



# Climate Change and Coldwater Refugia for Brook Trout

Scott Collenburg, Senior Fisheries Biologist  
New Jersey Division of Fish & Wildlife  
Freshwater Fisheries

[Scott.Collenburg@dep.nj.gov](mailto:Scott.Collenburg@dep.nj.gov)













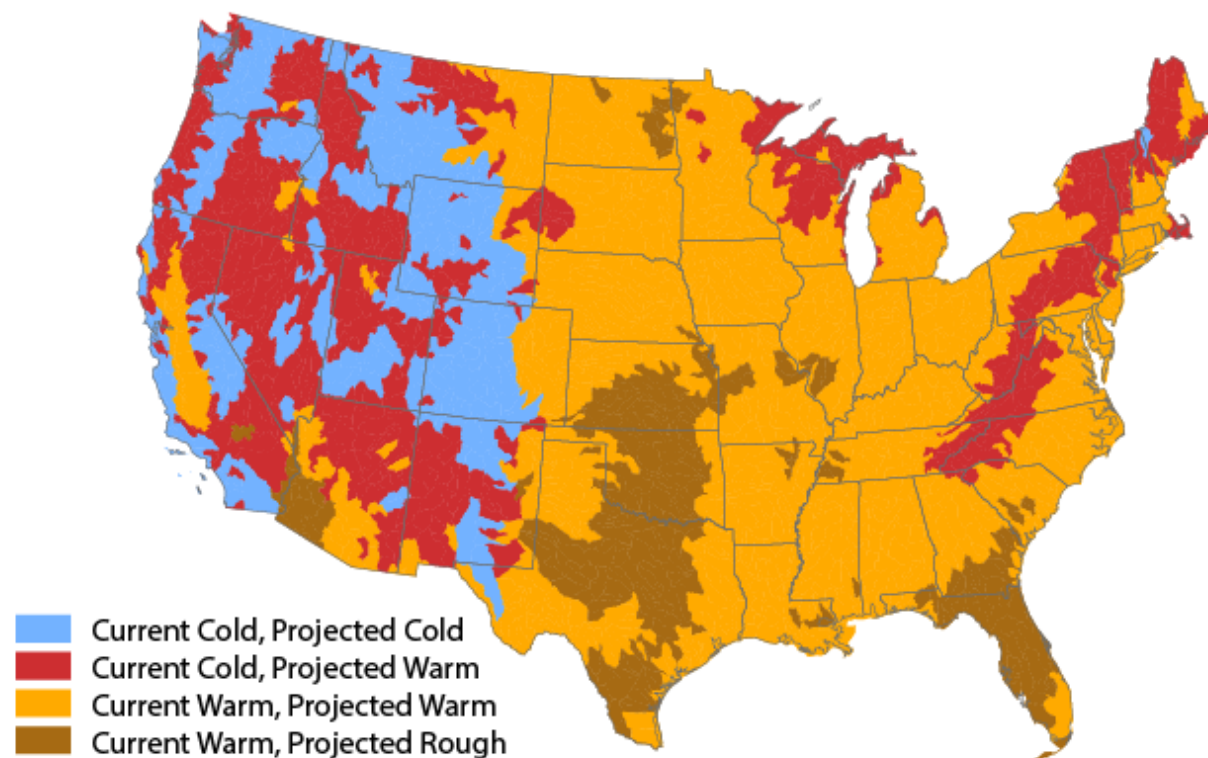


## Coldwater: Susceptibility to climate change

- IPCC reports global warming is likely to reach 1.5°C between 2030 and 2052 if it continues at the current rate
- In New Jersey, the majority of current cold-water fisheries are projected to be warm-water fisheries by 2100 regardless of climate scenario (Zimmerman and Vondracek 2006)

**Figure 1. Projected Impact of Unmitigated Climate Change on Potential Freshwater Fish Habitat in 2100**

*Change in distribution of areas where stream temperature supports different fisheries under the Reference scenario using the IGSM-CAM climate model. Results are presented for the 8-digit hydrologic unit codes (HUCs) of the contiguous U.S.*



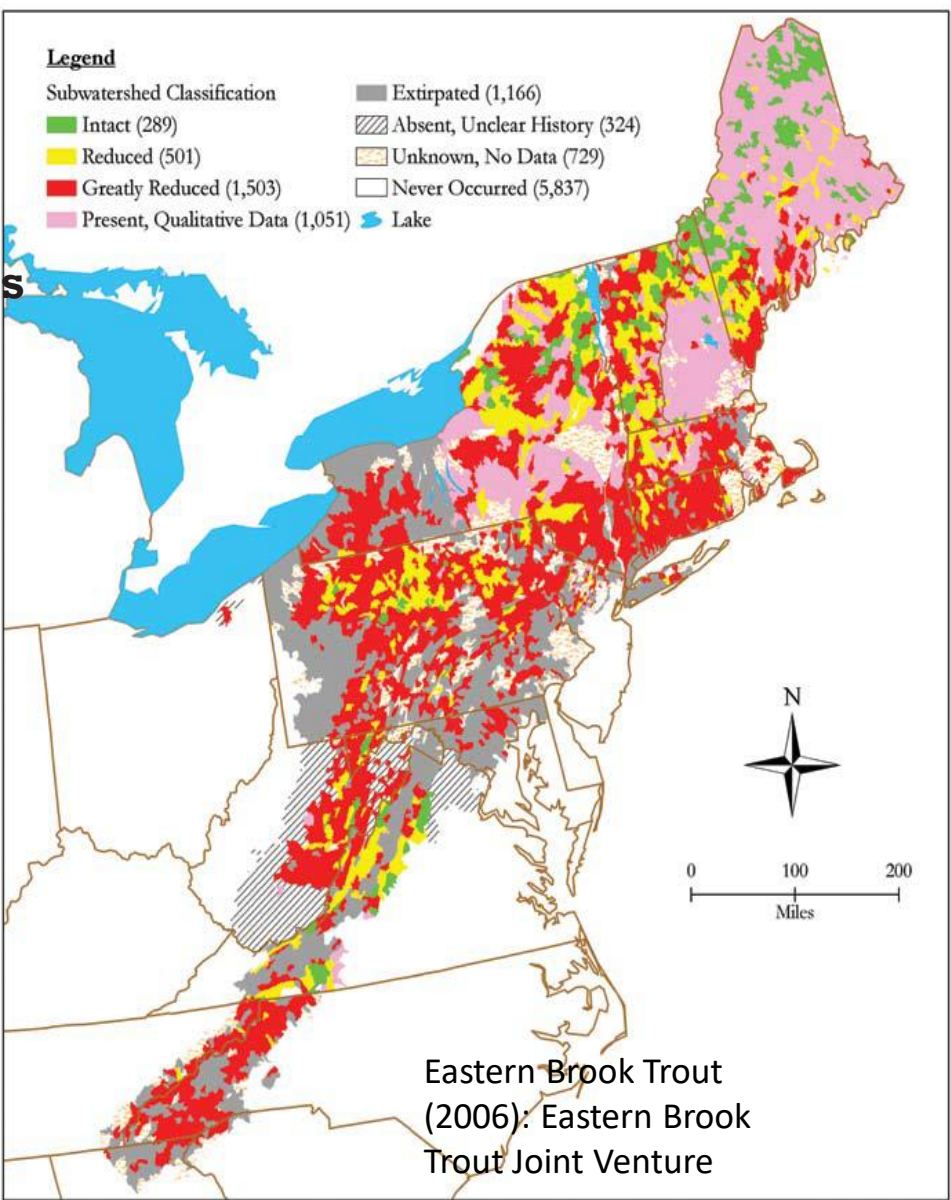
For more information, visit EPA's "Climate Change in the United States: Benefits of Global Action" at [www.epa.gov/cira](http://www.epa.gov/cira).



