Southeastern Section - 54th Annual Meeting (March 17–18, 2005)

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Presentation Time: 8:00 AM-12:00 PM

NATURAL ATTENUATION OF NUTRIENTS BY WETLANDS IN THE BUSH RIVER, SOUTH CAROLINA

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Natural processes in rivers have the capacity to remove pollutants. We examined attenuation of nutrients from wastewater treatment plants (WWTPs) in the 298 km^2 Bush River watershed in the Piedmont Province of South Carolina. Land cover in the watershed is mainly forest (56%) and agricultural (36%). The bedrock is high grade metamorphic and felsic to mafic igneous covered by thick saprolite and ultisols, resulting in naturally dilute waters sensitive to human perturbation. Two WWTPs discharge effluent along the 50 km of the main river channel and, according to a study in 2002, significantly alter the river's chemical composition. We collected water samples from June to August 2004 along the river at 13 sites which had been sampled in 2002. Downstream of WWTPs, increased concentrations of chloride, total dissolved nitrogen (TDN), nitrate, sulfate, and sodium were expected based on effluent chemistry and discharge volume; however, in both 2002 (drought conditions) and 2004 (higher flow conditions), concentrations of TDN, nitrate and sulfate 4 km downstream of the upper WWTP were much lower than expected. The river flows very slowly through a wetland complex (dissolved oxygen < 5 mg/L) ~2 km downstream of the upper WWTP. We hypothesized that the wetland removed nitrates and sulfates from river water.

We then conducted a more detailed study of a 6 km river section which included the upper WWTP. Chloride, nitrate and sulfate concentrations decreased from 46 mg/L, 87 mg/L, and 39 mg/L, respectively, in the WWTP effluent to 31 mg/L, 55 mg/l, and 25 mg/L at a site in the river 165 m downstream. This decrease mainly was a function of dilution by river water. At the base of the wetland, however, chloride, nitrate, and sulfate concentrations decreased to 15 mg/L, 0.42 mg/L, and 2.7 mg/L. The molar ratios of chloride to nitrogen and chloride to sulfur increased from 0.9 to 61.3 and from 1.6 to 7.4, respectively, from the WWTP effluent to the base of the wetland. In contrast, the chloride to sodium ratio remained near 0.5, and ammonium concentrations either did not decrease or increased slightly in the wetland. These data suggest that denitrification, dissimilatory nitrate reduction, and sulfate reduction in the wetland are removing nitrates and sulfates from the river water, thereby decreasing the effect of the WWTP on river chemistry.

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General Information for this Meeting

Session No. 19--Booth# 19
Undergraduate Research (Posters)
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8:00 AM-12:00 PM, Friday, March 18, 2005

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