Using remotely-sensed multispectral data to help understand vegetation cover in Northern Alaska

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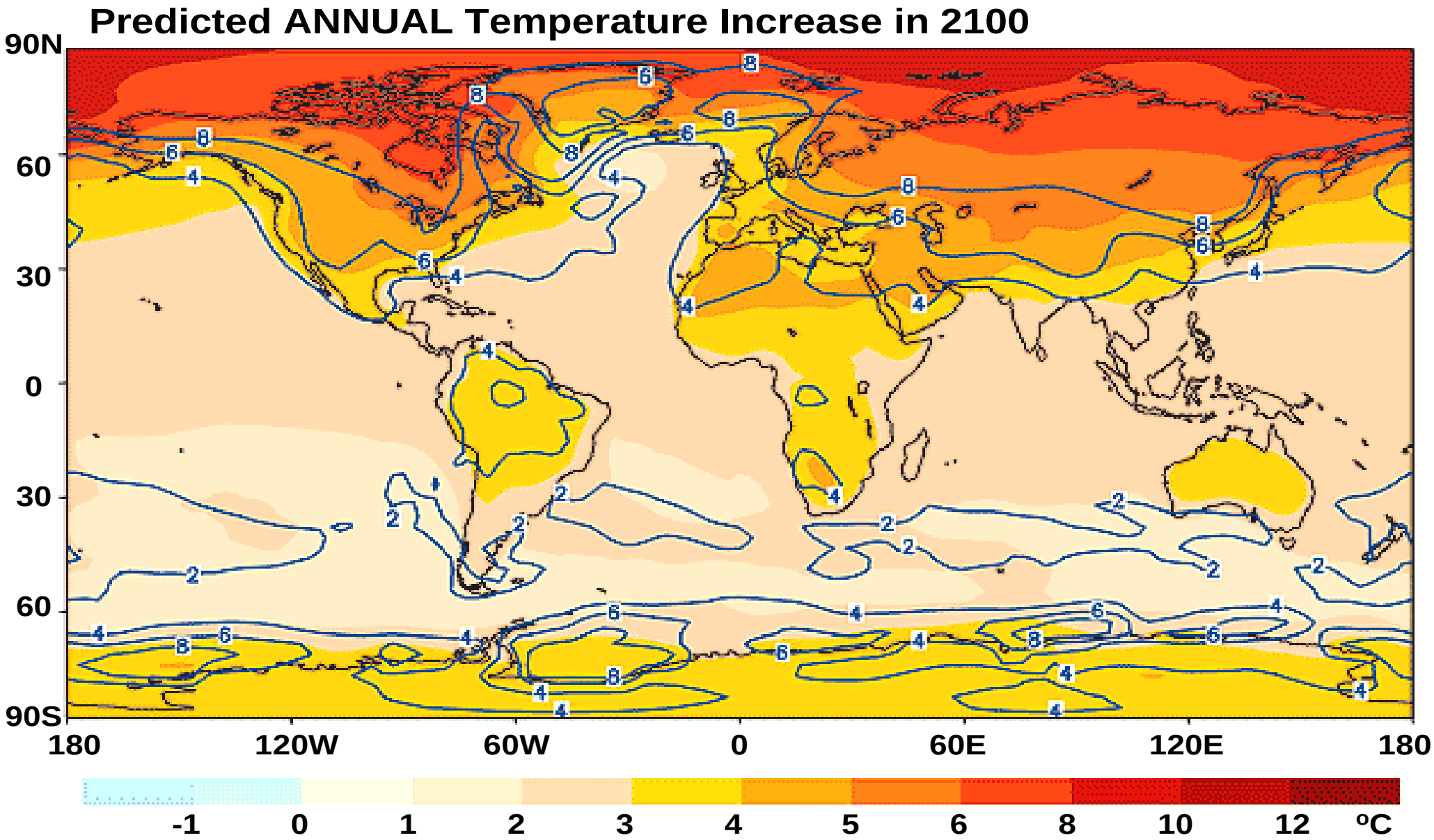
Grand Valley State University

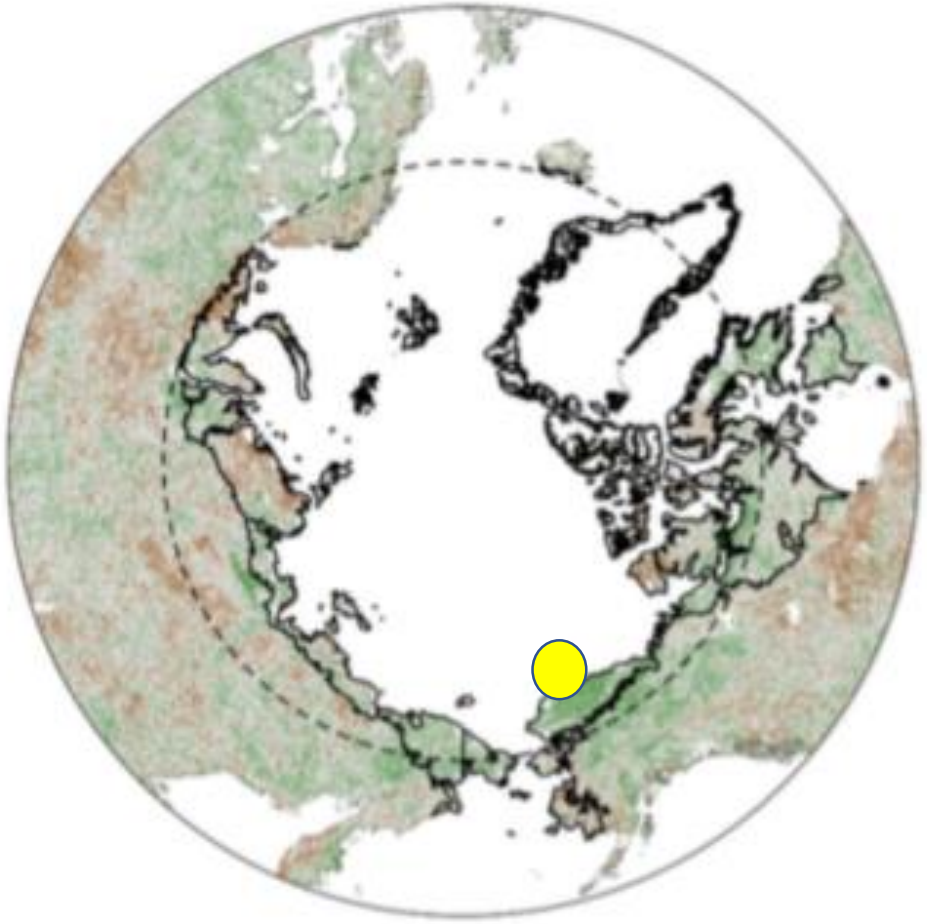
Biology Department

Committee: Robert Hollister, Alexandra Locher, Sergio Vargas



IPCC (International Panel on Climate Change) 2001.

Pixel-level GIMMS (2000-2015)



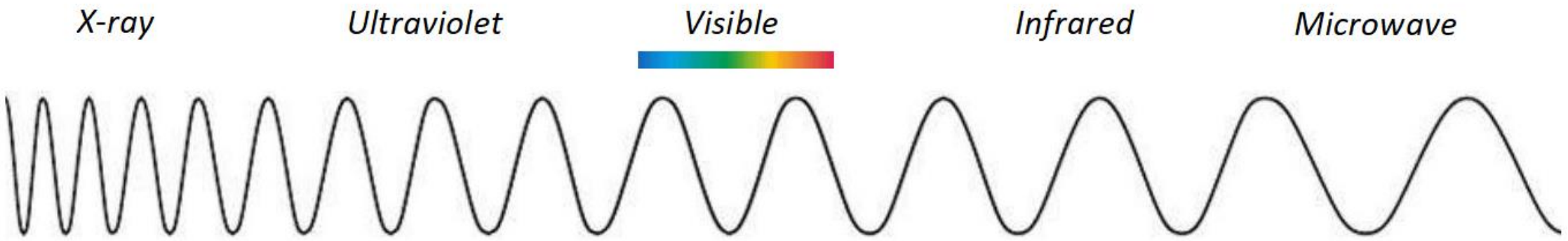
Increasing NDVI

Decreasing NDVI

- Normalized Difference Vegetation Index
- Remotely-sensed **greening** or **browning** trends in the Arctic

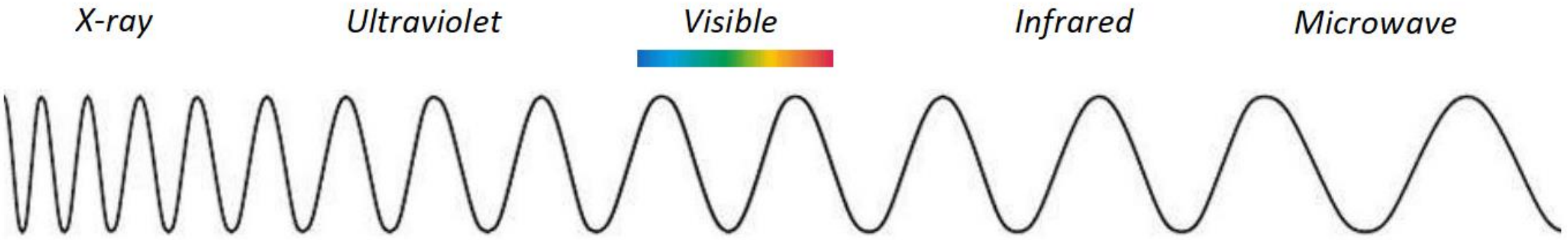
Myers-Smith, I., et al., (in review).

