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Management effects on vegetation characteristics of pastures in north of Iran

Ali Akbar Tajali[1*], Mehrdad Khazaeipool[2]

[1]*Department of Agriculture Shahre Rey branch, Islamic Azad University, Tehran, Iran*

[2]*Master of the Natural Resources and Watershed management Department, Noshahr, Iran*

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Abstract

In this study some characteristics of vegetation, including canopy, plant composition, forage production and pasture condition in the pastures with different management including the grazed, short-term exclosure and long-term exclosure pastures located at watershed area in Kojur River in Chaloos-Iran were studied. To study the vegetation in each Pasture, four transects with 50 meters were located the randomized-systematic method and in each transect the characteristics of vegetation in 10 plots with 1 square meters were compared and classified using ANOVA and Duncan test. The results showed that the long-term exclosure pasture had the highest percent of canopy with 83% and the lowest percent was related to the grazed pasture with 55%. Also the highest percent of vegetations in class I in the short-term exclosure pasture and in class III in exclosure pasture have been 46% and 49%, respectively. The highest forb covering in the short-term exclosure pasture and the highest covering of bush plants in the long-term exclosure pasture were obtained 38% and 30%, respectively, that the results obtained were statistically significant at the 5% level. The amount of forage production in short-term exclosure pasture was increased 67% compared to the grazed pasture and in the long-term exclosure pasture was increased 2.5 times the grazed pasture. This study showed that the short-term removal of livestock grazing in semi-humid region has provided the opportunities required for growth of various species, especially species that were more pressured by livestock grazing and didn't have the opportunity for presence. But by the removal of livestock grazing in the long term, due to competing among species and making balance the ecosystem some species are removed and the number of species was decreased compared to the early stages of succession.

*Corresponding Author: Ali Akbar Tajali ✉ tajali_a@yahoo.com

Introduction

Pastures are the most valuable national resources for each country which its proper utilization and basic management can provide an essential role in soil and water conservation, in addition to meeting the country needs for protein(Mesdaghi 2010). Disproportion between the number of exploiters and thus the number of livestock units that feed on the pasture forage provide the grounds for the major problems including retrogression of pastures, reduction of the value pasture species, proliferation of invader species, soil erosion and totally destruction the environment(Moghadam 1998).

One of the major problems in range management projects is being livestock in excess of pasture capacity. In the pastures in the west of Mazandaran province-Iran due to stockbreeder's dependence on the licensed grazing and summer pastures and to being forested the areas that stockbreeder's livestock feed on, winter pastures have long been conventionally and after the socio-economic studies conducted by the ministry of Agriculture, the project of exit of livestock from the forest was implemented. By exit of livestock from the forest, the grazing livestock license of a large number of stockbreeders who exploit the summer pastures in the exploitation season was canceled and therefore the number of pastures became empty of stockbreeder and was declared unclaimed[1]. This research aims to study the changes in the vegetative form, the condition and trend of pastures, the production and palatability in the grazed pastures, the short and long-term exclosure for achieving the best method of management and exploitation of pasture according to the existing priorities as a result of assessing the changes in vegetation.

[1] Unclaimed in pastures that exploiter or exploiters withdraw from of the pasture management, or the pasture management license (grazing license) is canceled, the pasture become unclaimed.

Many studies were conducted about the exclosure effects on vegetation and its characteristics inside and outside the country. The study of the effects of management by using short and long-term exclosure and the grazed pasture can facilitate the process of vegetation changes vegetation and ultimately decision-making about the best exclosure way in the summer pastures through studied through changes an study of the pasture vegetation.In studying the vegetation of three area: reference, key and critical, in Golestan National Park-Iran and adjacent pastures, Ghilichnia (1996) found that in the exclosure area the forbs, in the key area where was representative and under study the grasses, and in the critical area where was the overgrazing the bush plants formed the highest percent of combination.In studying the exclosure as one of the corrective methods, Moghadam (1998) stated that in cases where all the pasture plants in the area have not destroyed and these species can be found in especial places in the areas where are as refuges for protecting the pasture species and the seed production in the pasture is possible by the eliminating livestock grazing and exclosure, the rate of pasture vegetation regeneration will be more than of seed planting in the area. Gharedaghi *et al.,* (1999) reported that uncontrolled livestock grazing on the lands under grazing caused the loss of class I and palatable species and a sharp reduction of Class II species. In studying the effect of exclosure in a period of 12 years ended 1998, in the exclosure area of pasture research station of Nir in Yazd-Iran, Arzani (1999) announced that the covering percent of *Salsola rigida*, *Stipa barbata* and *Artemisia sieberi*, inside exclosure and *Scariola orientalis* outside exclosure increased. Also in the area studied, the overall percentage of permanent vegetation inside exclosure 6% and total production of the plants measured by about 290 kg/ ha increased. In the study of semi-steppe pastures of Reza Abad area in Semnan province-Iran, Mousavi (2001) concluded that total plant canopy cover, total density of the permanent species, plant revegetation, total production per hectare and the final infiltration rate of

