Southeastern Section–55th Annual Meeting (23–24 March 2006)

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Presentation Time: 1:30 PM-5:30 PM

BIOGEOCHEMISTRY OF URBAN HEADWATERS IN THE BRUSHY CREEK WATERSHED, SOUTH CAROLINA

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The biogeochemistry of small headwater streams should be affected most by urbanization, given their strong connections to terrestrial ecosystems. We examined the chemistry of small headwaters in the urbanized Brushy Creek watershed in the South Carolina piedmont. Our previous research established that stream nitrate concentrations are positively correlated with percent urban land cover in watersheds in the South Carolina piedmont. Because the greatest urbanization in Brushy Creek is located in the headwaters, we hypothesized that the highest concentrations of nitrate and other solutes also should occur in the headwaters and that carbon and nitrogen speciation should differ from forest streams.

During summer 2005, we collected a total of 80 water samples from 54 localities in the Brushy Creek watershed. The chemical composition of headwaters differed from that of the main channel. Of the solutes measured, nitrate showed the strongest relationship to urban land cover, with concentrations ranging from about 3 mg/L in the main channel to 13 mg/L in the urban headwaters. In contrast to forested watersheds, total dissolved nitrogen at most locations in Brushy Creek consisted mostly of nitrate-nitrogen, as opposed to dissolved organic nitrogen.

We conducted detailed sampling of two 700 m headwater reaches. Along the first headwater, nitrate concentrations decreased exponentially from 13 mg/L at the source to 0.3 mg/L downstream. Sulfate concentrations decreased from 9 to 4 mg/L. Carbon dioxide concentrations decreased exponentially from 44 to 5 mg C/L over the first 370 m, then increased to 21 mg C/L over the next 300 m. In contrast, chloride concentrations began at 5 mg/L but reached 10 mg/L downstream from an industrial point source.

Along the second headwater, nitrate concentrations decreased exponentially from 6 to 1 mg/L, and sulfate concentrations decreased from as high as 22 mg/L to as low as 3 mg/L. Carbon dioxide concentrations ranged from 2 to 15 mg/L but showed no clear spatial trend. Chloride concentrations decreased from 4 to 2 mg/L.

Patterns of solute concentrations and land cover suggest that the source of nitrate and sulfate is most likely atmospheric deposition. We speculate that the high nitrate concentrations in the headwaters result from low denitrification and assimilation potentials of urban soils.

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