Facilitative Effects of Nurse Shrubs on Growth and Survival of California Sage Scrub Native Plants

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Introduction

• Facilitation by nurse plants is a common revegetation approach in restoration, where neighboring plants benefit from shared resources. Nurse plants may also provide protection from UV radiation, temperature extremes, and herbivory in water-limited environments, where such pressures are amplified on recruiting seedlings (5, 6).

• Herbivory pressures on recruiting seedlings under nurse plants is another factor that warrants further investigation (1, 2, 3).

• Prolonged drought in water-limited environments has left abundant dead shrubs in the landscape, whose effect on seedling establishment has received little study (1, 4, 7).

• Dry and degraded inland California sage scrub is an ideal system for studying the effects of nurse plants due to its need for restoration.

Questions:
1. Does native establishment and survival under nurse plants depend on abiotic factors or biotic factors?
2. Can dead nurse shrubs provide the same benefits as live nurse shrubs?

Methods

Study Site

Figure 1. Abiotic conditions under live and dead shrubs were less stressful compared to exposed areas. Symbols show monthly means. During summer, abiotic conditions were most stressful in exposed areas. Soil moisture was greater during winter 2017 than winter 2016.

Results

Figure 2. Herbivory had a significant impact on shrub growth, which was more pronounced in some nurse shrub types. Caged treatments and Shrub Type x Cage interaction term had significant effects on (A) A. californica growth in 2016 and (C) 2017 (Table 1). Caged treatments had a significant influence on (B) S. mellifera growth in 2016, while Shrub Type x Cage interaction term had a significant effect on growth in (B) 2017 (Table 1).

Table 1. Shrub growth and annual germination data were analyzed using Linear Mixed Effects Models, with a random Block term, fixed factors Shrub Type and Cage, and the interaction term (Shrub Type x Cage). Significant effects are shown below.

Discussion

• It appears that herbivory restricts uncaged A. californica growth under live and dead shrubs 2016 and 2017 (Question 1, Fig. 2A, Table 1). In 2016, caged A. californica seedlings under dead shrubs grew the most, being shaded and protected from herbivores (Question 2, Fig. 1A).

• It also appears that herbivory and nurse shrubs influenced A. intermedia and D. fasciculata germination in 2016 and 2017 (Question 1, Fig. 2A and 2B, Table 1). Greater soil moisture during winter 2017 increased germination in caged A. intermedia and P. distans under dead shrubs (Fig. 3B).

• Cage treatments also significantly increased biomass production of A. intermedia and P. distans; however it seems that Shrub Type had no significant effect on biomass production of these annual natives (Question 1, Fig. 4, Table 2). These results suggest that herbivory is a significant barrier to native plant growth and establishment, and that facilitative effects of live and dead nurse shrubs vary for certain species excluded from herbivores.

Future Directions

• Herbivore occupancy and abundance analysis of each block may reveal a stronger relationship between seedling survival and increased herbivore activity.

References


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