Spatio-Temporal Patterns of Stream Temperature in the Delaware Basin

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2020 Virtual Watershed Congress

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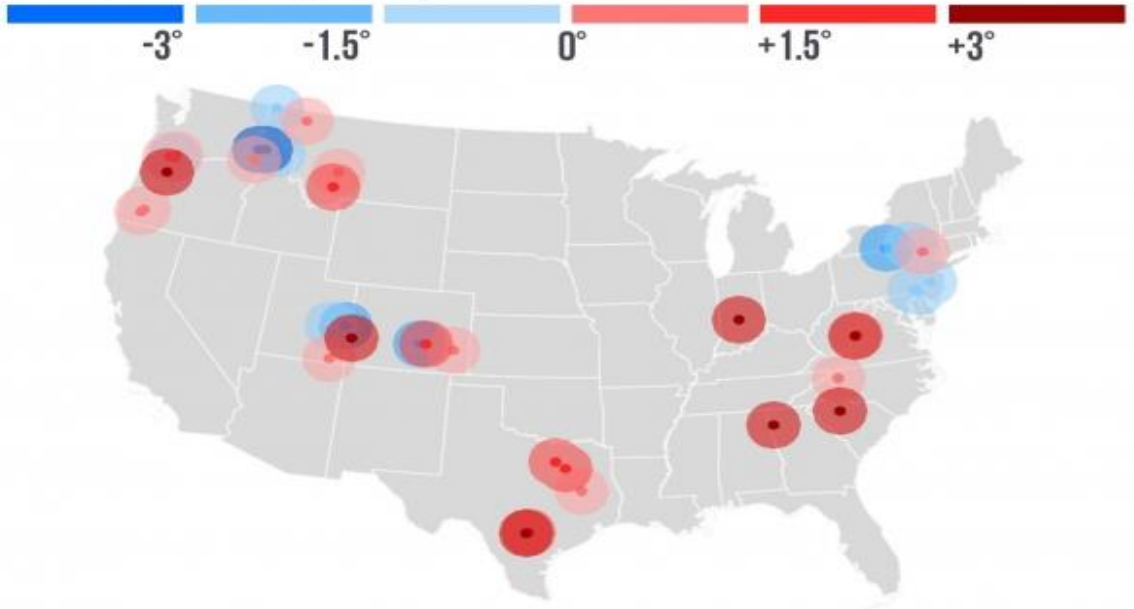
STROUD WATER RESEARCH CENTER

WILLIAM PENN FOUNDATION

DELAWARE RIVERKEEPER NETWORK

River & Stream Temperatures

Change in average temperature since 1990



Change in mean March–August temperature 1980–2018
Gauges chosen based on most consistent observational record
Source: USGS

CLIMATE CENTRAL

Warming Waters:

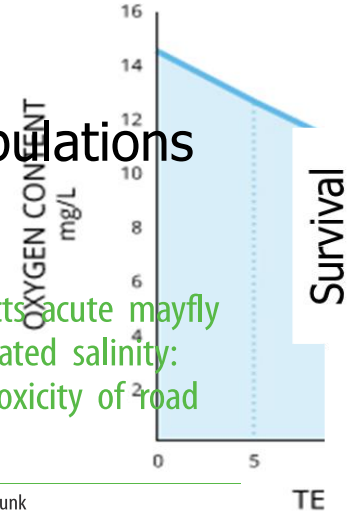
Temperature controls on aquatic organisms

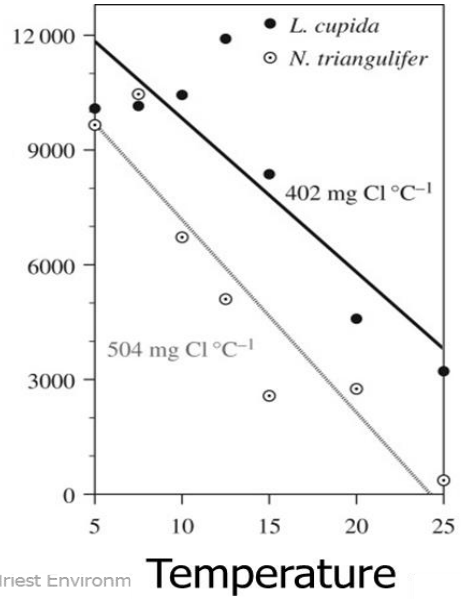
- Temperature effects on dissolved oxygen
- Temperature effects on algal growth/blooms
- Temperature effects on toxicity
- Temperature effects on fish populations

Temperature affects acute mayfly responses to elevated salinity: implications for toxicity of road de-icing salts

