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Full Length Research Paper

Impact of nomadic grazing on medicinal plants diversity in Miandam, Swat-Pakistan (Preliminary results)

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The coniferous forest play vital role to support the livelihood of rural poor and provides good ecological services for the maintenance of ecosystem. In this context the present study was initiated with the aim to evaluate the impact of nomadic grazing on the plant diversity, with special focus on medicinal flora. Comparisons were made between two sites; one protected from grazing for about seven years, the other being exposed to continuous nomadic grazing. Results of the survey showed that nomadic grazing poses serious threat to the occurrence and the distribution of medicinal flora. The area protected from nomadic grazing showed better vegetation cover and medicinal plant diversity. In August 2007, 33 medicinal plant species were found in the unprotected site, while 78 species were recorded in the protected site. It was also found that the medicinal plants diversity had decreased in the former site by about 90%. Moreover, two species *Paeonia emodi* and *Podophyllum emodi* had completely disappeared from the nomadically-grazed area. It was also observed that overgrazing had negative impact on the natural regeneration of conifers: 66 saplings were counted per ha in the grazed area compared to 840 saplings observed in the protected area. The study also observed that the availability of economically and therapeutically important plant species is decreasing and the number of rare and threatened species among the medicinal plants is increasing in the area. Further study is, therefore, required to quantify the availability of species and to suggest suitable method for their production and conservation.

Key words: Nomadic grazing, plant diversity, protected area, unprotected area.

INTRODUCTION

The mountainous area of the study is covered by moist temperate coniferous forest, which is highly associated with the life support system of the local inhabitants. Escalation of biotic pressure on natural resources has made the fragile Himalayan ecosystem vulnerable to a variety of ecological maladies. The degradation of the region as a result of the transformation of nomadic pastoralism to nuclear transhumance (migration by only one or two people per family) (VeldKamp and Fresco, 1996) has increased the resource extraction process.

This region has been regarded as a natural reservoir for the collection of a variety of wild medicinal plants (Sher and Hussain, 2009). Their forest resources represent unique and enormous diversity of flora and fauna within a relative small geographical area due to variations in topography, altitude and climate. The medicinal plant species have supported livelihood of many people in the study area.

Previously people of the valley were relying on herbal remedies as a principal means of preventing and curing illnesses. Beside this collection of medicinal plants from the forest area provides employment and fetches earnings to the poor local people. It has been estimated

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that almost 3000 people are earning 25% of their total income from the collection and sale of the plants. However, these resources, and local knowledge of these, are being threatened by nomadic grazers. Each year nomads carry more than 40,000 goats to the high altitude of pastures passing and browsing through the young forest crop and shrubs throughout. As per the existing traditions, they have to pay a tax (sum of US $ 85 to 120 per year) to the owners, called "Qalang" for their stay in the pastures. During their stay for 3 to 4 months (that is, May to August) in a year, in addition to grazing their animals, each nomad collect enormous amount of medicinal plants worth of US $ 450, but the owners of the pastures are not aware of such losses. Since 2000, some of the forest owners put a ban on the nomadic grazers on their land. It has been observed that the area where the nomadic grazing has stopped, showing better vegetation cover, improvement in medicinal plants diversity and good regeneration of pine species(Sher et al., 2005).

