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## CONFIGURATION OF BIOMASS PRODUCTION IN MASTUNG RANGLAND OF BALOCHISTAN



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### Abstract

*Study was mainly conducted to evaluate rangeland productivity in Mastung rang area in Balochistan. There are different types of range lands which include short grasses, tall grasses, steppes, herbs, sub shrubs and shrubs. In Balochistan approximately range lands consist of herbs and grasslands which possess various kinds of grasses and shrubs due to wide range of adaptability. Their nutritive value varies from region to region and season to season. District Mastung of Balochistan province having same range lands totally consists of steppes, seasonal grasses and perennial grasses. This was an extensive baseline study, consisting on both primary and secondary data. Results showed that perennial grasses of Mastung district are cymbopogon and crysopogon species. Rangeland productivity or biomass of district Mastung is effecting day by day due to precipitation, wind, transpiration and also nonexistence of grazing management practices because in semi-arid areas of Balochistan precipitation rate is very low due to which need of water and humidity of rangelands cannot be fulfilled by the low precipitation.*

**Keywords:** Biomass, Grasses, Grazing, Herbs, Rangeland, Shrubs

## INTRODUCTION

Pakistan has a total area of 88 million hectares, about 65% of which consists of rangelands. Five different types of range ecological zones (Sub-alpine and temperate, Sub-tropical humid, Sub-tropical sub-humid, Tropical arid and semi-arid deserts plains, and Mediterranean) are found in Pakistan (1). Mastung has an area of 5,896 square kilometers. Mastung (a district in Kalat Division) situated between East longitudes and North latitudes. Location of Mastung is at 735 km (aerial distance) south-west (235 degrees bearing) of Pakistan's capital city Islamabad and 45 km (aerial distance) south-west (200 degrees bearing) from Quetta city, the provincial capital of Balochistan. On the other hand, lands of Balochistan are mostly owned by tribes and different communities, therefore, no one is owning them, everyone is allowed to graze their animals. No one is applying the scientific rules like rotational grazing or resting the rangelands.

The livestock sector in Mastung is characterized by nomadic, sedentary and transhumant production system. Most of the farmers are very poor. In district Mastung the highest reported population among all ruminants was sheep (467 thousand), goats 335 thousand, and cattle 9 thousand (2). Sheep rearing is preferred as compared to other ruminants due to



suitable weather conditions. Mastung is also a migratory root during October nomads. Transhumant's and farmers of Mastung, Kalat and Mangochar migrate from Kand a masoori Dasht towards kacchi and also some transhumant, farmers and nomads from zonal areas of District Quetta migrate towards Kacchi using Dasht area of Mastung. When the spring starts in the month of April, they again migrate from Kacchi towards Mastung, Mangochar, Kalat and Quetta. The climate is characterized by dry hot summers and mild to cold winters. Rainfall is scanty and unevenly distributed. During winter, snow falls in the valleys of Kalat and Mastung makes these areas very cold. Geographically, the district is mountainous consisting of a series of parallel mountain ranges in the north and east, with ground elevation varying from 934 to 3,414 meters above sea level. The soil is mainly Limestone and Clay. Scott reported that vegetation in various altitudes varies according to zones of various districts. The mountain chain directions or higher mountain and ranges work as barriers against wind velocity, that affect on the rain fall as well as climatic conditions, cause observable effect on the distribution and vegetation of animals(3).

The study planned to know the management practices in rangelands grazed by small ruminants' in the region of Mastung. Study was aimed to determine the impact of different management practices on small ruminants' production and to determine worth of rangeland plants in relation to small ruminants' requirements. Information was also gathered regarding prevailing diseases of the area Information was taken regarding the vaccination program during the calendar year, information regarding ectoparasites and endoparasites was gathered whether they receive free or paid for worm infestation. The main objective of study was to determine the existing range land production in study area.

## **FEEDING AND BREEDING PRACTICES**

It is reported that grasses provide the bulk feed. However, many of browsing plants play an important role in improving the nutrition of grazing animal. The most desirable are legumes because they fix nitrogen and therefore, provide feed with high protein component as well as increase soil fertility (4). Rangeland species varies depending on climate, soil types, soil moisture topography, and biotic factors (4). In summer farmers/transhumant's/sedentary/nomads mostly fed their ruminants on grazing in rangelands, crop residues, and fodder. But when the winter starts, nomads/transhumant's/ migrate towards lowlands (Kacchi, Sibi) where they graze their flocks on residues of kharif crops. They stay during the whole winter over there. The breeding (allowing rams and bucks) starts during migration. Whereas the lambing and kidding starts from end of February to March or some times in the start or mid-April. As soon as lambing/kidding completes, they start to move back to Mastung, Mangochar, Kalat and zonal areas of Quetta as the Kacchi and Sibi get warmer. In summer, the small ruminants mostly fed on green grasses like legumes, alpha alpha, and barley, star grasses found and large ruminants are grazed. The degree of grazing strongly affects the structure, composition, quality, and productivity of rangeland vegetation. (5)

