# Polygon mires on the Yukon Coast, Canada

## vegetation composition and active layer properties

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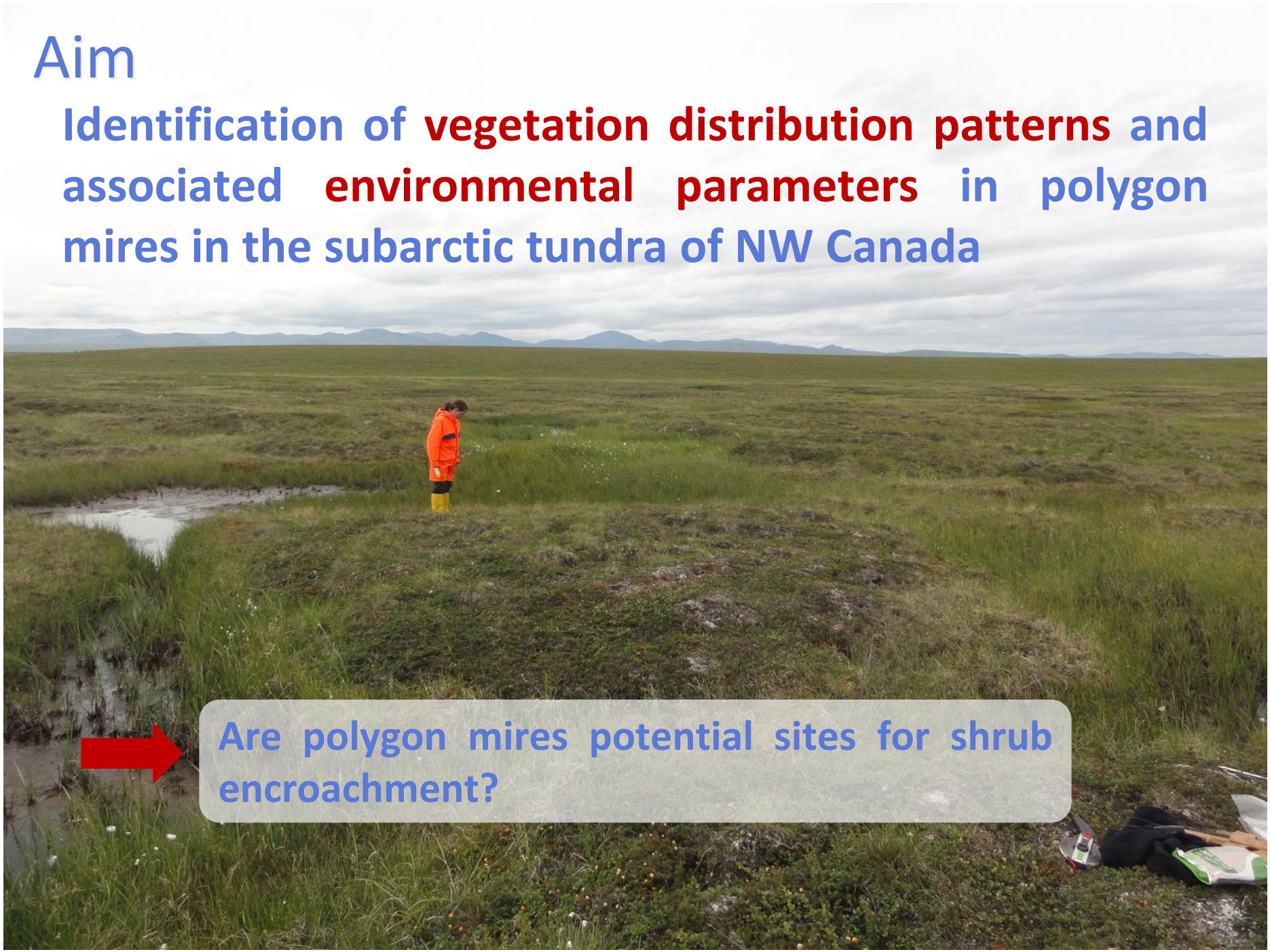
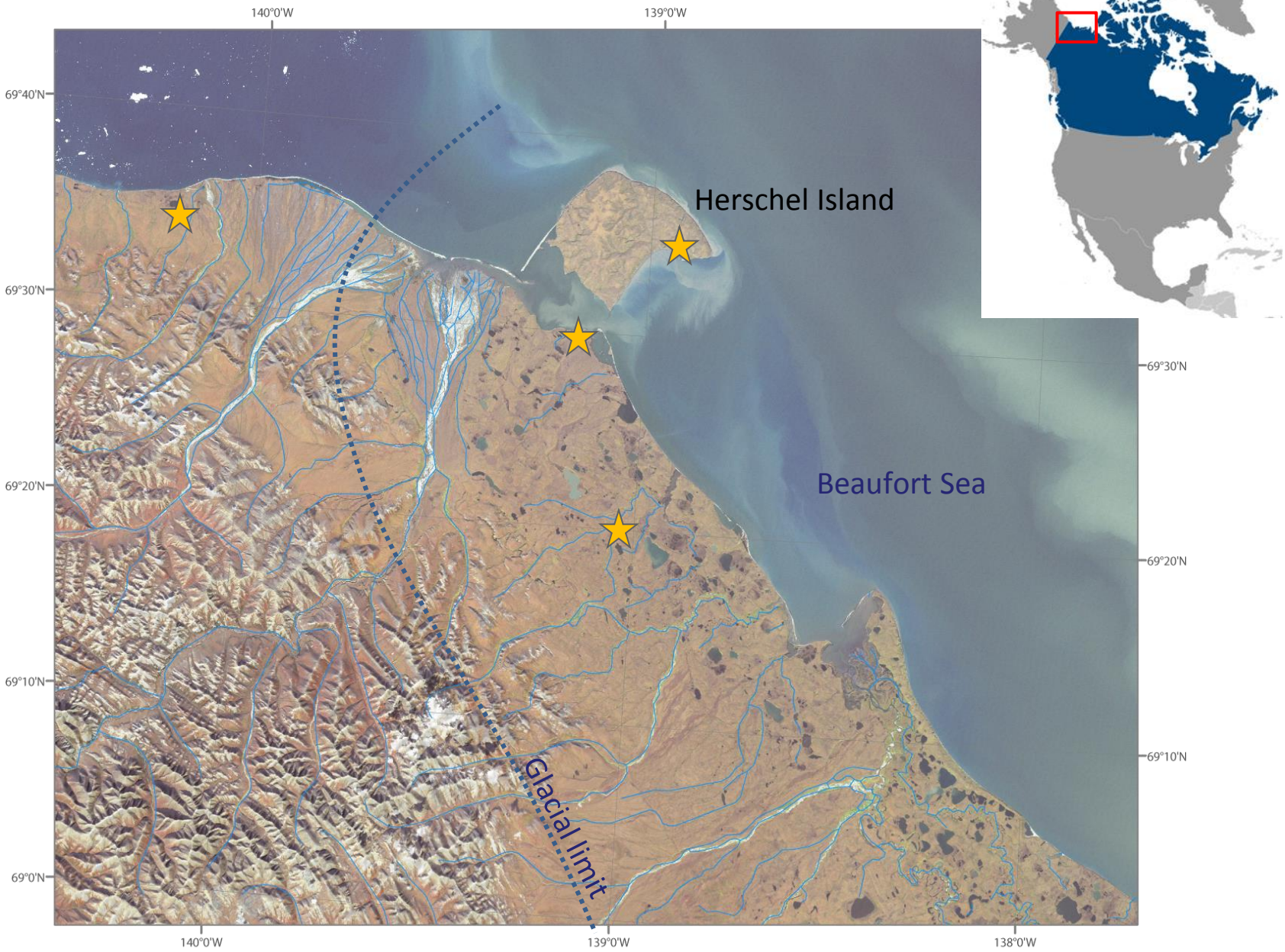
# Aim

