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PASTURE MANAGEMENT IN HIGH ALTITUDE PHASTI VALLEY OF CHITRAL

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ABSTRACT

Recognizing the diversity of vegetation, particularly weeds, is important in sorting out relationship between environmental changes, community composition and ecological processes. The effect of different methods of estimating relative abundance was needed to be addressed. In the present study, results of forage production represented higher values in the fenced area than in open grazing sites in both years during 2001-02 in Phasti valley of Chitral, Pakistan. The percent vegetation of the protected area recorded was 70% and barren soil was 29%; while in open grazing sites the vegetation decreased to 45% and the barren soil was increased to 55%. The percent vegetation which led to increased forage production was found to be higher inside the enclosure. Grazing capacity and forage production were found to be higher in fenced sites as compared to non-protected sites. The quantity of the animals in the area was too high to be fed with the existing forage production. Approximately 25 goats and sheep per family excluding cows, buffalos, horses and donkeys were recorded and the quality of these animals was also very low mainly because of feeding on low quality forage including mostly weedy species.

Key words: Chitral, high altitude, pasture management, weeds.

INTRODUCTION

Chitral valley is located in the North of Khyber Pakhtunkhwa province of Pakistan. It lies between 35-12^0 to 36-50^0 north latitude and 17-12^0 to 73-53^0 east longitude. The total area is 14,850 square kilometers with a population of 317,198 (Census, 1998). The altitudinal range of this zone is from 5000-11000 feet. High mountains of Hindukush range surround the Chitral valley. Being out of the monsoon rains, the dry winds from the Indus plains that enter this valley precipitate dry conditions. Growing season is short (April-September). Chitral valley receives only 50-64 cm (Chitral 54 cm, Drosh 65.8 cm) mean annual rainfall. In this xerophytic habitat vegetation is dwarf and scanty. Water is available from perennial falls and ravines. Maize, rice, wheat, cabbage tomatoes etc. are the main crops of the area. Since cultivated agriculture is not possible on large scale on these highland pastures, grazing by livestock enables pastoralist to convert the usable plant biomass in valuable animal

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products. The high land pastures are important for many reasons. They provide water as a source for many rivers and also provide habitat for flora and fauna. Numerous plants are of medicinal value and provide important genetic resources for future economic uses too.

Livestock sector plays a key role in Pakistan's economy. It accounts 55.1% to value added in the agriculture and 11.5% in GDP of the country (GOP, 2010-11). Livestock production practices based on hillside pastures grazing represent a source of milk, meat, manure, draught power, status and stable income for farmers; however the environment researchers took that as land degradation. Looking from the alternative and more rational viewpoint, grazing and rangeland vegetation are co-adopted throughout the process of evolution. However, both under-grazing and overgrazing have resulted in growth of undesirable plants (Jones and Martin, 1994; Hussain *et al.*, 2007). Additionally when the pastures are closed for grazing, the diversity and stability of plant cover decreases and the plant community simplifies and become unstable (Luhl, 1992). Overgrazing is not so much a function of animal numbers, but the duration for which the pasture is exposed to grazing (Briske and Heitschmidt, 1993).

Properly managed pasture can continue to be the source for water, provide habitat for wild animals and grazing land for livestock and continue to provide overall economic development .During winter forage deficiency is a major problem for poor local community in the valleys. In order to solve this problem and to improve the pasture conditions Agha Khan Rural Support Program in collaboration with CABI Bioscience conducted a three-month area survey to study the prevailing vegetation status and potential of the pasture.

Experimental site

The Phasti valley is rough, rocky and mountainous, 3000-4000 m above the sea level. It is one of the most remote areas of Chitral. It is connected to Chitral by a narrow road constructed by a joint project of IFAD funded Chitral Area Development Project and Agha Khan Rural Support Program.

Fodder shortage in winter was the main issue in Chitral valley. The production of fodder was too low, not meeting the requirements of the livestock and the farmers purchased forage during shortage. Due to the fodder shortage, the animals' productivity was continuously decreased. Due to less healthy feed and forage, animals got exposed to diverse diseases. Still the community preferred to the number of animals rather than their quality, which has led to retention of unproductive and uneconomic animals that further added to the grazing pressure.

