

Welcome to *PolarConnect*



Deep Roots

With PolarTREC Teacher Nell Kemp & Arctic Researchers

Dr. Michelle Mack and Dr. Rebecca Hewitt

31 August 2016

Getting to Know Adobe Connect

Slides will be shown here

Exit presentation

Mute your speakers

Raise your hand

List of all participants

Follow the chat

Find out more about the presentation

Chat here



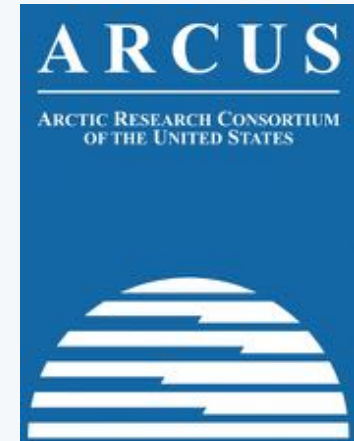
Participant Introductions

**In the Chat box, please introduce yourself
by typing in your:**

- ✓ Name
- ✓ School or Institution
- ✓ The number of students and adults participating with you in the same location

What is PolarTREC?

- Since 2004, the Arctic Research Consortium of the United States (ARCUS), a non-profit organization, has been administering the PolarTREC Program.
- PolarTREC is professional development for K-12 teachers. They are paired with researchers for 2-6 week research experiences in the polar regions.
- Over 150 teachers from around the United States have joined scientists in the Arctic and Antarctica to learn about science, the polar regions, and to share what they have learned with their students and communities.



25 Years of Connecting Arctic Research
www.arcus.org

Questions

During the Presentation:

- Type your question in the text chat box

At the End of the Presentation:

- Raise your hand with the “hand button”.
- PolarTREC staff will call on you and activate your microphone.
- Speak loud and clear, directly into the computer microphone or the phone to ask your question.



Interrupting the deep freeze: belowground
exploration of a new environment as
permafrost soils thaw

Deep Roots

Michelle Mack, Northern Arizona University

Rebecca Hewitt, Northern Arizona University

Nell Kemp, PolarTREC Teacher



Teachers & Researchers Exploring & Collaborating



Research questions

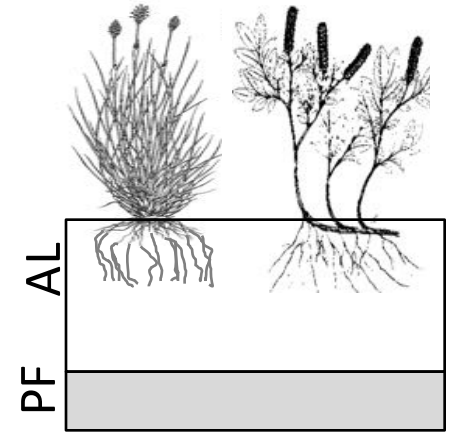
- Can plants in permafrost soils access deep Nitrogen (N)?
 - Via rooting traits
 - Via fungal symbionts
- What proportion of deep N is taken up by plants?
 - Where does the N end up in the tissues of plants?
- Can we understand the role of permafrost N in the Carbon balance of Alaskan tundra permafrost soils?

Where?