**Identification of vegetation distribution patterns and associated environmental parameters in polygon mires in the subarctic tundra of NW Canada**



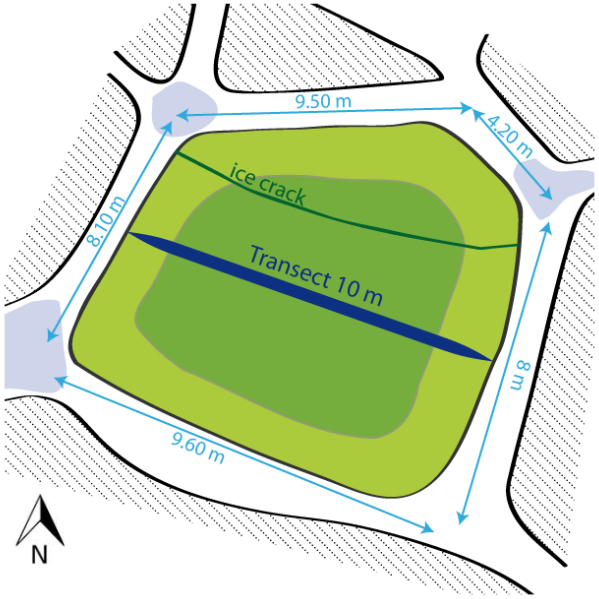
**Are polygon mires potential sites for shrub encroachment?**

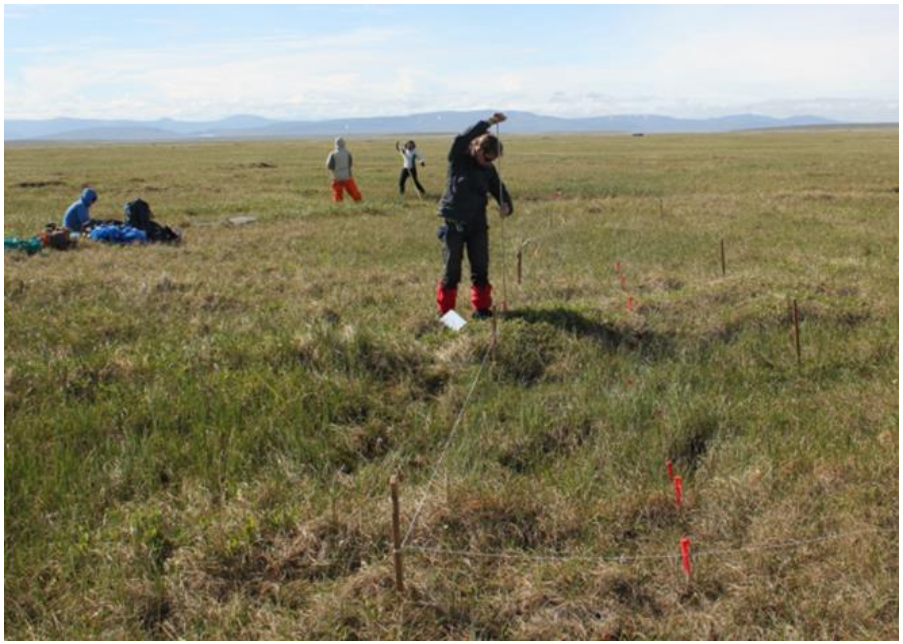
# Study area


140°0'W
139°0'W
69°40'N
69°30'N
69°20'N
69°10'N
69°0'N
Herschel Island
Beaufort Sea
Glacial limit
138°0'W

# Vegetation and environmental parameters

- General morphology
- Relative surface elevation and active layer depth
- Soil temperatures

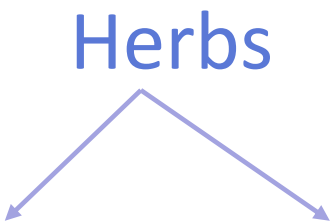


- Sediment surface samples: TOC, TN, TOC/TN, $\delta^{13}C$, pH and conductivity of pore water
- Vegetation survey (relevé after Braun-Blanquet)

# Identification of vegetation distribution patterns and associated environmental parameters in polygon mires in the subarctic tundra of NW Canada

