# Early detection and high resolution monitoring of terrain disturbance



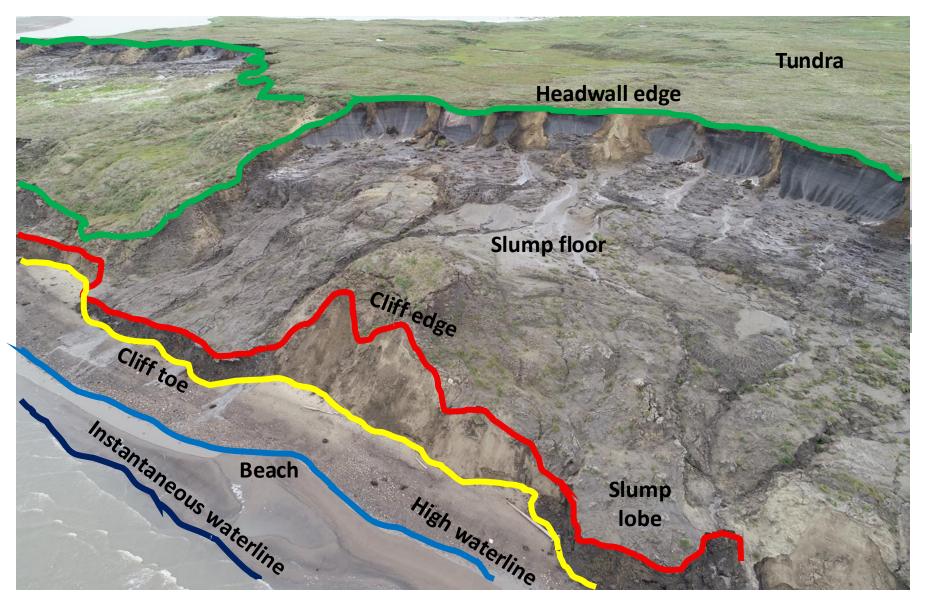
Identifying instability, before it gets to this

# Permafrost coastal erosion

- 1. Very high resolution RS UAV-SfM data collection strategies for planimetric and volumetric measurements
- 2. UAV-SfM and geographic object-based image analysis for multitemporal volumetric erosion
- Multiscale object-based classification and feature extraction along Arctic coasts
- 4. Towards broad-scale Arctic multi coastline proxy delineation based on object-based image classifications

