Community-based ice interventions in support of resilient winter trails in Nunatsiavut

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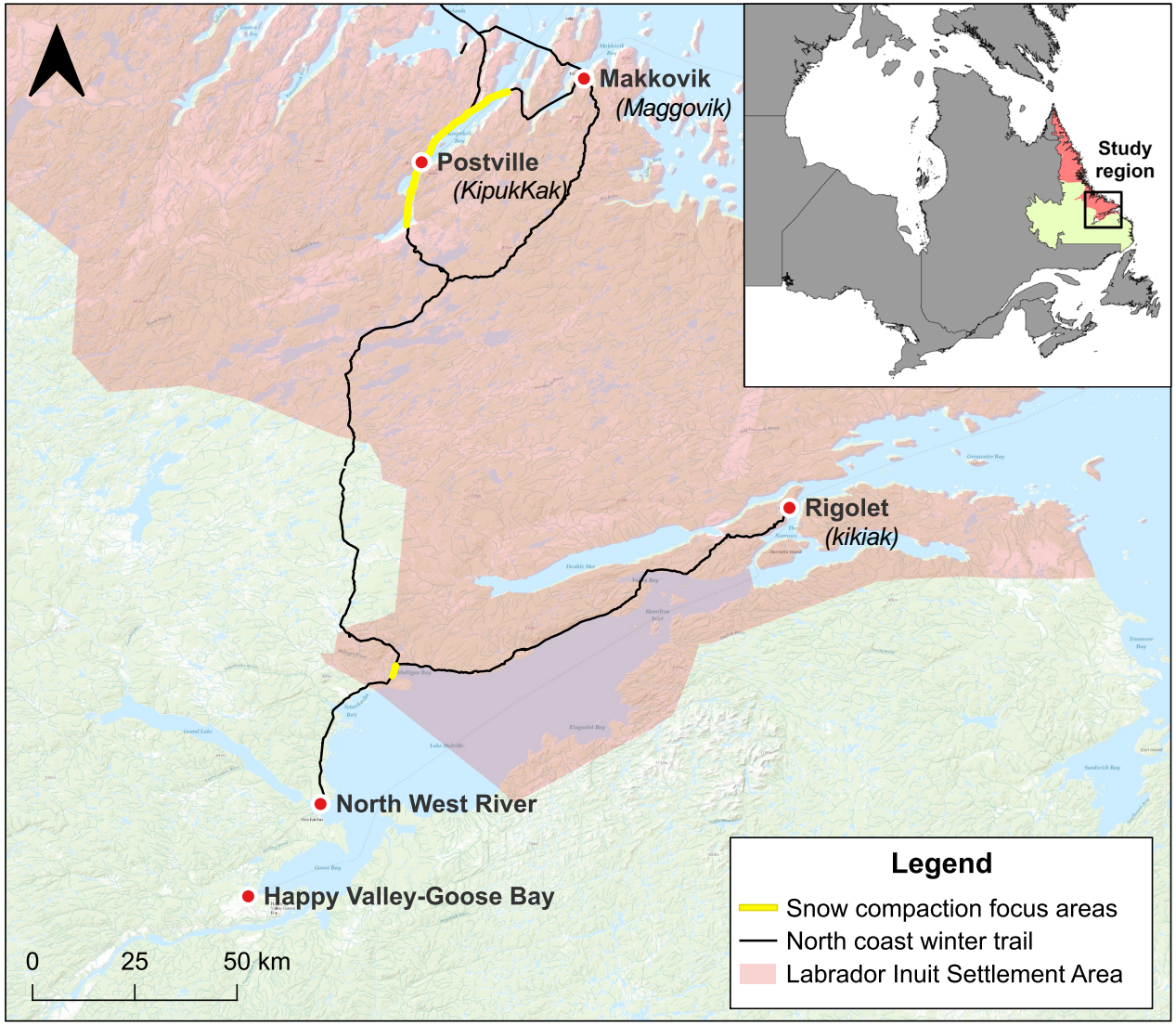
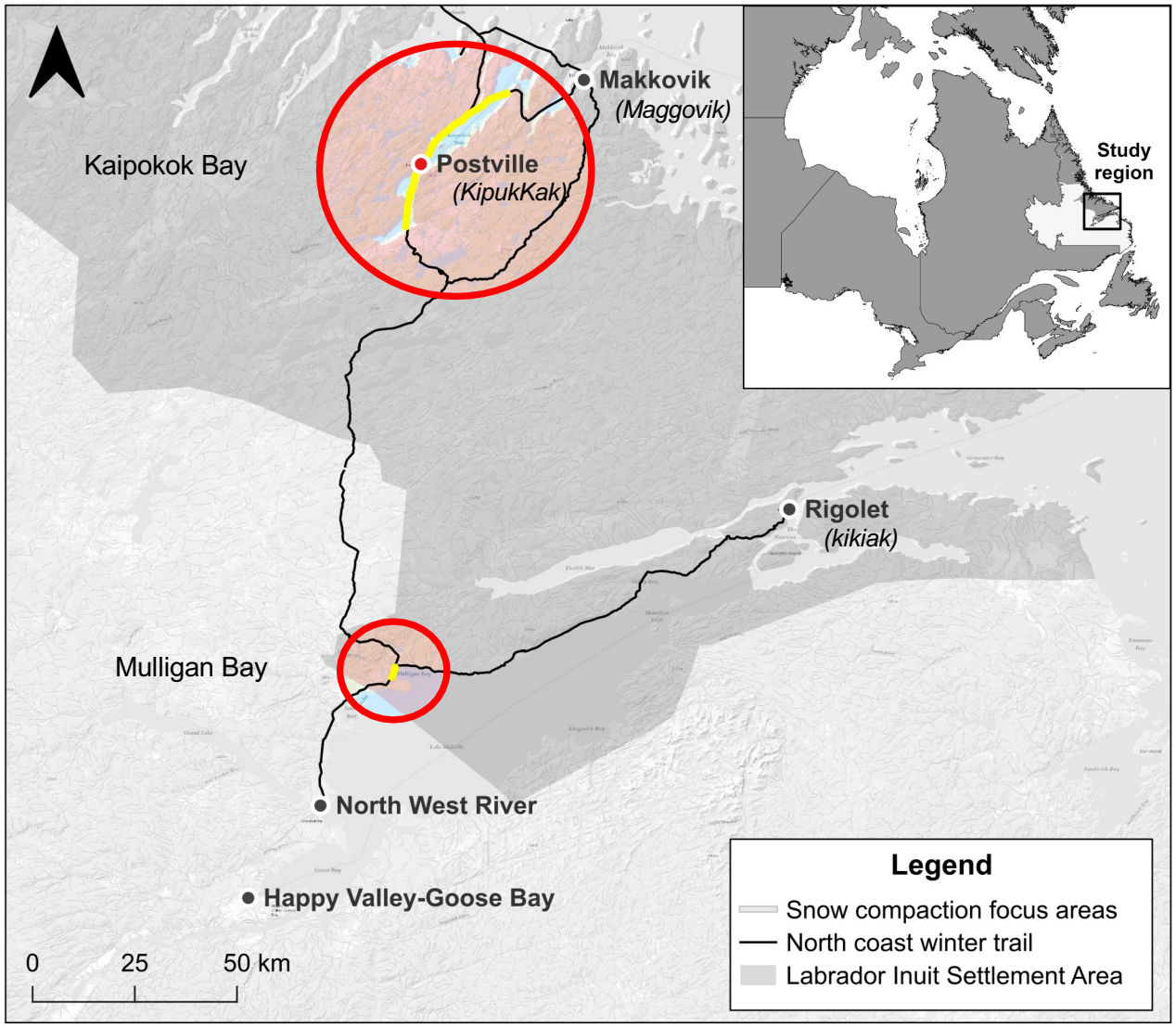
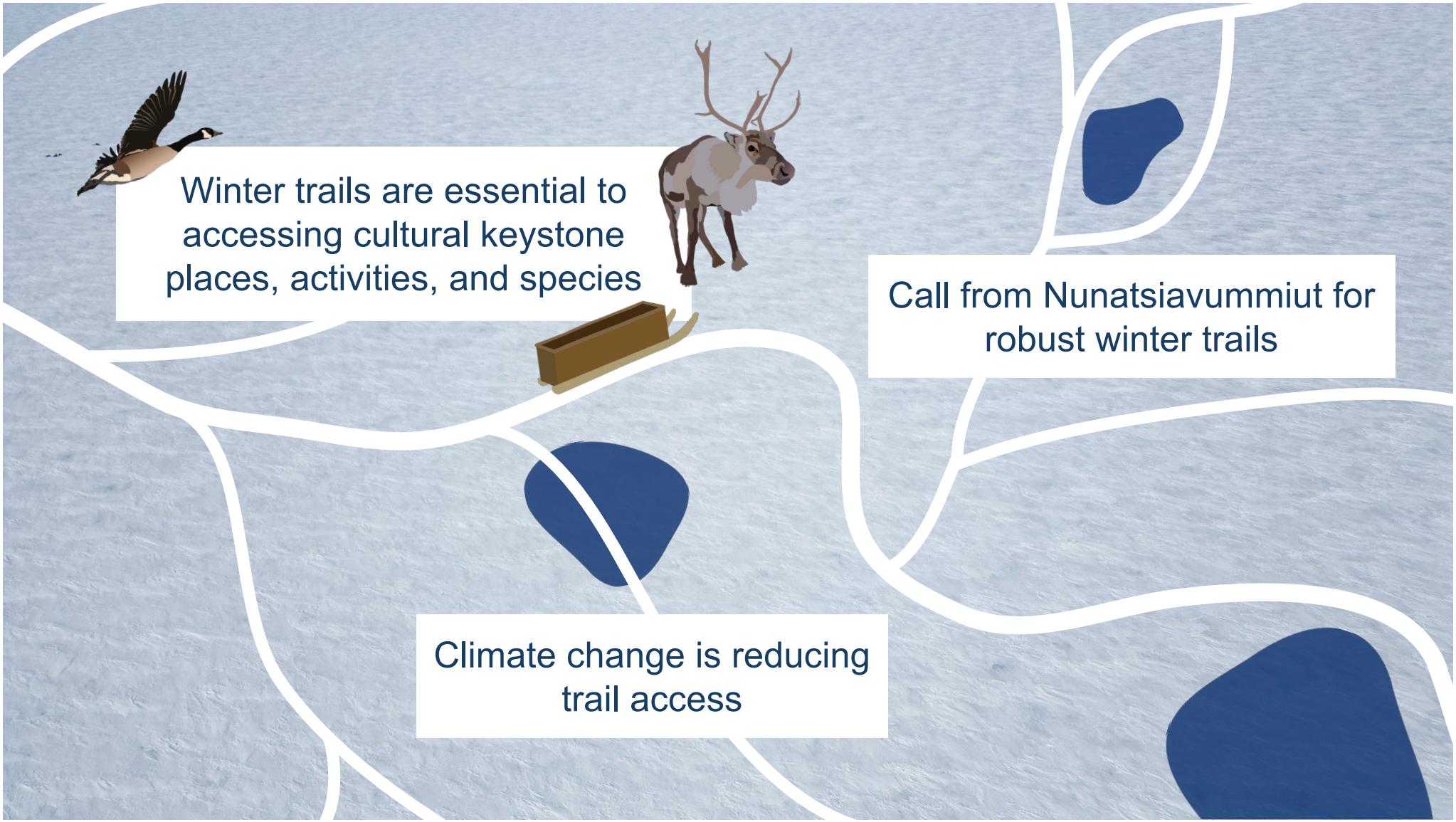
NEGL