Thus, first there is an urgent need to study the difference between vegetation cover, plant diversity and regeneration status under grazing and controlled grazing lands. The concluded results will be a good tool for an extension worker to provide awareness to the forest owners about economic importance of their Pastures and adverse effect of nomadic grazing on it. Grazing in the grasslands has played a key role in changing the botanical composition, which, however, varies with the type of grass cover, its palatability etc. Overgrazing represent the most obvious impact on the native biodiversity of grasslands. As overgrazing causes retrogression, stimulates growth of weeds and loss of diversity. In Assam overgrazing reduces the tall grass cover to tufted grass type to *Chrysopogon aciculatus* and *Imperata cyclindrica (*Olsen and Larsen, 2003). Livestock impact on biodiversity through trampling and removal of biomass, alteration of species composition through selective consumption and changed inter-plant competition. Changes in grazing intensity and selectivity will inevitably change biodiversity; under grazing and overgrazing can both have negative effects, but overgrazing by livestock is increasingly problematic Khan (1994). Over-grazing has resulted in land erosion, formation of boggy areas and reduction in plant diversity. The area of natural pasture land has declined from 1.4 million ha in 1940 to 808,000 ha today, and remaining areas have been degraded and have become dominated by rocks (87%), scrub (25%), and inedible (74%) or poisonous plants (47%), while diversity has declined. For example, while between 70 and 80 plant species are normally supported by steppe systems, the number of species found after intensive over-grazing drops to around 15 (Sher et al., 2004). Grazing animal may exert beneficial or mutual influences on the vegetations for their own good but on the other hand, large concentration of them often have harmful effects on the plants because of selectivity and over grazing. Quantifying the impact of livestock grazing on natural communities (forages) has become a major issue in the management of rangelands especially where the grazing is very widespread and its impacts may be in conflict with conserving biodiversity (Olsen and Larsen, 2003; Sher et al., 2005). Lamprey (1979) documented that grazing is among the important agents, which influence the distribution of some vegetation types. In most rangeland ecosystems, grazing, browsing and other factors such as fire and climate contribute to vegetation change.

Grazing animals influence species composition, change in biomass and distribution of biodiversity. Similarly, Pratt and Gwynne (1997) and Sher and Hussain (2009) observed that overgrazing reduces the ground cover vegetation, plant diversity and productivity. Furthermore, the impact of grazing on rangeland vegetation depends on three factors: (a) the type of herbivores (grazers and browsers) (b) Number and type of animals utilizing an area (c) Distribution of use in time and space. Gathering and processing of medicinal plants for family use in human and livestock treatment is centuries old practice, and have been used virtually in all cultures. Collection and sale of medicinal plants have long been an important economic activity in the Northern parts of Pakistan including the study area. Overshadowed by the vast impact that habitat loss has on plant species survival, it tends to overlook the fact that over-grazing of species can often result in their genetic depletion and in an often-rapid downward trend of their populations. They are being collected for domestic use and also for marketing, where feasible, however, the present overgrazing coupled with the factors of improper harvesting practices are leading to the decreasing population size of many valuable species of medicinal plants, and they have become rare and sparse in many areas of their occurrence. The study area provides vast biological resources for humans and their livestock. The mountainous area endowed by the environmental and topographical conditions offers limited areas for agricultural activities in the narrow fissures of the lowland valleys. The long term use of the mountains has resulted in a montane cultural landscape where the present pattern of resource utilization and habitats and their content of configuration reflect human impacts at different levels. The exploitation of biological resources from remote areas by either moving most livestock from permanent settlements or by nomads and fodder collection has made it necessary to assess the critical areas affecting resources. The present study was, therefore, conducted to assess the impact of nomadic grazing on medicinal plant species in a systematic manner (Figure 1).

METHODOLOGY

Study area

Miandam valley is located in the North East of Swat District, lies between 34° 34′ to 35° - 07′ N latitudes and 72° - 36′ to 73° - 35′ E longitudes in the Hindu Kush mountain range. The area is a

