

Thermal Infrared Data For Habitat Opportunities



CASCADIA
CONSERVATION DISTRICT

NV5
GEOSPATIAL



Mark Ingman, Project Manager, Cascadia Conservation District
Mousa Diabat, Ph.D. Hydrologist, Thermographer Level III | NV5 Geospatial

Entiat and Mad River TIR Extent - 2023

Thermal Infrared and True Color Imagery (66 miles)

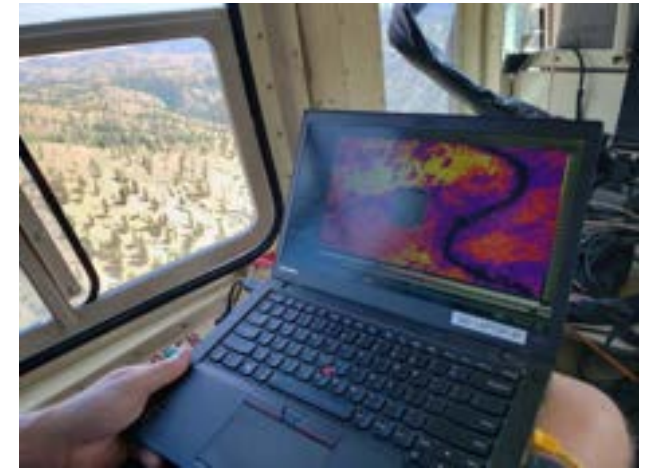
Date	Time (PST)	Tributary	Section (mile)
August 17, 2023	13:40 – 15:05	Mad River	0.0 - 12.3
		Tillicum Creek	0.0 - 4.3
		Cougar Creek	0.0 - 2.7
		Entiat River	11.0 - 37.8
August 18, 2023	13:13 – 14:00	Entiat River	0.0 - 11.8
		Roaring Creek	0.0 - 4.2
		Tillicum Creek	0.0 - 4.3
		(2nd pass)	0.0 - 4.3



