علـوم محـیـطی سال دهم، شماره اول، پاییز ۱۳۹۱
ENVIRONMENTAL SCIENCES Vol.10, No.1 , Autumn 2013
133-144

A Study of Vegetation Response to Grazing Intensities in Mountain Rangelands of Gorgan

Ghodratollah Heydari,[1] Reza Tamartash,[2] Mohammadreza Tatian[1] and Mohsen Baghestanifar[3*]

1-Assistant Professor of Range Management Department, Faculty of Natural Resources, University of Sari Agricultural Science and Natural Resources
2-Instructor of Range Management Department, Faculty of Natural Resources, University of Sari Agricultural Science and Natural Resources
3-M.Sc. Graduated of Range Management, Faculty of Natural Resources, University of Sari Agricultural Science and Natural Resources

تاریخ دریافت: ۹۰/۹/۲۸ تاریخ پذیرش: ۹۱/۶/۲۹

Abstract
The intensive grazing of livestock of is one of the physical destroyer pressures on the rangeland ecosystems that cause reduction of vegetation and species variations. The basis for this study was to investigate the grazing effect of livestock on the plant characteristics in the grazed and non-grazed area. The Mountain rangelands of Gorgan, which have been moderately and heavily grazed areas, were selected. The systematic sampling was done randomly on four plots with three transects in each area. Simpson, Shannon, Menhinick and Margalef indices in PAST Software, recorded the species characteristics as diversity and richness in each plot. The data method used to analyzed there data was analysis of variance and means comparison in *MINITAB* Software. The results showed that the vegetation indices in heavily grazed area were less than the non-grazed area. The species diversity did not show significant difference in the moderately grazed areas comparable to other regions.

Keywords: Vegetation, Grazing intensities, Plant species, Mountain ecosystem

مطالعه واکنش پوشش گیاهی به چرا در مراتع کوهستانی گرگان

قدرت‌اله حیدری[۱]، رضا تمرتاش[۲]، محمدرضا طاطیان[۱]
محسن باغستانی‌فر[۳*]

۱-استادیار گروه مرتع‌داری، دانشکده منابع طبیعی، دانشگاه علوم کشاورزی و منابع طبیعی ساری
۲- مربی گروه مرتع‌داری، دانشکده منابع طبیعی، دانشگاه علوم کشاورزی و منابع طبیعی ساری
۳-دانش‌آموخته کارشناسی ارشد مرتع‌داری، دانشکده منابع طبیعی، دانشگاه علوم کشاورزی و منابع طبیعی ساری

چکیده
فشار چرای دام یکی از عوامل مخرب مراتع است که موجب تغییرات پوشش گیاهی و گونه‌های موجود می‌شود. اساس تحقیق حاضر بررسی اثر چرای دام بر خصوصیات گیاهی در نواحی چراشده و چرانشده بوده است. بنابراین نواحی با چرای متوسط و سنگین در مراتع کوهستانی گرگان انتخاب شد. نمونه‌برداری سیستماتیک با استفاده از سه ترانسکت و ۴۰ پلات که به صورت تصادفی بر روی آن قرار گرفت، انجام شد. فرمول‌های سیمپسون، شانون، مارگالف و منهنیک در هر پلات با استفاده از خصوصیات گیاهی ثبت شده و در نرم‌افزار PAST محاسبه شد. آنالیز واریانس و مقایسه میانگین‌های داده‌ها در نرم‌افزار MINITAB انجام شد. نتایج نشان داد که در منطقه چرانشده خصوصیات گیاهی بیش از منطقه چرای سنگین بوده است. در منطقه چرای متوسط شاخص‌های گیاهی نسبت به مناطق دیگر اختلاف معنی‌داری نشان ندادند.

کلمات کلیدی: پوشش گیاهی، شدت چرا، گونه‌های گیاهی، اکوسیستم مرتعی.

