

SOCIO-ECONOMIC STRUCTURE OF POPULATION IN ARID RAJASTHAN

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FOREWORD

It is needless to emphasise that well being of a country depends upon proper management of its natural resources including human population. Studies on human factor are in progress at the Central Arid Zone Research Institute (CAZRI) as a part of basic resources surveys since its establishment in 1959. These studies include socio-economic aspects of settled, semi-nomadic and nomadic population. Anthropology, sociology and culture of the population in the arid areas is characteristic and somewhat different than rest of the country. A number of scientific and technical papers arising out of these studies have been published in various journals.

The primary objective of this bulletin is to summarise the work done in sociology at one place. It is hoped that the material of this bulletin will be useful. Comments and suggestions are invited.

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INTRODUCTION

Man has been one of the most important and active agent of biotic interference in the fragile eco-system of arid zone of Rajasthan. Human resources assessment therefore, formed an important component of integrated natural resources surveys for the resource use planning. Since the population of the region can be categorised in two distinct groups viz. settled and nomadic, socio-economic surveys were accordingly planned. Though various methodologies viz. observation, interview, case study and geneological method were applied for eliciting information, the most effective method had been the sample surveys through the application of specially formulated schedules. While random sampling design was adopted for the survey of settled population, quota sampling had to be followed for the survey of the nomads in view of the inherent difficulties of the availability of the universe at one place and at a time. For establishing macro-level data base pertaining to the human population, land use, cropping pattern, livestock population, etc. the data available in different census reports, revenue reports, statistical abstracts, have been utilized.

POPULATION CHARACTERISTICS

Density and spatial distribution

Spread over an area of 213.8 thousand km², the region had a population of 10.2 millions according to the 1971 census. The average density

TABLE 1*

DISTRICTWISE AVERAGE ANNUAL RAINFALL AND
DENSITY OF POPULATION

S.No.	Districts	Normal annual rainfall (mm)	Density per km ²	Density per km ² of sown area
1.	Jaisalmer	164.0	4	110
2.	Sri Ganganagar	253.7	68	95
3.	Bikaner	263.7	21	89
4.	Barmer	277.5	28	61
5.	Jodhpur	318.7	51	97
6.	Churu	325.5	52	70
7.	Nagaur	388.6	72	101
8.	Jalore	421.6	63	89
9.	Jhunjhunu	444.5	157	184
10.	Sikar	466.1	135	179
11.	Pali	490.4	79	154
12.	Sirohi	638.4	82	225

*Based on Rajasthan Statistical Abstracts, Govt. of Rajasthan, Jaipur

of 48 persons per km² is quite high as compared to the other desertic regions of the world (Malhotra, 1977). Though the variations in the densities of population occur on account of topography, soils, land, occurrence of economic minerals, accessibility and other socio-economic factors, water is the most important factor determining the distribution and density of population (Table 1). The co-efficient of correlation between the rainfall and density of population was worked out at +0.6079. The population density in the district of Sri Ganganagar is higher due to availability of surface water through canal irrigation. Similarly, the districts like Jhunjhunu, Nagaur, Jodhpur, Sikar, Sirohi and Pali having greater facilities of well and tank irrigation, have higher density of population.

Population per km² of sown area (physiological density) is lowest (61) in the district of Barmer which has an average annual rainfall of 277 mm. As rainfall decreases or increases this figure the number of persons per km² of sown area increases. The higher physiological densities in the wetter districts is due mainly to intensive cultivation while the same is higher in the drier districts due mainly to increase in pastoral activities.

Population trends

With a base of roughly 3.567 millions in 1901 the population increased to 10.23 millions - an increase of over three times. The growth rate of population between 1901-1971 had been of the order of 186 per cent as compared to 150 per cent increase in the Rajasthan state and 132 per cent increase in the country. During each successive decade (except 1911-1921) the population exhibited a constant increase. The acceleration of growth in recent times (Table 2) is exhibited by the fact that the number of new additions in only ten years (1961-1971) worked out to 62.64 per cent of the number present at the beginning of the century. Further the percentage increase of population was found to be higher in the areas receiving comparatively lower average annual rainfall, e.g. in the region receiving less than 300 mm rainfall and constituting districts of Barmer, Bikaner, Jaisalmer and Sri Ganganagar, it was 302.75 per cent as compared to 167.28 per cent in the region receiving 300 mm to 400 mm of rainfall constituting districts of Jodhpur, Nagaur, Churu and Jalore and 146.5 per cent in the region receiving 400 mm or more than 400 mm of

rainfall, constituting districts of Jhunjhunu, Pali, Sikar and Sirohi. Thus, relatively a higher rate of increase of population in the extremely arid tracts poses a serious situation specifically when viewed in the context of limited resource potentials in such regions.

TABLE 2*

DECENNIAL PERCENT VARIATION IN POPULATION IN ARID ZONE OF
RAJASTHAN AND INDIA (1901-1971)

Year	Arid Zone of Raj.		Rajasthan		India	
	Popula- tion (millions)	Growth rate (%)	Popula- tion (millions)	Growth rate (%)	Popula- tion (millions)	Growth rate (%)
1901	3.57	—	10.29	—	236.28	—
1911	3.88	+8.70	10.98	+6.70	252.12	+5.42
1921	3.58	-7.80	10.29	-6.29	251.35	-0.30
1931	4.28	+19.81	11.75	+14.14	279.02	+11.00
1941	5.28	+23.16	13.86	+18.01	318.70	+14.22
1951	6.20	+16.73	15.97	+15.20	361.13	+13.31
1961	8.00	+29.84	20.16	+26.20	439.24	+21.64
1971	10.23	+27.95	25.77	+27.83	547.37	+24.66
Over all from 1901 to 1971	6.66	+186.78	+15.47	+150.30	+311.08	+131.65

*Based on decennial census of India, Manager of Publications, Govt. of India.

Growth potential

The potentialities of the growth of population are indicated by the present age and sex composition of population and its marital

status. The age and sex composition of the population showed a preponderance of the young population e.g. those under 10 years of age represented 31.38 per cent of the total female population and 31.57 per cent of the total male population. The percentage distribution of children (0-14 years), young (15-34 years), middle aged (35-54 years) and old (55 years and above) worked out at 43.75, 31.73, 17.26 and 7.26 respectively during 1961 and 45.35, 29.75, 17.38 and 7.52 respectively during 1971. Thus the younger people (0-34 years) constitute over 75 per cent of the total population that would substantially enhance the population in the near future even if measures are taken to check the population growth. The most important factor brought out by the age-sex composition is the implied dependency ratio. Though earners are initiated at fairly young ages in arid areas and sometimes the old (about 55) do work as family workers their contribution is small. Taking the population within the age range 15-54 years as productive it is found that 47.12 per cent of the population in productive ages worked for 52.88 per cent of the population in non-productive ages i.e. every 100 persons in productive age group work to support 112 persons in non-productive ages.

Marriage is another important variable connected with age and sex which is indicative of future growth of population. The age

TABLE 3*

AGE AND SEX DISTRIBUTION OF THE UNMARRIED POPULATION IN
ARID ZONE OF RAJASTHAN

Age group (years)	1951		1961		1971	
	Male %	Female %	Male %	Female %	Male %	Female %
0-14	78.20	93.70	79.57	96.15	79.33	94.82
15-34	18.40	5.70	18.28	3.57	18.75	5.11
35-54	2.30	0.40	1.40	0.09	1.39	0.04
55 & above	1.10	0.20	0.75	0.19	0.53	0.03

*Based on Census of India, 1951, 1961 and 1971, Rajasthan Manager of Publication, Govt. of India.

distribution of unmarried males and females during the decades 1951, 1961 and 1971 (Table 3) reveal the practice of early marriage and its universal character. The data indicate that there were very few unmarried people over 35 year of age indicating a universal nature of marriage. Even in the age group 15-34 years the percentage of unmarried women was very small. Indications of future growth rate of population are further available by analysing the figures relating to the number of females in the reproductive period (15-44 years). There

TABLE 4*

**DISTRIBUTION OF WOMEN BY FIVE YEARS AGE GROUPS OF THE
REPRODUCTIVE PERIOD IN ARID ZONE OF RAJASTHAN**

Age group in years	1951 %	1961 %	1971 %
15-19	19.10	18.39	20.01
20-24	18.40	21.72	19.84
25-29	19.60	19.44	18.03
30-34	17.70	16.64	16.85
35-39	12.20	11.45	12.66
40-44	12.90	12.36	12.61

*Based on census of India, 1951, 1961 and 1971, Rajasthan Manager of Publication, Govt. of India.

were 4037 females in the age group 15-44 years for every 10,000 women of all ages which number is quite high. The age composition of the females (Table 4) in the reproductive period and their marital status further indicate the expansive potentialities for growth of population. There were greater number of women in their first half of the reproductive period through 1951 to 1971 than in the 2nd half of the reproductive period and the percentage of married women in the reproductive period worked out at 90.31 which also is indicative of the higher growth potential. One could surmise that if the growth of

population remains unabated and rate of growth remains the same as during the decade 1961-1971, the population by the turn of the century will be over 21.54 millions.

Growth factors

The major factor responsible for such a phenomenal rate of growth of population is the widening gap between the birth and the death rates. By and large the external migration has played a relatively insignificant role in the population dynamics in the arid zone. In-migration has been very limited because of the absence of the factors like productive lands, large scale industries and mineral production. In spite of the heavy push factors viz. excessive overcrowding on the already oversaturated lands etc. there has not been much of outmigration due mainly to the lack of pull factors (like absorption in big industries or other urban vocations) and also due to the backwardness of people, poor means of communication and the sway of the social institutions like the joint family system, caste system, early marriage, and the illiteracy and conservatism of the people (Malhotra, 1977). For instance, the percentage of in-migration from other states to Rajasthan (1961 census) worked out at 4.90 per cent of the total population while that of out-migration from Rajasthan to other states worked out at 5.62 per cent. Thus the net out-migration had been only 2.14 per cent of the total population.

