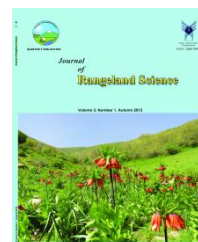http://www.opoosoft.com

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The Effect of Altitude and Aspect on Rangeland Plant Diversity (Case Study: Dashte Zahab, Kermanshah, Iran)

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Abstract. Recognizing the herbaceous plant species diversity could use as an important indicator applied for the rangeland and forests management. Considering the presence of vegetation and animal husbandry in Zagros region, Iran, being aware of the diversity and richness of plant species is necessary to management or the destructed vegetation restoration. In order to study the effect of aspect and elevation on species diversity of herbaceous plants 160 four m^2 quadrates were sampled via transect method in the Dasht e Zahab in Kermanshah, Iran. In each quadrate a list herbaceous species plants, altitude and aspect were recorded. After the inventory, the plant diversity indices were calculated and compared in three elevation classes (low: <800 m, moderate: 800 to 1200 m and high: >1200 m) and four aspect classes (North, South, East and West) using Shannon-Wiener diversity and Margalef richness indices. One-way ANOVA was used to investigate the effect of independent variables (altitude and aspects) on dependent variable (species diversity and richness). The results showed a significant effect of aspect and altitude on the diversity and richness of herbaceous plants (P<0.05). The maximum and minimum diversity and species richness were observed on the northern aspect coupled with middle elevation and on the southern aspect with low elevation, respectively.

Introduction

Biodiversity is defined as the kinds and numbers of organism and their patterns of distribution (Barnes *et al.,* 1998). Moreover, diversity has become an increasingly popular topic within the discussion of sustainability in the last decade (Schuler, 1998). This interesting topic stressed especially in the Rio declaration and renewed by the Lisbon Conference in 1998 (Neumann and Starlinger, 2001). Generally, biodiversity measurement typically focuses on the species level and species diversity is one of the most important indices which are used for the evaluation of ecosystems at different scales (Ardakani, 2004).

Considering the advance of science in the field of natural resources and needs to conserve the biodiversity and manage the precious resources of biodiversity, using of variety of different indicators to describe and compare the ecological state of ecosystems for making decisions for the natural resources management is attracted a lot of attention (Pilehvar *et al.,* 2001). Therefore, vegetation diversity studies have been conducted in order to achieve ecological information for problems solving related to the management and protection of natural ecosystems (Mesdaghi, 2001). Biodiversity guarantees the ecosystem health and diverse ecosystems leads to be more stable. Diversity is consisting of two separate concepts richness and evenness. Diversity is depending on the variety of environmental factors such as rainfall, soil and altitude within the vegetation regions outside of Northern Iran (Rahmani, 2009). Intensity of environmental resources such as light, soil moisture and nutrients in the region along with the plants ecological requirements causes the plant species habitats (Gray and Spies, 1997).

Researches on biodiversity in the Zagros vegetation region are scarce, Heydari *et al.* (2010) assessing the herbaceous plant biodiversity in a protected area, located in Ilam province, Iran and concluded that altitude and aspects have a significant effect on species richness and diversity of grass cover so that the highest rates of grass species richness and diversity were in the lower altitude (less than 1600 m) and the South direction, and the lowest diversity and richness level was observed in the high class of altitude (more than 1800 m) and the North direction. Khani *et al.* (2011) in a study for comparison between plant species richness and diversity indices along different grazing intensity in southern warm arid rangelands of Fars province, Iran showed that Margalef richness index had no significant difference between light and moderate grazing sites and no significant difference observed among Menhinick richness index of different grazing categories (p<0.05).

Lee (2005) in a study about plant diversity over the altitude ranges of 287-1680 m above sea level in southern Taiwan, illustrated that the most species richness and diversity was observed in middle elevations. Grytnes (2006) comparing the species richness of vascular plants and lichens along a altitude gradient (310-1135 m above sea level) in West Norway and concluded that most species richness was at intermediate elevations than other classes. Gracia *et al.* (2007) investigated the effect of aspects and altitude on species composition in Spain. They resulted in that aspects and altitude had no significant effects on species diversity but changes in altitude and aspects got species composition differed.

