Vegetation Analysis in Rangelands of Lasem, Iran

Reza Tamartash, Maedeh Yousefian, Mohammad Reza Tatian and Mohadeseh Ehsani

Faculty Member of Sari Agricultural Sciences and Natural Resources University, Sari, Iran

Number of Young Research Club of Azad University of Sari, Iran

Department of Range and Watershed Management, Sari Agricultural Sciences and Natural Resources University, Sari, Iran

Abstract: Topography has direct and indirect effects on plant distribution. So knowing of relationship between vegetation and topographic factors can be effective on the estimation of species kind for ecological management in different rangeland ecosystems. Therefore, this research has been studied the topographic factors effect on vegetation changes. Firstly, land units map were prepared by overlaying of slope, altitude and aspect and lithology map in GIS Software. The sampling was done after identification of plant communities by plots randomly in land units. Size and number of plots were determined by minimal area method and statistical formula. Then, plant characteristics and topographic data were recorded in each community by overlaying of plant communities and land units maps and field controlling. Also, ordination of plant communities was done by CCA and DCA. The results showed that different plant communities exhibited different correlations physiographic factors as shrubs had more correlation with altitude and aspect than grasses but those hasn’t significant relation with slope. Presence of invasive species has decreased this correlation with negative effect on ecological relationship in overgrazed communities.

Key words: Lasem • Altitude • Slope • Aspect and Vegetation

INTRODUCTION

Considering to the relationship between environmental parameters and plant cover shows that plants location is not accidental. This occurs due to ecological changes. Nowadays the effects of physiographic parameters on plant cover had been recognized and reaction of plant with soil moisture changes has been appeared in pattern of transmission. So, vegetation changes depend on these factors and can estimate the patterns of plant composition [1]. Because of this, identification of the environmental parameters is necessary [2, 3]. The relationships between physiographic factors and plant cover are shown in some researches [4-7]. They showed that each of ecological factors has many effects on plant distribution. Changes of topographic factors such as aspect and slope are effective parameters on vegetation changes that cause to distribution of different species in ecosystems by effect on soil characteristics [8-10]. Sneddon (2001) showed that topography caused to plant communities formation as ecological groups [11].

Study Area: Lasem is one of the basins of Elborz mountain in north of Iran with 4.925 km² that is located in 52°, 5’ to 52°, 23’ E and 35°, 46’ to 35°, 49’ N. This area is mountainous with high slope. The mean annual precipitation is 337 mm and means annual temperature is 9.4° and climate is cold-semi arid. In order to determination of relation between topographic factors and plant communities, the information layers such as slope, aspect and altitude were provided by topographic maps (1:50000) and also the geological maps (1:100000) in ArcGis 9.2 Software.

MATERIALS AND METHODS

The land units were determined by overlaying of these layers. The study of plant communities was done by field survey in each land units. The size and number of sample was determined by minimal area and statistical formula in each community respectively [12]. Sampling of plant canopy cover was randomly in each community. The topographic characteristics in each plant community found by overlaying the topographic layers and field

Corresponding Author: Mohammad Reza Tatian, Department of Range and Watershed Management, Sari Agricultural Sciences and Natural Resources University, Sari, Iran
controlling too. The data analysis includes correlation between physiographic factors, slope, aspect (based on northing) and altitude with vegetation of dominant species in each community and different plant communities were determined by Minitab13.3 software. Finally, the ordination of communities was done by Detrended Correspondence Analysis (DCA) and the effect of topographic factors and ecological species groups was determined by Canonical Correspondence Analysis (CCA) in Canoco for win 4 software.

RESULTS

8 plant communities were identified. These communities had different aspect, slope and altitude with the same lithology. Summary of these characteristics is brought in Table 1.

