Cholistan Desert, Pakistan

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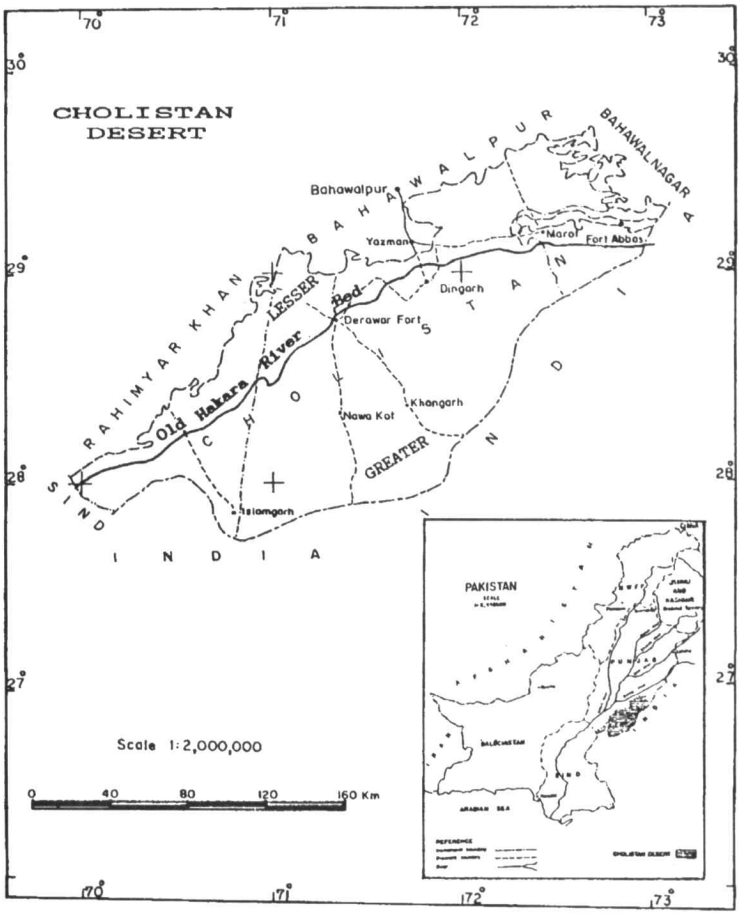
Rangelands in Pakistan constitute about 70% of the total area of the country. The importance of range management as a discipline was not recognized until 1954 when a development project with the U.S. Government technical and financial assistance was initiated in Balochistan province (Rafi 1965). This project helped policy makers and natural resource managers to identify clear goals. Range management was initiated with a number of research and development projects in areas falling under different ecological zones. Initial projects successfully demonstrated some of the water harvesting and sand dune stabilization techniques. Establishment of potentially promising local and introduced forage species in the Thal desert were also important initial projects. The government has now started focussing its attention on the, long ignored, Cholistan desert.

Cholistan desert, an extension of Great Indian Desert, is located in southern Punjab province between latitudes 27°42' and 29° 45' north and longitude 69° 52' and 75° 24' east (Baig et al. 1980). This desert is comprised of about 2.6 million hectares (FAO 1993). This desert has a length of about 480 km while the width varies from 32 to 192 km (Khan 1987; Chaudhry 1992). Based on the topography, parent material, soil and vegetation the whole Cholistan desert can be divided into two geomorphic regions. The northern region or Lesser Cholistan borders canal irrigated areas and covers about 7,770 km^2 and the southern region or Greater Cholistan is comprised of 18,130 km^2. The Lesser Cholistan consists of saline alluvial flats (locally called 'dahars') alternating with low sandy ridges. The clayey flats of Lesser Cholistan are generally homogenous to a depth ranging from 30 to 90 cm. These soils are classified as either saline or saline-sodic, with pH ranging from 8.2 to 8.4 and from 8.8 to 9.6, respectively. The Greater Cholistan is a wind resorted sandy desert and comprised of river terraces, large sand dunes, ridges and depressions (Baig et al. 1980; Khan 1987).

