Journal of Medicinal Plants Research Vol. 6(6), pp. 990-996, 16 February, 2012
Available online at http://www.academicjournals.org/JMPR
DOI: 10.5897/JMPR11.566
ISSN 1996-0875 ©2012 Academic Journals

Full Length Research Paper

Considering livestock grazing on the diversity of medicinal plants (Case study: Boz Daghi arid and semi-arid rangelands)

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Accepted 10 May, 2011

There is this growing trend of using medicinal plants and traditional medicine. Considering the types and diversity of these plants and identifying the effect of management measures on their quality and quantity can affect their development. In this research, in Bozdaghi Region, arid and semi arid rangelands in Maneh-o-Samalghan City of North Khorasan Province, the effect of livestock grazing on types and diversity of medicinal plants is considered. With selection of two enclosures and under grazing area, a number of 100 plates with one square meter are randomly located. The percentage of plant cover and type of medicine density is measured. For this purpose, diversity parametric indices including log series, log normal, geometric model and broken stick McArthor are assessed by using Bio-Dep software. For consideration of significance of measured levels, Ki-Square test is used. The results show that the grazed area tends to Log model and Log- Normal; thus the enclosure causes increase in ecological capacity and species diversity of medicinal plants. The logarithmic curve of frequency-level distribution in under grazing area has a lower level than enclosure area and also both follow log series and Log-Normal. Therefore, that means this region at first is a uniform region but has tended to Log series due to livestock grazing. As a result, we can conclude that this region is an under stress area. Therefore, livestock grazing causes a decrease in diversity of medicinal species in the region.

Key words: Medicinal plants, livestock grazing, frequency-level curve, log-normal series, geometrical model.

INTRODUCTION

Plants have been used in different fields such as in production and direct and indirect supply of food, medicines for curing diseases, soil and water conservation, environmental protection and stylized wood supply, air and human services. Use of medicinal plants is the result of years of human experience, which started in the early days of creation till date (Dini and Babakhanlou, 2003). These plants have been allocated considerable part of the flora and have a major role in the combination of plant communities (Akbarzadeh et al., 2007). Pastures and meadows, compoused of a wide variety of species, are rich sources of biodiversity (Dumlu et al., 2011). Medicinal plants have a several thousand years' history in Iran and the Far East. In recent years, because of damage caused by chemical drugs and their side effects, the use of medicinal plants in European countries and the U.S. has increased sharply (Moghaddam, 2008). At this time, the natural ecosystems, where these valuable species grow in including their diversities, are under destruction for different reasons. One of the reasons for ecosystems' destruction and their indicator species is uncontrolled livestock grazing. Therefore, considering the ecosystems and biological diversity derived from them requires our attention for two reasons. One, they provide for humans a wide range of direct and indirect benefits in local and global scale. Two, many human activities lead to an unprecedented loss of biodiversity, stability and durability,

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Table 1. Parametric formulas indicators (Ajtehadi, 2009).

Index name	Geometric series	Log series	Normal log series	Broken stick series
Formula	$n_i = NC_k K(1-K)^{i-1}$	$S = \alpha \ln(1+ N/\alpha)$	$S(R) = S_O \exp(-a^2R^2)$	$S(n) = \left[S(S-1)/N\right](1-n/N)^{S-2}$

