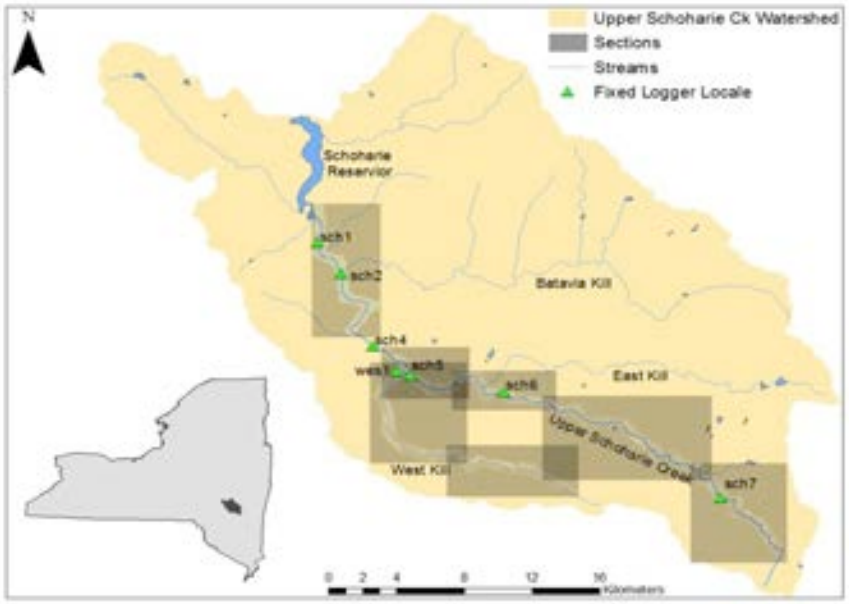
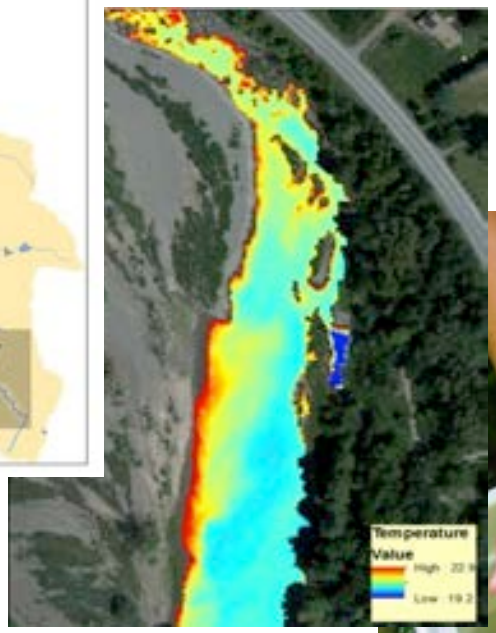
Variations in Water Temperature and Implications for Trout Populations in the Upper Schoharie Creek & West Kill, 2010-12





