RAJASTHAN
OF
AGRO-DEMOGRAPHIC ATLAS
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**Agro-demographic Atlas of Rajasthan**

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FOREWORD

One of the main activities of the Central Arid Zone research Institute is to collect all the information and relevant data available on basic resources (both physical, human and animal) and problems of arid and semi-arid zone of the country. The cartography section of the Basic Resources Studies Division often presents these data in the form of maps which are later compiled as atlases. Accordingly, a project on compilation of Atlases on the problems of arid and semi-arid zone has been taken up since 1963-64. A number of atlases have already been published. To visualise the problem of arid and semi arid zone it is necessary to find out the relationship between the distribution of human population, other demographic characteristics and food production. This information has now been translated into visual images in the present atlas entitled, “Agro-demographic Atlas of Rajasthan” by Shri A.K. Sen and his colleague Shri K.N. Gupta. In this task Shri Sen has been guided not only by the information generated from 1971 census data and agricultural statistics collected from the Revenue Board of Rajasthan but also by the information collected by him and other scientists in course of field work and other documents published by the scientists of the Central and State Governments.

The main objectives of this atlas are to express the relationship between the pressure of population and food production and to bring out the quantitative relationship between demographic characteristics and agricultural production, practices and land use systems. These variables have been used to generate a variety of indices which, in turn have formed the basis of sub-division of the Rajasthan State into agro-demographic regions. The levels of agro-demographic development of the different districts of Rajasthan have been worked out by the authors on the basis of the efficiency of rural occupational structure and rural production. Both these aspects of development are in turn susceptible to further analysis. Accordingly, fourteen indicators are rightly selected for deducting synthetic index to work out and map the levels of agro-demographic development. On the basis of synthetic index of each district thus worked out, a map showing three agro-demographic regions of the state has been prepared. The atlas shows the agro-demographic characteristics of the different agro-climatic regions in a very satisfactory manner. In all, the atlas contains 10 maps with a number of inset maps. These are self-explanatory and accompanied by the exhaustive notes.

The primary object of the atlas is to help in regional planning with reference to agro-demographic context of various districts and agro-climatic regions of the State. In presenting this atlas to the planners, demographers and geographers, the CAZRI has reason to feel confident that it will pave the way to more effective planning in the years to come, and as one associated with the developmental planning and administration of a large part of the State’s territory, I feel great pleasure in presenting and recommending this useful and laudable work.

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INTRODUCTORY NOTE

Agro-demography is a comparatively recent concept which envisages to depict the impact of human population trends and occupational patterns on agricultural production. On the basis of demographic and occupational factors, different cultivation units may be recognised, and mapped, within a single agricultural system. A number of such units would comprise an agro-demographic region. Cartographic analysis of the data pertaining to these regions form the basis of projection of production potentials of these regions. Agro-demographic study of a region is, therefore, vital to the region's future development, particularly in problematic and drought-prone states like Rajasthan. CAZRI has been aware of the need to conduct agro-demographic studies, particularly of the arid and semi-arid areas of Rajasthan, and a mass of useful, new information has been collected over the years. I am glad that Shri A. K. Sen, Cartographer in this Institute, and his colleague Shri K. N. Gupta have collected the available information in the form of a series of maps under the general title, "Agro-demographic Atlas of Rajasthan". I hope this compilation will prove useful to planners and administrators who may be concerned with the development of the state's productivity.

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Planning of rational utilisation of resources necessitates in the first place, to collect all the available information of a particular area for which the development planning programmes are to be formulated. This is necessary to know the pattern of the distribution of resources and the general problems of the area concerned so that planning and survey programmes can be initiated knowing the limitation of the data already collected or generated. This can be best achieved if the data are presented in the form of maps which are cartographed on a particular theme compiled in the form of an atlas. In the arid and semi-arid zone, particularly in Rajasthan, where the resources have not been fully assessed or the available resources are not properly being utilised, the need for such an atlas has been strongly felt. To deal with the problem the cartography section of Basic Resources Studies Division of this Institute is compiling atlases on various problems of arid and semi-arid zone of India, particularly that of Rajasthan state. The present atlas, “Agro-demographic atlas of Rajasthan” by Shri A.K. Sen & Shri K.N. Gupta is the outcome of this research project—“Thematic mapping: compilation of atlases on arid and semi-arid zone problem”. This is the fourth atlas in the series now being published by this Institute.

This atlas incorporates a good deal of the vital information that has been collected so far on the agro-demographic aspects of the Rajasthan state. It consists of 18 plates (arising out of 24 maps prepared on 1:2000,000 scale) and gives a complete picture of demography including growth of population, agricultural resources and agro-demographic relationship which have been vividly shown by dividing the state into agroclimatic regions and agro-demographic units. In most cases the administrative units and agroclimatic regions are taken as the mapping unit. Statistical data of 1971-1979 are mostly used as these are the latest figures available when the work on the project was going on. The difference in the latest data (after the maps are cartographed) are however only minor.

Some agro-demographic features in different agroclimatic regions have emerged while compiling the maps of this atlas. The atlas aims at classifying the agro-demographic regions of Rajasthan. The quantitative relationship between agricultural characteristics and demographic factors are determined in close examination of four variables: i) demography, ii) rural economic structure, iii) agriculture, and iv) human agricultural relationship. These variables have been used to generate a variety of indices, which, in turn have formed the basis of sub-division of the area into agro-demographic regions. Accordingly, the levels of agro-demographic development of the different districts and agro-climatic regions in Rajasthan state have been worked out and mapped on the basis of the efficiency of rural occupational structure and rural production. The details are clearly shown in the various maps cartographed and included in the atlas. Each map has been designed to represent a number of interrelated
and associated factors to depict vividly the various characteristics of the region. The complex maps are, however, easy to read, although the explanatory notes accompanying the maps give detailed description and original sources of the data.

In presenting this atlas to the wider public and specially to the planners, the CAZRI feels confident that it will be useful to Rajasthan Govt. to identify areas for undertaking development programmes which can generate self replicating and self propelling growth.

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INTRODUCTION

The need for an atlas of Rajasthan, depicting its demographic, agricultural and related economic activities and their relationship was felt since the inception of basic resources and human factor surveys. This may be viewed from two angles: first to assess the demographic characteristics, the pressure of human population on land, occupational structure and secondly to visualise the agricultural potential, its related problems, rural economic structure, etc. Finally it is also necessary to bring out the relationship between the population distribution and population growth with food production in order to find out the surplus or deficit food production zones (carrying capacity) in different parts of the State. This can be best done if the data available can be put in the form of maps and all such maps cartographed are assembled in the form of an atlas. Accordingly, a project on the “Agro Demographic Atlas of Rajasthan” was undertaken by the cartography section of the Basic Resources Studies Division of CAZRI since 1972-73. The project was however completed by the end of 1976. But, meanwhile, a number of requests came to revise the agricultural maps, published in the “Agricultural Atlas of Rajasthan” (Sen, 1972) to make them upto date. Accordingly, the agricultural maps were revised and the compilation of the atlas was completed during 1978-79 for printing.

The atlas depicts a fairly comprehensive and complete picture of the demographic, agricultural, rural economic and agro-demographic picture of the state, both districtwise and agroclimatic regionwise, in a fairly satisfactory manner. The maps are correlated to bring out the levels of rural economic development and agro demographic development in the different agroclimatic regions (Sen, 1972) of the State. The atlas depicts the regional characters in context of the development plans to be undertaken. Accordingly, the atlas is expected to be useful for regional planning.

Scale and projection

1: 250, 000 and 1:253, 440 survey of India topographical maps were used as guide maps. They were compiled on 1: 2,000,000 scale showing the district boundaries on modified polyconic projection to prepare the base map. The international boundary of the state was authenticated by the map publication Directorate of Survey of India. The maps were finally printed in the scale of about 1:3.8 million scale.

Mappable informations

The data for mapping was collected from various sources but mostly from the publications of 1971 population census data of the Office of Registrar General of India and Director of Census Operation, Government of Rajasthan. The agricultural land use and other related data were collected from the Board of Central Revenue (Land Records), Government of
Rajasthan, Ajmer, and agricultural departments, Survey of India maps; published literature; government records; data collected by the scientists of this Institute, etc. Some maps earlier published by this Institute, particularly in Agricultural Atlas of Rajasthan (1972) have been consulted or included in order to make the atlas self explanatory. All the plates include explanatory notes which indicate the source of information of the data used and the cartographic technique or methodology employed. Data thus obtained are not uniform and have however their limitations and shortcomings especially those relating to the regional comparability of the results are imperfectly apprehended by planners. Secondly, the pattern of demographic relationship between occupational structure, rural economy and level of agro-demographic (economic) development at both regional and the agroclimatic level has not been systematically explored. Finally, the census and other data were not supplemented by and checked against a body of detailed, comparative, uniformly executed field studies carried on by competent cartographers in their regional contexts. Thus, the data obtained, which were not uniform and of diverse nature, were compiled and analysed in the cartographic laboratory to make them mappable in an uniform scale. Thus, mappable informations for the present study were based on agricultural and revenue data, analytical data on the analysis of Survey of India maps, data of 1971 population census and some field investigations carried out by the authors.