History

Around 4000 B.C. the Cholistan was a cradle of civilization commonly known as the Hakra valley civilization. This was when the river Hakra flowed through the region. The river supplied permanent water until 1200 B.C. About 600 B.C. it became irregular in flow and consequently vanished within a century or so. The Hakra civilization that flourished here was one of the longest in the course of world history. It was also the earliest civilization of the Indian subcontinent. In cultural advancement it can be compared with the Mesopotamian, Anatolian, Egyptian, and Babylonian civilizations (FAO 1993). No one is sure how this great Aryan civilization ended. Probably a variety of problems such as hostile invading tribes, changes in the course of the river and depletion of irrigation facilities contributed to the ultimate disappearance of this great civilization (Khan 1987; FAO 1993).



Map of Pakistan showing location of Cholistan desert.

Climate

Cholistan is a hot arid sandy desert. The mean annual rainfall varies from less than 100 mm in the west to 200 mm in the east. Rain usually falls during monsoon (July through September) and in winter and spring (January through March). Monsoon rains occur mostly in heavy showers. Cholistan is one of the hottest deserts in Pakistan. Mean minimum and maximum temperatures are 20° and 40° C, respectively. Temperatures are high in summer and mostly mild in winter with no frost. The mean summer temperature (May-June) is 34° C with highs reaching nearly 50° C. Annual rainfall is highly variable both on temporal and spatial scales. Aridity is the most striking feature of Cholistan with wet and dry years occurring in clusters. The Cholistan was formed predominantly by the deposition of aeolian sands or alluvium deposits. The alluvium deposits are composed of granites, schists, gneiss and slates. The soils of Cholistan are generally saline, alkaline and gypsiferous. The dunes reach an average height of about 100 m.

There are no permanent, natural bodies of surface water in Cholistan. Factors like low rainfall, high rate of water infiltration into the sands, and high evaporation rate prevent the natural accumulation of surface water (FAO 1993). Fresh (rain) water is collected in locally made water ponds called 'tobas'. Underground water is at a depth of 30-40 m which, with a few exceptions, is brackish containing salts 9,000-24,000 ppm (Baig et al.. 1980).

Natural Vegetation

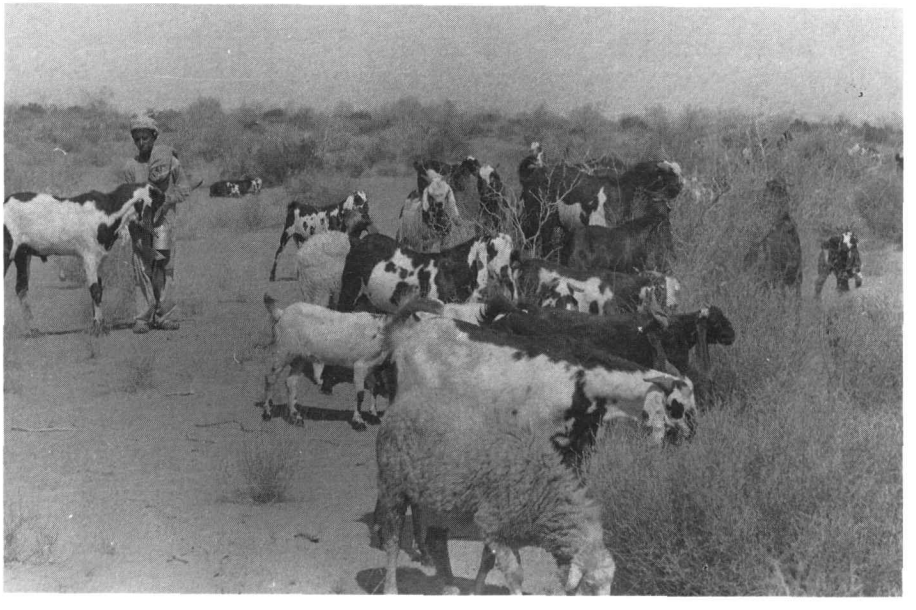
The vegetation in Cholistan is typical of arid regions and consists of xerophytic species which are adapted to extreme seasonal temperatures, moisture fluctuations and wide variety of edaphic conditions. Compared to the hyper arid southern region, vegetation cover is comparatively better in eastern Cholistan (200 mm rainfall zone).