# Plant functional groups




**Shrubs**

Low shrubs 0.4-2m

Erect dwarf shrubs 0.1-0.4 m

Prostrate dwarf shrubs <0.1m

**Forbs**

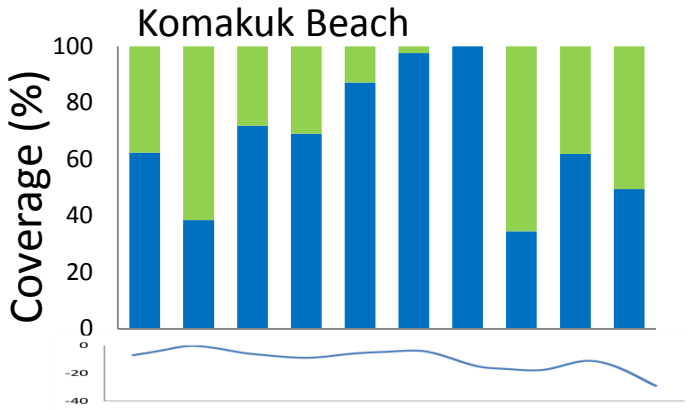
**Graminoids**

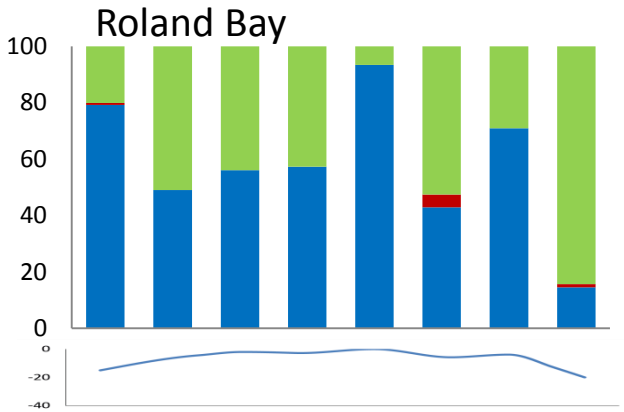
Grasses

Rushes

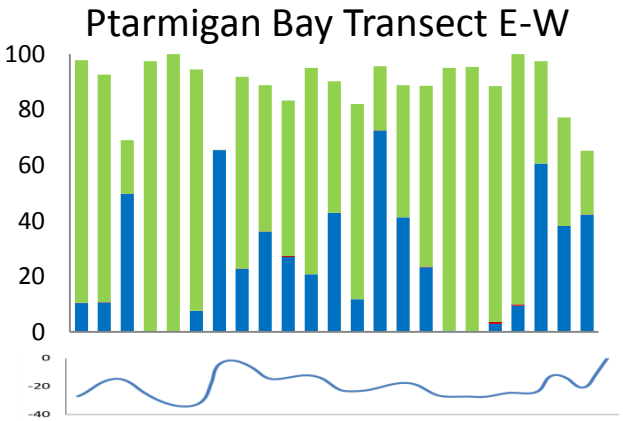
Sedges

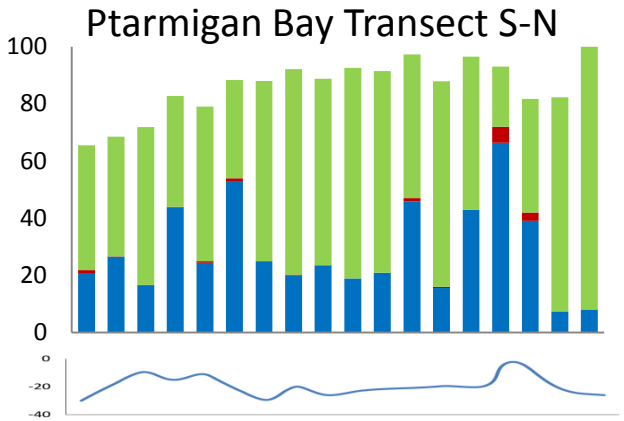
# Vegetation distribution



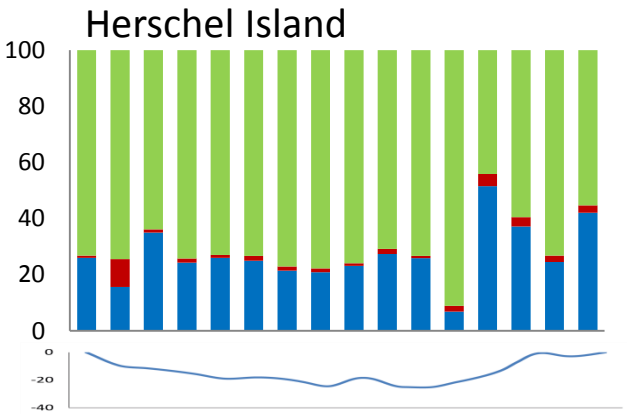




High-centered polygons