In short the administrative map was compiled from the district maps available with the state government. The demographic maps were cartographed on the basis of census data. The settlement pattern and dispersal of settlements map was based on the interpretation of aerial photographs, Survey of India topographical sheets and the plates 30 and 31 of Agricultural Atlas of Rajasthan (Sen, 1972). The occupational pattern and rural agro-demographic complex maps were also based on 1971 census data. The agroclimatic regions were drawn based on the maps prepared in Agricultural Atlas of Rajasthan. The agricultural maps were prepared on the basis of revenue data published in the statistical abstract of Rajasthan or collected from the district collectorate or Central Revenue Board (Land Records) Rajasthan at Ajmer. Data from 1969-70 to 1973-74 were used for compilation and mapping works.

Mapping units

As the census data are available mostly district and tehsilwise, the choropleth maps were prepared for the demographic maps taking district or tehsil as the mapping unit. Similarly, choropleth maps taking district as the unit are designed for agricultural maps. The data of the districts are computed to show their variation in different agroclimatic regions. Agroclimatic regions (Sen, 1972) are used as the unit of choropleth maps to show the agro-demographic relationship. In case the data of a particular district is not available, the same were computed by interpolation on the basis of consideration of data of adjacent districts.
The mapping units of agro-demographic regions were worked out on the basis of the efficiency of rural occupational structure and rural agricultural and industrial production.

Contents

The Atlas contains 18 plates. In general, 26 maps on 1:2,000,000 scale were prepared but some of the plates were ultimately combined together for correlation, analytical and economic purposes. Part I includes a general map, showing the administrative units of the state. Part II contains six plates (plates 2 to 7) showing the demographic characteristics of the different districts of the state. Part III includes 7 plates (plates 8 to 14) depicting agricultural pattern and agrodemographic characteristics including primary occupational pattern (agricultural and agricultural labour) in different districts and agroclimatic regions of the state. Part IV has 3 plates (plates 15 to 17) which present rural economy and occupational pattern of the rural workers. Plate 18 is the synthetic map and depict, (i) agro-demographic units, (ii) agro-demographic development, and (iii) rural economic development.

Cartographic representations

Collection of varied data and representing them in a single map in black and white, necessitated cartographical and geographical researches. Accordingly, a number of devices on cartographic representations were worked out which were successfully employed in this project. In choropleth maps like agro-climatic regions, level of agro-demographic development where the units of choropleth were framed by geographical interpretation of data and faithful correlations of a number of data and maps are noteworthy. Similarly, the cartography of population density zones, carrying capacity zones are also new additions to choropleth mapping. The map showing dispersal of settlement in relation to settlement and settlement pattern has been successfully drawn out by dot method and choroschematic technique.

Analysis

A brief analysis of the maps are given below:

1. The Atlas aims to correlate the rural population with the food crop-production in different districts of agro-climatic zones in Rajasthan and to establish or map the surplus and deficit areas or carrying capacity ones in relation to food production.

   In earlier communications (Sen, 1972 a & b) classified and mapped the macro and micro agroclimatic regions of the state showing their agroclimatic and cropping pattern characteristics. This Atlas deals only with the macro units. A little modification has, however, been made on parts of Udaipur and Sirohi districts with more than 750 mm of annual rainfall, which was earlier included in humid zone. But the area has only
under 15 per cent of the total area of the respective districts and is not of agricultural importance forming mostly hilly, rugged and barren terrains. In the present study these two districts are included in sub-humid zone. The five macro agroclimatic units dealt with in the present Atlas are:

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<tr>
<th>Agroclimatic region</th>
<th>Districts included</th>
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<tbody>
<tr>
<td>1. Arid</td>
<td>Ganganagar, Churu, Bikaner, Jodhpur, Barmer and Jaisalmer.</td>
</tr>
<tr>
<td>2. Transitional, between arid and semi-arid</td>
<td>Sikar, Jhunjhunu, Nagaur, Pali, and Jalore.</td>
</tr>
<tr>
<td>4. Sub-humid</td>
<td>Sirohi, Udaipur, Chittorgarh and Bundi.</td>
</tr>
<tr>
<td>5. Humid</td>
<td>Banswara, Dungarpur, Jhalawar and Kota.</td>
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2. Agro-demography

Some agro-demographic features in different agro-climatic regions of Rajasthan have emerged in course of compiling the population maps of the state. The rural population with percentage density and decennial growth rate during the last census decade (1961-71), occupational pattern, agricultural population, per capita agricultural land, agricultural land per cultivator and pressure on land; production of cereals and pulses per cultivator, per capita production of staple food crops, per capita requirements in different macro agro-climatic regions are serially described through a series of 1:2 million maps.

3. Agro-demographic aspects

**Rural population**: The density of rural population in the arid zone districts is very low and varies from 37 persons per sq km in Churu district to 12 persons in Bikaner and only 3 in Jaisalmer. The transitional between arid and semi-arid) districts have 80 to 95 per cent rural population, the average being 90 per cent. The decennial growth rate is, however, not uniform.

**Semi-arid zone**: The density of rural population in semi-arid zone is about 100 persons per sq km (Jaipur 126, Ajmer 114). All the other five semi-arid districts which form almost a semi-circular belt have more than 80 per cent rural population. The decennial growth rate is not uniform.

**Sub-humid zone**: The average density of rural population in the sub-humid zone is about 85 persons per sq km.

**Humid-zone** - The percentage of rural population is very high, being more than 90 on the average.
Taking Rajasthan as a whole, 82.39 per cent of the total population is rural. Except in Jodhpur, Churu and Bikaner districts of arid zone and Ajmer and Jaipur districts in semi-arid zone in all other districts the percentage is more than the state average (82.39 per cent). The density of rural population and decennial growth rate are not uniform and vary mostly according to rainfall and topographic conditions.

4. Occupational pattern

**Arid zone**: During the decade the percentage of workers fell by 17 per cent in Churu and Barmer districts. About 80 per cent of the total working population are cultivators and agricultural labourers. Per capita agricultural land in these two districts is about 4.5 ha. In the other four districts the percentage of workers to total population fell by about 10 per cent during the last decade.

In the districts of transitional zone (between arid to semi-arid) working population decreased considerably during the decade.

**Semi-arid zone**: 29 to 40 per cent of the total population are workers. During the last decade percentage of working population has decreased considerably. Cultivators vary from 50 to 53 per cent in Jaipur-Ajmer belt to about 70 per cent on the average in the semi-circular belt comprising five other districts. Per capita agricultural land varies from 1 to 2 ha.

**Sub-humid zone**: Working population accounts for 30 to 40 per cent of the total population.

**Humid zone**: 28 to 29 percent of the total population in the western districts (Dungarpur and Banswara) are workers. About 30 per cent of the total population in the eastern districts (Kota-30.95 and Jhalawar-32.53) are workers. Per capita agricultural land is 2 to 2.50 ha.

5. Population and staple food crops

**In arid zone**: The lowest production is in Jaisalmer district, being 117 kg per cultivator.

The districts, transitional between arid and semi-arid, have higher production. But per capita production, except Jhalor, is small varying between 200 to 235 kg.

**In semi-arid zone**: The production is the lowest in Ajmer (142 kg per capita and 806 kg per cultivator).

**In sub-humid zone**: Production per cultivator in Udaipur and Sirohi exceeds 1000 kg, whereas in the other two districts the figure is 800 to 1000 kg per cultivator.

The humid zone is characterised by high production (501 kg per capita and 2199 kg per cultivator).
6. Carrying capacity zones

The districts having less than 215 kg as per capita production are grouped as deficit zones. A transitional zone has been demarcated grouping the districts having per capita production between 215 kg to 265 kg. Districts having more than 265 kg fall under surplus zone. The districts of Churu, Bikaner, Jaisalmer and Jodhpur in the arid zone; Pali in the transitional zone; Jaipur and Ajmer in the semi-arid zone and Sirohi in the sub-humid zone form a compact group in deficit zone. Ganganagar of the arid zone in the north stands out as the granary of Rajasthan and forms a pocket showing a surplus zone. The surplus areas of the state form four isolated belts.

