THE CURRENT USE OF FORAGE RESOURCES OF THE NORTHERN MOUNTAINOUS REGION OF NWFP, PAKISTAN AND ITS IMPLICATIONS FOR SUSTAINABLE DEVELOPMENT

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Abstract

Northern mountainous region of NWFP (Pakistan) is comprised of Malakand and Hazara civil divisions. This region spans over 4697 thousand hectares and sustains about 51million sedentary livestock head in addition to a large number of nomadic herds. Principal land use of the region is grazing followed by agriculture and natural forests. The ranges in the region are classified as Alpine pastures, Trans-Himalayan grazing lands and Himalayan forest and open grazing lands. This region provides 4909.3 DM, 288.8 CP and 2402.2 TDN thousand tonnes in the form of crop residues, fodders, grazing and concentrates. However, there is shortage of feed amounting to 2508 DM, 231.4 CP and 1115.7 TDN thousand tones. This deficiency in food results in low production per unit area and/or per livestock head. To tap maximum economic return and sustainable livestock production range improvement activities like application of fertilizer, conversion of vegetation, exclosure, grazing management, introduction of nutritious and high yielding fodder crops, etc are recommended.

Key words: Forage Resources, Northern Mountainous Region, Sustainable Development, Rangeland.

Introduction

The northern mountainous region of North West Frontier Province (NWFP), Pakistan, consists of Malakand and Hazara Civil Divisions. It is rugged with narrow valleys having steep side slopes and high snow clad mountains. The area extends over 4697 thousand hectares (Table 1). It is located in the vicinity where 3 famous mountain ranges meet. The region is formed by the inner and outer Himalayas, southern parts of Karakorum and the north-eastern extremity of Hindukush. Though under the influence of these ranges various climatic zones and niches are found in the region yet the vegetation of this mountainous region has both Himalayan and Trans-Himalayan characteristics. Khan (1971) has described the vegetation of Hazara division based on concept of phyto-geographic region and ecological zones. According to him the vegetation of this division, though a portion of it is in the Himalayan range, is quite distinct from its Himalayan counterpart. On the other hand the vegetation of Malakand division is classified on the basis of Trans-Himalayan ecological zone. The favourable edaphic and climatic conditions, in parts of the

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region, give rise to dense vegetation which is still intact on difficult, remote and comparatively inaccessible mountain slopes of the region.

The climatic factors are as diverse as the physical factors of the region. A small portion of the region receives monsoon rains concentrated in 45-50 days during July - September period. Other parts receive very scanty rainfall in the summer as well in the winter. However, the snowfall is the major source of water supply to the entire region. Most parts of the region fall under sub-humid boreal and semi-arid climatic zones. The region has long frozen winters and short cool summers, particularly in upper and middle reaches. Mean minimum temperature may fall as low as -9°C in January and mean maximum temperature may be 25°C in July/August. Half of the months may witness below zero temperatures. Consequently growing period is short subsequently the growth of vegetation is slow.

Major Land Uses of the Region

The grazing, both by sedentary and nomadic livestock, by and large is one of the major land uses of the region. Other uses include agriculture (both irrigated & rain fed) and natural forests (Table 1). In summer months extensive and uncontrolled grazing takes place in the rangelands as well as in the forests throughout the region. Middle hills, foot hills and cultivated fields are grazed in the winter season. Certain areas, transitional and close to village settlements, are 'double' grazed, hence over grazed.

Table 1. Major Land Use Categories of the Region

(000 ha)

S.No.	Land use Categories	Malakand	Hazara	Total
1.	Cultivated area	353.9	282.8	636.7
i.	Cropped area	347.7	281.0	628.7
ii.	Orchard area	6.2	1.8	8.0
2.	Range lands	242.6	733.7	976.3
3.	Forests	420.7	401.3	822.0
4.	Others	219.0	237.4	456.4
5.	Unreported	1751.0	55.2	1806.2
	Total:	2987.2	1710.4	4697.6

The Range Lands

Leede and Rehman (1977) have classified the rangelands of Malakand division into five major ecological zones and Khan (1971) has classified the range lands of Hazara division into six main eco-zones with numerous sub-ecozones. Collectively these ranges have been classified in three major geographical zones namely, Alpine pastures, Trans-Himalayan grazing lands & Himalayan forest and open grazing lands (Rafique, 1997 & 1999). The area-wise distribution is given in table 2.

