



## Research Article

# Assessment of Species Composition and Carrying Capacity in Pothwar Scrub Rangeland of Kherimurat, Punjab

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**Abstract** | The present study was designed to assess the species composition and carrying capacity in scrub rangeland of Kherimurat, Punjab. For field data collection, two homogeneous sites i.e., grazed and un-grazed were randomly selected in Compartment No.12 of Kherimurat, scrub rangeland. Reconnaissance of the study area was carried out to layout the transect lines and quadrat method was used to collect the vegetation parameters such as cover percent and forage production. Three transect lines, each of 100 m long, were stretched in the sample area. On each transect line, ten (10) equally spaced one meter square (1mx1m) quadrats were placed at a distance of 10 meters. Thus, 30 quadrats from the area were studied. The clipping of grass was made at 2.5 cm above the collar point. Data were statistically analyzed using t-test. Results revealed that forage production in un-grazed site was significantly higher ( $P < 0.01$ ) than the grazed site. The results further revealed that air dried forage production and cover percent of *Cenchrus ciliaris* and *Cynodon dactylon* were significantly higher in the un-grazed area. This is attributed to protection from grazing while the cover percent and air dried forage production of *Eleusine flagellifera* and *Cymbopogon jwarancusa* were higher in grazed area. Apparently, grazing animals have shown lesser preference to these species when found in association with *Cenchrus ciliaris* and *Cynodon dactylon*. Therefore, it is recommended that there is a need for ecological management of the degraded rangelands through restoration efforts, manipulation of grazing system and regularization of grazing according to carrying capacity of the area to make the conditions better.

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**Keywords** | Species composition, Carrying capacity, Scrub rangeland, Quadrat, Forage production



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## Introduction

Sustainable use of rangelands through better management practices is very crucial to enhance the development of national economy. Overgrazing, fading of vegetation cover, scarcity of forage and

fodder resources and poor business of pastoral communities as influenced by the poor management practices are few of the major issues and problems for the food security in the country. Strict and balanced management of range resources is necessary for better livestock production (PARC, 2008).

Rangelands occupy an area of about 52.20 million hectares (m.ha.) out of total area of Pakistan and the Provincial Forest Departments have only 6.4 m.ha. rangeland area under their control (Anonymous, 1992). Livestock are the main component of rural economy which is mainly associated with the lives of 30-35 million people residing in rural areas through agriculture. Livestock sector contributes 11.5 % towards GDP of the Pakistan (Anonymous, 2015). The contribution of range resources in Pakistan are only 10- 50 % of their actual potential whereas it can be used to feed the increasing human and livestock population. Due to overgrazing and mismanagement in utilization of range resources, the palatable forage species are decreasing. The current annual production from rangelands is about 21 million ton DM (Dry matter) that could be increased to at least three times (Muhammad and Naqvi, 1987; Sultana *et al.*, 2000).

The rangelands of Pothwar scrub zone are generally grazed by the local as well as nomadic livestock when the nomads return from alpine pastures during winter season. So, increase in number of livestock leads to over grazing of these rangelands. The carrying capacity of the rangeland is low and most of the area is infested with un-palatable plants such as *Cymbopogon jwarancusa*, *Desmostachya bipinnata*, *heteropogon contortus*, *Prosopis juliflora* and *Sorghum halepense*. Minimal carrying capacity of the range area, soil erosion and low fertility are the results of removal of vegetation cover and un-scientific use of range resources (Arshadullah *et al.*, 2007). In Pothwar region, very few studies have been conducted so far to determine the carrying capacity and vegetation composition. This study in Kherimurat rangeland was an attempt in this direction to get updates of vegetation status and chalk out management plan of this area. Keeping in view of above, the present study was conducted with the objectives to estimate the forage production, carrying capacity and species composition of the study area.

## Materials and Methods

The study was conducted at Barani Livestock Production Research Institute, Kherimurat, District, Attock. The climate of the area is of extreme type, characterized by higher summer temperature, cold nights in winter, torrential and erratic rainfall mainly during the monsoon season. Map of the study area is presented in Figures 1 and 2.

