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Plant species in Oak (*Quercus brantii* Lindl.) understory and their relationship with physical and chemical properties of soil in different altitude classes in the Arghvan valley protected area, Iran

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ABSTRACT

The present survey was carried out in Oak (*Quercus brantii* Lindl.) woodlands of Arghvan valley protected area, in Ilam province, western Iran. The main aim of this study was to survey the understory vegetation of oak in different classes of altitude (1400-1600, 1600-1800 and >1800 m) in the southern aspects, and their relationship with physical and chemical properties of soil. Four transects, with an interval of 200 m were selected from the lowest to the highest points of hillside. 25 individual oak trees were selected on and out of the transects as a plot center. The plot area was obtained using Whittaker's nested plots and species / area curve. In order to find the relationship between soil properties and vegetation, and also to determine the most effective factors on the distribution of vegetation, multivariate procedures, i.e., Principal Component Analysis (PCA) and Canonical Correspondence Analysis (CCA) were used. Based on these analyses three groups were obtained. These groups exactly coordinated with our sample plots in altitudinal classes and had different soil and vegetation characteristics. The most important factors in the lowland group were pH, SP, OC, N,P and K, and those in the highland group were altitude, BD and stone percentage. The midland group was intermediate to these two groups, although its conditions were more similar to the highland group. The results also indicated a decrease in Shannon-Weiner and Margalef's indices from lowland toward the highland.

Keywords: *Oak, vegetation understory, site classification, altitude, Zagros, Iran*

INTRODUCTION

There is increasing interest in understanding the mechanisms which control species distribution and diversity (Rosenzweig, 1995). Global climate change and human impact through habitat disturbance are important processes which currently threaten original relations of biodiversity between vegetation and environmental factors, and it has become critical to understand the underlying mechanisms which determine biodiversity if we are to minimize its loss, particularly in sensitive areas susceptible to degradation such as Zagros forest ecosystem in the west of Iran. Zagros forests with an area of 5 million hectares cover ca. 40 % of Iran's forests and are the widest forest regions of the country (FAO, 2002, Sagheb -Talebi *et al.*, 2004). This region has sub-Mediterranean, semiarid temperate climate, mainly consisting of deciduous, broad-leaved trees with dominant species of Quereus spp. (Zohary 1973, Olfat and Pourtahmasi 2010), some xerophytes and cold weather tolerant climax vegetation (Sagheb -Talebi *et al.*, 2004). Quercus brantii (covering more than 50% of the Zagros forest area) are the most important tree species of this region growing at 1000-2000 m altitudes (Sagheb-Talebi, 2005). Climate, topography, soil and organisms are the most important factors (Jazerehei and Ebrahimirastaghi, 2003) that influence water supply, soil conservation as well as climate change and socio-economical balance of the area (Sagheb-Talebi *et al*., 2004). According to several researchers, vegetation characteristics especially richness, diversity and sociability are influenced by environmental factors (altitude, soil physical and chemical properties, topography) (Kingston *et al*., 2003; Hillebrand 2004; Rahbek 2005; Sohrabi, 2004, Enright *et al*., 2005). Heshmati (2003) reported that topography effects directly on environmental factors (e.g., soil and vegetation), and indirectly influences soil formation. It has a significant impact on plant community properties (e.g., diversity, richness and social accountability). Diversity is one of the most important indices used to describe different regions (Barnes, 1998). Change in diversity varies considerably and reflects the determinant factor among plant groups (Austin *et al*., 1996). Plants are indicators of habitat conditions, soil ecology, and in fact there is a close relationship between vegetation and soil, and changes in any one of them can affect ecosystem functions (Beno, 1998). Thus, the evaluation of the forest habitat and vegetation in relation to environmental factors could be an important step towards sustainable forest management (Zahediamiri and Lust, 1999). Relationships between soil factors and plant species distribution was evaluated in the upper Minjiang River basin (Tibetan plateau). Direct gradient analysis showed that soil moisture, pH and organic matter were the most important factors in the distribution of plant species (Lu *et al*., 2006).Vegetation abundance and diversity in relation to soil nutrients and soil water content was examined in Vestfold Hills, East Antarctica. Data from site pairs and transects showed that lichen diversity and abundance increased with increasing soil nutrients, with soil P having a stronger influence than soil N. In contrast, soil nutrients were not significantly associated with moss diversity or abundance. Instead, number of moss species and abundance were positively associated with soil water content (Leishman and Wild, 2001). A comparison of plant ecological groups can help understand the patterns of diversity (Pausas and Austin, 2001).The patterns of biodiversity on the mountain can be very complex (Gebeyehu and Samways, 2006a,b).The effect of different factors (especially chemical and physical soil factors, altitude) on diversity of plant species have been discussed by several authors (Small and McCarthy, 2005; Krzic *et al*., 2003; Roem and Berendse 2000, Hegazy *et al*., 1998; Fisher *et al*., 2004; Bruun et al. 2006; Heydari and Mahdavi 2009a, Kingston and et al., 2003). Multivariate analysis methods are used for determining the different aspects of ecological capacity of the region and evaluating current and predicted future state of the region (Gholami, 2006). Oak habitat destruction is an important problem in Zagros ecosystem that has changed soil physicochemical properties and its vegetation. So far, various short and long term conservation managements have been carried out in Zagros region. What are the best conditions (soil and vegetation and their relationships at different altitudes) in this habitat? To answer these questions, in the current survey, Oak understory plant species and edaphic conditions of a relatively undisturbed area (Arghvan valley protected area) were determined to serve as a model to examine the effect of conservation management programs on relationship between vegetation and soil. As mentioned above, the main purpose of this research was to investigate the relationship between soil characteristics and plant species to determine the most important factors affecting the separation of vegetation in different altitude classes and the group of plant species in each altitude class.