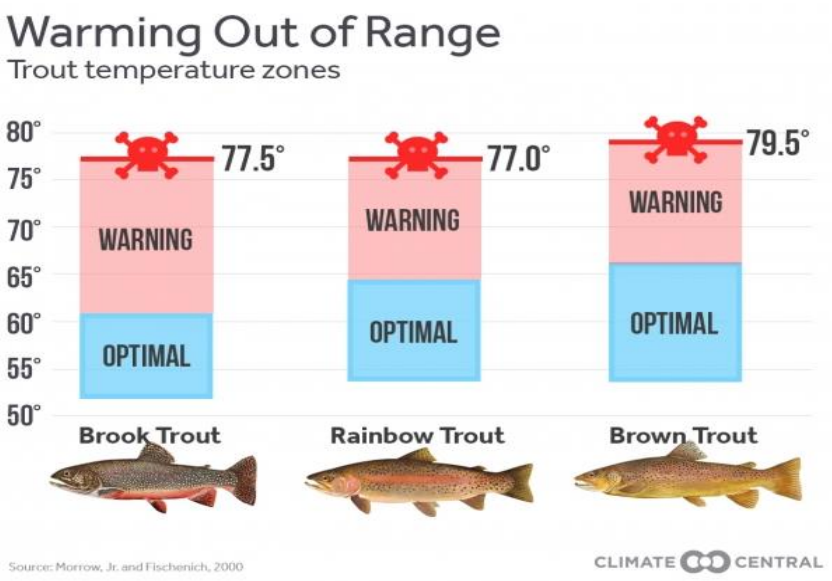
John K. Jackson and David H. Funk

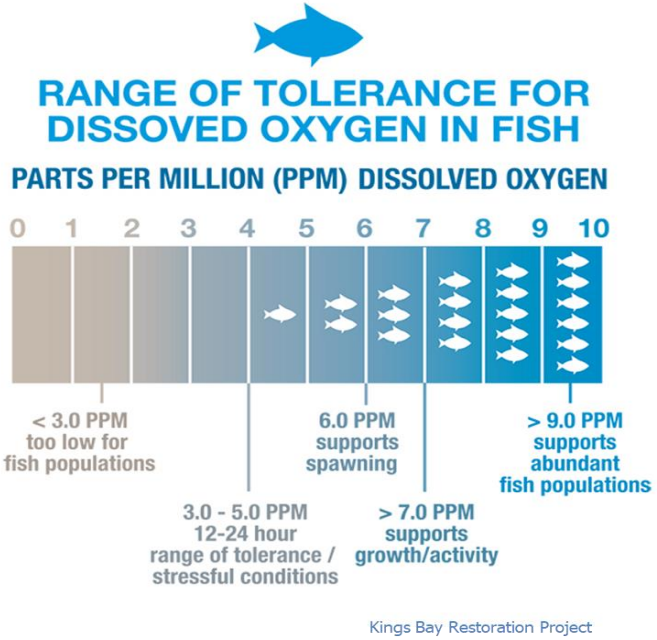
Stroud Water Research Center, 970 Spencer Road, Avondale, PA 19311, USA





Temperature effects on fish populations





How does stream temperature vary OVER TIME?

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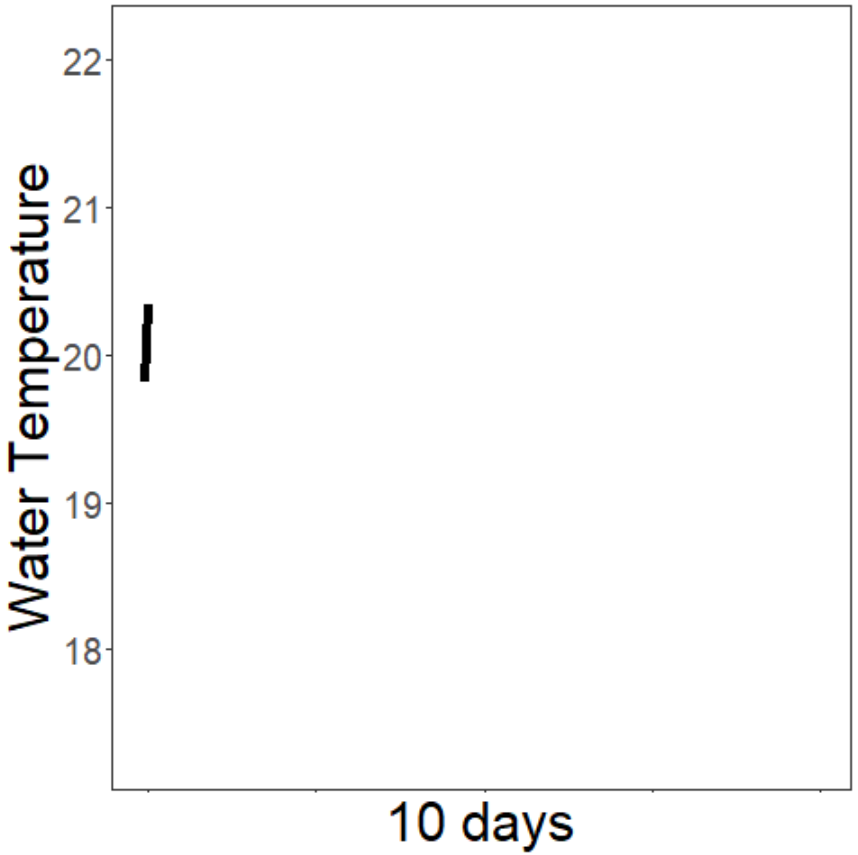
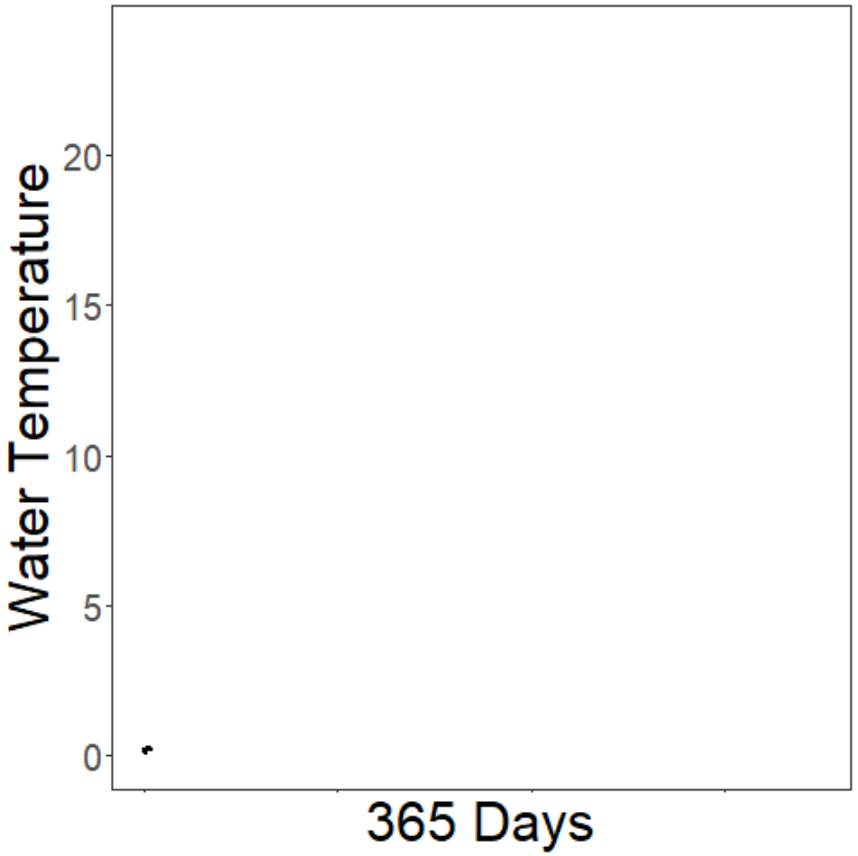
Diel Fluctuations (day/night)