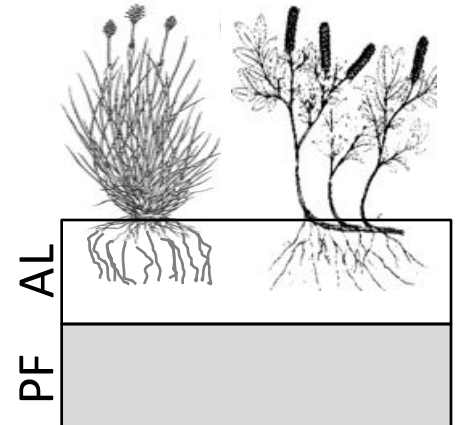
Eight Mile Lake

- Discontinuous PF
- Warm
- Deep



Toolik

- Continuous PF
- Cold
- Shallow



PF permafrost
AL active layer

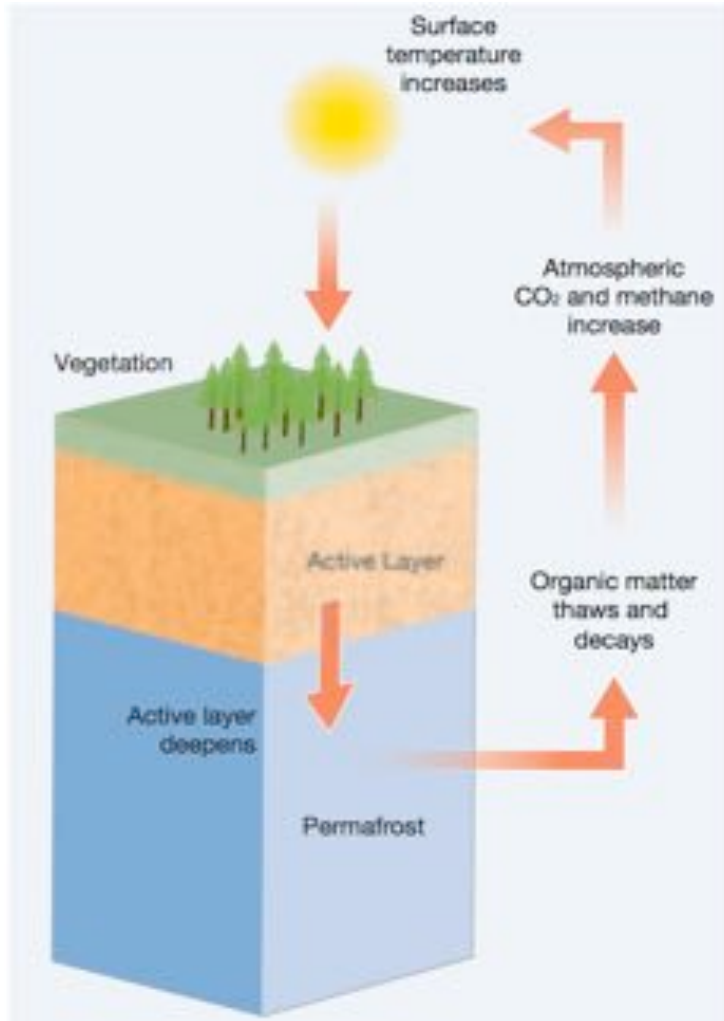
Why permafrost?