The purpose of this study was investigate Dasht e Zahab plant diversity in relation to variables such as altitude and aspect with respect to contents and the importance of herbaceous plants diversity in order to better management of natural resources.

Materials and Methods
Study area
The study was conducted in Dasht e Zahab rangeland which is located in the Kermanshah province (Iran) and has a total area of about 13199 ha (latitude range: 34°33′34" to 34°40′34" N, longitude range: 07°43′45" to 23°55′45"

E). Altitudinal range is from 480 m to 1562 m a.s.l. and the climate is semiarid temperate. Average annual rainfall is 429.5 mm and average annual temperature is 20.7 °C (Fig. 1) (Natural resource office documents, Anonymous, 2006).

Fig. 1. Geographic location of study area in Kermanshah province and Iran

Data collection
In this study in order to investigate the species diversity of herbaceous plants, 160 four m^2 quadrate were sampled on transects from low altitude to high altitude in different aspects (North, South, East and West). Within each plot, the full floristic composition of herbaceous plants were recorded. Cover classes for each species (Braun-Blanquet scale, Dombois and Ellenberg, 1974) were estimated. Topographic variables measured using GPS on each plot included: elevation (m), aspect (degrees azimuth), slope (%). At the center of each sample plot, a soil sample was taken from 0-30 cm layers of mineral soil at the same time as the floristic inventory. Soil samples were air-dried and sieved with a 2 mm screen. Total Nitrogen (N) was analyzed by the Kjeldahl method. Available Phosphorus (P) was determined by colorimetry according to Bray-II method (Bray and Kurtz, 1945) and organic carbon by the Walkley and

Black (1934) method. Exchangeable Potassium (K) was extracted with ammonium acetate (1) N and analyzed by atomic spectrometry.

Data analysis
The plant diversity indices were calculated and compared in three elevation classes (low: <800 m, moderate: 800 to 1200 and high >1200 m) and four aspect classes (North, South, East and West) using Shannon-Wiener diversity index and also Margalef index.

Margalef species richness index was calculated as following:

$$R = \frac{S-1}{Ln(N)} \qquad (1)$$

Where R is Margalef species richness, S is the number of species, and N is the number of individuals.

We applied the Shannon index (H') as a measure of species abundance and richness to quantify diversity of the plant species. This index takes both species abundance and species richness into

account, is sensitive to changes in the importance of the rarest classes (Heuserr, 1998). For any sample it is calculated as:

$$H' = -\sum_{i=1}^{s} p_i \ln p_i \qquad (2)$$

Where:

Pi is the proportion of individuals belonging to the ith species in the dataset of interest. Where equals the number of species and equals the ratio of cover of each species to total cover. In addition, we consider the Shanon-Winer index (E=Evenness), a measure for evenness of spread (Magurran 1988).

The Shannon-Wiener Evenness index (E) is defined as:

$$E = \frac{H'}{H_{max}} = \frac{-\sum_{i=1}^{s} p_i \ln p_i}{\ln s} \qquad (3)$$

Where:

E = Evenness = H/H$_{max}$

H$_{max}$ = ln(S) Maximum diversity possible number of species.

S = number of species = species richness Data distributions were checked for normality using the Kolmogorov–Smirnov (Zar, 1984). All diversity indices were calculated using PC-ORD for windows version 4.14 (McCune and

Mefford, 1999). Regarding to the normal distribution of the data, a one-way ANOVA were conducted and DMRT was used to test the significant differences among the aspect and elevation classes for species richness, diversity and evenness indices. The Statistical tests were conducted using SPSS 18.0.

Results
Analysis of variance and means comparisons

ANOVA result showed that aspect and altitude had a significant impact on Shannon diversity and evenness indices (P <0.05) (Tables 1 and 2).