water in the soil in the exclosure area was increased compared to the grazed area. He also acknowledged that the reason of differences in significant levels inside and outside exclosure is the pasture management practices inside the station that lead to improve the vegetation and soil conditions and has shown itself as another effective factor in determining production levels. Hovize (2001) in his study titled effects of exclosure on the status and trends of semi-steppe pastures in Khoozestan province-Iran found that the most important effect of exclosure is increasing the production and density of the plants in exclosure. The results of this study also showed that the species diversity of pastures has been averaging about 50 to 60 species and the palatability parts of class I, II and III in the Ramhormoz area-Iran exclosure were the 2.7%, 40.27% and 57.03%, respectively and total density of plants inside exclosure increased about 40% compared to outside exclosure. Javadi *et al.,* (2004)In their study titled effects of livestock grazing on the vegetation combination and diversity pasture in Lar area-Iran, concluded that the percent of grasses and forbs covering inside the exclosure has been more than outside exclosure while the percent of bush plants has been more outside exclosure. In studying the 19 years effects of exclosure and grazing on vegetation changes in the south of Zanjan province-Iran, Aqajanloo *et al.,* (2007, 2004) stated that the combination of plant species with the palatability value of the class I had significant difference inside the exclosure compared to outside and show 28% increase. Bouchard *et al.,* (2003) in their studies stated that the proper grazing increases the species diversity and richness but the heavy grazing or lack of grazing reduces the plant species diversity and richness. Zhaoa *et al.,* (2007) concluded that heavy grazing reduces the diversity of palatable species and changes in the morphological structure of dominant species.

Materials and methods

The areas studied that have the same elevation, slope, geology and climate, include: Golestanak pasture (long-term exclosure pasture) is one of the pastures that has been excluded for 19 years and its area is 9350 hectares. Haniskord pasture (short-term exclosure) that has been excluded for 3 years and its area is 520 hectares and Tajire pasture (under grazing in range management plan) with 1258 hectares area that 1453 livestock units use from it belonging to 10 stock breeders that are located in watershed area of Chaloos river in Mazandaran province with the longitude from 51°, 25′, 00″ to 51°, 25′, 30″ and the latitude from 36°, 16′, 00″ to 36°, 18′, 30″, respectively. The climate of this area is Semi-humid according to the De Martonne method and the amount of rainfall is over 500 mm per year and the highest rainfall occurs in spring - April and the lowest rainfall occurs in summer - September. In each of long-term exclosure, short-term exclosure and under grazing areas, 40 plots with 1 m^2 area along the transect with 50 m height was measured. From the beginning, 4 transects with 50 meters were located that the two transects were perpendicular to the slope and the other two were in the direction of the slope. Along each transect, the specifications of vegetation including the percent of canopy, plant composition based on the growth form, palatability class, the production, percents of bare soil, sand and gravel and the amount of litter and number of species available in each pasture, condition, trends, and grazing capacity of pasture was studied and deduced in 10 plots. Forage production by using the method of cliping, pasture condition by using modified four-factor method and pasture trend by using trend scale were evaluated. Considering the quantitative data and proper repeat for each type in the pasture (40 repeats), the one-way ANOVA was used to compare the factors measured in three pastures described. However, before using analysis of variance, the normality and equality of variances were also studied. For the average comparison and classification of each factor, Duncan multiple-range test was used. The statistical calculations were performed using SPSS software.