Social values are pre-disposed (Malhotra, 1976) for having more children and positive sanctions for fertility far out-number the negative ones. Early marriage and begetting of children are integral parts of the social ethos of these people. Mainly to save expenditure on separate feastings, marriages of the girls of lineage in which a person has died are performed on the third day of his death when a death feast called "*mossar*" is organized. Thus the "*Kukkawar*" (mourning cries) and "*Gitgawar*" (marriage songs) are heard at the same time on this day. Marriages were recorded to have been performed on the 3rd day of the death of even the real mother or father of the girl. After the third day all mournings are over. Child marriages are most prevalent and the minimum age of marriage of both girls and boys may be even less than a month. In some cases, marriages are settled before the child has seen the light of the world. The *Bishnois* - a predominant agricultural community in the region holds the view that girls should

be married before they attain the age of 12 years or before her coming to first menstruation. The actual consummation of marriage (Muklawā), however, takes place when the girl attains the age of 12-14 years. Marriages once enacted cannot be annulled. Any deviation from the established norm being not only looked down upon as grossly aberrant but also as wholly incompatible with the social fabric of the community. Divorce is a rarity if not altogether unknown and widowhood soon culminates in remarriage. While begetting a son is considered a must in order that the family line remains unbroken, a daughter born in the family is also held in importance among several communities inhabiting arid zone, as she has to be given in marriage in exchange for a prospective bride from the family of the daughters-in-law. Additionally, among several communities the prevalent dowry system provides financial premium on sons and this leads to craze for having greater number of sons. Coupled with this strong and deep rooted adherence to the custom of marriage and procreation, improved medical care in recent times has greatly minimised mortality at birth and prolonged the span of longevity. More than eight out of every ten persons still live in the rural areas with all their problems, backwardness and daily life saturated with customs and practices which often override prudence. The percentage literacy and its level is rather low and even today not even 2 out of every 10 persons are literates and the majority did not send their children to school as the services of the children could not be afforded to be spared. Caste is still the pivotal social institution and has restricted social and occupational mobility and fostered values and sanctions concerning fertility. The present and the prospective role of the women is no better than what has been described by Romilla Thapar (1954) "she should never be independent, her father has authority over her in childhood, her husband has authority over her in youth and in old age her son has authority over her". The percentage literacy among the female population worked out at 5.86 in 1961 and only 7.85 in 1971, thus exhibiting a very small increase during a period of ten years. Similarly, the rural females getting work outside the home (apart from the family labour that they provide), would have been another factor towards changing the attitude of the females for limiting the number of children that she should bear has not exhibited a substantial increase.

The major form of human occupancy is marked by instability that carry the hazards of sudden failure leading to famine conditions.

Under such circumstances to a person who needs a fresh capital to be able to produce or earn, an extra child is very good risk capital. And since many of these children do not get to school the cost of this risk capital far out-weighs the tempting benefits that this will provide right when the child attains 9-10 years of age (Malhotra, 1977) he is initiated as worker in desert areas specifically engaging him in the livestock grazing etc.

Population control

Family planning programmes undertaken in the region after independence have not yet made much headway, due mainly to their inherent weaknesses in terms of negligence of cultural variables which are mainly responsible for creating chain of resistances. It may be emphasised that the obstacles to small family norms are not primarily technological but sociological. Unless the ancient prejudices, deeply ingrained beliefs and traditional cultural practices are taken into account it will deprive us of the sources of support to any family planning programmes and lead us to centres of resistance. A mere addition, in the number of family planning clinics which do provide information and services is likely to have a limited effect and motivation will not increase in view of these two aspects alone. Additionally, it may also be necessary to have an intensive population education programme both in and out of the formal school system-because of the high rate of school drop outs. Such a programme also needs thorough integration with the running adult education programmes.

SETTLEMENT PATTERN

It is largely due to the distinct physical and cultural characteristics of the desert, like the dunny character of the landscape, the scattered location of water sources, the socio-cultural heritage of certain castes, the *Jagirdari* system and the traditional custom of bringing in tenant-cultivators, that the villages are located over long distances from each other and majority of the population live in dispersed dwellings situated in their respective agricultural fields. According to 1971 Census there were only four villages per every 100 km² as against 10 villages for every 100 km² in Rajasthan. Many villages have marked shift from smaller to larger size. Despite these tendencies, over 90 per cent of the population has been residing in villages having less than 2,000 persons (1971 Census). Tracing the history of settlement pattern in arid zone villages it has been observed that the sequence of settlement has been initially for the compact settlement to grow around the houses of the first few families who settled there. Later, people moving seasonally to their agricultural fields and finally establishing households there. Availability of land and the possibility of better agriculture were two important factors influencing settlement. Other factors were, kinship ties, the protection to the settled farmers, tradition and the desire of the *Jagirdar* (erstwhile feudal landlord). Most of the migrants to the village came from nearby places. The present form of settlement shows clustering not only by caste and clan but also by lineages, since in the patrilineal structure of society agnatic ties have much greater influence on the proximity of settlement. Uterine kins and affines influence settlement pattern only when individuals live with their maternal uncles or relations-in-law and settle nearby. In course of time, they have their own lineage groups. Thus each settlement has one or more kin groups (Bose and Malhotra, 1963).

The difference in age and sex distribution, nature, size and composition of households, average number of earners, size of holding and

number of fragments per household in *dhanis* (dispersed dwellings) and in village core were not significant. However, households living in *dhanis* have on the average, a larger number of livestock and the sale value of livestock produce is also greater. Indebtedness is higher in the case of households living in compact settlement. The nature of activities and the type of social relationships have also been conditioned by the form of settlement. The web of social relationships is confined within the cluster of *dhanis*. Households living at the core make greater use of the community facilities while households living in *dhanis* are inadequately covered (Bose and Malhotra, 1962).

Rural household

The household is well nigh a universal institution and assumes the function of providing food, shelter and security. No authentic data from earlier surveys/records were available regarding the type of household traditionally, prevalent in this area. During surveys, it was found that in the past, majority, of the households were large sized joint households. The high growth rate of population coupled with the so called modern impact has led to the break up of the traditional joint families with the deep ties in rural community to the formation of the nuclear families. Of the households surveyed (Malhotra and Sen, 1964), 52 per cent were found to be nuclear. The traditional large size households are gradually disintegrating and among the population small, medium and large size households have come to exist. Survey (Malhotra and Sen, 1966) conducted in Barmer district of Rajasthan revealed that 27 per cent households had 1-4 members, 55.7 per cent had 5-8 members and the remaining 17.3 per cent had 9 or more than 9 members. The association between the type and size of households was significant.

With this transformation of the household from joint to nuclear, the individualism has become increasingly manifest in familiar relationships. This has resulted in increasing fragmentation of land, uneconomic but unavoidable duplication of assets and excessive pressure of livestock on land. The disappearing joint family is posing a paradox—just at the time when new longevity conditions are generating the necessity for the care of the aged in the joint family, the other forces are conspiring against it and more and more nuclear families are being formed. There being little state mooted old age security measures

(old age houses or old age pensions, etc.) the parents like to have additional number of male issues so that they can fall back upon at least one during their old age.

Housing pattern

Due to inherent difficulties caused by inadequate transport facilities and poor economic conditions of the people mostly the indigenous flora and other locally available material is utilized for the construction of houses. The nature and type of housing at the core differs from that in the *dhanis* in several ways. At the core the different families live close to each other while in the cultivated fields they are at a distance. In the *dhanis*, however, the family builds a *jhupa* (hut) in one of its fields so that the families live scattered. Secondly, at the core a few houses belonging to Mahajan, *ex-jagirdar* and some other are built of sandstone brought from towns. Most of the families in *dhanis* live in *jhupas*. The bulk of the circular *Jhupas* are 'Katcha.' The walls are often made of mud and the conical roofs are skillfully thatched with the stalks of *Senia* (*Crotalaria burhia*), *Kheemp* (*Leptadenia spartium*), *Bajra* (*Pennisetum typhoides*) and *Aak* (*Calotropis procera*), etc. The central pole which supports the apex of the roof is also made out of the local flora and is commonly made from the stumps of *Khejri* (*Prosopis cineraria*) and *Rohira* (*Tecomella undulata*). A household may have one or more *Jhupas* depending on the needs and the socio-economic status of the inhabitants. Often in the compound there are small structures called "Dhan-kothis" for storing grains. The compound is generally covered with a boundary wall built of the twigs of *Bordi* (*Zizyphus nummularia*) about six feet high to ward off animals, thieves and also for protection against strong winds. In many villages the most imposing structure in the village is the mansion of the former *Jagirdar* of the village. Government functionaries (*Patwari* and the *Gram Sewak*) living in the village generally reside in the new stone quarters constructed for them.

The number of living-rooms is usually related to the economic status of the household, its values, and the age and the sex composition of the members. However, the available space sets the limits to the number and the type of structures that can be put up. There is usually a *jhupa* or *padwa* for each young married couple. Old and middle-aged

married men and unmarried men often sleep together. Old and middle-aged women and young unmarried women do likewise. Children usually sleep with their parents or grandparents. The congestion in living rooms is fairly acute, the only redeeming feature being the open space and courtyard frequently used for sleeping in the summer.

Occupational castes use a portion of the house usually a shed near the entrance, for following their crafts and for attending to their clients.

Segregation by sex in social relationships is reflected in the arrangement of rooms and their use. People who can afford keep an additional room for receiving guests and visitors. The influence of caste in housing design is noticeable in the greater seclusion of women among castes observing *purdah* as, for instance, in the families of Rajputs and Mahajans, separate inner wings out off from the outer rooms are built. Cattle are usually tied in a portion of the house as a precaution against cattle thefts. There is no particular orientation followed by families in the construction of houses for making the best use of light, air or sun. These are built facing the streets which are narrow and meandering with varying width. There are usually no windows. The doors are low and the rooms somewhat dark and stuffy. Cow dung mud coating is extensively used at regular intervals on the walls and floors for maintenance and repairs.

Household conveniences are generally lacking. Several houses do not have even a separate kitchen. Pots, pans and utensils are few and vary with the economic conditions of the family. There is no provision for bathrooms or latrines. Defecation is done in the open. There is no provision for regular cleaning of the village streets or clearing refuse. Household equipments are few. The chief item of furniture is the cot. Lanterns or torches are not found with most families. There is no provision for public lighting so that when the day is over the whole village is enveloped in darkness. Most families retire to bed early and get up early.

Food and dress pattern

The staple food of the rural folk is *bajra* (pearl millet), the common preparation from which is *sogra*-the baked bread and the *dal* (pulses). Additionally, the air dried seeds and pods of locally available trees and

shrubs are used for preparation of curry. Ordinarily, the females cook the food and first serve to childrens, later to the other male members and then the females take food in the end. Due to prevalence and occurrence of frequent drought, however, *bajra* is also not always available in sufficient quantity. The farmers, therefore, adjust their food according to the grain availability e.g. during lean years instead of *bajra* bread the following is eaten which satisfies hunger by lesser consumption of grain. This is said to affect health but is a means of survival.

