The distribution, morphometry, and volume of wedge ice in the Barrens of northern Manitoba, Canada

Tabatha Rahman[1], Dr. Pascale Roy-Léveillée[1,2], Dr. Stephen Wolfe[3], Dr. Duane Froese[4]

[1]Université Laval, Centre d'études nordiques (Canada)
[2]Permafrost Geomorphology Research Chair, Sentinel North (Canada)
[3]Natural Resources Canada
[4]University of Alberta (Canada)

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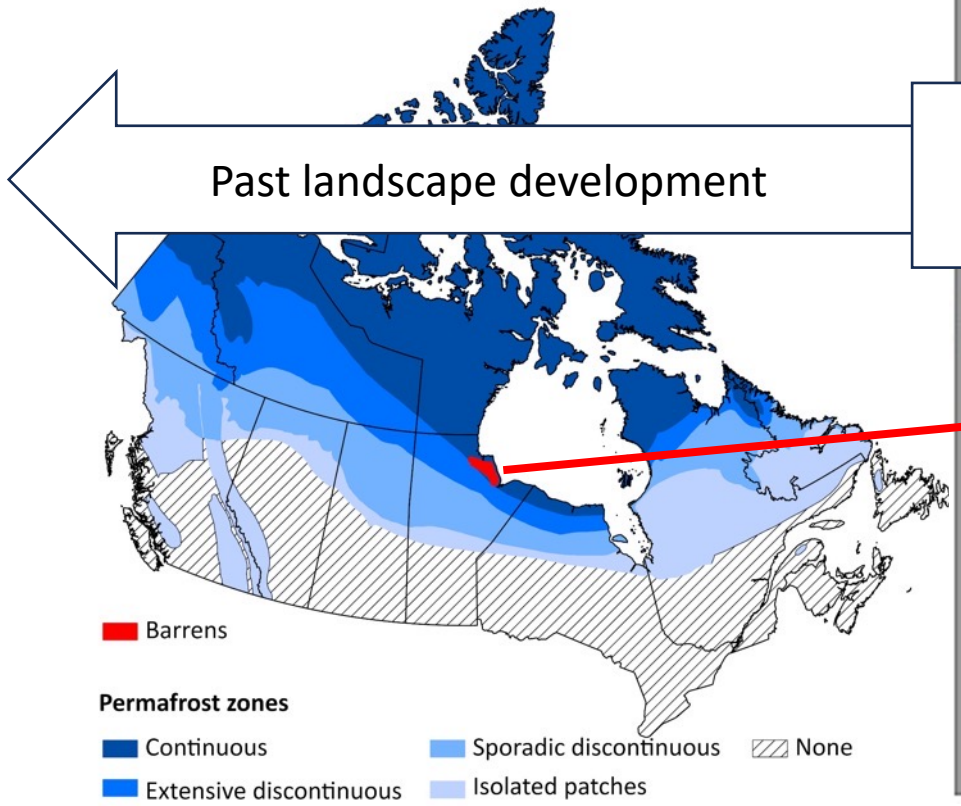
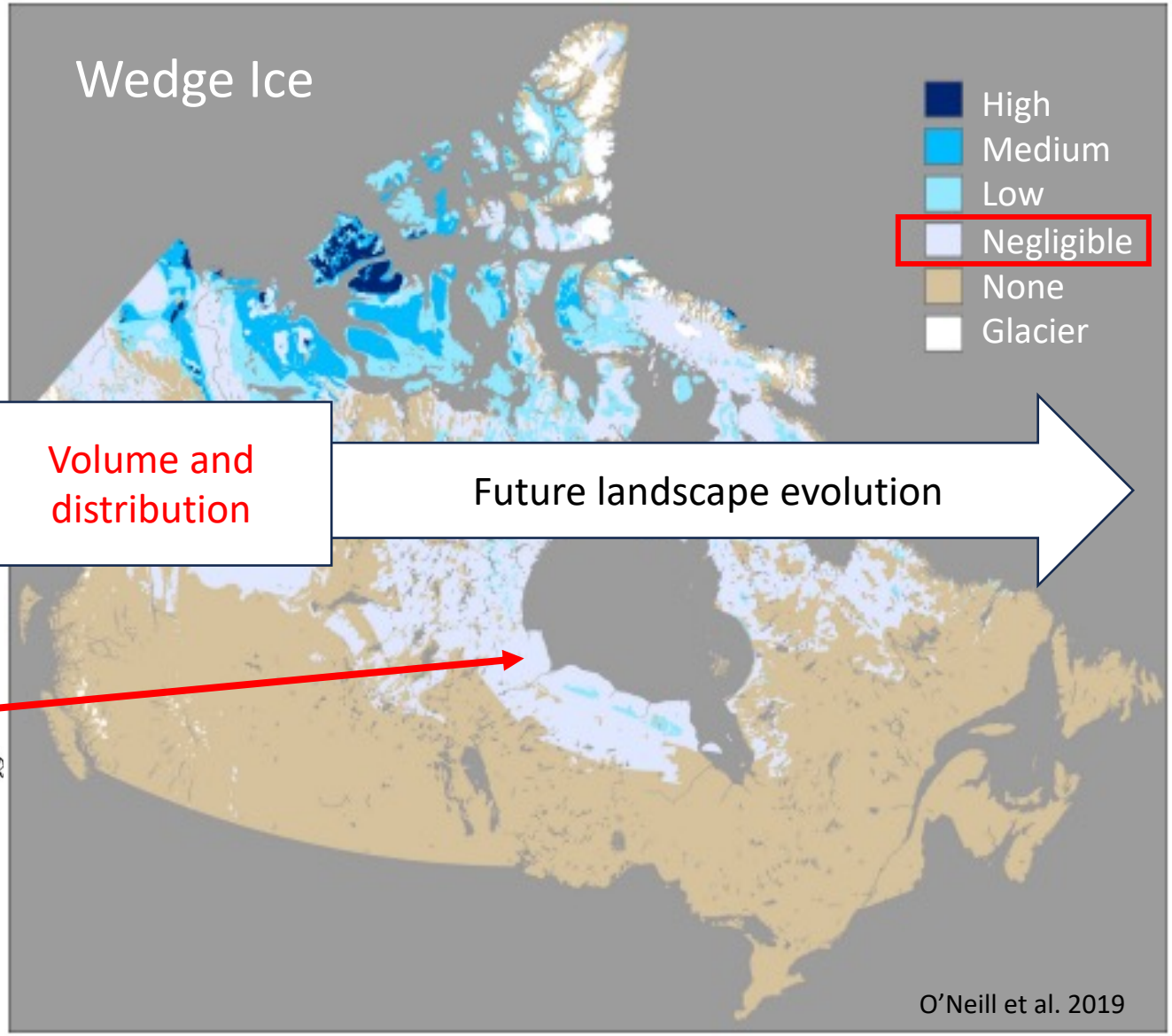
Wedge ice in the Barrens



