

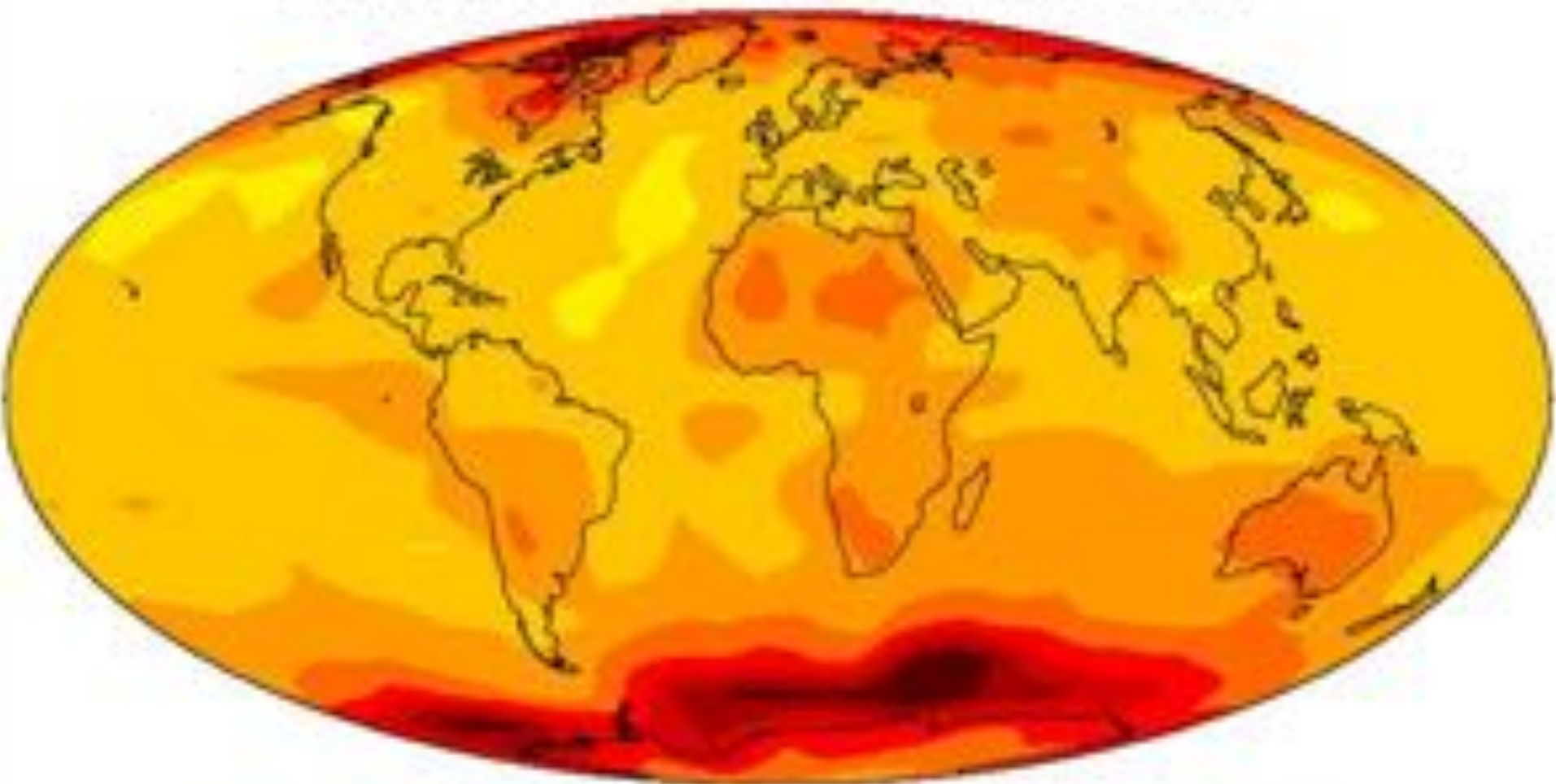


Monitoring Arctic Tundra Vegetation Across Varying Scales in Northern Alaska

Jeremy L. May

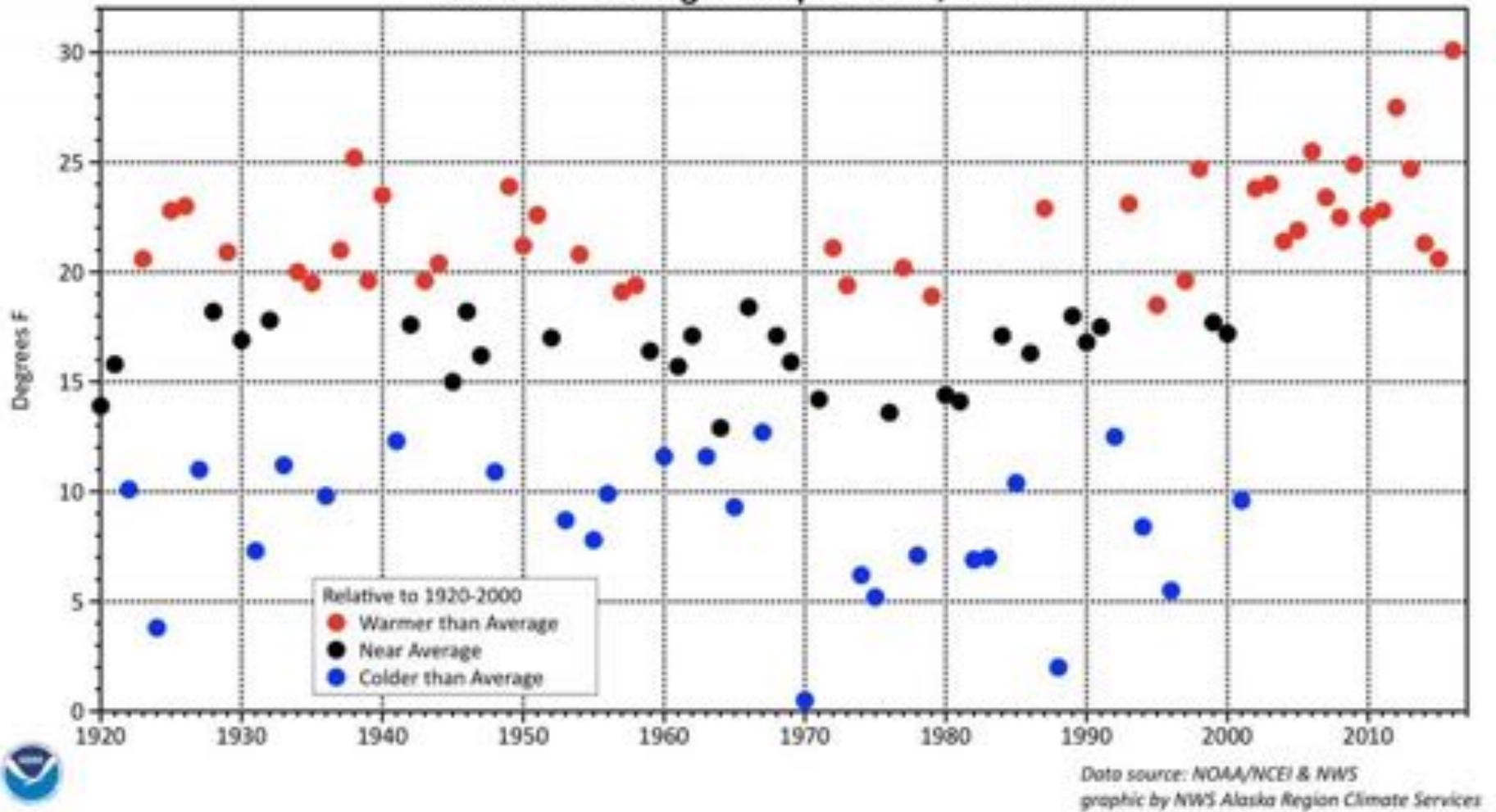


Surface Air Temperature Increase 1960 to 2060

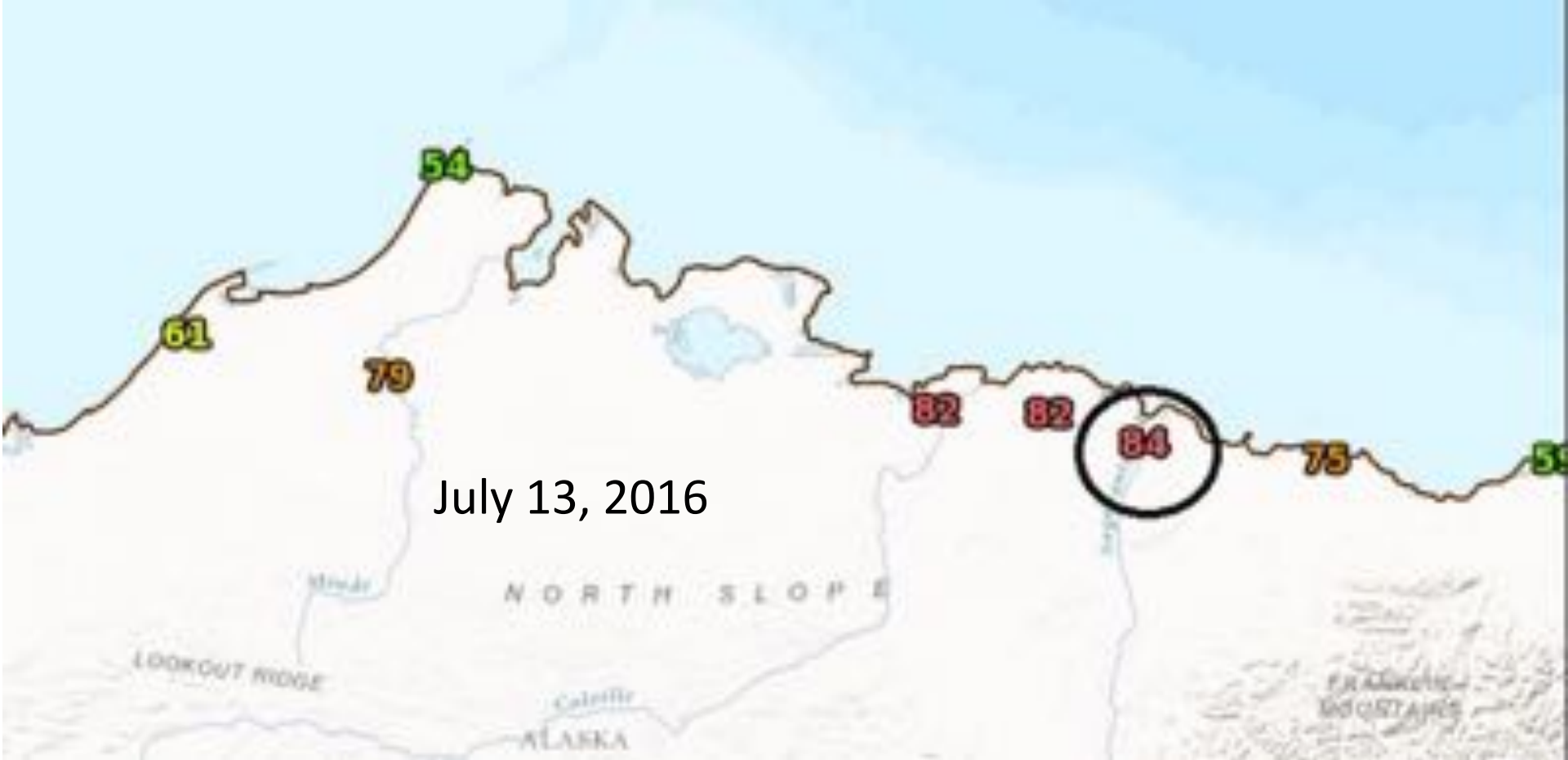


Climate warming is pronounced in high latitude regions