1. *Rabdi* — *Bajra* flour and butter milk is cooked and this provides 50% saving in the consumption of the food grains.
2. *Khich* — Ground *bajra* grains and *moth* are cooked in water and it was said the consumption of 5 kg grains is reduced to 2 kg grains.
3. *Doh* — During the extreme lean period, when even butter milk is not sufficiently available, the small quantity of butter milk is kept in the sun and allowed to ferment and this is used with cooked ground *bajra* grains. The continuous consumption of such food, however, supposedly affects the eyes and causes night blindness.

Similarly, in times of scarcity the seeds of *Blhoot*—a prickly grass is ground and used as a food.

The dresses worn by men and women are very colourful and of variegated designs. The menfolk wear long flowing shirt made of cotton or wool tied by laces known as *Angrakhi*. The *dhoties* are quite common and the headgear is made of variegated colours ranging from plainly dyed to those profusely covered with intricate designs. Women wear tight fitted blouse called *choli* often also studded with small circular mirror pieces. The headgear is very colourful known as *Odhini* and this also covers partly the *Angrakhi*. The rural females wear many ornaments both of silver and gold on their feet, ankles, neck, shoulders,



A typical village belle.



Children adorned with ornaments.

ear, forehead and head. Large sized *Bor* (a leaf shaped disc helped by the chain worn round the head) worn by the women are the sign of wedlock. Menfolk too, among certain castes and of a higher economic status wear ear rings known as *Murkees*. The material, quality and quantity of material however, depends chiefly on the socio-economic status of the family.

CASTE SYSTEM

Caste is still the most pivotal social institution. Several studies conducted on "caste" (Bose and Malhotra, 1964; Bose, Malhotra and Saxena, 1965; Malhotra and Bharara, 1965; Malhotra, Bharara and Shyam Lal, 1975; Malhotra and Trivedi, 1977) provide quantitative information about the occupational castes, agricultural castes, castes in a community development block and the scheduled castes, scheduled tribes and non-scheduled population and on the intercaste relations and caste hierarchy.

The villages have heterogenous caste composition and the village society enjoins upon each caste to perform certain functions which are inter-dependent and complementary and weave the economic system into a single integrated unit. All the castes practice cultivation, but some follow their traditional caste occupations as well, often as a household industry. On the basis of the traditional occupation or functional specialisation, the castes inhabiting the region may be grouped in five broad categories viz. (i) agricultural castes like *Jats*, *Bishnois*, *Rajputs*, etc. (ii) castes practising agriculture and also serving needs of agriculturists, like *Suthars*, *Lohars*, *Bambis*, etc. (iii) castes practising agriculture and also serving the needs of the community with regard to the socio-religious ceremonies like *Brahmins*, *Sads*, *Swamis*, *Sewaks*, *Dakots* and *Dadis* (iv) castes practising agriculture, and also serving the other needs (like hair dressing, stitching clothes, making silver and gold ornaments, providing cleaning services, etc.) of the community like *Nais*, *Darjis*, *Sonars*, *Khatris*, *Kumahars*, and *Sansis* and finally (iv) the castes having animal husbandry as the major occupation like *Raikas* and *Muslim* cattle breeders (*Goperas*, *Kharls*, *Billoch*, etc.)

The interdependence of the different castes in the economic organisation of the village becomes more emphasised during occasions of marriage, festivals, etc. when each caste has a specific contribution

to make. The services rendered by *Suthar*, *Lohar*, *Nai*, *Bambi* and *Darzi* castes are governed by what is known as the *aat system* under which every family caters to the need of a group of families for a particular type of service (like fabrication of wooden implements, shoe making and so on), payment for which is fixed by tradition and made on an annual basis either in cash or kind at the time of harvesting of grains. The amount to be paid depends upon the quantum of work, families with large agricultural holdings or large number of members generally paying more. Sometimes, a part of the services are governed by *aat* and a part by other transactions.

The study on agricultural castes has shown them to be numerically strong and high in ritual status with larger economic assets (larger land holding and livestock) than the other groups. This makes them the dominant group in village and even in political affairs, particularly in matters connected with land and agriculture. Most of the *Sarpanches* in *gram-panchayats* come from these castes. Commonness of interest and kinship ties among more families of these castes in the village add to their solidarity and effective functioning as a group. The recent land reforms diverting the *Jagirdar* of his powers over land have improved the political strength and prospects of the non-Rajput agricultural castes and made them a more vital force.

The scheduled caste and scheduled tribe population percentage in the arid zone of Rajasthan was 15.81 and 3.65, respectively, as against 16.67 and 11.67 per cent of such populations in the whole of Rajasthan (1971 Census). Cultivation formed a major occupation of approximately three-fourths of the households (Malhotra *et al.*, 1975). Only 4.03 per cent workers among the scheduled tribes were engaged in household industry as compared to 9.40 per cent workers among the scheduled castes and 7.27 per cent workers among the non-scheduled population engaged in this occupation. The land holding size is minimum among the scheduled tribes and maximum among the non-scheduled population.

Traditional caste, *Panchayat*, still plays a very important role in maintaining the social control in the society, specifically among the nomadic groups (Malhotra and Bose, 1963), the life is governed by their own political institutions which have been shaped by the exigencies of nomadic life. Majority of the disputes on social breaches of rules regarding eating, drinking and having other forms of social intercourse with the members of other castes, breach of rules regarding marriage, abduction, illicit relations and other cases of moral turpitude, all forms

of social vices prescribed by the *nyai* (caste *panchayat*), quarrels between different members on matters relating to property, money, etc., breach of caste etiquette and customs on occasions of births, deaths, marriages, etc., thefts, embezzlement of public money and violation of the religious beliefs and practices are more often than not decided by *nyai*. The sanctions which operate to ensure conformity to their codes are both positive and negative. Among the positive sanctions may be mentioned the desire to win the esteem of the group, which motivation is fairly strong in primary groups, and the desire to abstain from doing anything irreligious which has been possible only through rigid conformity to the unwritten social codes as manifested in customs, traditions and conventions. Among the negative sanctions may be mentioned the imposition of fines, social humiliation, the denial of certain rights, and even excommunication. The force of such sanctions has been over-whelming, for the codes are inclusive in character and embrace all phases of life unlike modern society in which there are separate codes for different spheres.

Many of the problems are solved by social ostracism and ridicule and one of the heaviest types of punishments among certain groups like *Banjaras* is the levy of the fine of two *paisa* or *takey ka dand* which implies that the man on whom this fine is levied is worth only two *paisa* and moves everywhere with this stigma. Among many nomadic groups the doctrine of collective responsibility and principle of clan vengeance is still operative.

LIVELIHOOD SOURCES

Approximately two-thirds of the total population constitutes the non-working class. Such high percentage of economically inactive population may largely be attributed to the high concentration of population in lower age groups. The occupational distribution of the working population (Table 5) revealed that cultivation and agricultural labour formed the main occupation of over three-fourth of the total workers. Another major occupation followed by the workers is the operation of household industries and manufacturing other than household industries. Trade, mining and other services formed the chief occupation of a small percentage of earners only. Animal husbandry is, however, often followed as a subsidiary occupation by the majority of the households and in certain pockets (where the aridity index is relatively high), such as the Anupgarh-Pugal region, it formed the main occupation of over two-thirds of the total workers (Malhotra *et al.*, 1966).

Agriculture

Prior to independence and subsequent land reforms, one-seventh of the villages in Marwar were under the direct management of *Darbar* (feudal kings) and were called *Khalsa* villages. Most of the remaining land was under the system of tenure known as *Jagiri*. The *Jagirdar* did not have any property rights but stood between the king and tiller of the land, but so far as the tenants were concerned, the *Jagirdar* behaved in all aspects as owner of land. Rents were in many areas fixed as a proportion of the produce which rose automatically with increase in production. Thus, there was little security of tenure or incentive to increase production. It was natural for the peasantry to over-exploit the trees and vegetal resources, the farm and the grazing lands in an indiscriminate manner. The feudal land systems were an

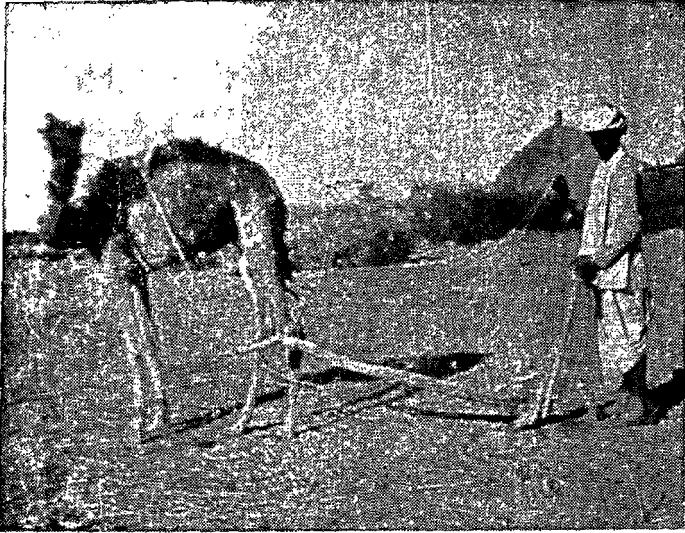
anathema to the cultivators, and the new democratic Government established to abolish them with the Rajasthan Land Revenue Act of 1956. Now almost all the land is held directly from the Government

TABLE 5*

OCCUPATIONAL DISTRIBUTION OF WORKERS
INHABITING ARID RAJASTHAN

Occupation	1961		1971	
	Total No. of workers	(%)	Total No. of workers	(%)
Cultivation	2.38	74.84	2.01	64.84
Agriculture labour	0.11	3.46	0.32	10.32
Mining quarrying and livestock	0.04	1.26	0.08	2.58
Household industry	0.23	7.23	0.11	3.55
In manufacturing of other than household industry	0.05	1.57	0.09	2.90
Construction	0.03	0.94	0.04	1.29
Trade and commerce	0.10	3.14	0.14	4.52
Transport, storage and communication	0.04	1.26	0.26	1.94
Other services	0.20	6.29	0.25	8.06
Total	3.18	100.00	3.10	100.00

*Based on census of India 1961, 1971, Rajasthan Manager of Publication, Govt. of India.

