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The Effect of Type of Marginal Land Use on the Plant Diversity

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Abstract: The objective of this study closely focuses on the settlement of the effect of marginal land use on plant diversity. The location of this study was Sar Firouze Abad region with rainfall of over 350 mm and slope of over 12%. Five treatments in terms of land use (exclusion area, grazed range, fallow, annual medic cultivation, wheat cultivation) done with the repetition of five times. The factors, such as the number of species and the number of plant bases in each species in each sampling were measured. The method used here is based upon complete randomized design applying Duncan test and Raunchier method for classification of plant species and also Shannon-Wiener index of diversity and homogeny utilized. The results show that there are 76 species belonging to 60 genus and 19 families spreading in the region under study. The most dominant families are Fabaceae with 15 species covering 20% and Poaceae with 13 species covering 17%, respectively. According to Raunchier method the life form of the region species can be classified as Therophytes 66%, Geophytes 3%, Hemicryptophytes 26% and Chamaephytes 5%. The results also illustrate that the treatment of exclusion area has the most plant diversity in comparison with treatments of fallow, annual medic cultivation, wheat cultivation and range grazed.

Key words: Land use, marginal lands, plant diversity

INTRODUCTION

Nowadays, researchers regard rangelands primarily as a main genetic bank. Sustainable bio-diversity proves to be the main objective in this regard and it insists on the fact that living things diversity should be preserved in possible ways. The change of rangelands into rain feed lands demonstrates the destructive interference of man in natural ecosystems led to the erosion of soil and cover and plant diversity. These lands called marginal lands which are in fact buffer regions. They protect main regions or rangelands like battlements. The establishment of permanent residence by man and his cattle in these regions destroyed the natural cover and increased the number of species bred by him. The relationship between variety and sustainability has arisen a lot of discussions among researchers (Eviner and Chapin, 2001; Waldhardt and Otte, 2003, 2004; Cingolani *et al*., 2005; Wellstein *et al*., 2006). Many ecologists maintain that the highs richness of species is viewed as one of the most favorable features in every society or ecosystem. This feature is of high significance in evaluating the methods concerning the issue of protection of nature (Stoblgren, 2006). In order to measure diversity many factors has been used invented, but perhaps the total number of species under the name of richness of species is much more well-known (Magurran, 1988). Naimi (2001) used satellite information in order to evaluate plant diversity in Golestan National Park. He shoed that plant diversity factor is the most effective one in analyzing floristic diversity. Chamani (1995) compared and contrasted diversity using similar and dissimilar factors. He demonstrated that mountain umites have the maximum level of diversity. Sharifie (1996) performed a research on determining diversity and the richness of species and classification of meadow. He made use of Whittaker method and cluster analysis. He showed that diversity of plant cover observed more in grasslands. Glichnia (2006) did a comparative study of variety and production of plant cover bath in and of out of Robat Garabil of Golestan National Park. The study carried out in key, critical and reference regions whose Topographical, soil and climate conditions were nearly the same. He maintained that the excessive grazing in critical region made diversity and product poor while in key

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region due to moderate grazing is Reich and in reference region due to lack of grazing plant diversity is poor but product is rich regarding the rest of regions. The planning and Budgeting Organization (2006) carried out a study on the cause of destruction on Chahar tang-e-Koshk-e-zar wetland. The study revealed that the cause of destruction of this ecosystem was due to the change of rich rangelands into farming lands and also excavation for supply of water for irrigation purpose. This change in land use made both rich flour of the region and plant diversity destroy. The destruction of plant diversity caused the bio-diversity of the region where was once a hunting-ground to vanish. So a serious damage was done to sustainable development of the region. Delitti *et al.* (2005) studied the fire effect on plant composition and productivity of shrub land of Valencia Region (Spain). He demonstrated that all of these effects on plant composition and productivity were negative and damaging. Otte (2005) made models of plant diversity and richness in farming lands, grasslands and wetland using GIS. Her model reveals the significance of diversity and richness in ecosystems in terms of economic management of these lands. Kosins (2005) carried out a research in Sweden and showed that the growth and variety of plants of rangelands and grasslands managed in traditional ways are 23% more than lands under mechanized management. Eycott *et al.* (2006) illustrated that one of the factors of sustainability in forests is plant diversity in these lands which means a positive sequence. So plant diversity is essential to sustainability of a ecosystem. It should be noted that habitations of village margins and margins of farming lands (marginal lands) can play a vital role in enriching and development of various species of plants. But there is a little in formation on how such habitations can effect on plant species. The issue of sustainable development in agriculture together with the preservation of diversity and genetic bank in lands changed in land use and also the study of the effects of such uses is the object of this study.

