J. Appl. Environ. Biol. Sci., 5(7)197-204, 2015

ISSN: 2090-4274
Journal of Applied Environmental and Biological Sciences
www.textroad.com

The Effect of Altitude and Slope in the Species Diversity of Herbaceous Plants (Case Study: Watershed Miandar Qarootag - Gilangharb)

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Received: February 26, 2015
Accepted: May 3, 2015

ABSTRACT

Herbaceous plants recognition of diversity in the management of pastures and forests, and all the natural sciences, is used. In this study, to investigate the diversity of herbaceous plants, with altitude and slope, 118 a square plot, over 24 transects in different geographical directions in the watershed Qarootag Gilangharb district, was walking in the Kermanshah Province. In each plot, the number of grass species to species, altitude, and slope were recorded and notes. In this study, species diversity as a dependent variable, and topographic factors such as altitude and slope, as independent variables, or using one-way ANOVA, were analyzed. The results showed that the altitude and slope, the diversity and species richness was significantly affected so that the slope of the lower classes (less than 15%), and in the middle elevation of occupants (1000-1200 m), the highest diversity index, Simpson and Shannon - Wiener there. In this study, the results showed that, statistically significant negative correlation, measures uniformity between Simpson and Shannon - Wiener, and the percentage of the slope at 95%, that is, so that by increasing the amount of tilt, the indicators uniformity Simpson and Shannon - Wiener, significantly reduced
KEYWORDS: Species diversity, altitude, slope, pasture, Gilangharb

INTRODUCTION

Range is a natural ecosystem, including large reserves of genetic resources, and a variety of plant species, which always includes a variety of grassland stability against environmental factors and biological variables (Mesdaghi, 2005). The presence and distribution of plant communities in rangeland ecosystems, but random factors of climate, terrain (topography) and earthy in their expanded role is fundamental physical and chemical properties of the soil, with vegetation, the diversity and the wide geographic distribution of plants are (Leonard et al. 1984). Destruction of vegetation ecosystems (forest and pasture), and transforming them into monoculture farming systems, loss of biodiversity is, so that many species of fauna and flora, nature, faded areas, or general are endangered (Mesdaghi and Sadegh Nejad, 2000). Therefore, due to the destruction took place, measuring biodiversity and its related parameters, such as species composition, dominance, uniformity and number of species in ecosystems, ecological assessment, is of great importance (Goodman, 1975). By studying vegetation, and different environmental factors such as physiographic, soil and climate can sustain plant communities, and the correlation between these factors and the vegetation realized that, the issue of development and restoring plant communities, is very important and practical (Basiri, 2003). Species diversity is made up of two components, the first of a number of species, and refers to the species richness. The second component is the variation of the uniformity of the distribution of species is concerned (Cocker and Kent 1996). Physiographic factors, the impact on soil moisture, chemical properties (nitrogen, potassium, Fsfrv ...), and physical (drainage, porosity, etc.), and other characteristics has an important role in the distribution of plant species and their diversity (Enright et al. 2005) .hadi (2001), about the height above sea level, with a variety of plant species, in Islam, Gilan, examined. He stated that, with increasing altitude diversity of plant species will decrease. Sohrabi (2004), with a diversity of plant species in relation to physiographic factors in forest area ten Red Javanrood city of Kermanshah, found in the lower slopes of highest diversity and species richness, and because it works Negative steep slopes, the leaching of soil, drainage, drying the soil, loss of nutrients, and reduced fertility knows. Mirzaee et al. (2007), Herbaceous plants species diversity, in relation to physiographic factors in forest ecosystems in central Zagros, examined. They said that, above sea level

