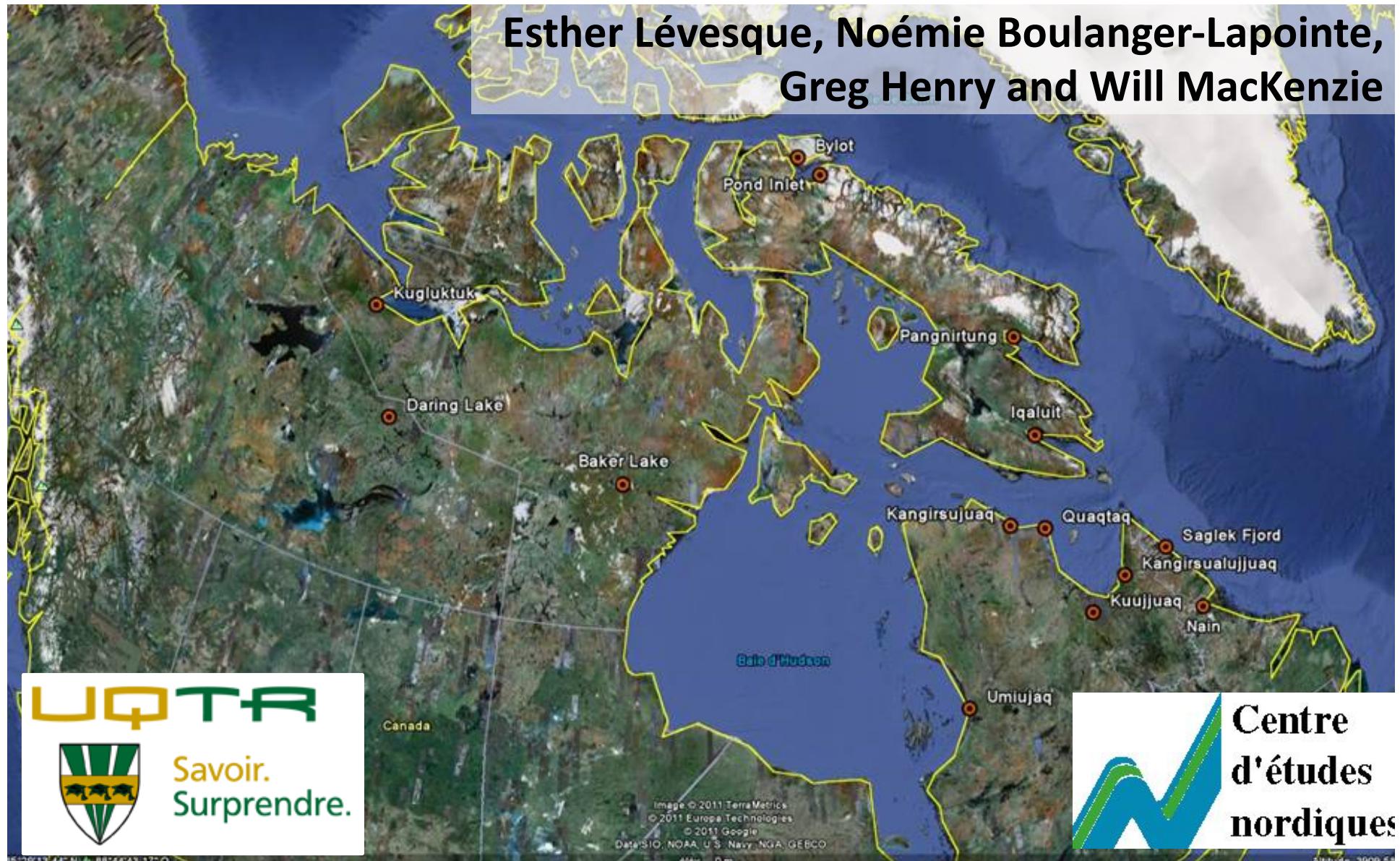


# Vegetation data available for classification of Canadian Arctic sites

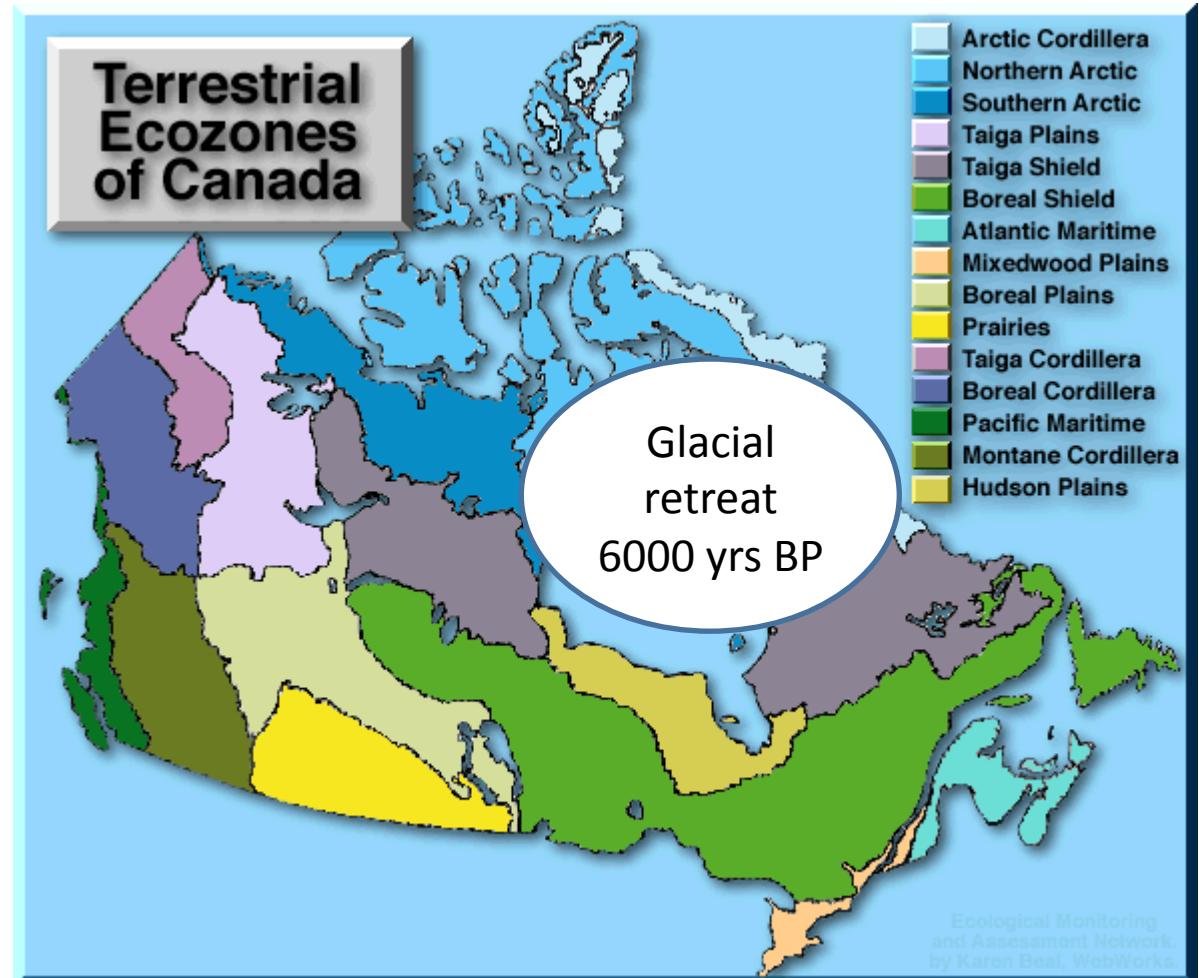
AVA workshop  
Krakow, April 2013

Esther Lévesque, Noémie Boulanger-Lapointe,  
Greg Henry and Will MacKenzie



# Vegetation in Arctic Canada

- Arctic Canada covers vast expanses from treeline to tip of North America
  - Mountains, glaciers
  - Lowlands
  - Rolling hills (bedrock)
- Gradient from sub-arctic to polar deserts
- Gradient in glacial history ...
  - refugia (west ...)
  - recent ice retreat...
- but overall, RECENT



Parc's Canada Ecozone classification

# Vegetation data in Arctic Canada

- Large effort during IPY



- Database of available vegetation datasets/studies
- Varied in quality and spatial distribution
- Data collected to answer a range of questions not necessarily for classification purposes
- Data more abundant in the western Canadian Arctic
- Some areas intensively studied (many plots in same area)
- Some studies do not have voucher specimen, taxonomy can not be certified

# Arctic Compilation and Classification

- IPY funding acquired by Catherine Kennedy to compile the Canadian Arctic data (2009-2010)
- Contracted BV Research Centre to acquire, then compile existing digital and hard copy data in a harmonized Vpro database
- Produce a draft classification of Canadian Arctic Associations
- Similar work is on-going for the subarctic
- Links to Canadian National Vegetation Classification

# 4800 Arctic Releves Compiled

- Adrian De Groot lead
- 482 projects, theses, and reports reviewed
- 82 acquired with suitable data
  - Plot size and sample methods acceptable
  - Relatively complete species list
- 17 additional projects identified with potentially suitable data but not acquired
- Does not include several potentially large datasets

