# Lessons and Approaches from Regional Monitoring Network Sites

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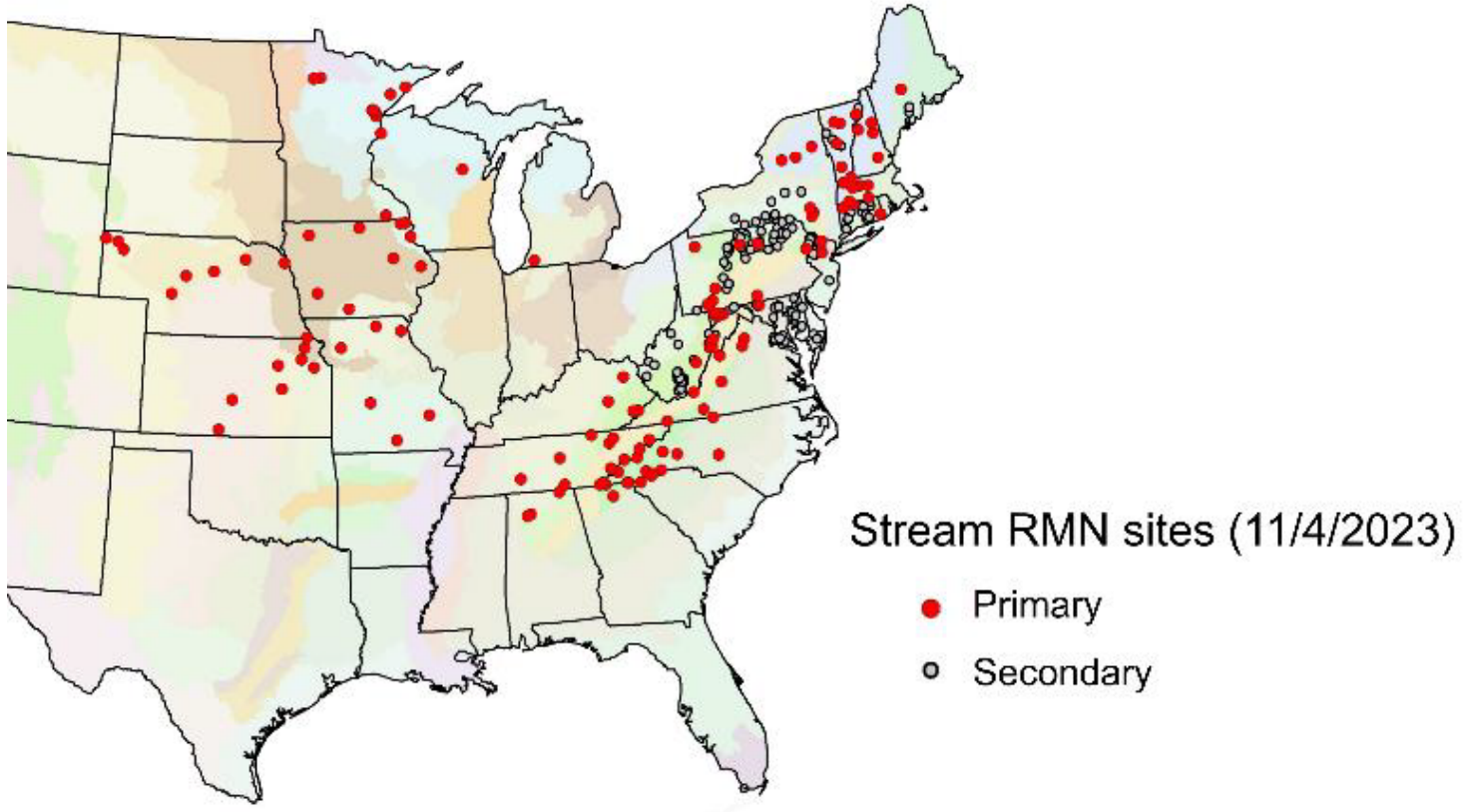
**Office of Research and Development**
Center for Public Health and Environmental Assessment, Integrated Climate Sciences Division

