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The comparison of qualitative assessment of potential of soil surface attributes in land units of rangeland bozdaghy in North- Khorasan province

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ABSTRACT

Soil, plant and indicators are the main criteria to recognize the function of natural ecosystems and evaluate their potentials. Rangeland ecosystem contains various patches with different functions. The structural and functional characteristics of fertilized patches in Bozdaghy rangeland, in North-Khorasan Province was measured and analyzed in this study. A group of measurable and simple indices of landscape function analysis (LFA) methods were used to evaluate these characteristics. The data were measured from seven land unit which is developed from overlaying of geology map on the dem and slope map. In this research the length and width of ecological patches by the forms of Grass, forb, shrub and bare soil with litter measured. Also we measured 11 soil surface parameters on three, 50 meters transects in the seven mentioned regions. These 11 parameters are belonging to 3 major attributes of soil: Stability, infiltration and nutrients. Statistical analysis of data using the software landscape function analysis, carried. Using multivariate analysis of variance and Duncan's test, functional characteristics associated with each of the land units were studied. Stability, infiltration and nutrients indices of Shrub, forbs and Grass showed significant differences in seven land unit ($p<0.05$). shrub was most important ecological indicators of areas.

Introduction

An appreciation of the processes by which scarce resources are regulated in landscapes is a pivotal step in the method. In landscapes with a high functional status, soil, water and nutrients (collectively called “resources”) are strongly conserved within the landscape and used within that system (Tongway & Hindley, 2004). Understanding of the relationships between vegetation and soil and topography would be very important for ecosystem restoration and management efforts in the dry valleys (Xu, 2008). Slope, the role is responsible for determining the potential of a rangeland. In steep land, is less chance of water infiltration and runoff will move. Production, density and diversity of plant were insignificant and its utilization is completely different than the slope low land (Barker, 1995).

Usually, many landscape on resource control, heterogeneous and non-uniform. Also it has patches and interpatches (Ludwig, et al, 2005). "Interpatch" In arid and semi-arid rangeland in performance are very important so that damages due to relative distribution of them, will have a great effect on performance rangeland (abedi, et al, 2006). soil surface cover is a good indicator of ecosystem status in arid and semi-arid. Understanding the relationship between soil and vegetation, is one of the main pillars in range management (Amanolahi, et al, 2008). Surface data in different groups are combined to provide three main indicators of soil quality: stability or resistance to erosion, infiltration and nutrient cycling. Each of the above indices are expressed as a percentage (Tongway & Hindley, 2004).

Soil is the most important resource in any rangeland. Some soil characteristics correlated with reproductive capacity and soil stability. there are certainly a variety of additional soil properties which may be responsible for the distribution of plants, and a variety of additional vegetation types occur in the region (Boer& Sargeant, 1998). Landscape function indicators such as soil stability, infiltration and nutrient cycle, simple indicators that are focused on indicators of soil ecosystem can be evaluated quickly. These indicators provide a broader range of information about ecosystem functioning and capable rangeland ecosystems in terms of evaluating the success of the reform and rehabilitation. These indicators provide a broader range of information about ecosystem functioning and could rangeland ecosystems in terms of evaluating the success of the reform and rehabilitation. rangeland monitoring using functional analysis to understand the functional status of ecosystems and in addition it can be helpful to realize how closely with management objectives (Bestelmeyer, etal, 2006).

Understanding the processes and resources within an ecological systems perspective is set, is an important step in maintaining the ecosystem. Performance depends on a landscape conservation and use of water, soil and food are within the ecosystem (Teague, etal, 2004). In order to correctly apply scientific management of rangeland ecosystems as indicators of ecosystem health and function of an ecosystem of information is required (Lotfi & Heshmati, 2009). Two different visions of the landscape as a function of environmental factors and management of the vegetative form is different. Establishment and spread of plant species in different landscape, a different result is the two landscape (Heshmati, 2007).