* Corresponding author. *E-mail Address*: mohsenbaghestani@yahoo.com

Introduction

Protection of the biodiversity in the pasture ecosystems with natural resource management as the ultimate goal indicators of diversity are criterion that shows the diversity of plants in the ecosystem. These indicators for the most part are calculated by combining the group/species richness and evenness, which are often due to its complexity; it is difficult to measure and estimate their composition/diversity in their natural habitat (Ludwig and Reynolds, 1988). Since the comprehensive protection of the pasture ecosystems-based management requires the maintenance of the diversity in their ecological community (Schulze and Mooney, 1993). This can only are achieved with the recognition and measurement of the species diversity. In this regard, awareness of environmental pressures that cause habitat degradation and destruction of the ecosystem, biomes, and the results are a reduction in the species diversity, is essential. The physical destruction of excessive livestock grazing is one of the pressures on pastures. Grazing of any kind is that, with changes in the abundance of key species and ecosystems are essential to guarantee survival, stability and function, these ecosystems are affected (Wilson, 1994). Grazing management has an important role in biodiversity, close administrative operations of the grazed rangelands will increase the flow of nutrients to the pasture ecosystems and biodiversity will ultimately increase (Allen-Diaz and Jackson, 2000; Allen-Diaz *et al.,* 2004; Mligo, 2006).

On the one hand, an important role in grazing management is to prevent the loss of plant species, which will eventually change the species composition in the pasture areas (Marty, 2005). At the present time, with the destruction of vegetation and loss of the pastures ecosystem and as a consequence of converting the pastures into single-system croplands the loss of species diversity is inevitable, as well as the loss of many valuable plant species, which have either disappeared from the realm of nature or are endangered (Mesdaghi, 2006).

Studies on grazing and its effects on the vegetation of the richness showed a reduction on the evenness and diversity indices as well ecological sustainability (Zahedi Pour and Ejtehadi, 1997; Salami *et al.,* 2008; Khademolhosseini, 2011). Moreover, a reduction in the richness and the diversity of species in the areas nearby, as well as the lodgings of the night animal (Hendricks *et al.,* 2005), in addition to the increasing diversity in the ecosystem and grazing pastures with moderate light conditions (Jouri *et al.,* 2008) have been reported.

Materials and Methods

The study area

The mountain rangelands of Gorgan are located south of Gorgan city. The maximum height of this region is 3688^{m} and 2218^{m} above sea level. The slopes vary in the different parts of the dominant South-North Western area. The average rainfall 330/5 mm, mean annual temperature of the Basin is 9/6 °C and the climate is cold and dry.

Research Method

The primary utilization units included a non-grazed, moderately grazed and heavily grazed areas (grazed areas around food and water sources) was determined in the rangeland.

The plant species in each of the units were collected and identified within the field survey, plant species identification and characterization of plant growth forms, palatability class of biological forms and information on existing species using the resources of flora (Flora Iranica, colorful flora of Iran) and Natural Resources Research Center of Golestan Province and with the assistance of experts.

Plant classifications were derived using the Raunkiaer biological form method; identification was based on the position of the terminal bud (Mobayen, 1982). The random-systematical sampling of vegetation was done using 100m transects and 1*1m^2 plots in each region, the most effective form of distribution pattern and size plot using local plants, the plot 1×1 m was considered (Mesdaghi, 1993). Transects to systematically determine the position and on each transect plots were inadvertently dropped. Canopy species in each plot and percent canopy cover were calculated to rank and position, additionally locations were determined by using GPS. Additionally, the basic number of plant diversity and species richness were assessed; using the VanDermark ranking method, vegetation cover within each plot was ranked (Table 1). Scale is an ordinal scale of VanDermark canopy cover was used to collect information) Barbour *et al.,* 1999). To calculate the diversity and richness indices Simpson and Shannon-Wiener diversity indices and Margalef richness index and Menhininc PAST software was used (Mesdaghi, 2006).