and ecosystem products and services, leading to human threat (Makhdoum, 2005). The land use effect on pasture and even on properties of soils develop (Gundogan et al., 2011). Land and soil degradation connote loss of biological and economic productivity (Agele, 2011). For the protection of species, diversity should be carried out with a basic action that involves partnering with all people, and a comprehensive and decisive legislation regarding protection should be imposed. In this regard, the fiftieth principle of the constitution of Islamic Republic of Iran regarding environmental protection has been deemed public duty, and any activities that cause environmental pollution and its destruction are forbidden. However, according to social and economic problems, exploiting such broad measures sometimes does not accept the result of damage done to ecosystems and variety of plants. Many valuable natural plant and animal species disappear or are endangered with these actions. Losing of these ecosystems, and converting them to single-product system (livestock utilization) is now widely common on pastures; diversity is also reduced (Kooijman and Smit, 2001; Mesdaghi, 2001). Natural resource management objective is maintaining plant's diversity in natural ecosystems, because the diversity of habitat that has more fertile and more ecological sustainability will change and a sustainable and dynamic ecosystems will be considered (Smith, 1996). Several studies have been carried out in the field of medicinal plants but the effect of grazing on the diversity of medicinal plants has not been done much. Most studies in this field are on effect of livestock grazing and management practices on total plant species diversity of ecosystem. Moeinpou (2008)'s study on grazing effects on plant diversity showed why grazed area due to the presence of species with intermediate frequency should follow the model of log normal. Noor (2006) observed that pasture management, livestock grazing and acceptance of heavy grazing practices occur in rangeland plant diversity. Behmanesh et al. (2008) studied medicinal plants species diversity of Chahar Bagh rangelands of Golestan Province, N Iran and concluded that medicinal species diversity in the study area was moderate and the highest frequency species was related to Cynodon dactylon, Gallium verum, Achillia millefolium and Euphorbia rigida.

Akbari and Babakhanlo (2003) collected medicinal plants from the Qazvin Province, which led to the discovery that 250 medicinal plant species are in the province. Din and Babakhanlou (2003) published list of the medicinal plants. In this list, more than one thousand and five hundred plants have economic value. Two hundred thousand species are plants that grow of these in Iran.

Therefore, studies on vegetation species diversity and environmental assessment are one of the important parameters used in determining the role of ecosystem's management and reviewing of its status. In this research, the level of exploitation of the role of pastures and natural actions and reactions to positive and negative feedback effects on the environment, the role of livestock grazing effects on species diversity of plants and also the impact on the conservation and diversity of the grazed parametric methods (ordinal model - frequency) are discussed.

MATERIALS AND METHODS

Research area is located in 45 km North of Maneh and Samanghan Districts, N Khorasan Province between 56°26′ 41" N and 37♁°50′ 08" E, with elevation of 833 m and surface area of about 4400 ha. This includes 2230 ha grazing area and 2170 ha which has been protected (for grazing) from 1998. Main annual precipitation is about 262 mm and annual main temperature is about 16.2°C. To assess the models of diversity, parameter variability of medicinal plants has been used including geometric series such as log, log normal and MacArthur broken stick. The formula is shown in Table 1.

In geometric series:

n_i = number in i species, N = total species, C_k = a constant that number can be calculated from $C_k = \left[1-(1-k)^s\right]^{-1}$ and guarantees $\sum n_i = N$., K = a constant number that can be calculated from $\frac{N_{\min}}{N}$

In log series:

S = Total number of species in the samples, N = total number of species in sample, α = Alpha diversity indices, Ln = Logarithm in base 10.

In normal Log series:

S(R) = total number of octaves of R In left and right symmetrical curve, $a = (2\sigma^2)^{\frac{1}{2}}$ = Inverse width of the distribution curve, S_0 = octave that has a number of species in mode.

In MacArthur broken stick series:

$S(n)$ =Number of species with n individuals in abundance classes, S = total number of species, N = total number of individuals. To estimate the parameters associated with these models, first,

consider choosing the dominant coverage area of a square meter lattice plot, and then plot the number that has been calculated, using the formula:

$$N = \left(\frac{t_{\alpha} CV}{d} \right)^2$$

In which N is at least samples, t-student, CV coefficient of variation, and d is the percentage of accuracy, computing (50 per treatment plot) and randomly dividing the field level implementation. Within each plot, the total canopy cover and individual species that separately estimate the number of any base were counted. After that data are transferred to Excel software to form the mass matrix. Data analysis was done using specialized software Magurran. For review of significant estimates and expected levels of species density in 99%, Chi-square test was used.