7. Agro-demographic development

The levels of agro-demographic development of the different districts of agro-climatic regions in Rajasthan State have been worked out on the basis of the efficiency of rural occupational structure and rural production. Both these aspects of development are in turn susceptible for further analysis. Accordingly, fourteen indicators are selected for deducing synthetic index to work out and map the levels of agro-demographic development. These consist of four structural indicators relating to rural population; eight occupational indicators relating to rural working population and rural economy and two productivity indicators relating to per capita production of food crops. On the basis of synthetic index of each district thus worked out a map showing three agro-demographic regions of the State has also been prepared.

8. Agro-demographic regions

On the basis of the synthetic index three agro-demographic regions are identified and mapped.

Region I (Below 550) includes 11 districts (46.75 percent of the State) mostly in arid and semi-arid regions. Considering the agro-demographic development, the region is ranked at the lowest order of development.

The second region comprising the second order of development (550-700) occurs in three belts.

The third region (the highest order of development (700-780) includes four districts in the south east in the humid and sub-humid belt with the exception of Bhilwara in semi-arid zone.

Good rainfall, minor irrigation and mining and industrial activities of Bhilwara are contributing to the rapid economic development of this belt. The region comprises 9.68 per cent of the total area of the State.

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ACKNOWLEDGEMENTS

Grateful thanks are due to Dr. H.S. Mann, the Director; Dr. C.T. Abichandani, Ex. Head Basic Resources Studies Division and to Dr. K.A. Shankarnarayan, Head Basic Resources Studies Division for their guidance in the work. Thanks are also due to Shri S.P. Malhotra, Head, Economic and Sociology Division and present Director of the Institute for his various helps. But for the keen interest, taken and help extended by Dr. H.S. Mann, Dr. K.A. Shankarnarayan the progress and publication of this atlas would have been much delayed.

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We express our sincere thanks and appreciation for the help given by Dr. P.K. Ghosh, Head, Division of Animal Studies, Dr. R.P. Dhir, Senior Scientist (Soil Science), Dr. J.C. Kalla, Ex-Agricultural Economist of CAZRI, and Dr. T.A. Mabutt, Professor of Geography, New South Wales, Australia, for their invaluable help. For editing and printing of the atlas we express our heartiest thanks to Dr. P.K. Ghosh, Head, Division of Animal Studies and Mr. R.K. Abichandani, Scientist, CAZRI, Jodhpur. But for their invaluable and sincere help the printing of this atlas would have been much delayed.

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A.K. Sen
K.N. GUPTA
PART I

Administrative Units
PLATE I

Rajasthan: administrative units, 1971

The map shows the up-to-date administrative units on tehsil levels including the sub-divisions and the district boundaries of the Rajasthan State. Rajasthan is situated between 23°03' N to 33°12' N latitudes and 69°30' E to 78°17' E longitudes and comprises a total area of about 342,261 km² (10.43% of the country). On the Western border is Pakistan. Towards the Southwest is Gujarat and to the Southeast is Madhya Pradesh. Towards the north are Punjab, Haryana and Uttar Pradesh. There are 26 districts in Rajasthan which are sub-divided into 196 tehsils. In all there are 33,305 inhabited and 2,490 uninhabited villages and 155 urban centres. Most of the tehsils comprise one or more Panchayat Samities or community development blocks. To compile the map 1:1 million map published by S.O.I; Administrative Atlas published by the Directorate of Census operations, Rajasthan (maps on various scales); the Plate 1 of Agricultural Atlas of Rajasthan (Sen, 1972) published by I.C.A.R./C.A.Z.R.I. are used. These are combined together and later converted into modified polyonic projection for proper cartographic orientation on 1:2 million scale. The territorial changes during 1961-71 were also considered. An inter district transfer of area between Chittorgarh and Udaipur districts took place during this intercensal period (1961-71). 399.1 sq km comprising 77 villages of the former Bhupalsagar
tehsil of Udaipur district was transferred to Chittorgarh district. Similarly, 34.7 sq km comprising 3 villages of Bhupalsagar tehsil were transferred to Mavli tehsil in Udaipur district. 10 villages (79.5 sq km) of Banera tehsil were transferred to Sahapura tehsil of Bhilwara district. Other changes made are as follows: 18 villages (293.2 sq km) of Desuri tehsil to Pali tehsil (Pali district). In Ajmer district 54 villages of Rupnagar tehsil (544.7 sq km) and 53 villages of Arian tehsil (558.7 sq km) were transferred to Kishangarh tehsil. Likewise, 34 villages (396.8 sq km) were shifted to Sawar tehsil from Kekri tehsil. The Rupnagar and Aravian tehsils are thus deleted from the map. The former six tehsils of Jaisalmer district were readjusted into only two tehsils, viz., Jaisalmer and Pokran by transferring 39 (7252 sq km), 155 (10, 6190 sq km) and 94 (4201 sq km) of Ramgarh, Sam and Fategarh tehsils to Jaisalmer tehsil (area increased, + 22,015.3 sq km) and 40 villages (3, 606.6 sq km) and one village (56.7 sq km) of Nachna and Jaisalmer tehsils, respectively, to Pokran tehsil (+ 3,663.3 sq km). In Ganganagar district three new tehsils are constituted: Sadulshahar (transferring 25 villages consisting 411.8 sq km of Ganganagar tehsil and 24 villages of 338.2 sq km of Hanumangarh tehsil); Sangaria tehsil (transferring 36 villages of 691.7 sq km of Hanumangarh tehsil) and Tibi (transferring 42 villages comprising 790.6 sq km of Hanumangarh tehsil). Thus Hanumangarh tehsil had a net loss of 1820.5 sq km during the intercensal period of 1961-71.
PART II

Demographic Aspects
PLATE 2

Decadal variation in population, 1901-1971

The map represents the decadal variation of population in Rajasthan State from 1901-1971. Mappable informations are collected from Series-I.B Rajasthan Part II A-General population tables published by Director of Census Operations, Rajasthan, Census of India, 1971. A choropleth map has been drawn by taking the districts as the mapping unit. Districtwise increases of population are shown in percent from 1901 to 1971 which are also recorded in the body of the map itself. The districtwise decadal variations are shown in graphs for each district. During the last 70 years the population have been more than doubled in the State. The map represents the population increase of 14 to 18 percent in every 10 years during the period upto 1941. But epidemics caused a decline during 1911-21 (-7.26). Since forties the population increased rapidly-26 percent during 1951-61 and 28 percent during 1961-71. But the increase is more due to immigration than local growth rate. The vital statistics of the State has however not yet been dealt properly. The high increase of population in Ganganagar even before 1941 was due to immigration on account of irriga-
tional facilities of Gang canal system; construction of railway lines and patronage of the royal families of the Bikaner State. The high increase during 1931-41 in Bikaner (34.29) was also due to construction of communication lines and personal endeavours of late Maharaja Ganga Singhji. High increase in Jaisalmer during 1931-41 (28.62) and 1951-61 (23.27) and 1901-11 in Bhiwana, Udaipur, Chittorgarh, Jodhpur are to be attributed to the construction of railway lines, roads and good rainfall. Jodhpur, Nagaur and Pali mark steady increase due to immigration on account of the construction of Jawai dam, opening up of mining activities like, salt, building stones, gypsum, marble, etc. The high increase of 59% in Dungarpur and Bundi during 1901-11 was followed by land settlement in the areas dominated by wandering tribes.

The population of the State, in general, has increased but without further researches on vital statistics like death or mortality rate, etc., it will probably not be correct to say that the State is being affected by high growth rate. The population in Jodhpur, Bikaner-particularly in Rajasthan canal area has recently increased but they are mostly due to immigration. Rural increase is however below than that of national average.
PLATE 3

Density of population, 1971

The map represents the tehsilwise density of population per sq km in the Rajasthan. On the basis of this study a map on population density zone has also been cartographed and presented as an inset map. Mappable informations are collected from 1971 population census figures published by the Director of Census Operation Rajasthan. The density of population for Rajasthan as a whole is 75 persons/sq km, being 63 in rural and 1,198 in urban areas, respectively. The density/sq km of the respective tehsils are also recorded in the map. The map shows that there is a distinct relationship between the rainfall and the density distribution of population. Thus the districts of extreme arid zone receiving less than 300 mm annual rainfall have a low density of less than 40 persons per sq km. Only Jodhpur tehsil, Jalore district, areas served by Gang, Rajasthan and Bhakra canal system, Churu, Rajgarh, Ratangarh and Sujangarh tehsils of Churu district and Nagaur district have a density of more than 51 persons /sq km. In general, Bharatpur, Jaipur, Alwar,
Jhunjhunu, Dungarpur, Ajmer, Sikar, Banswara, Sawai Madhopur and Udaipur districts have high densities. Bhilwara, Jhalawar, Kota, Tonk, Chittorgarh, Sirohi, Bundi and Pali has moderate densities. In the remaining parts the density is very low.

