



Illuminating Groundwater Seepage Zones Feeding Northern Peatland Pools Using Hydrogeophysical Sensing

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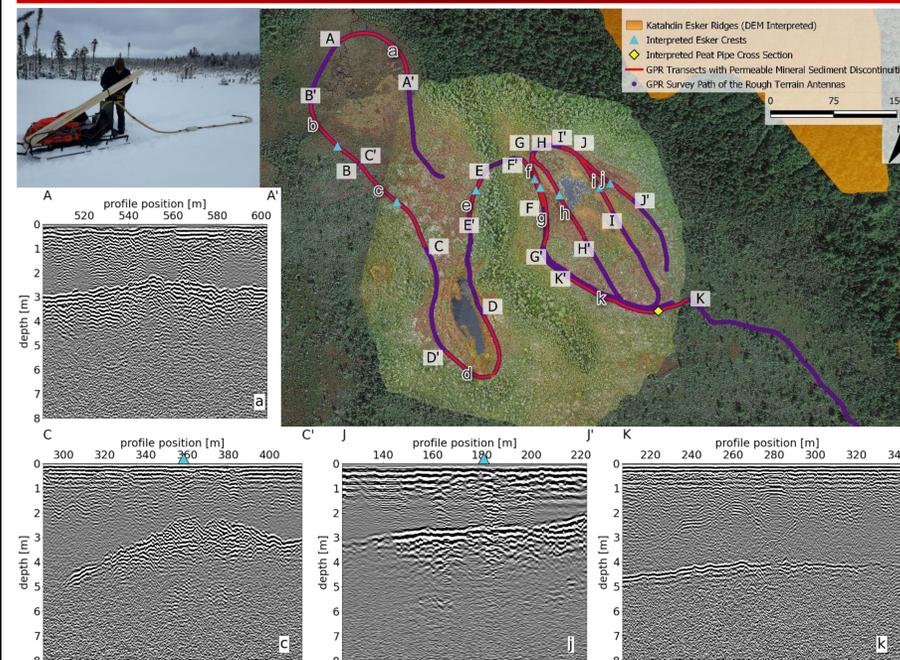
Plain Language Summary

- Critical zone hydrology regulates carbon-cycling and nutrient transport in peatlands.
- Hydrologic processes in northern peatlands are poorly constrained, with underlying hydrogeologic influences typically ignored.
- Networks of organic channels, known as peat piping, may serve as conduits for the vertical flow of mineral soil groundwater.
- This study explores the hydrologic connectivity between the surficial peatland pools and mineral soil groundwater.

Research Hypotheses

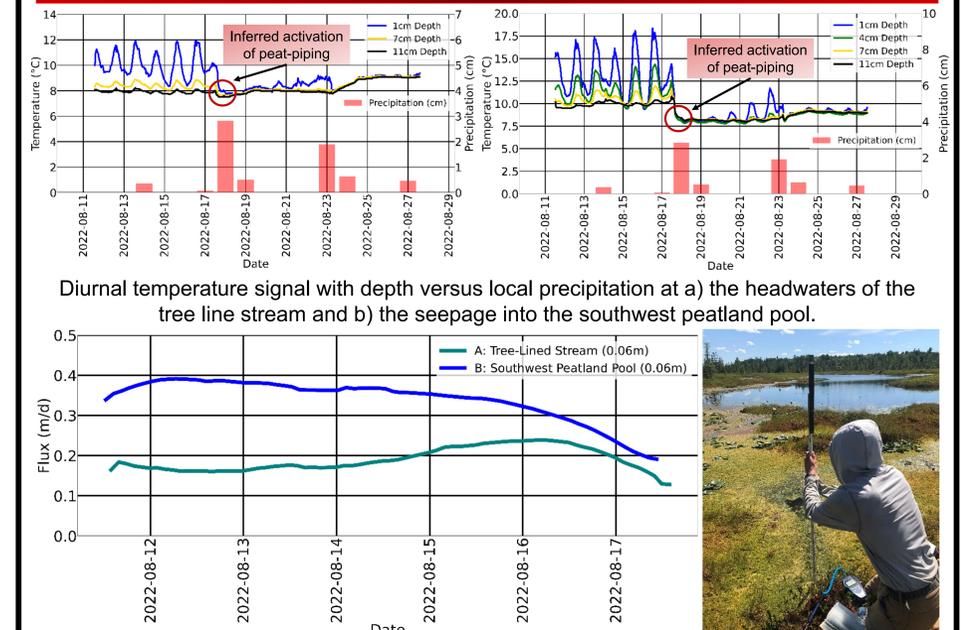
- 1) Focused upwelling of groundwater originates from permeable sediment deposits, such as glacial eskers, embedded in low-permeability sediments bounding northern peatland basins.
- 2) Groundwater upwelling terminates around peatland pools via matrix seepage and preferential flow pathways.