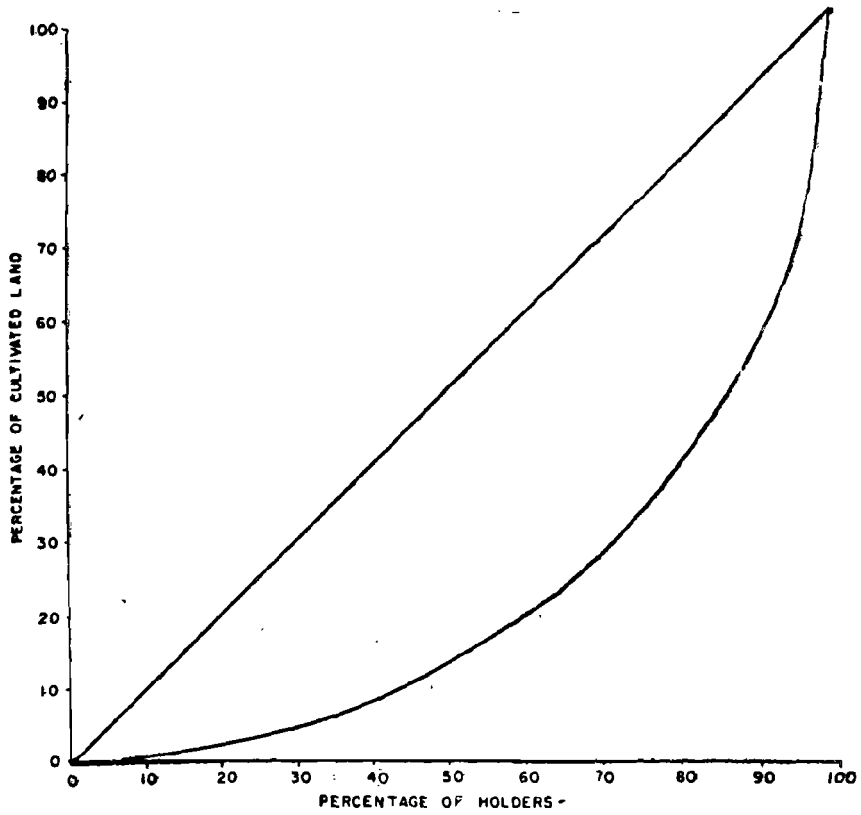


Ploughing by camel.



A group of kalbaliya jogia

DISTRIBUTION OF CULTIVATED LAND IN ARID RAJASTHAN



(Fig. 1)

on payment of land revenue, the rates of which vary according to the type of land. The land has been distributed to landless specifically to scheduled castes and tribes and other weaker sections of the society through various agrarian reforms (Purohit, 1976 and 1977).

Irrespective of the erstwhile land tenurial systems more than 85% of land was owned by single *Rajput* clan in 1893 in a case study area of *tehsil* Shergarh, district Jodhpur. This mono-caste monopoly remained pronounced upto *Jagir* abolition. After enactment of ceiling on holding acts (1963 and 1973) an overwhelming proportion of land was acquired from *Rajputs*, *Brahmins*, *Oswals*, etc. These types of land transfers in ownership rights has tended to initiate the reduction in gaps between 'have' and 'have-nots'. Allowing some degree of variance depending on caste and erstwhile land tenurial system, the implementation of land reform programme still has to go a long way in mitigating the sustenance and perpetuation of the imbalances of land resources.

The average size of land holding in the region worked out to be 9.9 ha which is almost double the average size of holding in the state. The land distribution (Fig. 1), however, is uneven and there is a concentration of land holding in the hands of a few richer farmers, e.g., only 11.2 per cent households possessed 50 per cent of the total land in the region, whereas 47.3 per cent of households held only 10 per cent of the total land. The man to land ratio, is fast declining. The total land available per household was 17.77 ha in 1951, only 14.69 ha and 12.40 ha was available during 1961 and 1971, respectively, and only 7.52 ha is likely to be available by the turn of century. Similarly, the total cultivable land available per household declined from 13.72 ha in 1951 to 9.95 ha in 1971 and only 6.03 ha is likely to be available in 2001.

As a consequence the farmers are making more and more constant use of the land for cropping thus disturbing the earlier practice of leaving it fallow for replenishing its fertility. The cultivation has also been extended to the marginal and submarginal lands. Viewing historically (Mann *et al.*, 1977) it is noticed that the percentage net sown area in arid zone of Rajasthan had been 28.61 in 1951, 41.07 in 1961 and 45.05 in 1971 while the percentage of double cropped area during this period ranged from 0.41 to 1.45 per cent only. The net sown area increased by 44.64 per cent during 1951-61 and by an additional 9.47 per cent during 1961-71 and the area under less intensive uses of land (Barren, cultivable and uncultivable waste lands, permanent pasture and fallow lands) declined by 16.83 per cent during 1951-61 and further by 6.95

per cent during 1961-71. The over crowding of labour force on agriculture has therefore, been resulting in the use of land beyond its ecological capabilities and its productivity has sufficiently declined. The annual linear growth rate (1954-70) in the area, total production and productivity of principal crops (Table 6) revealed that the area under important crops like *bajra* (Pearl millet), pulses and sesamum

TABLE 6

THE ANNUAL LINEAR GROWTH RATE OF THE AREA, PRODUCTION AND PRODUCTIVITY IN RESPECT OF VARIOUS CROPS (1954-70)

Crop	Area	Production	Productivity
<i>Bajra</i>	+2.41	+1.34	-0.66
<i>Jowar</i>	-3.41	-5.42	-4.88
Wheat	-0.82	-0.24	+0.60
Barley	-1.16	-0.05	+0.68
Gram	-6.31	-1.67	-1.59
Sesamum	+3.24	-3.57	-4.23
Other pulses	+1.91	-1.08	-2.70

exhibited an annual increase whereas in production only *bajra* crop exhibited an annual increase and the productivity of all the crops has exhibited negative linear growth rate which is mainly due to the bringing in of marginal and submarginal lands under cultivation.

There has been 67.92 per cent increase in irrigated area in 1972-73 over the base year 1956-57 (Table 7). The percentage area irrigated ranged from 2.37 in 1966-67 to 4.25 in 1969-70. As regards the annual changes in irrigated area, the region has been characteristically following almost a rhythmic pattern with rainfall.

Despite the availability of existing irrigation facilities and the incoming Rajasthan Canal there still would remain 89 per cent of the area fit only for dryland cropping (Mann *et al.*, 1977).

The system of agriculture followed is thus expressive of the limitations imposed by aridity. Subsistence farming is largely in vogue

which tends to make the farmer security oriented (Bose *et al.*, 1965). This is an important cause of low level of income. Low capital investment, labour intensive agricultural operations, poor communication and inadequate marketing facilities impose further checks on efficient agriculture. Additionally, the rural social structure has functioned to conserve the hold of tradition and the weaker wedding links between

TABLE 7*

IRRIGATED AREA AND ITS CHANGES IN THE ARID REGION OF WESTERN RAJASTHAN (1956-73) INCLUDING GANGANAGAR

Years	Total reported area ('000 ha)	Irrigated area ('000 ha)	Irrigated area as % of the total area	Annual change, % (+ or -)
1956-57	21461	533.14	2.48	—
1957-58	21420	588.15	2.75	+ 10.32
1958-59	21363	595.65	2.79	+ 1.28
1959-60	21341	721.00	3.38	+ 21.04
1960-61	21314	649.02	3.05	— 9.98
1961-62	21360	733.86	3.44	+ 13.07
1962-63	21451	764.01	3.56	+ 4.10
1963-64	21348	844.56	3.96	+ 10.54
1964-65	21363	823.99	3.86	— 2.44
1965-66	21363	883.06	3.20	— 17.10
1966-67	21361	506.65	2.37	— 25.83
1967-68	21361	868.29	4.06	+ 71.38
1968-69	21377	839.23	3.95	— 3.35
1969-70	21377	903.90	4.23	+ 7.71
1970-71	21380	827.70	3.87	— 8.43
1971-72	21381	842.15	3.94	+ 1.75
1972-73	21376	895.55	4.91	+ 6.34

*Source : Statistical abstract, Rajasthan Directorate of Economics and Statistics, Rajasthan.

the technology and adoption are not hard to be located. More often than not socio-religious feelings override prudence and social customs, rituals and taboos (not doing work on several religious days, voice of the twice born the *Brahmin*, etc.) act as bottlenecks in agricultural development.

The differential adoption of the recommended agricultural practices is a crucial problem facing the extension workers. Some of the factors like age of the farmer, size of land holding, social participation, caste status, educational status, technical know-how, value orientation, etc., have been widely reported to have relationship with the adoption of innovations. The technique of multiple correlation was used (Malhotra *et al.*, 1974) to find out the extent of variation in innovatives due to these factors in the region.

The inter-correlation matrix and percentage variation in adoption due to the independent variables (Table 8) indicated that the land holding score, irrigated land holding score, membership participation score, knowledge test and material possessions were significantly correlated with the adoption score. Membership participation and knowledge scores accounted for a greater amount of variation (53.23% and 51.51%, respectively) as compared to land holding score (14.88%), irrigated land holding score (11.16%) and material possession (17.67%). There was also highly significant correlation between membership participation score and knowledge test which taken together accounted for a variation of 66.26%, that is, an additional variation of 13.03 per cent as compared to membership participation score alone. Irrigated land holding score and membership participation considered together accounted for an additional variation of only 2.15%, and material possession score and knowledge test accounted for an additional variation of 2.40%. When any other character was included with membership participation score and knowledge test score, there was no significant gain. The study thus suggest that it will be useful to encourage as much participation and involvement in various activities as possible and to explore the ways and means to provide full knowledge of the improved package of practices and the qualities of the innovations as these two factors predispose the farmers to quicker adoption of innovations. It may also be useful to start extension activities with the people having comparatively greater participation in various activities and possessing more knowledge about the innovations rather than giving greater weightage to those possessing larger farms having greater

TABLE 8

INTER-CORRELATION MATRIX AND PERCENTAGE VARIATION IN ADOPTION

Character	(x ₁)	(x ₂)	(x ₃)	(x ₄)	(x ₅)	(x ₀)	(x ₇)	(x ₈)	Adoption Score (ya)
Age of the head of household	(x ₁)	0.2659*	0.3060*	0.1603 ^{us}	-0.1842 ^{ns}	0.0251 ^{ns}	0.4182**	0.1286 ^{ns}	-0.0006 ^{ns}
Land holding score	(x ₂)		0.9098***	0.6191***	0.3511**	0.3611**	0.1497 ^{us}	0.6382***	0.3857**
Irrigated land holding score	(x ₃)			0.6391***	0.2301 ^{ns}	0.2942*	0.0873 ^{ns}	0.5858***	0.3444**
Membership participation	(x ₄)				0.2816*	0.5811***	0.0676 ^{ns}	0.7092***	0.7296***
Value orientation	(x ₅)					0.0549 ^{ns}	-0.0276 ^{ns}	0.5188***	0.1787 ^{ns}
Knowledge test	(x ₆)						-0.0620 ^{ns}	0.3869**	0.7177***
Livestock score	(x ₇)							0.0596 ^{ns}	0.0247 ^{ns}
Material possession	(x ₈)								0.4204**
Percentage variation in adoption due to :									
	x ₂	-	14.88	x ₈	-	17.67			
	x ₃	*	11.86	x ₉ and x ₄	-	55.74			
	x ₄	-	53.23	x ₄ and x ₆	-	66.26			
	x ₆	-	51.51	x ₆ and x ₈	-	53.91			

Source : Malhotra *et al.*, 1974.

material possessions, better value orientations and to those belonging to certain particular age groups.