How does stream temperature vary OVER TIME?

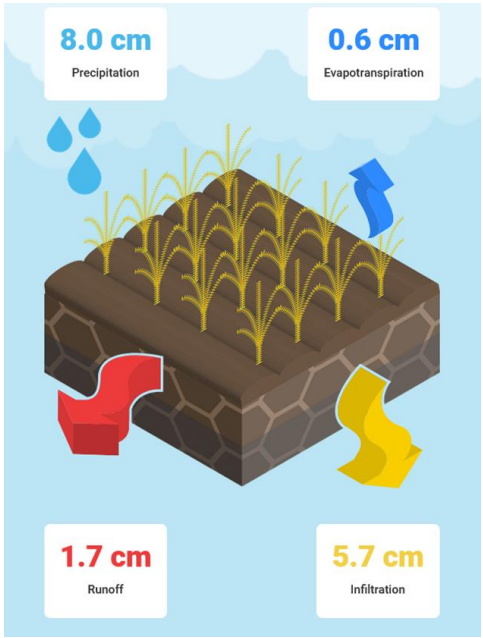
Seasonal Variation



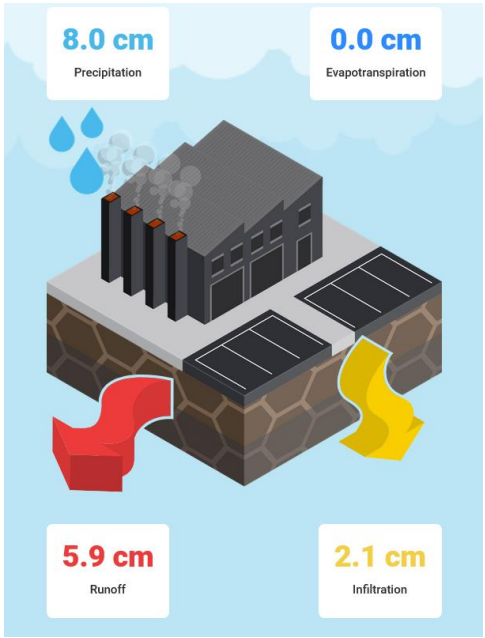
How does stream temperature vary OVER SPACE?

Forested watershed

Agricultural watershed

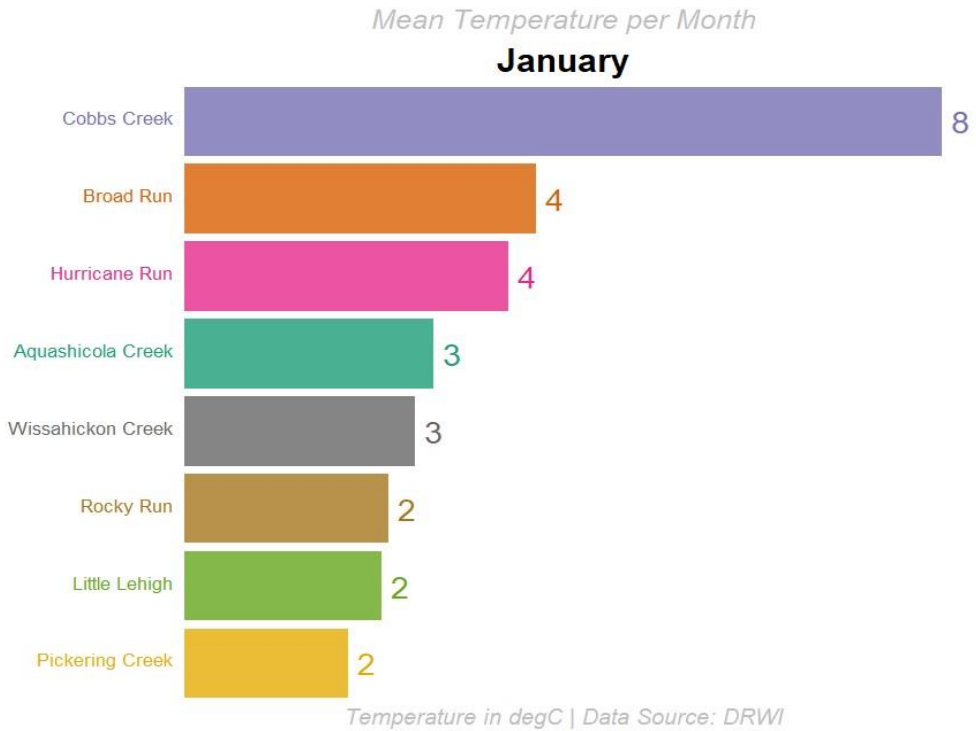


Urban watershed



Model My Watershed https://runoff.modelmywatershed.org/

How does stream temperature vary OVER SPACE & TIME?



