Effects of Dust Deposition from Diamond Mining on Subarctic Plant Communities and Barren-ground Caribou Forage

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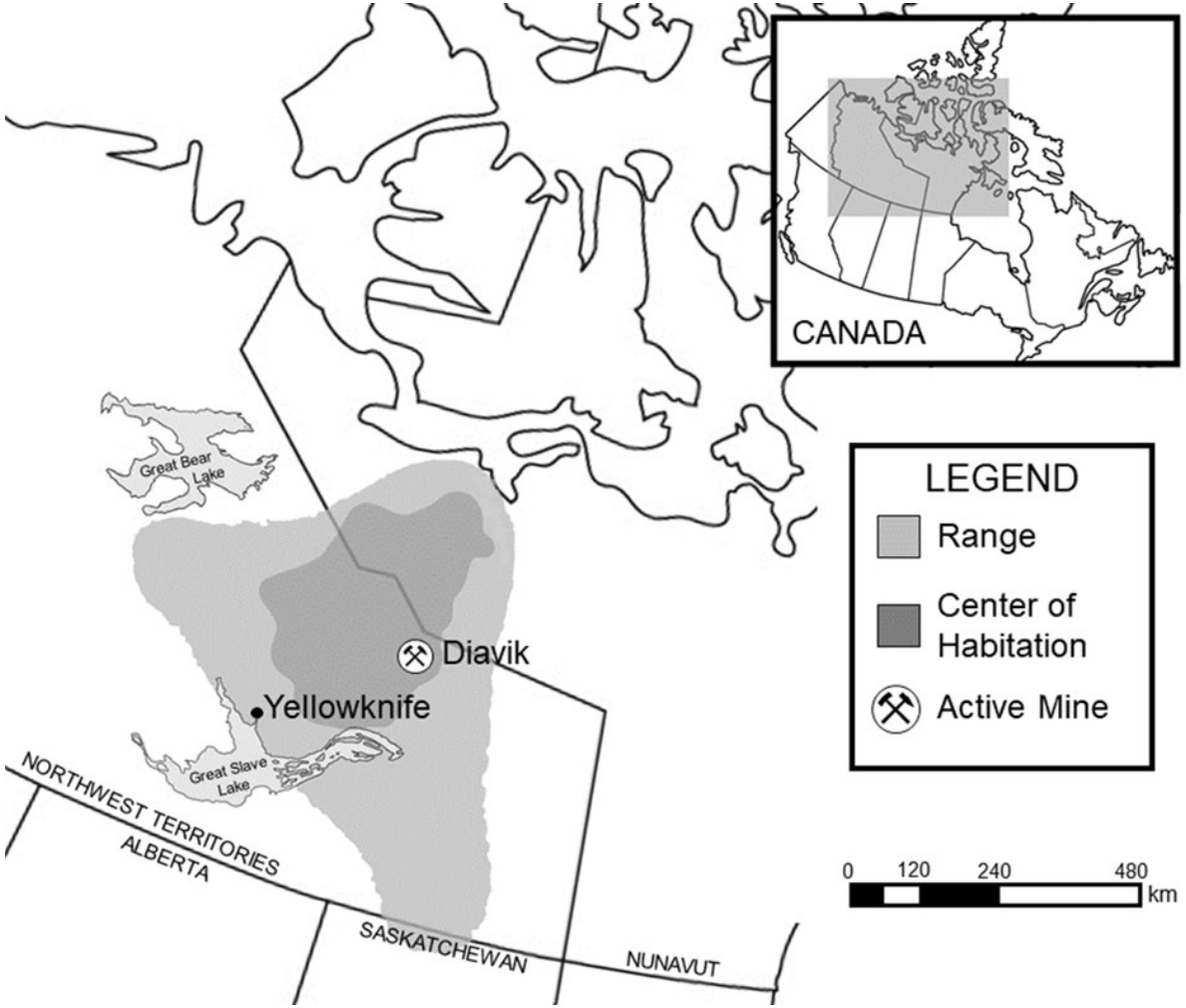
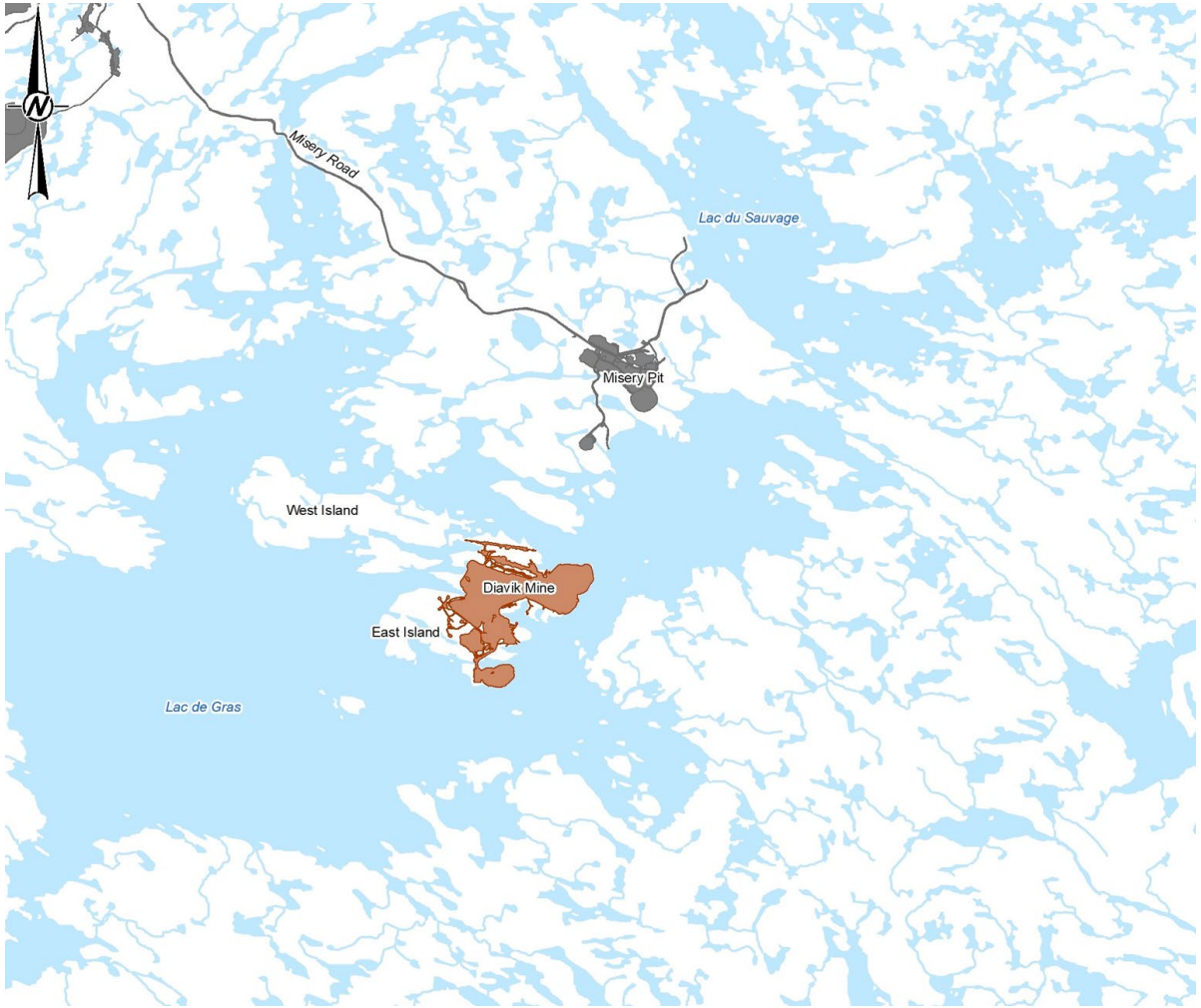
Location of the Diavik Diamond Mine and Bathurst Caribou Range

