

The effect of different combination of livestock grazing on herbage production in permanent dry grasslands

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Abstract

Rangelands are multifunctional natural non-arable land, covered by different types of vegetation, including herbaceous and woody plants. Dry grasslands occupy areas that have relatively dry and nutrient-poor soils and they are mainly used for livestock grazing. Grazing is recognized as an important ecological factor in grassland ecosystems, which has affected the structure, the composition and the characteristics of vegetation. The aim of this paper was to study the effect of different combination of livestock grazing on the production in two dry grasslands. The study area was located near the lakes Zazari and Chimaditida, in Florina region, western Macedonia, Greece. The grasslands in Zazari were used by small ruminants and cattle of the nearby village, while the grasslands in Chimaditida were used mainly by sheep and very few goats. The herbage production in both grasslands was measured in 2008. It was found significantly lower in the grasslands of Zazari than in the grasslands of Chimaditida. The grazing by different kind of animals has created a different plant structure and composition in the grasslands.

Key words: rangeland, livestock, small ruminant, cattle, composition

Introduction

Rangelands in the Mediterranean region occupy 52% of its total area (Le Houerou 1981), while in Greece, they cover 40% of the total area (NSSG 1997). They are natural ecosystems covered by herbaceous or woody vegetation, produce forage for both livestock and wild herbivores, and provide various goods and services (Bugalho and Abreu 2008). Natural rangelands are marginal lands used primarily as pastures by sheep, goats and cattle and are found mainly in arid, semiarid and sub-humid areas (Papanastasis 2008).

Grasslands are one of the four types of rangelands covered by herbaceous plants (grasses and broadleaf forbs) (Papanastasis and Noitsakis 1992, Papachristou 2000, Papanastasis 2000). Moreover, grasslands are often characterized by abundance of species, which contribute to the variability of floristic composition and production (Maranon 1985). Dry grasslands comprise a variety of grassland habitats that all have relatively dry and nutrient-poor soils (DMEFNA 2008) but are rich in plant and animal species and frequently used either as meadows or as pastures (Bolliger et al. 2010). Livestock grazing on dry grasslands enhance habitat diversity,

altering plant species with different habitat requirements to thrive (DMEFNA 2008). The aim of this study was to estimate the effect of different combination of livestock grazing on herbage production of two dry grasslands.

Methods and materials

The research was conducted in Florina region, in western Macedonia, Greece in 2008. The altitude of the area is 600 m. The climate is classified as Csb (mild Mediterranean climate in sites with altitude more than 500 m, mild winter, and dry summer) under the Koeppen climate classification. The average annual precipitation was 516 mm. The maximum temperatures was in July (29.2 °C) and minimum in January (-1.9 °C). The area has been characterized as a Natura 2000 site and is considered as an important biotope of the Corine Biotopes Project.

Two experimental areas based on different kind of grazing animals were selected: 1) dry grasslands in the region close to Lake Zazari, which was grazed by small ruminants and cattle of the nearby village (Limnochori) and 2) dry grasslands close to Lake Chimaditida, which were mainly grazed by sheep and very few goats (Table 1).

Table 1. Number of grazing animals in the two dry grasslands during the trial

Area /Animals	Sheep	Goat	Cattle
Zazari	1561	460	190
Chimaditida	1006	69	0

(Source: Directorate of Rural Development of Southeastern Florina).

In both dry grasslands the dominant species of the vegetation were recorded. The dominant herbaceous species for the Zazari's grasslands were the cool season (C₃) grasses *Festuca ovina* group and *Agrostis* sp. and the warm season grasses (C₄) *Dichanthium ischaemum*, *Chrysopogon gryllus*, followed by legumes such as *Lotus corniculatus*, *Trifolium angustifolium*, and *T. campestre* in a smaller percentage. In Chimaditida's grasslands, the dominant species were mainly broadleaved perennial forbs such as *Marrubium* sp., *Carlina* sp. and *Carduus* sp. In the same grasslands, were scattered perennial grasses such as *Phleum* sp. and annual grasses *Avena* sp. and *Dasypyrum villosum* in a small percentage and annual legumes such as *Trifolium hirtum*, *T. strictum* and *T. angustifolium*.

