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Study on Rangelands Issues and Their Improving Strategies in Muslim Bagh, Killa Saifullah Balochistan, Pakistan

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Abstract

The main objective of the study was conducted to improve the rangeland plans to regulate the issues regarding rangeland in the study areas. This was accompanied at different sites of Muslim Bagh (Nasai, Kan Mehterzai and Gut Shalizai) district Killa Saifullah. Sampling and data were collected throughout the year 2018 from protected and non-protected areas of the study regions by using different standardized methods.Most of the rangelands in study area was arid and semi-arid climatic. The plant resources of said area were deteriorating rapidly due to overgrazing, elicits cutting of trees for fuel and making housing roofs. Most of the rangelands belong different tribes were totally unprotected. Results indicated that the dominant grass species of the area were *Chrysopogon aucheri* and *Cymbopogon jwarancusa*. Total Dry matter production of palatable grasses were found 788.00 kg/ha in protected area, 466.00 kg/ha were in partially grazed area and 49.00 kg/ha were in open area. According to a survey in Muslim Bagh reported about livestock that only 30% sheep and 55% goats were nomadic, and 15% sedentary. Data also indicated that improvement of rangelands is possible with desire of community, provided an integrated approach of range livestock management and improvement can be made on proper grazing management systems, through community participation and cooperation, among different stake-holders.

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Introduction

Range land is uncultivated area support natural vegetation. In rangelands the native vegetation of an area comprises in the form of grasses, herbs, shrubs and without or with scattered trees suitable for grazing and browsing. Grazing plays an important role in rangelands. Proper grazing can be used to manage rangelands (Micropaedia Encyclopedia, 2010). Rangelands of Pakistan consists of 65% of the total area. Range ecological zones in Pakistan are dividedinto tropical arid and semi-arid deserts plains, sub-tropical humid, Sub-tropical sub-humid, Mediterranean, sub-alpine and temperate (Khan and Mohammad, 1987). These are the major prevailing feed source for livestock in Pakistan (Khan, 1987). Balochistan consists of 34 million hectares of total area in which 1.47 million hectares, the only 4% of the total area are under cultivation. About 32 million hectares' area of the Balochistan are Rangeland. Consequently, which cover approximately 93% of the total area. Rainfall zones in Balochistan were varies in range of 50-200 mm minimum and 250-400 mm maximum, in arid and semi-arid area (Kidd *et al.,* 1988). Ahmad and Islam, (2004) reported medicinal plants, Wildlife habitat, forage for livestock, water storage minerals, fuel wood are the parts of range lands used in different sources. In this regards progressive loss of productivity, damages of biodiversity, change in species composition, reduction in plant cover, soil erosion and increased run off water are major degradation factors of rangeland

The study area is located in Tehsil Muslim BaghDistrict KillaSaifullah Balochistan (Fig. 1). Its geographical coordinates are 31°51'N 66°43'26'E and mean elevation is 1789 meters. Total annual rainfall in study area ranges 125 - 500 millimeters. The study area is asserting about one third of the total area which is under permanent grazing as range land (Unicef and P&D District profile, 2011). Therefore, the most important factors are the area population. According to latest report of 2017 Census, the total population of the district is 342814, in which KillaSaifullah Tehsil is 132264 and Muslim Bagh Tehsil is 78,594. Loi Bund Sub-Tehsil is 28,061, Baddini Sub-Tehsil is 15,301, KanMehterzai Sub-Tehsil is 33,240 and Shinki Sub-Tehsil is 55,352 (Provincial Census result 2018). The climate of KillaSaifullah is semi-arid, usually warm in summer and cool during winter. The mean temperature of the rangeland study area so far reported is 27.0 °C, and minimum temperature -7 °C. The area has various environmental condition, including both cold and semi cold area. The Nasai area which is near to KillaSaifullah are semi cold but KanMehterzai, Kanchoghi and Murgha Faqarzai are cold area and extremely cold in winter season. During snow fall, in winter season the temperature some time extremely downcast up to -9 °C. The study area is mountainous and comprise of valleys with varying elevation above sea level which supports dry coniferous and dry sub-tropical scrub forests. Coniferous forests occur at 1,500 to 3,500 meters, mainly in Torghar and kand mountains of kanmehterzai. Scrub forests are found at 500 to 1,500 meters.

