

ASSESSING CARRYING CAPACITY OF PABBI HILLS KHARIAN RANG E

J. Afzal, M. Arshad Ullah and M. Anwar

Rangeland Research Programme, National Agricultural Research Centre, Islamabad–Pakistan

ABSTRACT

A survey was conducted to assess the carrying capacity of the Pabbi Hills Kharian Range during the month of May, 2005. A total of 374.27 kg ha⁻¹ dry matter was assessed using standard techniques. The livestock being raised in these areas were cattle and goats only. Average weight of a cow and a goat was estimated to be 300 and 25 kg, respectively. The annual requirement of dry matter per animal unit was estimated to be 2190 kg, which can be met through grazing of 12 ha / AU/ year carrying capacity.

Key words: Animal unit, Carrying capacity, Forage, Mesquite.

INTRODUCTION

Pakistan has a wealth of 135 million heads of livestock, which account for 10.8% of the GDP (Anonymous, 2005). Nutritional requirements of these animals are mainly met through fodder crops and agro-industrial wastes. The sustainable use of rangelands is vital for the development of national economy. Overgrazing of rangelands, depletion of vegetation cover, shortage of forage and fodder resources, and poor livelihood of pastoral communities as influenced by the fragile environment are some of the major issues and problems for the food security in the country.

Large herds of cattle and goats graze throughout the area. The area is not only grazed by the local livestock but also foraged by the nomads' livestock during winter when the nomads return from alpine pastures. Due to overgrazing, the carrying capacity of rangelands is low and most of the area is infested with unpalatable plants. Removal of vegetation cover and unscientific use of resources have accelerated soil erosion, low soil fertility, loss of biodiversity, and minimal carry over of range areas. Moreover, livestock producers have to educate that their livestock can perform better with proper grazing management and range improvement.

One of the major constrains in the management of rangelands is lack of authentic scientific inventory of range resources. In the absence of such data, the management and improvement plan cannot be developed and implemented affectively.

Determining carrying capacity is a fundamental component of rangeland evaluation, because it is an important management tool that connects forage supply and consumption. Evaluating carrying capacity is an important application of rangeland inventory and monitoring programmes because it represents the key management tool to ensure sustainable ensure of natural resources.

Information regarding the carrying capacity of a management unit is also useful for interpreting potential economic returns on ranch, developing watering points to improve livestock distribution or enhancing wildlife habitat. Therefore, the present study was planned in an area of Pothowar plateau at Pabbi Hills, Kharian District Gujrat.

MATERIALS AND METHODS

The Pabbi hills are a part of Himalayan foothills. The hillocks are detached from each other by terraces and gullies formed by severe erosional dissection of the anticline. They consist of a series of serrated ridges. The rocks consist of semi-consolidated, weakly cemented calcareous, coarse, friable sandstone, underlain by layers of clay, shale, and sandstone. Chemical analysis of soil showed pH value of 7.7, soil organic matter is very low (0.53%), indicating soil is very poor in fertility. The nitrogen status is also very low (0.04%) whereas the phosphorus (5.44 ppm) and potash (70-10 ppm) status lies between medium fertile soil.

Climate: Climatically the area falls in the sub-tropical continental and sub-humid regions of northern Punjab. Therefore, the climate is of extreme type, characterized by high summer temperature, cold nights in winter, torrential and erratic rainfalls mainly during the monsoon season. Summer from April to June is normally very hot and dry. The winter rains mostly occur in December and January. Frost occurs during December, January and sometimes it may occur in February. Windstorms are not common. Average wind velocity varies from 0.29 to 2.9 knots per hour (Anonymous, 2004).

Rangeland Inventory: The plant parameter namely, carrying capacity was determined in this study. These plant parameter is of colossal importance as these provide base line data for manipulation of a rangeland ecosystem

on scientific lines. Above-ground grazable biomass is the most important component of an ecosystem as all the herbivores depend on it. Therefore, we need to know whether the existing vegetation is enough to support herbivory without facing any downward trend in the range resource. If vegetation is overstocked, forage (total herbaceous and woody palatable plant biomass available to herbivores) supply in the long run gets reduced that can jeopardize all the related resources of the ecosystem, i.e., animal health, soil and watershed values.