# CAVC Data Quality

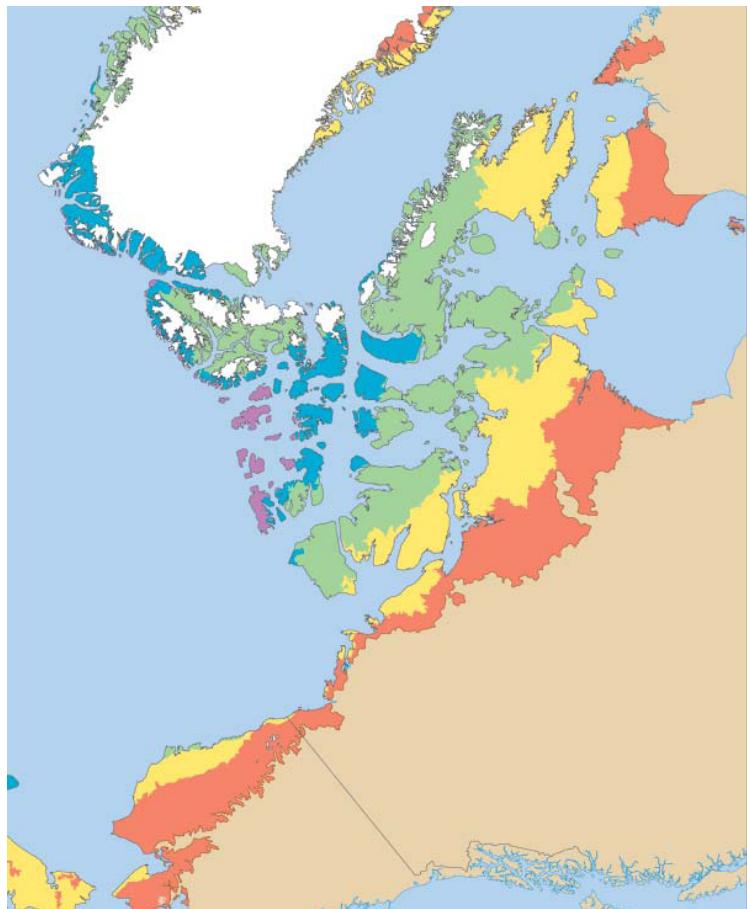
- Generally inclusive of plots with “issues”
- Relatively minor synonymy challenges but species list quality (Moss/Lichen layer, challenging genera *Carex* spp., *Salix* spp.) omits many projects/plots
- Generally excluded microplots and line-intercept data. Conversion of nested micro-plots into a single relevé
- Cover classes:
  - conversion to mid-point percent cover
- Environmental data: variable, often summarized data presented (plot data may exist with authors)