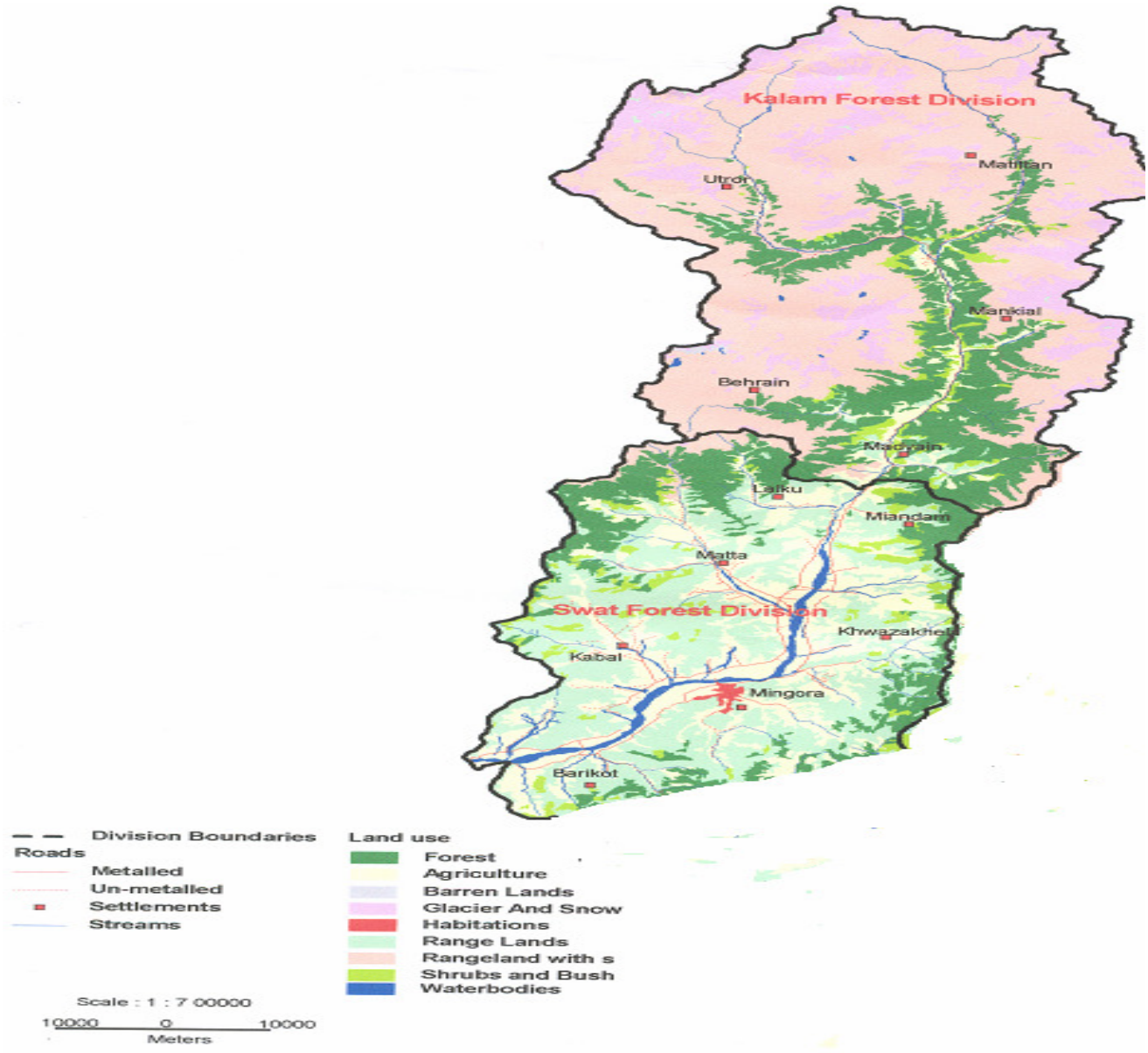

Figure 1. The impact of nomadic grazing on medicinal plant species in Swat District.

summer resort about 56 km from Saidu Sharif, the capital of Swat. The elevation of the valley ranges from 1200 - 3660 m. The valley comprises of 11 big villages and 15 small hamlets with a population of about 20,000 (Census Report, 2000). The economy of the inhabitants is mostly agro-pastoral. People usually keep goats, sheep, cows and horses/donkeys. Both agricultural and livestock economy are at the subsistence level except for some dry fruits, which are marketed both at local and national levels. The diversity of climate and geophysical features for plants growth signify the phyto-geographic diversity. Phyto-geographically, the district is represented with Sino-Japanese, Irano -Turanian and Euro-Siberian floristic elements. Rough and rugged terrain and extreme climatic conditions in the Montane Ecosystem have developed certain fragile habitats, which are exposed to rapid degradation due to ever increasing biotic pressure. The forest of the Miandam valley is a fundamental and potentially sustainable source of many services including economically important medicinal plants. Miandam is also facing the problem of overgrazing and deforestation. The basic reason of deforestation is commercial harvesting. In 2007, 2.6 million cft timber has been extracted from the forest while the illegal and unrecorded extraction is much more.

