



Dendritically-drained Peat Plateaus: A Distinctive Permafrost Peatland Landform of the Central Mackenzie Valley, Northwest Territories

Alexandre Chiasson¹, Alejandro Alvarez¹, Jurjen van der Sluijs², Brielle Andersen¹, Steven V. Kokelj³, Ashley Rudy³ & Duane Froese¹



¹Department of Earth and Atmospheric Sciences, University of Alberta, Edmonton, Canada
²NWT Centre for Geomatics, Government of Northwest Territories, Yellowknife, Canada
³NWT Geological Survey, Government of Northwest Territories, Yellowknife, Canada



PERMAFROST DISTRIBUTION

- Permafrost region covers about 50 % of Canada.
 - ↳ >75% of Northwest Territories (NWT)
- **Climatic phenomenon:**
 - Temperature
 - Vegetation
 - Snow cover
- In the **NWT**, peatlands cover an area of **28×10^6 ha** (**$\sim 280\,000$ km²**) = **$\sim 22\%$** of Canada's peatlands area.
- In the **Mackenzie Valley** itself contains approximately **23.7×10^6 ha** of peatland. = **$\sim 20\%$** of **Canada's** estimated **119×10^6 ha** of boreal and subarctic peatland cover.
 - **Dendritically-drained peat plateau = Dendritic peat plateaus**



OBJECTIVE

- Define dendritic peat plateaus in the central Mac
- Mac (la der Mac
- Under evolutic

What are dendritically-drained peat plateaus?



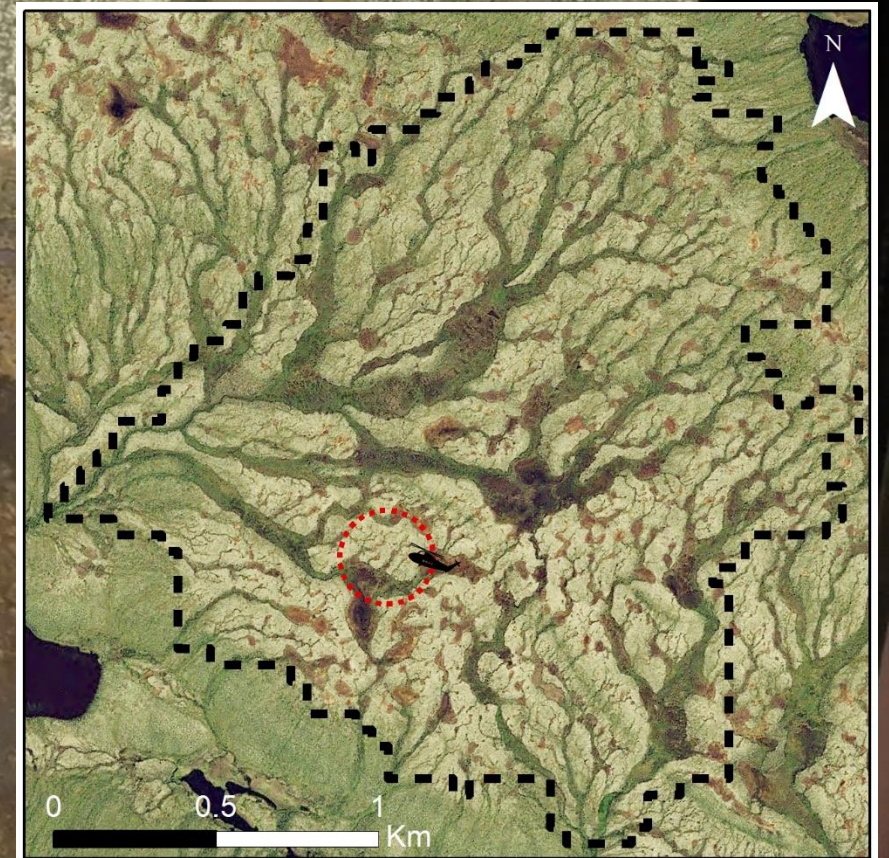
- Dissected by oriented drainage network

- Gradually sloping terrain (up to ~3m per km)

- Develop primarily on moraine plains or hummocky terrains

- Common landforms in the central Mackenzie Valley, but why?

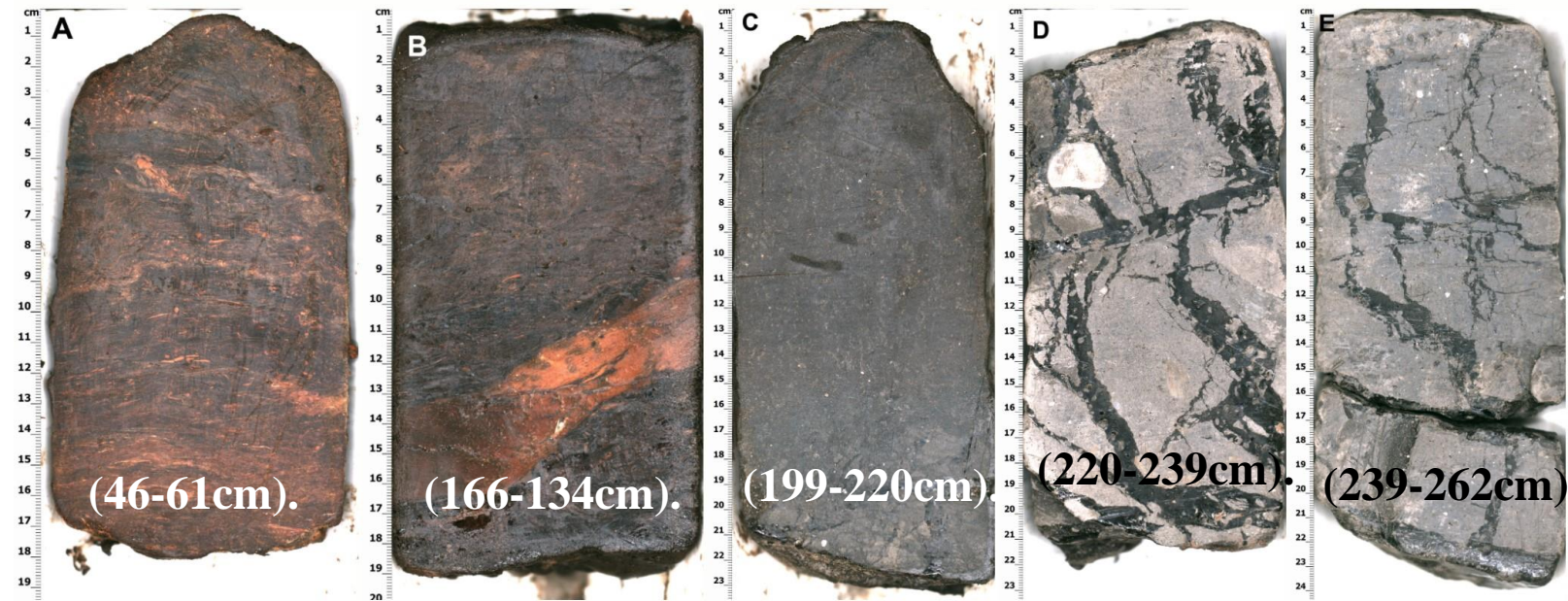
- Resembles a spreading oak or chestnut tree.