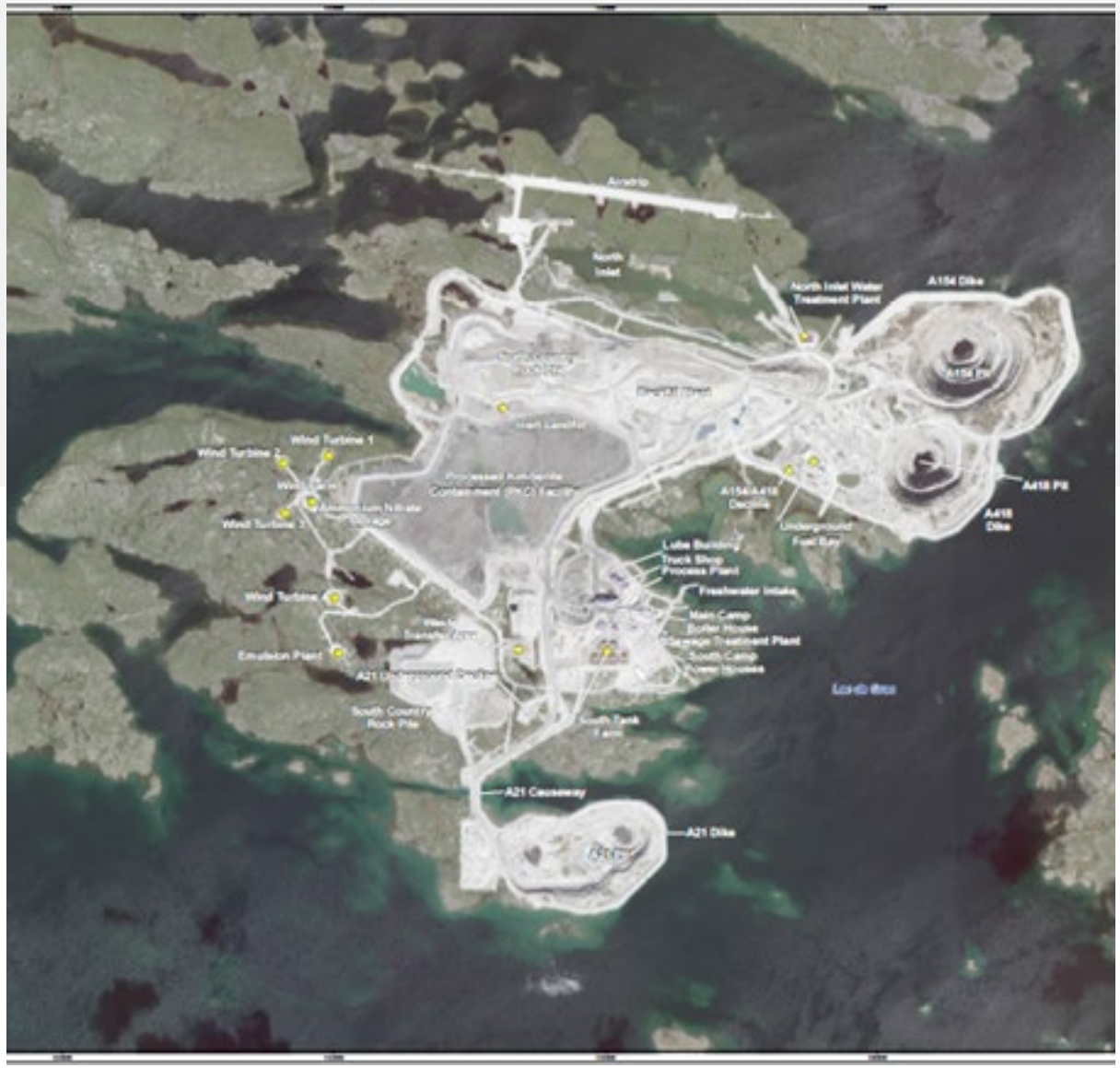


Diavik Diamond Mine



Vegetation and Lichen Monitoring Program

- **Objectives**
  - Dust deposition rates through time
  - Lichen chemistry among near-field, far-field, and distant-field sites through time
  - Plant species abundance (% cover) and richness between mine and reference sites through time
  - Health risks to caribou

