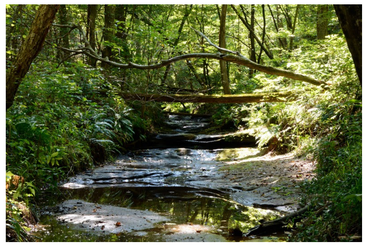
The relationship between canopy cover and water temperature in the Meramec River watershed



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Introduction

Water temperature is fundamentally important to freshwater species, ecosystem processes, and can also influence water quality. Ongoing changes in climate require a detailed understanding of factors regulating water temperature in rivers and streams. Canopy cover provided by riparian vegetation limits the amount of sunlight reaching the stream and is thought to result in cooler water temperatures. However, the degree to which various levels of canopy cover can reduce in-stream water temperatures is not well understood.

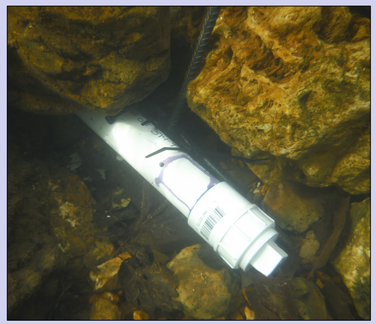
Objectives

Part 1: Explore relationships between canopy cover and water temperature in streams throughout the Meramec River watershed in eastern Missouri.

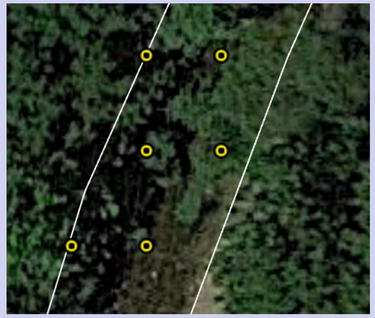
Part 2: Model water temperature in a section of stream to predict the influence of canopy removal or addition on stream temperature.

Study location

Fifteen stream sites in the Meramec River watershed in eastern Missouri. Canopy cover was estimated at each site using Google Earth and field collected data and water temperature data loggers were deployed at each site.



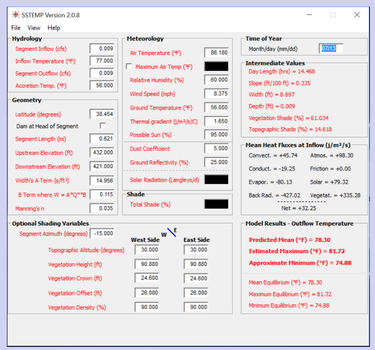
Methods



Part 1: A remote canopy estimation technique was developed using regular point sampling over Google Earth imagery for the 1km reach upstream of each logger. A spherical densiometer was used to estimate canopy cover in the same area**.**

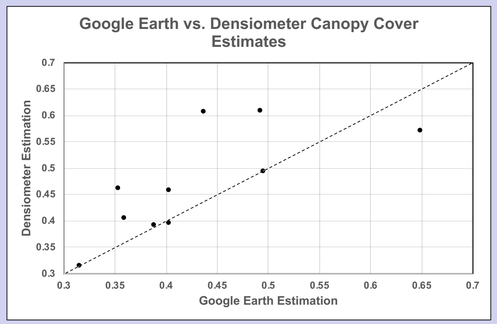
Water temperature sensitivity was calculated with a simple linear regression of daily average water and air temperature for one year.

Part 2: Instream temperature modeling program SSTEMP was used to predict water temperatures in LaBarque Creek for three versions of the same day - 7/13/2018 – under different canopy cover conditions: 90%, 50%, and 10% vegetation density.

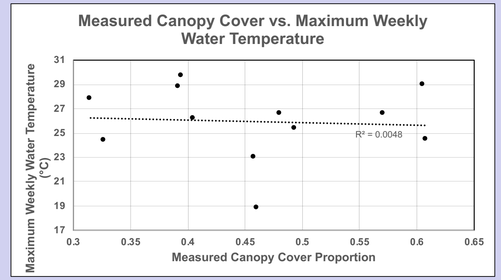


Results

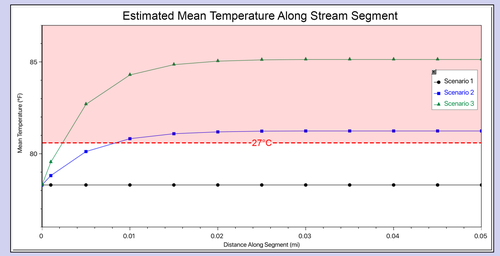
Part 1: There was a strong, positive monotonic relation found between the Google Earth and Densiometer methods, with a Spearman's coefficient of 0.817



Results



Part 1: No correlation was found between canopy cover and water temperature sensitivity or max. water temperature.



Part 2: Model estimates reveal that decreasing vegetation density from 90 to 10% would raise mean stream temperature by over 3.75°C and maximum stream temperature by almost 6°C

Conclusions

Remotely sensed data (e.g., Google Earth) may be a viable alternative to field collected data when estimating canopy cover. However, canopy cover alone does not appear to be an accurate predictor of water temperature sensitivity or maximum water temperature. In addition, modeled estimates of instream water temperature suggest that dramatic decreases in canopy cover can degrade fish habitat within a local stream.

Acknowledgements

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