Community Composition and Species Abundance Shifts in Long-Term Observational Studies in Northern Coastal Alaska

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Outline

- Background Information
- Research Questions and hypothesis
- Methods
- Significance

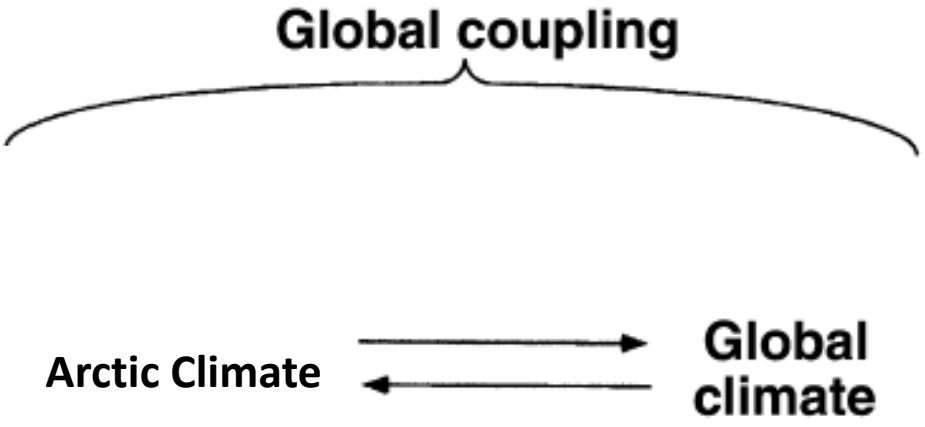
The Arctic

Red Line represents the tree line.

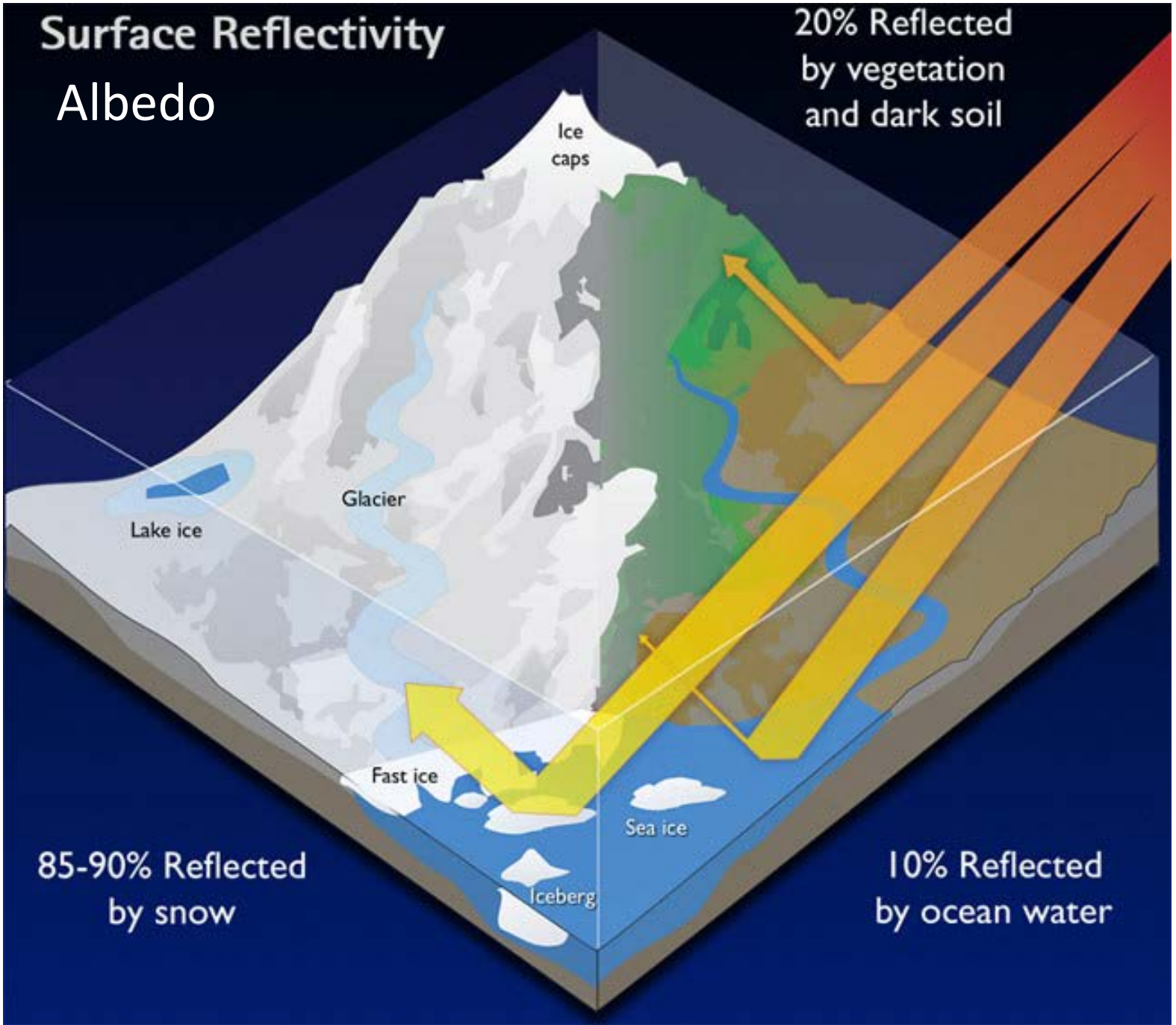
Courtesy of the University of Texas Libraries, The University of Texas at Austin.

Location with at least one day of full light or darkness.