MATERIALS AND METHODS

Study area

The study area is considered as a protected area, located (33°28' 24″ - 33° 27' 24″ E, 46° 38' 37″ -46°39' 27″ N) in north of Ilam province, southern aspect in the Arghvan valley region, west of Iran. This region has mediterranean climate, with average annual precipitation of 538.4 mm, mean annual temperature of 16.7 °C, located at 1400 - 2200 m altitudes a.s.l. (Eslahy *et al*., 2002), and slope ranges from 5 to 75%. The minimum (4.62°C) and maximum temperatures (29.93°C) were recorded in December and July, respectively. Oak (*Qurecus brantii*) is the most important tree species of this area. Cercis griffithii is also scattered in this region. This region has been considered as protected area since 1991 (Mirzaii *et al*., 2007).

Data collection

Vegetation sampling

At first, based on topographic maps three altitudinal classes were identified in the southern aspect of Arghvan valley. Four transects, with an interval of 200 m were selected from the lowest to the highest points of the hillside. 25 individuals of oak trees were selected on and out of transects in each altitudinal class and each tree was considered as a plot center. The plot area was obtained using Whittaker's nested plots and species/area curve (Pourbabaei and Ranjavar, 2008). This area in different altitudinal classes was as follows: lowland (16 m2), midland (32 m2) and highland (32 m2). All plant species were identified and the abundance-dominance of species was estimated according to Braun-Blanquet scale (Muller-Dombois and Ellenberg, 1974; Bredenkamp *et al*., 1986).

Soil sampling

Three soil samples were collected from the center of sample plots at the depth of 0-25 cm. The soil samples were mixed to obtain a combined sample of soil units (Tarrega, *et al*., 2007) then transferred to the lab for physical and chemical analyses. After the soil sample was air dried and passed through a 2 mm sieve, the following analyses were carried out: soil texture (by Bouyoucos hydrometer method), saturation percentage (SP %) (by gravimetric method), pH (using digital pH meter), electrical conductivity (EC) (by Conductivity Bridge), organic carbon (OC), total nitrogen (N), potassium (K) (by Walkley and Black rapid titration, Kjeldal and flame photometry methods respectively). Phosphorus (P) was determined according to BrayÕs (dilute acid-fluoride) procedure. Soil bulk density was determined by the un-disturbed soil core method (Blake and Hartge, 1986; Famiglietti *et al*., 1998; Kalra and Maynard, 1991). Percentage of gravel was also determined by passing soil samples through 2 mm sieve.