Barrow, Alaska October Average Temperature, 1920-2016



Every October since 2001 has been above average



July 14, 2016 the Kuparuk station just west of Deadhorse hit 86°!!!!

Barrow broke a temperature record of 66 °!

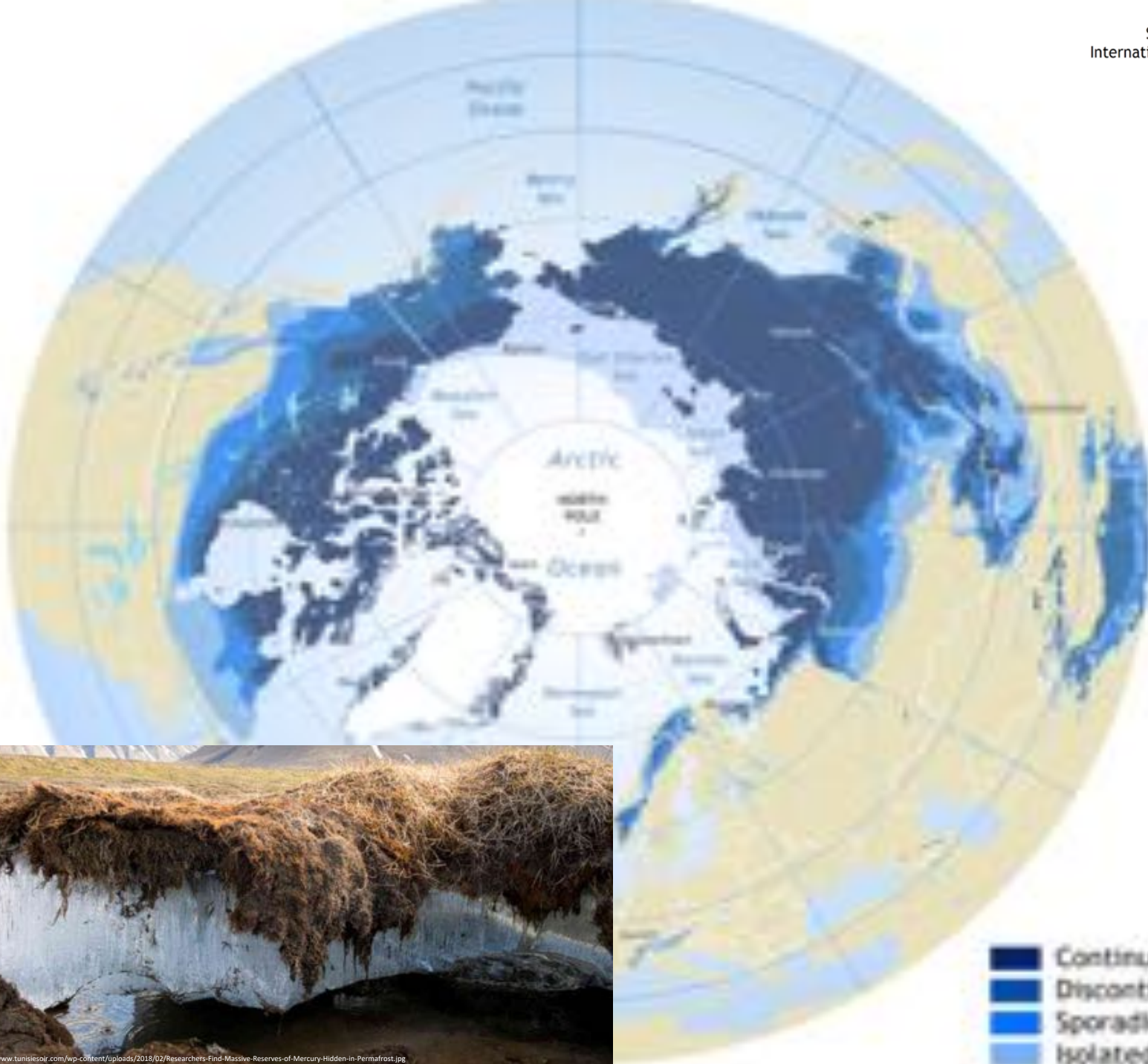


Long, cold winters and short, cool summers

24 hour daylight in summer (dark in winter)