The Arctic and Climate Change

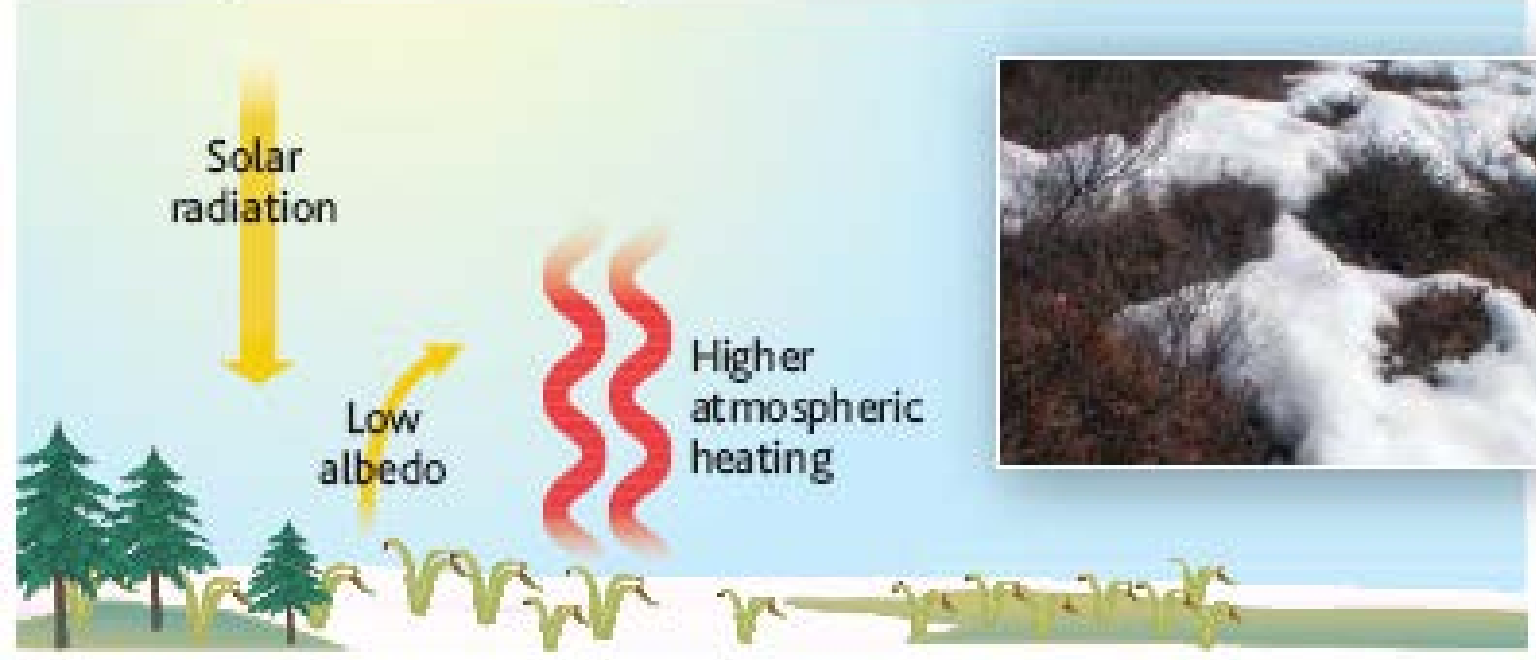


Chapin et al. 2000


Surface Reflectivity
Albedo
20% Reflected
by vegetation
and dark soil
Ice
caps
Glacier
Lake ice
Fast ice
Sea ice
Iceberg
85-90% Reflected
by snow
10% Reflected
by ocean water

