Investigation on Some Physical and Chemical Relationships in Soil and Plant in Arid zone

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This research was achieved for surveying of the relationships between vegetation cover and its density with soil physical and chemical characteristics in arid ecosystems. First of all soil and vegetation cover study was conducted in Allah-Yar region, north of Qom province.
According to the distribution of vegetation cover and field surveys, six types of vegetation were distinguished. For studying of vegetation, the area of quadrates was calculated by the minimum area method.
In each type of vegetation cover for all dominant species were selected five quadrates. Within each quadrate, vegetation factors such as canopy cover and density were investigated.
Then a profile was dug near the dominant plant species in the quadrate and sampled from two horizons namely 0-10cm and 10-30cm.
In the next stage, soil properties such as pH, Ec, Caco3 percentage, organic matter percentage and texture were determined in soil laboratory.
After collecting of data, multivariate analysis, correlation coefficients and factor analysis was done by using SPSS win and MSTAT programs. Results showed some relationship between plant species and soil characteristics that some of them were not significant because of number of low replications. Some important results are as follow as:
Eurotia ceratoides species has the most relation with amount of lime. This characteristic includes 83% of changes in canopy cover percentage.
Gravel percentage in the first horizon includes 25% of changes in canopy cover percentage of *Artemisia sieberi*. Organic matter in the first horizon includes 95% of changes in canopy cover percentage of *Pteropyrum aucheri*
Gravel percentage in the second horizon includes 94% of changes in canopy cover percentage in *Pteropyrum aucheri* species too.

INTERESTING - 3

INFORMATIVE - 7

[PRACTICAL REALISTIC] - 7

17

What is the purpose? Basically why was this done. Seems to be just an initial step in some direction.

ABSTRACT 6

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Key words: Qom province, vegetation type, soil characteristics, analysis of variance, multivariate analysis.

Investigation on relationship between vegetation properties and soil characteristics in an Arid-zone(Qom province)

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Abstract

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Introduction

Soil is common section between biotic and abiolic components. Soil is growth place where plants make tissues by mineral materials, solar energy and Co_2. Soil provides water and nutrient for plants. Plants establishment is done by their roots through soil. Soil has high importance in natural resources too. Soil and plant relationships is very high and little changes in soil show themselves in plant and vice versa. Revelation of relations between vegetation and soil is essential in natural resources management (2). Similar units in soil and plant can be used for improving and reclamation affairs. By mentioned relationships can develop failures and success in similar sites. Presence and plants growth depend to soil chemical and physical properties. There is similar vegetation in sites with similar soils. Of course, similarity in soil and plant units is observed where other factors are some. Different researches have been done for surveying relations. Azarnivand (1990) has stated that there is exact relations between geomorphology, soil and vegetation in Damghan City. Moghimi (1989) has searched plants distribution with salinity agents. Guity (1996) has identified effects of plantation *Tamarix* and *Atriplex* species on soil salinity. Boer (1996) has shown that index plants are indicators of soil ecological parameters. Bharmbe (1997) has surveyed soil nitrogen and organic regimes on relations between soil, plant and water in sunflower. Verloo (1996) has searched soil-plant relations in saturated soils. He/she analyzed pH, clay and organic matter effects on root pressure too. This research has done for determination of soil parameters and vegetation characteristics with attention to above cases.

Materials and Methods

Study site was located in center of Iran in Qom province with 3750 ha. Some characteristics such as height, average of air annual temperature, annual rainfall and annual evaporation are 1100-1600m, 15-17°c, 150-200mm and 2400-2600mm respectively.

For surveying vegetation factors and soil characteristics plant types were identified after region identification vegetation types were *Artemisia sieberi-Ptropyrum aucheri, Artemisia sieberi-Eurotia ceratoides, Artemisia sieberi, Tamarix taxa, Ephedra strobilacea-Amygdallus scoparia* and *Ephedra strobilaceae-Artemisia sieberi.*

Sample were taken from key areas. Plots size were determined with minimal area method with attention to plants kind and distribution.

Five plots were surveyed in each plant type, list of plants, crown cover percentage and density were recorded inside plots. Soil samples of profiles were taken from 0-10 and 10-30cm layers.