USGS science for a changing world

R·I·T

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Objectives

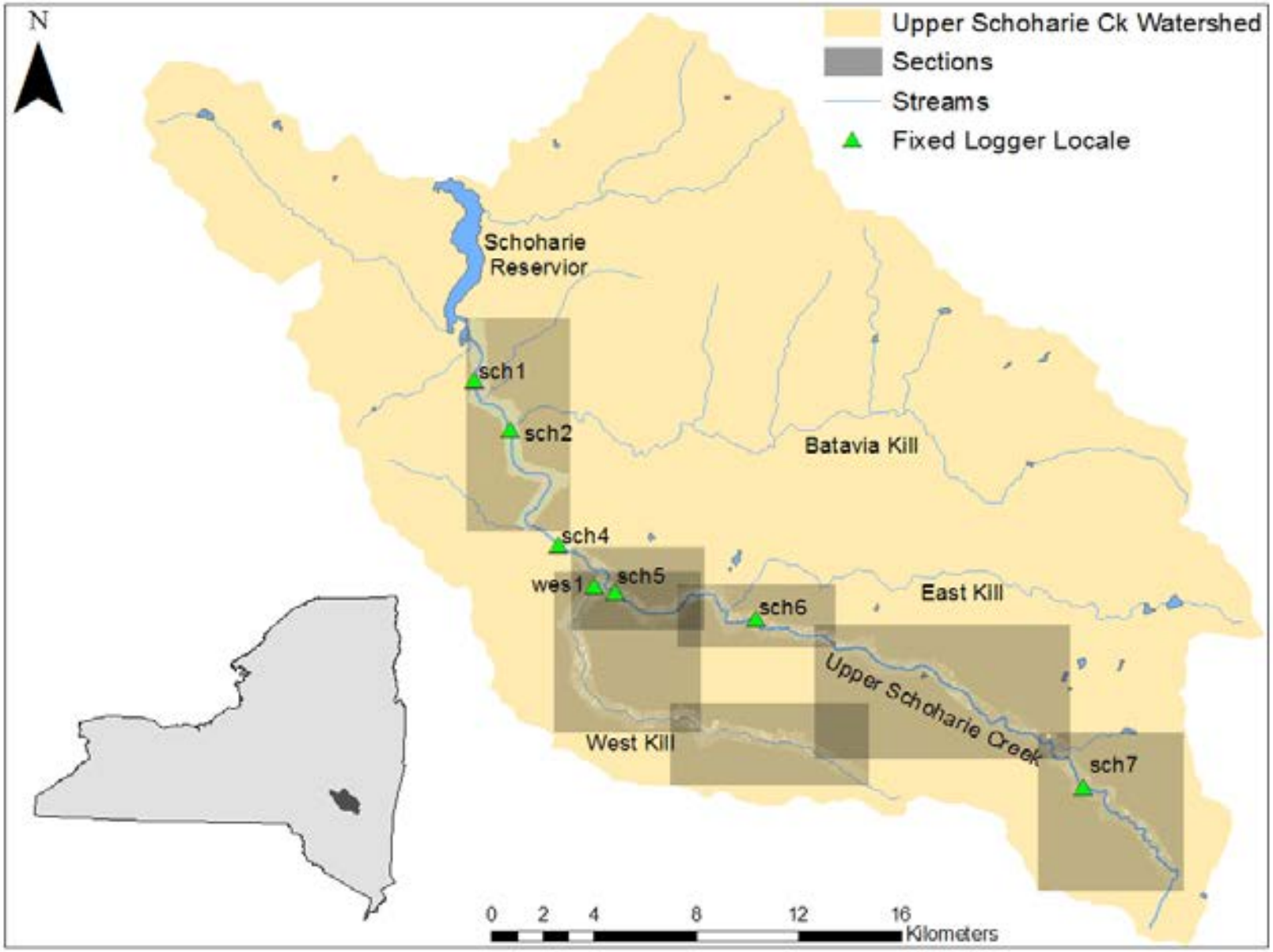
- **Increase knowledge of thermal conditions, so as to more effectively manage natural resources in the Basin.**
- **Specific goals were to document:**
  a. **contemporary thermal conditions,**
  b. **temporal and spatial variations in water temperatures,**
  c. **availability of thermal refuges, and**
  d. **implications for resident trout.**

Approach

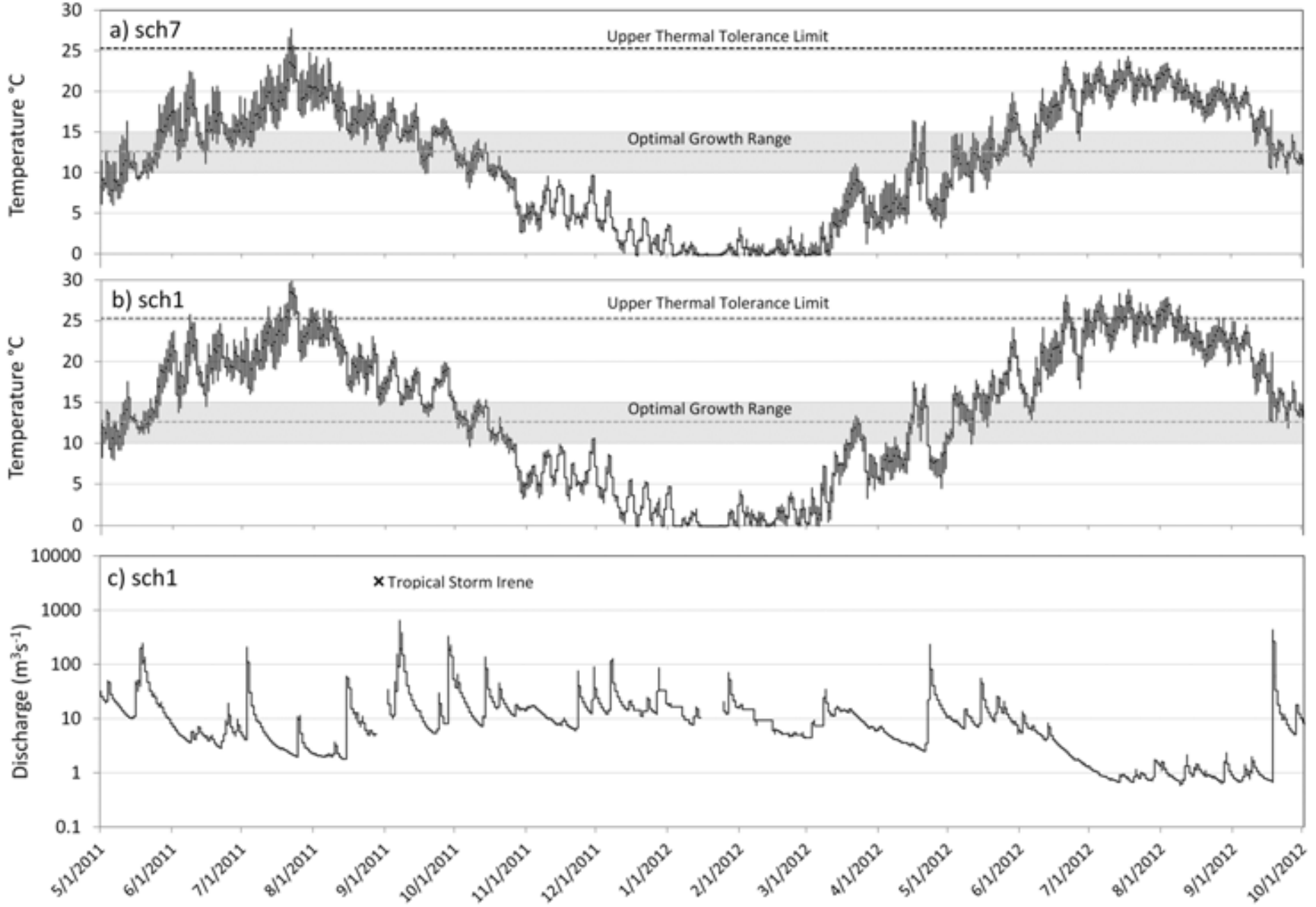
- **Temporal data obtained from 7 fixed temperature loggers operated for 12 to 24 months.**
- **Spatial data obtained from a single Thermal Infrared (TIR) flight (and fixed loggers).**
- **Thermal data from fixed loggers were compared to optimal growth and survival thresholds for brown trout to:**
  a. **estimate temporal limitations for each site,**
  b. **calibrate** (and add temporal context to) **the TIR data, and**
  c. roughly identify spatial limitations across the study area**.**
- **Thermal data from TIR flight were used to:**
  a. **detect the cool-water refuges and**
  b. **characterize the spatial distribution of suitable and unsuitable stream temperatures.**