No warming

Warming with snow and vegetation feedback

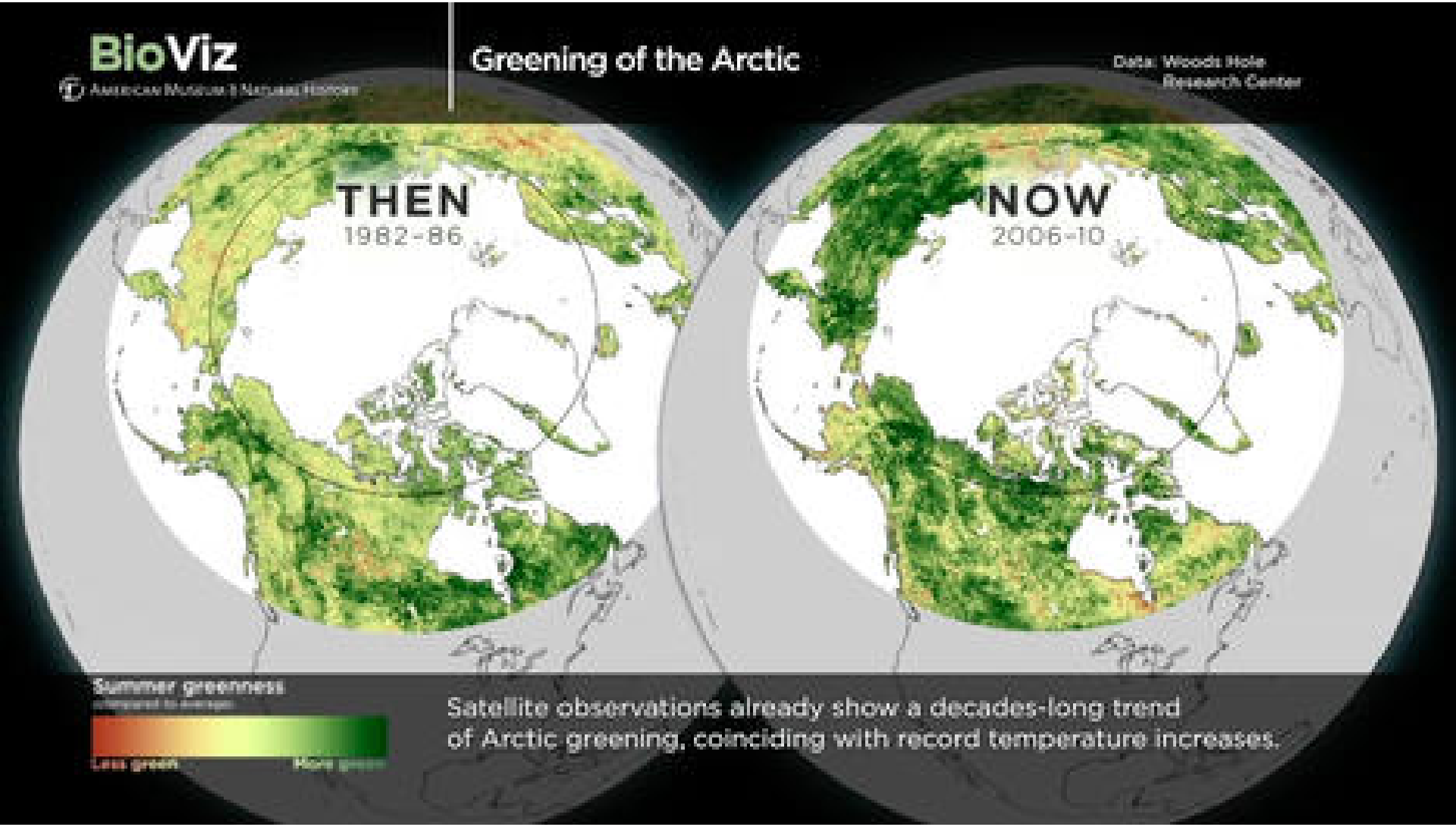


Influence of vegetation

Increased absorbed radiation

Denser Plant Layer

Arctic Vegetation Greening

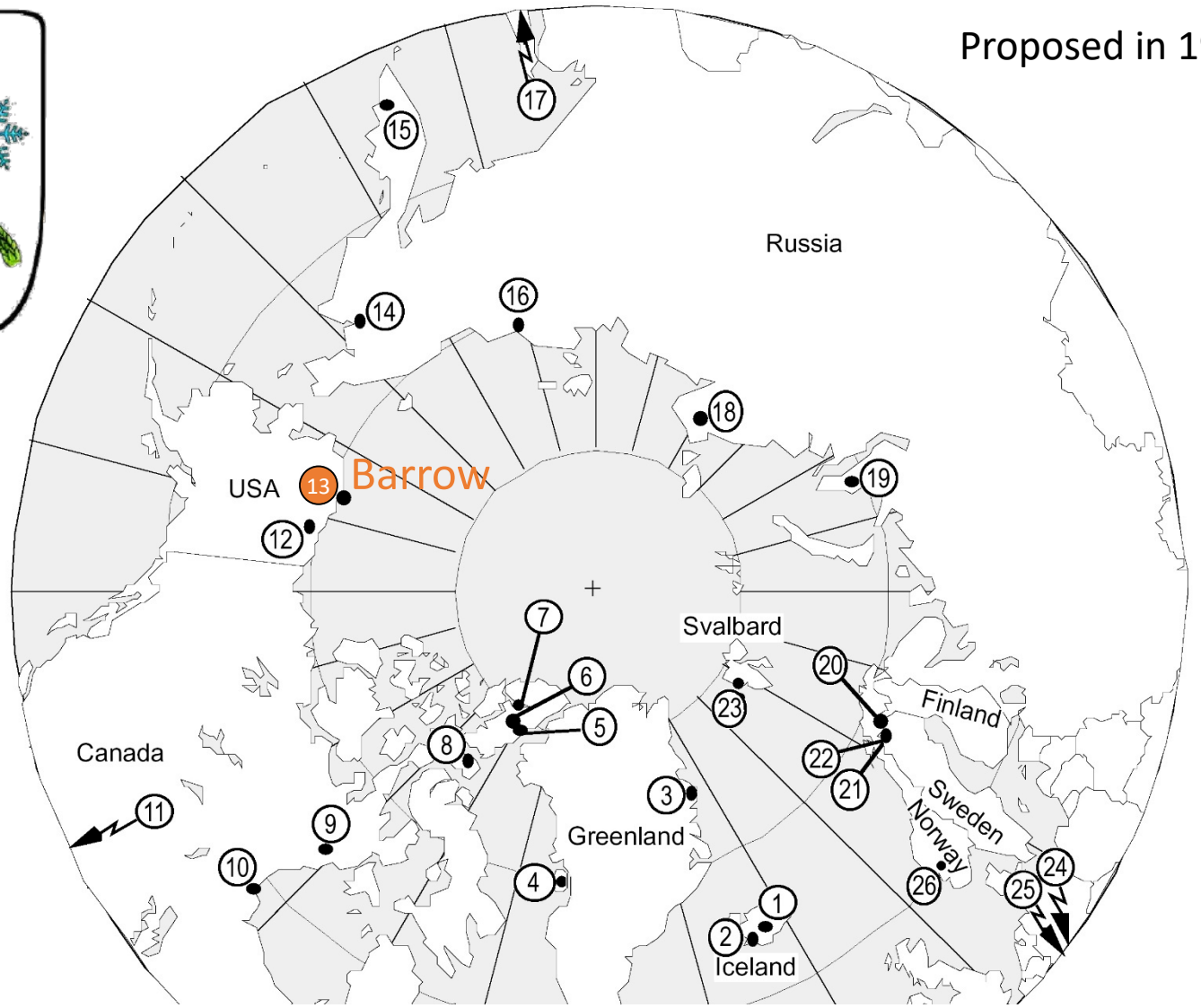


CAVM Team. 2003. Circumpolar Arctic Vegetation Map. (1:7,500,000 scale), Conservation of Arctic Flora and Fauna (CAFF) Map No. 1. U.S. Fish and Wildlife Service, Anchorage, Alaska.
ISBN: 0-9767525-0-6, ISBN-13: 978-0-9767525-0-9