Brief (but intense) growing season





Arctic Plant Adaptations



Short statured and grow close together



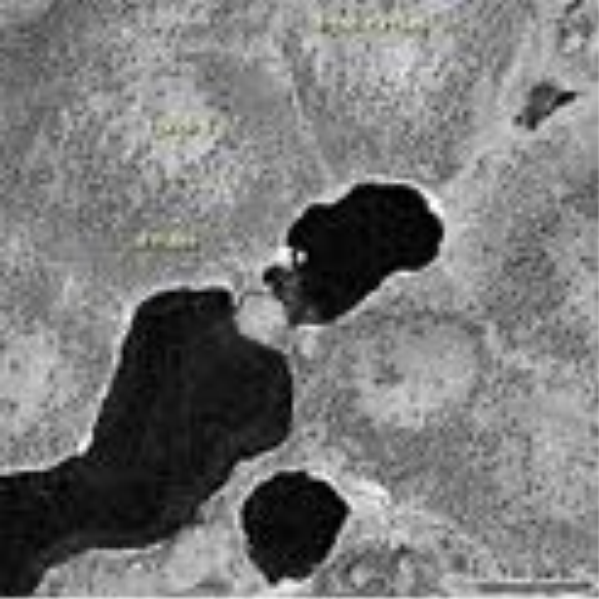
Pubescent



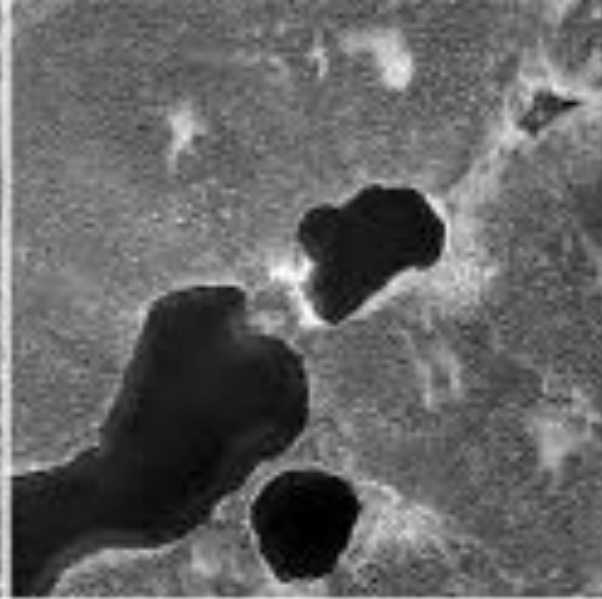
Flowers can take multiple years to develop
or do so quickly



Perennial

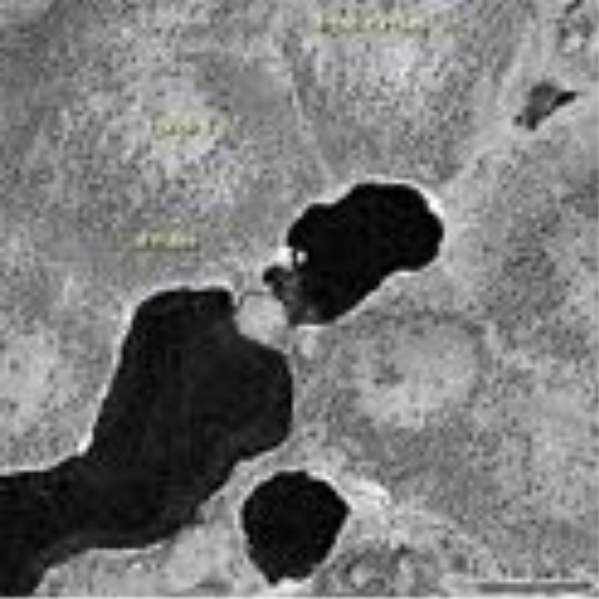


1966

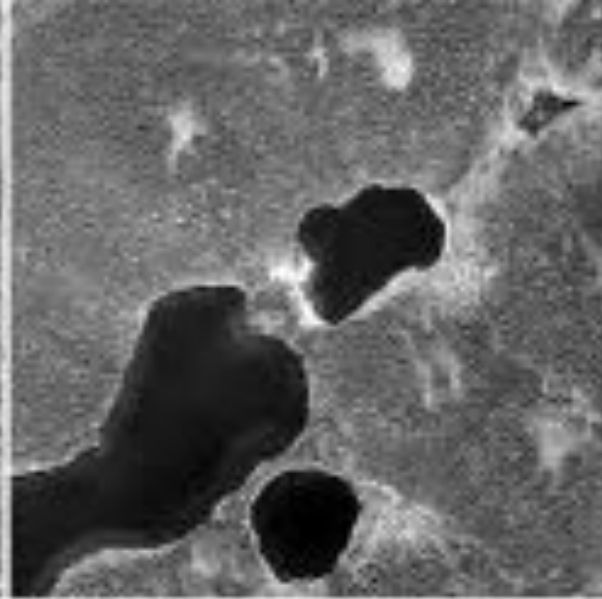


2009

Over the past decades vegetation has changed in several ways



1966



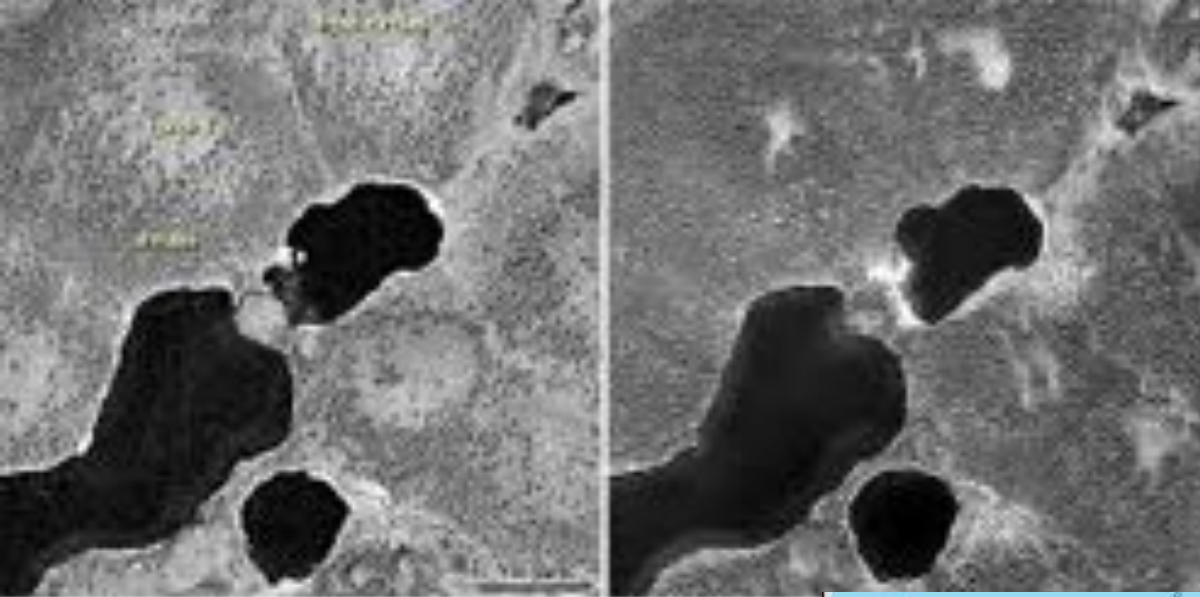
2009

Tall statured plants have increased

(Arft et al, 1999; Hobbie and Chapin, 1998; Hollister et al. 2015)

Community composition affects carbon balance

(Chapin and Shaver 1985)



Tall statured plants have increased

(Arft et al, 1999; Hobie and Chapin, 1998; Hollister et al. 2015)

Community composition affects carbon balance

(Chapin and Shaver 1985)

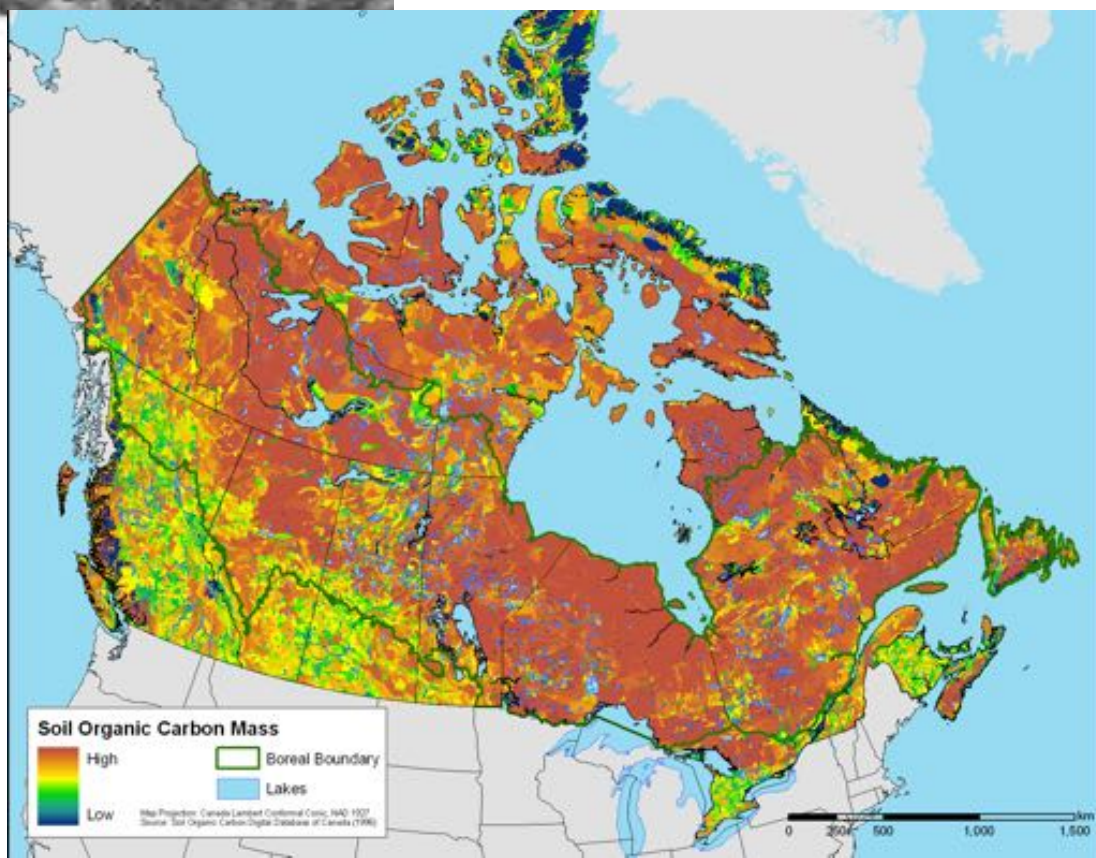
Increased warming and growing season shifts have changed tundra from carbon sink to source