Fixed loggers

Fixed Loggers



Fixed loggers: Temporal variations



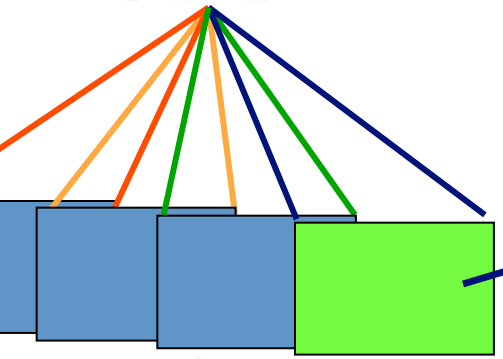
Fixed-logger temperatures (June-Aug)

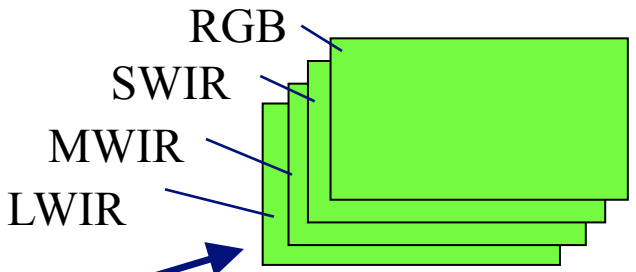
	Summer 2011			Summer 2012		
Site	Mean (°C)	No. days exceeding 1-d (25.3°C) threshold	No. days exceeding 7-d (23.3°C) threshold	Mean (°C)	No. days exceeding 1-d (25.3°C) threshold	No. days exceeding 7-d (23.3°C) threshold
sch1	21.1	4	21	22.9	18	54
sch2	21.1	4	22	22.7	15	51
sch4	20.3	4	13	22.3	8	41
sch5	20.8	4	16	22.5	13	44
sch6	20.3	4	14	22.1	5	41
sch7	17.6	0	2	19.3	0	0
wes1	18.3	0	2	20.2	0	7

Thresholds from: Wehrly, K.E., Wang, L.Z., and Mitro, M., 2007, Field-based estimates of thermal tolerance limits for trout: Incorporating exposure time and temperature fluctuation: TAFS, v. 136, no. 2, p. 365-374

RIT Airborne Sensor System

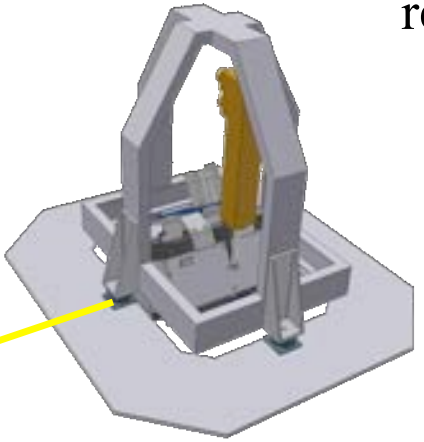
WASP captures a sequence of frames which form a mosaic in each of 3 IR bands and RGB