Each landscape type is likely to have characteristic modes or mechanisms by which scarce resources are regulated (Ludwig and Tongway, 1995). If this proposition is true, then degradation of any landscape can be defined in terms of a change in the

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manner in which scarce resources are redistributed in space and time. Tongway and Hindley (1995) proposed that a combination of terrain and vegetation properties that can be discerned in the field are indicators of the mechanisms involved, and these can be used to define whether the function of any particular landscape has changed in any way. The change may take a number of forms: the mode and scale of the redistribution system, or the efficiency of resource depletion/accumulation processes. It is an objective of landscape function analysis to account for or explain changes in, say, vegetation species composition both in terms of ecosystem processes referred to above and in the quality of the edaphic habitat. A change may signify a major landscape function shift with major consequences for production and biodiversity, or may be a much less significant issue, that is spontaneously reversible in management time (Tongway and Hindley, 2000). The aim of this study was to compare the performance of land units in the pasture area. In order to implement any corrective action, management must pay attention to the potential field.

Materials and Methods

The data were collected from seven vegetation types within the Bozdaghy rangeland, between $56^0\ 45^/\ 9^{//}$ and $56^0\ 50^/\ 13^{//}$ N and $37^0\ 49^/\ 39^{//}$ and $37^0\ 55^/\ 34^{//}$ E, north of Khorasan, Iran. The data were measured from seven land unit which is developed from overlaying of geology map on the dem and slope map (Figure 1).

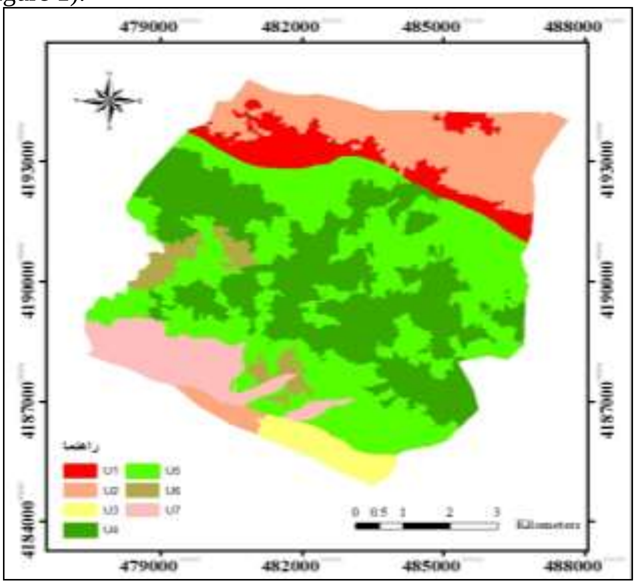

Figure 1 - Map of land unit

Table 1- Guidance of land unit map

Geology	slope	Elevetion	code
Ksr Formation	5-12	900-1000	U1
	12-20	900-1000	U2
	20<	900-1000	U3
Ksn Formation	0-5	800-900	U4
	5-12	800-900	U5
	12-20	800-900	U6
Qt1 Formation	5-12	900-1000	U7

In each work unit through the 50 m transect in the area to collect data for performance analysis of rangeland. After establishing transects at various patches in rangeland to separate life forms (shrubs, forb and grasses) were identified. Along each transect length and width of the various productive patches (patches dimensions) and the spaces between patchiness (bare soil) were recorded. Five replicates of each patch/inter-patch type are essential for statistical reliability. 11 soil parameters were evaluated (Table 2). Statistical analysis of the data using the software landscape function analysis (Tongway & Lodwig, 2004), carried. Using multivariate analysis of variance and Duncan's test, functional characteristics associated with each of the land units were studied.

Results

Structural characteristics of ecological patches

The assessment was based on three ecological patches, shrubs, grass and forbs were identified in 7 land units. The maximum number of patches allocated to the plant species is *Artemisia sieberi*. other shrub *Salsola arbusculiformis* can be pointed out. Patches of grass, *stipa barbata* and *Poa bulbosa*, and forbs such as *Phlomis cancellata*, *Cousinia spp* can be mentioned. Patches of shrub in this region compared to other patches are most patches. The most average ecological patches along transects in each area is shrub. The results of the statistical comparison between five structural features of ecological patches which are estimated using the software LFA in 7 land units is as follows: (Table 3).

