



Nutrient Injections: Evaluating differences in nutrient retention in restored and unrestored stream reaches



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Introduction

Improvement of water quality is consistently listed as one of the top goals for a successful stream restoration project. However, little data exists on the magnitude of impact restoration has on the ability of a lotic ecosystem to retain nutrients. Monitoring Nitrogen retention in both restored and degraded urban streams will help the restoration community begin to understand and predict the effects that ecologically based restoration elements have on stream water quality.

Monitoring of nutrient retention in restored and unrestored streams can be achieved by implementing nutrient injection experiments. In a WRRRI study currently being conducted by NCSU and UNC, nutrient injections are being performed on six paired (restored-unrestored) streams of varying ages of restoration with varying restoration techniques.

Materials and Methods

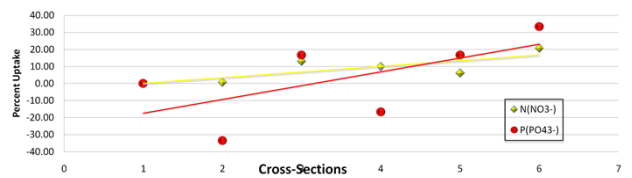
In the experiments nutrients (N and P) are injected in a solution with a conservative solute (NaCl) at a consistent rate using a Mariotte Bottle set-up. A conductivity probe is placed at the end of the study reach to monitor NaCl concentration. The probe measures the increase in conductivity as the solution mixes within the system. Once the conductivity plateaus and the stream is well mixed with the nutrient solution, water quality samples are taken at several points on the reach. From these samples nutrient concentrations are analyzed to create a graph (below) showing change in nutrients along the stream length. This is being repeated during each season over a 1-year period.

Mariotte Bottle Set-up

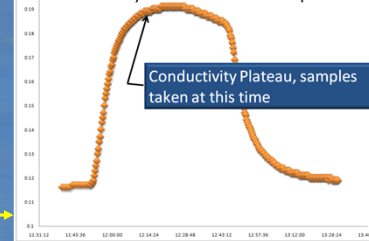


The photo (Left) shows a Mariotte Bottle set-up used at one of the study sites. Here, two bottles are used in parallel to allow for a longer injection period. During the course of the experiment the Mariotte Bottles were found to be more reliable than peristaltic pumps in terms of maintaining the same flowrate over several hours.

Percent Nutrient Uptake Along Stream Cross-Sections



Conductivity Over Time of the Experiment



Injection Point



Centennial Campus experiment site for restored stream reach.

YSI Sonde Location and Corresponding Data

Restored vs Unrestored Hypotheses

- Restored reaches have a higher capacity for nutrient retention than unrestored reaches along the same stream.
- Restoration strategies that introduce heterogeneity to the streambed substrata will increase the magnitude of nutrient retention in a reach.
- Timescales of reestablishing nitrogen retention can be relatively short and greatly impacted by the type of restoration strategy.