Like other valleys Phasti possessed short growing season (April-September) while from October-May whole area was covered with

snow. Such climatic conditions resulted in the slow growth of dwarf vegetation. Because of overgrazing, topographical and environmental conditions, the vegetation in pastures was quite scarce, slow growing and xerophytic in nature resulting in the fodder shortage. Besides farming, live stock was the main source to meet the domestic needs and income generation. Winter cuts the Phasti valley from Chitral, so the main source of fodder was only the pastures or stored forages reserves. Women folks were observed more frequently engaged in farm activities like weeding and care of livestock etc. The vegetation differed considerably in plant community structure, depending on altitude, temperature, and rainfall.

Forage production, soil conservation and animal health were entirely dependent on the management of the pasture. Livestock grazing was an important type of land use, however shortage of livestock forage and fuel wood was the major constraint of the area. The local community utilized the Chilam Lasht, Shadok and Koroi Shiaq pastures as Summer Grazing Lands. Rotation of livestock between different pastures and ranges helped conserve the grass and take advantage of topography and climatic factors to make the best use of the pasture or rangeland. The soil on side slopes was sandy-loamy-clay type with loose rocks.

The present study was therefore aimed at examining quantity and quality of vegetation in both the protected and open communal pastures of Phasti Valley, Chitral and to get better understanding of their bio-diversity. The objectives were to identify species in the protected/non protected pastures and also to assess ground features through relative occurrence of plant cover, litter, and bare soil in protected and open areas.

MATERIALS AND METHODS

Site selection

The data were collected from the previously selected pastures. Although the topographic and climatic factors resulted in the vegetation loss from the pasture day by day, but due to the better climatic condition i.e. good annual rainfall / snowfall as compared to last year has resulted in the growth of vegetation, but caused damage to most of the quadrates in the selected sites.

Plant data collection

For the collection of vegetation data Braun-Blanquet's approach (Braun, 1932) was used, which is still recognized worldwide. In this approach, sampling is done by the use of relves/quadrates, which are vegetation samples that are not randomly located and carefully selected as representative area of a vegetation type (Kent and Coker, 1992). Each of the protected fenced sites (totally banned from

animal grazing) and open pasture area (freely grazed by animals) were sampled for plant materials for a period of three consecutive months (March to September). Systematic sampling was done for herbage sampling and for recording physical characteristics of the soil by using twenty fenced and unfenced, (1x1 m^2) quadrates that were spaced widely and evenly through the study area in Phasti mountains. Within each quadrat, vascular plants and their estimated cover was recorded by visual estimation using the Dominance cover scale (Kent and Coker, 1992). Nomenclature of vascular plants followed Nasir and Ali (1972) and Nasir and Rafiq (1995).

The density, relative density, frequency, relative frequency, abundance, canopy coverage and importance value for each weed species were calculated by the following formulae (Kent and Coker, 1992).

$$\text{Frequency} = \frac{\text{Number of plots in which species occurs x 100}}{\text{Total number of plots}}$$

$$\text{Relative frequency} = \frac{\text{Frequency of a species x 100}}{\text{Total frequency of all species}}$$

$$\text{Abundance} = \frac{\text{Number of plants of a certain species x 100}}{\text{Total number of plants}}$$

$$\text{Density} = \frac{\text{Number of plants of a certain species x 100}}{\text{Total area sampled}}$$

$$\text{Relative density} = \frac{\text{Density of a species x 100}}{\text{Total density for all species}}$$

$$\text{Cover or dominance} = \frac{\text{Total area covered by a species x 100}}{\text{Total area sampled}}$$

$$\text{Relative cover} = \frac{\text{Relative cover for a species x 100}}{\text{Total cover for all species}}$$

Phyto-sociological attributes of vegetation

Like last years the quantitative study of plant community quadrate method (Hussain, 1994) was applied at the three previously selected pastures in Phasti Valley. The data on the forage production, carrying capacity, grazing capacities, utilization percentage, density, relative density, frequency, relative frequency, canopy cover, relative canopy cover, vegetation and barren soil percentage and soil analysis were collected from 20 fenced and 20 unfenced quadrates of size 1m^2 each.

RESULTS AND DISCUSSION

The data (fenced and unfenced) during the months of June, August and November, 2001-02 have been calculated on the basis of density, frequency, canopy cover and other parameters highlighted in the materials and methods. The species with highest importance value were

graded up to following communities established during June, August and November at fenced and unfenced sites.