Rangeland of the study area are being progressively losing and biodiversity of the area are being damaged. Therefore, the main objective of this investigation was to investigate the rangelands Issues and the improving strategies in Muslim Bagh, KillaSaifullah Balochistan Pakistan.

Material and Methods

This study was conducted at different sites of Muslim Bagh (Nasai, KanMehterzai and Gut Shalizai) district KillaSaifullah (Fig. 1.). Sampling and data were collected from the protected and non-protected areas of the study areas throughout the year 2018.

Comparison of biomass

The amount of living matter in a given area expressed as, the weight of plants per unit area or the volume of plants per unit area is known as biomass. Biomass was determined by using direct and indirect sampling methods. Direct methods techniques were used for weight or estimate the actual biomass of plants. Indirect methods were used for developing a relationship between plant weight and an easier-to-measure attribute such as plant height, canopy cover, forage production etc. (Pieper, 1988).

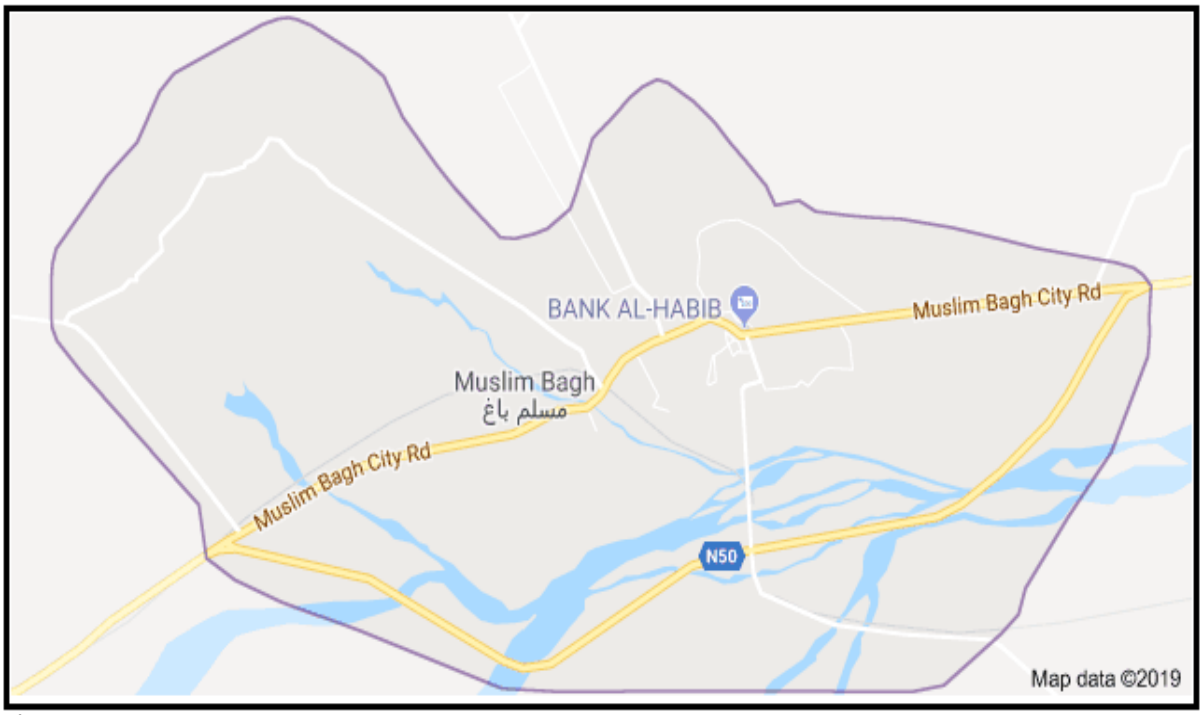

Fig. 1. Google map of the study area.

Plants samples were taken from both protected and non- protected areas of the rangeland for determining the effect of grazing and non-grazing. The biomass production of protected areas and partially Grazed areas and open areas of highly palatable species of grasses *Cymbopogonjwarancusa and Chrysopogonaucheri* were recorded. Vegetation data during different seasons were recorded to measure changes in above ground productivity and the rate of recovery as a result of protection from grazing. Above ground biomass production was measured by using 1 x 4 m quadrates randomly placed about 10 meters away from the permanent transect lines. The plants within the quadrate were harvested at ground level, then separated and dry weight were measured. The dry matter was converted into Kilogram per hectare (kg ha^{-1}). The dry matter forage individual species at different range sites are determined. Similarly, biomass production was also estimated from nearby unprotected range area.

