INTERNATIONAL RESEARCHERS

A Comparative Study of the Effects of Gazelle and Livestock Grazing on the Plant Community Characteristics on the Steppe Habitat of Golestan National Park, Iran

ELHAM BAGHERIRAD, MASOUME AMIRKHANI, MANSOUR MESDAGHI,

& NORHAYATI. AHMAD

Volume No 1 Issue No.1 March 2012

www.iresearcher.org

ISSN 2227-7471

THE INTERNATIONAL RESEARCH JOURNAL "INTERNATIONAL RESEACHERS"

www.iresearcher.org

INTERNATIONAL RESEARCHERS is peer-reviewed, supported by rigorous processes of criterion-referenced article ranking and qualitative commentary, ensuring that only intellectual work of the greatest substance and highest significance is published.

A Comparative Study of the Effects of Gazelle and Livestock Grazing on the Plant Community Characteristics on the Steppe Habitat of Golestan National Park, Iran

[1]ELHAM BAGHERIRAD, [2]MASOUME AMIRKHANI, [3]MANSOUR MESDAGHI, & [1]NORHAYATI. AHMAD

[1]*National University of Malaysia (UKM), Faculty of Science and Technology Universiti Kebangsaan Malaysia, Bangi, Selangor.*

[2]*PhD of Rangeland Sciences,* [3] *Professor of Rangeland Sciences*

(MALAYSIA)

Email: bagheryelham@yahoo.com

ABSTRACT

Rangelands are the main habitat for wildlife herbivores, while livestock grazing is the most common use of rangelands, and overgrazing by domestic livestock has stirred much debate concerning the continued use of rangelands on wildlife survive. Nowadays range managers value the impact of rangeland management and livestock grazing on wildlife habitat, that it can also because of change in society requirements and economic condition. In the other word, the demand for meat and other animal products is reduced and most landowners understand that the most proportion of their income is from poaching and nature landscape. Therefore, understanding the interaction between domestic and wildlife and improvement of the wildlife habitats are important for the extension of bio-environment and sustainable economic. Rangeland degradation has been widespread and severe throughout the steppe habitat of Golestan National Park (GNP) and its vicinity as a result of both unfavorable environmental conditions and human induced impacts. This study was conducted to explore the effectiveness of management-based strategies on establishing sustainable habitat development, it was compared the response of vegetation parameters (forage production and vegetation composition) on area under gazelle and livestock grazing. So, aboveground annual productivity and canopy cover was determined across 231, 1 m^2 plots based on a random selection method. Standing crop was estimated by clipping current year's crop to ground level and canopy cover was estimated visually as cover classes. Results indicated that gazelle grazing area had both higher biomass production (200kg/ha) and canopy cover (30%) than livestock grazing area (80 kg/ha production and 13% cover). Under livestock grazing some annual and unpalatable grasses such as *Eremopyrun bonaipartis* was dominant, that was indicated terms retrospection. Direct observation of food habit of gazelle and livestock showed that they have the same food habit and in steppe habitats in absence of forbs both of them prefer shrubs. Thus livestock in the Ghorkhoud Protected Area (located in east side of GNP) can be severing competitor with gazelle. Furthermore GNP that protected from livestock grazing had more species composition than area under livestock grazing. Thus, protection from grazing in protected area that one day was the gazelle habitat can increase forage production and species composition. A more balanced grazing management approach is recommended to achieve an optimal condition of biomass production (quantity), vegetation cover, quality and available forage species that contribute to proving wildlife grazing conditions.

Keywords: vegetation composition, grazing, Golestan National Park and Ghorkhoud Protected Area.

1. INTRODUCTION

Proper knowledge of the resources will, no doubt, help in planning for the future extrapolation of more reserve area. Studies dealing with the evaluation of these natural resources and monitoring of the changes taking place are strongly needed, especially the ecological studies (El-Gazzar et al., 1995). Moreover the socioeconomic and the tourism development of the reserved areas are based on evaluation of its natural resources (El-Demerdash et al., 1996). It is important to monitor the status of rangeland vegetation because of their high value for wildlife and the maintenance of the existing rangeland remnants.

Golestan National Park (GNP) is one of the oldest national parks in the Middle East, which has a long history in preserved areas and its successful management, can be an example for other unpreserved areas. Its variety of plant communities and the diversity of wild ungulates such as gazelle, feral goat, ran and ouch made it possible to achieve a sustainable management in comparison to other adjacent similar areas (Hassanzadeh Kiabi., et al 1994).

Similar to the benefits of domestic livestock grazing in natural pastures, the wild ungulate grazing also has a very important impact for human beings; when distinguishing the impacts of domestic livestock grazing from that of wild, we can derive useful conclusions with regard to the effective management of pastures. In determining the carrying capacity of an area, the impact of wildlife has often been ignored, while most pastures are actually affected by wild ungulates grazing (Holechek, 2004). In steppe habitat of Golestan National Park (GNP), there has been concern that livestock grazing in protected area near gazelle habitat, may decrease plant species diversity on a local and regional scale and adversely affect rare, threatened, or endangered species. Since, Native vegetation is the best indicator of the potential productivity of a specific location, the measurement of rangeland herbage standing crop is important in the management of multiple uses such as livestock production, wildlife food and niche, also soil protection against erosion.