(Webb et al, 2016)

1672Pg of carbon stored in permafrost

(Tarnocai et al. 2009)

1,672,000,000,000mT!





Arctic Observing Network (AON)

International Tundra Experiment (ITEX)

Circumpolar network of researchers
Established in the mid 1990s



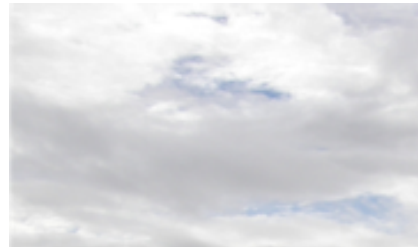


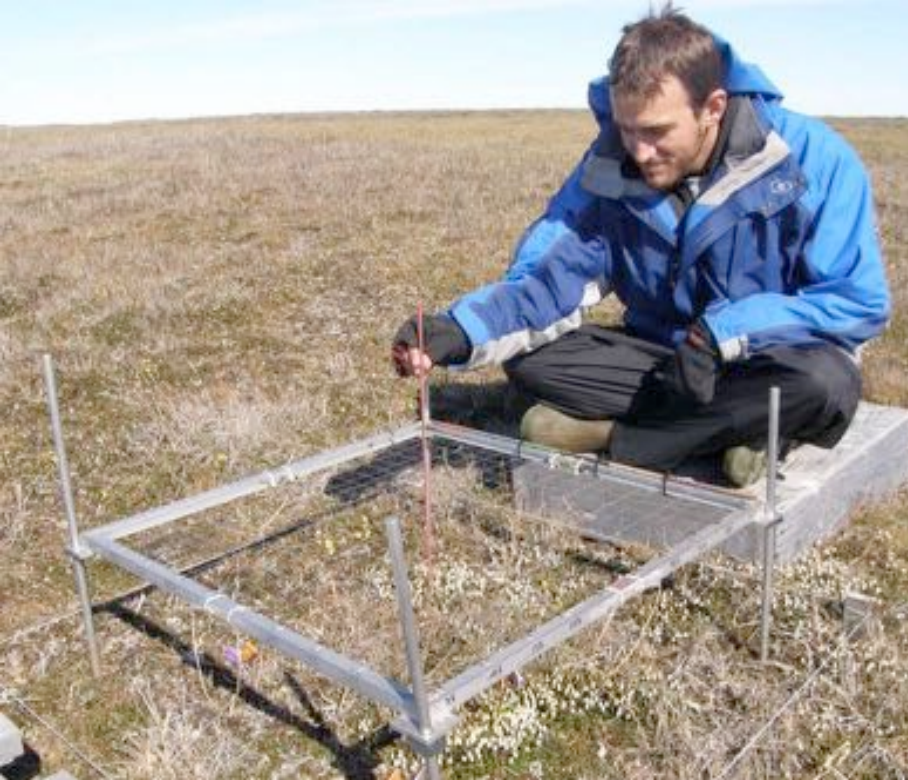
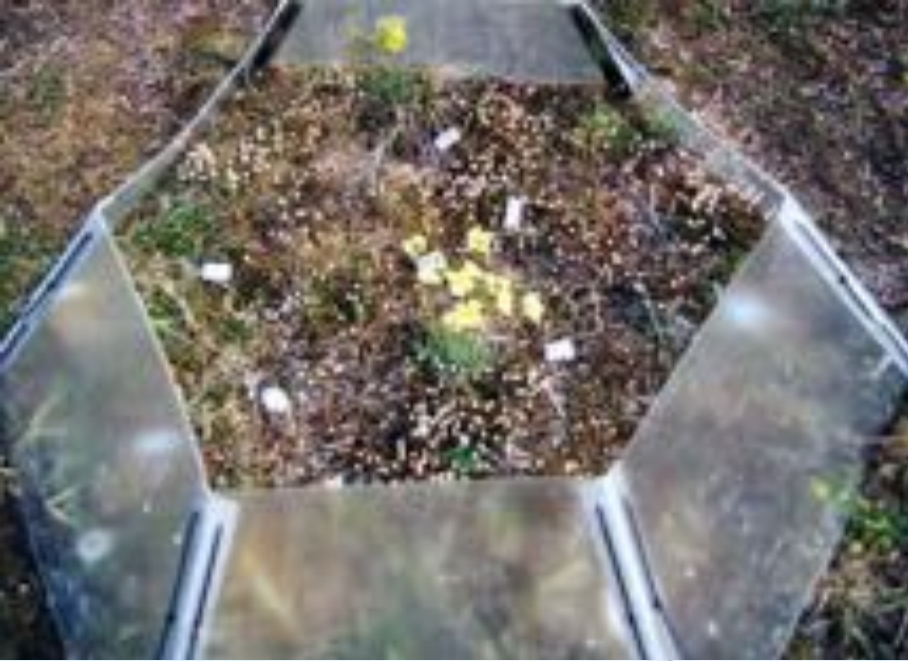
Arctic Observing Network (AON)

International Tundra Experiment (ITEX)



Circumpolar network of researchers
Established in the mid 1990s
Open-Top Chambers (OTC)





ITEX has focused on weekly and seasonal plot level measurements:

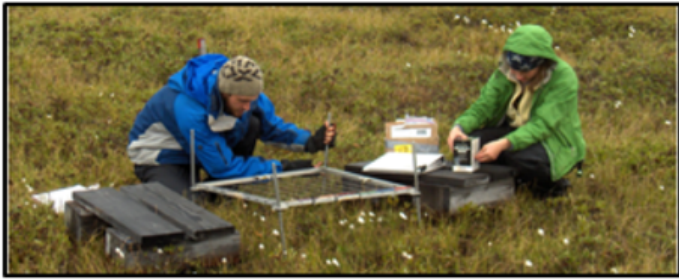
Phenology

Flower Counts

Growth Measures

Point framing

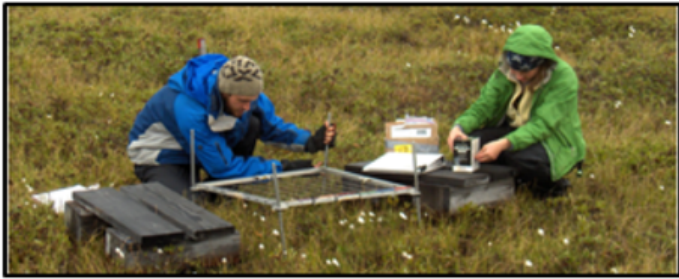
Plant Stem Density



Plot scale vegetation assessment

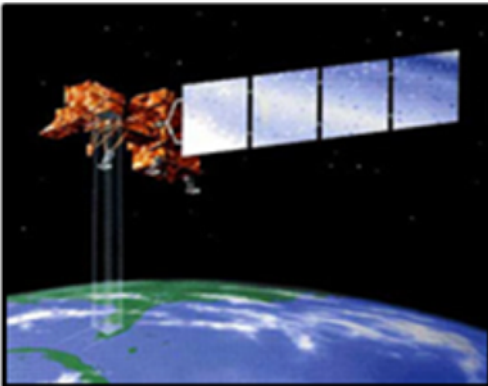
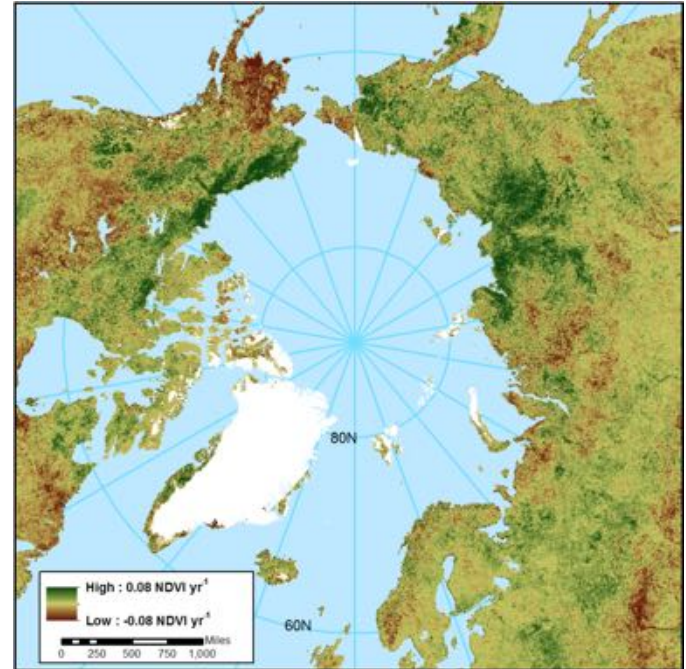
- Highly precise

- Time and labor intensive



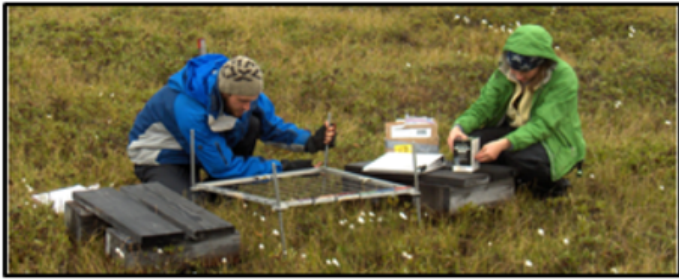
Plot scale vegetation assessment

- Highly precise
- Time and labor intensive

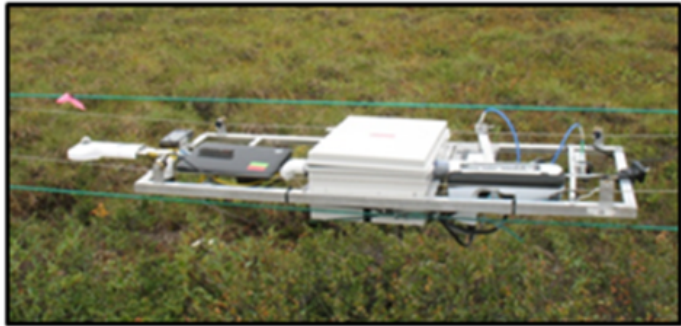


Satellites imagery

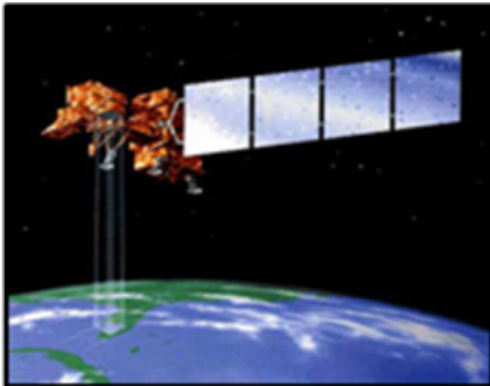
- Large scale monitoring
- Lower spatial and temporal resolution



- ## Plot scale vegetation assessment
- Highly precise
 - Time and labor intensive



- ## Mobile Instrumented Sensor Platform (MISP)
- Highly precise, less intensive
 - Higher resolution than satellite



- ## Satellites imagery
- Large scale monitoring
 - Lower spatial and temporal resolution

MISP Transects

Atqasuk, Alaska

Barrow, Alaska

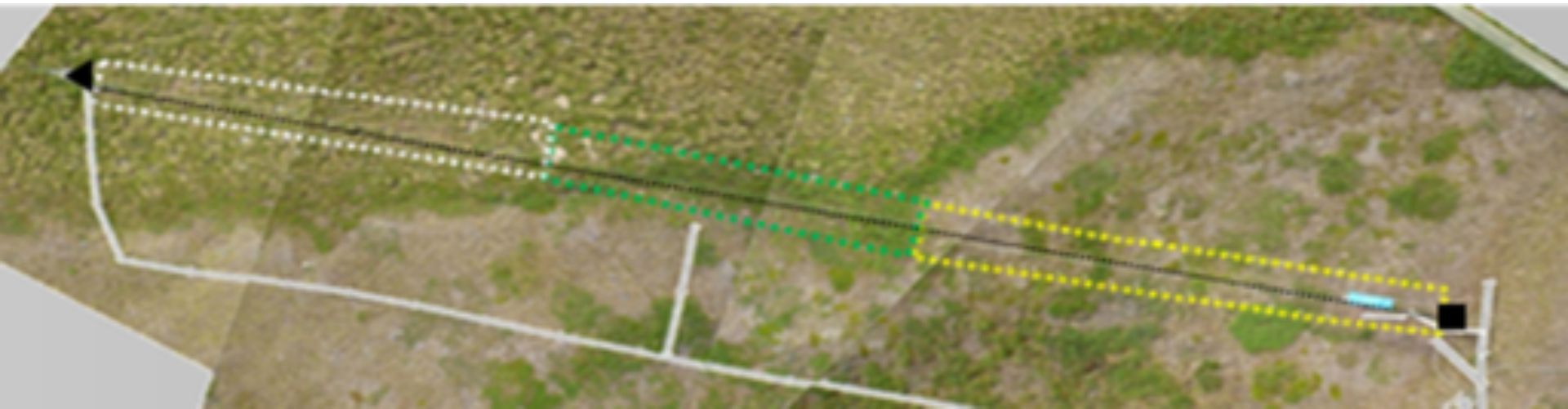
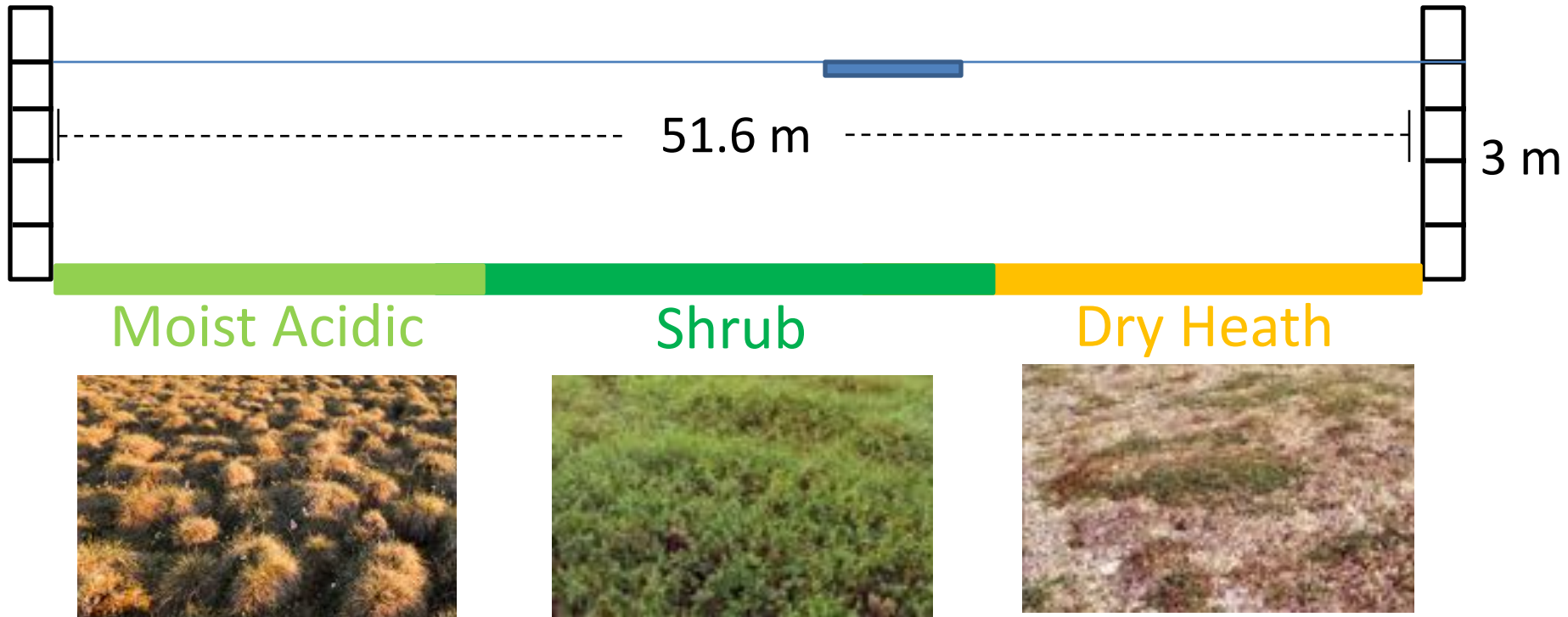
Imnaviat Creek, Alaska