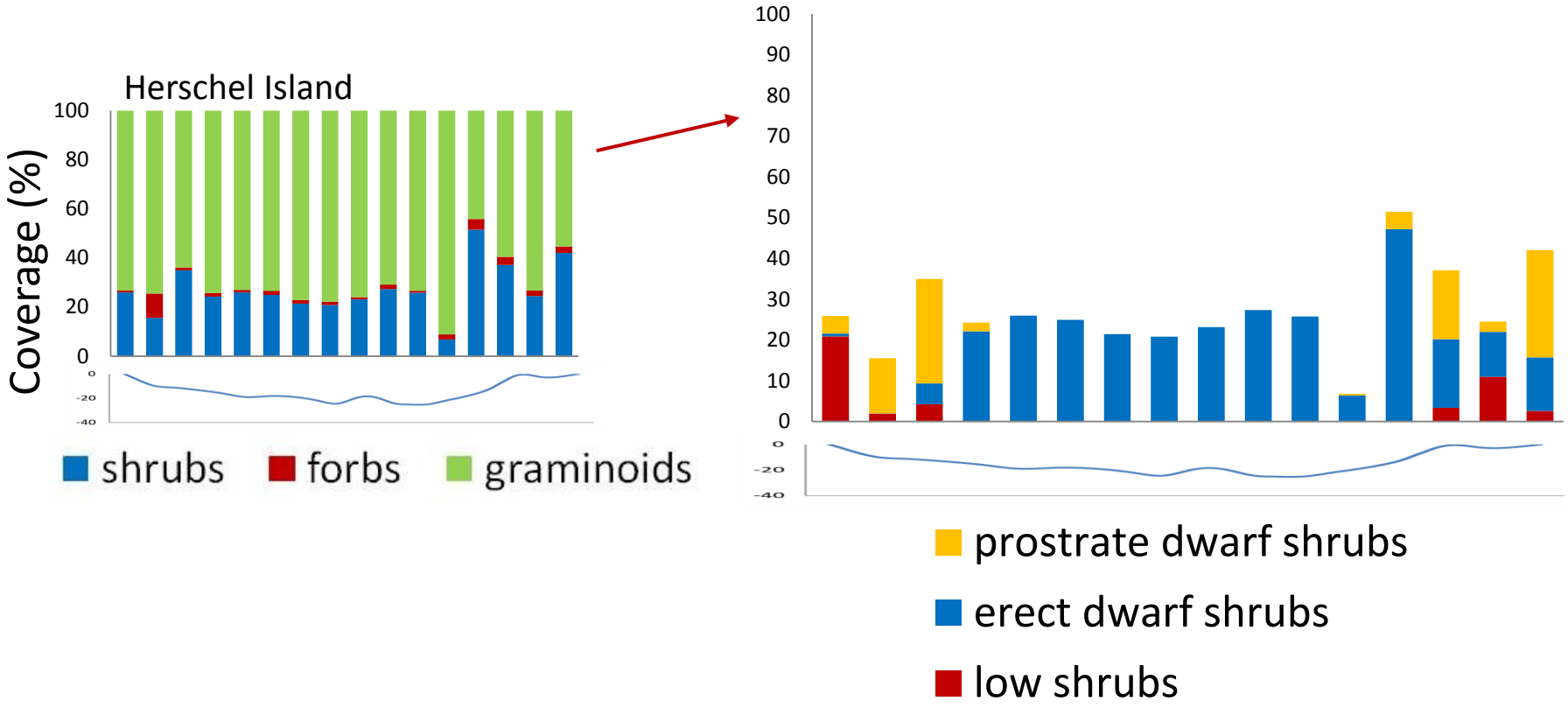


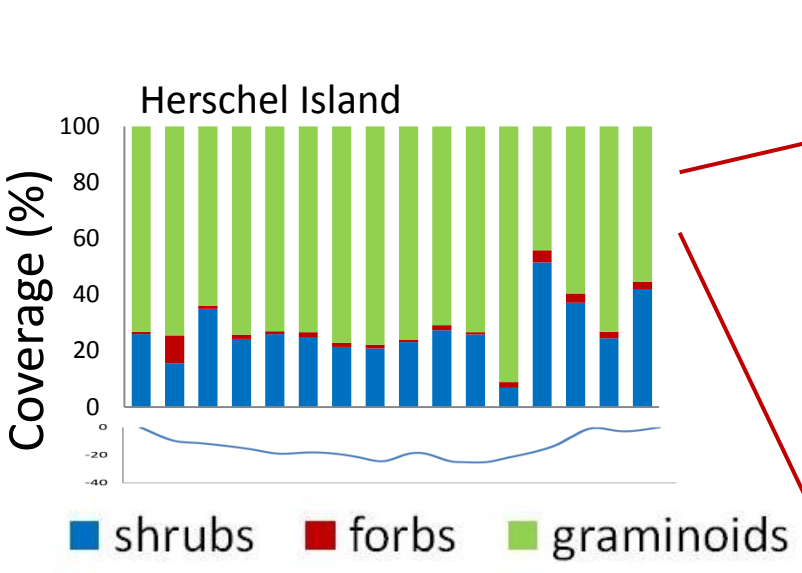



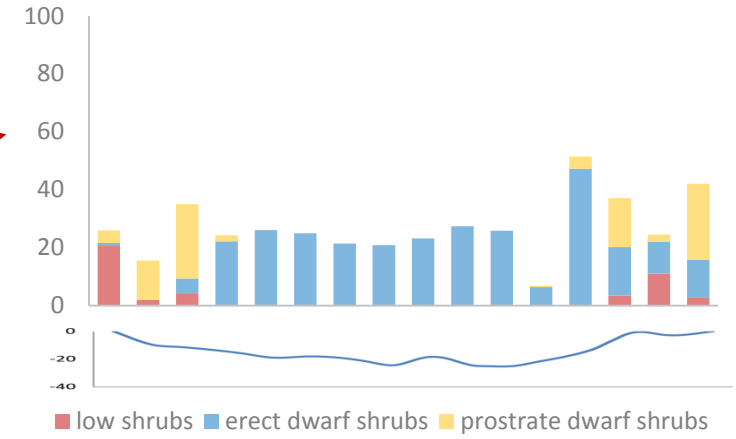

low-centered polygons

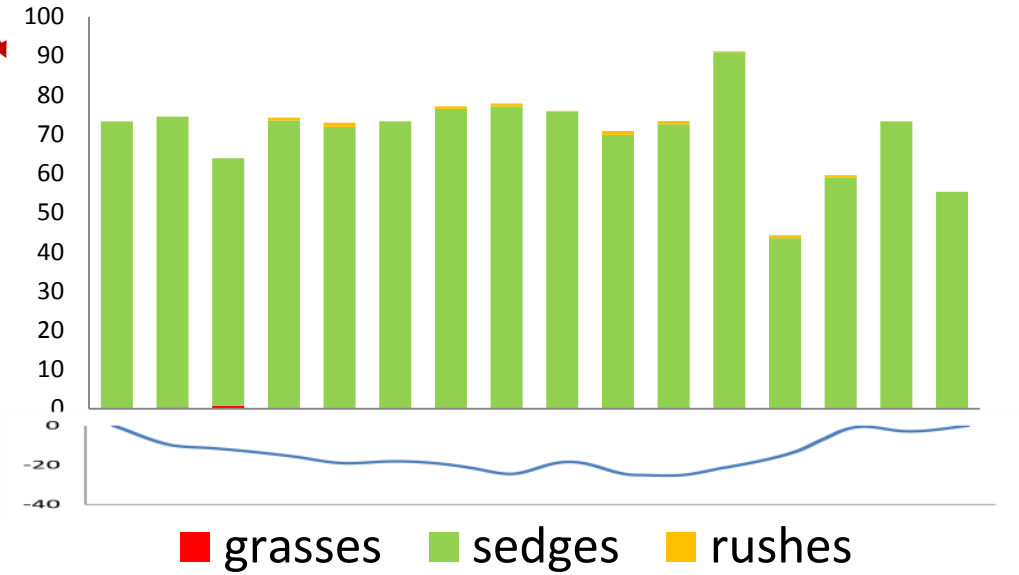


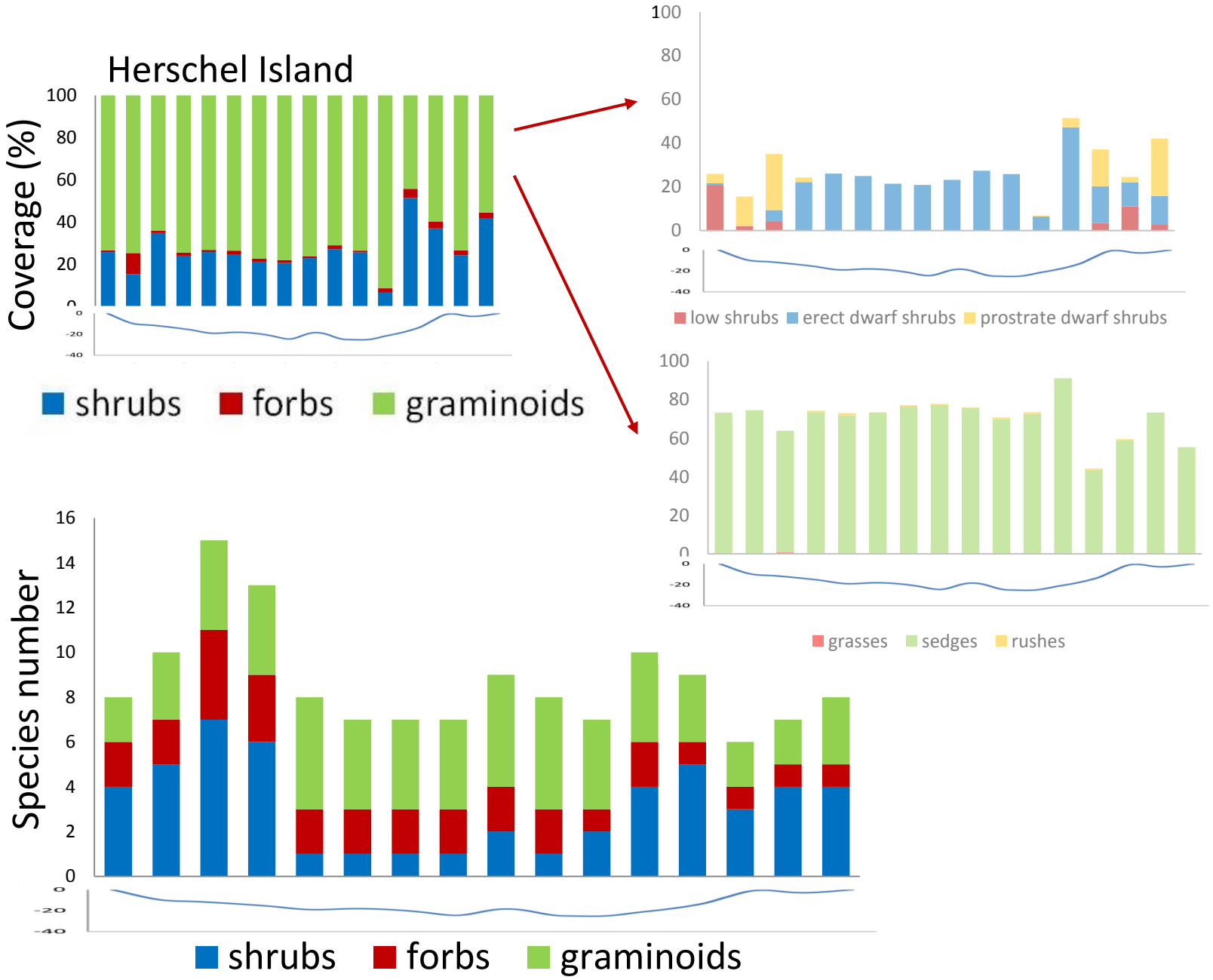

shrubs forbs graminoids


Herschel Island
Coverage (%)
100
80
60
40
20
0
shrubs
forbs
graminoids
100
90
80
70
60
50
40
30
20
10
0
prostrate dwarf shrubs
erect dwarf shrubs
low shrubs

