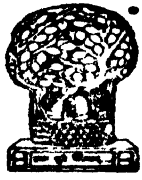
ECONOMIC GEOGRAPHY OF INDIA

V. S. GANANATHAN



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INDIA — THE LAND AND THE PEOPLE

ECONOMIC GEOGRAPHY OF INDIA

ECONOMIC GEOGRAPHY OF INDIA is a layman's guide to the range and extent of our economic activity. The book starts with a brief description of the physiography and natural resources of the Indian sub-continent, goes on to survey the main economic trends in the country under four broad heads (Land use and self-sufficiency, Development of Industries, Transport and Communications, and Dependancy on Imports), and outlines a broad future plan of action. The author, while acquainting the reader with facts and figures relating to the locations/production of our main crops and industries, has also assessed objectively the progresses made in agriculture, industries, oil exploration, power generation, communications etc. The many tables, charts and maps add to the usefulness of the book.

Professor V.S. GANANATHAN was educated at Madras and Syracuse, N.Y. (U.S.A.). He is Head of the Department of Geography at the University of Poona for the past 27 years. Widely travelled, and author of many papers published in International Geographical Journals, he has been actively connected with several committees set up by the Government for the publication of books on Geography.

INTRODUCTION TO THE FIRST EDITION

THE PLAN of the National Book Trust, India is to publish a number of small volumes each of which would be on one important aspect of India. The author, who was requested to prepare the volume on the Economic Geography of India, has done his best. A comprehensive view, with depth at places, has been given.

For most of the data the year is 1969-70; in some cases a later year has been specifically mentioned. Achievement in a single year is not so important as the nature of achievements in recent years. Trends are more important than short-period achievements. The author has tried to indicate the trends, the averages in production and so on. The aim has been to give an objective picture, a perspective rather than an accurate profile or contour-drawing.

Since the country is passing through a period of internal and external pressures, sudden changes occur in most aspects of its vibrating life; some of these may appear to be contrary to the conclusions indicated in the body of this volume; but the truth lies in trends based on past year's performances.

The author would be thankful to the readers of this volume for any helpful suggestions and constructive criticism.

Shri T.H. Jachak, Miss Razia Shaikh and Miss Veena Motee were very helpful in the preparation of the maps and the manuscript; the author desires to record here his appreciation of the help rendered by these people to him.

Without the helpful suggestions and encouragement received from Prof. George Kuriyan, it would not have been possible to get this work done. Prof. Kuriyan was good enough to read the manuscript; all his helpful suggestions have been adopted. The author is very grateful to him for all this help.

V.S. GANANATHAN

INTRODUCTION TO THE REVISED EDITION

THE opportunity of preparing a revised edition of the book has been utilised in making it more up-to-date; for most of the data the uniformly recent year is 1972-73; in some cases a later year has been specifically mentioned.

Without the help of Miss C.J. Patil it would have been very difficult to prepare the revised edition so thoroughly; her assistance to the author was not only in the mechanical/statistical aspect of the work but also in the academic aspects of the work; to her the author is particularly thankful. Mrs. K.D. Kulkarni has typed many of the new tables for which she deserves the author's thankfulness.

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CHAPTER 1

PHYSIOGRAPHY

THE INDIAN SUB-CONTINENT is a geographical unit very well defined by the mountains and the ocean surrounding it. It may be broadly divided into three large physiographic parts : (*a*) The Peninsular mass of ancient crystalline rock; (*b*) the mountain system in the north, composed of rocks of different geological ages, where the rocks have experienced folding and faulting; and (*c*) the alluvial lowland, between the northern mountain system and the peninsular shield, where a structural trough (a geosyncline) has been filled up with transported material from the adjoining areas, especially the northern mountain system.

THE PENINSULAR PLATEAU

This has been one of the stable surfaces of the earth's crust. For over 600 million years it has been a land surface exposed to the atmosphere; only locally, and for short periods, has it been submerged under the sea. It is a tilted plateau with a general slope eastwards, with the western edge forming the main watershed between the rivers flowing westwards and eastwards. Uninterrupted denudation over millions of years has made the plateau a highly dissected one; the plateau is approaching base level especially in the eastern half of the Peninsula.

This Peninsular massif of ancient crystalline rocks has today a surface marked by wide river valleys and flood plains with relict uplands, hills and mountains in between the river plains (*Map 2*). Valuable soils, with good depths, are to be found mainly in the river plains.

The western edge of the plateau is within 80 to 160 kilometres of the west coast. It is an irregular ridge-zone through which the main watershed meanders. Different sections of this ridge-zone are known by different names; generally the northern half is

known as the Sahyadris, while the southern half is referred to as the Anaimalais[1]. The eastern edge of the plateau, having been the lower edge of the tilted plateau, has been cut through by wide river plains; consequently, it appears as a number of isolated hilly tracts; each of these has a local name, like Shevaroy hills, Nallamalai hills and so on. This broken eastern edge joins the western edge to form the high Nilgiri complex, with many peaks exceeding 2500 metres (between 11° & 12° North lat. and 76° & 77° East long.). South of the Nilgiri section the Anaimalai (or the western edge) continues for another 300 km. High peaks exceeding 2500 metres also occur in this part of the Anaimalai. Actually outside the Himalayas, the highest peaks occur in the Nilgiri-Anaimalai region.[2]

The peninsular plateau is very important from the economic point of view. Because of its dissected character, there is scope for developing multi-purpose projects. This shield area possesses valuable economic minerals, as the other shields in the world do.

The Northern Mountains

The mountains that border India in the north are the product of tangential thrusts in the crust of the earth, derived from further north (Tibet and beyond), which resulted in folding, faulting and uplift of the sediments that largely compose them.[3] This region had been under the sea for a considerable period of its history and experienced successive marine depositions before it was pushed towards the peninsular massif. There are very high ranges inter-

[1] This ridge-zone is often referred to as the Western Ghats; according to the author, this is incorrect. The Western Ghats actually refer to the various passes in the ridge-zone, *e.g.*, Palghat Agumbhe Ghat, Amba Ghat, Bhor Ghat and so on.

[2] Hill resorts like Ootacamund, Coonoor and Kodaikanal belong to this region, attracting large numbers of people from the hot plains during the summer months.

[3] There is another view to the effect that the northern land mass was stationary, while the Deccan Peninsula moved northwards and eastwards (*Editor*).

spersed with large and small plateaux and valleys.[1] The ranges have a general east-west trend. The mountainous area as a whole extends for over 2000 km and has a width of 400 km; some of the highest peaks in the world are to be found here.

These northern mountains are of very great importance to India; they influence the climate, provide water to the plains and possess valuable vegetation and animal life.