Mean diversity and evenness index of Shannon-Wiener indices in the northern aspect values was significantly greater than those of other aspects (South, East and West) (Table 1). Also in comparison of diversity and evenness indices in three altitude classes, results showed that Shannon-Weiner diversity and evenness indices in middle elevation class was significantly greater than those of low and high classes (Table 2).

Table 1. Results of one way ANOVA for diversity indices in four aspect and mean ± standard error comparison based on Duncan 5% method

Aspect Classes	Shannon Diversity	Evenness
North	0.809±0.013 [a]	0.756±0.028 [a]
South	0.683±0.022 [c]	0.543±0.014 [c]
East	0.726±0.020 [c]	0.621±0.031 [b]
West	0.731±0.010 [b]	0.680±0.250 [b]
F Value	12.42[**]	7.45[**]

[**]=significant at 5% level
Index with different letters indicates significant differences at 5% level

Table 2. Results of one way ANOVA for diversity indices in three elevation classes and mean ± standard error comparison based on Duncan 5% method

Elevation Classes	Shannon – Weiner	Evenness
Low <800 m	0.648±0.015 b	0.68±0.035 b
Intermidate (800-1200)	0.734±0.018 a	0.818±0.058 a
High > 1200 m	0.645±0.011b	0.566±0.021 b
F Value	8.93**	10.61**

[**]=significant at 5% level
Index with different letters indicates significant differences at 5% level

Result of one way ANOVA for Margalef index data showed that the aspect had a significant effect on the on species richness (P<0.05). However, the effect of altitude on Margalef index was not significant (Table 3). Results of Duncan's comparison test showed that the highest species richness of the Margalef was obtained in the north aspect which is statistically higher than other aspects (Fig. 1). Results comparison between altitude showed no significant differences, however, the higher species richness was obtained in the middle-elevation and (Fig. 2).

Table 3. ANOVA results for species richness and range in elevations and aspects

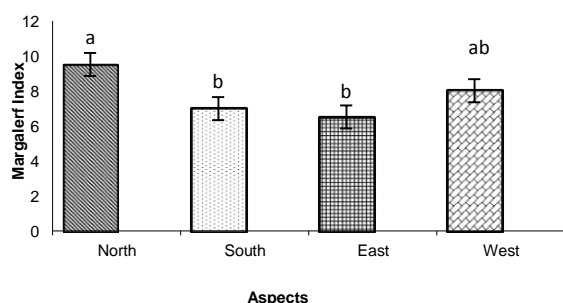| Source of Variation	Margalef Richness Index	
	df	F Value
Aspect	3	4.489^{*}
Altitude	2	1.33^{ns}

Fig. 2. Mean comparison of Margalef index in the four aspects
Column with different letters indicates significant differences at 5% level
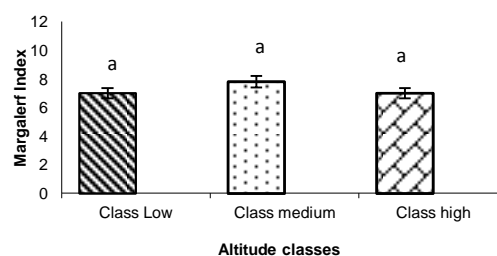

Fig. 3. Mean comparison of Margalef index in three altitude classes
Column with different letters indicates significant differences at 5% level

Correlation between variables

The effect of Nitrogen, organic carbon, potassium, phosphorous and altitude above sea level were analyzed on the different diversity, evenness and richness indices using Pearson correlation coefficients. Correlation between soil properties with diversity indices and altitude over of all aspects are presented in (Table 4).

Results showed a positive correlation between altitude with both organic matter and potassium (P<0.01). It was also showed a positive correlation between altitude and nitrogen and phosphorus (P<0.05). So that, with increasing the elevation the amounts of all of soil chemical properties was significantly increased for all of aspects (Table 4). Correlation coefficients show that there was no relationship between diversity index and Shannon evenness index and potassium, phosphorus, nitrogen and organic matter in over all of aspects. However, the correlation between Margalef Richness and organic matter was positively significant, indicating that by increasing soil carbon the Margalef species Richness will increased (Table 4).