Survey for rangelands improving strategies

A survey was conducted in different villages of Muslim Bagh areas to quantify the distribution of livestock in Muslim Bagh valley to highlights the importance of the rangeland management and to establish the grazing pattern for livestock and to identify the local traditional law regarding use and management of range land.

Evaluation of exotic shrub species

Atriplexcanescens, *Salsolavermiculata* and *Atriplexlentiformis* were grown in micro catchment harvesting water. Their growth percentage were determined of the survival plants and total plants. Plants Growth and their production data were recorded to monitor the performance of shrub species in different catchment areas. Tissues of each species in each catchment were randomly picked for recording plant height, canopy diameters, forage and wood production. Plant height was recorded in cm from the ground surface to the top of shrub growth. Canopy cover was calculated by using the formula CC=(¼ D1D2. Harvested shrubs were separated into leaves and wood and dried for calculation of dry matter forage and wood production.

Measurements of soil erosion

Soil erosion was monitored for every rainfall events during 2018. Soil was harvested on catch-traps. The harvested soil was collected and wet and dry weights were measured.

Measurements of soil moisture

Soil-moisture data were collected after four runoff events from open and catchment area. Soil moisture content was measured by the gravimetric method (Kelly *et al.,* 1946) at two depths 0-10 cm and 10-20 cm. The soil was taken with space of 5m, 10m and 15m in this way, soil data was collected and soil moisture data in percentage (%) was determined.

Result and discussion

Most of the rangelands in Muslim Bagh, Killa Saifullah were consists of the arid and semi-arid climatic regions. Dry matter forage production was recorded in open and protected areas.

Dry matter forage production and carrying capacities of different sites are presented in Table.1.

Table 1. Average dry matter (DM) forage production in different range areas of the study sites during study period.

Seasons	DM (Kg/ha) Protected		Carrying Capacity (ha/ewe/year)	
	Protected	Open	Protected	Open
Spring	333	140	2.19	5.21
Summer	128	40.00	5.70	18.25
Fall season	101.94	40	7.16	18.25

Table 2. Dry matter (kg/ha) forage production of two types of palatable gasses in protected, partially grazed, and in open areas.

Plant species	Dry matter (kg/ha)		
	Protected Area	Partially Grazed Area	Open Area
Cymbopogonjwarancusa	562.11	382.20	34.17
Chrysopogonaucheri	226.07	84.10	15.21
Total	788.00	466.00	49.00
Carrying CapacityHa/ewe/year	0.92	1.56	14.89

The vegetation sampling was carried out at three places (protected area, partially grazed area and open area) to determine the dry matter forage production. The dominant grass species of the area were *Chrysopogonaucheri* and *Cymbopogonjwarancusa.* Dry matter forage production of retained at different range areas. Twenty samples were taken from each area. The vegetation inside the quadrate was clipped at ground level and oven dried. The dry matter forage individual species at different range sites is presented in (Table 1).Dry matter forage production of shrubs at Nasai in protected site was 128 kg/ha compared to open site of 40.00 kg/ha. The rangeland productivity at shrub dominated site (KanMeterzai) ranged from 333.00 to 140.00 kg/ha in open and protected sites, and in gut Shalizai it was 101.94 to 40 kg/ha in open and protected area respectively (Table 1). Total Dry matter production of palatable grasses *Cymbopogonjwarancusa*and *Chrysopogonaucheri* were 788.00 kg/ha in protected area, 466.00 kg/ha were in partially grazed area and 49.00 kg/ha were in open area (Table 2).

Rangelands improvement strategies

Mostly, three animal production systems (nomadic, sedentary, transhumant) were noted common in the examined area. Most of the rangelands are used by nomadic and transhumant pastoral. According to a survey in Muslim Bagh Reported about livestock that only 30% sheep and 55% goats were nomadic, and 15% sedentary. Nomadic flocks travel continuously in search of forage. They migrate transhumant from cold area to warm area in winter and from warm to cold area in spring. Transhumant flock owners have some dry land agricultural activities. In winter some of them also migrate along with the families to warm area. Sedentary flock owner rears few animals on orchards, crop stubbles and also stale feeding.