THE ALLUVIAL LOWLAND

Extending over 400,000 sq. km., this area must have been once a deep trough (geosyncline); the rivers originating from the northern mountains have filled up the trough with enormous quantities of alluvial deposits. The thickness of the alluvium varies from 300 to 3,000 metres, giving us some idea of the depth of the original trough. The western sections of the plain also have wind-blown material mixed up with river-borne alluvium; the eastern section is essentially made up of river-borne alluvium. This extensive lowland is remarkable for the absence of local variations in relief; to an observer it looks much like a flat surface extending right up to the horizon. The slope towards the east, from Delhi to Calcutta, is so gentle that there is less than a 12-cm drop for each kilometre.

The alluvial plain is significant in the economic geography of India. Its [illegible] soil has encouraged agriculture from early times and its topography being conducive to easy communications has led to the development of settlements.

CLIMATE

The shape of the Indian sub-continent and its position just north of the Equator, partially surrounded by the arms of the Indian Ocean and backed by the high Himalayas, has great significance in explaining the nature of the climate experienced by

[1]Some of these valleys, like the Kashmir and Kulu valleys, are quite extensive and fertile; they have great scenic beauty and attract tourists.

this area. The water body around peninsular India provides moisture for the considerable precipitation over land in the sub-continent; it also helps in moderating the temperature conditions, especially along the coastal tracts. The northern mountains check the spread of cold continental winds from Interior Asia over the sub-continent and thereby make the winters comparatively mild. The area south of 20 degrees North latitude might be considered as the peninsular part of the country.[1] The peninsular part has, generally, high temperatures throughout the year, with a low to moderate annual range of temperature; the continental part has a high annual range of temperature with distinct summer and winter seasons.

With practically no winter in the peninsular part and only a mild one in the continental part, temperature conditions are favourable to the growth of vegetation all over the sub-continent for the whole year; only in very high altitudes in the northern mountains do the winters discourage continuous plant growth—such tracts would form less than 1% of the total area of the land. While temperature conditions are so helpful all over the country, precipitation is not. Distribution of rainfall is very uneven both areally and seasonally. Consequently, the importance of precipitation in Indian economic life is very significant.

On the basis of temperature and precipitation conditions, three seasons in a year are normally recognized for the country as a whole. They are :

(*a*) Hot dry season—end of March to end of May.
(*b*) Warm (or cool) dry season—middle of November to about middle of March.
(*c*) Warm (or cool) wet season—June to middle of November.

These seasons vary in their duration from year to year and place to place. Furthermore, they are not applicable to the

[1]The 20° N. lat. has been suggested arbitrarily; the East-West extent along this latitude is roughly 1500 km; most of peninsular India lies to the south of this latitude.

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South-East (mainly, Tamil Nadu State) and the North-West (mainly Jammu and Kashmir), where there is a good deal of precipitation during the September-January period. The year-to-year variation (in a given locality) is due to changes in the time of the onset of the monsoon[1] and the time that the monsoon ends; the variation could be as much as two to three weeks or below the normal duration. In addition to this, there is also the variation in duration from place to place. This is because the rainy season starts earlier in the south and moves northwards (*Map* 4) and ends later in the south than in the north. So the total duration of the rainy season is greater in the southern stations, particularly those in the Kerala State, than in the northern ones. During the rainy season, the limits of which are not easily recognizable, precipitation does not occur all the time; invariably days without rain occur between periods of continuous or intermittent rainfall.

The distribution of precipitation, in terms of quantity, is very uneven. Very high precipitation (over 300 centimetres annual average) is experienced in the southern slopes of the Khasi Jaintia Hills of Assam, the southern slopes of the Assam Himalayas and the western slopes of the Sahyadri and Anaimalai ranges in western Peninsular India (*Map* 5). Very low precipitation (less than 40 centimetres annual average) is experienced in western Continental India (in Kutch and western Rajasthan) and northern Kashmir (Ladakh, Baltistan and Gilgit). Between these extremes precipitation varies over the rest of India within the 40-cm-to-300-cm range. Most of the precipitation is derived from moisture-laden air moving over the sub-continent from the Bay of Bengal and the Arabian Sea; this movement is caused by the creation of a comparative low pressure axis over the central parts of the country as a result of the increasing insolation over land during the previous hot dry season; the low pressure area is itself a shifting one and is not stationary. The northward-moving mass of air approaches the southern

[1]The Arabs seem to have introduced the term 'monsoon' when referring to the periodical movement of the air across the Arabian Sea. Today most people, including geographers and meteorologists, use the term for referring to the season of precipitation.

tip of the peninsula some time late in May and moves further north in two distinct branches—the Bay of Bengal branch and the Arabian Sea branch (*Map* 4). About a week later, normally, the monsoon reaches the Bengal coast and the Bombay coast; after another week it can be expected in the middle Ganga Plains and on the Kathiawar coast. Such steady progress, though it represents the average mean conditions, however, is not to be seen every year.

The Bay of Bengal branch passes over the Ganga-Brahmaputra Delta and approaches the Khasi Jaintia Hills transversely. The moisture-laden air is funnelled up the numerous valleys on the southern flanks of these hills. As the air is forced up the valleys it yields heavy precipitation on the upper slopes. Cherrapunji, situated in one such valley, is one of the wettest places in the world with an average annual precipitation exceeding 1,100 centimetres. Of the mass of air approaching north-eastern India from the Bay of Bengal, only a part strikes the Khasi Jaintia Hills; another part, west of the 90 degree East longitude, reaches the southern slopes of the Himalayas between approximately 86 and 90 degrees East longitude. Part of this air mass moves westwards up the Ganga Plains, while some of it moves eastwards up the Brahmaputra Plains. Still another branch moves over the saddle between the Khasi Jaintia and Naga Hills to yield precipitation in the Abor and Mishmi Hills of the Assam Himalayas. The southern slopes of the eastern Himalayas thus receive heavy precipitations. Precipitation spreads westwards along the southern slopes of the Himalayas, though in decreasing quantities, right up to Kashmir.

The Arabian Sea branch of the monsoon approaches the western coast of peninsular India from a south-westerly direction. After passing over the Kerala and Konkan coastal plains, it is forced up the western slopes of the Anaimalai and Sahyadri ranges; considerable precipitation is received on the upper slopes, especially at altitudes of from 500 to 1500 metres. Precipitations on the leeward side of the Anaimalai and the Sahyadri are low and show an abrupt change in quantity from the nearby windward side stations. Some of the heaviest precipitation occurs in the zone of

500 to 1500 metre altitude between 11 and 18 degrees North latitude, roughly the latitude of Nilamber (50 kilometres east of Kozhikode) and Mahabaleshwar (70 kilometres east of Bankot). This Arabian Sea branch, apart from the precipitation it yields in the coastal plain and the western slopes of the Anaimalai and the Sahyadri, yields precipitations in the interior moving through (*a*) some of the ghats (Palghat, Bhor Ghat, etc.); (*b*) up the Tapi and Narmada valleys, and (*c*) through the Malwa uplands between the Vindhya and Aravalli ranges.

