WHERE AND WHY DO COASTAL RETROGRESSIVE THAW SLUMPS OCCUR?

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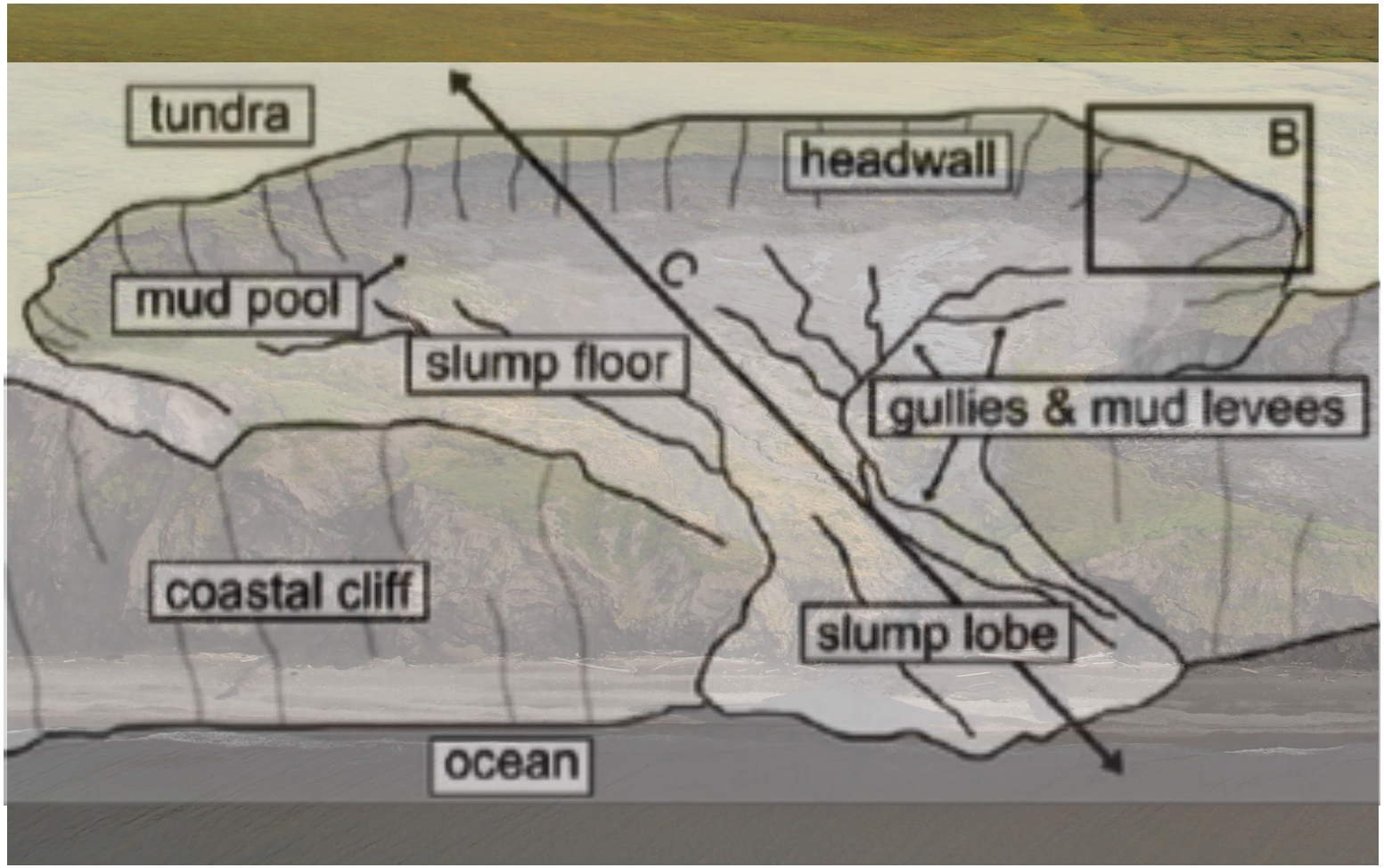
Retrogressive Thaw Slump?

Slump along the Yukon Coastal Plain, 2015

Retrogressive Thaw Slump?



Lantuit and Pollard, 2005

Why are they important?

