Effect of Drought on Rangeland Productivity and Animal Performance in Dryland Region of Balochistan, Pakistan

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Summary

Arid and semi arid areas of Balochistan are characterized by low and erratic rainfall and are prone to drought conditions which normally occur every three to four years. The prevailing drought is one of the most severe in its magnitude as annual rain (60-150 mm) has been well below average for a continuous period of four to five years in most parts of highland Balochistan. Results from a long term study on range monitoring in highland Balochistan show that the annual range productivity has declined from an average of 150-180 kg/ha dry matter of forage biomass to 30-45 kg/ha as a result of continuous drought in most parts of Balochistan. This has seriously affected the productivity of range-based small ruminants in terms of health and high stock mortality. Recommendations are provided in this paper on short and long term programs to combat the effects of drought on range based small ruminant production. Government sponsored drought relief programs should encourage early destocking so that the herders do not keep their stock longer into the drought period and thereby avoid catastrophic effects. A shift from extensive herding on rangelands is suggested to intensive or semi-intensive feedlot livestock production system by integrating range grazing and crop-based livestock production. This would make the livestock enterprise economically and environmentally sustainable.

Key words

drought, range grazing, small ruminant production, destocking, feedlot system

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Introduction

Balochistan is situated in the south western part of Pakistan in a desert belt between 25^0N to 32^0N latitude and 60^0E to 72^0E longitude (Fig. 1). With an area of 34.7 million ha and population of about five million, Balochistan is the largest and most sparsely populated province of Pakistan. Balochistan has an arid or semi arid climate with annual precipitation varying from 50 mm in the west to over 400 mm in the east. The rainfall distribution pattern is erratic with extremely low and high temperatures. Physically the area consists of an extensive plateau of rough terrain divided into basins by mountains. Most of Balochistan south of 30° N has been classified as hot subtropical desert, where the rainfall varies from 50-150 mm and the principal land use is grazing with some agriculture. Whereas the high altitude areas of northern and eastern (highland) Balochistan with an altitude of 1000 m to over 3000 m are climatically classified as semi arid continental Mediterranean (Kidd et al., 1988).

Balochistan ranges provide a diversity of uses, including forage for livestock, wildlife habitat, medicinal plants, watershed, fuel wood, and recreational activity. Rangelands are the major source of feed for 90-95% of sheep and goats. Sheep and goat rearing is the main use of these areas and about 80% of the rural population derive their livelihood from the sale of small ruminants and by products. Nomadic, transhumant, and sedentary are the three major grazing systems in Balochistan. Out of the total area of Balochistan, 21 million ha (60%) is used for grazing. Nearly 12 of the 21 million hectare is classified as poor grazing, provide annually only 30-50 kg dry matter (DM) per hectare, whereas only 2.9 million hectare of better rangeland providing 250-280 kg DM per hectare.

The climate of highland Balochistan is harsh, with annual rainfall increasing from 200 mm at the southern end of the highlands to over 400 mm in the north-east of the province. Rainfall occurs both in winter and summer, with winter rains being predominant in the north west, which is less affected by monsoons. Summers are hot in subtropical desert and mild in highland areas. Winters are cold with mean minimum temperatures in January close to zero, although absolute minimum temperatures can fall to -15°C (Kidd et al., 1988).

The unfavourable topographic, edaphic and climatic conditions in Balochistan limit cultivation practices, leaving most of the area to be used as rangeland grazing. Range based livestock production is the major economic activity in the region (Mohammad and Atiq-ur-Rehman, 2000). According to the latest livestock census, about 20 million sheep and goats have been reported in Balochistan, majority of which is reared in highland areas of Balochistan (Agricultural Census Organization, 1998). Most part of the rural population is engaged in livestock production for their livelihood as the risk for crop production is too high in most parts of Balochistan. A combined influence of altitude, temperature and the availability of water determine pastoralism in Balochistan.

As most part of the mountain region of Balochistan province falls in the typical arid and semi arid continental Mediterranean climatic zone, occurrence of dry spells is not un-common to this region. The analysis of long term rainfall data of Quetta valley (average 250 mm per annum) suggests that out of 10 years, three years are above average, while three years are average and the remaining four years are below average. However, it had rarely happened that the mean annual rainfall in highland Balochistan registered values in the range of 60-150 mm per annum in most parts of the region for a continuous period of four to five years (Table 1). As a result, the prevailing drought is one of the most severe in its magnitude in the recent climatic history of Balochistan (Islam et al., 2004).