RESULTS

The floristic species based on plot studies revealed that there grow 49 species of 46 genera and 21 families in the study area. Highest density and cover related to the pharmaceutical species of *Artemisia sieberi* in the study area show its branches as a useful organ in the usage of medicinal plant. Lowest density and canopy were related to the species *Onosma bulbotrichum* whose flowering branch has traditional medicine's usage (Table 2). The results show the greatest percentage cover and density in the grazed area for Compositae and the lowest canopy cover is related to Ranunculaceae. The highest and lowest crown densities in the grazing area belong to Compositae and Iridaceae, respectively (Table 3). Logarithmic graph of the frequency ratings distribution of species of two areas -protected from grazing and grazing areas- shows rated frequency chart of protected area from grazing has gentler slope and a higher rank than the rank of the frequency graph of grazing area (Figure 1). Frequency rank regression models have been used for investigating the study area with current Chi-square models (Table 4). Based on the table of the results , Chi-square values are calculated between the two regions grazed because the amounts expected of Chi-square geometric models and MacArthur broken stick have significant difference in the two regions ($p<0.05$). Therefore, frequency rank distribution of species density in both protected and grazed areas uses the geometric models and does not follow the broken stick.

The results also show that Chi-square frequency rank distribution curve of the area of grazed and protected density follows log and log normal –series. So the calculated value amounts of Chi-square have significant difference between these regions- Chi-square expected log series and log normal at level $p<0.01$. Also, we have shown in this research that the highest growing medicinal plants, shrubs have the highest density and vegetation cover. Herbaceous and tree species after a plant are in the next rank (Table 5).

Conclusion

Results of medicinal plants in the plot of this study show there are 49 species of 46 genera and 21 families. Herb canopy cover has declined by 38.7% in the protected area and 12.4% in the grazing area. Percent relative density of species in both areas that involves medicine in the form of a vegetative shrub has little difference with each other and relative density of herbaceous species under grazing area has relative increase than protected area. So protection from grazing increases crown cover and density of medicinal species in the study area. The results conform to the results of Akbarzadeh et al. (2007), Baghestani et al. (2007) and Bassiri and Iravani (2009). Highest percentage of canopy species in the protected area from grazing are the family of Compositae plant with a dominant species of *A. sieberi*; Ephedraceae with the dominant species of shrub; *Ephedra procera*; Apiaceae Herbaceous *Bunium persica* with dominant species and species with the dominant Labiatae Nepeta punens Herbaceous and *Salvia limbata*. In livestock grazing area, the highest percentage of canopy species is dedicated to the families Compositae, Caryophyllaceae and Labiatae species with medicinal Siberi Artemisia, *Dianthus crinitus*, *Zataria multiflora*, respectively. In the Iranian traditional medicine, boiled Artemisia with the local name "HFSHAN" is used for destroying tiny intestinal worms. Elimination of mucosal inflammation of the lungs, treatment of rheumatism and bone pain are parts of the health benefits of Ephedra with the local name "Shvyshk" or "koshki". Swelling, resulting from insect bites, is removed by part of the healing properties of sage; Cloves, with the local name "SHAFFER" is used for the treatment of head and heart pain, seizures, stomach pain and intestinal colic and also calms nerves. To treat abdominal pain and bone pain, migraine disposal headache, dyspnea, part of medicinal properties of mountain thyme with the local name "ANKH" is used (Amini, 2006). Results show that medicinal species density in protected from grazing areas should not follow the geometric series in the two study areas.

Therefore, it can be concluded that livestock graze medicinal species, despite their heavy grazing of forage species from other regions. This is because they utilize the essential oils and aromatic substances (Moghaddam, 2008) of medicinal species. These models are seen usually infecting communities or the environment in terms of species that are poor or are in early stages of succession (Ajtehadi et al. 2009; Pourbabaei, 2004). Diversity does not follow MacArthur broken stick series because the distribution of resources in protected from grazing and grazing area has a uniform distribution due to utilization by livestock, succession stages and competition between plant species resulting in protected area from grazing and grazing area. But the competition is for obtaining a larger share of resources and overcoming resistant strains grazing. In this context, Southwood (1978) believes MacArthur broken stick

Table 2. List of medicinal plant species in the study area.