✧ increasing in many places in the Arctic

✧ observed as dynamic landforms

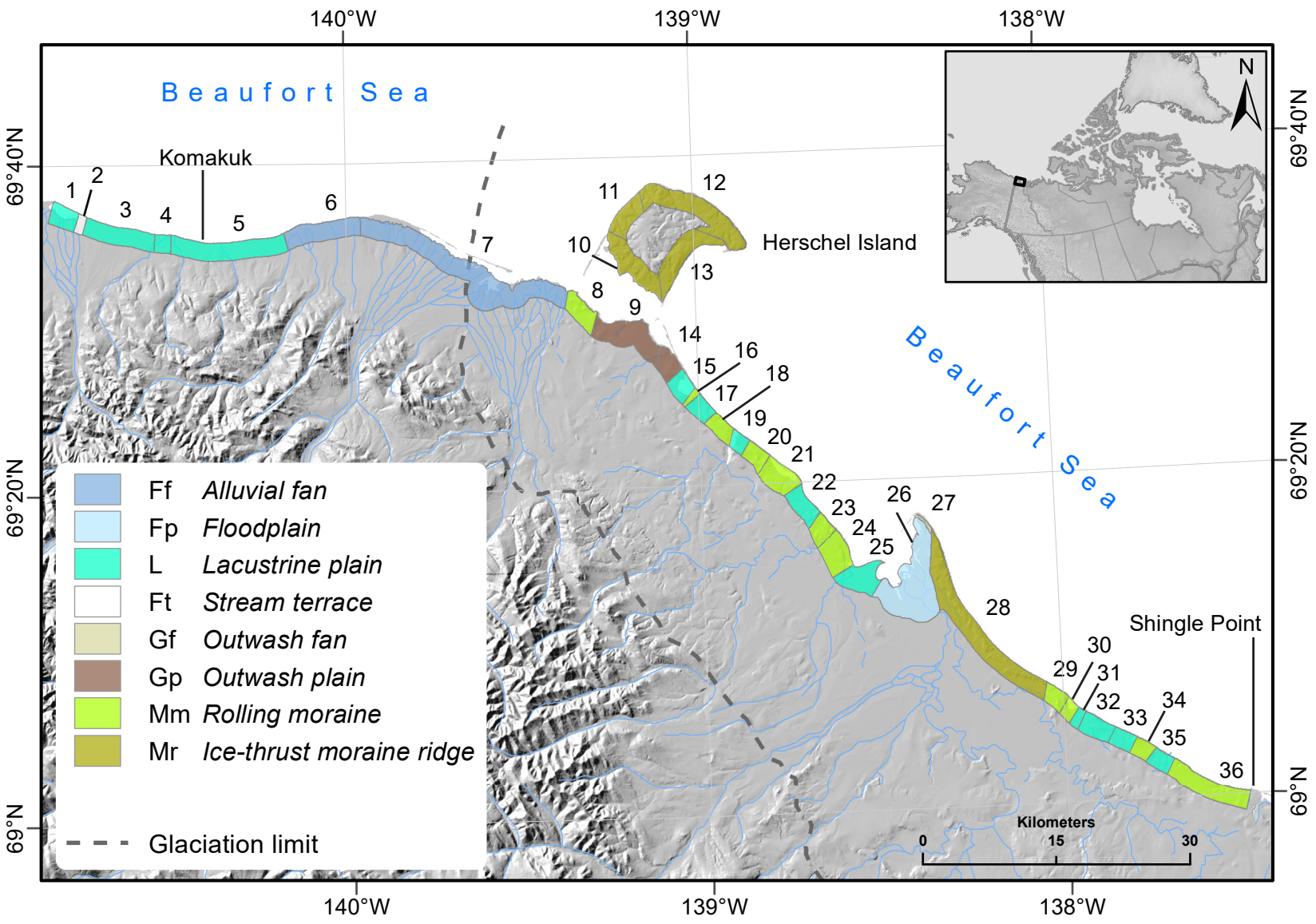
✧ affecting surrounding ecosystems

✧ impacting the transport of C,N and nutrients from land to ocean

Research Objectives

understanding the dynamics
of retrogressive thaw slumps
in coastal environments

Study Area


140°W
139°W
138°W
69°40'N
69°20'N
69°N
Beaufort Sea
Komakuk
Herschel Island
Shingle Point
1
2
3
4
5
6
7
8
9
10
11
12
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18
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20
21
22
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26
27
28
29
30
31
32
33
34
35
36
N
Ff Alluvial fan
Fp Floodplain
L Lacustrine plain
Ft Stream terrace
Gf Outwash fan
Gp Outwash plain
Mm Rolling moraine
Mr Ice-thrust moraine ridge
Glaciation limit
Kilometers
0
15
30

What do we want to know?

What do we want to know?

WHERE?

WHICH DENSITY?

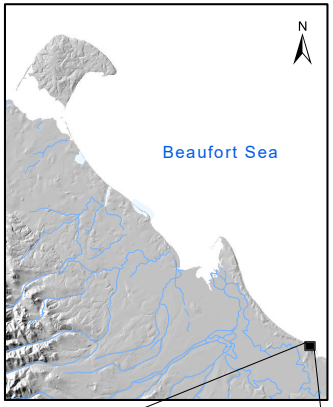
What do we want to know?

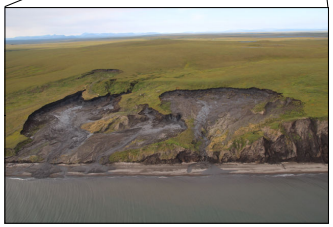
WHERE?

WHICH DENSITY?

WHY?