FIELDWORK OBSERVATIONS

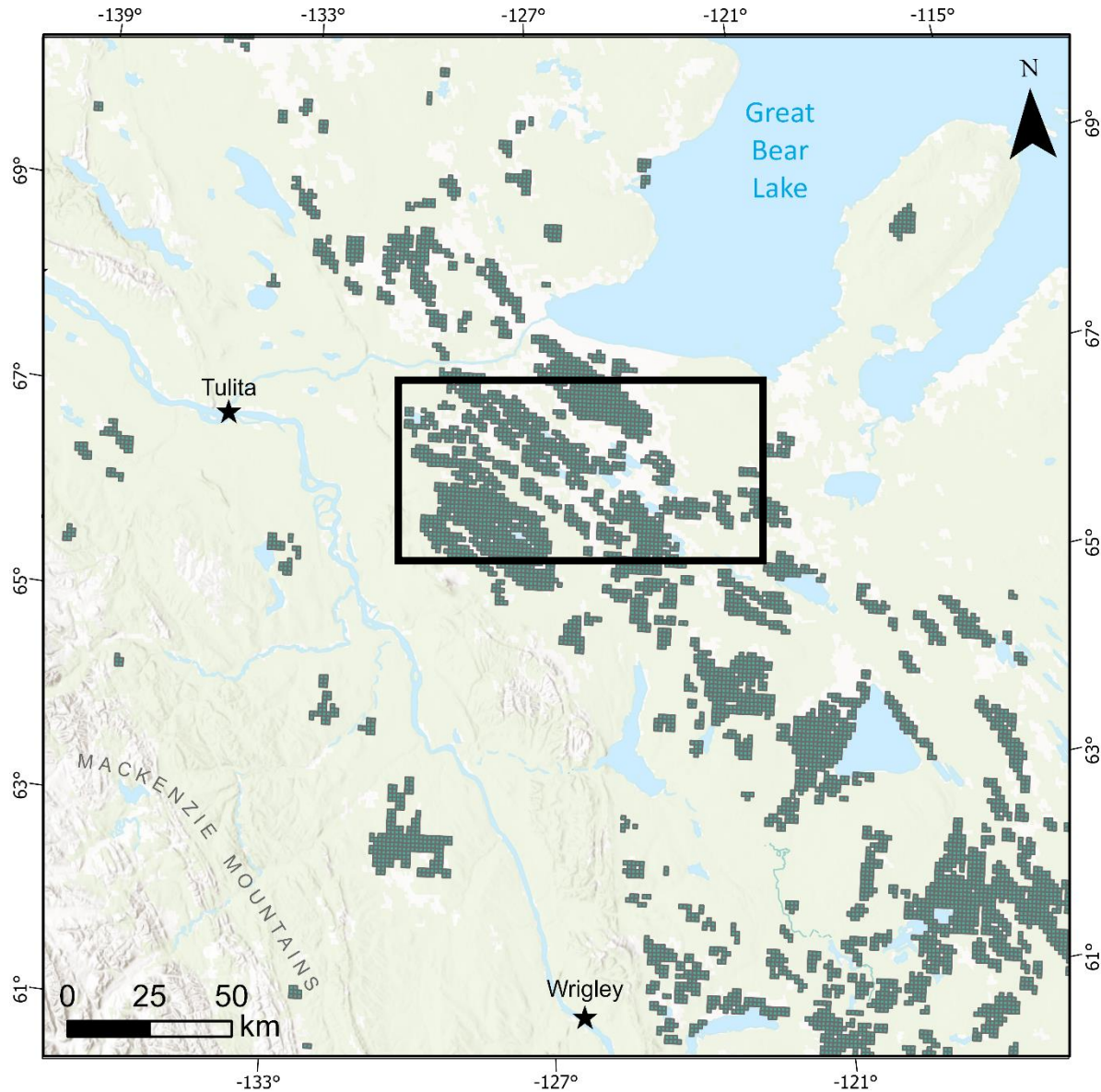
3 different dendritic peat plateaus monitored

- 8 Boreholes were recovered;
- 12 electrical resistivity tomography surveys (ERT) were carried out;
- 4 ground monitoring stations were installed;
- Basal peat sent for radiocarbon dating.

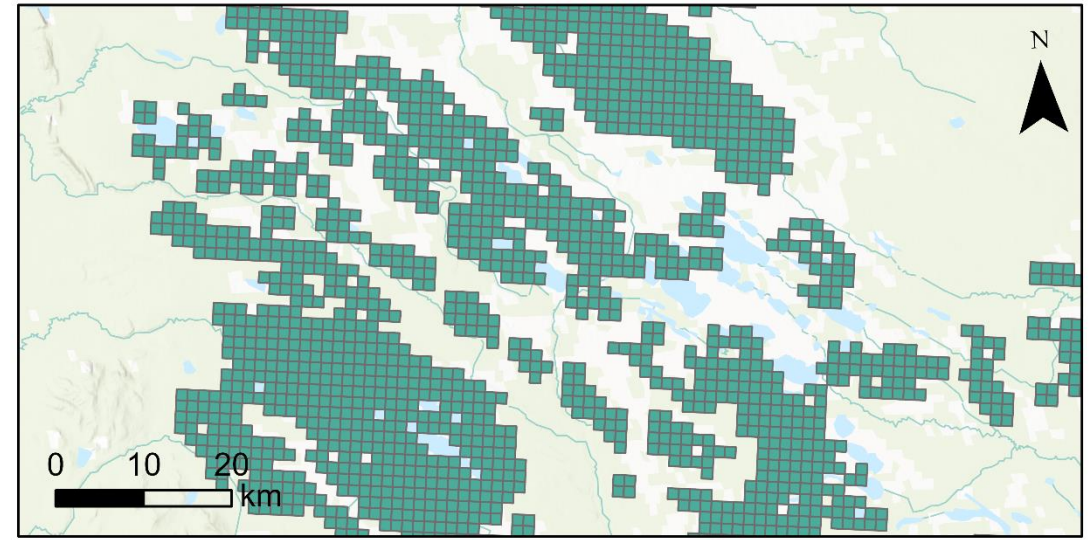


Longitudinal section of permafrost cores collected from the dendritic peat plateau.

LARGE SCALE – LANDFORM MAPPING AND SPATIO-TEMPORAL ANALYSIS (REMOTE-SENSING)



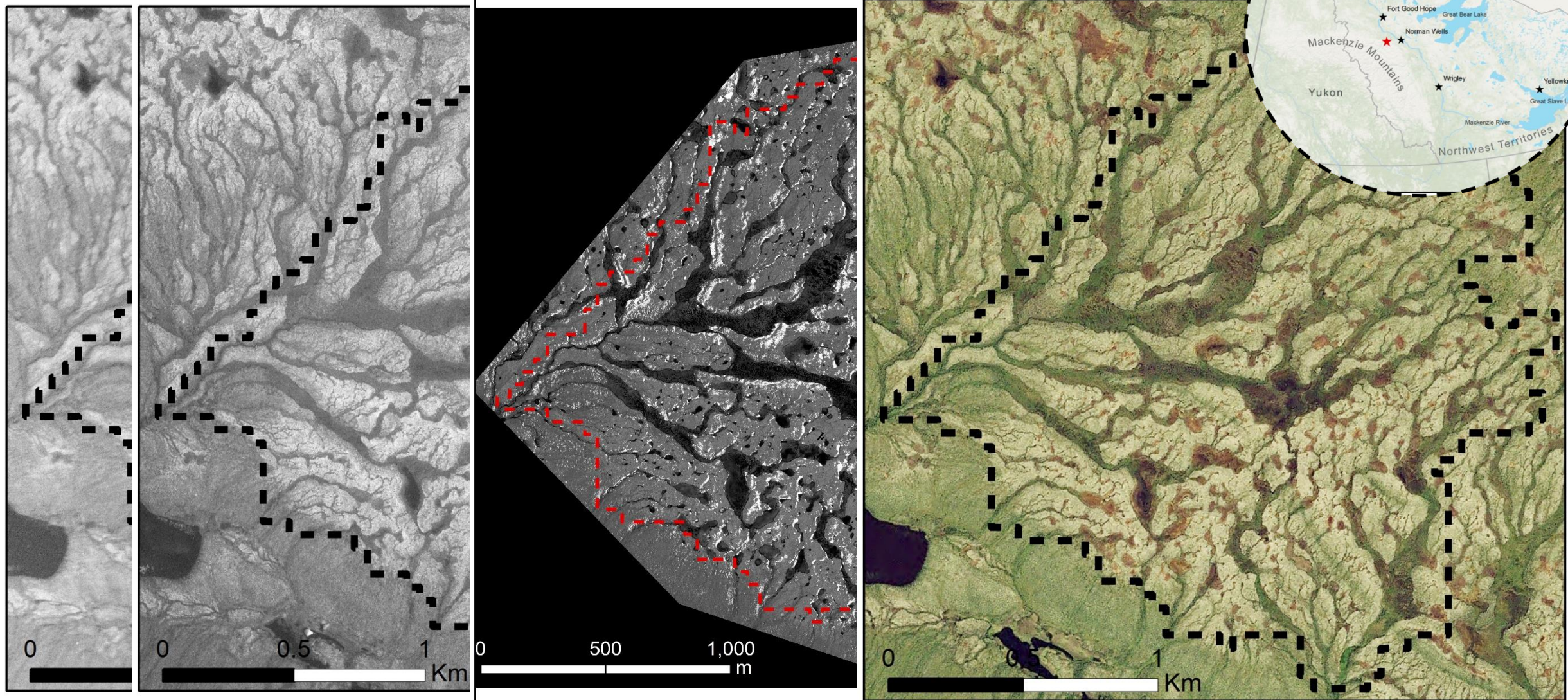
Landform mapping of the dendritic peat plateau.