Table 4. Correlation between diversity indices, evenness, species richness, soil chemical properties and altitude over of all aspects

Index	Nitrogen	Organic Matter	Potassium	Phosphorous	Altitude
Shannon Diversity	-0.021^{ns}	0.046^{ns}	0.137^{ns}	0.110^{ns}	0.026^{ns}
Shannon Evenness	-0.058^{ns}	0.041^{ns}	0.063^{ns}	0.059^{ns}	0.095^{ns}
Margalef Richness	0.150^{ns}	0.250^{*}	0.073^{ns}	0.133^{ns}	0.031^{ns}
Altitude	0.362^{*}	0.362^{**}	0.336^{**}	0.280^{*}	-

** Correlation significant at the one percent level, * Significant correlation at the five percent level
^{ns}=Showed no statistical relationship

Correlations coefficients between diversity indices and soil chemical properties for each individual aspect are presented in (Table 5). Correlation coefficients show that there was no relationship between diversity index and Shannon evenness with all of soil chemical properties in different aspects. However, in the north aspect there was a positive correlation between Nitrogen and margalef richness, indicating that by increasing soil nitrogen content in northern aspect, the margalef species richness will increase (Table 5). Furthermore, in the same aspect the effect of altitude was statistically significant on Shannon Diversity. Indicting that in the north aspect by increasing elevation, the margalef richness will be increased. There was generally no correlation between soil factors with diversity indices in south, east and west aspects in the study area.

Table 5. Correlation between diversity indices, evenness, species richness and soil chemical properties in the different aspects

Aspect	Soil Properties	Shannon Diversity	Shannon Evenness	Margalef Richness
South	Nitrogen	-0.041^{ns}	-0.034^{ns}	0.021^{ns}
	Organic matter	-0.008^{ns}	-0.006^{ns}	0.062^{ns}
	Potassium	0.142^{ns}	0.002^{ns}	-0.004^{ns}
	Phosphorus	0.071^{ns}	-0.051^{ns}	-0.012^{ns}
	Altitude	-0.013^{ns}	-0.007^{ns}	0.038^{ns}
North	Nitrogen	-0.056^{ns}	0.082^{ns}	**0.251^{*}**
	Organic matter	0.091^{ns}	0.074^{ns}	0.172^{ns}
	Potassium	0.085^{ns}	0.051^{ns}	0.072^{ns}
	Phosphorus	0.173^{ns}	0.023^{ns}	0.175^{ns}
	Altitude	**0.245^{*}**	-0.091^{ns}	0.071^{ns}
East	Nitrogen	0.008^{ns}	0.110^{ns}	0.163^{ns}
	Organic matter	-0.009^{ns}	-0.008^{ns}	0.103^{ns}
	Potassium	0.007^{ns}	0.004^{ns}	0.003^{ns}
	Phosphorus	0.007^{ns}	-0.004^{ns}	0.003^{ns}
	Altitude	0.083^{ns}	0.009^{ns}	0.021^{ns}
West	Nitrogen	-0.013^{ns}	0.021^{ns}	0.195^{ns}
	Organic matter	-0.021^{ns}	0.085^{ns}	0.112^{ns}
	Potassium	0.121^{ns}	0.054^{ns}	0.021^{ns}
	Phosphorus	0.106^{ns}	0.008^{ns}	0.097^{ns}
	Altitude	0.201^{ns}	0.122^{ns}	0.023^{ns}

*,** Correlation coefficients are significant at 0.05 and 0.01 level, respectively.
^{ns} = showed no significant relationships.

Discussion and Conclusion

Physiographic factors (aspect, slope, altitude) play an important role in the presence or absence of species with their effect on soil moisture, soil chemistry, and other factors (Enright *et al.,* 2005). The results of this study indicate that the aspect had a significant effect on richness, evenness and species diversity of plants, in this case, the northern aspect includes the most species diversity, evenness and richness indices and the Southern direction had lowest values. In agreement with the current study, many studies showed that aspect was an important factor in the distribution of ground flora (Hutchins *et al.*, 1976. Huebner *et al.,* 1995; Olivero and Hix, 1998; Eshaghi Rad and Shafiei, 2010).