Most of Cholistan is covered by sand dunes. Fortunately, a wide range of nutritious and drought tolerant species of grasses, shrubs and trees occupy the entire territory. These plant species, though slow growing, respond very well to the favorable climatic conditions and provide ample biomass for livestock consumption. Important genera of grasses include *Cenchrus, Lasiurus* and *Panicum*. Favored shrubs include *Calligonum* and *Holoxylon* and *Prosopis, Zizyphus* and *Acacia* are notable indigenous trees (Rao and Arshad 1991). Each site is represented by typical plant species based on availability of soil moisture, salinity and plant characteristics.

Socio-Economic Aspects

The total human population of Cholistan desert is around 1.2 million. The economy of the region is predominantly pastoral. People have practiced a nomadic life style for centuries. Large herds of camels, cattle, sheep and goats are owned by the nomads. The area is not served by a modern communication system and can be traversed by either camels or jeeps. Local people use camels as a mode of transportation. Habitations are small and extremely scattered (Baig et al. 1980).

The pastoral system is characterized by mass migrations of animals and people throughout the year in search of water and forage. The onset of monsoon and the distribution of rainfall mainly dictate the pattern of movement of nomadic herders. Around the months of March or April, nomadic households move towards surrounding irrigated areas forced there by rising temperature in the desert and depleted feed and water resources. The incentives for this movement include temporary employment opportunities within the irrigated farming community, grazing of livestock on wheat stubbles, drinking water for human and livestock and readily available markets for livestock and livestock byproducts. Farmers in the irrigated areas in turn obtain sufficient labor for crop harvesting and other farming operations and animal manure to enhance soil fertility through camping of livestock on fallow fields. The nomads and their herds return back to the deserts around July or August with the news of first monsoon showers. Distances travelled during this migration vary from 10 to 100 km. While in the desert natural vegetation is the main source of feed for grazing livestock. Tobas serve as drinking water both for nomads and their livestock. Tobas are made in clayey flats locally called dahars in a catchment area to avoid heavy water percolation. Tobas belonging to the same clan are generally located close to each other (often within 1 km



A local herder with sheep and goats grazing in the desert.

radius). At the start of the rainy season, livestock graze within one or 2 km radius of each toba. This distance increases to about 15 km as the season progresses. During October and November, when water resources become almost totally depleted, each clan moves its herds to semi-permanent centers equipped with a series of traditional (hand-dug and unlined) wells and kunds (usually lined) (FAO 1993).

The nomads manage their mixed livestock in such a way that milking cows are moved nearby the urban centers where milk is sold readily while other animals like camels, goats, sheep and bullocks are kept in the desert for grazing. Nomads attach high values to their herds. Livestock are the main source of their survival and a number of cultural norms are linked with the animals. Livestock are frequently used for meat, milk and, gifts. Communal ceremonies like weddings, funerals, and tribal celebrations include slaughtering and exchange of animals. A person's status in the desert nomadic life style is chiefly represented by the size of the herd he owns.

Numbers and trend in the Cholistan livestock population is summarized in Figure 1. The figure reveals average annual herd increase of 2.7% for cattle and 3.4% for goats and a slight decline in the numbers of sheep and camels. All livestock are indigenous breeds well suited to the environment. Herd reproductive performance is naturally poor with low birth rates and high mortality (FAO 1993).