Measured factors were texture (by Hygrometry method), pH in saturation extract (by pH meter), Electrical conductivity (by electrical conductivity meter), lime percentage (by calcimetry), organic matter (by cold, thick H_2So_4 method). Plant factors such as crown cover and density and soil characteristics such as texture, lime, organic matter, EC and pH were used for data analysis and soil-plant relations. Data analyzed by SPSS under Windows program. Analysis of variance were used for comparison of soil characteristics in different plant types. Step-Wise regression was done for determination of soil effective factor on vegetation changes. Plant factors as dependent variable and soil factors as independent variable were identified in this research.

Results

Table 1 shows soil chemical and physical characteristics in study area. Analysis of variance was done on data for comparison of vegetation types with a view to soil properties. Results has been shown in table 2. According to table 2 and Fisher test, surveyed characteristics are significant in 1% level. Therefore, vegetation types are differents with a view soil characteristics.

Multiple regression Analysis was done for surveying of relationship between soil and vegetation factors.

Step-wise method was used for determination of the most important soil effective agent that results are observed in table 3. Obtained results in different species are as following as according to table 3.

1- *Eurotia ceratoides*: Measured lime in the first depth has direct relation with crown cover percentage. In General, 83% changes in crown cover is justified by lime. 17% changes are justified by other characteristics that have not been surveyed there isn't any relation between measured soil factors with crown cover percentage in the second depth. Density changes have not justified through any of soil measured factors.

2-*Artemisia sieberi:* Crown cover has inverse relation with gravel in the first depth. Crown cover percentage decrease with increment of gravel percentage. This factor justifies only 25% changes. 75% changes are for other factors that have not been surveyed.

There isn't linear relation between crown cover percentage and soil measured factors. Density mentioned species has direct relation with loam in the first depth, but this species has inverse relation with gravel percentage in the second depth.

3-*Pteropyrum aucheri*: Crown cover percentage in mentioned species has direct relation with organic matter factor in the first depth. 95% changes in crown are justified by organic matter, but 5% changes is for other characteristics that have not been surveyed.

94% changes in crown cover percentage are justified by gravel percentage in the second layer. 6% changes are for other characteristics that have not been surveyed. There is negative relation between gravel and crown cover.

There isn't significant linear relation in measured factors and plant in the first and second depths.

4-*Ephedra strobilaceae*: 53% changes in crown cover percentage are justified by lime in the first depth. 47% other changes are for other characteristics that have not been surveyed. Crown cover percentage and has reverse relation. There isn't significant linear relation between crown cover percentage and soil measured factors in the second depth. Any of surveyed soil factors don't justify density changes. There isn't significant linear relation between crown cover and density in plants and measured soil factors in this research. In *Tamarix taxa* and *Amygdallus scoparia* crown cover and density changes in mentioned species have been justified by other properties that they haven't been surveyed.

Discussion and conclusion

There is the highest relationship between vegetation cover and soil factors such as lime, organic matter and gravel according to current research. Surveyed factors have important role in plants nutrition and growth. Noy-meir (1973) showed that vegetation changes are justified due to relations between rainfall and soil texture in Australian Arid-Zones. Of course, physical and edaphic factors that provide soil moisture are valuable indicies for justification of vegetation cover changes.

Lime, organic matter and gravel are important agents in formation of soil structure. Karsen and Hillhorst (1993) state that soil structure is important agent in seed germination. Structure determine situation of available water, solutions and gases distribution.

Hard pans due to high lime, high acidity and salts provide problems for plants roots. Organic matter because of high nitrogen and cation exchange phenomenon properties has essential role in plants nutrition.

Optimum gravel has important role in suitable structure and infiltration. High gravel is identified limited factor in vegetation.

All of plant species have strong relations with soil characteristics. Lime factor has direct relationship with crown cover percentage in *Eurotia ceratoides*. Lime percentage has inverse relation with *Ephedra strobilaceae.* This situation is due to physiological characteristic of mentioned species.

