

The impact of grazing on woody vegetation characteristics in sub-zone of Ostryo – Carpinion

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Abstract

The present work deals with the impact of grazing in a disturbed Mediterranean ecosystem in Greece. The aim of this study was to investigate the impact of grazing on silvicultural and vegetation characteristics of woody species. The study area was divided into two parts a protected and a grazed one, which were then separated into three belts of different latitude. The characteristics measured were total height, diameter for trees and root collar diameter for shrubs, crown length, richness, density and abundance cover in order to obtain a clear perspective of the vegetation and to estimate and compare the diversity between parts. In total, there were 822 individuals, 480 of which in the protected part. From the sixteen woody species identified 6 species were common in both parts, with *Quercus coccifera* as the dominant species. The results showed that grazing has a negative effect on the silvicultural characteristics of the woody species, mainly to their height growth, as is evident in the protected part where differentiation and discrimination of the vegetation storeys occurs. In addition, the number of tree storey species in the protected part was higher than in the grazed part and as herbivores prefer eating specific species the number of left over species was reduced leaving only these that exhibit tolerance to grazing leading thus, the grazed ecosystem to a regressive succession. The slope position is a factor that affects richness, density, abundance –cover and diversity as significant differences were found among the middle slope, upper and foot slope in both parts.

Keywords: Mediterranean ecosystems, *Quercus coccifera*, protected and grazed areas, woody species.

Introduction

The present work deals with the impact of grazing in disturbed ecosystems in sub-zone of Ostryo-Carpinion in Greece. The objectives of the study were: 1. The impact of grazing on silvicultural characteristics of woody species, 2. The study of differences among diversity, abundance-cover and density of vegetation between the grazed and protected parts.

Materials and Methods

The study area was divided into two parts the first one, labeled “protected”, and the second one, “grazed”. Each of them was separated into three belts: upper slope (800 – 980 m), middle slope (600 – 800 m) and foot slope (400 – 600 m) (Mekuria et al. 2007). For each of the investigated

belts three sample plots were selected, of 10x10 m representatives of the area (Khaznadar et al. 2009, Mihok et al. 2009). Silvicultural characteristics of woody species, such as total height (H, m), diameter (at breast height DBH, cm) for trees (height > 3 m), root collar diameter (D, cm) for shrubs (height <3 m), and crown length (L, m) were measured. For the complete imprinting of the woody vegetation two profiles 10x30 m were created. Additionally, for the woody species the number of species (richness), the number of individuals of each species (density) and the abundance cover were recorded in order to obtain a clear perspective of the vegetation and to estimate and compare the Shannon-Wiener index (H) between parts (Gairola et al. 2008).

The t-test (one-way ANOVA) was applied for statistical data analysis and comparisons of the average characteristics of forest vegetation.

Results and Discussion

In total, 822 individuals were counted. In the protected part there were 480 plants, 134 trees and 346 shrubs, while in the grazed part there were 342 individuals, 30 of which were trees and 312 shrubs. Sixteen woody species were identified. From these species, 12 were in the protected area - 5 in the tree storey and 12 in the shrub storey- and 10 in the grazed area - 4 in the tree storey and 10 in the shrub storey. The two parts had 6 species in common. Dominant species in the tree storey were *Quercus coccifera* and in the shrub storey were *Quercus coccifera*, *Phyllirea latifolia* and *Juniperus oxycedrus* mainly in the grazed part.

The results showed that grazing has a negative effect on the silvicultural characteristics of the woody species. Shoot grazing hinders height growth. As shrubs are grazed by herbivores it is difficult for them to gain height so as to make the new shoots inaccessible. In the grazed part low vegetation prevailed with many shrubs and a small number of trees. On the other hand, the higher shrubs and the presence of a greater number of trees in the protected part results in the differentiation and discrimination of the vegetation storeys. Ganatsas et al. (2004, 2010) indicate that the values of the silvicultural characteristics of woody species and that of the other vegetation characteristics were greater in protected sites, while the woody species of grazed sites had severe damages as a result of intense grazing. Primack (1978) reaches similar conclusions in a study on the effects of grazing on shrubs of New Zealand. He observed that the species of the grazed site showed a smaller height growth in relation to the species of the protected site (witness). Oba (1992) noted that in six years, the height of the shrubs decreased by 13.3% in the grazed part, while it increased 17% on

the protected one. Hester et al. (2006) observed that, in semi-dried savanna, goat grazing results in a significant decrease in diameter of shrub vegetation on root collar. The results also showed that the number of tree storey species on the protected part was higher than the grazed part. The present study found that the intense pressure from herbivores and their preference for specific species reduced the number of species leaving only the grazing-resistant *Quercus coccifera*. Peper et al. (2010) observed that over a one-month period the number of species in a fenced, protected from animals area increased. Species rare in the grazed part appeared in the protected area. Aronson et al. (1993) and Todd and Hoffman (1999) mentioned that under conditions of intense grazing unwanted spiny shrubs replaced desirable species that had been dominant, while after a few years of protection the undesirable species disappeared. El-Keblawy et al. (2009) pointed that in a comparison among controlled grazing, over-grazing and absence of grazing, species diversity was greater under the controlled grazing regime.

Table 1. Silvicultural characteristics of woody vegetation and the *Q. coccifera* as the dominant species, in the Protected (Pp) and the Grazed part (Gp).