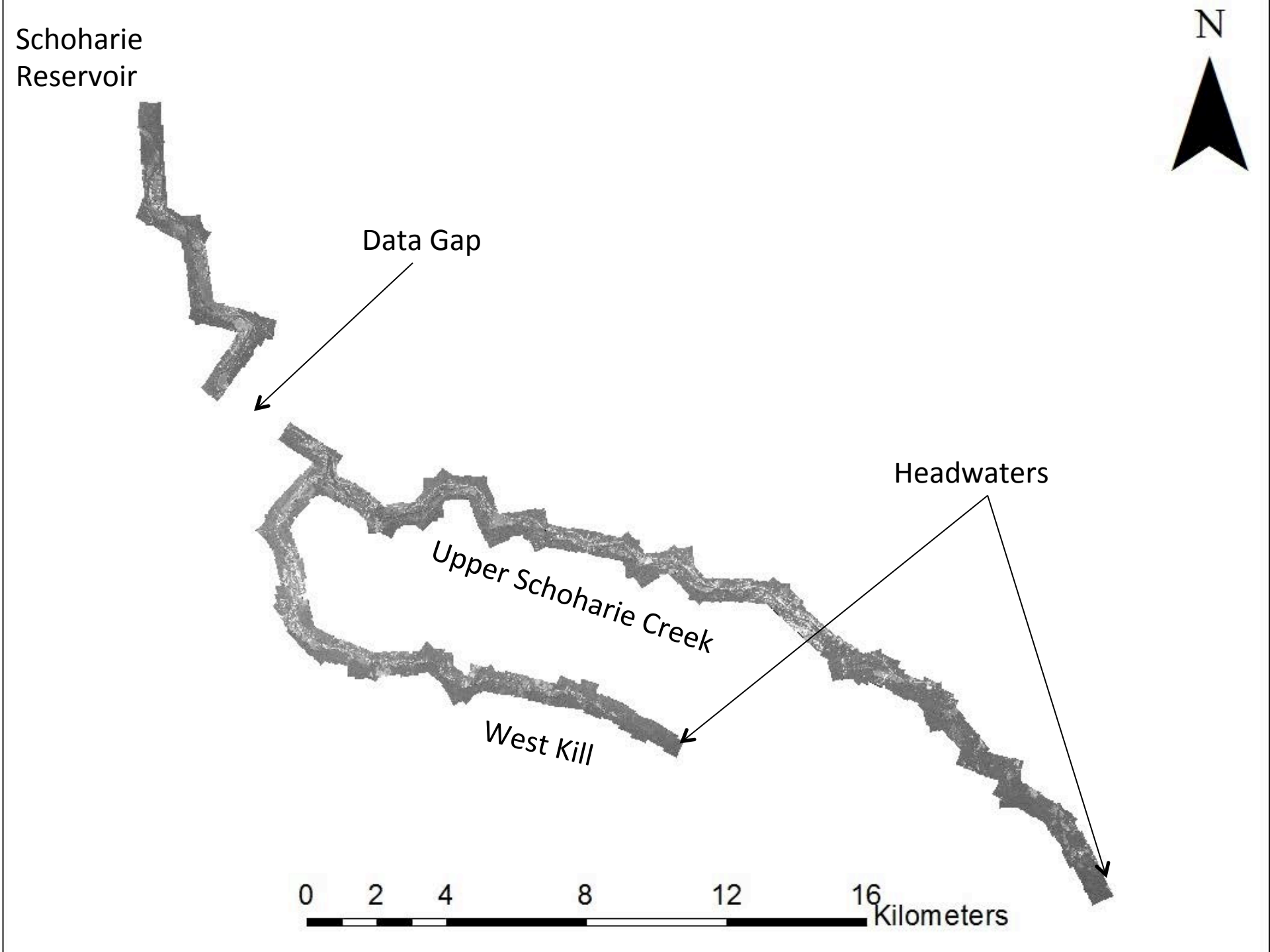


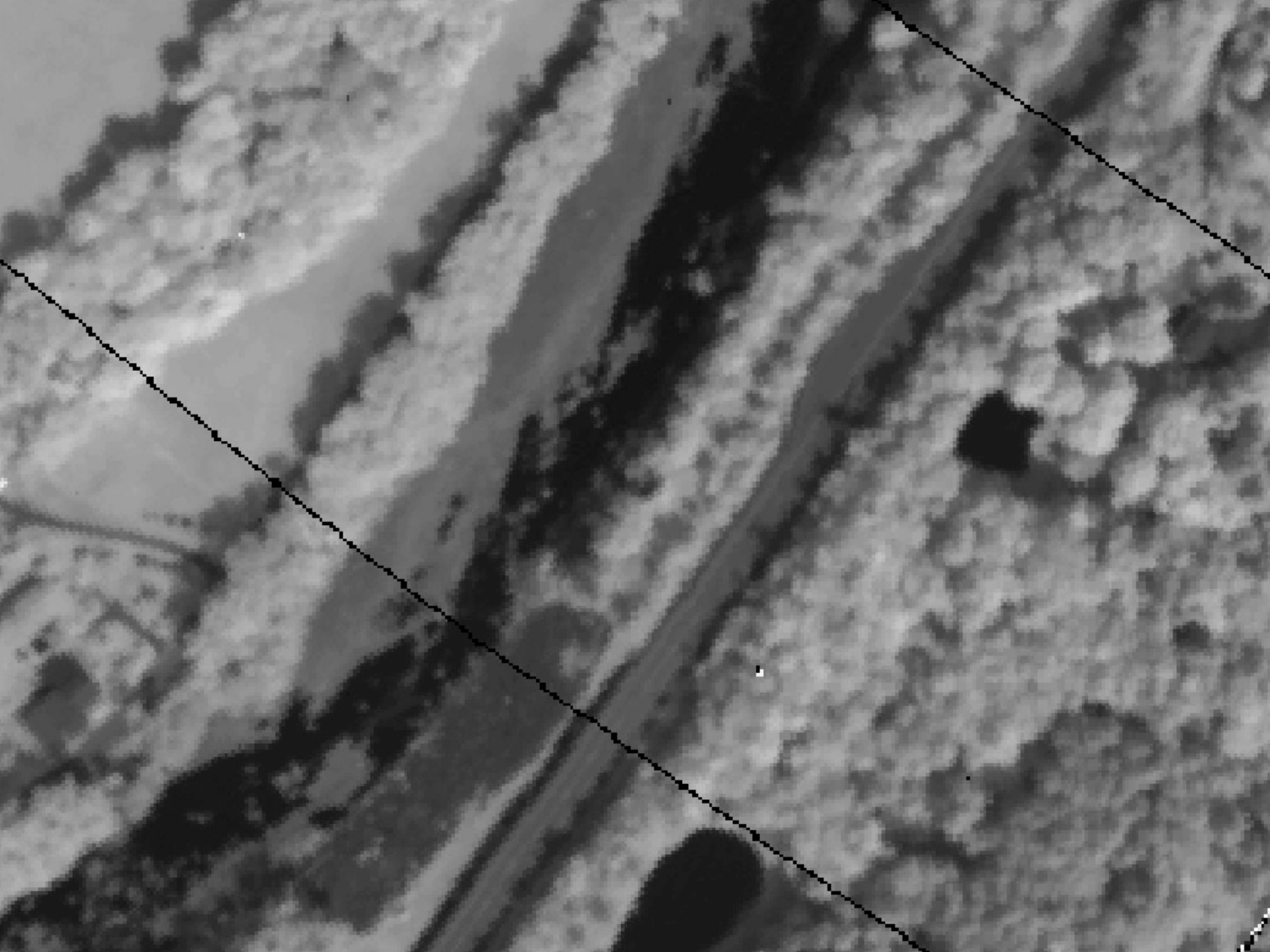
Imagery from each camera is spatially registered

