

PolarTREC STEM Experience Report

Winter Respiration in the Arctic



PolarTREC Expedition Page

<https://www.polartrec.com/expeditions/carbon-balance-in-warming-and-drying-tundra-2012>



This program is supported by the National Science Foundation under award 1345146. Any opinions, findings, and conclusions or recommendations expressed by this program are those of the PIs and coordinating team and do not necessarily reflect the views of the National Science Foundation.

Janet Warburton and Judy Fahnestock
Education Project Managers
Arctic Research Consortium of the US (ARCUS)
3535 College Rd. Suite 101
Fairbanks, AK 99709
(907) 474-1600
info@polartrec.com
www.polartrec.com

The PolarTREC Experience

PolarTREC is a teacher professional development program funded through the Arctic Research Consortium of the United States (ARCUS) and National Science Foundation (NSF). PolarTREC pairs middle and high school teachers with scientific research teams to allow them to “study-abroad” as a scientific team member authentically integrated into polar (Arctic or Antarctic) field science. The PolarTREC experience facilitates the building of mutually beneficial relationships between teachers and researchers to support each other in reaching professional goals.

The Science Explained

Working with various science teams from Utqiagvik to Anchorage, I was able to observe a full range of the diverse types of polar research that is happening in Alaska across varying geography; there is no one single type of polar science.



Aerial view of polygons made by permafrost thaw somewhere between Utqiagvik to Atkasuk.

Climate science is also incredibly complex; no single experiment is gathering a full picture of what is happening in the Arctic. Because of this, scientists often work on individual experiments that are part of larger networks or teams of research. The project I got to spend the most time working on is a study of winter respiration in the Arctic, run by the Woods Hole Research Center as part of NASA ABoVE (Arctic Boreal Vulnerability Experiment). This project is one of the first examining rates of CO₂ release from soils in permafrost regions during the cold winter months, using a continuous measurement technique. Understanding the amount of CO₂ released into the atmosphere from these soils is an important data to include when developing climate models. CO₂ release

from permafrost soils during the winter is currently not accounted for in many models.

Importance of Interdisciplinary Collaboration

Partnerships between scientists and teachers are essential for the successful integration of emerging scientific discoveries and methods into education curriculum. Scientists can help teachers expand their content knowledge and understanding of what can be taught in classrooms; teachers can help scientists develop their outreach and communication skills to a general audience. Equally as important is continuing to expand the definition of whose “job” it is to teach about the Arctic and climate change. All K-12 educators, regardless of discipline, have a responsibility to integrate climate change education into their curriculum. Future solutions to environmental problems, along with messaging to the public about the



Soil Respiration Station near Fairbanks, Alaska.

need for changes in human behaviors and resource use



The view after a hike to Reflection Pond with a clear view of Denali from the North.

will come from interdisciplinary teams, not just the STEM field alone. Scientists: don't be afraid to welcome a humanities teacher into your network – their outsider's perspective may raise interesting conversations and questions. Humanities teachers: don't be afraid of trying to explore content that may seem unfamiliar to you– while it does feel at times like scientists speak another language, they make great collaborators.

Overall throughout my PolarTREC expedition I was surprised at how well my training as a historian prepared me for participating in an Arctic science expedition.

Methods of critical thinking are a great connector across

disciplines; history teachers can help explain the impact larger human systems are having on climate data.

Goals: Short-term Outreach

The following outreach activities will take place by June 2019:

1. Collaboration between myself and Weston High School student Michael M. who participated in the Joint Science Education Program (JSEP) this summer. We will be doing presentations on climate change and polar science to Weston High School classrooms – October 2018 to January 2019.
2. Extended Unit on the impact of climate change on Inupiat and Inuit cultures as part of the Grade 9 World History study of the Americas. This will include lesson plans on permafrost (science and social impact).
3. Poster presentation at the American Geophysical Union (AGU) December 2018 Meeting entitled “Winter Respiration in the Arctic: An Interdisciplinary Perspective on Improving K-12 Educator Resources on the Changing Alaskan Landscape through PolarTREC” as part of the Resilience and Vulnerability of Arctic and Boreal Ecosystems to Climate Change VI Posters Session
4. Creation of ESRI StoryMap resources related to the Woods Hole Research Center NASA ABoVE winter respiration study
5. Small group student visit to Wood's Hole Research Center lab (weekend field trip)
6. Hosting of Wood's Hole Research Center scientists to WPS classrooms



Cleaning out lemming traps as part of an open grid on the Barrow Environmental Observatory.

Goals: Long-term Outreach

Initial steps towards these long-term goals will be taken during the 2018-2019 school year, but they are unlikely to be completed:

1. Hosting of OMSI Under the Arctic: Digging into Permafrost exhibit at a New England area science museum/center, collaborative outreach events between myself, museum, and Woods Hole Research Center
2. Organizing a "Science on Screen" event at the Coolidge Corner Movie Theater in Brookline, Massachusetts. Woods Hole Research Center Scientist(s) to speak.
3. Creation of collaborative citizen science project between Weston Public Schools and Meade River School in Atkasuk, Alaska. Writing of grants to support this project.
4. Creation of a Weston High School June Academy course that will include a longer visit by students to the Woods Hole Research Center.
5. Creation of immersive 360 content and curriculum related to permafrost education, bringing together work done by many researchers. Possible support from Intel/National Geographic.



Looking at large ice wedges in the new section of the permafrost tunnel.