Plant-Environment Interactions of Arctic Vegetation and Implications for CO_2 Flux

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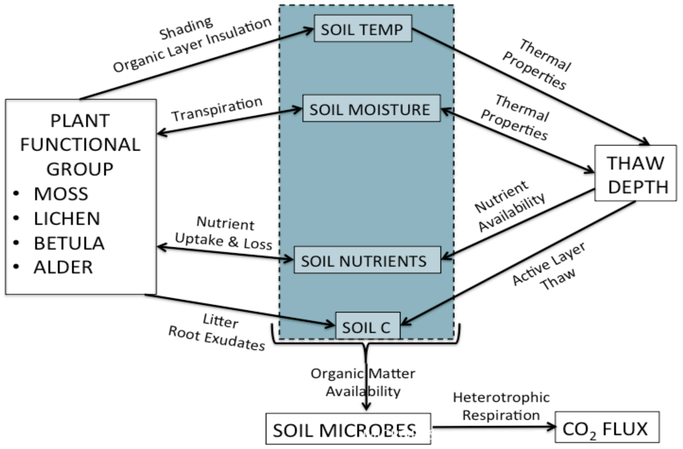
Introduction

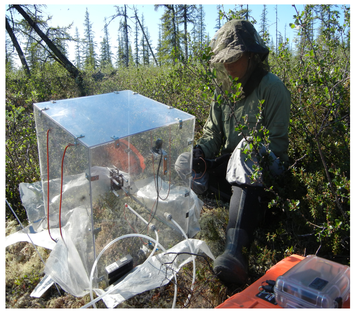
- Plant functional groups may shift in response to altered climate in northern latitudes (Loranty & Goetz 2012).
- Plant-environment interactions influence microclimate, including temperature and moisture, which can influence microbial communities
- Microclimatic variation between plant functional groups may result in different rates of respiration and CO_2 flux from these plants and associated microbes



Objectives

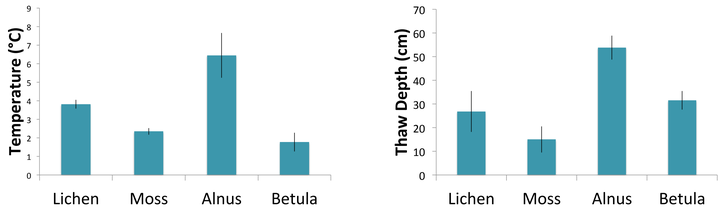
- Compare microenvironment and soil characteristics between isolated patches of plant functional groups
- Compare microbial community composition and CO_2 flux between plant functional groups
- Begin reciprocal transplant experiment by switching moss and lichen plots to analyze relative direction of plant-environment relationship over a longer timescale

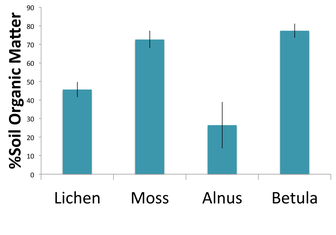
Methods

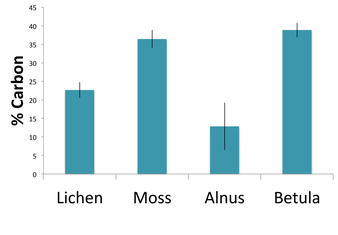


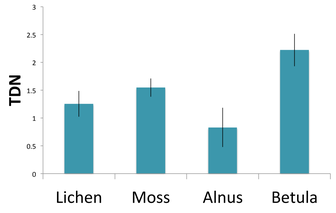
- Isolated patch types of four functional groups
- Measured microenvironment variables
- Measured CO_2 flux with Li-Cor 820
- Biolog assays to compare microbial communities

Results









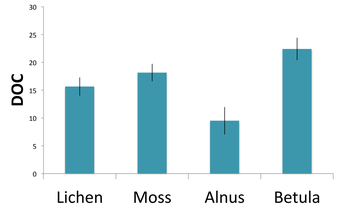


Figure 1. Microenvironment variables by plant functional type. One-way ANOVA tests performed for each variable found significant differences in means ($p<.05$). Field measurements were taken five times over the course of one month, and soil moisture and nutrient data was obtained from soil samples collected early in the month.

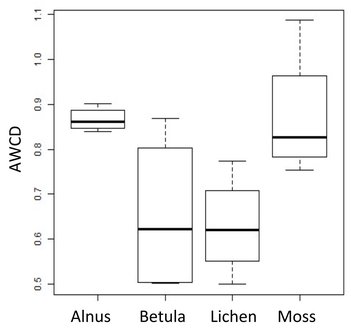


Figure 2. Boxplot of average well color development (AWCD) of the bacterial Biolog EcoPlates at the end of inoculation for four different vegetation types.

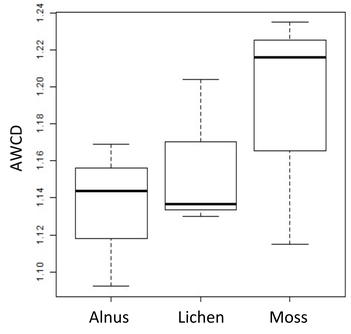
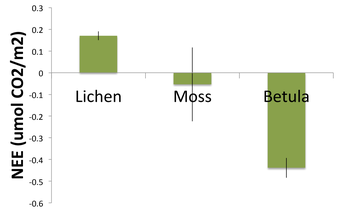
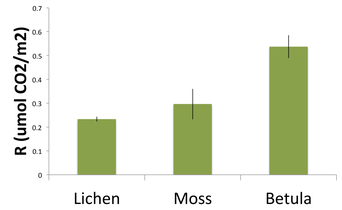


Figure 3. Boxplot of average well color development (AWCD) of fungal Biolog FFPlates at the end of the inoculation for three different vegetation types.





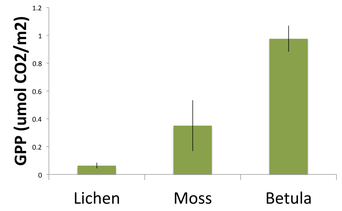


Figure 4. NEE, R, and GPP data from isolated patch types. Positive NEE represents a CO_2 source, and negative NEE represents a CO_2 sink. Values represent an average from measurements taken at two different days using a Li-Cor 820.

Conclusions & Future Directions

- There are differences in microenvironment between plant groups, especially between thaw depth and temperature
- Alder and moss have higher microbial diversity than lichen and betula, which may indicate that more carbon substrates are able to be used by these vegetation types.
- Shrubs appear to be a net CO2 sink, while mosses and lichen are a net source or neutral
- Differences in CO_2 fluxes between plant functional groups may be partially driven by variations in microclimate and microbial communities
- Link between environment and CO_2fluxes may become more clear with reciprocal transplant data taken over time
- Contributions to CO_2flux by different plant functional groups can be used to predict how vegetation shifts in response to climate change can alter ecosystem carbon balance

A reciprocal transplant of moss and lichen patches might clarify the relationship between plant, microenvironment, and CO2 flux

References & Acknowledgements

- Loranty, M.M., and S.J. Goetz. 2012 Shrub expansion and climate feedbacks in Arctic tundra. *Environmental Research Letters* 7 011005 doi:10.1088/1748-9326/7/1/011005

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