# Historical Impacts to Brook Trout

## Primary Threats to Brook Trout

Disturbances	Subwatersheds
1. Poor Land Management	(37%)
2. High Water Temperature	(36%)
3. Sedimentation (Roads)	(27%)
4. One or More Non-Native Fish Species	(26%)
5. Urbanization	(25%)
6. Riparian Habitat	(23%)
7. Brown Trout	(19%)
8. Stream Fragmentation (Roads)	(17%)
9. Dam Inundation/Fragmentation	(16%)
10. Forestry	(14%)



- Intact
- Reduced
- Greatly Reduced
- Extirpated

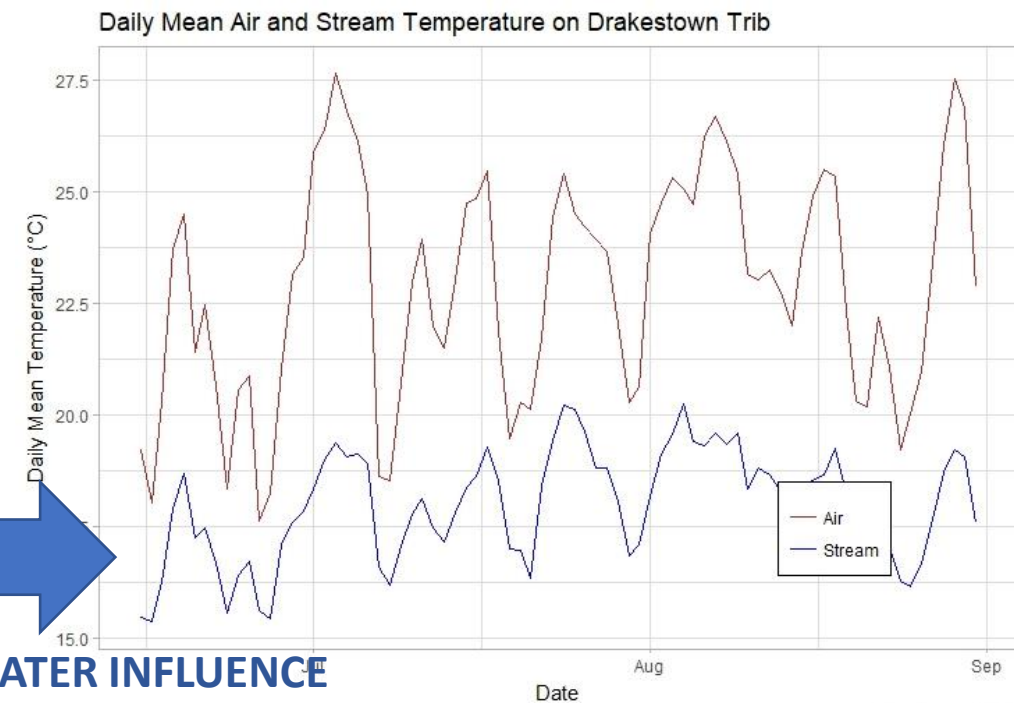
**Will coldwater habitat vanish?**

## Coldwater Habitat

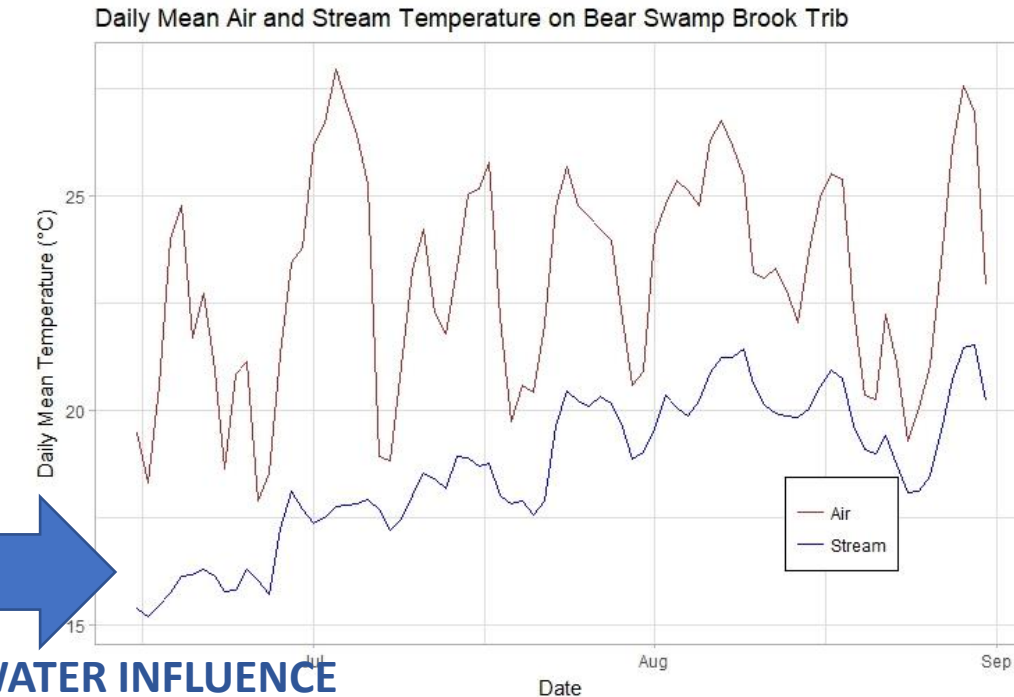
- Resilience of coldwater habitat in headwater streams varies spatially (Snyder et al. 2015)
- This variation is largely due to influence of local groundwater



### LOW GROUNDWATER INFLUENCE



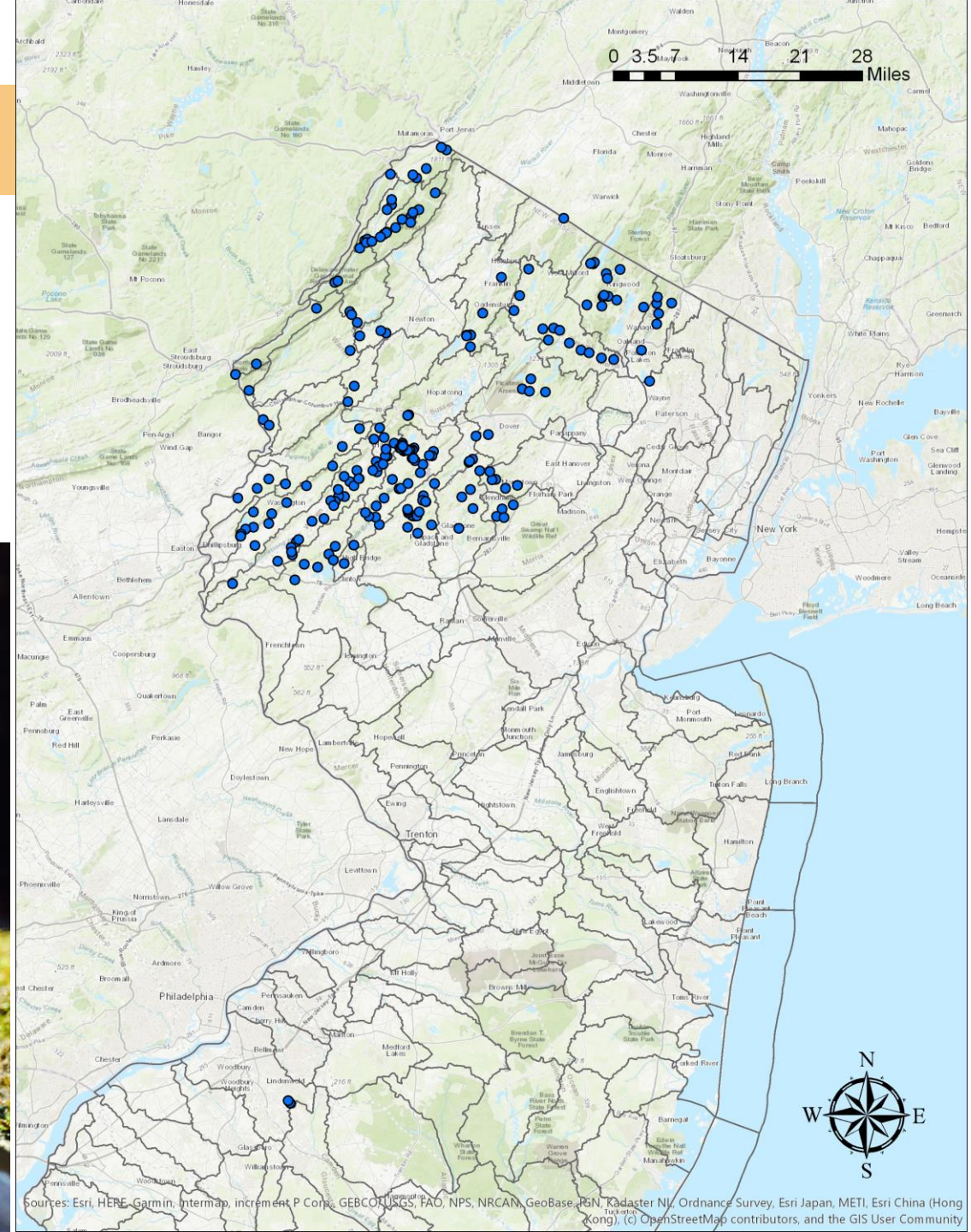
### HIGH GROUNDWATER INFLUENCE





# Coldwater Habitat – Stream Temp Monitoring

- 2018-2021 – 242 sites were monitored (blue dots)

