Lessons from India

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Abstract

This paper describes how high density rural populations in desert regions of northwest India have sustained themselves in the face of diminishing natural resources. By modifying traditional production systems, pastoralists and farmers have been able to cope with the vagaries of climate and diminishing rainfall in arid zones of India. Many of the lessons learned here could be applied elsewhere in arid rangelands of the developing world.

Introduction

We had the opportunity to view these agro-pastoral systems on one of the post-conference tours following the 3rd International Rangeland Congress in New Delhi, India, in November, 1988. The trip was to the Great Western (Rajasthan) Desert across northwest India. We were very impressed with the way in which mixed agricultural production systems were integrated and also how closely they fit into the climatic gradient encountered. This tour went west from the subhumid rice growing area near Agra for about 800 km (500 mi) into the very arid sand dune desert near the Pakistan border through what is sometimes referred to as the Thar or West Desert (Figure 1).

The Setting

Our route was over a uniformly flat sub-tropical plain at nearly 25° North latitude at elevations that varied between 250 and about 500 m (825 to 1,650 ft) above sea level. This region has been occupied for thousands of years by various Hindu and Islamic groups. The remains of exotic palaces and hilltop fortresses are reminders of past conquests. The landscape is geologically quite old having ancient basement system and sandstone complexes interrupted by seams of volcanic outcroppings.

Rangeland and climatic features of the western Rajasthan through the arid and semi-arid land (ASAL) portions are not unlike those of the African Sahel. In spite of low productivity, the western desert of India sustains a very high population of people and livestock relative to ASAL worldwide.

Over the entire 800 km gradient, monsoonal rainfall varies from about 1,000 mm (40 in) in the subhumid east to less than 100 mm (4 in) in the arid west. The desert region is subjected to climatic extremes. Frosts usually occur in February; during the 6 spring/summer months, winds averaging 20–30 km per hour (12–18 mi per hour) suck up the soil moisture from the meager rainfall and fill the sky with billowing dust.

The trip west took about 6 days and we were well entertained by our Indian hosts at animal production research stations, plant material centers and livestock auctions (Figure 2). The return trip, however, was in one very long day and it was not until then that we realized the significance of what earlier had unfolded so gradually before our eyes. We had seen a highly integrated spectrum of agricultural production systems grading from the extremes of absolute desert with camels to that of rice paddies and water buffalo. By way of ease of description—simple to complex—we'll take the backtrack route to recount the systems of agriculture along this aridity gradient.

Around Jaisalmer city, about 65 km (40 mi) from Pakistan, the rainfall averages a scant 50 mm (2 in). Agricultural production is based on rangeland grazing of annual plants and woody browse by camels and a limited popula-
tion of indigenous goats and even fewer hair sheep. These latter "small stock" are mostly intermixed and herded daily from semipermanent homesteads by very young or very old family members. Since neither predators nor rustlers present stock loss problems, loose herding is common and night stockades are not usually required. During the rainy season, male camels and dry stock are taken several hundred kilometers into the desert for fattening. When local rains fail, the entire extended family may move with their livestock in search of greener pastures.

The Rajasthani desert people are mostly seminomadic herdsmen and local traders along ancient east-west camel caravan routes. Their highly colorful clothing and mideast turbans set them apart ethnically from people of Punjab to the north and Gujarat to the south.

Mixed Agro-Pastoral Systems
East of Jaisalmer some 150 km (93 mi) on the way to Jodhpur, one sees more goats and sheep relative to camels (Figure 3). An occasional small but hardy looking cow used for milking was often seen grazing near the family compound, which was usually a collection of 3 or 4 mud and dung plastered huts. Roofing material was thatching grass.

Here, nearer Jodhpur, with perhaps 250 - 300 mm (10 - 12 in) of rainfall and a more dependable wet season, camels are seasonally herded far out in the desert for 2 - 3 months browsing. Whenever rains have been substantial, rapidly maturing crops such as millet or sorghum will be planted somewhere near the homestead in a bush-fallow cropping system. After the flush of wet season growth, native grasses are hand cut and stacked beside the compound as hay for dry season feed. After harvest, crop residues are also placed in stacks and small stock graze field aftermath late into the dry season.

Mixed Livestock with Cropping
Close to Jodhpur with perhaps 500 - 600 mm (20 - 24 in) of rainfall exists a semi-arid marginal cropping zone with a high density livestock agriculture. Now, cattle are common and camels are only seen as beasts of burden pulling carts of cotton, hay, fuelwood or water (Figure 4). Wool sheep are plentiful but the number of goats has diminished. The more permanent cropping system has become one of periodic fallow with some maize, cotton and small grains. Intermixed on shallower less fertile ground, natural pastures exist along with small improved grass-

![Fig. 2. Nomadic herders and stock traders from distant rangelands assemble at traditional auction centers not unlike pastoral people worldwide.](image)

![Fig. 3. Sheep and goats are popular animals with Rajasthani people and provide diversity for utilizing the desert plant communities. These "Sewan" (Lasiurus sindicus) grasslands occupying vast stretches of desert are dotted with nutritious woody browse.](image)
and the occasional water buffalo is seen tethered at homesteads for milking. Around cities, small but trim horses are used for drawing taxi carts and in rural villages donkeys commonly pack water, farm supplies or market produce.

**Mixed Cropping with Livestock**

Several hundred km on east and somewhat beyond Jaipur one enters subhumid conditions with very intensified crop agriculture. Animal production systems are limited to that needed for efficient use of crop residues to provide the necessary household milk and to meet field traction requirements. Much of the rural milk in this region is produced by stall-fed livestock under “cut and carry” conditions of zero grazing pioneered by Indian agriculture research. Horticulture has diminished but forage trees and even fuelwood plantations on shallower rocky soil are commonplace.

Where cereal cropping is intensive, fuel for cooking is limited and quite expensive. This causes competition for cow and buffalo manure. Instead of being returned to the fields for crop fertilizer, dung is dried into patties and burned as fuel for cooking.

In areas where high water tables allow irrigation and further on east into the rice belt, agroforestry is still common and highly encouraged as an integrated land-use system. Farming systems in these rice growing areas utilize water buffalo as the principal animal component. They supply milk, meat, hides, dung, and traction power. Buffalo are more easily traded and disposed of in the cultural atmosphere of central India where the time honored Bos indicus cattle are partly protected.

**Conclusions**

In all, we were very impressed with the labor intensive energy efficient agricultural production systems that have long been developing in this ancient civilization. Food needs of India are generally met even in the face of expanding populations. Although human pressures are straining the natural resources in the arid and semi arid regions, more efficient integration at the crop-livestock interface continues to boost production.

India has long been a leader in livestock oriented agroforestry technology, especially silvi-pastoral practices. Pastoralists in Africa and similar hard pressed areas of the developing world would do well to follow the lessons learned here.