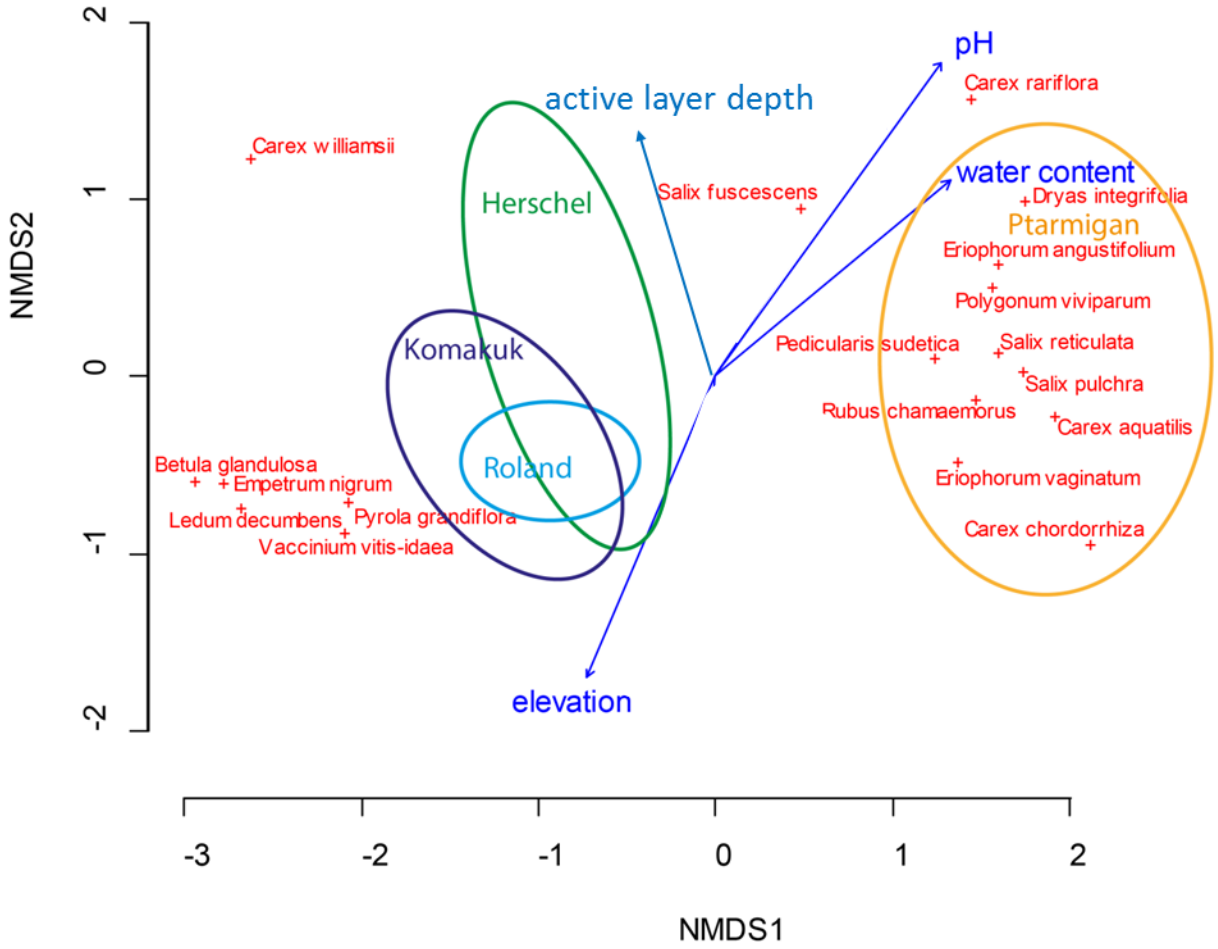

Herschel Island
Coverage (%)
100
80
60
40
20
0
0
-20
-40
shrubs
forbs
graminoids


100
80
60
40
20
0
0
-20
-40
low shrubs
erect dwarf shrubs
prostrate dwarf shrubs


100
90
80
70
60
50
40
30
20
10
0
0
-20
-40
grasses
sedges
rushes


Herschel Island
Coverage (%)
100
80
60
40
20
0
shrubs
forbs
graminoids
low shrubs
erect dwarf shrubs
prostrate dwarf shrubs
grasses
sedges
rushes
Species number
16
14
12
10
8
6
4
2
0
shrubs
forbs
graminoids

# Identification of vegetation distribution patterns and associated environmental parameters in polygon mires in the subarctic tundra of NW Canada