Past landscape development

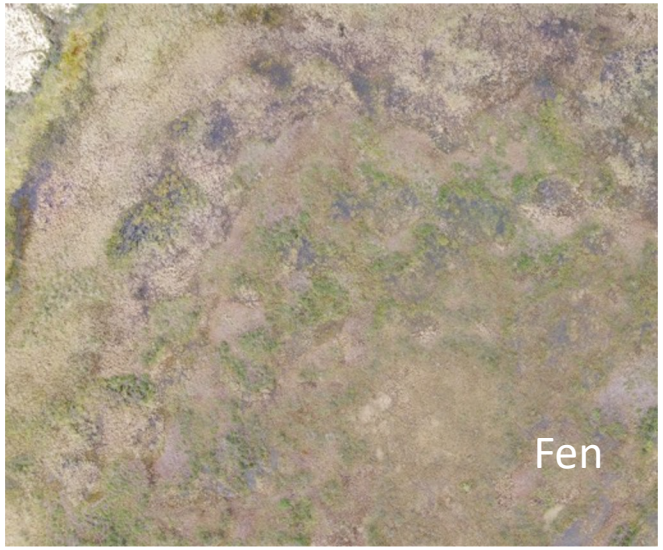
Volume and distribution

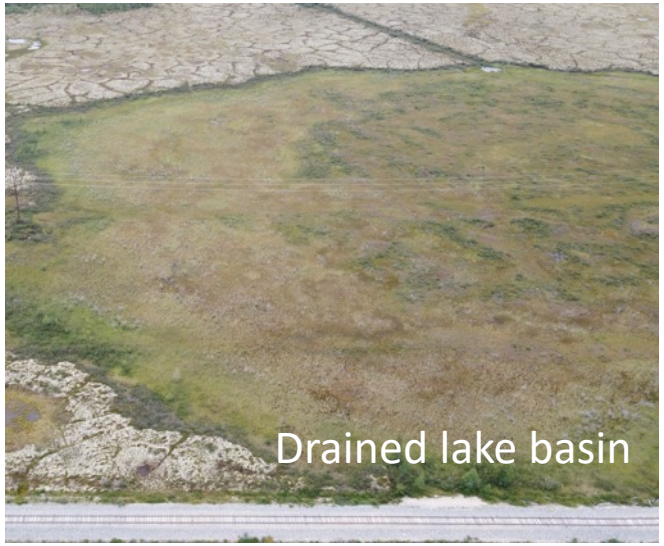
Future landscape evolution



The Barrens

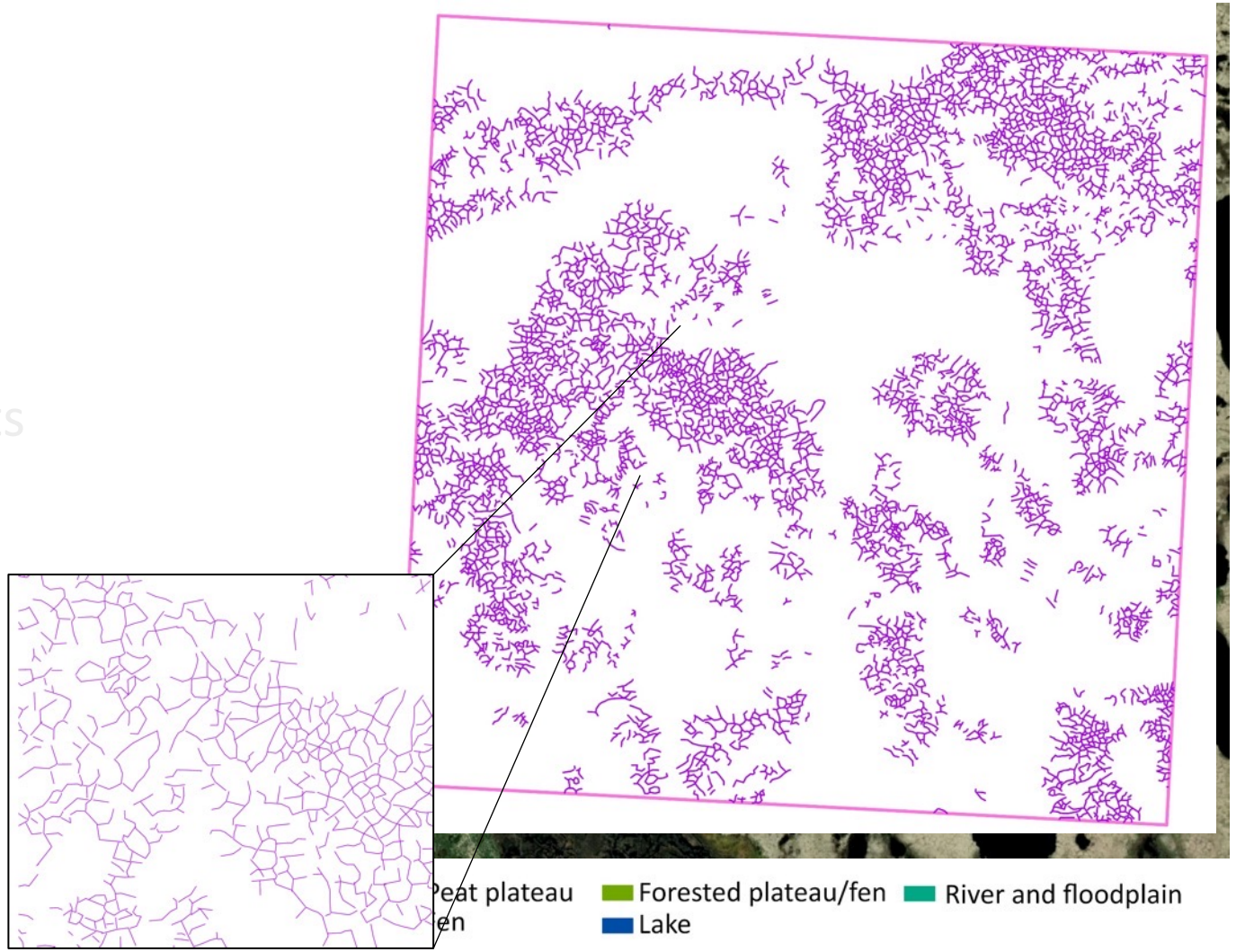
- Canada's southernmost continuous permafrost
- Canada's largest permafrost peatland
- Offshore glaciomarine sediment & peat



