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Environmental factors affecting on distribution of plant communities in semi-arid area (Case study: Kamyaran rangelands, Iran)

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ABSTRACT

The aim of this study was to survey the effective environmental factors on distribution of plant communities as one of the most important structure in semi-arid rangelands via field visits and various environmental factors measurements. However, various plant communities was studied in some part of kamyaran rangelands in about 10000 ha within different characteristics (altitudes and slopes), in each community 4 transects established with 300m length. 15 plots (1m^2) established along each transect in 20 meter distances. The kind and the amount of existing species and the percentage of vegetation cover were determined in each plot. Various soil parameters such as physical factors (soil depths, soil texture) and chemical factors such as amount acidity, organic matter, electrical conductivity, lime and nitrogen were also measured. Soil and plant data were analyzed with multivariate analyzing, principal component analyzing (PCA). The results showed that among environmental factors, 5 factors including clay, sand, nitrogen, slope and altitude have the highest correlation with principal components and are the most effective influencing factors on plant communities' distribution in semi-arid rangelands.

Key words: Environmental factors, Plant community, PCA, kamyaran, Iran

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INTRODUCTION

The appearance of a plant group in a given area isn't accidental, but occurs in response to changes in climatic, topographic, edaphic and biotic parameters. In fact, vegetation groups are determined by the combined effects of a whole range of ecological factors. Thus, change in the soil, topography and grazing factors can lead to vegetation responses in each area of the landscape (13). The regions that contain similar ecological species groups create ecological groups that are homogeneous habitats with similar ecologic and floristic composition, which can be used in habitat classification (20, 15 and 16). With development of restoration ecology and understanding of principles of biodiversity, it is realized that species composition and diversity are fundamental characteristics of ecosystems (6, 14, 10 and 3) and vegetation diversity should be considered (10 and 3). Plant species distribution over a high geographical range is controlled by climatic factors, mainly temperature and rainfall (1). Over a small range, however, species distribution is related to edaphic factors (11, 4, 5, 1, 2, 17and 9). Unfortunately, nowadays plant species conversation is less considerable in our country. Lately, because of urban and agronomy development, forests and rangelands destruction and natural changes, some of these plants are reported as extinct species (18). (8 and 19) Showed that the importance of topography in explaining the variation in soil properties and composition among different stretches of land, in its hydrological features and the distribution of plants. Interactions between

plant groups and environmental parameters provide a useful opportunity to alter management to improve rangeland ecosystems. Thus, Principal Component Analysis (PCA) was used in this research to investigate the effect of edaphic and physiographic factors that formed ecological plant groups in the Kamyaran rangelands in Kurdistan province of Iran. The main purpose of the present study was to determine the strongest factors affecting the separation of plant groups. Identification of these parameters in a given ecosystem helps us to apply appropriate management for restoration and development in the present and in similar regions.

MATERIALS AND METHODS

The study area was chosen in semiarid rangelands of Kamyaran, Iran (between 34° 51' to 34° 59' N and 46° 68' to 46° 77' E). The area is approximately 10000 hectares with elevation ranging from 1320 m to 1740 meter. The means of precipitation is 530mm/year that maximum and minimum of precipitation occur in February and July respectively. The mean of annual temperature is 12° C. Initially in order to general reorganization of study area and investigation of plant vegetation, a field survey was done. Then using GPS the slop, aspect and elevation were obtained. Based on primary study, major plant types and species selected and sampling was done within them with systematically-randomized method. According to species and distribution of plant communities the proper area of sampling plot was determined by minimal area method and the number of plot after the primary sampling was the determined by statistical method. Sampling in each plant type was done along four 300 meter transects. 15 plots ($1m^2$) established along each transect in 20 meter distances. The kind and the amount of existing species and the percentage of vegetation cover were determined in each plot. In each type, 8 profiles was dug and taken soil the same distribution in within sampling unit. A total number of 40 soil samples were taken from 0-30 cm depth at the starting and ending point of each quadrate. The soil samples were air dried at room temperature and passed through a 2mm sieve. The weight of fine fraction (<2 mm) in each soil sample was determined and was kept for laboratory analyses. Soil texture was determined by the hydrometer method, pH and EC in a saturation extract by pH meter and EC meter; organic matter by the Walkley and Black's method; the proportion of CaCO3 by the Calsimeter method. Total Nitrogen (N) was obtained by Kjeldahl method. Principal component analysis (PCA) was conducted on vegetation and plant type-environmental variable matrix using the program PC-ORD.