The Persian gazelle (Gazella subgutturosa subgutturosa) is the dominant ungulate species within the desert ecosystems throughout Iran as well as other countries in both the Middle East and Central Asia (Farhadinia et al., 2009). It is currently categorized Vulnerable (VU) and if conservation efforts are not implemented for this species in the near future, it could change to the Extinction (EX) category (IUCN Red List, 2012). As Jiang et al (2000) reported that one of the important causes of decline in Przewalski's gazelle around Qinghai Lake, China, the extinction of the habitat as a result of desertification, predators, poaching and human activity. In the same condition, Farhadinia et al (2009) in northeaster of Iran reported that livestock (more than 15000 heads) graze over most of the area's rangeland during winter which forces gazelles to concentrate in hilly terrain which increase gazelle susceptibility to predators as Cheetah and poachers. He also found that because of small population of gazelles in their habitat, they cannot compete with livestock over there, also herd dogs tend to chase the gazelles; therefore, it makes them abandon their habitat.

Although the various factors such as climate, soil ingredients and kind of management affected plant structure in pastures (Le Houerou & Hoste, 1977), but there is no doubt that overgrazing, over cultivation and wood cutting are among the human factors, which lead to the deterioration of pasture production in arid regions. Under long-term-intensive grazing the shift in species composition frequently involves the replacement of palatable with unpalatable plant species, in particular woody perennials that provide low to no forage value. Grazing systems, which are management tools for controlling the frequency and duration of grazing and rest periods, optimize livestock and plant performance and minimize undesirable woody species invasion (Heitschmidt & Taylor, 1991). Grazing by domestic livestock is commonly associated with changes in species composition in native grasslands (Milton et al., 1994; Ruiz-Fernandez, 2007). Over time, impacts associated with livestock grazing have been heightened due to the arid or semiarid climate regime characteristic of rangelands (Chaichi et al., 2005). Average annual precipitation and temperature patterns are highly variable with low average annual rainfall that is erratic and poorly distributed both temporally and spatially. Droughts are common within the region, resulting in lower forage and crop productivity and limited water availability for plants, livestock and wildlife. Additionally, annual to seasonal air temperatures can range widely with highs reaching over 45°C during the summer months. The effects of high temperatures are aggravated by dry winds, or sirocco, which may occur during the growing season, making the steppe an exceedingly hostile environment.

Before Islamic revolution in 1976, gazelle lived in large steppe habitats with 125895 ha under the name of Golestan National Park, which was conserved under the law of national park. But after 1978 year, in consider needing of villagers and livestock holders, the national park was divided in two areas under the name of Golestan National Park (GNP) with 91895 ha and Ghorkhoud protected Area (GPA) around 34000 ha. So, base on the law of protected area domestic livestock can grazing in limited duration of year, therefore in the area that once gazelle lived, now livestock graze. In result, over-grazing by livestock (sheep and goat) makes erosion in this area and sometimes flood damage vegetation cover of gazelle habitat in GNP. Also based on our observation gazelle and sheep have the same food habits and this cause to food competition between them.

2. METHODOLOGY

Study area: Golestan National park (GNP) with an area of 91895 hectares has been a protected area since 1957 under the name of "Almeh" and "Yashki. This Park is one of the most famous national parks in the Middle East, Because of its natural values like verdant and virgin forest, also different species of flora and fauna. GNP located to the east of the Caspian Sea between longitude 55º 43' to 56º 17' E and latitude 37º 16' to 37º 31' N. To quantify the differences between gazelle and livestock on plant communities, two adjacent sites were selected. The first site was located in southeast side of Golestan National Park that is called the Mirzabaylou plain, covering an area of 3500 ha, and the second site was situated in steppe part of Ghorkhoud protected Area (the east side of GNP) with an area of 1000 ha. Elevations in our study area range from 1200 to 1300 m, and the climate varies from arid to semi-arid. The average annual precipitation is 150 mm. and the annual temperature is 11.9 °C from April to October and 10.5 °C

from December to March. Vegetation sampling occurred in the spring of 2010, during the peak season of primary production.

Eastern vegetation cover of Golestan National park is comprised of two parts Hyrcanian and Irano-Touranian (Javanshir 1976). Both of which are considered as the most important growing ranges of Iran. The dominant species in both of them is sagebrush (Artemisia herba-alba), with the highest coverage in Mirzabaylou plain. In most communities sagebrush is also the dominant species.

Mirzabaylou vegetation is covered steppe and xerophyte plants, which consist of short trees, permanent and annual forbs. The plain has vegetation communities of Stipa barbata and Artemisia herba-alba. The dominant species of Artemisia herba-alba has a 20% canopy cover and Stipa barbata has a 10% canopy cover. Relative mass of Artemisia herba-alba is 18% and Stipa barbata is 15%. The total canopy cover of this community is 50% and is extended from 1150 m. to 1500 m. altitude in the southern slope of Mirzabaylou Sorkh Mountain (Gholamy 1383). Plants such as Eurotia ceratoides shift toward higher altitudes. While within the water channels plants such as Saueda fruticasa, Aelenia sp. Salsola spp and Haloxylon persicum are signif icantly present. Eremopyrun bonaipart and Alyssum strigosum are commonly scattered in the whole region. In the heights of Mirzabaylo plain at an altitude of 1500 m on the southern rocky slope of the Sorkh Mountain, Hultemia persica, which is an aggressive species, is seen with low density.