Ecological survey

The study was conducted in two sites of natural coniferous forest of Miandam valley district Swat. One site of the study is protected by the locals from nomadic grazing, while, the second one is open to free grazing. For comparative assessment the data were collected from both sites by using quadrat method of vegetation analysis. Before data collection, a reconnaissance survey was conducted to make sure that all other factors like aspect, altitude and slope

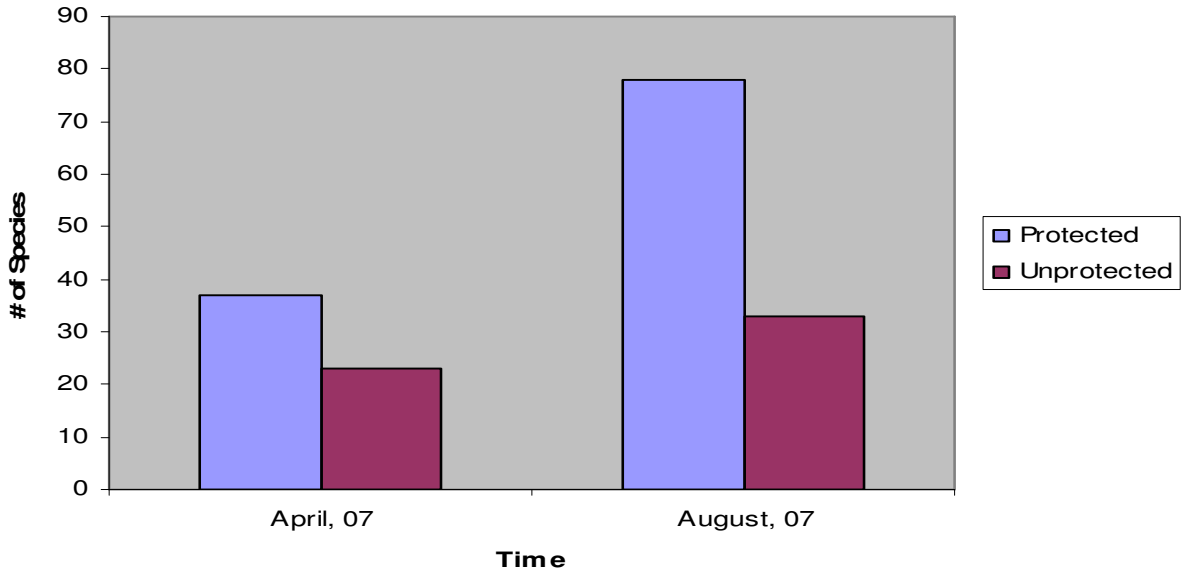

Figure 2. Floral diversity in protected and unprotected sites.

remain constant in both the sites; the only variable is grazing pressure. Sample plots (quadrats) were taken randomly from bottom to top in a transect walk in four direction in each site. In this way the whole site was sampled and covered. After every 200 meters sampling was done. The density, frequency, availability and vegetation structure of protected and unprotected sites was recorded in 40 quadrats, each of 5 × 5 m^2 following the method of Hussain (1989) Sher et al (2005). The data collected in the field for all parameter was analyzed and evaluated by using the parameters like standard deviation and co-relation variance for checking the data accuracy and validity.

The number of plants of each species, average phenological stage of the plants, general habitat, altitude and aspect of the plot were recorded on a Performa. The altitude, slope and aspect of each site were measured by using GPS. This was decided well before starting the counting of plants, and practiced throughout, that all those individual plants whose roots were inside or beneath the quadrat line, irrespective of the place of their shoots, were counted. Similarly, in certain species with rhizomes and bunches, forming compact inseparable clusters having difficulty in defining a single individual, the entire bunch or patch was counted as one individual. Voucher specimens were collected of all species and identification was done with the help of available flora (Nasir and Ali, 1971-1995). The nomenclature was later on confirmed from National herbarium and the collected voucher specimens were lodged over there.