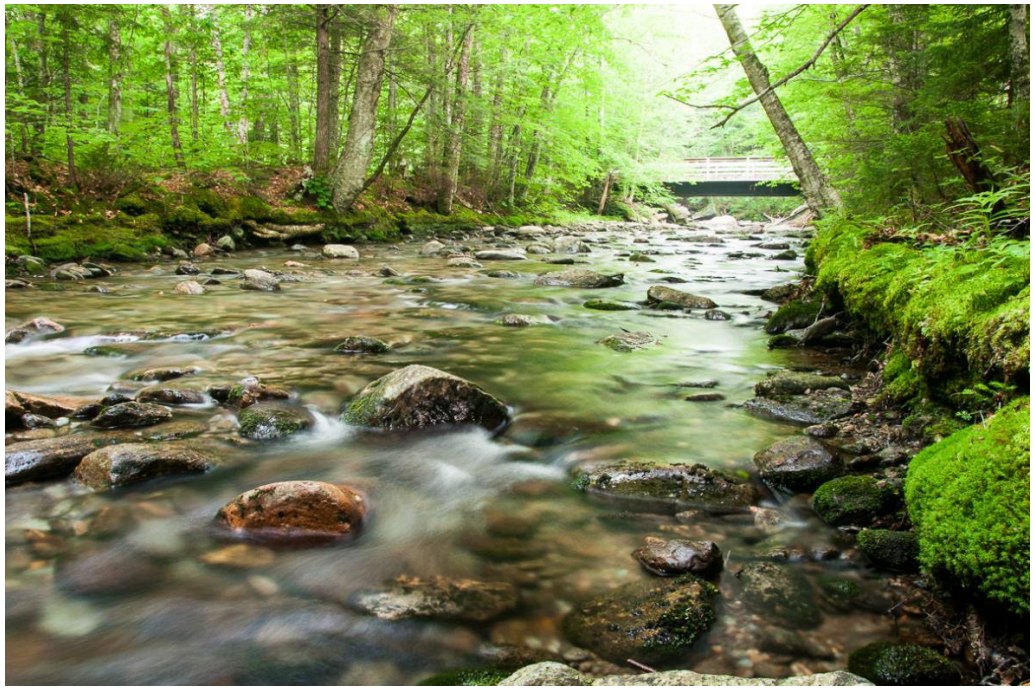
# Stream RMN Sites

- Collaborative, volunteer effort to collect comparable long-term monitoring data at targeted sites to detect changes over time