Communities of Fenced sites

1. *Cousinia-Piptatherum-Minaurtia* community (June)
2. *Cousinia-Minaurtia-Piptatherum* community (August)
3. *Cousinia-Piptatherum-Minaurtia*- community (November)

Communities in Unfenced sites

1. *Cousinia-Minaurtia-Piptatherum* community (June)
2. *Cousinia-Piptatherum-Minaurtia* community (August)
3. *Cousinia-Minaurtia-Piptatherum* community (November)

After a drought year of 2001, the rainfall and snowfall of the year (2002) triggered up the vegetation growth and the results indicate that percent vegetation cover in protected areas was measurably higher than in the previous year. Several species were observed only inside the Protected areas while these were absent in open grazed areas.

The results of forage production (Fig. 1) represented high values in the fenced area than in open grazing sites in both years (2001-02). Beside that the climatic conditions of the year has led to the enhancement in the vegetation of the fenced sites as well as in the unfenced sites. The utilization in fenced and unfenced sites as represented in Figure 2 markedly indicates the high % age of utilization with the passage of time.

The soil was analyzed to assess the fertility of the selected pasture. The amount of organic matter (0.98 - 1.57 %), Soil pH (6.5-7.5), Phosphorus (medium) and Potassium (100-200 mg kg^{-1}), Electrical conductivity (EC) (0.35-0.50 ds m^{-1}) indicated that the soil was good in condition and well supplied with all the necessary nutrients required for the good vegetation. Plants were collected to study the floral composition of the study area (Phasti Pastures). For the future reference the samples were processed and preserved. During the survey the most dominant plants and indigenous knowledge about those plants is supplied in Table-1.

Keeping in view the annual rain/snowfall, the results indicated a progressive growth trend of vegetation. The plants dominant in fenced and unfenced sites were *Cousinia* sp., *Festuca valesiaca*, *Piptatherum* sp., and *Minaurtia kashmirica*. Others were *Acantholimon lycopedoides*, *Thymus serphyllum*, *Astargalus lasiosemius, A. leucocephalus, Scorzonera virgata*, *Iris hookeriana, Artimisia* sp. and *Psychrogeton andryaloides* from which only 6 were highly palatable (*Cousinia* sp., *Festuca valesiaca*, *Piptatherum* sp. *Acantholimon lycopedoides*, *Thymus serphyllum*, and *Scorzonera virgata*.

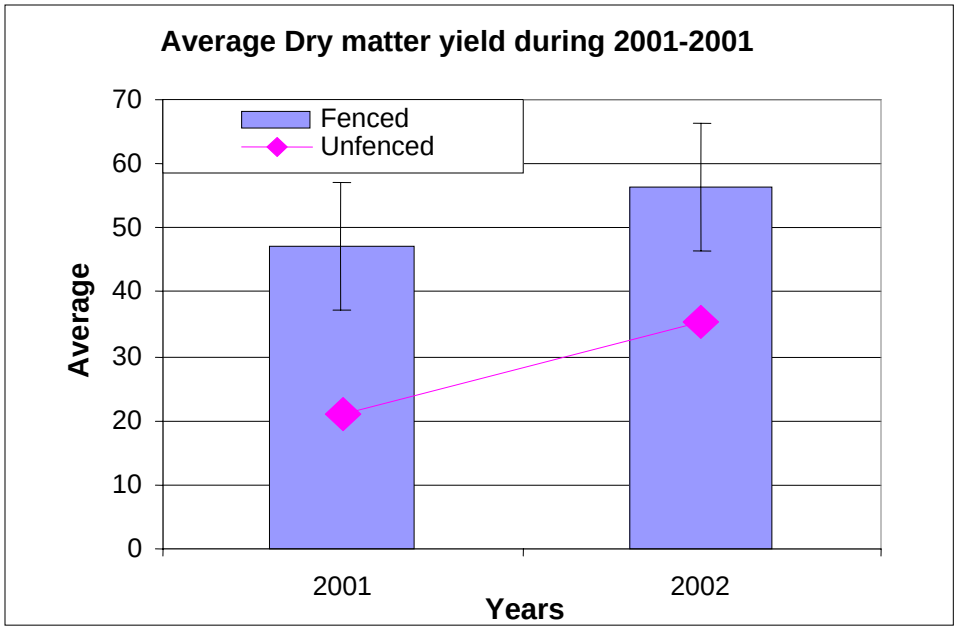


Figure 1. Comparison between forage production or dry matter yield (DMY) in Protected and Non-protected sites during 2001 and 2002.