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on a variety of herbaceous floor, had a significant impact and the low altitude (less than 1630 meters), the highest value of diversity, while the effect of altitude on the uniformity and species richness in not statistically significant, they also have the highest species richness, the middle class is high, because of the conditions in terms of temperature, the altitude class knew. Hejazi (1998), the analysis of the vegetation along the altitudinal gradient, in south-western Saudi Arabia, studies in three altitudinal range 500-0, 2500-500 and higher than 2500 meters, did. After the inventory to the conclusion that, in the medium height class (2500 -500 m) continuous plant communities and vegetation in the highlands, is the highest level of richness and smoothness. Heidari et al. (2010), in a protected area Dalab Ilam, herbaceous plant biodiversity in relation to physiographic factors (altitude, slope and aspect), were evaluated. They concluded that, altitude and aspect, a significant impact on the diversity and richness of herbaceous species, in this case, in the range of low (less than 1600 meters), and the highest diversity and species richness of South There. They also found that the percentage of the slope had a significant effect on the diversity and richness, in which the slopes of less than 30%, the highest species diversity was observed and richness. They are due to less diversity in higher slopes, from rock known of these areas, the steep rise due to leaching of soil, drain and dry the soil too much, and the lack of suitable vegetation. According to the information given, the purpose of this study herbaceous plant biodiversity in relation to factors such as altitude, slope and the percentage is.

MATERIALS AND METHODS

Characteristics of the study area

Gilangharb city, with an area of 2230 square kilometers, 1.9 percent of Kermanshah province has been allocated. The study area includes the watershed Miandar Qarootag, 5 km from the city Gilangharb, located at the foot of the Zagros Mountains. Size of the area in question, using topographic maps of 1: 50,000 of Forest and Rangelands, 18/2172 hectares respectively. The area between latitudes 34 degrees and 3 minutes and 47 seconds ("47 03 34), to 34 degrees 6 minutes and 55 seconds (55 06 34), and 45 degrees 54 minutes and 34 seconds geographical lengths (00, 54 □45), and 45 degrees 59 minutes and 43 seconds ") 43 '59 □45) located to the East and North-East of the mountains Saravan, from the West and South West by mountains Bidmian, is enclosed. Altitude the area is 1700 meters above sea level and the lowest point at 900 meters above sea level (Figure 1). Average annual rainfall in the region, which is 431/4 mm, the highest annual rainfall for the month of February, the amount of 97/4 mm, the smallest of August, with the zero mm. The average annual temperature domain, 20/69 ° C. In this way, the mean temperature of the warmest and coldest months of the year, respectively. including 39/8 ° C (August), and (9.3) C (February).