Table 3. Characteristics of pastoral communities in study area.

Pastoral type	Characteristics
Nomadic	They depend on animal production on rangelands, continuous movement, purchase fodder crops during winter. Camels and donkeys was also important flock composition.
International Nomads	Mostly border area nomads, cross the international border of Pakistan and enter in to Afghanistan.
Commercial Nomads	Local nomads of Muslim Bagh and Afghan refugees were mostly the commercial Nomads, do not own any flock, establish camps for good livestock market, and buy few animals on low prices, daily market visit, daily buy and sale on some profit.
Nomad Transhumant	Fixed a point on summer ranges, occupied rangelands with no recognized ownership, family members also work as a labor, most have tractors, and migrate 1n winter due to cold climate.
Transhumant	They own some agricultural property, dry land crop production, shorter spatial movement.
Nomads (locally called Powinda)	Generally in mountain area of Muslim Bagh migrate in winter towards warmer areas of Pakistan (KPK, Sind, and Punjab) and to other area of Balochistan.
Afghan Refugees	Are Accidental nomads, greatly built pressure on rangeland resources, key operators to induce shifts and changes in historically classified socio-economic systems of Pastoralists?
Sedentary	Permanent settlement, do not migrate, keep livestock mainly for domestic use, actively involved in irrigated agriculture.

Table 4. Major issues of range management in study area.

S. No.	Issues
1	Open rangelands, no grazing management
2	Land ownership
3	Rangeland degradation
4	Lack of information on rangeland resources and pastoral communities
5	Transformation of pastoral communities
6	Conversion of rangelands into agricultural activities
7	Weak community participation
8	Recurrence of drought
9	Lack of integrated range management approach
10	Lack of awareness,, education and dissemination of knowledge
11	Technical range management approach
12	Lack of incentives to communities in range management / improvement
13	Lack of alternate energy sources
14	Non-availability of stock water ponds in some productive range areas
15	Early spring migration of nomads to the area
16	Limited research activities on different areas of range management
17	Lack of trained manpower
18	Short term approaches of range management
19	Reform in range management policies
20	Release of chromite mining in a huge amount

However, these systems are under transformation due to many factors like increase in livestock, human population growth, water mining for agriculture and extraction of mining of chromite and other minerals. The main characteristics of Pastoral communities are described in Table 3.

In Range management activities, Land ownership was one of the major issues of Muslim Bagh (Table 4).

The ranges are degrading very rapidly particularly in open grazing system (Fig. 2Band Table 4). Another main degradation factor is mining of chromite which

has been observed in large scale in Muslim Bagh. In chromite mining areas the range were mostly effected(Fig. 2C and2D)and have been destroyed because of a large number of labor were workings there. They used mostly the range land species for fuels and for grazing purposes (Fig. 2Band Table 4).

Table 5. Shrub survival % under different catchment areas.

Species	5 m			10 m			15 m		
	Total seedling	Survived	Survival %	Total seedling	Survived	Survival %	Total seedling	Survived	Survival %
A. canescens	244	194	79	244	199	81.5	244	205	84
S. vermiculata	150	105	70	170	120	70.5	203	184	99.6
A. lentiformis	55	29	52.7	47	31	65.9	49	40	81.6
A. canescens	244	144	59	244	179	73.3	244	194	79.5
S. vermiculata	150	120	80	170	155	91.0	203	194	95.5
A. lentiformis	71	38	54.3	65	47	72.3	49	47	95.5
A. canescens	244	200	81.9	244	207	84.8	244	219	89.7
S. vermiculata	150	129	86	170	161	94.0	203	191	94
A. lentiformis	40	21	52.5	51	37	72.5	49	46	93

Table 6. Shrub growth under different catchment areas.