Gridcell (1.25x51.25 km) covering Sahtu Settlement

Presence	Degree of degradation	Slope	Elevation	Fire history
Yes	Low	°	m	Yes
No	Moderate	-	-	No
-	High	-	-	-
-	Severe (very high)	-	-	-

FINE-SCALE – LANDFORM MAPPING AND SPATIO-TEMPORAL ANALYSIS (REMOTE-SENSING)



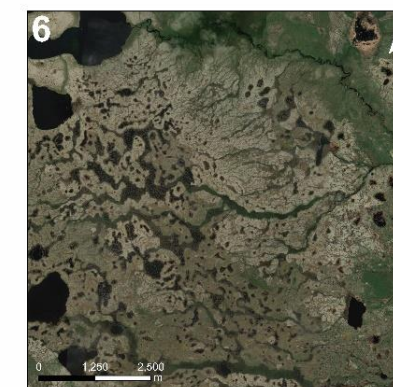
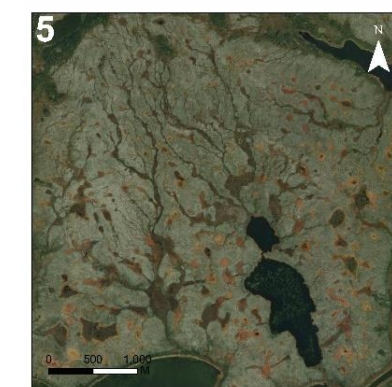
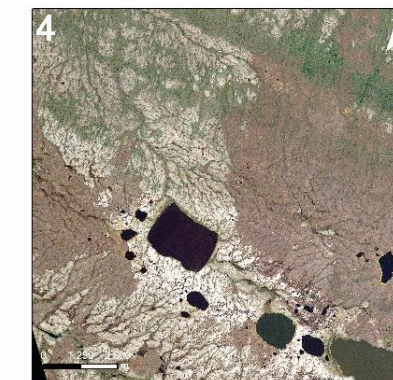
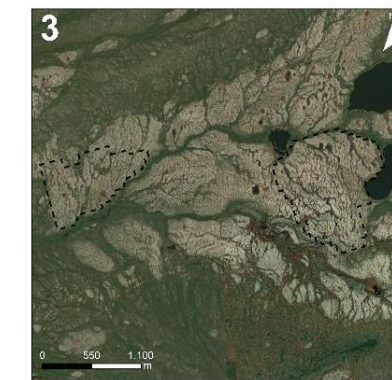
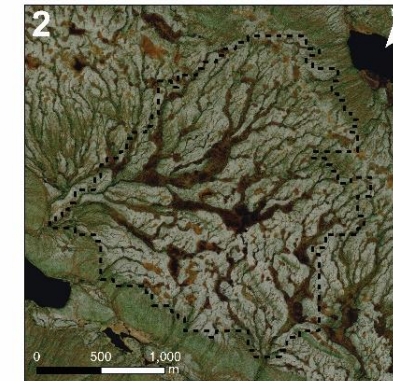
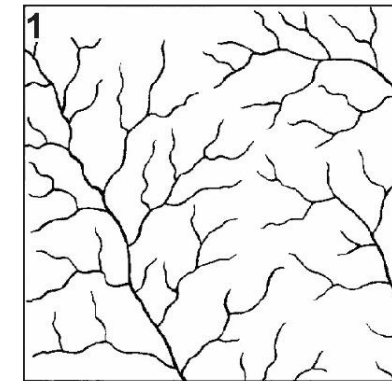
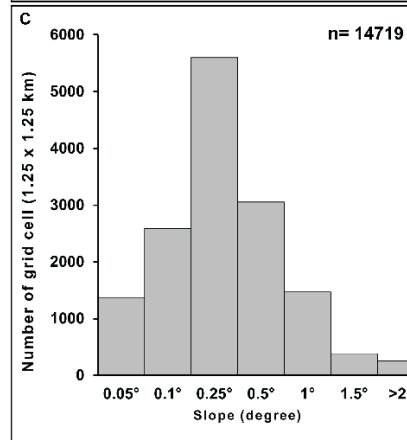
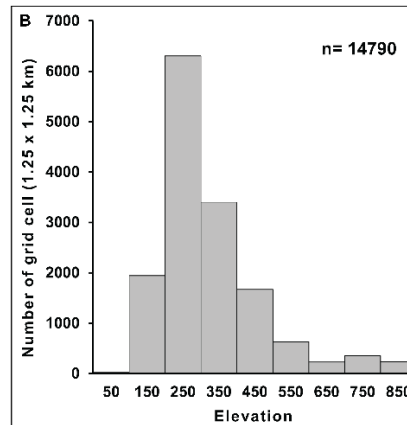
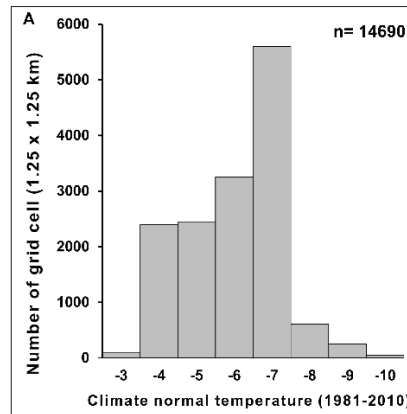
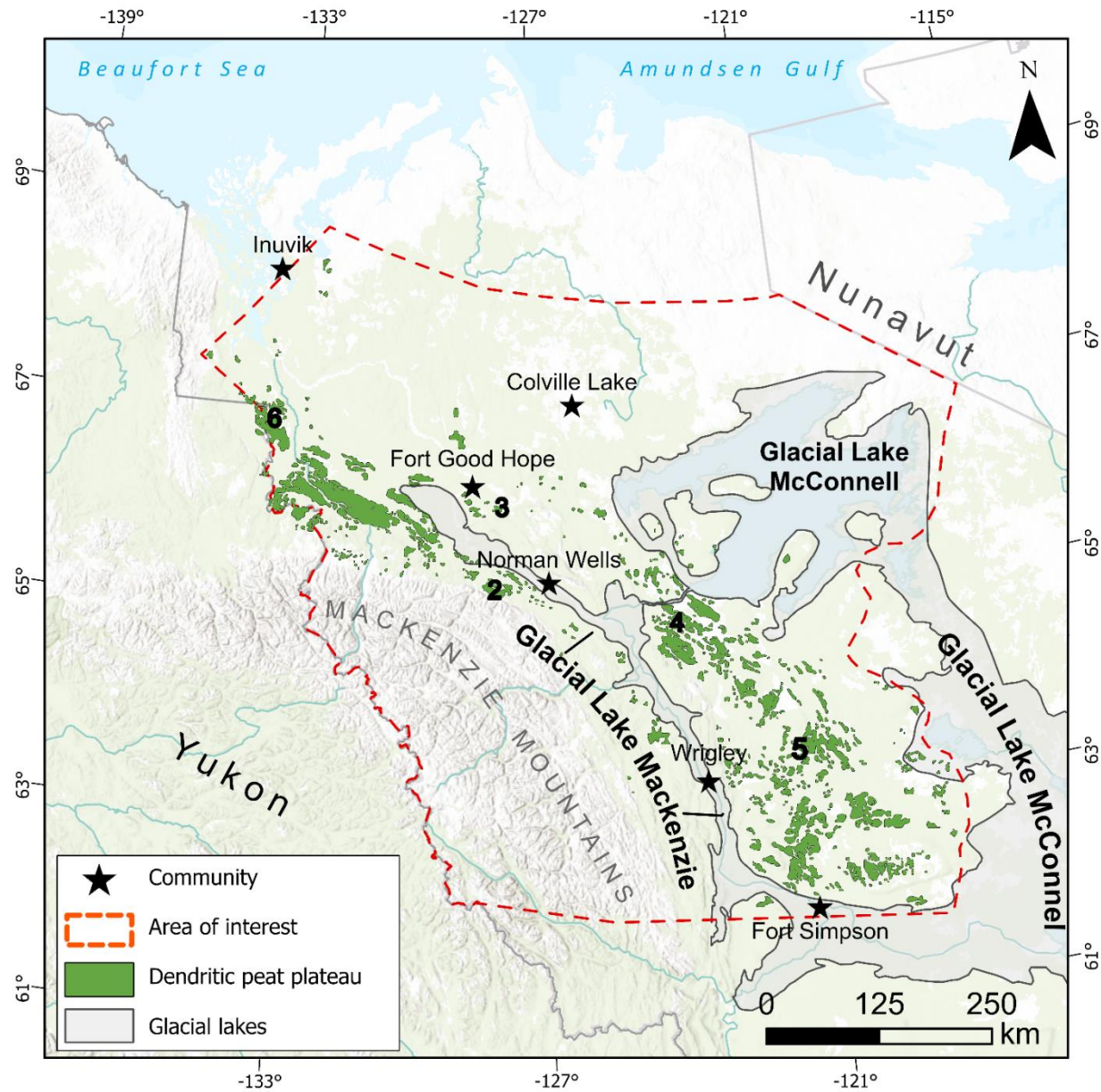
1949

