NC STATE UNIVERSITY College of Agriculture and Life Sciences

Department of Biological & Agricultural Engineering

The Short-term Response of Nutrient Loads to an Agricultural Stream Restoration in Coastal Plain of North Carolina

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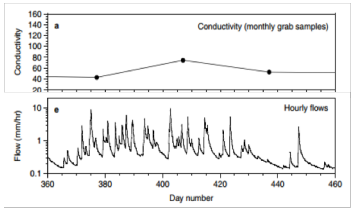
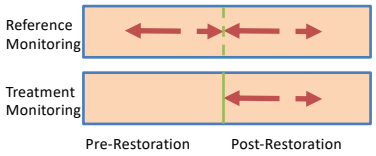
Billions of dollars have been spent on stream restoration, yet questions remain about its effectiveness for improving water quality, as many studies report either mixed success or lack the adequate data/methodological framework.



Comparison between low-frequency and high-frequency monitoring scheme



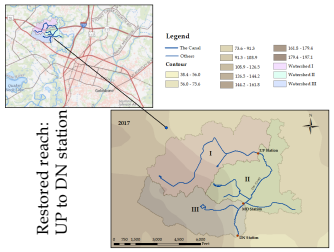
Lack adequate data and fair methodological framework

Objectives:

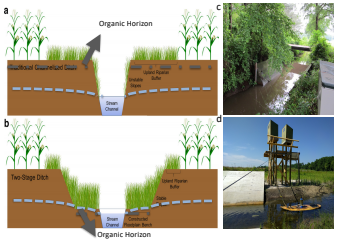
- Improve monitoring system and collect high-frequency hydro-chemical data;
- Quantify restoration effects on **nitrate and DOC loads** using paired-watershed method and double mass curve

Study Area:

A 2.2 km low-gradient agricultural ditch that ran approximately north to south through Claridge Nursery, Goldsboro. Three dominant land uses for the Canal's watershed are cropland (57%), forest (14%) and developed land (10%). The Canal underwent a priority 2 restoration, creating a new connected floodplain and meandering channel.

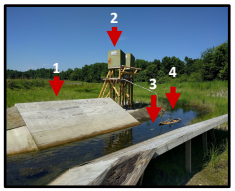


Map of the study area



Conceptual diagram comparing channelized ditch during pre-restoration (a) to restored two-stage ditch (b), and photographs depicting the pre-restored ditch (c) compared to the post-restored two-stage reaches (d)

Methodology:

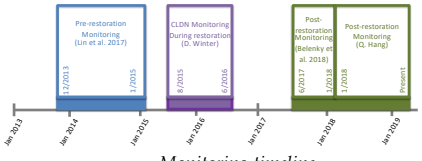


Field site monitoring system set-up

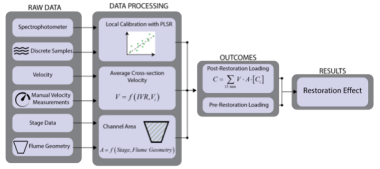
1. Trapezoidal Wooden Sections
2. Time-paced Discrete Sampler (ISCO Autosampler
3. Doppler Velocity Meter
4. UV-Vis Spectrophotometers

Equipment	Parameter	Purpose	Frequency
Manual Velocity Meter	Velocity, Stage	Flow rate calibration	2 weeks
Grab Sample	Sample Degradation	Degradation Study	2 weeks
Discrete Sampler	NH_3, NO_x, TKN, TSS, DOC, TP, PO_4	Local calibration	14 hours
Doppler Velocity Meter	Velocity, Stage	Flow rate calculations	15 minutes
UV-Vis Spectrophotometer	Absorbance Data	Cumulative load calculations	15 minutes

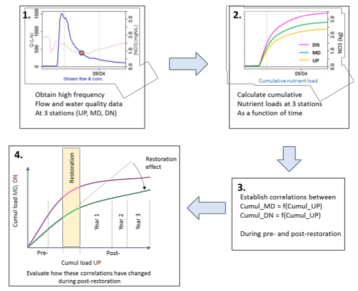
Monitoring Scheme



Monitoring timeline

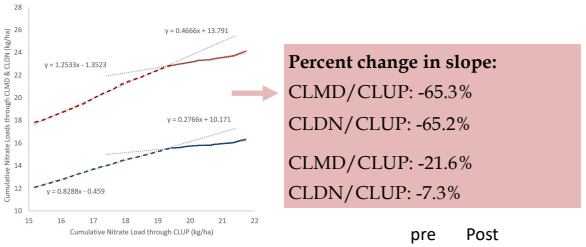


Data analysis scheme

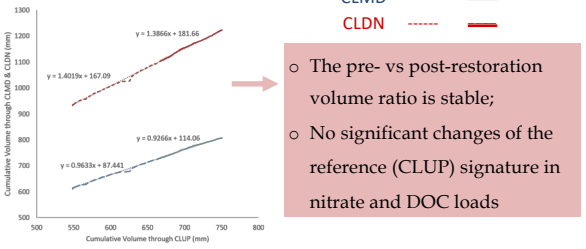


Schematic approach for visualizing the bulk effect of stream restoration on nutrient loads

Results:



Verification:



- The pre- vs post-restoration volume ratio is stable;
- No significant changes of the reference (CLUP) signature in nitrate and DOC loads

Conclusions and Future Research:

High-resolution monitoring scheme helps generate more precise nutrient loads during pre- and post-restoration. It has been observed an dramatic short-term improvement of nitrate loads reduction after restoration. However, we do not know what processes or functions at play. Therefore, we are considering to further our research to:

1. Continue high-resolution monitoring and estimate **long-term restoration effects on nutrient and suspended sediment loads**;
2. **Identify the drivers for the observed effects**;
3. **Derive additional guidelines of practices** which we will find to have contributed most to the overall restoration benefits and **monitoring scheme** for estimating restoration effects.