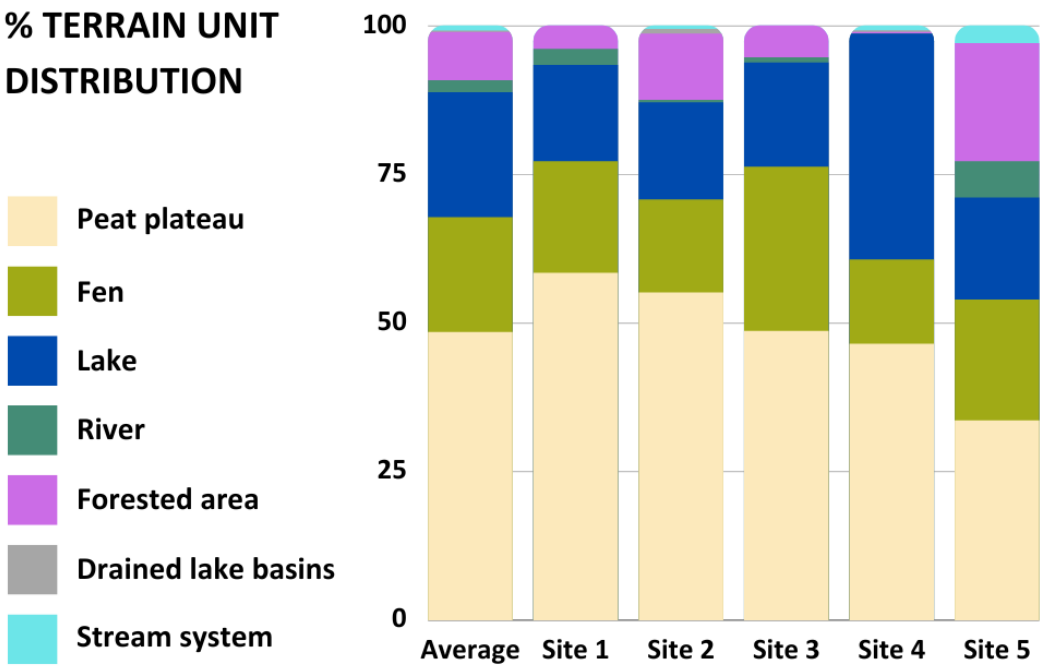


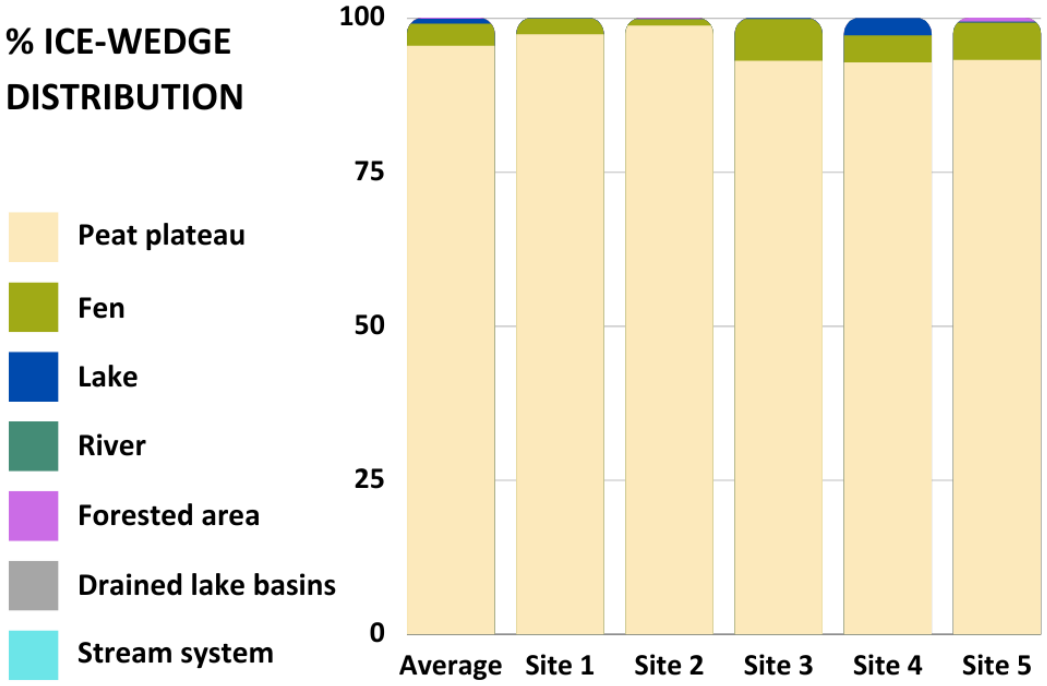
Wedge ice & terrain unit distribution

- 5 sites (2.25 km^2)
- Mapping terrain units
- Mapping ice wedges
- Distribution of ice-wedges within each terrain unit