After transferring the data obtained in the software Excell, the data matrix was formed in action. Various tests were used on the species canopy cover percent data after logarithmic conversion Log (X+1). As a result, the mean percent canopy species were converted to a geometric mean, based on the conversion to the desired output, data processing and analysis using Minitab software version 15 the analysis ANOVA and compared in a randomized complete block design was performed with the Tukey test.

Results

Overall, 78 species of plants were included this in this operation, three of reference, the key areas and critical areas were to identify the species belonging to the 59 genera of which 22 were family. Referenced areas were 35 species, 25 species in the key area and 28 species were observed in the critical region area. Seven species are species-specific to the referenced area were included, *Allium sp.,Anthemis arvensis, Dianthus sp., Medicago sativa, Myosotis arvensis, Polygonum officinalis* and *Poterium sanguisorba*. In this region, some species such as *Artemisia aucheri, Festuca ovina, Stipa barbata, Poa bulbosa, Hordeum sp.* and *Bromus tomentellus* had the highest percentage canopy cover. Respectively, the species of the key area were *Artemisia aucheri , Stipa barbata, Festuca ovina, Poa bulbosa* and *Hordeum sp.,* the highest percentage allocated to the canopy. Also critical to the canopy cover the largest percentage belongs to *Verbascum aureum Achellea, millefoloium*

Onobrychis cornuta, Acantophyllum sp. and *Gundelia torunefortii.*

Specific species, 14 species that include the critical region were *Acantholimon sp, Anchusa sterigosa, Artimisia seiberi, Bromus danthonia, Circium armanicum, Cousinia sp, Euphorbia robustus, Eurosia sp., Lactuca orientalis, Noea mucronata, Stachys inflata, Taraxacum officinalis, Thymus serpyllum* and *Verbascum aureum*. Additionally, these11 species common to the three referenced areas, were the key and most critical *Acantophyllum sp., Achilea melifolia, Agropyron cristatum ,Agropyron desertorum, Astragalus gossipinus, Gundelia torunefortia, Hordeum sp., Melica persicus, Onobrychis cornata, Poa bulbosa* and *Stipa barbata*. Between the reference area and a key member of the 11 species common include, *Agropyron intermedium, Artemisia aucheri, Bromus inermis, Bromus tomentellus, Convolvulus arvensis, Festuca ovina, Melilotus officinalis, Poa pratensis, Potentila reptents, Trifolium alba* and *Trifolium repens.*

Review of existing vegetative forms in the three regions showed that the highest frequency in the referenced area forbs with 49% of grass and bush were the next category while the grass had a few in key differences. Most of which were forbs, then bushes, and the highest frequency in the critical region, with 46 percent bushes. According to the biological forms, and key to the reference area, respectively Hemi cryptophytes 35/63 and 84/59 percent had the highest frequency in the critical region, initially chamophytes (40/85) and then Hemi cryptophytes (37/71) were previously the highest frequency. The results suggest that the studied species is palatability class that in reference and key area Class II species. With 43 species with 39 percent devoted to the highest frequency the difference, that abundance of the key area in the same class species I had with the class II (39%), however, in the reference region there is a lower frequency (40%). The most abundant species in the critical region, with 57 percent of Class III and Class II and I respectively with 25 and 18 percent is allocated (Table 1).

Analysis variance ANOVA indicator species and species richness (Margalef index and Menhinick) vegetation in the reference area, the key and critical indicate that All three of these indicators between the three regions with significant differences were that For species number and Margalef index at 0.01% and for Menhinick index at 0.05 percent (table 2).

The averages were compared between species richness index based on data of vegetation cover in the three regions indicating that the number of species index in the critical region significantly more than the reference area and the keys were not significantly different between the two regions. About the Margalef richness index and Menhinick, a significant decrease in both indices in the critical region was to two key areas and the reference but despite higher rates of these indicators in the reference area, there was no significant difference between these two regions (Figure 1).

ANOVA results in uniformity index and Simpson and Shannon diversity indices showed that the uniformity index, and Simpson has a significant difference in the level 0.05, and Shannon index has a significant difference in the level 0.01 percent (Table 3).