Vegetation cover of Ghorkhod Protected Area (GPA) region in the aspects of slope, direction, altitude, climate and soil is almost different of Mirzabaylo plain. Dominant species in this region is sagebrush (Artemisia h erba-alba). Tribulus terrstris has a uniform distribution in the whole region. As a result of sheep grazing species such as Myosotis peseudoprovinqua, Carex stenophila and Descraina Sophia can be seen in this region.

Fig 1. Location of study area under gazelle and livestock grazing (http://turkmenecolodge.com/nature/golestan)

3. SAMPLING METHODS

Standing crop: A randomly plot 1 x 1 m. was used to sample each grazing area. In this plot, peak standing crop by species group was assessed during spring 2010. A number of 197 plots were randomly distributed inside Golestan National Park (GNP) and 34 plots in Ghorkhoud Protected Area (GPA) to estimate biomass production. Above-ground biomass was harvested by manually clipping 2.5 cm above soil surface within each quadrate. This height represents a typical standing crop height after the plants have been bit ten by animals like gazelle and sheep during grazing. Once plants were clipped and bagged, all vegetation material was oven dried (48 h at 70°C) and weighed. The percent of total standing biomass for above-ground plant parts was determined for all species present.

Canopy cover: Canopy cover was measured in a 1× 1 m on plot by ocular estimation (Daubenmire, 1959). Cover classes were: 0 = 0%, 1 = 0.01-1%, 2 = 1.1-5%, 3 = 5.1-25%, 4 = 25.1-50%, 5 = 50.1-75%, 6 = 75.1-95%, 7 = 95.1-

99%, and 8 = 99.1- 100% and converted to the midpoint percentage of the estimate. Canopy cover was estimated for each plant species having canopy within plot boundaries.

Species composition: Species composition presents an efficient expression for revealing the spatial distribution of a species and the numerical strength of a particular species present across a landscape. Furthermore, it reflects a combination of environmental and historical events at a site.

Life form: Plant species were split into seven groups based on morphology (life form) and life span. The groups included: Phanerophyte (the surviving buds or shoot apices are borne on shoots, which projected into the air), Chamaephyte (a perennial plant that sets its dormant vegetative buds just at or above the surface of the ground), Hemi-cryptophyte, Cryotophyte, Geophytes (a perennial plant that propagates by underground bulbs or tubers or corms), Therophyte (plants completed their life cycle from seed to seed and died), Epiphyte (Kreps, 2001).

Palatability class: All recorded species were placed into 3 classes. Class I (increase species), II (decrease species), III (invader species) represent high palatability, moderate palatability and low to unpalatable, respectively.

Food habits: Considering the impact of gazelle and sheep grazing on vegetation cover, their tracks and fecal remains around vegetation can be used to determine the species which are under gazelle and sheep grazing in any region (Cretenberger, 1987).

Statistical analyses: 2-Sample t test was used to test for vegetation differences between gazelle and livestock grazing plant communities. All analyses were conducted using MINITAB 16 software (MINITAB, 2010). Differences between means were considered significant if P values were ≤ 0.05.

Motyka's similarity index (Mueller-Dombois & Ellenberg, 1974) was used to make comparisons between species composition and life form group at each site:

Similarity index (%) = 2c/(a+b) x 100%.

Where c is the number of species common to the both samples a and b are the number of all species in sample A and all species in sample B, respectively.

4. RESULTS

The plant species from both sites are listed in Table 1. A total of 42 plant species belonging to 17 families were recorded of these species 38.22%, 32.5% and 20.56% belonging to the families Asteracea, Poaceace and Salsolacea, were the dominant family in both sites. In Golestan Natonal Park (GNP) Astracea (33.41%), salsolaceae (27.76%) and Poaceace (24.43%) are most common family while in Ghorkhoud Protected Area (GPA) Astracea (43.04%), Poaceae (40.57%) and Salsolacea (13.36%) are dominance family (table1). Results of this analysis indicated that differences occur among measured variables including biomass, percent cover and species composition under gazelle and livestock grazing

Table 1. Main family names for Golestan National Park and Ghorkhoud Protected Area (more than 1%)

Family name	Golestan National Park		Ghorkhoud Protected Area	
	No. of species	%	No. of species	%
Asteracea	4	33.41	2	43.04
Poaceae	4	24.43	3	40.57
Salsolacea	5	27.76	3	13.36
Brassicacea	5	7.25	1	1.93
Papaveracea	2	2.86	0	0

Lamiacea	4	2.03	1	1

Biomass of gazelle and sheep grazing area. As expected, there was more biomass production in the GNP areas (200 kg/ha) than in the GPA (80 kg/ha) (P=0.000) (table 2).