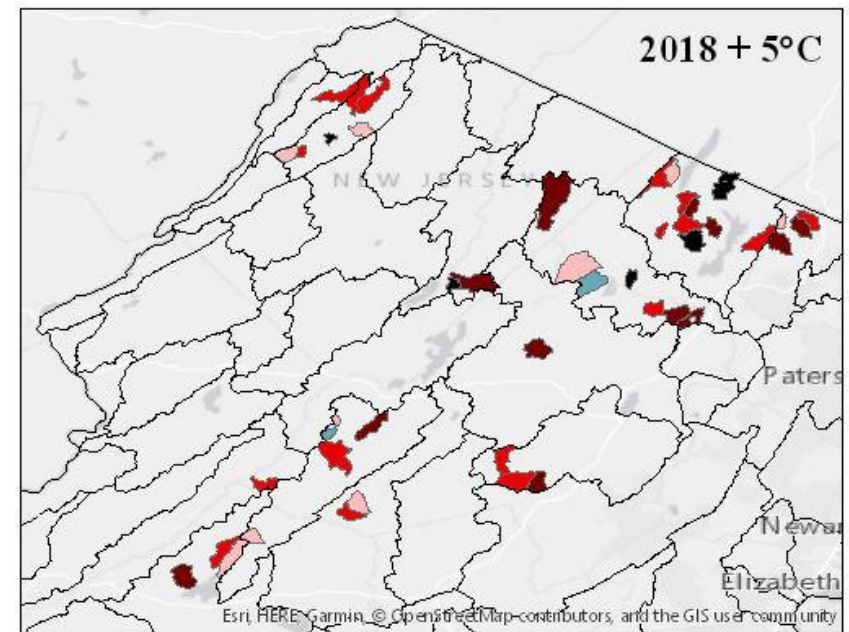
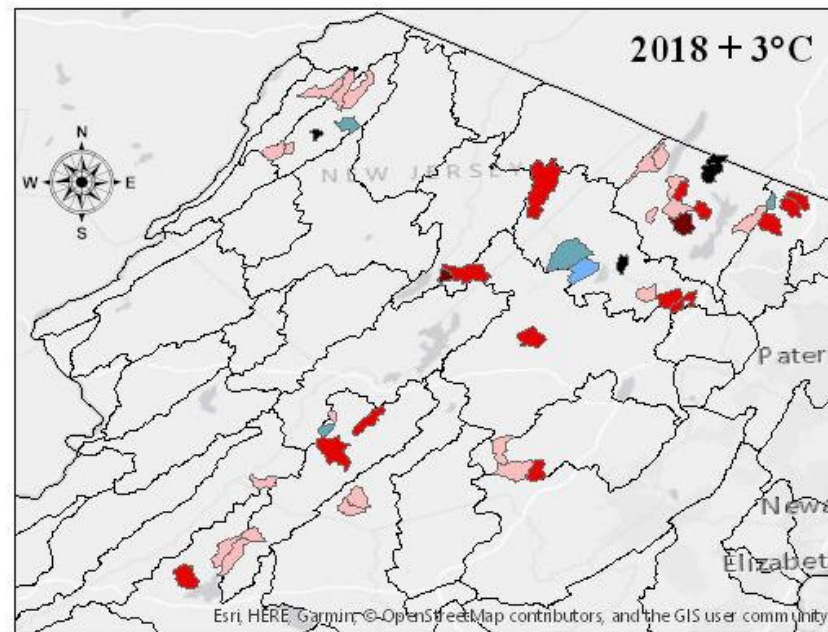
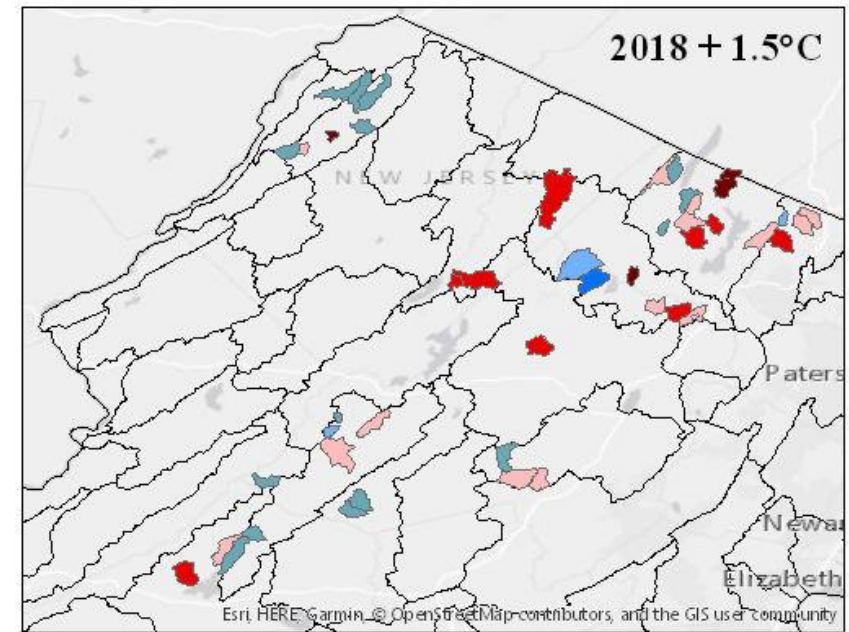
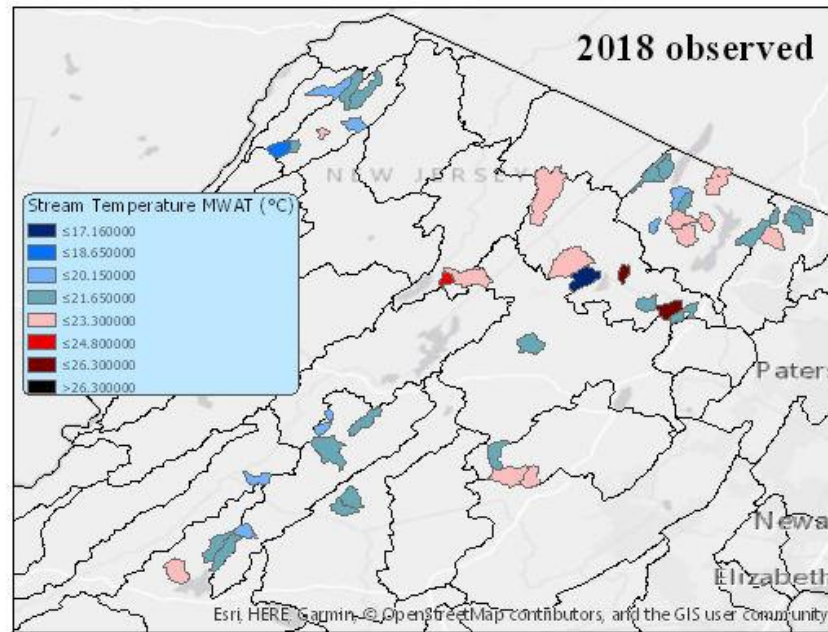