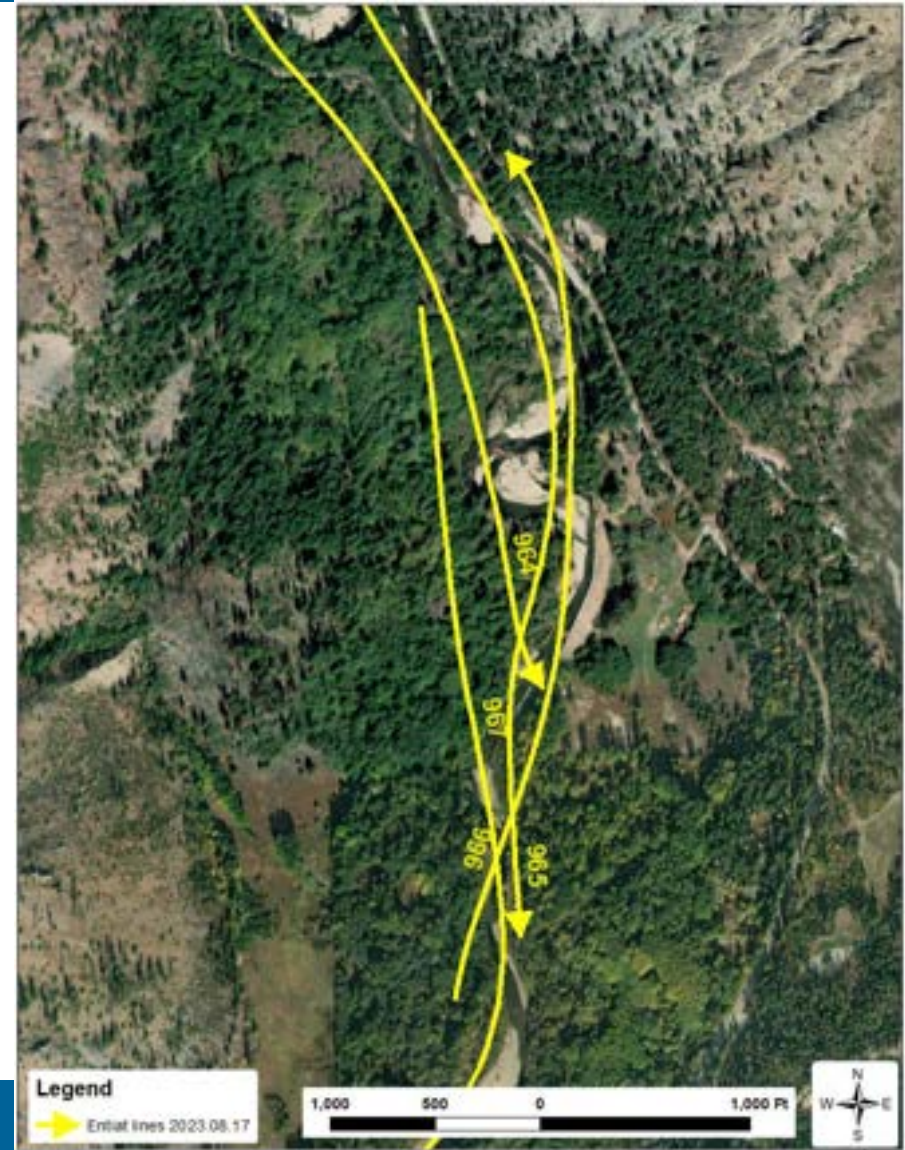
Flight Specs

FLIR System SC6000 (LWIR)

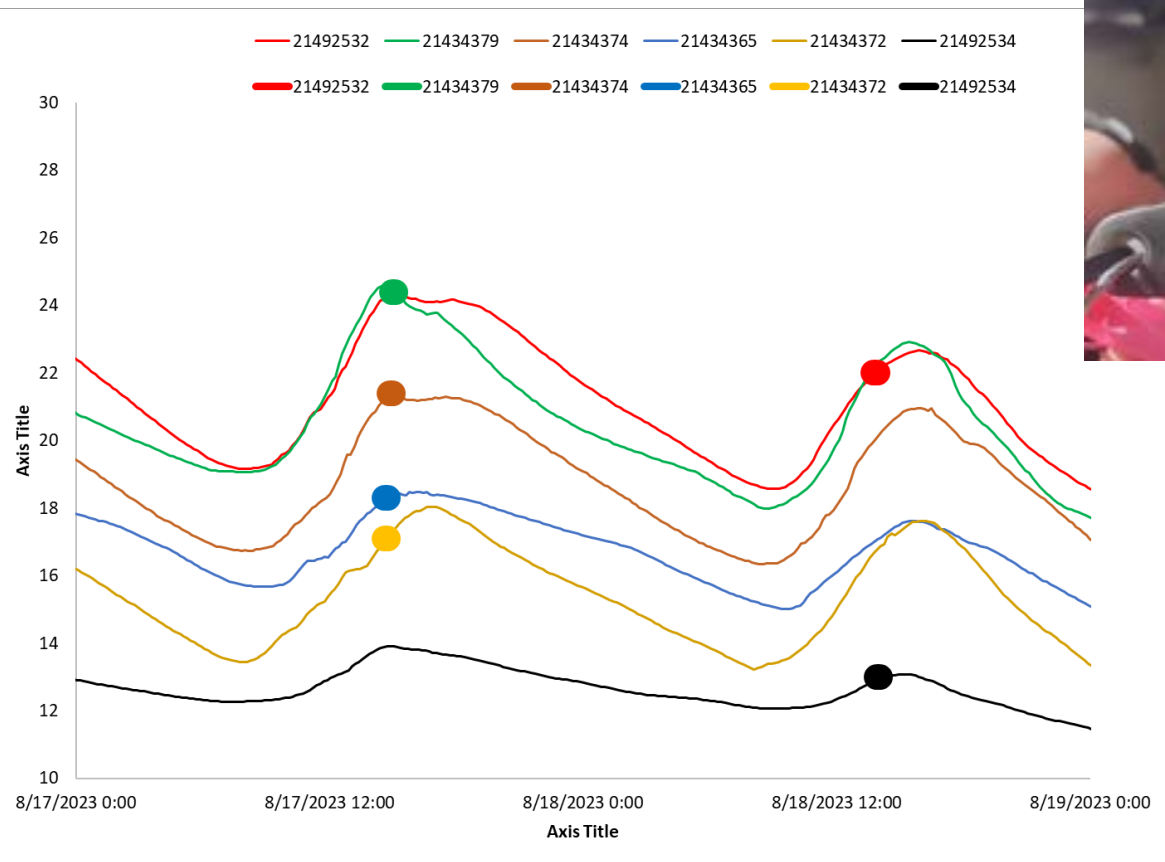
Wavelength:	8 – 9.2 μm
Noise Equivalent Temperature Differences (NETD):	0.035 $^{\circ}\text{C}$
Pixel Array:	640 (H) x 512 (V)
Encoding Level:	14 bit
Horizontal Field-of-View:	35.5 $^{\circ}$
Sensor Focal Length	25 mm
Planned Flying Height Above Ground Level (AGL):	1,200 ft
Image Footprint Width:	1,000 ft
Pixel Resolution:	1.5 ft