Table 1- Percent abundance, growth form, the form biological and Palatability class of species in three regions of utilization

Palatability class			biological form					growth form				Areas
I	II	III	Ph	Ch	Cr	He	Th	Shrub	Grass	Forb	Bush	
40	43	17	-	20.6	8.03	63.35	8.02	-	34	49	17	Non
39	39	22	-	14.08	3.52	59.84	10.56	-	41	39	20	Mo
18	25	57	-	40.85	3.14	37.71	6.29	-	29	25	46	Heav

Therophytes = Th, Hemicryptophytes = He, Cryptophytes = Cr, Chaemophytes = Ch, Phanerophytes = Ph, I: High Palatability ,

II: Average Palatability, III: Low Palatability

Table 2- ANOVA results of number of species and species richness indices in the study areas

Areas of operation	Number of species	Margalef	Menhinick
Non-grazed	8.95	1.784	.965
Moderate	8.17	1.640	.918
Heavily	4.55	.903	.652
F	26.12**	21.68**	12.64*
MS	8.44	.412	.090
df	117	117	117

Ns: No significant; *: Significant level 0.05; **: Significant level 0.01

Table 3- Analysis of variance for uniformity and species diversity indices in the study areas

Areas of operation	Uniformity	Simpson	Shannon
Non-grazed	0.85	0.81	1.94
Moderate	0.86	0.80	1.87
Heavily	0.92	0.67	1.31
F	15.75*	16.06*	22/51**
MS	0.0163	0.0163	0.216
df	117	117	117

