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ABSTRACT TITLE: Using vegetation and soil characteristics to inform model scaling of a polygonal tundra landscape

ABSTRACT: In complex, heterogeneous landscapes such as polygonal tundra, identification of distinct vegetation communities according to their structural and functional characteristics is essential to determine the approach to fine-scale model parameterizations. Further, linking these communities to observable geomorphic units in the landscape provides a key mechanism for scaling from plot-level measurements to the broader grid-cell scale used in climate models.

During July 2012, vegetation community composition was determined in 48, 1 m^2 plots located on the centers, rims and troughs of low-centered, high-centered and transitional polygons in the polygonal tundra of the Barrow Environmental Observatory (BEO), Barrow, Alaska. Vegetation and soil characteristics (e.g. plant biomass, plant height, leaf area index, plant tissue chemistry, nutrient availability, soil moisture, Soil temperature and thaw depth) were measured at the same locations.

One-way cluster analysis identified four vegetation communities in the study area: i) tall *Carex* (sedge) dominated communities, ii) mixed tall graminoid-forb-moss communities, iii) dry graminoid-lichen communities and iv) low-stature, lichen dominated-communities. These groupings were confirmed by non-metric multidimensional scaling (NMDS), which also showed that the dominant environmental gradients relating to community composition were soil moisture (R^2 = 0.75) and soil NH_4 availability (R^2 = 0.65), though these variables were not independent. The four groups mapped clearly to micro-topographic position, corresponding with i) low centers ii) troughs, iii) rims and transitional polygon centers, and iv) high centers.

Comparison of this vegetation classification with a 10-group unsupervised landscape classification from high resolution multi-spectral data (Worldview2) showed good correspondence in some, but not all, areas. This indicated that this is a promising approach for scaling from point measurements, but that further refinement of both vegetation and landscape classifications could prove useful.

Overall, this analysis identifies four key units to resolve in geomorphological analyses of the BEO, and presents a framework for parameterizing of fine-scale models (e.g. TEM-DVM) for the intensive study areas associated with the Next Generation Ecosystem Experiments (NGEE) in the Arctic. Future work will include incorporating additional soil variables into the classification, and determining the extent to which soil and vegetation classifications are coupled.