Nunatsiavut,
Labrador, Canada



Nunatsiavut, Labrador, Canada




Winter trails are essential to accessing cultural keystone places, activities, and species
Call from Nunatsiavummiut for robust winter trails
Climate change is reducing trail access

Research rationale

- Ice crossings are particularly vulnerable to extreme years
- Increasing challenges with trail maintenance
- What can reliable winter trails look like?

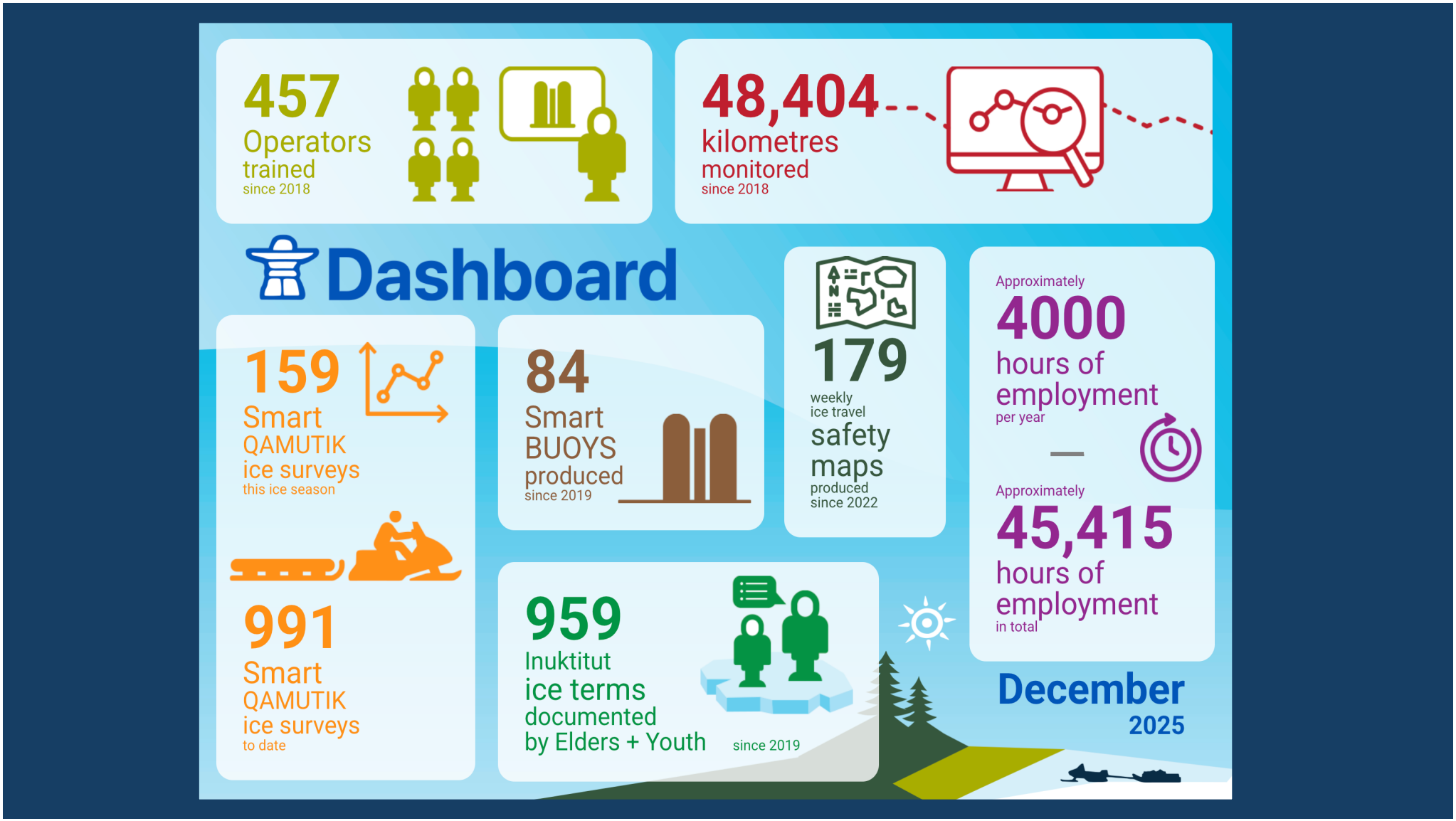
North West River's mechanical groomer broke through the ice in 2018 (Saltwire, 2018).