Peat plateaus - most prevalent terrain unit with majority of ice wedges

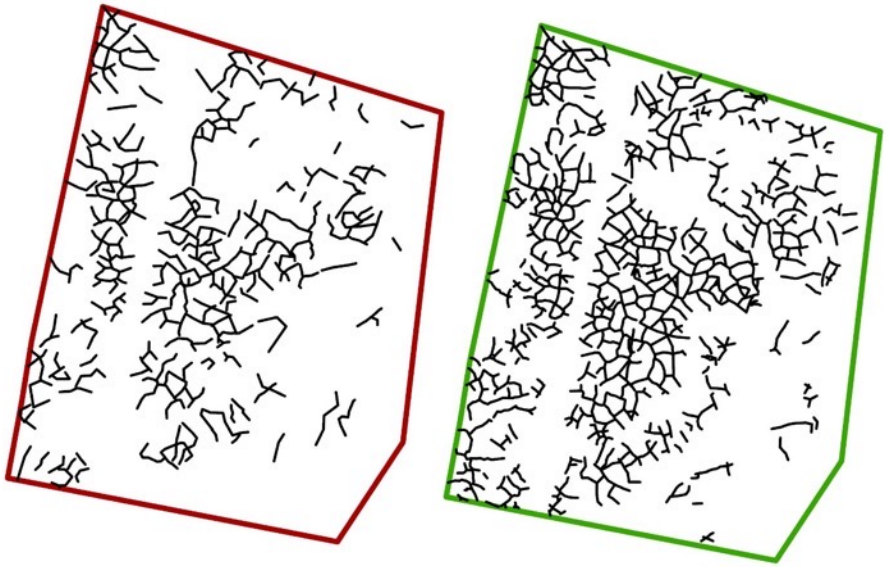




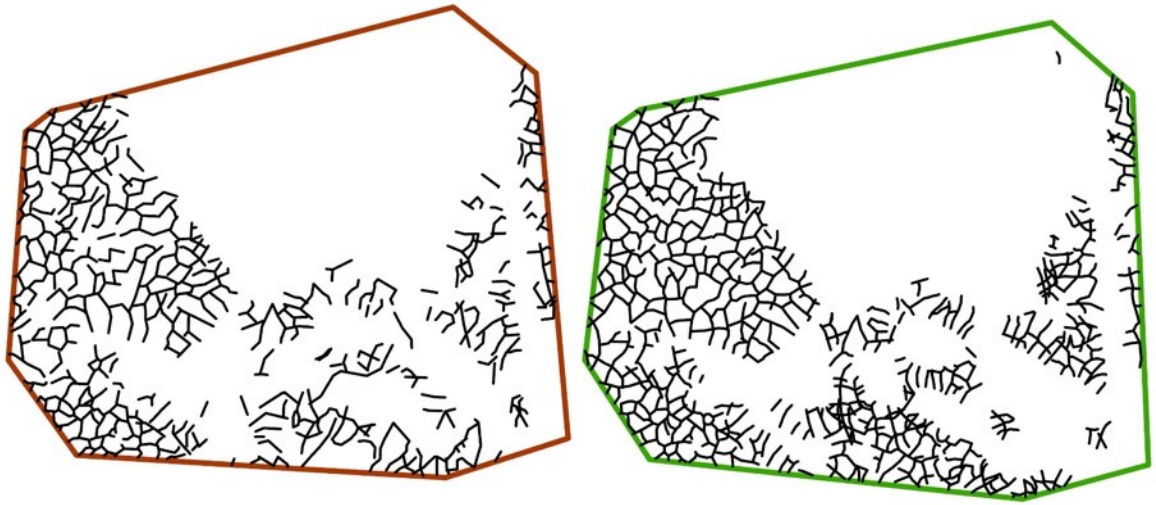
21 000 m/km^2
(1.0 billion m in Barrens)

