Submitted Abstract

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Abstract

Polygonal periglacial patterned ground provides a mosaic of microhabitats. These polygons generally have snowy edges with non-snowy centers and are found on the climate-change sensitive alpine tundra of Goat Flat (2837 m; 46° 3' 17" N, 113° 16' 43" W) of the Pintler Mountains of Montana. The polygons represent an array of microhabitats with predictive value concerning which plants may live in the alpine tundra with loss or gains of snow.

At Goat Flat, we studied the spatial distribution of plant species and functional traits with respect to position on the edges or centers of the polygons and installed an array of ONSET Hobo TidbitV2 #UTBI-001 soil temperature sensors 5-10 cm beneath the soil surface, with hourly measurements from 2018-2022. We found that plant species and functional traits (which interact with the environment and influence where plants can live) differ with position on the polygons. The sparsely vegetated polygon centers are inhabited by a significantly higher percentage of xeromorphic (drought tolerant), tap rooted, herbaceous plants, with a significantly higher relative percent cover (RPC) of Sedum lanceolatum and Sedum rosea, which both have the drought-tolerant trait of crassulacean acid metabolism (CAM), and a significantly higher RPC of the viviparous Polygonum viviparum. In contrast, the polygon edges were dominated by mat-forming adventitiously rooted dwarf shrubs, including the evergreen Dryas octopetala and the deciduous Salix arctica, also had herbaceous monocots and dicots, and the gymnosperm, Picea engelmannii.

Polygon centers had higher summer temperatures with more variable annual temperatures than the polygon edges. These temperature differences may contribute to patterns of plant functional trait distribution. In addition, we anticipate obtaining soil moisture data from the polygon edges and centers of Goat Flat in the summer of 2022 and onward. Sensor data are valuable in linking environmental conditions with the distribution of life forms on the alpine tundra. Current microhabitats with contrasting snow conditions, soil temperatures, and plant functional trait distributions can be used to predict the distribution of plant species and functional traits with increased or decreased snow.