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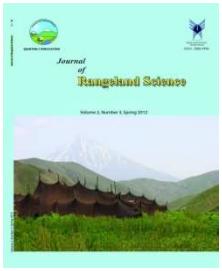

Full Length Article:

Comparison between Some Vegetation Traits and Bioindicators in Two Grazing and Exclosure Areas (Case Study: Sorkhe-Graz and Valikbon Rangelands)

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Abstract. Overgrazing, via harvesting of forage species and decrease the other herbs, is of progressive factors in biodiversity destroying. In order to investigate the animal grazing impacts on changing of plant structure and diversity, we selected the comparison between this effect with exclosure area, and proving of the excluded area effects on plant diversity; two sites of Kojour rangeland, Mazandran province, Iran. Four transects, 50 m were systematic-accidentally established on two different aspects including along of slope (two transects) and staple on steep slope side. Cover percentage was recorded by 10 plots $1m^2$ in each transect. Rangeland condition and trend was determined by 6-factor and Trending Balance methods, respectively. Diversity indices in each area, by analysing of vegetation parameters, were calculated using PAST software. Vegetation traits and bioindicators were analysed by independent T-test using SPSS software. The result showed that percentages of all life-forms in rangeland were different between the exclosure and grazing areas, especially, grasses and forbs were meaningfully remarked. Regarding to bioindicators, diversity-Shannon index and richness-Menhinick index values were higher in the exclosure area than open area ($P<0.01$). Dominance index in grazing area was significantly higher than exclosure area ($P<0.05$). Evenness index, however, has not punctual difference in both areas.

Key words: Exclosure, Grazing, Bioindicators, Kojour.

Introduction

Rangeland ecosystems in moderate regions contain the magnitude amount of biodiversity. Diversity of biologic and ecologic in the rangeland ecosystems are directly influenced by vegetative traits and plants species diversity which perform as a protective guard to guarantee the ecosystem stability (Salami *et al.,* 2007). It also takes into account as a tool to assess the vegetation cover (Cairnes *et al.,* 1979). Since, the vegetation cover is the most important part of natural ecosystems' structure as symptom of quantitative and qualitative events on these ecosystems and it is also affected by different environmental and directorial factors (Hoveyzeh, 2001) the study of such a subject can accede the optimum practical and scientific approaches in ecosystem management. The study of vegetation condition in inside and outside of exclosure can perform as an indicator that draws out the long-term impacts of exploiting and managing on the rangeland ecosystems (Shokri *et al.,* 2007). Hence, probe of the grazing influences upon vegetation changes can well conduct the utilisers to exploit the rangeland ecosystems via ecologic concepts (Alder, 2000).

There are many studies which investigate the gradient of vegetation structure under grazing and non-grazing conditions, and they had stated that overgrazing and disregard the grazing management principles are the most factors of destroying the rangelands. Valone & Sauter (2005), by means of inspection the exclosure in rangeland, had resulted that improvement of perennial grasses in the sense of grazing is difficult and impossible. The study of Rosingol and Aguiar (2006) in France had shown that the grazing of rangelands had been caused to reestablish the shrubs into grasses and forbs. The exclosure in alpine zone also is brought out that mosses and other unpalatable species are decreased and palatable species increased (Mayer *et al.,* 2009). The covers of grasses and forbs inside the exclosure were more than open area in the Roudshor rangelands, but shrubs' covers were not significant in both areas (Akbarzadeh, 2005). In tropical areas, the over grazing is one of the natural disturbance and in grazingland, spiny bushy trees increased while the shrubs and forbs decreased and soil infiltration also was declined (Takar *et al.,* 1990). Noor *et al*., (1991), after investigation of combination and production of grasses, forbs, and shrubs in upland of Pakistan, had pointed out that there was not any meaningful difference between exclosure area, which six-year was confined, and grazingland and the range managers that should directly interfere to improvement of grazing area in semi-arid regions as well as and Verdoodt *et al*., (2010) have also pointed it. The study upon grazingland and its adjusted area, which was ten years as enclosure, had shown that the limited area incline towards climax condition because of grazing protection and the frequency of perennial forages was increased (Potvin & Harrison, 1994). Mclean & Tisdale (1972) and Yayneshet *et al.,* (2009) had reported that the exclosure was of directional tools to improve the rangeland condition in the direction of excellent. Robertson (1971) also has drawn attention to soil and vegetation condition and their progressive intendancies after 30 years of exclosure.

