# Investigation of Plant Diversity in Middle Rangelands of Taleghan by Using BIO-DAP

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**Abstract.** Plant Diversity conservation is a main objective in rangeland management. Plant diversity is a suitable index for showing the changes of vegetation in rangelands and has a high correlation with ecosystem parameters. Therefore, using this index it is possible to find the changes and manage the ecosystem correctly. The current research was performed to determine the species diversity in Fashandak rangelands of Taleghan. To do this, 110 plots each one with an area of 1 m2 were established based on randomized-systematic method and density of the species within each plot was recorded. Species properties including the related genus and family in addition to life form, growth form and biological type were determined. Shannon, Simpson and McIntosh diversity indexes were used. Results showed that diversity of Fashandak rangelands could be considered as moderate. The highest distribution frequency was related to the species of *Bromus tomentellus*, *Hypericum perforatum* and *Thymus kotschyanus*.

**Key words:** Range species, Plant diversity, Density, Fashandak rangelands, Taleghan.

## Introduction

With development of restoration ecology and understanding of principles of biodiversity, it is realized that species composition and diversity are fundamental characteristics of ecosystems (Chapin 1992; Hooper 1997; ESA 1999 and Burke 2001) and vegetation diversity should be considered (ESA 1999 and Burke 2001). Biodiversity has more wide meaning than species diversity and it includes genetic and eco-systematic diversity, however species diversity consists of a main part of biodiversity at native and zonal scale (Hamilton 2005; Krebs 1998 and Noor Alhamd 2006). So, in many researches in the world, species diversity is considerable as the indicator of biodiversity (Harrison 2004).

Species diversity is a significant concept of ecology and vegetation covering management (Mesdaghi 2005) and plays a major role in health (Odum 1983), production (Noor Alhamd 2006) and evaluation of ecosystem (Magurran 1988). Species diversity is a composition of two connected factors (Magurran 1988 and Mesdaghi 2005), including species richness and species evenness that the first one is related with the number of observing species in the plots and the second one is a distribution of species individuals.

As a result of geographic and climatic variety conditions, Iran is the place of many plant species. So that, about 9000 kinds of plant species are collected and named until now and changed Iran to the one of ten important plant species place in the world (Mohammadi 2000). The main parts of these plants are visible in the rangelands that contain 90 million hectares of Iran. Rangeland plant species, in addition to forage production and industrial and medicinal consumptions have an important role in water and soil conservation.

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 (Mohammadi 2000). The current research was performed to determine the species diversity in Fashandak rangelands of Taleghan. So, Species properties including the related genus and family in addition to life form, growth form and biological type were determined.

## Materials and Methods

Taleghan catchment, is located in 90 km of northwest of Tehran province (between Karaj and Alamote catchment). The area of this catchment is about 13250000 hectares. Taleghan lies between latitude 36° 5′ 19 ″ and 36° 19′ 19 ″ north and between longitude 50° 36′ 43″ and 50° 53′ 20″ east and covers an area of 1325 km2. Average annual rain fall is about 500 mm and the climate of this area is cool according to Gaussen method (Taroodi 2003). We used 4 transects and 110 plots each one with an area of 1 m2 were established based on randomized-systematic method. Density of the species within each plot was recorded. Species properties including the related genus and family in addition to life form, growth form and biological type were determined. Shannon, Simpson and McIntosh diversity indexes were used. Data were analyzed using BIO-DAP software (Thomas 2000). These parameters were calculated using the following equations:

Shannon diversity index→ $H=-\sum(p_i)(\ln p_i)$

Simpson diversity index→ $D=1-\sum pi$

McIntosh diversity index→ $U=\sqrt{\sum ni2}$

Shannon equation index→ E=H`/Hmax=H`/lns

Simpson equation index→ E 1/D=1/D/S

**Results and Discussions**

Table 1. The List of Rangeland Plant Species in the Studying Area

| Number | Plant species | Plant family | Life form | Biological type | Growth form |
|---|---|---|---|---|---|
| *1* | *Astragalus gossypinus* | Leguminosae | Shrub | CH | perennial |
| *2* | *Euphorbia rigida* | Euphorbiaceae | Herb | TH | annual |
| *3* | *Hypericum perforatum* | Hypericaeae | Herb | CR | perennial |
| *4* | *Thymus kotchyanus* | Labiatae | Shrub | CH | perennial |
| *5* | *Dianthus barbatus* | Caryophyllaceae | Shrub | CH | perennial |
| *6* | *Sanguisorba minor* | Rosaceae | Herb | CR | perennial |
| *7* | *Bromus tomentellus* | Gramineae | Herb | CR | perennial |
| *8* | *Echinops robustus* | Compositae | Shrub | CH | perennial |
| *9* | *Phlomis olivieri* | Labiatae | Herb | CR | perennial |
| *10* | *Verbascum speciosum* | Scrophulariaceae | Herb | CR | biennial |
| *11* | *Borago officinalis* | Boraginaceae | Herb | TH | annual |
| *12* | *Acantophyllum pungens* | Caryophyllaceae | Shrub | CH | perennial |
| *13* | *Achillea millefolium* | Compositae | Herb | CR | perennial |
| *14* | *Medicago sativa* | Leguminosae | Herb | CR | perennial |
| *15* | *Gundelia tuornefortii* | Compositae | Shrub | CH | perennial |
| *16* | *Eryngium bungei* | Umbelliferae | Shrub | CH | perennial |
| *17* | *Scariola orientalis* | Compositae | Shrub | CH | perennial |
| *18* | *Artemisia aucheri* | Compositae | Shrub | CH | perennial |
| *19* | *Poa bulbosa* | Gramineae | Herb | GE | perennial |
| *20* | *Bromus tectorum* | Gramineae | Herb | TH | annual |
| *21* | *Geobelia alopecuroides* | Leguminosae | Herb | CR | perennial |
| *22* | *Teucrium chamaedrs* | Labiatae | Herb | CR | perennial |
| *23* | *Papaver arenarium* | Papaveraceae | Herb | TH | annual |
| *24* | *Salvia limbata* | Labiatae | Herb | CR | perennial |
| *25* | *Melilotus officinalis* | Leguminosae | Herb | TH | annual |
| *26* | *Stachys lavandulifolia* | Labiateae | Herb | CR | perennial |
| *27* | *Allysum strigosum* | Cruciferae | Herb | TH | annual |
| *28* | *Iris germanica* | Iridaceae | Herb | CR | perennial |

P=Perennial, Bi=Biennial, A=Annual, TH=Therophyte, PH=Phanerophyte, CR=Hemicryptophyte, CH=Chamophyte

Table 2. Density of Rangeland Plant Species According to Family

| Family | Density(n/m2) |
|---|---|
| Legominose | 80 |
| Euphorbiaceae | 76 |
| Labiatae | 115 |
| Gramineae | 223 |
| Compositae | 145 |
| Boraginaceae | 36 |
| Caryophyllaceae | 90 |
| Umbelliferae | 10 |
| Papaveraceae | 2 |
| Scrophulariaceae | 60 |
| Cruciferae | 4 |
| Iridaceae | 2 |
| Hypericaeae | 186 |

Table 3. Density of Rangeland Plant Species According to Biological Type, Life Form and Growth Form

| Biological type | Density | Life form | Density | Growth form | Density |
|---|---|---|---|---|---|
| HE | 395 | Forb | 581 | A | 125 |
| TH | 320 | Shrub | 231 | P | 857 |
| CH | 295 | Bush | - | Bi | 60 |
| CR | 5 | | | | |
| PH | - | | | | |

CH=Chamophyte, PH=Phanerophyte, CR=Hemicryptophyte, TH=Therophyte, A=Annual, Bi=Biennial, P= Perennial

