

Submitted Abstract

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Abstract

The GLORIA, (Global Observation Research Initiative in Alpine Environments) is a vast, world-wide observation network for long-term monitoring of alpine plants and temperature on mountain summits. The SW Montana GLORIA Target Region (2008-2022 and onward) in the Pioneer Mountains is on Mt. Keokirk (2987 m, 45.5938° N, -112.9510° W) and Mt. Fleecer (2873 m, 45.8264° N, 112.8019° W), where we measure soil temperature hourly with Hobo Tidbit v2 temperature loggers 5-10 cm underground, and at each cardinal direction 5 m beneath four summits along an elevational gradient from treeline to the alpine zone. We surveyed the distribution and relative percent cover (RPC) of plant species and their qualitative functional traits upon establishment of the site and at five-year intervals.

Shifts in the distribution and RPC of plant species and functional traits occurred between 2008-2019 at the SW Montana GLORIA Target Region on Mt. Fleecer and on Mt. Keokirk. These shifts included decreases and increases in abundance of species and functional groups, with the most pronounced changes at Mt. Keokirk's southern aspect, (2987 m), where summer soil temperatures increased and winter soil temperatures decreased from 2013-19. The RPC of *Potentilla nivea*, a stoloniferous member of the rose family, increased from 5.75 +/- 2.8 (2013) to 14.00 +/- 6.68 (2019) and by over 50% in some 1M X 1M quadrats. This suggests increased clonal reproduction via stolons with higher temperatures, although a different trait of *P. nivea* may have contributed to its increased RPC. However, the RPC of rhizomatous species decreased (12.37 to 4.87%), which is linked to the decreased RPC of rhizomatous monocots, but which may signify changes in clonal mechanisms with increased temperature. When considering all four aspects of Mt. Keokirk from 2013-2019, vascular plant cover decreased (44.52 to 38.87%), with monocots decreasing (11.37 to 3.7%) but dicots increasing slightly (29.98 to 33.12%). Morphology shifted, with decreases in mat-forming (13.25 to 6.00%) and cushion plants (8.12 to 5.00%). The increased RPC of AM plants (33.00 to 40.48%) suggests that temperature influenced AM symbioses on Mt. Keokirk. Changes in the RPC of species and functional traits co-occurred with increasing summer temperatures at the SW Montana GLORIA Target Region.