Consistent ice and snow cover

Strong ice cover

Adaptability to changing conditions

Predictability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Operators
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BUOYS
produced
since 2019
179
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ice travel
safety
maps
produced
since 2022
Approximately
4000
hours of
employment
per year
—
Approximately
45,415
hours of
employment
in total
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Smart
QAMUTIK
ice surveys
to date
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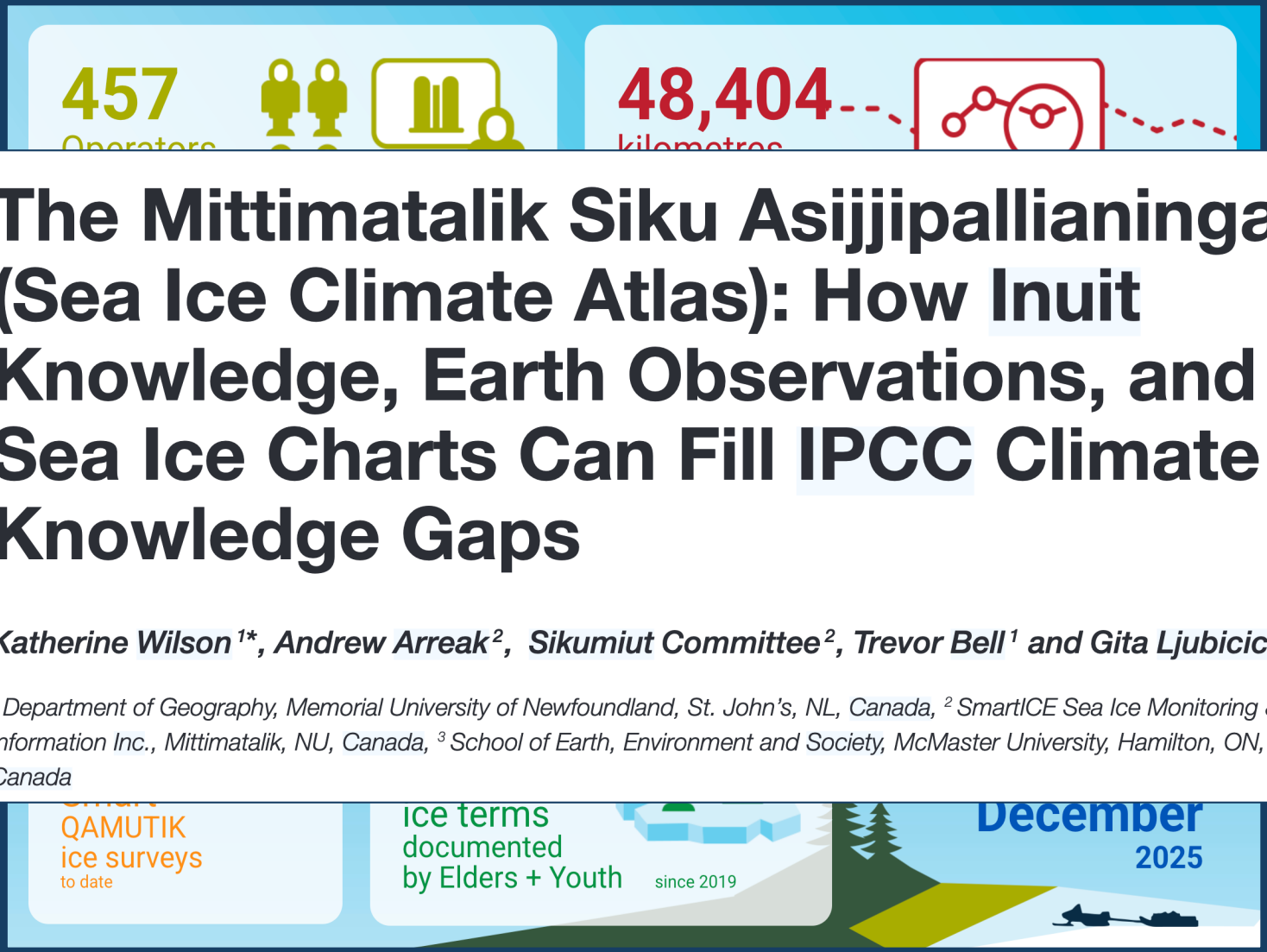
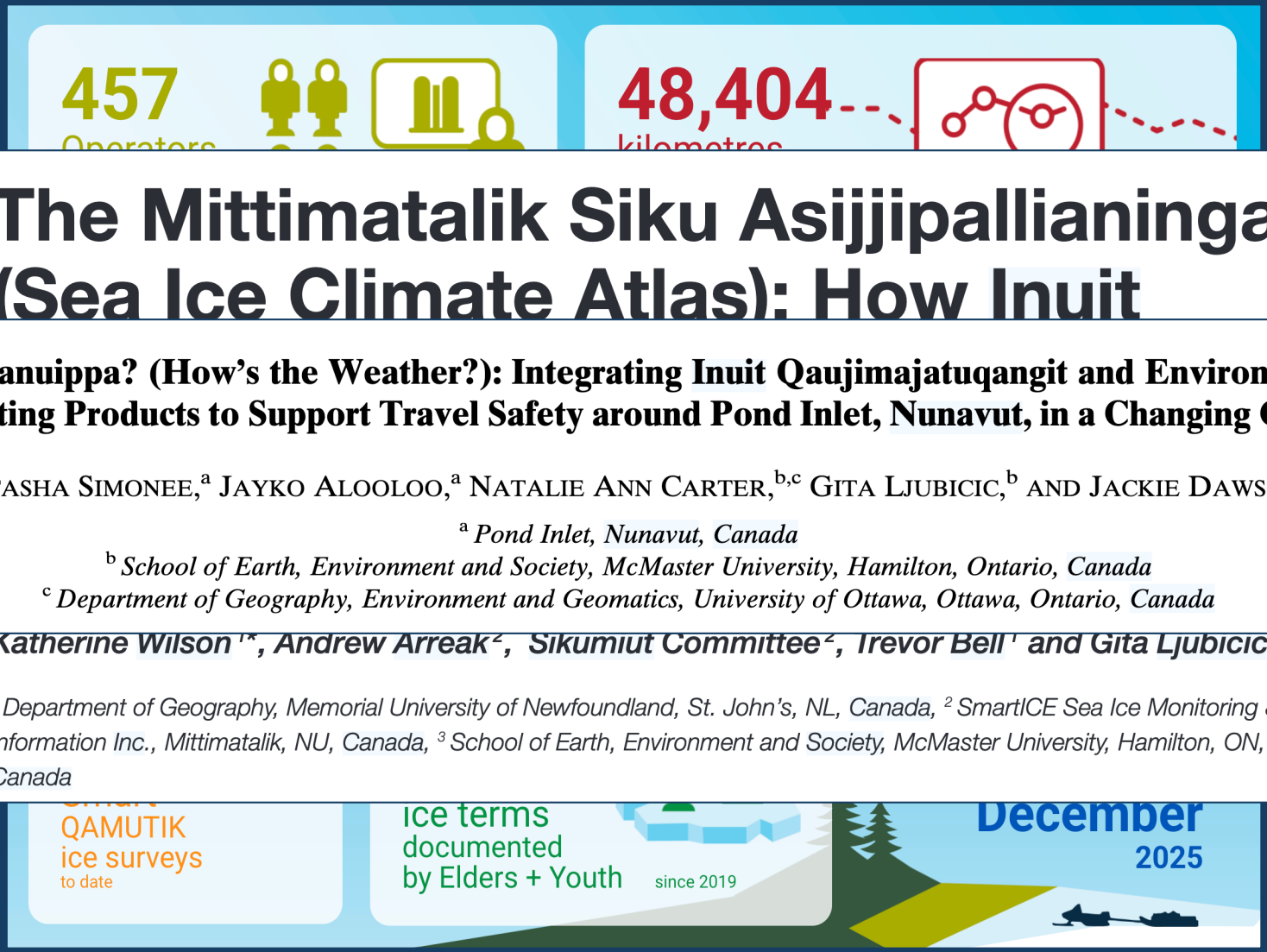
documented
by Elders + Youth
since 2019
December
2025