RESULTS

Topography of the area

The results revealed that the topography of both sites i.e. protected and unprotected from grazing, is rugged with slopes very steep to precipitous, between 60 to 80%. Both sites occupy predominantly the northern aspect of the main mountain ridge running in North-east direction. The altitude varies between 1,850 to 2200 m in both the sites. All the three main factors including aspect, slope and altitude that influence the vegetation pattern in an area are (more or less) the same. It could be infer that any change in the vegetation density/diversity will be the impact of different grazing pressure in both the sites.

Medicinal plants diversity

The study revealed that 37 and 23 medicinal plants species were found in the protected and unprotected site respectively, during the month of April, 2007. In August, 2007 after the monsoon, 33 MP's species were found in unprotected site, while 78 species were recorded from the site that has been banned for nomadic grazing since 2000 (Figure 2). Table 1 showing name of species, recorded from both the sites.

Economically important species

The study reported (Table 1) total 78 species of medicinal value from protected site of the investigated area. These are used for the treatment of various health problems in traditional system of medicines. Out of 78 species, 10 medicinal plants viz: *Bistorta ampilexicaulis, Morchella esculenta, Valeriana wallichii, Adiantum venustum, Viola biflora, Bergenia ciliata, Geranium wallichianum, Berberis lycium, Podophyllum emodi*, and *Paeonia emodi* have high economic and pharmaceutical value and are collected in large amount for sale (Table 2). The present study observed that the pharmaceutical industries need those herbs in a high quantity. The prices of each species vary from year to year and also depend on demand and supply. Greater demand of herbal industries for those species has threatened their occurrence and abundance. Out of the 10 plant species, four were declared as

Table 1. List of medicinal plants reported from protected and unprotected sites.