Range Management: Past and Present

Total area available in Cholistan for grazing is estimated to be 2.3 million hectares. The Greater Cholistan is seldom used for grazing due to lack of water and inaccessibility. Average range forage production is about 168 kg/ha (FAO 1993). Total carrying capacity for the area being currently grazed is estimated at 687,500 A.U.M.'s with grazing capacity of 3.24 hectares per A.U.M. Based on these calculations, Cholistan grazing grounds may provide feed for 140,000 animal units for a 5 months period. The livestock population of Cholistan is increasing and according to recent estimates is well above 150,000 animal units. This increase has placed greater pressure on presently over-grazed rangelands. An increasing livestock population accompanied with cutting of vegetation by the desert pastoralists for meeting their domestic requirements for construction of thatched houses, fuelwood and cloth washing has seriously deteriorated the plant cover (FAO 1993). One should also realize that most of the native vegetation of Cholistan is either moderately palatable or unpalatable due to selective and persistent grazing of the palatable species.

Although range areas are in poor grazing shape they have potential for development. There is a dire need for research directed toward improving carrying capacities of Cholistan ranges. Improvements to maintain a balance between livestock and the vegetation for sustained productivity in the area needs emphasis (Khan 1987).

The Provincial Forest Department of Punjab started a range management project during 1963. To solve problems with brackish underground water, the project activities included construction of ponds to collect rain water for human and livestock consumption. A total number of 487 ponds were created. Range reseeding with grasses was also attempted but failed due to unfavorable climatic conditions, socio-economic factors, and inadequate planning. Moreover, nomadic grazing style prevalent in the desert did not conform to the modern and planned grazing systems (Khan 1971; Sheikh and Hafeez 1977).

During 1975 the Pakistan Agricultural Research Council established an Arid Zone Research Station. The stations main objectives were to develop a regional capability for tackling the problems of arid areas and to develop best management techniques for existing landuses. To achieve this objective the station carried out a number of activities including evaluation of a wide range of grasses, trees, shrubs and forage legumes. Promising forage species were arranged not only from local sources but also from developed countries like the USA and Australia. The trials were conducted for several years in the desert environment and potential species were selected for large scale introduction and multiplication. Some of the

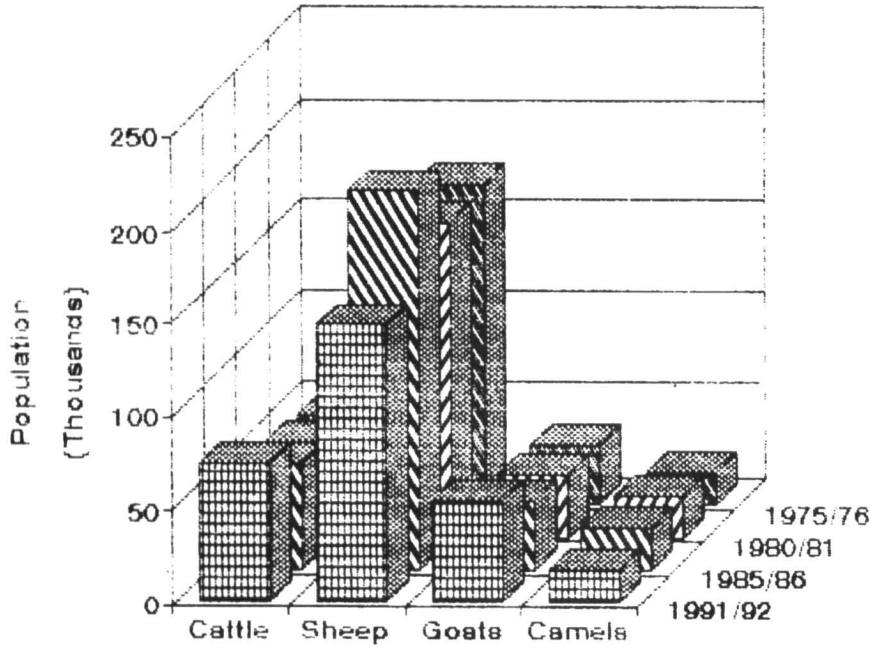


Fig 1. *Livestock population of Cholistan desert over different years.*

Planting of promising forage grasses in the desert has successfully been carried out without disturbing the natural vegetation.