The Mittimatalik Siku Asijjipallianinga (Sea Ice Climate Atlas): How Inuit Knowledge, Earth Observations, and Sea Ice Charts Can Fill IPCC Climate Knowledge Gaps

Katherine Wilson [1]*, ***Andrew Arreak*** [2], ***Sikumiut Committee*** [2], ***Trevor Bell*** [1] ***and Gita Ljubicic*** [3]

[1] *Department of Geography, Memorial University of Newfoundland, St. John's, NL, Canada,* [2] *SmartICE Sea Ice Monitoring & Information Inc., Mittimatalik, NU, Canada,* [3] *School of Earth, Environment and Society, McMaster University, Hamilton, ON, Canada*



The Mittimatalik Siku Asijjipallianinga (Sea Ice Climate Atlas): How Inuit

Sila Qanuippa? (How's the Weather?): Integrating Inuit Qaujimajatuqangit and Environmental Forecasting Products to Support Travel Safety around Pond Inlet, Nunavut, in a Changing Climate

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[a] *Pond Inlet, Nunavut, Canada*
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Katherine Wilson [1]*, Andrew Arreak [2], Sikumiut Committee [2], Trevor Bell [1] and Gita Ljubicic [3]

[1] Department of Geography, Memorial University of Newfoundland, St. John's, NL, Canada, [2] SmartICE Sea Ice Monitoring & Information Inc., Mittimatalik, NU, Canada, [3] School of Earth, Environment and Society, McMaster University, Hamilton, ON, Canada

The Mittimatalik Siku Asijjipallianinga (Sea Ice Climate Atlas): How Inuit

Changing access to ice, land and water in Arctic communities

J. D. Ford[1,2*], D. Clark[2], T. Pearce[3], L. Berrang-Ford[1], L. Copland[4], J. Dawson[4], M. New[5,6] and S. L Harper[7]

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48,404
The Mittimatalik Siku Asijjipallianinga
Projected decrease in trail access in the Arctic
J. D. Ford [1]✉, D. G. Clark [2], L. Copland [3], T. Pearce[4], IHACC Research Team* & S. L. Harper [5]
S. L Harper [7]
[1] Department of Geography, Memorial University of Newfoundland, St. John's, NL, Canada, [2] SmartICE Sea Ice Monitoring & Information Inc., Mittimatalik, NU, Canada, [3] School of Earth, Environment and Society, McMaster University, Hamilton, ON, Canada
QAMUTIK
ice surveys
to date
ice terms
documented
by Elders + Youth
since 2019
December
2025

The Mittimatalik Siku Asijjipallianinga (Sea Ice Climate Atlas): How Inuit

Initiatives looking at trail resilience?