Protected site						Unprotected Site	
S. no	**Scientific name**	**S. no**	**Scientific name**	**S. no**	**Scientific name**	**S. no**	**Scientific name**
1	*Acorus calamus*	27	*Cynodon dactylon*	53	*Paeonia emodi* Wall.	1	*Acorus calamus*
2	*Aconitum violaceum*	28	*Cynoglossum lanceolatum*	54	*Plantago lanceolata* L.	2	*Adiantum venustum*
3	*Adiantum capillus-veneris* L.	29	*Dryopteris jaxtaposta* christ.	55	*Plantago major*	3	*Ajuga bracteosa* Benth.
4	*Adiantum venustum*	30	*Diospyros lotus*	56	*Podophyllum emodi* Wall.	4	*Arisaema jacquemontii* Blume,
5	*Aesculus indica* Coleb. Ex Wall.	31	*Elaegnus umbellate*	57	*Podophyllum hexandrum* Royle,	5	*Artimisia vulgaris* L.
6	*Allium sativum*	32	*Fagonia arabica* Linn.	58	*Primula denticulata* Sm.	6	*Berberis lycium* Royle.
7	*Ajuga bracteosa* Benth.	33	*Ficus palmate*	59	*Rubia cordifolia* Hochst. ex A. Rich.	7	*Bergenia ciliata (Haw.) Sternb.*
8	*Amaranthus viridis*	34	*Fragaria vesica*	60	*Rumax hastatus*	8	*Bistorta ampilexicaulis* (D. Don) Greene
9	*Arisaema flavum* (Forssk.) Schott	35	*Fumaria indica* Pugsley	61	*Ricinus communis*	9	*Caltha alba* Jacquem.
10	*Arisaema jacquemontii* Blume,	36	*Geranium wallichianum* D. Don,	62	*Skimmia laureola* Sieb. and Zucc. ex Walp.	10	*Cannabis sativa* L
11	*Artemisia scoparia* Waldst. and Kit.	37	*Hedera nepalensis* K. Koch,	63	*Solanum nigrum* L.	11	*Chenopodium album*
12	*Artimisia brevifolia* Wall.	38	*Hypericum heterantha*	64	*Stachyus parviflora* Benth.	12	*Corydalis govaniana* Wall.
13	*Artimisia vulgaris* L.	39	*Hypericum perforatum* Linn.	65	*Salvia moorcorftiana*	13	*Cynodon dactylon*
14	*Asparagus adsendens*	40	*Indegofera trifoliate*	66	*Swartia elata*	14	*Cynoglossum lanceolatum*
15	*Avena sativa*	41	*Isodon rugosus*	67	*Silene uugaris*	15	*Fragaria vesica*
16	*Berberis lycium* Royle.	42	*Lanthyrus aphaca*	68	*Sonchus asper*	16	*Geranium wallichianum* D. Don,
17	*Bergenia ciliata (Haw.) Sternb.*	43	*Launea procumbens*	69	*Sambacus wightina*	17	*Hedera nepalensis* K. Koch,
18	*Bistorta ampilexicaulis* (D. Don) Greene	44	*Male fern*	70	*Taxus buccata*	18	*Hypericum heterantha*
19	*Bunium persicum*	45	*Mentha longifolia*	71	*Taraxcicum officinale weber*	19	*Indegofera trifoliate*
20	*Caltha alba* Jacquem.	46	*Mentha spicata* L.	72	*Trachysepermum ammi*	20	*Isodon rugosus*
21	*Celtis australis*	47	*Micromeria biflora*	73	*Urtica diotica*	21	*Male fern*
22	*Caralluma edulis* Benth. Ex Hook. f.	48	*Myrsine africana* L	74	*Valeriana jatamansi* Jones.	22	*Mentha spicata* L.
23	*Chenopodium album*	49	*Nepta govantiana*	75	*Valeriana wallichii* DC.		
24	*Chamomilla recutita* Rauschert.	50	*Onosma hispidium*	76	*Verbena offcinalis* L.		
25	*Chenopodium botrys* L.	51	*Otostagia limbata*	77	*Viola biflora* L.		
26	*Corydalis govaniana* Wall.	52	*Oxalis corniculata*	78	*Viola serpens* Wall.		

Table 2. Medicinal plants of Miandam valley: Prices and quantities harvested.

Botanical name	Part used	Prices (Rs/kg) for			Qty extracted (kg/yr)
		Collector	Retailer	Customer	
Bistorta ampilexicaulis	Rhizomes	10	12	15	15,000
Morchella esculenta	Fruiting Bodies	7,000	10,000	14,000	300
Valeriana wallichii	Rhizomes	60	100	130	20,000
Adiantum venustum	*Leaves*	16	20	30	12,000
Viola biflora	Leaves and Flowers	180	280	450	10,000
Bergenia ciliate	Rhizomes	10	20	30	1,000
Geranium wallichianum	Rhizomes	40	60	100	1,000
Berberis lyceum	Rhizomes	80	150	300	100
Podophyllum emodi	Rhizomes	75	100	170	100
Paeonia emodi	Rhizomes	10	18	30	800

endangered in Pakistan, (Red Data Book of IUCN threatened species 1998).

Density and frequency of the target species

Density, which is the number of plants of particular specie per unit area, is essential to determine the population density. Hence total number of plants of individual specie in the quadrat was counted and extrapolation for the area of the site was applied. The study revealed that the average population density of the target species decreases upto 90% due to nomadic grazing, while two species, *Paeonia emodi* and *Podophyllum emodi* were completely vanished due to overgrazing. Table 3A shows density (# of plants/ha) of the target species in both sites.