Data analysis

Diversity, species richness and evenness were obtained using the following formula

Table 1. Diversity, species richness and evenness formula

Shannon- Wiener (H')	Margalef (R1)	Peilou's evenness (J')
$H'=\frac{n\log n-\sum f_i \log f_i}{n}$	$R_1 = \frac{S-1}{Ln(N)}$	$J' = \frac{H'}{H_{Max}'}$

Based on the presence and absence of herbaceous species data, sociability of more than two species were determined. The hypothesis is that three species do not occur together. First, variance of total samples can be calculated for the occurrence of S species:

Variance ratio is equal to:

$$VR = S^2_T / Q^2_T$$

If VR>1, the sociability is positive

If VR <1, the sociability is negative.

The data have been checked for normality with the Kolmogorov-Smirnov test and data were transformed as necessary (OC and BD). To study the correlation between diversity indices and altitudinal classes Pearson's correlation test was carried out.

Classification and ordination methods were used to analyze data. The TWINSPAN method was used to classify the floristic data (Hill, 1979). In order to find the relationship between soil factors and vegetation properties and also to determine the most effective factors on the distribution of plant types, multivariate procedures, i.e., Principal Component Analysis (PCA) and Canonical Correspondence Analysis (CCA) were used (Jafari *et al*., 2003). CCA is a technique that shows non-linear relationships between species with environmental factors and chooses the best weights for environmental variables (Coroi et al., 2004; Fu et al., 2004). To analyze the difference among altitudinal classes in term of diversity indices one way analysis of variance (ANOVA) were applied. Moreover, Duncan's test was used to compare the means at 1% probability level. Cochran's test was performed for homogeneity of variance on data sets. The analysis was carried out using PC-ORD and SPSS.

RESULTS

In this study, 37 species were identified in understory of Oak forest. The results of sociability in the low (VR <1 (0.59)), middle (VR <1 (0.52)) and high altitude (VR <1 (0.49)) indicate that the occurrence of species is not accidental. The results of ANOVA showed that Shannon- Wiener diversity and Margalef richness indices are significant in different classes. The results indicated that Shannon and Margalef's indices have decreased from the lowland towards the highland, while there was no significant difference among different altitude classes in term of Pielou's evenness index (Fig. 1).

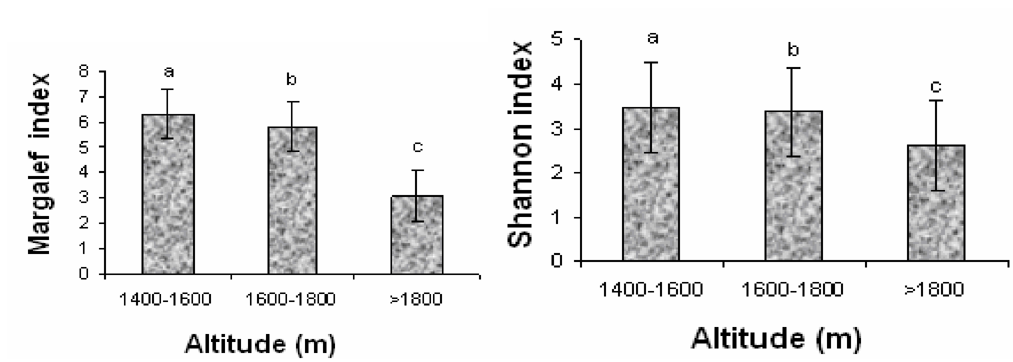

Fig. 1. Mean and standard error diversity values in different altitudinal classes. Results of ANOVA are also included (when $p < 0.05$, different letters indicate significant differences using the Duncan's test).

There is a linear relationship between diversity, richness, dominance and altitude in the study area. Diversity and richness decrease with increasing altitude, but dominance increases (Figure 2).