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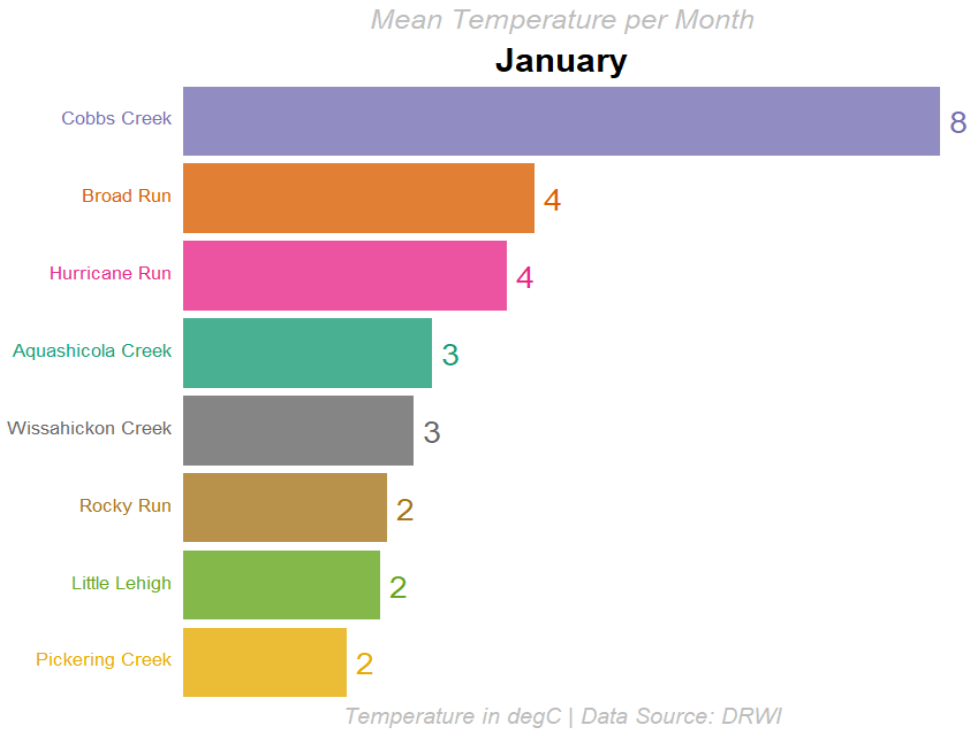