Ns: No significant; *: Significant level 0.05; **: Significant level 0.01

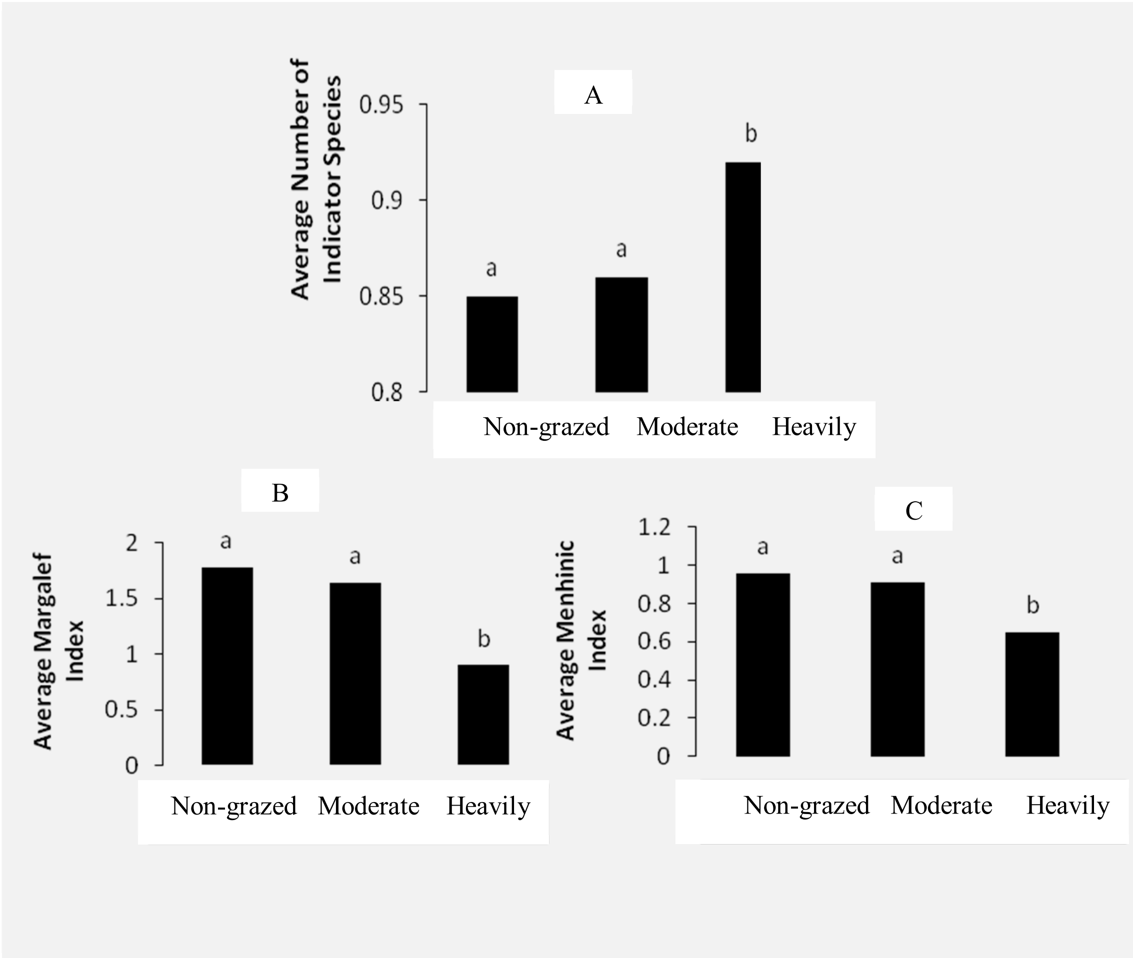

Figure 1- Mean Comparison of number of species (A), Menhinick (B) and Margalef (C) indices in the study areas

Comparison mean of species diversity and evenness indices in the reference area, a key and critical data on vegetation cover suggests that uniformity index in the critical area increased significantly compared to the reference areas and the key value key and reference in the two regions is almost identical and no significant difference. Average Simpson and Shannon diversity indices also showed no significant difference between these two indicators together in the reference area and the key while in the critical region of this area is significantly less of these two regions has been (Figure 2).

Discussion

Overall, among the 78 plant species in the reference area, key and critical were identified, the number of species was not much different in the three regions. In fact, it can be said that the operational effect and the grazing on a small number of species has changed. But what is certain, some species such as *Acantophyllum sp., Agropyron desertorum, Astragalus gossipinus, Achillea melifolia, Hordeum sp., Melica persicus, Onobrychis cornuata and Stipa barbata,* that the common presence in the three units are operating that can be seen as the native