November-March Period

As the northern summer comes to an end, the northward movement of the monsoon begins to recede; a reversal of pressures over the Indian sub-continent and the adjoining seas begins. During this period moderate precipitations through cyclonic storms occur on the South-East Coast, mainly in Tamil Nadu State[1].

April-May Period

By the end of March the cool season is over and the rainfall also decreases. This period is characterized by dry conditions over most of India, the exception being Kashmir. Day and night temperatures rise significantly. In the interior the absence of the moderating influence of the ocean is keenly felt. During the latter part of this period, the heat becomes unbearable in the continental parts of the country. Rains due to thunderstorms bring relief for short periods; but real relief comes only when the monsoon moves into the country again.

Variability of Precipitation

An important aspect of precipitation in the country is its variability. Variability from normal, even as low as 10%, is serious

[1]This is the rainy season for this area. In the same period precipitation is received in the Jammu & Kashmir sections of the country; this is due to the penetration of westerly cyclonic disturbances from beyond Pakistan.

in areas of moderate precipitation where the precipitation is just enough for the crops produced there; this would be so particularly when it is on the negative side. It is in such areas that famines occur. In the rainfall map (*Map* 5), the area covered by the vertical lines in peninsular and western India shows the parts of the country where famines occur rather frequently; this is the area where precipitation, normally, ranges from 50 to 75 centimetres; this is the area where variability ranges from 20 to 30% (*Map* 5).

High variability, over 30%, is characteristic of the western section of continental India where precipitation is moderate to very low; because of the low precipitation land-use is based on irrigation facilities or on "risk" basis. Precipitation below the normal in any year, consequently, does not take the people unawares. Precipitation above the normal is a pleasant surprise. On the other hand, low variability below 15% is characteristic of areas of high precipitation (*Map* 5). Even though the percentage is low the actual quantity below or above the normal can be high because of the high normals for these areas. Here precipitation below the normal in any year is not unwelcome, but precipitation above the normal, even to a moderate extent, can be unhelpful because the total quantity increases above the high normals and tends to inundate vast areas.

GEOLOGY AND SOILS

It is possible to divide the whole country into four broad areas on the basis of rock-dominance.

(*a*) The northern mountains with sedimentaries and metamorphosed rocks;

(*b*) The Ganga-Brahmaputra plains where the underlying rocks are completely concealed by thick alluvial deposits;

(*c*) The lava-covered (trap) part of the peninsular plateau; and

(*d*) The peninsular plateau composed of various types of rocks, mostly crystalline.

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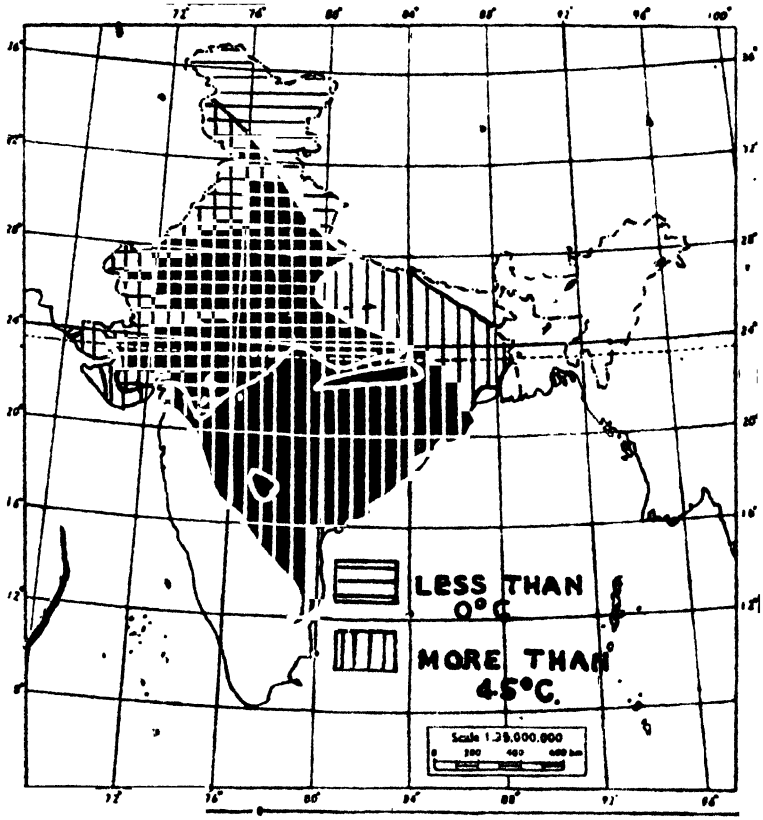
Map 3 Areas of Highest and Lowest Temperatures recorded

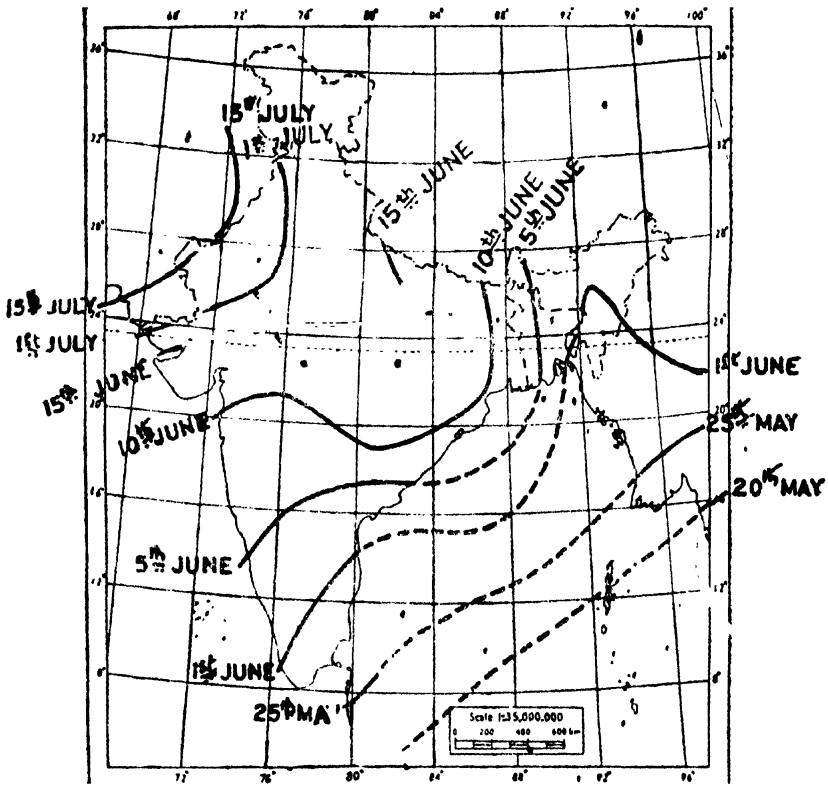


Based upon Survey of India map with the permission of the Surveyor General of India, 1978

The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line.

