RANGELAND IMPROVEMENT BY COMMUNITY PARTICIPATION IN HIGHLAND BALOCHISTAN: EXPERIENCE OF MANGUCHAR (KALAT) BALOCHISTAN, PAKISTAN

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ABSTRACT

Rangeland productivity in Balochistan is substantially affected due to non-existence of grazing-management practices, low and erratic rainfall distribution, and over-exploitation of natural resources. Most of the rangelands in Balochistan lie within the arid and semi-arid climatic zones. These ranges are degrading very rapidly in terms of biomass production and desirable range-species. Most of the rangelands either belong to individuals or are common rangelands. The owners of the rangelands have the rights and power to stop the grazing by either outsides and/or local pastoralists. However, at present, this system is not in practice in most of the rangeland areas in Balochistan.

The pastoralists are facing a numbers of challenges, the major one being the shortage of feed for livestock. Efforts were directed to improve the community rangelands at Manguchar (Kalat) Balochistan, by understanding the existing range livestock production system, capacity building in co-management concept of rangelands, and involvement of different stakeholders in the planning and implementation of the range management and improvement.

Studies were carried out to determine the potential of biological recovery of heavily grazed rangelands by protecting the area from grazing hazards. Drought and cold-tolerant fodder shrub (Atriplex canescens) plantation was introduced to the community for establishment of forage-reserve blocks for winter grazing. Above-ground dry matter forage-production at community-protected site was recorded as 140 kg/ha, 174 kg/ha, and 190 kg/ha in spring 2005, fall 2005 and spring 2006, respectively. The dry matter forage production in open range area was 40 kg/ha during spring 2006. The community had also collected some native medicinal plants (Achillea santolina, Matricaria lasiocarpa, Ziziphora clinopodiodes) from the protected site. The results indicate that improvement in community rangelands is possible, provided an integrated approach of range livestock-management and improvement is made mandatory, through community participation and collaboration, among different stake-holders.

INTRODUCTION

Pakistan has a total area of 88 million hectare, 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 (Khan and Mohammad, 1987). These rangelands are the major feed-source of about 97 million heads of livestock. Precipitation varies from 125 mm to over 1500 mm per annum. About 60 to 70% of monsoon rains are received in the months of July to September, while the winter rains are received from December to February (Khan, 1987) and sometimes the rainy season goes on till April.

Balochistan has a total area of 34 million hectare, of which only 4% (1.47 mha) is under cultivation, while 60% of the cultivated area is rainfed (Khan, 1987). Approximately, 93 % of this area is characterized as rangelands (FAO, 1983). Arid and semi-arid areas are falling within the rainfall zones of 50-200 mm and 250-400 mm, respectively (Kidd, et. al., 1988). Rainfall patterns are unpredictable, due to great fluctuations in its pattern. Like other arid and semi-arid rangelands of the world, Balochistan ranges also provide a diversity of uses, including forage for livestock, wildlife habitat, medicinal plants, water storage and distribution, energy, minerals, fuel-wood, recreational activity, wilderness and natural beauty.

Livestock rearing is the main activity of the inhabitants of Balochistan. Sheep and goats are the main livestock of the province. About 87% of the people in Balochistan, directly or indirectly, derive their livelihood from livestock rearing (Heymell, 1989). About 20 million sheep and goats population have been reported in Balochistan (GOB, 1996). Rangelands are the major feed-source of these animals and approximately 90% of the total feed-requirements of sheep and goats are met from rangelands (FAO, 1983). Overgrazing, drought, erosion, and human-induced stresses have caused severe degradation of rangelands in Balochistan. The degradation of rangelands includes changes in composition of desirable plant-species, a decrease in rangeland diversity and productivity, reduction of perennial plant-cover, and soil erosion (Milton, et. al.,

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1994).

In Balochistan, the mixed grass-shrub steppe is more common than single grass communities. The types of range-vegetation in Balochistan changes from South to North alongwith the rainfall distribution. In the South, shrub species (Haloxylon and Artemisia) while in the North, the perennial grass species (Cymbopogon jwarancusa and Chrysopogon aucheri) are dominant. The fragile ranges of Balochistan are exposed to heavy grazing pressure, aridity, and human disturbances. However, many of these ranges still have potential for improvement by using grazing-management practices, natural recovery of vegetation and artificial re-vegetation in suitable sites, coupled with better water harvesting and conservation practices.