Electromagnetic Spectrum



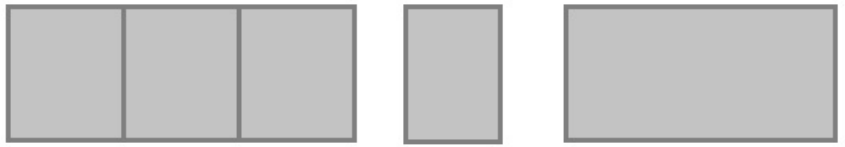
*not to scale

Electromagnetic Spectrum

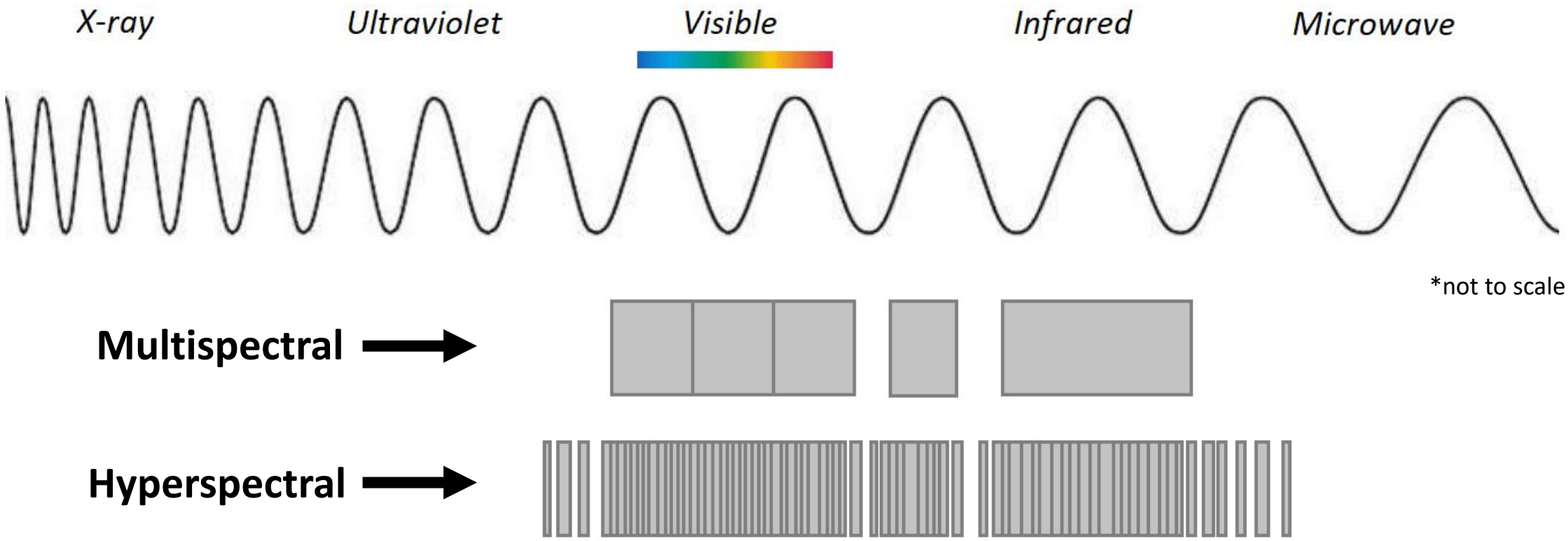


*not to scale

Multispectral →



Electromagnetic Spectrum



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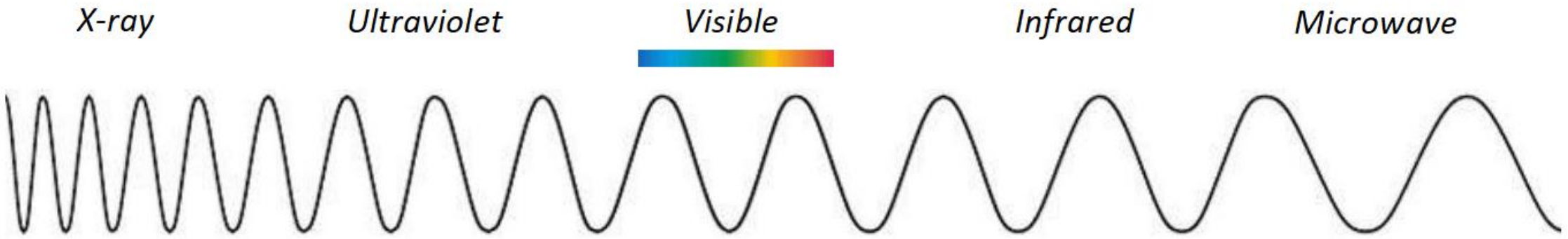


