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Assessing Watershed Health: Multiproxy Contaminant Tracing in a Geographic Context

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Pathogen loading, specifically high *E. coli* concentrations, is a major cause for poor surface water quality worldwide. Many rivers and streams are used recreationally, and contamination poses a communal health risk. In this study, we focus on a mixed-use watershed with agricultural, urban, and rural areas that has a history of poor water quality in central Alabama. Our goal was to track fecal contamination within the watershed and determine if anthropogenic input played a significant role in *E. coli* loading. To test this, we collected water samples at nine sites and quantified *E. coli*, pharmaceutical and personal care products (PPCPs), major and minor metals, nutrients, and other water quality parameters over 6-months. We utilized the multi-proxy dataset with geospatial context to assess the relationships between land-use and water contamination.

PPCPs were frequently detected over the recreational period, including acetaminophen (13% of samples), caffeine (50%), salicylic acid (25%), sucralose (38%), and Bisphenol A (13%). We found a strong, environmentally significant correlation between *E. coli* concentrations and the total concentration of all PPCPs ($r = 0.5075$; p-value = 0.0448) and the total number of compounds ($r = 0.5339$; p-value = 0.0331). Other significant variables that were correlated with *E. coli* included water temperature, pH, and average total phosphorous. Finally, the multiproxy data was interpreted in a geographic context to understand controls from land-use and the built environment. Sample sites were categorized into pristine, agricultural/rural development, and urban development and enrichment factors were calculated for each site. The agricultural/rural development sites had elevated total PPCP concentrations (3.58, 2.28, and 1.78) compared to the pristine site (1) which may be due to a high density of septic systems and low density of municipal sewer infrastructure in the region. Malfunctioning septic systems could contribute to the increased *E. coli* and PPCP in these areas and our combined results support that idea: they point to a significant anthropogenic loading of *E. coli*, particularly in agricultural/rural regions of the watershed. In a larger context, our results suggest that malfunctioning septic systems may play a largely unrecognized role in contamination of surface water in mixed land-use watersheds.