Flight Pattern



Ground Truthing



Water temperature data logger that was used for the project. Brand and model: HOBOTemp Pro V2 ONSET U22-001

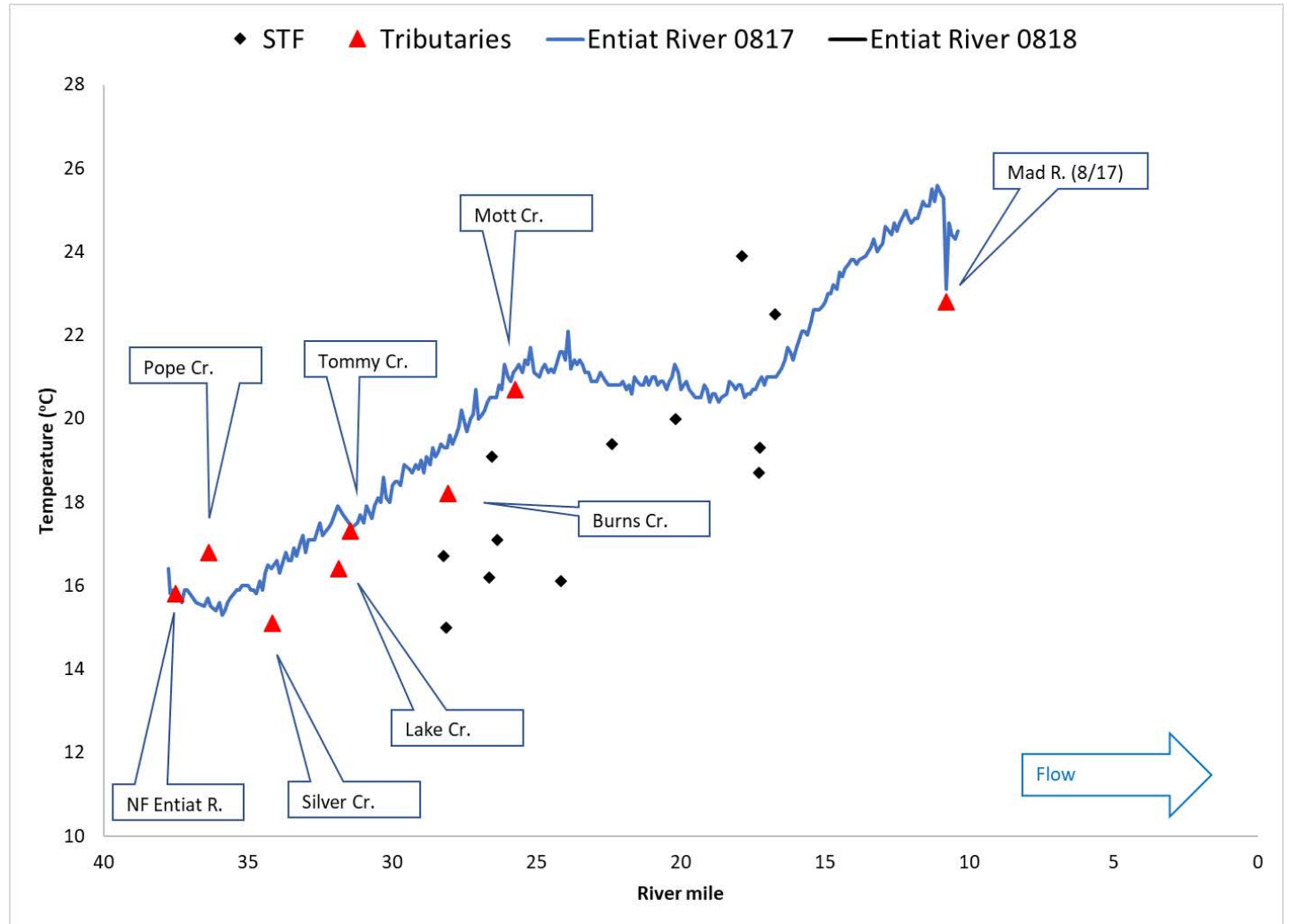


Results- LTP & STF

