Response of Stream Biofilms Across an Urbanization Gradient

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Abstract. This study examined 30 sites from 2010-14 investigating stream biofilms response to urbanization in Athens-Clarke County, GA. Urbanization initiates cascading environmental stressors impacting stream systems altering abiotic factors including hydrology and water chemistry. Biofilm, the active biological surface on stream bottoms comprised of algae, bacteria, fungi and organic matter, integrates the effects of multiple stressors. Thus, biofilm characteristics including its biomass and nutrient content can indicate the effects of watershed land use on stream condition. We determined watershed land cover and used physical/chemical data provided by Athens-Clarke County to determine relationships with biofilms. We found a positive correlation between impervious surface cover (%ISC) and total nitrogen (TN), dissolved inorganic N, and temperature of stream water. An isotope of N, ^{15}N is typically found in higher quantities in streams with wastewater inputs. Total phosphorus was positively correlated with δ^{15}N, suggesting sewage or wastewater input but surprisingly, there was a negative relationship between biofilm δ^{15}N and %ISC. The δ^{15}N response to forest cover yielded expected values (3-4) in heavily forested areas (>60%), increased values (4 – 9) in moderately forested areas (30-60%), and decreased values (>2.5) in reduced forest area (>15%). These findings suggest that land uses can differentially affect inputs and cycling of N in biofilms, resulting in non-linear relationships between potential source indicators (e.g., δ^{15}N) with single types of land cover change.