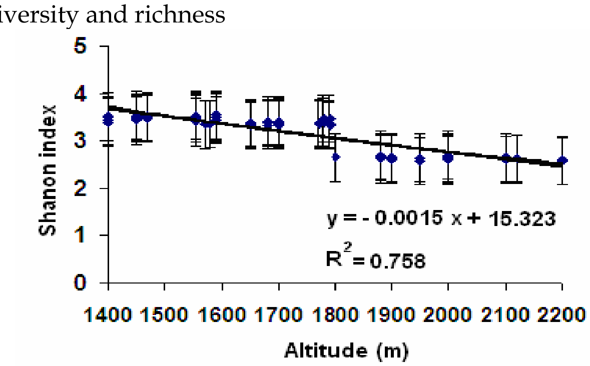

Fig. 2. Relationship between diversity and richness with altitude

The result of Pearson correlation also showed that the correlation between Shannon diversity and Margalef's richness with altitude are -0.862 and -0.899, respectively. Regarding the position of plots on the first and second axes of PCA, 3 groups were recognized in the study area. Broken-stick Eigen values for data set indicate that the first two principal components (PC1 and PC2) resolutely captured more variance (Table 2). This means that the first and second of PCA are by far the most important for representing the variation of the three groups.

The sample plots of low altitude area (A) has a positive correlation with axes1, 2 and show high positive correlation with percent moisture saturation, pH, organic carbon, total nitrogen, phosphorus and potassium. The sample plots of middle and high altitude areas (B and C) show negative correlation with axes 1 and 2 with low percent moisture saturation, organic carbon, total nitrogen, phosphorus and potassium. These plots show correlation with bulk density, percentage of gravel and stone, salinity and altitude (Fig. 3 and Table 3).

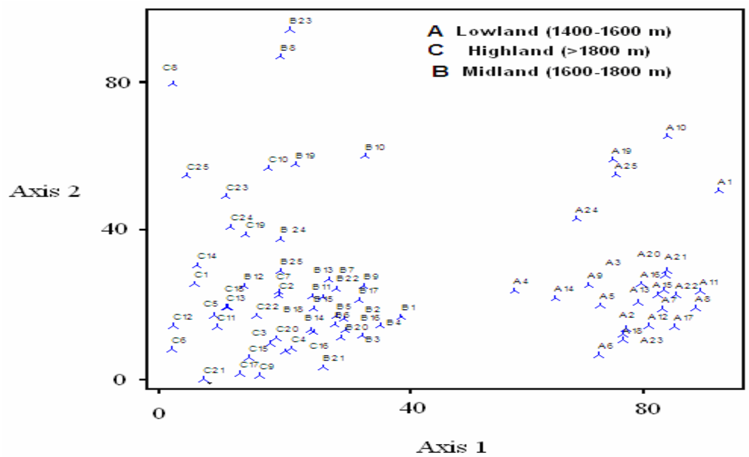

Fig. 3. Result of PCA ordination for sample plots

Table 2. Eigen Value, % of variance and Broken-stick Eigen Value of PCA

AXIS	Eigen Value	% of Variance	Broken-stick Eigenvalue
1	5.32	42.748	3.25
2	4.2	21.11	2.52
3	1.35	13	1.78

Table 3. The first and second PCA axes correlations with environmental factors

Environmental factors	Axis 1	Axis 2
OC	0.775 **	-0.137 ns
N	0.874	-0.009 ns
P	0.813**	-0.12 ns
K	0.723**	-0.105 ns
PH	0.914**	-0.02 ns
SP	0.662*	0.408*
EC	0.136 ns	0.935**
BD	-0.924**	-0.053 ns
Stone	-0.814**	0.02 ns
Elevation	-0.889**	0.061 ns

ns: no significant, * significant (5%) and ** significant (1%)

The first and second CCA axes with the highest Eigen value (0.52 and 0.21) were used to indicate correlation (Table 4).

Correlation analysis conducted for the environmental variables showed that some factors especially the percent of saturated moisture (0.549), nitrogen (0.810), phosphorus (0.747), potassium (0.684), pH (0.912) and organic carbon (0.767) have a positive correlation with axis 1, while other factors e.g. bulk density (- 0.915), altitude (- 0.950) and the percentage of gravel and stone (- 0.790) have a negative correlation with the same axis. Altitude (0.429) and the percentage of moisture saturation (0.376) have a positive correlation with the axis 2 (Figure 4). According to CCA, plots are divided into three groups. The first group is separated, and based on higher percentage of saturated moisture, nitrogen, phosphorus, potassium, acidity and organic carbon. The main factors separating the third group are bulk density, altitude and the percentage of gravel, while the second group has an intermediate position between the first and third groups (Table 5). Indicator value (IV) for species in different groups was obtained based on Monte Carlo's test (Table 6).