Results

According to the results obtained from this research, in figure 1 the percent of pasture vegetation in three long-term exclosure, grazed and the short-term exclosure pastures at the same altitude and soil conditions has had a significant difference at the level of 5%. The average of vegetation in long-term exclosure pasture is 83.04%, in the grazed pasture is 54.98% and in short-term exclosure pasture is 71.43%. Also the percent of litter in three pastures studied had significantly difference so that the highest percent of litter has been in long-term exclosure (74.45%) and lowest has been in the grazed pasture. The percent of bare soil in long-term exclosure pasture has been the lowest amount of bare soil (8.59%) and the highest percent of bare soil has been in the grazed pasture (27.05%). The vegetation changes in various ways of long-term exclosure, under grazing, and short-term exclosure show the effects of domestic livestock grazing pressure on decrease of vegetation and palatable species (forbs) in the grazed pastures and by eliminating the cause of livestock grazing the percent of vegetation, litter increases in the short-term and long-term. Also the exclosure of pasture leads to increase soil conservation and decrease the bare soil surface.

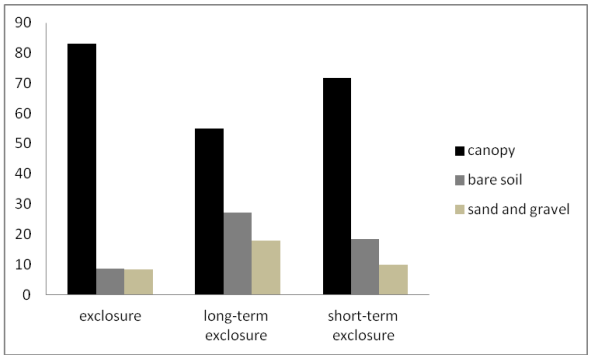

Fig. 1. Comparison of percent canopy, bare soil and sand in pastures studied.

The percent of class I vegetation in the pasture of long-term exclosure and under grazing had no significant difference but its amount compared to short-term exclosure pasture had a significant difference. Accordingly, the highest percent of Class I plants was related to the short-term exclosure pastures with 45.80%. The percent of Class II species covering in the pastures that are managed as long-term exclosure and under grazing has no significant difference together but the percent of Class II species covering with 3% in short-term exclosure pastures, like class I plants, is more than long-term exclosure pasture and pasture under grazing and shows significant differences. Also in the grazed pastures and short-term exclosure the percent of vegetation of class III species was 17.3% and 20.47% and do not show significant differences but it has a significant difference at 5% level with its amount in long-term exclosure (49.36%). The percent of poisonous plant covering in pastures under grazing and long-term exclosure was 6.1% and 5.6%, respectively, that had no significant difference together but had significant difference with the percent of poisonous plants in short-term exclosure (2.4%) (Table 1). Continuous grazing of livestock or long-term removal of livestock grazing don't cause to enhance and establish the class I species but by short-term removal of livestock grazing for 2 years, the class I plant covering was significantly increased. Perhaps the exclosure was done in the pasture where the class I and II plants has decreased or lost due to excessive grazing and by exclosure, despite the strengthening of this species, the class III species that have had better presence due to excessive grazing, could propagate and win in the competition. In studying the palatability of species, in short-term exclosure pastures the percent of covering of species with class II palatability is increased. The percent of Class III plant covering in the pastures with long-term exclosure management had no a significant difference with short-term exclosure pastures and the grazed pastures that it is caused by the type of management in the pastures. In the short-term exclosure pasture, by removing livestock from the pasture the percent of plant species with class III palatability will not increase much that it arises from the lack of the preference value of this species in fed by livestock in this pasture that was previously used. On the other hand the long-term exclosure by making

changes in plant composition reduced the presence of palatable species. the percent of poisonous plants that are mainly forbs, was observed in the grazed pastures and long-term exclosure pasture more than short-term exclosure pastures that it can be occurred due to the increase of the vegetation and appearance of species with class I and II palatability that competed against poisonous species in the grazed pastures.

Table 1. Comparison of palatability class in the pastures studied

Type of management	Factor	Percent of different class plants				Total
		I	II	III	poisonous	
Long-term exclosure	canopy	32.93	0	44.51	5.60	83.04
Grazed pasture	canopy	31.33	0.175	17.35	6.10	54.9
Short-term exclosure	canopy	45.80	3	20.48	2.40	71.68

Table 2. Forage production rate according to palatability class/kg.