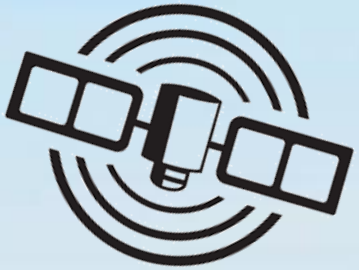
*not to scale

Multispectral →

Hyperspectral →

$$NDVI = \frac{NIR - RED}{NIR + RED}$$

Spaceborne



High Altitude

Low Altitude

Ground

Logistically-demanding

Logistically-demanding

Enormous area

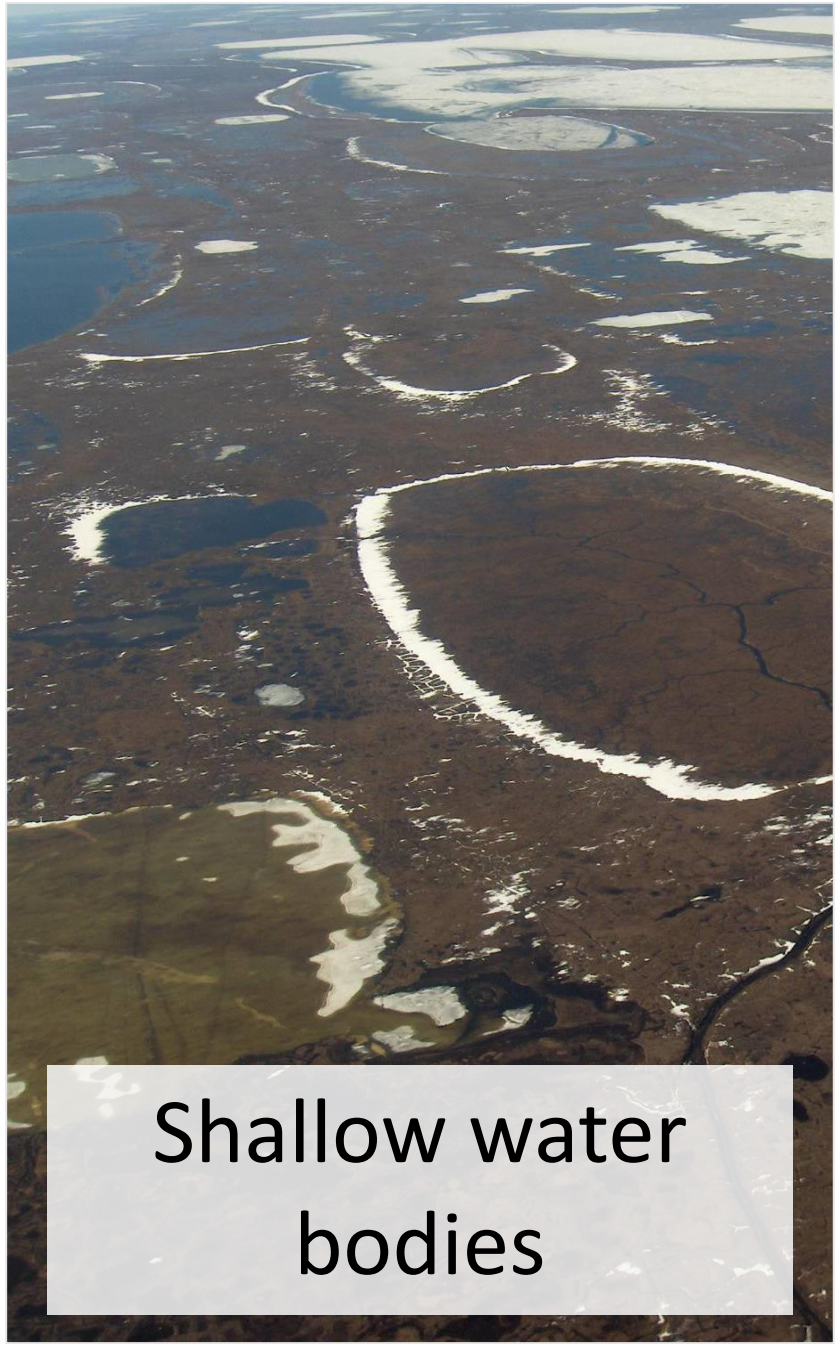
Logistically-demanding

Hazards

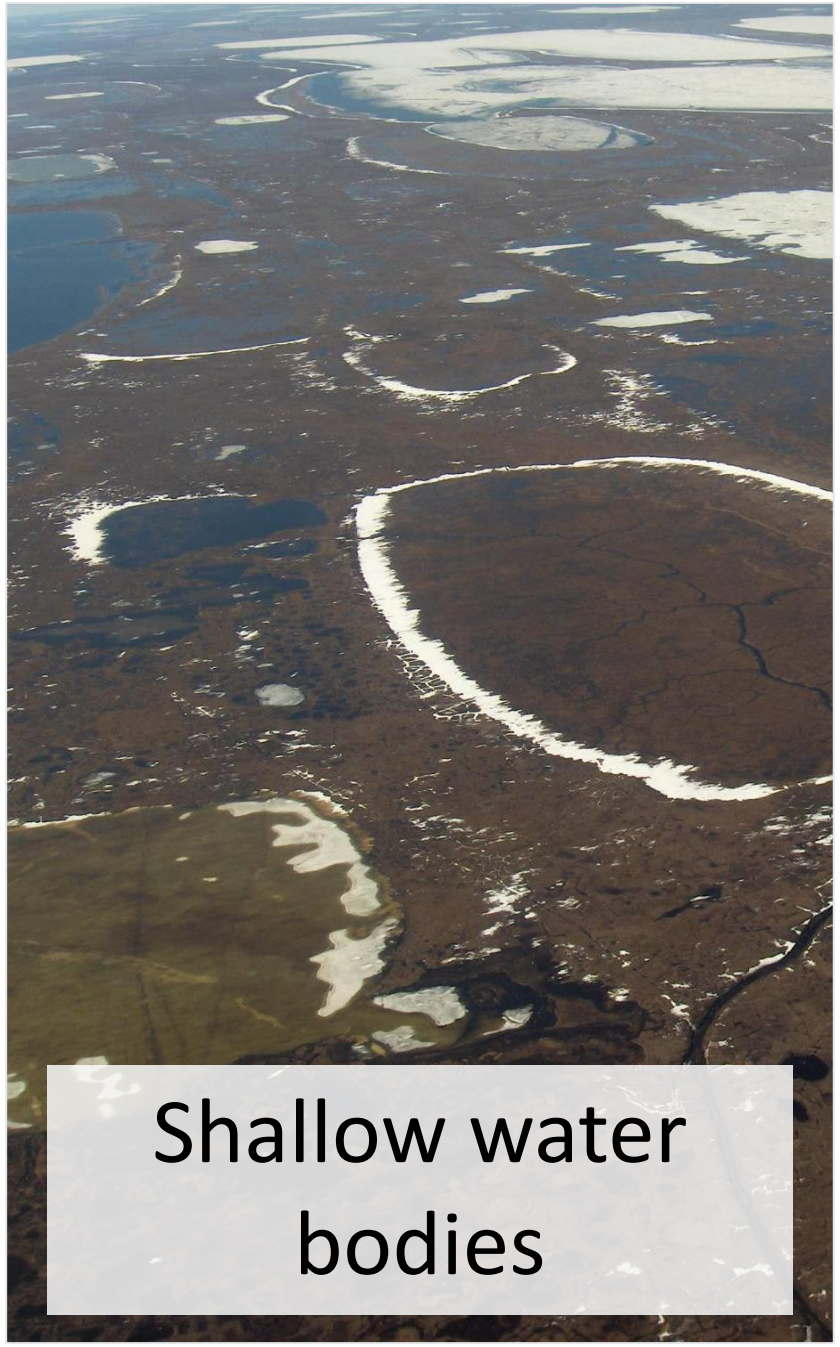