Centerline
Manually digitized along the thalweg

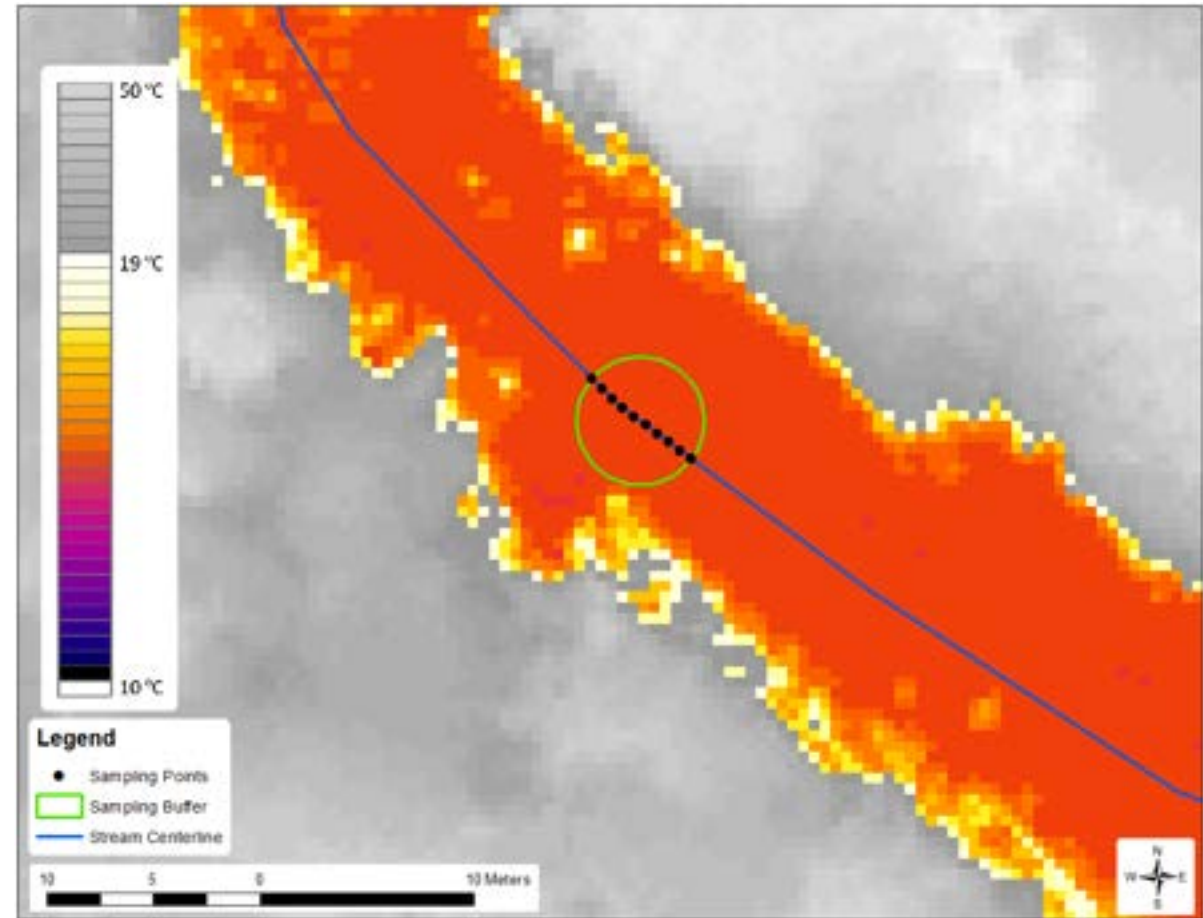
LTP
Longitudinal Temperature Profile

STF
Significant Thermal Features



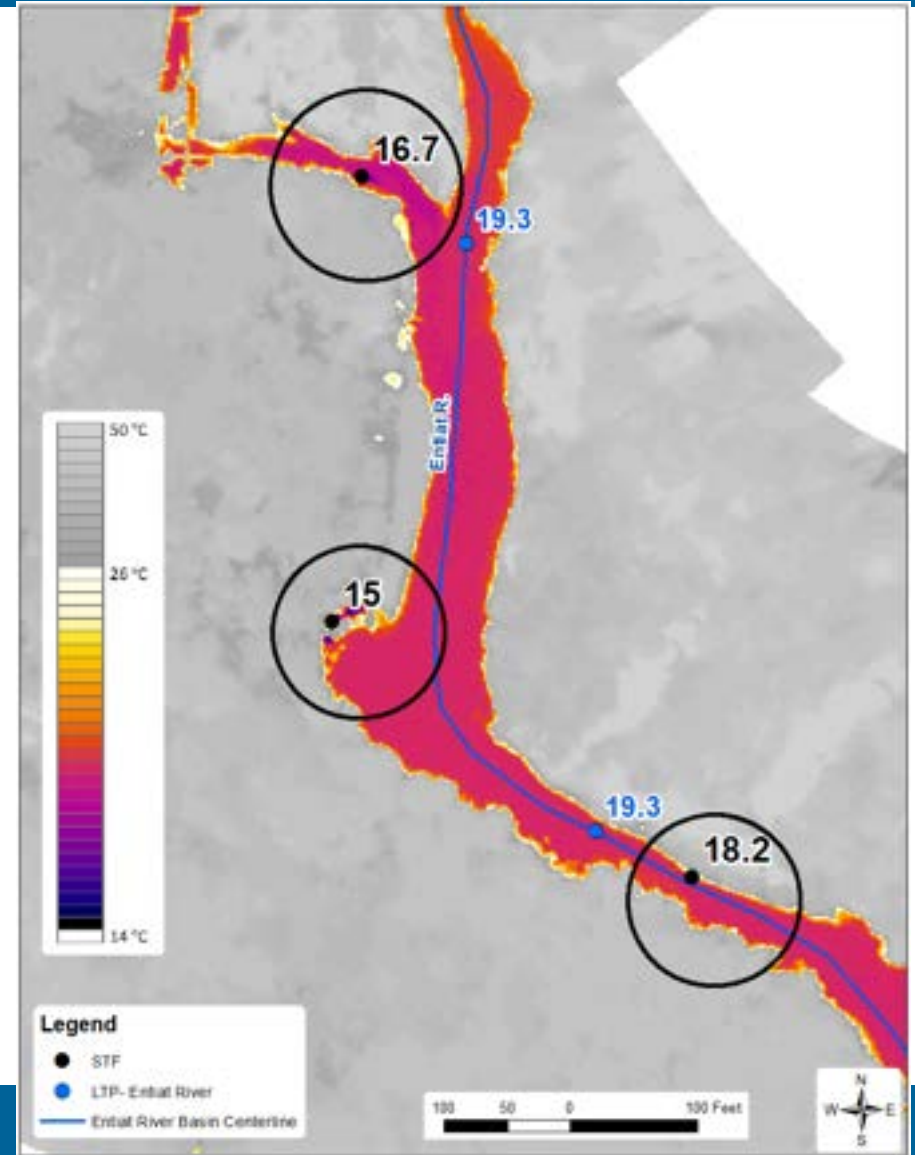
LTP Sampling

- Sampling the TIR mosaic at 0.1-mile intervals along the centerline
- 10 sampling points within 20-ft buffer
- Statistics: min, max, mean, median, stdev
- Automated, with manual quality control