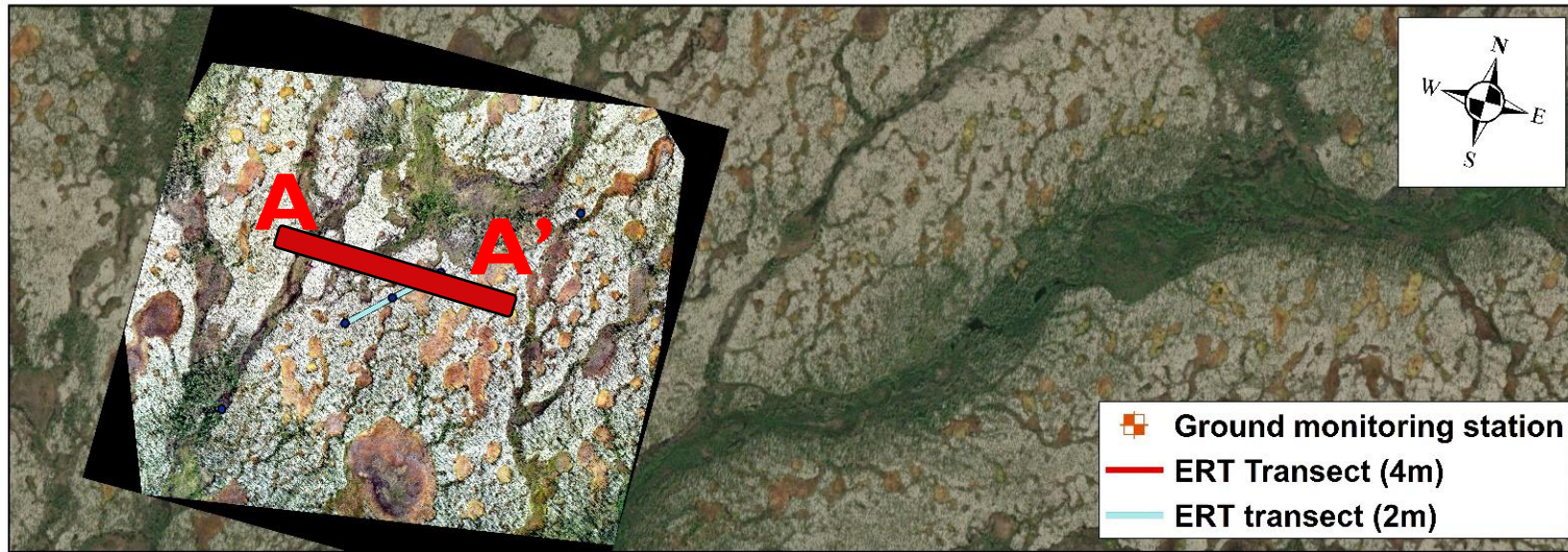
1970

2011

2018

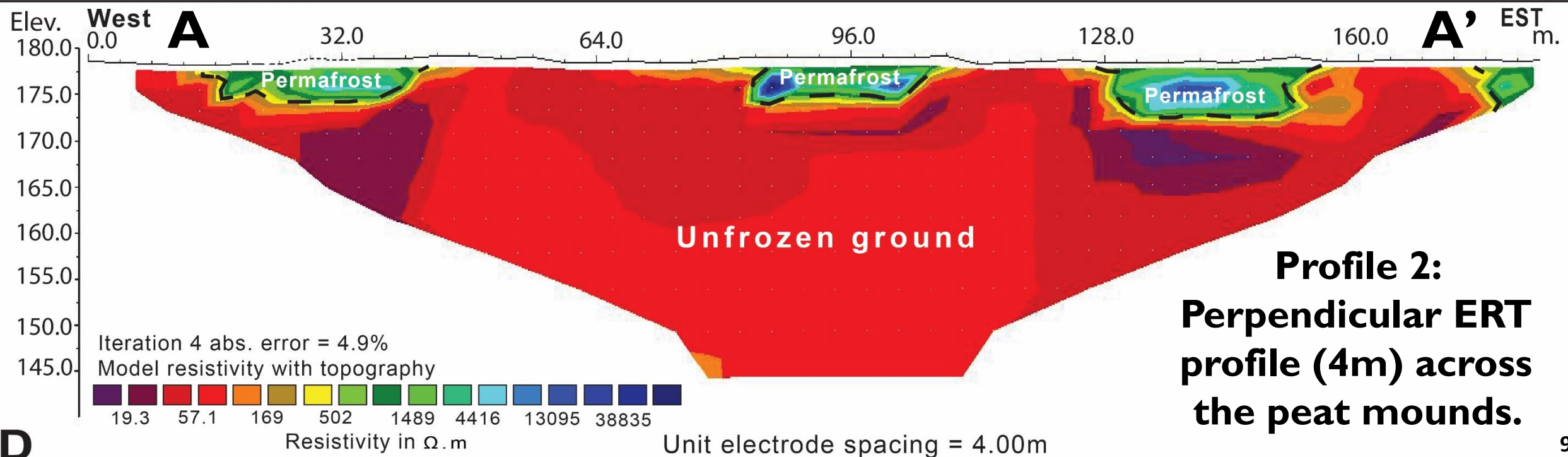
LANDFORM MAPPING AND SPATIO-TEMPORAL ANALYSIS