Mapping





Legend

Active RTS

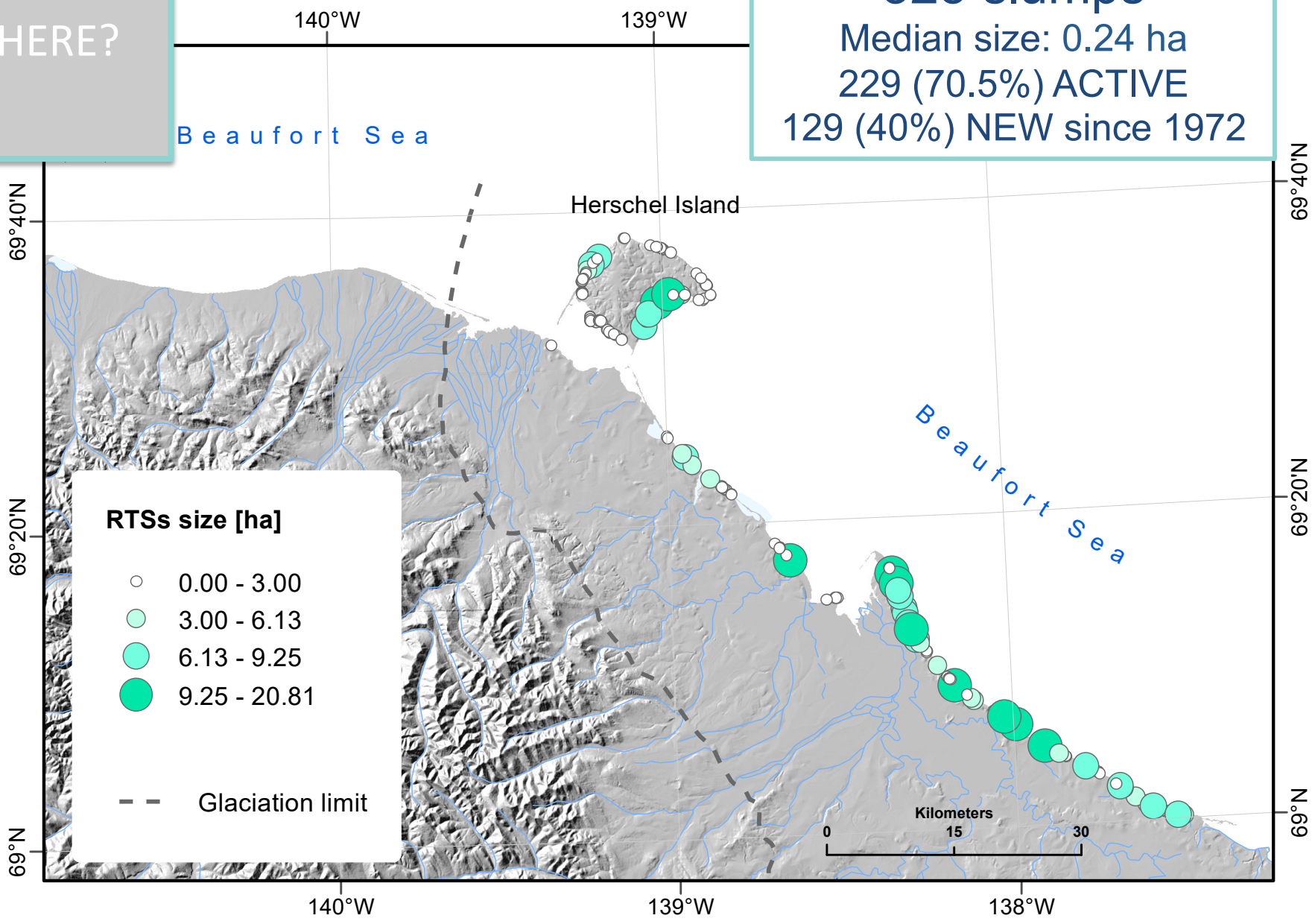
Stable RTS

0 25 50 100

Meters

WHERE?

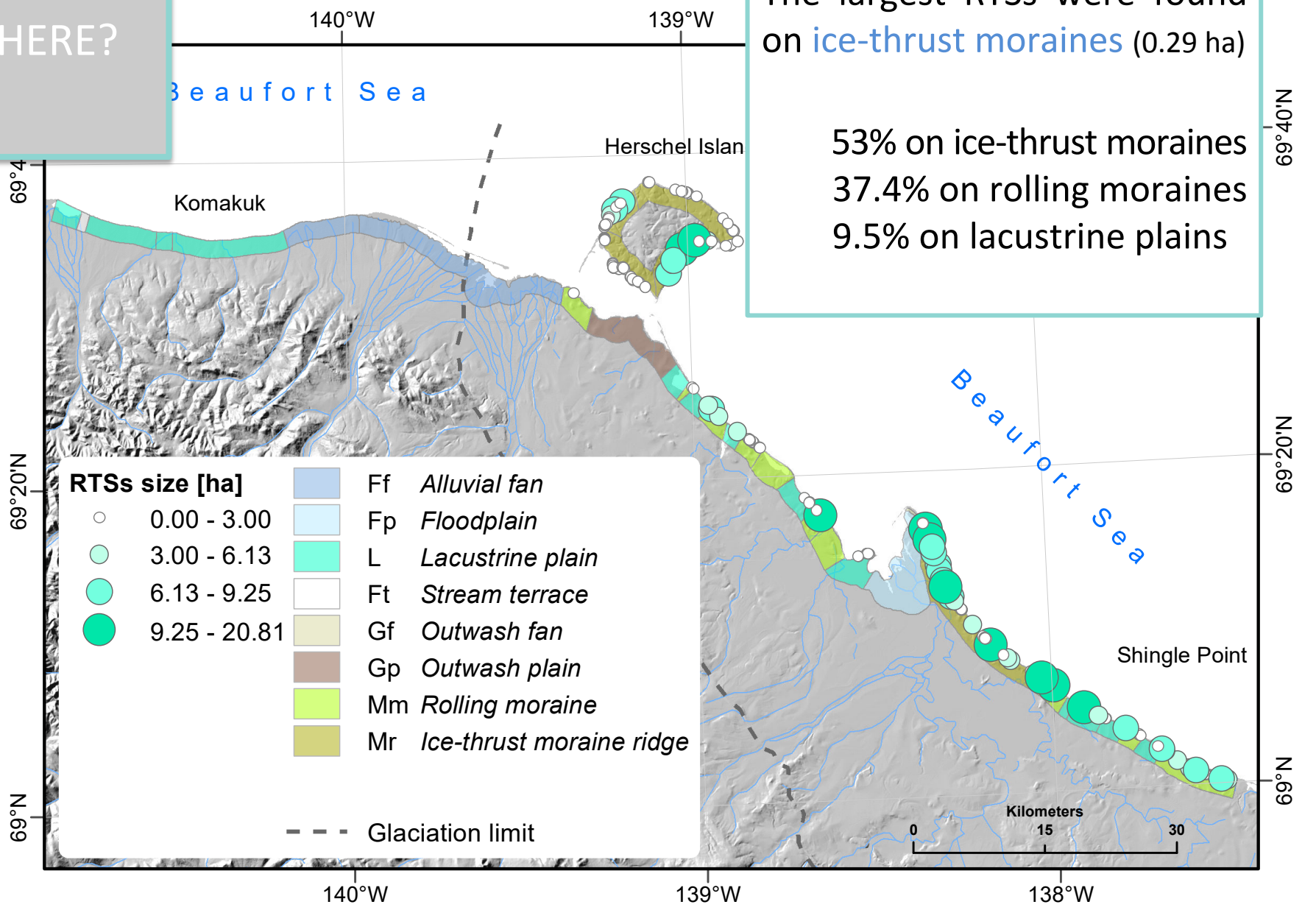
325 slumps
Median size: 0.24 ha
229 (70.5%) ACTIVE
129 (40%) NEW since 1972



WHERE?