4700  
Arctic  
Plots  
(and 4500  
Subarctic)

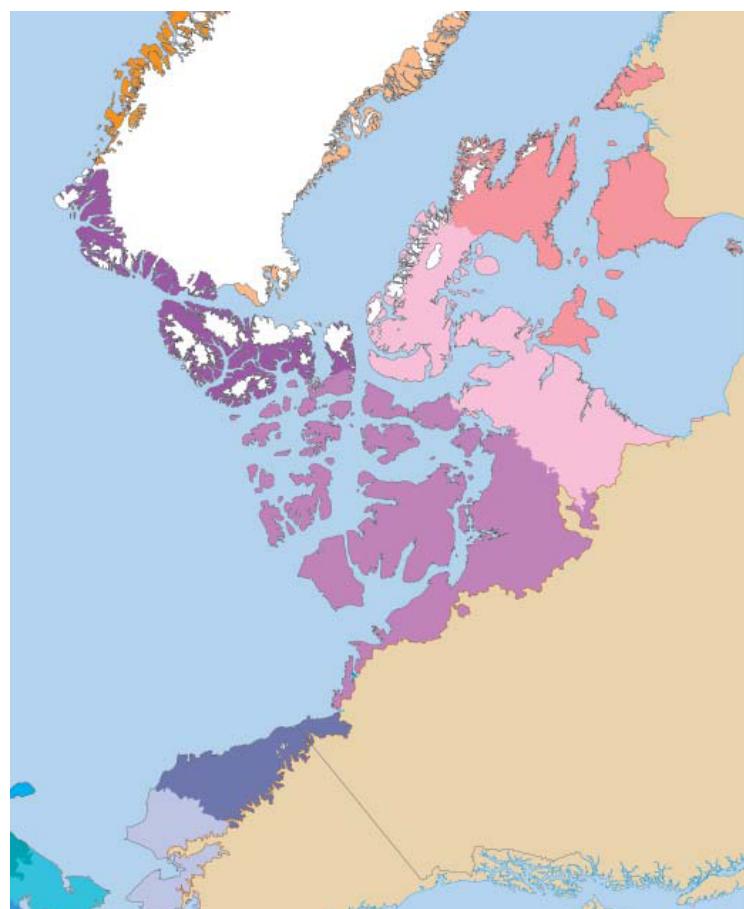


# CAVM “zones”

Subzones



Floristic Provinces



# Gap Analysis

| SubZone | N Alaska<br>Yukon | Central Canada | West Hudsonian | Baffin -<br>Labrador | Ellesmere N<br>Greenland | Total |
|---------|-------------------|----------------|----------------|----------------------|--------------------------|-------|
| A       | N/A               | 104            | N/A            | N/A                  | 0<br><b>Few</b>          | 104   |
| B       | N/A               | 92             | 3              | N/A                  | 69                       | 164   |
| C       | 203?              | 101            | 544            | 87                   | 349                      | 1284  |
| D       | 592               | 21             | 0              | 64                   | N/A                      | 677   |
| E       | 1578              | 726            | 229            | 0                    | N/A                      | 2533  |
| Total   | 2373              | 1044           | 776            | 151                  | 418                      | 4762  |

# Data Analysis

- Largely a Braun-Blanquet table analysis approach
- Currently no specific attempt to fit into any existing Braun-Blanquet higher levels
- Emphasis on vascular plant community composition
- Treatment of “barrens” largely from published units.
- Other units with insufficient data
- 3800 plots used in described Associations

# 58 “Proto” Associations

## Shore Zone

- Intertidal, Estuarine
- *Leymus mollis*, *Puccinellia phryganodes*, *Salicornia*, ...

## Poor tundra, dry to very wet

- *Betula* – *Ledum* – *Vaccinium* Group
- *Vaccinium vitis-idaea*, *Eriophorum vaginatum*, *Ledum* – *Sphagnum*, *Carex bigelowii*

## Intermediate – Basic Tundra

- *Dryas* – *Cassiope tetragona*
- *Dryas* tundra, *Cassiope* tundra and snowbeds

## Wetland and wet tundra

- *Carex aquatilis* – *Eriophorum angustifolium*, *Eriophorum scheuchzeria*, *Arctophila fulva*, *Alopecurus alpinus*, *Dupontia fisheri*

## Barrens

- Very low cover high latitude units
- *Luzula confusa*, *Saxifraga oppositifolia*, *Dryas*, *Phippsia algida*

# Association Gaps

Additional Units lacking sufficient data (<10 plots):

- Some marine shore types
- Bryoid/Cryptogam types
- Some willow and sedge types.
- Arctic-Alpine types (Labrador and Yukon) not included.

# Types of data

- **Two main approaches:**
  - 1) Classical relevé
    - Braun-Blanquet approach
  - 2) Plot data
    - Sampling with repetition of small quadrats
- Common interest:
  - Obtain the best description of the vegetation