Brief Description of the Grazing Lands

Muhammad (1989) has described these range lands in detail. The brief description is as follows:

Alpine/Sub-alpine Pastures

The Alpine pastures are located beyond 3000 m elevation above Sea level (asl) and below snow line. These areas are characterized by short, cool growing season and long cold winters. The topography of the alpine pastures is rugged, rocky and steep sloped. It has been estimated that alpine areas consist of about 30 percent grassland, 10 percent shrub lands and 60 percent rock lands (Martin, 1989). The grass lands and shrub lands are good grazing grounds because of regular moisture but are over grazed and hence degraded.

Table 2. Area of the grazing lands located in different geo-ecological zones

S. No.	Category	Area (000 ha)	Percent of total grazing range land
1.	Alpine pastures	269	11.5
2.	Trans-Himalayan grazing lands	1258	53.5
3.	Himalayan forest and open grazing lands	822	35.0
	Total:	2349	100.0

The vegetation is mostly dominated by slow growing perennial herbaceous and shrubby plants and extensive mats of mosses and lichen in moist places. The important

plant species found are: *Salix* and *Juniperous* among shrubby plants and *Poa*, *Festuca*, *Agropyron*, *Trifolium*, *Potentilla*, *Taraxicum*, *Polygonum*, *Rumex* and *Iris* among the herbaceous plants.

The alpine pastures are very important water producing areas and supply water to rivers/streams round the year. Over-grazing has caused accelerated soil erosion and need proper management both for sustained forage and water supply.

Trans- Himalayan Grazing Lands

These range lands consist of high mountain ranges varying in elevation from 1500 to 3300 meters (asl). The area is rugged, steep with deeply dissected slopes and narrow valleys. The area is prone to land slides, rock falls, debris flows and accelerated soil erosion. The climatic variation is influenced by altitudinal and locational differences. The foot hills and valley bottoms have large diurnal as well as seasonal temperature variation and scanty rainfall. The areas between 2300 and 3300m elevation (asl) receive snow fall and experience temperate climate.

The vegetation is influenced both by altitudes as well as climatic factors. The following important range plant species are found:

Trees/Shrubs: *Juniperous macropoda, Quercus ilex, Pinus gerardiana, Cedrus deodara, P. wallichiana, Fraxinus spp., Artimisia spp., Ephedra spp., Daphene spp., Sophora spp., Sorboria spp.* and *Caragana spp.*

Grasses/Forbs: *Chrysopogon spp., Cymbopogon spp., Dicanthium annulatum, Pennisetum orientale, Aristida spp., Oryzopsis spp., Poa spp., Bromus inermis, Agropyron spp., Eragrastis spp., Iris spp., Tulip spp., Polygonum spp., Astragalus spp., Sambucus spp., Lotus spp., Medicago spp., Plantago spp., Thymus spp., Nepeta spp., Viola spp., Taraxicum spp.* and *Ferns.*

Himalayan Forest and Open Grazing Areas

Temperate Zone

These areas are mostly located between 1800 to 2800m elevation (asl) and are classified as temperate zone. Mixed coniferous forests are also found in this zone which is open to grazing unless these are closed due to silvicultural practices. Forest glads (gaps)

consist of rich ground flora and same is true for sites having poor tree densities. The open grass lands may have medium to tall grasses which are harvested for hay-making but are also open to grazing. Most of the areas in this zone receive more than 1000 mm rainfall during the monsoon which may cause accelerated erosion as the topography is rugged with steep slopes. Important plant species found in the zone are:

Trees/Shrubs: *Pinus wallichiana, Picea smithiana, Abies pindrow, Cedrus deodara, Quercus spp., Juglans spp., Acer spp., Aesculus spp., Populus spp., Pyrus spp., Vibernun spp., Indigofera spp., Rosa spp., Cotoneaster spp.*

Grasses/Forbs: *Dactylis spp., Agropyron spp., Alopecrus spp., Pennisetum spp., Chrysopogon spp., Bothriochloa spp., Themeda spp., Plantago spp., Rumex spp., Astragalus spp., Trifolium spp., Polygonum spp., Taraxicum spp*.