Table 2. Result of variance analysis of biomass production GNP and GPA

Source	DF	SS	MS	P
Areas	1	4066	4066	0.000
Error	229	73125	319	
Total	230	77191		

Plants cover gazelle and sheep grazing area. Percent plant canopy cover was higher in the GNP than in GPA and there was significant differences were found in these sites (p=0.000) (table 3).

Table 3. Result of variance analysis of canopy cover on GNP and GPA

Source	DF	SS	MS	P
Areas	1	7939	7939	0.000
Error	229	85627	374	
Total	230	93566		

The gazelle grazing area at the GNP site provided over 30% of total plant cover with Artemisia herba-alba (33.10%) exhibiting the highest percent cover by species. Salsola rigida had 14.59% cover and Eremopyrun bonaipartis had 13.18% cover. Also the favorite and water juice plant for gazelle as Salsola arbeskoliphoimis with 6% cover that only was seen in GNP. The protected area had 13% total plant cover with Artemisia herba-alba 33.10%, Eremopyrun bonaipartis at 33.40% and Salsola rigida at 6.94% plant cover by species (Figur 2 and 3).

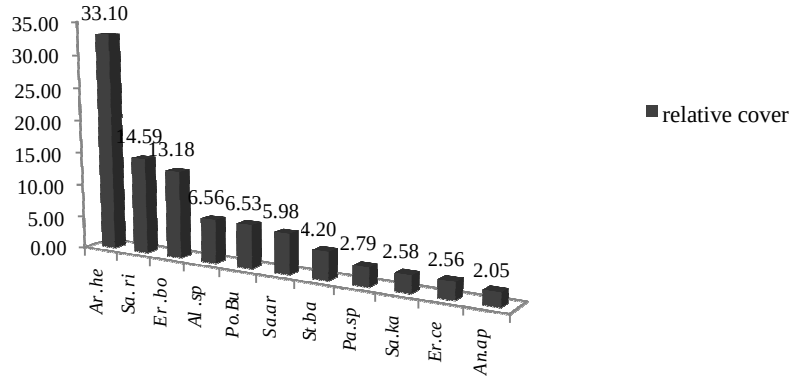

Fig 2. Percent of dominance species relative cover in GNP (more than 1%)

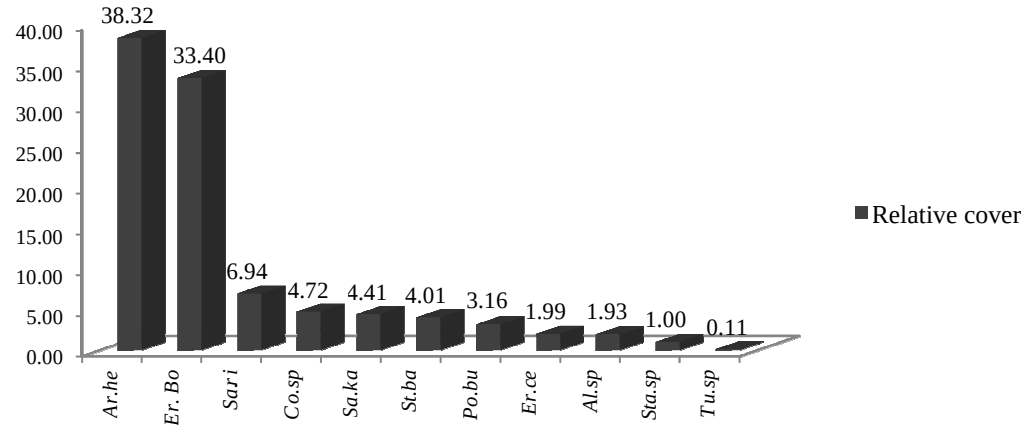

Fig 3. Percent of vegetation relative cover in GPA

Species composition and frequency. The gazelle grazing area had more species (38) than the sheep and goat grazing area plots (17) (Table 6). Figures 2 and 3 showed the proportion of main vegetation cover (more than1%) in GNP and GPA. the percent of shrub composition in GNP under gazelle grazing (58 %) is more than sheep grazing in GPA (43%), while the percent of grasses in livestock grazing area (44%) is more than gazelle grazing area (25%) (Fig 4).

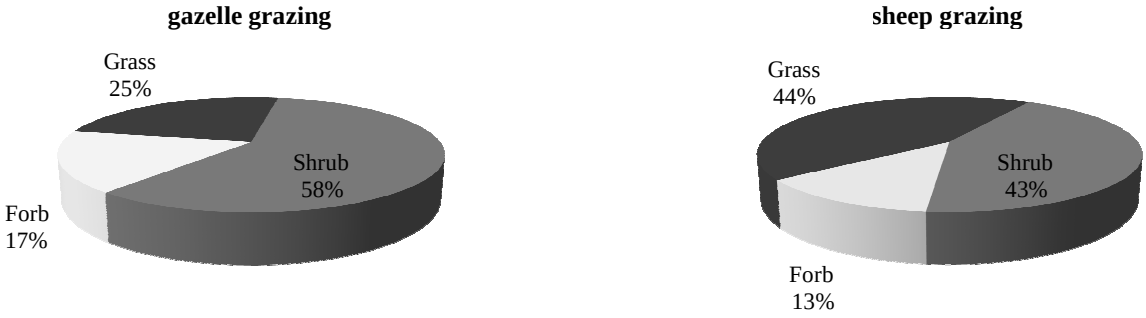

Fig 4. The percent of life form composition under gazelle and livestock grazing in study area.

