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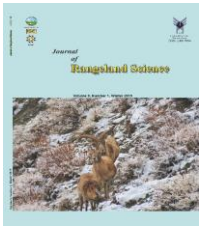

Research and Full Length Article:

Investigating the Effects of Different Harvesting Intensities on Forage Production in Sahand Rangelands of Eastern Azerbaijan Province, Iran

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Received on: 19/09/2017
Accepted on: 15/07/2018

Abstract. Due to the decreasing trend of rangelands, many native species are vulnerable and even at risk of extinction. Therefore, seed preservation and propagation of native species of rangelands and recognition of the characteristics of grazing, drought tolerance and their production potential are very beneficial. In this study, the five species of *Festuca ovina*, *Festuca rubra*, *Bromus tomentellus*, *Alopecurus textilis* and *Thymus kotschyanus*, which are the key species of Sahand Rangelands in Eastern Azerbaijan province, were studied. Treatments in each block included four grazing intensities, namely 25%, 50%, 75% and the control (no harvesting). The harvest was performed during the growing season and at the beginning of the grazing season for four years (2007-2010). Results of statistical analysis showed that the effect of harvesting intensity, year and intensity by year interaction were significant for forage production of *F. rubra*, *B. tomentellus* and *A. textilis* ($p<0.01$). However, the effect of year and intensity for *T. kotschyanus* and the effect of year for *F. ovina* were not significant. Results showed that forage production of species was different in years. Higher forage production in 75% harvest intensity was obtained in *B. tomentellus*, *F. rubra* and *A. textilis* with average values of 15.8, 18.1 and 16.7 g/p, respectively. In latter species, forage production was much affected by climate changes rather than the harvest intensity. The highest forage production of *F. ovina* was obtained in light harvest. Increasing the harvest intensity may decline plant vitality. It was recommended that allowable grazing intensity of Sahand rangeland might be 25% up to 50% harvesting intensity for preserving these species.

Key words: Allowable use, Key species, Sahand Rangelands, Climate

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Introduction

Considering the role of rangelands in livestock grazing and by products, studying the effective factors in conservation and development of rangelands for the purpose of achieving sustainable development is highly important. By the reduction of rangeland capacity, many native species are now vulnerable or at risk of extinction. Therefore, collection, seed propagation and cultivation of these native species and identifying the resistant ones to grazing and drought stress coupled with higher production are beneficial. So far, several studies have been carried out in order to determine the allowable use and capacity of rangelands. Holechek *et al*. (2003) studied the effects of light and medium grazing in the desert rangelands of southwest America for 3 years. Their results showed that moderate and light grazing (allowable use: 50% and 25%) caused decreasing and increasing the grass and *Bouteloua eriopoda* production in the year after grazing, respectively. Firincioglu *et al*. (2008) concluded that heavy grazing significantly reduced vegetation and regeneration of dominant species such as *Bromus tomentellus* in semi-degraded steppers in central Turkey. The rate of harvesting for this species in this area was recommended as 50%. According to Fulstone (2009), the allowable use of key species including *Stipa nevadensis*, *Stipa californica*, *Purshia tridentata* and *Salix spp*. were 35, 50, 55 and 55 percent, respectively. Mushtaque *et al*. (2009) studied the effects of different cutting intensities (simulated grazing) on the growth and production of *Panicum antidotale*. They concluded that frequent cutting, the height and crown area of the plant increase but the number of flowering stems decreases. Arzani *et al*. (2009) using a grid method for estimating the production and utilized intensity of rangelands in Taleghan, Iran found that 25% allowable use of *Bromus tomentellus* had the highest correlation with production. Siyah Mansoor *et al*. (2011) investigated the effect of light, medium, and heavy harvesting intensities on the *Bromus tomentellus* species and showed that this species had a negative reaction to the grazing conditions and heavy grazing had affected its liveliness. Khodagholi *et al*. (2012) studied the effects of different harvesting intensities on forage production and vitality of *Stipa barbata* Desf. in Soh site in Isfahan rangelands, Iran. Similar to other studies, their treatments included four harvesting intensities as 25%, 50%, 75% and 0(control). Their results indicated that the heavy intensity harvesting reduced the vigor and vitality of the species during the trial period so that the amount of forage production was gradually decreased during four years. They proposed the harvesting intensities of 50% for *Stipa arabica* in the study area to maintain the species' vigor and vitality during the harvest years. Zahedi *et al*. (2012) studied the effects of different harvesting intensities on forage production, vigor and vitality of *Bromus tomentellus* in Kurdistan province, Iran. They obtained the highest production from 25% intensity in 2010 (390 mm rainfall) and the lowest production for 50% and 75% intensities in 2008 (170 mm rainfall). They proposed the 25% harvesting intensity as appropriate for maintaining the production and vitality of *Bromus tomentellus*. Similarly, Bayat *et al*. (2016a) stated that climatic factors had a positive and significant correlation with the production and coverage of *Bromus tomentellus*. Karimi *et al*. (2013) investigated the appropriate allowable use for *Ajuga chamaecistus* in Kordan region, Iran. Their results showed that the amount of production was different during different years with different climate conditions. The 50% harvesting intensity was identified as suitable for *Ajuga chamaecistus*. Ahmadi *et al*. (2013&2014) studied the effect of