Earth's Freezer



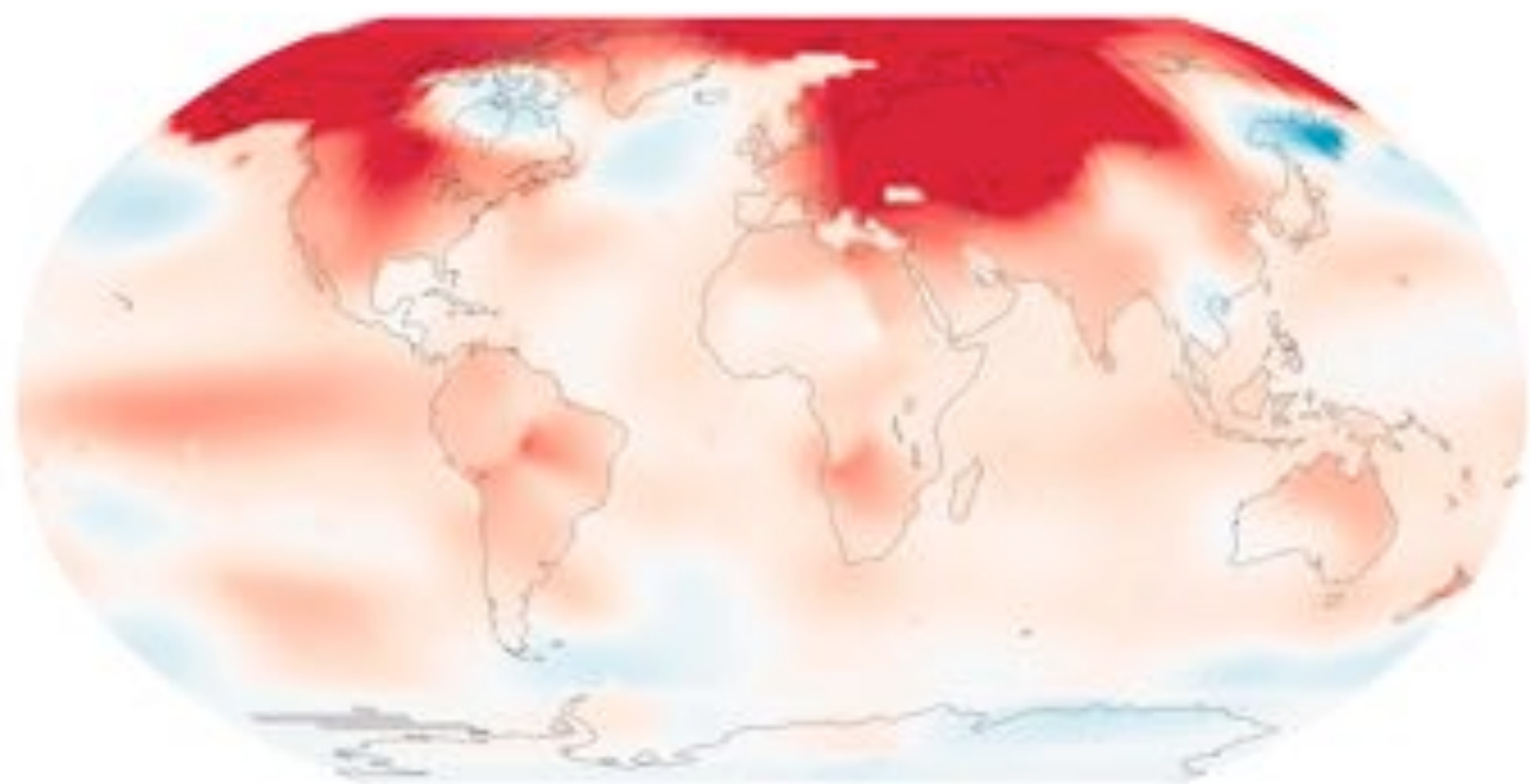
Tree and plant roots in the permafrost, potentially 5-10,000 years old.
Photo courtesy of Lynn Reed.

Permafrost stability and global C cycle



Source: International Permafrost Association, 1998.
Circumpolar Active-Layer Permafrost System (CAPS), version 1.0.

Why does the Arctic matter?



February 2016 Mean Surface Temperature Anomaly (°C)



Why Nitrogen?

Nitrogen

- Nitrogen is a vital element that plants use to build complex structures (DNA, proteins)
- Plants that take in more N tend to grow larger



AGGRAND[®]
**Fertilizer Organic Series™ provides the primary nutrients:
Nitrogen, Phosphorus and Potassium**

Directions: Some product settling will occur, agitate well before and during use. Use of coarse to very coarse spray nozzles is recommended. Once product is diluted use within 48 hrs. Application recommendations on this label are general guidelines. For additional application information visit us at www.aggrand.com. Soil testing is recommended. Do not freeze. Keep out of reach of children.

Foliar Spray Rates: Mix 2 to 3 oz. of AGGRAND Fertilizer with 1 gal. of water. Apply as a fine mist with enough liquid to thoroughly cover leaves. Addition of a biodegradable surfactant increases adhesion to the leaf surface. For best results apply in early morning or late evening. Do not apply before or after rainfall or irrigation. Foliar feeding is intended as a supplement to a regular fertilization program.

Garden & Field Rates: Mix 1 gal. of AGGRAND Fertilizer with a minimum of 32 gal. water. Broadcast mixture over 4,000 sq. ft. Till into soil in spring or fall, or band mixture in 800 ft. rows.

