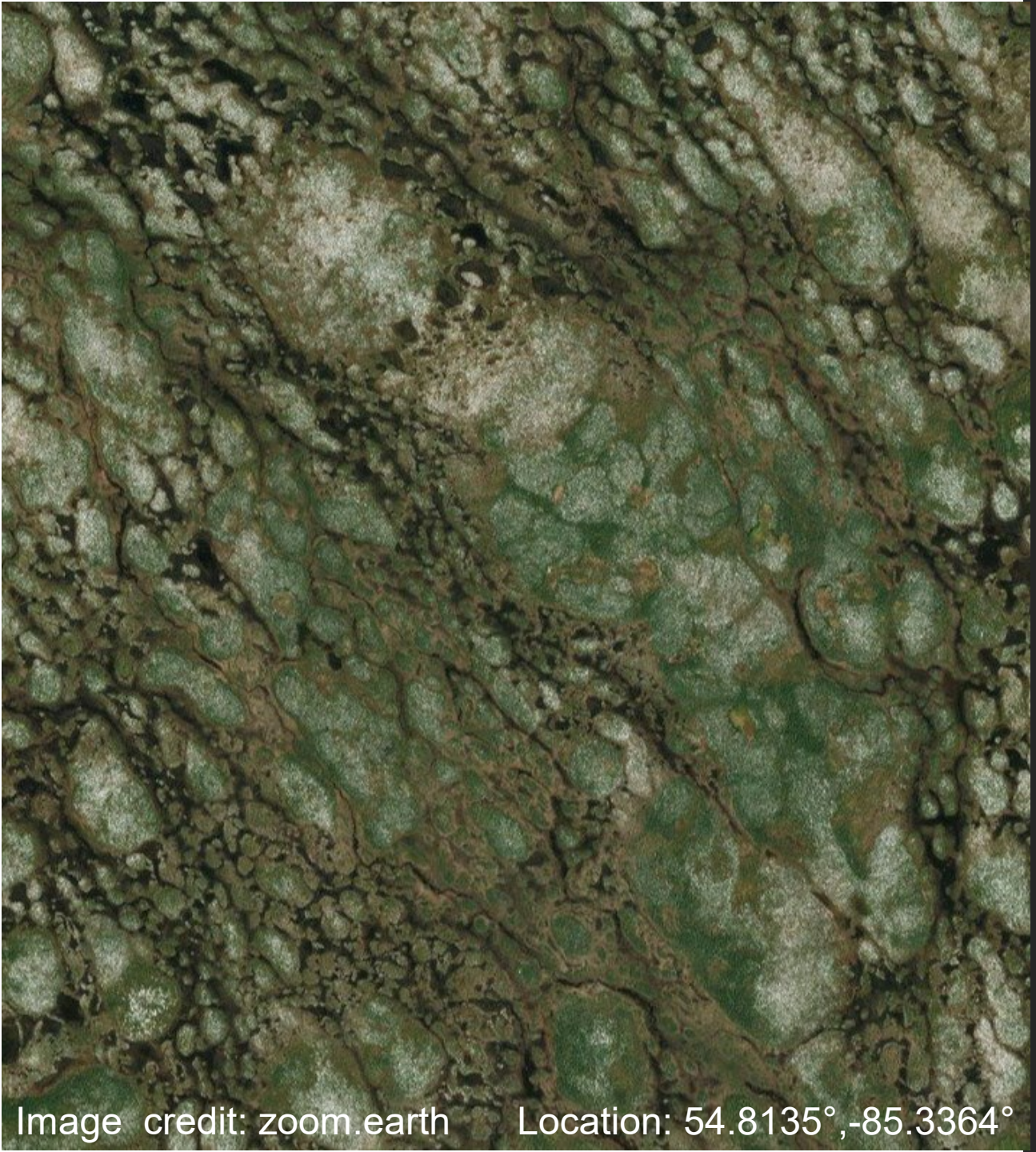


Vulnerability of peatland complexes in the Hudson Plains, Canada to permafrost-thaw-driven hydrological change

Mikhail Mack[1], William Quinton[1], James Mclaughlin[2], and Chris Hopkinson[3]