MATERIALS AND METHODS

This study performed in Sarfirouze Abad rangelands in Kermanshah province with geographical latitude 47 dgree and 6′, longitude 34 degree and 15′, rainfall over 350 mm, altitude 1542 m and sleep 12%. The texture of soil is loamy-clay. Five treatments in terms of the type of use including: exclosure land (evidence), rangeland under grazing, fallow, annual medic cultivation and wheat cultivation with repetition of five times were used in farming year of 2005-2006. The measures of sampling are an area of 1×2 m.

In each plot, factors such as: the number of plant bases and the number of species were measured. The results of this study are analyzed by SPSS computer program and Duncan test. The formulas for plant diversity used here are:

$$J = \frac{H'}{H'_{max}} = \frac{\sum_{i=1}^{s} PiLnPi}{LnS} \text{ and } H' = -\sum_{i=1}^{s} PiLnPi$$

here, Pi is the ratio of one species to all, LnPi log of species ratio and S is the total number of species. In this index the bigger number, the more diversity and the bigger values of J demonstrate that the distribution of species is more consistent in the frame. So we can conclude that it a satisfactory evidence for the suitable propagation of plant species.

RESULTS

The results demonstrated that there were total 76 species belonging to 60 genera and 19 families in the geographical region under study (Table 1). The richest families are Fabaceae with 15 species (20%) and Poaceae with 13 species (17%), repetitively. Out of total number of existing species in the region under study, 10% belong to Fabaceae family and sixteen percent belongs to Poaceae family. With regard to abundance of genera and species, the other plant families are Compositae, Ranunculaceae, Caryophyllaceae, Euphorbiaceae, Lamiaceae, Boraginaceae and Apiaceae, respectively. Plant species of the region can be classified with accordance to live form and Raunchier method as 66% Therophytes, 3% Geophytes, 26% Hemicryptophytes and 5% Chamaephytes. Duncan test showed that there was a significant difference between treatments at the level of 1%. This occurred due to the number of plant (Table 2). The exclosure treatment had the maximum number of plant. There was also a significant difference between treatments at the level of 1% regarding the plant diversity. With regard to Duncan test and the diversity index of Shanon-Wiener, the treatment of exclosure pasture was more diverse and equal than the rest of the treatments (Table 3). Shanon-Wiener index was used in treatment number six (the exclosure pasture having the maximum diversity) to determine the effect of plot positioning in sampling unit. The result also illustrated that the plot number five had the maximum diversity and equally constancy.

Table 1: The floristic list of plant species observed in the geographical region under study

Families	Scientific name	Families	Scientific name
Poaceae	*Henrardia persica*	Euphorbiaceae	*Cousolida oliveriana*
	Hordeum bulbosm		*Aquilegia olympica*
	Lolium sp.		*Adomis flammea*
	Parapholis incurva		*Ranunculus lingua*
	Poa bulbosa		*Nigella* sp.
	Taeniatherum crinitum		*Euphorbia helioscopia*
	Heterantlium sp.		*Euphorbia* sp.
	Bromus sp.		*Euphorbia virgata*
	Bromus sp.		*Euphorbia falcata*
	Bromus tectprum	Boraginaceae	*Onosma macrophyllum*
	Bromus dantonia		*Onosma bulbotrichum*
	Agropyrum sp.		*Nonnea caspica*
	Stipa barbata	Lamiaceae	*Phlomis oliviri*
Compositae	*Chardinia orientalis*		*Stachys inflata*
	Senesio vernalis		*Ziziphora* sp.
	Taraxacum sp.		*Salvia staminea*
	Echinops persicus	Caryophyllaceae	*Cerastium* sp.
	Echinops orientalis		*Convulvolus arveusis*
	Carthamus oxyacantha		*Vacaria pyramidata*
	Lasiopogon muscoide		*Minuartia meyeri*
	Xeranthemum squarrosum		*Silen conoidae*
	Tragopogon sp.	Geraniaceae	*Geranium tuberosum*
	Antemis sp.		*Erodium oxyrrhnchnm*
	Crupina crupinastrum	Malvaceae	*Alcea tehranica*
	Scariola orientalis		*Malva parviflora*
Fabaceae	*Vicia michauxii*	Apiaceae	*Cancalis platycarpus*
	Vicia villosa		*Eryngium caeruleum*
	Vicia ervilia		*Torilis arveusis*
	Medicago polymorpha	Cruciferea	*Conringia orientalis*
	Medicago scntelata	Papaveraceae	*Papaver gaubae*
	Medicago radiate	Primulaceae	*Androsace* sp.
	Trifolium sp.	Brassicaceae	*Lepidium perfoliatum*
	Trifolium sp.	Dipsacaceae	*Scabiosa olivieri*
	Lathyrus sp.	Iridaceae	*Gladiolus atroviolaceus*
	Pisum sativum	Asteraceae	*Gundelia tournefortii*
	Trigonella monatha	Rubiaceae	*Galium* sp.
	Astragalus gossypinus		
	Astragalus cordatus		
	Astragalus cruciatus		
	Astragalus kohrudicus		