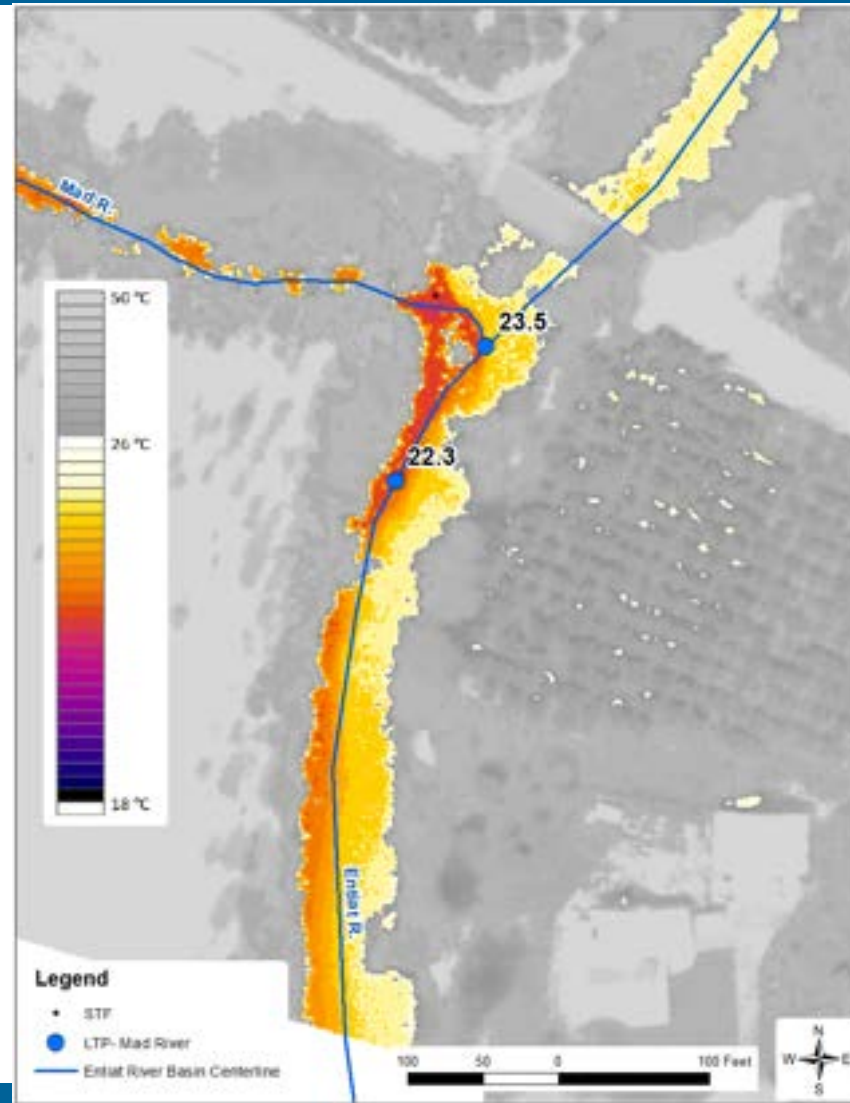
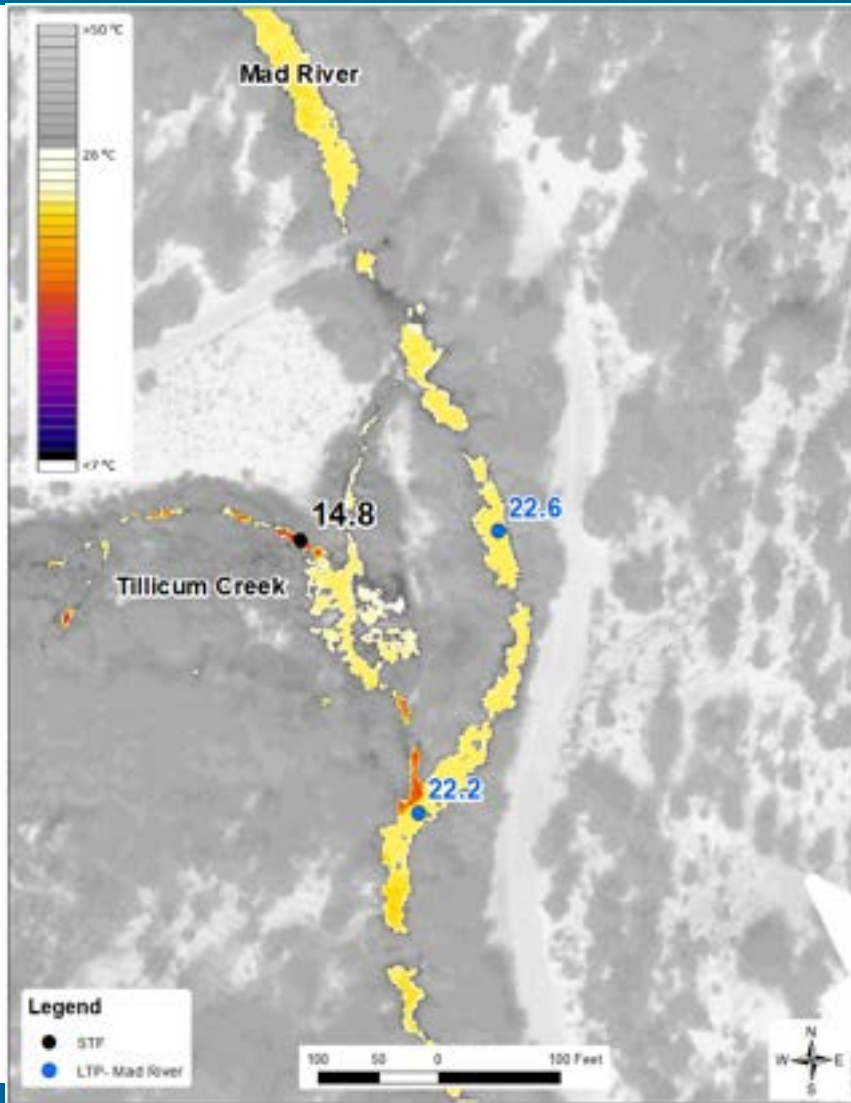