Ground-Penetrating Radar

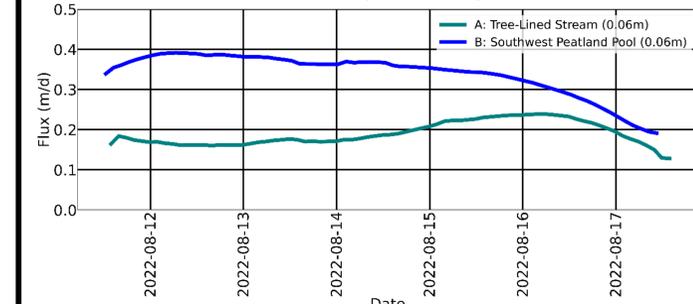


Permeable glacial esker lenses and peat-piping underlying Sawtelle Heath.

Groundwater Flux Estimates

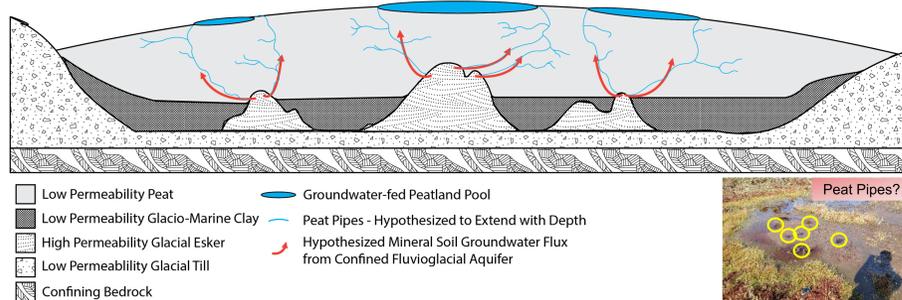


Diurnal temperature signal with depth versus local precipitation at a) the headwaters of the tree line stream and b) the seepage into the southwest peatland pool.



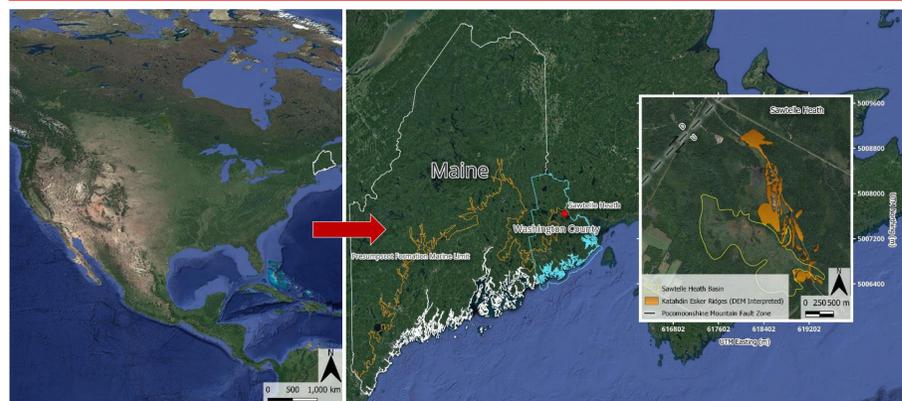
Groundwater flux estimates in the tree-lined stream and southwest peatland pool.