Considering the difference in the amount of the received solar radiation energy on the different aspect and also the more the sun's energy, the more soil moisture evaporation (Garcia *et al.*, 2007), the soil moisture in the north aspect is higher than that of in the South aspect, so it finally caused to the establishment of herbaceous species in the north compared to the southern aspect.

In contrast with our finding, Heidari *et al.* (2010) concluded that diversity and species richness is highest in the south aspect in the oak forests. Vaseghi *et al.* (2011) studied the plant diversity in relation to the aspect and altitude and concluded that the aspect and altitude significantly affected the species diversity and richness. They reported that the highest species richness, evenness and species diversity of herbaceous plants are in the South aspect.

Hence the results of the present study did not match with Heidari *et al.* (2010) and Vaseghi *et al.* (2011) results. In addition, this study results showed that elevation above sea level significantly affected the richness, evenness and species diversity, so that higher diversity indices of herbaceous plants observed in moderate altitude and the minimal values occurred

in low altitude. Hegazy *et al.* (1998) studied the elevation gradient of vegetation in a southwestern Saudi Arabia, and concluded that there was the highest amount of richness and diversity in moderate altitude.

Vaseghi *et al.* (2011) in their study concluded that the moderate altitude had the most diversity and species richness. Thus, the present study results is consistent with Hegazy (1998) and Vaseghi *et al.* (2011) regarding to elevation gradient. But it is not match with the results of Heidari *et al.* (2010) who stated that most of the diversity and richness observed in low altitudes.

The main reason for the low species richness and diversity in the low altitude could be justified as this class was more accessible area for livestock grazing and man-made disturbance. The results of north aspect showed that by increasing organic carbon and phosphorus the species richness significantly increases and also we founded that the Simpson diversity index increases while organic carbon, phosphorus, potassium, and altitude increase, but the Shannon diversity index does not significantly change (Table 4). Fu *et al.* (2004) found that soil organic matter content was a good index of soil fertility and nutrient availability. More fertile soils will allow more vascular species to co-exist at small scale (Bruno *et al.,* 2002; Hart *et al.,* 2003). Mahdavi *et al.* (1389) expressed that herbaceous species diversity increased significantly with increasing organic matter in the northern aspect, which is consistent with the results of the present study.

They also expressed that the species diversity is significantly reduced with increasing altitude. Small and McCarthy, (2005) reported high amount of soil nitrogen in northern aspect of low altitudes and its influence on the distribution of vegetation types and the correlation of N and C/N ratio with vegetation location. In present study, the

results showed that the low diversity and species richness at low elevations compared to other middle and high classes, which it is due to the pastures availability human and livestock pressure on pastures that it can significantly affected the rate of production and diversity and species richness.

Therefore, the Range Plan is suggested by considering the good potential of the region weather, by drilling and wadding with the native rangeland pasture species to revive and strengthen the pastures.

References

Anonymous, 2006. Executive comparative studies of vegetation within the Dasht e Zahab. Inc. Consulting Engineers of Arman Gostar Atyeh, 45-30. (In Persian).

Ardakani, M. R., 2004. Ecology, Tehran University Press, 340pp. (In Persian).

Barnes, B. V., Zak, D. R., Denton, S., Spurr, S., 1998. Forest ecology, John Wiley and Sons, INC., 773 pp.

Bray, B. M., Kurtz, L. T., 1945. Determination of total, organic and available forms of phosphorus in soils, Soil Sci. **59:** 39–45.

Bruno, J. F., Stachowicz, J. J., Bertness, M. D., 2002. Inclusion of facilitation into ecological theory, Tree. **18:** 119–125.

Dombois, D. M. and Ellenberg, H., 1974. Aims and methods of vegetation ecology, John Wiley, New York.

Enright, N. J., Miller, B. P. and Akhtar, R., 2005. Desert vegetation and vegetation- environment relationships in Kirthar national park, Sindh, Pakistan. *Jour. Arid Environment.* **61:** 397-418.