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different harvest intensities on the reproductive and plant characteristics of *Koeleria cristata* and *Bromus tomentellus* species. The results showed that 75% and 50% intensities had the lowest and highest production, respectively. Also, Ghasriani *et al*. (2014) investigated the effect of different harvest intensities on forage production of *Puccinellia distans* in western Azarbaijan salina rangeland, Iran and found that the 50% allowable use was suitable for this plant. Elmi *et al*. (2014) investigate the effect of two cutting management procedures on *Agropyron elongatum* in 2006-2009. The results showed that in two cutting methods, the forage production was decreased but the quality of the forage increased. The average of production in two and one cutting methods was 3190 and 2143 kgh^{-1}, respectively. Ghahareh Ardestan *et al*. (2014) studied the suitable utilization of *Astragalus caragan*, *Astragalus cyclophyllon*, *Astragalus podolobus* and *Medicago sativa* in the research greenhouse of Isfahan. According to the results, *Medicago sativa* and *Astragalus caragan* remained resistant up to 60% harvest intensity while *Astragalus cyclophyllon* and *Astragalus podolobus* were very sensitive to harvest. Ghasriani *et al*. (2014) studied *Aeluropus littoralis* in Tezkharab, Urmia, Iran. Their results showed that by increasing harvest intensity, the species production and vitality were decreased. Zarekia *et al*. (2015) proposed the 25% allowable use for *Salsola laricina* in dry rangelands of Saveh, Iran and stated that the harvesting intensity of 25% would be the guarantor of *Salsola laricina* survival in this area. Mirhaji *et al*. (2016) evaluated the tolerance of *Agropyron intermedium*, *Oryzopsis holciformis* and *Thymus fedtschenkoi* in return of harvesting intensity in Firoozkooh rangeland, Iran. Their results showed that 25 to 50% harvesting intensities were suitable for these species. In accordance with this study, Bayat *et al.* (2016b) studied the effect of three important climatic factors including precipitation, temperature and relative humidity on crown cover and forage production in Alavijeh and Khondab Steppe rangelands of Isfahan province as well as semi-steppe rangelands of Mazandaran, Iran. They reported that climatic factors had positive and significant correlation with the production and species coverage. Ghasriani *et al*. (2017) reported that increased exploitation caused problems and deteriorated vital capacities of *Aeluropus littoralis* species. By considering the harvesting effects in selected treatments, the 50% allowable use was recognized with the least negative effects on plant characteristics and vital capacity and the optimal use of all forage. Shooshtari *et al*. (2017) reported that the *Bromus tomentellus* production was not affected by different harvesting intensities and allowable use was up to 75% in the Gavanban Harsin, Kermanshah, Iran.

Investigation on grazing resistant species coupled with higher production and their roles in soil protection is in high priority. The aim of this study was to determine the best harvest intensity and to find the resistant species to grazing in five range species using a simulated grazing method.