[1]Cold Regions Research Centre, Wilfrid Laurier University, Waterloo, Canada

[2]Ontario Forest Research Institute, Ontario Ministry of Natural Resources and Forestry, Sault. St. Marie, Canada

[3]Department of Geography, University of Lethbridge, Lethbridge, Canada

My contact info:
E: mackmikhail@gmail.com

Background and approach

- In recent decades, the unprecedented thaw of peat plateaus in northwestern Canada's Taiga Plains has resulted in more basin runoff (Connon *et al*., 2014) as permafrost-free peatlands increasingly connect (Connon *et al*., 2015), and their overall area expands (Carpino *et al*., 2018).

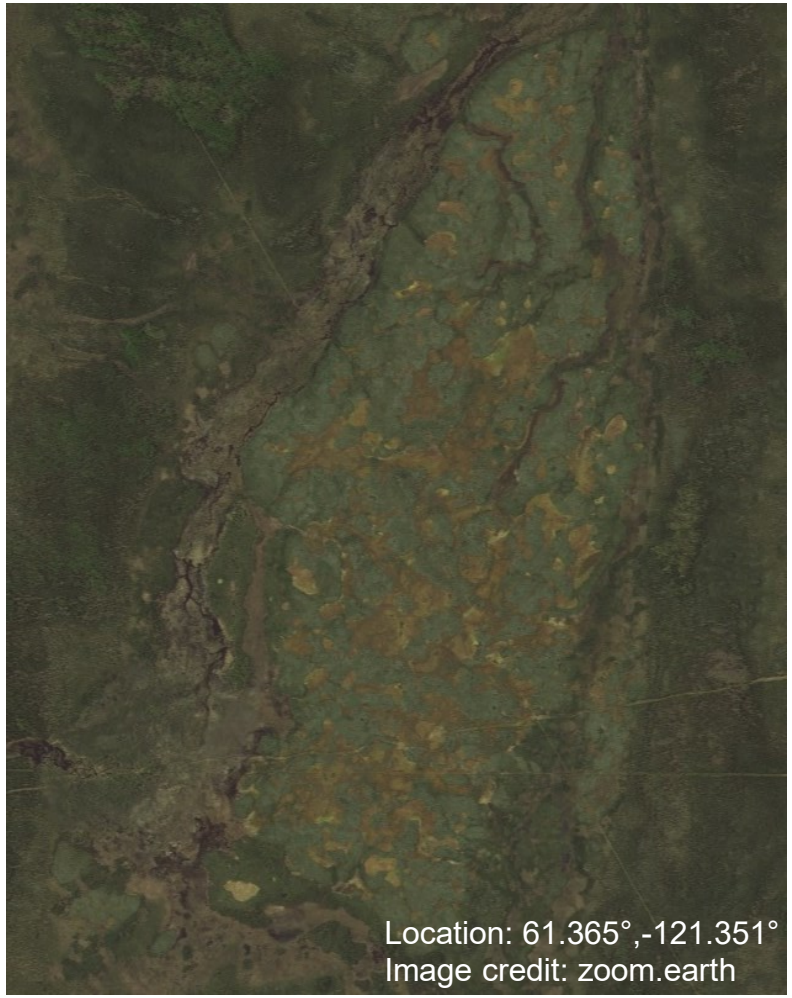
- To determine where or if similar landcover and hydrological changes occur in the Hudson Plains, Canada our study analyzed peatland landscape at a higher-order (Ivanov, 1975), the peatland complex (Canjander, 1913).