Names of species	Family	Persian name	Part used
Acanthophyllum crassifolium	Caryophyllaceae	Chobak khorasani	Root
Achillea tenuifolia	Compositae	Bomadaran kohestani	Flowering branches
Alhagi persarum	Papilionaceae	Kharshotor irani	Latex
Alium linifolium	Liliaceae	Piaze irvani	Onion
Alium synthamantum	Liliaceae	Piaze irvani	Onion
Alyssum marginatum	Cruciferae	Ghodomeh	Seed
Amygdalus cioides	Rosaceae	Badam	Fruit
Artemisia sieberi	Compositae	Dermane, yoshan, trakh	branches
Astragalus gossypinus	Papilionaceae	Gavan	Gum
Atraphaxis spinosa	Polygonaceae	Karvan ksh	Gum
Bongardia chysogonum	Podophyllaceae	Sineh kapaki	Rhizome
Brassica elongate	Cruciferae	Kalam	Shoot
Bunium persica	Apiaceae	Zireh	Fruits
Capsella bursa-pastoris	Cruciferae	Kiseh kshish	Flowered branches
Centaurea kotschyi	Compositae	Gole gandom	Flower
Citrullus colocynthis	Cucurbitaceae	Hendevaneh abojahl	Shoot
Dianthus crinitus	Caryophyllaceae	Mikhake korki	Fruits
Discurainia sophia	Cruciferae	Khakshir	Seed
Ephedra procera	Ephedraceae	Rish boz	Branches
Euphorbia cheiradenia	Euphorbiaceae	Farfune khoshehei	Latex
Euphorbia falcata	Euphorbiaceae	Farfune helali	Latex
Glaucium corniculatum	Papaveraceae	Shaghayegh khardar	Flowers and leaves
Heracleum lasiopetalum	Apiaceae	Golpar kohestani	Seed
Hyoscyamus nigra	Solanaceae	Bazr albanj sefid parcham	Seed
Iris acutiloba	Iridaceae	Zanbagh sefid khati	Rhizome
Lactuca glaucifolia	Compositae	Kahoye nok deraz	Shoot
Malva sylvestris	Malvaceae	Panirak	Flowers and leaves
Nepeta pungens	Labiatae	Poneh	Flowered branches
Onobrychis transcaspica	Papilionaceae	Espers	Shoot
Onosma bulbotrichum	Podophyllaceae	Sineh kapaki	Shoot
Papaver pavoninum	Papaveraceae	Shghayegh lakeh dar	Flower
Peroveskia abrostanoides	Labiatae	Gole kaboud	Flower
Phlomis cancellata	Labiatae	Gosh bareh khorasani	Flower
Prunus divaricata	Rosaceae	Alocheh	Fruit and bark
Ranunculus arvensis	Ranunculaceae	Alaleh	Shoot
Reseda luteola	Apiaceae	Vrse zard	Shoot
Salvia limbata	Labiatae	Maryam goli sabz	Flowered branches
Sophora alopecuroides	Papilionaceae	Talkh bayan	Leaves
Stachys lavandulifolia	Labiatae	-	Inflorescence
Taraxacum montanum	Compositae	Gole ghased kohi	Shoot
Teucrium polium	Labiatae	Klporeh	Flowered branches
Tragopogon buphthalmoides	Compositae	Sheng cheshm gavi	Leaves
Trifolium repens	Papilionaceae	Shabdar khazandeh	Shoot
Tulipa micheliana	Liliaceae	Laleh khat dar	Flower
Verbascum sangoricum	Scrohulariaceae	Gole mahor	Flower, leaves and fruit
Vicia monantha	Papilionaceae	Mashak tak gol	Shoot
Zataria multiflora	Labiatae	Avishan shirazi	------
Ziziphora clinopodiodes	Labiatae	Kakoti	Flowered branches
Ziziphora tenuior	Labiatae	Kakoti	Leaves and seed

Table 3. Percentage cover and density of each family of medicine species in study area.