RESULTS

Plant types of this study are including: *Astragalus gossypinus - Gundelia tournefortii*; *Astragalus nervestipulius – Prangus ferulaceae*; *Bromus tomentellus-Festuca ovina*;
Psathyrustachys fragilis- Bromus tomentellus; *Ferula hausknekhtii- Prangus ferulacea*

Table 1: variance extracted, first 4 axes of PCA in the study area

Axes	1	2	3	4
Broken Stick	3.548	2.548	2.148	1.714
Variance%	45.753	34.922	11.485	7.840
Cum. % of Var.	45.753	80.675	92.160	100
Eigenvalue	8.692	6.635	2.082	1.490

Table 2: PCA applied to the correlation matrix of the environmental factors

Factors	Axis					
	1	2	3	4	5	6
pH	0.0492	0.0234	-0.2132	0.5421	-0.0127	0.1430
EC	0.2500	-0.2200	0.3091	0.2919	-0.3150	0.1050
Organic matter	-0.0945	0.3508	-0.0388	0.4452	-0.0231	0.0235
Clay	0.0817	0.1247	0.0974	-0.0392	0.0247	-0.0145
Silt	0.1340	-0.0459	-0.0453	0.0818	0.0250	-0.0548
Sand	0.2814	0.0231	-0.2435	-0.2193	0.0165	-0.0148
Lime	-0.1336	-0.1512	0.6271	-0.0075	-0.1401	0.2543
Nitrogen	0.0867	-0.0987	-0.0057	0.0456	-0.0873	0.0214
Altitude	0.1940	-0.1456	-0.0359	0.0089	-0.0620	0.1551
Slope	-0.4510	0.0968	0.1040	0.1560	-0.1610	-0.0890
soil Depth	-0.3364	0.1031	0.3126	0.0745	-0.624	-0.0458

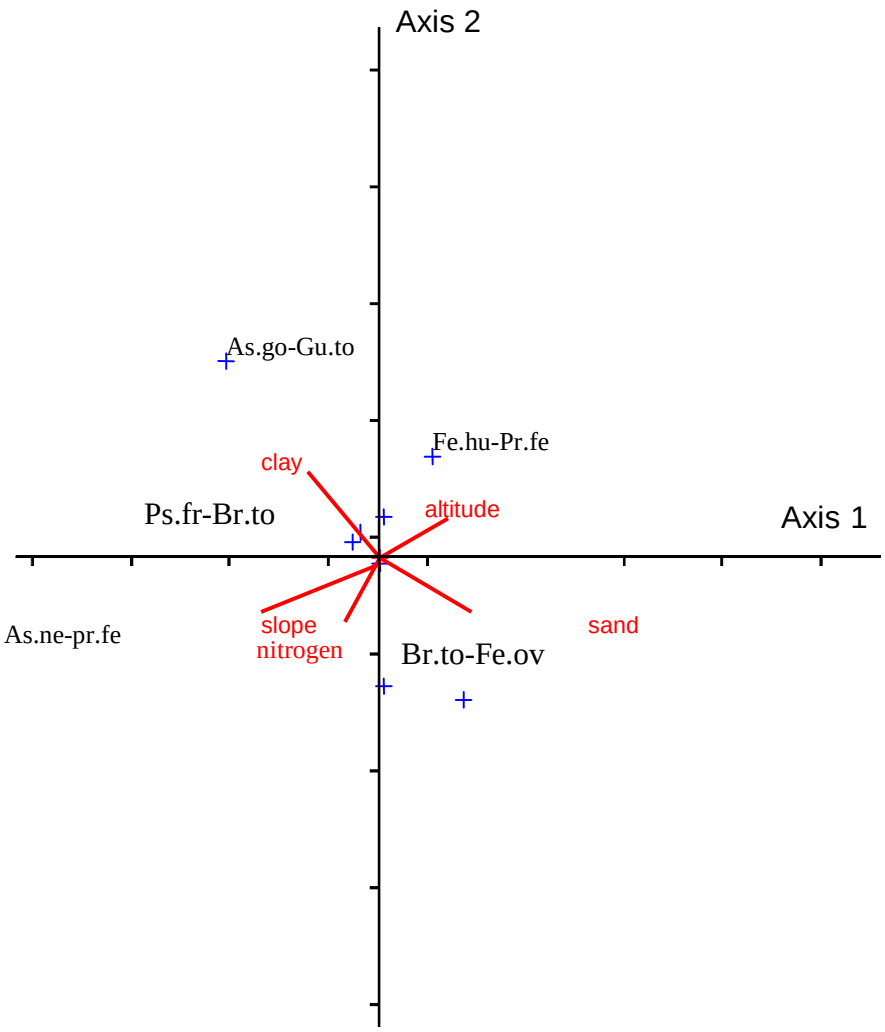

Fig. 1: Axis 1 and 2 of the PCA diagram of the vegetation types related to the environmental factors in the study area

Five plant types and 11 environmental factors were used in the principal component analysis (PCA) in order to determine the most effective environmental parameters controlling the distribution of vegetation. The first two axes of the PCA ordination of soil and physiographic parameter accounted for 45.753% and 34.922% of the total variability, respectively. Therefore, the first two principal components together accounted for 80.675% of the total variance in data set (Table 1). The first axis was positively correlated with sand and altitude and negatively correlated with slope. The second axis was positively correlated with clay and negatively with nitrogen. Figure 1 showed that two types including *Astragalus nervestipulius –Prangus ferulaceae* and *Psathyrustachys fragilis-Bromus tomentellus* are correlated with axis 1 and are affected by properties of first axis (altitude, slope, sand). Other types are affected by properties of second axis including nitrogen and clay.