Warming Affects Vegetation

- Growth is temperature dependent
- Longer growing season
- Soil temperatures (thawed soil and nutrients)
- Moisture availability
- Vegetation cover

Proposed in 1990



The original International Tundra Experiment sites

agreed on a common warming manipulation
to simulate climate change

Traditional Plant Measurements

- Plant phenology
- Plant growth
- Plant reproduction

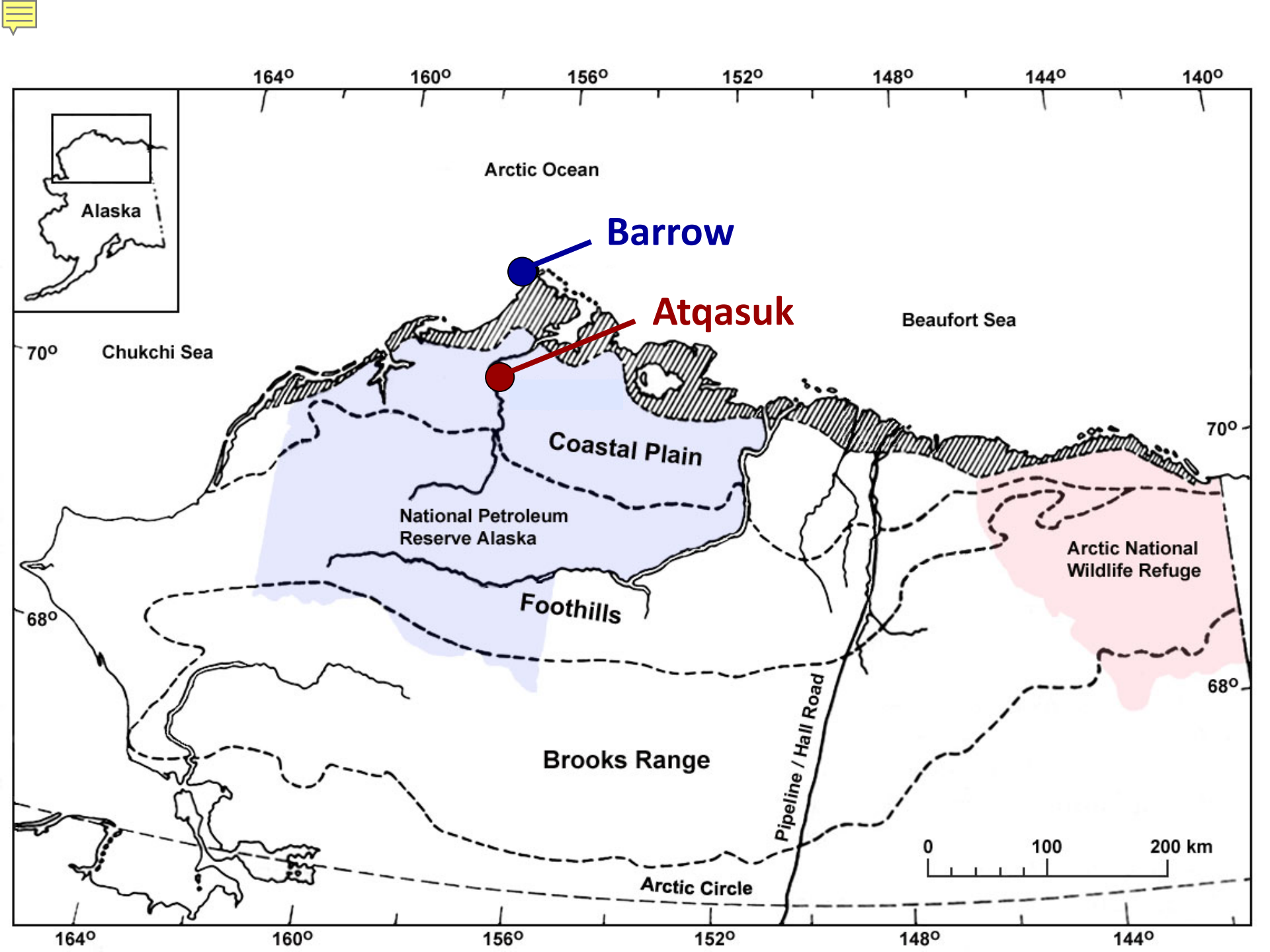