The largest RTSs were found on ice-thrust moraines (0.29 ha)

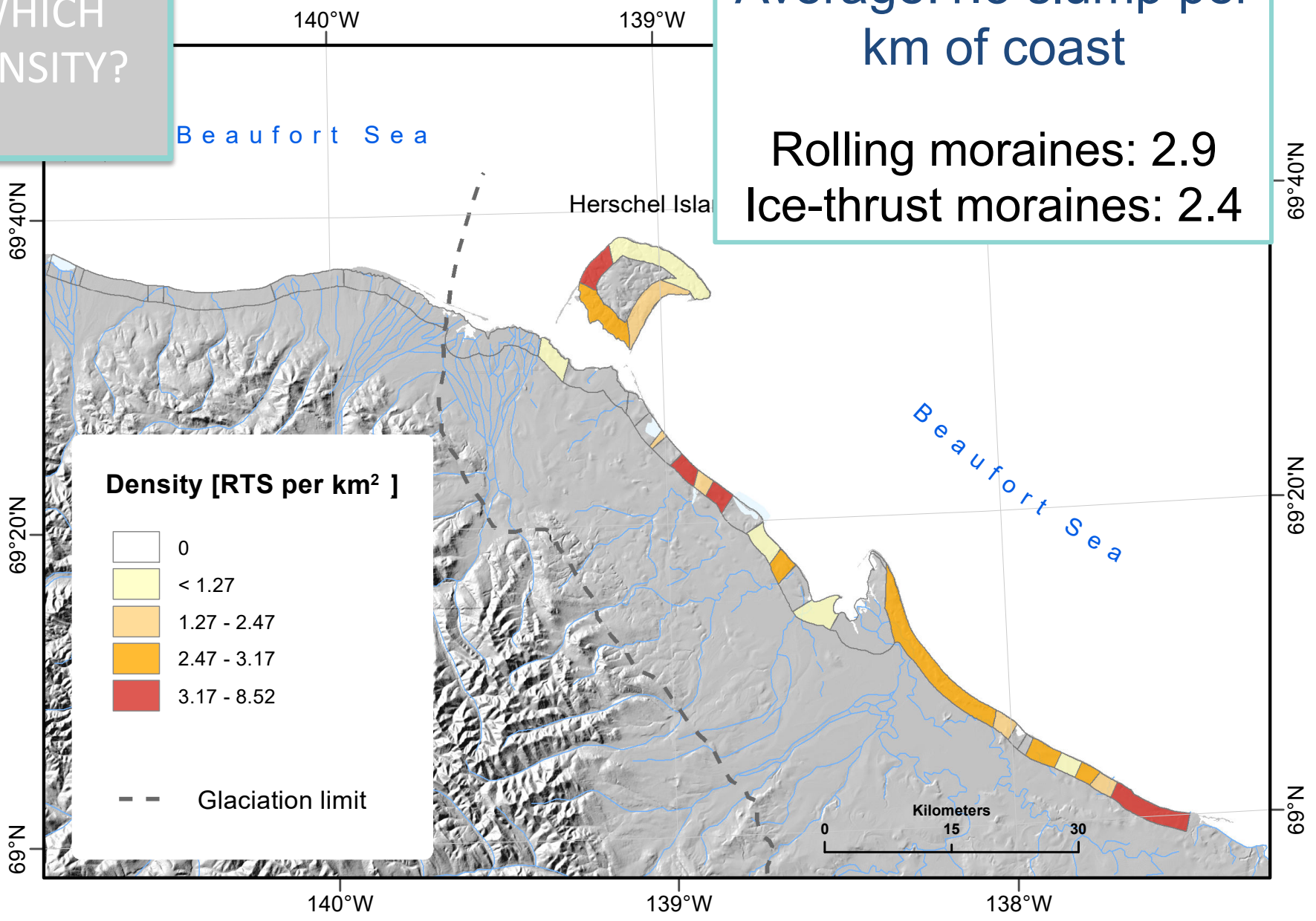
53% on ice-thrust moraines
37.4% on rolling moraines
9.5% on lacustrine plains



WHICH DENSITY?

Average:1.3 slump per km of coast

Rolling moraines: 2.9
Ice-thrust moraines: 2.4



WHY?

What is the reason behind this heterogeneous distribution?

WHY?

Univariate Regression Tree analyses

Which factor controls most high densities of RTSs in the study areas?

WHY?

Univariate Regression Tree analyses

Ground ice contents

Total of 16 environmental variables

WHY?

Univariate Regression Tree analyses

Ground ice contents

Coastal Geomorphology

Total of 16 environmental variables

WHY?

