

# Weather variation affects the dispersal of grasshoppers beyond their elevational ranges

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## Abstract

1.) Understanding how abiotic conditions influence dispersal patterns of organisms is important for understanding the degree to which species can track and persist in the face of changing climate. 2.) The goal of this study was to understand how weather conditions influence the dispersal pattern of multiple non-migratory grasshopper species from lower elevation grassland habitats in which they  $\neg$ complete their life-cycles to higher elevations that extend beyond their range limits. 3.) Using over a decade of weekly spring to late-summer field survey data along an elevational gradient, we explored how abundance and richness of dispersing grasshoppers were influenced by temperature, precipitation, and wind speed and direction. We also examined how changes in population sizes at lower elevations might influence these patterns. 4.) We observed that the abundance of displaced grasshoppers along the gradient declined 4-fold from the foothills to the subalpine and increased with warmer conditions and when wind flow patterns were mild or in the downslope direction. Thirty-eight unique grasshopper species from lowland sites were detected as dispersers across the survey years, and warmer years and weak upslope wind conditions also increased the richness of these displaced grasshoppers. The pattern of grasshoppers along the gradient was not sex biased. The positive effect of temperature on dispersal rates was likely explained by an increase in dispersal propensity rather than by an increase in the density of grasshoppers at low elevation sites. 5.) The results of this study support the hypothesis that the dispersal patterns of organisms are influenced by changing climatic conditions themselves and as such, that this context-dependent dispersal response should be considered when modeling and forecasting the ability of species to respond to climate change.

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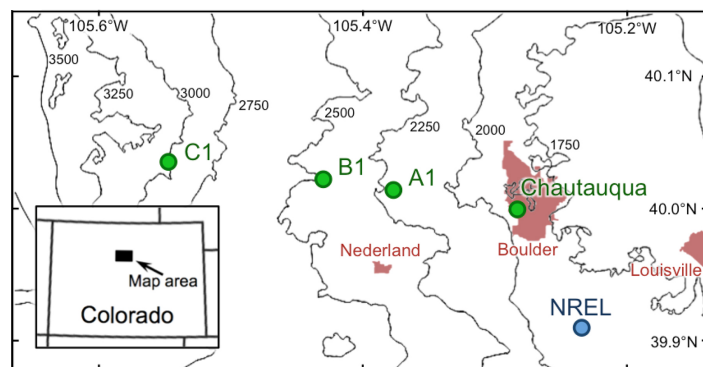


Figure 1

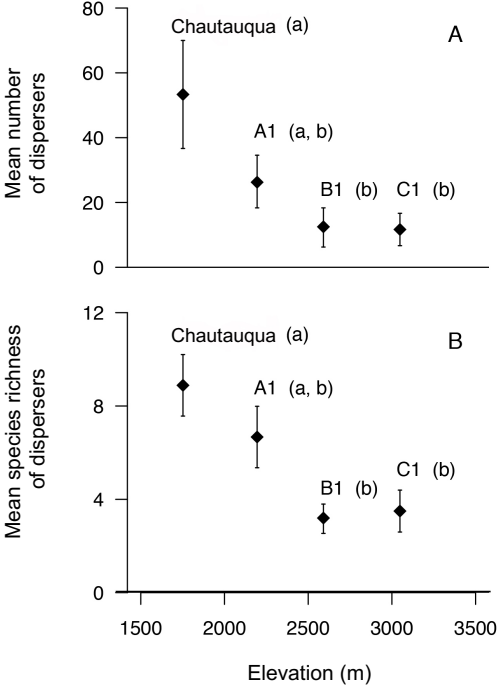


Figure 2

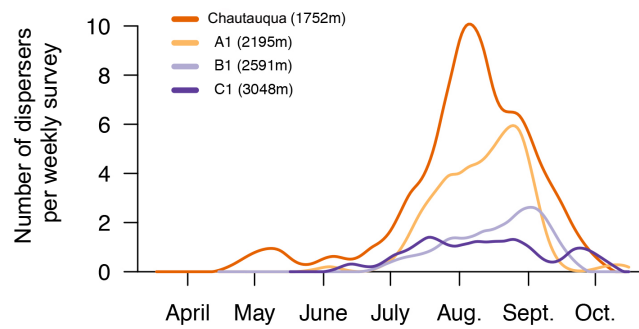


Figure 3