S. L Harper [1]

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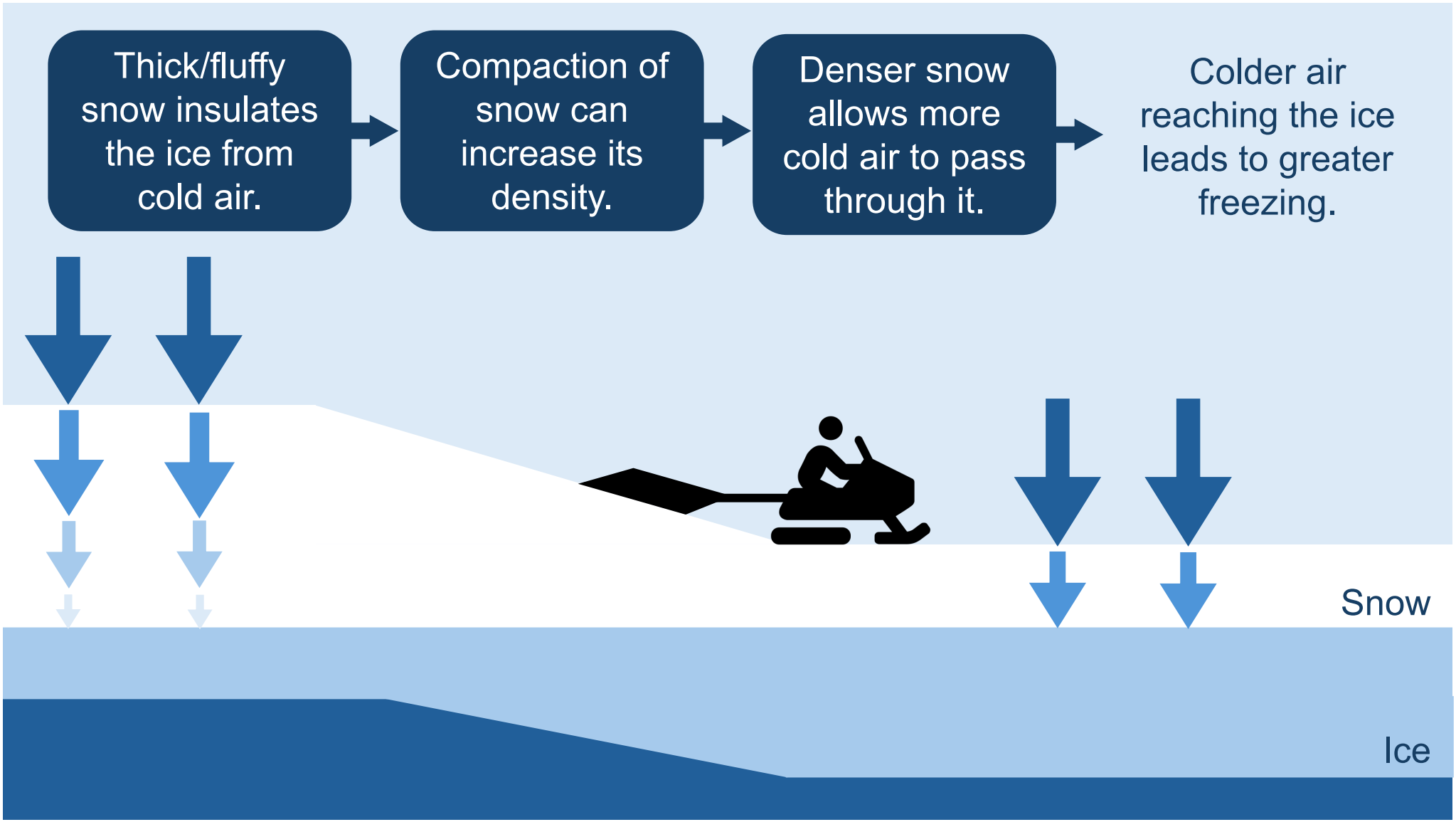
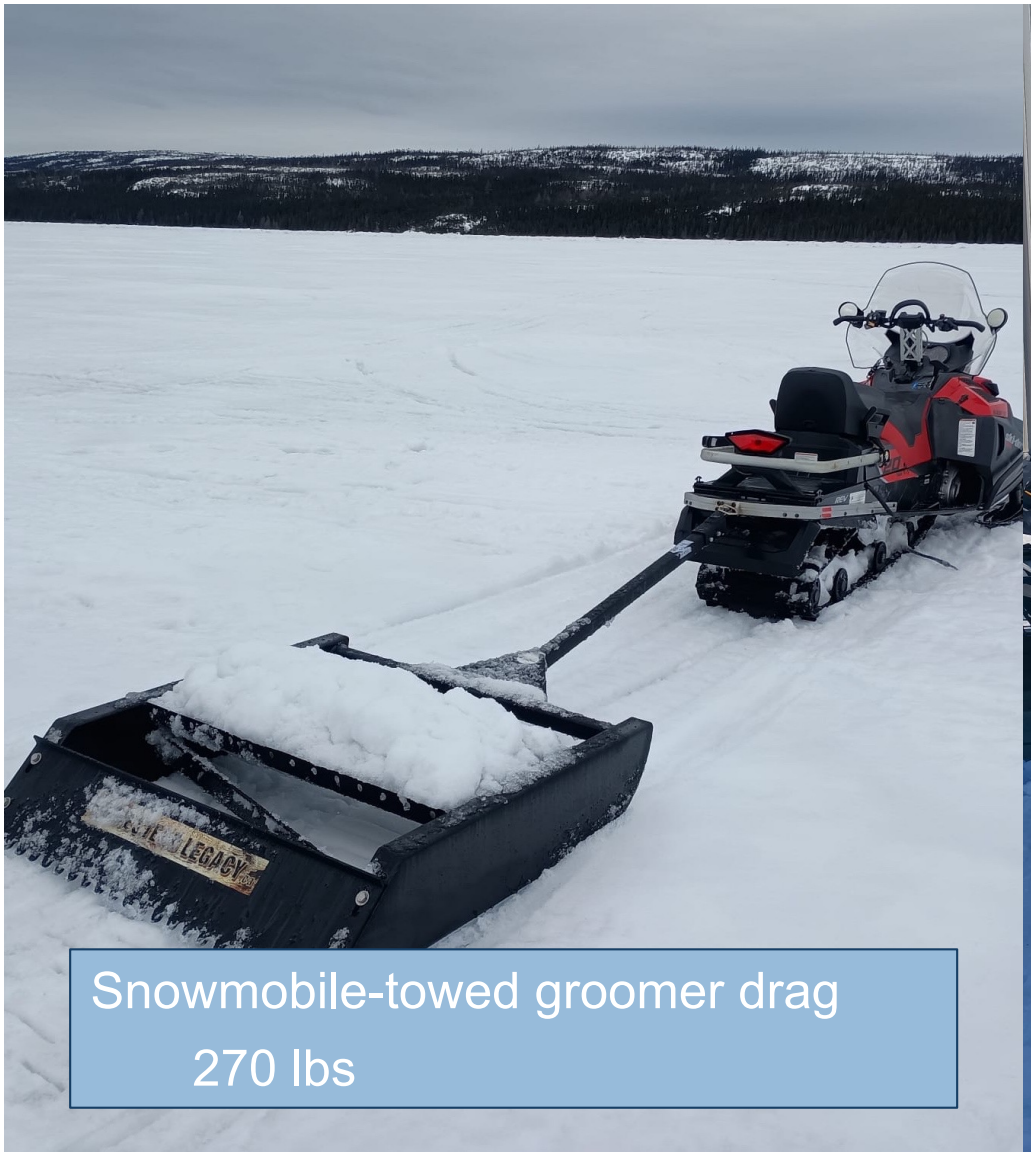

Thick/fluffy snow insulates the ice from cold air.
Compaction of snow can increase its density.
Denser snow allows more cold air to pass through it.
Colder air reaching the ice leads to greater freezing.
Snow
Ice



