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Rangeland Efficiency with in Diverse Shrub-Grassland of Baluchistan Highlands

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ABSTRACT

Rangeland productivity was evaluated in mixed shrub grassland in moorlands of Baluchistan, Pakistan. The field experiment was conducted at three zones of Baluchistan province namely (Quetta, Mastung, Ziarat). Productivity in range was determined both in protected and open sites. Four splits were established at each site (1 x 5 m2) quadrat was applied at 5m interlude at alternate site for biomass estimation. Inside the quadrant all rooted species were harvested then oven dried at 800 C for dry weight estimation into kgha-1. Standard errors and averages were determined for descriptive analysis. Annual rainfall in Quetta, Ziarat and Mastung was 157.6, 214.8 and 126.6 mm respectively. The production of forage in protected range site was better than open range areas as compared. Production of open range was (32.42, 138 and 168 kgha-1) and protected sites was recorded (586, 310, 411 kgha-1) at Ziarat, Mastung, Quetta. Due to high forage productivity carrying capacities of protected site were better than open sites. Results reflect that open rangelands are degraded due to unintended and uninhibited grazing. However, these open sites can enhance its productivity by protection and proper grazing management practices.

Keywords: *Rangeland productivity, Forage production, Carrying capacity, Shrub and grasses*

INTRODUCTION

Rangelands are those areas and lands in which there is physical limitations, low annual rainfall, irregular landscape, meager soil drainage, severe weather temperatures not fitting for cultivation, source of forage for conjugal animals as well as source of wildlife, water and wood products (Stoddart *et al.*, 1975). It is described by Environmental Monitoring and Assessment Program (EMAP) of the US Environmental Agency (EPA) as for worldly characterized by evapo-transpiration aggravate precipitation where annual rainfall from (50 to 600 mm) and temperature ranges in between (40 to 50 degrees). Vegetation is subjugated in excess of grasses, shrubs, cactus and succulents along with drought resistant trees.

The rangelands of the world are type of areas which are often too dry, unproductive and unpredictable that necessitate for challenging management inputs. These sites have low production rate so the research effort zone per unit was to limited and less intensive systems. Rangelands normally falls at one end of minimum four continua which are reviewed many times (Stafford and Pickup, 1993). The uses of the range lands are very dominated in terms of grazing with multitalented social economic goals.

In Pakistan only 49 million hectares are under different ranges zones out of total 80 million hectares. Rangelands comprises in Pakistan are both mountainous and arid base. The area under ranges in Baluchistan is 79 percent, KPK 60 percent, Sindh 55 and 40 percent in Punjab. The areas are committed to livestock production from semi natural to natural vegetation. Goats, sheep and cattle are the primary income source of farmers and rural community in semi-arid to arid zones of Baluchistan (Mirza and Ahmed, 2001). Rangeland vegetation contains grasslands, shrub lands and forests. These lands exert from alpine pastures towards north to the Arabian Sea in the south. It constitutes the biggest land holding area of Pakistan (Mirza *et al.*, 2002)

Baluchistan has a semi-arid to arid climate. The annual rainfall is anecdotal from 50 mm (in west) and above 400 mm (in east). Rainfall

distribution extends with extremely temperature fluctuations low to very high. By means of physical the area consists on extensive plateau of rough surfaces, divided by basins of mountains. The Baluchistan province is divided into two prominent ecological zones. The south of Baluchistan has been classified into subtropical hot desert where average rainfall ranges from (50 to 150 mm) with the land used for grazing with some agriculture products. Whereas the northern site with high altitudes areas (1000 m to over 3000 m) are climatically classified as semi-arid zone. Range management impresses on the improvement, protection and sustainable use of available and basic resource such as scarce plants, soils, animals and vegetation, water and optimum production of agricultural goods and services in combination needed by community living (Heady and Child, 1994). The rangeland requires management and selection of substitute suitable techniques for better and optimum production of goods with zero damage of resources. The holistic resource management is known to be as planning and application of many alternatives (Savory, 1988).

The objectives of the current research were to estimate the over surface productivity of rangeland in mixed shrub grassland and the grazable biomass of different regarding species.

MATERIALS AND METHODS

The field experiment was conducted at Quetta, Ziarat and Mastung during 2008. Sampling sites were selected according to the presence of major and dominant plant species like shrubs and grasses. For the starting point randomization was done by pencil spinning and follow the pencil point of direction put a transect line. Four replications of (35 m) each was laid out random with permanent transects of (35 m) long. Four replications are parallel to each other at 15 m distance in between replications. To identify the boundaries of these transects permanent identification points were used. The sampling was carried out in protected, open and partially grazed sites. Surface production of biomass was estimated by using four quadrants (1 x $5m^2$) randomly settled on alternate sides of the transect lines. Plant species which are inside the quadrants of $5m^2$ were cut with a fine cutter near the surface of ground. The sample was gathered if each species in a paper bags for fresh weight right after harvest. Separate woody fractions from twigs and leaves from each plant. These samples were oven dried at (80^0C) to measure the grazable fraction (leafy material) and wood. The dry and fresh production of biomass was converted into $kgha^{-1}$. Calculating carrying capacity on the basis of average live weight of 33 kg Balochi Ewe, forage requirement @ 3 % of body weight (live) of 1 $kgday^{-1}$, 50% is a proper use factor, no fuel wood extraction of assumptions and neglecting the animal grazing preference. Rainfall data was obtained from Arid Zone Research Centre, Quetta. Descriptive analysis was used to estimate the standard errors and averages (Steel and Torrie, 1997).