Table 4. Canonical Correspondence Analysis for environmental data

	Axis 1	Axis 2	Axis 3
Eigen Value	0.522	0.211	0.02
% of variance explained	59.7	21	5

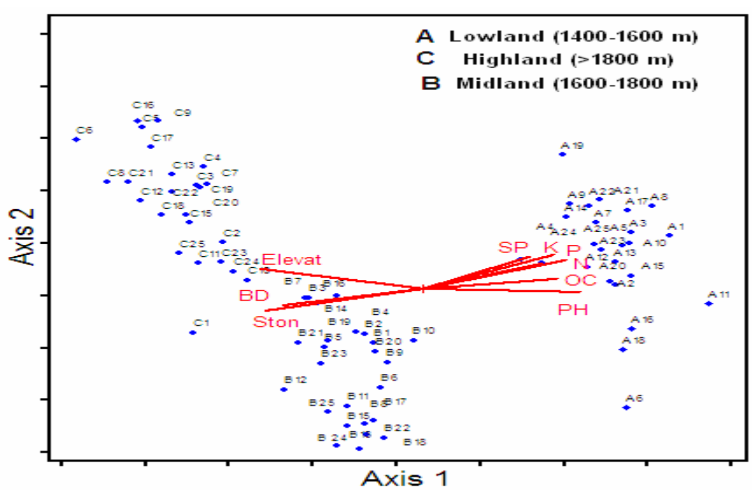

Fig. 4. Result of CCA ordination for sample plots
pH: Soil acidity, OC: Organic carbon, Nt:Total nitrogen, P:phosphorus, K:Potassium, EC: soil salinity, SP: Saturation and BD: Bulk density.

Table 5. The first and second CCA axes correlations with environmental factors

Environmental factors	Axis 1	Axis 2
OC	0.767 **	-0.081 ns
N	**81**	0.161 ns
P	0.747 **	0.201 ns
K	0.684 **	0.124 ns
PH	0.912 **	-0.228 ns
SP	0.549*	0.276 ns
EC	0.09 ns	0.034 ns
BD	-0.915 **	-0.041 ns
Stone	-0.79 **	0.01 ns
Altitude	-0.95 **	0.429 *

ns: no significant, * significant (5%) and ** significant (1%)

Table 6. Indicator Value (IV) for species in different groups based on Monte Carlo's test

Species	Value (IV)	Max group	*p* *
Ono hau	49.1	3	0.02
Ger tub	49.3	3	0.02
Col rob	49.6	3	0.01
Ant alt	50	3	0.01
Hyp sp	50	3	0.03
Fer ana	50	3	0.002
Pap agr	51.7	3	0.001
Sil com	53.1	3	0.001
Fib mac	53.7	3	0.001
Cen tri	55.9	3	0.001
Aca eri	56.6	3	0.002
Phl oli	91.7	3	0.002
Nep sp	95.9	3	0.001
Tor lep	50	2	0.02
Ery bil	50.1	2	0.03
Bro tec	50.2	2	0.002
All lon	51.2	2	0.01
Hor bul	51.2	2	0.01
Aca bra	51.5	2	0.01
Kol nit	51.6	2	0.01
Sta ben	51.6	2	0.02
Lac ser	51.9	2	0.01
Poa bul	51.9	2	0.01
Mar vul	52.5	2	0.01
Het pil	50.9	1	0.002
Lat sat	50.5	1	0.02
Tra ved	52	1	0.02
Tar cal	52.5	1	0.002
Lop phl	92.8	1	0.001
Lin alb	97	1	0.001
Gal mit	100	1	0.001
Ech kot	100	1	0.001
Ono car	100	1	0.001
Pic aca	100	1	0.001
Sal pal	100	1	0.001
Dia ori	100	1	0.001
Cir con	100	1	0.001
Car dra	100	1	0.001
Eup mac	100	1	0.001
Pim eri	100	1	0.001
Ziz ten.	100	1	0.001
Cou pic	100	1	0.001
Gun tur	100	1	0.001