Part of the

Beginning in 2009

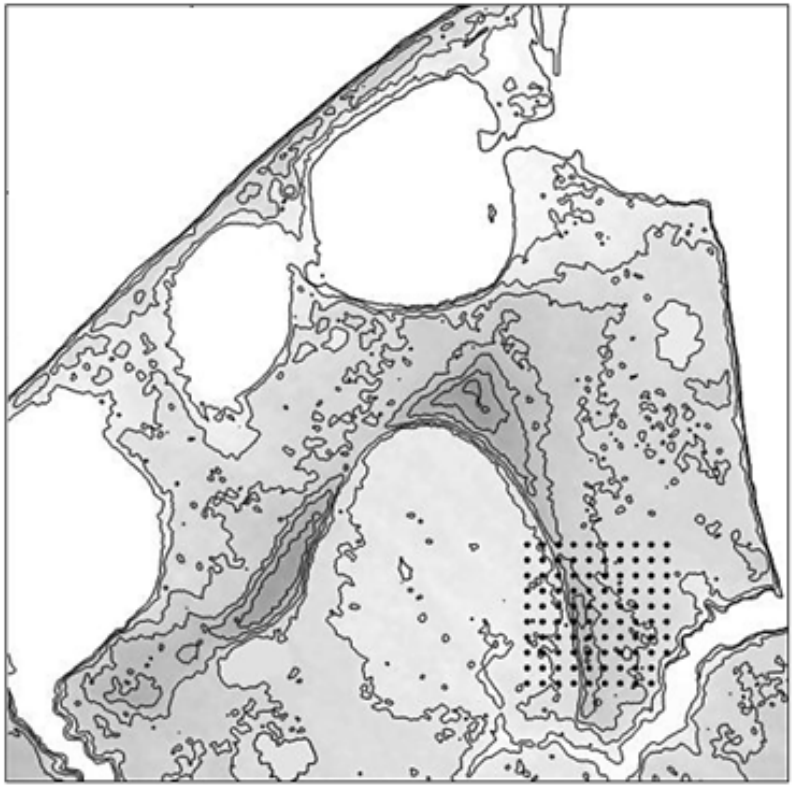
Arctic Observatory Network

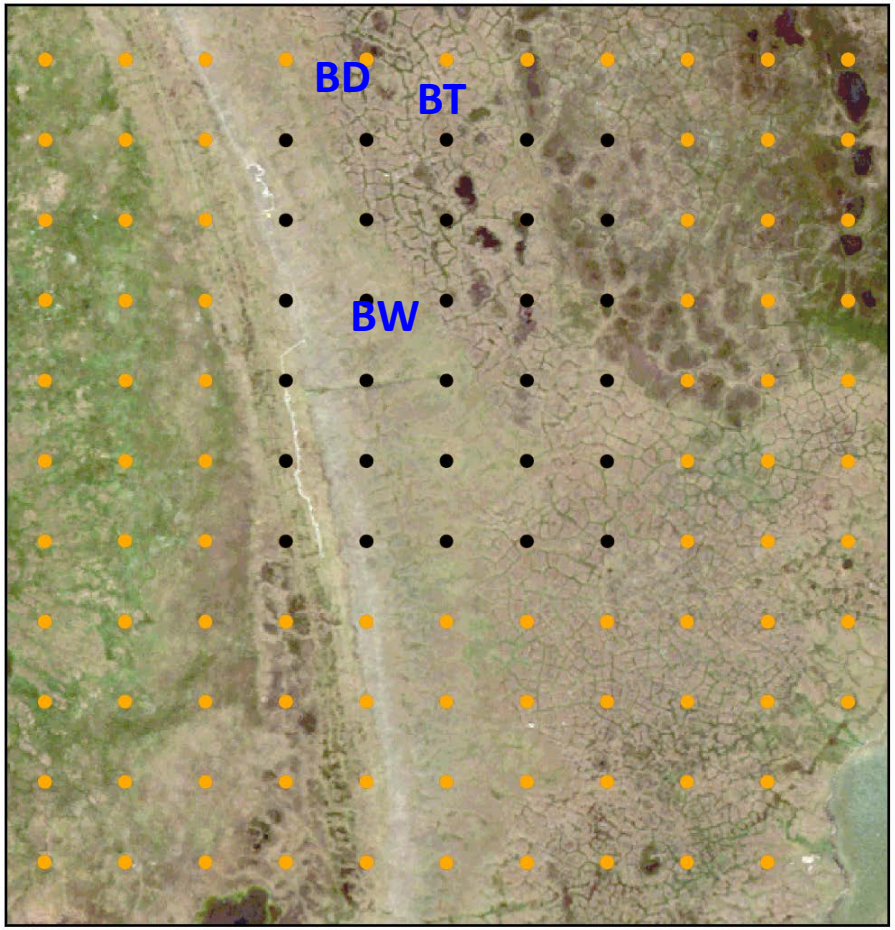
Collaborative Research: Sustaining and amplifying the ITEX AON through automation and increased interdisciplinarity of observations

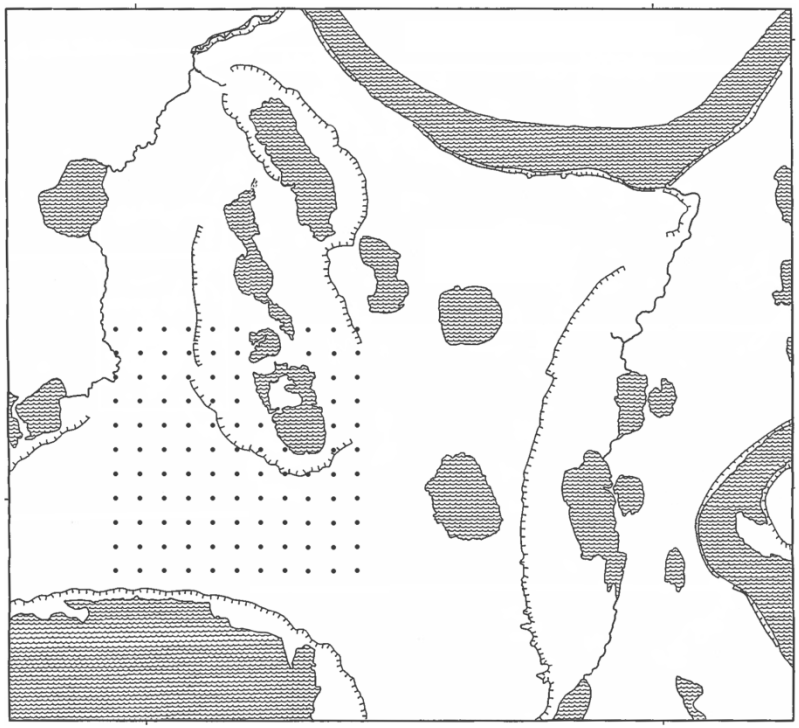
Collaborators: FIU, Florida International University
UTEP, University of Texas at El Paso
UAA, University of Alaska at Anchorage