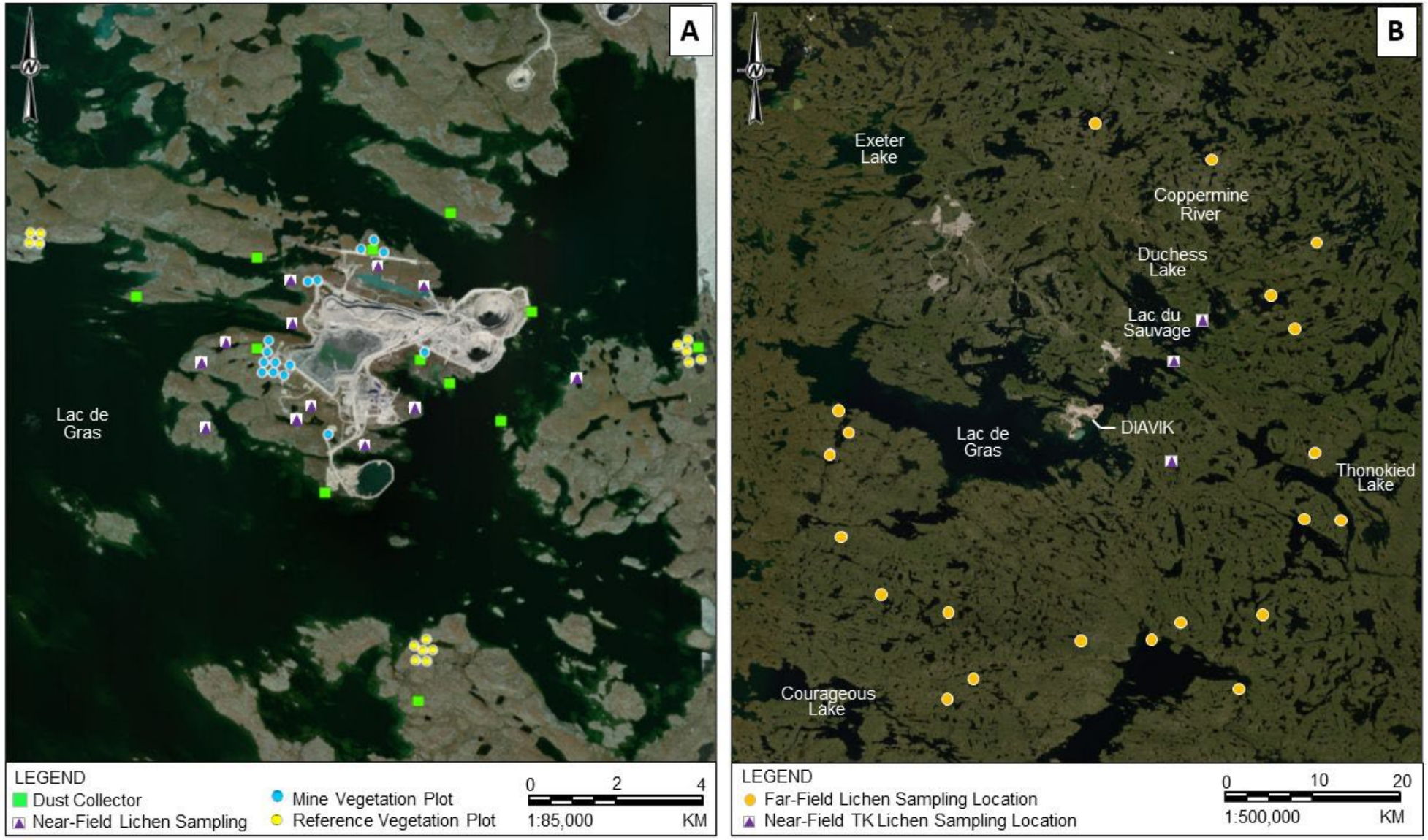


Zone of Influence and Caribou

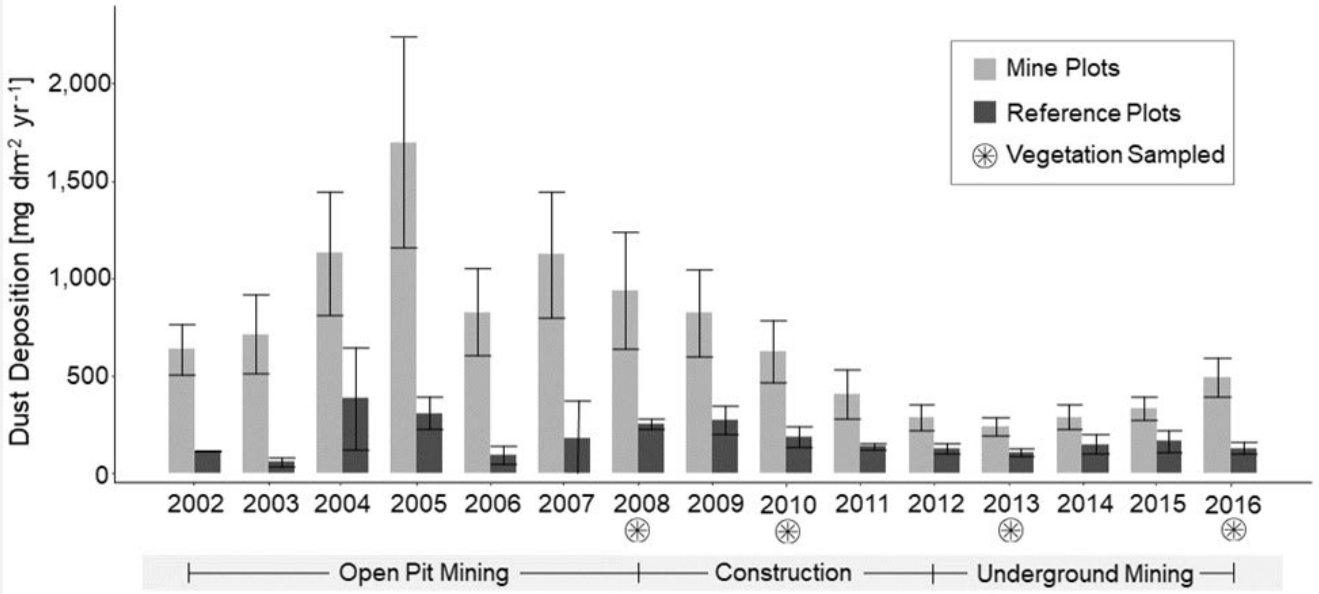
- Zone of Influence = change in habitat quality or function with distance from human development
- Measured by change in animal behaviour, movement, abundance, occurrence
- Has direction, magnitude, and spatial extent
- Ultimately can have demographic consequence on population
- 6 to 18 km (mean of 14 km) for Ekati-Diavik mine complex
- One hypothesis: related to dust deposition and associated decrease in food abundance and/or quality

Study Design and Methods

- Dust (TSP) sampled every 3 months 2002 to 2016:
  - 6 mine (200 m) and 6 reference (3 km)
- Lichen sampled for metals in 2010, 2013, 2016:
  - 21 near-field (900 m)
  - 24 far-field (30 km)
  - 3 distant-field (100 km)
- Plants (%cover, richness) in 2008, 2010, 2013, 2016:
  - 15 mine (100 m)
  - 15 reference (4 km)
- Regression and Repeated measures ANOVA


A
Lac de Gras
LEGEND
Dust Collector
Near-Field Lichen Sampling
Mine Vegetation Plot
Reference Vegetation Plot
0 2 4
1:85,000 KM
B
Exeter Lake
Coppermine River
Duchess Lake
Lac du Sauvage
DIAVIK
Lac de Gras
Thonokied Lake
Courageous Lake
LEGEND
Far-Field Lichen Sampling Location
Near-Field TK Lichen Sampling Location
0 10 20
1:500,000 KM