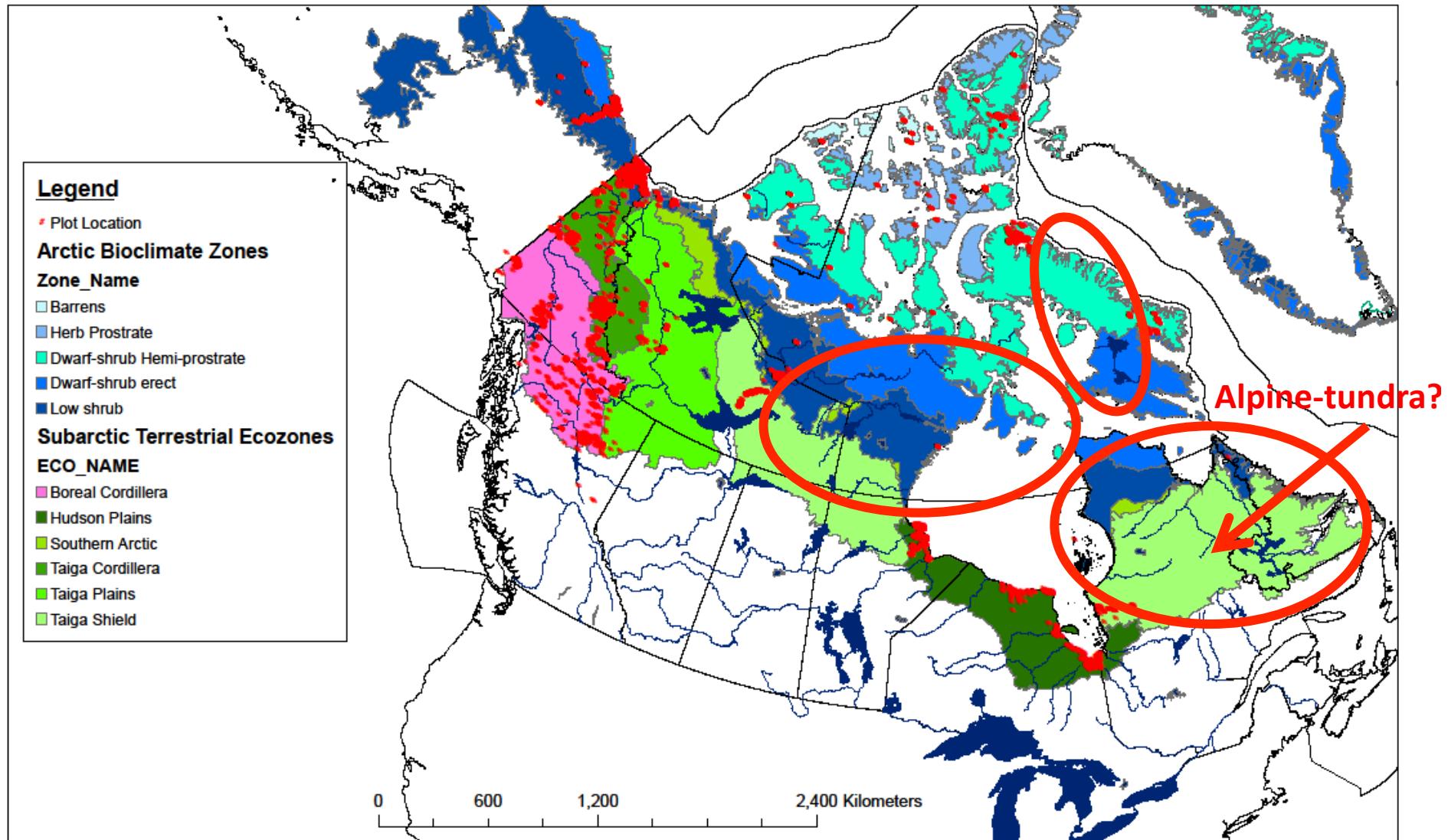
# Relevé approach

- Identify representative, homogeneous area
- Sample minimum area (size dependant on vegetation structure and complexity)
- Evaluate abundance of all taxa:
  - Vasculars
  - Bryophytes
  - Lichens
- Evaluate environmental characteristics.

# For the plot data? The same?

- Identify representative, homogeneous area : **Yes**
- Sample **minimum area** (size dependant on vegetation structure and complexity): **Similar**
  - **Area sampled with repetition of small samples (e.g. 20 x 1m<sup>2</sup> quadrats)**
  - **Complete species list for a known area**
- Evaluate abundance of all taxa: **Variable**
  - Vasculars **Yes**
  - Bryophytes **rarely to species but total cover**
  - Lichens **rarely to species but total cover**
- Evaluate environmental characteristics? **Variable**

## Plot Location by Arctic Bioclimate Zone or Terrestrial Ecozone



# Example of plot based approach Tremblay and Gagnon, Nunavik

(Part of : Northern Quebec Biodiversity Atlas )

1) Scale of the region :

- Pre-selection :
  - a) Automated stratified random sampling based on satellite image + geology (minimum size 8 ha)
  - b) Visual analysis to include small habitats (linear or not, snow bed, marsh etc.)

**Aim : describe the biodiversity**



# Example of plot based approach Tremblay and Gagnon, Nunavik

(Part of : Northern Quebec Biodiversity Atlas )