Table 3 - Changes average structural features of ecological patches in land units

Land unit	structural features of ecological patches				
	Landscape Organisation Index	Patch Area Index	Number of patch zones/10 metres	Total Patch area	Average inter-patch
U1	0.16^{*a}	0.006^{a}	4^{a}	3^{a}	2.05^{b}
U2	0.27^{b}	0.013^{ab}	3.1^{a}	3.7^{a}	2.28^{c}
U3	0.4^{b}	0.024^{b}	5^{b}	13.8^{b}	1.22^{a}
U4	0.26^{a}	0.013^{ab}	4.48^{b}	6.5^{a}	1.66^{a}
U5	0.18^{a}	0.008^{a}	3.5^{a}	6.5^{a}	2.24^{c}
U6	0.2^{a}	0.008^{a}	4.2^{b}	4.5^{a}	2^{b}
U7	0.31^{b}	0.002^{b}	6.2^{c}	8.2^{b}	1.12^{a}

The landscape indicator that shows the capabilities and potential of ecosystem. Respective land units of the third, seven and second most index value is landscape structure. The index is obtained of bare space in the landscape. Therefore patch area rather than average inter-patch length in the third, seventh and second land units, respectively, with values of 0.4, 0.31 and 0.27. The amount of index in three land units with other land units are different significantly ($p<0.05$). patch area rather than average inter-patch length in first land units are about double second land units. The increase in potential of first land units effected of patch ecological uniformity in this area and shows the difference between the two groups were affected of patches. patch area index (mean patch area divided by the total number of patches) in land units of three and seven respectively is 0.024 and 0.02. These values are significantly most than in land units. The total number of patches in U7 land unit is 6.2, which shows significant differences with other land units ($p<0.05$). In this land unit, patches are interconnected and wider than other land units. The average length of the bare soil or interpatch, in land units of U7 and U3 respectively with values 1.12 and 1.22 were lowest and showed significant differences ($p<0.05$) (table 3).

Functional characteristics of ecological patches

Soil surface assessment calculations (stability, infiltration and nutrient cycles index) for different forms of vegetation and bare soil in 7 land units in study area is shown in Table 4. Comparisons of soil stability in land units shows that the amount of shrubs life form in land unite U3 and U7, also forb and grass life forms in land unite U3 more than other land units.

Table2- indicators of Landscape Function Analysis (Tongway & Hindley, 2004)

row	Indicator	Number of Classes	function		
			Stability	Infiltration	Nutrient Cycling
1	Soil Cover	5	✓		
2	Perennial grass basal and tree and shrub foliage cover	4		✓	✓
3a	Litter cover	10	✓		
3b	Litter cover, origin and degree of decomposition	4		✓	✓
4	Cryptogam cover	4	✓		✓
5	Crust broken-ness	4	✓		
6	Erosion type & severity	4	✓		
7	Deposited materials	4	✓		
8	Surface roughness	5		✓	✓
9	Surface resistance to disturb.	5	✓	✓	
10	Slake test	4	✓	✓	
11	Soil texture	4		✓	

Have a statistically significant difference ($p<0.05$). land unit U1 have a least amount of stability index for bare soil and showed a significant difference with other land units ($p<0.05$). Land unit U3 have a more than infiltration index of shrubs patch other land units, and showed statistically significant difference ($p<0.05$). Land unit U7 have a least amount of infiltration index of bare soil and shows significant value in other land units ($p<0.05$). Most value of nutrient cycle for shrub patch in land unit U3 and U7 with other land units is significant. But bare soil in these units was the lowest value is significantly different from other land units ($p<0.05$) (Table 4).