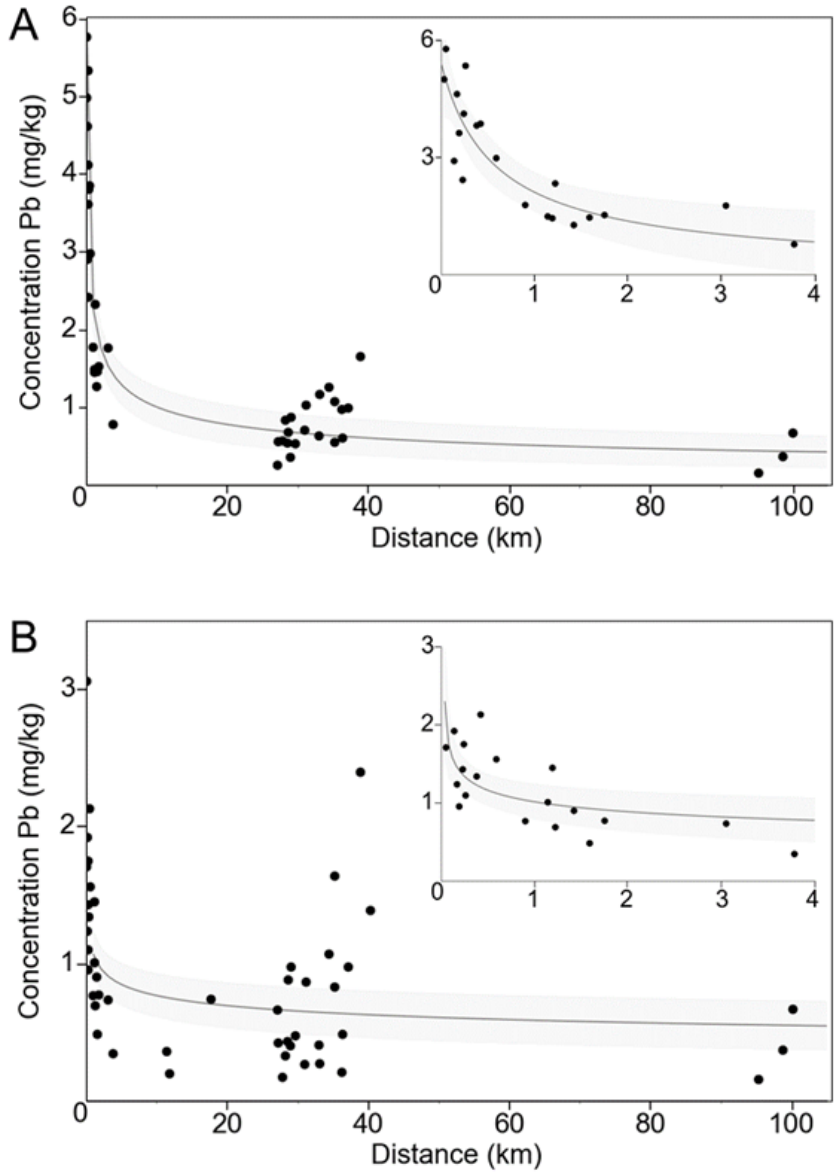
Results - Dust



- Linear regression:
  - dust deposition on mine plots decreased significantly across years;
  - dust deposition on reference plots showed no temporal trend
- RM ANOVA:
  - Deposition significantly higher on mine plots than reference plots during open pit mining, but not during other phases