Enormous area

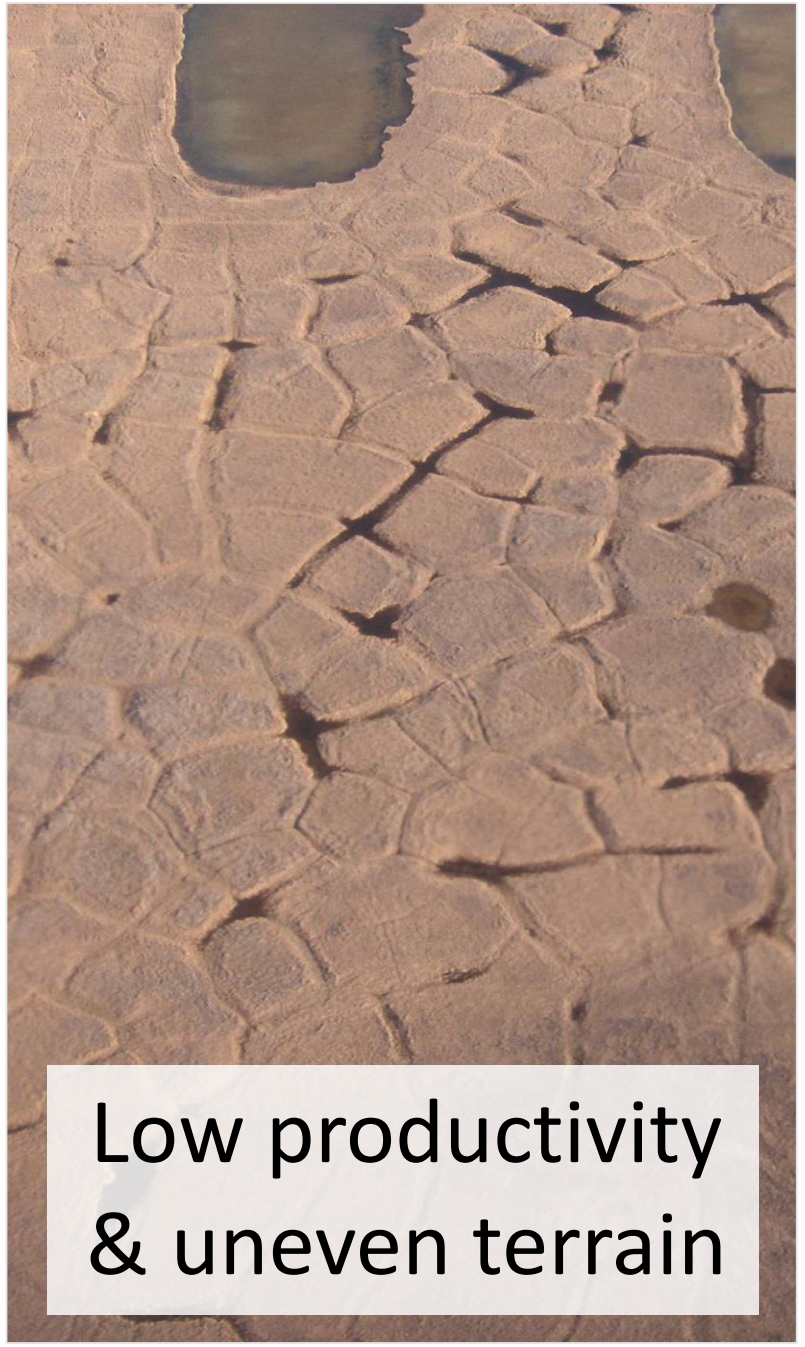
Low cloud cover &
snow melt

Low cloud cover &
snow melt


Shallow water
bodies

Low cloud cover & snow melt


Shallow water bodies


Low productivity & uneven terrain

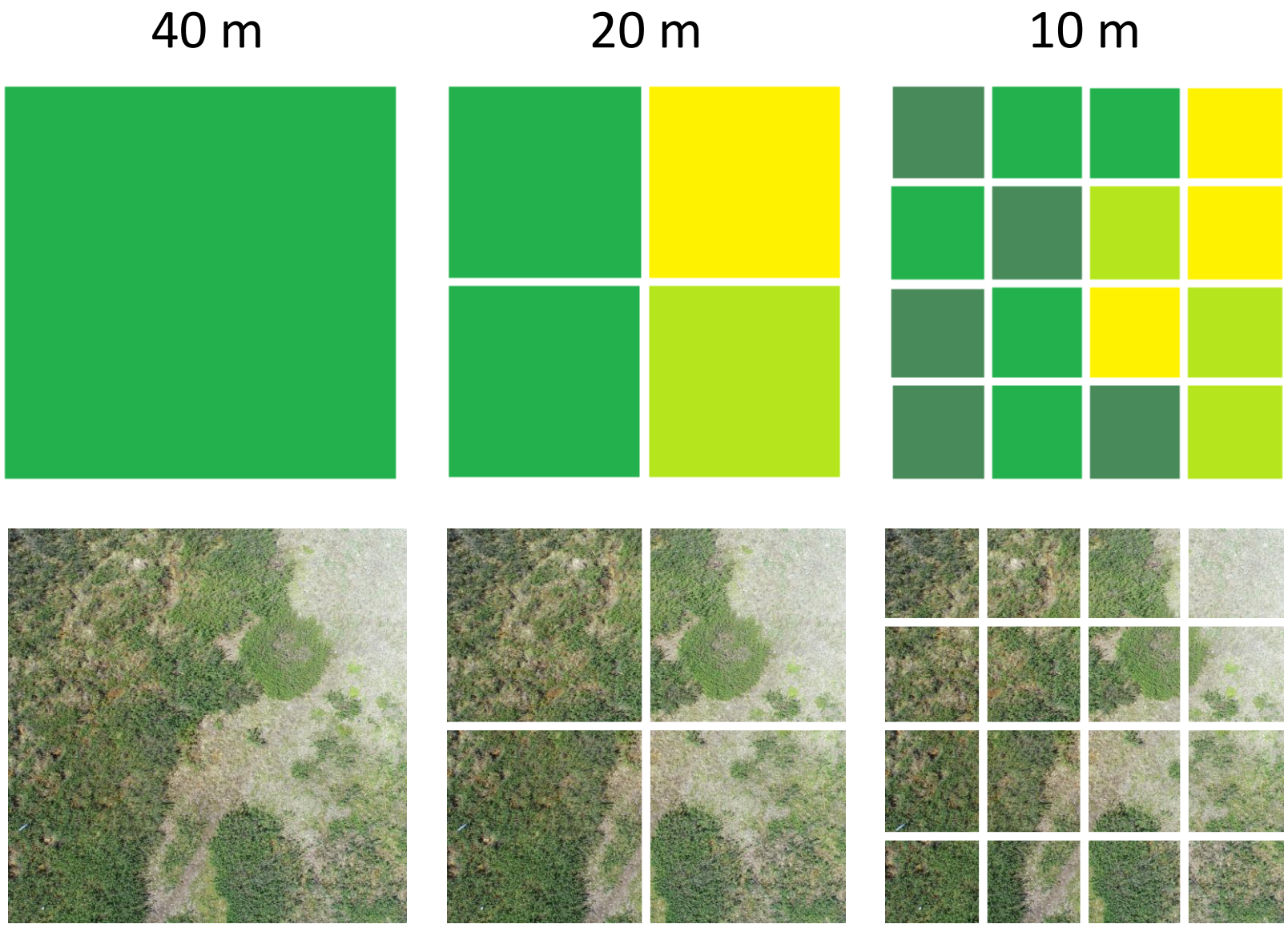
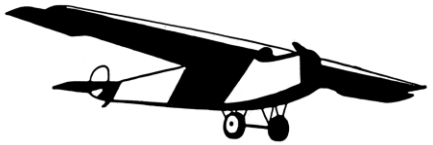
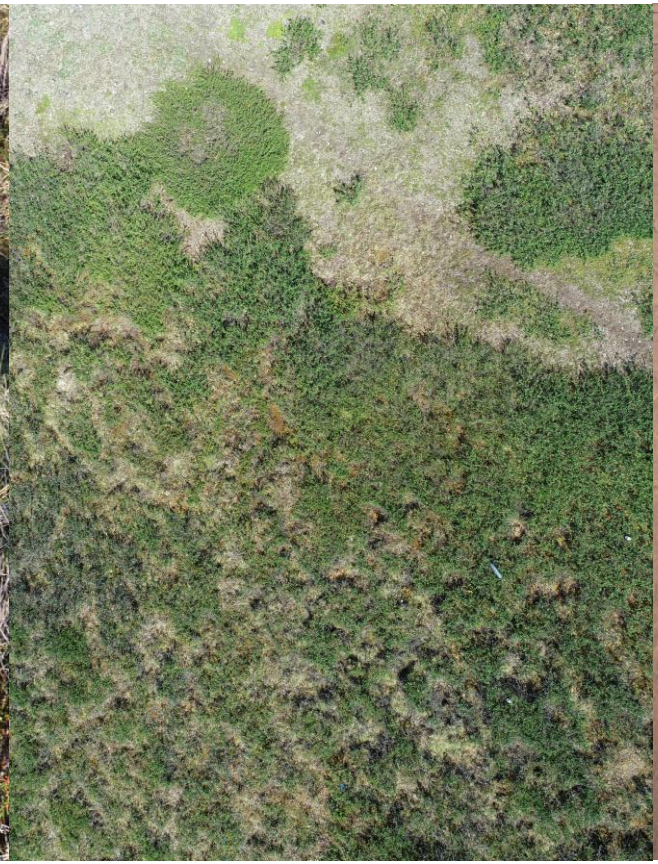