Materials and Methods

The Study Area

The study area is located in Eastern Azerbaijan Province, Iran, 60 km south of Tabriz with the longitude of 37º 42' N 46º 17' E, and altitude of 2700 - 3420 m (Fig. 1). The area is considered as nomadic summer rangeland with the total extent of 365 ha. Based on the modified Dumarton method (Khalili, 1991), its climate is mild Mediterranean. The mean long-term rainfall based on the synoptic station (Sahand) according to data available for the period of 1990–2010 is 202.7 mm. The mean railfall in 2007 till 2010 was 347.4, 140.4, 250.4 and 261.2

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mm, respectively. The minimum, maximum and overall means of annual temperature are 7.8°C, 16.8°C and 12°C, respectively. The region land type is majorly mountainous. The vegetation landscape is grass-shrubbery and vegetation types according to composition percent and vegetation cover in the region include *Astragalus aureus*, *Festuca ovina* and *Festuca rubra*. The utilization system in this rangeland is nomadic and the grazing capacity is estimated to be 400 sheep/years. The grazing period is from mid-June until mid-September for 90 days based on the rangeland grazing permission.

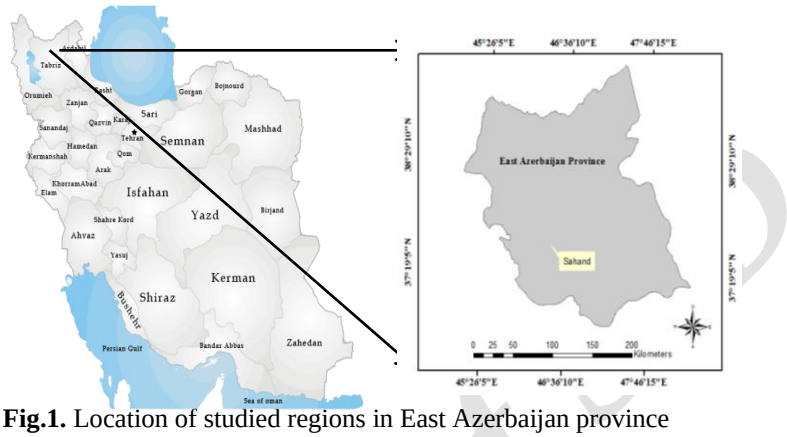

Fig.1. Location of studied regions in East Azerbaijan province

Methodology

Five important (key) species as *Festuca ovina*, *Festuca rubra*, *Bromus tomentellus*, *Alopecurus textilis* and *Thymus kotschyanus* were selected in the area of study. Then, grazing was simulated in the treatments according to the growing season of the plants and the annual regional livestock calendar (Fayaz *et al*., 2010). At the beginning of the grazing season, 40 similar shrubs from each species were selected and marked with numbered wooden plant markers. The bases were fixed during four years and no grazing was performed on them. There were four treatments for each species and each treatment included 10 replicated bases; therefore, an overall number of 40 bases were evaluated for each species. The first treatment was the control (no harvest), the second was subjected to 25% harvest intensity, the third to 50% and the fourth to 75%. Each base in each treatment was a replicate and the forage harvested from it was placed in a separate envelope to be weighed after drying. For each treatments, the cover of each base was divided into two equal parts (50%); then, each half was divided into two equal parts (25%) and this process was continued until the desired percentage for each treatment was achieved in each base (Fayaz *et al*., 2010) (Table 1). At the end of the growing season and after the plants became dry, the yield of the control treatments and the rest of the forage of the treated bases were picked and weighed. The total forage yield of each year was calculated by adding the collected yield of its months to the residual forage at the end of the growing season.

Table 1. Harvest percent of the species during the grazing season

Treatment	First turn	Second turn	Third turn	Residual forage
0 (control)	-	-	-	100
25% harvest	9	8	8	75
50% harvest	18	16	16	50
75% harvest	25	25	25	25

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In the end, the most suitable allowable was determined for each species The total forage production was analyzed using split plot design based on a completely randomized design with ten replications in four years by SPSS statistical software 17.0 and the means were compared using Duncan test.