Univariate Regression Tree analyses

Ground ice contents

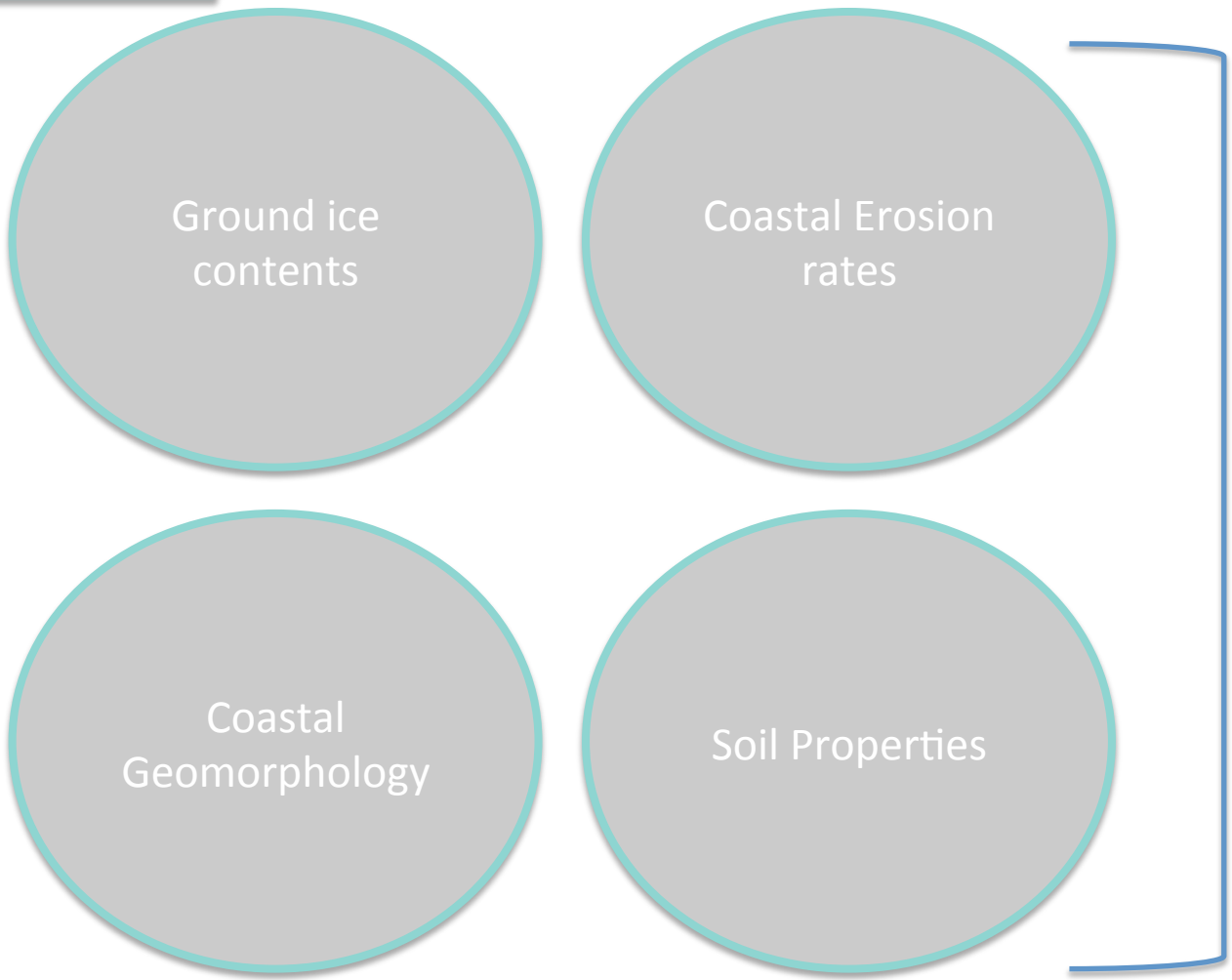
Coastal Erosion rates

Coastal Geomorphology

Total of 16 environmental variables

WHY?