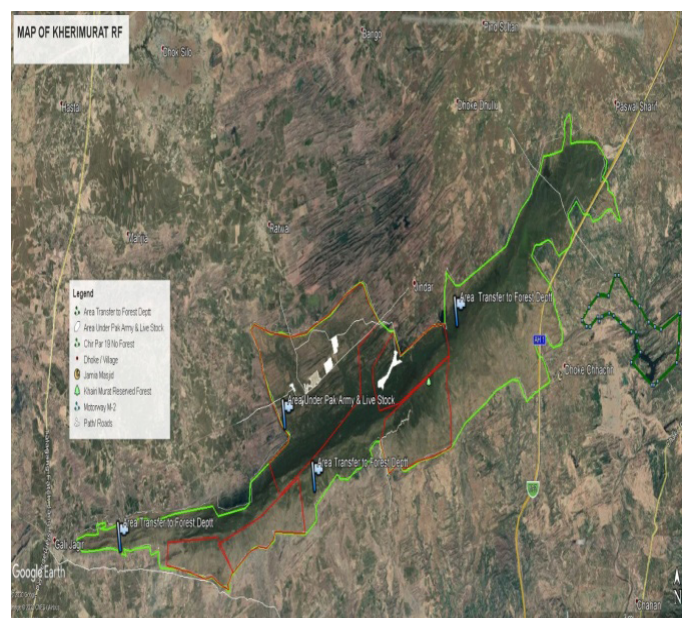


Figure 1: Map of the study area.

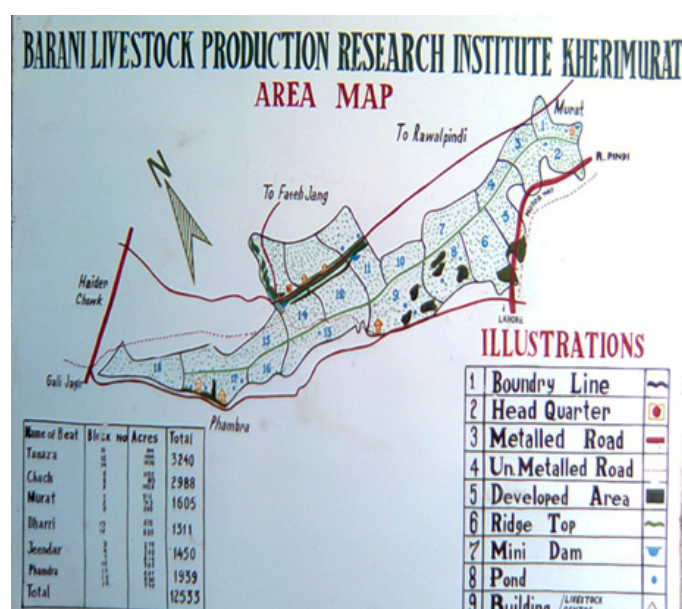
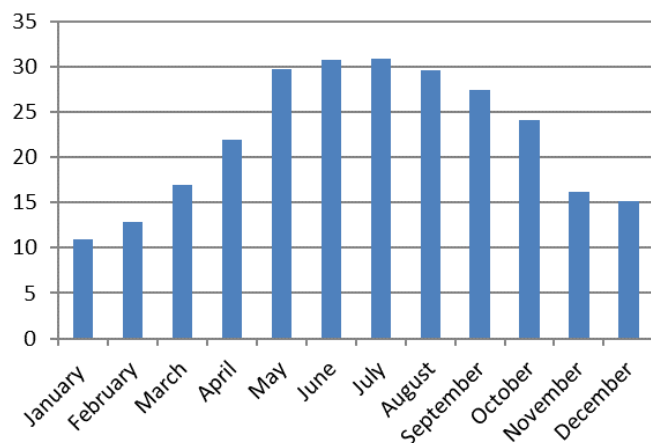


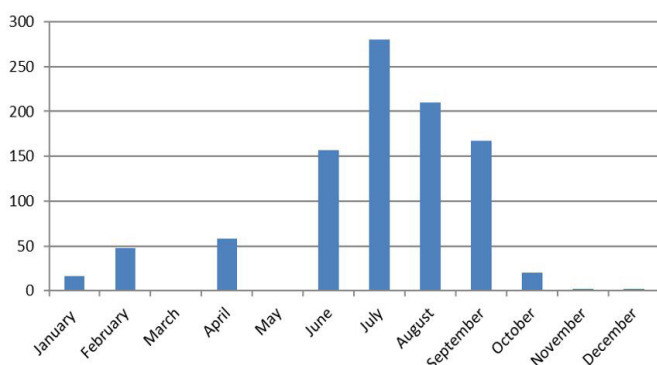
Figure 2: Map of the study area.