Information regarding the contents and levels of metals in this product is available on the internet at <http://www.aapfco.org/metals.htm>

CONDITIONS BEYOND OUR CONTROL MAY AFFECT RESULTS. AMSOIL DOES NOT WARRANTY OR GUARANTEE ANY PARTICULAR LEVEL OF PERFORMANCE OR RESULTS. TO THE FULLEST EXTENT PERMITTED BY LAW, AMSOIL INC. LIMITS, EXCLUDES, AND DISCLAIMS LIABILITY FOR INCIDENTAL AND CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OF THIS PRODUCT. BUYER ACCEPTS THESE CONDITIONS. WARRANTY OF THIS PRODUCT IS LIMITED TO REPLACEMENT OF THE PRODUCT THAT IS DETERMINED TO BE DEFECTIVE IN MANUFACTURE OR PACKAGING.

AMSOIL INC • AMSOIL Building • Supercenter • 54880 U.S.A.
Visit us on the web at www.amsoil.com

GUARANTEED ANALYSIS

Total Nitrogen (N)	4.0%
2.75% Water Soluble Nitrogen	
1.25% Water Insoluble Nitrogen	
Available Phosphate (P ₂ O ₅)	3.0%
Soluble Potash (K ₂ O)	3.0%

Derived from: Fish Emulsion, Rock Phosphate, Sulfate of Potash and Kelp.