Table 4: Assessment of changes in soil ecological patches with different life forms

Land unit	patch	Assessment soil surface index		
		Stability	Infiltration	Nutrient cycle
U1	shrub	49.9^{Sa}	37.5^{Sa}	27.6^{Sa}
	forb	47.5^{Fa}	39.4^{Fa}	23.5^{Fa}
	grass	53.1^{Ga}	30.7^{Ga}	24.6^{Ga}
	Bare soil	30.1^{Ba}	31.4^{Ba}	11.7^{Ba}
U2	shrub	49.9^{Sa}	33.4^{Sa}	25.8^{Sa}
	forb	45.6^{Fa}	36.8^{Fa}	24^{Fa}
	grass	54^{Ga}	33.6^{Ga}	27.9^{Ga}
	Bare soil	40.6^{Bc}	22.4^{Bc}	13.3^{Bb}
U3	shrub	59.3^{Sb}	47.7^{Sb}	37.4^{Sb}
	forb	56.8^{Fb}	37.5^{Fa}	22.5^{Fa}
	grass	61.2^{Gb}	39.9^{Gb}	34.5^{Gb}
	Bare soil	48.1^{Bd}	27.3^{Bc}	7.7^{Bc}
U4	shrub	49.3^{Sa}	37.3^{Sa}	29.9^{Sa}
	forb	49.4^{Fa}	27.6^{Fb}	22.5^{Fa}
	grass	51.1^{Ga}	28.8^{Ga}	21^{Ga}
	Bare soil	41.6^{Bc}	23.8^{Bb}	10.2^{Ba}
U5	shrub	52.1^{Sa}	34.1^{Sa}	27^{Sa}
	forb	42.7^{Fc}	26.6^{Fb}	11.8^{Fb}
	grass	48.3^{Ga}	40.1^{Gb}	27^{Ga}
	Bare soil	43.8^{Bc}	24.2^{Bb}	10.2^{Ba}
U6	shrub	40.8^{Sc}	24^{Sc}	18.1^{Sc}
	forb	39^{Fc}	27.4^{Fb}	18.5^{Fa}
	grass	42.3^{Ga}	29.9^{Ga}	21.8^{Ga}
	Bare soil	35.5^{Bb}	26.3^{Bc}	11.2^{Ba}
U7	shrub	57^{Sb}	39.9^{Sa}	35.3^{Sb}
	forb	41.4^{Fc}	26.5^{Fb}	13.3^{Fa}
	grass	53.9^{Ga}	36.1^{Gb}	29.2^{Ga}
	Bare soil	40.6^{Bc}	18^{Bd}	7.7^{Bc}

* Similar letters are not significantly different at the level of 0.05. B, S, G and F Respectively are bare soil, shrubs, grasses and forbs.

Indicators of soil ecological values of each of patch obtained in previous step was applied to the type plant. In each of land units based on specific ecological conditions, patches are deployed on each type has different performance levels. With information on each of patch can be determined land units performance and impact of environmental factors on performance of ecological patch judged. According to composition of patches in land units and values of indicators soil surface, landscape function was determined in each land units. The results show that assessment values of soil parameters in land unit U2 and U3 are more than other land units (Figures 2, 3, 4).