Natural re-vegetation practices, particularly grazing management, may restore vigour and accelerate the spread of desirable species (Vallentine, 1980). However, in arid and semi-arid rangelands, grazing-management alone may not accelerate the succession towards desirable species, due to limited precipitation. Artificial re-vegetation involves the establishment of adapted species, either by seed or transplanting seedlings (Roundy and Call, 1988). Restoration and rehabilitation are the two main procedures for regeneration of a depleted rangeland. Restoration or biological recovery can bring the ecosystem to the pristine situation and rehabilitation or artificial recovery is the artificial establishment of a new type of vegetation, different from the pristine native vegetation (Le Houerou, 2000a). Biological or artificial recovery may include increase in biomass, plant cover, organic matter, soil micro and macro-organisms, better water-intake and turnover, lower evaporation and runoff. Biological recovery may be obtained by protecting the area under consideration from human and livestock intrusion. Artificial recovery is usually achieved by artificial planting of exotic grasses, shrubs, and trees. The purpose of rehabilitation of rangelands may be diversely ranging from forage production, timber production, landscaping, wind breaking, sand-dune fixation, and erosion control (Le Houerou, 2000a).

A major concern of arid and semi-arid ranges is about the progressive reduction of secondary productivity and diversity (West, 1993) and how to manage these changes (Walker, 1993). The management and improvement of arid and semi-arid ranges is always a challenging job. Different theoretical models of rangelands have been developed and a few are also tested in different rangeland ecosystems of the world. However, the arid rangeland ecosystem of Balochistan is very dynamic and major climatic and agricultural changes are occurring in this area. In Balochistan, many range-management projects were carried out with little success. Therefore, there is a need to re-examine the research, policy and management issues in Balochistan for better productivity of rangelands and livestock production. Co-management of rangelands may be a better option as it is a situation in which two or more social actors negotiate, define and guarantee amongst themselves a fair sharing of the management functions, rights and responsibilities for a given territory, areas or set of natural resources. This paper highlights the experiences and lessons learned during the ICIMOD funded project 'Rangeland Improvement by Community Participation in Highland Balochistan', Pakistan.

MATERIALS AND METHODS

Grazing Systems, Pastoralists and Rangeland Survey: A survey was conducted in six villages of Mangucher areas (Mungri, Burdo, Soore, Mahmood Gohram, Purdozai, and Aalikhail) to quantify the distribution of livestock in Mangucher valley throughout the year and establish the importance of the range, to establish the grazing pattern of livestock throughout the year and to identify the local customary law regarding use and management of range.

Recovery Potential of Degraded Rangelands: Five hundred hectares of degraded rangeland at Mangochar (Kalat) was protected with community participation during the month of March 2005. Fifteen permanent transects 25 m long were established in the range area. These transects run parallel to each other at a distance of 20m. Vegetation data during different seasons were recorded to measure changes in above-ground productivity and the rate of recovery as a result of protection from grazing. Above ground biomass production was measured by using 1 x 5 m^2 quadrates randomly placed about 5-10 m away from the permanent transect lines. Plant species inside the 5 m^2 quadrates were clipped at ground-level (destructive sampling). The plant species were separated and their dry weight was recorded. Similarly, biomass production was also estimated from nearby unprotected range area.

Establishment of Fodder Shrub (Atriplex canescens) Blocks: Four thousand seedlings of Atriplex canescens were planted during April and May

2005, in pits, with community participation. The main purpose of this plantation was to develop a forage reserve blocks for winter grazing when most of the native range- species are in dormant stage and livestock suffers from feed-shortage. Plant growth and survival rate and forage production were recorded.

RESULTS AND DISCUSSION

Socio-economic Profile: The average age of the respondent farmers was estimated as about 48 years. They had a mean experience of about 23 years in livestock herding. Crop-production experience in Pastoralists was found to be higher than in the transhumants. Majority of the respondents (89%) did not attend the school and the mean formal education of the respondents was estimated to be below one year of schooling. A significantly higher percentage of the agro-pastoralists attended the school, as compared with that of the pastoralists. The average family size of the respondent's families was estimated as about 13 persons per household, comprising approximately 1 old person (>60 years), 6 adults (>16-60 years) and 6 children (upto 16 years). So the dependency ratio was around 54%. The family size in the tribal set up is large and shows extended family system. In Mangochar, the average distance of various facilities from village/settlement locations ranged from 3 to 22 kilometres.

Natural Capital: The average size of the operational land-holding of agro-pastoralists was estimated to be 13.6 acres. The average livestock herd size of nomad and sedentary was 160 and 43 small ruminants, respectively. Large ruminants average animal-holding was 0.5 for camels and 1.13 cow per household. The agro-pastoralists in Mangucher area were operating farms of significantly smaller size than their counterparts in other districts. In Manguchar, livestock production is well integrated with the availability of water and vegetation. Irrespective of the type of livestock-production system followed (i.e. pastoralist or agro-pastoralist), the livestock herders spend a part of their summer in villages. Apart from grazing in the harvested fields and weedy fallow, the weak animals are given supplemental feeding at home.

