Evaluation of Nutrient Concentrations, Sources and Pathways in Three Urban Streams in Durham County, North Carolina - Some very preliminary results

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U.S. Department of the Interior
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303(d) Listed Reservoirs
Study Background

- NC EMC adopted comprehensive nutrient management strategies for Falls and Jordan reservoirs
  - Reduce nitrogen and phosphorus loads from urban, stormwater, wastewater, and agriculture sources
- Durham Stormwater Services is tasked with implementing best management practices (BMPs)
- BMPs are required for new development and existing development
- Implementing effective BMPs is complex in urban watersheds because of diverse sources
Research Objectives

- Evaluate nutrient sources in selected tributaries in the vicinity of Durham that feed nutrient-impaired Falls Lake and Jordan Lake
- Document and compare concentrations of nitrogen and phosphorus among 3 urban streams in the Falls Lake and Jordan Lake watersheds
- Evaluate the utility of stable isotopes for characterizing nitrogen sources and transport pathways in urban, low-order streams
Site 1 – Cabin Branch Creek
Cabin Branch Creek

- Falls Lake watershed
- DA = 3.45 mi²
- Least developed watershed
- No public sewer
- Assumption that greatest nitrate source is failing septic tanks
Site 2 – Ellerbe Creek
Ellerbe Creek

- Falls Lake watershed
- DA = 6.01 mi$^2$
- Urban industrial
- Highest percentage of impervious surface
- Assumption that greatest nitrate source is runoff
Site 3 – Third Fork Creek
Third Fork Creek

- Jordan Lake watershed
- DA = 14.79 mi$^2$
- Urban residential
- Assumption that nitrate is mixed from multiple sources
Sampling Plan

- One year study began in July 2011
- Nutrient, stable isotopes of water, and stable isotopes of nitrogen samples collected monthly
- Sample results thus far for 7 events
  - 2 stormflow – falling limb
  - 5 baseflow
- Hope for a combination baseflow (75%) and stormflow (25%) samples
Preliminary results show...

- **Good news for City of Durham!**
  - Nitrate and phosphorus concentrations are $<0.4$ mg/L

- **Bad news for USGS**
  - No nitrate makes source tracking with N isotopes difficult
$\delta^{18}O$-H$_2$O vs Discharge
Typical Source Ranges
Typical Source Ranges

- Cabin Branch Cr
- Elerbe Cr
- Third Fork Cr
Typical Source Ranges

July – low baseflow
Typical Source Ranges

August – Post Irene but very low flow
Typical Source Ranges

Sept – Falling limb
What have we learned so far?

- In terms of nutrients, healthy urban creeks
- Stable isotopes of water are plotting above the GMWL and LMWL
- Nitrogen stable isotopes suggest atmospheric deposition is an overlooked component
- Cabin Branch Creek does not display adverse effects due to leaking septic tanks
Questions?

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