Five density zones are distinguished and mapped. Their extent and location are shown in the inset map. The map itself is self explanatory and does not require further elaboration. The following are the main characteristics:

1. The low density zone concentrates with the desertic condition.
2. The higher density in the Ganganagar and parts of Bikaner districts of arid zone is due to irrigational facilities.
3. The mining activities along with agropastoral economy contribute to the high density in Nagaur, part of Jodhpur, Ajmer, Bhilwara, Jhunjhunu, Alwar and Udaipur districts.
4. The good rainfall and irrigational facilities are the reasons for moderately high density in Chittorgarh, Kota, Bundi, Jhalawar, Tonk, Pali and Sirohi districts.
Plate 4

Dispersal of population in relation to settlement

The map shows the dispersal of population by dot system (each dot representing 1,000 inhabitants) in the different settlement pattern belts earlier mapped and published in Agricultural Atlas of Rajasthan (Sen, 1972) and Man in India (Sen, 1966). The map also exhibits the concentration of population and the relationship between the population distribution and settlement pattern. The map reveals the following characteristics.
Table 1. Population density in settlement zones

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Settlement pattern</th>
<th>Population density</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Scattered dune settlement</td>
<td>Low, 0 to 40 persons/sq km</td>
</tr>
<tr>
<td>2. (a)</td>
<td>Compact interdune settlement</td>
<td>Medium density—40 to 80/sq km</td>
</tr>
<tr>
<td>2. (b)</td>
<td>—</td>
<td>Medium to high—80 to 700, canal irrigated area</td>
</tr>
<tr>
<td>3.</td>
<td>Scattered settlement of rocky desert</td>
<td>Medium density—40 to 80/sq km (Above 100 in Jodhpur Tehsil)</td>
</tr>
<tr>
<td>4.</td>
<td>Compact settlement of rocky desert</td>
<td>— Same as above—</td>
</tr>
<tr>
<td>5.</td>
<td>Scattered settlement of the Aravallis</td>
<td>Medium—40 to 80/sq km</td>
</tr>
<tr>
<td>6.</td>
<td>Compact river side settlement (E. Rajasthan)</td>
<td>High—80 to 100/sq km</td>
</tr>
<tr>
<td>7.</td>
<td>Compact cum-scattered settlement (complex) of the Chambal Valley</td>
<td>Variable—high to very low, 80 to 225 and above.</td>
</tr>
</tbody>
</table>
The map represents the following:

(i) Districtwise distribution of urban population to total population of the district. The actual percentage of urban population of the respective districts are also indicated in the mapping units (district).

(ii) Percentage of urban population of each urban class of the districts (shown by bargraphs) and that of Rajasthan.

(iii) Districtwise total population of each class of urban centres.

(iv) Decennial growth rate of urban population during 1961-71 (shown in an inset map).

The mappable informations are collected from the official data of 1971 census which are compiled to make them mappable in the cartographic laboratory. The urban population of Rajasthan constitutes 17.63 percent of the total population. The percentage of urban population is highest in Bikaner district (41.56 percent) mostly due to the desertic conditions where in the land of shifting sand settled areas are only the urban centres. Jaipur (30.01), Ajmer (37.61), Jodhpur (32.17) has the urban population varying from 30 to 40 percent. 20 to 30 percent of the total population is urban in Churu (29.48) and Kota (20.46) districts. Jaisalmer (14.62); Sirohi (17.88), Udaipur (12.38); Bhilwara (11.03); Chittorgarh (10.41); Tonk (17.45); Bharatpur (13.74); Sawai Madhopur (11.36) have low urban population—10 to 20 percent of the total population. The last category or the lowest urban population is concentrated in Barmer
(7.24); Jalore (4.42); Alwar (9.21); Jhalawar (9.46); Banswara (5.07) and Dungarpur (5.91). Thus the urban population is more in arid tract where nomad or semi-nomadic populations are common, followed by semi-arid, sub-humid, and humid areas. There are seven Class I (population more than 1,00,000); 7 class II (50,000—99,999); 3 class III (20,000—49,999); 68 class IV (10,000—19,999); 41 class V (5,000—9,999) and 4 class VI (below 5,000) urban centres in Rajasthan. 41.93; 11.52; 20.98; 22.51; 6.68 and 0.38 percent of the total urban population of the State live in class I, II, III, IV, V and VI urban centres, respectively. Maximum number of towns are located in Ganganagar (12) and Jhunjhunu districts wherein only 16.07 and 17.58 percent of the total population are respectively urban. The map itself depicts clearly the details of the variation in different districts. Jaipur has 11 urban centres where about 83% of the total urban population resides in class I town (Jaipur). About 86% and 80% of the total urban population of the Jodhpur and Bikaner districts respectively, resides in class I town.

The decennial growth rate of urban population during 1961-71 was maximum in Bhilwara district (+83.28) followed by Jaisalmer (+78.28). The former was due to increased mining and industrial activities whereas the latter one is due to services. Due to rapid industrial development Kota had also an increase of +71.81%. Jaipur (48.84), Ganganagar (49.34) and Tonk (48.73) experienced also a rapid increase of about 50%. In 1971 Alwar was the only town added to the list of class I. 4, 12, 24 and 11 new towns have been added, respectively, to class II; III; IV and V urban classes, respectively, during 1971. It has been observed that in Rajasthan the number of class II and III towns are increasing more than the others.
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Occupational pattern in Rajasthan, 1971

The map represents the districtwise variation of the (i) percent of workers to total population; (ii) districtwise % of non workers and workers of different categories—cultivator; agricultural labourer and other workers (shown in pie graphs); and (iii) percent of agricultural population (cultivator + agricultural labourers) in an inset map; (iv) percentage of workers to total population of each district are also shown in the map.

The map is cartographed on the basis of 1971 census data. In Rajasthan 32.2 percent of the total population are classified as workers (cultiva-
tor, 20.5%; Agricultural labourer, 2.9% and other workers, 8.8%). Percentage of workers to total population is highest in Bhiwara (40.1%) followed by Nagaur (36.0%); Barmer (35.2%); Pali (33.7%); Sawai Madhopur (33.8%); Jodhpur (31.6%) and Jaipur (31.2%). The reasons are mostly due to services, mining and industrial activities. But in all the districts, primary activities—cultivator and agricultural labourer predominates. Percentage of agricultural population is mostly more than 85 percent of the total workers of all the districts. Districtwise variation of the primary workers to total population is shown in the inset map. The proportion of workers and non workers in case of rural areas is 1:2 while it is 1:3 in urban areas. The map depicts the vivid picture of the districtwise distribution. The proportion of workers is lowest (26.3%) in Jhunjhunu district.
PLATE 7

Rural population in Rajasthan, 1971

The map which has been compiled on the basis of 1971 census data represents the following:

i) Districtwise distribution of rural population (percentage) to total population (choropleth).

ii) The decennial growth rate of rural population during 1961-71 and the actual % of rural population.

iii) Density of rural population/sq km (shown in inset map).

Taking Rajasthan as a whole 82.39 percent of the total population is rural. Except in Jodhpur (67.83), Churu (70.52) and Bikaner (58.44) districts in arid zone and Ajmer (62.39) and Jaipur (69.99) in semi arid zone in all other districts the percentage is more than the state average (82.39). The density of rural population and decennial growth rate are not uniform and vary mostly according to rainfall and topographic conditions.

Two distinct patterns are evident in the arid zone of the State. 50 to 70 percent of the total population is rural in a belt comprising the districts of Churu, Bikaner and Jodhpur. The decennial growth rate of rural population during the last decade shows an increase of 25 to 36 percent of rural population. In another belt in the west comprising the districts of Jaisalmer and Barmer the rural population constitutes more than 85% of the total population. The decennial growth rate of rural population in this belt is below 20 percent. Another district of arid zone - the Ganganagar, has the similar characteristic, the growth rate being + 31.77 percent during the last decade. The density of rural population in arid zone districts is very low and varies from 37 persons per sq km in Churu to 12 in Barmer and only 3 in Jaisalmer.
The transitional (between arid and semi-arid) districts have 80 to 95 percent of rural population to total population, the average being 90 percent. The decennial growth rate is however not uniform. In the northern districts (Jhunjhunu and Sikar) it is above 25 percent and about 20 percent in the south (Pali and Jalore). The density of rural population in the north is 110 and in the south 65 persons per sq km.

