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Water status of plants under strips management in shrub-grass steppe of Southern Patagonia

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Introduction

In the province of Santa Cruz, *Junellia tridens* shrublands cover 2,8 million ha. These communities grow on sites with coarser-textured soils, are dominated by 60-70 cm tall shrubs. Water is the most important factor regulating primary production. No prior studies of shrubland management to improve grass and animal production have been conducted in the region. Therefore, the objective of this work was to determine the water status (a surrogate of plant response) of shrubs, tussocks, and short grasses of a shrub-grass steppe ecosystem under strip management.

Material and Methods

The study was carried out in Chali Aike ranch (51° 07' 23"S, 70° 58' 38"W). The climate is semi-arid, cold and with mean precipitation of 150 mm. Strip management areas (2 ha) with two shrub removing intensities: 1) low intensity, removing 50% of original shrub cover (strips 4 m wide by 250 m long with 4m undisturbed area in between); 2) high intensity, removing 75% (strips 8 m wide and same length and 4 m undisturbed): and 3) a control area (1 ha) were established in 2009. Each treatment was replicated 3 times. Shrubs were removed with a hydraulic shredder. Vegetation cover was determined by point-quadrat lines procedure (nine 50 m transects in each treatment, 500 hits per transect) at peak biomass. Return of debris to the soil from harvested shrub canopies was assessed. Stomatal conductance (gs) was measured on a random sample of the youngest fully expanded leaves on main life form species (shrub *J. tridens*, tussock *Stipa chrysophylla*, short grasses *Poa dusenii* and *Bromus setifolius*) in each treatment during the dry season (February 2010) and at noon using a leaf porometer.

Results and Discussion

Initial mean vegetation cover was 71% (45% *J. tridens*) with thirty-three species recorded. After 1 year of treatment application, there was an increasing trend of tussock, short grasses and dwarf shrub relative cover in both strip management intensities (Fig. 1). Return of shrub debris to soil varied from 5.7 to 9.1 Mg ha^{-1} (covering 55%) for low and high strip management intensities, respectively. This incorporation of debris to soil had a significant ($p<0.05$) positive effect on plant water status. Thus, gs in short grasses showed higher values growing with debris in the strips. However, tussock showed no significant increases in gs among treatments which may correspond to the physiological response of more water stress tolerant plants (Pugnaire and Haase, 1996). Deep-rooted shrubs did not show differences among treatments; gs of shrubs was higher compared with grasses presumably because in soils with high gravel content shrubs can use moisture stored in deep levels. Difference in shrub-grass gs values was higher for shrub regrowth (Table 1).

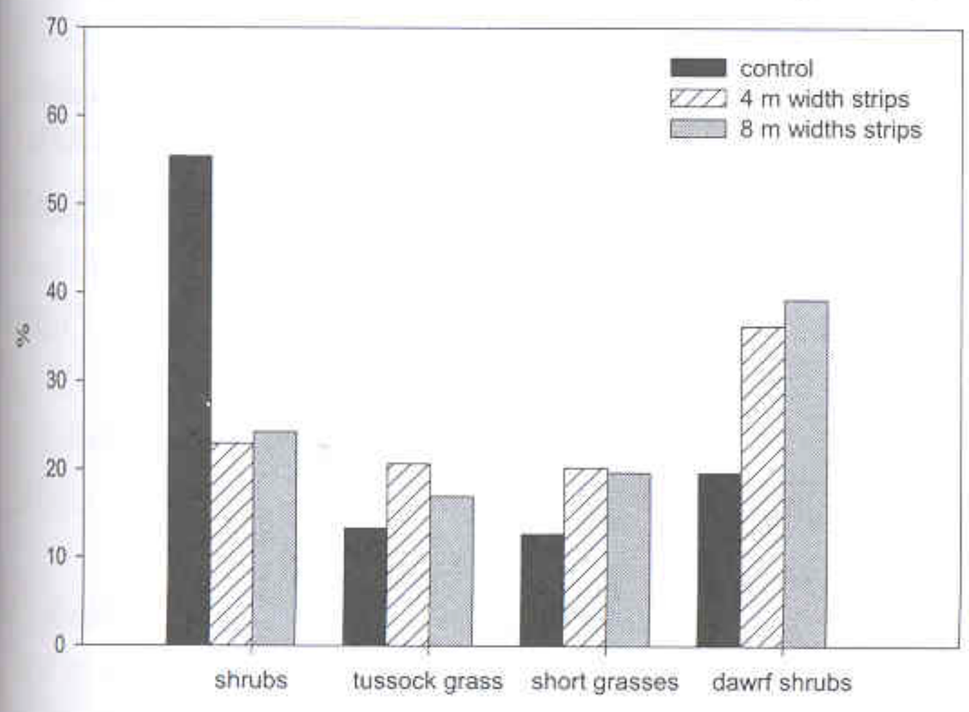

Figure 1. Relative cover of main life forms for of a shrub-grass steppe ecosystem under strips management after 1 year treatments application

Treatment	Shrub	Shrub regrowth	Tussock	Short grasses
Control	0.14 a	-	0.12 a	0.0025 b
4 m width strips	0.19 a	0.23 a	0.08 a	0.0085 a
8 m width strips	0.17 a	0.25 a	0.09 a	0.0076 a

Table 1. Mean leaf stomatal conductance (mol H_2O m^{-2} s^{-1}) of main life form species (February 2010) for control and for low and high strip management intensities. Different letters (a, b) indicate significant differences at $p<0.01$ level.

Conclusion

Strips management in a shrub-grass steppe ecosystem has promising results mainly because the improvement in cover and water status of short grasses.

Reference

Pugnaire, F.I., Haase P., 1996. Comparative Physiology and Growth of Two Perennial Tussock Grass Species in a Semi-Arid Environment. Annals of Botany 77, 81-86.