

Functional ecology of shrub seedlings after a natural recruitment event at the Nevada Desert FACE Facility

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Abstract Seedling recruitment is an important determinant of community structure in desert ecosystems. Positive photosynthetic growth and water balance responses to increasing atmospheric carbon dioxide (CO_2) concentrations ($[\text{CO}_2]$) are predicted to be substantial in desert plants, suggesting that recruitment could be stimulated. However, to date no studies have addressed the response of perennial plant recruitment in natural populations of desert shrubs exposed to elevated $[\text{CO}_2]$. In April 1997, we employed Free-Air Carbon Dioxide Enrichment (FACE) in order to increase atmospheric $[\text{CO}_2]$ in an undisturbed Mojave Desert ecosystem from ambient ($\sim 370 \mu\text{mol mol}^{-1}$) to elevated CO_2 ($\sim 550 \mu\text{mol mol}^{-1}$). From 1997 to 2001 we seasonally examined survival, growth, gas exchange and water potential responses of *Larrea tridentata* and *Ambrosia dumosa* seedlings that germinated in Fall, 1997. Recruitment densities were not influenced by $[\text{CO}_2]$ in either species, although a two-fold higher adult *Ambrosia* density under elevated $[\text{CO}_2]$ resulted in two-fold higher seedling density (0.87 vs 0.40 seedlings m^{-2}). Mortality was greatest for both species during the first summer (1998), despite above-average rainfall during the previous Winter-Spring. A significant $[\text{CO}_2]$ x time interaction revealed that early survival was greater under elevated $[\text{CO}_2]$, whereas a significant species time interaction revealed that overall survival was greater for *Ambrosia* (28%) than for *Larrea* (15%), regardless of $[\text{CO}_2]$. Microsite (understorey or interspace) alone had no significant influence on survival. Significant species, microsite and species x microsite effects on growth (seedling height, stem diameter and canopy size) were found, but elevated CO_2 had minimal impact on these parameters. Photosynthetic rates (A_{sat}) for both species were higher at elevated $[\text{CO}_2]$ during certain seasons, but not consistently so. These results suggest that increased atmospheric $[\text{CO}_2]$ may enhance carbon (C) assimilation and survival of aridland perennial shrubs during favourable growing conditions, but that it may not counteract the effects of prolonged drought on mortality.