The boundary of Meghalaya shown on this map is as interpreted from the North-eastern Areas (Reorganisation) Act, 1971 but has yet to be verified.

Map 4 India—Approximate Dates of the Onset of Monsoons



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The boundary of Meghalaya shown on this map is as interpreted from the North-eastern Areas (Reorganisation) Act, 1971 but has yet to be verified.

In these areas, excluding the Ganga-Brahmaputra plains, soils are generally developed on the dominant surface rocks with the aid of climatic and vegetational factors. In the Ganga-Brahmaputra plains, however, the soils are transported soils derived from beyond this area.

The soils of the northern mountains are largely forest soils including Podzols, developed under temperate humid conditions. Oaks and pines cover the higher slopes and provide organic matter for the soil. As the soils develop, because of the slope in the terrain, they are transported down the slopes to the valley bottoms and, as a consequence, do not develop distinct zones in their profile. The valley bottoms with accumulated soils provide useful land for rice, wheat, some plantation crops, and a variety of fruit crops.

The Ganga-Brahmaputra plains are made up of alluvial soils derived from the northern mountains and the southern uplands. The western one-third of the plains includes some amount of wind-blown material mixed with river-borne alluvium. The eastern two-thirds of the plains are largely made up of river-borne alluvium. The alluvial soils themselves are of two types—older and newer. The older alluvium (known as Bangar) is usually found higher up in the plains, occurring mostly as river-terraces away from the rivers, and is characterized by calcareous clays; this is generally found in massive beds with a light or ash grey colour. The newer alluvium (known as Khadar) belongs to the lower levels near the rivers and is mainly clay loams. This alluvium is characterized by the addition of new surface layers year after year during monsoonal floods. In general, the older alluvium, which covers a much larger area than the younger one, provides the foundation for intensive land-use in this area of high agricultural production. A variety of crops including wheat, rice, sugarcane, pulses, cotton and jute are produced in this vast area of about three-quarter million sq. kilometres.

Desert soils cover most of the western part of continental India, most of Rajasthan and parts of Gujarat. These are sandy soils, alkaline in character, poor in organic matter and porous. The area under these soils, about one-quarter million sq. kilometres,

is covered with scattered patches of poor scrub vegetation.

Black soils[1] are characteristic of the north-western third of the peninsular plateau; these have been developed on the basalts that cover this area. The soils are deeper in the river valleys and thinner in the upland portions. These soils are clayey and derive the colour from the clay-humus complex. Clay, silt and sand are formed in these soils. Clay dominates the surface layers, while sands increase in the lower layers. The percentage of clay in the surface layers may be 45 to 60. These soils are generally very useful for cereal crops, oil-seeds and sugarcane.

Red soils cover a large part of the peninsular plateau—Andhra Pradesh, Karnataka and Tamil Nadu States. These soils are developed on the crystalline rock of the area and have a mixture of clay and sand; most of these soils are loams deriving their colour from "ferric oxides, occurring as their coatings on the soil particles". The soils are poor in organic matter and provide easy movement of moisture through them. In the uplands they are useful for growing millets, while in the river plains they help the cultivation of cereals, oil-seeds, and sugarcane.

[1]Most of Maharashtra State and the adjoining portions of Gujarat, Madhya Pradesh, Andhra Pradesh and Karnataka.

CHAPTER II

NATURAL RESOURCES

THE NATURAL RESOURCES of a country may be considered under four broad heads, *viz.*, Minerals, Plants, Animals and Population.

MINERALS

The mineral resources of the country are considerable and varied enough to provide for sound economic development. Some of the important items available in very large quantities are iron-ore, aluminium-ore, titanium-ore, manganese and mica. Other minerals are not procurable in such large quantities, and the country must utilise them with great care based on sound planning.

The bulk of the valuable minerals and metals obtained in India is products of the pre-Palaeozoic age and they are mainly associated with the metamorphic rocks of the peninsular plateau. The distribution of minerals is quite uneven; some States are very rich (Bihar and Orissa), while others are relatively poor (Uttar Pradesh and Punjab). State-wise distribution of the more important minerals may be indicated as follows[1] :

State	*Minerals (important ones only)*
	2
Andhra Pradesh	Coal, Mica
Assam	Petroleum
Bihar	Bauxite, Coal, Mica
Gujarat	Bauxite, Petroleum
Karnataka	Iron, Manganese
Kerala	Ilmenite
Madhya Pradesh	Bauxite, Manganese, Limestone
Tamil Nadu	Ilmenite, Limestone

[1]Source: *Statistical Abstracts of the Indian Union*, 1962, Central Statistical Organisation, Department of Statistics, Government of India.

1	
Maharashtra	Bauxite, Manganese
Orissa	Iron, Manganese
Rajasthan	Mica
West Bengal	Coal

Bihar takes the first place in the variety of important minerals it produces and also in the total annual value of the minerals produced. For two items, coal and mica, it holds the first place among the States in the country for the annual value of production; for bauxite it holds the second place, and for iron the third place. After Bihar, from the point of view of variety of important minerals produced, Madhya Pradesh and Orissa take the second and third places, respectively; but, from the point of view of the value of annual production, West Bengal takes the second place after Bihar because of the large quantity of coal it produces annually. After these four States, Andhra Pradesh, Karnataka, Maharashtra, Rajasthan, Gujarat and Madras are important producers of minerals. Each of these has an annual production exceeding 25 million rupees in value.

Since the distribution of important minerals is uneven even within the States, it is possible roughly to mark out areas of high mineral productivity by ignoring State boundaries. The most important of these is that which includes parts of Bihar, Orissa and West Bengal associated with the north-eastern part of the peninsular plateau. The second one includes parts of Madhya Pradesh, Andhra Pradesh and Maharashtra. The third one spreads over Karnataka, Andhra Pradesh and Tamil Nadu. Then there is the one extending from south-eastern Andra Pradesh to northern Tamil Nadu. Finally, there is the area including parts of Rajasthan and Gujarat. A large number of the heavy industries belong to these areas.

The nature of distribution of minerals in the five areas mentioned in the previous paragraph is as follows :

(*a*) BIHAR-ORISSA-BENGAL — Coal, Mica, Bauxite, Iron-ore,

		Limestone, Copper, Manganese and Chromite.
(*b*)	MADHYA PRADESH-ANDHRA PRADESH-MAHARASHTRA	Manganese, Iron-ore, Bauxite, Limestone and Coal.
(*c*)	KARNATAKA-ANDHRA PRADESH-TAMIL NADU	Gold, Iron-ore, Manganese, Chromite and Copper.
(*d*)	ANDHRA PRADESH-TAMIL NADU	Mica, Lignite and Manganese.
(*e*)	RAJASTHAN-GUJARAT	Petroleum, Manganese, Mica. and precious stones.

The other important areas that should be mentioned are north-east Assam where petroleum is produced, and the far south (Kerala-Tamil Nadu), where monazite occurs on the beach sands in association with ilmenite.