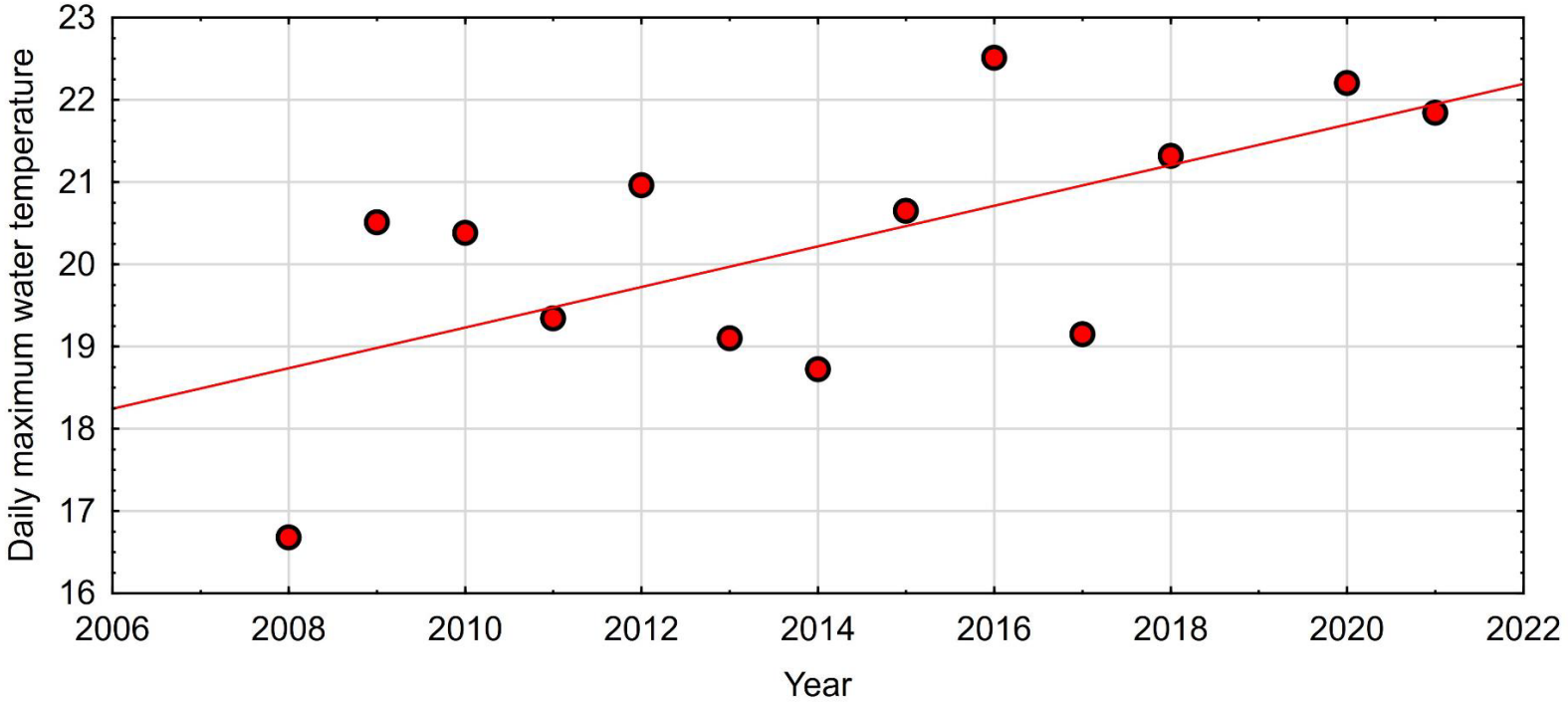
# Initial focus on ‘reference’ sites

- Provide baseline
- Measure current conditions
- Describe year-to-year variability
- Understand relationship between biology, temperature and hydrology
- Analyze any trends over time



# Stream RMN site over time

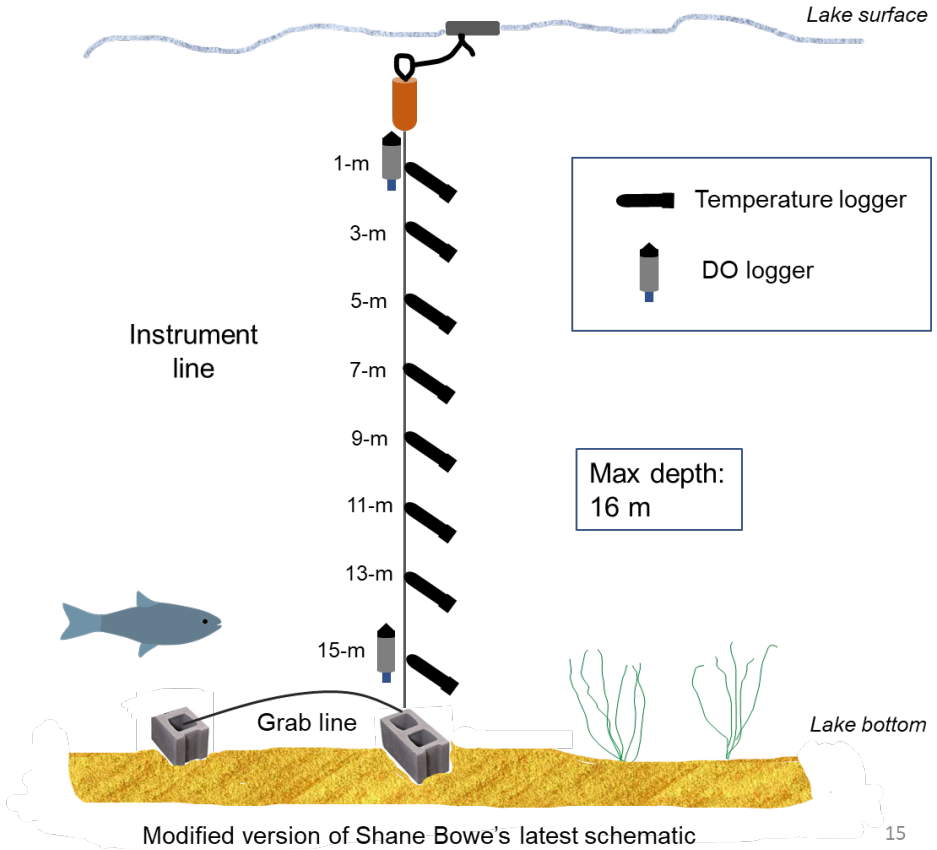
- Not enough years of data to detect clear regional trends, but some sites are showing monthly warming signals