pH

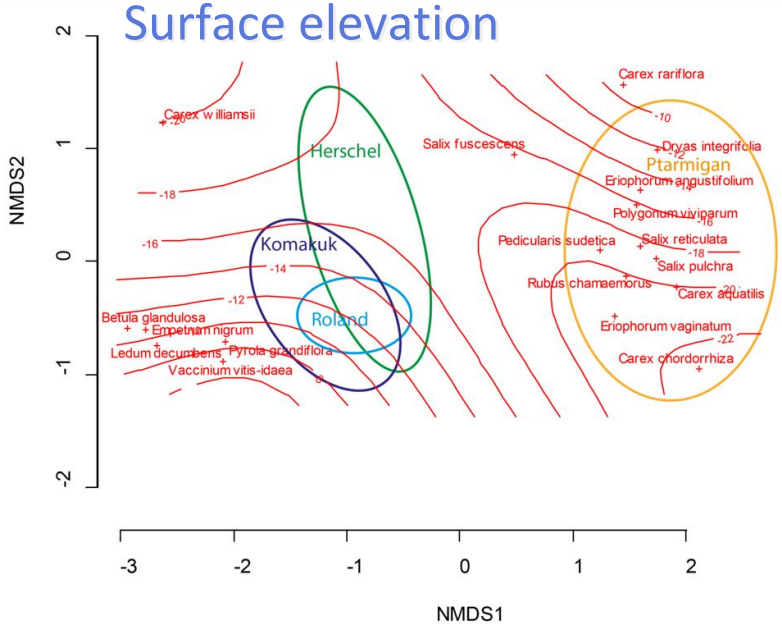
water content

surface elevation

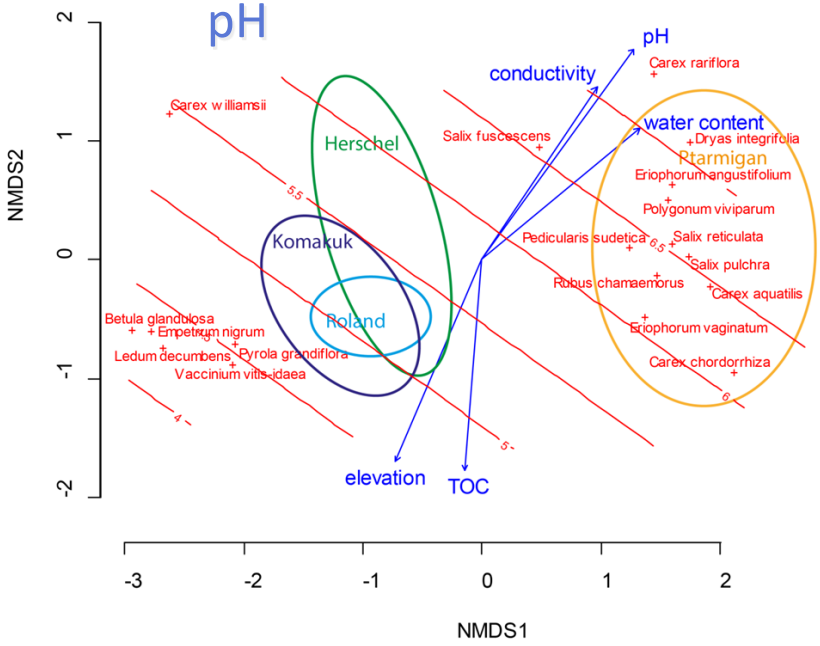
active layer depth

# Environmental parameters

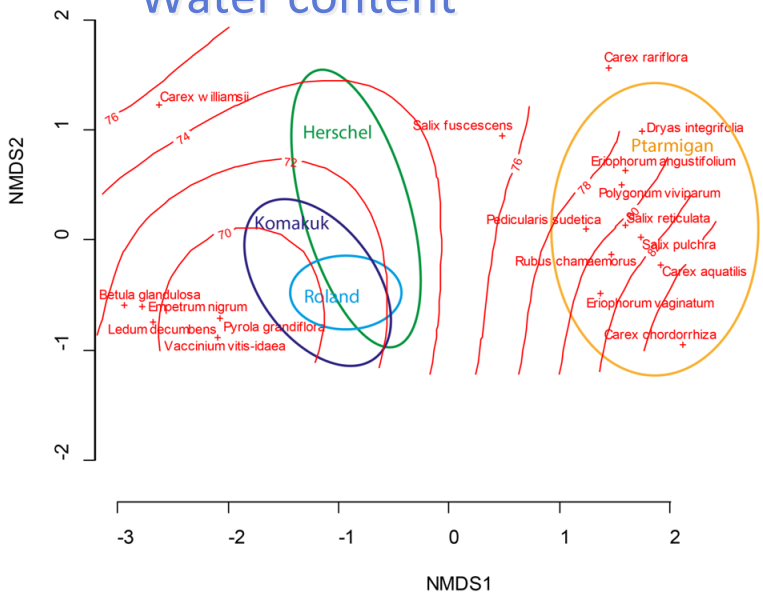
## Surface elevation



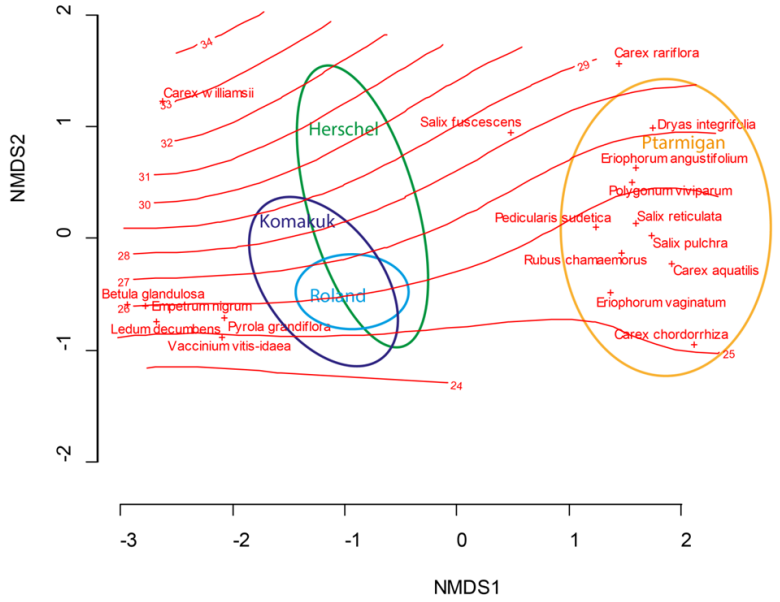

## pH




## Water content

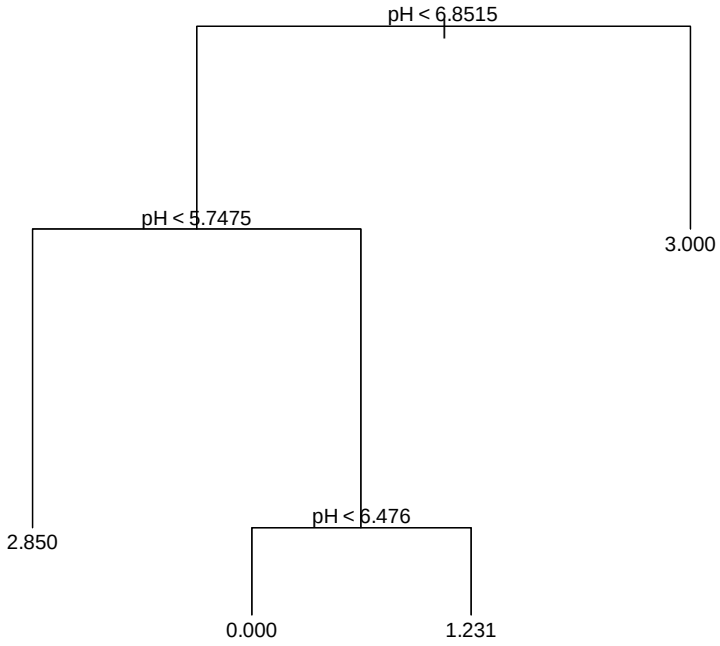


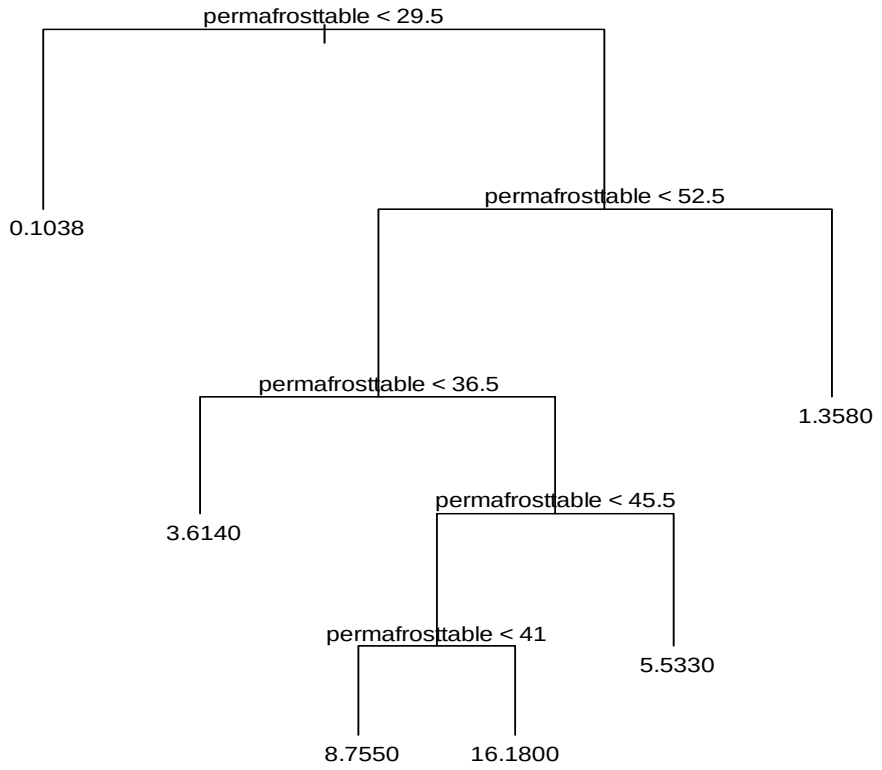

## Active layer depth



# Univariate regression trees

- Identifying boundaries



# Where do the shrub species grow?

## Microtopography (surface elevation)

- Elevated ranges: 0 to -10 cm (mesic sites)
- Transitional ranges: -11 to -16 cm (moist sites)
- Depressional ranges: < -16 cm (wet sites)

Elevated ranges

*Betula glandulosa*,
*Salix arctica*,
*Cassiope tetragona*,
*Empetrum nigrum*,
*Ledum decumbens*,
*Vaccinium vitis-idaea*