## MATERIAL AND METHODS

### IDENTIFICATION AND COLLECTION OF RANGELAND SPECIES

Samples of rangeland species preferred/grazed by small ruminants were collected from different locations of Mastung region. In this connection, 36 rangeland species collected based on animals' preference. It is reported that large number of rangeland species are going to be replaced with low or unpalatable species of shrubs such as *Othonophasis intermedia* and *Peganumharmala* due to visible erosion of soil (6).

### RANGELAND SPECIES IDENTIFICATION

The Statistical Package for the Social Sciences (SPSS v.23) program was used to study the statistical analysis, by using "Independent t-test" and "chi-square. The participants included in our study were chosen randomly.

### SPECIES BOTANICAL IDENTIFICATION

Species which fed by small ruminants in district Mastung and surroundings were identified by two team members, one from CASVAB, University of Balochistan Quetta and second from Balochistan Agricultural Research and Development Center Quetta.

## RESULTS AND DISCUSSION

The study on "range land refrying to small ruminant's grazing in Mastung district and surroundings" was conducted in 2017 and comprised of four major parts i.e.

1. Information collection about livestock farmers, small ruminants and rangelands
2. Species botanical identification
3. Rangelands and their production
4. Rainfall data in Mastung

### LOCAL INFORMATION COLLECTION FROM FARMERS ABOUT SMALL RUMINANT FARMERS ABOUT SMALL RUMINANTS AND RANGELANDS

Collected information from five locations (Dasht, Mastung city, Sheereenaab, Sheikh wasil and Bidrung) from thirty five (n=35) small ruminant farmers. Seven farmers/ sedentary/nomads/transhumant's were interviewed from each location. The basic profile data was recorded on basis of farmers, flock/herd composition, feeding practices, and grazing time.

### LITERACY RATE OF SMALL RUMINANT FARMERS IN DISTRICT MASTUNG

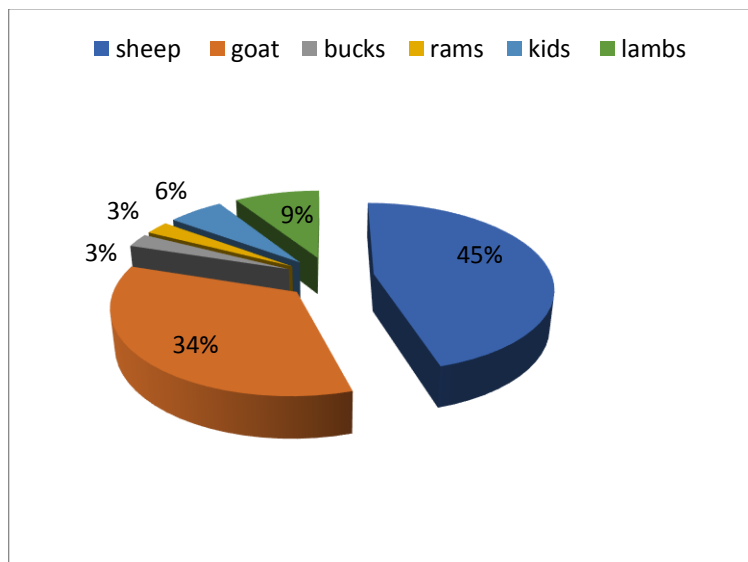
The data obtained on the literacy rate of small ruminant farmers of Mastung District is literate= 57%, primary= 33%, middle= 12% metric= 5%, higher 7%. The 57% of educated farmers are mostly sedentary and those farmers and transhumant's whose families are in there homes when the winter season starts schools of Mastung take final exams of students then they migrate towards Kacchi and the 43% of uneducated are those nomads , transhumant's which migrate seasonally in April and September October these nomads, transhumant's are 100% illiterate.

## COMPOSITION OF SMALL RUMINANTS IN MASTUNG

Results of herd/ flock composition of livestock farmers in Mastung region is given in Table I. The flock/herd was comprised of sheep, goat, bucks, rams, kids and lambs shown in Fig 01. The numbers of sheep were maximum (45.39%), goats were (34.51%), lambs (9.08%), kids (5.89%), bucks (2.58%) while rams were least in number (2.51%).