Table 2: Analysis of variance for number of plants and number of species

Source of variation	df	SS		Average of square		F	
		No. of plants	No. of species	No. of plants	No. of species	No. of plants	No. of species
Treatment	4	906130.640	2268.960	226532.660	567.240	47.312**	42.080**
Error	20	95760.400	269.600	4788.020	13.480		
Total	24	1001891.040	2538.560				

*Significant, **Significant, NS = Non Significant

Table 3: Analysis of variance number of plants and number of species based on Duncan test and plant diversity based on Shanon-Wiener index in different treatment

Treatments	Grazed range	Wheat	Fallow	Annual medic	Exclosure
No. of plants	353.00c	167.00b	4.00a	55.0ab	514.00d
No. of species	17.00b	4.00a	4.00a	3.0a	26.00c
Diversity	1.56	0.15	2.03	0.3	1.96

Values with different letter(s) are significantly different at $p<0.05$

DISCUSSION

The rainfall of the region made the anticipation that the majority of plant species would be Therophytes and annuals regarding Rankayer's classification. This fact also reported by other researchers because the region under study had the driest days in a year (regarding Amberege's classification). In this climate plant species (their seeds) have to be buried into the ground in order to survive in harsh season conditions and then grow again in convenient temperature and rainfall. The dry climate and insufficiency of rainfall also caused the dominance of Poaceae family due to their resistance to dry climate. The diversity in annual medics and Trifoliate family in the

region under study made Fabaceae family have the most diversity due to pass harsh dry season, burying their hard-cover seeds into the ground. The Duncen test illustrated that there was the maximum number of plants and plant diversity in the treatment of exclusion pasture approved by Shanon-winer index. The treatment of exclosure pasture had the maximum plant composition, consistency and the production of plants which agree to Delitti's (2005) study. This result differed slightly from Glichnia's (2006) because the comparison made by him was based upon the treatment of exclusion under balanced grazing. It showed that the balanced grazing caused natural harvest which controlled the competition among plants. The studies done by Programming and Budgeting Organization (2005) and Kosins (2005) demonstrated that diversity could be observable in the lands where there were no human interferences and change in land use. Nowadays researchers and scientists regard pastures as a genetic bank rather than a source of cattle nourishment and so on. As the present study revealed, the exclosure of pasture is the best way to protect plant cover in order to preserve water, soil and plant diversity which keep safe genetic banks. It also moderated climate conditions and safeguarded medical herbs, wild life, an parks. The reason why the treatment of medic had more diversity than the wheat treatment and fallow would be explained in terms of the fact that this treatment was closer to the treatment of exclosure pasture. The measurement of diversity and consistency in the treatment of exclosure pasture demonstrated that the frame number five was more diverse and constant than the rest of the frames. The reason was that this repetition located in the low part of the slope. This region had deeper soil so it bore more penetrating effect which provided better condition for the growth of plants. Regarding Table 1, it can be claimed that Shanon-wiener index is not suitable for measuring diversity and consistency in the regions where the number of plants is small and this small number exists in all of the frames. Result showed that there is minimum plant diversity and minimum number of plant in the fallow treatment in comparison with other treatments. Thus for a suitable development must avoid fallow land. It can be concluded that the modern use of pastures as a genetic bank, protection of water and soil, wild life, medical herbs, parks, moderation of climate and other public benefits, except the supply of forage for cattle, support the idea that they should be used as exclosure pastures. This can be generally recommended for all pastures. The change of marginal lands into exclosure pastures will be of high importance here.

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