Elevated/Transitional

*Salix reticulata*,
*Dryas integrifolia*,
*Rubus chamaemorus*

Transitional ranges

Transitional/Depressional

*Salix fuscescens*,
*Salix pulchra*

# Where do the shrubs species grow?

pH

- Acidic: 3 to 4.5
- Slightly acidic: 4.5 to 5.5
- Circumneutral: 5.5 to 7

Acidic

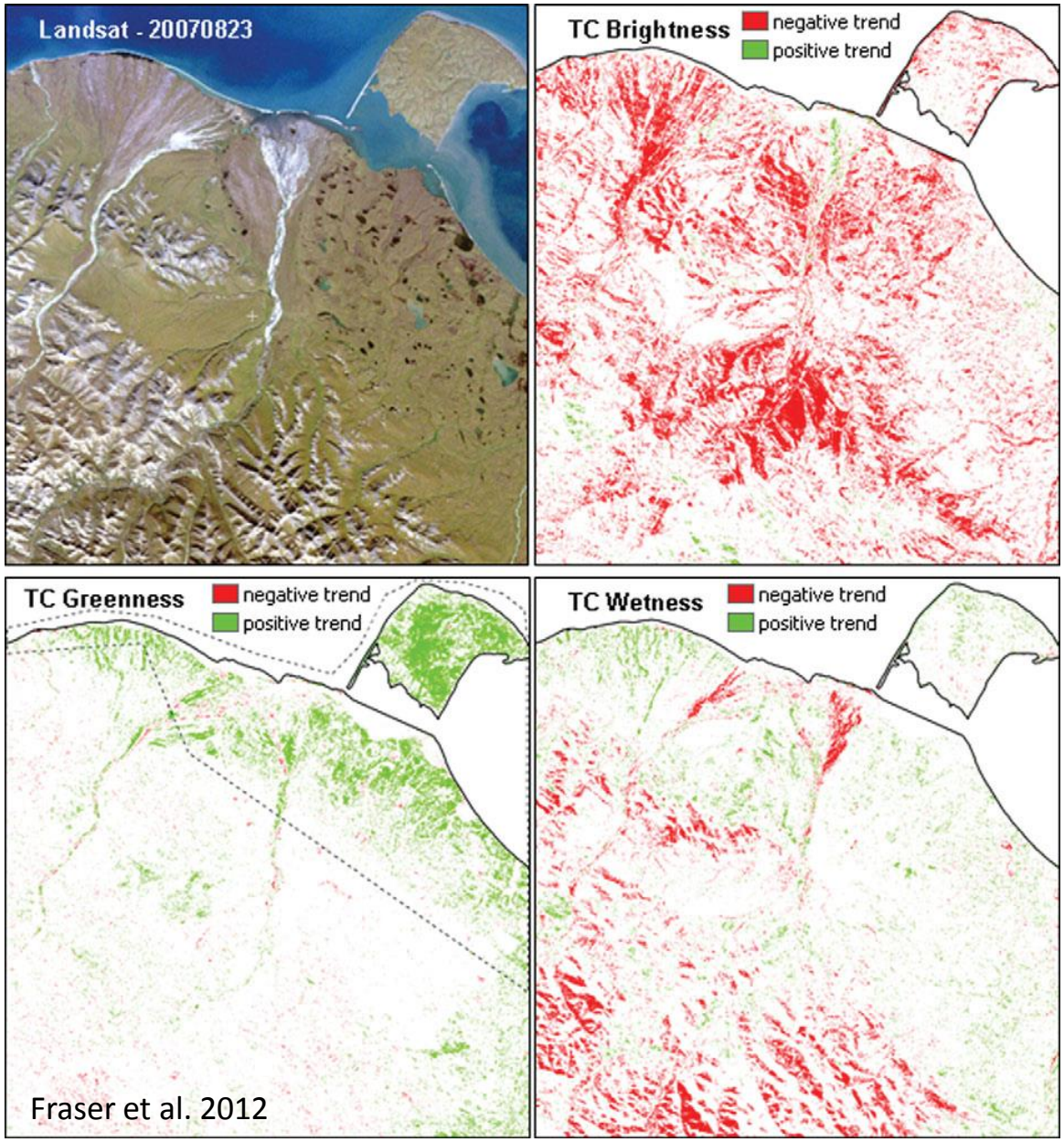
*Betula glandulosa*,
*Cassiope tetragona*,
*Empetrum nigrum*,
*Ledum decumbens*,
*Vaccinium vitis-idaea*

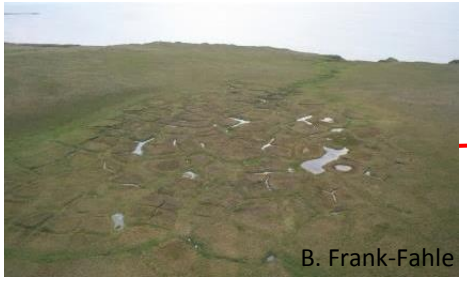
Slightly acidic

*Salix fuscescens*,
*Rubus chamaemorus*

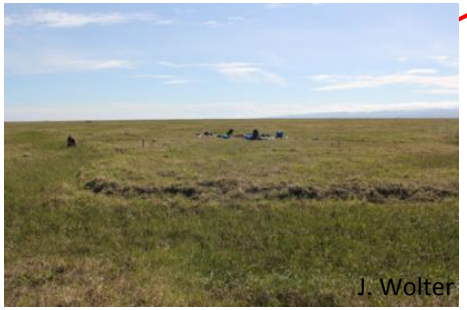
Circumneutral

*Salix arctica*,
*Salix pulchra*,
*Salix reticulata*,
*Dryas integrifolia*

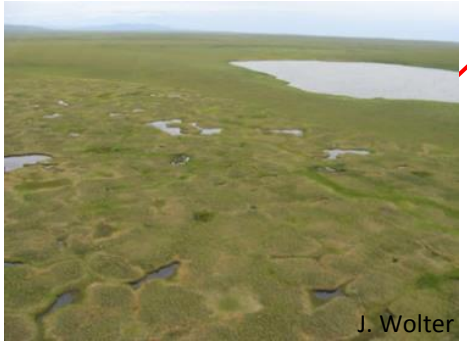

Landsat - 20070823
TC Brightness
negative trend
positive trend
TC Greenness
negative trend
positive trend
TC Wetness
negative trend
positive trend
Fraser et al. 2012



