Effect of Slope Topography on the Above- and Below-ground Traits in Tundra Biome: Case Study at the Seward Peninsula

Alexander Kholodov,[1*] and Amy Breen,[1]
[1]University of Alaska, Fairbanks, AK

Contact: (alkholodov@alaska.edu)
BER Program: ESS
Project: NGEE Arctic
Project Website: https://ngee-arctic.ornl.gov/

Slope terraces are a widespread feature on the Seward Peninsula. These landforms affect the redistribution of snow during the winter season and control soil temperature and moisture regime, thus influencing vegetation and soil development. To study these mechanisms, we conducted research at one of such terraces at milepost 28 of the Teller Road. Our field activities included soil, vegetation, and snow surveys along a 70-meters long transect parallel to the terrace tread, biomass productivity assessment, decomposition experiment, and continuous measurements of the ground temperature and soil moisture at three points located in the rear, middle and front parts of the terrace. Our results showed mean annual ground temperature at the depth of 1.2 meters in 2019 gradually decreases from 1.9-4.2°C at the rear part to 0.1-0.5°C with a potential for a perennial frozen layer at the terrace's edge. Such a pattern in the ground thermal regime is most likely caused by the difference in winter temperature due to snow redistribution. The soil moisture regime is identified as Ustic at the rear and middle parts and Udic at the front of the terrace. Across the tread of the terrace vegetation changes from Mesic graminoid-herb meadow in the rear part to Cassiope dwarf shrub tundra in the middle and Ericaceous-lichen dwarf shrub tundra at the front. Aboveground bioproductivity increases from the rear (449.6 g/m^2) to the front part (1099.76 g/m^2) of the terrace. But, because of the differences in composition of plants communities, amount of annual litter biomass decreases from the rear to the frontal part. The highest rate of litter decomposition during the summer season occurs at the middle section of the terrace and the lowest – at the front. Processes of the organic stabilization were the lowest at the rear part of the terrace. A combination of all about mentioned factors and processes explain the pattern in soil sequence. The most developed soil profile (Ustic Haplocryols) can be found at the rear part of the terrace replaced with the Typic Humicryepts at the middle and Typic Dystrogelepts/Haplogelepts at the front. All of these processes also create the patterns of spatial variability of carbon budget and the greenhouse gases fluxes.