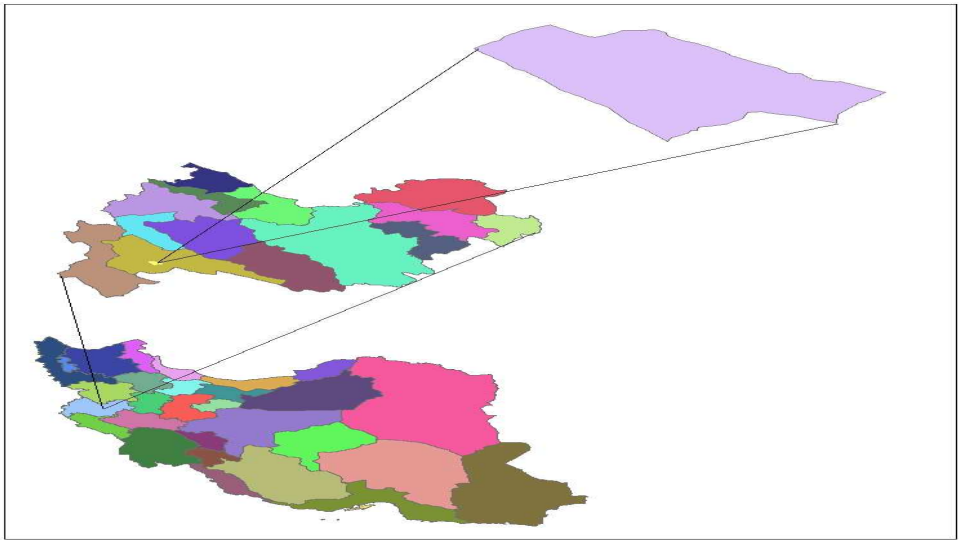

Figure 1. Geographical position in the region, the map of Iran – Kermanshah

The study area, with tree cover (wooded pasture), the type most Iranian Oak (Quercuspersica) is. With its species Amygdalussp, Cratagossp, Pistaciaatlantica, etc. Most of pasture cover it, so Brmoos Bromusdanthoniae and Helianthemumsalicifolium form. Among the species most common in sub-storey type can, to Erodiumsp, LoliumspTrifoliumcampester, Medicaho minima, Aegilopssp and so on. n the present study selected transects in each domain were selected randomly, so that after implementing transects in different geographical directions (North, South, East and West), initially a point randomly chosen during transects, and the first plot was implemented, at a later stage in the transects, the slope for every 50 meters difference in height, were recorded with a GPS device, a plot was no longer walk. Within each plot, cover every single species of sea level plot, and using the slope inclinometer percent, was down. A total of 118 square meter plot that had achieved statistical methods, over 24 transects in the study area, on foot and was picked up. After data collection biodiversity, and the uniformity of herbaceous plants, using a variety of indicators, and the uniformity of Simpson and Shannon - Wiener in three low altitude (1,000 m), middle (1000-1200), and high (more than 1200 m.), and four classes gradient (slope less than 15 percent of the first class, second class gradient of 15-30%, the third class gradient 30-45% and the fourth class of the slope is greater than 45%), were analyzed. For statistical analysis, the data processed and prepared in Excel format. In order to analyze the data, the SPSS 16 software have been used to demonstrate how data distribution (normal or normal), the test Kolmogorov - Smirnov was used, in the case of normal, the ANOVA one way, ANOVA and for comparison of Duncan was used, and for the non-normal, the nonparametric test, Kruskal-Wallis, and statistical comparison test u Mann - Whitney was used to assess the relationship between the dependent variable and independent Spearman correlation were used.

The formulas used in this study:

Simpson diversity index $\frac{1}{D} = {}^{1}/_{\sum_{i=1} Pi^2}$

Shannon diversity index - Wiener $H = -\sum_{i=1}^{s} Pi \, Ln \, Pi$

Simpson uniformity index $Esi = \frac{1/D}{1/S}$

Uniformity index, Shannon - Wiener $Esh = \frac{H}{LnS}$

$\frac{1}{D}$: Simpson diversity index

S: the number of species

N: total abundance of species

Pi: individuals or abundance of species i,

RESULTS

The results of data analysis using ANOVA showed. The altitude, and slope Significant effect statistically the diversity indices Simpson and Shannon - Wiener, the percentage of calls (Table 1). In this way, the three-storey low altitude (1,000 m), middle (1000-1200), and high (over 1200 meters), and four classes gradient (slope less than 15 percent of the first class, second class gradient of 15 - 30%, the third class gradient 30-45% and the fourth class gradient higher than 45%), a statistically significant difference, there is a 95 percent confidence level (P <0/05) (Table 1). The results of statistical comparison with Duncan's test also showed that, at the height of the middle class (1000 - 1200 m), the highest diversity index, Simpson and Shannon - Wiener, there are statistically significant at 95 percent, more than any other Height classes (P <0/05) (Figure 2 and 3). The results compared variation in the four classes of slope, using Duncan's test showed that the highest diversity index, Simpson and Shannon - Wiener, the slope of the first class (less than 15%), and lowest diversity index, Simpson and Shannon - Wiener, The slope of the fourth class (more than 45 per cent), as can be seen, with an increase of diversity index, was significantly reduced (P <0/05) (Figure 4 and 5).