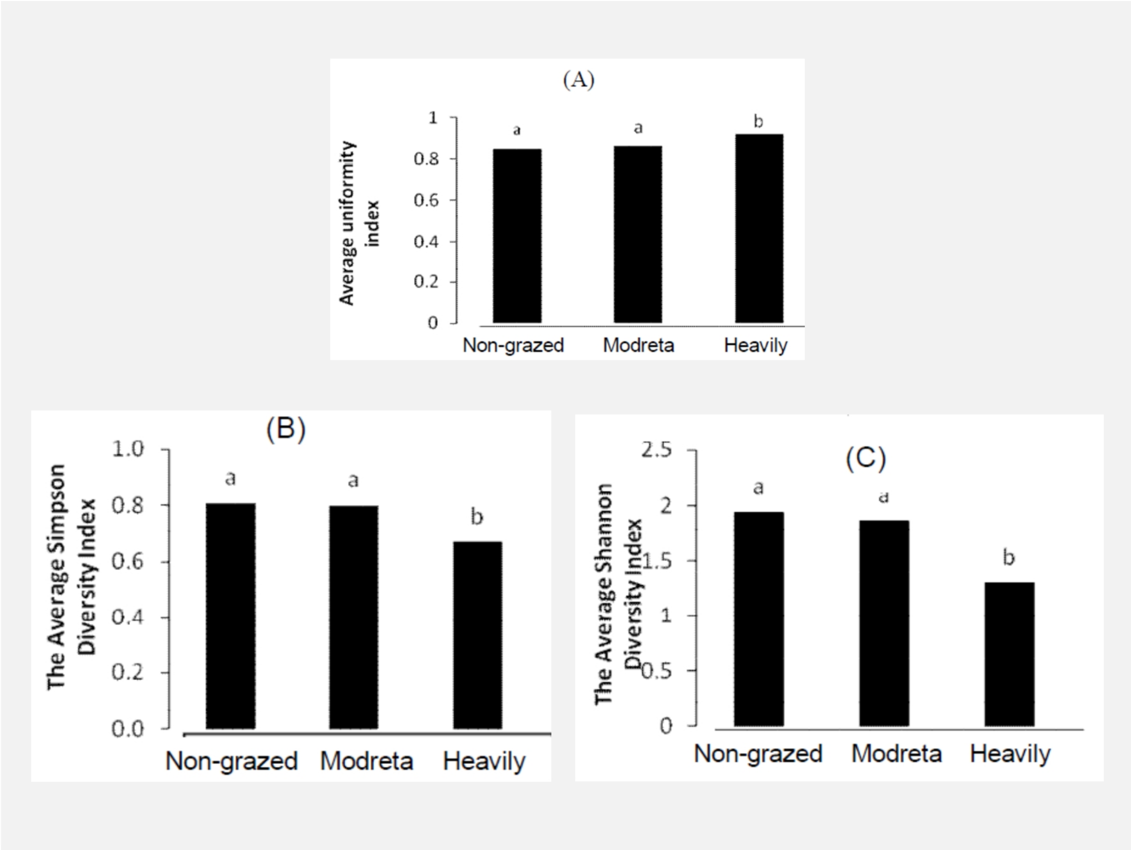

Figure 2- Mean Comparison of uniformity (A), Shannon (b) and Simpson (c) indices in the study areas

species and natural area under different conditions of operation have maintained their presence. This common species in other studies as well as the sustainable local growth in the Alborz Mountains is compatible with the habitat requirements of these ecosystems (Asadi *et al*., 2002; Shokri *et al*., 2003; Taghipour, 2006). However, the other species of livestock grazing have dramatic differences in the three units and the grazing change effects on the species composition and operation of existence show well. The presence of specific species is quite different in the operational units so that decreasers and vulnerable species to grazing such as *Medicago sativa, Polygonum officinalis* , *Poterium sanguiosorba, Dianthus sp.* are merely present in the reference areas and grazing pressure. In the critical region because of food preferences by livestock place to increase and invader species such as *Circium armanicum, Cousinia sp, Euphorbia robustus, Noea mucronata, Stachys inflata, Taraxacum officinalis* and some other species of animal that are not welcomed by facing have. These results were confirmed by Mesdaghi (2000) as well. The percentage cover of species present in each of the three regions of operation can also be received as that of a non-nutrient species. Livestock grazing is less in the critical region, which has the highest percentage of coverage, while in the key areas and the reference had a higher percentage of a more nutrient rich species. However, it should also be noted that high or low percentage of canopy cover in some cases (species *Artemisia aucheri or Dianthus sp.*) the nature of the species depends on the species and their growth forms must be considered. In this connection, Kirkpatrick & Bridle (2005) illustrated that the increase in canopy covers palatable species, due to reduced grazing pressure and preventing the entry of additional animals to the pasture. Furthermore, Pakdamani (1998) reduced the amount of canopy cover plants under the influence of livestock grazing pressure. In general, many have found what is well visible in the associated increase in species with low Palatability class III region is critical due to the intensification of grazing pressure more than any class I and II and reference key area. Ghareh daghi and Jalili (2000) and Ahmadi and Sanadgol (2007), grazing the pasture capacity decrease of canopy cover and abundance of species, invasive species and the relative increase in Class I and Class III combined pasture vegetation have been considered.

Based on the results of the survey forms and vegetative forms of biological species that can be found due to the prevailing climatic conditions associated with altitude, seasonal and annual rainfall, Therophytes species or species that cannot cope with this situation in the region, many have little, despite this position due to exposure to biological forms, its terminal bud, in dealing with grazing conditions can be difficult (Sinclair, 2005). However, Hemicryptophytes and Chaemophytes or vegetative forms of plant and perennial grass, with regard to more resistance in the environment, many studies have more than three units and in the critical region due to reduced grass species and forbs affected because of the dominance enjoy more. Studies Bastin (2003) the frequency of plant bushes species that has since influenced greatly increased.