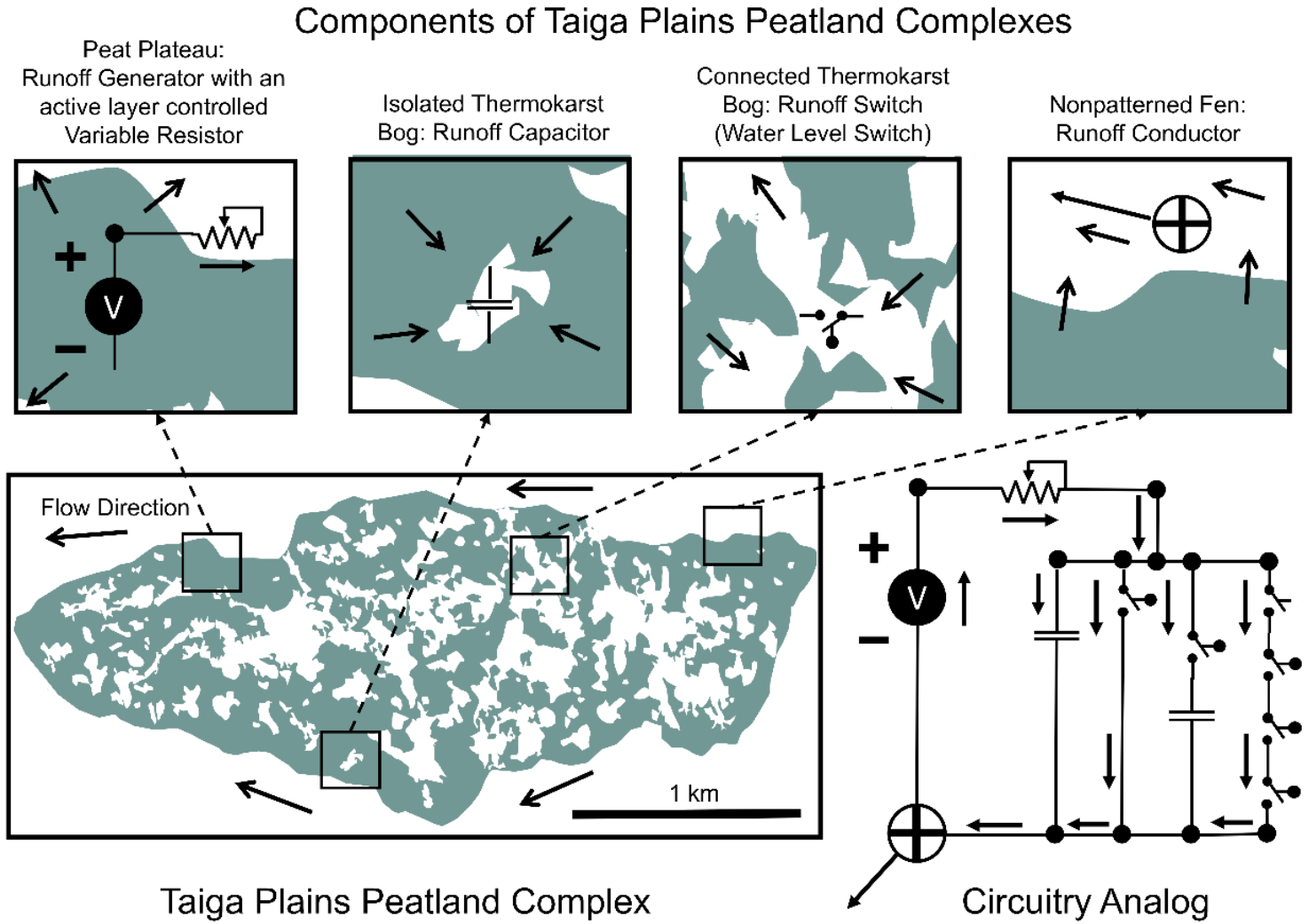
Background and approach

- For this study, we conceptualized the hydrological function of peatland complexes using circuitry analogs (Kirkham, 2005), whereby each complex component (e.g., peat plateau, bog, fen) was assigned a specific circuitry component (e.g., runoff generator, capacitor, conductor, etc.…)

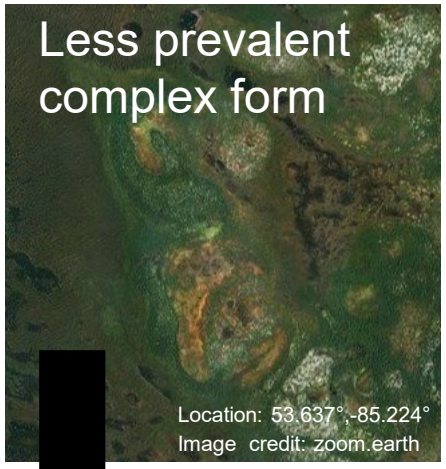
- Then using a distribution of peatland forms and peatland complex types we had classified across a large transect (8550 km^2) of the Hudson Plains we assigned vulnerability rankings at a 7.5 km × 7.5 km grid cell resolution based on peatland complex structure and our understanding of complexes in the Taiga Plains.