Snowmobile-towed groomer drag

270 lbs

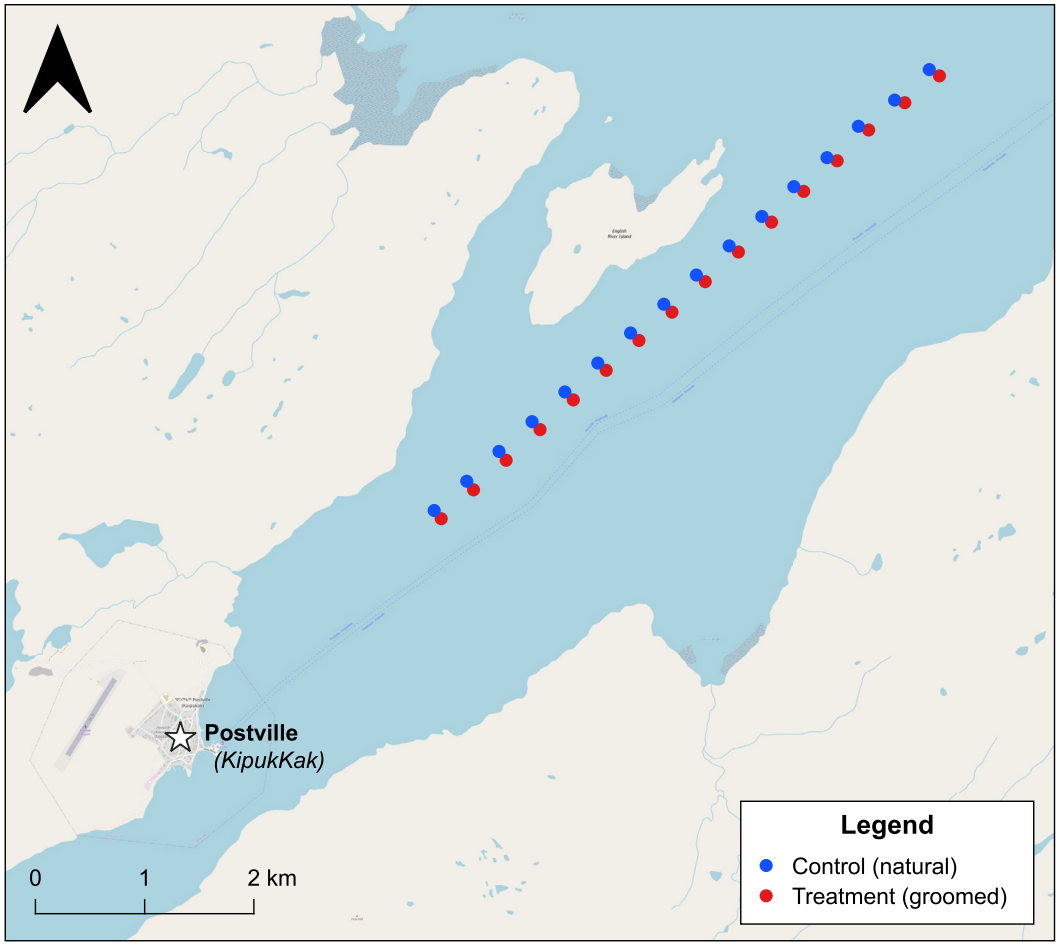
Conventional, mechanical groomer

~20,000 lbs fully-loaded


So…
Can snow compaction techniques be used to enhance the resilience of winter trail ice crossings in Nunatsiavut, Labrador?

Snow compaction: study site

- March 21 – April 16
- Two 6 km transects, 16 sampling points spaced 400 m apart
- 4 passes with the groomer drag every 1-3 days, total 40 passes



Snow compaction: study site

- March 21 – April 16
- Two 6 km transects, 16 sampling points spaced 400 m apart
- 4 passes with the groomer drag every 1-3 days, total 40 passes

1

160 and 450 MHZ ground penetrating radar (GPR) surveys were conducted along marked transects.

2

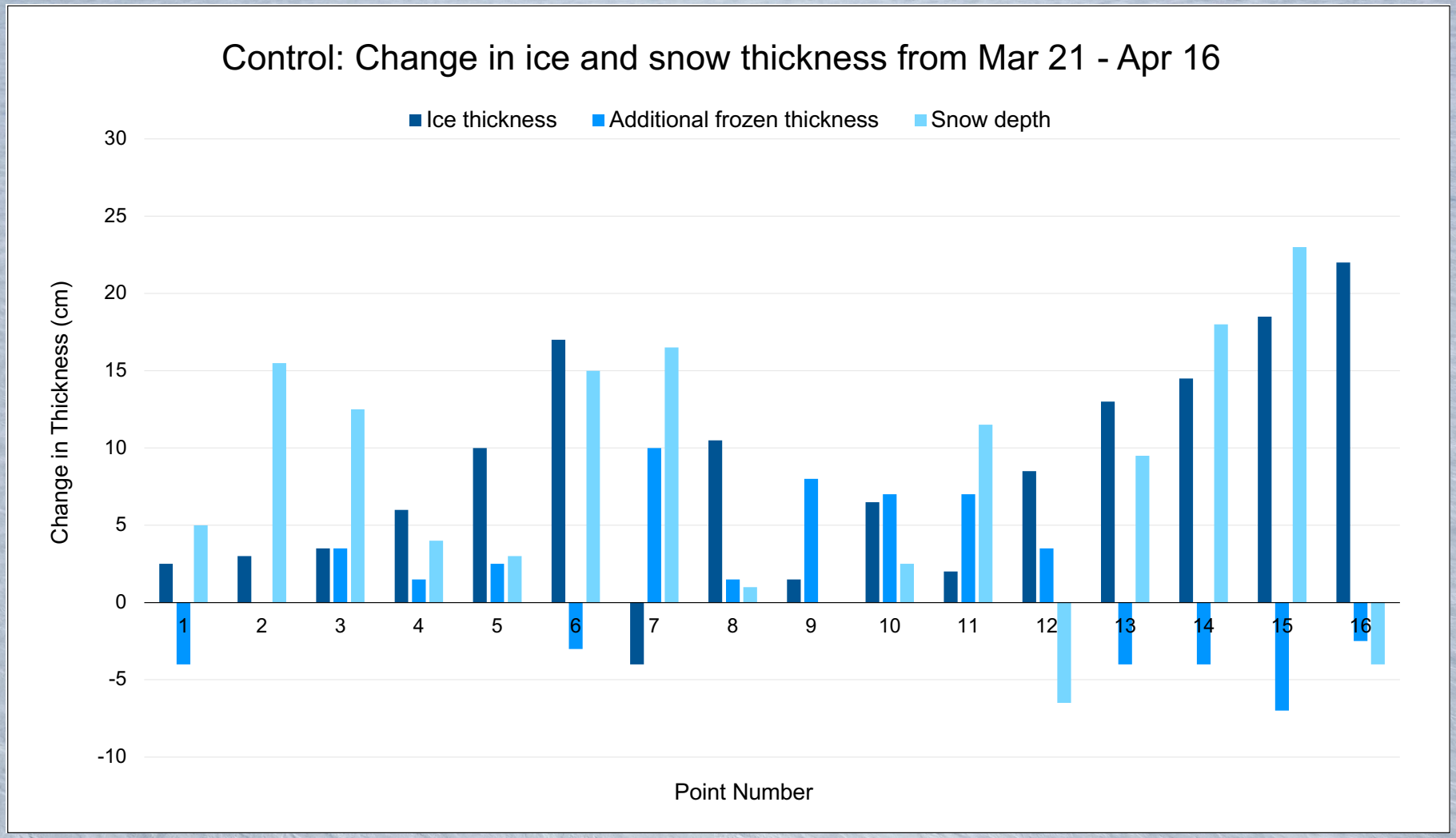
Snow and superimposed ice layers were identified and measured using snow pits. Snow density samples were collected at certain snow pits.