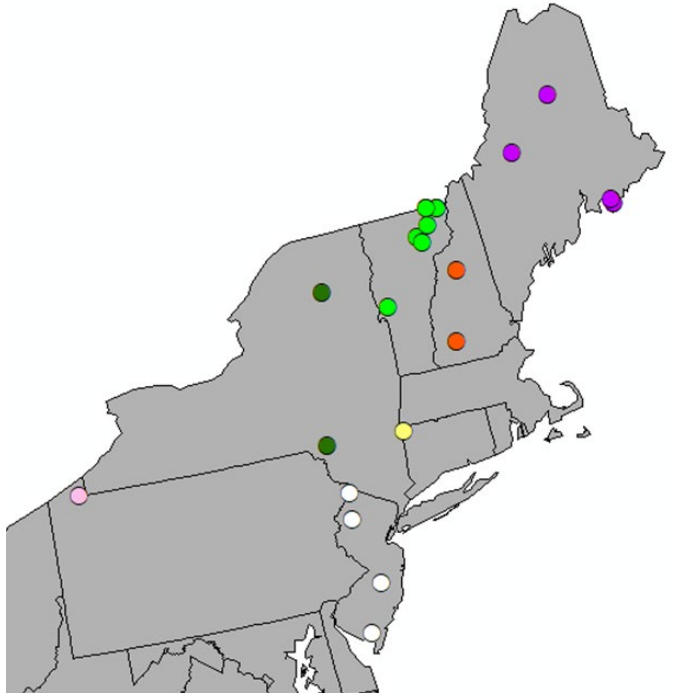

Bingo, VT
August daily maximum
Significant increasing trend ($p<0.05$)
in June & August