In semi-arid zone too, two distinct patterns are noticed. In a belt comprising the districts of Ajmer and Jaipur rural population is below 70% of the total population having growth rate below 22 percent during the last decade (1961-71). These two districts are however more urbanised. The density of rural population is about 100 persons per sq km. Other semi-arid districts have more than 80% rural population. The decennial growth rate is not uniform. In the north, in Alwar, Bharatpur and Sawai Madhopur, it is above 25% with rural population density of 100 to 150 persons per sq km. In the southern districts, Bhilwara and Tonk, the decennial growth rate during the last decade is about 18% whereas the density of rural population is below 100 persons per sq km (Tonk 73, Bhilwara 90).

In sub-humid zone the percentage of rural population varies from 82 in Sirohi to 90 in Chittorgarh - the average being 85. The decennial growth rate is not uniform. The density of rural population is 90 persons per sq km in Udaipur. The average density of rural population in the zone is about 85 persons per sq km.

The percentage of rural population is very high, in the humid zone, being more than 90 on the average. Kota has the lowest figure (76%). The decennial growth rate is highest in Banswara (38.04%). In the other districts the figure varies from 25 to 30 percent. The western districts (Dungarpur and Banswara) have rural population density of more than 120 persons per sq km. In the eastern districts (Jhalawar and Kota), it is below 100 persons per sq km.
Agricultural and Agro-demographic Aspects

PART III
The map represents the rural agricultural workers to total rural workers of each district of Rajasthan. Besides the map also represents by bargraphs the % of cultivators and agricultural labourers to total rural population of each district. The mappable informations are collected from the official data of 1971 population census.

The total agricultural workers to total rural workers are maximum (above 90%) in three areas - (i) Barmer (91.98%), Jodhpur (90.14%) and (ii) Churu (96.73%) in arid zone and (iii) Dungarpur (91.02%) and Banswara (92.87%) in humid zone. In arid zone this is also very high in Bikaner (80.62%) and Ganganagar (89.73%). In the districts transitional between arid and semi-arid it is between 80.01 to 90% in Jalore (83.87%), in Sikar (70.01 to 80%) in Jhunjhunu (79.06%) and Pali (75.06%). Hence in this belt the % of rural agricultural workers to total rural workers accounts about 80% in general. The percentage is 80 to 90% in almost all the semi-arid, sub-humid and other humid district. Due to hilly and rugged terrain the figure is however a little low in Sirohi, a sub-humid district (72.72%).

The percentage of cultivators and agricultural labourers to total rural population in different agroclimatic regions are given in Table 2.
<table>
<thead>
<tr>
<th>Agro-climatic region</th>
<th>Percentage agricultural population to total population</th>
<th>Percentage agricultural cultivators to total rural population</th>
<th>Percentage agricultural labourers to total rural population</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a) Arid-mono cropping <em>Kharif</em></td>
<td>53.45</td>
<td>27.73</td>
<td>25.72</td>
</tr>
<tr>
<td>1b) Arid irrigated <em>Kharif</em>- <em>rabi</em> cropping</td>
<td>41.02</td>
<td>20.40</td>
<td>20.62</td>
</tr>
<tr>
<td>2a) Transitional-Arid-semi arid <em>kharif</em> mono cropping</td>
<td>32.13</td>
<td>25.09</td>
<td>7.05</td>
</tr>
<tr>
<td>2b) Transitional-Arid-semi arid irrigated <em>kharif</em>-<em>rabi</em> cropping</td>
<td>25.69</td>
<td>19.54</td>
<td>6.15</td>
</tr>
<tr>
<td>3a) Semi-arid <em>kharif</em> mono cropping</td>
<td>31.37</td>
<td>22.47</td>
<td>8.90</td>
</tr>
<tr>
<td>3b) Semi-arid <em>kharif</em> and <em>rabi</em> cropping</td>
<td>34.17</td>
<td>24.15</td>
<td>10.20</td>
</tr>
<tr>
<td>3c) Semi-arid <em>kharif</em> and <em>rabi</em> multiple cropping</td>
<td>32.37</td>
<td>29.02</td>
<td>3.35</td>
</tr>
<tr>
<td>4) Sub-humid</td>
<td>28.67</td>
<td>25.41</td>
<td>3.26</td>
</tr>
<tr>
<td>5a) Humid <em>kharif</em> mono cropping</td>
<td>25.87</td>
<td>22.98</td>
<td>2.89</td>
</tr>
<tr>
<td>5b) Humid-<em>kharif</em> and <em>rabi</em> cropping</td>
<td>26.38</td>
<td>20.33</td>
<td>6.05</td>
</tr>
</tbody>
</table>
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Population density in agro-climatic regions

The map represents districtwise (1) density of population/sq km in different agro-climatic regions of Rajasthan; (2) percentage of rural population to total population further subdividing percentage of cultivators and agricultural labourers to total rural population as shown and described in the previous map (by pie graph); (3) land use showing cultivated and un-cultivated lands and the area under principal agricultural crops produced in different agro-climatic regions— as shown in Plate 24 of the Agricultural Atlas of Rajasthan (1972).

To compile the map, Plate 24 of the Agricultural Atlas of Rajasthan (1972) and the 1971 census data are used. The data for each agroclimatic regions are computed and plotted to make the map self explanatory.

The details shown in the map are summarised in Table 3.
<table>
<thead>
<tr>
<th>Mapping unit</th>
<th>Total population</th>
<th>Total area (sq km)</th>
<th>Density of population/ sq km</th>
<th>Total rural population</th>
<th>Percent rural population in total population</th>
<th>Percent agricultural population to total rural population*</th>
<th>Total cropped area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a) Bikaner, Jaislamer, Jodhpur, Barmer</td>
<td>2633514</td>
<td>119353</td>
<td>22.06</td>
<td>1981466</td>
<td>75.24</td>
<td>1</td>
<td>Cropped area 28,70,000 ha, pearl millet (1,38,560 ha), wheat (132,609 ha).</td>
</tr>
<tr>
<td>1b) Ganganagar</td>
<td>1393384</td>
<td>20311</td>
<td>68.60</td>
<td>1164242</td>
<td>83.55</td>
<td>2</td>
<td>Cropped area 12,80,000 ha, pearl millet (1,38,560 ha), wheat (132,609 ha).</td>
</tr>
<tr>
<td>2a) Jhunjhunu, Churu, Sikar, Nagaur</td>
<td>5957772</td>
<td>48485</td>
<td>122.87</td>
<td>3355006</td>
<td>56.31</td>
<td>3</td>
<td>Cropped area 2052,000 ha, pearl millet (1,38,560 ha), wheat (132,609 ha).</td>
</tr>
<tr>
<td>2b) Pali, Jalore</td>
<td>1632491</td>
<td>22467</td>
<td>72.66</td>
<td>1499933</td>
<td>91.88</td>
<td>1</td>
<td>Cropped area 12,18,000 ha, pearl millet (4,27,435 ha), Sorghum 1,04,528 ha.</td>
</tr>
<tr>
<td>3a) Jaipur, Alwar</td>
<td>3854359</td>
<td>23598</td>
<td>163.33</td>
<td>3000789</td>
<td>77.85</td>
<td>3</td>
<td>Cropped area 14,28,000 ha, pearl millet (3,40,062 ha).</td>
</tr>
<tr>
<td>3b) Bharatpur, Alwar, Sawai Madhopur</td>
<td>2679935</td>
<td>18023</td>
<td>143.90</td>
<td>2168553</td>
<td>80.91</td>
<td>1</td>
<td>Cropped area 10,14,000 ha, pearl millet 2,17,998 ha, wheat 1,45,108 ha.</td>
</tr>
<tr>
<td>3c) Bhiwara, Tonk</td>
<td>2823574</td>
<td>25591</td>
<td>110.41</td>
<td>2170839</td>
<td>76.82</td>
<td>1</td>
<td>Cropped area 11,57,000 ha, Sorghum 2,22,893 ha, wheat 26,21,587 ha.</td>
</tr>
<tr>
<td>4 ) Part of Sirohi, Chittorgarh &amp; Udaipur</td>
<td>3169611</td>
<td>30876</td>
<td>102.65</td>
<td>2740177</td>
<td>86.45</td>
<td>1</td>
<td>Cropped area 10,16,000 ha. Main crops maize &amp; wheat.</td>
</tr>
<tr>
<td>5a) Part of Sirohi, Udaipur</td>
<td>1648839</td>
<td>14568</td>
<td>113.18</td>
<td>1540635</td>
<td>93.43</td>
<td>2</td>
<td>Cropped area 5,43,000 ha. Main crop maize.</td>
</tr>
<tr>
<td>5b) Kota and Jhalawar</td>
<td>1365011</td>
<td>18346</td>
<td>96.20</td>
<td>1432015</td>
<td>81.13</td>
<td>2</td>
<td>Cropped area 8,39,000 ha. Main crops sorghum &amp; wheat.</td>
</tr>
</tbody>
</table>

* 1 Cultivator, 2 Agricultural labourer, 3 Total
+ In subsequent works Churu has been included in arid zone.
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PLATE 10

Density of net area sown and agricultural products, 1971

The map represents the districtwise variation of the density of agricultural land (percentage of net area sown to total area of the district) and area and production of cereals and pulses in ha and tonnes within the respective mapping units. The mappable informations are collected and compiled from the statistical abstracts published by the Directorate of Economics and Statistics, Govt. of Rajasthan and Central Revenue Board (Land Records), Govt. of Rajasthan, Ajmer.