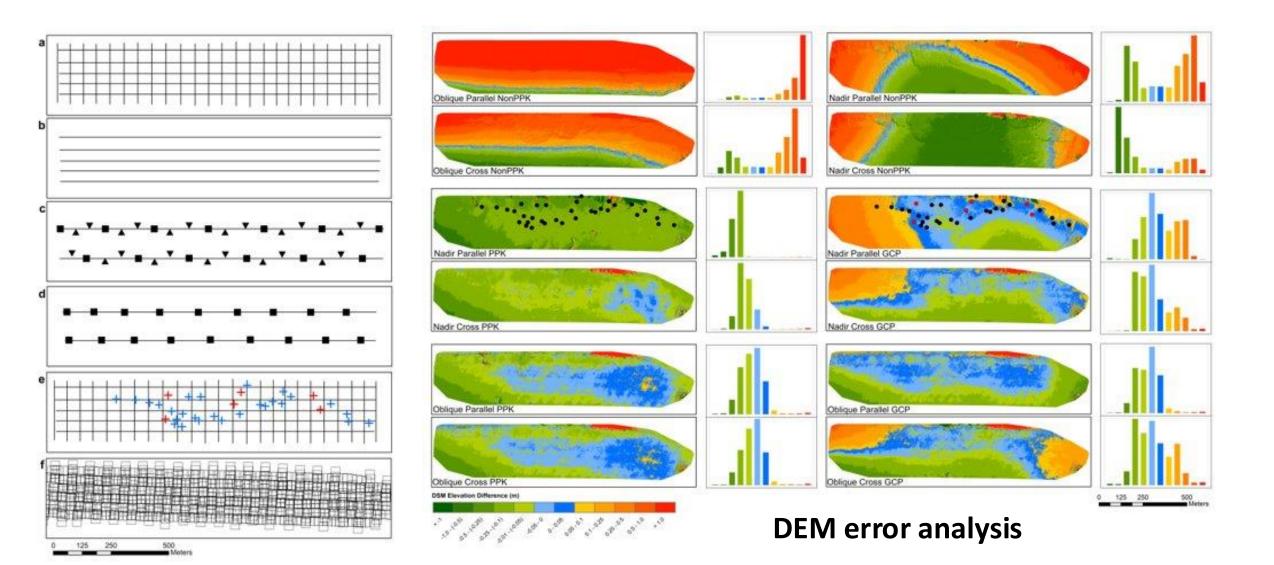


**Andrew Clark** 

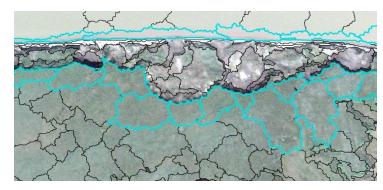


Permafrost coastlines can be complex environments

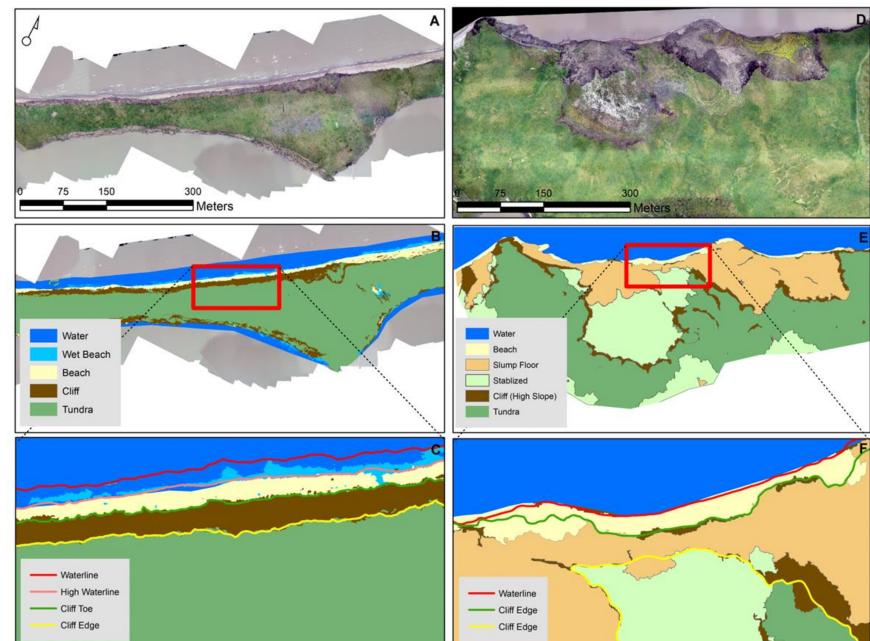
## What is the most effect way to collect and process UAV data?

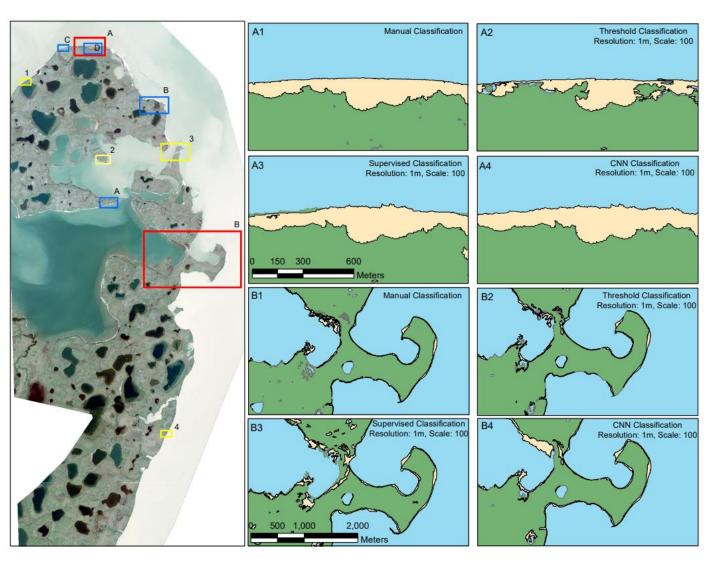


# High resolution object-based image analysis



- Turning pixels into objects, with attributes
- Increasing classification accuracy
- Partially automating the process





What is the best scale to do this at in different situations?

Determining what will work where and how well it works

Developing analysis efficiencies

# **Beaufort Sea**

# Implementation on a large scale

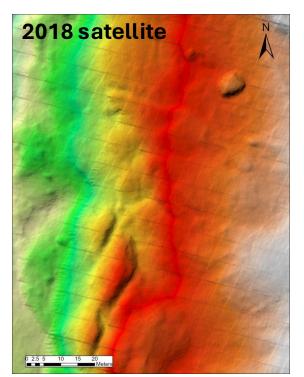
Assess accuracy against manually delineated tundra and waterlines and validation points and across varying coastal types

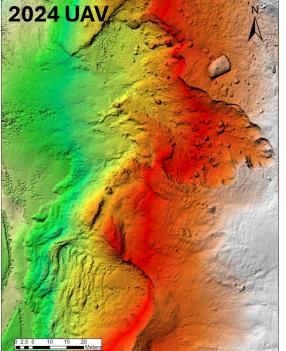
Working up processes to monitor entire coastlines

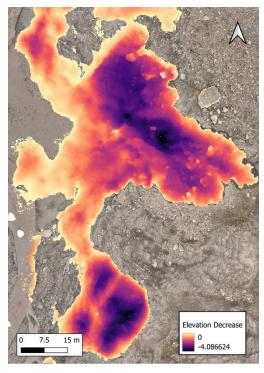
Liam Carson

# Bringing it to different environments

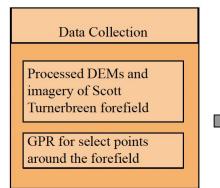
Use of high resolution remote sensing to quantify landscape change in the paraglacial/periglacial environment







# Taking it to the next level



Extract Input Variables

Thermal Imagery

Lithology

Subsidence (Change Detection)

Raster Stack Input Variables for Model Input/ Optimize Model

Utilize Terra package in R to format input data

Utilize RandomForest package to perform analysis

# Developing machine learning techniques for predicting future landscape instability





Model Output/Accuracy
Assessment

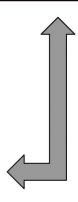
Map of ground ice
locations, validated with

Assess accuracy with overall accuracy, confusion matrix, ....

GPR/field observations

Rank input variable importance

Quantify volume of ice?



**Lucas Fuertes** 

# Bringing it all together

- Collaboration
- Cross fertilization
- Providing early career researchers with important experience





