

## **ABSTRACT**

**THESIS:** The Influence of Copper, Lead, and Iron on Microbial Nitrification

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Metals are naturally found in ecosystems but can also enter *via* human activity such as fossil fuel combustion, and disposal of metal products. Copper, lead, and iron have frequently been detected throughout Indiana freshwaters based on historical samples. Since microbial activity is a holistic measure of ecosystem function, changes in microbial activity in response to metals may indicate potential areas of concern. Metal concentrations in seven streams of the Upper White River watershed of central Indiana were measured during spring (May) and summer (August) in conjunction with measurement of sediment nitrification rates using the nitrapyrin-inhibition technique. Additionally, the influence of copper, lead, and iron on microbial nitrification was studied using *in vitro* mesocosms inoculated with stream sediment from selected sites. Copper, lead, and iron concentrations in stream sediment and water varied among sites with sediment concentrations ranging 654 – 1985 mg Fe/kg sediment and 1.00 - 2.91 mg Cu/kg sediment. Water concentrations ranged from below detection to 0.10 mg Fe /L, and 0.01 – 0.02 mg Cu/L. Lead concentrations were below detection at all sites except in May at one site (Pleasant Run Creek 0.47 mg Pb/kg sediment) and in August at one site (Mud Creek 0.38 mg Pb/ kg

sediment). Stream sediment nitrification rates were positively correlated to stream sediment copper concentration ( $r = 0.78$ ,  $p = 0.001$ ). There was no significant correlation between sediment nitrification rates and stream sediment iron, pH, dissolved iron, or total dissolved solids (TDS;  $p > 0.05$ ). Positive correlations were found between nitrification response rates and total Fe ( $r = 0.61$ ,  $p = 0.02$ ) and Cu ( $r = 0.74$ ,  $p = 0.002$ ) concentrations. Experimental mesocosms indicate metal addition of 127 mg/L may reduce stream sediment nitrification rates though stream physiochemical characteristics and history of metal exposure likely dictate microbial response. Further, metal concentrations in the stream sediment may have more of an influence on nitrifying microbes than dissolved metal in the water column.