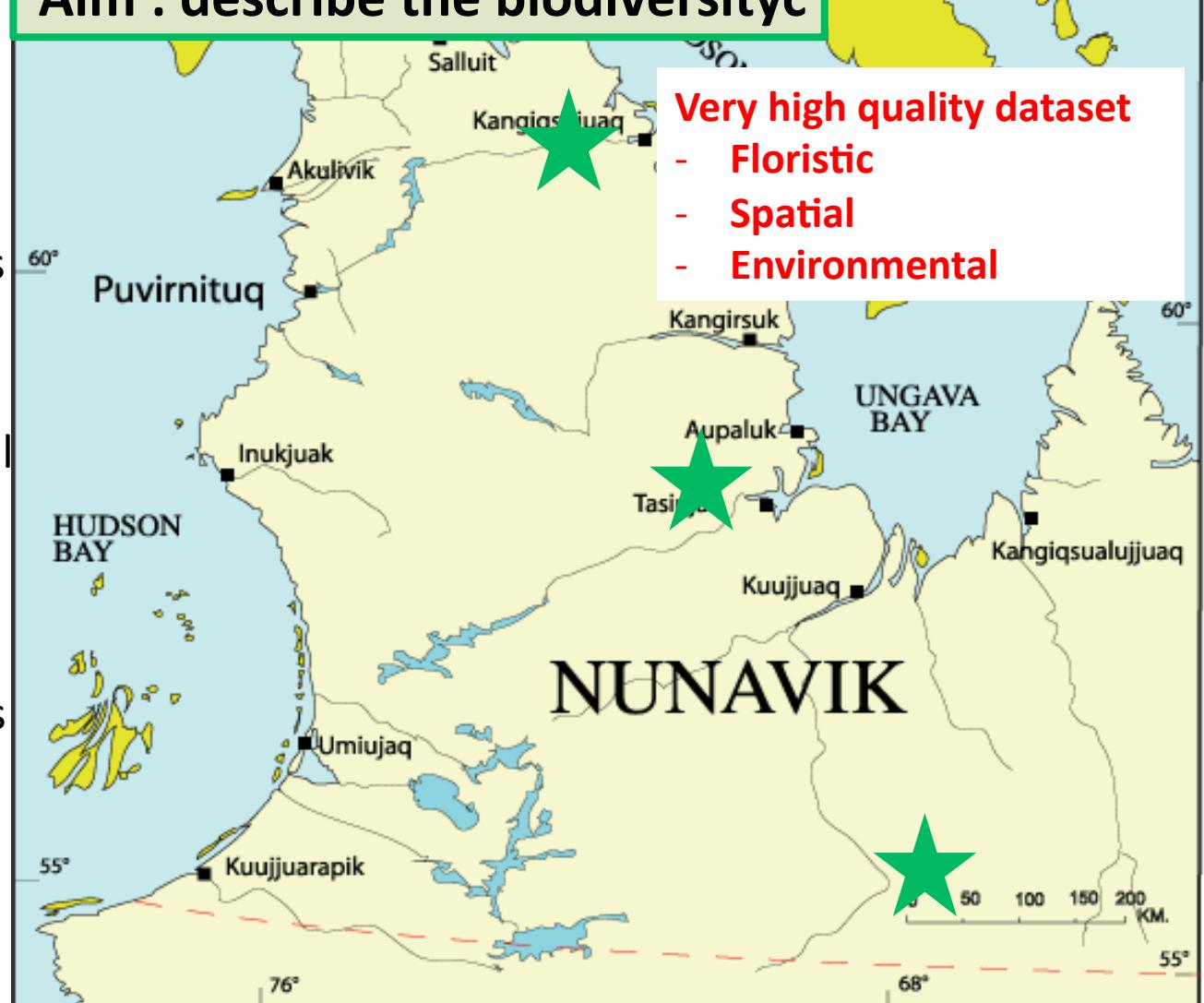
## 2) In the field :

- Sampled plots (n= 230) of 1, 4 or 25m<sup>2</sup>
- In 25m<sup>2</sup> plot, sub-sampling for bryophytes and lichens (1m<sup>2</sup> or 0.5m<sup>2</sup>)
- Extensive environmental data