Results – Lichen Chemistry

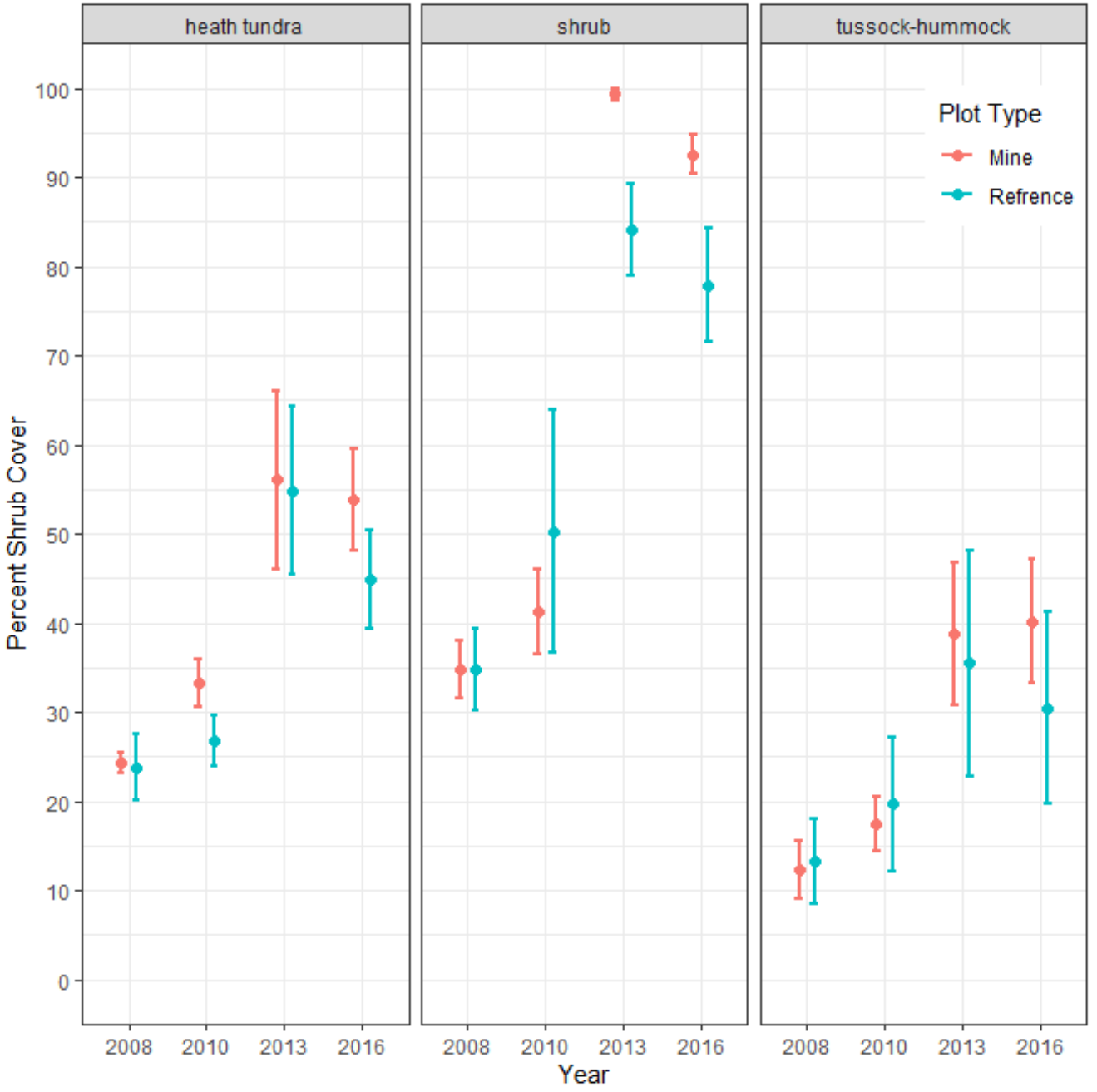
- Non-linear regression:
  - Metal concentrations rapidly decreased with distance from the mine
- RM ANOVA:
  - Near-field plots had significantly greater metal concentrations than far-field plots
  - Tissue concentrations were higher in 2010 than in 2016 for all plot types.
  - Decrease in metals over time was more evident in near-field plots
  - Temporal trends were more variable in far-field plots



