2006 Philadelphia Annual Meeting (22–25 October 2006)

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NITROGEN IN URBAN STREAMS: POSSIBLE SOURCES, SINKS, AND TRANSFORMATIONS

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In the piedmont of the southeastern United States, urbanization typically begins along the topographic divides between watersheds. As a result, urban areas tend to develop around the headwaters of streams, and any agricultural areas occur along downstream reaches. This pattern of urbanization is useful for understanding the impact of urbanization on stream chemistry because there are no upstream agricultural impacts. In the South Carolina piedmont, streams drain high-grade metamorphic silicate rocks resulting in dilute streams sensitive to anthropogenic effects. The goal of our study was to characterize the chemistry of streams in urban areas free of agriculture and point-source discharge and to determine the sources and sinks of non-point source nitrogen. Our study area included small watersheds (15-100 km^2) in the Enoree and Saluda River basins of South Carolina.

We have found that solute concentrations, especially nitrate concentrations, are highest in urban headwaters and decrease downstream. The concentrations of most solutes are lower during drought than during periods of normal rainfall. Nitrate concentrations can be as high as 13 mg/L in headwaters associated with high percentages of impervious surfaces. Nitrate typically constitutes more than 90% of the total dissolved nitrogen, with dissolved organic nitrogen second in abundance and ammonium typically less than 2% of the total. Solute concentrations appear to decrease primarily in response to dilution by groundwater and tributaries, but in-stream processes may also be important. In particular, nitrate concentrations decrease dramatically within urban ponds, most likely by denitrification.

We hypothesize that the main sources of solutes in urban headwaters are wet and dry atmospheric deposition. Stream nitrogen concentrations are high because of the low potential of the urban soils to function as nitrogen sinks, either through nitrogen assimilation or denitrification. Deep stream incision may lead to enhanced nitrification of both dissolved organic nitrogen and ammonium in the shallow groundwater. Downstream decreases in the concentration of less reactive solutes, such as chloride and sodium, may be a function of increasing distance from major roadways and associated dust.

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General Information for this Meeting

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