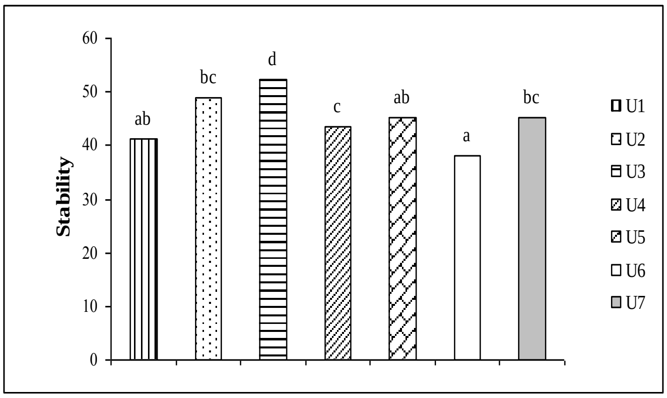

Figure 2 – mean of stability index in land units

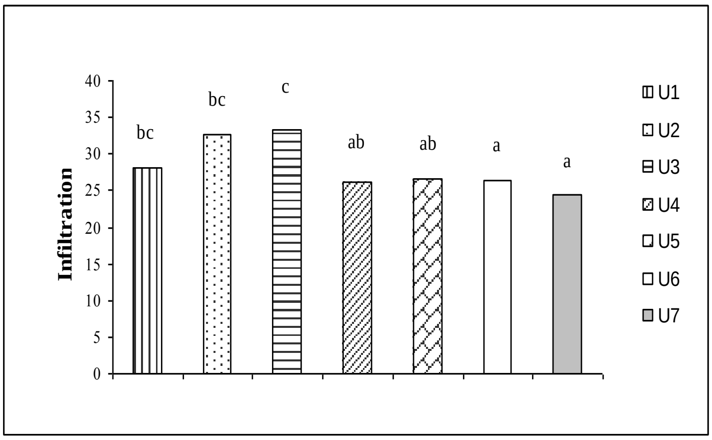

Figure 3 – mean of infiltration index in land units

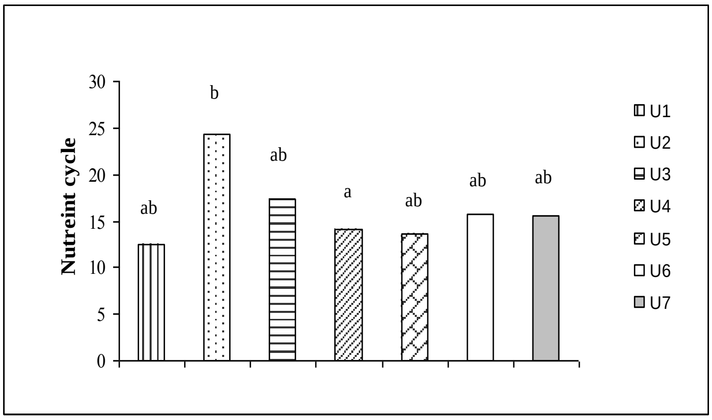

Figure 4 – mean of nutreint cycle index in land units

Discussion

Using indicators of soil surface is determined ecosystem condition by three numerical indices (stability, infiltration and nutrient cycle) that reflect functional status of a region, associated with ecosystem processes and quantitative measurements. The results of soil properties for various life forms confirm this matter. Shrub life form showed highest stability index. This can cause a wide canopy and lying on the ground and a strong, deep root system of shrub. Dominant species of *Artemisia sieberi* be noted. Low canopy cover, high density at base of plant due to soil conservation and stability. Bestelmeyer & etal. (2006) expressed that different forms of vegetation patches due to differences in structure, they have different effects on soil stability. life forms that are larger also stability are more. Abedi & et al. (2007) found similar results. between Shrubs and forbs have not difference. But grass has been least stability and differente by other forms. Due to the high porosity that are related to the biological activity and plant roots,infiltration in patches increased and they are consistent by research (Tongway, et al, 1989; Lowdig, et al, 2005). Lotfi & Heshmati (2009) studies on effects of patch and interpatch on infiltration of shrub between plants dry fields conducted. Due to the high penetration rate of dominant plants in arid rangeland ecosystems, species of plants are the best option to renew these areas as ecohydrologic patterns. The collection and transmission of less resources have played a prominent role in the ecosystem.

Result shows values of indicators to assess soil and landscape function inland unit of U2 and U3 are more than other land units. This difference may reflect influence of environmental factors in rangeland. The overall function of grassland ecosystem function of environmental factors, management grazing, Therefore; structure, function and ecological patterns in their patchs. Hydrological processes, structure and spatial pattern of patches in landscape ecological interactions with together. They increase system performance is improved rangeland (godsi, 2010). Pasture performance indicators such as stability, infiltration and nutrient cycling, soil characteristics are simple and visible. Quick and easy to ecosystem studies. And the influence of environmental factors and management changes, so any management decisions, evaluate the soil surface is recommended. Landscape function analysis can be a valuable model that increases capabilities of expert to easier reach for introduce of rangeland quality indicators.

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