species selected include *Cenchrus ciliaris*, *Cenchrus setigerus*, *Panicum turgidum*, *Panicum chloratum*, *Panicum antidotale*, *Panicum maximum, Lasuirus scindicus, Chlorus gayana* and *Sporobolus iocladus*. Among trees *Prosopis cineraria, Acacia nilotica, Zizyphus nummularia* and *Zizyphus mauritiana* have shown greater promise. Among shrubs a number of Atriplex species and Jojoba *(Simmondsia chinensis)* are highly successful. These plant species are being used for reseeding, planting and sand dune stabilization. Economically viable water harvesting techniques have been developed after long term and careful evaluation. Among these, pitcher irrigation is the most successful. Jojoba plants are planted along side earthen pitchers. Jojoba plants take about three years to produce seeds. A farmer is interested in short-term economic returns. To mitigate this problem, suitable creeping type vegetable crops like Gourd and water melon *(Citrulus lanatus)* are being raised along pitchers to get maximum utilization of seepage water and to harvest immediate cash returns. These vegetable crops and water melons not only provide immediate produce for a household use but also serve as a mulch for the jojoba plant to save it from hot desiccating desert winds.

In addition to the Arid Zone Research Station some other agencies like Cholistan Institute of Desert Studies of Islamia University, Bahawalpur (Pakistan) is also contributing significantly to overall range development efforts. This institute is collaborating actively with the Arid Zone Research Station. Studies are underway on phytosociological surveys of desert area and evaluation of different ecotypes of desert grasses for drought tolerance, and forage production. The emphasis is to develop the ways and means for greater participation of the desert pastoral community in range development activities.

Future Challenges

A clear message from the past 40 years of range management efforts is that development of range resource in any ecological setting is directly related with its compatibility to the prevailing socio-economic patterns. People in Cholistan do not follow those grazing systems that rely heavily on fenced-boundaries. Under a tribal situation where land is a common entity, fences serve as a sign of hatred. People loose their trust in government agencies and consciously or unconsciously do not cooperate and hence make such management a failure. Restrictions on movement of nomads and their beasts is not liked at all.

Under situations like that of Cholistan, where both people and vegetation behave in an opportunistic manner, people keep on moving after the rain. Similarly, when considering

Jojoba plant planted along side a pitcher. Pitcher is filled with water once in a week. The water seeps out of the pores of the pitcher and becomes available to the plant. This technique has yielded highly successful results in terms of plant survival in the desert. In the background, vegetables (Gourd) growing along pitcher are also visible.

vegetation, the well known theory of plant succession and climax communities does not hold. According to this theory, the vegetation can be expected to follow a predictable path of recovery once the grazing pressure is relieved. In hot arid conditions, even when grazing pressure is relieved, recovery of vegetation is dictated by the uncertain but favorable incidents of rainfall and temperature. Moisture and temperature are the key factors for the recovery of range health. Another approach that has yielded negative response from a nomadic community is our advocacy for reduction of herd size. People do not like this idea because the larger herd a pastoralist owns the more secure he feels under harsh environmental conditions.

Under the scenario presented above, it is imperative to understand the delicate balance between living and non-living components under a given set of conditions. The human factor is the most important element of living component and its needs must not be overlooked. With special reference to Cholistan, the needs of the desert pastoralists are few and their demands are simple. They should be given an even chance to fight the battle against the cruel and unsparing desert (FAO 1993). Their problems include: (*) A shortage of drinking water for both human and animal populations (*) Basic health facilities for both human beings and their livestock (*) Marketing facilities to sell their livestock and livestock-based products such as (wool, embroidery works, camel and goat hair mats, animal fat (Ghee), milk etc).

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