The percentage of cultivated land is highest in Churu (65.23); Jhunjhunu (71.86), Sikar (67.59) and Nagaur (63.30) districts of arid zone
(above 60.01%) and Bharatpur of semi-arid zone (61.80%). The second zone (40.01 to 60.00%) is concentrated in the following belts: (i) Jodhpur (42.4); Pali (42.46) and Jalor (49.0) of arid zone; (ii) Ganganagar (51.73) of irrigated arid area; (iii) a continuous belt comprising the semi-arid districts of Jaipur (53.24), Alwar (57.16) Tonk, (55.16), Ajmer (42.96) and Sawai Madhopur (44.70); (iv) Jhalawar (46.37) and Kota (44.35) in humid-zone. 20.01 to 40 per cent of the lands of Barmer, Chittorgarh, Dungarpur, Banswara and Sirohi are cultivated. The % is the lowest, below 20%. In the two extreme arid districts Jaisalmer (1.19%) and Bikaner (15.44%) and hilly Aravalli district of Udaipur (18.89%).

The area and production of cereals and pulses are shown clearly in the map and further illustrated and described in Plates 12 and 13.
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Map 11 shows the occupational pattern and per capita agricultural land in the different districts of Rajasthan and as such represents the agricultural population and its pressure on agricultural land. Cultivators and agricultural labourers constitute the agricultural population. This has been expressed in terms of percentage to total working population. Per capita agricultural lands in different districts as indicated in the map are worked out by Net sown area in ha. As per 1971 census, the working agricultural population of Rajasthan is 32.22 per cent of the total population. It is interesting to note that although the decennial growth rate during the last decade is +27.63 per cent, the percentage of workers in the state falls from 47.55 per cent in 1961 to 32.22 per cent in 1971. In the State the cultivators and agricultural labourers constitute 63.59 per cent and 9.10 per cent, respectively, of the total working population. It is thus seen that not only the bulk of the total population is rural but also the majority of them depends on agriculture. The analysis of the map shows the following characteristics.

Arid zone: 30 (Ganganagar) to 35 (Barmer) per cent of the total population are workers. During the decade the percentage of workers falls by 17 per cent in Churu and Barmer districts, where about 80 per cent of the total working population are cultivators and agricultural labourers. Per capita agricultural land in these two districts is about 4.5 ha. In the other four districts the percentage of workers to total population fell by about 10 per cent during the last decade. In Ganganagar, agricultural population accounts for 78 per cent of the total working population out of which 59 per cent are cultivators and 18 per cent are agricultural labourers. Per capita agricultural land here is 3.65 ha. Agricultural population accounts for 60 to 66 per cent in the other three districts; cultivators and agricultural labourers vary from 6.39 per cent in Bikaner to 7.95 per cent in Jaisalmer.

In the districts of transitional zone, between arid to semi-arid working population decreased considerably during the last decade. In
Sikar and Jhunjhunu in the north, working population constitutes 27 per cent of the total population out of which about 70 per cent forms the agricultural population. 30 to 35 per cent of the total population of the other three districts are workers. Cultivators and agricultural labourers account for 70 and 9; 48 and 19 and 66 and 14 per cent to total working population in Nagaur, Pali and Jalor districts, respectively. Per capita agricultural land varies from 2 to 3 ha.

**Semi-arid zone:** 29 to 40 per cent of the total population are workers. During the last decade percentage of working population has decreased considerably. In Jaipur and Ajmer belt the total agricultural population accounts for about 59 per cent of the total working population, whereas in the other five districts this comprises 75 per cent. Agricultural labourers constitute about 8 per cent of the total working population on the average. Cultivators vary from 50 to 53 per cent in Jaipur-Ajmer belt to about 70 per cent on the average in the semi-circular belt comprising five other districts. Per capita agricultural land varies from 1 to 2 ha.

**Sub-humid zone:** Working population accounts for 30 to 40 per cent of the total population. In Sirohi only 43 per cent of the total working population are cultivators, whereas the agricultural labourers account for 20 per cent. In the districts the figures are, however, not uniform. Cultivators and agricultural labourers constitute 58 and 12, 73 and 8, and 68 and 6 per cent of the total working populations in Bundi, Chittorgarh and Udaipur districts, respectively. Per capita agricultural land is less than 2.50 ha.

**Humid zone:** 28 to 29 per cent of the total population in the western districts (Dungarpur and Banswara) are workers. 80 per cent of the workers from agricultural population, the cultivators and agricultural labourer being 73 and 4 and 82 and 7 in Dungarpur and Banswara, respectively. Per capita agricultural land is 1 to 2 ha. About 30 per cent of the total population in the eastern districts (Kota 30.95 and Jhalawar 32.53) are workers, cultivators and agricultural labourers being 48 and 16 and 63 and 16 percent total workers, respectively in Kota and Jhalawar districts. Per capita agricultural land is 2 to 2.50 ha.
PLATE 12

Production per cultivator of cereals and pulses

Population and staple food crops

Plate 12 represents the production of cereals and pulses (staple food crops) per cultivator in kilogram along with percentage of area under cereals and pulses in the different districts of the State during 1971. Cultivated lands per cultivator (cultivator/total sown area, have also been indicated in the map. Associated with it is an inset map which shows districtwise percentage of area under cereals and pulses during 1971. These two maps and plate 13 show the relationship between population and food production. These maps bring out the following salient features in different agro-climatic zones.

Arid Zone: The lowest production is in Jaisalmer district, being 117 kg per cultivator. Considering the total population, per capita production is only 23 kg in a year (plate 13). The production is expected to be low because only 4.34 per cent of total land is cultivated for cereals and pulses. Production per cultivator in churu-Bikaner-Jodhpur belt is 700 to 900 kg, where per capita production is only 120 to 170 kg. In Barmer the production is a little more. Due to irrigation the production is the highest in Ganganagar district (3326 kg per cultivator and 585 kg per capita).
The districts, transitional between arid and semi-arid, have higher production. But per capita production, except Jalor, is small varying between 200 to 235 kg. Per capita production in Jalor, in this belt, is however higher (330 kg). Production per cultivator, except in Nagaur (857 kg) exceeds 1000 kg in all the districts.

_Semi-arid zone:_ The production is the lowest in Ajmer (142 kg per capita and 806 kg per cultivator). Alwar and Bharatpur have higher production. Per capita production is about 325 kg. Production per cultivator varies between 1500 to 1600 kg. Tonk, in this zone, has the highest production (561 kg per capita and 2382 kg per cultivator).

_Sub-humid zone:_ Production per cultivator in Udaipur and Sirohi exceeds 100 kg, whereas in the other two districts the figure is 800 to 1000 kg per cultivator. But the per capita production is the highest in Chittorgarh district (280 kg). In other districts per capita production of cereals and pulses varies between 200 to 240 kg.