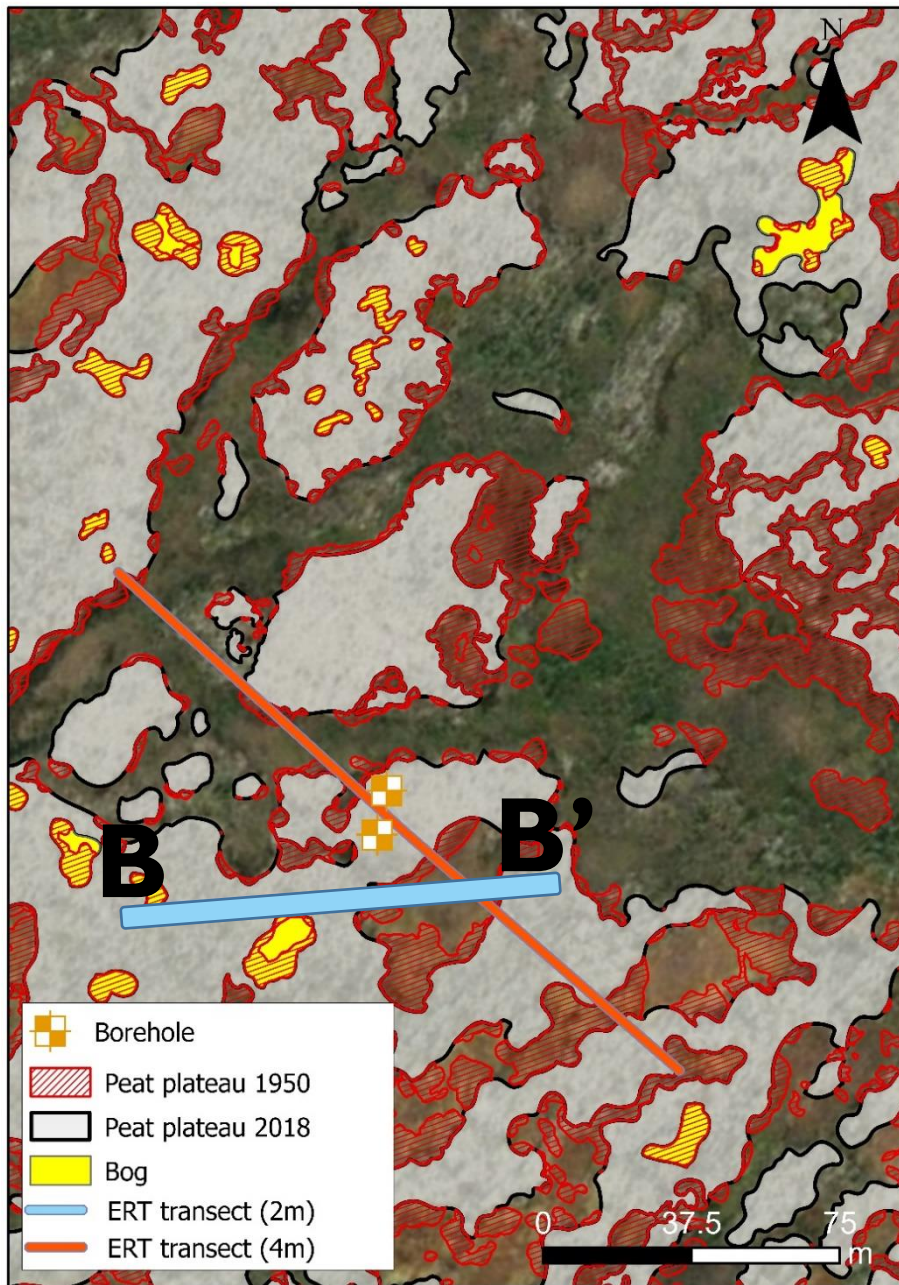


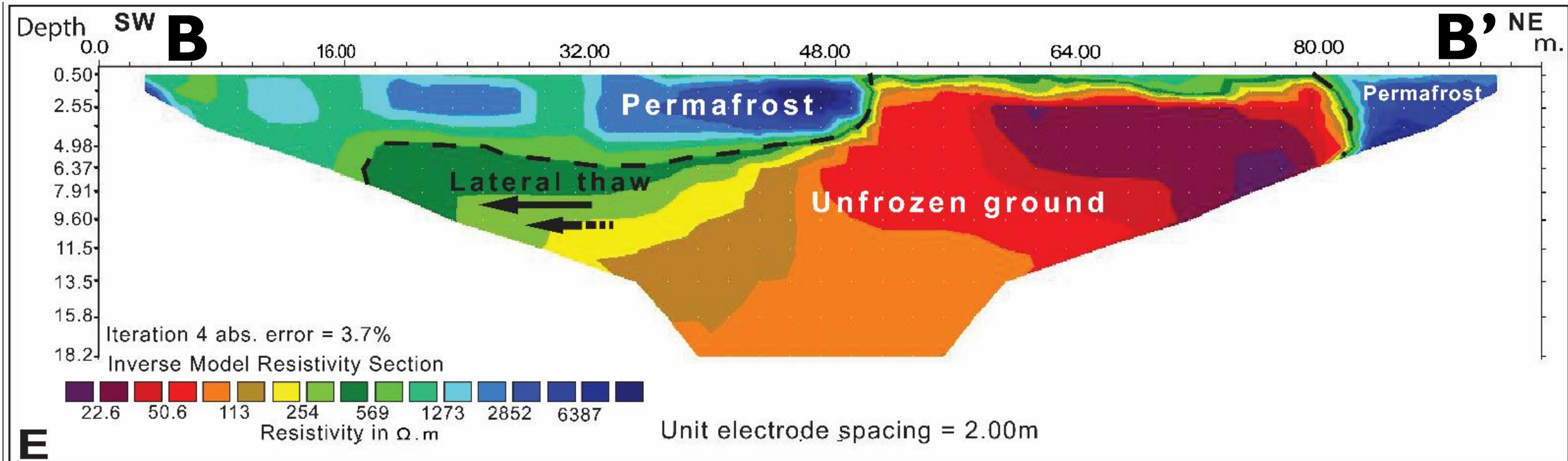
Dendritic peat plateau
– Lower section

Mechanisms of DPP degradation



2 m spacing electrode survey

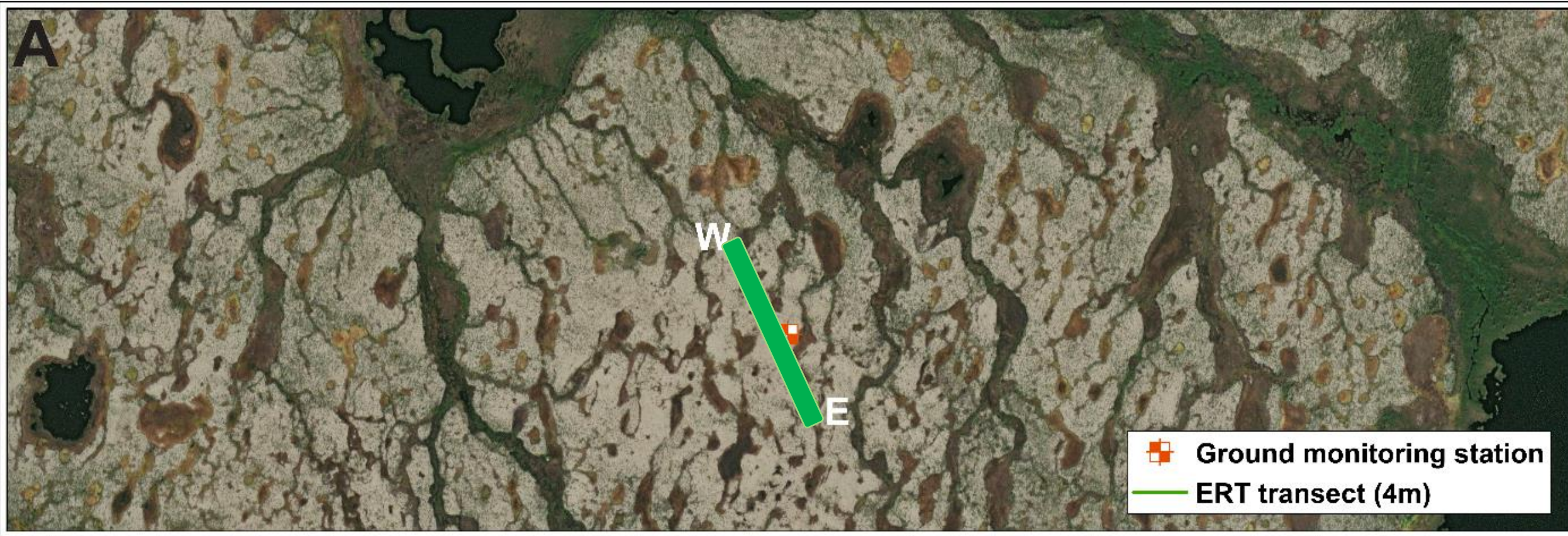




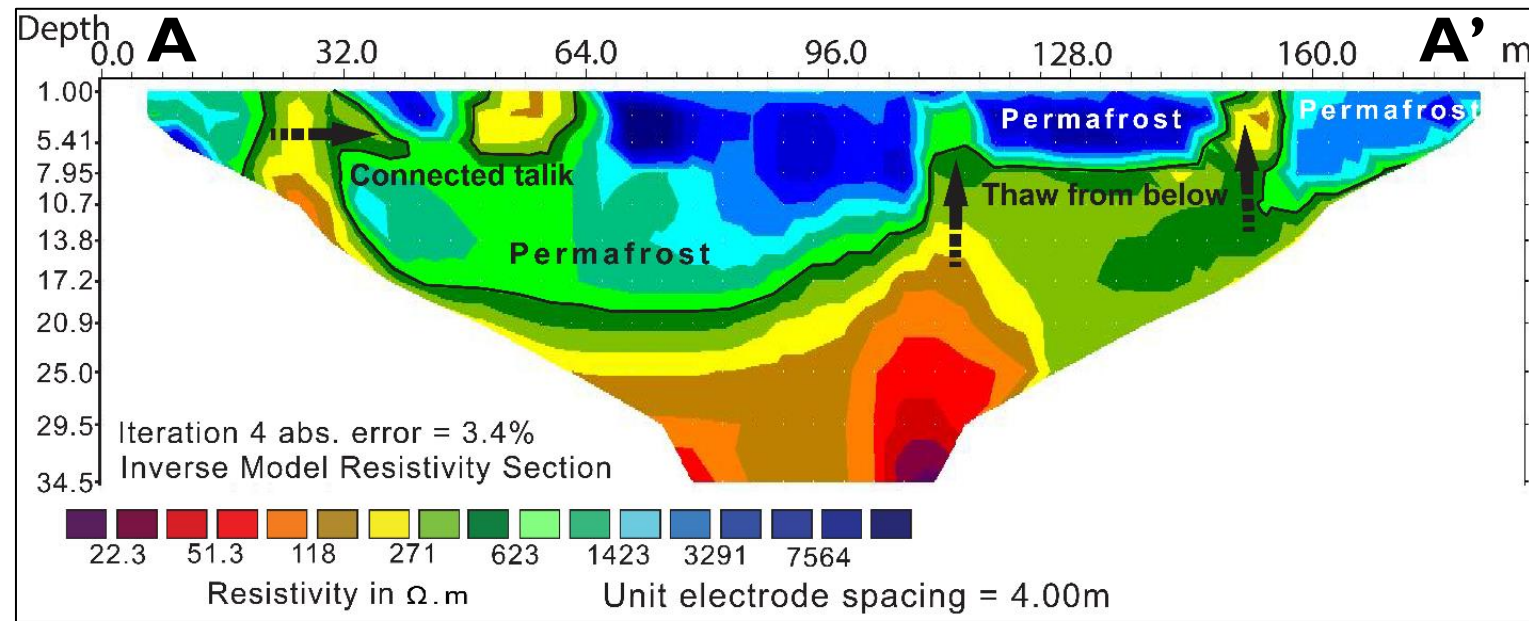
ERT profile (2m) across a peat mound and the edge of a plateau.