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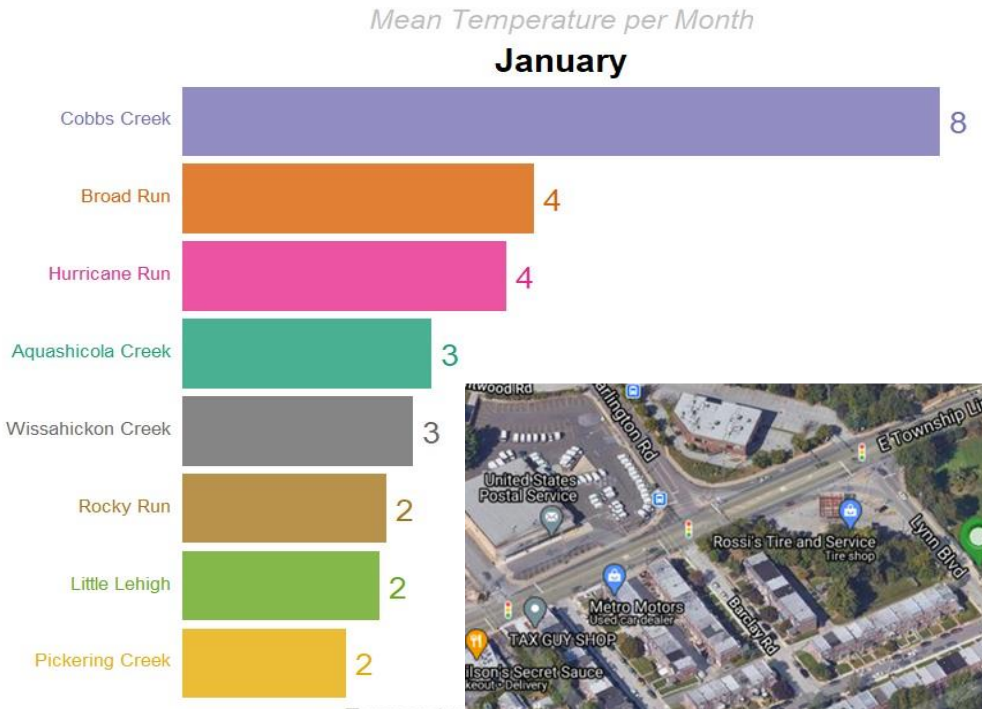
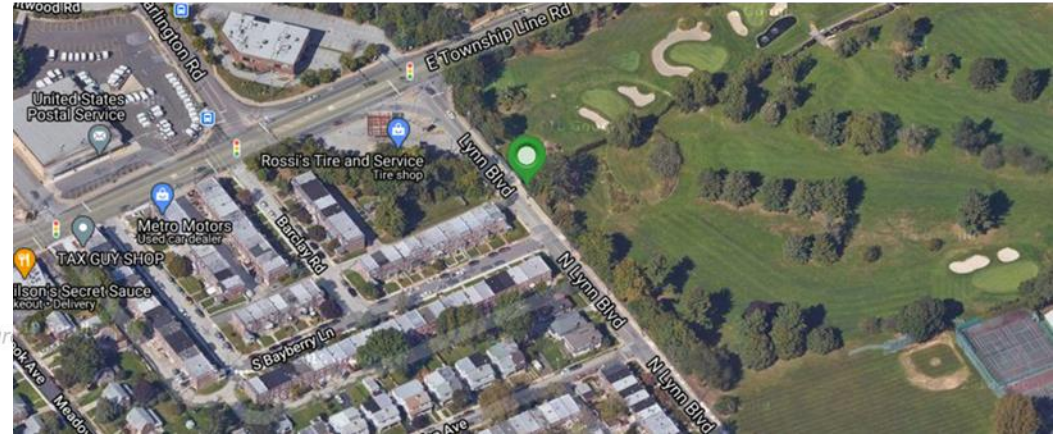
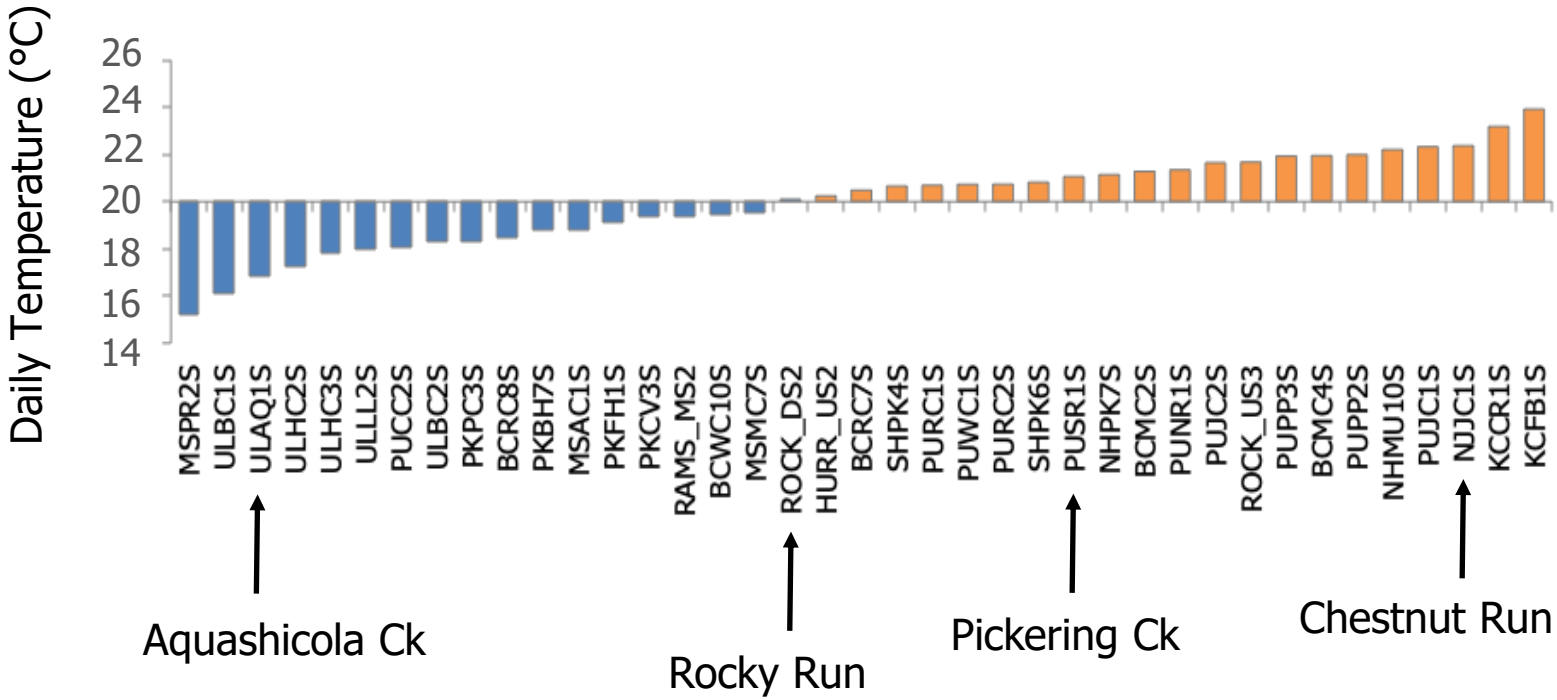