Frequency is the occurrence and distribution of a particular plant in a particular site. A plant may have high density with low frequency when the plants generally occur in patches. This will indicate non uniform distribution on the site and any indiscriminate harvest can endanger the species on the site. The plant will also be vulnerable to the local adverse biotic and ecological collapses. Frequency of all the target species from grazed and no grazed land is given in Table 3B. Comparing the plants frequency of both, protected and unprotected sites shows that there is a clear relation between frequency and overgrazing. The study revealed that the sites banned for nomadic grazing showing uniform distribution of all the target species on the site. On the other hand in unprotected site, frequency occurrence of some of target species was restricted to the steep slops only. Maximum decrease in frequency was recorder in *Valeriana wallichii* followed by *Viola biflora* while *Paeonia emodi* and *Podophyllum emodi* were completely disappeared from the overgrazed site. The adverse impacts of overgrazing are severe more in terms of frequency than on density. Some plants may have low density with high frequency where the plants will have uniform distribution in a particular site. The harvest of such plants could be safe because of its occurrence throughout the site and the plant will not be threatened if some limits of harvest are imposed. Form the above one can infer that the impact of overgrazing on *Valeriana wallichii* is more severe as compare to *Bistorta ampilexicaulis.*

DISCUSSION

The natural vegetation in general and medicinal plants of the study area in particular is under heavy biotic pressure in the form of overgrazing, illicit cutting, and conversion of forest land into agricultural land. Although, plants have vital role in improving the livelihood of mountainous dwellers, yet they are not properly managed. Vesk and Westoby (2000) reported that the number of endangered species is increasing due to environmental degradation and over grazing. The present study also revealed that the pattern of distribution and availability of economically valuable MAP species and other economically important forest resources were found to be quite variable according to differences in grazing and coniferous forest stand. For instance the population size of some medicinal plants (especially *Morchella esculenta, Viola biflora, Paeonia emodi, Podophyllum hexandrum, Valeriana wallichii, and Berberis lyceum* etc.) in unprotected site was highly threatened due to rapid destruction of habitat by grazing coupled with unsustainable harvesting. Similar results were also reported by Sher et al. (2005) who stated that protection from grazing and over-harvesting for two to three years increase medicinal plant diversity in alpine pasture and meadows.

The results of the present study were very promising in protected site and the density, frequency and availability of *Morchella esculenta, Viola biflora, Paeonia emodi, Podophyllum hexandrum, Valeriana wallichii, and Berberis lyceum* etc were increasing by protection from grazing. The results also indicate that these species occur in large quantities in the reserved/protected site of

Table 3a. Density of the target species in both sites.

Species	Density (#/ha)		Reduce in %age	Frequency in %	
	Protected	Unprotected		Protected	Unprotected
Bistorta ampilexicaulis	53200	3900	92	100	75
Morchella esculenta	145	0	Not Found	10	0
Valeriana wallichii	2900	533	81	70	30
Adiantum venustum	37200	800	79	90	40
Viola biflora	13560	1100	91	100	50
Bergenia ciliata	240	133	45	20	10
Geranium wallichianum	12340	800	93	80	40
Berberis lycium	1000	300	70	50	40
Paeonia emodi Wall	920	0	Not found	50	0
Podophyllum emodi Wall.	320	0	Not found	30	0

The test hypothesis shows that there is no statistically significant difference in the population density of the target species in both the sites.

Figure 3b. Statistic of the target species on both sites.

X1 (A) density in protected site	X2 (B) density in unprotected site	d = (A – B)	d^2
53200	3900	49300	2.43E+09
2900	533	2367	5602689
37200	800	36400	1.32E+09
13560	1100	12460	1.55E+08
240	133	107	11449
12340	800	11540	1.33E+08
1000	300	700	490000
920	0	920	846400
320	0	320	102400
Total		$\sum d = 114114$	$\sum d^2 = 4.05E+09$

N = 9
D = $\sum d/N$ =114114/9=12679.3.
$S^2 = \{\sum d^2 – (\sum d)^2 / N\} / N – 1$.
$= 1/8 \{4.05E+09 – (114114)^2 / 9\} = 3.26E+08$.
S = 19026.
$T = (D – 0) / S/ \sqrt{N} = 6337.3$.