Image resolution





Questions

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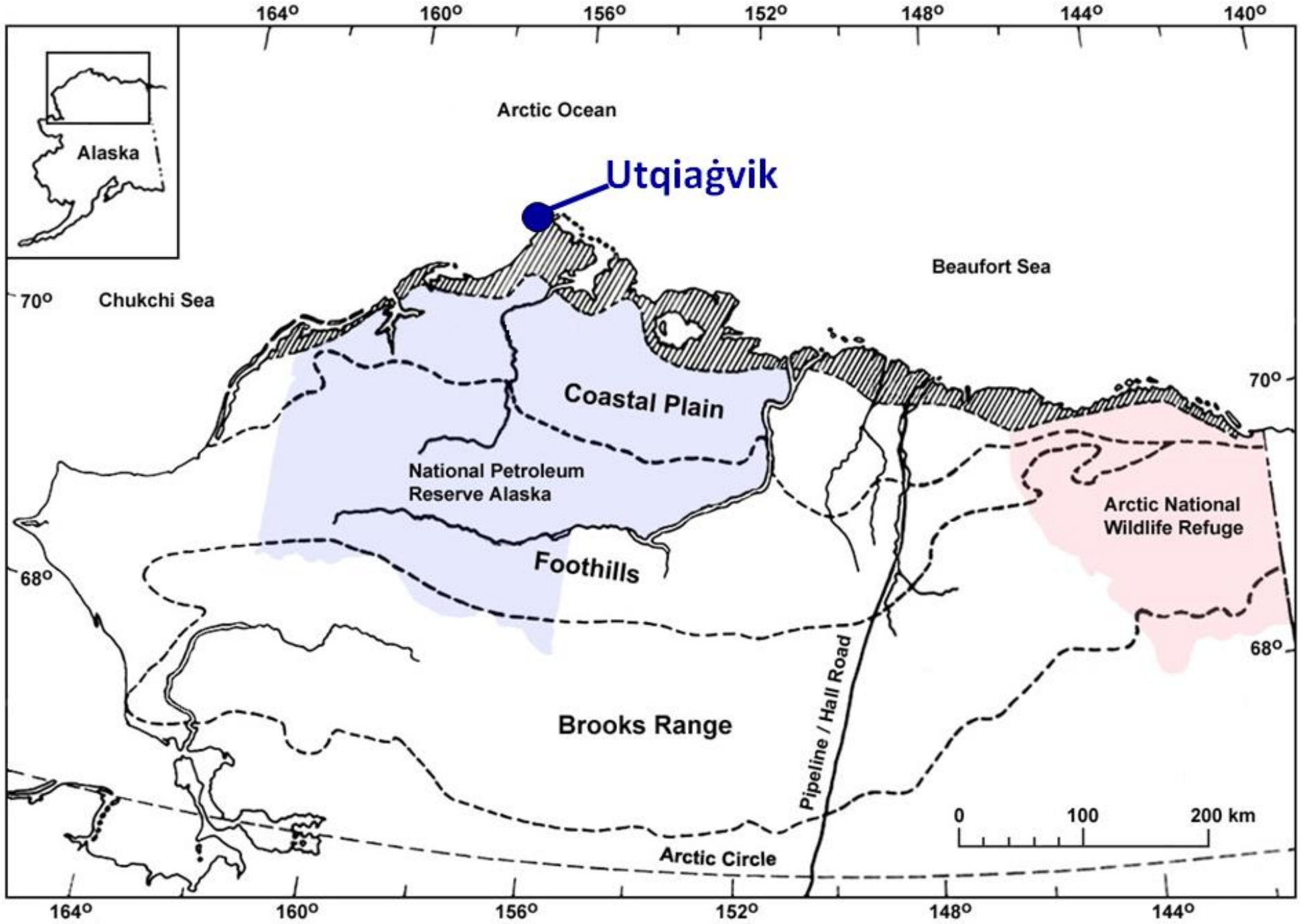
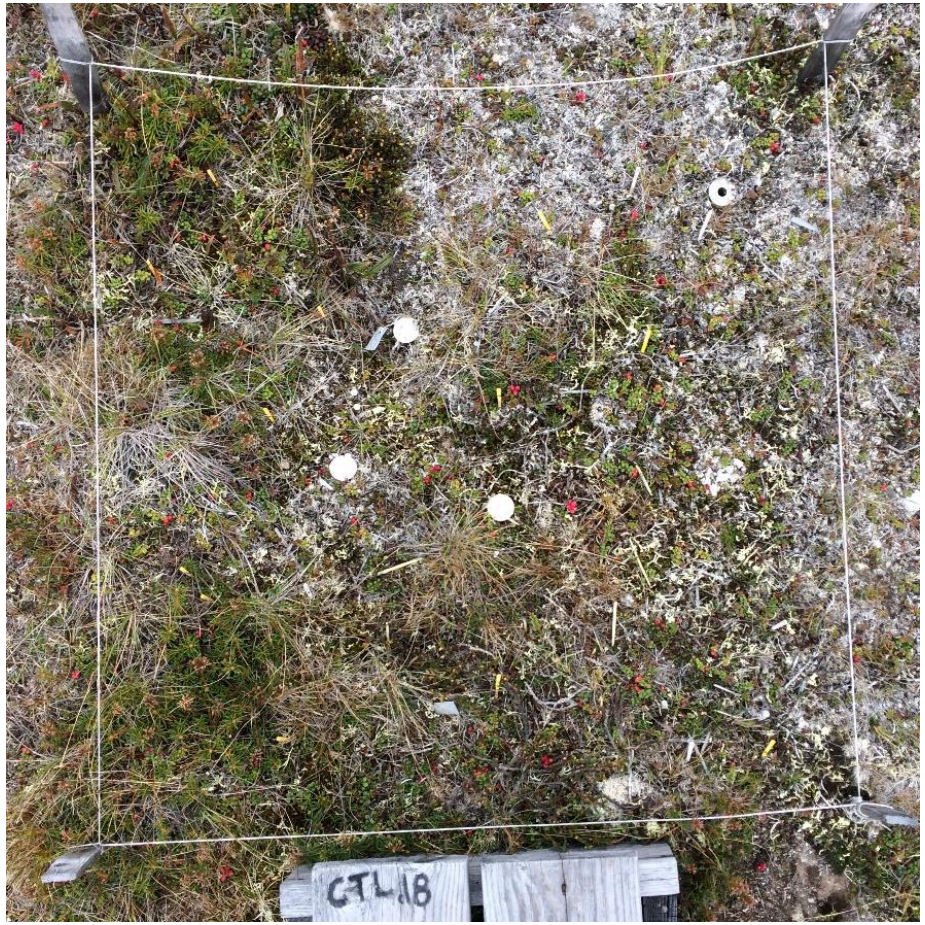
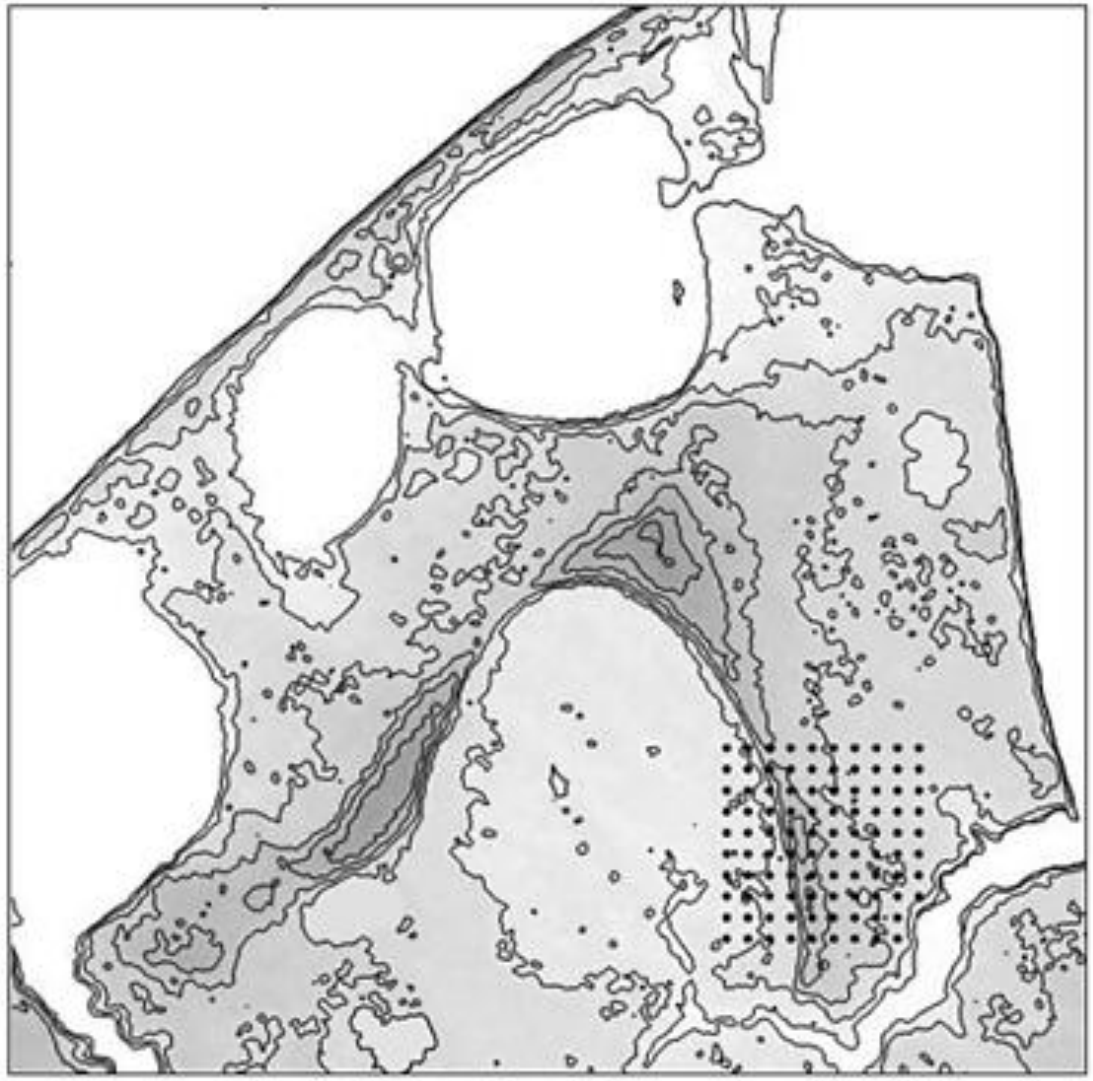

164°
160°
156°
152°
148°
144°
140°
Alaska
Arctic Ocean
Utqiaġvik
Beaufort Sea
70°
Chukchi Sea
Coastal Plain
National Petroleum
Reserve Alaska
Arctic National
Wildlife Refuge
Foothills
68°
Brooks Range
Pipeline / Hall Road
0
100
200 km
Arctic Circle