Cobbs Creek location

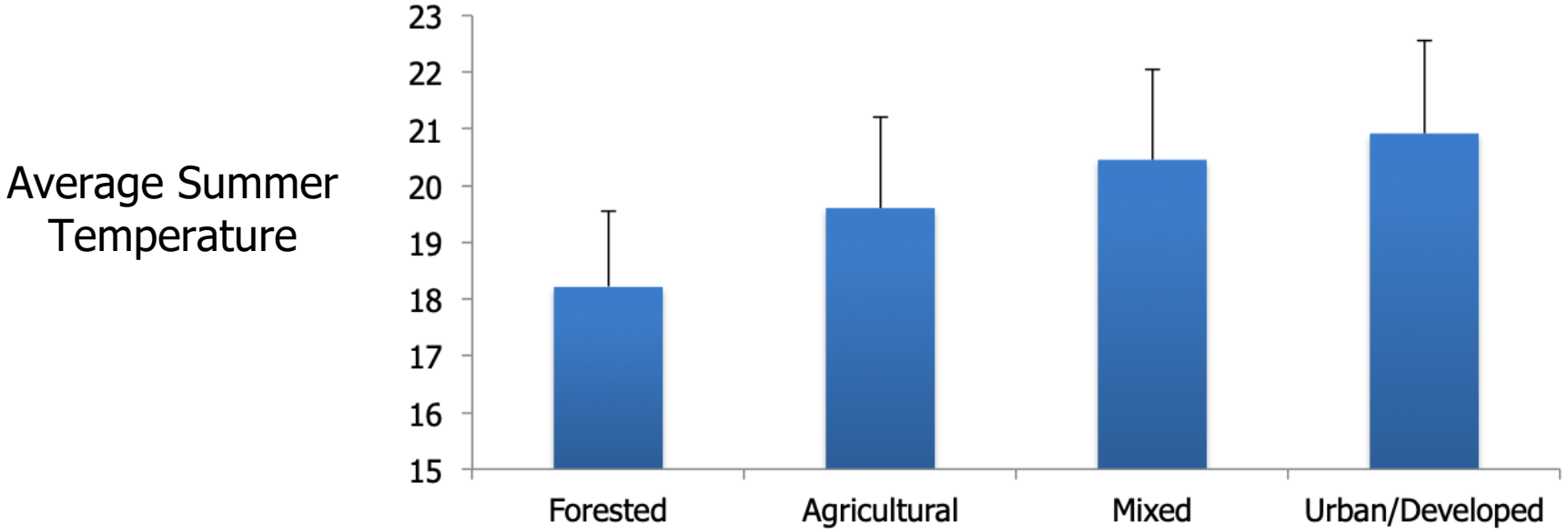


Summer Stream Temperature

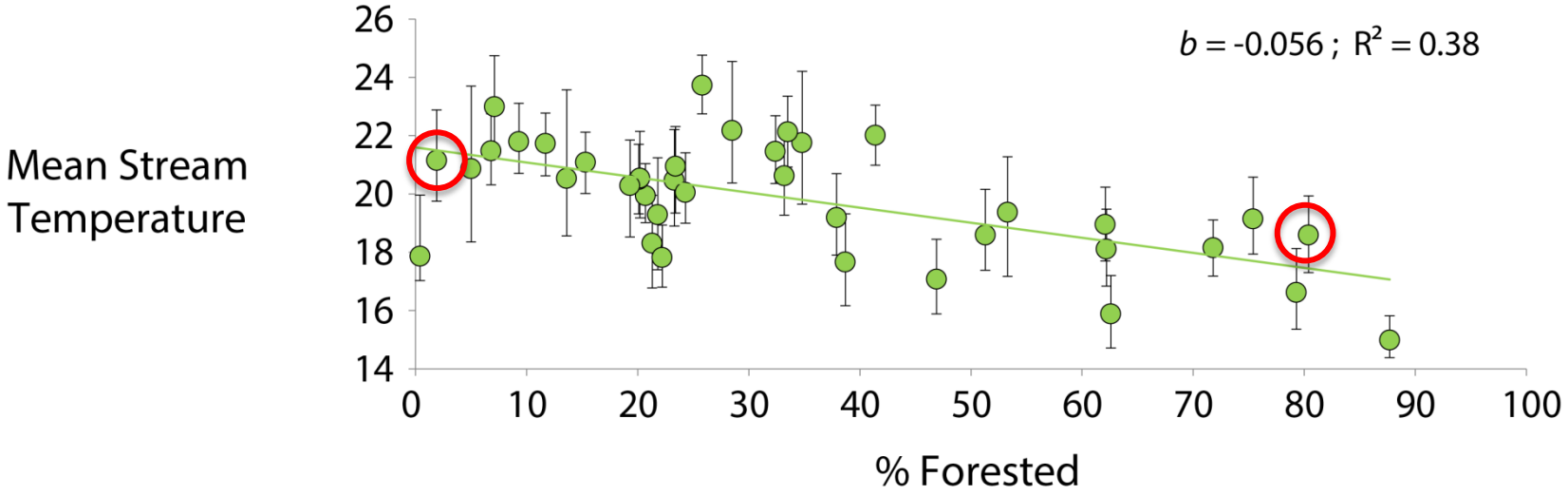
50 watersheds of different size with varying land uses