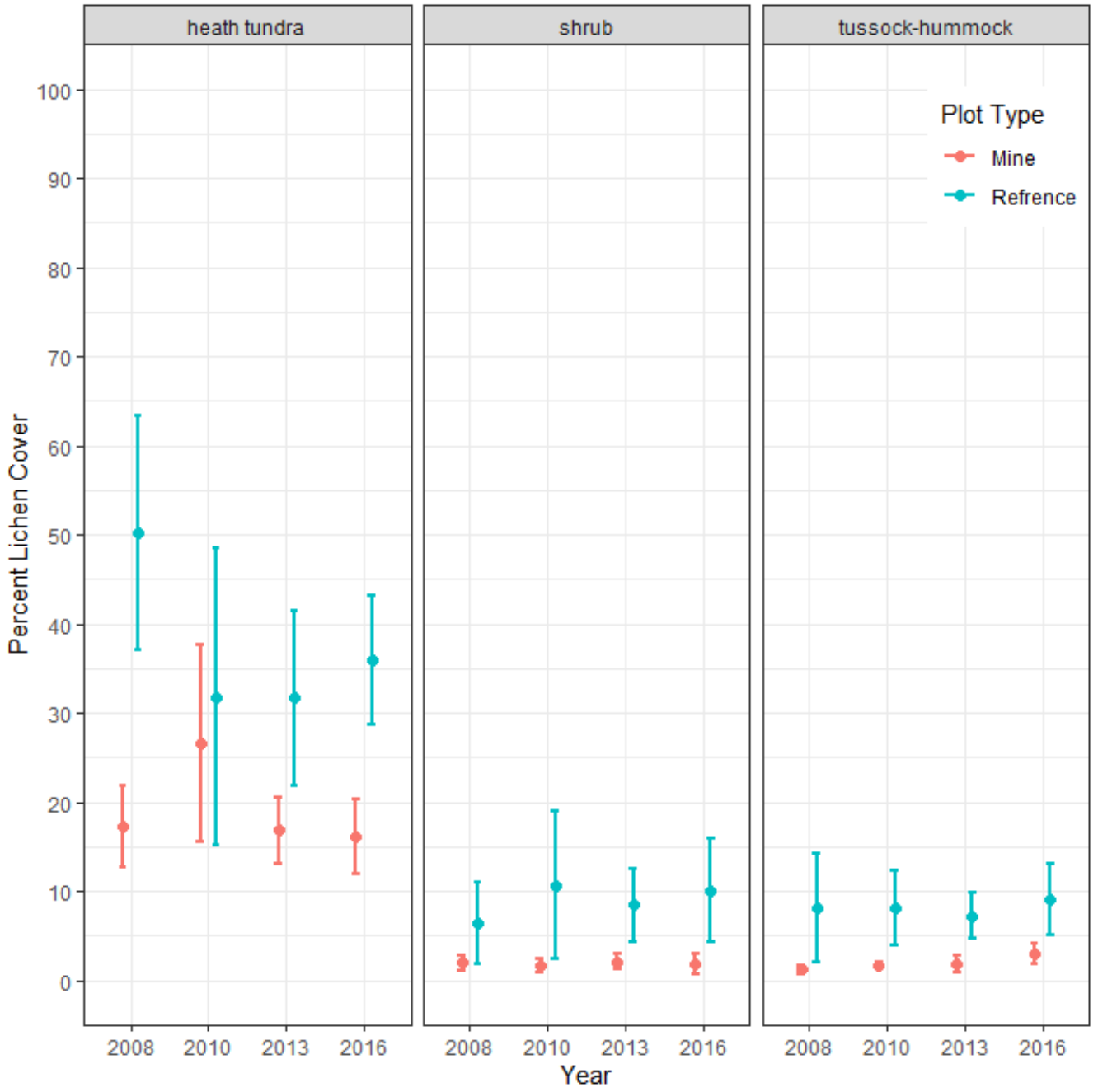
Results - Vegetation

- Over time, shrub cover increased in all 3 plant communities on mine and reference plots
- Forb and graminoid cover and richness greater in mine plots in the Heath Tundra and Shrub communities than reference plots
- Lichen cover was greater in reference plots than in mine plots in all 3 plant communities

Shrub Cover


heath tundra
shrub
tussock-hummock
Plot Type
Mine
Refrence
Percent Shrub Cover
0
10
20
30
40
50
60
70
80
90
100
2008
2010
2013
2016
Year

Lichen Cover



Key Messages

- Dust deposition was 2-5 times greater within 4 km of the mine
- Metals in lichen decreased rapidly beyond 4 km from the mine
- Vascular plant cover was higher and lichen cover lower within 500 m of the mine
- Dust is a weak mechanism explaining zone of influence (14 km) for caribou, with likely no measurable consequence to demography