RESULTS AND DISCUSSION

The distribution of rainfall at Quetta, Ziarat and Mastung was recorded 157.6, 214.8 and 126.6 mm respectively. The annual rainfall with its distribution was better at Ziarat when compared with other two sites. At Quetta, the production of forage was recorded 168 and 411 $kgha^{-1}$ in protected and opens sites. The carrying capacity of protected range site was 1.77 $ha^{-1}ewe^{-1}year^{-1}$ while the carrying capacity of open range was 4.34 $ha^{-1}ewe^{-1}year^{-1}$ (Table.1)

The carrying capacity of site Mastung ranges from 2.35 to 5.28 ha/ewe/year in both protected and open sites. The production of forage was 138 and 310 $kgha^{-1}$ in protected and open Mastung site (Table.1). At Ziarat, the production of forage in protected, open and partially grazed site was 586.54, 32.42 and 413.74 $kgha^{-1}$ while the carrying capacity of protected and partially grazed sites was lies in between 22.51 to 1.24 $ha^{-1}ewe^{-1}year^{-1}$ (Table.1). The production of forage in protected range sites was comparatively better among all sites. At Ziarat, the production of forage in open site was lower when compared with Mastung and Quetta. Difference in vegetation and herd compositions along with grazing pastures are considered. Shrubs like (*Haloxylon grifithi* and *Seriphidium quettense*) are dominant at Mastung and Quetta while grasses like (*Chrysopogon aucheri* and *Cymbopogon jwarancusa*) are dominant at range area of Ziarat.

Table1. *Rangeland Productivity in a Mixed Shrub-Grassland at Quetta, Mastung and Ziarat*

Sites	Forage production ($kgha^{-1}$)			Carrying Capacity $ha^{-1}ewe^{-1}year^{-1}$		
	Quetta	Mastung	Ziarat	Quetta	Mastung	Ziarat
Open	168± 29.33	138 ± 44.62	32.42 ± 40.56	4.34	5.28	22.51
Partially grazed	315± 30.52	238 ± 35.02	413.74 ± 28.54	0.78	1.23	1.76
Protected	411± 33.14	310 ± 29.67	586.54 ± 22.43	1.77	2.35	1.24

Range productivity is greatly influenced by rainfall distribution (Scoones, 1995). Surface total production is a primary variable in natural resource management because it reflects the availability of forage for both domestic and wild herbivores. (Oesterheld *et al*., 1992) found a strong relation between surface primary production and stocking density for rangelands of South America.

Pasture production influenced by numerous factors as soil nature, climate, structure of vegetation, botanical composition and intensity type of management i.e. patterns, grazing, stocking rates, wildlife and fire wood (Le Houerou and Hoste, 1977). Although the carrying capacity is a rangeland utilization unit but due to temporal variable, spatial range production, animal preference and specie composition the calculation sometimes mislead to management practices so therefore the actual rangeland model system is one which balances the effect of unpredictable events with frequent impacts of small and cumulative changes (Watson *et al*., 1996).

The amount of biological recovery is low in semi to arid regions. The recovery rate is dependent on the rainfall distribution beside seasonal rainfall distribution. Strong recovery has been reported even desert and drought conditions where annual rainfall is (60 to 80 mm) under permeable and deep soil (Le Houerou, 1992).

The recruitment grasses rate may not be achieved within two to three years of protection. Change in composition of specie is a very slow process in both semiarid and arid areas (West *et al*., 1984). The analysis of long-term precipitation data of Quetta region (avg. 250 mm per annum) out of ten years, three years shows above average rate while three are at average and remaining four years are below average (Kidd *et al*., 1988). Due to yearly fluctuation in rainfall the animal feed resources are low (Mirza *et al*., 2004).

In Ziarat site, the dominant range species are perennial bunchgrasses (*Chrysopogon aucheri* and *Cymbopogon jwarancusa*). These grasses are located on a wide type of soil over elevations of Balochistan (Ahmad *et al*., 2000a). These grasses provide grazing around the year totally depends on management practices and rainfall. (Ahmed *et al*., 2000a; b) studied the regrowth of these species at highlands of Baluchistan and observed that the (*Cymbopogon jwarancusa*) has more seed production and viable with better seedling recruitment under natural weather conditions.

In Mastung range site, shrubs like (*Haloxylon grafithii* and *Seriphidium quettensis*) are more dominant over other grasses. Other range species provide limited dry matter under arid and drought conditions (Gul *et al*., 2007; Ahmed *et al*., 2007). The species in Baluchistan are deficient in digestible protein and nutrients and dry matter which are animal requirements (FAO, 1983; Wahid, 1990; Islam *et al*., 2008).

Conclusion

Biomass and production data of numerous sites in Baluchistan shows that the rangelands acquire very low productivity but with good management and utilization practices, improvement in production can be made possible.

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