**Table I.** Livestock herds and their percentage in study area

| S. No | Livestock | Animal Heads<br>(Farmer = 35) | Percentage |
|-------|-----------|-------------------------------|------------|
| 1     | Sheep     | 3103                          | 45.39      |
| 2     | Goat      | 2359                          | 34.51      |
| 3     | Bucks     | 177                           | 2.58       |
| 4     | Rams      | 172                           | 2.51       |
| 5     | Kids      | 403                           | 5.89       |
| 6     | Lambs     | 621                           | 9.05       |
|       | Total     | 6835                          | 100        |



**Fig. 1.** Percentage composition of small ruminants in study area

## GRAZING AND FEEDING PRACTICES IN SUMMER

Small ruminants feeding practices in Mastung District is mentioned in table II. Total six different methods of feeding practices were recorded in summer. Grazing+fodder+crop residue (34.58%) was the most preferred practice. Grazing+fodder+concentrate (5.69%) was the last preferred practice while the other practices were Grazing+Fodder (18 %) Grazing+crop residue (20%) Grazing only (15%) Grazing+Fodder+Concentrate+Crop residues (6.73%).

## GRAZING AND FEEDING PRACTICES IN WINTER

In winter season sedentary of district Mastung do not migrate towards Kacchi remain in Mastung in winter these practices are some different then summer shown in table no (3). Most preferred practice was (grazing +fodder ) 40% while the least preferred practice was only grazing 1% because in winter rangelands become dry only the few plants remain while the percentage of other method of feeding practices were (grazing+crop residue) 10% (grazing+fodder+crop residue) 28% (grazing+concentrate +fodder) 07% ( grazing + crop residue +fodder +concentrate) 15%.

**Table II.** Grazing and feeding practices in winter

| S #   | Grazing and feeding Practices                      | Percentage |
|-------|--|------------|
| 1     | Natural Grazing only.                              | 01%        |
| 2     | Natural Grazing + crop residue                     | 10%        |
| 3     | Natural Grazing + fodder                           | 40%        |
| 4     | Natural Grazing +fodder + crop residue             | 28%        |
| 5     | Natural Grazing +fodder +concentrate               | 07%        |
| 6     | Natural Grazing +fodder +crop residue +concentrate | 15%        |
| Total |  | 100%       |

## TIME OF GRAZING IN SUMMER

Grazing time of small ruminants in summer of district Mastung was different then winter. The farmers /sedentary/nomads/transhumant's of district Mastung graze there small ruminants at 6 different times. Farmers of Mastung like better to graze small ruminants from morning to evening while the nomads like better to graze there small ruminants before morning to noon after that evening to night. Only evening time grazing was preferred by those who goes to his work or business at morning time whenever he gets free at evening time then he grazes his few small ruminants there for the percentage of only evening is 1%.

## TIME OF GRAZING IN WINTER

The winter grazing time of small ruminants of district Mastung is little bit different from summer season shown in Table 3. In winter, days are smaller than nights and in early morning and after evening weather becomes too cold due to which small ruminants are took for grazing at that time when the sun rises about 9 or 10 o'clock and after 4 to 5 o'clock they finish their grazing in early evening.

**Table III.** Time of grazing in winter

| S. No. | Grazing time       | Percent |
|--------|--------------------|---------|
| 1      | Morning to evening | 67%     |
| 2      | Noon to evening    | 1%      |
| 3      | Only morning       | 32%     |
| 4      | Only evening       | 0%      |
|        | Total              | 100%    |

## EFFECT OF RAINFALL AND MOISTURE CONTENT

In 2017, which was dry, the soil moisture in April was 10% and 7% in un-grazed and grazed plots respectively while in September it was 7 % in un-grazed plots and 4% in grazed plots. In autumn the soil moisture was 13 % in un-grazed plots and 9% in grazed plots.

In 2018, the soil moisture condition was little bit good due to rainfall. In spring, the total rainfall was 56% due to which the soil moisture in un-grazed plot was 55 % and in grazed it was 40 %.