Animal husbandry

Animal husbandry is the next important sector to agriculture. Livestock population far exceeds human population and like the growing human population the livestock population increased from 10.27 millions in 1951 to 16.44 millions in 1972 (Livestock census 1951, 1972). Table 9 presents the number and composition of livestock in arid zone of Rajasthan during the different quinquennial periods from 1951 onwards.

It is observed that of the total livestock, the percentage of sheep and goats ranged from 55.94 to 65.87 during the period 1951-1972. Due to recurring droughts and famines between the period 1967-1971 the number of cattle fell down heavily (19.91 per cent decrease) due to high mortality while the number of hardy animals like goats increased (34.97 per cent increase) to a substantial level.

In the Central and Lower Luni Basin area it was found that on an average a household owned 19.55 heads of livestock of which about one-third were bovine (Bose *et al.*, 1964). Bullocks and cows were kept by the largest percentage of households. Six-tenths of the households kept only cattle. The proportion of bullocks to cows was about 2:1. Among the cattle breeders of Anupgarh-Pugal region, where the animal husbandry formed the main stay of two-thirds of the workers, a household on an average had 2.05 bullocks, 11.80 cows, 6.66 young cows, 0.11 buffaloes, 0.06 young buffaloes, 2.37 camels, 50.47 sheep and 7.05 goats (Malhotra *et al.*, 1967). Approximately 97 per cent of the households kept cattle as one of the livestock. More than one-third of the households kept all types of livestock. About 50 per cent of the households were engaged in raising flocks of sheep. The herd size with a household was positively correlated with the size of household ($r = +0.463$), the number of earners in a household ($r = 0.4625$) the size of land holding with a household ($r = +0.1822$) and its extent of indebtedness ($r = +0.1862$) (Malhotra *et al.*, 1968). The partial correlation worked out for these factors revealed that size of household and number of earners per household accounts for more variation in herd size as compared to the extent of indebtedness and holding size indicating that labour force available in the family largely accounts for

TABLE 9*
NUMBER OF LIVESTOCK (millions) IN ARID ZONE OF RAJASTHAN

Livestock	1951		1956		1960-61		1965-66		1971-72	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Cattle	3.431	33.41	4.142	29.59	4.635	32.02	4.944	30.09	3.712	22.58
Buffaloes	0.775	7.55	0.826	5.90	1.030	7.12	1.218	7.41	1.167	7.10
Sheep	3.374	32.86	4.896	34.98	4.501	31.09	5.403	32.89	5.082	30.91
Goats	2.370	23.08	3.746	26.76	3.661	25.29	4.283	26.07	5.747	34.96
Camels	0.214	2.08	0.288	2.06	0.541	3.73	0.472	2.87	0.630	3.83
Others	0.104	1.02	0.099	0.71	0.108	0.75	0.109	0.67	0.101	0.62

*Source : Report on the Livestock Census of Rajasthan 1961, 1966 and 1972.

the possession of the size of herd in a household. The joint households possess larger herd size as compared to nuclear households. Hindus in the region had comparatively smaller herd size than the herd size possessed among the Muslim households. The sale value of livestock and livestock produce in a household increases with the households having larger herd size. Nomadism and the herd size possessed are significantly associated.

The information both from the primary as well as secondary sources thus revealed not only the preponderance of goats and sheep in the total livestock population but also the increase in goat population during the famine years. The importance of goats, lies not merely in the returns this hardy animal gives to the owner but also in its role in raising of sheep (Bose *et al.*, 1965). Goats often act as foster mothers to lambs as well as assist the shepherd in grazing and herding the sheep. Also, in case of any attack by wild beasts it is only the goats which bleat and give an instant indication to the owner about the attack. The rate of mortality among sheep is comparatively much higher than in goats during scarcity conditions. It is common saying that "*oont chodde aakra aur bakri chodde kankra*" i.e., during scarcity conditions, the camel will only leave the *Calotropis* but the goats will leave only pebbles. This implies that the goat can survive on the most scanty vegetation. The goat also acts as a poor man's cow. If, therefore, the goat is to be displaced because of its alleged association with rapid range denudation and soil erosion, a suitable substitute has to be found in order that there may not be a functional vacuum with consequent difficulties, in sheep rearing which is an important arid zone industry.

One of the limiting factors in improving animal production in arid and semi-arid regions is inadequate forage and drinking water. The feed given to animals varies according to the type of animal and the extent to which the feed is available. Cattle are given grass, *pala*, *doka*, *pharakti*, *gowar*, oil cakes and sometimes cotton seeds. *Pala*, which forms an important fodder and is extensively used, is the name for the dried leaves of *bordi* (*Zizyphus nummularia*) which are obtained from the fields of the cultivators themselves every year, when the shrubs are cut. It is generally given after mixing it with *doka*. *Doka* is the local name for *bajra* stalks. It is cut into small pieces, and is given as fodder after mixing it with *pala*. *Pharakti* is the outer-covering of *gowar* grains. *Gowar* grains are given to the bullocks and to the

milk-yielding cows and buffaloes. Sometimes the grains are mixed with other types of fodder. Oil cakes are also given to the better type of animals after the oil has been extracted from *til*. Grass in dry and green form is given quite extensively. Sheep and goats, particularly the latter, graze on all types of vegetation. They are also given *moth-chara*. The same is true for camels who are in addition given *Pharakti*. Most of the feed is home produced. It is only when shortage is felt in some items that purchases are also made.

Productivity of livestock is rather low because of their poor health and rate of mortality. Additionally, the socio-religious feelings and deeply ingrained beliefs towards animal life often over-ride prudence and the connected rituals add to the deterioration of already meagre available resources (Malhotra, 1966). The households belonging to upper castes consider it irreligious to get their bulls castrated and often wait till the opportunity for exchanging the same is available.

The decidedly greater advantage of keeping smaller number of animals of superior breeds are understood by the farmer. It is, therefore, suggested that facilities for exchange of poor quality livestock with better ones be provided. This should include giving of bullocks in exchange of bulls as the present system of exchange with *Sattias* is at present to the farmer's disadvantage. Vigorous efforts need to be made to control disease dissemination, to demonstrate improved techniques of animal husbandry and to extend supply of marketing and other facilities.

VEGETATION-HUMAN-RELATIONSHIP

Due to increase in population not only has more land been brought under the plough thereby reducing the number of trees and shrubs but also the increasing demand for wood has led to unwise exploitation of vegetal sources much in excess of what prudence would dictate. Trees and shrubs are put to multifarious use by households, particularly for meeting requirements of fuel wood, housing, fencing, animal feed and making ropes and baskets. For making agricultural implements, however, sometimes the timber is purchased when local resources prove inadequate for the purpose.

The National Council of Applied Economic Research calculated the fuel energy requirement per person per year to be 0.254 tonnes of coal equivalent of 1512.00 kcal. In rural areas, there is a tendency to use more energy than absolutely necessary since usually no expenditure has to be incurred. Assuming this extra consumption to be 10 per cent, the total wood requirement for fuel for rural population of arid zone of Rajasthan worked out to 2.06 million metric tonnes in 1951, 2.76 million metric tonnes in 1961 and 3.50 million metric tonnes in 1971. Apart from this, the annual wood requirement for other purposes worked out to 0.24 million metric tonnes in 1951, 0.31 million metric tonnes in 1961 and 0.31 million metric tonnes in 1971. The total wood availability on the ground from the degenerated land forms was estimated to 25.04 million metric tonnes in 1951, 23.48 million metric tonnes in 1961 and to 20.76 million metric tonnes in 1971.

The requirement and ever-increasing demand is huge and over exploitation of the vegetal resources is inescapable. Most of the villagers in rural areas procure firewood free from their own fields or from unoccupied lands. Digging *Phog* (*Calligonum polygonoides*) is a regular vocation and provides employment to a large number of people and use of their camels when not otherwise occupied. The digging of the roots loosens the soil and accelerate wind erosion. Unless alternative

sources for meeting the fuel needs are developed the process is likely to continue to add to the desertification process in the area.

Majority of the rural population is now facing acute shortage of fuel wood. Studies conducted in Central Lower Luni Basin (CAZRI, 1963) revealed that 89.7 per cent households, meet fuel requirements from their own fields, however, for agricultural implements 59.7 per cent households have to make purchase from the market. Shortage of fuel wood is experienced by seven-tenths of the households. Only 14.4 per cent households had planted trees during last 3 years. Villagers were interested in planting trees primarily for shade and for obtaining timber for agricultural implements. The older people in the village admitted that during the course of years the number of trees and shrubs has gone down steadily and not even 35-40 per cent of what was available 30 years ago has been left over. People were found to be aware of the need for planting trees for different purposes but a deep rooted belief exists that even if these were planted they would not grow because of scarcity of water except what grow in a natural way. Additionally, large proportion of population burns dung which would have otherwise been used for manure purposes. Thus, the rapidly growing population has inflated the demand for wood for different purposes while it has reduced the area under fallows, waste and forests.

Based on studies on social aspects of farm forestry (Bose *et al.*, 1965) it has been recommended that the rural population should be encouraged to plant trees around their habitation sources. Religious feelings of women folk should be exploited by having a small grove of *peepul* (*ficus religiosa*). It has been observed in the village that women pour water on them on their own initiative as this is regarded as a pious act. Similarly, on the *oran* lands (lands left after religious temples) tree plantations should be intensified as cutting of vegetation is religiously prohibited from such lands.