Mechanisms of PPD degradation

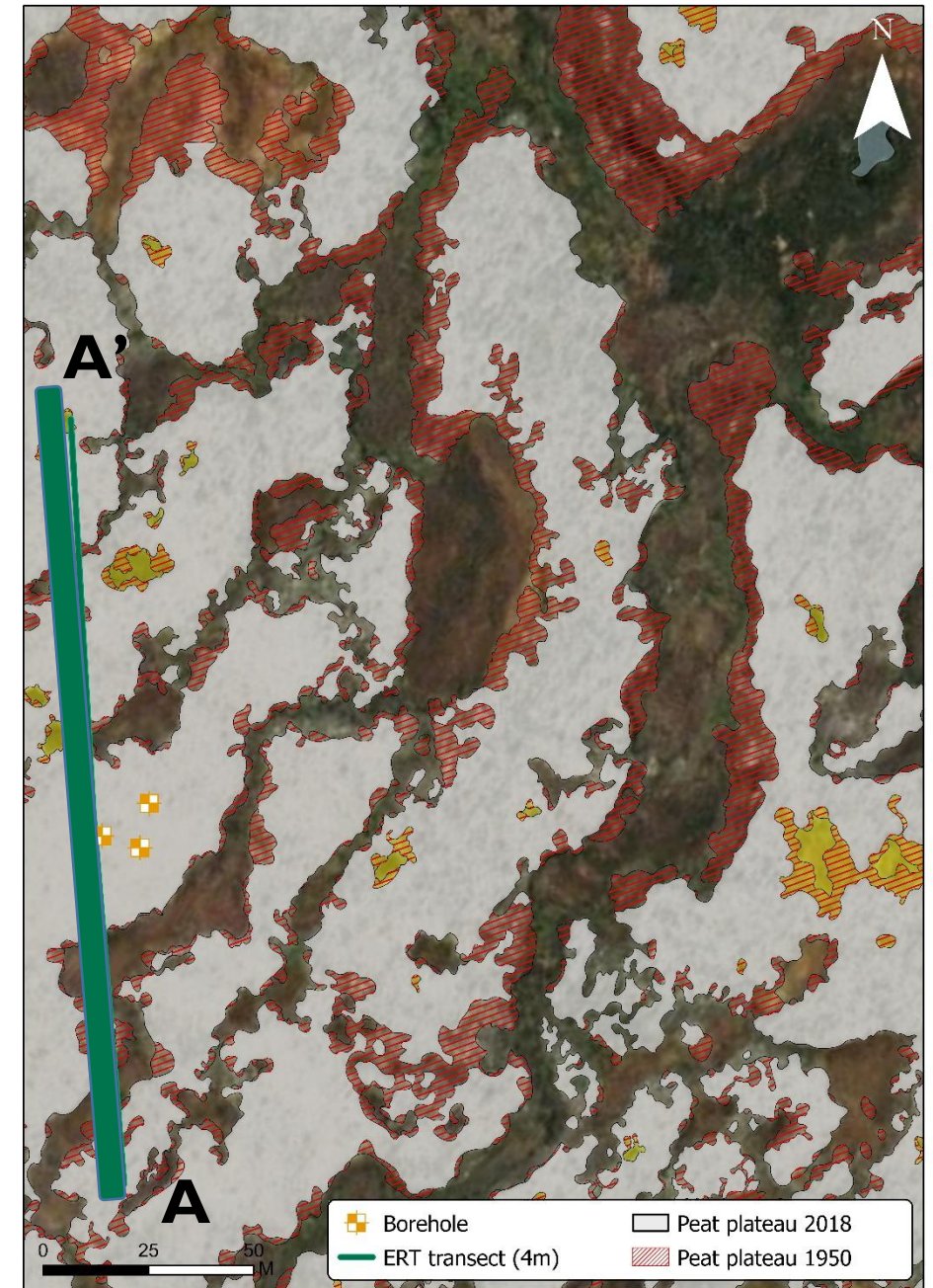
Dendritic peat plateau – Upper section



4-m spacing electrode survey

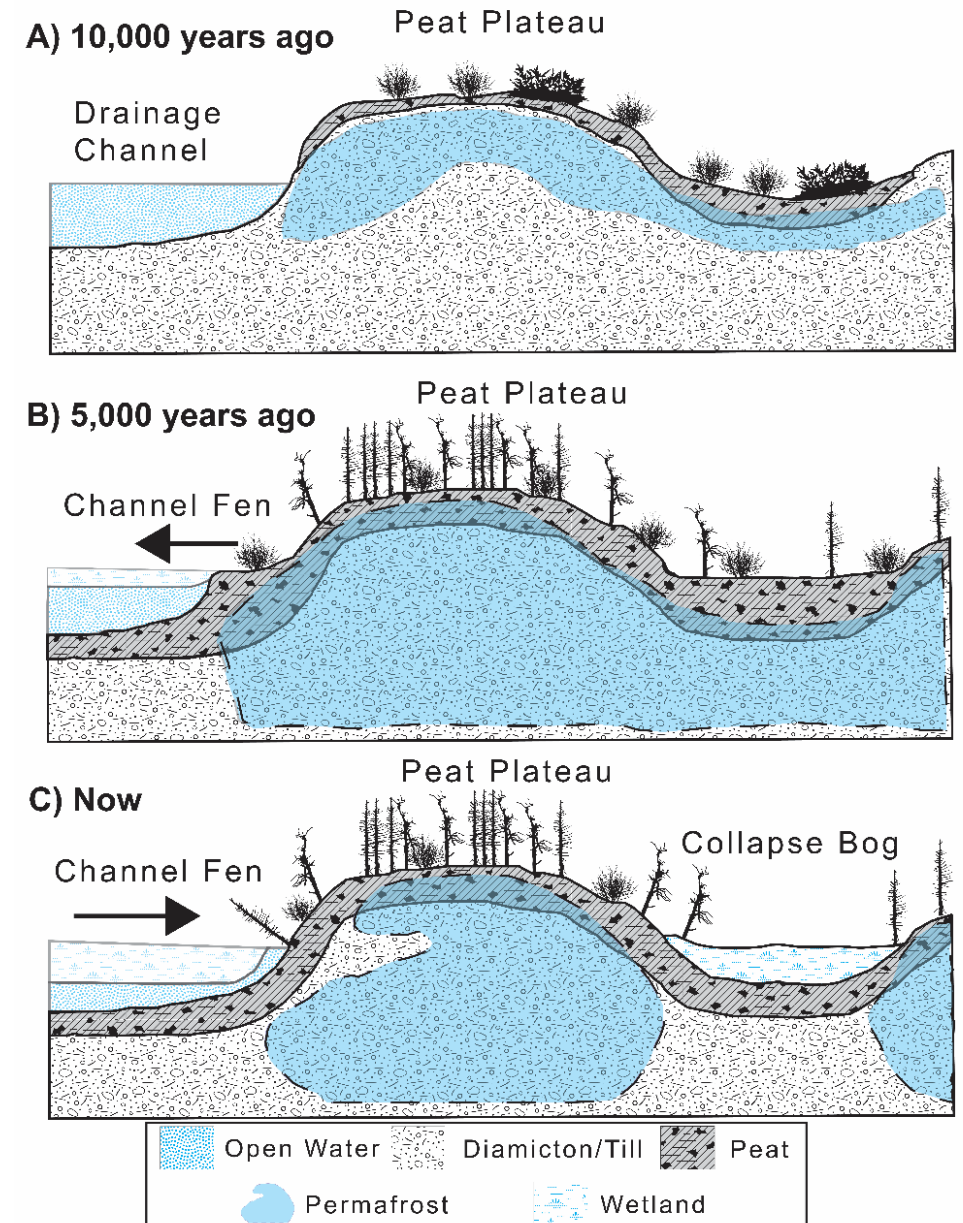


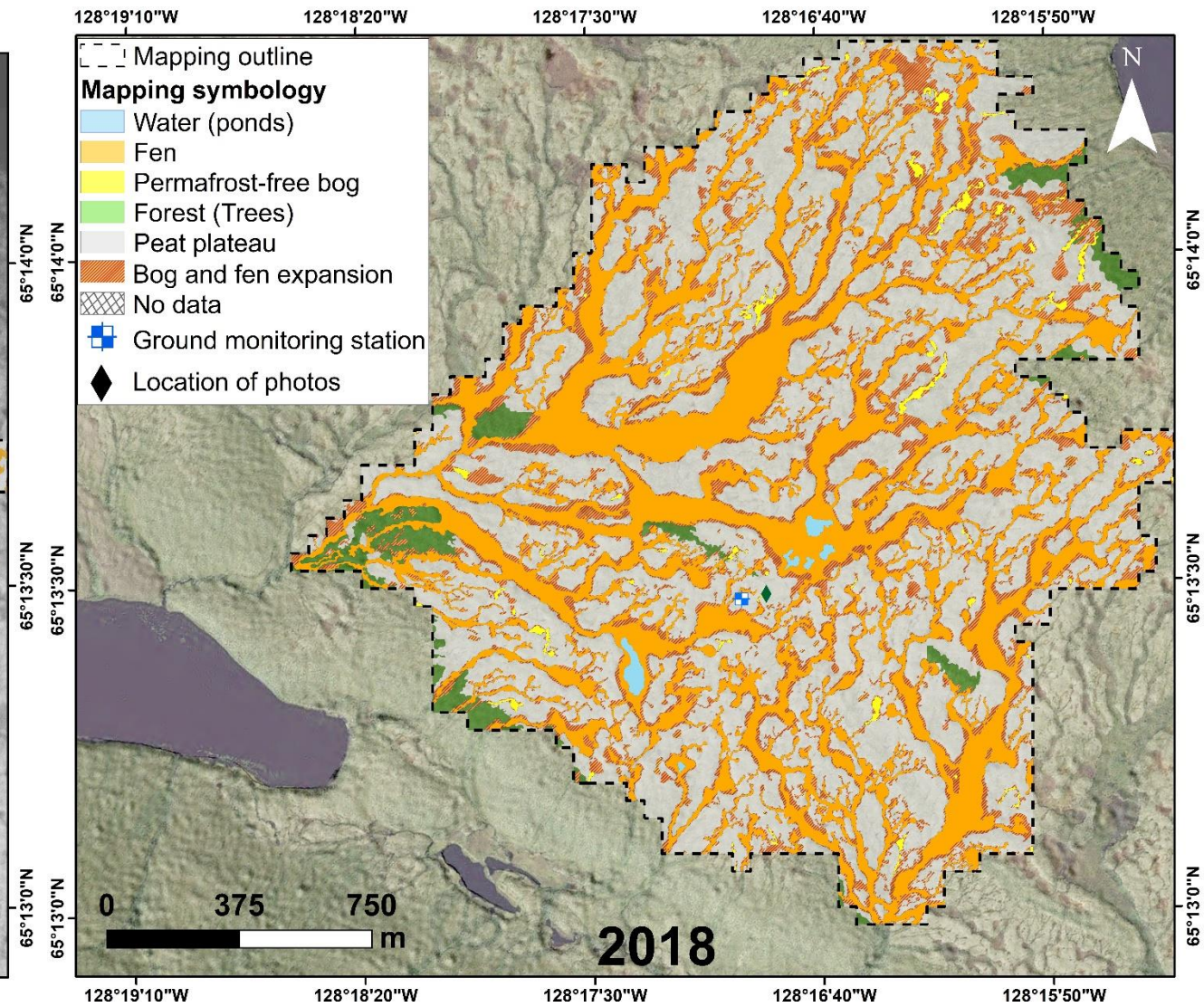
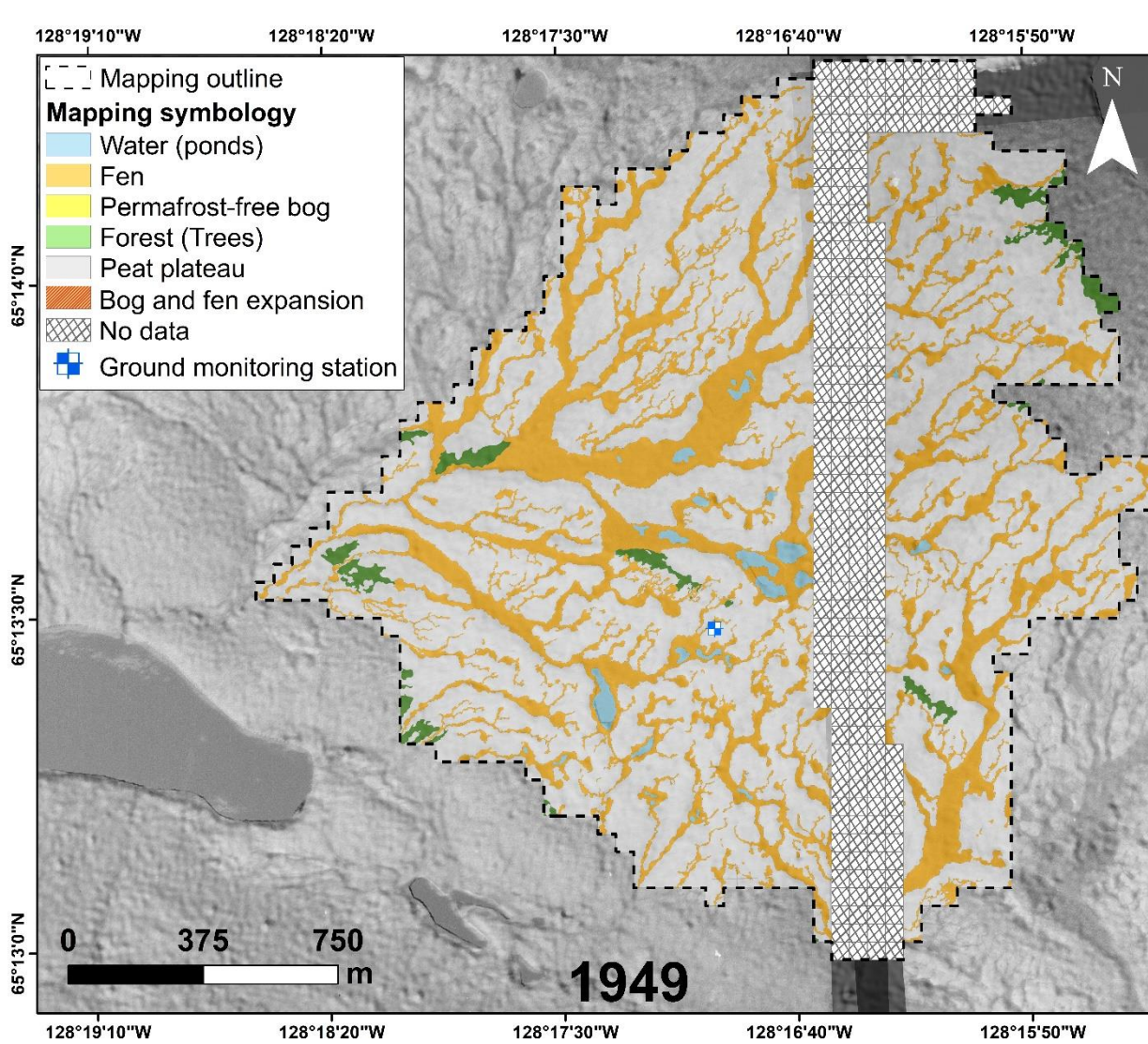
- Thaw from below or the top of the peat plateaus from the bogs.
- Connected talik



Basal peat ages of around 10,194 and 9,307 cal. yr. BP for FGH and Mackenzie Mountains, respectively.

- 10,000 years ago: Peat inception around dendritic fluvial drainage channel.
- 5,000 years ago: Peat expanded into the channels. Grow of dendritic peat plateaus
- Now: Channelized fens have begun to expand along the edges. Loss of peat plateau area.
- Relation with glacial Lake Mackenzie and McConnel.



