Conceptualizing and quantifying the function of beaver dams and storm water ponds on the hydrology and biogeochemistry of urban streams

Urbanization changes the way that water and nutrients move in our cities. The high level of impervious surfaces causes water to flow quickly across surfaces, pick up nutrients from a variety of sources, and deposit them directly into streams rather than properly infiltrate into groundwater. As a result, urban streams are characterized by wide chemical variability, and their discharge levels are highly responsive to storm events. The combination of these factors increases the risk of harmful algal blooms and flash floods. Beaver dams, which are impoundments along a stream channel that reduce stream velocity, have the potential to reduce this “flashiness” by increasing baseflow, decreasing storm flows, and enhancing nutrient processing rates. Previous studies regarding the impact of beaver on water quality have largely focused on sites in forested and protected settings in the Western US or abroad, but these ecosystem services could have vast implications for urban stream restoration in the Southeastern US. Our study aims to quantify the impact of beaver dams on urban water quality by 1) using discrete synoptic data gained from field observations, taken above, at, and below the outlets of three urban beaver marshes, to represent the impact of beaver on carbon flux dynamics in the primary stream; and 2) using local rainfall data, continuous water level observations, and discrete discharge readings to establish a baseflow and compare flood attenuation potential between sites.We find preliminary evidence that water flow is better attenuated in beaver marshes than in man-made stormwater ponds during both wet and dry periods, and that beaver marshes have the potential to both increase and decrease rates of CO2 release depending on hydrological conditions such as stream discharge. Future work is needed to validate these initial findings and to explore their implications for the processing, uptake, and removal of nutrients from these environments.