# Understanding Nitrogen Fluxes in Agricultural Soils through Mesocosm Incubations

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## Motivations for New Methods in Measuring Nitrogen Fluxes

Until recently, denitrification has been the major focus of study in order to understand how nitrogen is removed from ecosystems. However, this does not account for the conversion of organic nitrogen to inorganic nitrogen that is seen in aquatic ecosystems, and recent studies have shown that alternative pathways are important in accounting for this discrepancy. Pathways such as Dissimilatory Nitrate Reduction to Ammonium (DNRA) and Anerobic Ammonium Oxidation (Anammox) are not well studied in freshwater systems. Better understanding these pathways is necessary for management of these systems, as well as improved accounting of the global nitrogen budget. These incubations were designed to bettter understand the relationship between microbial communities in soils and nitrogen attenuation in floodplains.

## Background on Shavers Creek Outlet

Shaver's Creek watershed encompasses the subwatersheds of Shale Hills and Garner Run, which are both monitored by the Critical Zone Observatory. The land use surrounding the outlet is mixed, with the lower portion of the watershed being surrounded by agricultural land, while the upper portion is forested. Discharge is monitored continuously by the CZO and stream chemistry is sampled biweekly.

**Figure 1** -Map of Shaver's Creek Outlet. The blue line indicates the first order stream under study. Image credit to Google Earth.

**Figure 2**-Picture of study site.

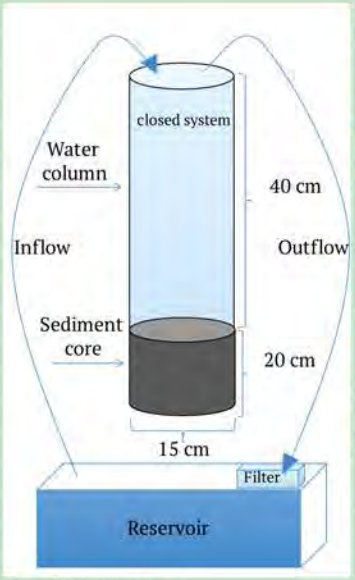


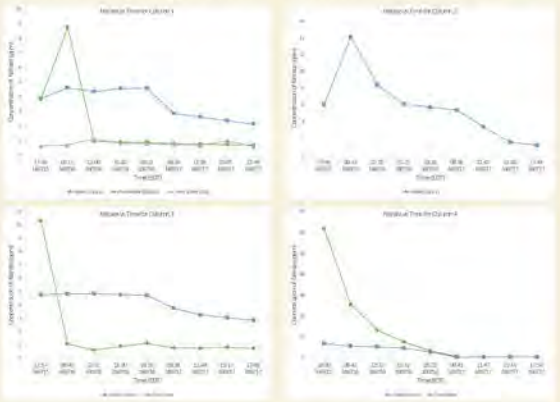

**Figure 3** - Mesocosm Schematic

**Figure 4** - The picture in the top left depicts all the columns. The top right depicts a top view of one of the columns, which has a plexiglass lid with holes for inflow/outflow/sampling. The bottom left picture shows a side view of a column. The bottom right picture shows the reservoir that all the columns receive their inflow water from and eventually outflow into.

## Understanding Mesocosm Incubations

These incubations were designed to simulate flooding conditions in the lab. They are approximately 60 cm in height and 15 cm in diameter. The rate of inflow was selected to be low enough to maintain nonturbulent conidtions within the column, but keep the water column well mixed. These conditions are suitable for tracer additions that will occur in further experimentation.

## Preliminary Data from Incubations: Monitoring the Stabilization Phase



The incubations were flooded and then sampled regularly for a 48 hour period, and both nitrate and ammonium (not shown) concentrations were monitored. Only one column contained microlysimeters at two depths (column 1), while the remaining columns had lysimeters at one depth. Concentrations appear to start at higher values and level out to relatively lower values, indicating a stabilization phase that occurs within the first 24 hours of the columns being flooded. Oxygen depletion in soils due to the flooding conditions increase rates of nitrogen transformation and deplete levels of nitrate in the soil which diffuse from the water column over time. This is indicated by differences between the pore water and water column time series that decrease over the 48 hour stabilization period.

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