The relationship between diversity and ecosystem stability, with a view to determine and know the dynamic factor of that ecosystem, has the special importance in performing (Tilman *et al.,* 1998). Some researchers had focused on the grazing impacts on species diversity (Maguran, 1996). The study of grazing impacts on species diversity and combination in semi-rangeland, for instance, there were significant differences between species diversity in different grazing intensity in order that maximum diversity was seen in low pressure of grazing (Mligo, 2006).

Hendricks *et al.,* (2005) had studied on species diversity and richness along the different grazing gradient in south of Africa and they had shown that the diversity in high pressure of grazing was in the lowest amount. The research consequences in arid and semi-arid lands had shown that species frequency and richness of typical plants in the exclosure rangeland had decreased than the other grazingland (Firincioglu *et al.,* 2009). Indigenous species dispersion and richness also decreased because of overgrazing (Haarmeyer *et al.,* 2010). Andra (2007) had shown that species diversity of grasses increased after restricting the livestock. The research of Hickman *et al.,* (2004) also proved that the exclosure is caused to increase the frequency and richness of perennial and grasses species, however, this result was not significant for shrubs species. Wilms *et al.,* (2002) revealed that livestock grazing is brought about species diversity and the exclosure is caused to richness changes. Mesdaghi (2000), by assessment of different indices of biodiversity in three different sites, had disclosed that the exclosure and heavy grazing areas had the maximum and minimum of richness, respectively. In a final manner, the research of Salami *et al.,* (2007) had demonstrated that the exclosure habitat, with 93 species in comparison to species of grazingland, had the most richness and diversity. Because of sensitive soil and having landslide position of the study area, the current research wants to know what has happened to vegetation traits in this area after 8 years enclosing.

Materials and Methods

Area description

The study area, including two adjacent range with the exclosure of 646 ha and grazingland of 609 ha, is located in upland area of Kojour in Mazandaran Province, Iran. The minimum and maximum altitude of the study area is 1270 and, 2256 m above sea level. The coordinate position of the study area is $51^{O}\,46'7''$ to $51^{O}\,47'00''$ as longitude and $36^{O}\,25'\,10''$ to $36^{O}\,24'44''$ as latitude. The area climate is semi-humid on the basis of Emberger's classification (Salami *et al.,* 2007). The annual precipitation is 480.58 mm based upon the average of synoptic stations' data that the minimum occurs on June and the maximum happens on April and May. Temperature degree reaches -10^{o}C in winter period (MMSAS, 2003). Soil texture in this area is silty-loam to silty-clay-loam with pH between 6 to 7 that soil is less fertility and lack of humus. With the goal of geological formation, the area is formed by sand stone and marl, which are sensitive to erode, with marly limestone. It is quite sensitive with the intention of delicate structure to erosion. Type dominant of erosion is water-erosion with unnatural watercourse which is shaped as gully.

Research methods

The study sites are selected on the basis of key species in each area with possibility of better access whichever introduces the vegetation traits of whole region (Mesdaghi, 2007). For the purpose of punctual determining of vegetation type, first of all, it was settled on aerial photo with scale 1:55,000 and secondly, stand areas in each type was specified. Sampling was systematic-accidentally done (Mesdaghi, 2007). Plot size was obtained by minimal area method (Cain, 1932). Plot shape was square and its dimension was 1 m^2. Sample volume was determined by statistical method via below formula (Mesdaghi, 2008; Bonham, 1989):

$$N = \frac{t^2 S^2}{P^2 \bar{x}^2}(1+\frac{2}{n})$$

Where:

N = amount of sample

S= dataset variance

t= represents t-student which is marked by t-table in a distinct probability level

$\bar{x}_=$ is average of initial sampling

P= depicts probability range which is usually ±0.01

n= is primary sample volume.