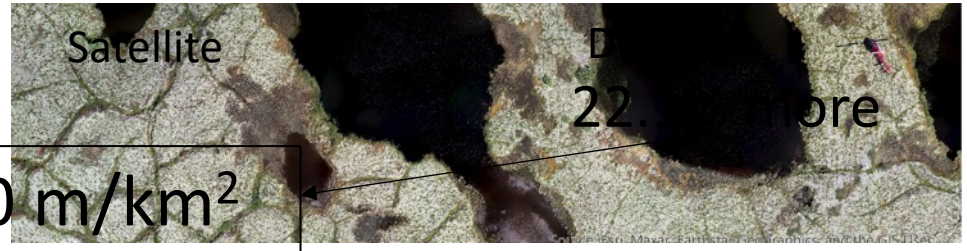
Comparison with drone imagery

Site A



Site B





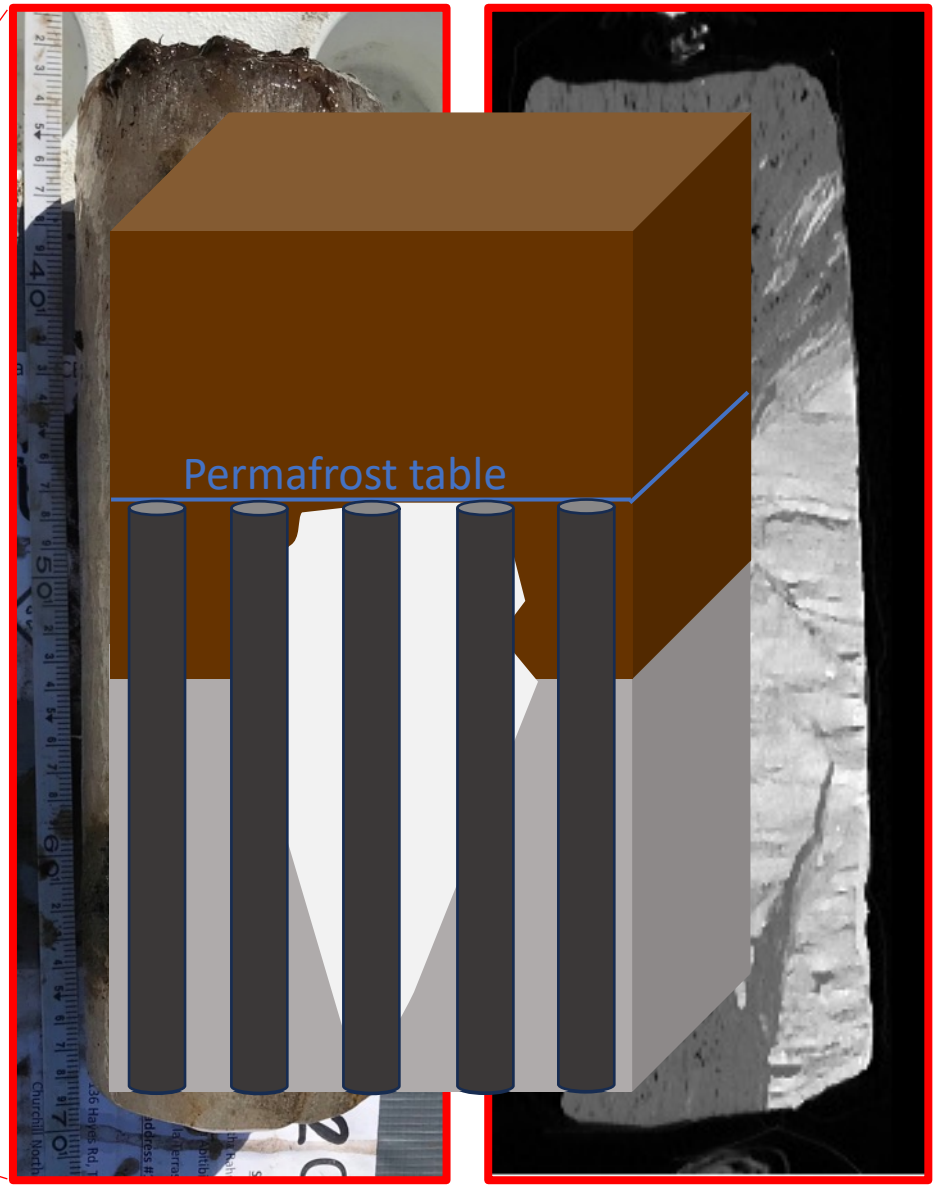
25 000 m/km^2