Type of management	production of Class I plants	production of Class II plants	production of Class III plants	Total production per hectare
Long-term exclosure	598	0	1002	1600
Grazed pasture	389	18	233	640
Short-term exclosure	698	6	192	950

According to the results of this study, the percent of grasses covering in the grazed pastures and short-term exclosure and long-term exclosure was 28.1%, 30.3% and 32.6%, respectively, but these results had no significant difference at 5% level statistically. The results of this comparison in forbs show significant difference between the exclosure pasture and the grazed pasture with the short-term exclosure pasture. So the highest forb canopy with 38.07% is related to short-term exclosure pasture. The percent of bush plant covering in short-term exclosure pasture with 3.3% and in the grazed pasture with 4.65% had no significant difference but they show significant difference with the percent of bush plant covering in long-term exclosure pasture with 30.35% (figure 2). In this study it was determined that the percent of grasses covering in all three pasture has no significant difference and almost the covering of this vegetative form had no many changes but by the change of the management method in short-term exclosure pastures the forb species covering increased considerably that this resulted from the forage value of forbs compared to grasses and bushes for foraging the type of livestock located in the grazed pasture so that before being emptied the pasture of the farmer, the type of livestock located in the pasture was the sheep and this indicate the preference value of forbs compared to other vegetative forms for being used by livestock. In the pasture that is managed as long-term exclosure, despite presence of wildlife, the percent of bush species covering was more and has significant difference with the covering of these species in the grazed pastures and short-term exclosure pastures.

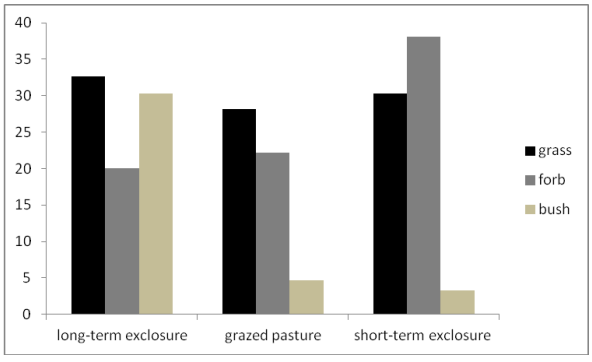

Fig. 2. Comparison of the percent plant covering based on vegetative forms.

Table 3. Determining the condition of pastures studied

Type of management	Pasture condition based on a four-factor method				Total score	Pasture condition
	Plant vigor and vitality	Plant composition	Percent of canopy	soil erosion and conservation		
	score	score	score	score		
Long-term exclosure	5	4	10	20	39*	good
Grazed pasture	7	8	6	10	31*	fair
short-term exclosure	10	10	10	16	46*	excellent

*Total score including scores of plant vigor, plant composition, percent of canopy and soil conservation in 4 factors method to determining pasture condition.

Table 4. The number of species observed in the grazed pastures.

Type of Management	the number of species observed in plots								Total
	According to vegetative form				According to palatability class				
	grasses	forbs	bushes	Total	Class I	Class II	Class III	poisonous	
Long-term exclosure	4	15	9	28	4	0	20	4	28
Grazed pasture	3	27	3	33	8	1	21	3	33
Short-term exclosure	4	28	5	37	10	1	23	3	37

The forage production rate of Class I plants in the grazed pasture is 389 kg/ha that has significant difference at 5% level with the production rate of these species in short and long term exclosure pastures . The highest production rate of class I species is in the long-term pasture with 598 kg/ha and in short-term exclosure pasture with 698 kg/ha. The results obtained from producing the species with class II palatability in the pastures studied showed that production of class II species in the short-term exclosure pasture with the amount of 60 kg/ha has a significant difference at 5% level with the production of these species in the grazed pastures and the long-term exclosure pastures. The forage production rate of class III species had no significant differences in the grazed pastures and short-term exclosure pastures but the production rate of these species had a significant difference compared to the long-term exclosure pasture. The highest production rate of these species was in the long-term exclosure pasture with 1002 kg/ha and the lowest production rate was in the short-term exclosure pasture with 192 kg/ha (Table 2). Removing the livestock factor and the long-term exclosure in the pastures studied had effect on increase of forage production rate and this amount in Class I and II species in unclaimed pastures and for the class III species in the long-term exclosure pastures had more increase and the forage production rate in the short-term exclosure pasture increased 67% compared to the grazed pasture and in the long-term exclosure pasture increased 2.5 times the grazed pasture. This increase in forage production can result from moving the pasture to climax and process of succession stages in order to achieve a balance in the ecosystem.