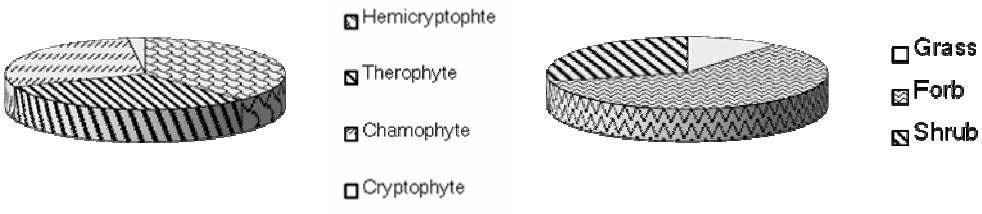


Fig 1. Life Form and Biological Type of Plant Species in Studying Area (Percentage)

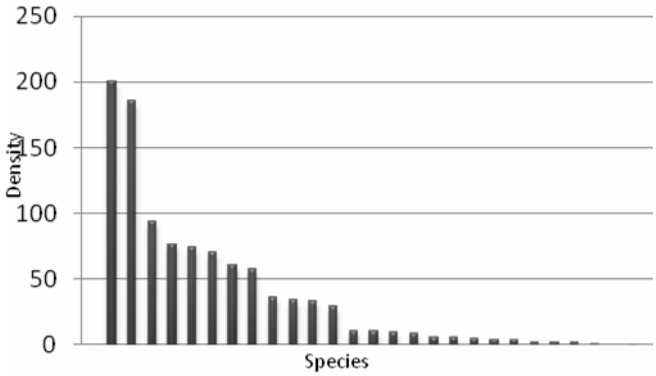


Fig. 2. Density of Rangeland Plant Species

Table 4. Results of Plant Species Diversity According to Species, Family, Biological Type, Life Form and Growth Form

| Evenness index | | | Diversity index | | | Richness | According to: |
|---|---|---|---|---|---|---|---|
| McIntosh | Simpson | Shannon | McIntosh | Simpson | Shannon | | |
| 0.82 | 0.346 | 0.78 | 0.68 | 12.01 | 2.84. | 28 | Species |
| 0.73 | 0.31 | 0.68 | o.61 | 6.1 | 2.1 | 13 | Family |
| 0.58 | 0.41 | 0.6 | o.29 | 2.1 | 1.02 | 4 | Biological type |
| 0.25 | 0.418 | 0.34 | 0.10 | 1.01 | 0.39 | 2 | Life form |
| 0.39 | 0.44 | 0.51 | 0.14 | 1.2 | 0.4 | 3 | Growth form |

The results have shown that, 28 plants species of 13 families are found in the studying area, and the most density of them is related to Geraminea family. Also, because of mountainous condition, perennial plants with forbs life form have existed more than the others. According to the results of table 4 the maximum amount of Shannon index is 2.84. The range of this index is between 0-4.5. if, only one species has existed in the plot, or the society has been under the pollution and stress, it is zero and when all the species have been equal individuals or the society is out of the stress and pollution, it

will be maximum. Absolutely, low amount of Shannon index is related to the hard situation of society, and in the society with the high amount of evenness and richness indexes indicates the high species diversity (Krebs 1998). The of study area has medium diversity. This area located at 2000 elevation and higher, and with less richness and more evenness has medium diversity. Akhani (2000) and Baghani (2007) also confirm this result. With high diversity in taxonomic level, the community has high stability and environmental stress is less. The diversity is function of richness and evenness at taxonomic level. This condition has seen in Shannon diversity index and gradual reduction in richness and evenness index between species, family, biologic type, vegetative form and vegetative stage (Table 3). In this area some species has high density. Abundance distribution of species unevenly reduces in this area and higher density is related to species of Germaine (Fig. 3). Magurran (1988) suggested that if the number of species with medium abundance is high and a few number of species has very high or very low abundance, community will have medium diversity. With comparing the indexes we can evaluate the effect of management activities in a plant community in long-term period.

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