The estimated reserves of iron-ore in the country exceed 20 billion (20,000 million) tonnes. This is about 22% of the world's reserves. The most valuable ore varieties are haematites and magnetites with 60-65% metallic content. Half of the annual output, 32 to 35 million tonnes, is consumed within the country; the rest is exported. Along with the large reserves of good quality iron-ore, the country also possesses very large reserves of manganese which is used for hardening steel[1]. The estimated reserves of high-grade ores, containing over 48% manganese, are between 20 and 25 million tonnes. Low grade ores with less than 48% manganese occur widely and the reserves may be as much as 150 to 160 million tonnes. The annual output is about 1.7 million tonnes of which about 1.3 million tonnes are exported. Brazil, India and the Soviet Union are the three largest producers of manganese in the world.

Muscovite is a widely distributed mineral in the crystalline rocks of the country, it yields valuable mica. India is the top producer of mica in the world, contributing between 60 and 75% of the world's requirements. Indian deposits of this valuable mine-

[1]Manganese has also many other uses in the chemical, electrical and glass industries.

ral are considered to be the finest in the world; they yield large and good crystal plates. About 38000 tonnes of mica are exported annually, realizing about 50 million rupees. Mica is useful as an insulating material in electrical goods and is being increasingly used for the making of micanite. Very small bits or scraps of mica are ground for making paints, lubricants, etc.

Bauxite is found in the country at a number of places. It is found in the laterites which are widely distributed in the peninsula. The laterites containing high-grade bauxite are found in Bihar and Madhya Pradesh. These bauxites have an alumina content of 50 to 58%. The reserves of high-grade ore are estimated at about 30 million tonnes, while the total reserves of all varieties of bauxite might be as much as 250 million tonnes. The annual output of metallic aluminium in the country is about 120 thousand tonnes. Besides its use as a source of the metal aluminium, bauxite is also used in the cement-making industry and in the refinement of oil.

Coal and petroleum are valuable power minerals. Reserves of good quality coal in the country occurring within a thousand feet from the surface are estimated at about 6 billion tonnes (6,000 million) of which roughly a half is coking-coal. Over 90% of these occur in south Bihar and the southern parts of West Bengal. At the present rate of extraction, allowing for a gradual rise in the consumption of such coal, these reserves would be used up in another eight or nine decades. Inferior coals, with less carbon content (40 to 53%), occur in Assam and the Punjab. Lignite, with low carbon content, occurs in Tamil Nadu. The reserves of such inferior coals and lignite are about 4 billion tonnes (4,000 million). By confining the use of superior coals to metallurgical purposes and of the inferior ones to power production, the present estimated reserves could be made to last a century at the most. If, however, mining is extended to deeper levels and some of the likely coal-bearing Gondwana rocks below the lavas of the Deccan trap are also discovered, the prospects of a longer period of self-sufficiency are high.

Petroleum resources are quite limited in the country. They

are confined to the tertiary strata in the north, especially the Assam sector, and the coastal tracts, particularly the Gujarat coast (Cambay-Kutch). Tentative estimates suggest a potential oil-bearing area of about .75 million square kilometres. Since the programme of oil exploration is still in progress, it is not possible to indicate, even roughly, the real extent of these sources. It is, however, believed that within a decade the country will be producing 10-12 million tonnes of crude oil from the Assam and Gujarat fields alone. The present production of crude oil from these fields is about 7.5 million tonnes. In anticipation of an increasing oil production within the country and with a view to saving valuable foreign exchange, many refineries have been completed or are nearing completion. Bombay (Maharashtra), Koyali (Gujarat), Barauni (Bihar), Nunmati (Assam) and Vishakhapatnam (Andhra Pradesh) are some of the centres for refining. The refineries are at present being fed with imported crude oil in addition to Indian crudes.

PLANTS

Peninsular India lies wholly in tropical latitudes, while the continental part is largely confined to sub-tropical latitudes. Outside the high Himalayas, no part of the country experiences temperatures below freezing-point. With helpful temperature conditions and heavy monsoon precipitations, the country must have had many years ago considerable areas under forest and grassland. Such natural vegetation has been largely wiped out now. It is limited today to small patches that are too inaccessible to man or too barren for profitable exploitation. The total area of such type must be less than 5% of the geographical area of India.

Even considering natural plant resources, however, forests and grasslands that have had human guidance in their development are important. Not more than 25% of the total geographical area of the country is under forests and useful grasslands. About 0.8 million square kilometres are under forests and a little less than 0.1 million square kilometres under grasslands. Actually the small

area under useful grasslands mostly in sloping terrain belongs to forests and their fringes. Of the forests a little over 42 thousand sq. kilometres are under the coniferous type, while the remaining area, about .77 million sq. kilometres, is under the broad-leaved type. Forests are important because they yield timber and rewood. fi Indirectly also they are of great value because they prevent soil erosion and influence temperature and precipitation conditions.[1]

On the basis of data available for recent years, the annual value of forest produce is approximately 1000 million rupees. The more important uses of the forest produce are as follows :

(1) Structural timber
(2) Wood for making furniture
(3) Pulp and matchwood
(4) Firewood
(5) Wood for making charcoal
(6) Gum and resins
(7) Canes
(8) Fibres and flosses.

The distribution of forests in the country is very uneven. In some States (Assam and Orissa) more than 20% of the area is under forests. In others (Punjab and Rajasthan) less than 3% of the area is under forests. This uneven distribution is largely because of their irregular distribution of precipitation; areas of high precipitation alone are capable of having forests. There are five types of forests which can be recognised as below :

Forest type	Precipitation	Wood
1	2	3
(*a*) *Evergreen rain forests* Western - ridge zone of the peninsular pla-	Precipitation over 200 centimetres annually.	Teak, Rosewood, amboo, Sal.

[1]They are also important for the animals that inhabit them. To preserve wild life in the country, it is absolutely necessary to prevent depletion of forests and grasslands.