The pasture condition that is managed as short-term exclosure is better than the pastures that is managed as long-term exclosure and in studies this mainly results from the plant composition, vigor and vitality of plants located in the pastures such that the long-term exclosure pastures move to sustainability of the ecosystem, and the pressure of livestock grazing in the 19 years prior exclosure has caused to slow ascending process of pasture trend in the stage of succession

while in 2 years short-term exclosure pasture this process has gone more quickly toward balance. Also in the grazed pastures due to pressure from the livestock grazing and lack of observing the grazing season and the belated exit from the pasture, the pasture condition is fair and the pasture trend is descending. In study of pasture condition and trend, the process of changes from the grazed pastures to the long-term exclosure pastures shows the succession process and moving toward climax (Table 3).

Also results show that the number of species in plots for measuring the vegetation and forage production are different together in each of pastures. The number of species observed in the short-term exclosure pasture was 37 species and more than in long-term exclosure pastures and the grazed pastures. The number of species observed in long-term exclusure pasture was 28 species and the number of species in the grazed pasture was 33 species (Table 4).

Discussion

The different methods of range management including long-term exclosure, short-term exclosure and under grazing indicate the effects of grazing pressure on the reduction of vegetation and palatable species with forbs in the grazed pastures and by removing the factor of livestock grazing, the percent of vegetation and litter increases in the short and long-term. The exclosure also leads to increase the soil conservation and decrease the bare soil surface in the pasture. Also the results obtained from studying the effects of management method on plant palatability showed that continuous grazing of livestock or long-term removal of livestock grazing have not led to enhance and establish the class I species but by removal of livestock grazing in the short-term for 2 years, the class I plants covering significantly increased. Perhaps the exclosure was done in the pasture where the class I and II plants were decreased or lost due to excessive grazing and by exclosure, despite the strengthening of these species, the Class III species that have better presence because of excessive grazing, could propagate and win in the competition. Also the percent of poisonous plants which are mainly forbs were observed in the grazed pastures and long-term exclosure pastures more than short-term exclosure pastures that this can be due to an increase in vegetation and appearance of the species with I and II palatability that compete against poisonous species. As Bouchard *et al.,* (2003) and Zhaoa *et al.,* (2007) in their studies found that heavy grazing leads to decrease the diversity and richness of palatable species. The results obtained from studying the effects of management on vegetative forms showed that the percent of grasses cover in all three pasture had no significant difference and the canopy cover of this vegetative form almost had no many changes but by the change of the management method in short-term exclosure pasture, forbs species cover increased considerably that this resulted from the forage value of forbs compared to the grasses and bushes for foraging the type of livestock located in the grazed pasture so that before being emptied the pasture of the farmer, the type of livestock located in the pasture was the sheep and this indicate the preference value of forbs compared to other vegetative forms for being used by livestock. However the exclosure duration and climate of area studied can be effective for establishing and changing the plant combination resulted from exclosure. In the pasture that was managed as long-term exclosure, despite the presence of wildlife, the percent of bush species covering was more and had a significant difference with the covering of these species in the grazed and the short-term exclosure pastures. Although in the study of Javadi *et al.,* (2004) has been stressed the increase in bushes species outside exclosure, this can be due to the change in the combination of plants and the establishment of bushes in a pasture as a result of long-term exclosure. Removing the livestock factor and long-term exclosure in the pastures studied had effect on the increase of forage production rate and this amount in Class I and II species in unclaimed pastures and for the class III species in the long-term exclosure pastures had more

increase and the forage production rate in the short-term exclosure pasture increased 67% compared to the grazed pasture and in the long-term exclosure pasture increased 2.5 times the grazed pasture. This increase in production can result from moving the pasture to climax and process of succession stages in order to achieve a balance in ecosystem. The studies of Aqajanlo *et al.,* (2004), Madadi (2006), Baghestani Meibodi *et al.,* (2006) suggest that the exclosure causes to increase the pasture production that results obtained from this study also indicate it while Baghestani Meibodi (2003) in studying the short-term effects of intensity of goat grazing for 2 years considered the balanced grazing as the most appropriate way for the sustainability of ecosystem and increase of production rate. The long-term exclosure in the pastures causes the change in plant composition and as the condition results (excellent condition of long-term exclosure pasture) shows it seems that the pasture reach climax stage and the ecosystem sustainability can be obtained and therefore the small number of species succeed in the competition and remain in the plant combination. The factor of livestock grazing can keep the pasture in the stage under climax and in this stage the number of species present in the pasture is more than stable state. In this regard, Nelson *et al.,* (1997) stated that in pastures that are overgrazed in the middle stages of succession, access to food for wildlife can be easily due to the more diversity of vegetation and Nelson *et al.,* (1999) in their studies on desert pastures in Chiahuahuan emphasized the more diversity in plant communities and vegetation structure in the pastures that are in the middle stages of succession (50% remaining to the climax vegetation). Also Zamora *et al.,* (2007) in their study stated that by keeping the balance in exploitation mode human can maintain the species diversity and richness in ecosystems. In this study it was determined that the short-term removal of livestock grazing in semi-humid region provided the opportunity required for growth of different species especially species that were more pressured by livestock grazing and didn't have the opportunity for presence and therefore the number of plant species in the short-term exclosure pastures is more than two other pasture, of course It can be argued that by long-term removal of livestock grazing, due to competing among species and making balance the ecosystem, some species are removed and the number of species become less than the early stages of succession.