The correlation relationship between plant cover of dominant species and topographical factors showed that there was a positive correlation between Br. to - Tr. Re, Br. te - Ho. Fr, On. co - Ag. Cr, On. co-Br. To, Br. da-Ci. ar, Ho. fr-Ci. Ar types with altitude and aspect and negative correlation between As. br-Ph. ol and Eu. he - On. ae types with altitude. Also, there was no relationship between these two types and aspect. The plants type hasn’t any relationships with slope too (Table 2). The correlation of types (1, 2, 3 and 4) showed that the dominant species have more frequency in northern aspect with altitude and in Onobrychis cornuta is more than the others. Also there is a less correlation in types of 5 and 6. The dominant species in types 7 and 8 have more frequency in low altitude and had distribution in all of aspects.

Determination of the ecological plants groups by (DCA) showed that plants species can be ordinate in 3 groups: Ast.bra, Agr.cri, Bro.tom, Tri.rep, Bro.tec and Ono.cor as group1, Hor.fra, Bro.dan and Ono.ae as group2 and Cir.arv, Phl.oli and Euph.he as group3 (Fig. 1). The relationship between these groups and physiographical factors, that analyzed by (CCA), showed that each group is in separated parts and also each part has similar reaction. According to this, the species of group1 responded to higher altitude and north and west aspects. But that was less in the group2. The group3 was located near to center of coordinate (Fig. 2).

Abbreviation of symbols: Asp(N), North; Asp(S), South; Asp(E), East; Asp(W), West; S1, 0-15% slope, S2, 15-30% slope; S3, 30-45% slope; H1, 2280- 2645m; H2, 2646- 3010m; H3, 3011-3375m; H4, 3376-3740m

Table 1: The characteristics of plant communities in Lasem rangelands (Aspect of Mountain (North, South, West, South)

<table>
<thead>
<tr>
<th>Lithology</th>
<th>Altitude Class (m)</th>
<th>Aspect</th>
<th>Slope (%)</th>
<th>Plant Communities</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alluvial Terrace</td>
<td>2600-2700</td>
<td>North and West</td>
<td>15-40</td>
<td>Bromus tomentellus - Trifolium repence</td>
<td>1</td>
</tr>
<tr>
<td>Alluvial Terrace</td>
<td>2600-2700</td>
<td>North</td>
<td>15-40</td>
<td>Bromus tectorum - Hordeum fragile</td>
<td>2</td>
</tr>
<tr>
<td>Alluvial terrace</td>
<td>2200-3000</td>
<td>North, West and East</td>
<td>15-40</td>
<td>Onobrychis cornuta - Agropyron cristatum</td>
<td>3</td>
</tr>
<tr>
<td>Alluvial Terrace</td>
<td>2200-3000</td>
<td>North, West and East</td>
<td>15-40</td>
<td>Onobrychis cornuta - Bromus tomentelus</td>
<td>4</td>
</tr>
<tr>
<td>Alluvial Terrace</td>
<td>2200-3000</td>
<td>East, North and South</td>
<td>0-40</td>
<td>Bromus d antiuniae - Cirsium arvense</td>
<td>5</td>
</tr>
<tr>
<td>Alluvial Terrace</td>
<td>2200-2300</td>
<td>South and West</td>
<td>0-30</td>
<td>Hordeum fragile - Cirsium arvense</td>
<td>6</td>
</tr>
<tr>
<td>Alluvial Terrace</td>
<td>2200-2600</td>
<td>North, West and South</td>
<td>0-30</td>
<td>Astragalus brachystachys - Phlomis olivieri</td>
<td>7</td>
</tr>
<tr>
<td>Alluvial Terrace</td>
<td>2300-2600</td>
<td>North, West, East and South</td>
<td>0-40</td>
<td>Euphorbia heliosc lus-Onobrychis aequidentata</td>
<td>8</td>
</tr>
</tbody>
</table>

Table 2: The correlation between plant cover of plants with physiographical factors