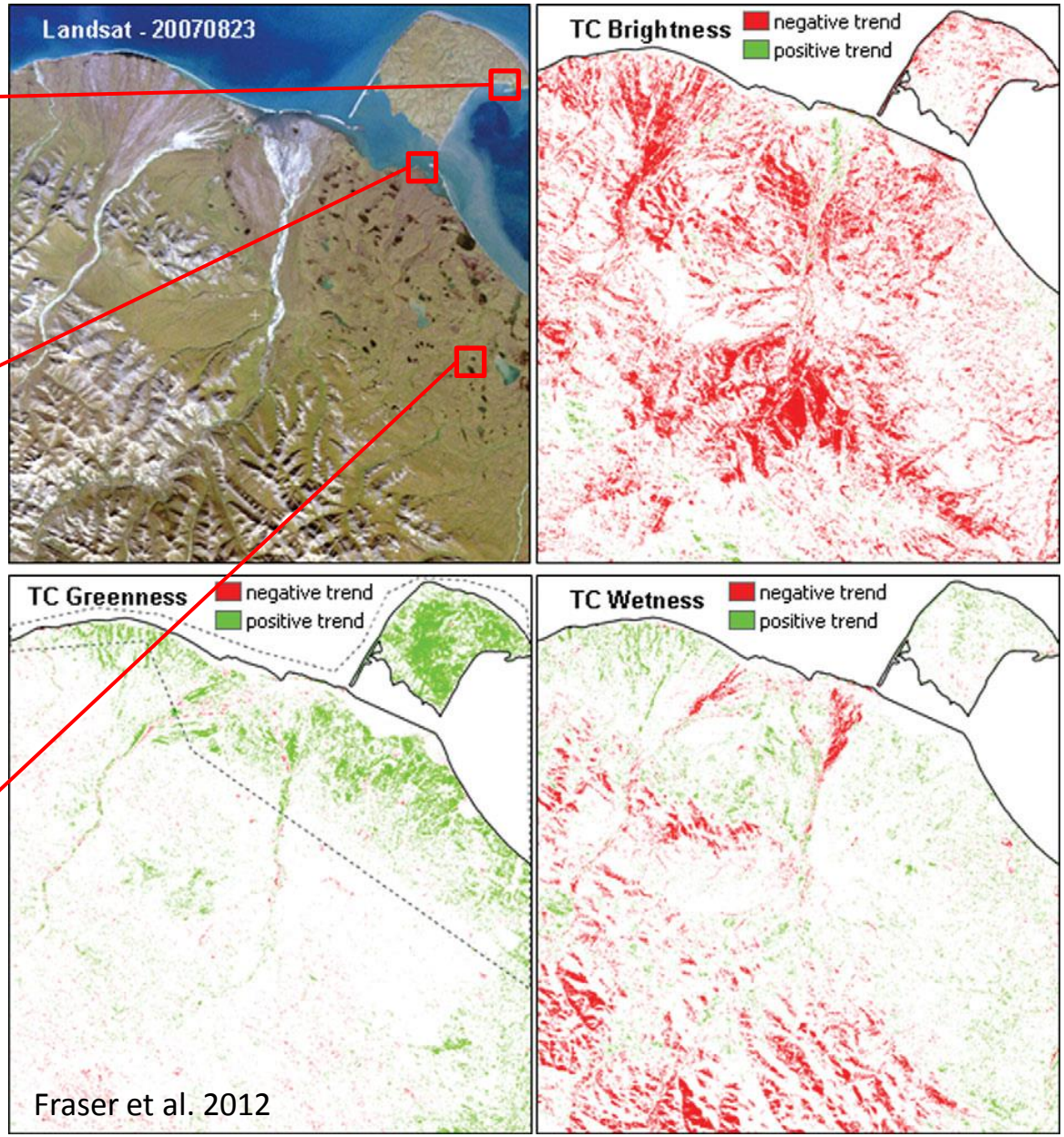

Herschel Island



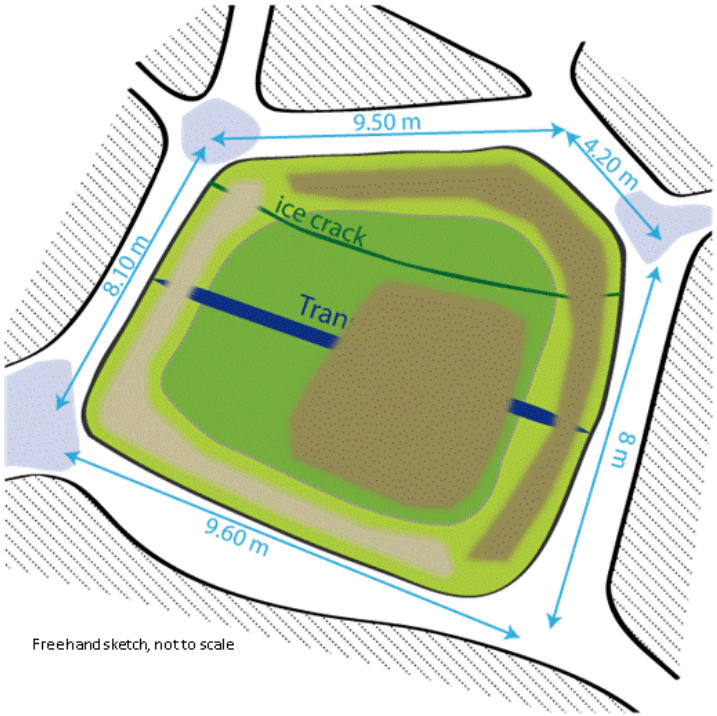

Ptarmigan Bay




Roland Bay



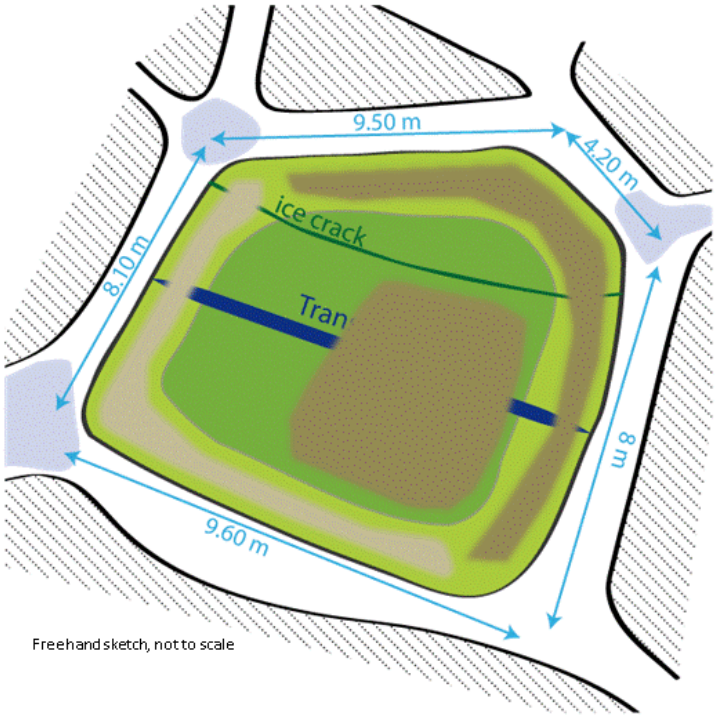
# Potential shrub expansion?




Low shrubs

Dwarf shrubs

# Potential shrub expansion?




Low shrubs

Dwarf shrubs

1. Infilling of patches
2. Increasing height

# Conclusion

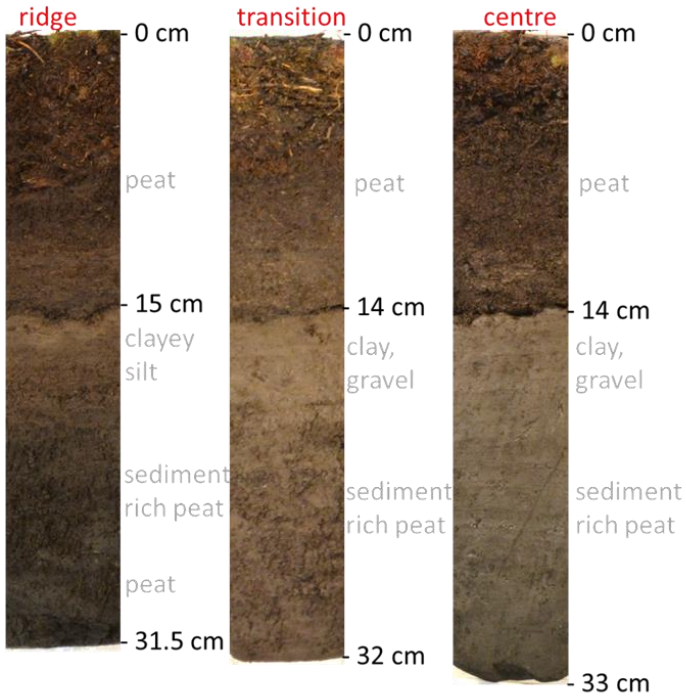
Shrubs are

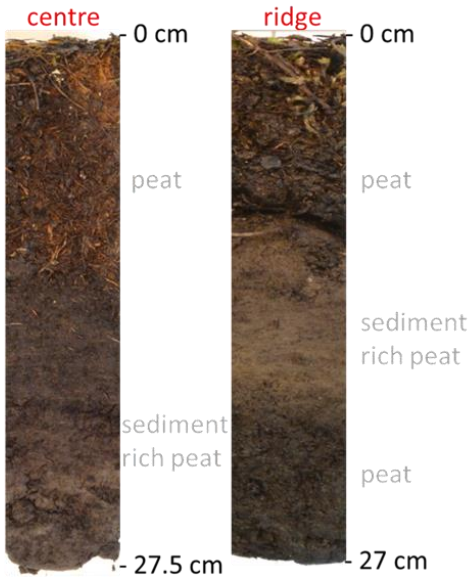
- Found in all the investigated polygon mires,
- never more than a few meters away,
- ready to expand when conditions improve for shrub growth.

If the wetness trend continues, shrubs may decrease locally, the overall trend for polygon fields on the Yukon Coastal Plain is the expansion of shrubs.

# Outlook

- Look into the past: Peat monoliths



# Outlook

- Quantify and upscale findings using remote sensing

→ satellite imagery, photographs in very high resolution

# Thank you for your attention!

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