodplain restorations in removing N, especially due to denitrification, has been a challenge.
- Denitrification enriches the soil $\delta^{15}\text{N}$ and soil $\delta^{15}\text{N}$ also accounts for the effects of other N processes. Thus, we hypothesized that soil $\delta^{15}\text{N}$ could provide an integrated measure of denitrification N removal on restored floodplains.

Project findings

- Important differences were observed between restored and unrestored sections of 12 restored sites across four age categories (0-2, 2-5, 5-10, 10-22 years).
- Contrary to our hypothesis, we found that bulk soil $\delta^{15}\text{N}$ decreased with restoration age and was not correlated to denitrification rate. We attributed this to increasing input of depleted $\delta^{15}\text{N}$ from floodplain vegetative biomass.
- However, soil organic matter, total soil organic carbon, bulk density and soil moisture were better correlated with floodplain soil denitrification and showed important changes with restoration.

Recommendations

- Soil organic matter, total soil organic carbon, bulk density and soil moisture could be better metrics (than soil $\delta^{15}\text{N}$) to assess N removal effectiveness of restored sites.
- Long term monitoring of floodplain soils is recommended for stream restorations.



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Why does this study matter?

Currently there are no robust and/or easy metrics to assess effectiveness of floodplain restorations and there is no guidance on which metrics to use. This study fills that important knowledge gap.

What should we do with this information?

- Use soil organic matter, soil organic carbon, bulk density and soil moisture to help determine the health and performance of stream restorations over time.
- If possible, measurement of denitrification rate should be considered, but other metrics may be used as proxies.

What will the end-user (regulator/manager and practitioner) do with this information?

- Determine organic matter, organic carbon, bulk density and soil moisture values for restored floodplains.
- Use those values to assess if the restoration is effective.
- Report the organic matter, organic carbon, bulk density and soil moisture values to the regulatory agency to receive water quality credits.

For more information:

Please contact Shreeram Inamdar (Inamdar@udel.edu) or Joe Galella (jgalella@udel.edu).

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