Sub-Tropical Zone

The sub-tropical sub-humid zone is located between 1000 to 2000m elevation (asl). It is represented by pure 'chirpine' forests. In this zone shrub savanna and grasslands are also found. Important plants species include:
Pinus roxburghii, Quercus spp., Olea spp., Acacia spp. (trees) and *Chrysopogon spp., Heteropogon spp., Aristida spp., Themeda spp, Cynodon spp*. (grasses)

Improvement Potential of the Forage Resources

Range Lands

Narrowly focused and small scale plot research has successfully demonstrated, particularly in the Himalayan forest and open grazing lands, that application of fertilizers or exclosure or species introduction enhances the forage production (Rafique, 1991, 1993). Khan (1971) and Anon (1989) have found many folds increases in forage resources of Alpine, Temperate and Sub-tropical humid zones due to fertilizer application or exclosure effect (Table 3). Similarly promising grass and legume species were successfully introduced in Alpine, Temperate and Sub-tropical Zones (Anon, 1989). All these studies were carried out in small plots and their large scale adaptive trials were not carried out. However, there are indications that the selected sites could be improved through these activities.

Table 3. Current status and improvement potential of different grazing lands

S. No.	Main ecological zone and range sites	Current Status		Improvement Potential/Activity	
		Veg. Cover (%)	Kg/ha(DM)	Veg. Cover (%)	Kg/ha (DM)
1.	Alpine Pastures				
i.	Saif-ul-Maluk	60.7	1400	81.3	2280/Fertilizer
ii.	Sari, Shogran	70.1	1753	80.7	3233 "
iii.	Upper Kaghan Valley	89.8	1164	-	-
iv.	Garam Chishma,Chitral	69.2	500	-	-
2.	Trans-Himalayan Grazing Lands				
i.	Saeedabad, Chitral	25.0	191	47.6	537/Fencing
ii.	Fazagat, Swat	32.3	220	56.8	3150/"
iii.	Boni, Chitral	27.0	135	42.6	384 "
iv.	Utror, Kalam	63.1	330	75.4	1810 "
3. Himalayan Forest and Open Grazing Lands					
i.	Tutni, Abbottabad	72.5	1767	87.3	3367/Fertilizer
ii.	Jaba, Mansehra	78.0	2567	91.2	6133/"
iii.	Kund, Mansehra	69.3	1864	85.5	4327/"
iv.	Hill Kot, Mansehra				
a)	Grass Land	87.9	3936	-	4858/Fertilizer
b)	Forest Land (Ground Cover)	64.1	421	-	-
c)	Shrub Land	56.7	2039	-	-

Cultivated Fodders

The fodder production by growing high yielding nutritious fodder crops in this mountainous region has not been given due priority though its importance is recognized. This was mostly due to the non-existence of the focal discipline in the agriculture department (Hatam *et al*., 2001) though it is highly desired. The farmers had to be sensitized about this issue with vigorous extension service. Further good quality seed and appropriate technology must be made available to the farmers. Presently the farmers are growing conventional fodder crops on a limited area. There is scope to enhance fodder production by bringing more fallow lands (culturable waste, see table 1) under cultivation or increasing per ha yield or conservation of conventional and non-conventional fodders by silage making.