Eshaghi Rad, J., Shafiei, A., 2010. The distribution of ecological species groups in Fagetum communities of Caspian forests: Determination of effective environmental factors, Flora. **205:** 721-727. (In Persian).

Fu, B. J., Liu, S. L., Ma, K. M., Zhu, Y. G., 2004. Relationships between soil characteristics, topography and plant diversity in a heterogeneous deciduous broad-leaved forest near Beijing, China, Plant Soil. **261:** 47–54.

Garcia-Aguirre, M. C., Ortiz, M. A., Zamorano, J. J. and Reyes, Y., 2007. Vegetation and landform relationships at Ajusco volcano using a Geographic Information System (GIS). For. Ecol. Manage. **239:** 1–12.

Gracia, M., Montane, F., Piquea, J. and Retana, J., 2007. Overstory structure and topographic gradient determining diversity and abundance of understory shrub species in temperate forest in central Pyrenees (NE Spain), For. Ecolo. Manage. **242(2-3):** 391-397.

Gray, A. N. and Spies, T. A., 1997. Microsite controls on tree seedling Establishment in conifer forest canopy gaps, Ecology. **78:** 2458-2473.

Grytnes, J. A., 2006. Species richness of vascular plants, bryophytes and lichens along an altitudinal gradient in Western Norway, Acta Oeculogical. **29(3):** 241-246.

Hegazy, A. K., EL-Demedesh, M. A. and Hosni, H. A., 1998. Vegetation, Species Diversity and floristic relations along and altitudinal gradient in south-west Saudi Arabia, *Jour. Arid Environ.* **3:** 3-13.

Heuserr, M. J., 1998. Putting diversity indices into practice. Some considerations for forest management in The Netherlands. Proceedings of the Conference on Assessment of Biodiversity for Improved Forest Planning, Monte Verita, Switzerland. Kluwer Academic Publishers, Dordrecht, 171–180. Implications for vegetation management, For. Ecolo. Manage. **95:** 1-10.

Heydari, M., Ata roshan, S., Hatami, K. H., 2010. Herbaceous plant biodiversity assessment in relation with physiographic factors in mid forest ecosystems - Dalab protected area. Renewable Natural Resources Researches**. 1(2):** 28-42. (In Persian).

Huebner, C. D., Randolph, J. C. and Parker, G. R., 1995. Environmental factors affecting understory diversity in second-growth deciduous forests, American Midland Naturalist. **134:** 155–165.

Hutchins, R. L., Hill, J. D. and White, E. H., 1976. The influence of soils and microclimate on vegetation of forested slopes in eastern Kentucky, Soil Sci. **121:** 234–241.

Khani, M., Ghanbarain, G., Kamali, M., 2011. Comparison between plant species richness and diversity indices along different grazing gradients in southern warm-arid rangelands of Fars province, Rangeland. **5(2):** 129-136. (In Persian).

Lee, T. H., 2005. Ecological patterns of distribution on gradients of elevation and species diversity of Snakes in southern Taiwan, Amphibia-Reptilia. **26(3):** 325-332.

Magurran, A. E., 1988. Ecological Diversity and Measurement. Princeton University Press, Princeton.

Mahdavi, A., Heidari, M., Eshaghi Rad, J., 2010. Study the biodiversity and species richness in relation with physiographic factors and physical-chemical soil conservation in the Great Mountain. Forest Poplar Research **18 (3):** 436-426. (In Persian).

McCune, B., Mefford, M. J., 1999. PC-ORD for windows (software). Multivariate Analysis of Ecological Data, Version 4.14. MjM Software, Gleneden Beach, OR, USA.

Mesdaghi, M., 2001. Describe and analyze vegetation (translation), Mashhad University Jihad Press, 287 pp. (In Persian).

Neumann, M., Starlinger, F., 2001. The significance of different indices for stand structure and diversity in forests, For. Ecol. Manage. **145:** 91-106.