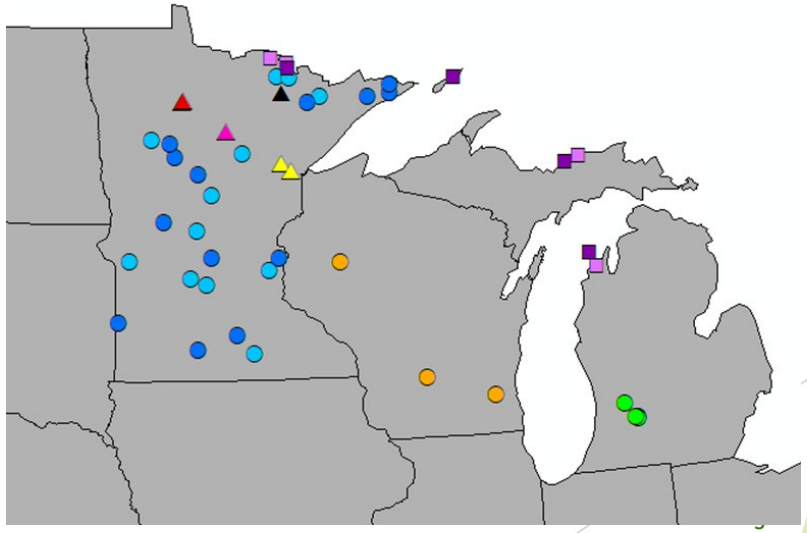
# Lake RMN sites

- Sensor array schematic




Modified version of Shane Bowe's latest schematic





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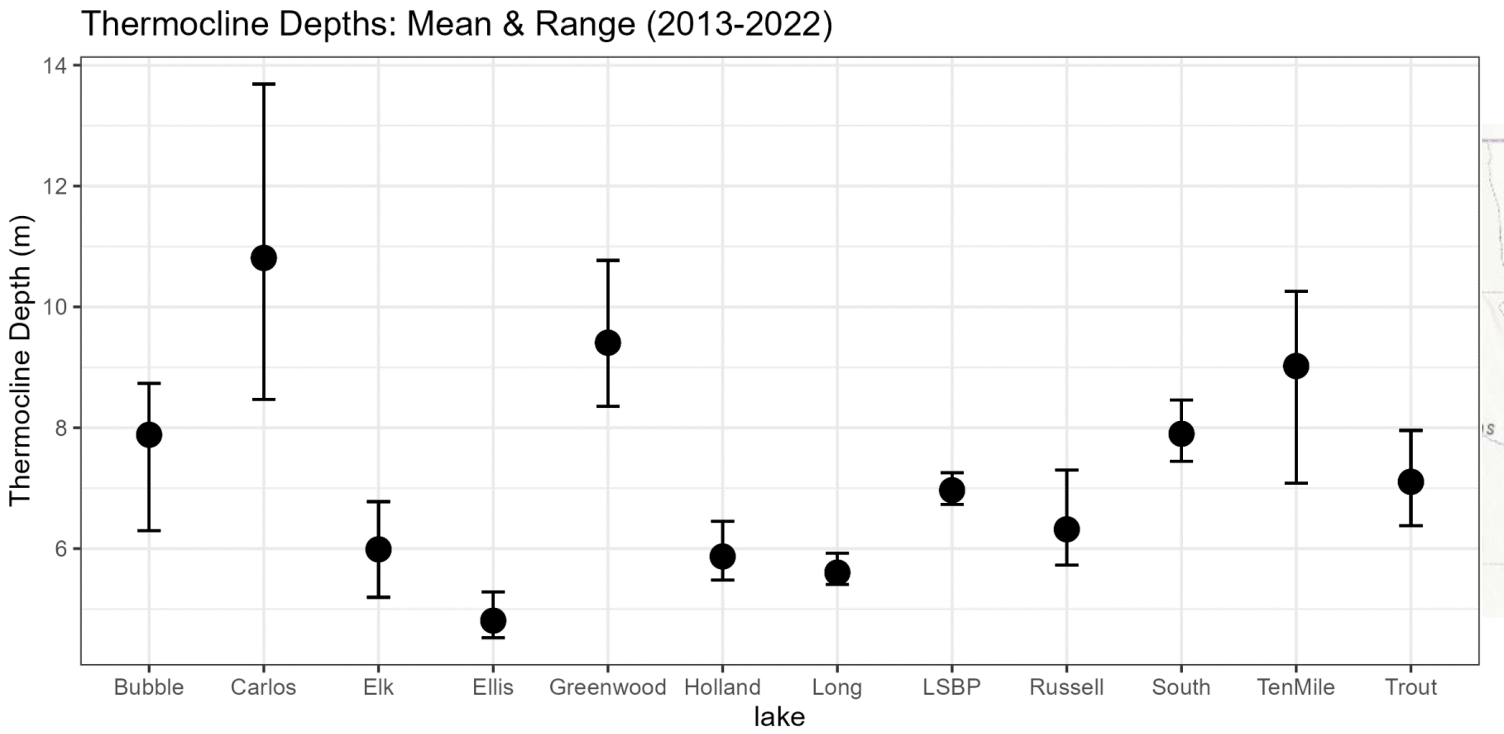
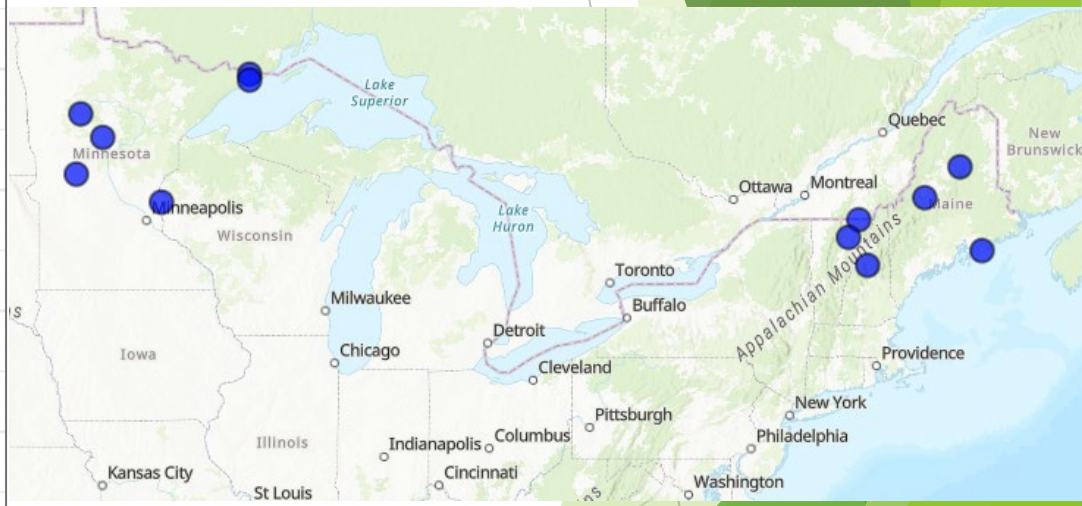
# Annual variations in lake thermocline depth across northern sites