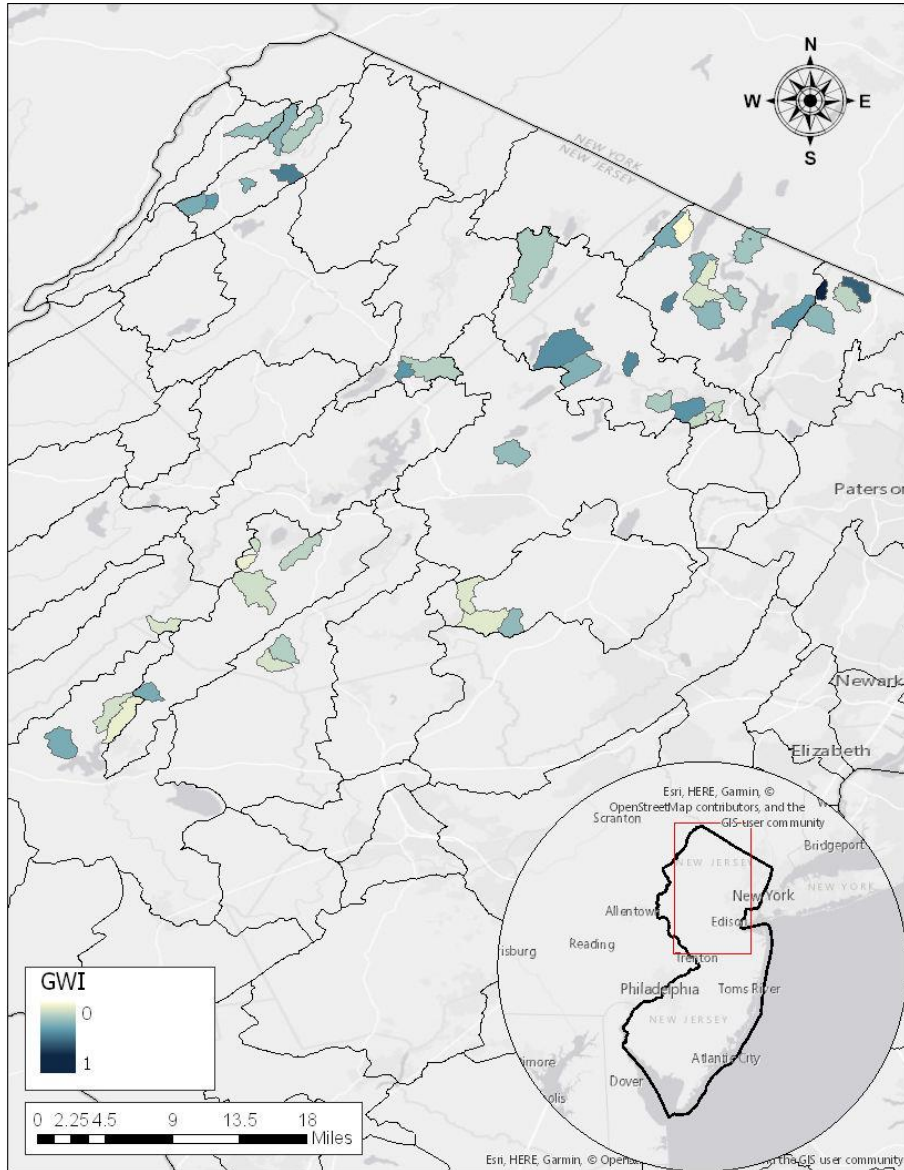
# **Objectives:**

- 1. Determine where we have resilient coldwater habitat**
- 2. Prioritize protections/projects at strongholds**
- 3. Identify locations, that with help, can be fixed**