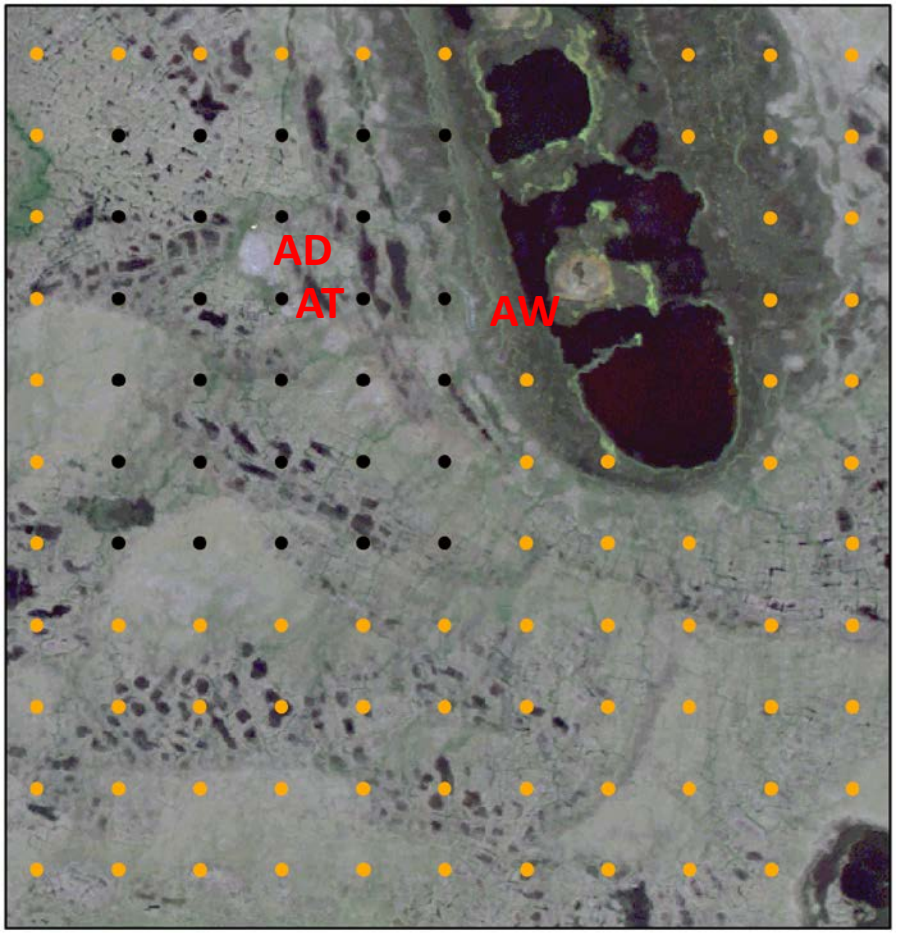

164°
160°
156°
152°
148°
144°
140°
Alaska
Arctic Ocean
Barrow
Atqasuk
Beaufort Sea
70°
Chukchi Sea
Coastal Plain
National Petroleum
Reserve Alaska
Arctic National
Wildlife Refuge
Foothills
68°
Brooks Range
Pipeline / Hall Road
0
100
200 km
Arctic Circle