Life form and similarity index.

Results of species, sampling and their respective life forms are shown in Table 4. Chamophyte and Therophyte were the most predominant life form of total species recorded in study area. The computation of the similarity index in species composition between the gazelle and livestock grazing area was 53.57%. Result showed that the percent of Chamophyte under gazelle grazing area was more but the percent of Therophyte in livestock grazing area was more.

Table 4. Life-form distribution of surveyed species of GNP and GPA

Life form	Golestan National Park		Ghorkhoud Protected Area	
	No. of species	%	No. of species	%
Chamaephyte (CH)	5	58.28	3	47.25
Geophyte (GEO)	3	6.77	2	3.27
Therophyte (TH)	20	28.48	6	35.33
Hemychriptophyte (HE)	9	6.15	5	10.13
Epyphyte (EPY)	1	0.21	0	0

Species palatability. The dominance palatable Class in both site was medium palatable class (II) with 47.56%. The percent of high palatable class (I) under gazelle grazing was twice of under livestock grazing, While the percent of low – unpalatable (III) under livestock grazing was more (table 5).

Table 5. Palatability class: I = high palatable; II = medium palatable; III = low-unpalatable

Palatability class	Golestan National Park		Ghorkhoud Protected Area	
	No. of species	%	No. of species	%
I	4	15.49	1	6.94
II	8	47.64	4	47.48
III	26	36.76	6	45.57

5. DISCUSSION

Many studies worldwide have shown that constant and intensive grazing of rangelands can be damaging to plant and plant communities, because it removes leaf area that is necessary to absorb photo synthetically active radiation and convert it to chemical energy (Caldwell et al., 1981; Briske & Richards, 1995; Ahmed et al., 2006; Mosallam, 2007). steppe habitat of GNP's vicinity under livestock grazing have experienced similar plant removal from herb ivory that has result in dominance unpalatable (class III) and annual species such Salsola kali, Cousinia bakhtiarica and Eremopyrun bonaipartis. It can be said that annual species (Therophytes) exist mostly in livestock grazing areas, and occur much less in gazelle grazing area with proper management (Fig 2 and 3). The negative impact of continuous grazing on species composition will continue to increase as long as no change in management has taken place. We observed substantially higher herbaceous species diversity in gazelle grazing area compared to livestock grazing area. In agreement with these results Milchunas and Lauenroth (1993); Osem (2002) reported that grazing by domestic livestock is commonly associated with changes in species composition in rangelands throughout the world. Holechek et al (2004) investigated the direct and indirect impacts of livestock grazing on wild life habitats. He said that "the direct effect of livestock grazing in wildlife habitat is removal forage and trampling, that cause to destroyed suitable food and refuge for wild life and lost their habitat. Kind of livestock has different impact on vegetation cover because of food habits of them are different. If removal of forage is severed the number of wildlife is reduced due to destroyed of food diversity and vegetation cover. Studies about indirect impacts of livestock grazing in wildlife habitat is less than direct impact, but the first and main of these impacts is change on vegetation composition and biomass production because of grazing". Result indicated, under livestock grazing the percent of grasses (especially Therophyte) were more than under gazelle grazing (Fig 4) and (table 4); Eremopyrun bonaipartis at 33.40% is annual

grass (Therophyte) that was dominant under livestock grazing (Fig 3). The high percentage of Therophytes indicated that recovery time was limited for other plants to establish in the community, in particular Phanerophytes and Chamaephytes, which required more time to re-establish in newly rested sites. Both Phanerophytes and Chamaephytes place their buds higher off the ground and subsequently are more sensitive to grazing compared to plants that maintain their buds at ground-level or below the soil surface (Liddle, 1975). These findings correspond with several studies, which report changes in plant species composition result from livestock grazing (Smith & Schmutz, 1975; Noy-Meir et al., 1989); Domestic Livestock by selecting grazing can decrease plant mass and change plant composition and then make change in wildlife habitat (Holechek et al, 2004).

Regarding biomass production, this study substantiates results reported in comparable studies from similar biophysical regions, where grazing has had a negative effect on rangeland productivity and sustainability (Gallacher & Hill, 2006; Ouled Belgacem, 2008). Differences in overall herbaceous biomass production between gazelle (200 kg/ha) and livestock grazing (80 kg/ha) and area were highly significant (P = 0.000). Continuous grazing has been shown to be particularly disturbing toward total herbaceous biomass production (Crawley, 1983). Investigate of vegetation cover is important from two aspect; in one hand, An increase in exposed soil coinciding with a reduction in vegetation cover can be perceived as an indicator of ecosystem dysfunction (Tongway & Ludwig, 1997). Lower vegetation cover reduces the efficiency with which resources can be captured and utilized such as water, organic material and nutrients (Blackburn, 1986; Humberto et al., 1996; Simons & Allsopp, 2007). On the other hand, cover for wild life herbivores in compare of livestock is more important, because they use of cover as a habitat and refuge. Wild life tends to live in shrub lands due to escape of predators. Also Exist of strong correlation between cover and food is proved. In this case study, While both area had significant different canopy cover (P=0.000) with preventing of livestock grazing in Protected area resulted in an increase in total plant cover, food production and preventing of water erosion at this area and gazelle grazing area in GNP.