Total biomass production and plant density varied greatly between sites and years ( $p < 0.05$ ). The effect of precipitation deficits were seen in biomass production especially in 2017 winter and spring (January –April). In 2018, good rainfall tended to increase total biomass production and cover abundance compared with 2011, where deficit rainfall/ drought reduced

**Table IV.** Physicochemical properties of soil (Result of sample collected from Turkaman Dasht Mastung)

| Soil Parameters         | Units               | Results   | Remarks                    |
|-------------------------|---------------------|-----------|----------------------------|
| Textural Class          |                     | Silt loam | Medium in texture alkaline |
| pH                      |                     | 7.91      | Alkaline                   |
| Electrical conductivity | dSm <sup>-1</sup>   | 0.28      | Non-saline                 |
| Organic matter          | (%)                 | 0.033     | Low in organic matter      |
| Total nitrogen          | (%)                 | 0.018     | Low in total nitrogen      |
| Available phosphorus    | Mg kg <sup>-1</sup> | 9.41      | High in phosphorus         |
| Available potassium     | Mg kg <sup>-1</sup> | 60        | Medium in potassium        |
| Sodium                  | meq L <sup>-1</sup> | 2.17      | Normal                     |
| Ca + Mg                 | Meq L <sup>-1</sup> | 1.60      | Normal                     |
| SAR                     |                     | 1.74      | Normal                     |

**Table V.** Identification of rangeland species preferred by livestock in Mastung

| Local Name      | Botanical Name              | Family    | Seasonal/ |
|-----------------|-----------------------------|-----------|-----------|
| Peon pulli      | Xylanthemum                 | Herb      | Seasonal  |
|                 | Macropodium                 |           |           |
| Saggdaru        | iOtropium balochistan nicum | Herb      | Seasonal  |
| Busunduik       | Sophoragriffithi            | Herb      | Seasonal  |
| Jirrobotove     | SeriphidiumQuettence        | Herb      | Seasonal  |
| Chittirk        | Caraganabrachyanthe         | Grass     | Seasonal  |
| Gorka           | Stippapennata               | Grass     | Seasonal  |
| Jambo           | Cruciferac                  | Grass     | Seasonal  |
| Ashea naporchek | Menthe longifolia           | Herb      | Seasonal  |
| Kisankur        | Peganumharmala              | Herb      | Seasonal  |
| Aishwark        | RhazyaStricta               | Grass     | Seasonal  |
| Tolangoor       | Solanumminiatum             | Herb      | Seasonal  |
| Shampastir      | Sophormollis                | Herb      | Seasonal  |
| Kalpora         | Teueriummasum               | Herb      | Seasonal  |
| Isghand         | Withania                    | Herb      | Seasonal  |
| Gaozuban        | Trichodesma                 | Herb      | Seasonal  |
| Pnair bund      | Withaniacaogulans           | Herb      | Seasonal  |
| Matetov         | Salviacabulica              | Herb      | Seasonal  |
| Karkava         | Fagonia Arabica             | Herb      | Seasonal  |
| Saimsoke        | Nepetaprectervisa           | Herb      | Seasonal  |
| Shinz           | Alhajimaurrum               | Herb      | Seasonal  |
| Boemadran       | Achilleasantolina           | Herb      | Seasonal  |
| Ba oshok        | Malcolmia                   | Grass     | Seasonal  |
| Garbost         | Lepidium                    | Grass     | Seasonal  |
| Mangoli         | Othonopsisstevum            | Herb      | Seasonal  |
| Goarikh         | Tulipa Montana              | Grass     | Seasonal  |
| Koanjiir        | Ficuscarica                 | Sub shrub | Seasonal  |
| Kuj             | Chrysopogonauchri           | Grass     | Perennial |
| Gandailgusht    | Eleasineflagellfers         | Grass     | Seasonal  |
| Nul             | Pharagmitiscummunis         | Grass     | Seasonal  |
| Pusso           | Trticumaertevum             | Grass     | Autumn    |
| Rubdurika       | Andropogoncontortus         | Grass     | Perennial |
| Away            | Cymbopogonlwaracisa         | Grass     | Perennial |
| Goathk          | Fructusanisi                | Grass     | Seasonal  |
| Karboti         | Salsolagriffithi            | Sub shrub | Seasonal  |
| Sheenalo        | Phoenix dacatytifre         | Grass     | Seasonal  |
| Mashanajambo    | Crepicfoetida               | Grass     | Seasonal  |



the rangeland productivity. Thus, in protected area, the species richness was higher compared with the grazed sites. Species richness of the un-grazed plots was highest ( $P < 0.05$ ), compare to grazed plots.

## BIOMASS AVAILABILITY BOTH IN GRAZED AND UN-GRAZED AREAS OF EXPERIMENT

In Mastung ecosystem, in un-grazed area, the shrubs are well established as compared to grazed plots where these shrubs have been removed for fuel wood. In 2012, due to good soil moisture, the dominant grasses of the area *Chrysopogon aucheri* and *Cymbopogon jwarancusa* contributes approx. 60 of the total biomass especially in spring in both grazed and un-grazed plots while in autumn these grasses only contribute 20-25 %. In spring, the contribution of *Cymbopogon jwarancusa* was more than 80 % in total biomass of grasses.