3

Ice thickness measurements were taken at the base of snow pits using a drill and weighted tape measure.

4

Point-based snow and ice measurements along the GPR transects were geolocated using a DGPS.


Control: Change in ice and snow thickness from Mar 21 - Apr 16
Ice thickness
Additional frozen thickness
Snow depth
Change in Thickness (cm)
30
25
20
15
10
5
0
-5
-10
1
2
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4
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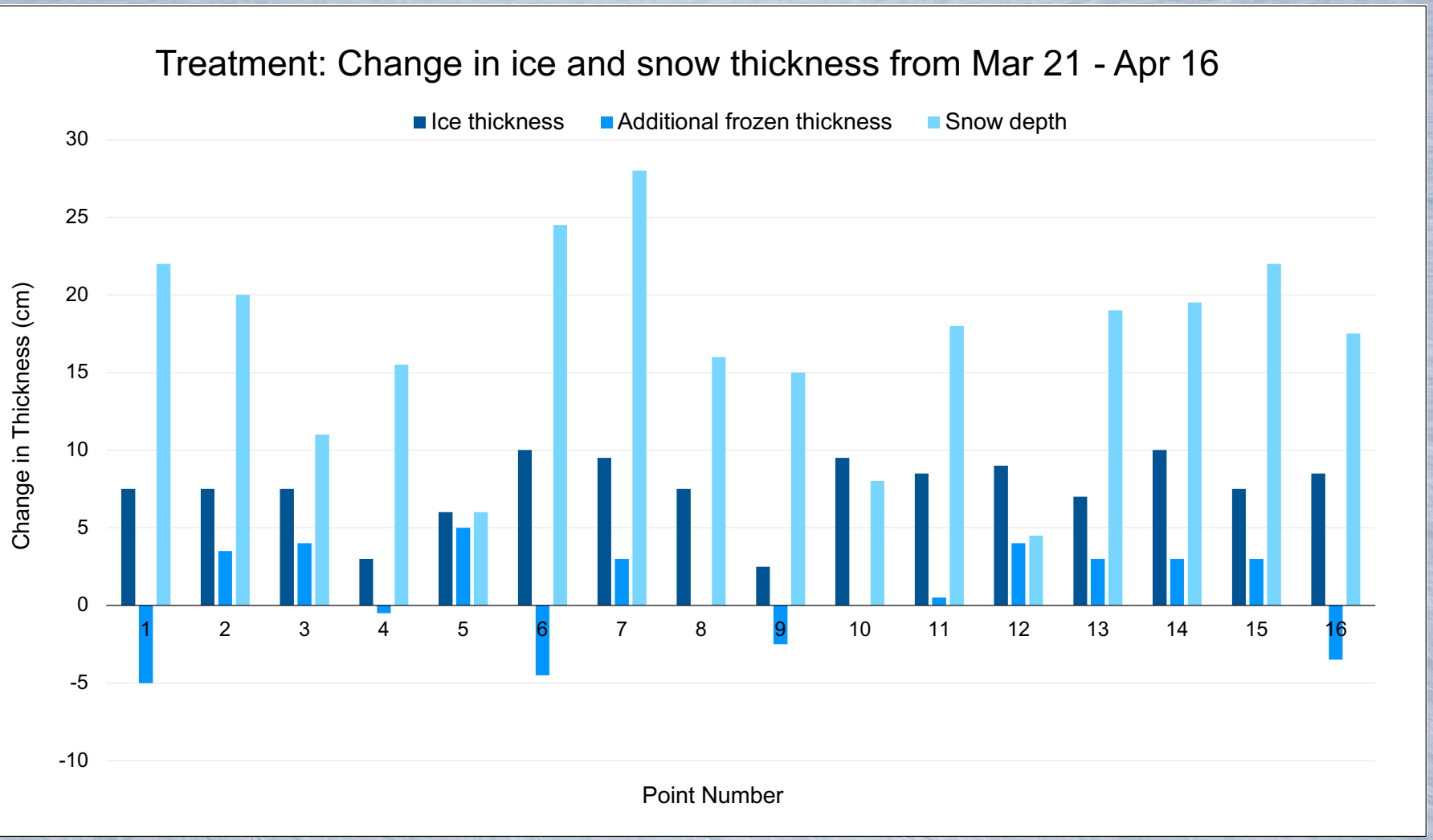
6
7
8
9
10
11
12
13
14
15
16
Point Number


Treatment: Change in ice and snow thickness from Mar 21 - Apr 16
Ice thickness
Additional frozen thickness
Snow depth
Change in Thickness (cm)
30
25
20
15
10
5
0
-5
-10
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
Point Number

Preliminary results

Treatment displayed

- More homogeneous ice thickness and snow density
- Greater snowpack retention

No significant

- Difference in ice thickness compared to control
- Increase in snow density after compaction

Challenges

- Late start (warm January)
- Comparability between transects
- No measurements into melt season
- GPR GPS failure
- Large groomer did not operate

Community feedback

Many mechanical groomers no longer used on marked trails, concerns for groomer operator safety but need an alternative for maintenance.

Benefits of trail grooming: snowpack and ice preservation throughout season, trail hardening, ease of travel.

Modifications to study design: look at effects on freshwater lakes, add weight to groomer drag, look at snowpack temperature.

Marked trail land crossings are overgrown with tall vegetation, creating challenges for travel and maintenance.

Looking ahead

Experimental plan for Winter 2026

- Begin experiment in early winter
- Reassess control offset
- Incorporate community feedback and recommendations

Mulligan Bay

- Large, mechanical groomer
- Snow compaction effect size

Explore opportunities for this intervention

Thank you

Crown-Indigenous Relations and Northern Affairs Canada

Relations Couronne-Autochtones et Affaires du Nord Canada

NSERC CRSNG

NUNATSIAVUT kavamanga Government

NEGL

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Queen's UNIVERSITY

Postville Inuit Community Government, Makkovik Inuit Community Government, Town of North West River

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