Results

Results of variance analysis showed significant effects of treatments (harvesting intensities), year and year by harvest intensity interaction for forage production of *Festuca rubra*, *Bromus tomentellus* and *Alopecurus textilis* ($p<0.01$). However, the effect of year and harvest intensities for *Thymus kotschyanus* and the effect of year for *Festuca ovina* were not significant (Table 2).

Results of means comparison between treatments are presented in Table 3. Results showed significant differences between harvesting intensities in all of species except *Thymus kotschyanus*. The higher and lower forage production in *Festuca rubra*, *Bromus tomentellus* and *Alopecurus textilis* were obtained in 75 %harvest intensity and control (no harvesting). In contrast, for *Festuca ovina*, higher production was obtained in both 25% harvest intensity and control (Table 3). The effect of year was significant for *Festuca rubra*, *Bromus tomentellus* and *Alopecurus textilis* ($p<0.01$). The lowest forage production of these species was obtained in 2008 (Table 4).

The year by harvest intensity interaction effect was significant for *Festuca rubra*, *Bromus tomentellus* and *Alopecurus textilis*. Result of means comparison showed that for *Festuca rubra* and *Alopecurus textilis*, higher forage production was obtained in 75% harvesting intensity in 2007, 2009 and 2010. For *Bromus tomentellus*, higher production was obtained in 2009 and 2010 (Table 5).

Table 2.Analysis of variance of year effect, effect of harvesting intensity and interactions of year and harvest intensity on forage production of studied species

Source of variation	DF	MS				
		F. ovina	*B. tomentellus*	*A. textilis*	*Festuca rubra*	*T. kotschyanus*
Harvest intensity (H)	3	80.2**	249.13**	163.6**	198.6**	1.5
Error1	36	4.06	3.24	4.8	6.67	1.15
Year (Y)	3	2.07	37.5**	43.8**	78.59**	0.77
H xY	9	1.43	8.96**	9.6**	11.75**	0.66
Error2	108	1.69	3.17	2.89	3.1	0.79
CV%		11.5	14.4	11.8	11.68	20.5

*, **= significant at 1% probability levels.

Table 3. Means comparison of harvest intensity for forage production in each species

Harvest intensity	*F. ovina* g/p	*F. rubra* g/p	*B. tomentellus* g/p	*T. kotschyanus* g/p	*A. textilis* g/p
No harvesting	12.6 [a]	13.2 [c]	10.9 [c]	4.08 [a]	13.2 [c]
25% harvest	12.1 [a]	13.5 [c]	12.2 [b]	4.40 [a]	15.1 [b]
50% harvest	9.7 [b]	15.3 [b]	10.2 [c]	4.30 [a]	12.2 [c]
75% harvest	10.4 [b]	18.1 [a]	15.8 [a]	4.50 [a]	16.7 [a]

Means of column with the same letters are not significant at 0.05 probability level.

Table 4. Means comparison of years for forage production in each species

Year	*F. ovina* (g/p)	*F. rubra* (g/p)	*B. tomentellus* (g/p)	*T. kotschyanus* (g/p)	*A. textilis* (g/p)
2007	11.1 [a]	15.4 [a]	12.5 [a]	4.50 [a]	14.7 [a]
2008	11.3 [a]	13.1 [b]	10.9 [b]	4.20 [a]	12.7 [b]
2009	11.5 [a]	15.8 [a]	12.6 [a]	4.20 [a]	14.9 [a]
2010	11.3 [a]	16.0 [a]	13.1 [a]	4.30 [a]	14.8 [a]

Means of column with the same letters are not significant at 0.05 probability level.