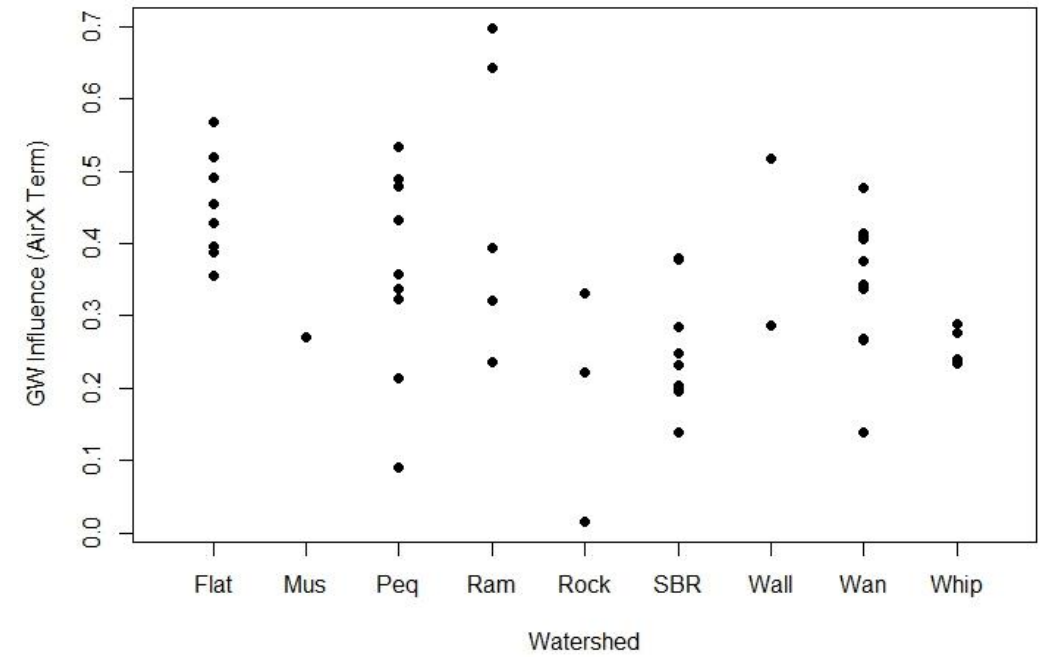








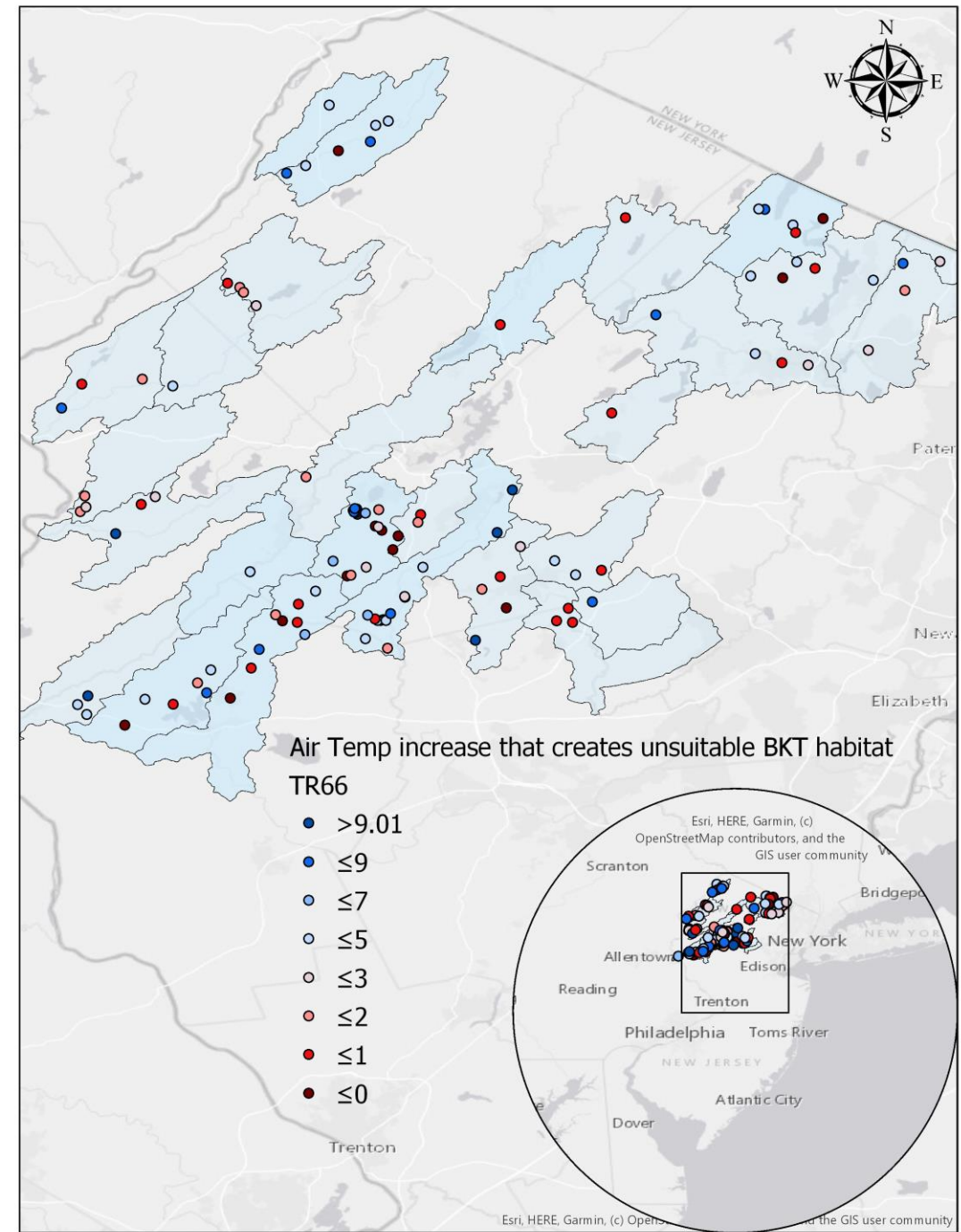
# GWI Metric





# Under a warming scenario of 3°C

Loss of ~35% of coldwater habitat





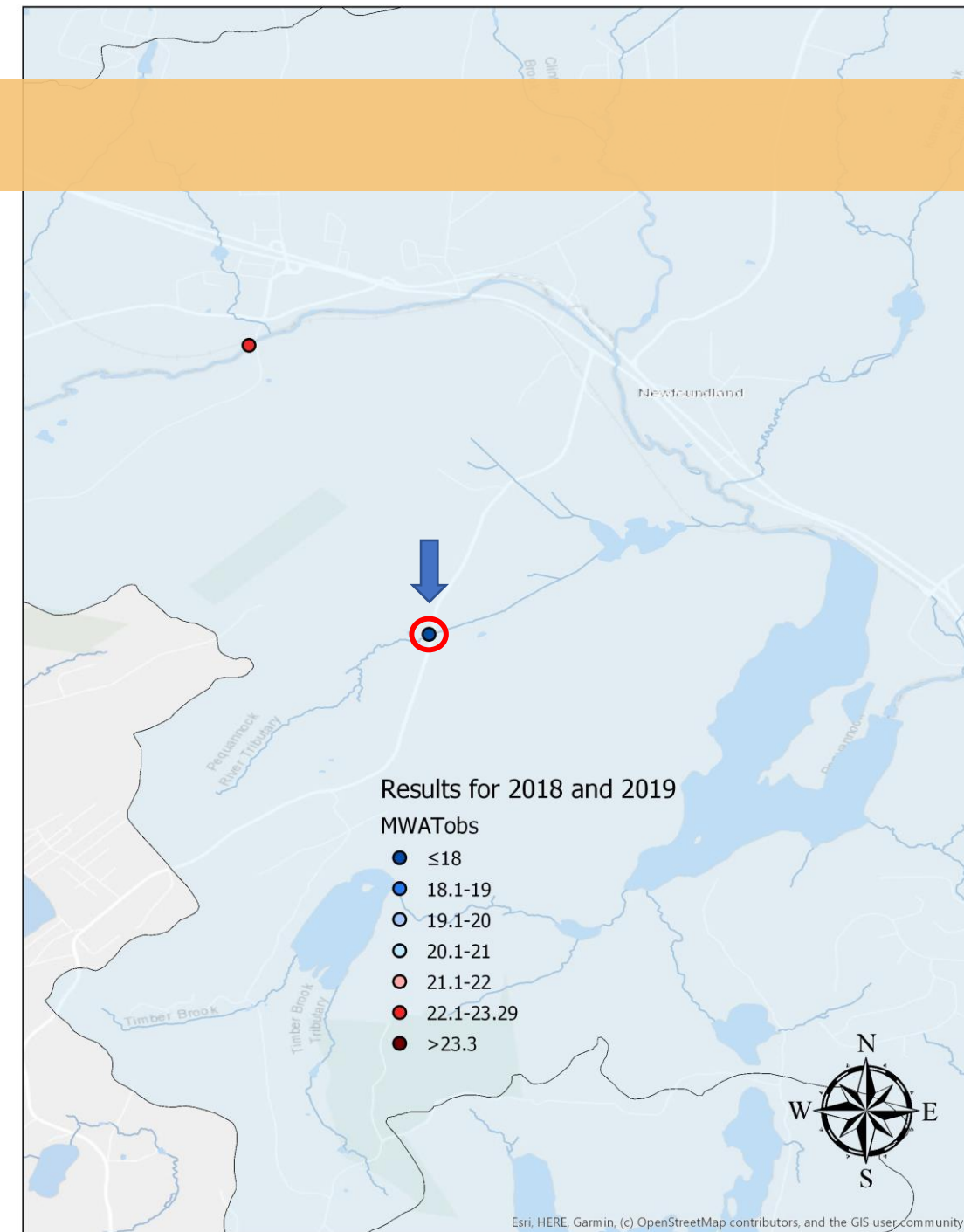
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## Potential Projects – Removal of competitors

- Pequannock River Trib. (Copperas Mtn)
  - Brook Trout population and stronghold in terms of temperature
  - Brown Trout removal



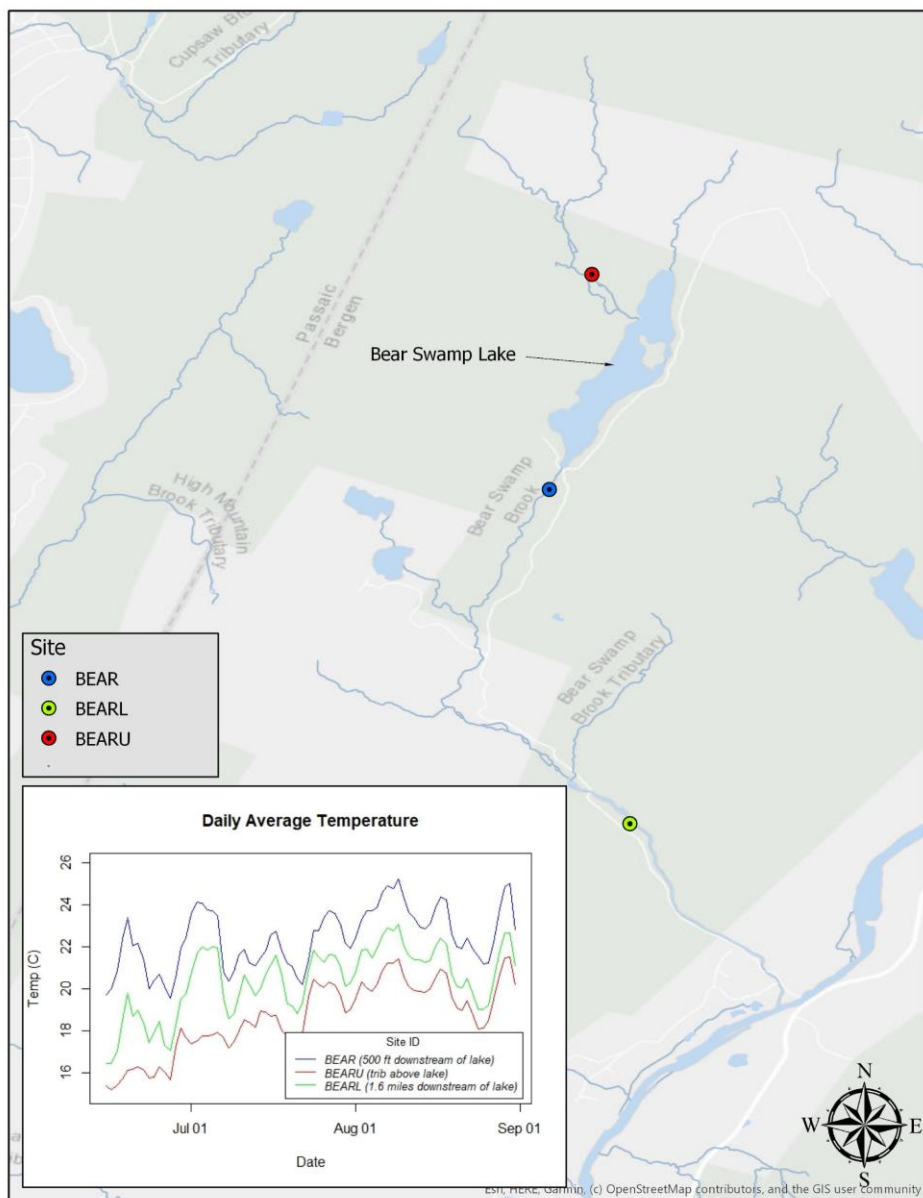


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# Projects - Brook Trout Habitat Restoration