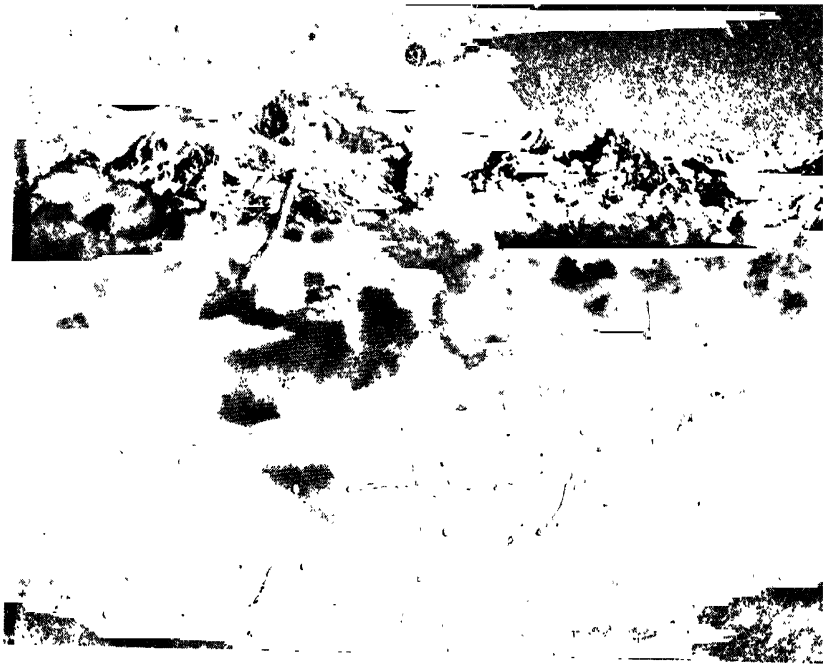


Plate 1 Eastern Himalayas - Everest and other Peaks (*see page 2*)

Plate 2. Landscape in Kashmir

(*see page 5*)

Plate 3. Silver Fir Forests in Western Himalayas (*see page 16*)

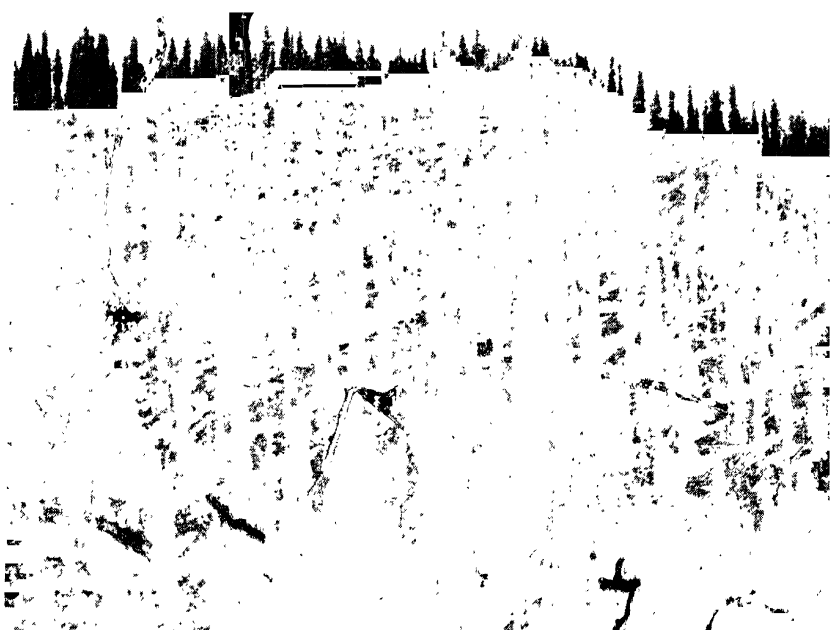


Plate 4. A Rural Landscape

(*see page 71*)

Plate 5. Paddy Cultivation (*see page 25*)

Plate 6. Wheat Cultivation in Central India (*see page 27*)

Plate 7. Millet

(*see page 31*)

Plate 8. Maize Farm in North India (*see p ge 31*)

1	2	3
teau and southern sections of the Assam-Bengal Himalayas.		
(*b*) *Deciduous monsoon forests* Peninsular hills, central and western sections of the Himalayas.	Precipitation from 120 to 200 centimetres annually.	Teak, Sal Ebony, Sandal, Deodar, Bamboo (Hard woods).
(*c*) *Scrub forests* Interior peninsular plateau, north-western India.	Precipitation less than 120 centimetres annually.	Acacia, Babool, Banyan, Neem.
(*d*) *Sub-tropical and temperate evergreen forests* Over 1500 metres in peninsular India and over 1000 metres in the Himalayas.	Precipitation over 120 centimetres annually.	Oak, Deodar, Pine, Chestnut; Walnut, Poplar, Birch and Fir (Soft and semi-hard woods).
(*e*) *Coastal forests* (littoral types) Larger deltas along the east coast and salt water creeks and marshes on both coasts.		Mangrove type of vegetation, *e.g.*, Sundri.

The most important product of the forests is timber. With human assistance special timber forests have been developed. They are the teak forests of the Sahyadris and the Anaimalai sections, the teak forests of the Malwa plateau, the sal forests of the north-east including the Chota Nagpur plateau, the Assam hills and plateaux, the sandal forests of the Karnataka plateau and the coniferous forests of Kashmir, the Punjab and the Kumaon Himalayas.

Schemes and projects have been undertaken in recent years to increase the area under forests. This can be done only by bringing the unutilised lands under some sort of vegetation in the

initial stages. A special programme for increasing the wood required for the match, plywood, and paper industries has been started with the adoption of fast-growing species in selected areas. The aim of the Government is to increase the area under forests to at least 30% of the total area of the country. The major difficulty in achieving this aim would be the increasing demand for food-crops, which would require more and more land for cultivation.

ANIMALS

India is one of the few countries of the world which have, within their frontiers, a variety of large and small animals, reptiles, birds and innumerable small creatures. Among the larger animals in their natural condition, India has the elephant, the rhinoceros, the gaur (Indian bison), the wild buffalo, the yak, the wild-ass, the sambar, the tiger, the lion, the cheetah and the bear. Smaller animals include a variety of deer, wild goat, hare, langur, rhesus monkey, jackal, fox and mongoose. Of the domesticated type, it has most of the animals known to the world—the camel, the horse, the donkey, the yak, the cattle, the sheep, the goat and the like. Of the reptile family, it has a very impressive variety from pythons and crocodiles to cobras, vipers and lizards. Multilegged creatures that crawl around and speed about (scorpions, centipedes, spiders, cockroaches, etc.) also abound. The distribution of fauna is indicated below

Region	*Climate and nature of forest*	*Animal life (not domesticated)*
1	2	3
(*a*) North-eastern region: Parts of West Bengal, Assam, Sikkim and Bhutan.	High monsoon precipitation; high humidity; monsoon forests (dense).	Tiger, sloth bear, elephant, rhinoceros, gaur, antelope, langur, crocodile, python.
(*b*) South-western region: Parts of Karnataka, Kerala and Tamil Nadu.	High monsoon precipitation; high humidity; dense monsoon forests.	Tiger, elephant, gaur, wild bear, deer, monkey, python.

1	2	3
(c) East-central region: Parts of Andhra Pradesh, Maharashtra, Madhya Pradesh, Orissa and Bihar.	Monsoon precipitation; monsoon forests (not dense).	Tiger, cheetah, deer, monkey, jackal, hare.
(d) South-eastern region: Parts of Andhra Pradesh and Tamil Nadu.	Monsoon precipitation; open monsoon forests.	Cheetah, jackal, wild goat.
(e) Northern region: Jammu and Kashmir, parts of the Punjab and Uttar Pradesh.	Mostly moderate; winter precipitation, sub-tropical and temperate forests.	Tiger, fox, deer, hare.
(f) Western region: Gujarat and parts of Rajasthan and of the Punjab.	Low to moderate precipitation; scrub forests.	Lion, wild ass, jackal, swamp deer, wild goat.