Meteorological data i.e., Temperature (Figure 3), rainfall (Figure 4) and relative humidity (Figure 5) of the study area for the year 2014 were collected from Directorate of Barani Livestock Production Research Institute, Kherimurat.

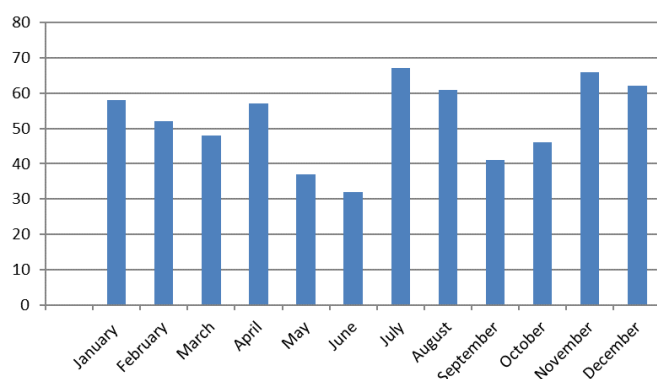
For field data collection, two homogeneous sites i.e., grazed and un-grazed were randomly selected in Compartment No. 12 of Kherimurat scrub rangeland. Reconnaissance of the study area was carried out to layout the transect lines and quadrat method was used to collect the vegetation parameters such as cover percent and forage production.



**Figure 3:** Mean monthly temperature (°C).



**Figure 4:** Mean monthly rainfall (mm).



**Figure 5:** Mean monthly relative humidity (%).

The main tools and equipment used in the field were: quadrat (1 meter square), measuring tape (100 meter long), spring balance, scissors, pegs, field book, range

vegetation data form and paper bags. Three transect lines, each 100m long, were placed in the study area. On each transect line, 10 equally spaced quadrats at 10m distance were systematically marked to collect data on the cover percentage and forage yield. Systematic sampling with random start procedure was used to collect the data from 30 quadrats. In each quadrat, data on species wise cover percent was recorded. All the palatable grasses and forbs were clipped at 2.5cm above ground level with clipper in every quadrat. Carrying capacity of the study area was calculated by applying 50% Proper Use Factor (PUF) (Hussain, 1986). Average cover percent for each species was calculated by dividing the total cover percent of each species with number of quadrats. Fresh weight of the clipped material was weighed by spring balance and then clipped material of each quadrat was placed in paper bags separately and left for drying in open air. The air dried weight of the material was recorded when the weight of material become constant after 7 days. Data were analyzed using paired plot t-test.

## Results and Discussion

### Species composition

Species composition is the proportion of various plant species in relation to the total cover of all species on a given range and is usually expressed in terms of cover, fresh weight, dry weight etc.

$$\text{Species composition (\%)} = \frac{\text{average cover of a species}}{\text{Total cover of all the species}} \times 100$$

Species composition from cover percent data is presented in Table 1 and graphically shown in Figure 6. Species composition from forage production data is presented in Table 2 and graphically shown in Figure 6. Results of study revealed that mean air-dried forage production in un-grazed and grazed sites was 1313 Kg/ha and 854 kg/ha respectively. This showed an increase in forage production in un-grazed site as compared to grazed site.

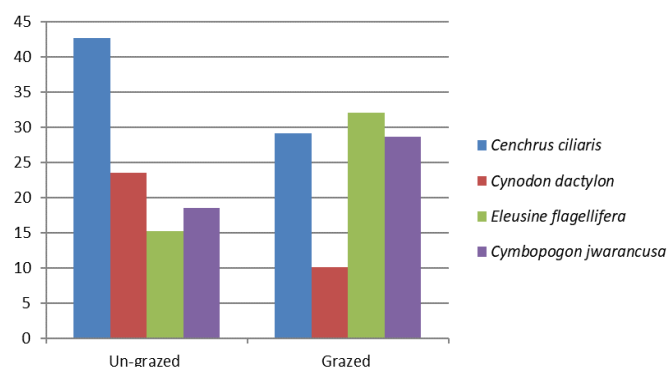
**Table 1:** Species composition from cover percent data.

| S. No.          | Species                      | Mean cover (%) |        | Species composition (%) |        |
|-----------------|------------------------------|----------------|--------|-------------------------|--------|
|                 |                              | Un-grazed      | Grazed | Un-grazed               | Grazed |
| 01.             | <i>Cenchrus ciliaris</i>     | 24.5           | 12.5   | 42.68                   | 29.17  |
| 02.             | <i>Cynodon dactylon</i>      | 13.5           | 4.30   | 23.52                   | 10.03  |
| 03.             | <i>Eleusine flagellifera</i> | 8.75           | 13.75  | 15.24                   | 32.08  |
| 04.             | <i>Cymbopogon jwarancusa</i> | 10.65          | 12.30  | 18.55                   | 28.70  |
| Total cover (%) |                              | 57.40          | 42.85  | 99.99                   | 99.98  |