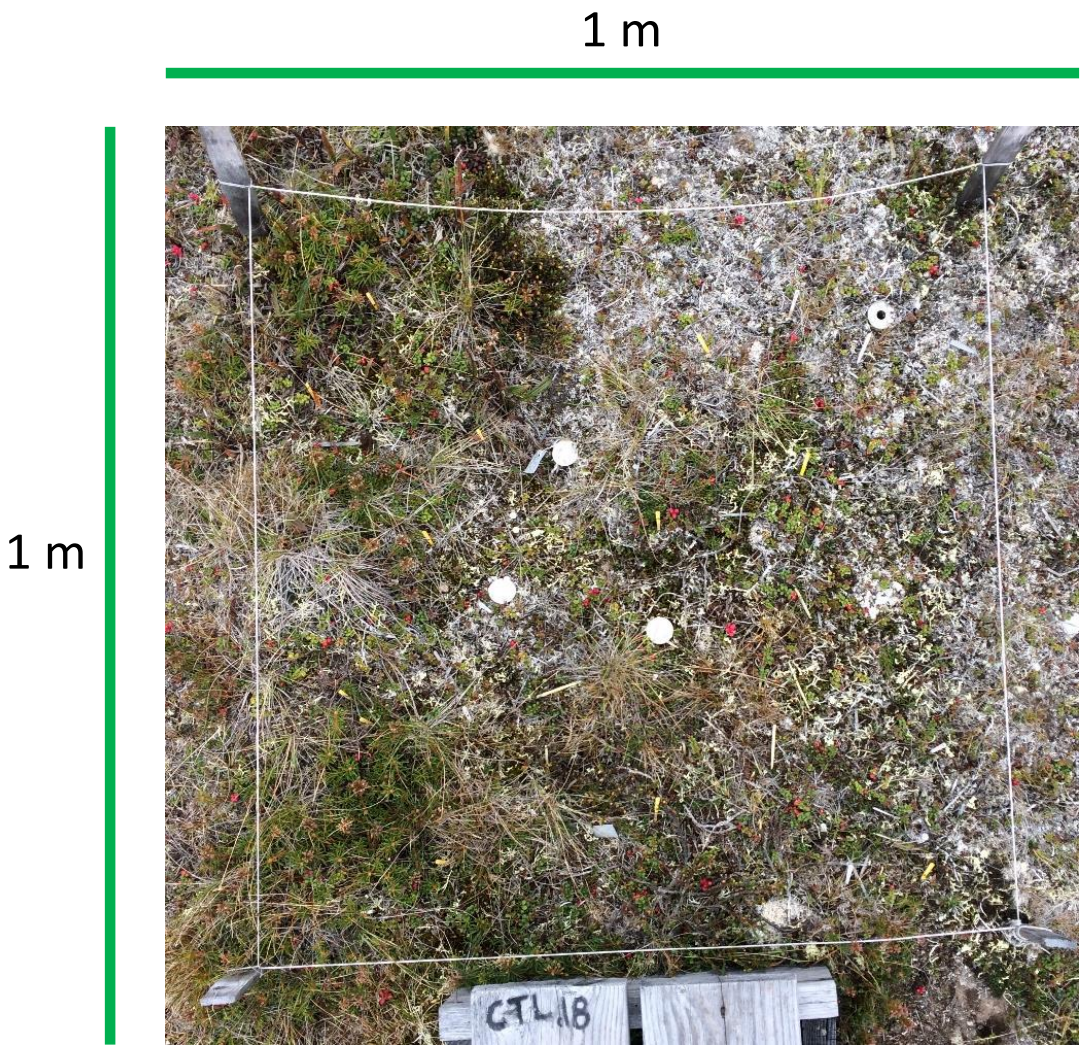
1 m

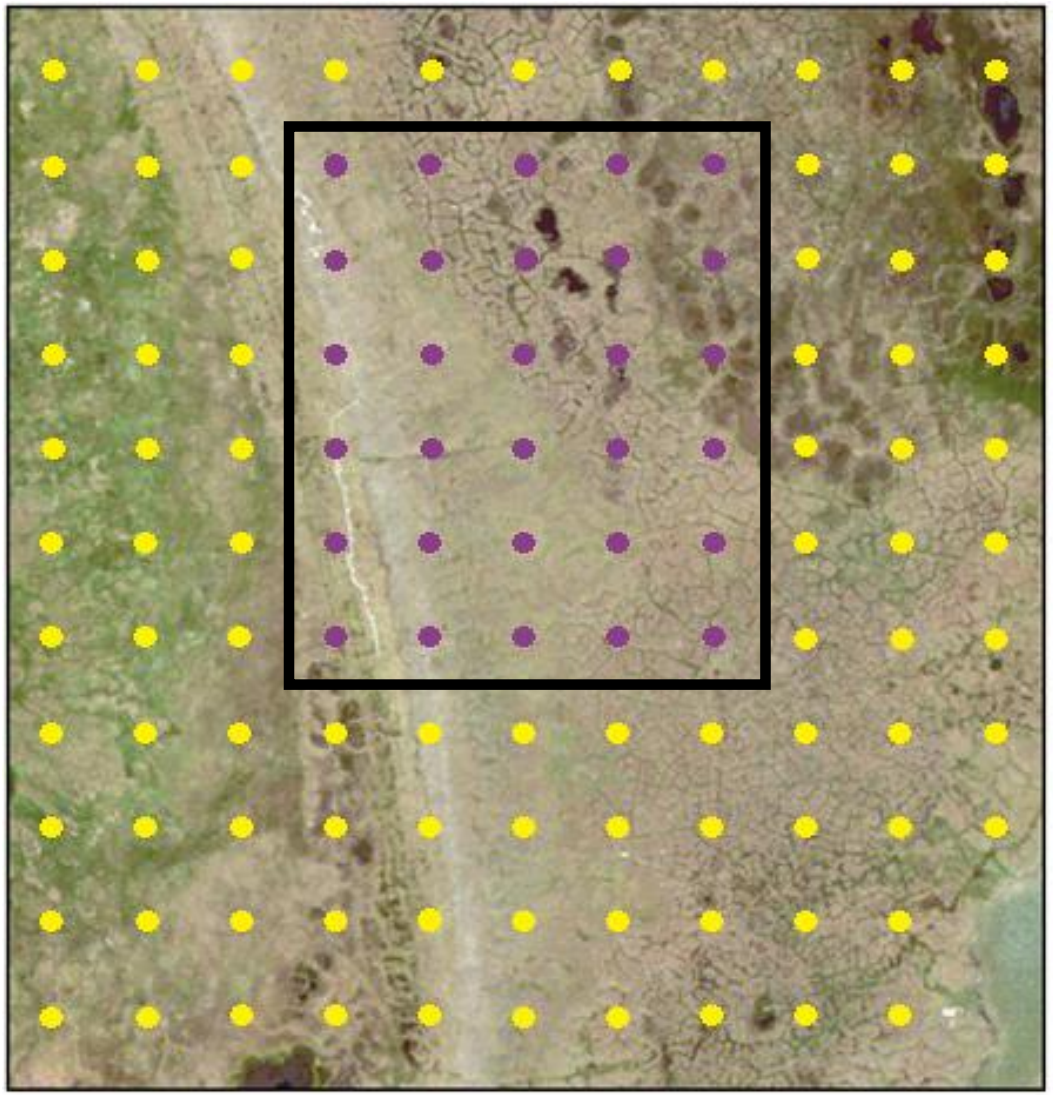
1 m





Arctic **S**ystem **S**cience (**A**RC**SS**)





Arctic System Science (ARCSS)

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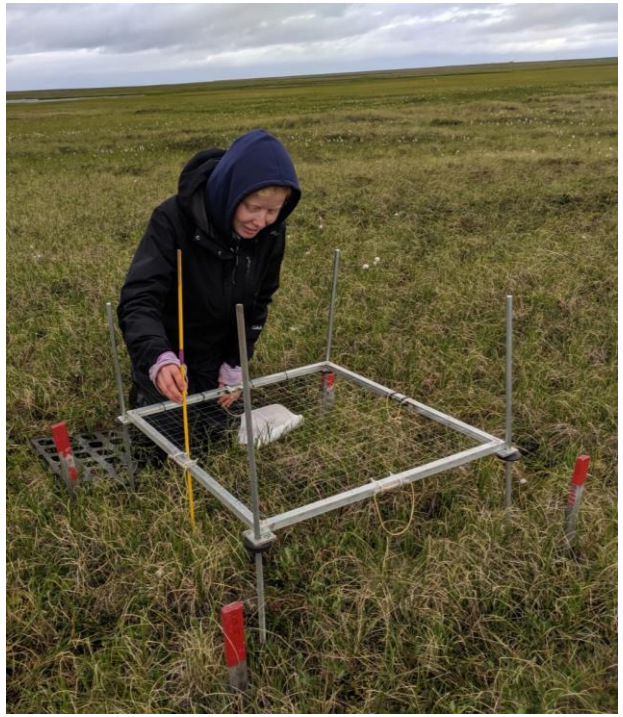

