

# 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 disturbed Mediterranean ecosystem in Greece. Aim of the research is to investigate the impact of grazing on silvicultural and vegetation characteristics of woody species. The research area divided into two parts a *protected* and a *grazed* one, which were separated into three belts of different latitude. The characteristics that 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 in the protected part, while in the grazed part there were 342. Sixteen woody species were identified, from which 6 species in common in both parts, with *Quercus coccifera* as the dominant species. The results showed that grazing has negative effect on woody species silvicultural characteristics, mainly in their height growth, so that on protected part presents differentiation and discrimination of vegetation storeys. Plus, the number of tree storey species on protected part is higher than on the grazed part and as herbivores prefer eating specific species the number of left over species is reduced leaving only these that present a resistance to grazing. That leads the grazed ecosystem to a regressive succession. Finally, the slope position is a factor that affects richness, density, abundance – cover and diversity as there been found significant differences between the middle slope, upper and foot slope in both parts.

**Key words:** 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 research are: 1.The impact of grazing on silvicultural characteristics of woody species, 2.The research on differences between diversity, abundance-cover and density of vegetation among the grazed and protected parts.

## Materials and Methods

The research area is divided into two parts. The first one, named *protected*, which is protected from grazing and the second unprotected one, named *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 belt three sample plots were selected, of dimensions 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 woody vegetation were also created two profiles, with dimensions 10x30 m. Additionally, for woody species there were recorded the number of species (richness), the number of individuals of each species (density) and the abundance cover 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).

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

### Results and Discussion

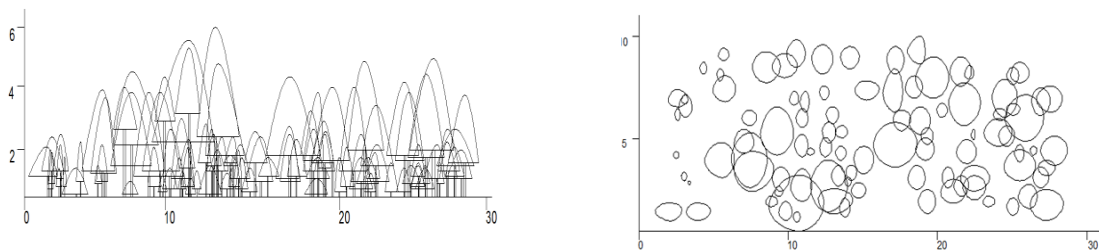
In total, there were counted 822 individuals. In the protected part there were 480 plants, 134 trees and 346 shrubs, while in the grazed part there were 342 individuals, which were 30 trees and 312 shrubs. Sixteen woody species were identified. From these species 12 were in the protected area -5 on tree storey and 12 on shrub storey- and 10 in the grazed area – 4 on tree storey and 10 on shrub storey. The two parts have 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.

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

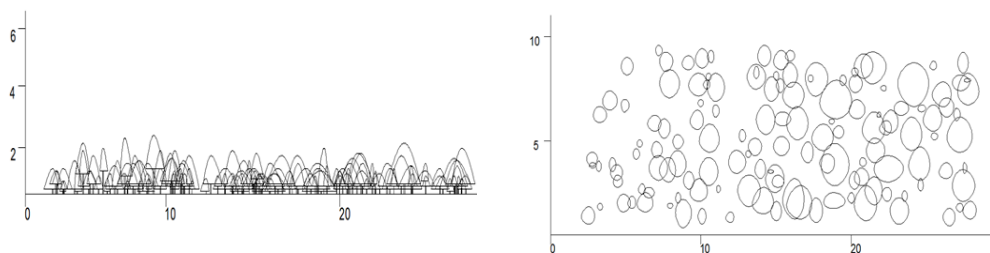
Storey	Total Height (m)			Diameter (cm)		
	Pp	Gp	pv	Pp	Gp	pv
Trees	4,18(0,07)*	3,51(0,09)	0,0005	11,00 (0,32)	9,34 (0,37)	0,02
Shrubs	1,9(0,20)	1,45(0,05)	0,02	4,36 (0,18)	3,60 (0,12)	0,0005
<i>Q. coccifera</i>						
Arborescent form	4,14 (0,08)	3,47 (0,10)	0,0005	11,91 (0,31)	9,46 (0,35)	0,005
Shrubby 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 research area, were constructed to complete the structure analysis (Fig. 1,2).



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



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

**Table 2.** Species richness and density/ storey in Protected (Pp) and 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 Protected (Pp) and 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 Protected (Pp) and Grazed part (Gp).

Storey	Vegetation cover (%)		
	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 Protected (Pp) and Grazed part (Gp).

	Shannon – Wiener Index					
	Upper slope		Middle slope		Foot slope	
	Shrubs	Trees	Shrubs	Trees	Shrubs	Trees
Pp	1,37	0,83	1,4	1,09	1,72	0,74
Gp	1,72	0,72	1,32	0,26	0,81	0

The results showed that grazing has negative effect on woody species silvicultural characteristics. Eating shoots are obstacle for height growth. Shrubs as they are cut by animals are hard to gain height to make the new shoots inaccessible. In grazed part low vegetation prevails with many shrubs and little number of trees. On the other hand the protected part due to the higher shrubs and the presence of a greater number of trees presents differentiation and discrimination of vegetation storeys. Ganatsas et al. (2004, 2010) indicate that the values of the silvicultural characteristics of woody species and the other vegetation characteristics were greater in protected sites, while the woody species of the grazed site had severe damages as a result of intense grazing. Primack (1978) concludes to similar facts, in a research 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 grazed part, while it increased 17% on the protected one. Hester et al. (2006) observed that in semi-dried savanna goat grazing results a significant decrease in diameter of shrub vegetation on root collar. The results also showed that the number of tree storey species on protected part is higher than the grazed part. In the present research has been found that the intense pressure from herbivores and their preference for specific species reduced the number of species leaving only the *Quercus coccifera* that present a resistance to grazing. Peper et al. (2010) observed that in one month period the number of species in a fenced, protected from animals, area increased. Species that were rare in the grazed part appeared to the protected one. 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 dominated, while after a few years of protection the undesirable species were disappeared. El-Keblawy et al. (2009) pointed that in a comparison between controlled grazing, over-grazing and absence of grazing, species diversity was grater under controlled grazing regime.

## Conclusions

- Woody species between protected and grazed parts differ in silvicultural and vegetation characteristics. That leads the grazed ecosystem to a regressive succession. The

research showed that both height and diameter of individuals differ significantly in the two parts, as grazing pressure prevents plants growth in height and diameter.

- In the tree storey of the protected part it has been found a greater richness, density, abundance –cover, while in shrub storey there were not found any significant differences between the two parts.
- The Shannon - Wiener index is higher in the protected part because of the number of the species that are preferred by most animals and thus in the grazed part their proportion in vegetation composition is reduced.
- Finally, the slope position (belt) is a factor that affects richness, density, abundance – cover and diversity as there been found significant differences between the middle slope, upper and foot slope in both parts.

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