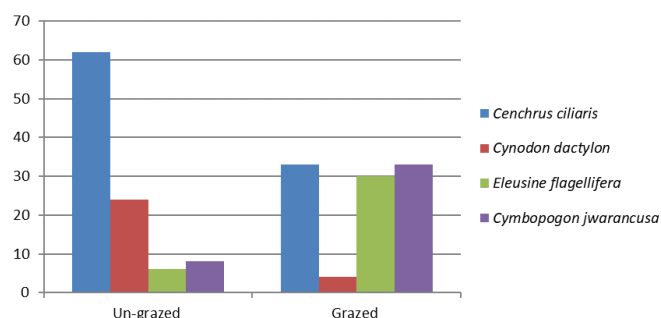


**Table 2:** Species composition from mean forage production in un-grazed and grazed sites.

| S. No. | Species                      | Mean air dried forage production (Kg/ha) |        | Species composition (%) |        |
|--------|------------------------------|------------------------------------------|--------|-------------------------|--------|
|        |                              | Un-grazed                                | Grazed | Un-grazed               | Grazed |
| 01.    | <i>Cenchrus ciliaris</i>     | 814.06                                   | 281.82 | 62                      | 33     |
| 02.    | <i>Cynodon dactylon</i>      | 315.12                                   | 34.16  | 24                      | 04     |
| 03.    | <i>Eleusine flagellifera</i> | 78.78                                    | 256.2  | 06                      | 30     |
| 04.    | <i>Cymbopogon jwarancusa</i> | 105.04                                   | 281.82 | 08                      | 33     |
| Total  |                              | 1313                                     | 854    | 100                     | 100    |



**Figure 6:** Species composition (%) from cover percent data.



**Figure 7:** Species composition (%) from forage production data in un-grazed and grazed sites.

**Table 3:** Air dried forage production and carrying capacity in Un-grazed and Grazed sites at Kherimurat rangeland.

| Parameter                                | Un-grazed site | Grazed site |
|------------------------------------------|----------------|-------------|
| Forage production (Kg/ha)                | 1313           | 854         |
| Carrying capacity (Animal unit/ha/month) | 2.43           | 1.58        |

### Carrying capacity

Forage production and carrying capacity of un-grazed and grazed sites are presented in Table 3.

Results revealed that mean air dried forage production in the un-grazed site was significantly higher than that of grazed site. Similarly, carrying capacity was also significantly higher in un-grazed area. Due to

protection from grazing, air dried forage production and carrying capacity of un-grazed area increased as there was sufficient opportunity for the vegetation to grow and regenerate.

The results of this study are in agreement with prior research findings of other researchers who showed that the protection practices increased the forage production and carrying capacity of depleted areas of rangelands (Chaudhry *et al.*, 2010; Hussain *et al.*, 2009; Sana-ul-Haq *et al.*, 2011).

## Conclusions and Recommendations

Air dried forage production and cover percent of *Cenchrus ciliaris* and *Cynodon dactylon* are significantly higher in the un-grazed area which is attributed to protection of the rangeland from grazing. In grazed area, the cover percent and air dried forage production of *Eleusine flagellifera* and *Cymbopogon jwarancusa* are significantly higher. This indicates that grazing animals prefer these species less when found in association with *Cenchrus ciliaris* and *Cynodon dactylon*. Carrying capacity is also significantly higher in the un-grazed area because of protection measures against the grazing animals. Conclusively, it is deduced that the carrying capacity and grazing potential of a rangeland could be enhanced by initiating different protection programmes.

## Acknowledgements

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## Novelty Statement

Species composition and carrying capacity of a

rangeland are the key components for optimum utilization of vegetation resources in a grazing system. This study has focused on the identification of palatable species and their contribution in forage production.

## Author's Contribution

**Farrukh Waheed:** Writing the manuscript, literature review, data collection, analysis and presentation

**Ashar Farooq:** Critical thinking, concept, design and proof reading

**Asad Abbas Khan:** Collaboration, communication and institutional support.

## Conflict of interest

The authors have declared no conflict of interest.

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