With the expansion of human settlements and associated land-use, the larger animals have decreased in their numbers to such an extent that, outside the museums, some may not exist, after a century or two. In recent years attempts have been made to preserve wild life in selected areas—Assam, northern Uttar Pradesh, western Gujarat and the Tamil Nadu-Kerala border. Outside these limited reserved areas, the larger animals are losing in their struggle against human expansion. The smaller and less conspicuous creatures, which are a greater nuisance to man, continue to thrive because of their inconspicuous nature. Centipedes, cockroaches, spiders, scorpions, mice and rats seem to multiply vigorously and claim a considerable share of the economic output of mankind.

POPULATION

The population of India has been rising at a rapid pace for some decades; it is now about 550 million. One cannot honestly

consider all this humanity as a valuable asset to the natural resources of the country. This population has two important features which make its consideration necessary in this chapter: its size and its composition. There can be no doubt that it is enormous. In addition it is made up of many religious and linguistic groups with a variety of customs and conventions based on differing associations. Such a population may be capable of performing any activity because of its quantity and quality. Even if only 10% of the population is considered as superior manpower, the quantity of such superior manpower is considerable. It is this valuable part of the total population that deserves a place in this chapter dealing with natural resources.

In the fields of philosophy, art and science, the country has produced some very great men. Even in modern technology its knowhow in Asia is second only to Japan. The country's record in defence, industry and other human activity has also been of a high calibre. Its political stability since independence is itself the result of human capability—the capacity of its people to work successfully a democratic set-up. Of all the newly-emerged sovereign powers, India must be considered the most stable. This is largely due to the character of the people.

CHAPTER III

LAND-USE: FOOD CROPS

A FEW THOUSAND YEARS AGO "land-use" would have meant use of land by any of the living creatures on land—by plants for their growth and expansion, by animals also for their community life; by man for maintaining himself and his family, and so on. Today, land-use refers only to utilization of land by man, Nature's selfish and arrogant son.

Man uses land and other natural resources for providing himself with food, shelter, clothing and other comforts. In such efforts procurement of food must have been right from the beginning his primary activity. In the early stages man probably plucked the fruits from trees, or caught smaller animals that came his way for satisfying his hunger for food. As his family increased, he must have had to roam over larger areas to get food. This led on to a stage when the natural supply of fruits, nuts and animals could not by itself sustain the human population. Then came the human effort to produce on a given piece of land food crops year after year. To the original fruits and nuts many grains were added. The more easily tamed animals were domesticated and allowed to grow in numbers under human supervision so that there was a continuous supply of milk and meat.

Human beings have increased steadily to such an extent that most of the available land is now being utilized largely to satisfy human needs. Of the many uses to which land is put the most important is agriculture. In India, where a very large part of the population consumes cereals as the main item of its daily meals, agriculture has been the dominant land-use for centuries. Many cereals, millets, pulses and a variety of spices and vegetables are grown year after year, often in the same areas, to meet the increasing demand for food. In addition to these crops, which are mainly for direct consumption within the country, there are a good number of plantation crops that

need processing and have a higher value in international trade.

Agriculture is important not only because it provides food for the millions in this country but also for the employment it gives to a very large section of the population. Approximately seventy per cent of the people are engaged in such activities, producing food crops, and raw materials for the various industries. In the following pages of this chapter activities concerned with the production of food crops will be examined.

Of a total geographical area of 328 million hctrs about 176 million hctrs form the cropped area. Of this about 26 million hctrs are sown more than once every year. About 31 million hctrs of the cropped area are irrigated where a large variety of crops is produced. Cereals are the most important of these crops. Cereal grains are the edible starchy seeds of crop plants belonging to the grass family *Gramineae*.[1] Among the principal cereal grains rice and wheat are the most important. They are the chief sources of concentrated carbohydrates for the people. Fortunately these two important cereals thrive best under differing geographical conditions. They do not require the same type of geographical conditions for their optimum growth. Their distribution, therefore, shows only limited areas where they overlap each other.

RICE

Over 90% of the world's rice crop comes from Monsoon Asia, where it is also consumed. Among the countries of this region, India is a major producer and consumer.

The rice crop requires considerable quantities of water and thrives best when there are 5 to 10 centimetres of standing water in the field during the earlier period of its growth. Periodical changing of water helps growth. This requirement implies the need for not only large amounts of water but also compara-

[1] Strictly speaking, the term 'cereal' refers to the entire plant and not only to the grain part of it.

tively flat land. Consequently river deltas[1] prove to be the best areas of its production In addition, the rice plant needs a warm or hot humid climate. Generally areas with average temperatures ranging from 22°C to 35°C are suitable for its cultivation. During the season of its cultivation, the temperature should be more than 25°C. Eastern and peninsular India have suitable temperatures for its growth throughout the year, making it possible to obtain two (even three) crops of rice from the same land in a year. This crop can be grown at different altitudes so long as its temperature needs are satisfied. It is grown even at heights of 1000 to 1500 metres, as in Kashmir and Coorg. The bulk of the crop in the country, however, comes from alluvial plains and deltas. From the point of view of surface relief, the important requirement is not altitude but flatness of topography.

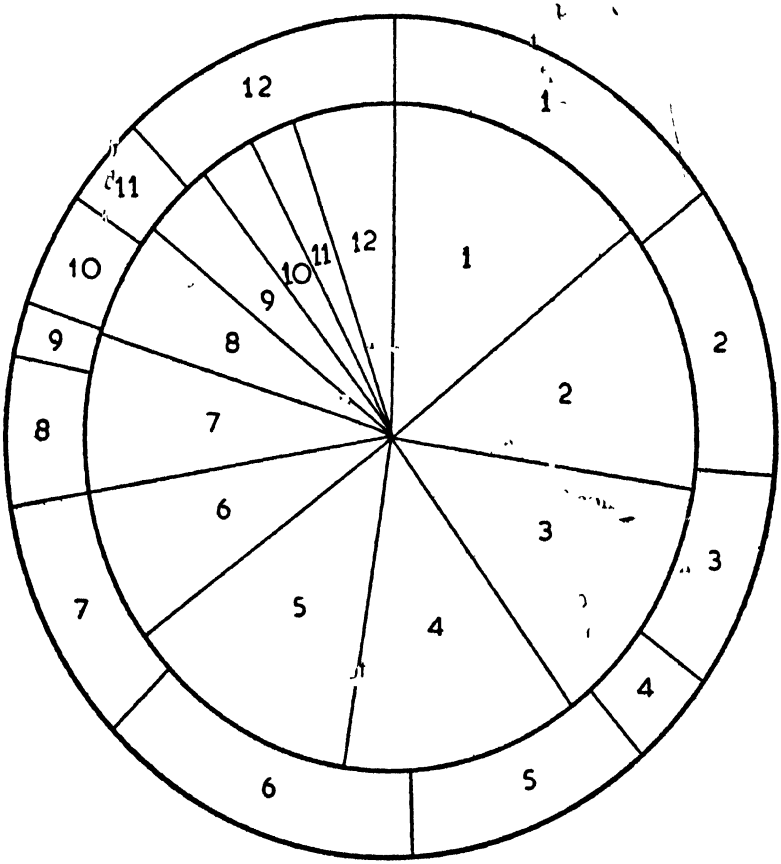
The main rice-growing areas are confined to those parts of the country which experience over 100 centimetres of annual precipitation. A comparison of Maps 5 and 8 will make this clear.[2] Within this area in many favourable sections with adequate supplies of water, two, and sometimes even three, crops of rice have been and are still being produced. The cropping seasons vary from one part to the other. Moreover, different local names are given to these seasons and crops (*refer to Table III*).