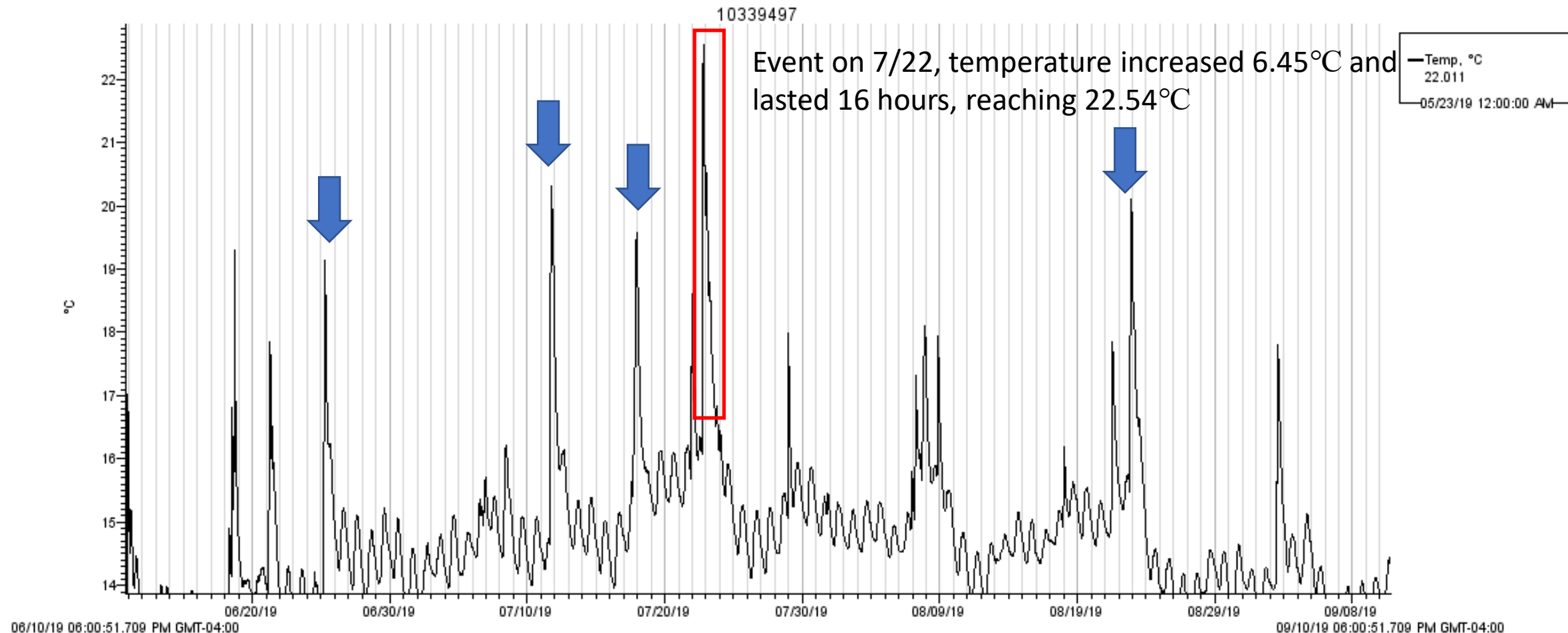
- Brook Trout exist downstream of an impoundment impacting naturally cooler temperature regimes
- Bear Swamp Brook

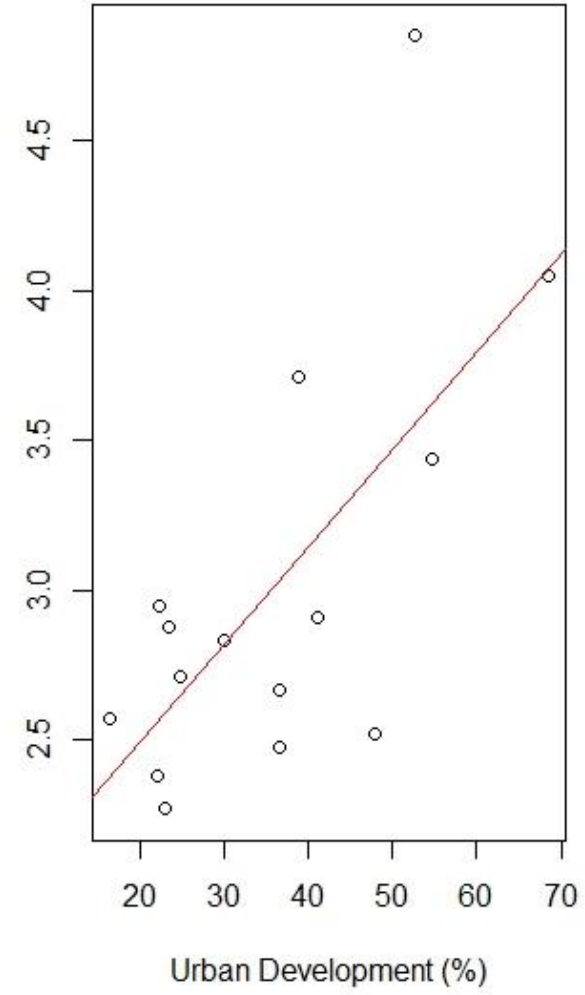
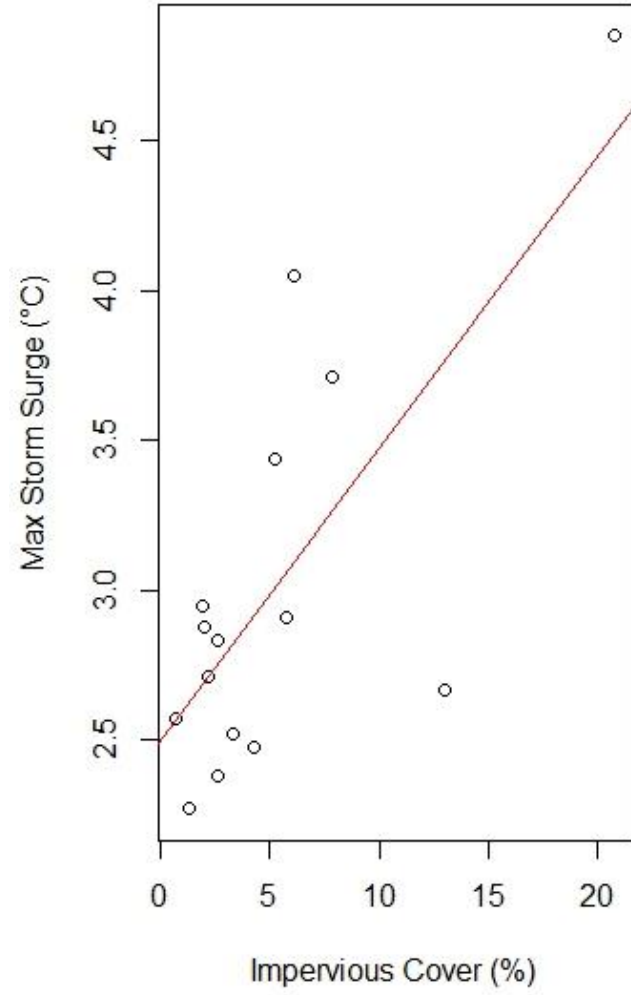