Considering the impact of gazelle and sheep grazing on vegetation cover, their tracks and fecal remains around vegetation can be used to determine the species which are under gazelle and sheep grazing in any region. Erutia ceratiidea, Alyssum strigosum, Artemisia. herba alba, Poa bulbosa, Bromus tectorum species are under gazelle grazing, as similarly reported by Ajami (2002). Sheep also feed from these species in their grazing area. According to our results, sheep and gazelle use the same growth types, but their food preference is different according to time and place. Campos-arceiz et al (2004) reported that botanical compositions and particle size distributions of the feces were similar between those of Mongolian gazelles and sheep/goats (Pianaka's index 0/97), Therefore, the increase in the number of domestic sheep/goats might pose a risk of increased competition for food and space for Mongolian gazelle populations. In fact this is obvious that sheep grazing in protected area near Golestan National Park can reduce the production of gazelle food because of they are competitor with them and have strong food overlap. The food preference of gazelle in descending order is: shrubs, forbs and grasses, respectively, while sheep prefer forbs to shrubs and grasses, respectively. Therefore, forbs constitute an important proportion in the diet of gazelle and sheep. Our results indicate that the production of forbs was lower than shrubs and grasses in the study area, but grazing density in radiation plots around watercourses (gazelle grazing area) and in sheep grazing area showed that gazelle and sheep prefer to use forbs and shrub rather than grasses. Junsheng et al. (1999) reported that the election Index (E) value of forbs is bigger than that of grasses in spring and summer and gazelle preferred to utilize forbs although the amount and distribution of forbs were smaller in the study area. Dirschl (1963) reported that Pronghorn distribution in Saskatchewan, Canada, was directly correlated with the occurrence of plant species (i.e., shrubs and forbs) with high protein content. In confirming this, Holchek (2004) argued that if forbs were abundant in a region, then domestic and wild livestock would prefer to feed on them. However, to achieve a more accurate result regarding sheep and gazelle food preference, it is necessary to use other techniques such as stomach and fecal analysis. According to the results of this study gazelles in general would not adversely affect natural pastures, however, in many areas, especially in the dry lands they could cause much damage to artificial pastures, and wheat and barley crops planted in spring.

6. CONCLUSION

Studies have shown that in compare with wild gazelle, intensive grazing by livestock in semiarid rangelands can damage plant community structure, increase bare-ground exposure. This degradation often results in undesirable plant species composition, invader species, sharp declines in plant biomass production and canopy cover. In a Ghorkhoud Protected Area that has been exposed to livestock grazing, we found that intensive grazing of more palatable species shifted plant community composition toward less desirable forage species (i.e Salsola kali, Cousinia bakhtiarica and Eremopyrun bonaipartis). A reduction in floristic structure and composition subsequently reduced the carrying capacity of these lands, a condition that strains the economic and social fabric of this region. We were also able to describe the palatability of the species found in gazelle and livestock grazing area. From these data, we are able to propose a management strategy to reduce the impacts of overgrazing by domestic animal on

plant community condition. Proper management can in turn reduce rangeland degradation and slow the rate of desertification in more habitats of vulnerable wildlife species. So, from the viewpoint of range management and conservation of the endangered gazelles, livestock grazing should be controlled in protected area that located close to Glestan National Park.

ACKNOWLEDGEMENTS

I am very thankful to Mr. Javad Selyari and his colleagues in Golestan National Park for helping me in data collection. I would also like to thank Dr. Mousa Akbarlou for his help in Identification of floristic list of field study and vicinity area.

Table 6. List of species in steppe habitat of GNP under gazelle grazing and GPA under livestock grazing.