- **Ground truth** plot-level photos

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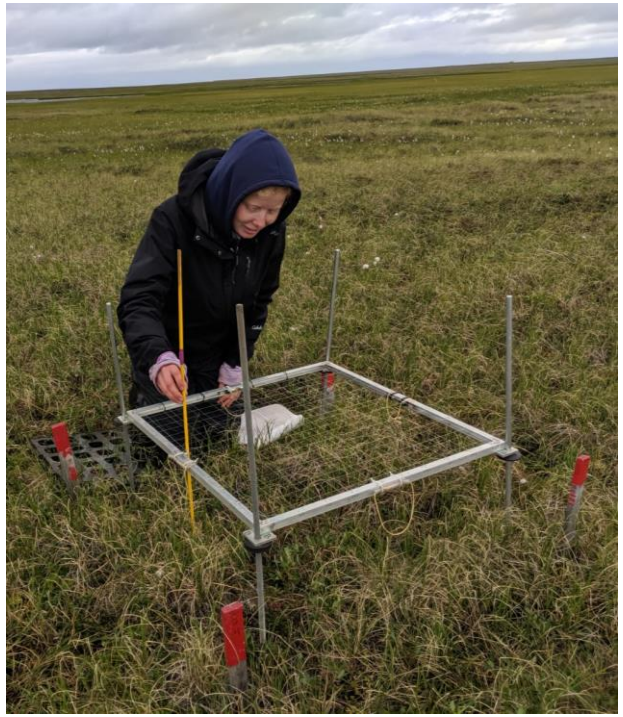

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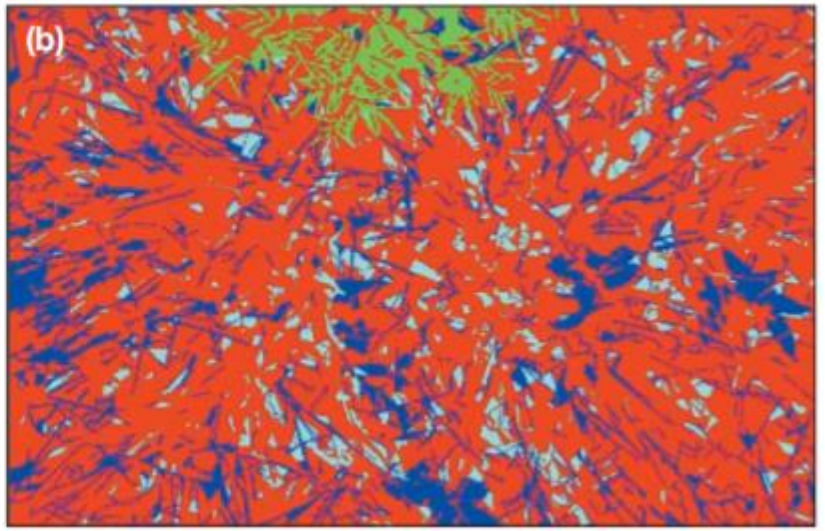
- Apply object-based image analysis to **segment and classify** pixels



Shrubs (12%)

Grass (45%)

Forbs (25%)

Litter (18%)

Liu, J., et al., 2006.

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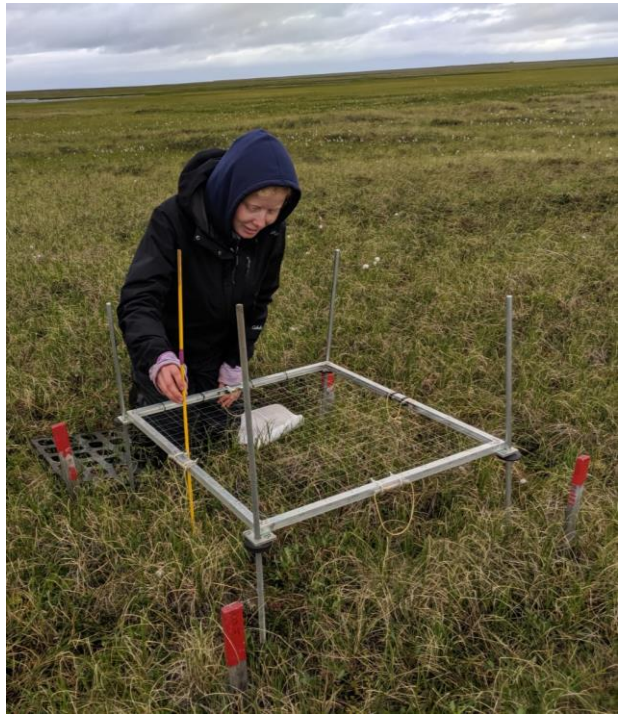

- **Ground truth** plot-level photos
- Apply object-based image analysis to **segment and classify** pixels
- Create a classification map
- Assess classification **accuracy**
- Analyze **change** from 2012 - 2019

2. Does drone data accurately quantify presence and estimates of tundra vegetation?

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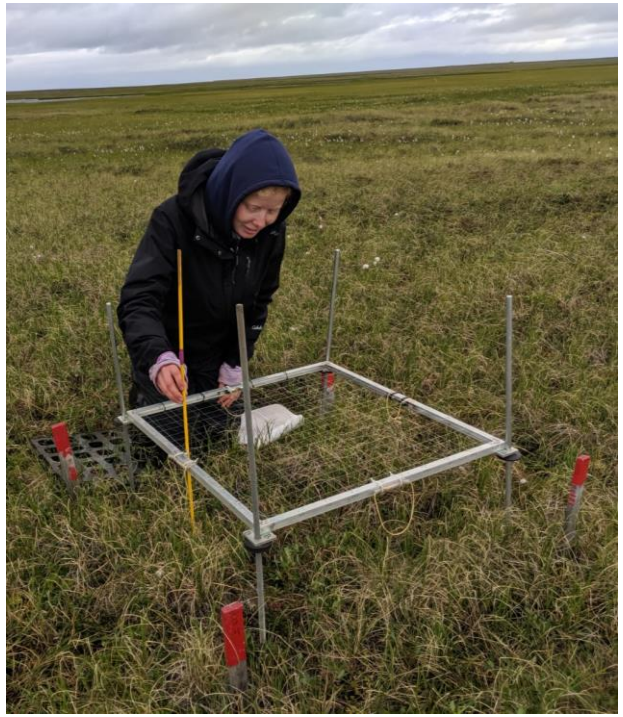

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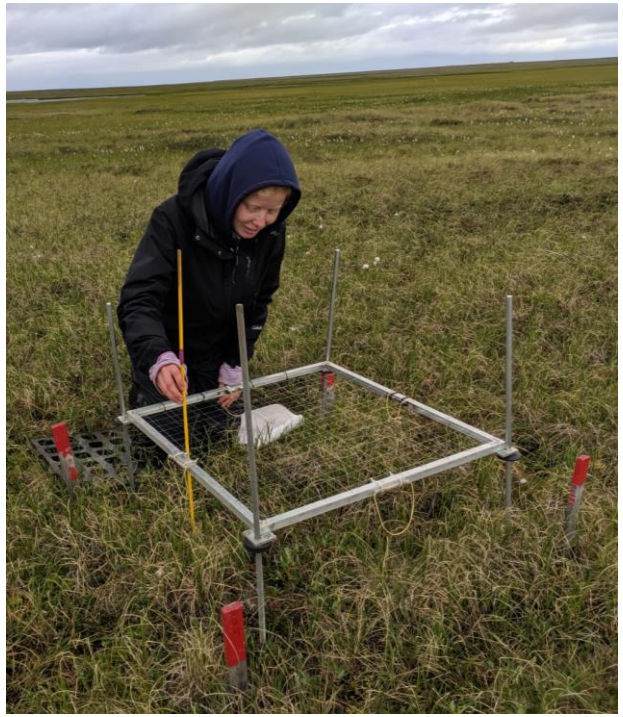

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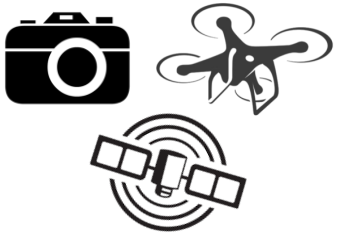