The soils are moderately deep, strongly calcareous, gravely clay loam. There is no evidence of salinity problems and the soil is considered suitable for agricultural purpose. Major diseases in animals are lung-worm-infestation, wire-worm-infestation, liver fluke, mange/mites, ticks, systematic, metabolic, contagious diseases like (foot and mouth, brucellosis, tuberculosis, pes-des-petites ruminants, contagious caprine plueropneunomia, sheep/goat pox anthrax) Non-contagious like (Blue tongue, tetanus, enterotoxaemia, theileriosis, campylobacteriosis). Poor nutrition is generally blamed for low birth rates and high mortality immediately after lambing and kidding (7).

Area wise Balochistan is the largest province of Pakistan. It has a total area of 34 million ha out of which only 4% is under cultivation while 60% of the cultivated area is rain fed (8). Approximately 93 % land of this province is characterized as rangelands (8). The human population is least, thin and sparsely spread as compared to other provinces of the country. The area of this largest province is mostly comprised of rangelands having varying carrying capacities. These rangelands serve as the major source of grazing for small ruminants particularly for the animals of nomads, sedentary and transhumant production systems. In these livestock production systems, the flock is mostly comprised of sheep with comparatively less number of goats than sheep. About 87% of people of Balochistan directly or indirectly derive their livelihood from small ruminants rearing (9).

It is reported that 90% feeding requirements of livestock in Balochistan is fulfilled from these rangeland species. However, the degradation of rangelands occurs because of poor plans for grazing management and vegetation loss for the purpose of fuels in the form of wood. It happens due to lack of any visible administration for its ownership. Important indications for the degradation of rangeland are species shift, composition biodiversity, range losses with decrease in the production of biomass and low covering plant (10).

Rangelands are the major feed source for these animals and approximately 90% of the total feed requirements of sheep and goats are met from rangelands. In the beginning of winter sedentary of Mastung fed their small ruminants on the leaves of trees and the residues of onion, and other vegetables leaves (cucumber, tomato, pumpkin, brinjal, ladyfinger) some

of the sedentary have their own gardens and some of them buy leaves for their ruminants they also fed on straw and concentrates (barley, wheat, sunflower, soya bean, maize, grain)

In this phase, questionnaire was developed in order to gather local information from the shepherds/farmers of the randomly selected locations (Dasht, Mastung city, Bidrung, Sheikh Wasil, Sheereenaab) of Mastung region. From each location, seven (7) shepherds/farmers were interviewed. The total shepherds/farmers were 35 in numbers. The information was collected on farmers' basic profile, livestock grazing time, feeding practices, flock/herd composition, preferred rangeland species (grasses, herbs, shrubs, tree leaves) by small ruminants and their local names.

It is reported that drought and rain fall have direct effect on the yield of forages, grazing pastures and nutrition in different sites of rangeland (11). In district Mastung there was no practice on land management, no rest or rotational grazing systems was applied by farmers. The degradation of rangeland in Balochistan is site specific and depends on the existing vegetation, grazing pressure, grazing accessibility, human population, availability of stock water, and tribal conflicts (12). Pastoralists are also in agreement that the changes in species composition or degrading is due to over grazing of range lands by sedentary/nomads/transhumants. This was due to free lands communal no one is owning and protecting the lands.

## RANGELAND PRODUCTION

According to (13) the tradition management of grazing has been used by pastoralists for improving the environmental condition of arid areas and can save from overgrazing to confirm the sustainability of the natural resource. The grazing management strategies are flexibly used in overall in the result of collective information regarding the natural resources, distribution of rain fall and range condition (13). The experiments were conducted in Mastung near Kand a masoori. Two sites were selected, one for protected and second for unprotected area. Protected area was protected by the forest department Mastung for their normal routine research work. The permission was taken from divisional forest officer Mastung and continued experimental work over there. Selected area in one hector was manually a one square meter (1 sq m) and clipped at ground level. The grasses or plants from that one square meter area separated their leaves and woody parts and dried them in oven after completely drying weighted the dry forage and converted in to kg/ha.

## CONCLUSION & RECOMMENDATIONS

In Balochistan, range resource is one the major land uses. The studies undertaken had clearly shown the recovery potential of the natural vegetation and introduction of the exotic species. However, the findings are inadequate to be considered as representative comparing the research area covered to the extent and ecological zone and climate variability of the resource. In the wake of the existing institutional gaps, ambiguous land tenure, lack of policy and grazing management, it is more likely that the biodiversity of the resource will diminish and the desertification process will enhance many folds.



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