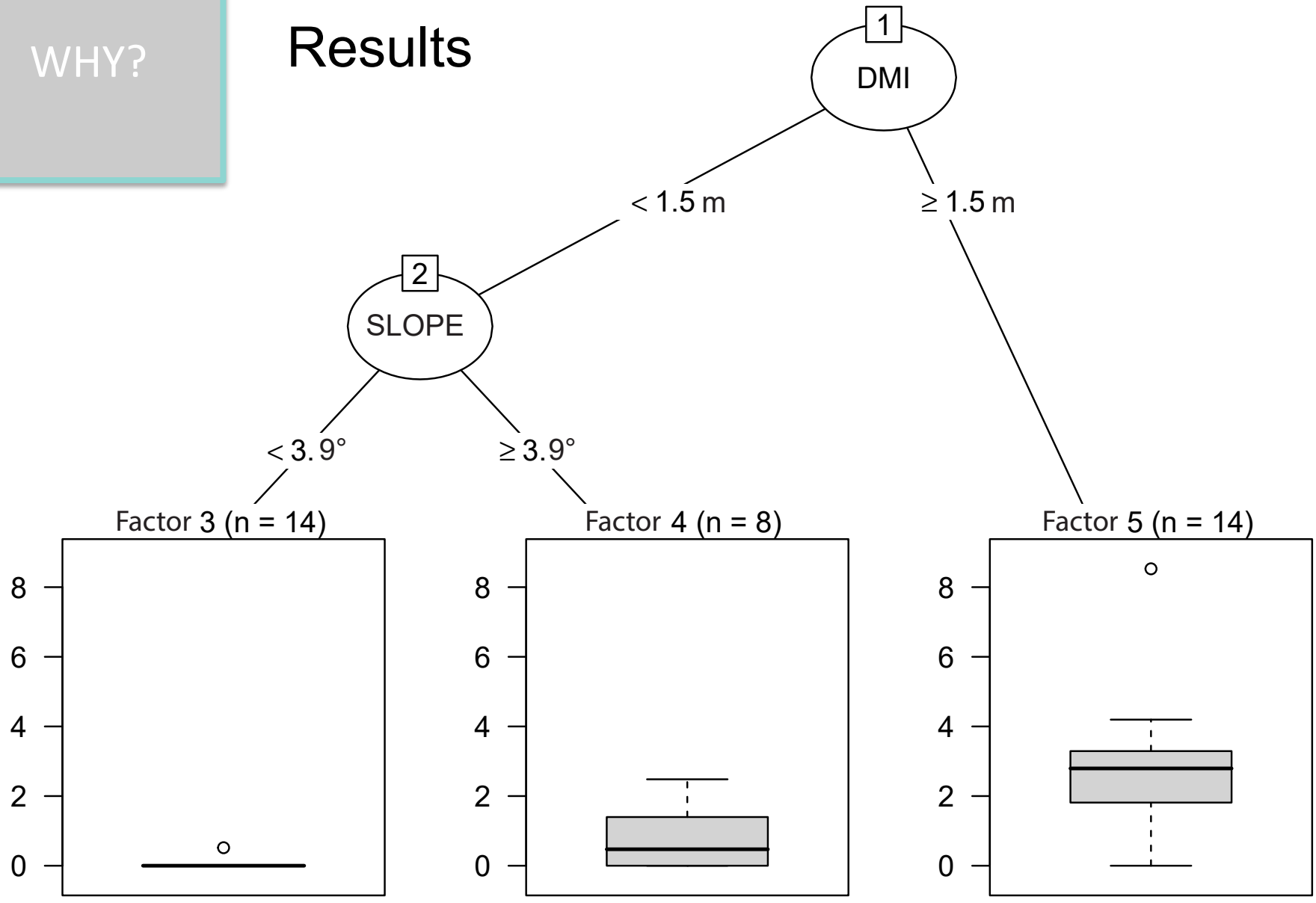
Univariate Regression Tree analyses



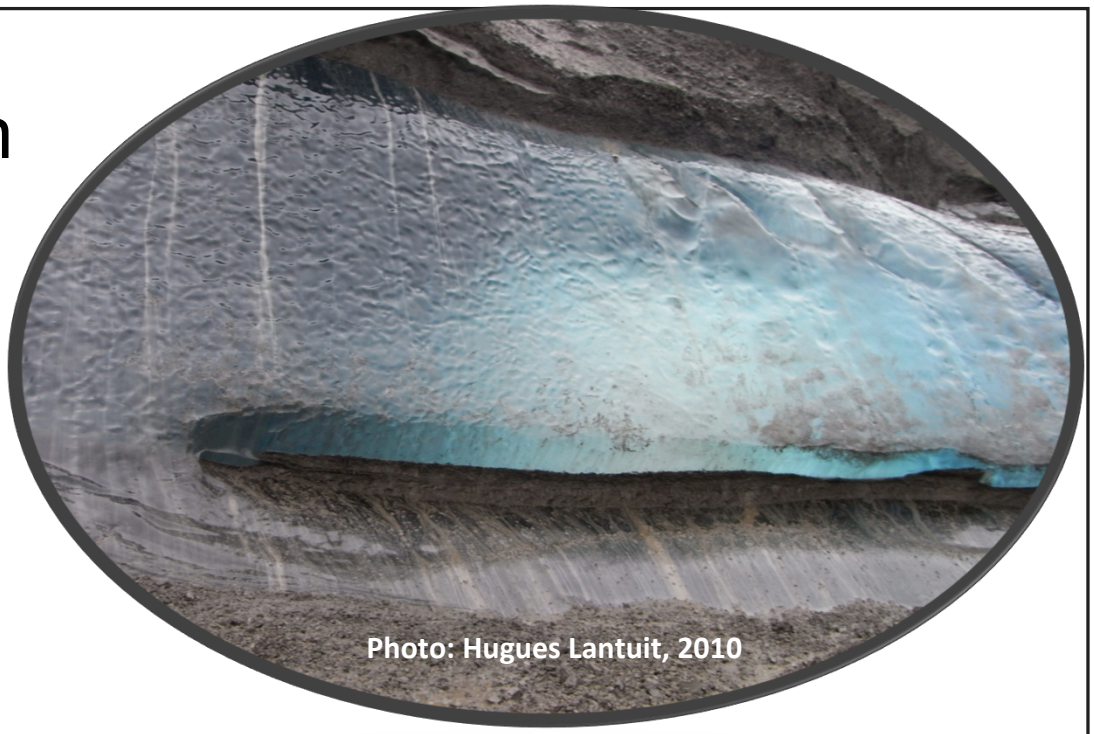
Total of 16 environmental variables

WHY?

Results


1
DMI
< 1.5 m
≥ 1.5 m
2
SLOPE
< 3. 9°
≥ 3.9°
Factor 3 (n = 14)
Factor 4 (n = 8)
Factor 5 (n = 14)
8
6
4
2
0

Explanation



Thickness of
Massive Ice > 1.5 m

WHY?