The tabulated value of 't' for 8 degree of freedom (df) is 2.306 at significance level 0.05 while the calculated value of't' is 6337.3, which are much more than 2.306. Therefore null hypothesis of no difference is rejected. We infer that the density of target species in both the sites is differing significantly from one another.

the study. Similar results were also reported by Hegland et al. (2001) and Sher et al. (2005) who reported that protection might help in the revival of original vegetation and recovery of natural habitats where degradation resulted due to heavy grazing and other biotic pressure. The results of the present study also revealed that in unprotected site some medicinal plants like *Morchella esculenta, Viola biflora, Paeonia emodi, Podophyllum hexandrum, Valeriana wallichii, and Berberis lyceum* etc were declining. As a result these species along with other biodiversity components have occurred rare in the site. The present findings are in line with the study of Hurska (1991) who documented that some components of the biodiversity are threatened and becoming extinct by over use and habitat destruction in many parts of developing world. It is generally believed that the relationship exists between the growth of plants and the impact of grazing. The regeneration response of most medicinal plant species to over grazing is poor (Oba et al., 2001). Although most of the medicinal plants are non-palatable species, but under certain conditions even their mature plants are grazed and browsed. The species do not reach

maturity to complete their life cycle. Similar results were also reported by Vesk and Westoby (2000) and Sher et al. (2005) they observed that overgrazing is a dove tail to the degradation of existing vegetation and reduces the spread of species not only through direct consumption but also through materially altering their habitats.

However, a detailed study is required to establish such relationship in different sites of the different intensities of grazing and impact on various plant species.

The indirect effects of overgrazing include soil compaction, mechanical injuries to seedling and soil organism. These practices increase the susceptibility of the soil to erosion and loss of soil fertility. The browsed part of the species is susceptible to fungus infestation. As a result most of the plants now appear rare in most of the grazing sites.

Most of the species especially targeted plants reported here have multiple uses. These were invariably used for curing various diseases and for earning livelihood. However, the target plants were severely grazed by the local livestock. This agree with the findings of Watkinson and Ormerod (2000) and Landsbery et al. (2001) who documented that overgrazing has caused the destruction, as green parts are being removed and damaged due to trampling. It, therefore, becomes important to manage the grazing system and encourage the regeneration of medicinal plants. This aspect must be correlated with phenological cycle. Plants or shoots that are grazed and collected for medicinal purposes are a threat to their regeneration. Similarly, a grazeable plant that is collected for roots, rhizome or bulb is threatened. The plants fail to develop flowers and seeds while under ground parts are destructively collected. This definitely reduces the chances of their regeneration. During the survey, sapling of Pine trees was also counted in the quadrat while mother trees were calculated through full enumeration. It has been observed that overgrazing had negative impact on the natural regeneration of pine trees. Total number of plants recorded from protected site were 840 while those from unprotected were 66 saplings/ha. This could jointly be attributed to the presence of low number of mother trees, but this could not be regarded that much significant. The findings are in line with the study of Champion et al. (1965) and Adnan et al. (2006) they documented that 24 mature trees/ha is required to established good regeneration in the moist temperate zone, while during survey 27 mother trees/ha has been recorded from the unprotected site. From the above one can infer that the major contributing factor that signifies is the over grazing resulting in much reduced regeneration capability of the forest.

Conclusion

Medicinal plants are the sustained source of income for improving the livelihood of rural poor especially in the northern parts of Pakistan and can be used as a tool for biodiversity conservation. Miandam is rich in floral diversity, particularly in medicinal plants. However, these precious resources are facing a tremendous danger due to the nomadic grazing thus threatening their occurrence and abundance in its natural habitat. Results of the study indicate that overgrazing represent the most obvious impact on the floral diversity. The areas which were opened to nomadic grazing shows a massive decline in their density, frequency and specie diversity. 33 species were only found in the unprotected site making a huge difference of 78 species in the site banned for nomadic grazing. The study suggests that areas protected for 2-3 years had an increase diversity of medicinal plants and their measured growth parameters. The study, therefore, recommend rehabilitation and recovery practices of the present study in order to enhance restoring of vegetation/plant diversity in general and medicinal plants wealth in particular.

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