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Table 5. Means comparison of the year by harvest intensity interactions for forage production of the species

Years	Harvest intensity	*Festuca rubra* (g/p)	*Bromus tomentellus* (g/p)	*Alopecurus textilis* (g/p)
2007	No harvest	13.1^{def}	10.9 ^{efg}	13.1^{ef}
	25% harvest	13.5^{def}	13.6^{bc}	15.7^{bc}
	50% harvest	16.1^{bc}	10.8^{efg}	11.7^{fg}
	75% harvest	18.9^{a}	14.7^{b}	18.5^{a}
2008	No harvest	12.8^{def}	9.80 ^{g}	12.8^{ef}
	25% harvest	12.6^{ef}	9.40^{g}	13.7^{ed}
	50% harvest	11.7^{f}	9.70^{g}	11.1^{g}
	75% harvest	14.8^{cd}	14.6^{b}	13.4^{ef}
2009	No harvest	13.2^{def}	11.1 ^{efg}	13.2^{ef}
	25% harvest	13.9^{de}	12.5^{cde}	15.7^{bc}
	50% harvest	16.6^{bc}	10.0^{fg}	12.8^{ef}
	75% harvest	19.4^{a}	16.6^{a}	17.7^{a}
2010	No harvest	13.8^{de}	11.7 ^{def}	13.5^{ef}
	25% harvest	14.05^{de}	13.2^{bcd}	15.3^{cd}
	50% harvest	16.9^{b}	10.3^{fg}	13.2^{ef}
	75% harvest	19.2^{a}	17.3^{a}	17.4^{ab}

Means of column with the same letters are not significant at 0.05 probability level.

Discussion

Each rangeland requires a scientific management which is applied based on the characteristics of the key species of that rangeland. In Sahand rangelands, *Festuca ovina, Festuca rubra*, *Bromus tomentellus*, *Thymus kotschyanus* and *Alopecurus textilis* were considered as valuable key species. A comparison of the four-year results of forage production of the control treatment indicated that various factors affect forage production and other plant characteristics. The amount and distribution of rainfall as well as the temperature of the growing season months and the inherent characteristics of plant species are among these factors. The highest annual rainfall in Sahand rangelands was 347.4 mm (2006-2007) and the lowest was 140.4 mm (2007-2008) which was one of the dry statistical years. The forage production of *Festuca ovina* varied in the different years of study. The lowest amount of forage production was related to the 50% and 75% harvest intensities. There were no significant differences among medium and heavy harvest intensities. Also, the effect of year was not significant on this plant and the amount of production did not differ significantly over the years. Hosseini and Ghasriani (2013) investigated the exploitation of *Festuca ovina* in semi-steppe rangelands of Saralai Abad Golestan, Iran. Their results showed that heavy harvesting had a negative impact on production. However, despite the fact that the control treatment had a significant difference in different years, another factor has been the reduction in production which the researchers described as the cause of the climatic factors and proposed the 60% intensity of harvesting for this plant. The highest amount of forage production of *Festuca rubra* was related to the 75% harvest intensity in 2009 (19.4 g/p) and the lowest was related to the 50% harvest intensity in 2008 (11.7 g/p). It seems that the intensity of harvesting did not have a negative effect on *Festuca rubra*; this plant was mostly affected by climatic conditions. In 2008, drought reduced the amount of forage production in all treatments. The heavy harvesting did not affect forage production. Therefore, in good weather conditions, medium to heavy harvesting does not cause any harm to these plants. Therefore, it is necessary to exceed the allowable use of these species during both wet and dry years for preservation of the species in the rangelands and optimization of their forage production. The amount of forage production of *Bromus tomentellus* varied in the years of study. The highest amount of forage production was related to the