(~1.3 billion m in Barrens)

ArcGIS Pro World Imagery Basemap (30 cm/pixel)

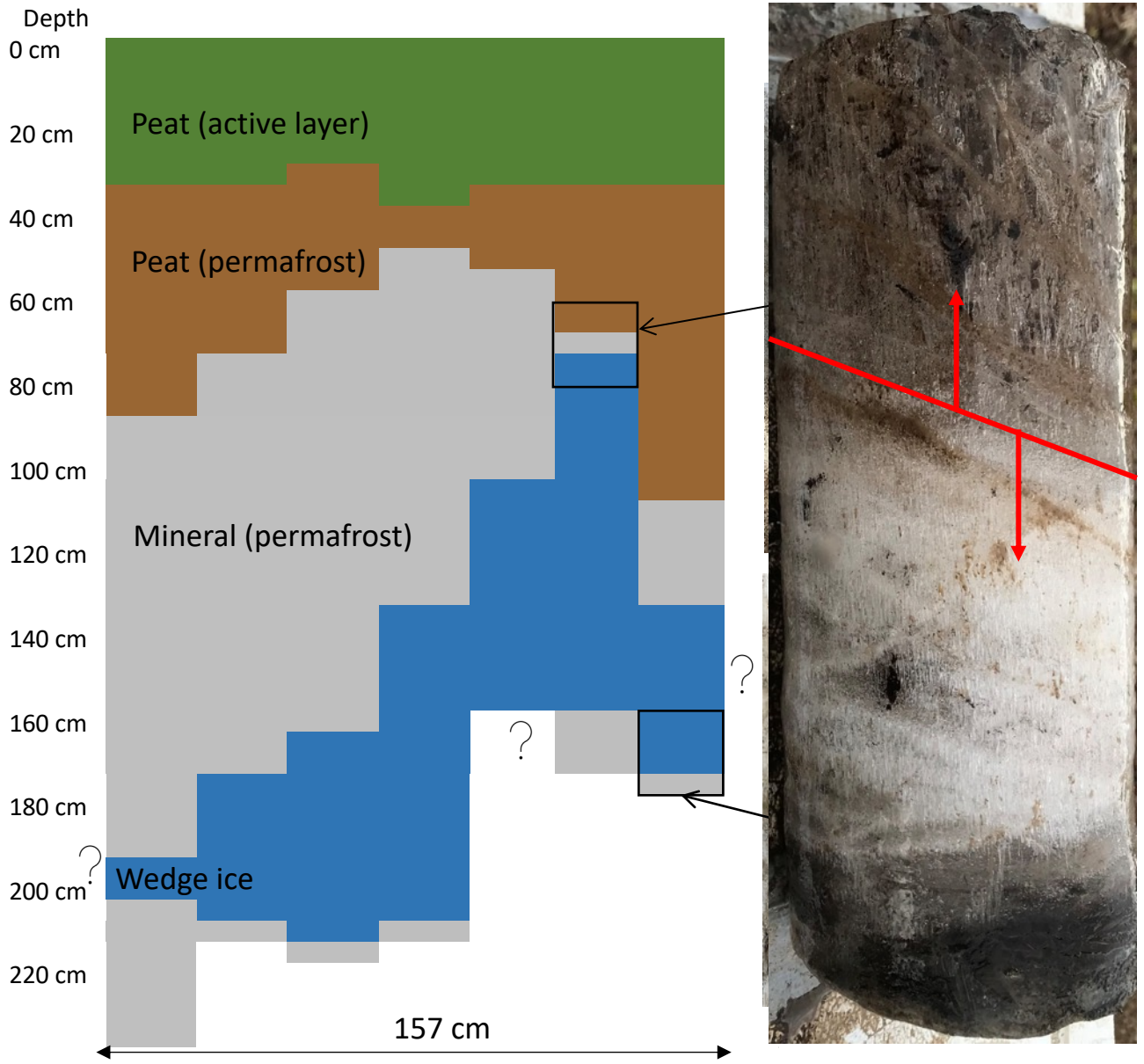
Drone (2.47 cm/ pixel)