Conceptual Hydrostratigraphy



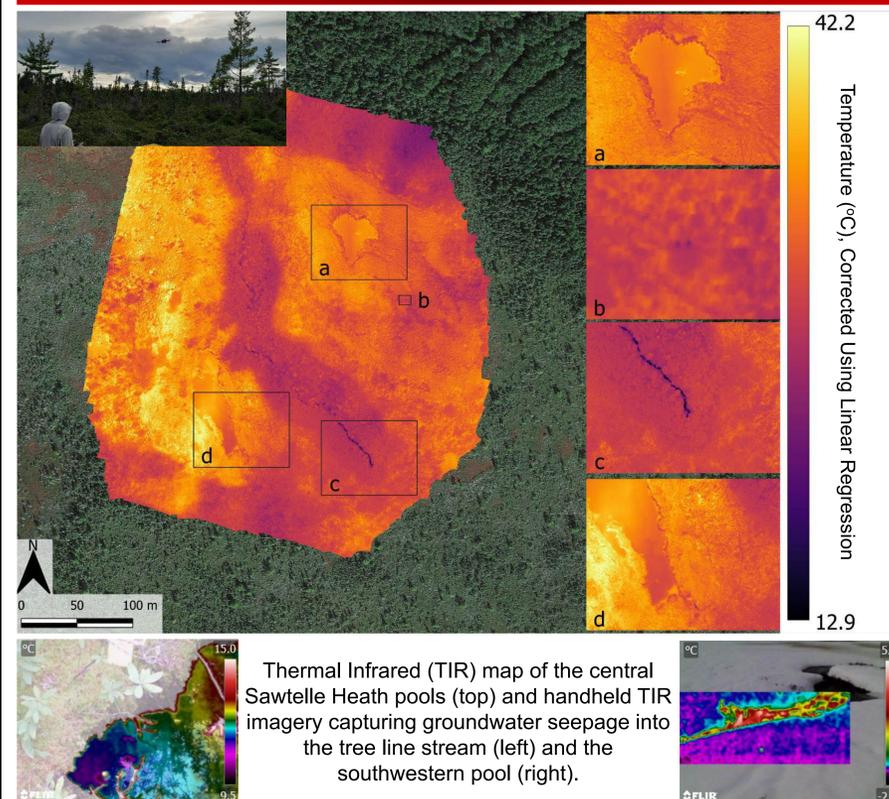
Conceptual hydrostratigraphy driving groundwater upwelling in northern peatlands.

Study Area: Sawtelle Heath



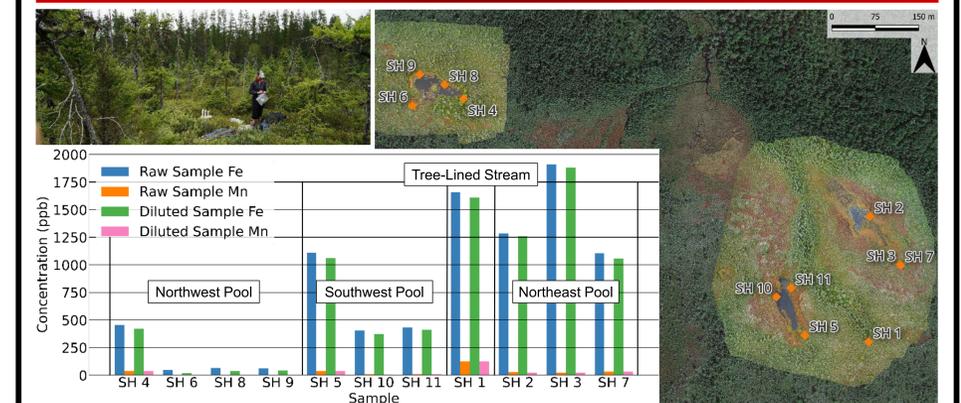
Sawtelle Heath basin and surrounding surficial geologic setting, including mapped Katahdin glacial esker deposits based on Digital Elevation Maps.

Hydrological Heat Tracing



Thermal Infrared (TIR) map of the central Sawtelle Heath pools (top) and handheld TIR imagery capturing groundwater seepage into the tree line stream (left) and the southwestern pool (right).

Geochemical Analysis



Surficial locations of water samples and trace iron (Fe) and manganese (Mn) concentrations measured using Inductively-Coupled Plasma Optical Emission Spectrometry.

Conclusions

- Highly localized exchange of mineral sediment groundwater feeds northern peatland pools.
- Mineral sediment groundwater may be plumbed through the matrix via peat-piping.
- Rapid local recharge of permeable deposits underlying northern peatlands enhances matrix seepage into peatland pools.

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