Sheep ownership averaged 61 heads per herd, including 1 ram, 49 sheep and 11 young stock. Breeding rams and bucks were found with very few herders. The agro-pastoralist types of livestock farmers were found keeping bigger herds of each type of animals (except camels and goats), but the difference between both categories was non-significant. Sedentary is the dominant grazing system in the area. Very few farmers are transhumant and practice cyclic migration to the low lands in the severe winter for feed, fuel and to get off-farm work opportunity. Feed source of various livestock population is derived from the crop sector and rangelands. The major source of feed for small ruminants is rangeland and weedy fallow areas. The survey results indicated that animal feeds were consisting of two types, i.e. stall feeding and open grazing. Cereal straw was given round the year to fill the belly of animals. Native pasture and weedy fellow was found as a major feed-source.

Rangeland Status: There are two types of private rangelands in Balochistan, according to the property type: common rangelands (Community) and open rangelands (Tribal). Tribes traditionally own common rangelands with customary institutional arrangements for their sustainability and effective managements. Open rangelands, used to be commonly owned, have free access to all whether nomads or local pastoralists and have usually deteriorated. So these rangelands are at risk and are considered as no man's land. The other alarming fact is that rangelands are being leveled for agricultural purposes. The water rights often limit the amount of land farmed and uncultivated land is usually held on a communal basis, recognized as Shamalat. All the communities in the project area have Shamalat, as 3rd category of range, which is near the village/land settlements.

There are tribal norms rather culture, e.g. when any outsiders entered in the area, they offer at least two healthy animals to the community head as token of respect. On the other hand, pastoralists have accepted the leadership and follow the tribal norms, as a member of this community. Mixed response was observed regarding rangeland management; whether open access for outsiders or permission is compulsory. More than 90% of the respondents were of the view that we know the nomads since our forefathers' time, and they do not need formal permission. The nomadic pastoralists used to migrate from highland to lowlands when the winter started, along with their animals and families. They normally start migrating in October and come back in March. The precise time of departure and return of herders depends on weather conditions and occurrence of rains. Normally, they start travelling back to the highland in the end of March. During an interview, it has been observed that since 10-15 years, the nomads have settled and adopted agricultural tenancy as additional source of income and the utilization of

surplus labour force. Now they are permanent members of the society, despite the fact that they are living in their traditional huts. This shift can be linked with the severe drought for the last five to six years.

Livestock marketing system here in Balochistan is a very complex issue due to un-systematic marketing. Distance to market, lack of infrastructure and traders' monopoly are the major hindrances. The livestock marketing channels include local selling to fellow herders, livestock traders or beoparies, butchers and in the livestock markets. A significant number of farmers used more than one marketing channel for selling their animals. Selling of livestock to beoparies or/and butchers was the most frequently used channel. A small proportion of the herders sold their animals through livestock markets. It can be concluded that beoparies or/and butchers constituted the major livestock marketing channels in Balochistan. Relatively high percentage of agro-pastoralists was selling their animals through livestock markets than that of their counterparts.

RECOVERY POTENTIAL OF DEGRADED RANGELANDS

The main range vegetation of the area includes:

Dominant Shrubs:	Haloxylon grifithii, Artemisia species, Peganum harmala, Hertia intermedia
Rare Shrubs:	Astragalus stocksii, Convolvulus leiocalycinus
Annual Grasses:	Poa bulbosa
Perennial grasses:	Saccharum species, Cymbopogon jwarancusa, Chrysopogon aucheri

Peganum harmala and *Hertia intermedia* are species less preferred by small ruminants. Peganum harmala is only grazed in winter season when plants are dry, while only the flowers of Hertia intermedia are grazed by sheep and goats. Perennial grasses were grazed very severely and only the hummocks of grazed plants were existing. During 2005, total rainfall (253 mm) and its distribution was also better. As a result, the overall range productivity and species composition was better. However, during the 2006 monsoon season only 71 mm rainfall was received, resulting in low forage production. Above-ground dry matter forage production at community protected site was recorded 140 kg/ha, 174 kg/ha, and 190 kg/ha in spring 2005, fall 2005 and spring 2006, respectively. The dry matter forage production in open range area was 40 kg/ha during spring 2006. The protection of degraded rangelands of Mangochar showed some recovery of vegetation. Perennial grasses are coming back and shrubs have better growth and had reached up to seed production. The community also had collected some native medicinal plants (Achillea santolina, Matricaria lasiocarpa, Ziziphora clinopodiodes) from the protected site. The protected site has much better species biodiversity, compared to open rangelands. The community also has the opinion that now it has better availability of fuel-wood resources. This site provided a demonstration to other tribes and communities about range-management options and proper utilization of rangeland resources.