The known Taiga Plains peatland complexes



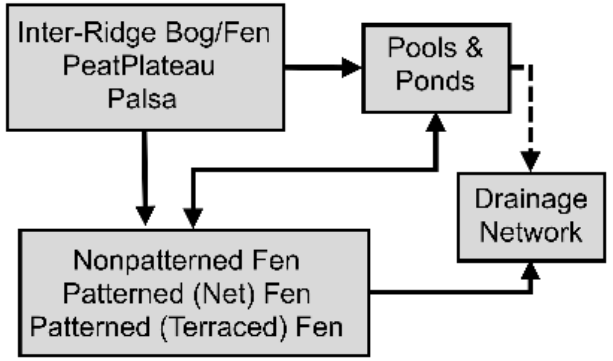


Hudson Plains peatland complexes

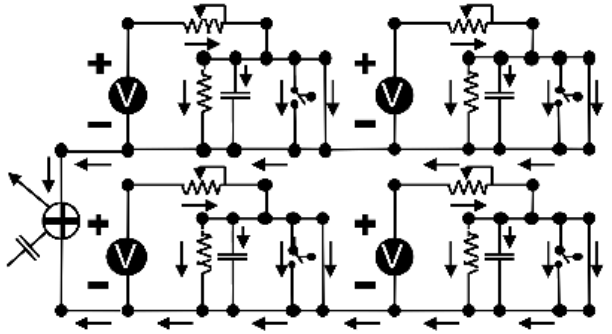


Permafrost Peatland–Fen–Pond (Dispersed Amperage)

Peatland Complex

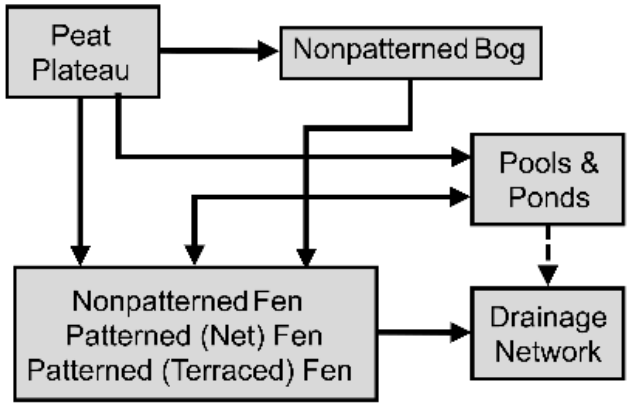


Circuitry Analog

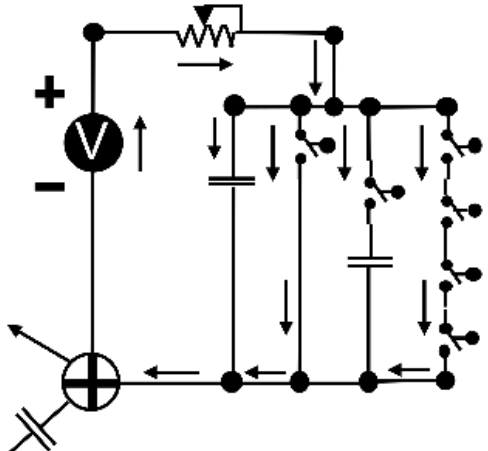


Permafrost Peatland–Bog–Fen (Concentrated Amperage)