The overall project

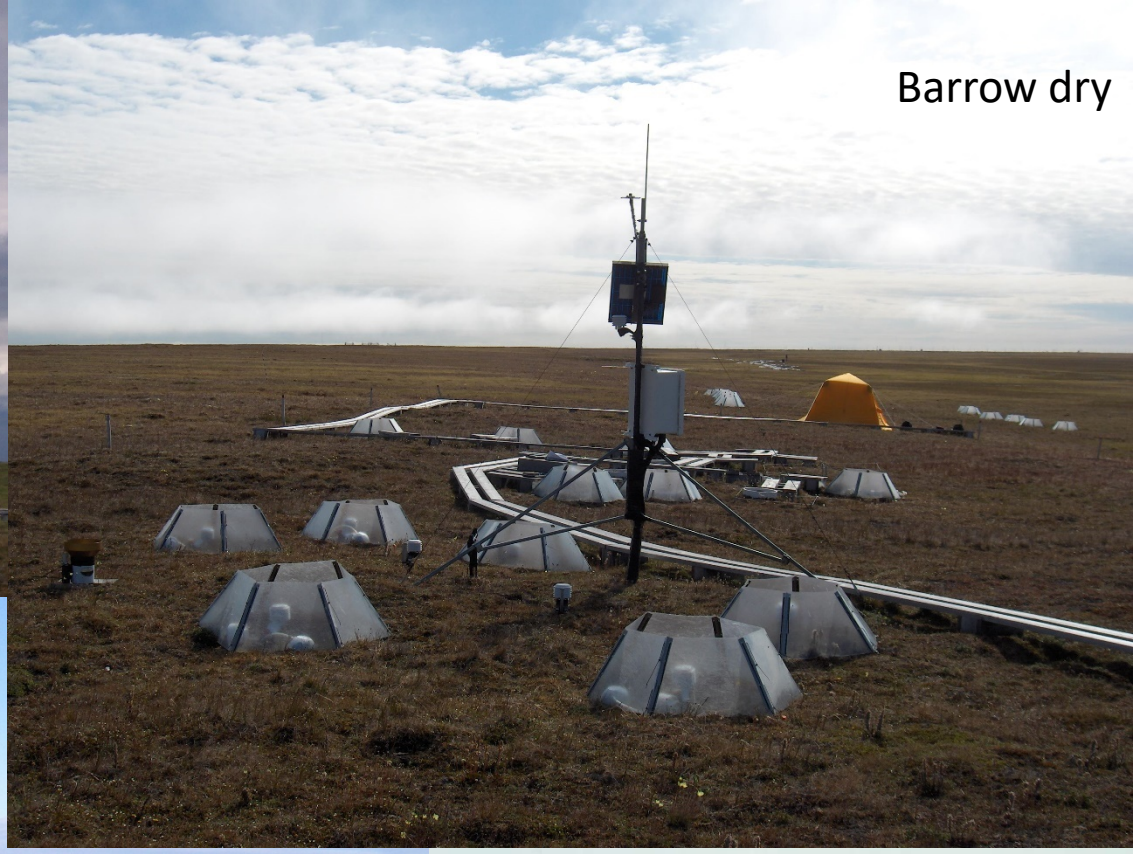


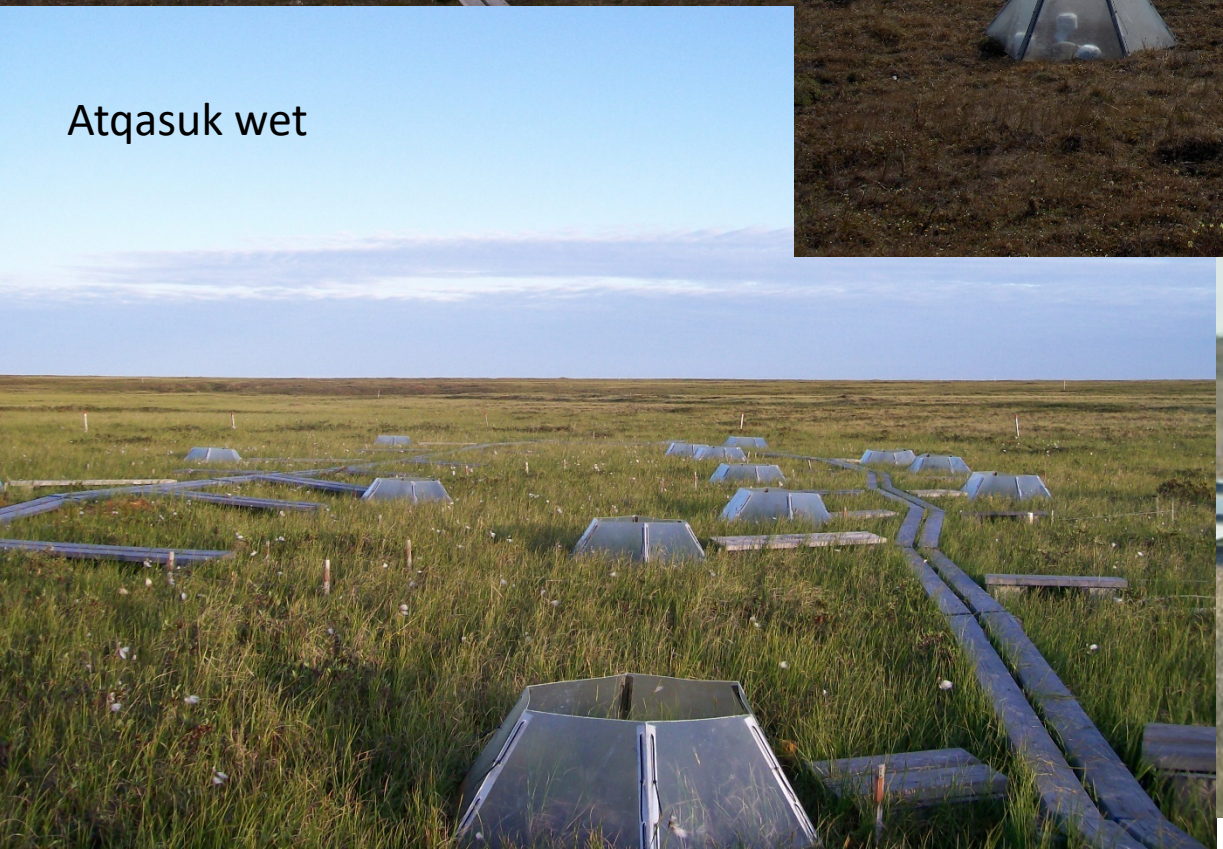





AD
AT
AW


Atqasuk dry


Barrow dry


Atqasuk wet

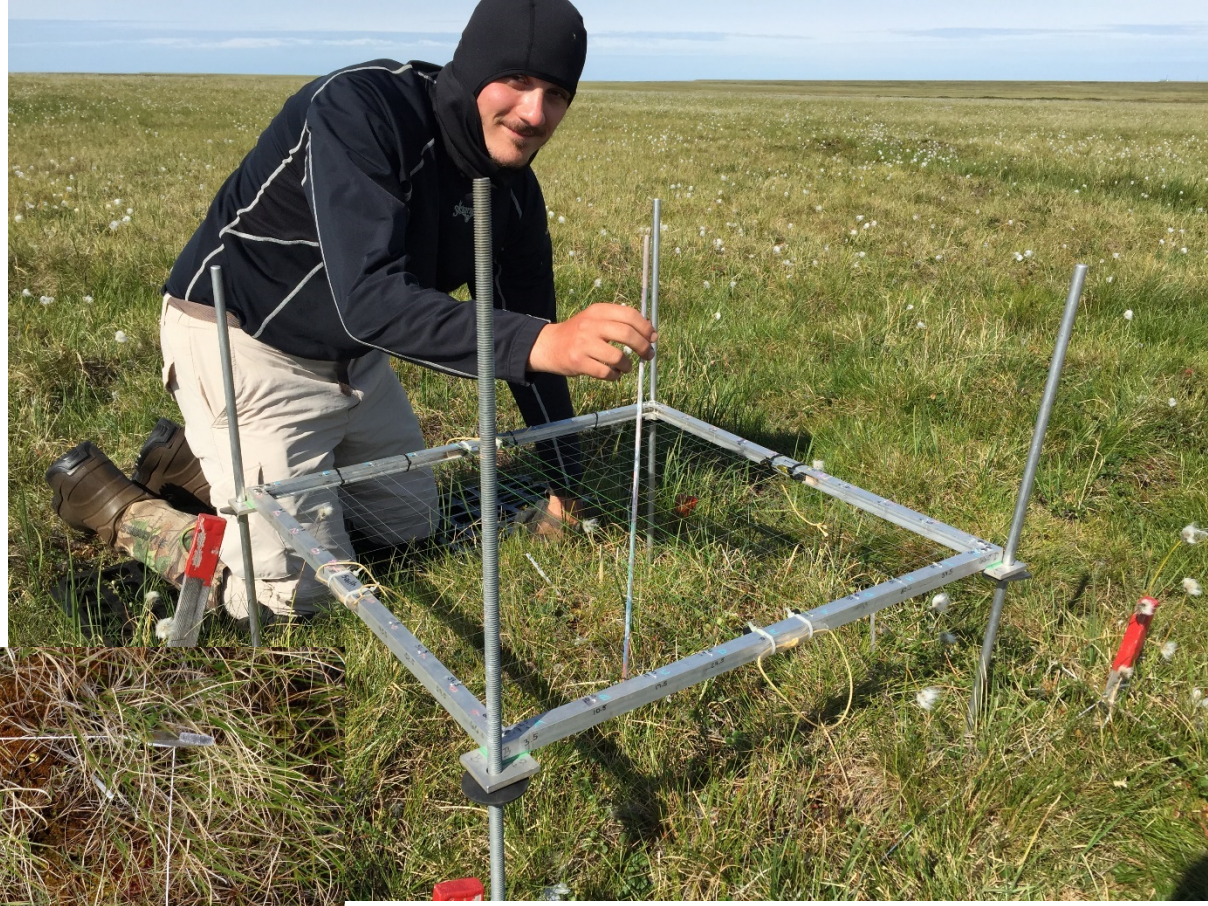

Barrow wet

My Research Questions & Hypothesis

- Does an increase in the abundance of a particular plant species affect the abundance of another plant species?
- Does warming influence this?
- Are any species directly competing?
- H_a: There will be evidence for possible abundance relationships within warmed plots.
- Analysis through ANOVA.
- Abiotic factors well established; investigate biotic factors.

Methods

- Point-framing →
- Density estimates



Control Plots
(Normal Conditions)

Treatment Plots
(Experimental Warming)

Many smaller plants