Explanation

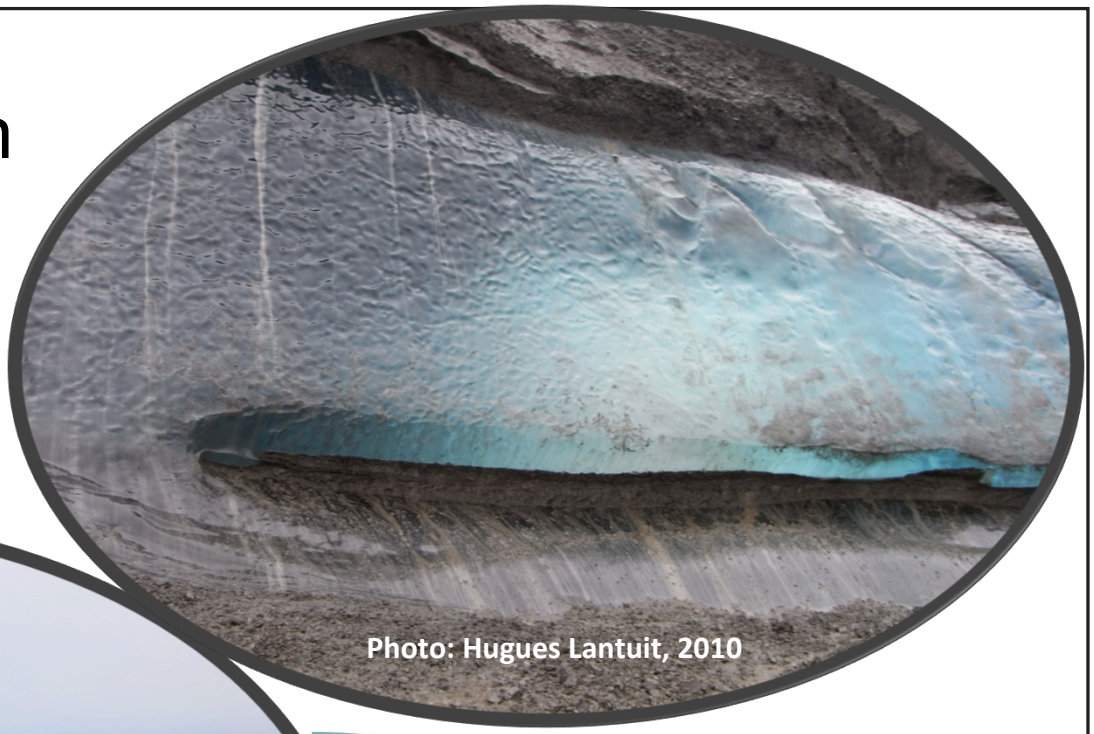


Photo: Hugues Lantuit, 2010

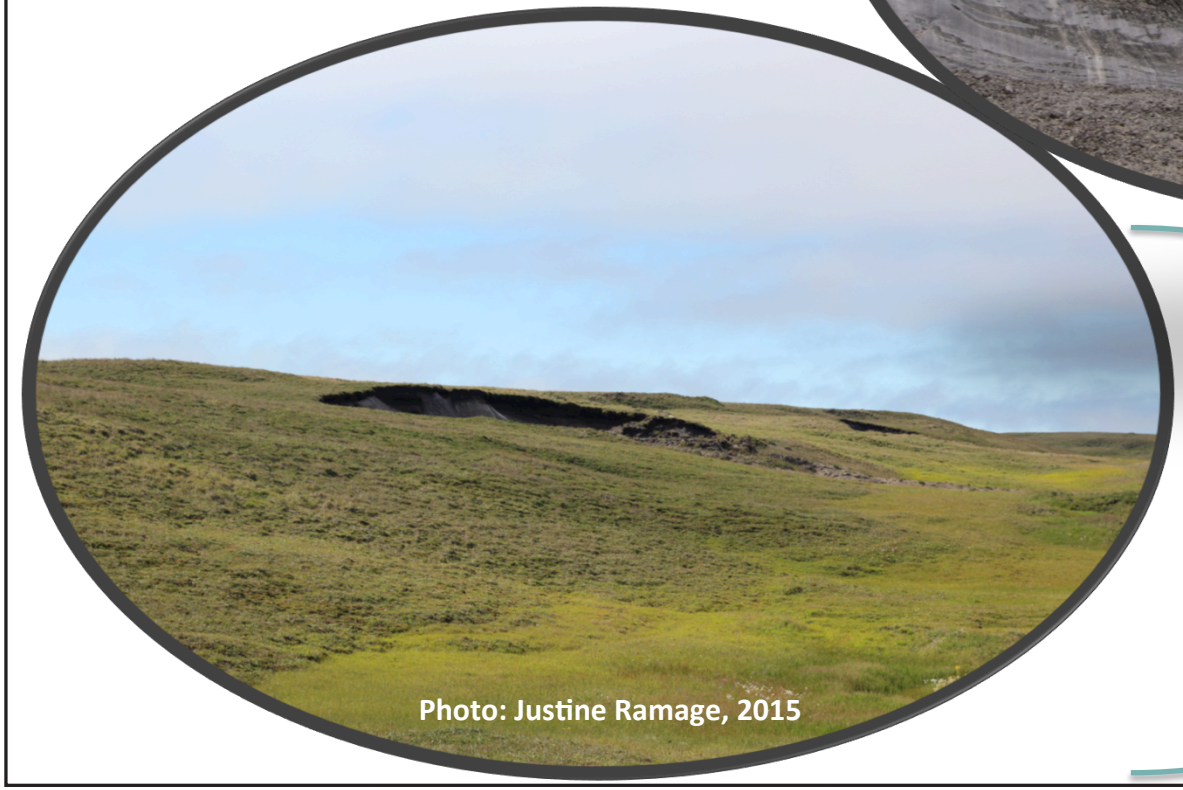
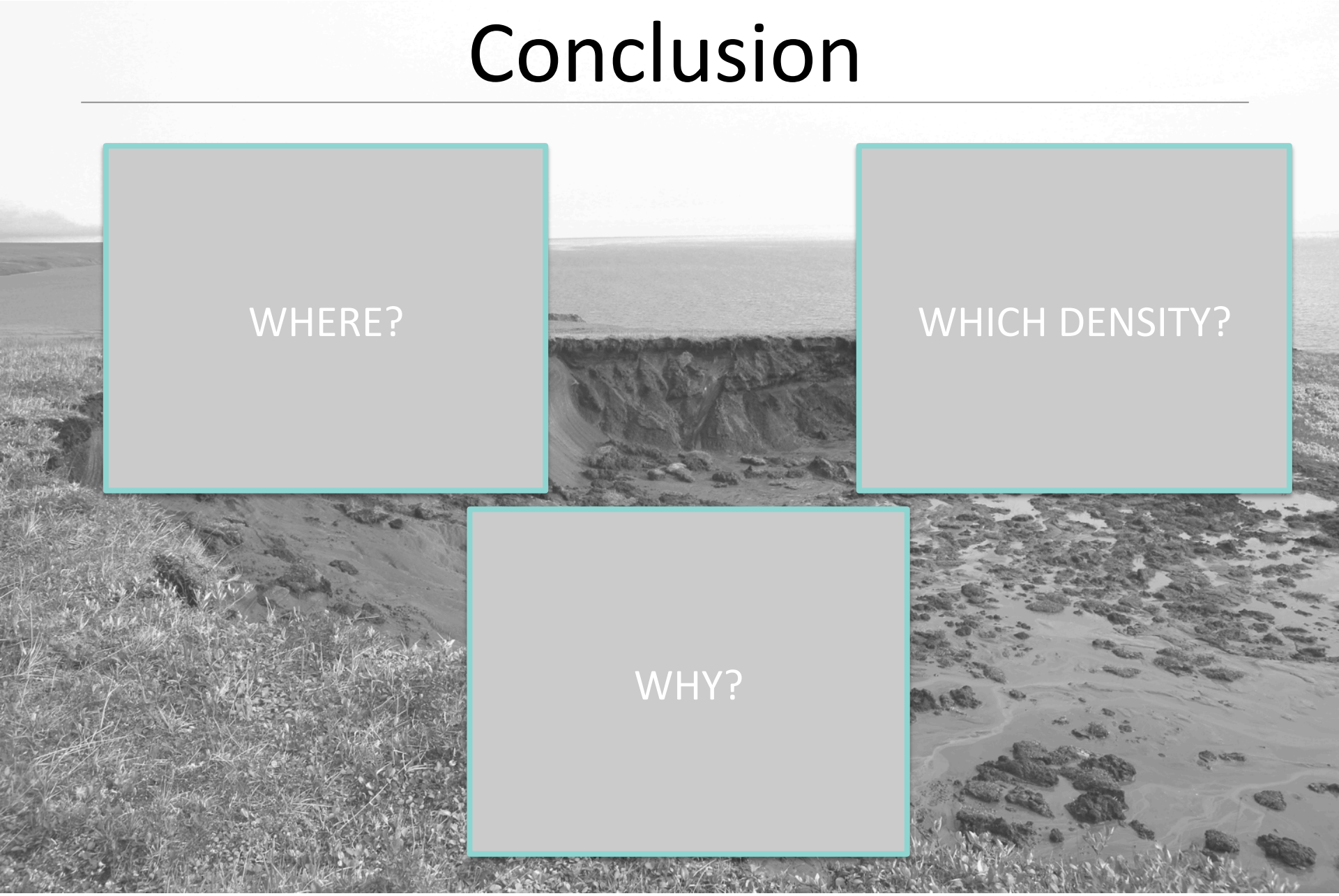


