Research Journal of Biological Sciences 3 (2): 186-188, 2008
ISSN: 1815-8846
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Comparison of Plant Species Diversity in 3 Grazing Systems

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Abstract: Three treatments were used to evaluate the effect of grazing intensity on plant diversity, richness and evenness in Rhazhan rangeland (West Azerbaijan province, Iran). We used the Shannon-Wiener index to evaluate the plant species diversity and the Pielou's index for calculation of species evenness. Sorensen's similarity index was used to evaluation of similarity between vegetation of 3 sites. The study was showed that plant diversity, richness and evenness affected by grazing intensity. Also plant species composition and cover were affected by grazing intensity.

Key words: Plant species diversity, species richness, species evenness, Razhan, Iran

INTRODUCTION

Mountain grassland systems are affected by a combination of physical and environmental factors, as well as by grazing and human activity. The nature, while human being had no serious effect, could maintain equivalence between soil, climate, vegetation and other organisms. The impact of grazing animals on vegetation has been recognizes for many years. Herbivores are major determinants of structure and organization of plant communities (Berge *et al*., 1997; Chase *et al*., 2000; Gillen *et al*., 2000; Bai *et al*., 2001). Herbivores affect plant community structure by selective foraging, trampling, inducing physiological changes and changing competition parameters among species (Gillen *et al* ., 2000; Bai *et al* ., 2001), leading to important effect on net primary production, nutrient cycling and redistribution of nutrients in plant species and landscapes (Biondini *et al*., 1988).

The structure, functioning and species diversity of grassland ecosystems are inter-related (Archer and Smeins, 1991; Tilman and Downing, 1994) and can be altered by grazing (Huntly 1991). Diverse plant communities can be more resistant to disturbances. (McNaughton, 1985; Tilman and Downing, 1994). Some research indicates that moderately grazed lands can actually be healthier, produce more forage and have less standing dead materials than rangelands where grazing is excluded (Stelljes and Sinft, 1994; Howitt, 1995).

Nowadays most of the Rangelands in our country are threatened by very heavy and early and uncontrolled grazing pressure. In this study we evaluate the relationships among plant species diversity and different grazing systems. The results of this kind of studies can be efficient in Range management plans.

MATERIALS AND METHODS

This study was conducted in the Razhan region (West Azerbaijan province, North West of Iran), between 44°, 48', 40" to 44°, 53', 07" east longitude and 37°, 21', 03" to 37°, 23', 30" north latitude. The region is mountainous and the range of altitude is 1651-3000 m. Mean temperature and precipitation is 5.6°C and 459.3 mm, respectively.

The region area is about 1600 and 450 ha area of the region, was protected from grazing from 1994. We selected a site in protected portion. And two sites under light and heavy grazing intensity. Estimates of grazing intensity were based on visual inspection and information provided by range managers.

Field sampling was conducted in May and June 2007. All plots were located on level upland to avoid variations caused by slope or aspect or altitude. Plots (2×2 m) within randomly selected areas were defined and percent cover of each species, were visually estimated. Mean percent cover of each species was calculated for each site. Species richness,evenness and diversity was calculated for each site. The Shannon-Wiener index was used to calculate plant diversity on the basis of foliar cover (Kent and Coker, 1992). Only species with cover values higher than 1% were included in the cover comparisons. The Pielou's evenness index was used to calculate species evenness. Sorensen's similarity index was calculated for

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grazing intensity (Kent and Coker, 1992). Species diversity was analyzed by analysis of variance and student's t-test was used to evaluate significant differences between 3 sites (Hutcheson, 1970; Magurran, 1988).

RESULTS AND DISCUSSION

Overall 94 species was recorded in ungrazed site, 85 sp. in light grazing site and 67 sp. in heavy grazing site but most of them for their low mean cover eliminated from diversity analyze (Table 1). Some species with high meancover found in overgrazing site were those with a low nutritional value, such as: *Eryngium billardierii*, *Euphorbia* sp., *Astragalus* sp.