Field measurements of ice-wedge morphometry



$\delta^{18}O$ and $\delta^{2}H$

Depth below surface: > 70 cm
Depth below active layer: > 20 cm
Height: 120 cm
Width: > 157 cm



Ice-wedge cross-section area

Top 1 meter of permafrost
Field measurements (this study):
0.04 m^2
Morse and Burn (2013):
0.46 m^2

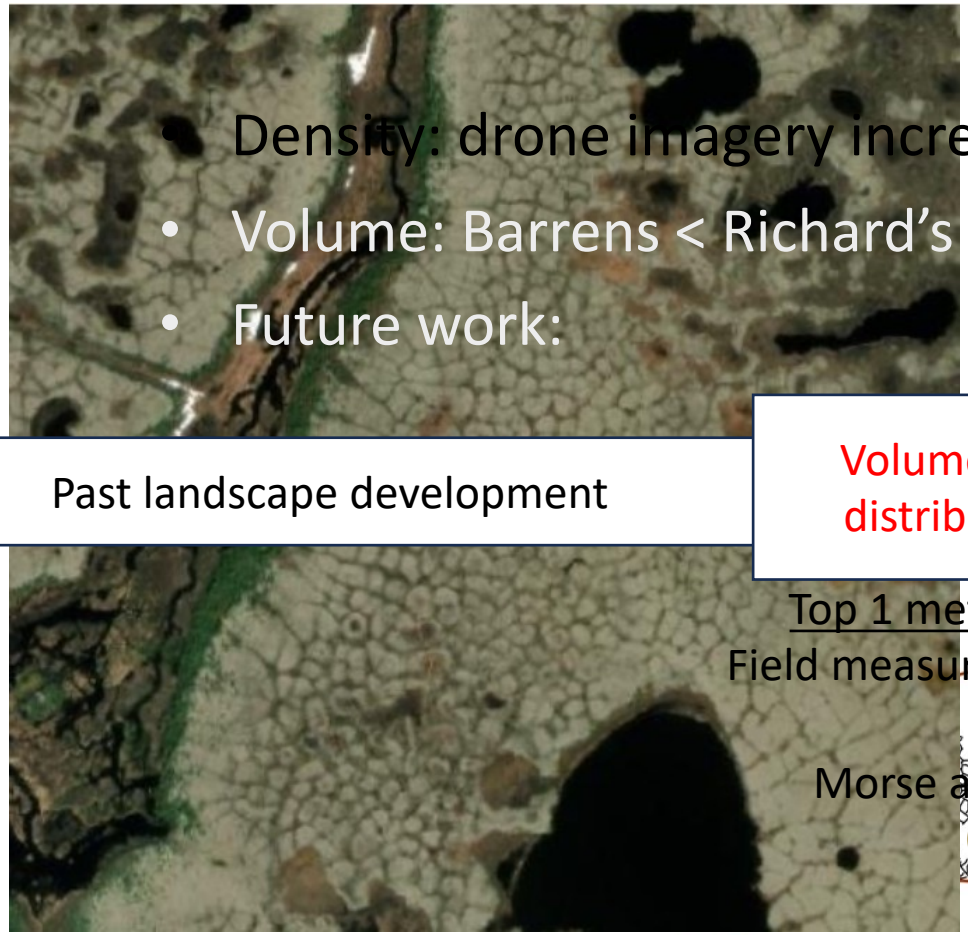
Top 2 meters of permafrost
Field measurements (this study):
0.94 m^2
Pollard and French (1980):
2.34 m^2