ENVIRONMENTAL PERCEPTION

Studies (Malhotra, 1976 and 1977) undertaken on the experience of farmers and their traditional perceptibilities towards desertification indicated that the region has been experiencing accentuation in conditions of desertification over the last 25-30 years and was also stated to be prone to the same effect in near future. The proper atmospheric conditions and wind directions at particular times in crop-cycles were crucial for a good harvest and this is reflected in their following common sayings.

1. "Sawan Baje Suryo Bhadron Purvahi"
"Asoj Baje Samandri-To Hove Sakh Swai"

(If the wind direction is from N.W. to S.E. in the month of July, from N.E. to S.W. in August and from S.W. to N.E. in the month of September then the farmer is likely to get a bumper yield).

2. "Vairo Baje Suryo"- "To Haloo Kiyon Purio"
"Ghare Bethi Janio"- "To Bhatta Kiyon Anio"

(the farmer asks his wife that when she had been knowing that the winds were coming from N.W. to S.W. direction in the month of July, why did she send the ploughmen and also bring his meal as the farmer was to return home because of the oncoming rains).

The farmers stated that wind direction had not, of late, been following the direction so aptly described in their above sayings. Regarding occurrence of dust storms most of the farmers in the *Panchayat Samiti* reported that the black and yellow dust storms quite common in earlier years have not occurred during recent years. These black storms of high intensity in earlier years were followed by heavy rains.

All the respondents opined that the amount of rainfall received in their region now as compared to that 25-30 years ago is much less.

Whereas they used to get *Sehlot* or *Adi-Mal* (the rains, covering all the villages within 60-100 miles) rains, rainfall now is much less wide-spread, so much so that it may pour in one portion of the village and the other portion may remain dry. Also, the erratic nature of the rainfall has increased and these *Khadia Badia* (erratic and less widespread) conditions have started occurring in the last 8-10 years.

The effect of desertification can be gauged by significant changes in fauna and flora of desertified area. The farmers perceived that total vegetal cover had registered a marked decrease followed by almost systematic proportion of decrease in livestock herd sizes. Some farmers have even started substituting cattle by goats and sheep. In opinion of respondents with marked decrease of vertebrates (Neelgai, wild pigs and deers), the nocturnal animals are on an increase which showed that desertification had been intensified in recent years.

Regarding changes in agrarian structure, it was opined that increase in cropped area has resulted into impoverishment of soil fertility. Combined with menace of salinity, the crop yields have according to respondents, registered significant fall save *rabi* crops where fertilizers have been applied.

Another common problem in cropping in the desert areas is the unsatisfactory germination of crops (known as "Rod") due to crust formation as a result of rains immediately after sowing of seeds. The problem was stated to be comparatively more now than it was 25-30 years ago, the main reason attributed was the less uniform pattern in the occurrence of rainfall now. Moreover, due to better soil fertility 25-30 years ago it used to take only 5-6 days for the germination of the seeds and for the growth of the plants upto the 3 leaves stage as compared to 8-9 days being taken now. Due to excessive and untimely winds, the seeds are also often covered by sand in the desert areas (locally known as "Rilna") and about one-third of the respondents reported losses on this account, though 30 years ago this problem was much less.

The farmers, thus opined that as a result of interplay of the increasingly harsh climatic factors and due to increase of population and in its needs the region has been experiencing accentuation in conditions of desertification over the last 25-30 years and was also

stated to be prone to the same effect in prevalence of improper winds, lesser precipitation, greater erraticity and uneven distribution of rainfall, decreased natural vegetation, introduction of xeric vegetation, impoverishment of soil, increasing salinity build up, lower yields per unit area and increasing famine periods as compared to 55-30 years ago.

NOMADS AND NOMADISM

The source of livelihood and the way of life of the people have been conditioned by disturbance in ecological balance due to severity of arid climate, continuous deterioration of soil, dwindling natural resources, occasional droughts, invasions, poor means of communication and consequential social and economic uncertainties. Famines of different kinds namely *Ankat* (great famine), *Jalkal* (scarcity of water), *Tinkal* (scarcity of fodder) and *Trikal* (scarcity of fodder, water and grain) have been of common occurrence in the region. To cope up with such unfriendly climatic and environmental conditions, the inhabitants have been resorting to nomadic and semi-nomadic life. Some of the significant findings of the studies conducted (Bose *et al.*, 1964; Malhotra, 1971; Malhotra and Bose, 1963, 1967; Malhotra *et al.*, 1966 a, b, c, 1967) are summarised in the following pages.

Nomadic groups

The nomads are not a separate ethnic group and do not have a separate territory with exclusive rights and economic framework. They are strictly speaking, not tribes but caste groups. Some of them like the *Banjaras* and the *Raikas* occupy a high position in the caste hierarchy while others like *Sattias* and *Sansis* occupy low rungs in the social order. Various factors account for this differential caste status but the nature and type of occupation practised gives a broad indication of their position in the society. Resource use having the decisive factor of the pattern of their living, the nomadic groups of the arid zone may be broadly grouped into four categories, viz., (a) the pastoral nomads (*Raikas*, *Sindhis*, *Parihars*, *Billochs*, etc.), (b) the trading nomads (*Banjaras*, *Ghattiwala Jogis* and *Gawariyas*), (c) the artisan nomads (the *Gadoliya Lohars*, *Sansis* and *Sattias*) and (d) miscellaneous type of

nomads (*Nats*, *Kalbeliya Jogis*, etc.). The pastoral people inhabiting the Rajasthan desert have been carrying on livestock breeding for generations and have contributed to the economy of the region by way of providing milch cattle, *ghee*, wool, mutton, etc.

The *Banjaras* trade in salt, cattle, fullers earth, onions and also engage in haulage of goods. The *Gawariyas* trade in beads, mirrors, combs, etc., and cater primarily to the needs of the village women. They use donkeys as pack animals and have fixed areas of operation, visiting the villages *en-route* at regular intervals. The *Ghattiwala Jogis* sell grinding wheels, *chhelum* (indigenous smoking pipe) and baskets to the sedentary population.

The *Gadoliya Lohars* are adept in fabrication and repairing iron implements and move about with their families in their bullock carts in small kinship groups. They also do trading in livestock, particularly bullocks, to a limited extent.

The *Sattias* and *Sansis* castrate the male calves maintained by the sedentary population, exchange their bullocks with the uncastrated male stock of such households who consider it irreligious to castrate the animals themselves, and trade in cattle to a limited extent. They are believed to be associated with immoral activities and stealing. The *Nats* show acrobatics and physical feats and also beg food grains. They are widely believed to be associated with criminal activities. The *Kalbeliya Jogis* are snake charmers who move from village to village showing snakes and begging food grains in return.

Relationship with settled population

The nomads performed an important complementary function in the economy of the region but in recent years, due to changes in the political, social and economy set up, the traditional relationship of mutual dependence between the nomads and settled population has largely broken down. Each type of nomad is associated with some kind of livestock which make indiscriminate use of the meagre available water and grazing resources and destroy the local soil conservation measures. The nomads in the present day thus prove a menace for the whole society and their sedentarization is inescapable. The opening up of means of communication has reduced the importance of distribution activities by the trading nomads. Shrinkage of grazing lands in

same area due to extension of cultivation has created difficulties for the cattle breeder nomads. Villagers are no longer dependent upon those nomads who rendered specialised services. The sedentary population in general do not welcome the nomads to visit their area. The feelings run strongest against the visit of *Raikas*, *Sindhi* cattle breeders, *Banjaras*, *Sansis*, *Sattias* and *Nats*. *Gawariyas*, *Ghattiwalla Jogis* and *Gadoliya Lohars* are more welcome.

Most of the respondents felt that the visit of pastoral nomads and trading nomads with large herds of cattle results in the destruction of standing crops and exhaustion of local water and grazing resources thus imposing hardships on the livestock of the settled population. The problem has been aggravated due to extension of area under cultivation. A significantly greater percentage of respondents considered that the visit of *Gadoliya Lohars*, *Gawariyas* and *Ghattiwala Jogis* was not disadvantageous to the settled population; some however, felt that the livestock kept by them as pack animals caused damage to crops and exhaust water and grazing resources. It was also alleged that they charged higher prices for low quality goods. *Sansis* and *Nats* were commonly believed to be associated with thefts and other criminal activities. A significantly greater percentage of respondents felt that the visit of *Sattias* does not result in any harm to the settled population. An appreciable number, however, felt that they are associated with thefts, crimes and immoral activities.

It was further opined that the settled population did not get any benefit from pastoral nomads, *Sansis* and *Nats*. About the visit of *Banjaras*, two-thirds of the respondents felt that there was no benefit, while one-third felt that the settled population could purchase salt and other commodities from them. About the other trading nomads, a significantly greater percentage felt that articles could be purchased, sold, exchanged or repaired.

Pastoral nomads

The pastoral people inhabiting the Rajasthan desert have been carrying on livestock breeding for generations and have contributed to the economy of the region by way of providing milch cattle, *ghee*, wool, mutton, etc. Detailed survey conducted among the livestock breeders of Anupgarh-Pugal region revealed that these nomads have been facing difficulties in grazing their livestock as there has been

shrinkage in the extent of grazing lands due to the extension of cultivation and also with the coming in of Rajasthan Canal in this area the economy of these livestock breeders is being much disturbed. The inhabitants of the region are not completely nomadic but have a permanent home and generally a parcel of land. Their nomadism is directly dependent on the necessities of their herds. The economy of these breeders is largely dependent on the harvesting of available water and the efficient use of extensive grazing lands available in the area, as the cultivated area is only 4 per cent of the total land surface.

Among the breeders, water harvesting for livestock is in vogue since generations. Having regional ecological association the traditional livestock breeders of the region have evolved it and is being implemented more profitably and effectively for raising livestock in the region. This old method, presently known as *Toba* constructed amidst the sand dunes which provide water and pasturage to the livestock is a very fascinating place to live. A hard plot of land with very low porosity is searched for construction of *toba* and again this place should form a good catchment area so that water from all the four sides runs down and collects at this place. Each village of the cattle breeders have 5-6 *tobas* dug depending upon the caste and community composition. With the onset of the monsoon, there is dispersal of herds far and wide within the boundaries of the village wherever surface water is available in the dug out ponds locally known as *tobas* which are constructed and kept in repair for the efficient use of meagre available water and the grasses. The use of *tobas* is regulated by conventions and it is customary to make use of other *tobas* when the water in one's own *toba* exhausts. Nobody was thus prepared to deepen their *toba* lest the grazing resources are utilized by others. Thus the people stressed that the *tobas* have to be dug deep on large scale rather than making any piece meal efforts. In case the rains fail the breeders migrate with their livestock to irrigated areas of Ganganagar and Ferozpur districts. Prior to the formation of Pakistan, they used to go to Bahawalpur region which is now a closed boundary.