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75% harvest intensity in 2010 (17.3 g/p) and the lowest was related to the 50% intensity in 2008. Therefore, the climate had more impact than the intensity of the harvest and drought coupled with heavy harvesting intensity reduces the amount of forage production in this plant. Also, Saedi *et al*. (2011) investigated the effects of cutting on *Bromus tomentellus* and stated that due to the environmental and management changes affecting this important species, grazing of livestock less than 40% of annual growth even in drought conditions will guarantee survival of this species in Saral rangelands of Kurdistan. These results are in agreement with those achieved by Zahedi *et al*. (2012). They found the highest amount of production related to the 25% harvest intensity (March 2010-February 2011) with 390 mm rainfall, and the lowest amount related to the 50% and 75% intensities (Mach 2008-February 2009) with 170 mm rainfall. The researchers proposed the light harvest intensity as the most suitable one for maintaining the production amount of *Bromus tomentellus*. According to the result, the effect of year and harvest intensities was not significant on the forage production of *Thymus kotschyanus*. The mean amount of produced forage for this species was approximately 4 g/p. Also, other researches such as Mirhaji *et al*. (2016) studied the intensity of harvesting on *Thymus fedtschenkoi* in the Firoozkooh ranges, Iran. They stated that the 75% harvesting intensity in herb growth would weaken this plant and severe grazing would disrupt plant metabolism and subsequently, reduce the forage production. In contrast, the balanced grazing had a positive effect on physiology of species and the growth of the new branch had ultimately increased its production. They also stated that this species was affected by the drought in 2008 and the lowest production was related to this year. Considering that *Thymus kotschyanus* is a multifunctional species of rangelands (medicinal uses, consumption as forage and conservation purposes), heavy harvesting can jeopardize this plant. Therefore, the 25% harvest intensity is proposed as an appropriate one for preservation of *Thymus kotschyanus*. According to the result, the effect of year and harvest intensities was significant on forage production of *Alopecurus textilis* ($p<0.01$). The highest value of forage production was related to the 75% harvest intensity in 2007 and 2009 (18.5 g/p) and the lowest value was related to the 50% intensity in 2008 (11 g/p). It seems that the climatic effect was more relevant than harvesting intensity on this plant. Also, Ghasriani *et al*. (2017) studied the effects of different harvesting intensities on forage production of *Aeluropus littoralis* species in Urmia ranges, Iran. They stated that in different years with different climate conditions, it affected forage production. Their results showed that increasing plant utilization caused plant deterioration. They proposed 50% harvesting intensities for this species. Our results showed that the level of plant resistance to grazing was not the same and this difference is due to differences in physiological and morphological characteristics of these plants. Each rangeland requires scientific management actions based on the characteristics of its plant species. The Effects of year on different harvesting intensities on *Bromus tomentellus*, *Festuca rubra* and *Alopecurus textiles* were significant ($p<0.01$) and the different harvesting intensities till 75% did not have a negative effect on the species. Therefore, these species are more affected by the climatic conditions than the harvesting intensity. In appropriate climatic conditions, medium to heavy harvesting did not harm the plants and these herbaceous species managed to maintain their vitality and vigor.

According to the results, the permitted

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margin of exploitation for Sahand rangeland, which indicates the tolerance of these species to the grazing of livestock, is proposed to be about 25 to 50 percent.

References

Ahmadi, A., Ghasriani, F., Bayat, M., Ahmadi, E., and Zare, N. 2013. Investigation the different harvesting simulation treatment on production and vigority of *Bromus tomentellus* (case study: Qarebagh rangelands, Western Azerbaijan. Journal of Range and Desert Research. 20(2):320-332. (In Persian).

Ahmadi, A., Ghasriani, F., Sanaee, A., Bayat, M., Ahmadi, E. 2014. Evaluation of effects of different cutting intensities on generative and vegetative attribute of *Koeleria cristata* in Gharebagh rangelands-West Azarbaijan province. Watershed Management Research (Pajouhesh & Sazandegi) 103: 138-146 (In Persian).

Arzani, H., Ghanimat, A. and Zare-Chahuki, M. A. 2009. Evaluating efficiency of grid method for estimating the production and utilized intensity of rangelands, Iranian Journal of Rangeland, 3(4): 611-622 (In Persian).

Bayat, M., Arzani, H., Jalili, A and Nateghi, S., 2016a. the effects of climatic parameters on vegetation cover and forage production of four grass species in semi-steppe rangelands in Mazandaran province, Iran. Journal of rangeland Science 6(4): 368-376.