The result of Indicator Value (IV) showed: Vegetation at low altitude with highest IV: *Ziziphora tenuir* L., *Galium mite* Boiss. & Hohen, *Pimpinella eriophora* Banks & Soland, *Cirsium congestum* Fisch. & C. A. Mey. ex. DC., *Cousinia pichleriana* Bornm. Ex Rech. F, *Euphorbia macroclada* Boiss., *Echinops kotschyi* Boiss. *Lophochloa phleoides* (Vill), *Gundelia turnefortii* L., *Cardaria draba* (I.) *Medicus* picnomon *acarna* (L.) Cass., *Taraxacum calliops* Hagl, *Heteranthelium piliferum* (Banks & Soland.) Hochst, *Lathyrus sativus* L., *Muscari neglectum* Guss, *Salvia palaestina* Benth. These species have high percent of saturation moisture, OM, N, P, K, pH values but low bulk density, gravel and stone percentage.

Oak understory vegetation at high altitude includes the following species: *Geranium tuberosum* L., *Onosma haussknechtii* Bornm., *Colchicum robustum* (Bge.) Stefanov, *Hyoscyamus* sp., *Silene commelinifolia* Bioss. Var. *commelinifera*, *Ferulago anagulata* Schlecht. Bioss. Subsp. *Angulata*, *Centaura triumfetii*., *Anthemis altissima* L., *Nepeta* sp., *Fibigia macrocarpa*. These species had high correlation with high class of altitude, bulk density, gravel and stone percentage. In this site the lowest percent of saturation moisture, OM, N, P, and K were recorded.

Oak understory vegetation in middle altitude includes the following species: *Hordeum bulbosum* L., *Eryngium billardieri* F. Delaroche, *Allium longicuspis* Regel, *Acantholimon erinaceum*, *Marrabium vulgare* L., *Koeleria nitidula* velan., *Poa annua* L., *Poa bulbosa* L., *Bromus tectorum* L., *Stachys benthamiana* Boiss., *Lactuca serriola* L.

Understory vegetation in middle altitude has an intermediate environmental condition of the two above groups. For vegetation analysis, TWINSPAN was performed in 75 plots and three groups were identified. The first division includes 26 plot samples (on the right) and 49 plot samples (on the left). Heteranthelium piliferum, (on the left side) and Nepeta sp. (on the right side) are two indicator species of the first division (Figure 5). The second division is divided into two groups of 24 (on the left side) and 25 (on the left side) sample plots. Cirsium congestum - Picnomon acarna (on the left side), and Fibigia macrocarpa (on the right side) are the indicator species in this division. Mean, standard deviation and significance level of environmental variables among different altitudinal classes are presented in Table 7.

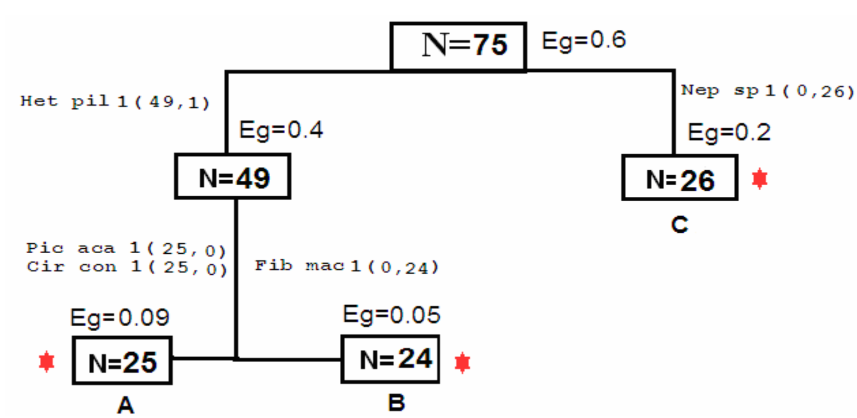

Fig. 5. Dendrogram of TWINSPAN for vegetation in the study area.