F1136

1112



0 97012 405432 9

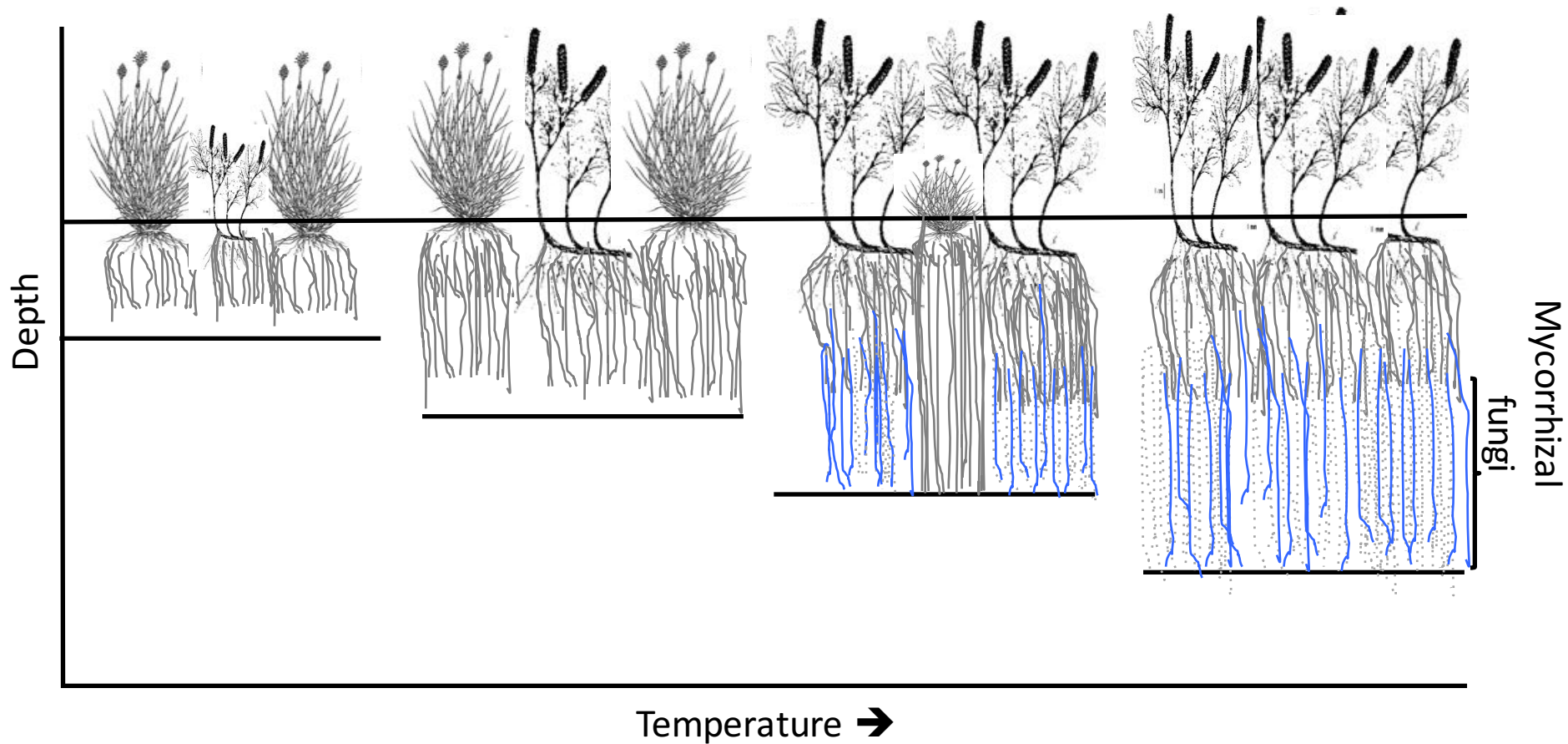
PRODUCT CODE OSF-05

Fertilizers contain nitrogen

Putting it all together

- Permafrost stores Carbon and Nitrogen
- As Arctic warms, permafrost thaws and releases the stored nutrients
- Plants with deep root systems can access these nutrients
- Plants with fungal symbionts may take up more N
- More N, plants can grow bigger
- Bigger plants = more atmospheric CO₂ uptake, reducing positive feedback

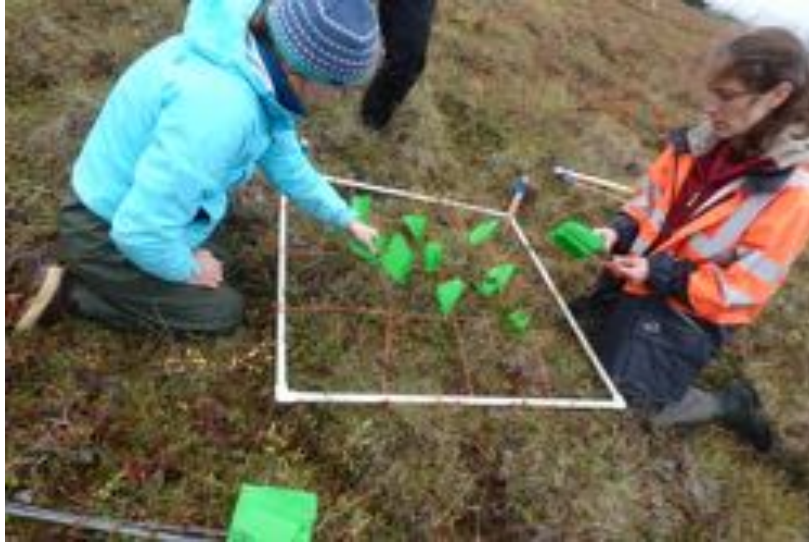
- Plants in the PF may increase their ability to access deep N by their fungal communities