Crown cover percentage in *Artemisia sieberi* species has inverse relation with gravel percentage in the first layer. Canopy cover percentage in *Pteropyrum aucheri* species has direct relation with organic matter in the first depth, but there is reverse relation between canopy cover percentage and gravel in the second layer.

There isn't significant relation between *Tamarix taxa* and *Amygdallus scoparia* species and surveyed soil factors. Therefore, changes are for other agents that have not been studied.

Obtained relations of different plant species in study area can be developed to similar regions.

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Table 1: Soil physical and chemical characteristics in study area in different vegetation types

O.M* (%)	Lime (%)	pH	EC (ds/ m)	Sand (%)	Loam (%)	Clay (%)	Gravel (%)	Depth (cm)	Vegetation type*
1.35	4.12	7.56	0.33	51.78	23.30	24.92	43.5	0-10	*Ar.si-Eu.ce*
0.79	6.05	7.6	0.303	49.92	23.72	26.36	50	10-30	
0.62	7.25	7.68	0.316	81.71	13.40	4.89	42.7	0-10	*Ar.se-Pt.au*
.223	6.25	7.73	0.258	89.38	6.40	4.22	55.5	10-30	
0.642	3.70	7.69	0.269	73.63	18.28	8.09	37.11	0-10	*Ep.st-Am.sc*
0.587	4.94	7.73	0.254	72.36	18.10	9.54	38.86	10-30	
0.212	5.92	8.72	3.46	88.65	8.18	3.17	21.8	0-10	*Ta.ta*
0.296	6.83	8.12	2.46	86.096	10.952	3.952	27.6	10-30	
1.12	6.71	7.60	0.378	53.81	26.07	20.12	48.8	0-10	*Ar.si*
0.402	9.29	7.66	0.296	52.18	21.09	26.73	30.2	10-30	
0.373	6.56	7.04	0.247	80.545	12.62	6.835	40.88	0-10	*Ep.st-Ar.si*
0.335	8.02	7.73	0.254	77.38	12.26	10.36	43.5	10-30	

* O.M=Organic matter *Ar.si: Artemisia sieberi*
Eu.ce: Eurotia ceratoides *Pt.au : Pteropyrum aucheri* *Am.sc : Amygdallus scoparia.* *Ep.st: Ephedra strobilaceae* *Ta.ta: Tamarix taxa.*

Table 2: Results of analysis of variance in measured soil factors in study area

S.O.V	D.F	O.M* (%)	Lime (%)	pH	EC (ds/m)	Sand (%)	Loam (%)	Clay (%)	Gravel (%)
Between vegatation types	5	1.60***	70***	1.03***	23.57***	2898***	530.88***	119.6***	864.86***
Within vegetation types	78	0.15	8.77	0.06	1.41	31.3	31.3	27.7	77.15

S.O.V: Source of variation D.F: Degree of freedom ***: Significant in 1% level

Table 3: Stepwise regression between crown cover pecentage of species and soil factors

Equation*	R^2	M.S	df	S.O.V	Soil factor*	Depth (cm)	Species*
Y=2.88Li-1.4	0.83	158.30** 10.80	1 3	Regression Error	Lime	0-10	*Eu.ce*
			——	Regression Error	————	10-30	
Y=-0.47Gr+40.51	0.25	290.75** 50.60	1 17	Regresion Error	Gravel	0-10	*Ar.si*
				Regression Error	————	10-30	
Y=43.69OM-0.11	0.95	2470.19*** 41.93		Regression Error	O.M	0-10	*Pt.au*
Y=-3.66Gr+232.57	0.94	2444.4*** 50.52		Regression Error	Gravel	10-30	
Y=-3.88Li+38.66	0.53	247.40*** 30.66		Regression Error	Lime	0-10	*Ep.st*
————	——	————	——	————	————	10-30	
————	——	————	——	————	————	0-10	*Ta.ta*
————	——	————	——	————	————	10-30	
————	——	————	——	————	————	0-10	*Am.sc*
————	——	————	——	————	————	10-30	

S.O.V: Source of variation D.F: Degree of freedom M.S: Mean of squares
Li: Lime Gr: Gravel O.M: Organic matter Y: Crown cover percentage
: Significant in 5% level *: Significant in 1% level