Based on statistical analysis of the diversity and species richness in the three areas of reference, key and critical, which can be understood, livestock grazing on all parameters studied included the number of species and uniformity, as well as Margalef, Menhininc impact. Subsequently the critical region with the reference area and the key difference was significant but the key difference between the references was not significant. This difference in species number and uniformity index increased significantly in the critical region, in contrast, the richness and diversity indices, had a significant decrease that was observed in the critical region. Note that the uniformity index and the number, species abundance and distribution of individuals in the species are stressed. This shows that the effect of grazing pressure and operation eventually leads to a decrease in diversity and species richness (The concept of diversity is hidden) but on the other hand given the proliferation of invasive species can be combined to increase the uniformity and the number of lead indicators. Reduced diversity and species richness influenced by grazing pressure ZahediPour (1997) and Mesdaghi and Sadeghnezhad (2000) have also been confirmed.

No significant differences between the key and critical area that can be expected in the case of severe grazing conditions that show a certain decrease in the diversity index, otherwise, with the average difference in the amount of grazing is found. In this connection McCann (2000) stated that should not necessarily indicators of diversity between grazed and grazing in the area, there is moderate but there the difference is dependent on duration grazed. Also Hendricks (2005) and Mligo (2006) the greatest diversity of species to areas with low grazing pressure compared with grazed areas, reported.

The results of the study area vegetation can be said diverse and rich vegetation of pastures, Livestock due to excessive investment, especially in the critical region, the situation is appropriate. The key area of operation based on the best model for any level of management can be exploited in other parts of a pasture. Removal or addition of species can cause significant changes in community structure and dynamics and if the goal is to preserve the ecosystem and its component species under moderate grazing, while reasonable utilization, species richness and vegetative forms can be maintained.

Due to closed area positive effects on vegetation, the management can use non-grazing method for improvement of vegetation in critical areas. However, due to economic-social challenges we have to study these characteristics in rangelands for accesses to suitable results. In addition, with moderate grazing systems (especially in key areas) we can increase species diversity, thus this management is the best tools for sustainability of grasslands.

Resources

Ahmadi, A. and A. Sanadgole (2007) The effect of balanced grazing on the range condition improvement and animal productions in Salmas Goladam research station. Iranian Journal of Range and Desert Research, 14 (1): 80-87.

Allen-Diaz, B. and R.D. Jackson (2000) Grazing effects on spring ecosystem vegetation of California's hardwood rangelands. Journal of Range Management, 53:20-27.

Allen-Diaz, B., Jackson, R.D., Bartolome, J.W., Tate, K.W., and L.G. Oates (2004) Long-term grazing study in spring-fed wetlands reveals management tradeoffs. California Agriculture, 58(3):144-148.

Asadi, M., Masoumi, A., Khatamsaz, M. and V. Mozafarian (2002) Flora of Iran. Tehran: Research Institute of Forests and Rangelands Press. Vol, 1-27.

Barbour, M.G., Burk, J.H. and W.D. Pitts (1999) Terrestrial plant ecology. 3rd ed. Menlo Park, California: Benjamin/Cummings Publishing Company.

Bastin, G.N. (2003) Vegetation changes in semi-arid tropical Savna, Northern Australia: 1973-2002. Rangeland Journal, 25(1): 3-19.

Gharedaghi, H. and A. Jalili (2000) Comparison of vegetation composition of grazed and closed lands in Roudshour steppe Rangelands. Journal of Forest and Rangeland, 43:28-34.

Hendricks, H.H. (2005) Plant species richness and composition a long livestock grazing intensity gradients in Namaqualand (South Africa) protected area, Journal of Plant Ecology, 176: 19-33.