_Humid zone:_ Like Ganganagar in the arid and Tonk in the semi-arid zone, Banswara district in the humid zone is characterised by high production (501 kg per capita and 2199 kg per cultivator). In all the other four districts production per cultivator exceeds 1300 kg. Per capita production here varies between 268 kg in Kota to 323 kg in Jhalawar.
Plate 13

Per capita production of cereals and pulses and
carrying capacity zones

Plate 13 shows per capita annual production of cereals and pulses in
different districts of Rajasthan. On the basis of this map an attempt has
been made to classify the surplus and deficit in relation to local supply
of staple food crops (cereals and pulses) and to map the carrying capacity
zones of the state. Per capita daily consumption of cereals and pulses in
Rajasthan seldom exceeds 0.5 kg. Considering different age groups and
male-female composition of population it has been estimated that minimum
per capita requirement of cereals and pulses in Rajasthan is 215 kg in a
year. Accordingly, the districts having less than 215 kg as per capita
production are grouped as deficit zones. In Rajasthan, particularly in the
arid and the semi-arid zones, agriculture is mostly dependent on rainfall.
Due to rainfall uncertainties, crop failure is very common, and once in
every four years crop failure hits the State. The per capita crop production
of the State is based on a year of fairly good rainfall. The production in
many districts, falls even during average rainfall year. Accordingly, a
transitional zone has been demarcated grouping the districts having per
capita production between 215 kg to 265 kg. Districts having more than 265 kg fall under surplus zone. Accordingly, a carrying capacity map of the State in relation to the production of staple food crops has been tentatively prepared (inset map). The map depicts the districts of Churu, Bikaner, Jaisalmer and Jodhpur in the arid zone; Pali in the transitional zone; Jaipur and Ajmer in the semi-arid zone and Sirohi in the sub-humid zone form a compact group in deficit belt. Ganganagar of the arid zone in the north stands out as the granary of Rajasthan and forms a pocket showing a surplus zone. Three groups of districts, one formed by Alwar and Bharatpur of the semi-arid zone in the north east; the second by Bundi and Chittorgarh of sub-humid zone, all the four districts of the humid zone and Tonk of the semi-arid zone and the third by Jalor district of the transitional (arid-semi-arid) zone also belong to the surplus belt. Thus the surplus areas of the State form four isolated belts. The arid, and semi-arid zone districts including the transitional one (Jalor) have high production due to irrigation (Sen, 1972 a). The rest of the districts have per capita production between 215 kg to 265 kg and form the transitional zone between surplus and deficit zones. Except in the years of very good rainfall these districts practically come under deficit zone. Barmer is the only district of the arid zone, which belongs to this group.
The map represents the district wise yield of the major crops produced in Rajasthan namely wheat, barley, maize, gram, \textit{bajra} and \textit{Jowar}. Besides the intensity of cropping of different districts are also shown by shading in the map. To compile the data of crop yield, the area and production of the crops for the years 1969 to 73 were used. This gives rather a fair picture as variation in yield is often noticed due to extreme drought conditions or unexceptional heavy rainfall in certain years. The intensity of crop for various districts are worked by \[ \frac{\text{Net sown area}}{\text{Total cropped area}} \times 100. \] The mappable informations are collected from the statistical abstracts published by the Directorate of Economics and Statistics, Govt. of Rajasthan.

Yield of crops are also given in Table 4. The cropping intensity of the different districts are recorded on the body of the map. The cropping intensity is very low in the districts of arid zone (less than 101) except in Ganganagar (107.7) where irrigational facilities are available. In the districts which are transitional, between arid and semi-arid, intensity of cropping is low to moderately low, at Jalal (107.6); Pali (104.8); Sikar (103.8) and Jhunjhunu (103.7).

In semi arid zone, the cropping intensity is moderately low to moderate, varying from 106.6 at Tonk and 109.8 at Ajmer to 114.6 at Bharatpur, 124.2 at Bhilwara. In humid and sub-humid belt it is moderate like Banswara (120.0); Udaipur (123.5); Dungarpur (121.0) and Sirohi (113.2). In general the cropping intensity is however not satisfactory in Rajasthan and in arid zone in particular is very poor.

The crop yield in general is also very poor. In arid zone the yield of \textit{bajra} (peral millet) varies from 58 kg/ha in Jaisalmer, 66 kg/ha in Bikaner to 300 kg/ha in Jodhpur. In transitional zone between arid and semi arid the yield of \textit{bajra} varies from 230 kg/ha in Nagaur to 337 kg/ha in Jhunjhunu & Sikar districts. In semi arid zone the yield ranges from 743 kg/ha in Bharatpur; 614 kg/ha in Sawai Madhopur; 542 kg/ha in Jaipur to 214 kg/ha in Ajmer. In sub-humid and humid the yield is in general 300 kg/ha. The trend of yield of other crops are same as is evident from the map. Following features are however noticed.

(i) According to area and production the crops can be arranged in order of importance as \textit{bajra}; \textit{jowar}; gram; wheat; maize and barley. But if the yield is considered the condition is reversed. This is because in Rajasthan the primary cereals are grown
under wet and irrigated conditions whereas the secondary cereals like bajra, jowar and gram are grown under rainfed conditions.

(ii) Secondary crops are the principal products and practised in large areas. The primary cereals which are subsidiary products are combined in limited area and are under intensive cultivation. This has resulted in higher yields than the secondary cereals which are under extensive cultivation.

Table 4. Crop yields in different climatic zones (kg/ha)

<table>
<thead>
<tr>
<th>District</th>
<th>Bajra</th>
<th>Jowar</th>
<th>Maize</th>
<th>Wheat</th>
<th>Barley</th>
<th>Gram</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A. Arid zone (Kharif mono cropping)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barmer</td>
<td>211</td>
<td>209</td>
<td>708</td>
<td>1090</td>
<td>975</td>
<td>526</td>
</tr>
<tr>
<td>Bikaner</td>
<td>66</td>
<td>1757</td>
<td>500*</td>
<td>976</td>
<td>639</td>
<td>516</td>
</tr>
<tr>
<td>Churu</td>
<td>159</td>
<td>234</td>
<td>964</td>
<td>586</td>
<td>331</td>
<td></td>
</tr>
<tr>
<td>Jaisalmer</td>
<td>58</td>
<td>383</td>
<td>1491</td>
<td>1500</td>
<td>405</td>
<td></td>
</tr>
<tr>
<td>Jodhpur</td>
<td>210</td>
<td>185</td>
<td>687</td>
<td>1225</td>
<td>902</td>
<td>524</td>
</tr>
<tr>
<td>1B. Arid irrigated kharif and rabi cropping</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ganganagar</td>
<td>300</td>
<td>309</td>
<td>916</td>
<td>1091</td>
<td>878</td>
<td>578</td>
</tr>
<tr>
<td>2A. Transitional (Arid semi-arid) kharif mono cropping</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sikar</td>
<td>337</td>
<td>297</td>
<td>553</td>
<td>1115</td>
<td>1098</td>
<td>303</td>
</tr>
<tr>
<td>Jhunjhunu</td>
<td>328</td>
<td>266</td>
<td>500*</td>
<td>1005</td>
<td>1005</td>
<td>297</td>
</tr>
<tr>
<td>Nagaur</td>
<td>230</td>
<td>156</td>
<td>715</td>
<td>1012</td>
<td>995</td>
<td>416</td>
</tr>
<tr>
<td>2B. Irrigated kharif - rabi cropping</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pali</td>
<td>337</td>
<td>235</td>
<td>532</td>
<td>1551</td>
<td>975</td>
<td>502</td>
</tr>
<tr>
<td>Jalore</td>
<td>356</td>
<td>52</td>
<td>536</td>
<td>1170</td>
<td>509</td>
<td>532</td>
</tr>
<tr>
<td>3a. Semi arid kharif mono cropping</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alwar</td>
<td>527</td>
<td>423</td>
<td>510</td>
<td>1392</td>
<td>1100</td>
<td>828</td>
</tr>
<tr>
<td>Jaipur</td>
<td>542</td>
<td>242</td>
<td>935</td>
<td>849</td>
<td>105</td>
<td>1115</td>
</tr>
<tr>
<td>3b. Semi arid - kharif and rabi cropping</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bharatpur</td>
<td>743</td>
<td>357</td>
<td>494</td>
<td>1301</td>
<td>1297</td>
<td>960</td>
</tr>
<tr>
<td>Sawai Madhopur</td>
<td>614</td>
<td>554</td>
<td>605</td>
<td>2210</td>
<td>895</td>
<td>694</td>
</tr>
<tr>
<td>3c. Semi arid - kharif and rabi multiple cropping</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ajmer</td>
<td>214</td>
<td>158</td>
<td>485</td>
<td>1194</td>
<td>897</td>
<td>286</td>
</tr>
<tr>
<td>Bhilwara</td>
<td>311</td>
<td>140</td>
<td>863</td>
<td>1230</td>
<td>1073</td>
<td>448</td>
</tr>
<tr>
<td>Tonk</td>
<td>467</td>
<td>240</td>
<td>47</td>
<td>940</td>
<td>507</td>
<td>498</td>
</tr>
<tr>
<td>4. Sub-humid - kharif and rabi cropping</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bundi</td>
<td>369</td>
<td>471</td>
<td>895</td>
<td>1063</td>
<td>1009</td>
<td>547</td>
</tr>
<tr>
<td>Sirohi</td>
<td>245</td>
<td>149</td>
<td>1041</td>
<td>1352</td>
<td>962</td>
<td>412</td>
</tr>
<tr>
<td>Udaipur</td>
<td>330</td>
<td>286</td>
<td>10947</td>
<td>1513</td>
<td>919</td>
<td>679</td>
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<tr>
<td>Chittorgarh</td>
<td>395</td>
<td>458</td>
<td>1260</td>
<td>1312</td>
<td>973</td>
<td>302</td>
</tr>
<tr>
<td>5a. Kharif mono cropping</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dungarpur</td>
<td>297</td>
<td>342</td>
<td>926</td>
<td>1330</td>
<td>1038</td>
<td>496</td>
</tr>
<tr>
<td>Banswara</td>
<td>285</td>
<td>345</td>
<td>283</td>
<td>1124</td>
<td>954</td>
<td>518</td>
</tr>
<tr>
<td>5b. Kharif rabi cropping</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kota</td>
<td>282</td>
<td>528</td>
<td>804</td>
<td>1026</td>
<td>958</td>
<td>642</td>
</tr>
<tr>
<td>Jhalawar</td>
<td>309</td>
<td>573</td>
<td>789</td>
<td>937</td>
<td>1011</td>
<td>544</td>
</tr>
</tbody>
</table>

