Plant Response to Climate and Hydrologic Factors: The Importance of Vegetative Microclimate and Elevation in the Successful Germination and Establishment of *Abies magnifica* Seedlings

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Abstract:

Microclimates created by mature vegetation can strongly influence the establishment patterns and survival success of conifer seedlings by altering local temperature, soil moisture, and solar radiation levels. *Abies magnifica* (California red fir) trees grow in a narrow band on the eastern slope of the Carson Range in western Nevada, nearly exclusively on north-facing slopes. While abundant on the western slopes of the Sierra Nevada, this distribution of *A.magnifica* on eastern slopes is likely limited by drier climate conditions, and microclimate refugia may aid in species persistence. Understanding the establishment and survival patterns of *A.magnifica* seedlings based on microclimatic and topographic factors may help predict spatial patterns of future regeneration. This study compares *A.magnifica* seedling establishment in a range of vegetative microclimates over an altitudinal gradient. Seedlings were sampled in replicate watersheds on the eastern slope of the Carson Range and associated abiotic data were monitored over the summer of 2011. Soil surface temperature, below soil temperature, and soil moisture in open and shrub-shaded microclimates differed significantly across all elevation classes. Elevation significantly influenced the occurrence of seedlings in vegetative microclimates. *Abies magnifica* seedling occurrence was significantly greater in open microclimates at high elevations than in shrub-shaded microclimates, while at low and intermediate elevations occurrence was significantly greater in shrub-shaded microclimates. These preliminary results suggest that preferred establishment microclimates change across an altitudinal gradient, possibility due to changes in abiotic stress. These differences may be a significant factor in determining seedling establishment success and consequent mature stands of *A.magnifica*. Understanding the importance of microclimate refugia to *A.magnifica* seedlings is vital for determining future watershed vegetative cover, which in turn, aids hydrologic modeling activities where vegetation composition influences water infiltration and run-off patterns. This research contributes to investigations of the role of climate change and the distribution of coniferous trees throughout the western US.

Presenting author is a graduate student.