Table 7. Mean, standard deviation (Sd) and significance level of environmental variables among different altitudinal classes

Environmental Variables	Lowland		Midland		Highland		P
	$\bar{X}$	Sd	$\bar{X}$	Sd	$\bar{X}$	Sd	
OC %	9.04 [a]	1.69	5.36 [b]	1.95	3.6 [c]	2.3	0.003**
Nt (ppm)	0.63 [a]	0.14	0.27 [b]	0.05	0.24 [b]	0.08	0.00**
P (ppm)	22.88 [a]	6.81	8.8 [b]	3.75	8.68 [b]	3.24	0.001**
K(ppm)	613 [a]	167	346 [b]	129	316.4 [b]	82.41	0.00**
pH	7.56 [a]	0.21	7.26 [b]	0.04	6.96 [c]	0.09	0.001**
SP%	57.68 [a]	10	37 [b]	1046	39.64 [b]	11.95	0.00**
EC (dS/m)	0.64	0.04	0.62	0.06	0.59	0.05	0.7 ns
BD (gr cm-3)	1.1 [c]	0.08	1.41 [b]	0.06	1.49 [a]	0.04	0.002**
Stone %	7.36 [c]	2.9	23.4 [b]	7.4	28.4 [a]	9.5	0.00**
Altitude (m)	1504 [c]	71.46	1721 [b]	53	1990 [a]	107	0.00**
Sand%	40.76	3.8	4.06	3.7	4.03	3.4	0.91 ns
Clay%	22.1	1.74	22	1.25	21096	1.25	0.9 ns
Silt%	37.13	4.05	37.3	4.2	37.7	4.02	0.87 ns

ns: No significant, * Significant (α = 5%),** Significant (α =1%)

Discussion

One of the fundamental topics in ecology is to understand the factors affecting the composition and abundance of species in ecological communities (Menninger and Palmer, 2006). This includes the interaction of living and non-living factors (Larkin *et al*., 2006). Knowing the relationship between species and environmental factors provide a model framework for understanding the species spatial distribution, modeling succession and management vegetation (Botkin, 1992; Austin and Smith, 1989; Zabel *et al*., 2003). Soil type, slope, aspect and altitude are the most outstanding environmental factors and their influences on vegetation patterns and distribution of species have been reported by previous authors (Hejcmanova *et al*., 2006).

The result of this research revealed that understory herbaceous species of Oak tree (*Quercus brantii*) vary with altitudinal classes. Cushman and Wallin, (2002) reported the important effect of altitude in classifying the forest communities. Several important effects of altitude (e.g., on temperature, rainfall and soil properties, various species types in different levels) have been described by Fisher *et al*., (2004); Grytnes and Vetaas (2002), Garcia *et al*., (2007, Ediriweera, et al., (2008). The effects of soil characteristics and altitudinal gradients on the distribution of two Artemisia species (*A. sieberi* and *A. aucheri*) were studied. The results showed that the most important factors affecting the distribution of mentioned species were altitude and soil characteristics such as organic matter, nitrogen, texture and gypsum (Azarnivand *et al.,* 2003). Based on observations in the present study, soil chemical and physical properties vary with change in altitude. Small and McCarthy (2005) reported high amounts 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. Results of the present study indicated that soil chemical properties were more effective than its physical properties on changes in Oak understory plant composition. Based on CCA, percent of saturation moisture, nitrogen, phosphorus, potassium, acidity and organic carbon were the most outstanding factors (comparing to physical factors e.g., soil texture) for separating the plant groups. The group of Oak understory plant species in the lower altitudes showed strong positive correlation with soil nutrient elements, organic carbon and moisture saturation. In this site, in contrast to high saturation moisture, organic carbon, nitrogen, phosphorus and potassium, low bulk density, percent gravel and stone were recorded. Usually nitrogen and organic carbon increases through increasing in soil moisture. As previous researchers reported (Fisher *et al*., 2004; Grytnes and Vetaas, 2002; Heydari and Mahdavi, 2009b), our results showed an increase in diversity and higher species richness at lower altitudes. This is related to nutrient availability (Roem and Berendse, 2000) and therefore, species richness and composition is affected by nutrients limitation (Verhoeven et al., 1993), Koerselman and Meuleman, 1996). Accordng to our results, high percentage of soil bulk density, gravel and stone were observed at higher altitudes. In contrast,low bulk density was recognized in lower altitudes. This can be due to higher organic carbon content at lower altitudes (Heydari et al., 2009, Shifang, *et al*., 2008). The degree of species sociability can be expressed quantitatively using a set of samples (Mesdaghi, 2005). The results showed that the degree of social accountability in three altitude classes was more than 1 (but positive). This means that the presences of these species are not accidental (Mesdaghi, 2004). Cirsium congestum and Picnomon acarna were present with oak species in the lower altitudes and defined as separating elements of this group. Mozaffarian (2008) has reported the same species with oak in deep and fertile soil). Fibigia macrocarpa was identified as a separate species in the mid-altitude. This species was identified by Mozaffarian (2008) at higher altitudes of Zagros. Some species especially Bromus tectorum, Prangos acaulis, Stachys benthamiana, Lactuca serriola , Torilis leptophylla had high frequency. These species were present among all plant communities in the study area. According to Matajy and Eshaghy rad (2007) wide distribution of these species is caused by lack of clear preference for specific environmental conditions. The result of the present study led to introduce a group of indicators species for oak habitat in different environmental conditions and altitudes. This was considered as an advantage against single indicators species. Because use of a particular indicator species is limited and varies from an ecosystem to ecosystem (Barnes, 1998), lack of indicator species in a region is related to some non-related factors of site quality e.g. habitat disturbance, forest history and sudden events. Therefore, instead of using a particular indicator species, a group of species can serve for identifying habitat conditions. This issue will be very effective in Zagros forests. In fact identification and introduction of ecological species groups in undisturbed area can be useful to assess changes in similar areas after management practices such as protective management.