Forest Grazing Lands

The forested ranges, particularly forest glads, have reasonably good ground cover. Forest grazing is practiced as rights/concessions of local farmers as well as illicit grazing. However, the forest resource is never managed for forage production though it has potential to support grazing without damage to trees. There is need to manage these forests; their carrying capacities must be determined and grazing be allowed under proper grazing management.

Livestock population in the region

The population of sedentary livestock in 1999 was 5.1 million head. Out of it 3.3 million or 64 percent were in Malakand division and 1.8 million or 36 percent were in Hazara division. Goats were the highest (45%) in number followed by cattle (30%). However, all types of the livestock are raised by the farmers mostly in small number for domestic needs (table 4). In addition, large number of nomadic goats, sheep and mules/horses visit the alpine pastures in the summer and also graze all other areas on their way then up to alpine pasture or down to foot hill ranges. Furthermore, a large number of livestock mostly sheep of Afghan refugees have also been grazing all the ranges for the last 12-15 years. The exact number of both nomadic and Afghan refugees' livestock is not well documented.

Table 4. Livestock population in northern mountainous region in1999

S. No.	Type	Hazara division (Number)	Malakand division (Number)	Total
1.	Cattle	473,764	1,055,204	1,528,968
2.	Buffaloes	292,795	256,016	548,811
3.	Goats	875,901	1,405,015	2,280,916
4.	Sheep	92,650	479,620	572,270
5.	Camels	871	2,746	3,617
6.	Horses	7,592	4,740	12,332
7.	Mules	1,509	3,707	5,216
8.	Donkeys	75,830	49,791	125,621
	Total:	1,820,912	3,256,839	5,077,751

Feed requirement and availability

The major feed sources for livestock are grazing lands (uncultivated areas including forests), cultivated fodders and crop residues. Concentrates are also provided in limited quantity to specific livestock (milking or sick animals) in the region. Hatam *et al*.(2001) have estimated the following feed requirement for above livestock population and availability in the region table 5.

Table 5. Livestock feed availability and requirement

Type of Feeds	Available Quantity (000 tons)			Percent of the total		
	DM	CP	TDN	DM	CP	TDN
I. Feed Availability						
i. Crop residues	1516.9	47.1	627.2	31	16	26
ii. Fodders	193.4	13.6	111.1	4	5	5
iii. Grazing	3119.2	218.2	1599.9	64	76	67
iv. Concentrates	79.9	9.9	64.1	1	3	2
Total:	4909.3	288.8	2402.2	100	100	100
II. Requirement	7417.3	520.2	3517.9	-	-	-
III. Feed Balance	-2508.0	-231.4	-1115.7	34	45	45

In case of non-availability of other good quality fodders/ forages, crop residues are fed to the livestock. About 31 percent of total requirement of dry matter (DM) is met with the crop residues. A variety of crop residues which includes, besides other, wheat straw, barley straw, rice straw, maize stovers, millet stovers, sugar cane tops and pulse straw is provided to animals when green forage is not available or short in supply. Similarly, conventional fodder crops are cultivated on limited areas and fed green or conserved for later feedings. These fodder crops are cultivated during Kharif (summer) and Rabi (winter) growing seasons both on irrigated and un-irrigated (rainfed) areas (table 6). The Kharif fodder crops, besides others, included are; maize, cherry/jowar, bajra and moth. In Rabi season shaftal, berseem, barley, sarsoon, etc. are cultivated.

Table 6. Fodder area and farms reporting fodder cultivation (Ha)

Particulars	Malakand division	Hazara division	Total
1. Farms reporting(No.)	4407(17%)	4732(3%)	9139
2. Area under Fodder Crops(ha)	17385	1673	19058
i. Kharif	4392	725	5117
ii. Rabi	12993	948	13941
iii. Irrigated	13642	828	14470
iv. Un-irrigated	3743	847	4590

The reasons for cultivation of fodder crops on small area could be; firstly that subsistence farmers are unable to spare more areas for fodder crop due to pressure of cereal crop production for human consumption from small land holdings. Secondly, that tradition of feeding crop residues to livestock which discourages them for fodder production. Thirdly that good quality seeds of high yielding fodder crops are not available. This could be a single major cause for such cultural practice.