Deep Roots – a pictorial overview



Determining tundra plots, soil profiles

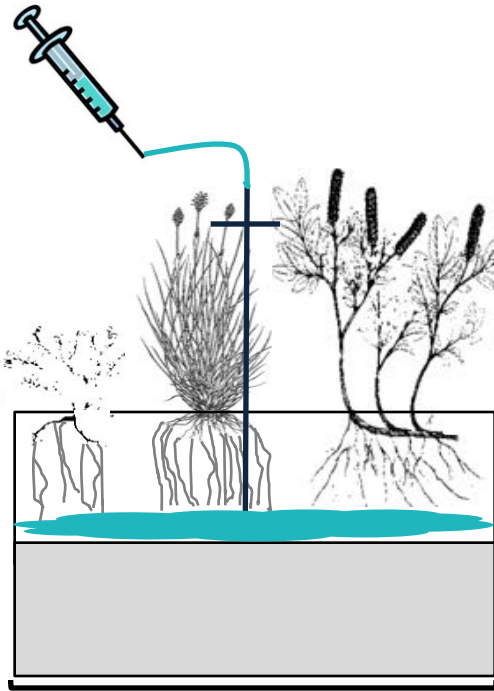


Injecting labeled N at thaw depth



Experimental tracer study design at Toolik

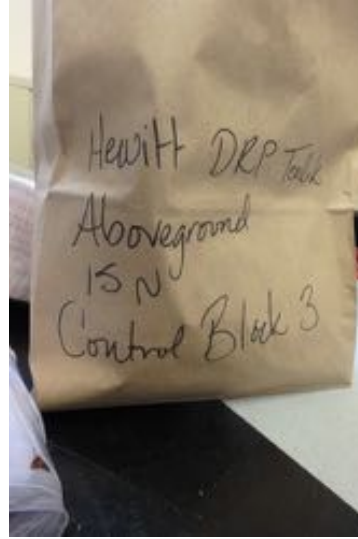
Label with 100 mg of $^{15}\text{NH}_4^+\text{Cl}$



Time line

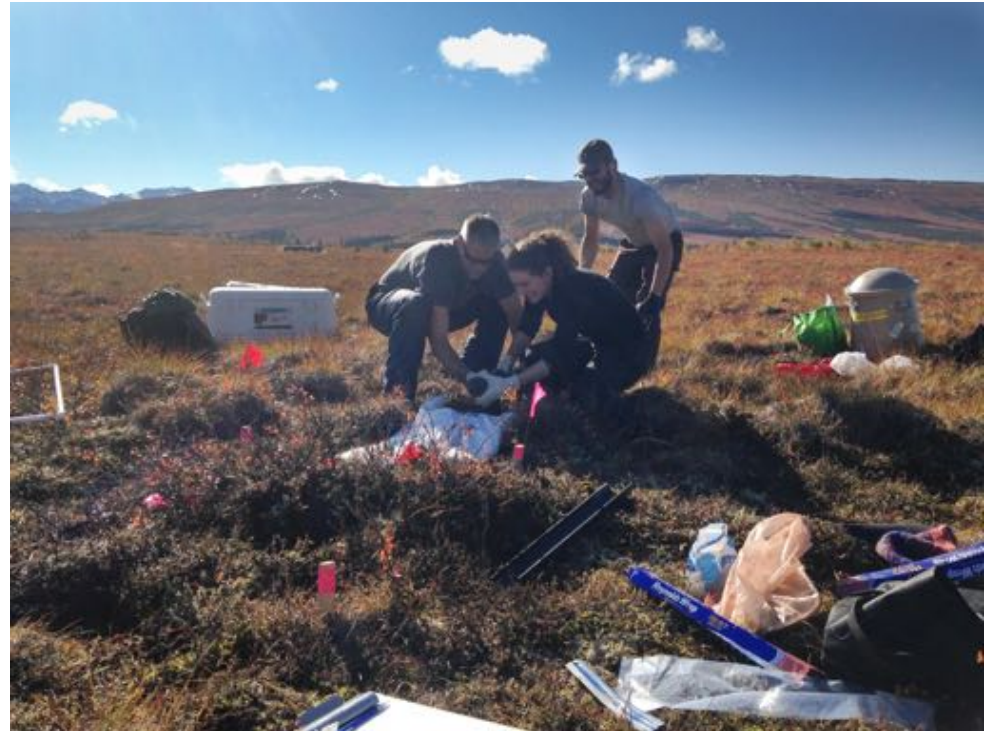
- Label 8 replicate plots X 2 treatments (greenhouse and control)
- 5 plots harvested/treatment after 24 hours
- 5 plots harvested/treatment after 1 year

Analyzing above & below ground biomass 24 hours after N injected



8 Mile Lake, Healy, AK

- The above/below ground biomass for 1 year analysis will be harvested from 8 Mile Lake this weekend (Toolik next year)



Thank you! Questions?



Join PolarTREC!

www.polartrec.com/about/join

Everyone can participate in different ways:

- **Follow Expeditions**
- **Participate in PolarConnect Events**
- **Join the Polar Education Email List**
- **Check out the great resources**
- **Become a PolarTREC Teacher or Researcher**
- **Become a member of ARCUS**

Thank You!

An archive of the event will be available shortly.
<http://www.polartrec.com/polar-connect/archive>



25 Years of Connecting Arctic Research
www.arcus.org