Storey	Total Height (m)			Diameter (cm)		
	Pp	Gp	pv	Pp	Gp	pv
Trees	4.18(0.07)*	3.51(0.09)	0.0005	11.00 (0.32)	9.34 (0.37)	0.02
Shrubs	1.9(0.20)	1.45(0.05)	0.02	4.36 (0.18)	3.60 (0.12)	0.0005
<i>Q. coccifera</i>						
Arborescent form	4.14 (0.08)	3.47 (0.10)	0.0005	11.91 (0.31)	9.46 (0.35)	0.005
Shrubby form	1.81 (0.06)	1.46 (0.05)	0.0005	6.40 (0.28)	4.00 (0.16)	0.0005

*The table shows the means and their standard errors ($p < 0.05$).

Two representative profiles (vertical and horizontal) of each part of the study area, were constructed to complete the structure analysis (Fig. 1, 2).

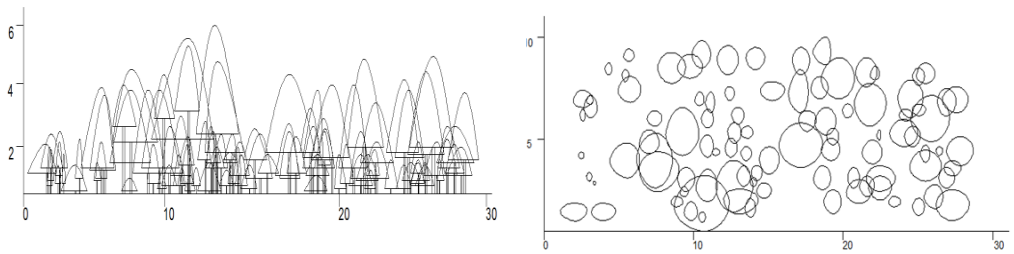


Figure 1. Profiles (vertical and horizontal) of vegetation in the Protected part.

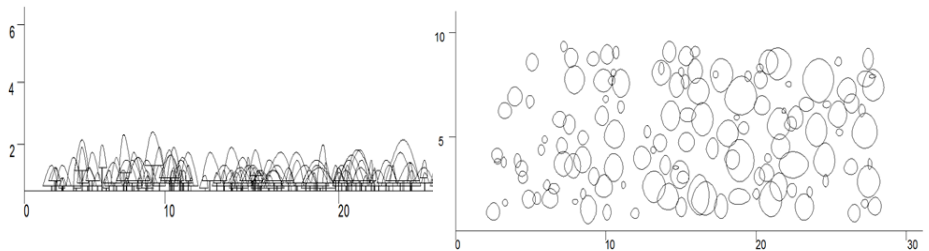


Figure 2. Profiles (vertical and horizontal) of vegetation in the Grazed part.

Table 2. Species richness and density in the Protected (Pp) and the Grazed part (Gp).

Storey	Richness			Density		
	Pp	Gp	pv	Pp	Gp	pv
Trees	2.44 (0.44)*	1.00(0.37)	0.024	14.88 (2.20)	3.44 (1.21)	0.005
Shrubs	4.66 (0.40)	4.33(0.37)	ns	38.44 (3.69)	34.66 (6,,29)	ns

* The table shows the means and their standard errors ($p < 0,05$).

Table 3. Species richness and density, per belt in the Protected (Pp) and the Grazed part (Gp).

Belt	Richness		Density	
	Pp	Gp	Pp	Gp
Upper slope	6.66 (2.80)*	6.33 (0.33) a	41.66 (6.48) a	27.66 (12.71)
Middle slope	8.88 (0.88)	5.33 (0.33) a	65.00 (1.52) b	32.00 (5.50)
Foot slope	6.66 (0.88)	4.00 (0.57) b	56.66 (4.37) a	54.33 (4.66)

Table 4. Abundance -cover in the Protected (Pp) and the Grazed part (Gp).

Vegetation cover (%)			
Storey	Pp	Gp	pv
Trees	44.44 (6.94)*	15.83 (5.78)	0.006
Shrubs	54.54 (7.01)	30.00 (3.75)	0.007

*The table shows the means and their standard errors ($p < 0,05$).

Table 5. Shannon-Wiener Index, per slope belt in the Protected (Pp) and the Grazed part (Gp).

Shannon – Wiener Index						
	Upper slope		Middle slope		Foot slope	
	Shrubs	Trees	Shrubs	Trees	Shrubs	Trees
Pp	1.37	0.8 3	1.4	1.09	1.72	0.74
Gp	1.72	0.7 2	1.32	0.26	0.81	0

Conclusions

- Woody species in protected and grazed parts have different silvicultural and vegetation characteristics leading, as a result the grazed ecosystem to a regressive succession. The study showed that both height and diameter of individuals differ significantly in the two parts, as grazing pressure hinders the plants' growth.

- In it has been found A greater richness, density, abundance –cover was found in the tree storey of the protected part, while no significant differences were found in the shrub storey between the two parts.

- The Shannon - Wiener index was higher in the protected part than in the grazed one where there was a reduced proportion in the vegetation composition of the number of species preferred most by herbivores. The slope position (belt) is a factor that affects richness, density, abundance – cover and diversity as significant differences were found among the middle slope, upper and foot slope in both parts.

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