## 3) Analyses :

- Combination of multivariate approaches and visual analyses

Aim : describe the biodiversity

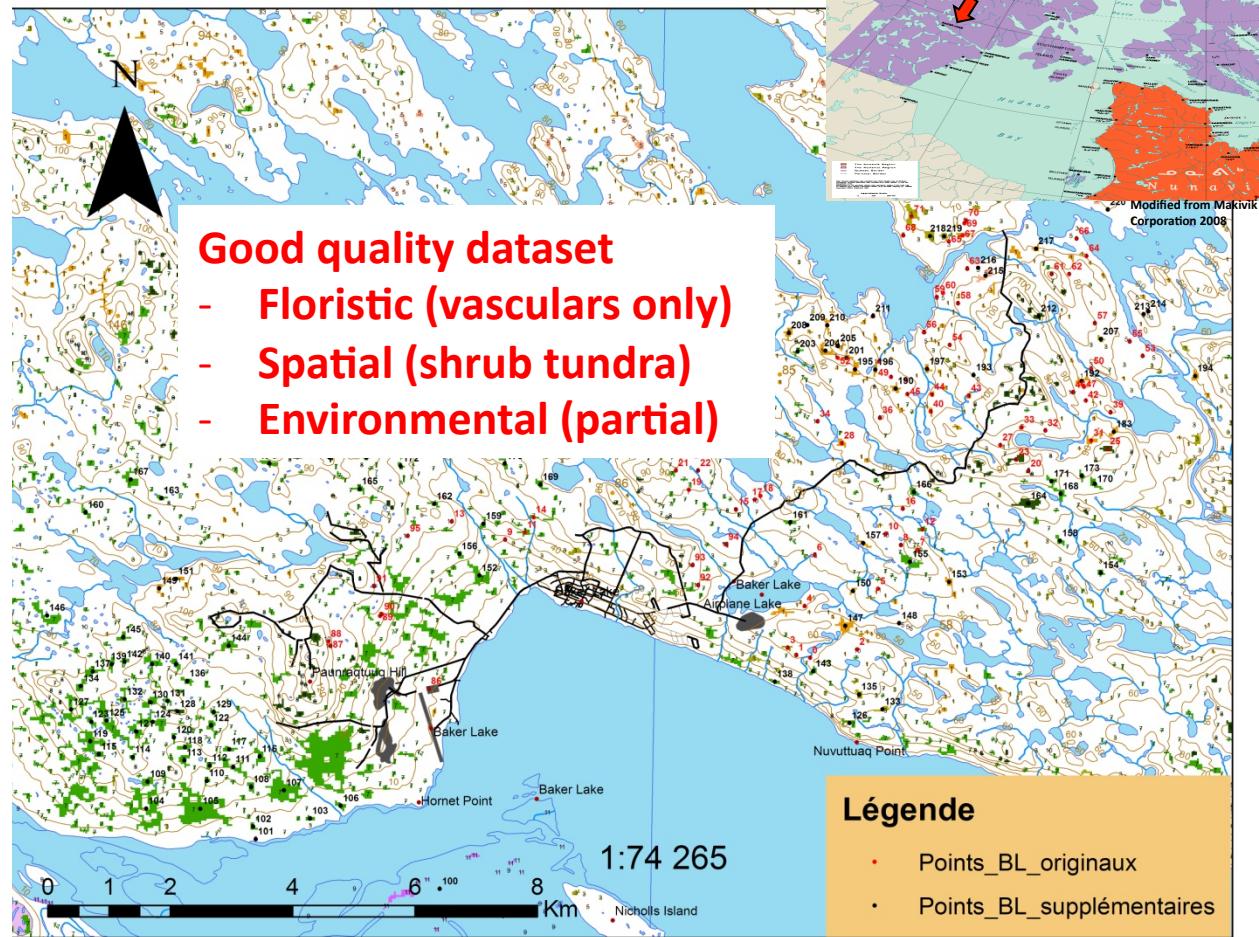


# Example of plot based approach

## Baker Lake, Nunavut (MSc Carmen Spiech, UQTR)

Aim : landscape scale berry shrub distribution

Classification de Olthof (2007)  
Landsat circa 2000 (30m)



1) Scale of the region:

- Preselection of “homogeneous” zones based on pre-existing Landsat classification:

Areas with 3 pixels x 3 pixels

2) In the field :

- Find preselected point
- Aim to find a “central”, representative area
- Plot 25m<sup>2</sup>, n=80
- Cover estimates :  
vasculars, total moss,  
total lichen, basic env.

# Example of plot based approach

## Nunavut : pointing (Tundra Northwest 1999)

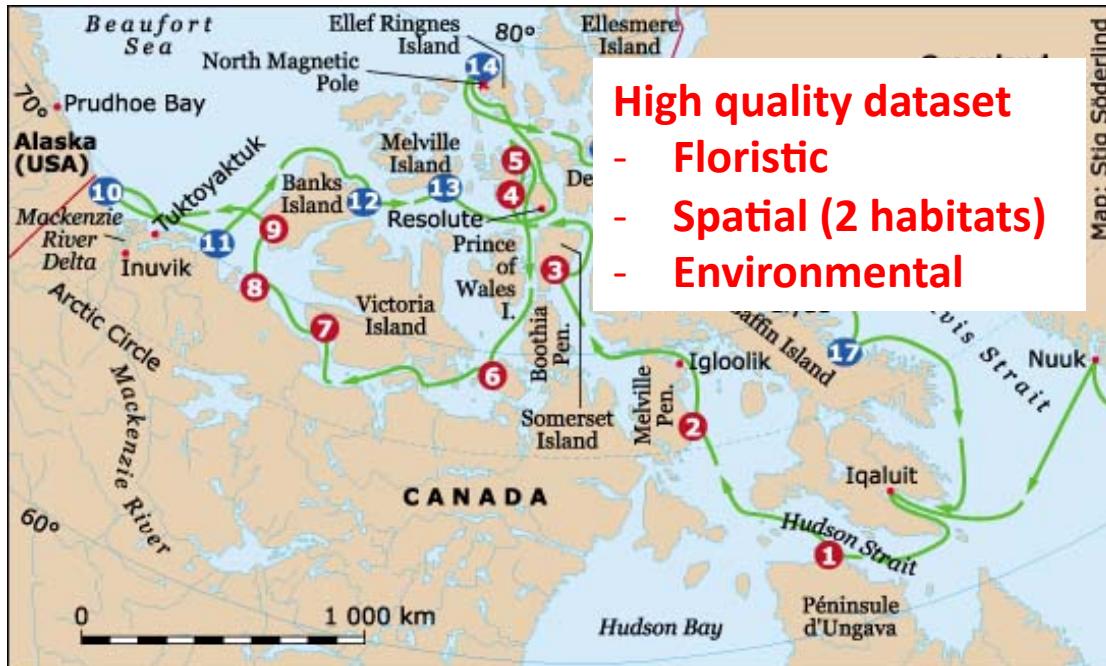
Aim : multisite biodiversity comparisons