Land use and stream temperature

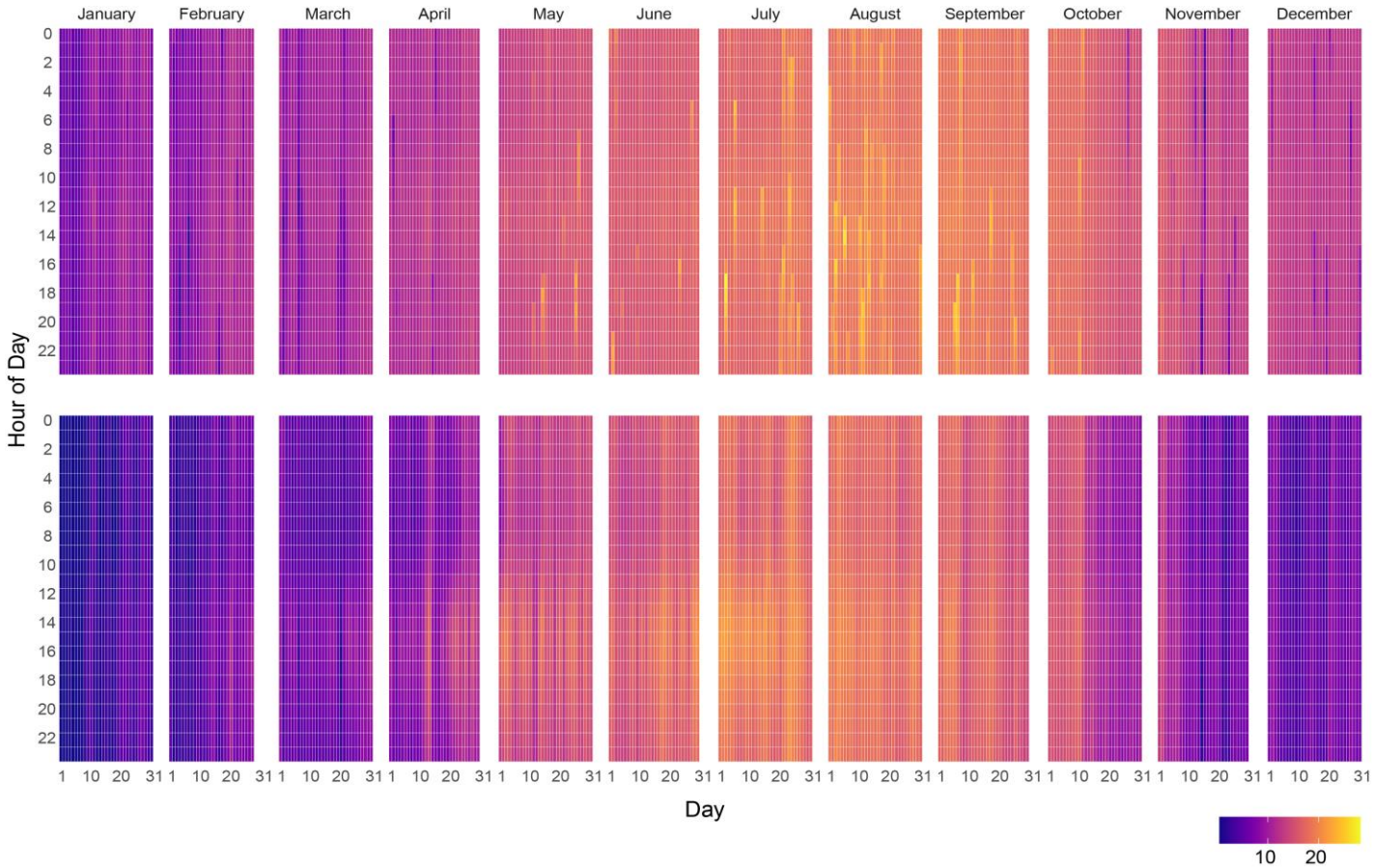


Forest area and stream temperature



10% forested area yields a 0.5°C decrease

Land use and HOURLY stream temperature



Cobbs Creek

Aquashicola Creek

EnviroDIY sensor stations

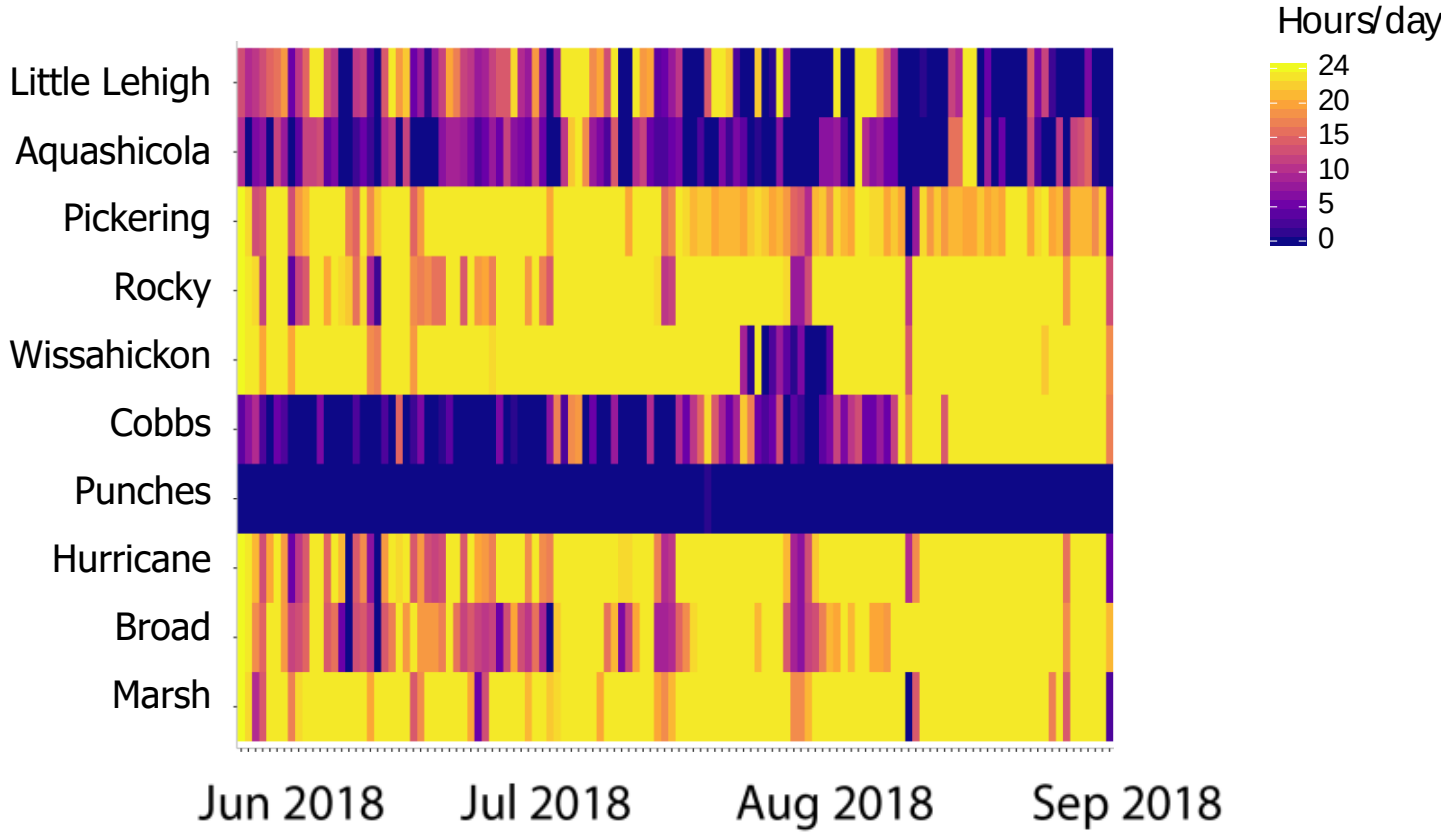
Sentinels of thermal stress in cold-water fisheries