Family	Protected area		Grazing area		Family	Protected area		Grazing area	
	Canopy cover	Percent relative density	Canopy cover	Percent relative density		Canopy cover	Percent relative density	Canopy cover	Percent relative density
Apiaceae	1.09	2.41	0.27	3.31	Podophyllaceae	0.064	1.66	0	0.00
Caryophyllaceae	0.92	0.60	1.08	1.84	Ranunculaceae	0.05	0.6	0	0.00
Compositae	31.15	40.72	7.63	43.38	Rosaceae	0.5	0.6	0.28	0.37
Cruciferae	0.418	19.76	0	0.00	Scrohulariaceae	0.06	0.15	0	0.00
Ephedraceae	1.14	0.75	0	0.00	Solanaceae	0.5	1.06	0	0.00
Euphorbiaceae	0.8	10.86	0.69	12.50	Boraginaceae	0	0.00	0.04	1.10
Iridaceae	0.08	0.90	0.028	2.57	Cucurbitaceae	0	0.00	0.14	0.37
Labiatae	1.07	10.56	0.948	25.00	Malvaceae	0	0.00	0.06	0.37
Liliaceae	0.17	3.62	0.07	4.04	Polygonaceae	0	0.00	0.28	0.37
Papaveraceae	0.08	1.36	0.07	2.57	Resedaceae	0	0.00	0.26	0.74
Papilionaceae	0.61	4.37	0.54	1.47					