Table 1. Analysis of variance values diversity in three heights and four board slopes

F amount	Degrees of freedom (df)	Diversity index	Independent variable
7/83**	2	Simpson	**Altitude**
10/57**	2	Shannon - Wiener	
3/931*	3	Simpson	**percent slope**
4/608**	3	Shannon - Wiener	

**** Indicates statistical difference at the level of 99%**
*** Indicates statistical difference at 95%**

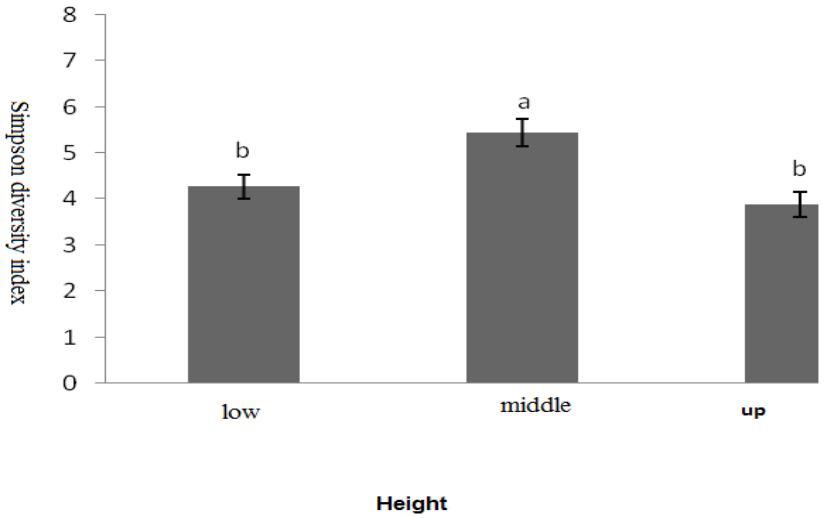

Figure 2. Average Simpson diversity index, in three categories: high (loads on the columns, Represent the standard error of different Latin letters indicate significant differences at the level of 95 percent.)

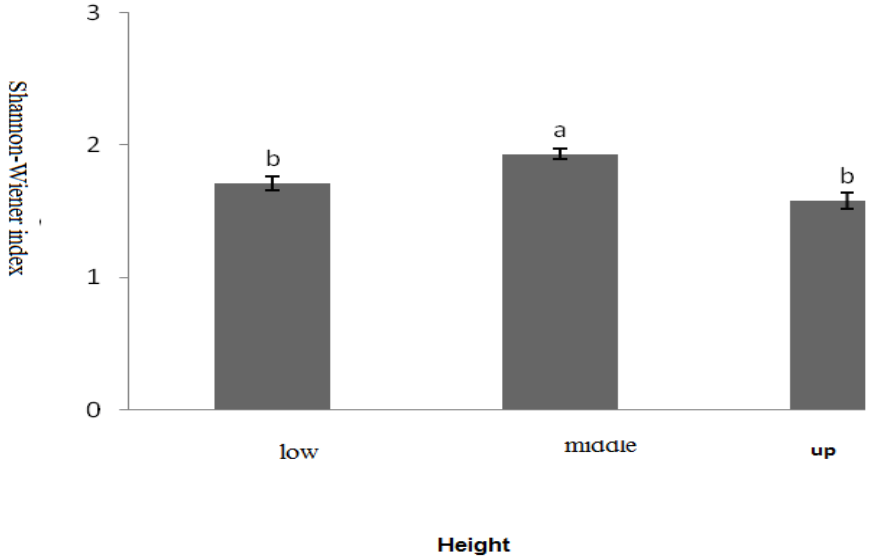

Figure 3. Average index, Shannon - Wiener in three heights (loads on columns Represents the standard error of different Latin letters indicate significant differences at the level of 95 percent.)