Year	Species	Plant height (cm)			Canopy cover m²		
		5 m	10 m	15 m	5 m	10 m	15 m
2017	*A.canescens*	19	25	30	2	2	3
	A.lentiformis	11	20	38	1	2	3
	S.vermiculata	13	18	21	1	2	3
2018	*A.canescens*	13	19	39	3	10	12
	A. lentiformis	14	26	42	3	5	12
	S.vermiculata	12	20	34	1	7	10

Growth of exotic shrubs

Atriplexcanescens, *Salsolavermiculata* and *Atriplexlentiformis*were found exotic shrub species in Muslim Bagh generally cultivated for range restoration and forage production for livestock (Fig. 2E-2H). Previously Some Atriplex species like *Atriplexlentiformis, Atriplexcanences*and *Salsolavermiculata*have been evaluated for forage production. The total rainfall during 2018 was very low. Total seasonal rainfall (January-December) was recorded 67.32 mm. Therefore, five irrigations (from March-July) of 5 liters each were applied to each shrub during the first year of establishment. The first survival data of June, 2018was subject to rainfall and the irrigations. Up to June, 2018 the survival percentage was 84% 99.6%, and 81.6% for *Atriplexcanescens*, *Salsolavermiculata* and *Atriplexlentiformis*, respectively (Table 5). The dead plants were re-placed after each survival data. The seedling replaced after recording the second and third survival data were planted on winter rains and after wards no irrigation was provided.

In December, 2017 the survival percentage ranged from 79.5% to 95.5%. In June, 2018 the survival percentage was 89.7%, 94% and 93% for *Atriplexcanescens*, *Salsolavermiculata*, and *Atriplexlentiformis* (Table 5). Survival % of all three species is reasonable.

It has been observed that the survival % of all species is increased with the increase in micro-catchment area. *Generally, the results of growth and production* indicate a particular trend in relation to micro-

catchment. Better growth and forage production was recorded in bigger catchment areas as compared to the smaller ones. During second year of growth the dry matter forage production ranged from 7.62 g/plant to 49.65 g/plant (Tables 7). During 2017 and 2018 under different catchment area the plant height was found 11-42 cm and canopy cover was noted 1-12m² (Table 6).

Table 7. Dry matter forage and wood production of shrubs under different catchment areas.

Year	Plant species	DM forage production (g/plant)			Wood production (g/plant)		
		5 m	10 m	15 m	5 m	10 m	15 m
2017	*A.canescens*	11	15	18	8	12	17
	A.lentiformis	5	7	12	3	4	14
	S.vermiculata	6	5	18	3	3	14
2018	*A.canescens*	25	35	35	31	39	44
	A.lentiformis	23	33	48	25	29	49
	S. vermiculata	7	12	19	11	16	26

In Muslim Bagh dominant plant species among tree were *Pistaciakhinjuk* along with *Fraxinusxanthoxyloides*, *Juniperusexselsa*. *Prunusebusnea, Cotoneaster racemiflora, Stocksiabrauhica and Berberis vulgaris* are dominant shrubs (Table 6). *Artemsiamaritima, Haloxylongriffithii*, *Seriphidiumquettensis, Peganumharmala*, *Caraganaambiguac*over the ground part of the area.

Fig. 2A. Protected rangeland in study area with community participation.

The major grasses were *Stipapennata, Chrysopogonaucheri, Cymbopogonjawarancusa, Poasinaica, Bromus japonicas* and *Poabulbos* (Table 2).

Individual percentage of plants species were determined in different rangelands in study area at Lower zone of hills, the entire coverage of all species were 28.5% at higher elevation Top of the hills, the Entire coverage of all species were 29.3% and in Slopes of the hills, the Entire coverage of all species were 35.5% in Chana area near Nasai.

Fig. 2B. Grazing rangelands system in study area with mixed range plants species.