Species richness in ungrazed site is higher than other two sites, but species evenness in lightly grazed site is higher. Species diversity is equal in ungrazed and lightly

Table 1: Plant species included in plant diversity calculation with their cover values for ungrazed, light and heavy grazing intensities

	Grazing intensity		
Species	Ungrazed	Light	Heavy
Grasses			
Aegilops touschii Cosson.	2.20	5.0	0.10
Agropyron trichophorum (Link.) Richter	-	2.0	-
Bromus tectorum L.	-	t	1.00
Bromus tomentellus Boiss.	6.50	1.8	-
Dactylis glomerata L.	0.80	t	-
Hordeum bulbosum L.	10.00	t	-
Koeleria cristata (L.) Pres.	-	4.0	-
Poa bulbosa L.	7.50	0.5	0.12
Stipa barbata Desf	-	0.4	-
Taeniatherum crinitum	1.42	-	-
Forbs		4.5	-
Acantholimon bracteatum Boiss.	-	4.5	-
Achanthus dioscoridis L.	-	0.2	-
Achillea biebersteinii Afan.	1.50	0.9	-
Aethionema grandiflorum Boiss and Hohen	-	0.8	-
Alcea ficifolia L.	t	-	-
Allium atroviolasum Boiss.	1.15	-	-
Anchusa italica Retz.	0.14	-	-
Artemisia absinthium L.	0.14	-	-
Artemisia sp.	0.13	t	0.11
Centaurea virgata Lam.	0.30	0.1	-
Cirsium hygrophilum Boiss.	-	-	0.60
Echinops ritrodes Bunge.	1.20	-	-
Eryngium billardierii, *F. Delaroche*	3.00	6.0	6.50
Erysimum crassipes Fisch. Et C. A. Mey	0.20	T	0.10
Euphorbia sp.	0.58	2.2	3.00
Falkaria vulgaris Benth.	0.40	-	-
Gypsophilla ruscifolia Boiss.	0.90	5.0	-
Hypericum lysimachioides Boiss. and Boiss.	5.00	-	-
Hypericum scabrum L.	4.00	3.0	-
Salvia multicaulis Vahl.	1.10	-	T
Salvia virgata Jacq.	1.00	-	-
Silene spergulifolia (Willd.) M.B.	0.15	-	-
Stachys lavandulifolia Vahl.	-	0.4	-
Thymus migricus Klokov.and *Desj-Shost*	t	2.0	-
Thymus pubescens Boiss. and *Kotschy*	0.70	1.0	1.00
Verbascum cheiranthifolium Boiss.	0.20	0.9	2.50
Veronica orientalis Miller	0.45	-	-
Legums			
Astragalus aureus	3.60	0.5	10.00
Astragalus effuseus Bge.	0.75	-	-
Astragalus hyminosteqis Fisch.and *C.A. Mey*	0.14	-	-
Astragalus pycnocladus Boiss.and *Hausskn*	6.20	2.2	11.00
Medicago sativa L.	0.15	T	-
Onobrychis migataphros Boiss.	0.20	4.0	-
Vicia prergrina L.	0.14	-	-
Shrubes and Trees			
Amygdalus elaegnifolia Spach.	-	5.0	-
Cotonoaster nummularioides pojark	-	0.1	-
Daphne mucronata Royle	-	-	0.80
Populus nigra L.	1.5	-	-
Salix excelsa S.G. Gmelin	6.5	-	-
Tamarix ramosissimo Ledeb.	0.7	-	-

Table 2: Species diversity, Richness and evenness calculated in 3 sites

	Grazint intensity		
Parameters	Ungrazed	Light	Heavy
Spesies diversity	2.303	2.303	1.544
Species richness	94.000	85.000	67.000
Spesies evennes	0.812	0.872	0.793

Table 3: Sorensen's similarity index calculated for 3 sites

Site	Ungrazed	Lightly grazed	Heavily grazed
Ungrazed	-	0.56	0.47
Lightly grazed	-		0.46
Heavily grazed	-	-	-

grazed sites but these two sites have significant difference with heavily grazed site ($p<0.01$) (Table 2).

The presence of species in 3 sites was affected by grazing intensity (Table 3).

CONCLUSION

The basic assumption made in this study was that if all other variables influencing vegetation were the same, then any differences must be a result of grazing influences. Grazing intensity affects plant species diversity, richness and evenness in Razhan rangeland. As the intensity of grazing increases from light to heavy, species diversity tends to decrease. Also species richness decreases under heavy grazing and since a few species present with high cover, the evenness decreases too. We couldn't find any differences in plant diversity between ungrazed and lightly grazed sites. Grazing alters species composition, so that some species with low nutritional value found with high cover in heavily grazing site.

Sorensen's similarity index showed differences between the species present at 3 sites. *Poa bulbosa*, *Hordeum bulbosum*, *Aegilops touschii*, *Bromus tomentellus*, *Onobrychis megataphros* that are palatable species, decrease under heavy grazing and *Eryngium billardierii*, *Verbascum cheiranthifolium*, *Euphorbia* sp. increase under heavy and uncontrolled grazing. Therefore a practical suggestion for range managers is that the overpopulations of such species indicate that resting such rangelands is necessary to allow palatable grasses and legumes to increase. Maintaining species diversity should be an important objective of grazing management.

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