Jouri, M.H., Tamzad, B., Shokri, M. and B. Banihashemi (2008) Comparison of diversity and richness indices for evaluation of mountain rangeland health (Case study: rangelands of Javaherdeh of Ramsar). Rangeland Journal, 2(4): 344-356.

Khademolhosseini, Z. (2011) Comparison of numerical plant species diversity indices in three site of diference grazing intensity (Case study: Gardane Zanboori Rangeland of Arsanjan). Rangeland Journal, 4(1): 104-111.

Kirkpatric, J.B. and K.L. Bridle (2005) Comparative effects of stock and wild vertebrate herbivore grazing on treeless subalpine vegetation, eastern central plateau, Tasmania. Australian Journal of Botany, 47(6): 817-834.

Ludwig, J.A. and J.F. Reynolds (1988) Statistical ecology. New York: John Wiley.

Marty, T. (2005) Effects of Cattle Grazing on Diversity in Ephemeral Wetlands. Conservation Biology, 19(5): 1626-1632.

Mc Cann, K.S. (2000) The diversity-stability debate. Nature, 405: 228-233.

Mesdaghi, M. (1993) Vegetation analysis of semi-arid regions in northeastern Iran. Proceeding of XVII International Grassland Congress, New Zealand, 56-57.

Mesdaghi, M. (2000) Investigation of plant richness and vegetative forms of three level rangeland utilizations in semi-steppe grasslands of northeast of Iran. Journal of Agricultural Sciences & Natural Resources University of Gorgan, 7(3):55-62.

Mesdaghi, M. (2006) Plant ecology. Mashhad: Jihad Daneshgahi Press.

Mesdaghi, M. and M. Sadeghnejad (2000). Comparison of plant diversity indices of three level utilizations in semi-steppe grasslands of northeast of Iran. Journal of Agricultural Sciences & Natural Resources University of Gorgan, 7(3):63-76.

Mligo, C. (2006) Effect of grazing pressure on plant species Composition and diversity in the semi-arid rangelands of Mbulu district, Tanzania. Agricultural Journal, 1(4): 277-283.

Mobayen, S. (1982) Plant geography; plant world development, ecology, phytosociology and the main lines of Iran vegetation. Tehran: University of Tehran Press.

Pakdamani, G. (1998) Investigation of diversity and production of three levels utilization in morphological units, Robat Gharebil region. M.Sc. Thesis of Agricultural Sciences & Natural Resources University of Gorgan.

Salami, A., Zare, H., Amini Eshkevari, T., Ejtehadi, H. and B. Jafari (2008) Comparison of plant species diversity in the two grazed and un-grazed rangeland sites in Kohneh Lashak, Nowshahr. Pajoohesh & Sazandegi, 75:37-46.

Schulze, E.D. and H.A. Mooney (1993) Biodiversity and ecosystem function: a summery in: Schulze, E.D. & H.A. Mooney (eds.), Biodiversity and ecosystem function, Berlin, Springer Verlag, 497-510.

Shokri, M., Bahmanyar, M.A. and M.R. Tatian (2003). An ecological investigation of vegetation cover in Estival Rangelands of Hezarjarib (Behshahr). Iranian Journal of Natural Resources, 56(1,2):131-142.

Sinclair, R. (2005) Long-term changes in vegetation, gradual and episodic on the TGB Osborn vegetation reserve, Koonamore, South Australia. Australian Journal of Botany, 53(4): 283-296.

Taghipour, A. (2006) The effect of environment factors on rangeland plant species in Behshahr Hezarjarib region. M.Sc. Thesis of Agricultural Sciences & Natural Resources University of Gorgan.

Wilson, E.O. (1994) Biodiversity: challenge, science, opportunity. American Zoological Studies, 34:5-11.

Zahedipour, H. (1997) Investigation of plant diversity in three range management based on sampling method by models. Pajoohesh & Sazandegi, 33:71-77.

Zahedipour, H. and H. Ejtehadi (1997) Grazing effects on diversity of rangeland vegetation: a case study in Mouteh Plain, Iran. Acta Botanica Hungarica, 40: 1-4.