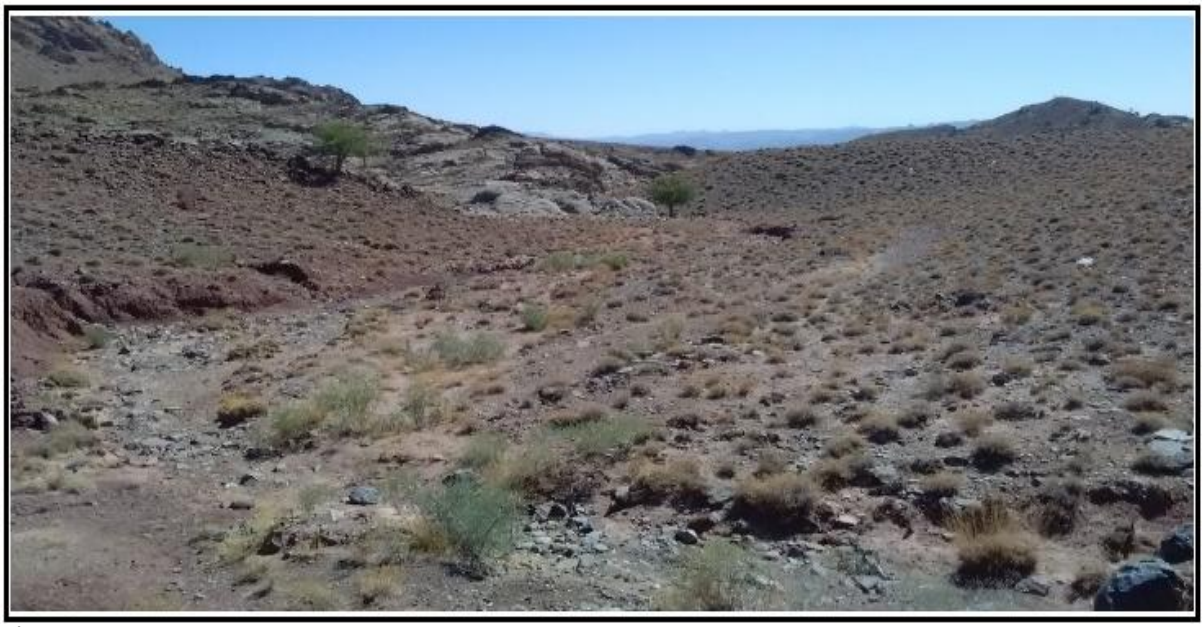

Fig. 2C. Effected rangelands in study area.

In Slopes of the hills in Gut Shalizai area, The Entire coverage of all species were 40.28%. The major range land degradation factors are: progressive loss of productivity and loss of biodiversity, changes in species composition, reduction in plant cover, soil erosion, reduction in infiltration rate and increased run off (Milton *et al.,* 1994). Total Dry matter production of palatable grasses *Cymbopogonjwarancusa*and *Chrysopogonaucheri* were 788.00 kg/ha in protected area, 466.00 kg/ha were in partially grazed area and 49.00 kg/ha were in open area (Table 2). Results show that natural vegetation has potential of biological recovery if protected from grazing at least four years depends on rainfall distribution.

The crude protein content in the leaves of forewing saltbush has been reported 12-15 % during mid-winter (Thomson *et al.,* 1997).

It has been suggested that one acre of four wing saltbush might provide the supplemental protein

requirements for 0.5 to 1 animal unit during a 90-day period (Ueckert, 1985). Like other halophytes, forewing saltbush has low energy values because of high ash contents.

The energy values are reported to cover only maintenance requirements of sheep if they consume 1.2-1.5 kg DM/d (LeHouerou, 1992). Major degradation of rangeland factors were: progressive loss of productivity and loss of biodiversity, changes in species composition, decline in plant cover, soil erosion (Milton *et al.,* 1994) and socio-economic changes are occurring in diverse ecosystem of Balochistan (Ahmad and Islam, 2004).

Fig. 2D. Rangeland destruction in study area during chromite mining production.

Fig. 2E. Growth of exotic Shrubs in study area.

Biological or artificial recovery of rangelands may include increase in biomass, plant cover, organic matter and erosion control (Le Houerou. 2000). However, in arid and semiarid rangelands, grazing management alone may not accelerate the succession towards desirable species due to inadequate

precipitation (Roundyand Call, 1988). Several rangeland areas in Balochistan have still great potential of natural recovery if properly grazed.

Rangeland degradation in Muslim Bagh were occurred as improper grazing, cutting of the plants for fuel burning and for other purpose (Table 4). Severe grazing and without any planning for rangeland ownership it causes rangeland damages. Major compensation which destroying the rangelands or loss of biodiversity, soil erosion and the loss of land fertility. Hence, Results directly on production of biomass and only few limited palatable shrub species and Perennial grasses were found (Table 4).

