Restoration alters stream metabolism without affecting dissolved organic nutrients

Allison Schellenberg, Ashlee Hernandez, Charles Yang, Joji Sherman, Irfan Eshan, Mary Poteet, Ph.D.
Urban Ecosystems, Freshman Research Initiative (FRI), College of Natural Sciences, The University of Texas Austin

Introduction

Waller Creek Diversion Tunnel

The Waller Creek Diversion Tunnel diverts streamflow from Waller Creek into an underground tunnel to reduce flooding in downtown Austin, TX, USA. During high flow, floodwaters are diverted from the creek and into the tunnel, which dumps floodwaters into Lady Bird Lake. During base flow, water from Lady Bird Lake is pumped from the tunnel into the creek channel at the diversion tunnel, altering the water source in the creek. The tunnel was expected to lead to better water quality and a “functioning creek ecosystem” (Waterloo Conservancy, 2023). We measure stream function as metabolic regime in Waller Creek. We expect that the difference in source water could significantly alter nutrient quality and quantity, which is measured to assess whether dissolved nutrients controls stream metabolism.

Dissolved organic matter (DOM) and stream metabolism

DOM is closely tied to hydrology patterns, tending to be more microbially derived during dry summers and terrestrially derived during rainy fall and spring months (Goldman et al., 2014). In urban streams these patterns may vary due to organics introduced by storm drains and leaky sewers and shift metabolic regimes of streams to more dominated by respiration. We measured DOM in a heavily urbanized creek in Austin, TX, USA, across multiple seasons and upstream and downstream of the flood diversion tunnel that significantly alters creek hydrology. These results are compared to a rural reference creek, Bear Creek.

Methods

Sample Site Description:
- 6 Waller Creek sample sites
  - 3 upstream of the diversion tunnel
  - 3 downstream of the diversion tunnel
  - 1 Lady Bird Lake sample site
  - 3 Bear Creek sample sites

DOM Collection and Processing:
- 3 replicate samples collected at each site
- Filtered samples through a 0.45 micron filter
- Teledyne Tekmar total carbon analyzer
- Dissolved Organic Carbon (DOC) measured in mg/L
- Total Nitrogen (TN) measured in mg/L
- UV-spectrophotometry:
  - SUVA absorbance levels 254 nm/DOC (mg/L) (Findlay & Parr 2017)
- Linear Mixed Effects models were used to assess statistical differences among dates, sites and interactions among dates and sites

Acknowledgements

- Support to A. Schellenberg by the TEJAS Program, FRI/TIDES Fellowship and CNS Advanced Summer Fellowship
- Support to M. Michalec by the S-STEM Fellowship
- Special thanks to Phil Bennett and Daniella Rempe who provided access to specialized instruments.
- Thanks to Rebeeha Garza, Nathan Vu, and Shyamal Waghwala who helped develop the methods and sampling protocols for this study.

References