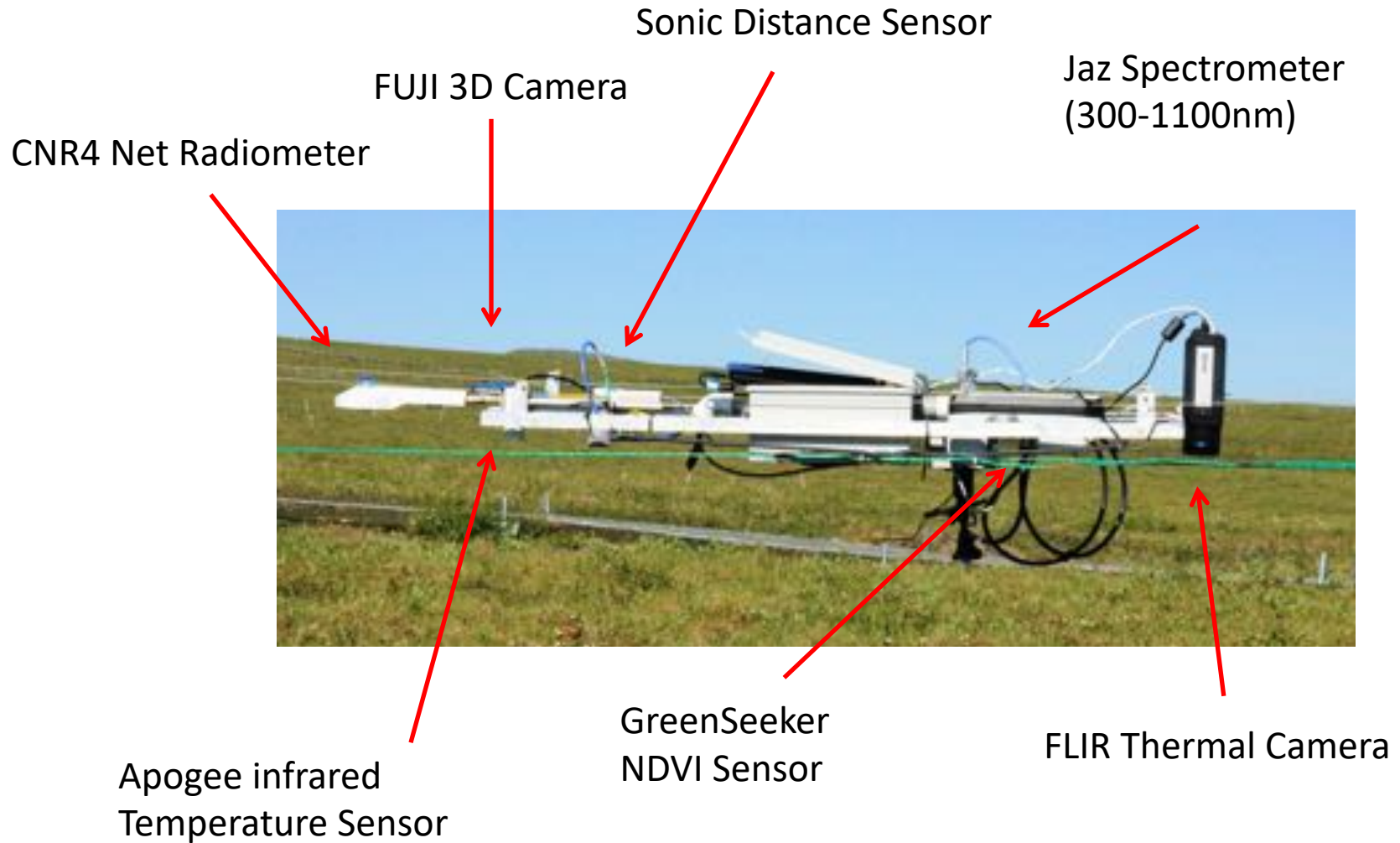
Thule, Greenland

Toolik Lake, Alaska



Toolik Lake Transect





Visually assessed at 10cm² scale

Peak season (mid-late July)

Vascular Plants

Cryptogams

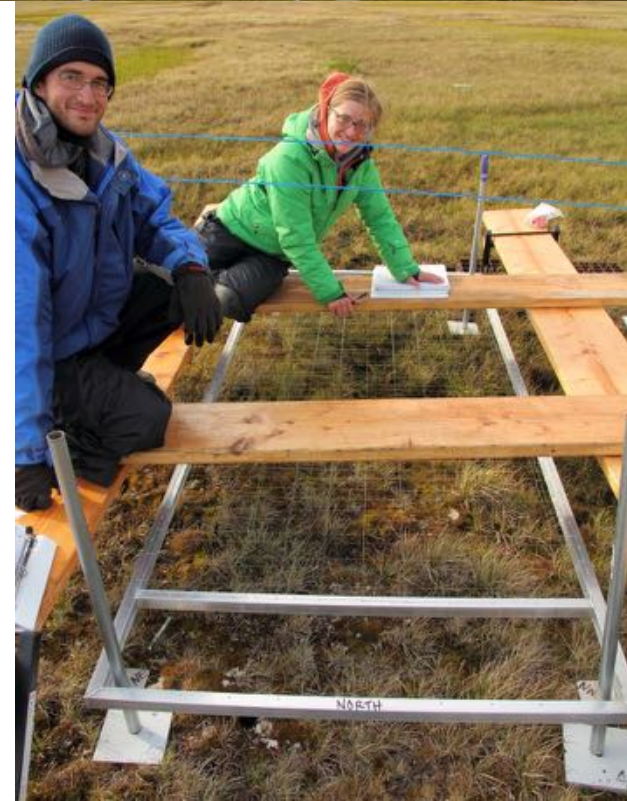
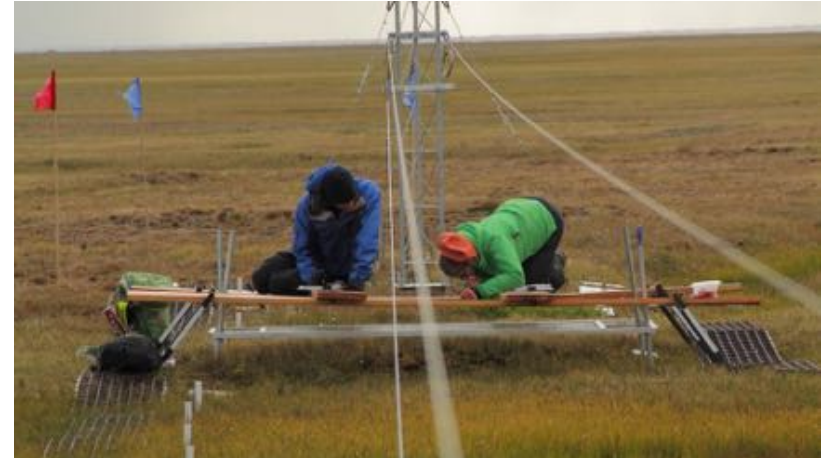
Non-living objects

2011 (Barrow and Atqasuk)
(80-105,000 data points)