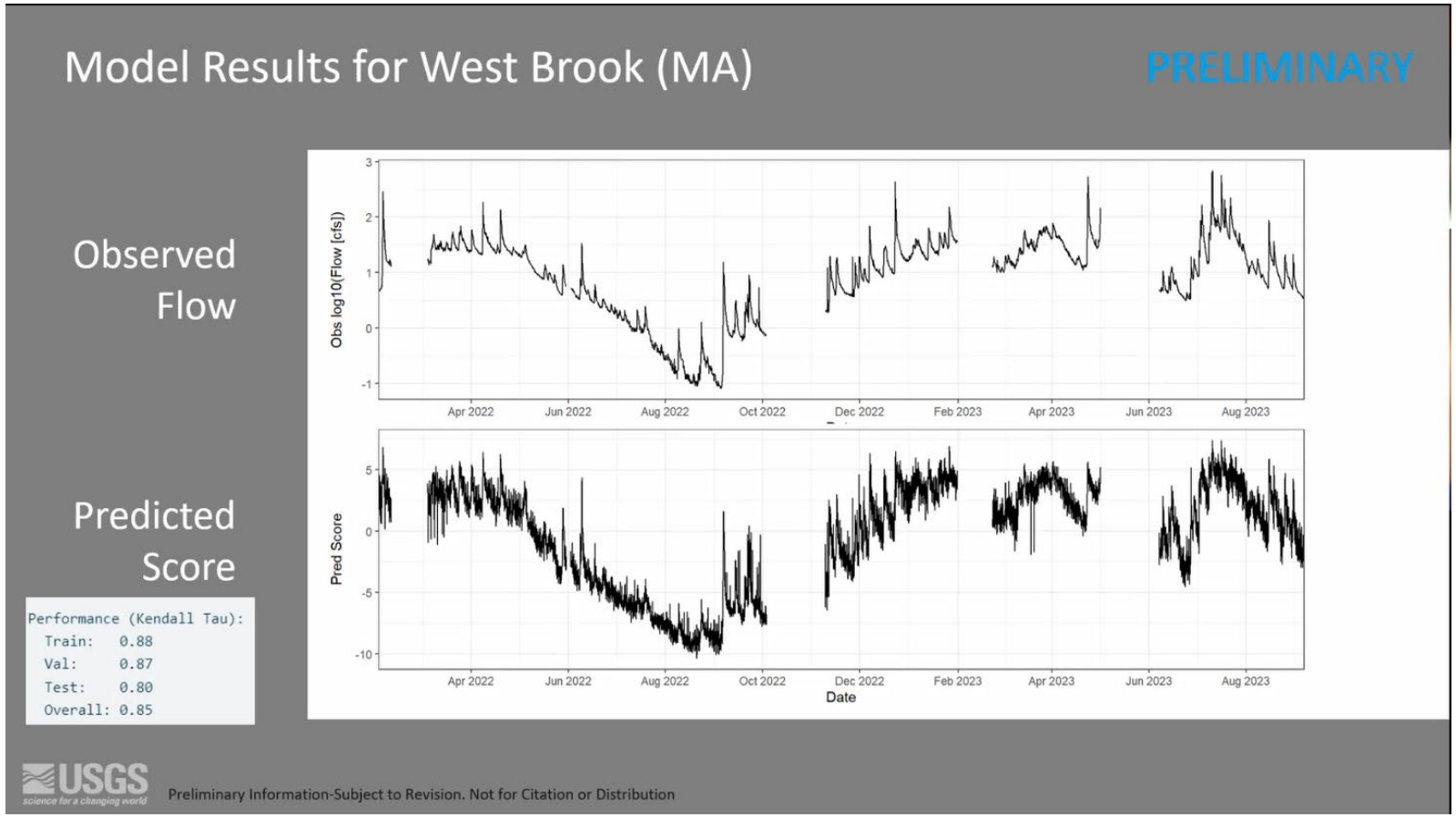



# Waterbody monitoring with machine learning modeling

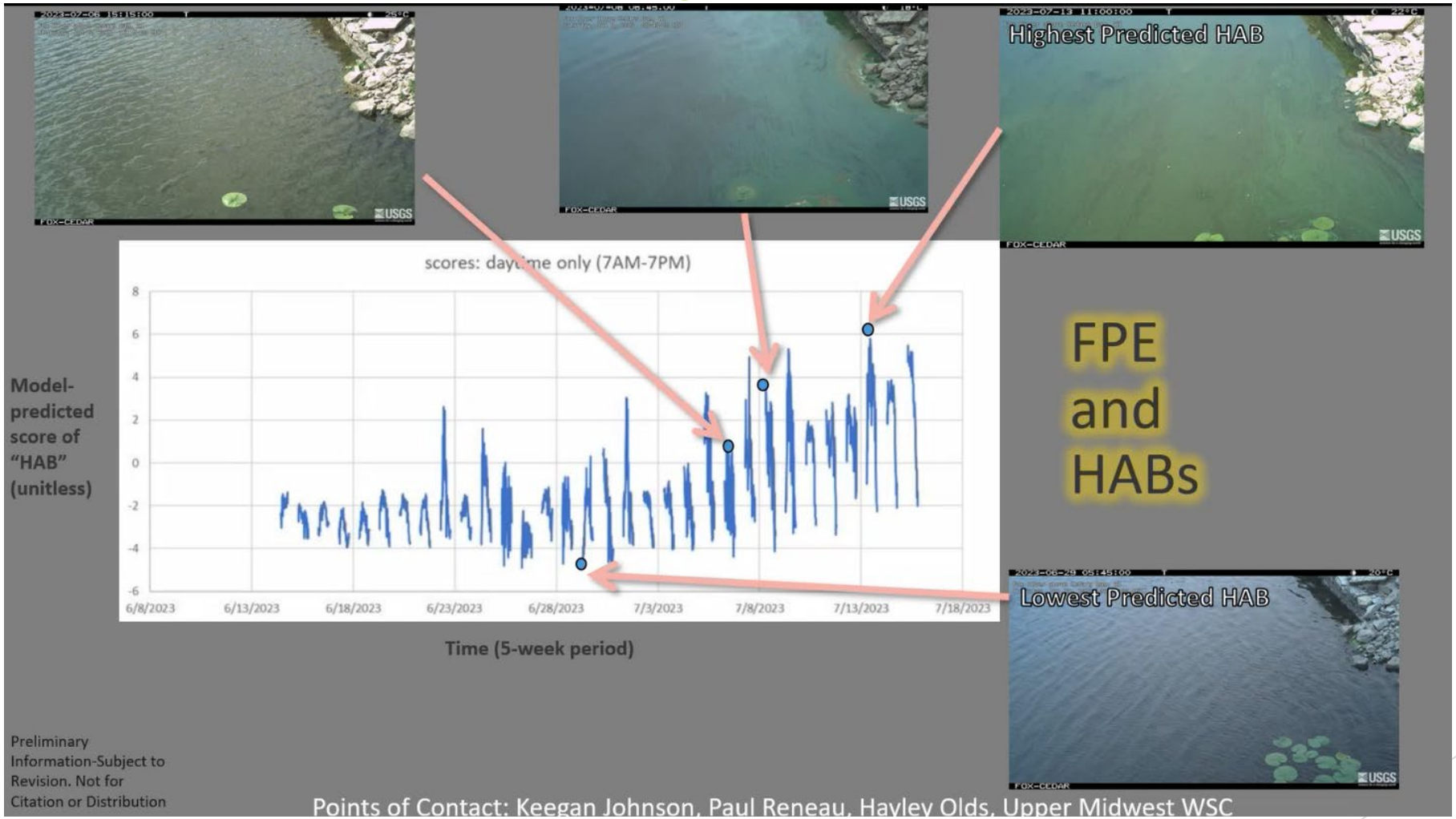
- Waterbodies are vulnerable to climate change, including increases in the frequency, duration and intensity of droughts and floods
- Need a cost-effective approach to monitoring to understand the impacts of changing hydrologic conditions
- Evaluating use of imagery and machine learning to monitor hydrologic changes in streams, lakes, and wetlands
- Using neural network model to rank images, e.g., more or less water, higher or lower flow