Figure 1. Map of Balochistan (Pakistan) showing dry rangeland region of the province

The major underlying cause for the poor performance of range livestock sector in arid and semi arid mountainous region is the fact that range productivity is low due to the harsh climatic conditions especially low and erratic rainfall (Afzal et al., 1993; Islam et al., 2004). As a result ranges can not meet the year round forage requirements and the animals are confronted with severe nutritional deficit especially during autumn and winter months (Akbar et al., 1990). Most of the pastoralists resort to migration from the summer grazing grounds to the lowlands in search of additional fodder. The feed shortage period during late winter also coincides with the late gestation period of animal productivity which further intensifies the problem. Though the problem of feed shortage in these areas is a general phenomenon, the situation worsened as a result of severe drought prevailed in the region for four to five years which peaked in the year 2000-2001 when a calamity like situation occurred in the dryland region.

Materials and methods

The effect of prevailing dry spell on rangeland productivity was measured at the three representative sites in highland Balochistan as part of the long term study to monitor the changes in vegetation cover and biomass productivity as a function of grazing and rainfall patterns. An informal survey was conducted in these sites during the drought

Table 1. Forage biomass (DM Kg/ha) in relation to annual rainfall at three range sites in arid rangelands of Balochistan from 1996 to 2002

Years	Hazarganji (Quetta)		Mangochar (Kalat)		Tomagh (Loralai)	
	Rainfall (mm)	Forage biomass	Rainfall (mm)	Forage biomass	Rainfall (mm)	Forage biomass
1996	242	127	67	197	187	164
1997	307	167	84	192	316	238
1998	152	100	121	198	334	170
1999	150	65	119	145	300	53
2000	79	28	27	52	110	24
2001	83	35	41	55	179	44
2002	134	42	90	67	115	48

Source: Islam et al. (2004)

period to assess the damage to the livestock owned by the sedentary and semi sedentary livestock owners (Islam et al., 2004; Mohammad and Atiq-ur-Rehman, 2000; Rafique et al., 1998). Data of vegetation dynamics were collected from representative sites in the highland Balochistan along permanent transects (Fig. 1). These range sites are open to grazing and are utilized under medium (Mangochar / Kalat) to heavy (Hazarganji / Quetta) and (Tomagh / Loralai) grazing pressure by nomadic and transhumant herds of sheep and goats.

Results and discussion

The forage biomass data collected from the range sites in a typical dryland region show that the rangeland productivity is more a function of seasonal rainfall than the grazing pressure alone. Though the vegetation types (*Artemisia-Haloxylon* shrub steppe) in Hazarganji (Quetta) and Mangochar (Kalat) sites and (*Cymbopogon-Chrysopogon* mixed shrub grassland) in Tomagh (Loralai) range site are considered to be fairly drought resistant (Ahmad *et al.* 2000-a, b, c). The spring and fall season forage production showed drastic low values at all sites during the years 2000-2001 as the annual rainfall was the lowest during this period among all sampling years. However, low forage biomass values also indicate heavy grazing pressure during the drought years and therefore, reflect combined effect of both drought and the resultant heavy grazing pressure.

The low range productivity in the wake of present drought also affected the livestock productivity to a great extent (Rafique et al., 1993). An informal survey was conducted in these sites during the drought period to assess the damage to the livestock owned by the sedentary and semi sedentary livestock owners (Islam et al., 2004; Mohammad and Atiq-ur-Rehman, 2000; Rafique et al., 1998). The overall livestock mortality recorded during 2000-2001 in these sites was around 15-20 % as a result of catastrophic drought in Balochistan province. In addition, pastoralists suffered great economic losses in terms of selling weak and starved animals at very low prices. Farmers reported selling their stock at very low prices in the range of $3-$5 per sheep or goat during extreme drought conditions. The mutton prices recorded during extreme drought period went to a record low as a result of over supply of weak animal in the market at the rate of $2 per kg. However, this forced destocking resulted in severe shortage of livestock numbers in a year's time and the mutton prices jumped to a high value of $3.5 per kg during the year 2002. The livestock population in these sites was reduced to about 50% to the pre-drought period as a result of drought hit forced destocking.

As part of the short term measures to mitigate the effects of drought, government institutions established relief camps and concentrated animals in large camps in order to lessen the gravity of drought stricken pastoralists. The government and other aid giving agencies provided some relief by supplying emergency feed mainly wheat straw, wheat bran and to some extent commercially prepared feed. A well majority of pastoralists from the affected region also opted to migrate to the plains in search of better feeding conditions for their stock. However, as part of the long term strategy, the Departments of Livestock and Forest have also started various programs to improve the feed, fodder and stock water availability in the province. One such project is being undertaken by the Department of Forest at district level with the objectives to improve range condition and establish fodder reserves of shrubs and trees. Arid Zone Research Centre is providing technical assistance in terms of species selection, seeds of fast growing *Atriplex* and other exotic species and monitoring. *Atriplex canescens* and *Atriplex lentiformis* commonly known as fourwing saltbush and Quail saltbush are exotic halophyte from the western United States (Afzal et al., 1992; Akbar et al., 1994; Islam and Adams, 2000-b; Mirza, 1995; Mirza et al., 1994). These are perennial drought and cold tolerant shrubs and can successfully be planted in areas with 250 mm annual rainfall (Thompson et al., 1998). These species start new growth in early spring that continues until late summer when moisture limits further growth. Micro-catchment water harvesting could enhance and prolong growth. A 1.0 m tall *Atriplex canescens* plant with 0.60 m crown diameter would provide about 0.25 kg dry matter as leaf and about 0.72 kg dry matter as wood. The amount of leaf offered each day, supplemented with wheat or barley straw or stubble, is sufficient to maintain the live weight of a sheep (Rafiue et al., 1993, 1998).