In this study, the sample amount obtained 40 based upon prime sample (10 samples). The length of transect was acquired by way of vegetation form and density and climatic condition. Cover percentages of all vegetation forms recorded in each line transect. The rangeland condition and trend were determined by 6-factor method (Daubenmire, 1968) and Trend Balance methods, respectively. Calculating of species bioindicators was done in PAST software (Ganis, 1992). Mean comparison between parameters data set of two communities was carried out by independent T-test in SPSS v.17.

Results

The results showed that the mean amount of all vegetation forms in the exclosure area were higher than grazing area (Fig. 1).

Difference between the exclosure and grazing areas was significant (P<0.01) for perennial grasses and forbs. Estimation of the rangeland condition showed that the range condition score of exclosure and grazing area were 71.1 and 37.59, respectively; which indicated good condition of exclosure area than that poor condition of grazing area (Table 1).

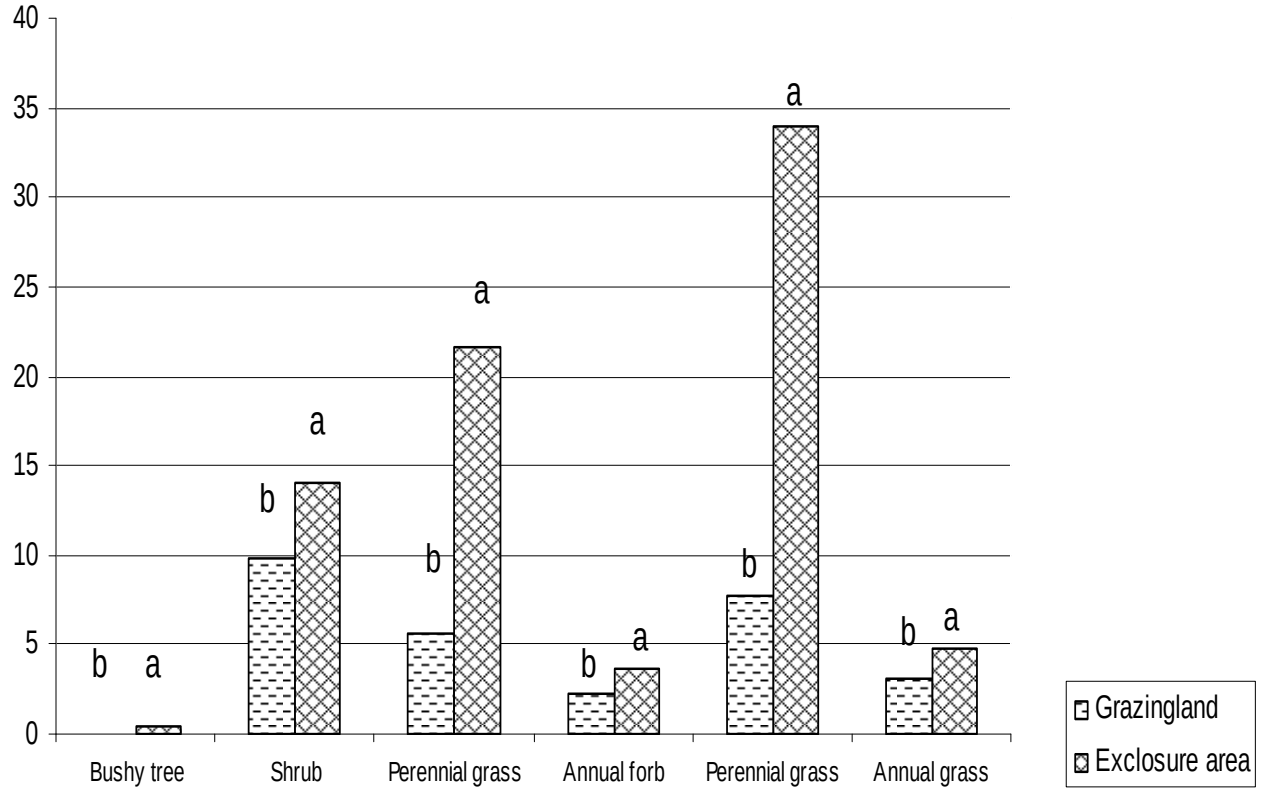

Fig. 1. Comparison between vegetation forms in two rangelands (exclosure and grazing area)

Table 1. Comparison of the exclosure and grazing areas on the basis of their condition and trend details' characteristics

Management Practice	Grazing Area	Exclosure Area
Cover (%) Score	4.51	15.1
Soil conservation (%) Score	17.09	16.6
Natural regeneration (%) Score	9.17	10.3
Litter (%)Score	1.41	5.8
Potential production (%) Score	4.23	11.3
Plant combination (%) Score	1.43	12
Range condition Score	37.59	71.1
Rangeland condition	Poor	Good
Range trend	Regressive	Progressive

The result of T-test showed significant differences between two sites for diversity-Shannon index and richness-Menhinick index ($P<0.01$) and dominance index ($P<0.05$). However, there was not significant difference for evenness index between two areas (Table 2).

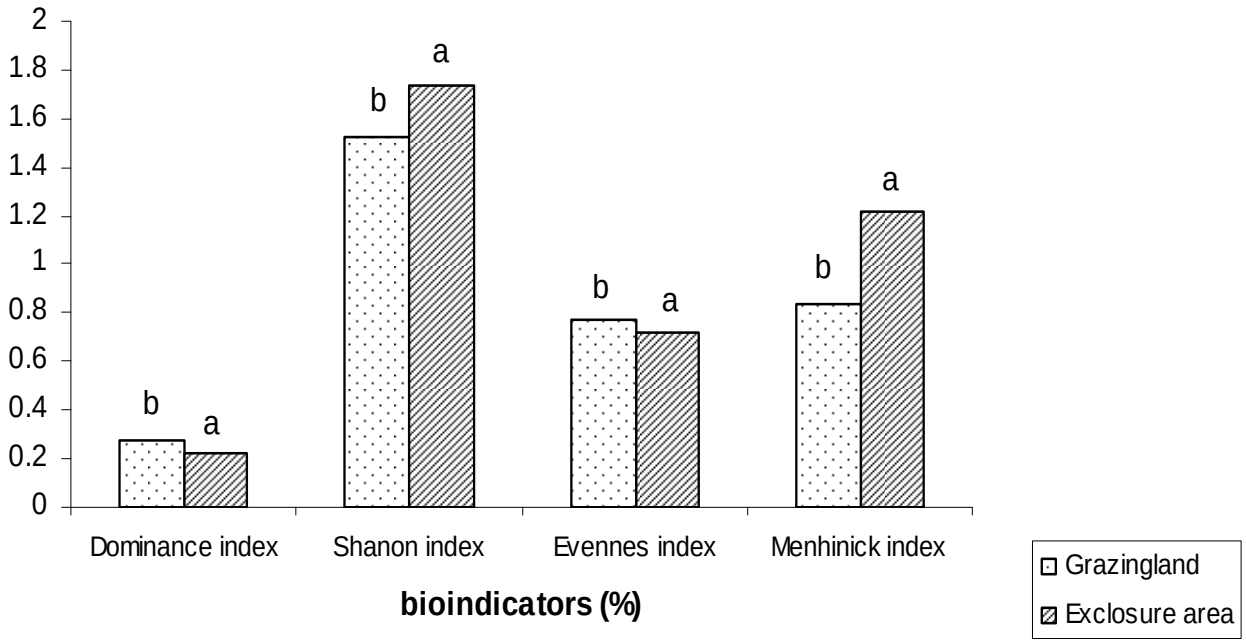

Fig. 2. Comparison of bioindicators in the both grazing and exclosure areas

Table 2. Comparison of vegetation forms and bioindicators in the both grazing and exclosure area