Trail Camera with timelapse mode

# Comparison of observed flow vs. predicted from neural network model



# Game camera images to detect HABs

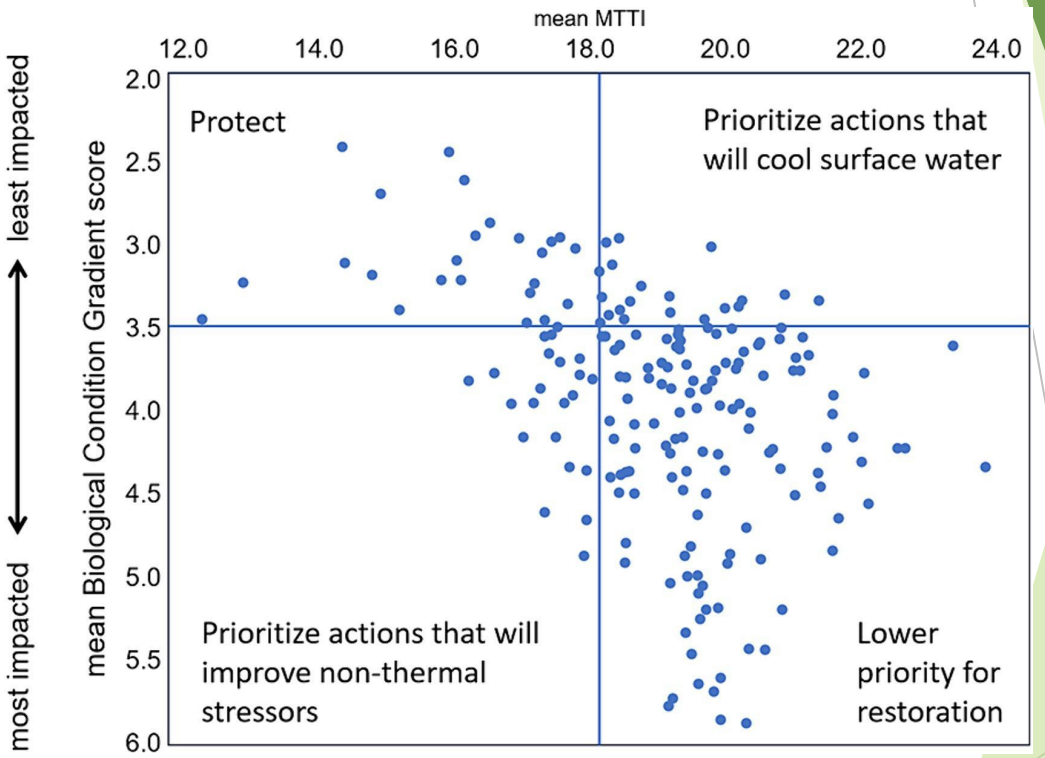


# What does this all mean?

- States, tribes, and Regions are trying to collect baseline information of continuous temperature, flow, and dissolved oxygen
- Using sensors and trail cameras to collect information and innovative machine learning algorithms to analyze data (as well as R scripts to visualize data – come to the Continuous Monitoring breakout!)
- Collecting biological data and developing thermal preference metrics to understand impacts and changes (*currently in progress*)
- Ultimately use information to better protect and restore waterbodies to maintain thermal and hydrologic conditions that maintain cold and cool water taxa

# Salmon restoration in King County, WA

- Protect streams that support macroinvertebrate communities with colder thermal conditions (MTTI < 18˚C), and overall good biological condition (<3.5)
- Streams with good overall biological condition supporting warmer macroinvertebrate communities (MTTI > 18˚C) may be candidates for thermal restoration
  - E.g., riparian planting to increase shading, or stormwater management to increase infiltration and limit retention in ponds



# Goal

Ultimately use data and information collected to better protect and restore waterbodies to maintain thermal and hydrologic conditions that maintain biodiversity, especially cold and cool water taxa