

Effects of livestock grazing on the shrub vegetation biomass in the ‘Sierra de Guara’ Natural Park (Spain)

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Introduction The ‘Sierra de Guara’ Natural Park (80.7 Kha) is a Mediterranean mountain area in Huesca, south of the Spanish Pyrenees. Shrub and forest pastures dominate the Park. They are grazed mainly by sheep, but also by suckler cattle and goats. Average stocking rate is 0.15 LU/ha. As in other European mountain areas, agricultural activities have declined during the last few decades. This has caused a process of secondary vegetation succession towards shrub invasion, with consequent landscape changes. This study aimed to quantify the effect of grazing on shrub vegetation biomass.

Materials and methods Six locations, representative of different areas of the Park and different sheep grazing management regimes, were selected. At each location, 2 plots (10x10 m) were fenced to avoid grazing. All individual shrubs were identified along a fixed transect located inside and outside the plots (1x10 m). The volume of each individual shrub (height, length and width) was measured before the grazing season in 3 consecutive years (2001-2003) to estimate shrub biomass. Biomass was then related to volume for the 7 predominant species (77.5% of total number of shrubs), using prediction equations (Torrano, 2001) for *Genista scorpius* (L.) DC.; *Buxus sempervirens* L.; *Prunus spinosa* L.; *Thymus sp.*; and *Dorycnium pentaphyllum* (L.); and in-situ developed equations for *Santolina chamaecyparissus* L. (Biomass (g DM)= 3551.1 x Volume (m³) (R²= 0.9258; P<0.001)) and *Echinopartum horridum* (Vahl.) Rothm. (*Genista horrida* (Vahl) DC.) (Biomass (g DM)= 7252.8 x Volume (m³) (R²= 0.9753; P< 0.001). The annual increment rate of shrub biomass was calculated.

Results Biomass accumulation occurred in both Grazed and Non-grazed areas (Figure 1). The increment rates were respectively 31.9 and 14.9% (NS) in Non-grazed and Grazed areas in 2001-02, 46.6 and 29.1%, (NS) in 2002-03 and 80.0 and 42.2% (P<0.01) for the entire period (2001-03). In common with results obtained by Bartolomé *et al.* (2000) in a similar area, grazing reduced but did not stop the increment of shrub biomass. Nevertheless, Casasús *et al.* (2003) observed no increment of shrub biomass in grazed areas with higher stocking rate during a 6-year study in the Pyrenees. In the current study, differences were found between species. Increment of biomass was null in *Thymus sp.* in Grazed areas (P<0.01) and small in *Genista scorpius* (NS). The effect of grazing was minor with the other species. This phenomenon was related to animal preference towards different species.

Conclusions There was a strong trend towards shrub invasion in the Park at current stocking rates. Although the effects of grazing were not strong enough to prevent shrub invasion, Grazed areas had less invasion. Adequately managed grazing livestock systems could be effective to modulate vegetation dynamics, and thus could preserve the natural resources and landscape in protected mountain areas.

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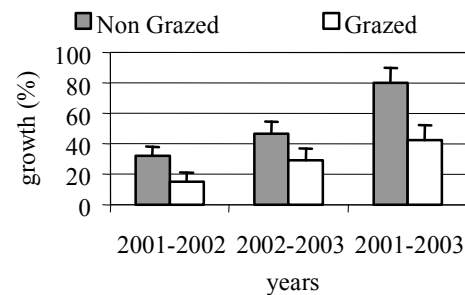


Figure 1 Biomass growth rate in Grazed and Non-Grazed areas (% of initial values)