Three experimental plots were established in each of the two grasslands. At the end of the growing season the herbage biomass remained after grazing was harvested using four (4) 0.5x0.5 m quadrats. The samples were oven-dried at 60°C for 48 h, and weighed. The herbage production was subjected to one way- analysis of variance (ANOVA) using the SPSS program. Differences among means were determined by the LSD test at $P < 0.05$ level of significance (Steel and Torrie 1980).

Results - Discussion

Herbage production of Chimaditida's grasslands was significantly higher than the one of Zazari's grasslands (Figure 1). This is probably due to the fact that Chimaditida's grasslands were grazed mainly by sheep (Table 1) resulting in the increment of unpalatable species for sheep, such as broadleaved spiny forbs *Carlina* sp., and *Carduus* sp. These species have higher biomass compared to grasses and legumes. It is known that sheep preferred grasses, followed by legumes and then by broadleaved species and after continuous grazing, species composition was significantly altered with an increment of broadleaved species (Pillai et al. 1985). In addition, selective grazer as sheep provides competitive advantages to unpalatable plants, increasing their robustness and their number (Mueggler 1972), resulting in the increase of unpalatable species for sheep, such as broadleaved spiny forbs.

Herbage production of Zazari's grasslands was low, probably because it was grazed by a combination of small ruminants and cattle (Table 1). Cattle and sheep have a complementary feeding behaviour (Putfarken et al. 2008), as they consume the available feed resources in different way depending on their diet preference (Rook et al. 2004). It is known, that grazing could either increase or decrease species richness and diversity in herbaceous plant communities, depending mainly on foraging behaviour of the herbivores in relation to the dominant plant species (Zhang 1998).

The use of the two dry grasslands by different combination of livestock has led to different species composition as it seems from the dominant species. Mixed grazing may have affected the vegetation differently from that of single-species grazing, as herbivore species differ in diet preferences, terrain use and their potential to impact vegetation growth (Walker 1994, Bakker 1998, Rook et al. 2004).

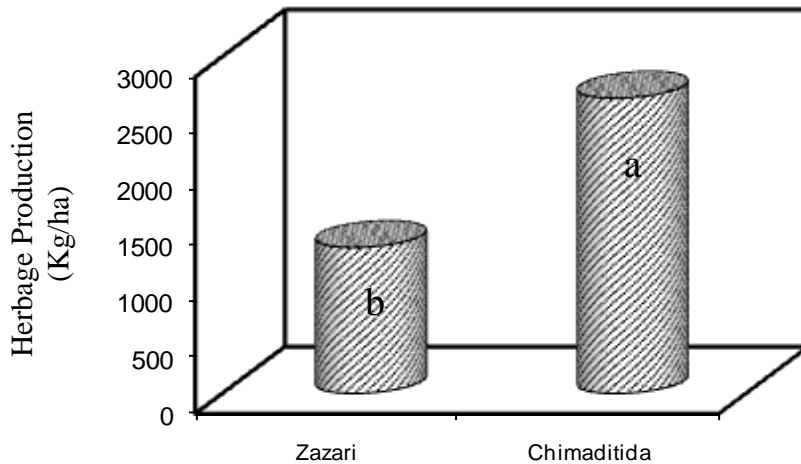


Figure 1. Herbage production kg/ha of the two grasslands. Means indicated by the same letter are not significantly different ($P \leq 0.05$).

Conclusions

In Zazari, the rational use of livestock with different types of animals has resulted in the presence of desirable species, while in Chimaditida sheep grazing has led to the dominance of undesirable species. Therefore, a proper grazing management with mixed grazing animals is necessary for the proper utilization of the rangelands by the farmers.

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