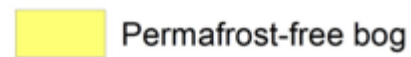


Dendritic Peat Plateau Network

Mapping symbology



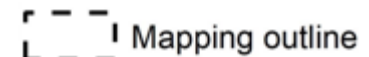
Water (ponds)



Permafrost-free bog



Peat plateau



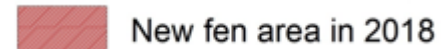
Mapping outline



Fen

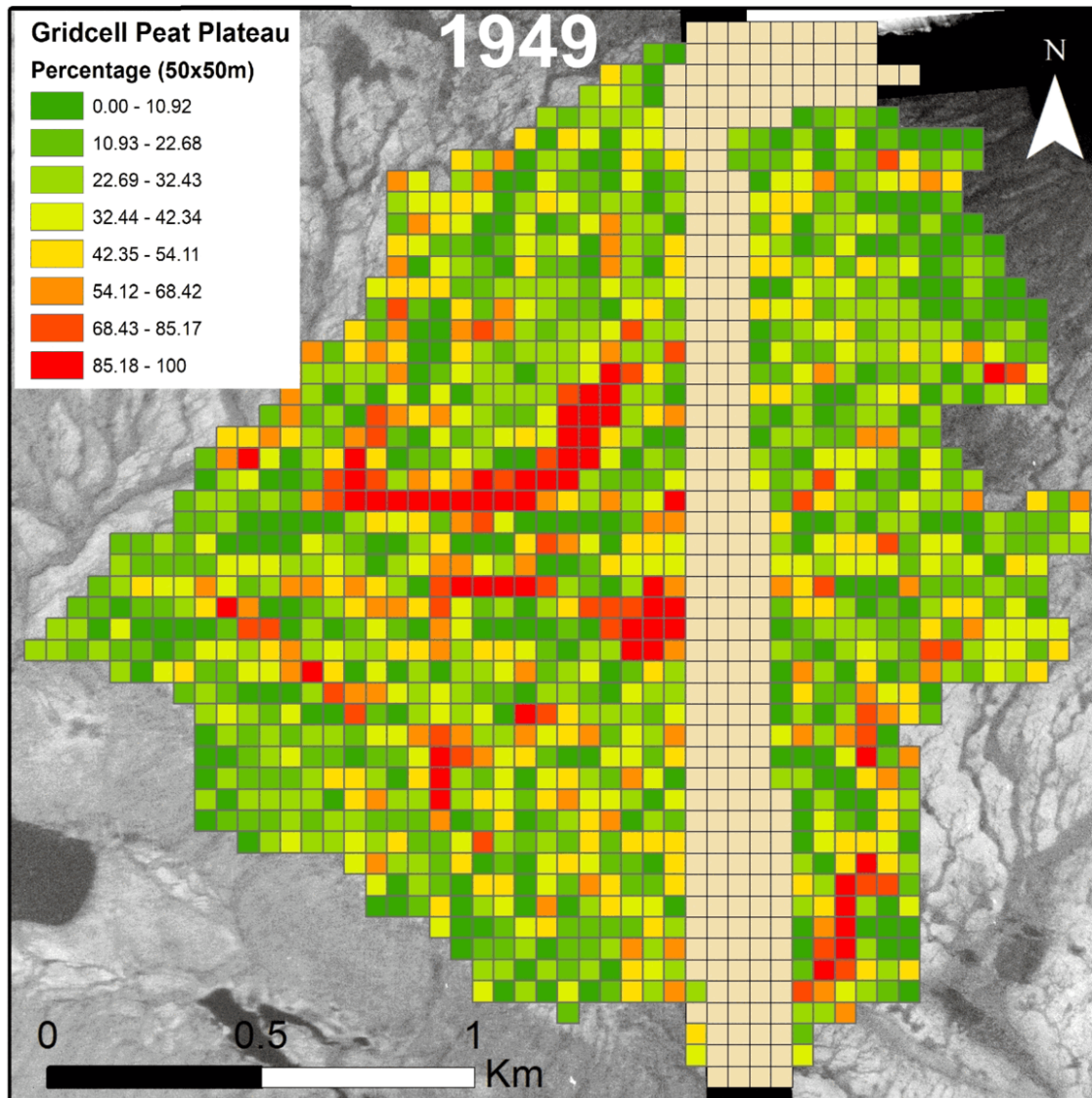


Forest (Trees)

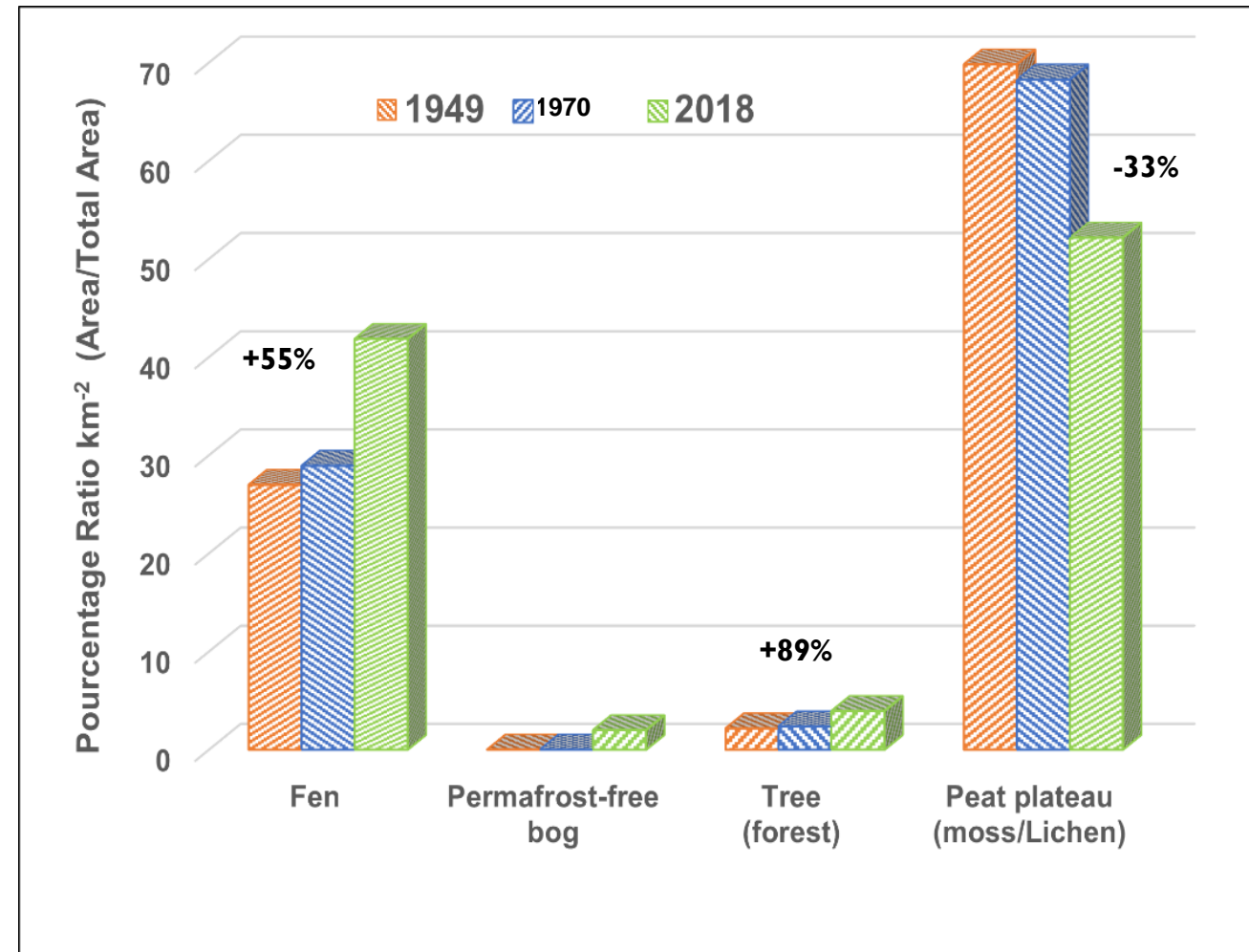


New fen area in 2018

Change over time (1949-2018)



Percentage of degradation in 1949, 1970 and 2018



Proportion of the analyzed area covered by four different classes from 1949 to 2018.



CONCLUSION


General point of the talk

1. First detailed analysis of dendritically-drained peat plateaus, names dendritic peat plateaus, of the central Mackenzie Valley;
2. Peatland initiation (~10,000 - 9,000 cal. BP) started aggraded around dendritic fluvial systems on till deposit. Coincide with glacial Lake Mackenzie/McConnell;
3. DPPs cover ~24,000 km² of the NWT. Low elevations (~300m) and MAAT between -6°C and -7°C. Gentle sloping terrain where the gradient is < than 0.50°;
4. Peat plateaus degradation mechanisms driven: 1) thermal erosion of the plateau edges from the ice-rich diamict deposit underlying the peat deposit, 2) also by the formation of ponds within the peat plateaus.

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ualberta**north**



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Canada

oto: MFFP



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