DISCUSSION AND CONCLUSION

The present study examined the relationship between environmental variables and plant distribution in a part of semiarid ecosystem of Kamyaran rangelands in Kurdistan province of Iran. In our study area, the differences of climate features are relatively small, so plant distribution may be potentially affected by soil and topographical properties. Analysis with PCA confirms that there is a relatively high correspondence between vegetation and soil or topography factors that explain 81% of the total variance in data set. The PCA results showed that soil texture

including sand and clay, nitrogen, altitude and slope are the most important factors for the distribution of the vegetation pattern (Table 2, Fig. 1). Distribution of *As.nervestipulius –Pr. ferulaceae* and *Ps. fragilis- Br. tomentellus* types seems to be more influenced by physiographical factors. Soil texture is one of the effective factors in the distribution of *As. gossypinus – Gu. tournefortii*, *Br. tomentellus-Fe. ovina* and *Fe. hausknekhtii– Pr. Ferulacea*. These results were in conformity with the results reported by (12) and (21). This research showed that most important factors on distribution of plant communities in rangelands of Kamyaran rangelands are physical soil properties and physiographic factors. Soil texture is one of the effective factors in the distribution of plant communities in this region.

The present study addressed some aspects of relationships between environmental factors and plant vegetation in native rangelands within semiarid areas of Iran. It was anticipated that this finding could be used as a tool for prediction of presence and absence probability of these plant species in rangeland within similar ecosystems.

REFERENCES

[1] Ayyad MA. and E1-Ghareeb R., *Oikos*., **1972**, 23: 125-131.
[2] Bouyoucos GJ., *Agronomy J*., **1951,** 54: 464-465.
[3] Burke A., *Ambio*., **2001**, 30: 29–36.
[4] Chapman VJ., Salt Marshes and Salt Deserts of the World. Interscience Publishers Inc., New York., **1960.**
[5] Chapman VJ., Vegetation and Salinity. *Monographiae Biologicae*., **1966**, 16: 23-42.
[6] Chapin SF., Schulze ED. and Mooney HA., *Trends in Ecology and Evolution*., **1992,** 7: 107– 108.
[7] Debelis S P., Bozzo AA., Barrios MB. and Bujan A., *Spanish J. Agric. Res*., **2005**, 3(2): 232-242.
[8] E1-Ghareeb R. and Abdel-Raziz M., *Bull. Fac. Sci. Alex. Univ*., **1984**, 24: 213-234.
[9] ESA (Ecological Society of America)., Biodiversity and ecosystem functioning: maintaining natural life support processes. http://esa.sdsc.edu., **1999.**
[10] Gates DH., Stoddart AL. and Cook WC., *Ecol. Monogr*., **1956**, 26: 155-175.
[11] He MZ., Zheng JG., Li X R. and Qian YL., *J. Arid Environments*., **2007**, 69: 473-489.
[12] Holechek JL., Pieper RD. and Herbel CH., Range Management. Principles and Practices. Prentice-Hall, New Jeresy., **1989.**
[13] Hooper DU. and Vitousek PM.., *Science*., **1997**, 277, 1302–1305.
[14] Kashian DM., *Plant Ecol*., **2003**, 66: 75–91.
[15] Kooch Y., Jalilvand H., Bahmanyar MA. and Pormajidian MR., *Pak J Biol Sci*., **2008**, 11: 752–757.
[16] McLean EO., Soil pH and lime requirement. In: A.L. Page, (Ed.) and Methods of Soil Analysis. Part, American Society of Agronomy, vol. 2. Soil Science Society of America, Madison, Wis., **1982**, 199-224.
[17] Mohammadi F., Seminar on paleontology and biodiversity, dayereh sabz publications., **2000,** 350 p.
[18] Rhoades J.D., Soluble salts. In: A.L. Page, (Ed.), Methods of Soil Analysis, American Society Agronomy, vol. 2. Soil Science Society of America, Madison, Wis., **1982**, 167-179.
[19] Zahedi Gh. and Mohammadi S., *Nat Resour* (In Persian with English abstract.)., **2002**, 55: 341–355.
[20] Zare S., Jafari M., Tavili A., Abbasi H.R. and Rostampour M., *American-Eurasian J. Agric. & Environ. Sci*., **2011**, 10 (1): 97-105.