References

Aqajanlo F, Mousavi A. 2007. An investigation on the effects of exclosure on quantitative and qualitative changes of range land vegetation cover. Iranian Journal of Natural Resources **59(4),** 981-986.

Aqajanlo F, Akbarzadeh M. 2004. Short-term effect of exclosure on the vegetation of pastures in the various vegetative areas of Zanjan. A series of articles of the Third National Symposium on Pasture and Pasture management in Iran, Volume 1, p. 317- 324.

Arzani H. 1999. Studying the qualitative and quantitative process of changes of vegetation in the pastures of Poshtkuh, Yazd during 1986- 1998. Research and Construction Journal No. 44.

Baghestani Meibodi N, Zare M, Abdollahi G. 2006. Effect of exclosure on the changes of vegetation in the steppe pastures of Yazd in the past two decades (1986- 2004). Agriculture and Natural Resources Research Center, Yazd, Desert and pasture Research Journal of Iran 13(4).

Baghestani MN. 2003. Studying the short-term effects of different intensities of grazing goats during 1999- 2001 on some characteristics of vegetation and livestock performance in the steppe pastures of Yazd. MS Thesis, Tehran University, School of Natural Resources.

Bouchard V, Tessier M, Digaire F, Vivier JP, Valery L, Gloaguen JC, Lefeuvre JC. 2003. Sheep

grazing as management tool in Western Europen saltmarshes. Journal of Biological Conservation **326(1),** 148-157.

Gharedaghi H, Jalili A. 1999. Compare the combination of vegetation in the lands under livestock grazing with exclosure in the steppe pastures of Roodshoor. Forest and Pasture Journal, No. 43. p. 28-44.

Gilichnia H. 1996. Comparison of vegetation in reference, critical and key areas of Golestan national park and improvment pastures. Research and Construction Journal **30,** 72- 75.

Hovize H. 2001. Effect of 10-year exclosure on status of the semi-steppe pasture trend in Khuzestan. abstract articles of the Second National Symposium on Pasture and Pasture management in Iran **1,** 214.

Javadi S., Jafari M., Azarnivand H. Zahedi Q. 2004. Effects of livestock grazing on combination and diversity of vegetation Lar pasture. A series of articles of the Third National Symposium on Pasture and Pasture management in Iran **2,** 702- 707.

Madadi H. 2006. Studying the vegetation changes in Karaj Dam watershed during the past 20 years (1973-1993). MS Thesis, Islamic Azad University, Tehran Science and Research Branch, School of Natural Resources.

Mesdaghi M. 2010. Management of Iran's Rangelands. Astan Ghods Pub, p. 336.

Moghadam MR. 1998. Pasture and pasture management. Tehran University Pub, p. 480.

Mousavi M. 2001. Effect of exclosure on vegetation and soil changes in semi-steppe pastures of R. Abad, Semnan. A series of articles of the Second National Seminar on pasture and pasture management in Iran p. 254- 262.

Nelson T, Holechek J, Valdez R. 1999. Wild life plant community preference in the chihuahuan Desert .J. Rangelands **21(1),** 9-11.

Nelson T, Holechek J, Valdez R, Cardenas M. 1997. Wildlife numbers on late mid seral Chihauhuan Desert rangelands.J .Range Management **50,** :593-599.

Zamora J, Verdu JR., Galante E. 2007. Species richness in Mediterranean agroecosystems: Spatialand temporal analysis for biodiversity conservation. J.Biological conservation **134,** 113-121.

Zhaoa WY, Li JL, Qi JG. 2007 .Changes in vegetation diversity and structure in response to heavy grazing pressure in the northern Tianshan Mountain. China. Journal of Arid Environments **68(3),** 465-479.