Factors	Treatments	Average	SD	T Statistic
Annual grass	Grazingland	3.1	3.84	-1.36^{ns}
	Exclosure area	4.8	6.74	
Perennial grass	Grazingland	7.6	6 4.21	-11.53**
	Exclosure area	33.9	13.73	
Annual forb	Grazingland	2.3	1.69	-1.72 ns
	Exclosure area	3.7	6.23	
Perennial grass	Grazingland	5.06	3.69	-6.28**
	Exclosure area	21.6	14.59	
Shrub	Grazingland	9.81	7.32	-1.9 ns
	Exclosure area	14	11.93	
Bushy tree	Grazingland	0.02	0.11	-1.78 ns
	Exclosure area	0.42	1.41	
Rangeland condition	Grazingland	37.59	8.04	-8.21**
	Exclosure area	71.1	11.62	
Shannon index	Grazingland	1.51	0.387	-3.25**
	Exclosure area	1.73	0.333	
Menhinick index	Grazingland	0.83	0.345	4.72**
	Exclosure area	1.22	0.29	
Dominance index	Grazingland	0.28	0.114	2.42**
	Exclosure area	0.22	0.073	
Evenness index	Grazingland	0.77	0.159	0.50 ns
	Exclosure area	0.72	0.11	

ns: non-significant, **: meaningful in 99% level, *: meaningful in 95% level

Discussion

The amount of all vegetation forms inside the exclosure area was estimated higher than grazing area. If the amount of perennial grasses and forbs is high in the exclosure, it is because of omitting the livestock from this area that gives desirable opportunity to plant to regenerate swiftly. Suitable climate circumstances are caused that all vegetation forms are rehabilitated within a short time. Proliferation of grasses and forbs has also underlined to the exclosure performance to provide an appropriate condition to occupy palatable species for herbivores. The results of Valone and Sauter (2005), Rosingol and Aguiar (2006), and Mayer *et al*., (2009) have pointed out same view as it is given in this research. The research of Takar *et al.*, (1990) had reversely shown that protection of grazing causes the increasing of the bushy trees and phytomass. It is useful for the both livestock and climate condition. The study of Noor *et al*., (1991), in surveying of the combination and production of grasses, forbs, and shrubs in upland rangeland of Pakistan, had also shown that there were no significant differences between these vegetation forms inside and outside of exclosure area after six years, from restriction of semi-arid area. Tendency of the exclosure condition to good and grazing area condition to poor are due to lack of grazing in limited area and increasing of palatable species there. Animal trampling in open area and overgrazing of livestock in this area, as negative factors cause that regressive trend is cleared in vegetation formation and soil. It is also brought about toxic and less-palatable species in the grazingland. Moreover, the research of Robertson (1971) and Mclean and Tisdale (1972) have emphasized the same subject. Increasing of the diversity-Shannon and richness-Menhinick (1964) indices in the restricted area can be interpreted and the probability of more presence of palatable species and lack of animal in the exclosure area cause the increasing of these bioindicators, and vice versa, in the grazingland, continuous presence of animal causes the reducing of the amount of all vegetation forms, especially palatable species. Hence, the exclosure site has more performance in ecologic stability of habitat. It also proves that exclosure can create environmental balance between all sorts of species and gives the opportunity to plants to find suitable niches. This result is similar to reports of Maguran (1996) and Tilman *et al*., (1998). As a result, the research findings put an emphasis on fundamental role of the exclosure in order to generate the indigenous species, which can conserve the soil surface. It should be stated that the regressive condition of rangeland in northern feature of Alborz can be rehabilitated by the exclosure, even for a short period.

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