15.5°C – 18.8°C

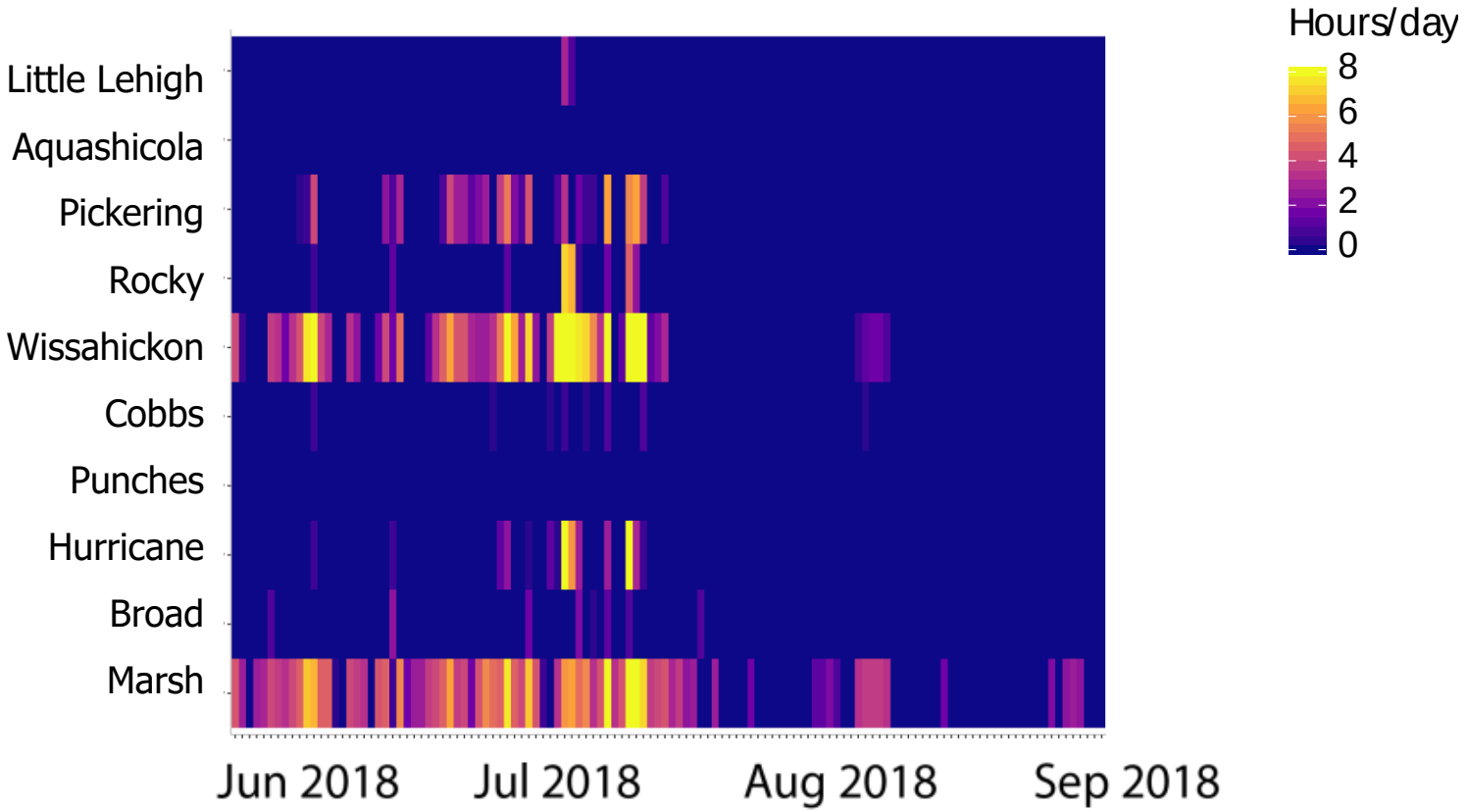
Guidance for trout stocking locations

21°C – 31°C

Hours/day exceeding Cold-Water Criteria



Hours/day exceeding Stocking Temperature Criteria



In summary

- Sensor temperature data helps us understand the complex interaction between land use and temporal effects on stream temperatures.
- *At large scales:* we can identify significant 'cooling effects' of forested watersheds on stream temperatures
- *At fine scales:* Hourly resolution of temperature data allow us to better assess the compliance and exceedance of state criteria for Cold Water Fish and trout-stocking in streams of similar average temperatures.

Acknowledgments

- Citizen scientists
- Collaborators:
  - Diana Oviedo-Vargas
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  - David Bressler
  - David Arscott
  - Charlie Dow

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