Bayat, M., Arzani, H., Jalili, A., 2016b. The effect of climatic conditions on vegetation cover and production in steppe rangelands (Case Study: Alavijeh and Khondab-Isfahan province). Journal of Range and Desert Research. 23(2): 357-372 (In Persian)

Elmi, A., Jafari, A.A., Farnia, A., and Bakhtiari, M., 2014. Studying Varieties and Relationships of Yield and Quality Traits in Tall Wheatgrass (*Agropyron elongatum*) under Two Cutting Management Procedures. Journal of Rangeland Science 4(3): 224-233.

Fayaz, M.,Ghasriani, F. Ehsani, A., Akbarzadeh, M., 2010. Determining the amount of harvestable forage in rangelands, National Project of Research Institute of Forests and Rangelands, Agricultural Research, Education and Extension Organization (AREEO), Tehran, Iran (In Persian).

Firincioglu, H.K., Seefeldt, S.S., Ahin, B.S. and Vural, M., 2008. Assessment of grazing effect on steppe rangelands, in the semi-arid Central Anatolian region of Turkey. Journal of Arid Environments. 73: 1149-1157.

Fulstone, F., 2009. Annual operating instruction in Missouri flat allotment for the 2009 grazing season. USDA, Forest services, Humboldt-Toiyabe national forest, file code :2210.USA

Ghahareh Ardestan, A., Basiri, M., Wahabi, M., Torkesh, M., 2014. The effect of utilization of forage production on four range species.Journal of Applied Ecology 3(8): 77-69 (In Persian).

Ghasriani, F., Bayat, M., Ghaemi, M.T., and Yeganeh, H., 2017. Effect of different harvesting intensities on forage production and vigority and vitality of *Aeluropus littoralis* species (Case study: in Tezkhrab-uromieh saline lands of West Azarbaijan province). Journal of Range and Desert Research 24(1): 142-151 (In Persian).

Ghasriani, F., Bayat, M., Jabarzare, A., and Ghaemi, M.T., 2014. Effects of different harvesting intensities on forage production of *Puccinellia distans* in saline lands of West Azarbaijan province. Journal Range and Desert Research. 21(3): 507-517. (In Persian)

Hosseini, A., Ghasriani, F., 2013. Investigation on allowable use of sheep fescue (*Festuca ovina* L.) at Saraliabad Gorgan rangelands Seyed. Journal of Range and Desert Research. 20(2): 407-416 , (In Persian).

Holechek, J. L., Cole, R., Fisher, J. and Valdez, R., 2003. Natural resources: ecology, economic and policy. Rangelands, 26:118-223.

Karimi, GH., Yeganeh,H., Barati, H., Ghasriani, F. 2013. The effect of different levels of utilization of forage production on vegetative and generative characteristics of *Ajuga chamaecistus* at Kordan in Alborz province. Range and Watershed Journal 67(2): 316-305 (In Persian).

Khalili, A. 1991. Integrated water plan of Iran. Vol. 4: Meteorological studies, Ministry of power, Iran.

Khodagholi, M., Ghasriani, F., Bayat, M., and Azimi, M.S., 2012. Effect of different harvesting intensities on forage production and vigority of *Stipa arabica* species in Isfahan Soh site. Iranian Journal of Range and Desert Research, 19(3): 512-521. (In Persian)

Mirhaji, T., Ghasriani, F., and Azhir, F., 2016. Harvesting tolerance of *Agropyron intermedium*, *Oryzopsis holciformis* and *Thymus fedtschenkoi Ronniger*. In Firoozkooh Rangelands. Journal of Range and Desert Research. 23(2): 265-274 (In Persian)

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Mushtaque, M., Ishaque, M., Ahmad Alias Haji, M. & Bakhush, A., 2009. Effect of clipping stage on growth and herbage yield of blue panic grass. Pakistan Journal of Science, 61(4): 229-233.

Saedi, K. and Ghasriani, F., 2011. Study the seasonal changes of production and utilization of range plants in key ranges of 5 bioclimatic zones of Iran (Saral-e- Kordestan). Research Institute of Forests and Rangelands publication, 90 p. (In Persian)

Shooshtari, M., Ghasriani, F., and Ghorbankhani, A., 2017. Effects of different harvesting intensities on forage production and other characteristics of *Bromus tomentellus* Boiss. In Gavanban Rangelands of Kermanshah Province. Iranian Journal of Rangeland.23(4):810-822 (In Persian).

