Shrub dynamics in pre- and post-encroachment phases of grassland-to-shrubland transition
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INTRODUCTION

• Shrub dynamics during woody plant encroachment are likely mediated by belowground resources and contrasting root architectures.
• In the grassland state, competition with abundant grasses could slow shrub growth to adult life history stages (Fig.1A).
• In the shrubland state, maximum woody cover may depend on the intensity of density-dependent intraspecific interactions (Fig. 1B).
• We tested these hypotheses by conducting selective removal (SR) experiments along a Bouteloua eriopoda grassland – Prosopis glandulosa shrubland transition at the Jornada Basin LTER site in the Chihuahuan Desert.

METHODS

• In SR1, focal P. glandulosa shrubs had their immediate (3x canopy diameter) B. eriopoda grass neighborhoods left intact (controls) or neutralized.
• In SR2, P. glandulosa shrubs within 5 m of a conspecific focal individual were left intact (controls) or killed (foliar herbicide).
• Target shrub aboveground net primary productivity (ANPP) was estimated at peak biomass (Sept.-Oct.) in SR1 and SR2 using species- and site-specific allometric equations2.

RESULTS

• The ANPP response of small shrubs (< 50 cm diameter) to grass removal was positive and linear, but only in years with above-average growing season rainfall (Fig.2, solid lines).
• Larger shrubs showed no response to grass removal, regardless of growing season precipitation (Fig.2, dashed lines).
• Removal of shrub neighbors did not significantly influence focal shrub ANPP relative to controls in any year (Fig.3A).
• No relationship exists between focal shrub ANPP and the cumulative aboveground biomass of conspecific shrubs within 5m (Fig.3B).

CONCLUSIONS

• Results from SR1 indicate that when rainfall is above average, ANPP of small shrubs is suppressed by grasses, consistent with rainfall manipulation experiments at JRN2,3.
• When grasses are abundant, the time required for small shrubs to attain a stature that can modify the physical environment in self-promoting ways4,5 would be extended. Reductions in grass biomass (e.g. by drought or grazing) would ostensibly hasten grassland-to-shrubland transition.
• Lack of significant differences between treatments in SR2 suggests that maximum shrub cover may be more a function of constraints on plant size than on density-dependent interactions.
• Intraspecific interactions among larger shrubs may operate on time scales longer than this experiment.

REFERENCES


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