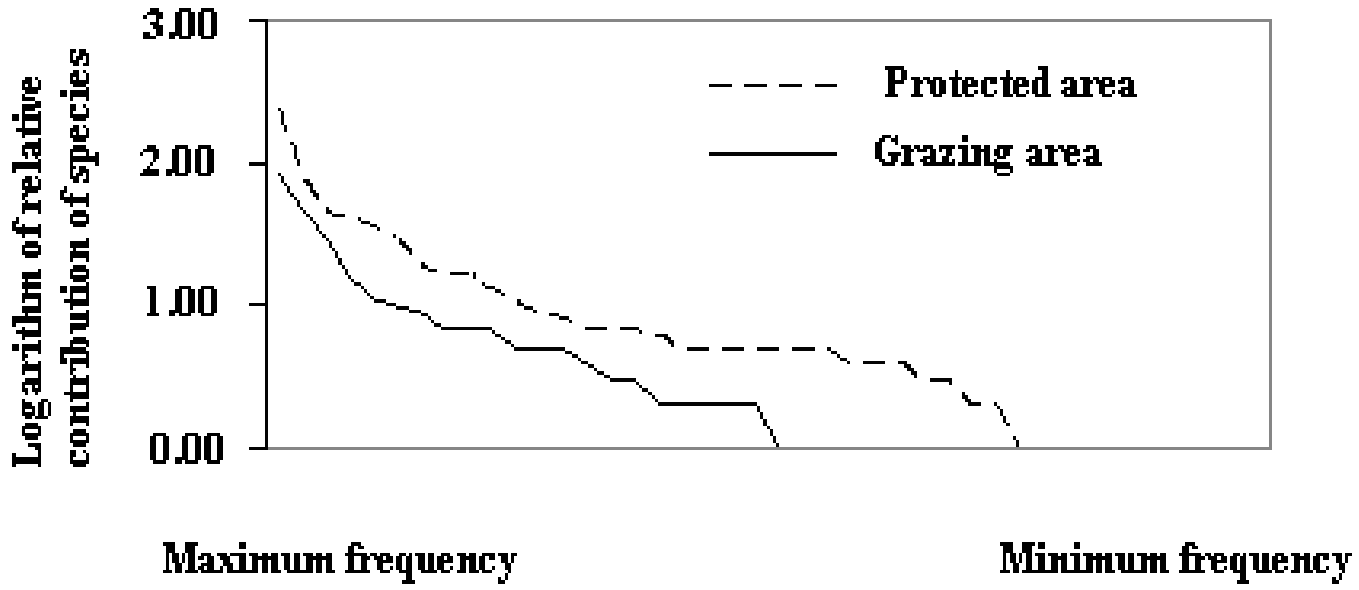

Figure 1. logarithmic rank frequency distribution of medicinal plant species in the study area.

Table 4. Results of models regression rank the frequency density in the study area with current models and Chi-square.

Index	Log normal series	Log series	Geometric series	Broken stick series
Grazed area	2.32**	3.01**	279.75^{ns}	82.19^{ns}
Protected area	5.78**	9.43**	686.72^{ns}	143.79^{ns}

**: Significant At 0.01%, ^{ns} = no significant.

Table 5. Percentage cover and density of species of medicinal plants in the study area.

Vegetative form	Grazing area		Protected area	
	Percent relative density	Canopy cover	Percent relative density	Canopy cover
BU	0.7	0.56	0.6	0.5
F	68.8	4.864	6.25	7.5
SH	30.5	6.98	36.5	30.66

BU = Tree, F = herbaceous, SH = bush.

model of the lowest occupation state reflects completely equal division of resources between species. Protected from grazing area follows log and log normal models; so it can be concluded that protected from grazing areas have increased ecological stability and diversity of medicinal plants species. Plants have combination in the region so that the average frequency that is seen in most species is for rare plants. Logarithmic distribution diagram of species abundance ratings (Figure 1) indicate how to allocate local resources among species (Mesdaghi, 2001). The logarithmic graph of the frequency distribution of ratings in the protected from grazing area is more than the under grazing area. This is due to the increase in species richness and consequent increase in the diversity and uniformity of medicinal species in this region. Magurran (1988), in this context, believes that if the number of species with moderate abundance in the community is high and the number of species with much or little abundance is few, then they have a log-series model and log normal distribution is the dominant community. Akbarlou (2009) concluded in his research, adherence to a variety of log series model and log normal distribution indicates good stability of ecosystems. However, in the logarithmic graph of the frequency distribution ratings, because medicinal species in the region are protected from grazing area charts, it can be concluded that species diversity and consequently the diversity and uniformity in this area has reduced due to livestock grazing. As a result, the frequency distribution of ratings Medicinal species in the region of log and log normal models should be followed. This is because this area was initially a uniform environment and for livestock grazing but under environmental stress exposure, which shows the log model has environmental pressure. Therefore in utilization of the region, grazing is not balanced. Akafi and Ajtehadi (2008) concluded in their research that because protected area diversity profile is higher than the utilization zone, it is more diverse. Also, protected area has under curve slope, and is more uniform and grazing area has a sharp slope and its function has changed from log normal model to logarithmic situation. This represents the destruction of the region. The results show that, despite the fact that livestock use forage, they also used medicinal species usually for their oil or alkaloid which reduces their palatability. If there is continuous utilization, it is feared that the species with medicinal value will be damaged or become extinct with livestock grazing. According to the results of this study, it can be concluded that livestock grazing reduces genetic diversity of medicinal plants in the region. But in the grazing areas, if they follow the log series and log normal and adhere not to geometric series, these areas will not lose their talent and potential to increase genetic diversity of medicinal plants. Ten years protection of grazing area will increase the level of diversity. So protection of grazing pasture or proper utilization of the plant species can increase the level of diversity of medicinal plants in the region. This indicates that removing the impact of livestock and protecting pastures from grazing have progressive sequence or allogenic retrogression (Holechek et al., 2004).

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