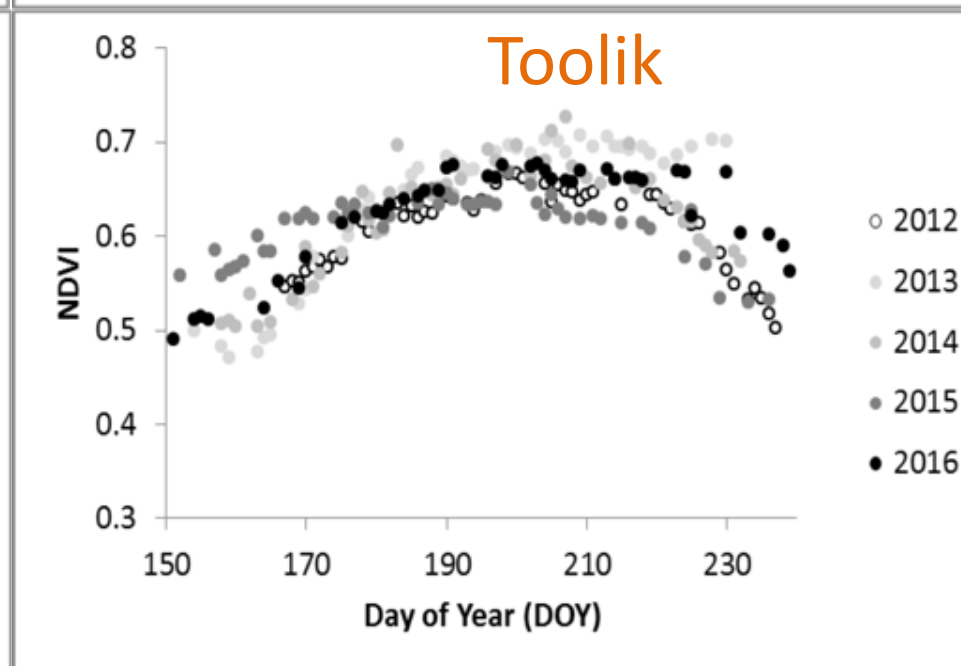
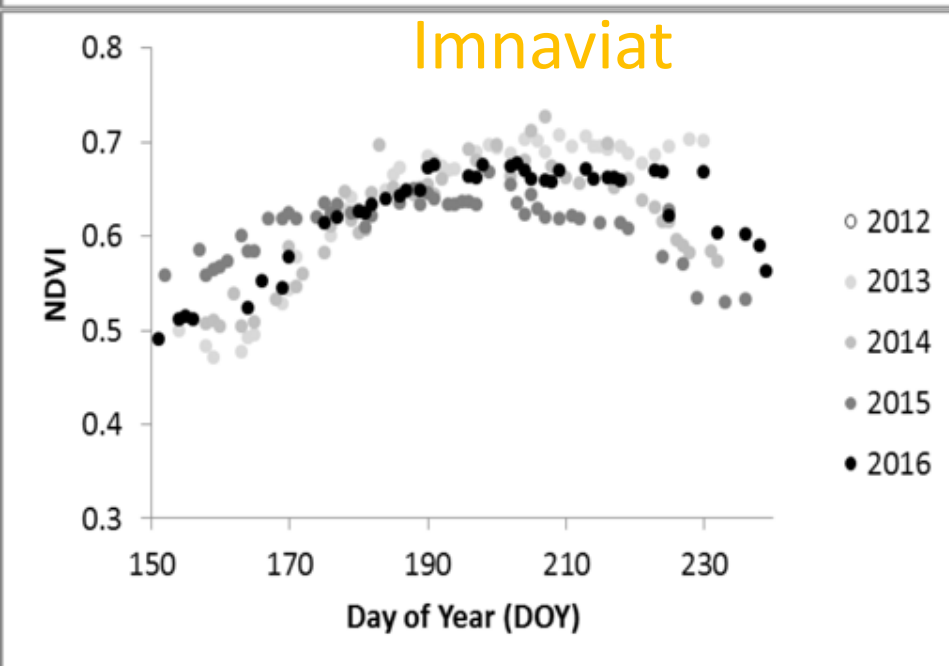
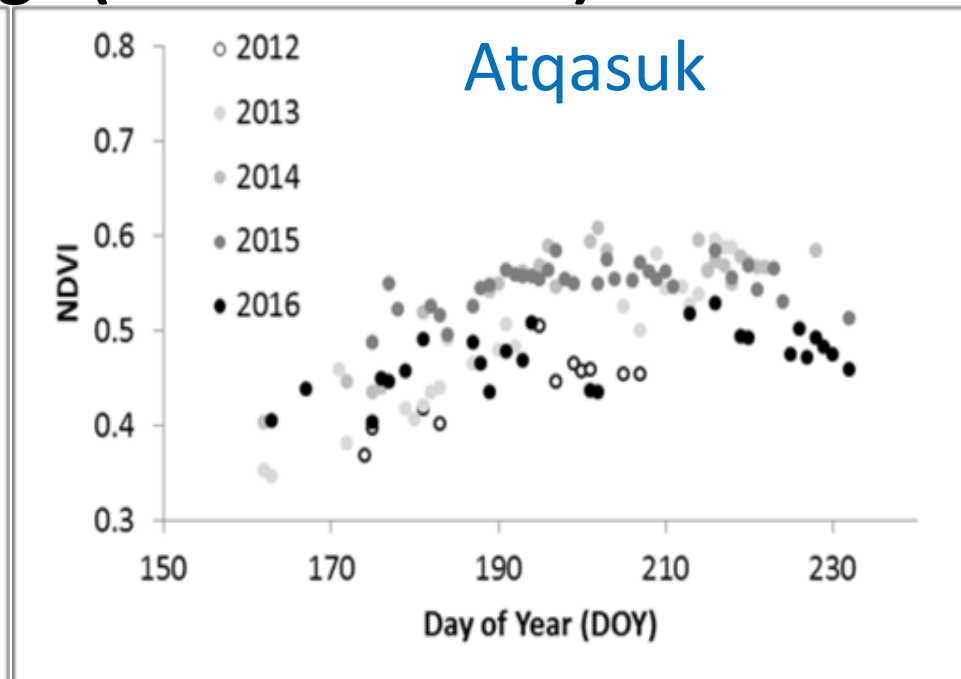
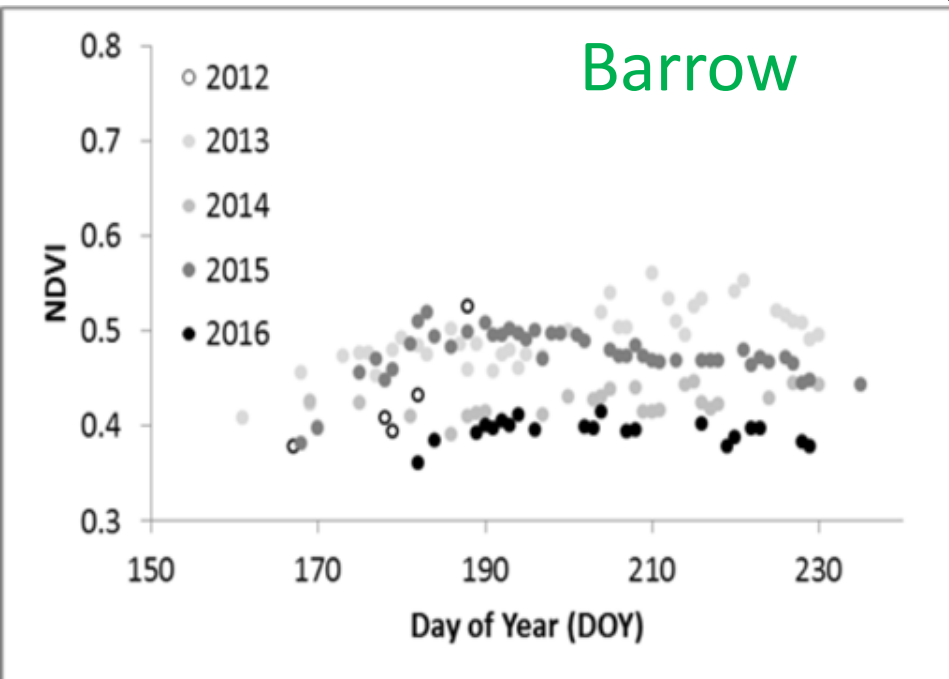
2013 (Toolik and Imnaviat)
(72-80,000 data points)

2017 (Toolik and Imnaviat)

2018 (Barrow and Atqasuk)



Season NDVI Change (whole transect)