<table>
<thead>
<tr>
<th>Df</th>
<th>R-Sq</th>
<th>R</th>
<th>Altitude</th>
<th>Slope</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>71.2%</td>
<td>0.801**</td>
<td>66.9%</td>
<td>0.818**</td>
</tr>
<tr>
<td>11</td>
<td>69.8%</td>
<td>0.83**</td>
<td>74.8%</td>
<td>0.865**</td>
</tr>
<tr>
<td>11</td>
<td>91.4%</td>
<td>0.892***</td>
<td>99.1%</td>
<td>0.995***</td>
</tr>
<tr>
<td>11</td>
<td>90.5%</td>
<td>0.852***</td>
<td>94.1%</td>
<td>0.973***</td>
</tr>
<tr>
<td>11</td>
<td>57.7%</td>
<td>0.672**</td>
<td>62.4%</td>
<td>0.790**</td>
</tr>
<tr>
<td>11</td>
<td>68.8%</td>
<td>0.706**</td>
<td>36.8%</td>
<td>0.607*</td>
</tr>
<tr>
<td>11</td>
<td>39.1%</td>
<td>0.68**</td>
<td>92.6%</td>
<td>-0.959*</td>
</tr>
<tr>
<td>11</td>
<td>35.3%</td>
<td>0.561**</td>
<td>89.3%</td>
<td>-0.945*</td>
</tr>
</tbody>
</table>

* None Significant, **P ≤ 0.05, ***P ≤ 0.01, ****P ≤ 0.001
DISCUSSION

The results showed that the correlation of four communities; Br. to - Tr. Re, Br. te - Ho. Fr, On. co - Ag. Cr and On. co-Br. To with altitude and aspect were more than the other types as the cover percentage of the dominant species increased to high altitude and north and west aspects. The CCA analysis confirmed this matter too as the grasses and shrubs were in northern and western aspect and located in higher sections. This increase is clear in shrubs especially in Onobrychis Cornuta. The location of this species in the end of the vectors appears this subject. So altitude and aspect have more effects on shrubs especially Onobrychis Cornuta. Kohestani (2000)

and Saberian (2003) declared that high altitude and north aspect have effects on moisture content that is suitable for shrubs distribution [13, 14]. Irvani (2001) also showed that the topographical factors have effects on separating the habitat of grasses from the other forms [15].

The distribution of Bromus danthoniae, Hordum fragile and some shrubs (Astragalus brachystachys, Onobrychis aequidentata) in high altitude and northern and western aspects is less than the other types. Introduce of the invader species such as Cirsium arvene, Euphorbia helioscolca, Phlomis olivieri in these types (5, 6 and 8) caused to this different reaction in these types and adaptation of them to hard moisture condition and grazing pressure in these sites probably [16-17]. Also, the invader species haven’t clear relationship with topographic parameters. This can be due to ecological imbalance in their sites. In diagram CCA, the Euphorbia helioscolca, Phlomis olivieri and Cirsium arvene are near the center of coordinate. So, these species didn’t response to the physiographical factors. The existence of invader species such as Eryngium bungei, Gundelia tornefortii, Cirsium obvallatum, Centaurea depressa in these types caused to this matter. Invader species mostly appears instead of climax species by heavy grazing. The human factors have negative effects on rangeland ecosystems and disturb the normal relations between ecological parameters [19, 20].

The result of species group’s comparison by DCA analysis appeared the separation of different plant groups in reaction to the studied parameters. So shrubs and grasses species had the most relationship with ecological factors and situated as separated groups (types 1, 2, 3 and 4). Actually the species of Trifolium repence, Bromus tectorum, Bromus tomentellus, Agropyron cristatum and Onobrychis cornuta can be named native species with less effect of human activities such as grazing pressure. On the other hand, appearance of invader species such as Gundelia torneforty in 5 and 6 community and negative effects of unnatural factors in destroyed types (7 and 8) and increase of the other invader species caused to these types location in separated groups. Different responses of plant types to the investigated factors showed that the unnatural factors such as intensive grazing can change the reaction of plant species relevant to the physiographical parameters by change of environmental relations especially in soil characteristics. Zarechahahooki et al. (2001) showed that the soil characteristics affected by aspect and slope that have important role in determination of plant ecological group [21]. According to the indirect effects of topographic parameters on grazing rate and soil moisture, separation and grouping of the studied species, can be related to slope, aspect and elevation and also soil factors. So it’s necessary to study more about determination of soil physical and chemical parameter’s effects in Elborz mountain rangelands.

REFERENCES