## Projects – Stormwater Management

- 2018-2020: ~20% of TP sites documented significant temperature increases associated with a rainfall event

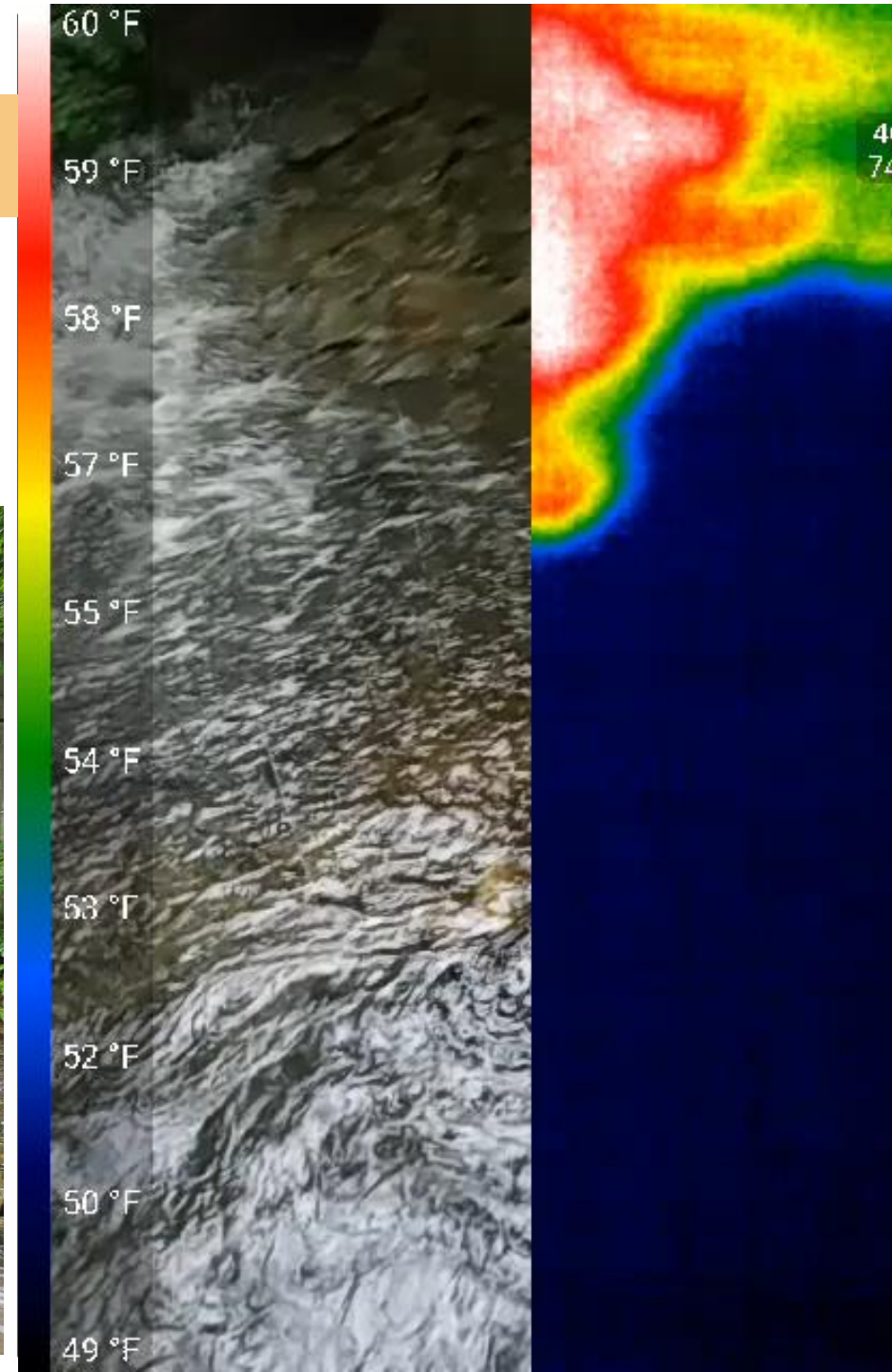






## Projects – Stormwater Management

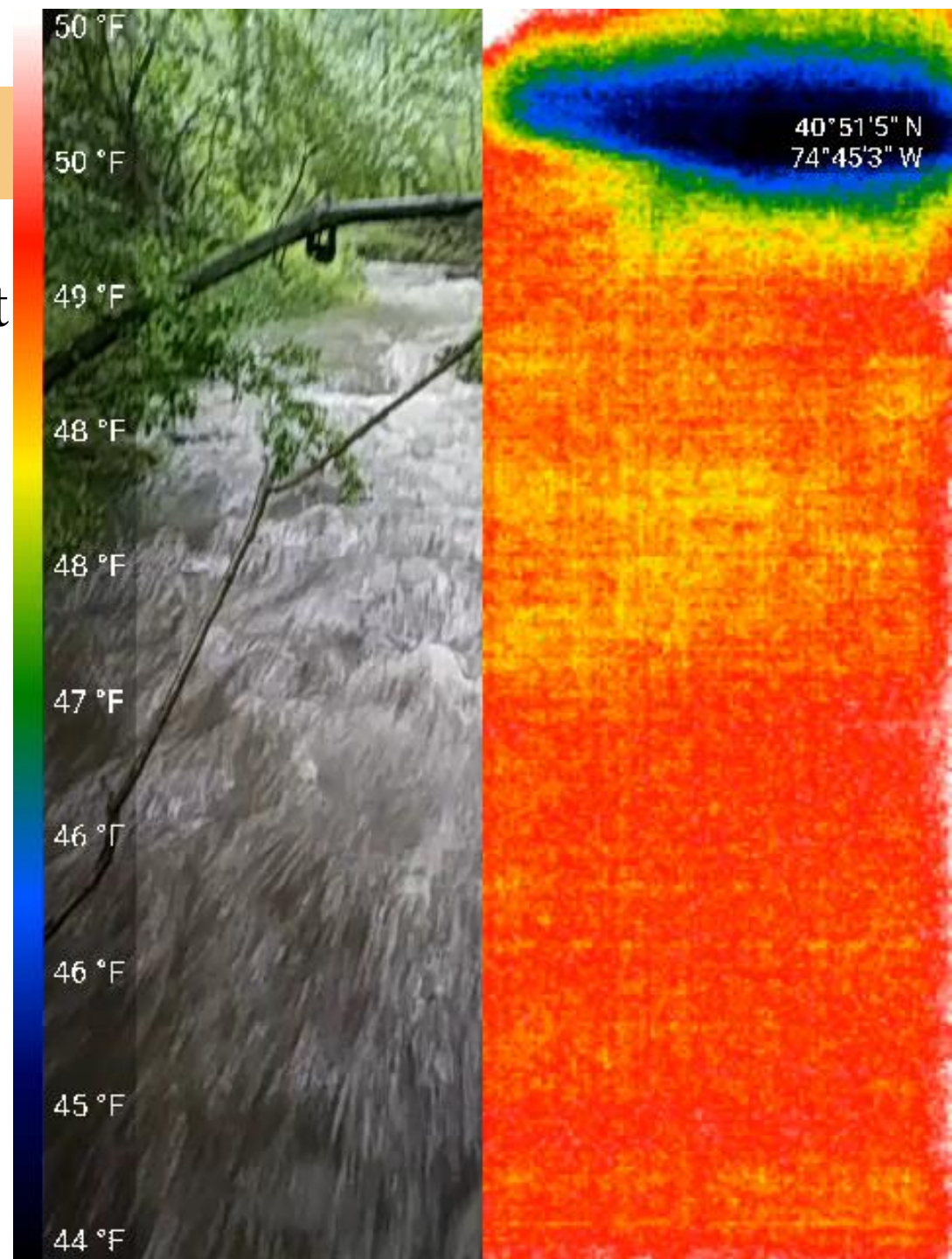
- Sun Valley Brook
- TIR images





## Projects – Stormwater Management

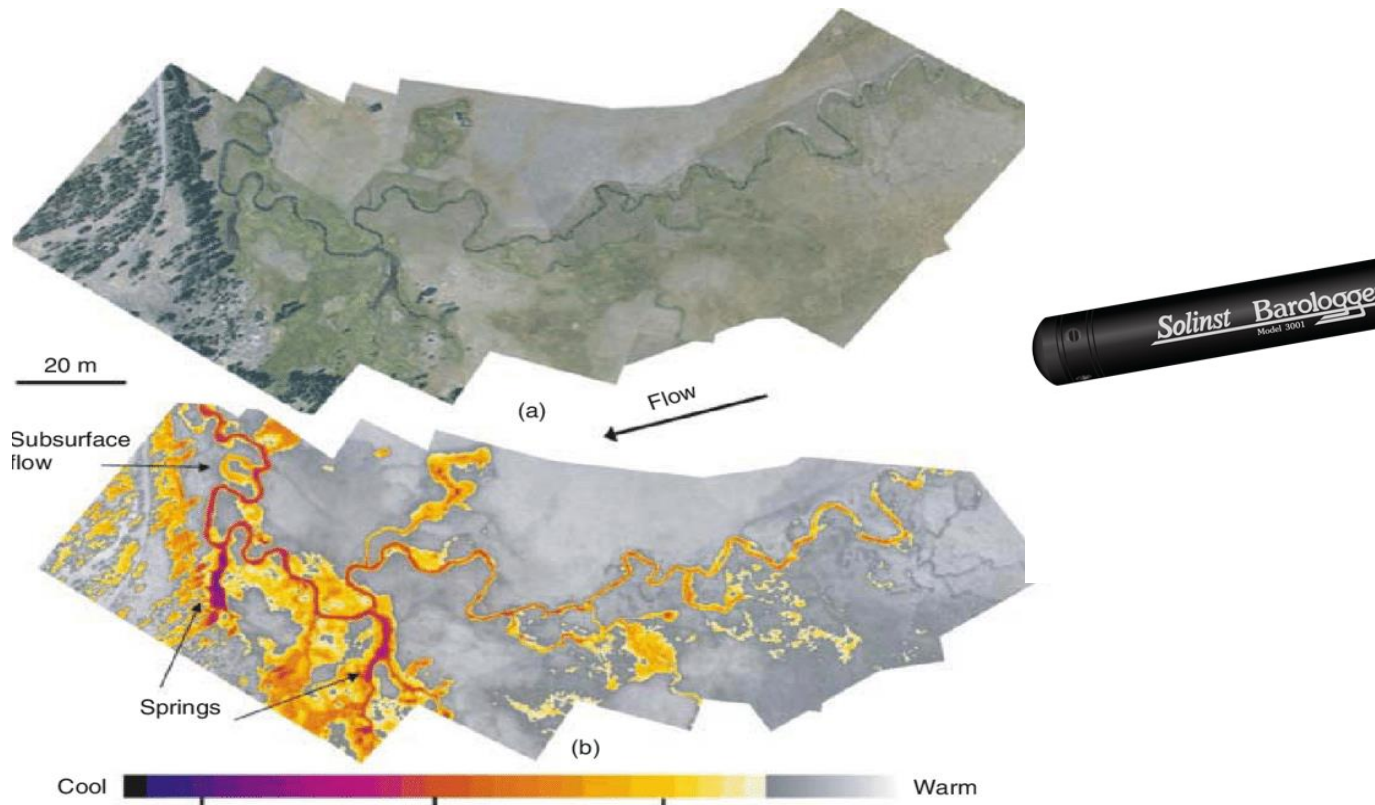
- Currently or historically Brook Trout present
- Sun Valley Brook



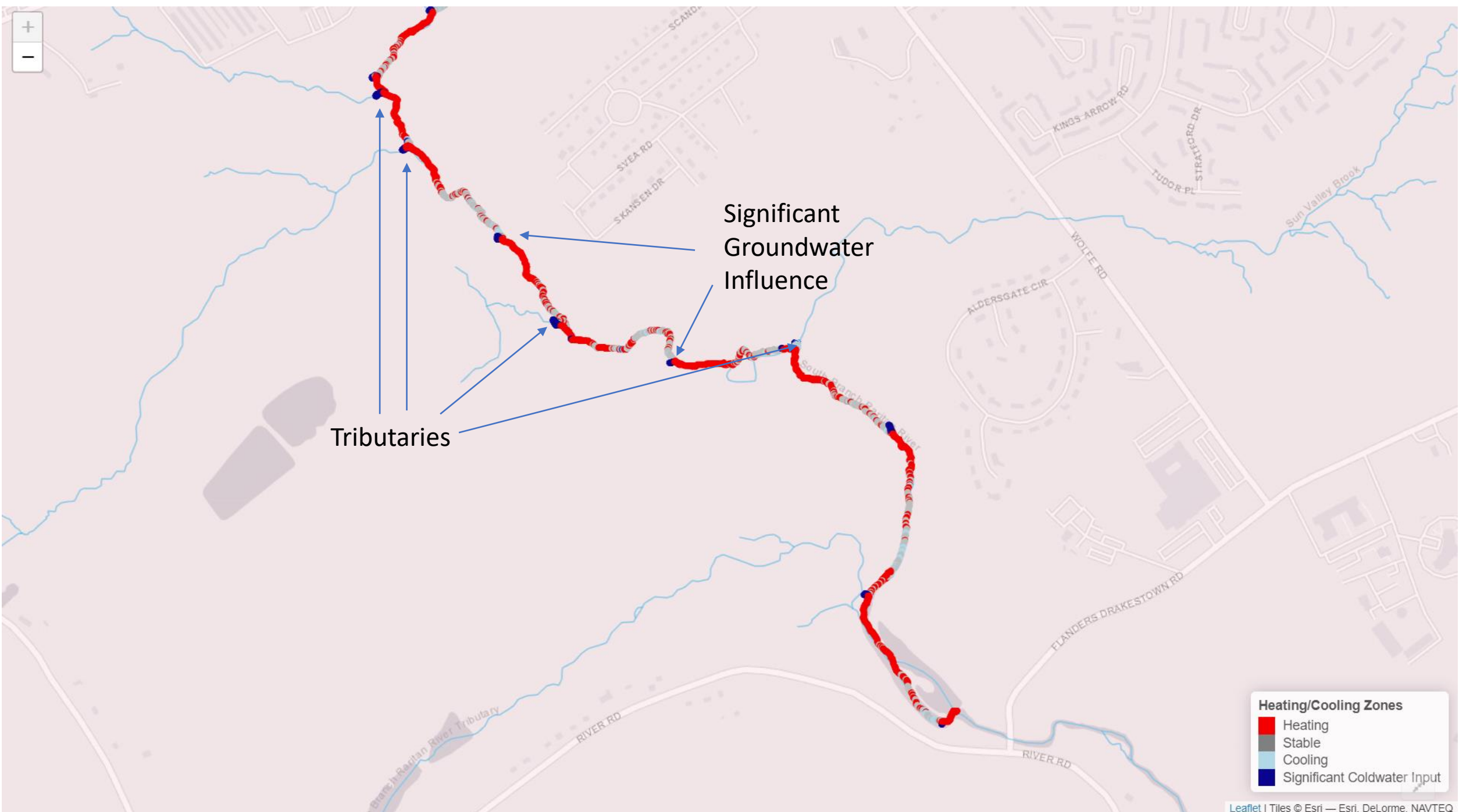


## Projects – Identifying Coldwater Refugia – Fine Scale

- Finding and Protecting Thermal refuge on a fine scale
  - Thermal Profile Methods (TIR- FLIR vs “Vaccaro” Method)
  - Restoration/protection of important habitat









A photograph of a person's hands holding a small, spotted fish in shallow water. The fish is light-colored with dark spots and is being held gently. The water is clear and shows some ripples. The background is a solid orange color.

# Questions??

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