Using Vegetation Cover Type To Predict And Scale Methanogenesis In Peatlands
Kellen McArthur1, Ruth Varner2, Carmody McCalley2, Michael Palace2, Christina Herrick2, Jessica DelGreco2
1University of Minnesota, Morris. 2University of New Hampshire, Durham

Background
● Study site: Stordalen Mire, Abisko, Sweden. (68.352, 19.014)
● Stordalen is located along the discontinuous permafrost boundary.
● Permafrost regions contain about 50% of the global soil carbon.
● Methane emissions are increasing as permafrost thaws.
● Measuring δ13CH4 values can indicate pathways of methane production:
  • Acetoclastic vs. Hydrogenotrophic

Importance
● No study has examined pathways of methogenesis across a landscape using a random sampling design.
● Atmospheric inversion models currently use a 5°C - 60‰ to -65‰ for peatlands, and therefore assume a mostly acetoclastic pathway.
● Better understanding of pathways will help to improve the accuracy of atmospheric inversion studies.
● By linking field based measurements with a remote sensing effort, the spatial implication of methogenesis pathways, can be ascertained.

Methods
● Pulled porewater samples from a depth of 20 cm at each site and measured δ13CH4, methane concentration, and pH values.
● Compared δ13CH4 values to vegetation cover type.
● UAV imagery and field based plot locations of cover type were used in a neural network to determine covrttype across our study area

Results
● As permafrost thaws, the presence of surface water flow will create tall graminoid sites, while hydrological isolation will create wet sites.
● Tall graminoid sites shift methane production to a more acetoclastic pathway.
● Wet sites shift methane production to a more hydrogenotrophic pathway.
● Graminoids are believed to pump acetate back into the system, which may explain this pathway difference.
● Our observed δ13CH4 values range from -44‰ to -79‰, inversion models use -60‰ to -65‰.
● The UAV cover type map is important in interpreting biogeochemical processes on the landscape level.
● The neural network currently has difficulty distinguishing between tall graminoid and wet sites.
● Some of the variability in δ13CH4 may be explained by pH levels.

Acknowledgments: I’d like to thank the NSF, the NERU program, all of the mentors and students involved, Duc Nguyen, and Allison Hobbie

Image credit: M. Palace, C. Herrick, c.herrick@unh.edu

References