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The Effect of Nutrient Availability on Plant Communities in the Alpine Tundra

Terrestrial ecosystems are frequently limited by one or more nutrients. Most nutrient limitation studies have been conducted in grasslands, with few studies looking at the effects of nutrients in tundra ecosystems. Understanding how nutrient limitation affects the alpine tundra is critical because increases of anthropogenic nitrogen (N) alter nutrient ratios, which may adversely affect species dependent on other nutrients. This study investigated the effects of N, Phosphorus (P) and Potassium-based micronutrients (K) on species composition and diversity in alpine plant communities in Niwot Ridge, Colorado (elevation 3259 meters). Since 2008, 40 plots have been treated with combinations of these nutrients biennially. The point intercept method was used to determine species composition in 2013 and 2017 and data were analyzed using R. Micronutrients showed no significant treatment effect on diversity in 2013 ($t(10) = 1.498, p = 0.165$) and in 2017 ($t(10) = 0.779, p = 0.454$). In 2017, there was a significant treatment effect on diversity between N+P+K and N ($p, \text{adj} = 0.00556$). Forbs demonstrated a preference for certain nutrients ($F_{4,23} = 2.976, p = 0.0407$), with the percent of forbs increasing between N and N+P+K ($p, \text{adj} = 0.0497$) but not between N and N+P ($p, \text{adj} = 0.263$). The results of this study indicate that micronutrients alone are not limiting nutrients in this community. However, the response of forbs to N+P+K but not N+P warrants further research to understand how micronutrients affect communities in tandem with N and P.