STF and Tributary Sampling

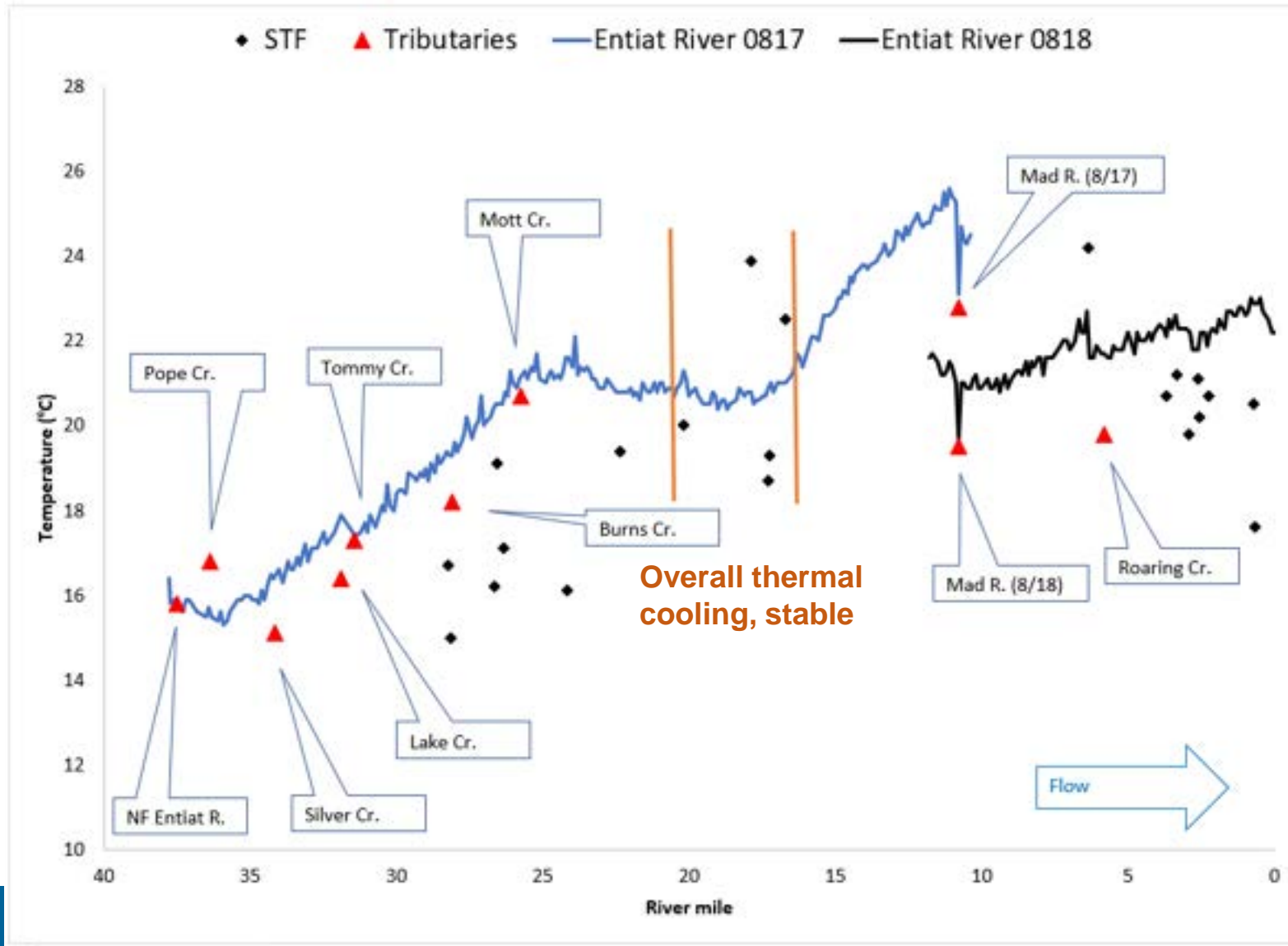
- Sampling the TIR mosaic at hand-picked sites
- Visually identifying thermal anomalies
- Mostly at river's edge, near gravel bars, and tributaries
- Statistics: (min, max, mean, median, stdev)



Cold-Water Inflows and Tributaries



Making Sense of the Data



Enhancing Thermal Anomalies - Other Methods

- Reconnect floodplains to benefit cold water and base flows
- Target the shading of tributary streams
- Other multi-component projects for thermal enhancement?



BDAs “irrigating” riparian planting plots on Potato Creek (Entiat River) 2023

TIR Data as a Screening Tool, Data Sharing

- TIR data provides a detailed map for project implementers (snapshot at chosen time)
- After reviewing the TIR dataset, tributaries and STFs can be targeted for enhancement
- Challenge: TIR datasets and data access are very limited ... a consortium? Other ideas?



Closing Thoughts

- We need more salmon recovery projects that focus on enhancing thermal refugia (sponsors & screening/scoring)
- TIR datasets can function as screening tools for habitat project opportunities (sponsors)
- How can funders, regulatory agencies, organizations and other partners work to support and share data through something like a consortium for TIR datasets?
- Has a project ever unknowingly increased mixing of an thermal anomaly?
- Your ideas?

Questions



CASCADIA
CONSERVATION DISTRICT

NV5
GEOSPATIAL

Credits:

Mark Ingman, marki@cascadiacd.org, Cascadia Conservation District

Mousa Diabat, PhD, mousa.diabat@nv5.com, NV5 Geospatial

Melissa Christie, melissa.christie@nv5.com, NV5 Geospatial

Scott Venables, scott.Venables@nv5.com, NV5 Geospatial

Abby Gleason, abigail.gleason@dnr.wa.gov, WA Geological Survey/ DNR

US Bureau of Reclamation

WA RCO Salmon Recovery Funding Board

Upper Columbia Salmon Recovery Board