Photo: Justine Ramage, 2015

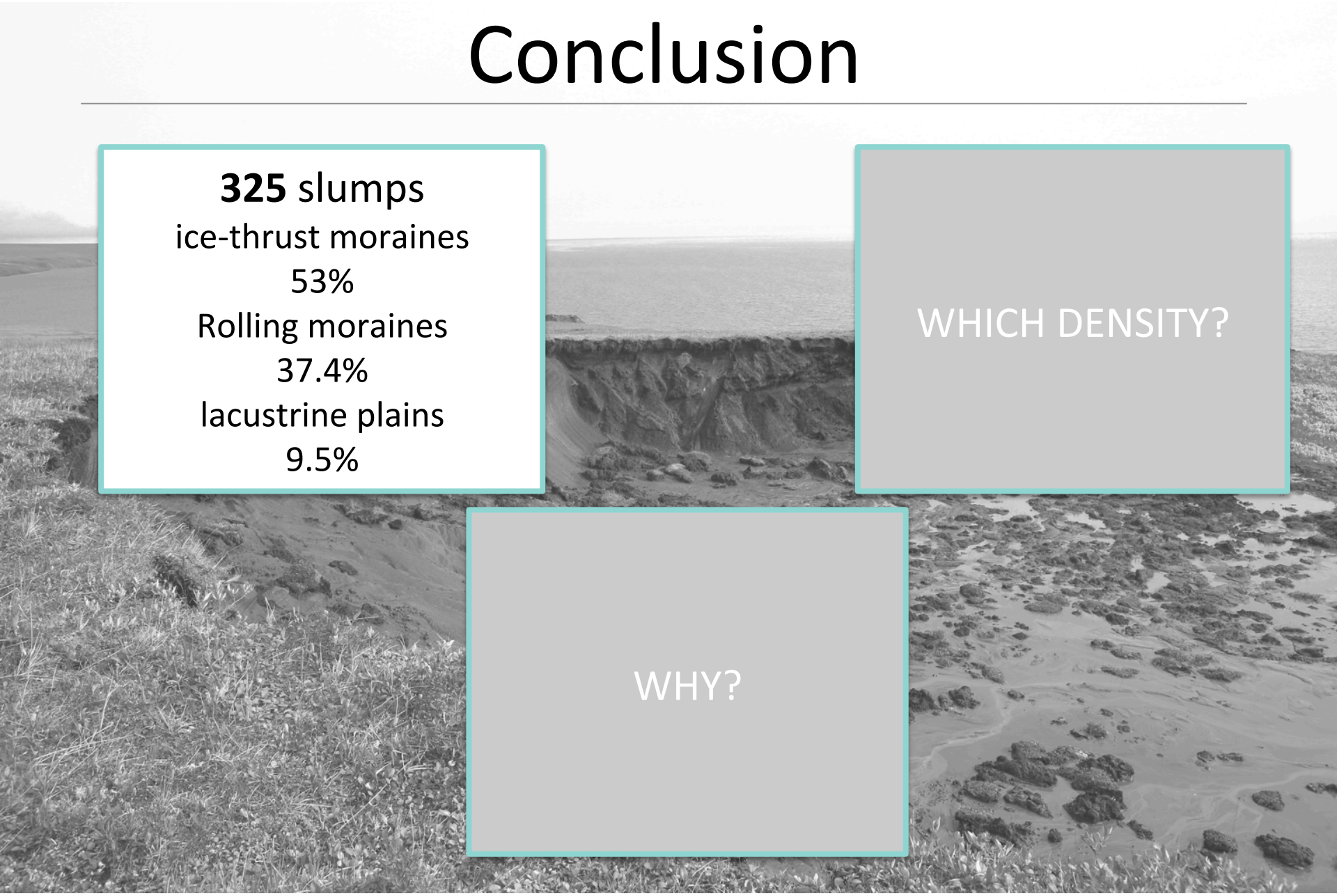
Thickness of Massive Ice > 1.5 m

Slope > 3.9°

Conclusion



Conclusion



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53%
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WHICH DENSITY?

WHY?

Conclusion

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1.3 slump / km of coast
Rolling moraines: 2.9 ice-thrust moraines: 2.4

WHY?

Conclusion

325 slumps

Ice-thrust moraines: 53%
Rolling moraines: 37.4%
Lacustrine plains: 9.5%

1.3 slump / km of coast
Rolling moraines: 2.9 ice-thrust moraines: 2.4

Thickness of Massive Ice bodies > **1.5 m**

Slope > **3.9°**

Thanks!