Few Large plants

Smaller plants

Larger plants

LOW Cover

HIGH Cover

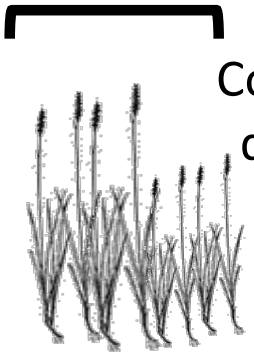
HIGH Cover

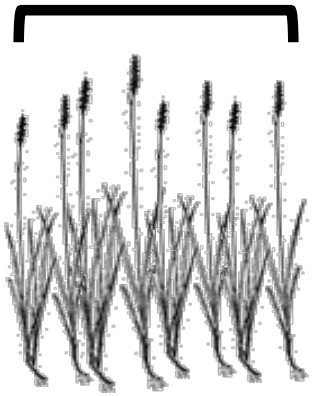
LOW Cover

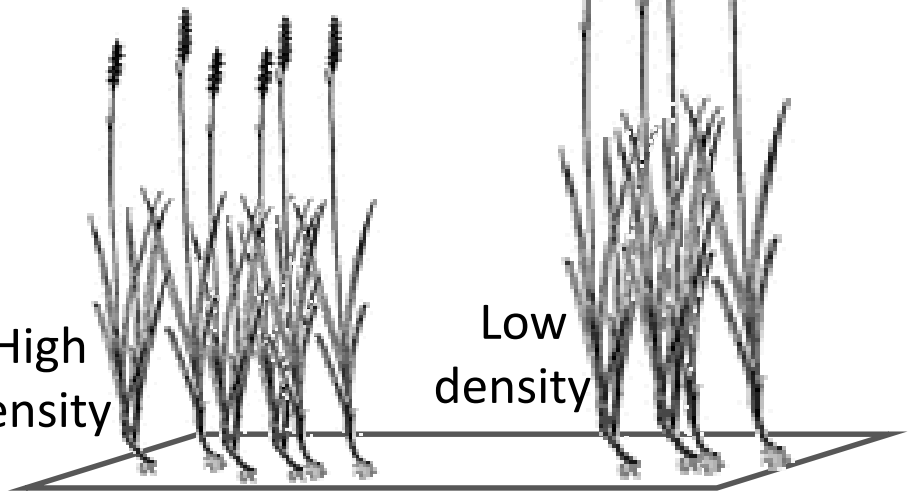
Constant density

High density

Low density







Gregory 2014

Significance

- Enhanced prediction of plant community composition via biotic factors.
- This information may have implications for understanding larger ecosystem processes.

Acknowledgements

- International Tundra Experiment (ITEX) researchers, especially Dr. Hollister and the 2016 AEP crew.
- National Science Foundation (NSF)
- Ukpeagvik Inupiat Corporation (UIC)

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Questions?
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