Results from this study show that mixed shrub-grassland steppe of Manguchar have potential of biological recovery, if protected from grazing at least two to three years, depending on rainfall distribution. The rate of biological recovery might be slow, as expected in the arid and semiarid climatic zones. The rate of recovery is also related with the rainfall-distribution, rather than total rainfall. Strong vegetation recovery-response has been reported even under desert conditions with mean annual rainfall of 60-80 mm under deep and permeable soils (Le Houerou, 1992a). From Morocco to Iran, the perennial ground cover and primary productivity are enhanced by a factor of 2-5 and in most cases, 3-4 within a few years, either by total or partial protection (Le Houerou, 1992a). In West Asia and North Africa, range exclosures from 11 countries showed that productivity in exclosures enhanced by 2.8 times (average) than the adjacent grazed areas (Le Houerou, 1998). However, very long-term protection may not yield better results, due to accumulation of dead old material (personal observation) that reduced the new fresh growth. Controlled grazing may produce similar or better results than exclosures in some cases (Le Houerou, 2000a). The recruitment rate of grasses may not be achieved within two to three years protection. The changes in species composition are very slow processes in arid and semiarid areas (West et. al., 1984). Limited spring season rainfall (the optimal time of seedling recruitment) in Balochistan is the main factor for low seedling recruitment, even under complete protection from grazing. According to long-term meteorological data-analysis in Balochistan, it is observed that above-normal rainfall amounts that promoted spring seedling emergence, occur with about 10% and less than 10% probability

(Keatinge and Rees, 1988).

ESTABLISHMENT OF POTENTIAL FODDER SHRUB (ATRIPLEX CANESCENS BLOCKS)

Seedling survival-rate was 75% and surviving plants attained average plant height of 90 cm. During Spring 2006, the average dry matter forage production per plant was recorded to be 30 gm, with an equal amount of wood production. The growth of the surviving plants was affected during 2006 due to limited rainfall, particularly during the spring season. The community was also educated about the nursery raising, transplantation, management and utilization of the fodder shrubs.

The biomass and productivity of fourwing saltbush is highly variable, depending upon the ecological condition of the soil and climate, as well as the management applied. Artificial plantations of fourwing saltbush under rainfed conditions can yield 2000-4000 kg dry matter/ha/year in areas with mean annual rainfall of 200-400 mm, under proper management. The most desirable characteristics of fourwing saltbush include its extreme drought and cold tolerance and high-quality browse, especially during summer and autumn months. The crude protein contents in leaves of fourwing saltbush have been reported in the range of 12-15 % during mid winter (Thomson, et. al., 1997). It has been suggested that one acre of fourwing saltbush might provide the supplemental protein requirements for 0.5 to 1 animal unit during a 90-day period (Ueckert, 1985). Like other halophytes, fourwing saltbush has low energy values because of high ash contents. The energy values are reported to cover only maintenance requirements of sheep, if they consume 1.2-1.5 kg DM/d (Le Houerou, 1992b). The digestibility of dry matter and of organic matter has been reported to be around 60% and 50%, respectively (Le Houerou, et. al., 1983). The digestibility of nitrogen has been reported to be around 65%, but the retention of nitrogen is only 55%. Atriplex supplemented with grazing of native ranges resulted in animal weight-gains of around 80 g/h/d (Le Houerou, et. al., 1983). Atriplex forage consumption, in addition to stubble or wheat straw consumption, could lead to a well balanced ration and fulfil the nutritional requirements of animals in a productive grazing system (Le Houerou, et. al., 1991, Mirza, et. al., 2000).

CONCLUSION

Increase in range dry-matter forage production, species biodiversity, and demonstration to the community about range-management options.

The recovery of degraded rangelands is possible by providing two to three years rest from grazing and other human disturbances. The fodder shrubs should be transplanted in early spring for maximum utilization of rainwater and better establishment chances. Most of the pastoralists are unaware about range-management and improvement options. Heavily grazed rangelands of Balochistan have recovery-potential if protected from grazing for three to four years depending upon rainfall distribution. Communities alone cannot bear the re-vegetation cost. Legal, regulatory, and administrative incentives are required. Co-management of rangelands requires long time to gain the confidence of communities and show them some impact on their range and livestock production.