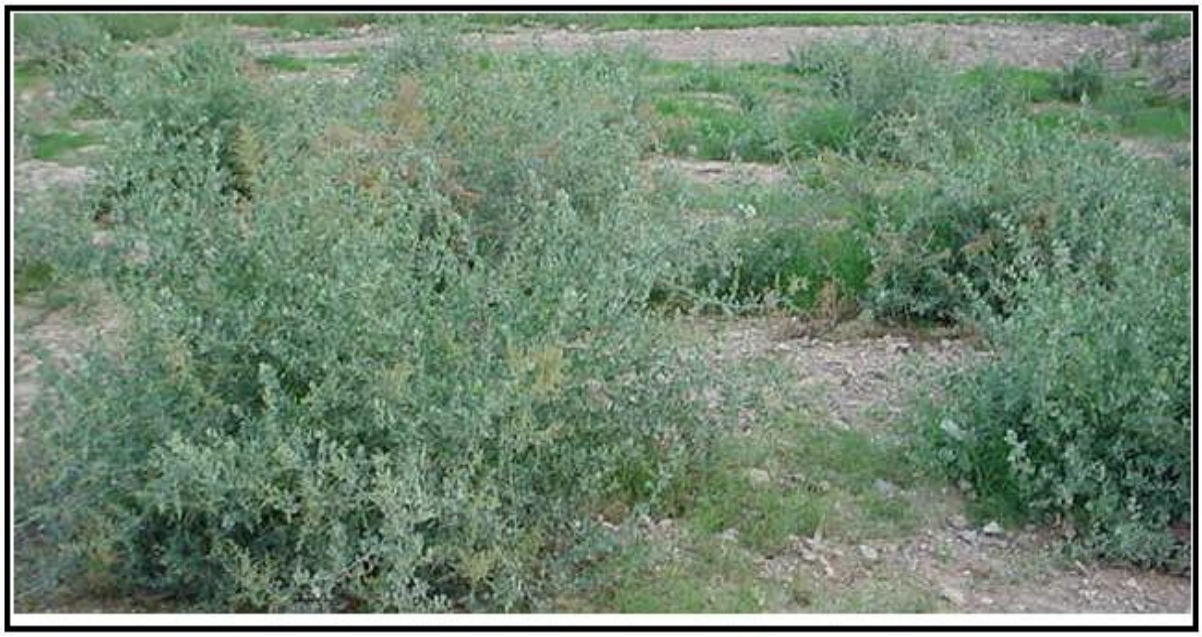

Fig. 2F. Growth of *Atriplexlentiformis*in study area.

According to literature studies highest grazing, transfer of the sensory nomads in area, huge growth of human population and tribal conflicts cause rangeland degradation. The damages are also effected number of wildlife population in the study area and sometime species of plants have been proved as an endangered species the result become extent from area.

Atriplex species *(A. canescens, A. lentiformis)* and *Salsolavermiculatawere* grown in highland areas of Balochistan (Table 5). These fodder shrubs were also grown and introduced in to the communities for forage production, wood production and for winter grazing. These fodder shrubs were in different field area ofMuslim Bagh for improvement the range lands. The survival percentage were 84%, 99.6%, and 81.6% for *Atriplexcanescens*, *Salsolavermiculata* and *Atriplexlentiformis*, respectively. Creation of a range Management Committee at federal and provincial level is recommended for research, advocacy and policy development and its implementation.The results indicate that improvement of rangelands is possible with desire of community, provided an integrated approach of range livestock management and improvement is made on proper grazing management systems, through community participation and corporation, among different stake-holders (Table 4).

Atriplex supplemented with grazing of native ranges in animal weight gains of around 80 g/h/d (Le Houerou*et al.,* 1983). *Atriplex* forage should be used in combination with stubble or wheat straw to accomplish the nutritional requirements of animals (Le Houerou*et al.,* 1991; Mirza *et al.,* 2000). Mixed shrub are more common than monospecific plant communities in range lands of Balochistan. Among shrubs, *Haloxylon*and *Artemisia* while in grasses species *Cymbopogonjwarancusa* and

*Chrysopogonaucheri*are dominant (Table 2). These species can survive under the extreme winter temperature (Mirza *et al.,* 2000). *Salsoalvermiculata*commonly called saltwort is an exotic Mediterranean arid zone fodder species. This species has the potential of self-regeneration and establishment under good rainfall years (Murad, 2000).

Fig. 2G. Growth of *Atriplexcanences*in study area.

Fig. 2H. Growth of *Salsolavermiculata*in study area.

Conclusion

The plant resources of said area are deteriorating rapidly due to overgrazing, elicits cutting of trees for fuel and making housing roofs. Most of the rangelands belong different tribes are totally unprotected. The Pastoralism was main challenge of exploiting important native flora and a number of medicinal plant species which were using broadly as Bforage by their livestock's.

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