Ice-wedge volume

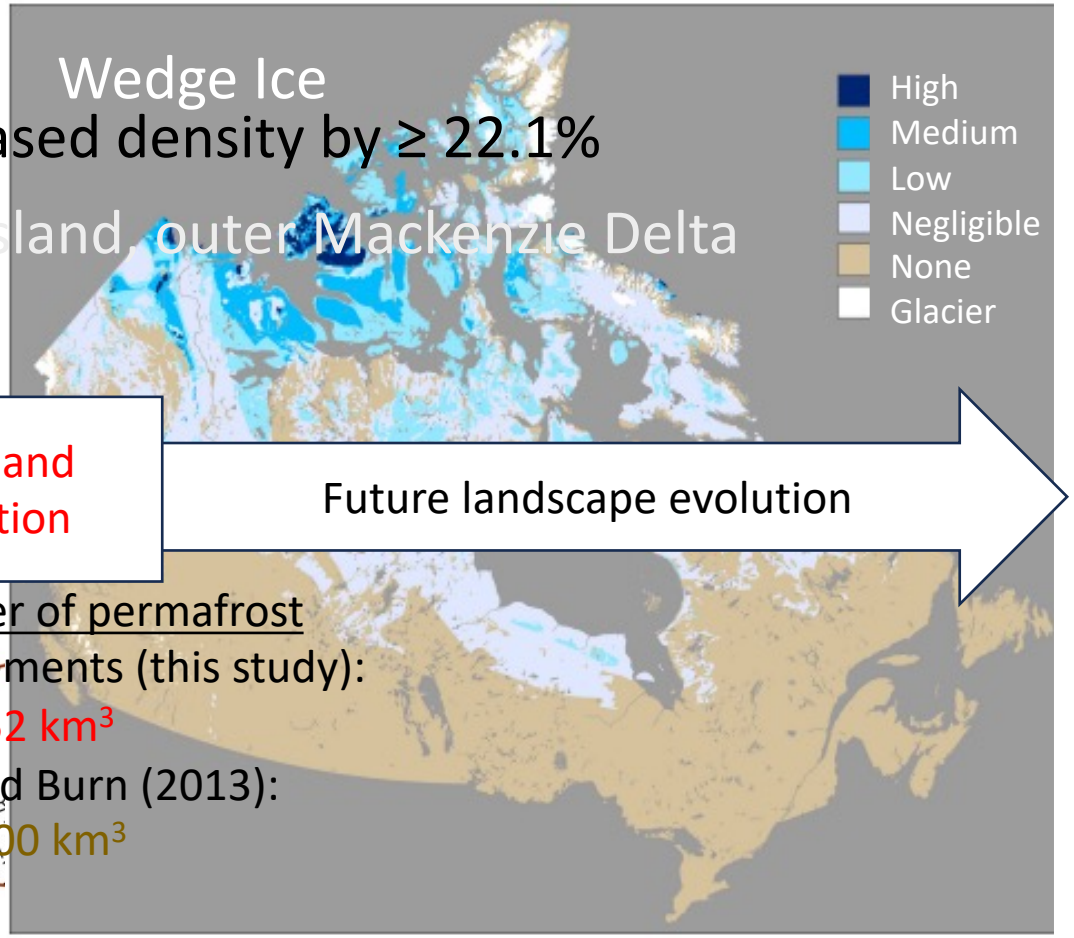
Top 1 meter of permafrost (50 000 km^2)
Field measurements (this study):
52 km^3
Morse and Burn (2013):
600 km^3

Top 2 meters of permafrost (50 000 km^2)
Field measurements (this study):
1200 km^3
Pollard and French (1980):
3000 km^3

Ice-wedges: extensive but small



- Density: drone imagery increased density by ≥ 22.1%
- Volume: Barrens < Richard's Island, outer Mackenzie Delta
- Future work:



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Volume and distribution

Future landscape evolution

Top 1 meter of permafrost

Field measurements (this study):

52 km^3

Morse and Burn (2013):

600 km^3

O'Neill et al. 2019

Thank you for listening!

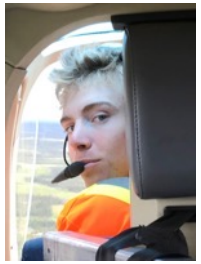
I'd be happy to discuss further:
tabatha.rahman.1@ulaval.ca

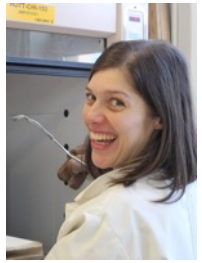

Emmanuel L'Hérault

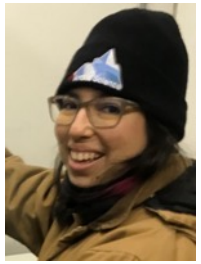

Adam Kirkwood

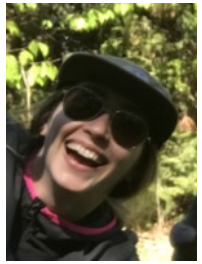

Frederic Brieger

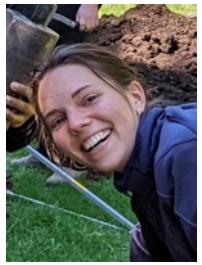

Brett Young

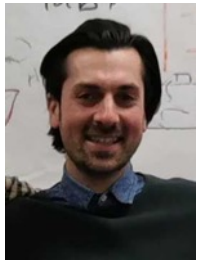

Alex Janson


Arianne B. St-Amour


Nicole Corbiere


Dr. Sarah Gauthier


Rose-Marie Cardinal


Dr. Samuel Gagnon


Danielle Chiasson


Dr. Antoine Boisson

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