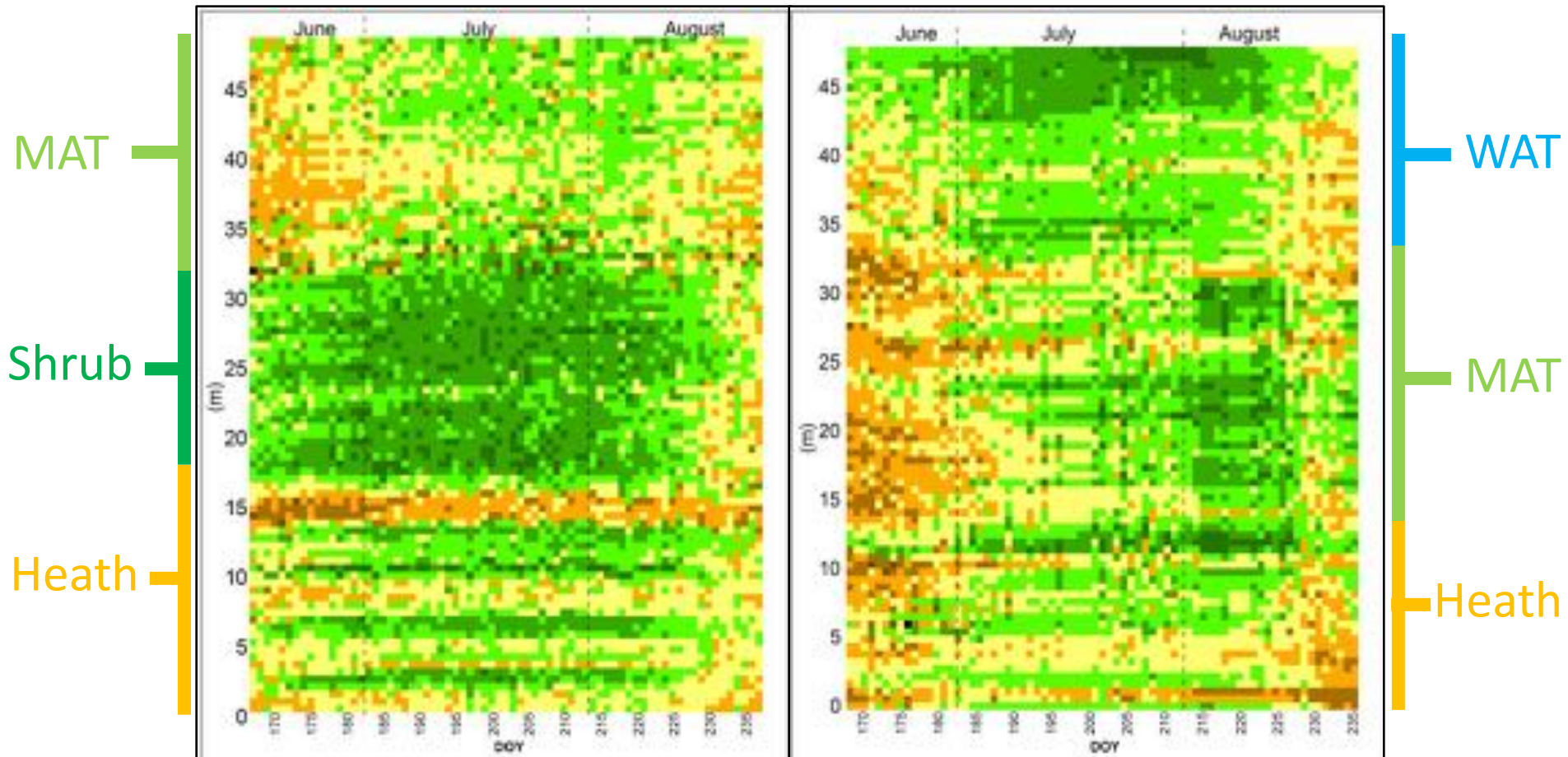


NDVI mapping through time



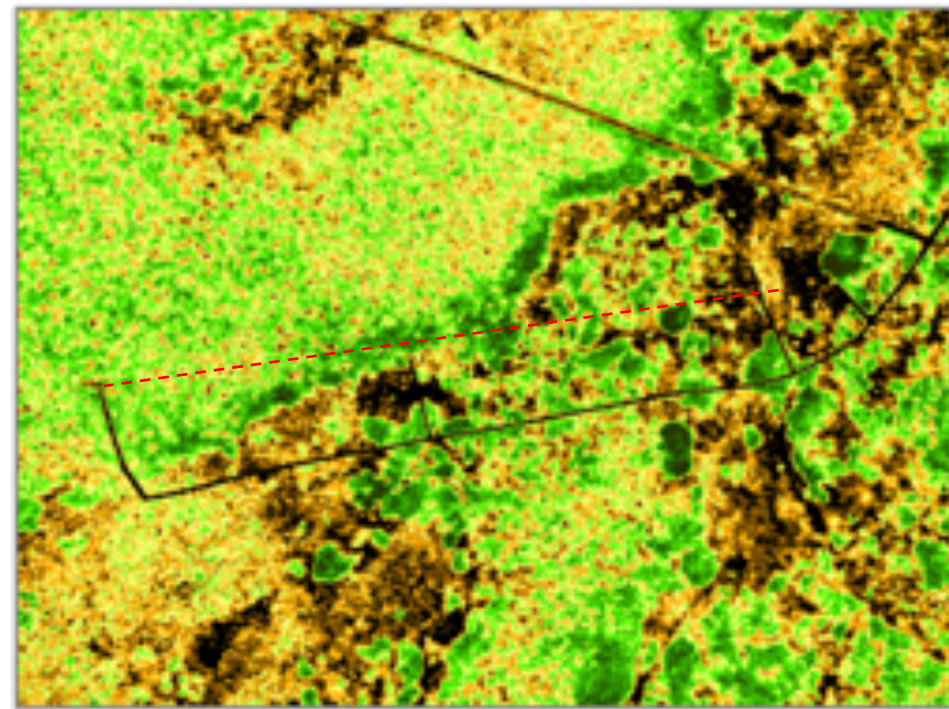
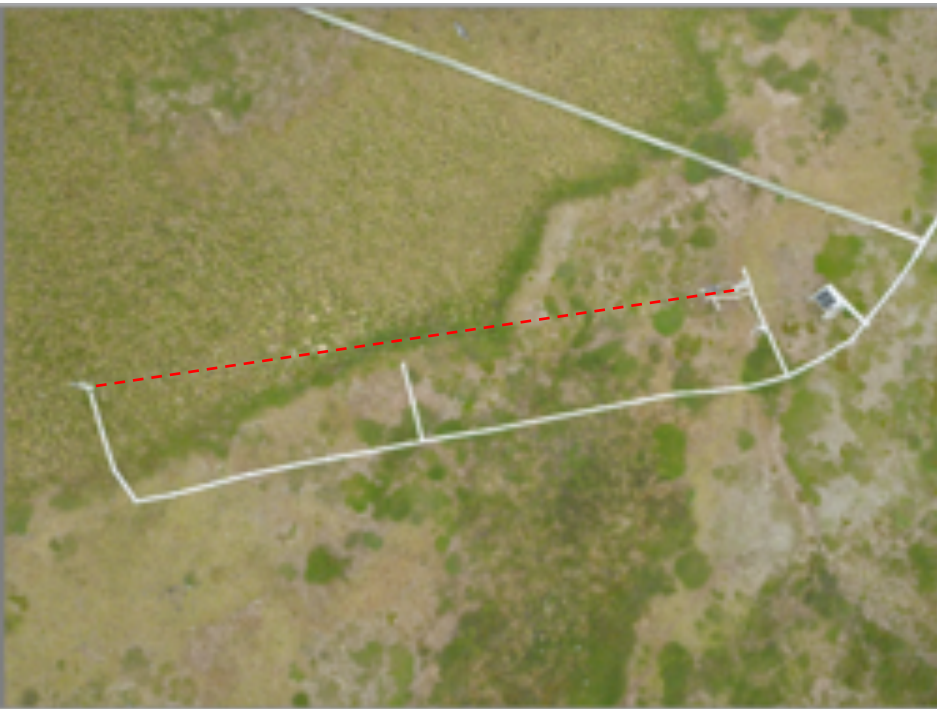
Toolik Lake

Imnaviat Creek











GreenSeeker data 2014

NDVI Transect Map Credit: Dr. Nathan Healey



$$2GRBi = (2G - (R + B))$$

-  -86 - 15
-  16 - 26
-  27 - 38
-  39 - 52
-  53 - 66
-  67 - 81
-  82 - 99
-  100 - 180

*2GRBi analysis of the image to the left.
Image date: July 11, 2014*

$$2GRBi = (2 * green) - (red + blue)$$

Questions?