A forage-reserve of one hectare of *Atriplex canescens* with 2,500 plants would maintain 28 sheep with browse for

three months in late summer, fall, or winter when range vegetation is extremely scarce in highland Balochistan (Islam and Adams, 2000-a, b). Area Development Program with the assistance of Government of Balochistan and UNDP is undertaking developmental activities in the field of natural resource improvement by involving farming communities across various parts of Balochistan. A number of wind mills have already been installed at suitable locations for providing water for stock as well as human consumption. Balochistan Livestock Department is catering the need of livestock in terms of health and nutrition by providing veterinary services as well as emergency feed to the livestock.

Recommendations to improve range livestock production in drought hit areas

The feed shortage from range grazing and its effect on animal performance can be tackled in long term by the integration of crop and livestock production systems thereby ensuring adequate supply of supplementary feed (straw, grains) to the livestock during the lean period. This can be achieved by directing government policies towards improvement in pricing and marketing of small ruminants. Policies that favours moving away of small ruminant production system from nomadic and semi-nomadic to intensive and semi-intensive production system would only work when current policies on pricing and marketing would change which are directed towards consumers rather than producers. The present pricing policies encourage extensive herding (to obtain all nutrition from rangelands) instead of semi-intensive herding. Prices which consider grading of carcasses and encourage producers to provide better quality livestock would ultimately attract intensive or semi-intensive (feedlot) livestock production system. It has been proved through a number of fattening trials of sheep and goats that this practice is economical in Balochistan if fattened animals are sold on special occasions to fetch more prices (Mohammad and Atiq-ur-Rehman, 2000). This system would not only increase the income of livestock producers but also help relieve some pressure from already overstocked rangelands.

Few other options can also be tried in order to compensate for the shortage of feed in this region which include the establishment of feed mills at strategic locations in the region. The commercial feed prepared at these mills can thus be made available at reasonable rates to the livestock producers through co-operatives. At present, there is only one feed mill (Shukrana) at Quetta which produces commercial feed. The feed supplied through this mill during the current drought period helped the pastoralists maintain good body condition of their stock even fed at lower rates. In some areas, farmers mix their own feed which is less expensive as compared to the commercial feed. This practice needs support from development agencies in terms of improving the quality of feed. Preparation and distribution of urea molasses blocks in Balochistan was also tried by the Livestock Department and UNDP Area Development Programme as part of the relief package in the wake of the current drought. However, efforts are required to make these technologies economically feasible and provision to the farmers at their doorsteps through co-operatives. Experience gained during the drought relief programme implemented in highland Balochistan showed that farmers would be willing to purchase such feeds if supplied at reasonable price and at nearby location.

Grazing animals in dry region are also confronted with health problems which are normally associated with poor feeding condition on the range. This issue could be addressed by arranging mobile veterinary camps at regular intervals in these areas where a large number of animals can be treated against major diseases and associated health problems. Such camps can also be used for educating the pastoralists about the importance of preventive measures against various diseases and improving the livestock handling and housing condition.

Conclusions

Government sponsored feed subsidy programme designed to provide emergency relief during drought also has the inherent drawback. It enables herders to retain livestock on rangelands longer into the drought period thereby causing further degradation of soil, vegetation and animal mortality (Thurow and Talylor, 1999). Before initiation of such a program, government agencies should prepare herders for early destocking in response to dry conditions. The incentives in the form of feed subsidy should only be provided to the farmers who respond to the drought conditions by reducing their stock numbers to the level of available feed resources.

Policies that favor aggressive destocking in the beginning of drought can lead to sustained livestock activity in arid regions even in the absence of government support in the form of emergency feed (Foran and Stafford Smith, 1991). As part of this policy, government agencies can intervene at the beginning of drought and facilitate mass level campaign to purchase stock from farmers and arrange hauling to areas where adequate fodder supply is available.

During the prevailing drought in Balochistan, farmers suffered great economic losses in terms of livestock mortality as they kept their herds longer into the drought partly because of the expectations from the government to provide emergency relief and partly due to the lack of any mechanism to dispose off their stock at reasonable prices during drought conditions. This situation resulted in forced destocking and majority of herders either sold their starved animals at nominal prices or suffered heavy losses due to high stock mortality. Such a scenario can be prevented in future if a sound environmental management strategy can be incorporated into Government sponsored drought relief package.

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