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گونه های گیاهی زیر اشکوب بلوط ایرانی در رابطه با خصوصیات فیزیکی و شیمیایی خاک در طبقات مختلف ارتفاعی در منطقه حفاظت شده دره ارغوان، ایلام، غرب ایران

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چکیده

این مطالعه در جنگل های بلوط ایرانی منطقه حفاظت شده دره ارغوان در غرب ایران انجام شده است. هدف اصلی این مطالعه بررسی پوشش گیاهی زیراشکوب بلوط ایرانی در رابطه با خصوصیات فیزیکی و شیمیایی خاک در طبقات مختلف ارتفاع از سطح دریا (۱۴۰۰-۱۶۰۰،۱۶۰۰-۱۸۰۰ و >۱۸۰۰ متر) در دامنه جنوبی است. چهار ترانسکت با فاصله ۲۰۰ متر از هم از پایین بند به طرف قله پیاده شد. ۲۵ درخت بلوط رو یا کنار ترانسکت ها در هر طبقه ارتفاعی به عنوان مرکز قطعه نمونه انتخاب شد. روش پلات های حلزونی ویتاکر و منحنی سطح - گونه برای تعیین سطح برداشت پوشش گیاهی بکار رفت. تجزیه و تحلیل دو طرفه گونه های شاخص برای طبقه بندی داده های پوشش گیاهی و به منظور درک رابطه بین پوشش گیاهی و خصوصیات خاک و نیز مؤثرترین عوامل در پراکنش پوشش گیاهی از روش های چند متغیره یعنی تجزیه و تحلیل مؤلفه اصلی (PCA) و تجزیه و تحلیل تطبیقی متعارف (CCA) استفاده شد. بر این اساس سه گروه مشخص بدست آمد. این گروه ها دقیقا منطبق با قطعات نمونه ی ما در کلاسه های ارتفاعی بود و خصوصیات مشخصی از نظر پوشش گیاهی و خاک داشتند. مهمترین عوامل درتشکیل گروه پایین بند اسیدیته خاک، درصد رطوبت اشباع، کربن آلی، ازت، فسفر و پتاسیم، در گروه بالا بند ارتفاع از سطح دریا، وزن مخصوص ظاهری و درصد سنگ و سنگریزه بود و گروه میان بند شرایط حد واسط این دو گروه را داشت، اگرچه شرایط آن به گروه سه شبیه تر بود. نتایج همچنین نشان داد که شاخصهای تنوع شانون و مارگالف از پایین بند به طرف بالابند کاهش پیدا کرده و بیشترین مقدار این شاخصها در گروه پایین بند به دست آمد.

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