Species	GNP	Protected are	Family	Growth	Growth form	Biology type	Palatability
Artemisia sieberi	√	√	Asteraceae	P	Shrub	CH	II
Poa bulbosa	√	√	Poaceae	P	Grass	GEO	II
Eremopyrun bonaipartis	√	√	Poaceae	A	Grass	TH	III
Anabasis aphylla	√	0	Salsolaceae	P	Shrub	CH	III
Stipa barbata	√	√	Poaceae	P	Grass	HE	II
Raphanus sp	√	0	*Brassicaceae*	A	Forb	*TH*	II
Gagea sp	√	0	*Liliaceae*	p	Forb	*GEO*	III
Zosimia absinthifolia	√	0	Apiaceae	P	Forb	HE	III
Sencio sp	√	0	Asteraceae	A	Forb	*TH*	II
Papaver nemai	√	0	*Papaveracea*	A	Forb	*TH*	III
Delfinia sp	√	0	*Brassicaceae*	A	Forb	*TH*	III
Salvia nomorosa	√	0	*Lamiaceae*	p	Forb	*HE*	III
Capsella bursa-pastoris	√	0	*Brassicaceae*	A	Forb	*TH*	III
Myosotis peseudoprovinqua	0	√	Boraginaceae	A	Forb	TH	II
Alyssum strigosum	√	√	*Brassicaceae*	A	Forb	TH	III
Astragalus spp	√	0	Fabaceae	A	Forb	TH	I
Tragopogon sp	√	0	Asteraceae	P	Forb	HE	I
Papaver spp	√	0	Papaveracea	A	Forb	TH	III
Jeaenium sp	√	0	*Geranniacea*	A	Forb	TH	II
Eurotia ceratoides	√	√	Salsolaceae	P	Shrub	CH	II
Carex stenophila	√	√	Cyperaceae	P	Forb	HE	III
Veronica persicum	√	0	*plantaginaceae*	A	Forb	TH	III
Cousinia bakhtiarica	√	√	Asteraceae	P	Forb	HE	III
Tulipa sp	√	√	*Liliaceae*	P	Forb	GEO	III
Arabis sp	√	0	*Brassicaceae*	A	Forb	*TH*	III
Lathyrus sp	√	0	*Fabaceae*	A	Forb	*TH*	III
Salsola arbeskoliphormis	√	0	Salsolaceae	P	Shrub	*CH*	III
Descraina Sophia	0	√	*Brassicaceae*	A	Forb	*TH*	III
Bromus tectorum	√	0	Poaceae	A	Grass	*TH*	II
Ziziphora sp	√	0	*Lamiaceae*	A	Forb	*TH*	III
Salsola rigida	√	√	Salsolaceae	P	Shrub	*CH*	I
Orbanch sp	√	0	*Orbancheace*	A	Forb	*EPY*	III
Salsola kali	√	√	Salsolaceae	A	Forb	*TH*	III
Stachys sp	√	√	*Lamiaceae*	P	Forb	*HE*	III
Terigounela sp	√	0	*Fabaceae*	A	Forb	*TH*	I
Eromostachys sp	√	0	*Lamiaceae*	P	Forb	*HE*	III
Asteragalus tribuloides	√	0	Fabaceae	A	Forb	*TH*	III
Consolida ajasis	√	0	*Ranunculaceace*	A	Forb	*TH*	III
Euphorbia.spp	√	0	*Euphorbiaceae*	A	Forb	*TH*	III
Peganum hermula	√	√	Zygophillaceae	P	Forb	*HE*	III
Tribulus terrstris	0	√	Zygophillaceae	A	Forb	*TH*	III
Zygophyllum atriplicaides	√	√	Zygophillaceae	P	Bush	*PH*	III

present: √ Absent: 0 A: annual P:pernnual

REFRENCES

Ahmed, M., F.A. Raza, J. Masoud and I. Ali, 2006. Ecological assessment of production potential for rangeland vegetation in Southern Attock, Pakistan. *Int. J. Agric. Biol* 8: 212–215.

Ajami, H. 2002. Estimation of gazelle carrying capacity in Kolah Ghazi National Park, Master thesis, Faculty of Natural Resources, University of Tehran.

Briske, D.D. and J. H. Richards, 1995. Plant responses to defoliation: a morphological, physiological and demographic evaluation. *In*: Bedunah, D.J. and R.E. Sosebee (eds.), *Wildland Plants: Physiological Ecology and Developmental Morphology*, pp: 635– 710. Society for Range Management, Denver, Colorado.

Blackburn, W.H, T.L. Thurow and C.A. Jr. Taylor, 1986. "Soil erosion on rangeland". *In*: *Use of Cover, Soils and Weather Data in Rangeland Monitoring Symposium Proceedings*, pp: 31–39. Society for Range Management, Denver, Colorado.

Caldwell, M.M, J.H. Richards, D.A. Johnson, R.S. Nowak and R.S. Dzurec, 1981. Coping with herbivory: photosynthetic capacity and resource allocation in two semiarid Agropyron bunchgrasses. *Oecologia*, 50: 14–24.

Chaichi, M.R, M.M. Saravi and A. Malekian, 2005. Effects of livestock trampling on soil physical properties and vegetation cover (case study: Lar Rangeland, Iran). *Int. J. Agric. Biol*., 7: 904–908.
.
Campos-arceiz, A, S. Takat suki and B. lhagvasuren. 2004. Food overlap between Mongolian gazelles and livestock in Omnogobi, southern Mongolia. J. SpringerLink. 19: 455-460.
Crawley, M.J, 1983. *Herbivory: The Dynamics of Plant-animal Interactions*, p: 437. Oxford, United Kingdom: Blackwell Scientific Publications, UK.

Cretenberger, J .1987. Mammalian, t.51, n. 4.

Daubenmire, R. 1959. A Canopy-coverage method of vegetational analysis. Northwest Science. 33:43-64.

Dirschl, H. J. 1963. Food habits of the pronghorn in Saskatchewan. Journal of Wildlife Management 27:81-93.

El-Gazzar, A, M. A. El-Demerdash, H.F. El-Kady and S. Henidey, 1995. *Plant Life in the Gulf of Aqaba Area (S. Sinai, Egypt)*. Final report submitted to the Department of Protectorates of the Egypt. Egypt Environ. Affairs Agency (EEAA), Cairo.

