Nitrogen Cycling in San Juan Mountain Streams: A Holistic Ecohydrological Approach

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How does acid mine drainage affect hydrology and nitrogen cycling?

Many streams in the San Juan Mountains are affected by acid mine drainage (AMD) and acid rock drainage (ARD) from a combination of natural geologic processes and historic mining impacts. At the same time, atmospheric nitrogen deposition (nitrogen in precipitation) is increasing. How will San Juan Mountain streams be affected by these increased nitrogen inputs?

A pilot study in summer 2006 focused on testing the hypothesis that iron hydroxide cementation from AM/RD impairs the exchange of water between the stream channel and groundwater. This stream-groundwater ecotone is termed the "hyporheic zone" and is known to be important for many geochemical and ecological processes including nutrient cycling.

Iron hydroxide cementation in Cement Creek, San Juan County

MSI's Koren Nydick and technician Kyle Skaggs worked with collaborator Chris Arp to complete dye tracer studies in 11 stream reaches to measure transient storage associated with the hyporheic zone. The group also collected data on several physical and biological parameters including iron hydroxide accumulation rate, substrate size, channel gradient, stream discharge, water chemistry, algal biomass, and nutrient limitation of algal growth. The stream reaches were located on Cement Creek, Mineral Creek, and South Fork of Mineral Creek and represented a mixture of severe, moderate, low, and non-AM/RD conditions.

Degradable dye tracer is used to study stream – groundwater hydrology

Preliminary results suggest that the AM/RD stream reaches experience several impairments to ecohydrological functioning depending on the severity of AM/RD chemical and physical impacts. For example, we found that cementation of stream substrates resulted in reduced hyporheic exchange as well as lowered algal biomass. Both of these factors likely will impair stream nitrogen cycling. In contrast, algal biomass was similar in moderate and non-AMD streams. Phosphorus limited algal growth, however, so the ability of algae to take up excess nitrogen is probably low.

This pilot will result in at least one peer-reviewed journal article and a proposal for future funding.

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