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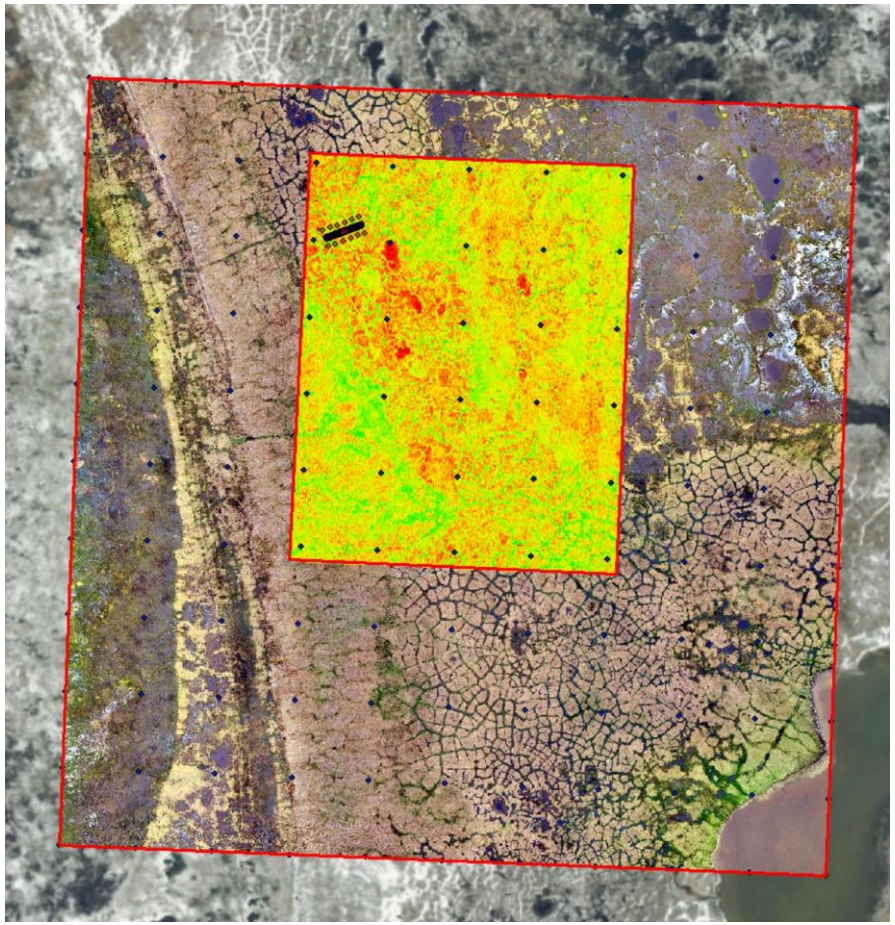

- Compare **NDVI** across platforms

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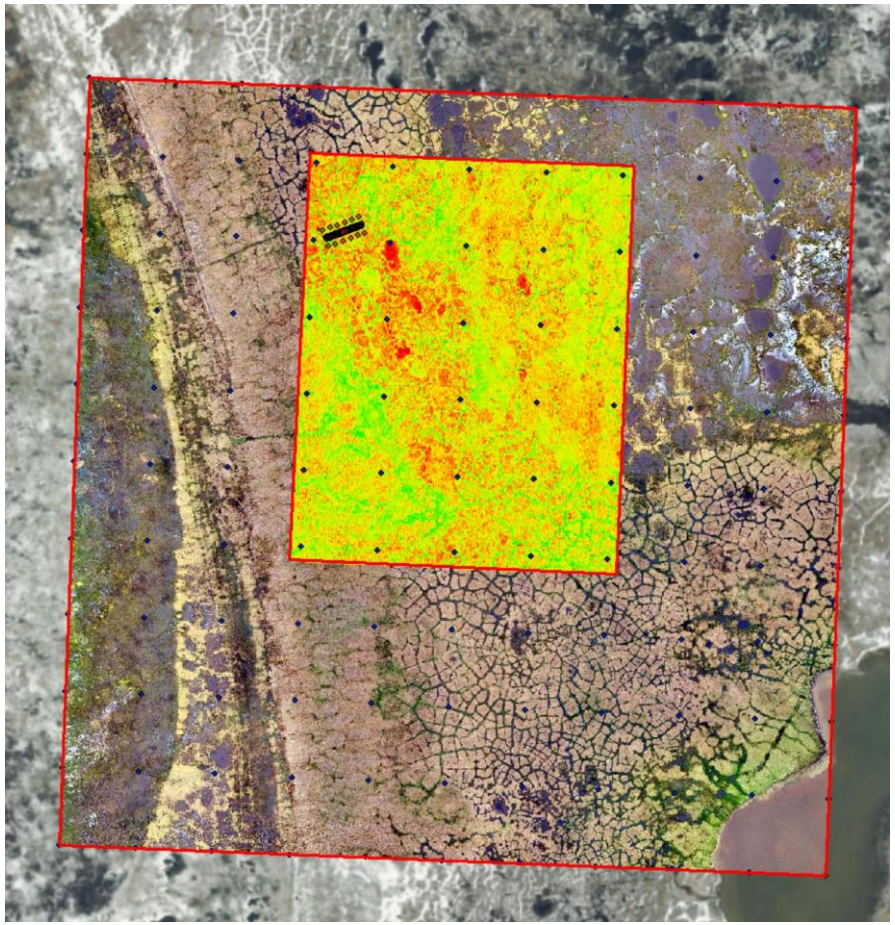

- Compare **NDVI** across platforms
- Compare **other** vegetation indices (SAVI, ARVI, EVI)?

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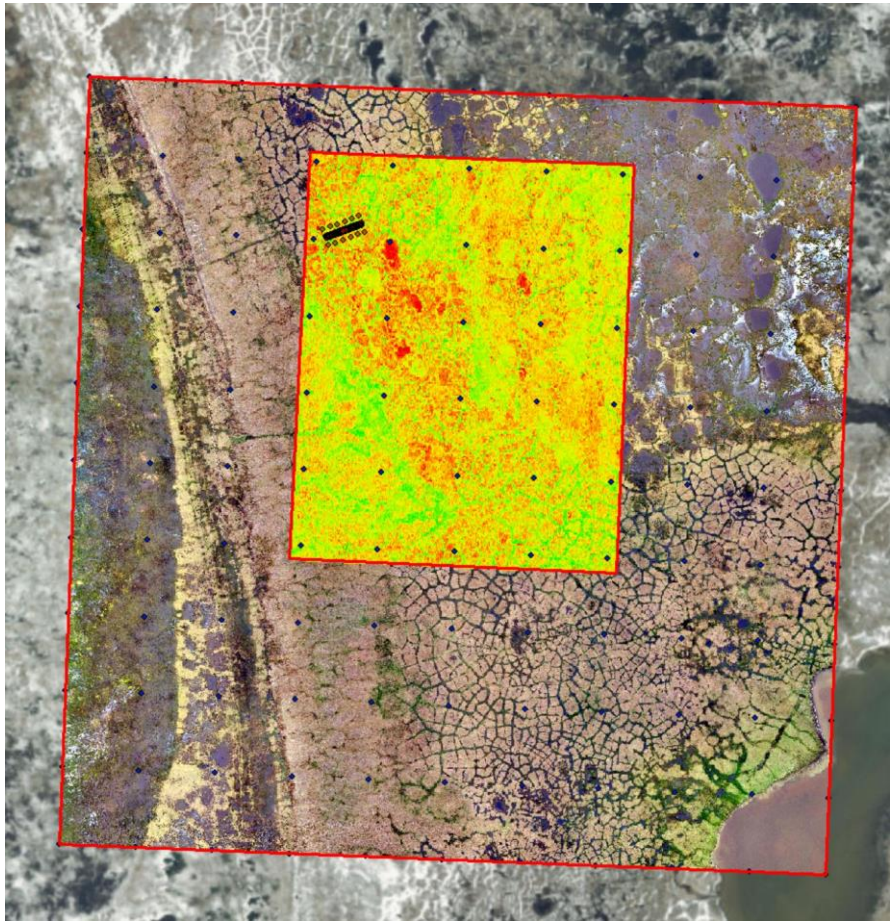

- Compare **NDVI** across platforms
- Compare **other** vegetation indices (SAVI, ARVI, EVI)?
- Use **satellite** imagery (Worldview-2)?

Acknowledgements

Arctic Ecology Program
Grand Valley State University
FIU
UTEP
UAA
ITEX
UIC Science
AON Arctic Observing Network
NSF
Barrow Arctic Science Consortium (BASC)

Questions?