Olivero, A. M. and Hix, D. M., 1998. Influence of aspect and stand age on ground flora of southeastern Ohio forest ecosystems, Plant Ecology. **139:** 177–187.

Pilehvar, B., Makhdoom, M., Namiranian, M., Jalili, A., 2001. Measure the Forest Woody plant diversity by using a modified Whittaker plots for Iran north forests. *Jour. Research and Development*. **53(14):** 45-41. (In Persian).

Rahmani, B., 2008. Biodiversity, pamphlets course. Gorgan University of Agricultural Sciences and Natural Resources, Gorgan, Iran. (In Persian).

Schuler, A., 1998. Sustainability and biodiversity forest historical notes on two main concerns of environmental utilization. Assessment of Biodiversity for Improved Forest Planning. Kluwer Academic Publishers, Dordrecht, 353-360.

Small, C. J., McCarthy, B. C., 2005. Relationship of understory diversity to soil nitrogen, topographic variation, and stand age in an eastern Oak forest, USA. Forest Ecology and Management. **217:** 229-243.

Vaseghi, C., Ijtihad, C., Zahedi Pour, H., 2011. Study the biodiversity and species richness in relation with aspect and altitude variables: The case of the Kalat highlands of Gonabad, Khorasan. *Jour. Science Teacher Education*. **9(3):** 558-547. (In Persian).

Walkley, A., Black, I. A., 1934. An examination of the Degtjaretf method for determining soil organic matter, and a proposed modification of the chromic acid titration method. Soil Science, **37:** 29–38.

Zar, J., 1984. Biostatistical Analysis. Prentice-Hall press.718pp.

تأثیر ارتفاع، جهت دامنه و حاصلخیزی خاک بر تنوع زیستی گیاهان مرتعی در دشت ذهاب

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چکیده

شناخت تنوع گونه‌ای گیاهان علفی می‌تواند بعنوان یک شاخص بسیار مهم در مدیریت مراتع و جنگل‌ها مورد استفاده قرار گیرد. در منطقه رویشی زاگرس با توجه به حضور دام و دامدار، مطلع بودن از وضعیت تنوع و غنای گونه‌ای گیاهان به منظور مدیریت و یا در صورت تخریب احیاء پوشش گیاهی ضروری می‌باشد. در این تحقیق به منظور بررسی تاثیر جهت دامنه و ارتفاع بر روی تنوع گونه‌ای گیاهان علفی در منطقه دشت ذهاب استان کرمانشاه (زاگرس مرکزی) تعداد ۱۶۰ کوادرات ۴ متر مربعی به روش تصادفی در منطقه پیاده گردید. در هر کوادرات فهرست گیاهان موجود به همراه فراوانی گونه‌های علفی، ارتفاع از سطح دریا و جهت دامنه ثبت شد. بعد از آماربرداری میزان تنوع زیستی در سه طبقه ارتفاعی (پائین کمتر از ۸۰۰ متری، میانی ۸۰۰ – ۱۲۰۰ متری و فوقانی بیشتر از ۱۲۰۰ متری) و چهار جهت دامنه (شمالی، جنوبی، شرقی و غربی) با استفاده از شاخص‌های تنوع سیمپسون، شانون – وینر، مارگالف و منهینیک مورد بررسی و مقایسه قرار گرفت. نتایج حاصل از آنالیز واریانس یکطرفه نشان داد که جهت دامنه و ارتفاع تاثیر معنی‌داری روی تنوع و غنای گونه‌ای گیاهان علفی در سطح ۹۵ درصد اطمینان دارد ($P<۰/۰۵$). به این صورت که در دامنه شمالی و طبقه ارتفاعی میانی (۸۰۰ – ۱۲۰۰ متری از سطح دریا) بیشترین مقدار تنوع و غنای گونه‌ای و در دامنه جنوبی و طبقه ارتفاعی پائین (کمتر از ۸۰۰ متری) کمترین مقدار تنوع و غنای گیاهان علفی مشاهده شد.

کلمات کلیدی: تنوع گونه‌ای، غنا، جهت دامنه، ارتفاع، کرمانشاه