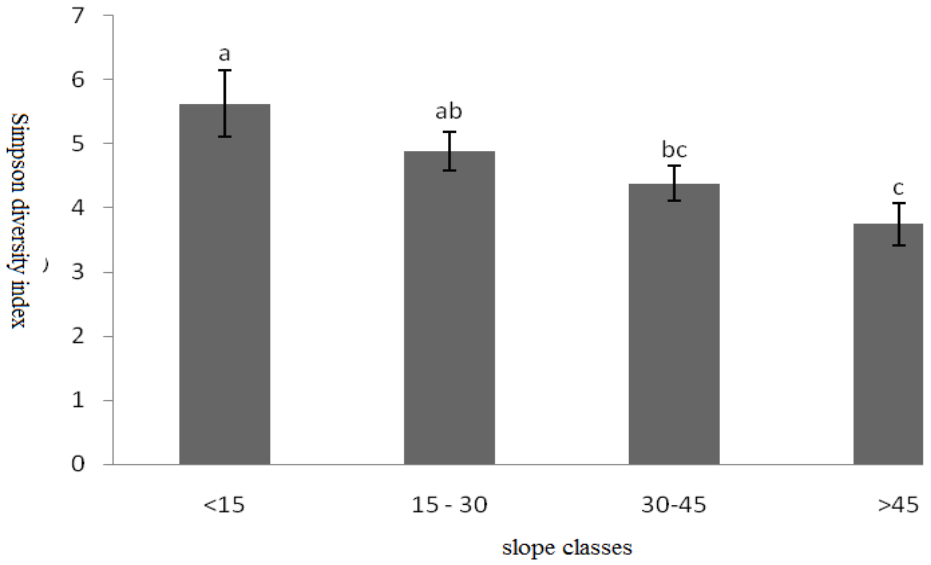

Figure 4. Average Simpson diversity index gradient in four classes (loads on columns Represents the standard error of different Latin letters indicate significant differences at the level of 95 percent.)

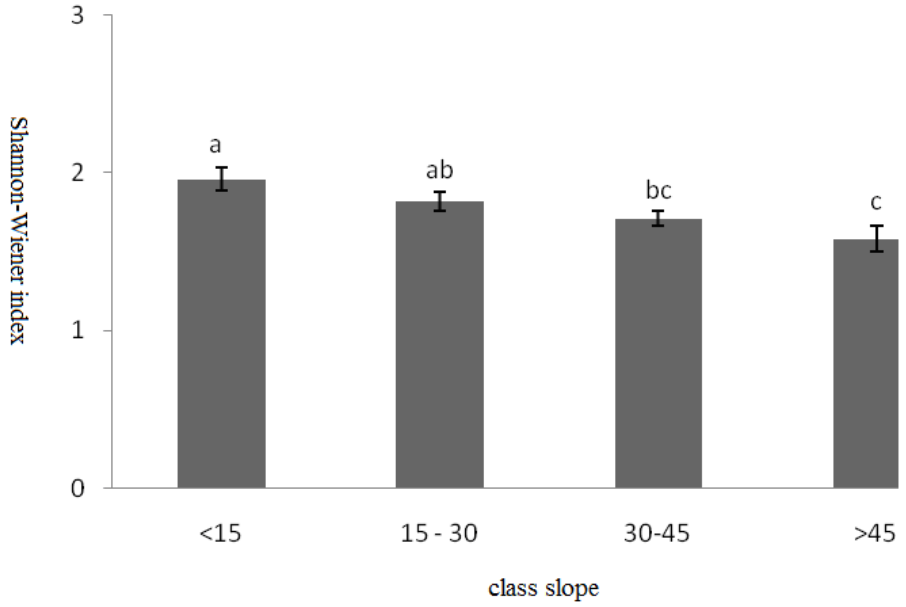

Figure 5. shows the average index of Shannon - Wiener slope in four classes (loads on columns Represents the standard error of different Latin letters indicate significant differences at the level of 95 percent.)

The results of data analysis using ANOVA showed. The uniformity index Simpson and Shannon - Wiener, between four classes gradient (slope less than 15 percent of the first class, second class gradient of 15-30%, the third class gradient of 30-45% and the fourth class slopes greater than 45 percent), and three categories: low (less than 1000 meters), middle (1000-1200), and high (more than

1200 m), there are significant differences in the level of 95 percent, in other words the percentage of slope and altitude, with significant impact on the uniform criteria Simpson and Shannon - Wiener, is (P <0/05) (Table 2).