Measuring Carrying for Standing Crop Forage Production: Standing crop is the weight of plant material present in a system at any given point in time. In this study, only grazable plant portion was taken into consideration, therefore, mesquite (*Prosopis juliflora*), Bhakar (*Adhatoda vasica*), and Karir (*Capparis spinosa*) being unpalatable plants were not clipped in this study as plants pods can be grazed by goats. However, mesquite pods and tender branches of Karir were included in the grazable plant parts as goat can graze these. Since the grazing animals in the area were cattle and goats only, therefore Phulai (*Acacia modesta*)--the only grazable tree--was harvested up to the grazing reach of the animals, i.e. approximately two meters above the ground level.

Squared quadrats were randomly stretched through out the area. Plant parts that fell inside the quadrat boundary were clipped to the ground level. Plant parts that were not rooted in the quadrat but occupied space in the volume were also harvested while plant parts that were rooted in the quadrat but did not occupy the quadrat volume were not harvested (Bonham 1989). The harvested plant material was stored in paper bags individually and air-dried for more than 72 h until air-dried weight became constant at room temperature. Plants were weighed at electric balance and rounded to the nearest gram weight. Since allowable factor has not been calculated yet for the plant species of the areas, it was taken as 0.5 for all the species as suggested by Hussain (1968).

Sampling was done from 12-23 May 2005 and there were 80 samples taken for measuring forage production. For determining how many quadrats were required to measure standing crop forage production within 10 and 20 g per quadrat of the population mean at 90 percent probability level, the quadrat weight (total of grazable DM) was taken as a sampling unit. The sample mean (x) and standard derivation (s) for different quadrat weights were calculated from the data. The following well-known formula suggested by Bonham (1989) for a univariate and normally distributed vegetation characteristic was applied for sample size computations:

$$n = \frac{t^2 s^2}{(kx)^2} \dots (i)$$

Where

- n = Sample size
- t = The value of 't' from t-table
- s² = Variance
- k = the precision level in decimal fraction that the true difference of the sample mean occurs from the population mean.
- x = Mean weight of the quadrats

RESULTS AND DISCUSSION

Table 1 describes the various forage trees, shrubs, grasses available in the study area. The total grazable DM was determined as 347.27 kg ha⁻¹. Therefore, the grazable DM at 50 percent utilization level (0.5 percent allowable factor) available for livestock grazing was 174 kg ha⁻¹. Since the grazing livestock comprised of cattle and goats, the carrying capacity was estimated for these kinds of livestock only. Holechek (1988) reported daily dry matter (DM) intake for elk, moose, bighorn sheep, mule deer, white-tailed deer, and pronghorn antelopes as two percent of their body weight. Since DM intake for the cattle and goats of Pabbi Hills has not been worked out yet, therefore DM intake for these animals was also taken as two percent of their live-body weight as suggested by the Holecheln *et al.* (1998) for other animals of similar type. Based on the information of the livestock producers of the area, a young cow (equal to one AU) may attain average live-body weight of about 300 kg whereas the average live-body weight of a goat is about 25 kg. Keeping in view these animal live weights, DM requirement of an AU was calculated as 6 kg ha⁻¹. Thus, the annual DM requirement of an AU came to be 2,190 kg. Based on these standards, the carrying capacity of the area was calculated as 12 ha/AU/year. On live body weight basis 12 goats are equivalent to one AU. So, there will be one ha required for grazing of a goat round the year at 50 percent utilization level of the forage available from the standing crop of the study area.

Table 1. Grazable Dry Matter Production (kg ha⁻¹) by Different Plant Forms

Plant Form	DM Production (kg ha ⁻¹)	Percent Contribution
Trees	(161/80) 10=20.13	(161/2,778) 100=5.80
Shrubs	(9,522/800) 10=65.25	(5,222/778) 100=18.79
Perennial grass	(1,851/80) 10=231.38	(1,851/2,778) 100=66.63
Annual grass	(24/80) 10=3.00	(24/2,778) 100=0.86
Half shrubs	(163/80) 10=20.38	(163/2,778) 100=5.87
Climbers	(39/80) 10=4.88	(39/2,778) 100=1.40
Forbs	(18/80) 10=2.25	(18/2,778) 100=0.65
Total	347.27	100.00

Limitations of the survey: The assessment of palatability of different plants was based on the experience of the local people and these information were not backed by the field observation of the sampler; The survey was conducted a little bit late. It was better to conduct such type of survey after the spring season when plant can attain maximum growth and are in bloom stage.

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