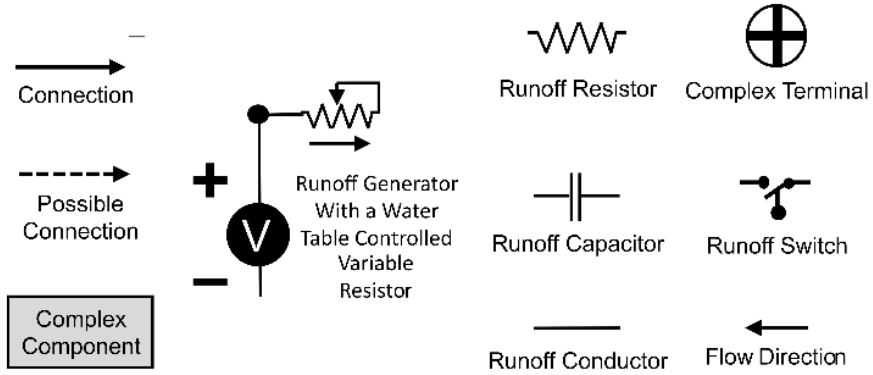
Peatland Complex



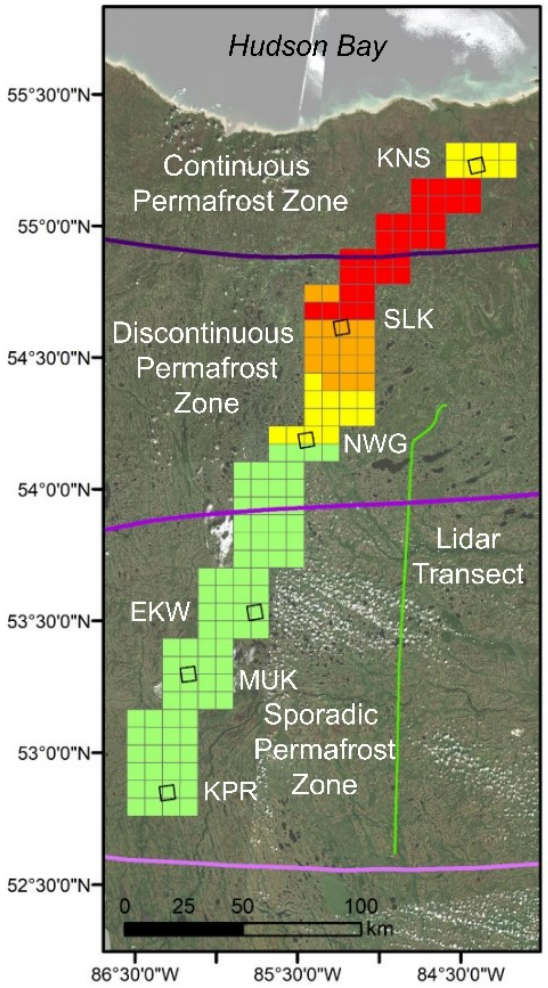
Circuitry Analog

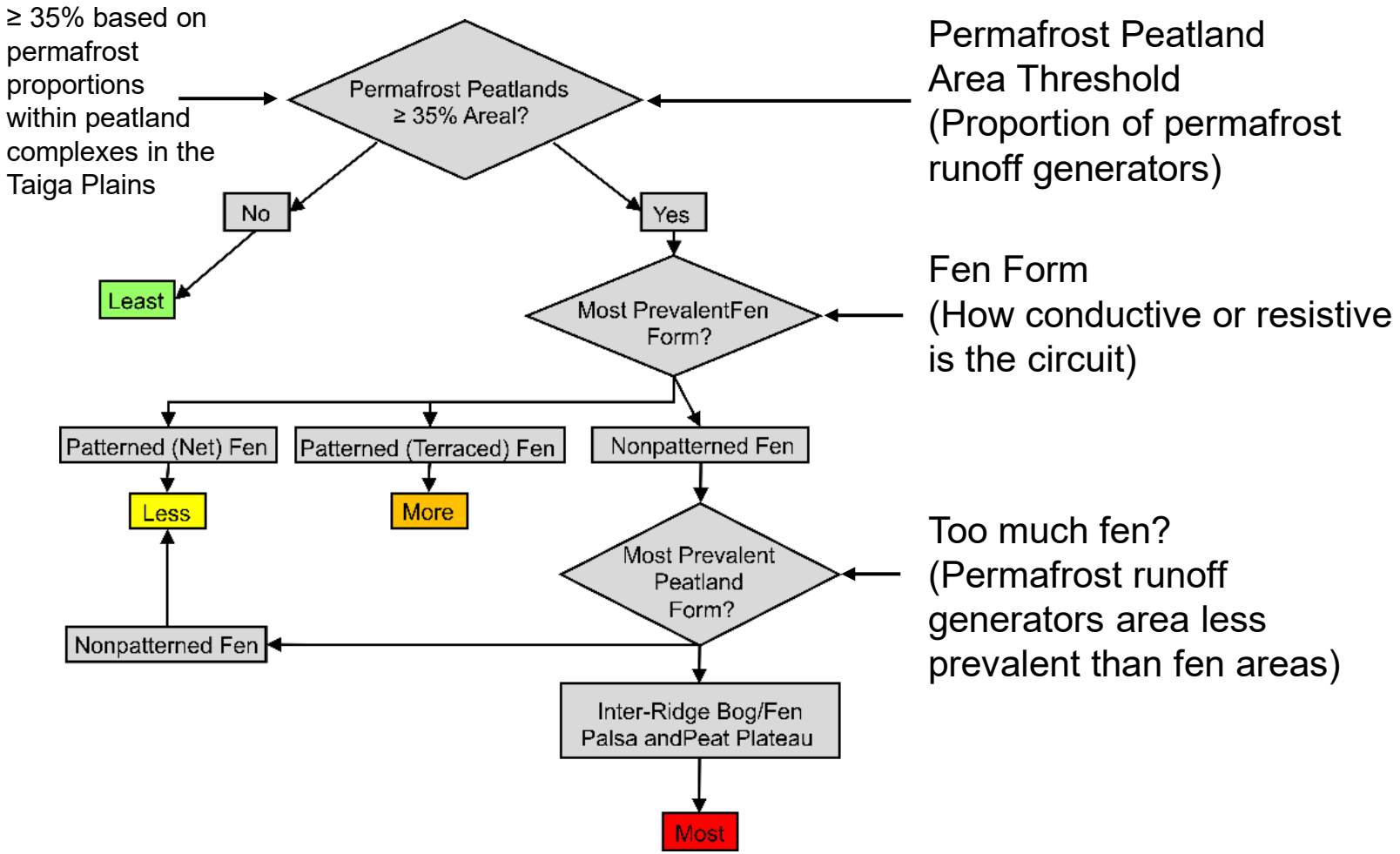


Legend



Hudson Plains peatland complex vulnerability to permafrost-thaw-driven hydrological change





Acknowledgements and References

Carpino, O. A., Berg, A. A., Quinton, W. L., & Adams, J. R. (2018). Climate change and permafrost thaw-induced boreal forest loss in northwestern Canada.. *Environmental Research Letters, 13*(8), 84018. https://doi.org/10.1088/1748-9326/aad74e

Connon, R. F., Quinton, W. L., Craig, J. R., Hanisch, J., & Sonnentag, O. (2015). The hydrology of interconnected bog complexes in discontinuous permafrost terrains. *Hydrological Processes, 29*(18), 3831–3847. https://doi.org/10.1002/hyp.10604

Connon, Ryan F, Quinton, W. L., Craig, J. R., & Hayashi, M. (2014). Changing hydrologic connectivity due to permafrost thaw in the lower Liard River valley , NWT , Canada. *Hydrological Processes 28*, 4163–4178. https://doi.org/10.1002/hyp.10206

Ivanov, K. (1975). *Vodoobmen v bolotnykh landshaftakh* [Water movement in mirelands]. Leningrad : Gidrometeoizdat

Kirkham, M. B. (2005). Electrical Analogues for Water Movement through the Soil-Plant-Atmosphere Continuum. *In Principles of Soil and Plant Water Relationships* (pp. 341–356). Amsterdam: Elsevier Inc.

Special thank you to Laurier Institute for Water Science for providing me with the conference scholarship needed to present at EGU 2022 today!