Table 2. Analysis of variance uniformity index, a height of three floors and four classrooms slope

F amount	Degrees of freedom (df)	Diversity index	Independent variable
7/909**	2	Simpson	**Altitude**
1/899ns	2	Shannon - Wiener	
3/398*	3	Simpson	**Percent slope**
2/868*	3	Shannon - Wiener	

**** Indicates statistical difference in the level of 99%**
*** Indicates statistical difference in the level of 95%**
ns: show no statistical difference

The results of statistical comparison with Duncan's test showed that middle-class altitude (1000 - 1200 m), the highest uniformity Simpson index is significantly higher than the other classes is high. The results showed that the statistical comparison between the height of the uniformity index, Shannon - Wiener, there is no statistically significant difference (Table 3). The results of statistical comparison with Duncan's test showed that, among the four classes of the slope, there is a significant difference, in this case, the highest uniformity index, Simpson and Shannon - Wiener, the slope of the first class (less than 15 per cent) a statistically significantly higher than the fourth class is steep (P <0/05), but the slope of the second and third classifieds, the difference was not statistically significant (Table 3).

Table 3: Mean ± standard error of index homogeneity of Simpson and Shannon - Wiener, at a height of three stores.

High (over 1200 meters)	Middle (1000 - 1200)	Low (less than 1000m)		
0/333 ± 0/044b	0/619 ± 0/057a	0/409 ± 0/045b	Simpson	**Uniformity index**
0/758 ± 0/023a	0/81 ± 0/013a	0/785 ± 0/023a	Shannon - Wiener	

Different Latin letters indicate significant differences at the level of 5%.

Table 4. The mean ± standard error of index homogeneity of Simpson and Shannon - Wiener, in the four classes of the slope.

>45	percent 45 – 30	percent 30 – 15	<15		
0/341± 0/04b	0/417± 0/049b	0/512± 0/054ab	0/656± 0/1a	Simpson	**Uniformity index**
0/73 ± 0/031b	0/786± 0/017ab	0/8± 0/017a	0/827 ± 0/019a	Shannon - Wiener	

Different Latin letters indicate significant differences at the level of 5%.

Different Latin letters indicate significant differences at the level of 5%.
In this study, the correlation between diversity and uniformity Simpson and Shannon - Wiener, the altitude, and slope using the Pearson correlation coefficient, were evaluated. The results showed that, the altitude above sea level, and indices of diversity and uniformity Simpson and Shannon - Wiener, the relationship is negative, the relationship between the dependent variables (diversity index, Simpson), and independent variables (altitude) statistically not significant, but a significant negative correlation, statistically significant indicators of uniformity between Simpson and Shannon - Wiener, and the percentage of the slope at 95%, that is, so that by increasing the amount of tilt, the uniformity index Simpson and Shannon - Wiener, significantly decreases (Table 5).

Table 5. Evaluation of correlation (correlation) between diversity and uniformity index with altitude, and slope

Percent slope	Altitude	Index	
-0/387**	-0/111ns	Simpson	**Diversity index**
-0/429**	-0/212ns	Shannon - Wiener	
-0/345*	-0/208ns	Simpson	**Uniformity index**
-0/410**	0/003ns	Shannon - Wiener	