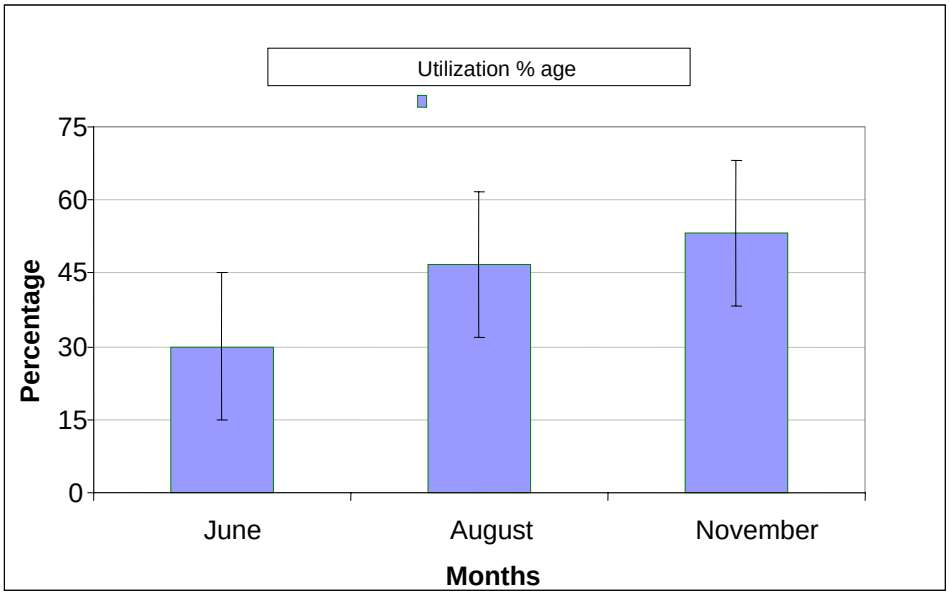
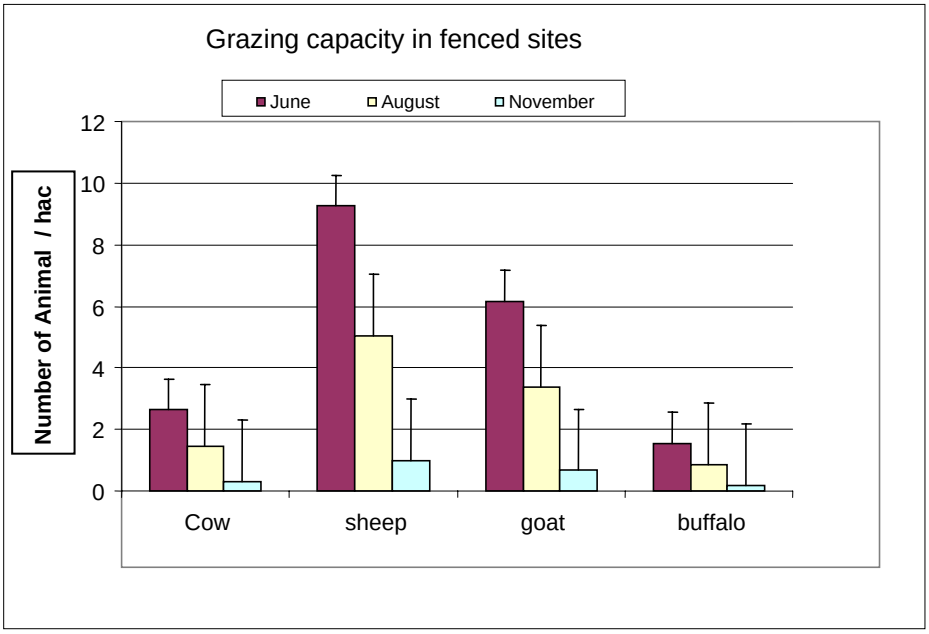