Siyah Mansoor, R., Ghasriani, F. and Khademi, K. 2011. Final research report of "Study the seasonal changes of production and utilization of in some key species in five bioclimatic zones of Iran (Zaghehe-Lorestan)". Research Institute of Forests and Rangelands publication, Tehran, Iran, 86p.

Zahedi, S., Ghasriani, F. Bayat, M., 2012. Effects of different harvesting intensity on production, strength and vitality of *Bromus tomentellus* (case study: Majid Abad Qorveh rangelands, Kurdistan). Iranian Journal of Range and Watershed Research, 66(2): 276-267 (In Persian).

Zarekia, S., Ghasriyani F., Bayat M., Nemati H., 2015. Determine the most appropriate of allowable use of *Salsola laricina* (Case study: Khoshkerood-e- saveh). Journal of Range and Desert Research, 22(2): 266-274, (In Persian).

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بررسی آثار شدت‌های مختلف برداشت بر تولید علوفه گونه‌های شاخص مراتع سهند در استان آذربایجان شرقی

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تاریخ دریافت: ۱۳۹۶/۰۶/۲۸
تاریخ پذیرش: ۱۳۹۷/۰۴/۲۴

چکیده. با توجه به روند سیر قهقرایی مراتع بسیاری از گونه‌های بومی در شرایط آسیب‌پذیر و حتی در معرض خطر نابودی قرار گرفته‌اند، بنابراین حفظ و تکثیر گونه‌های مرغوب بومی مراتع و شناخت ویژگی-های مقاومت به چرا و خشکی و توان تولید آن‌ها بسیار سودمند است. در این پژوهش ۵ گونه *Festuca ovina, Festuca rubra, Bromus tomentellus, Alopecurus textilis* و *Thymus kotschyanus* که از گونه‌های کلید و مهم مراتع سهند آذربایجان شرقی می‌باشند، مورد بررسی قرار گرفتند. تیمارها شامل چهار شدت برداشت ۲۵ و ۵۰ و ۷۵ درصد و شاهد(بدون برداشت) بودند و برداشت در فصل رشد با آغاز فصل چرای دام در منطقه به مدت ۴ سال (۱۳۸۶-۱۳۸۹) انجام گرفت. نتایج تجزیه آماری نشان داد، اثر شدت‌های مختلف برداشت و سال و اثر متقابل سال و شدت برداشت بر روی تولید علوفه گونه‌های *Festuca rubra*، *Bromus tomentellus* و *Alopecurus textilis* در سطح احتمال ۱ درصد معنی‌دار بود ولی اثر سال و شدت‌های مختلف برداشت در گونه *Thymus kotschyanus* و اثر سال در گونه *Festuca ovina* بر روی تولید علوفه معنی‌دار نبود. نتایج نشان داد، در سال‌های مختلف با وضعیت آب و هوایی متفاوت میزان تولید علوفه، گونه‌های مورد بررسی متفاوت بود. در گونه‌های *Bromus tomentellus*، *Festuca rubra* و *Alopecurus textiles* شدت‌های مختلف برداشت تاثیر منفی بر تولید علوفه نداشت و این گونه‌ها بیشتر از شدت برداشت تحت تاثیر شرایط اقلیمی قرار دارند. در گونه *Festuca ovina* اثر سال معنی‌دار نبود و بیشترین میزان تولید علوفه مربوط به شدت برداشت سبک بود و افزایش میزان بهره‌برداری موجب بروز مشکلات و زوال در توانایی‌های حیاتی گونه مورد نظر گردید. با توجه به نتایج حد بهره برداری مجاز برای مرتع سهند که بیانگر میزان تحمل این گونه‌ها نسبت به چرای دام می باشد، بین ۲۵ تا ۵۰ درصد پیشنهاد می‌شود.

واژه‌های کلیدی: حد بهره‌برداری مجاز، گونه‌های کلید، مراتع سهند، اقلیم

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