RECOMMENDATIONS

a. ***Rangeland Research:*** The rangelands of Balochistan need an urgent and well-planned programme in management and utilization to halt the degradation process leading towards desertification. The degradation of rangelands is not only caused by overstocking but non-existence of grazing management practices. Experience and research work indicate that in some areas native vegetation recovery is still possible, either by deferred or rotational grazing methods. However, still very limited information is available on the present status of rangelands of Balochistan, like potential range areas, forage productivity, species composition and its contribution to animal diets, digestibility, nutritive value of range-species, growth, and propagation practices. Therefore, there is a need to characterize the rangelands of Balochistan and recommend appropriate management/ improvement work and policy. Monitoring of long-term changes in rangeland health at several representative range-sites should be initiated, to gather information on trends on vegetation dynamics and degradation processes. Drought-tolerant fodder shrubs could make a substantial contribution in feed during the winter season. The research work should be focused on identification of such range germplasm. Plantation of fodder shrubs with cereal inter-cropping should be explored on the farmer fields. The range-ecology research should focus on re-vegetating heavily degraded ranges with native shrubs and re-establishing native perennial grasses on potential

range-sites. Rangelands must be considered as an ecosystem, rather than just grazing lands. Combined efforts of range livestock management should be used, rather than single range management and improvement work. Watershed areas may be explored for both range livestock development and watershed management.

b. Rangeland Policy: Creation of National Range-Management Committee at federal and provincial levels is recommended for research, advocacy and policy development and its implementation. Research organizations should monitor the rangeland productivity, in different ecological zones, and plan grazing management plans; this should be a part of range management policy.

c. Rangeland Development Work: Social infrastructure should be improved in remote range areas for improving the livelihood of the pastoralist communities. Some incentives should be provided to the communities for range-management/improvement work. Forage-reserve block establishment on marginal lands, with some Governmental incentives may ensure forage supply in winter or drought years. Supply of high-production drought and cold-tolerant forage fodder crops, on minimum price, should be introduced to complement native rangelands. These pastures may be used during the critical forage-deficit period (winter months) and at the same time may allow some rest to the rangelands. An integrated approach of range-livestock production and dryland crop-production should be adopted to ensure the forage/feed availability by utilizing all the available resources.

Provision and development of stock water may ensure the grazing in some potential range areas that are, at present, not grazed due to non-availability of stock water. Awareness of communities about livestock diseases, control measures and better processing of skin/hides may ensure better marketing of by-products. Rangelands alone cannot meet the nutritional requirements of livestock, therefore, introduction of low-cost supplementary feed may enhance livestock production and productivity. The range management and improvement programme normally lasts two to three years. However, this duration in arid and semi-arid areas is too limited to show any noticeable impact to communities on range-management/improvement. Therefore, a more reasonable time-frame must be allowed for such projects.

d. Community Rangelands: Land-tenure and ownership of rangelands in Balochistan should be characterized. Awareness programme of communities, on indiscriminate removal of vegetation for fuel wood, should be initiated. Grazing associations at village-level and livestock cooperatives should be formed for community range management and creation of better marketing of livestock. Range-management and improvement work should be conducted on communities' rangelands and their involvement must be ensured in all decision-making and planning processes. In the past, most of the range activities were limited to Government lands. Generally, pastoralists are not willing to reduce their livestock numbers (de-stocking). However, it is possible to raise a lamb crop of marketable size in one season from February-March to October-November, with supplementary feeding and then keep only ewes during the winter season.

e. Human Resource Development: Lack of trained manpower on rangeland related issues are another major constraint. Therefore, on-the-job training programmes for scientists and field staff should be arranged on different range-related and researchable areas, like: rangeland monitoring; vegetation sampling; use of Geo-informatics for rangeland resource management; latest practices of range-management and improvement in arid and semi-arid areas; and community based research methods, either at National or International level.

ACKNOWLEDGEMENTS

The present study was carried out with the financial support of International Centre for Integrated Mountain Development (ICIMOD), under the ICIMOD Regional Rangeland Programme, Phase II. The authors are highly thankful to the management of ICIMOD for supporting the rangeland co-management initiation work in Balochistan. The contribution of ICIMOD and personal efforts of Dr. Yan Zhaoli and Mr. Muhammad Ismail are highly appreciated for arranging the Rangeland Co-management Training Workshop at Arid Zone Research Centre (AZRC), Quetta, and providing related information and literature from time to time.

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