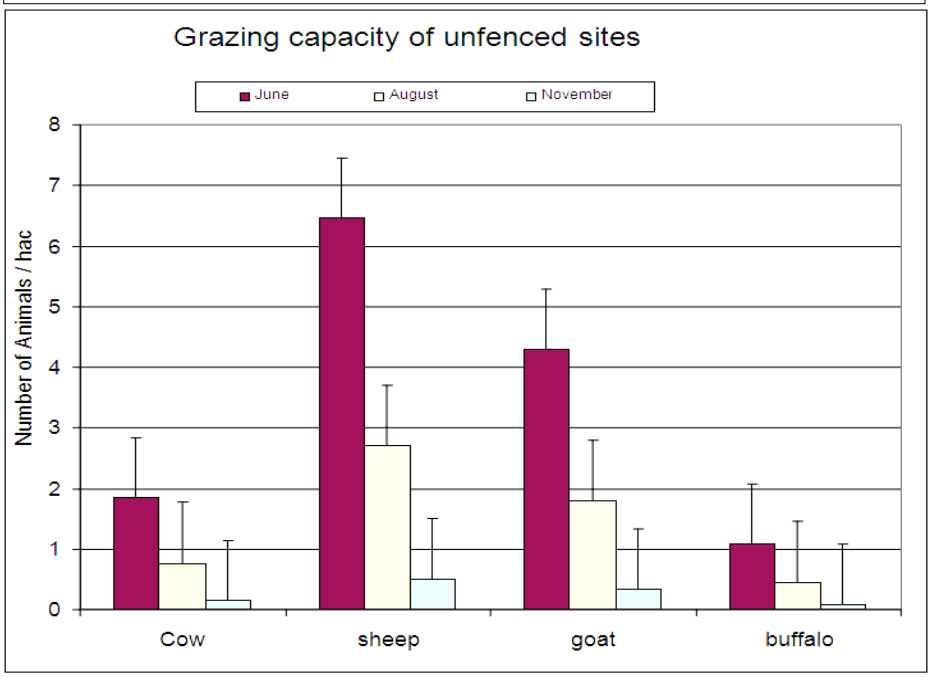
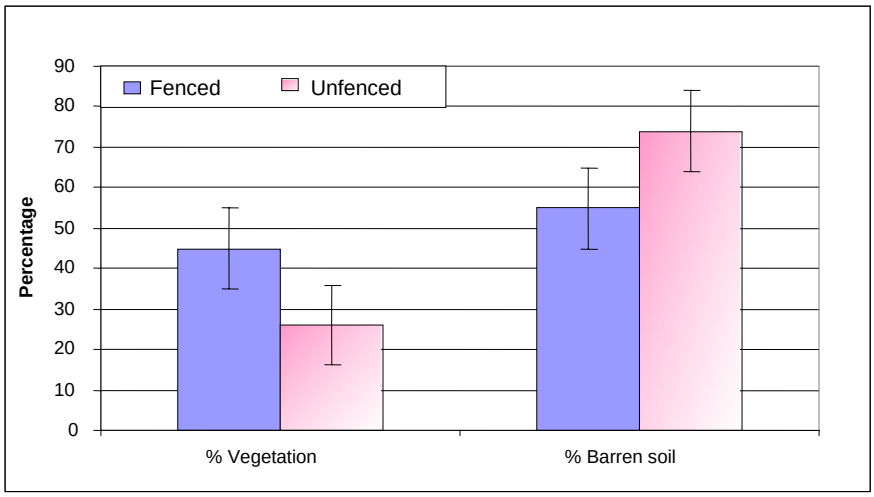