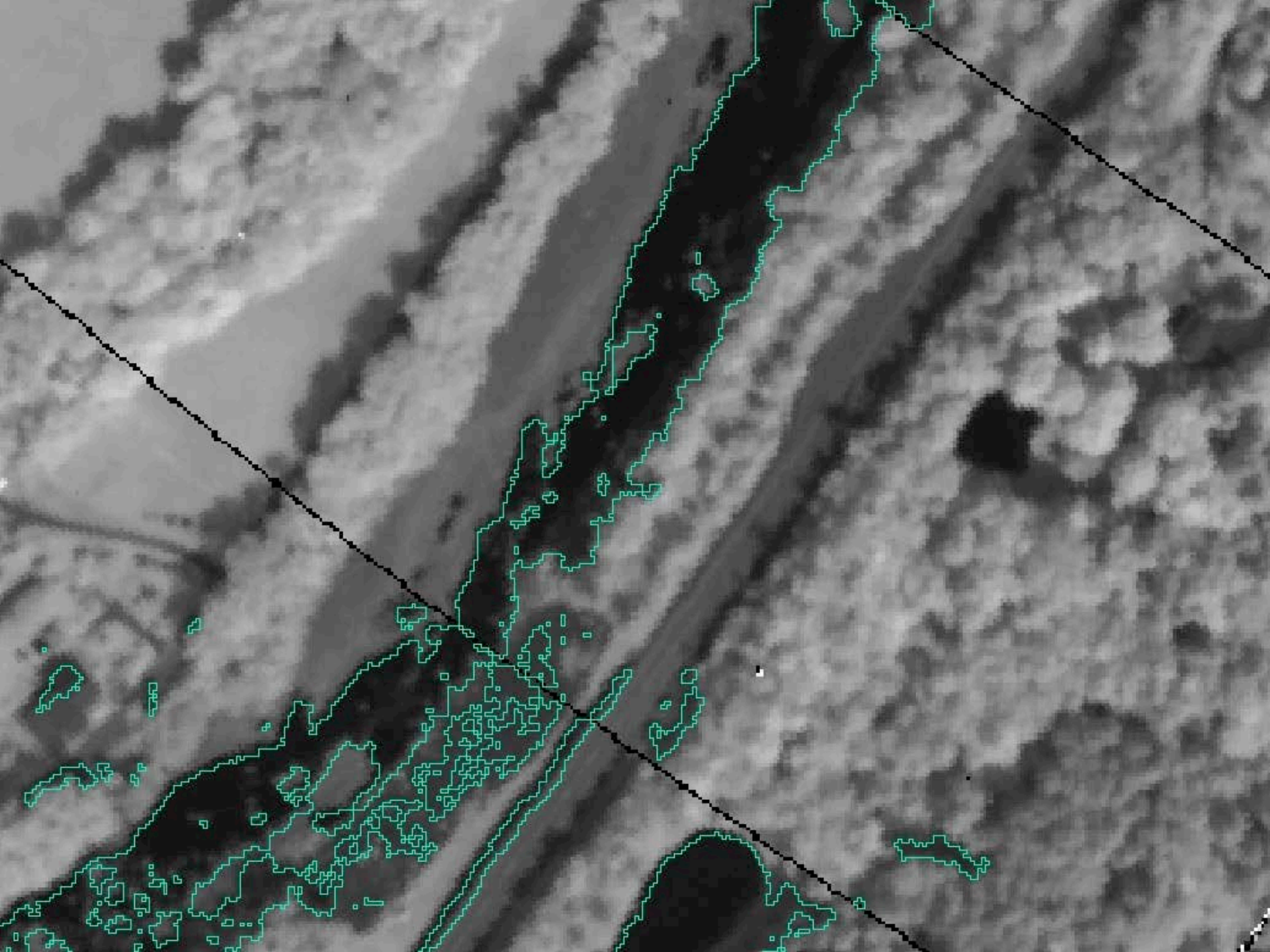
Gimbal Pivots About Line of Flight

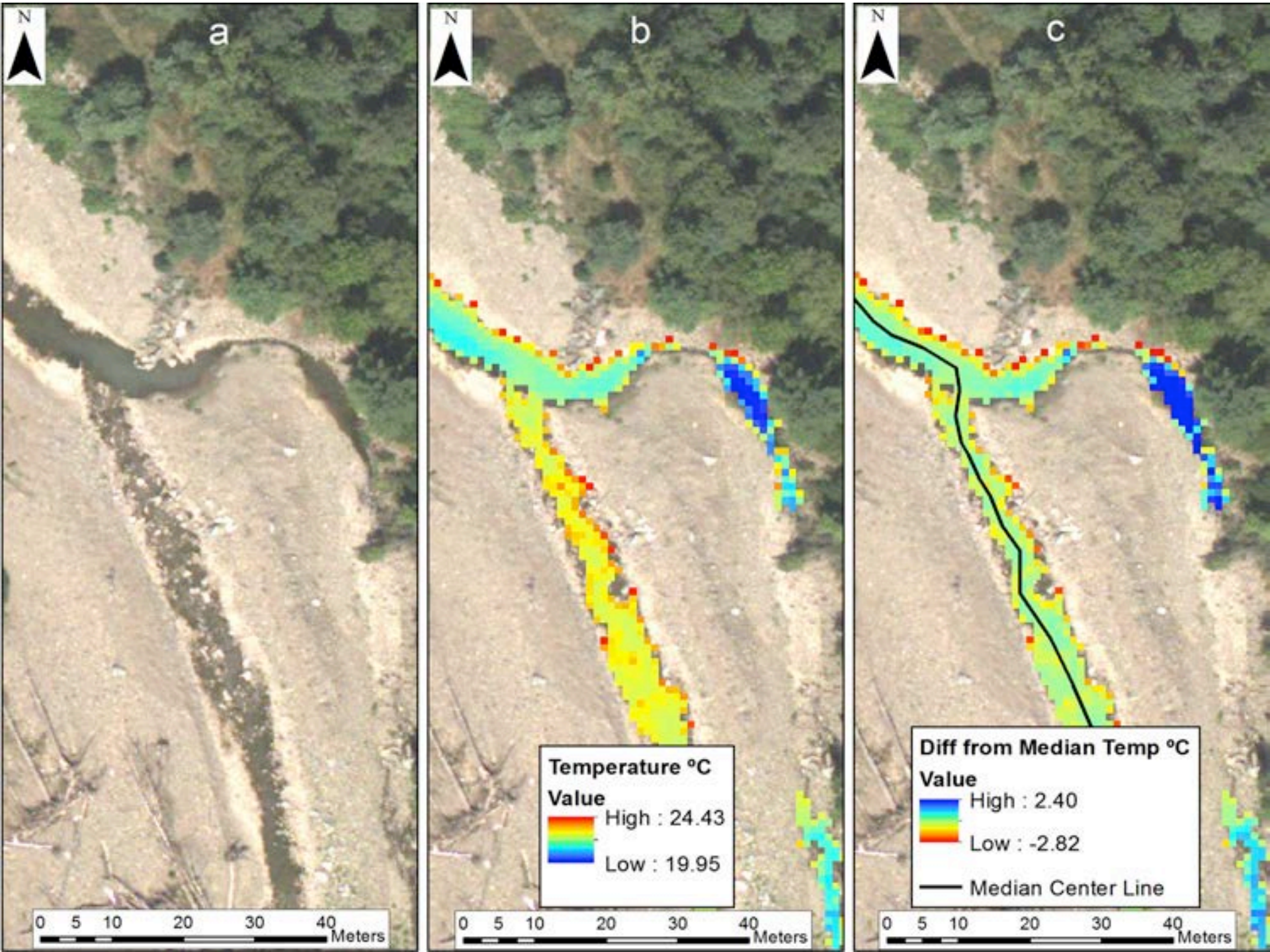


Single Axis Gimbal Provides Wide Field of Regard

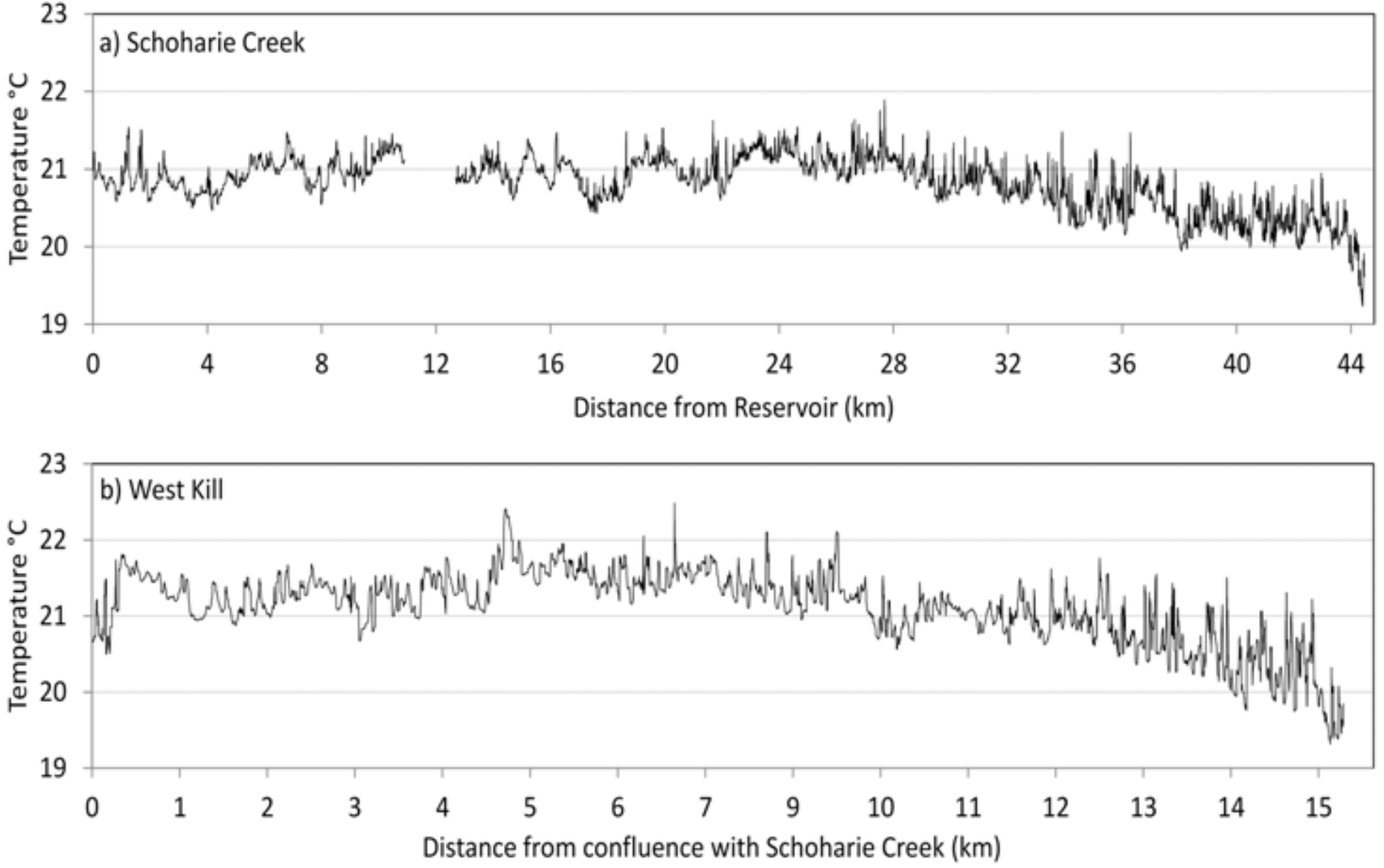

Schoharie
Reservoir
N
Data Gap
Headwaters
Upper Schoharie Creek
West Kill
0
2
4
8
12
16
Kilometers





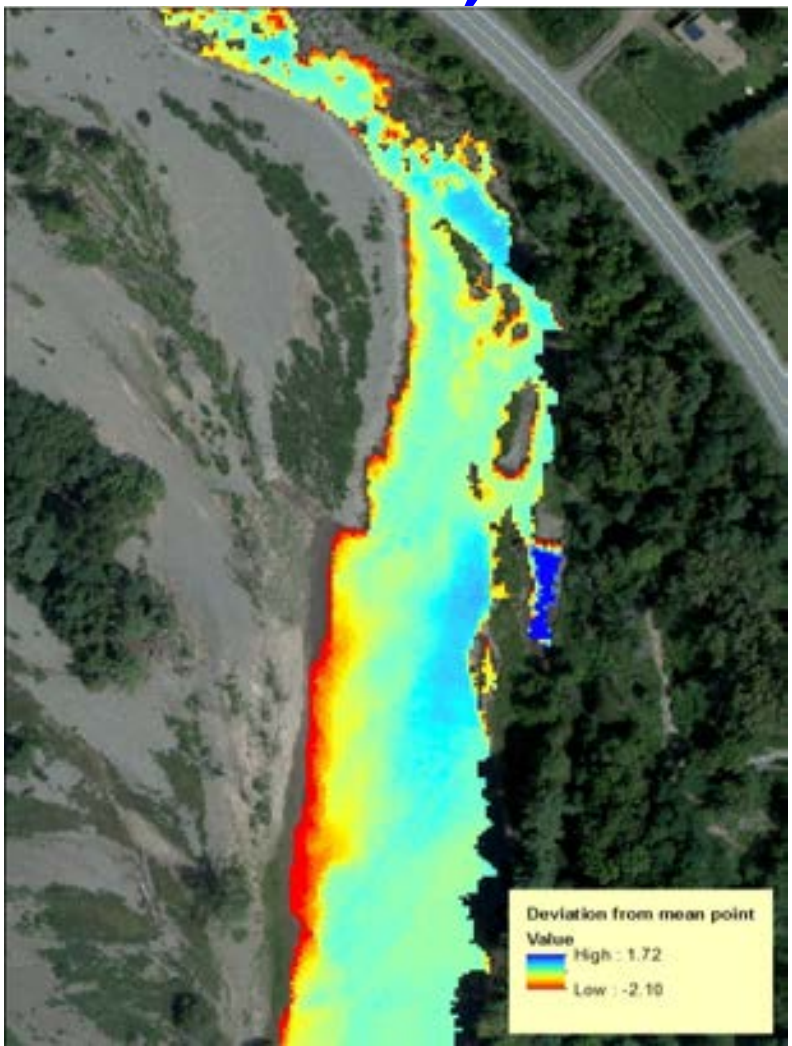

a
b
c
N
Temperature °C
Value
High : 24.43
Low : 19.95
Diff from Median Temp °C
Value
High : 2.40
Low : -2.82
Median Center Line
0 5 10 20 30 40
Meters

TIR: Spatial and basin variations



TIR: River and refuge summary

- Total of 769,268 m^2 river surface area imaged;
- only 0.02% (126 m^2) was > 1.0 ºC cooler,
- only 0.002% (14 m^2) was more than 2.0 ºC cooler,
- and 0% was more than 3.0 ºC cooler than the median river temperature at the thalwag.



Conclusions

- **Summer temperatures are unsuitable for trout growth throughout the basin.**
- **Summer temperatures are unsuitable for trout survival at most main-stem reaches.**
- **No high quality cold-water refuges were detected in both study reaches.**
- **Trout should be in poor condition and not survive hot summers at most main-stem reaches.**
- **Tributaries *have to be* critical trout-source areas.**
- **More extensive fishery data are needed to:**
    a. **fully define trout health and survival issues,**
    b. **define critical areas/tributaries to protect,**
    c. **create a contemporary fishery baseline, and**
    d. **assess/detect future changes in local fisheries.**

THE "END"
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QESTIONS?

Special thanks to:
MARK LOETE PHOTOGRAPHY