**** Indicate that significant, at 99%**
*** Indicates a link between, at 95%**
ns: show no relation between

DISCUSSION AND CONCLUSION

In this study, the results showed that the height above sea level, the diversity significantly affect the 95 percent confidence level. In this case, the highest indices of diversity and uniformity Simpson and Shannon - Wiener, a middle-class altitude (1200 - 1000 meters high). Physiographic factors (aspect, slope, elevation above sea level), the impact on soil moisture, soil chemistry, and other important factors that affect the presence or absence of species (Enright et al., 2005). Hejazi and et al (1998), at an elevation gradient in the southwest of Saudi Arabia to the conclusion that, in the most high class richness and diversity there. Lee (2005), a study on the vegetation in southern Taiwan in altitudinal range from 287 to 1680 meters above sea level, concluded that the greatest richness and diversity of middle height on the floor there. Grytnes&Vetaas (2002), a study in Nepal showed that the maximum diversity and richness of plant species, in the central highlands, and the height above sea level, diversity and species richness decreased again, they reduced species richness caused, knew temperature. Vaseghi et al. (2011), in their study concluded that, in the mid-high class highest diversity and species richness there. Fakhimi Abarqooyi et al. (2011), in their study showed that the height above sea level, and the percentage of slope on the diversity, richness and uniformity of plant species significantly affected so that, in the mid-altitude range (from 2400 to 2600 m), the highest value of diversity, richness and smoothness was so. Mirzaee et al (2007) examined the diversity of species of herbaceous plants. They established that the research results, the height above sea level on a variety of herbaceous floor, had a significant impact and the low altitude (less than 1630 meters), the highest value of diversity, while the effect of altitude on the uniformity and Species richness and abundance are not statistically significant. So the results of this study, the effect of altitude on biodiversity with the results Hejazi et al (1998), Lee (2005), Grytnes & Vetaas (2002), Vaseghi et al. (2011) and Fakhimi Abarqooyi (2011) consistent. But the results Heidari et al. (2010), and Mirzaee et al (2007) do not match. The study also found that the percentage of the slope, the value of the diversity index and uniformity Simpson and Shannon - Wiener, at 95 percent affected, so that a steep increase in the value of diversity and uniformity, significantly reduced, and highest species diversity, there is a low slope in the classifieds. Tilt is an important physiographic factors, could dispersion, diversity and richness of plant species to be effective, because the amount of slope and drainage in the soil, plays an important role (Dantia et al. 1994, Bell et al. 2005, Ebrahimi Kia, 2002). Enright (2005) stated that physical factors, such as the stone shelves, probably because of the impact on water, soil is the most important factor against chemicals. Sohrabi (2004), in their study concluded that, on the slopes below the highest diversity and species richness, and because it has a negative effect on leaching of soil, steep slopes, drainage, dry soil, the loss of elements Food and reduce fertility knows. Heidari et al (2010) found that the percentage of the slope have significant effect on the diversity and richness, in which the slopes of less than 30%, the highest species diversity was observed and riches. They are due to less diversity in higher slopes, from rock known of these areas, the steep rise due to leaching of soil, drain and dry the soil too much, and the lack of suitable vegetation. Mahdavi and Heidari (2009), the relationship aspect, slope and elevation above sea level, the diversity of plant species, were studied. They found that the percentage of slope significantly affect the diversity of species, so that slopes less than 25%, the highest species diversity and on slopes greater than 75 percent, the lowest diversity and species richness there. Mirzaee (2006), due to less diversity in higher slopes, from the rock of this region, compared to the lower slopes, he said, he also noted that the slope of the factors that, indirectly, the presence of plant species, positive and negative effects. Steep increase due to the leaching of soil, drain and dry the soil too much, and the lack of suitable vegetation. The results of this study, the effects on the diversity gradient, and uniform manner with the Sohrabi (2004), Heidari et al. (2010), Mahdavi and Heidari (2009) and Mirzaee et al (2006) is consistent. According to the results obtained in this study, and low diversity of herbaceous plants at high altitudes and steep slopes (more) suggested that, given the great potential of the Zagros Mountains, the weather in the lower elevations and soils shallow and weak areas, pasture conditions have generated losses, especially at high altitudes and high slopes, range management plans by heaps of work, and seeding with native forage species, and the balance of livestock and pasture production, in order to revive and strengthen Rangelands in, is a priority.

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