The livestock breeders have recently been facing great difficulties for feed and water for their livestock. Due to improved means of transport the local sedentary population does not depend upon the livestock breeders for livestock and livestock produce. Their visits are generally not liked by the villagers since their animals exhaust water and grazing resources of the village. With the construction of Rajas-

than Canal, extensive grazing lands are being converted into crop lands posing hardship on the nomadic life of the people.

It has been recommended (Malhotra *et al.*, 1966) that each household in the Canal Command Area may be allotted one sq (6.3 ha) of land and partial mechanisation of cultivation may be resorted to. Dairying industry may be introduced on scientific lines. Sheep raising is the chief subsidiary occupation in the region. At present the sheep owners have to travel long distances and their nomadism can be arrested by upgrading the short grass rangeland by reseeding these pastures by *Anjan* (*Cenchrus ciliaris*) and *Dhaman* (*Cenchrus setigerus*) grasses. Introduction of mutton industry, setting up of wool grading and shearing centres shall further save a lot of their energy and fetch the breeders much higher income than they earn at present.

Artisan nomads

The second important category of nomads are those who specialise in certain trades like the much publicised *Gadoliya Lohars*, *Sansis* and *Sattias*. The *Sattias* and the *Sansis* carry on limited trade in cattle and render veterinary services to the livestock of the villages on their routes. The *Sattias* and *Sansis* are known for their immoral activities, illegal transactions and skill in theft, who have created a resentment in the minds of the settled population against the helpless nomads. They are placed even by the nomads in the lowest rung of their social hierarchy.

The nomadic blacksmiths are locally called *Gadoliya Lohars*. They are one of the artisan nomads in the states of Rajasthan, Punjab and Madhya Pradesh. Their territorial extension is even in semi-arid and humid environments. Their nomadism is traced back to the conquest of the fort of Chittor by the *Mughals*. History has it that consequent upon this conquest the *Gadoliya Lohars* took a view that they would not have a settled home, would not eat in a plate and would not sleep on cot till the fort is reconquered (Malhotra *et al.*, 1966). The defeated rulers of Chittor fort needed blacksmiths to make weapons for war. The rulers had gone in the forest for seclusion and preparation and were moving from place to place so that the enemies would not trace them. This also rendered the settled blacksmiths to live a nomadic life and since then they became nomads.

The traditional occupation of the *Gadoliya Lohars* is blacksmithy and trade in cattle. Their movements to different places are dependent upon the availability of blacksmithy work and prospects of trade in cattle. They have developed a symbiotic relationship with the sedentary farmers for supplying them with agricultural tools and implements which they require. They also sell utensils for farmer's household affairs. These materials are supplied to the rural population on cash or exchange basis. The technology of manufacturing the tools, implements and utensils of iron is indigenous that involves hard work and large amount of labour. Almost all the members of family remain engaged in this occupation. On the average a household earns about one thousand rupees annually from this occupation. Uncertainty of availability of work and risk in earning has created feelings of fraternity and mutual give and take in the society. Unlike other nomadic groups generally, they do not take loan from the money lenders. They are economically and culturally very backward. Their children are not sent to schools and as such illiteracy is very common.

They move about in small kinship bands in their bullockcarts with their full family. The nature of movement of different bands of these artisan nomads follow a regular cycle on regular monthly intervals. They owe their allegiance to a definite demarcated area. In one band the number varies from one to twelve families. During movements they split themselves into smaller constituents which group and regroup at different places depending upon their social and economic needs. Their movements are limited only to those places which are connected by roads or tracks in which their bullock-carts can go. Due to the recent changes in economics and political set up and the increasing means of communication the *Gadoliya Lohars* are not as welcome in the villages now as about 15 years ago. About one-fourth of the *Gadoliya Lohars* stated that there has been a definite decrease in their getting work of blacksmithy or cattle trade in recent years. Ninety five per cent of the households surveyed, therefore, desired to divorce nomadic life and lead a sedentary or semi-sedentary life leading finally to sedentarisation.

Efforts have been made by the state Government of Rajasthan to sedentarise *Gadoliya Lohars* in colonies consisting of many households at one place but such sedentarization has achieved only a partial success.

Most of the *Gadoliya Lohars* desired to sedentarise in small kinship groups consisting of mostly agnatic (blood relations) and affinal (rela-

tion through marriage) relations. The nomadic *Gadoliya Lohars* desired sedentarization in scattered fashion at a central place within the present area of their movement locally known by them as *Chokla* (Malhotra *et al.*, 1966). Such a settlement shall ensure the continuation of their symbiotic relationship with the sedentary population, provision of marketing facilities for the articles fabricated by them and shall also provide better prospects for allotting them suitable agricultural lands of which the *Gadoliya Lohars* are most desirous to get. Over and above this shall also rule out occurrence of any feuds which are likely to occur when too many households of different clans are settled at one place.

Trading Nomads

The third important category of nomads—designated as trading nomads—consist of the *Banjaras*, *Ghattiwalla Jogis* and *Gawariyas*. The *Gawariyas* mainly cater to the needs of village women, selling beads, bangles and trinkets and use donkeys as the transporting animal for a fixed area of movement. Like that of the *Gawariyas* the area of *Ghattiwalla Jogis*, who manufacture and trade in grinding wheels and earthen smoking pipes is also fixed. While some of these trading nomads are on the move perpetually others lead a restricted settled life, taking to cultivation or working as daily wage agricultural labour during the cultivation season. After the season, they start peddling their age old wares again.

The *Banjaras* are one of the most publicised trading group of nomads. They are camp-dwellers. Their entire drama of life is enacted under the open sky. Historically, these are very old nomads and were associated with the desertic landscape. The *Banjaras* are organized into distinct class in different territories (Malhotra and Bose, 1967), each clan is divided into smaller groups called *tandas*. In each *tanda* there are six to twenty families. The doctrine of collective responsibility operates among the members of the *tanda*. The families within the *tanda* are bound by kinship ties which give security to the members. The rights, obligations and expectancies towards one another are well established. The structure of the family is patriarchal. Early marriage is very common among them. Every *tanda* has a headman who commands respect from other members.

The main occupation of the *Banjaras* is trading in salt. They roam from village to village with bullocks which carry goods and other material possessions that are few and limited to the bare necessities of life. Even though now-a-days, the salt trade is carried by big-wholesale traders with modern transport facilities, it remains the main source of sustenance of most of the families of the *Banjaras*. The trade is carried on with the family labour force. The woman render only minor assistance in economic pursuits.

With the onset of rains, the *Banjaras* move towards saline basins where salt is manufactured. After rains, grass and water are available *en-route* for their animals. In addition to salt trade, they sell Fuller's earth and onions in the remote villages of the desertic tracts. These *Banjaras* move towards Gujarat state during post monsoon period where they get ready employments in the form of haulage of commodities, like building materials, grains, etc., on the back of their bullocks.

The nomadic *Banjaras* do not avail of any community facility and have no social as well as cultural relationships with the settled population whom they meet only for trade purposes. There is some communication between the money lenders and the *Banjaras*, as the latter generally take loans from them for their trade, etc.

The *Banjaras* are economically backward and their standard of living is very poor. As a result of improved means of communication and the opening up of hitherto inaccessible areas to road transport their traditional relationship of mutual dependence with the sedentary population has broken down. The *Banjaras* find it difficult to sell their commodities with good margin of profit as in the past. Shortage of grazing land is another problem for them. Their earnings have sufficiently declined and several of them are in perpetual debt. For sedentarising the trading nomads (*Banjaras*) the *tanda* should be taken as one unit for settlement purposes in different villages. It shall be highly desirable to make use of the existing administrative machinery among the nomads rather than *supersede* them.

The fourth class consists of miscellaneous nomads like the *Nats* and *Kalbeliya Jogis* who earn their livelihood by showing acrobatics, jugglery and snake charming at village fairs and to roadside gathering.

Briefly it may be said that the technological, economic and political changes of the recent times are influencing the nomadic population in this region with such a rapidity that they are facing a social decay. This influence is chaotic in so far as it is not based on balanced and well

conceived plans, and is not adaptable to the traditional nomadic way of life and their aptitude. The sedentarization of nomadic way of life is a gradual and slow process. Though all round development of the region may result in spontaneous sedentarisation of the nomad, there is a possibility of social as well as cultural annihilation of the nomads. The question that haunts the ecologists and sociologists today is how to absorb these people within the framework of modern living and make them useful members of the society by exploiting their natural aptitudes.

The nomad has to settle down now but any attempt to induce him to do so should invariably be tempered with sympathy and understanding of his prejudices, beliefs, social concepts and above all of his basic requirements. Only a human approach can hope to win over the nomad so that he may be interwoven with the whole fabric of the day's society in the arid zone. The rehabilitation schemes based on their kinship structure and cultural values as exemplified earlier, are likely to provide stable sedentarization.

CONCLUDING REMARKS

By arid zone standards the Rajasthan arid zone is quite thickly populated and the demographic features reveal that apart from its higher growth rate the population exhibits expensive potentialities of future growth rate. Additionally, the high fertility norms originally developed in this high mortality culture to generate survival of the society, lineage and family are still prevalent inspite of the declining death rate. Population control programmes are likely to receive a limited success unless the deeply ingrained beliefs and socio-cultural factors associated with procreation are taken into account.

The society is patriarchal, patrilineal and patrilocal and the agnatic ties have much greater influence on the proximity of settlement. The settlement pattern predominantly constitutes dispersed homesteads and this provides greater benefits for raising livestock and in agricultural operations. However, there is much lesser use of community facilities and the net work of service institutions normally do not reach the *dhanis* (dispersed settlements) due to inherent difficulties created by inadequate communication facilities. This suggests scope for organizing intensive surveys and researches for bringing about effective improvements in human settlements compatible with the socio-cultural values and for making better use of local materials to make the traditional abodes comfortable.

People by and large have remained illiterate, traditionalists with heavy feelings of factionalism. The village society enjoins upon each caste to perform certain functions which are inter-dependent and complementary. This social institution has, however been restricting the social and occupational mobility and has fostered values concerning cultivation and animal husbandry some of which are definitely economically untenable. All the castes are hierarchically ordered and caste distinctions are commensal as well as with regard to other behavioural

aspects often act as a drag on the developmental activities. Such distinctions are more stringent within certain caste category and the removal of these practices of untouchability would go a long way for the acceleration of development programmes in the region.