El-Demerdash, M.A., S.Z. Henidy and H.F. El-Kady, 1996. Vegetation and conservation measures in Ras Mohammed sector of the protected areas in Southern Sinai, Egypt. *J. Union Arab Biology 3rd International Conference (b).*

Farhadinia, M.S, B. Esfandabad., M. Karami., F. Hosseini., H. Absalan and B. Nezami. 2009. Goitered gazelle, 1780: its habitat preference and conservation needs in Minadashtt Wildlife Refuge, northeastern, Iran. J. Zoology in Middle East. 46(2009): 9-18.

Gallacher, D.J. and J.P. Hill, 2006. Effects of camel grazing on the ecology of small perennial plants in the Dubai (UAE) inland desert. *J. Arid Environ*., 66: 738–750.

Hassanzadeh Kiabi, B, B. Zohdad., B. Farhangdareshori., H. Majnonian., H. Gashtasbmeigoni. 1994. Golestan National Park. Published by Environmental Conservation office, 203 pp.

Heitschmidt, R.K. and C.A. Jr. Taylor, 1991. Livestock Production. *In*: Heitschmidt, R.K. and J.W. Stuth (eds.), *Grazing Management: An Ecological Perspective*, pp: 161–177. Portland, OR: Timber Press.

Holechek, J.L., Pieper, R.D. and Herbel, C.H. 2004. Range management. Fifth ed. Premtice Hall, Engle wood Clipp, NJ. 607 pp.

Humberto, S., G.P. Nabhan and D.T. Patten, 1996. The importance of Olneya tesota as a nurse plant in the Sonoran desert. *J. Veg. Sci*., 7: 635–644.

IUCN Red List.2012. http://www.iucnredlist.org.

Jiang, Z., D. Li and Z. Wang. 2000. Population declines of Przewalski's gazelle around Qinghai Lake, China. J. Oryx.34 (2):129-135.

Javanshir. K. 1976. Atlas of Woody Plants of Iran (in Persian). National Society of Natural Resources and Human Environment Conservation, Tehran, 163 pp.

Junsheng, L., Jianping, W. and Zhaowen, J. 1999. Food habits and selective grazing of Mongolian gazelle (Procapra gutturosa) in Hulunber Grassland. J. Forestry Research. 10(3): 187-190.

Krebs, J. C 2001. Ecology. Benjamin Cummings, an imprint of Addison Wesley Longman, Inc.

Le Houerou, H.N. and C.H. Hoste, 1977. Rangeland production and annual rainfall relations in the Mediterranean Basin and in the African Sahelo-Sudanian zone. *J. Range Manage.*, 30: 181–9.

Liddle, M. J, 1975. A selective review of the ecological effects of human trampling on natural ecosystems. *Biol. Conserv,* 7: 17–36.

Milton, S.J., W.R.J. Dean, M.A. Du Plessis and W.R. Siegfried, 1994. A conceptual model of arid rangeland degradation. *Biol. Sci.*, 44: 70–76.

Mosallam, H. A. M. 2007. Comparative study on protected and non- protected areas. *Int. J. Agric. Biol.* 9: 202–214.

Milchunas, D.G. and W.K. Lauenroth, 1993. Quantitative effects of grazing on vegetation and soils over a global range of environments. *Ecol. Monogr.*, 63: 327–366.

Mueller-Dombois, D. and H. Ellenberg, 1974. *Aims and Methods of Vegetation Ecology*. Wiley, New York.

Osem, Y., A. Perevolotsky and J. Kigel, 2002. Grazing effect on diversity of annual plant communities in a semi-arid rangeland. Interactions with small-scale spatial and temporal variation in primary productivity. *J. Ecol.* 90: 936–946.

Ouled Belgacem, A., H. Ben Salem, A. Bouaicha and M. El-Mourid, 2008. Communal rangeland rest in arid area, a tool for facing animal feed costs and drought mitigation: the case of Chnini community, Southern Tunisia. *J. Biol. Sci.*, 8: 822–825.

Ruiz-Fernández, E.J, R.D. Valdez-Cepeda, L. Perez-Romero, D. Rodriguez-Tenerio and R. Magallanes-Quitanar, 2007. Strategies for re-vegetation of degraded arid rangelands in Zacatecas, México. *Int. J. Agric. Biol.*, 9: 857–862.

Simons, L. and N. Allsopp. 2007. Rehabilitation of rangelands in Paulshoek, Namaqualand: Understanding vegetation change using biophysical manipulations. J. Arid Environ, 70: 755-766.

Smith, A.D. and E.M. Schmutz, 1975. Vegetative changes on protected versus grazed desert grassland ranges in Arizona. *J. Range Manag.*, 28: 453–458.

Tongway, D. and J. Ludwig, 1997. The nature of landscape dysfunction in rangelands. *In*: Ludwig, J., D. Tongway, D. Freudenberger, J. Noble and K. Hodgkinson, (eds.), *Landscape Ecology.* Function and Management, Principles from Australia's Rangeland, CSIRO Publishing, Australia.