# Example of plot based approach

## Nunavut : pointing (Tundra Northwest 1999)

Aim : multisite biodiversity comparisons



- Data sampled with standard protocol
- High quality identification (validation, collection)
- Two contrasting habitats across gradients

1) Scale of the continent :

- Preselection of 20 km radius zone based on biogeography information and remoteness

2) In the field :

- Find gradient (mesic-dry)
- Mark 20m x 20m plot
- Evaluate cover with point sampling in 30 random quadrats ( $1m^2$ )
- Taxonomy to species
- Complete environmental dataset

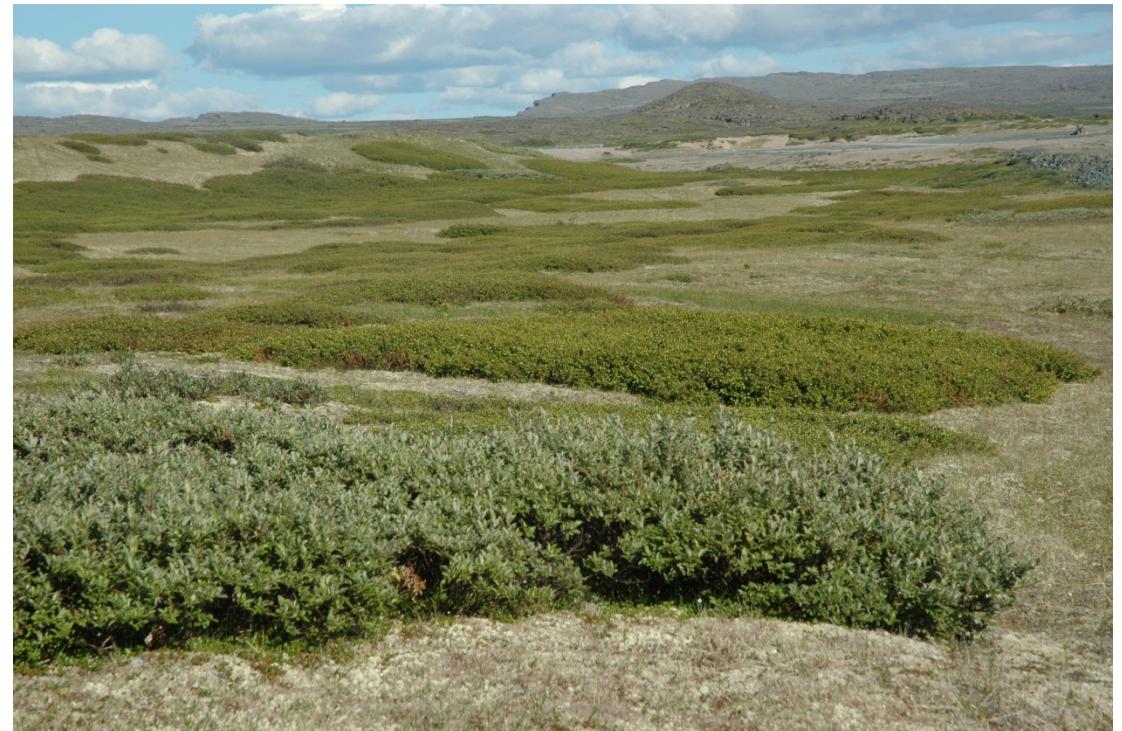
# Few questions for discussion

- Succession
- Disturbance
- Herbivores



# Variety of datasets

- Not all datasets equal in value (e.g. taxonomical identification, spatial distribution, environmental parameters)
- Some datasets are perfect for detailed floristical analyses
- Some are less complete but can serve to identify higher level organisation or describe spatial heterogeneity
- Arctic datasets are precious (cost to collect information) and can serve as reference



# Publishing vegetation data?

- Metadata : Polar data catalogue ( [www.polardata.ca](http://www.polardata.ca) )
- Centre d'études nordiques (CEN - [www.cen.ulaval.ca](http://www.cen.ulaval.ca) ) hosts a new publication for Databases
- Each database has a DOI (easy to cite)



[www.cen.ulaval.ca/nordicanad/](http://www.cen.ulaval.ca/nordicanad/)

- Currently microclimate data easily accessible
- Option for vegetation data...

# Acknowledgements

- All data contributors, graduate students and assistants
  - Collaborators (ArcticNet, CiCAT, ArcticWOLVES, ADAPT)
  - Logistical support by Polar Shelf and Agnico-Eagle Mine
  - Numerous partners including NSTP, Parks Canada and others:
  - [http://www.cen.ulaval.ca/nordicanad/en\\_index.aspx](http://www.cen.ulaval.ca/nordicanad/en_index.aspx)



**Fonds de recherche  
sur la nature  
et les technologies**

S Technologies  
Québec 