Figure 2. Utilization Percentage in 2002.





Figures 3 & 4. Comparison between grazing capacities of fenced and unfenced sites (2002).



Figures 5. Comparison between percentage vegetation and barren soil during June, August and November 2002.

The data of Carrying capacity is given in Figure 6, which clearly showed the significant differences in the value of protected and non-protected sites.

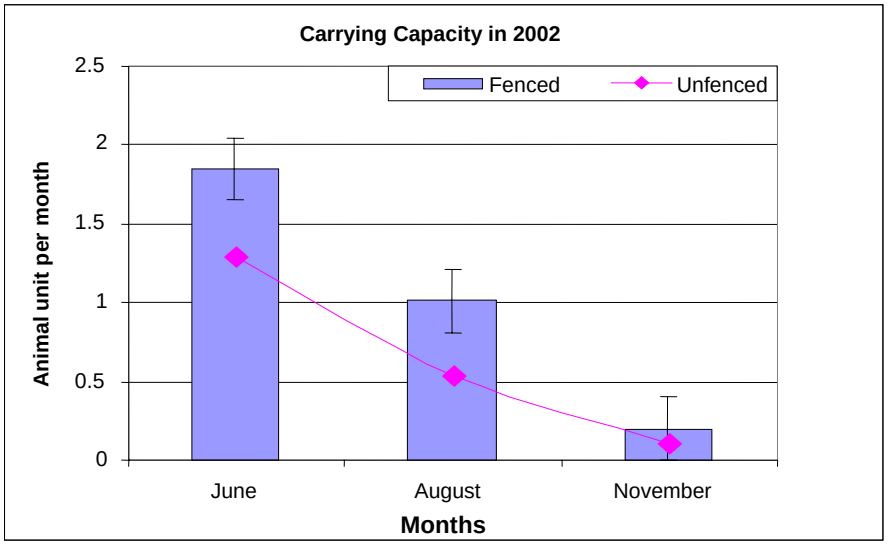


Figure 6. Carrying capacity in Enclosure and Exclosure.

The number of the animals in the Phasti valley was higher as compared to the forage production (approx. 25 goats and sheep per

family excluding cows, buffalos, horses and donkeys) and the quality of these animals was also low. These livestock depended on pastures forage and higher the number of the animals lesser was the availability of forage. These hill slopes were losing their mantle of soil and exposing the infertile mountainous range (Miller and Craig, 1996). Over stocking has damaged vegetation cover, which has in turn led to wind and water erosion.

The figures represent the relatively high grazing capacity in the fenced sites as compared to the non-protected sites, indicating the grazing pressure on the unfenced sites of the area.

The percentage vegetation of the protected area recorded was 70% while barren soil was 29%, which in open grazing sites decreased to 45%, and the barren soil % age was increased to 55 respectively. The percentage vegetation, which led to increase forage production, was found to be higher inside the enclosure. Without increasing the production levels of these resources, achieving optimum- or at least an improved level of animal biomass remains impossible (Miller and Craig, 1996; Miller, 1997).

The results from unfenced sites indicate grazing pressure on these pastures. The overgrazing has lead to the depletion of many useful species like Scorzonera, *Astragalus* and *Centaurea spp.* etc. The over grazing may lead to the absence of seed for the next year and overuse of palatable species and dominance of non palatable and injurious plants like Khhamboi (*Heracleum polyadenum*), Zar joshu and Waha joshu.

The data on the vegetation composition inside the protected area showed an increase in diversity of native plant species of this area. It was clear that plant over in protected sites was measurably higher than that in grazed areas. The ecological recovery and total vegetation cover was measurably higher in the protected sites than in area open to grazing (Sultana *et al.,* 2000).

The utilization percentage has increased with passage of time, indicated by two possibilities. Firstly, utilization was due to overgrazing or it was due to environmental change. Mainly annual drought of year 2001 has impacted adversely on recovery of the vegetation. Under severe drought the overgrazing has triggered the degradation of the pasture vegetation. The comparison of the fenced and unfenced data revealed a strong effect of over grazing and low ecological recovery of vegetation.

Grazing capacity and forage production were found to be higher in fenced sites as compared to non-protected site. Although the fenced sites data represented high forage production, carrying capacity, grazing capacity, vegetation cover and low barren soil %age but the potential of the pasture was very low.

The year 2001 was quite dry for Chitral, which had posed a negative impact on the growth of vegetation and eventually the forage production and carrying capacity, has decreased (Figure 1 & 5). The vegetation cover was easily impacted by drought (Miller and Craig, 1996). Although low but the ecological recovery in the protected areas as cover was much higher than un-protected sites. The reasons for the low recovery of the xerophytic vegetation of Phasti valley was firstly that ecologically the pastures were less fertile, deeply dissected with paved rocks and barren soil.

Secondly, the southern aspects were less warm so moisture availability was less during summer and resulting in the low regeneration of the plants. Thirdly, the misuse of the pasture i.e. overgrazing check the new plant growth leaving the soil barren which resulted in the soil erosion.

Besides reducing the cover of the vegetation and enhancing the erosion the over grazing also cause the reduction of the palatable species which ultimately resulted in the dominance of non-palatable species like *Heracleum polyadenum*. This weed had been left alone by the animals and the people so it got a chance of seed dispersal and this is the reason that this weed though indigenous to the area, was found to have an invasive impact on the biodiversity.