The traditional large sized joint households are disintegrating to small sized nuclear households and this is posing a paradox just at the time when new longevity conditions are generating necessity for the care of the aged in the joint families, the other forces are conspiring against it and more and more unclear families are being formed. There being little state mooted old age security measures the parents like to have additional number of male issues so that they can fall back upon at least one during their old age. This transformation of the household has further resulted in increasing fragmentation of land, uneconomic but unavoidable duplication of assets and excessive pressure of livestock on land.

Majority of the earners are tied to an outmoded system of agriculture which is expressive of the limitations imposed by aridity. The size of holdings are large and production is low. Due chiefly to linear escalation of population and consequent overcrowding on cultivation, more and more marginal lands have been brought under plough giving rise to a declining trend in yields per unit area. Animal husbandry though forms a subsidiary occupation for the majority, in certain pockets like Anupgarh-Pugal region is the main source of sustenance of over two-thirds population. The deeply ingrained socio-religious beliefs of the farmers in different spheres of life have often been found to over-ride prudence and the connected rituals often add to the already meagre available resources. The extension of improved technology is a crucial problem facing the extension workers. It will be useful to encourage as much participation and involvement in various activities as possible and to explore the ways and means to provide full knowledge of the improved package of practices and the qualities of the innovations as these two factors predispose the farmers to quicker adoption of innovations. It may also be useful to start extension activities with the people having comparatively greater participation in various activities and possessing more knowledge about the innovations rather than giving greater weightage to those possessing larger farms having greater material possessions, better value orientations and to those belonging to certain particular age group.

The rapidly growing population has also inflated the demand of wood for different purposes while it has reduced the area under fallows,

wastes and forests from where these needs are met with. Majority of the population is facing acute shortage of fuel wood. The rural population should be encouraged to plant trees around their habitation sources. Religious feelings of women folk should be exploited by having a small grove of *peepul* (*Ficus religiosa*) as it has been observed in the village, that women pour water on them on their own initiative as this is regarded as a pious act. Similarly, on the *Oran* lands (lands left after religious temples) tree plantations should be intensified as cutting of vegetation is religiously prohibited from such lands.

On the basis of their experience the farmers opined that as a result of interplay of the increasingly harsh climatic factors and increase of population and in its needs, the region has been experiencing accentuation in conditions of desertification over the last 25-30 years and was also stated to be prone to the same effect in near future. The dwellers perceived and attributed the process to the prevalence of improper winds, lesser precipitation, greater erraticity and uneven distribution of rainfall, decreased natural vegetation, introduction of xeric vegetation, impoverishment of soil increasing salinity build up, lower yields per unit area and increasing famine periods as compared to 25-30 years ago.

Sizeable proportion of the population still leads a nomadic or seminomadic life although the traditional relationship of mutual dependence between them and the sedentary population has largely broken down and the economy of the nomads has suffered a heavy decline. The opening up of means of communication has reduced the importance of distribution activities by the trading nomads. Each type of nomad is associated with some kind of livestock which make indiscriminate use of the meagre available water and grazing resources and destroy the local soil conservation measures. The nomads in the present day thus prove a menace for the whole society and their sedentarization is inescapable. The rehabilitation measures formulated on the basis of their kinship structure and cultural values are likely to yield fruitful results.

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REFERENCES

- Bose, A. B. and Malhotra, S. P. 1961. Form of settlement of desert village. *Indian Geographer* 6 : 9-20.
- Bose, A. B. and Malhotra, S. P. 1962. Economic structure in a village in arid part of Rajasthan. *J. Social Res.* 5:2,81-94,
- Bose, A. B. and Malhotra, S. P. 1964. Some characteristics of occupations castes in Central and Lower Luni Basin in Western Rajasthan. *The Eastern Anthropologist* 21:3.
- Bose, A. B. and Malhotra, S. P. 1963. Anthro Geo Geographical study of the settlement pattern of desert village. *Man in India* 43:3.
- Bose, A. B., Malhotra, S. P. and Bharara, L. P. 1962. Socio-economic differences in dispersed dwelling and compact settlement type in arid regions. *Man in India* 43:119-130.
- Bose, A. B., Malhotra, S. P. and Saxena, P. C. 1964. Problems of nomadism in the arid zone of Rajasthan. *General Symp. problems of India Arid Zone, Jodhpur.* 247:250.
- Bose, A. B., Malhotra, S. P. and Bharara, L. P. 1965. Socio-economic aspect of the practice of goat keeping in Central Lower Luni Basin. *Indian Forester* 91(5) 73-80.
- Bose, A. B., Malhotra, S. P., Johory, C.S.K. and Sen, M. L. A. 1965. Agriculture in Central and Lower Luni basin in Western Rajasthan. *Ann. Arid Zone* 4(2) : 195-206.
- Bose, A. B. and Malhotra, S. P. 1965. Residential segregation and housing in a desert village. *The Journal of the Asiatic Soc. Bengal, Calcutta* 7:3-4 173-180.
- Bose, A. B., Malhotra, S. P., Bharara, L. P. and Johory, C. S. K. 1966. Socio-economic aspects of animal husbandry. *Ann. Arid Zone* 5(1): 71-80.

- Census of India, 1961. Rajasthan Vol. XIV, Part I-A(i) General Report, 1961. Superintendent of Census Operation, Rajasthan, Jaipur.
- Census of India, 1973. Rajasthan series 18-Part II A, Director of Census of Census Operations, Rajasthan, Jaipur.
- Government of Rajasthan, 1962. Report on the Livestock Census of Rajasthan, 1961, Rajasthan, Jaipur.
- Government of Rajasthan, 1967. Report on the Livestock Census of Rajasthan, 1966, Rajasthan, Jaipur.
- Government of Rajasthan, 1974. Report on the Livestock Census of Rajasthan, 1972, Rajasthan, Jaipur.
- Government of Rajasthan, 1973. Statistical Abstract, Rajasthan Directorate of Economics and Statistics, Rajasthan, Jaipur.
- Malhotra, S. P. and Bose, A. B. 1963. Problems of rehabilitation among nomadic Banjaras. *Ann. Arid Zone* 2 (1):69-91.
- Malhotra, S. P. 1964. Land, Man and Livestock in Luni Basin. *Proc. International Symposium on Arid Zone*.
- Malhotra, S. P. and Sen, M.L.A. 1964. A comparative study of the socio-economic characteristics of nuclear and joint households. *The J. Family Welfare* 11 (2):21-32.
- Malhotra, S.P. and Bharara, L. P. 1965. Socio-economic characteristics of different castes. *Indian Sociol Bull.* 2:3.
- Malhotra, *et al.*, 1965. Report on the socio-economic survey of livestock breeders of Anupgarh-Pugal region of western Rajasthan Central Arid Zone Research Institute, Jodhpur. (*Mimeographed*).
- Malhotra, S. P., Bharara, L. P. and Joshi, P. L. 1966a. Socio-economic characteristics of inhabitants of Anupgarh-Pugal region. *Indian Sociol, Bull.* 3 (2).
- Malhotra, S. P., Bharara, L. P. and Joshi, P. L. 1966b. Impact of land, water and vegetation resources on the economy of the cattle breeders of a desert village. *Ann. Arid Zone* 5 (2) : 219-228.
- Malhotra, S.P., Sen, M.L.A. and Johory, C.S.K. 1966c. Problem of rehabilitation of nomadic Gadoliya Lohars. *Indian Sociol, Bull.* 4(1).

- Malhotra, S.P. and Sen, M.L.A. 1966. Socio-economic characteristics of small, medium and large size of households in a desert tract. *J. Family Welfare* 13(2):28-39.
- Malhotra, S.P. 1966. Ritual and belief concerning animal control. Indian Rodent Symposium, Calcutta.
- Malhotra, S.P. and Bose, A.B. 1967. Nyat as an agency of social control among the Banjaras Leadership in India. *J. Social Res.*
- Malhotra, S.P., Bharara, L.P. and Joshi, P.L. 1967. Role of Animal husbandry in Anupgarh Pugal region. *Indian Social Bull.* 5(1):11-20
- Malhotra, S.P. 1971. Nomads of Indian arid zone. *21st International Geographical Congress, Symposium on arid zones.*
- Malhotra, S.P., Roa, J.S., Goyal, D. and Patwa, F.C. 1972. Population land use and livestock composition in India and its arid zone. *Ann. Artd Zone* 11(1:2):116-121.
- Malhotra, S.P., Joshi, P.L. and Rao, J.S. 1974. Relative importance of some socio-economic factors in the adoption of agricultural innovation. *Indian J. Ext. Education* 10(1:2):62-64.
- Malhotra, S.P. and Sen, M.L.A. 1974. Studies in agricultural sociology some characteristics of lower, middle and upper class fass farmers. *J. Social Res.* 10(1):15-25.
- Malhotra, S.P., Bharara, L.P. and Shyamlal 1975. Some characteristics of schedule caste, schedule tribe and non-scheduled population in arid zone of Rajasthan. *Indian J. Sociol. Res.* 18-82
- Malhotra, S.P. 1976. Opinion survey and desertification. *Proc. on development and conservation of desert and semi-desert lands*, Ashkabad, USSR.
- Malhotra, S.P. 1977. Socio-demographic factors and nomadism in the arid zone. *Desertification and its Control.* pp. 310-323.
- Malhotra, S.P. 1877. Traditional perceptibilities of environment and desertification – A case study. *Economic Georaphy*, Clark University, Masschusett.
- Malhotaa, S. P. and Trivedi, H. S, 1978. Caste hierarchy and inter-caste relations in ae arid village. *Indian J. Social Work*, Bombay.
- Mann, H. S., Malhotra, S. P. and Kalla, J. C. 1974. Desert Spread – A quantitative analysis in the arid zone of Rajasthan. *Ann. Arid Zone* 13(2):103-113.

- Mann, H. S., Malhotra, S.P. and Shankarnarayan, K.A. 1977. Land and resources utilization in the arid zone. *Desertification and its Control*, pp. 89-101.
- Mann, H.S. and Singh, R.P. 1977. Crop production in the Indian arid zone. *Desertification and its Control*, pp. 215-224.
- Tharpar Romila 1964. The history of female emancipation in Southern Asia. In *women in the New Asia*. Barbara, E. Ward. Ed. Paris, UNESCO 473-99.