* Area and production negligible.
Rural Economic Development

PART IV
PLATE 15
The farm harvest prices of agricultural commodities in Rajasthan

The map represents the farm harvest price or the average wholesale price of eight crops of the districts in Rajasthan. The circles in the map represent the farm harvest values of the total crops which are also indicated by figures in the body of the map and the value of the individual crops are indicated in the proportionated bars radiating from the circle. The figure or the value in lakhs of rupees of the farm harvest price of the
eight crops are also indicated in the respective units (district) of the map. The mappable informations are collected from the statistical abstracts published by the Directorate of Economics and Statistics, Govt. of Rajasthan. The crops considered are: bajra, jowar, maize, wheat, barley, rice, tur and gram. The total harvest price of the commodities in Rajasthan during late sixties was 3562999392 of which bajra is the most important.

The map itself is self explanatory and records all the data.
PLATE 16

Rural workers in 'Mining - Quarrying' and 'Livestock-Forestry' in Rajasthan

The map represents the percentage of rural workers engaged in secondary activities of census industrial categories-mining, quarrying, livestock and forestry in different districts of Rajasthan. The % of rural workers to total rural workers of a district engaged in such different activities like (i) livestock, forestry, fishing, plantations and orchard and (ii) mining and quarrying are shown in bar graphs. Maps are prepared on the basis of 1971 Population Census data published in Series 18, Part IIA by the Directorate of Census operation, Rajasthan. Only 3.18 % of the
total rural workers in Rajasthan are engaged in such activities. Bhilwara (6.85%); Pali (6.16); Bundi (7.72); Sirohi (9.22); Tonk (5.46) and Ajmer (7.60) are the only districts where more than 5% of the rural workers are engaged in livestock and quarrying activities. On district level total rural workers engaged in livestock, forestry and fishing varies from 9.04% in Sirohi to 7.40% in Ajmer; 6.20% in Jaisalmer to 0.20% in Banswara. Similarly, in mining and quarrying the percentage of rural workers ranges from 1.73% in Kota; 1.51% in Jhunjhunu; 1.10% in Bundi to 0.02% in Ganganagar. Thus it is evident that only livestock farming has got some significance in the economic activities of Rajasthan. Still higher proportions of agricultural workers are observed in rural areas.
PLATE 17

Rural workers in household and related industries in Rajasthan

Like the previous map, this plate shows the district wise percentage of rural workers engaged in household and related industries like manufacturing, processing, servicing, repairing, construction, trade and commerce, transport, storage, communication and other services or the tertiary activities of the Indian Census industrial category. The source of data for mapping and representation are same like that of plate 16. Total number of workers engaged in these activities are however more than the secondary
one being 3.99% of the total rural workers. But the variation is however very small. Percentage of rural workers in household and other related industries account for 2.86 and 1.13 percent, respectively, of the total rural workers in Rajasthan. On district level household industries engage 5.54%; 5.03%; 3.95% of the total rural workers, respectively, Pali, Jaipur, Sawai Madhopur districts Kota (3.72%), Ajmer (3.19%), Alwar (3.49%); Jaisalmer (3.56%), Sirohi (4.93%) are also important. Participation of other districts is however small. Sirohi, Pali and Jaipur are the districts where about 6% of the total rural workers are engaged in this economic activities.
PLATE 18

Levels of agro-demographic development

Two synthetic maps have been cartographed on 1:2,000,000 scale to depict the agro-demographic regions of the State and the levels of rural and agro-demographic development. The two maps are cartographed in one plate. The maps attempt to depict the different agro-demographic regions of the State and their levels of rural economic development. 14 indicators are selected for deducing the synthetic index of rural economic and agro-demographic development. For purpose of analysis, the level of rural economic development are considered as having two fundamental aspects—efficiency of rural occupational structure and rural production both these aspects of development are in turn susceptible of further analysis. Accordingly, following indicators are considered to study and map the agro-demographic regions, rural economic and agro-demographic development.

(A) Structural indicators (percentage)

1. Rural population to total population
2. Cultivators to total population
3. Agricultural labourers to total population
4. Agricultural population to total population

(B) Occupational indicators (percentage to total workers)

5. Agricultural population to total rural population
6. Cultivators to total workers
7. Agricultural labourers to total workers
8. Agricultural population to total workers
9. Rural workers in livestock, forestry, fishing and hunting
10. Rural workers in mining and quarrying
11. Rural workers in household industry
12. Rural workers in other than household industry

(C) Productivity indicators

13. Per capita production of cereals
14. Per capita production of pulses

For analytical purposes three other indicators are considered only on broad levels; per capita income; gross value of agricultural output and agricultural land per agricultural population.

After calculating the districtwise data for the above 14 indicators ‘score’ for each indicator is arrived at by standardising the data tabulated. This was done mainly by following the methods evolved by Mitra (1968)
and Schwartzberg (1969). This is done by assigning zero to the least favoured district with respect to each variable and a score of 100 to the most favoured one. Intermediate scores are given to each intermediate districts according to the arithmetic distance of its non standardised scores for the two extremes. This can assign a comparable sets of scores or index numbers for each variables considered for mapping. The synthetic index for each district is thus calculated by adding the scores of all the 14 indicators (for agro-demographic regions) and by taking their average values (for rural economic and agro-demographic development). The State average is 700 for agro-demographic regions and 50 for rural-economic and agro-demographic development.

Following levels of agro-demographic development are identified and mapped (Table 5).

<table>
<thead>
<tr>
<th>Levels of agro-demographic development</th>
<th>Synthetic index or score</th>
<th>Number of districts included</th>
<th>Total area in km² and %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very poor</td>
<td>Below 30</td>
<td>One</td>
<td>27231</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bikaner (arid)</td>
<td>(7.95%)</td>
</tr>
<tr>
<td>Poor to very poor</td>
<td>30-40</td>
<td>Ten</td>
<td>132784</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Churu; Jodhpur, Jaisalmer,</td>
<td>(38.80)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(arid); Jhunjhunu; Sikar</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(transitional between</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>arid &amp; semi-arid); Ajmer,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Jaipur, Alwar (semi-arid);</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sirohi (sub-humid); Banswara (humid)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Eleven</td>
<td></td>
</tr>
<tr>
<td>Moderately poor to poor</td>
<td>40-50</td>
<td>Eleven</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Barmer, Ganganagar,</td>
<td>149125</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nagaur (arid); Pal;</td>
<td>(43.57%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Jalore (transitional)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sawai Madhopur, Bharatpur,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tonk (semi-arid, Udaipur</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(sub humid), Kota (humid)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dungarpur</td>
<td></td>
</tr>
<tr>
<td>Moderately developed</td>
<td>50-60</td>
<td>Four</td>
<td>133074</td>
</tr>
<tr>
<td></td>
<td>Max-55.69</td>
<td>Bhilwara (semi arid);</td>
<td>(9.68%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bundi-Jhalawar (humid);</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chittorgarh (sub humid)</td>
<td></td>
</tr>
</tbody>
</table>
Three agro-demographic regions on the basis of synthetic index are recognised and mapped.

Region I (lowest order of development, 550). The region includes 11 districts comprising 46.75% of the total area of the State. This occurs in a belt from Jaisalmer & Jodhpur in the south west of Alwar in the north-east and Ajmer in the south. This belt includes 10 districts-mostly the arid zone ones except Jaipur, Ajmer & Alwar of semi arid zone in the east. Sirohi and Barmer form two isolated pockets in this group.

Region II (second order of development, 550/700). Three belts one in the east (4 districts) along the chambal; other in the south west comprising Dungarpur, Udaipur, Nagaur, Pali, Jalor and Barmer and the other in the extreme north (Ganganagar) are distinguished-total area is 149125 sq km or 43.57% of the total area (in all 11 districts).

Region III comprises 4 districts (33074 sq km or 9.68%) in the south-east in humid to sub-humid climate (except Bhilwara which is semi-arid). This is the region of third order of development; synthetic score being 700 : 1 to 780.
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