To reduce the fodder shortage it was necessary to introduce high yielding and nutritious forage species, which can grow in adverse climatic conditions such as:

- *Lolium perenne* (Perennial rye grass)
- *Lolium multiflorum* (Italian rye grass)
- *Dactylis glomerata* (Orchard grass)
- *Phalaris tuberosa*
- *Agropyron destorum*
- *Agropyron cristatum* (Crested Wheatgrass)
- *Trifolium repens* (White clover)
- *Trifolium pratense* (Red clover)
- *Avena sativa* (Oats)

Because of the poisonous behavior, most plants were considered as weeds or invasive plants of the pasture and because of this effect these plants availed a chance for survival and spread. There is a need to identify the areas with dominant poisonous plants and to develop proper destruction strategies and to educate local people in weed management. Such type of activities will help in the improvement of the natural vegetation in the pasture.

Table-1. Inventory of the most dominant plants of Pasti valley.

Scientific name	Local name	Status (HP/P/ NP)	Remarks
HERBS			
Cousinisa sp.	Isterzokh	HP	Fodder, Increase milk production
Scorzonera virgata	Sher joshu	HP	"
Astragalus lasiosamius	Sher bozi		"
Astragalus leucocephalus		HP	"
Astragalus candolleanus		HP	"
Thymus serpllyum		P	Used for making tea, Fodder
Acantholimon lycopedioides	Thorpak	HP	Fodder, increase milk production
Saussurea spp.		HP	"
Onobrychus cornuta	Boozi	HP	"
Potentilla argyrophylla		P	Fodder
Minaurtia kashmirica		P	"
Potentilla cuneata		P	"
Pschrogeton andryaloides		P	"
Androsacea himalaica		P	"
Artemisia chitralensis		HP	"
Artemisia		HP	"
Plantago		P	"
Lotus corniculatus			"
Scutellaria			"
Sempervivella acuminate	Doder joshu	P	
Prangos pabularia	Mushain	HP	Hay
Allium chitralicum			
Iris hookeriana	Ishpoor	NP/P	
Nepeta spicata		P	
Rumex nepalensis		NP	
Verbascum Thapsus			Med. Plant
Capparis spinosa	Kaveer		"
Ferula jaeschkeana			
Hippophae rhamnoides			
Rhodiola quadrifida			
Inula rhizocephalla			
Tanacetum ssp.			
Saussurea jacea			
Rosa webbiana			
Cicer macreanthum		HP	
Oxytropis chitralensis		NP	
Bupleurum linearifolium		NP	
Heracleum polyadenum	Khamboi	NP	Highly Poisonous cause blindness in animals
GRASSES			
Piptatherum hilariae	Ghaas	HP	Fodder
Festuca valesiaca	Roghnik	HP	"
Brachypodium distachyon	Gachhari	HP	"

HP = Highly Palatable, P = Palatable, and NP = Not Palatable.

CONCLUSION

These local people of Phasti valley of Chitral, Pakistan possessed indigenous knowledge about the environment in which they lived and the animals they herd, but they were not well recognized by the people and organization working there. As a result the herders often left out of the development process and as a result with neither their knowledge nor their needs and desires being considered by government and development agencies in introducing more modern and in introducing more modern and scientific methods of live stock and pastoral development. There is a need to enhance the harmonization between the community and the organization before introducing the management practices for improvement of the pasture.

The present nutritional state of Pakistan's indigenous breeds indicates that there is acute shortage of animal feed in the country. Animals are now getting about 40% less green fodder from pastures and rangelands than they did in past. The fodder and nutrient shortage has a great negative impact on milk production and work performance. Including the drought, low moisture, steep slope, rock pavements, poor soil and mainly misuse of pasture has rendered the common pastures of Phasti in poor shape. Overgrazing and adverse climatic conditions are the main factors in reducing the vegetation cover. Before distributing any fodder crop seeds like Italian rye grass or any other grass for forage to the local community, there is a need to establish a demonstration plot to observe the successive growth of the crop in the area to avoid the failure of the ongoing project.

There is need of a social organizer to educate the local community about the benefits of keeping good quality animals in small number instead overstocking their pastures with large number of non or less productive herds. Fences are the prerequisite for the introduction of controlled grazing. With effective fencing pasture yield may be increased. Beside this, it is needed to encourage the local community organization to adopt the pasture management practices**.**

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