

Effects of various cattle grazing regimes on vernal pool grassland diversity

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Key words : biodiversity, vernal pools, California, seasonal grazing

Introduction Vernal pools are small seasonal wetlands with a unique flora and fauna that occur throughout grasslands in California, USA. These grasslands have been grazed by livestock for nearly two centuries and the plant community surrounding the vernal pools is dominated by non-native species (Barbour *et al.*, 1993). These habitats are decreasing in extent due to housing and commercial development. Government and non-profit organizations are protecting what remains of this habitat and often struggle to determine appropriate grazing regimens. The object of this study was to determine what level of grazing maintains the highest level of biodiversity in vernal pool grassland systems.

Materials and methods This study was conducted on a 5,000 ha parcel located in eastern Sacramento County, CA, USA (38°38' N, 121°02' W; elevation, 75 m). The climate of this region is Mediterranean with average annual rainfall of 56 cm occurring between the months of October and May. Less than 2 cm of rain falls during the summer months. Four grazing treatments were applied to randomly selected groups of vernal pools during the 2000-2003 grazing seasons. The treatments were: 1) fenced throughout the grazing season (ungrazed, UG), 2) fenced during the wet season (dry-season grazed, DG), 3) fenced during the dry season (wet-season grazed, WG) and 4) unfenced throughout the season (continuous grazed, control, CG). Cattle exclosures ranged in size from 0.33-0.80 ha. Treatments were stratified across two major geologic formations and were replicated six times across the site. Plant diversity was measured using 35cm×70cm permanent quadrats in each of three zones (pool, edge, upland) during the spring. Weekly measurements of vernal pool inundation were recorded.

Results Complete grazing removal for three years (UG) reduced the diversity of native plant species occurring within the vernal pools [Figure 1(a)]. This effect was most noticeable on the pool edges but was also significant in the upland. The cover of grasses (both native and non-native) relative to the cover of forbs increased significantly over the three years in the ungrazed treatments [Figure 1(b)]. The average maximum inundation period in the control pools (CG) was on average 115 (±9) days, whereas ungrazed pools (UG) were only inundated for an average of 65 (±8) days, dry-grazed pools (DG) for 78 (±7) days and wet-grazed pools (WG) for 65 (±8) days ($P < 0.0001$).

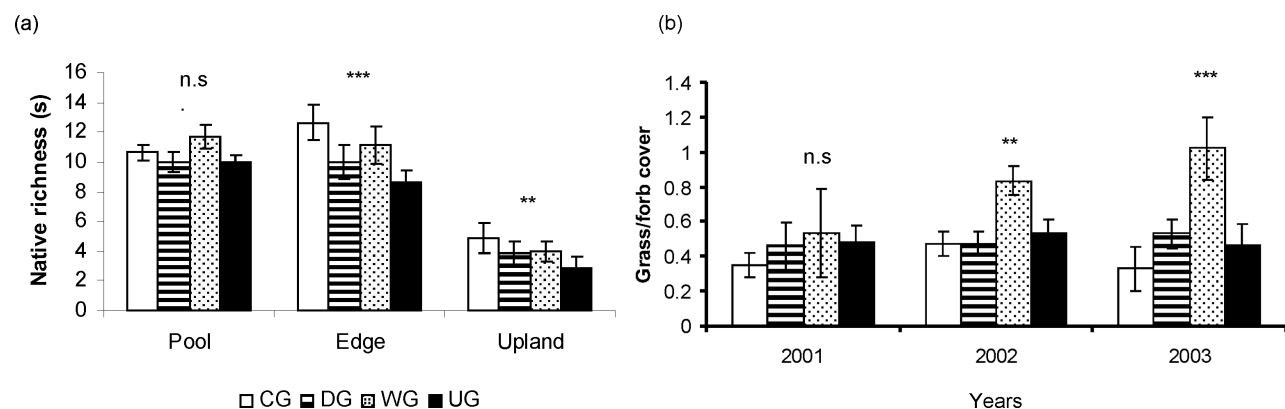


Figure 1 Effect of four levels of grazing after three years of treatment on (a) native species richness in three pool zones and (b) the ratio of grass to forb cover across three years. n.s., not significant; ** $p < 0.01$, *** $p < 0.001$.

Conclusions Cattle grazing at historic levels maintained higher native diversity in these vernal pool grasslands than any of the imposed grazing treatments. Complete removal of cattle grazing had the most negative impact on vernal pool systems reducing native richness, increasing grass cover and reducing inundation period within the pools during the wet season. Cattle grazing appears to be an important disturbance for protecting native diversity and pool inundation in these heavily invaded systems.

Reference

Barbour M., Pavlik B., Drysdale F. & Lindstrom S. (1993). California's changing landscape. *California Native Plant Society*, Sacramento, CA.