The range lands provide highest (64 percent) dry matter (DM) to the livestock. However, this estimate seems to be on higher side as all range land areas, reported in table 2 are not producing the utilizable forage due to geo-physical constraints and climatic variation. The current production and improvement potential of different selected sites, in different zones, are provided in table 3.

It is evident that all the above mentioned sources do not provide enough feed as per requirement. The feed deficiency is in the tune of 34 percent DM, 45 percent, each CP and TDN (table 5). Obviously the livestock owners either arrange feed from the market or the livestock are under fed and hence less productive. There is potential for improvement in forage/ fodder supply through range improvement practices, high yielding fodder crop production and increased production of crop residues. Feed conservation, urea treatment to crop residues and provision of concentrates can also solve the supply issues related to quality feed.

Management constraints

A number of geo-physical, technical, managerial, socio-economic and financial factors are non-conducive to proper management practices in the region. These include,

besides others, steep slopes, highly dissected terrains, poor shallow soils, rocky mountain tops devoid of soils, land slides/rock slides, debris flows, scanty and poorly distributed precipitation, cold temperatures, short growing seasons, poor vegetal covers with undesired plants and low productivity of the grazing land. Super-imposed on it are low technical inputs, heavy un-controlled grazing, poverty, faulty land tenural system, non-existence of range management policies & goals and low priority by the governments to livestock sector.

Implications for sustainable development

It is obvious that current use of the forage resources leads to inefficient production as livestock are underfed and hence low production per unit area or per livestock head prevails. This also indicates that livestock production is at or below subsistence level. This might be contributing to house hold economy to some degree but plays no major role in the national economy. No doubt range improvement activities like application of fertilizer, conversion of vegetation, exclosure, grazing management, etc. have potential for enhancing the forage production from the rangelands. Similarly the nutritious and high yielding fodder crops could be efficiently produced from the cultivated areas to support the ever-increasing livestock population. This improvement in forage resources may enhance the livestock production as well as improve the environmental factors of the region. Consequent upon the quality of life of the local communities, particularly livestock herders will improve. This will help reduce the poverty and reduce dependence on natural resources. The question rises how this improvement in feed production and consequent improvement in livestock production will affect/interact with sustainable development?

Sustainability of livestock production on above mentioned forage resources may not be assured. The grazing areas/range lands, in particular, depend on variable environmental factors. The shift in climate or soil fertility affects the productivity. Further the sustainability, besides ecological factors, also depends on political, economic and social factors. The technical approaches to develop forage resources may fail. Besides accurate knowledge of agro-pastoral systems, greater participatory role of communities, incorporating their social concerns would be utmost necessary. Further issues of over population both human and livestock have to be resolved. Continuous intervention in the form of projects is highly desired as practical option to act as catalysts to assure sustainability.

Priority areas for improvement/development

At present there is no focal authority for scientific management of the range lands in the northern mountainous areas of NWFP. There could be many reasons for this situation. These include, besides others, (1) Low priority being given to this discipline by the Govt. (2) Non-availability of the professionals/personnel and (3) In-effective policy for the range

resource management. Similarly there is no effective and strong organization for fodder production in the agriculture department. Based on these emerging issues the following priority areas/aspects for improvement by the state/NGOs are identified:

1. Establishment of Forage and Fodder Research and Development Institute/Center in the region.

2. Strengthening of the line departments (Forest, Livestock, and Agriculture) to cope with the forage and fodder production issues.

3. Long and short-terms in-depth trainings in forage and fodder production.

4. Technical and financial support for range resource inventory for effective planning and management.

5. Transfer of successful technologies from other countries of the region for range improvement, fodder production and forage/fodder conservation.

The efficient management of the traditional agro-pastoral systems on scientific lines, effective improvement of political, economic and social issues would help to achieve the sustainable development of the mountainous region of NWFP- Pakistan.

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