Methods of cultivation are still largely traditional. Most of the cultivators who are illiterate know how to construct and repair the simple implements they use. Mechanization, in the initial stages, has to be mainly in the form of improvement in the quality of the implements they use. Complicated new machinery cannot be of much value, except on experimental farms. Productivity thus can be increased not so much by mechanization as by the use of improved fertilizers and skilful rotation of crops.

[1] Rice is also grown in some upland areas where water supply is limited and largely depends on rainfall. Such "dry" or "semi-dry" systems of cultivation are generally risky ventures and account for only a small part of the total production.

[2] This is also largely the area of dense population (refer to map).

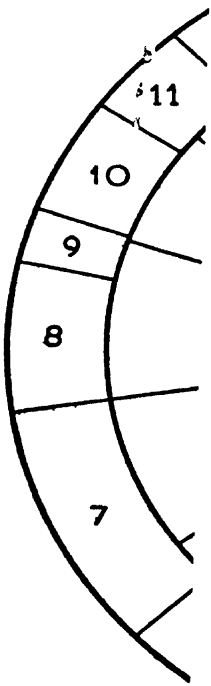
RICE: AREA AND PRODUCTION 1972-73



RICE – AREA (INNER SECTOR) AND PRODUCTION (OUTER RING)

1 W. Bengal	5 Orissa	9 Maharashtra
2 Bihar	6 Tamil Nadu	10 Karnataka
3 U.P.	7 Andhra Pradesh	11 Kerala
4 M.P.	8 Assam	12 Other States

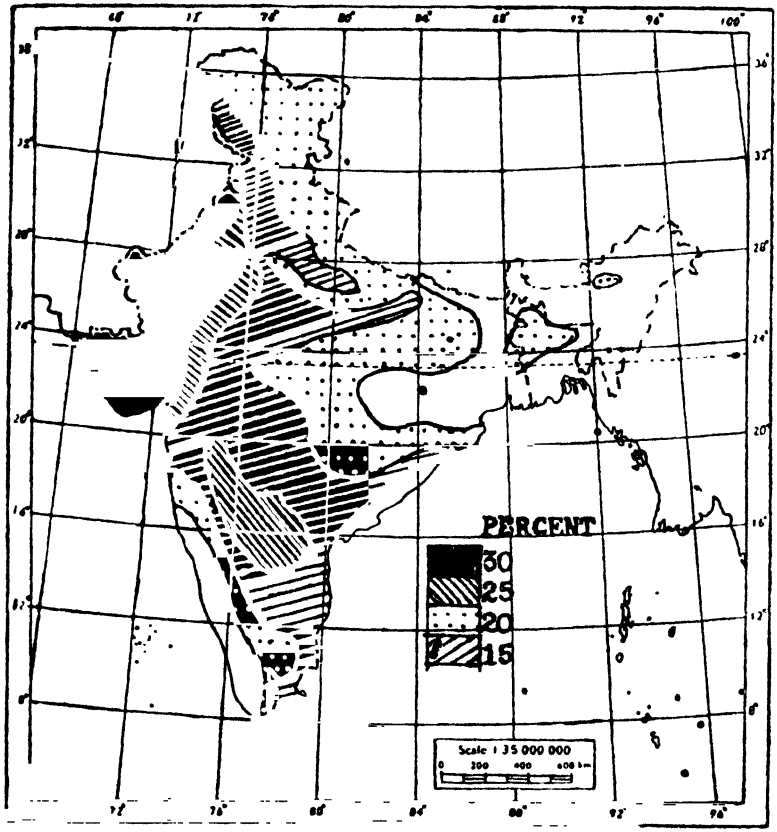
RICE: ,



RICE — AF
(O

1 W Ben
2 Bihar
3 U.P.
4 M.P.

Map 6 **India—Variability of Rain**



Based upon Survey of India map with the permission of the Surveyor General of India, 1978

Methods of sowing rice include transplanting, broadcasting, dibbling and drilling the seeds. Broadcasting is essentially throwing the seeds over the soil; dibbling is dropping the seeds at regular intervals in the furrows made by the country plough; in drilling the seeds are guided through a bamboo shaft attached to the plough so that they are laid in a straight line in the furrow made by the plough. Dibbling and drilling are better methods of sowing than broadcasting. Seeds are economically used and the plants are more evenly spread in the field. Drilling is actually the best method of sowing. In areas where moisture is moderate, the soil is compacted after sowing by a flattening plank that is driven over the furrow. This is not necessary in areas of high precipitation like Kerala and West Bengal. In some areas the seeds are soaked in water for some hours before being sown in the field. It enables easy germination in a soil that is not moist enough.

In transplantation, the seedlings are sown in a carefully prepared nursery. When they are about four weeks old they are uprooted and planted in the puddled fields which have been prepared to receive them. Transplantation is helpful in achieving an economical use of water and a higher yield of grain. After transplantation water in the fields is gradually increased as the seedlings grow. About ten days before harvesting the water in the fields is drained off. The right stage for harvesting is when the ears are nearly ripe and the straw is just turning yellow; long experience in the field enables the Indian cultivator to choose the right time and get through the harvesting quite methodically. Harvesting is done by human labour; the crop is cut and allowed to dry in the fields for 3 or 4 days. After that it is threshed by bullocks which are made to trample over the sheaths of crop, or by beating the heads of sheaths against a hard block.

Even though a very large amount of human labour is applied to rice cultivation, it cannot be considered intensive in the sense of high productivity per hctr. The average yield per hctr for the whole country is about 12 quintals. This compares poorly with average yields exceeding 25 quintals in Japan. At experimental stations in different parts of the country yields of 1500 to 2000

kilos per acre have been reported. On these experimental farms cultivation (using more fertilizers, better seeds and better techniques) has been intensive in the European or Japanese sense. Mere numbers of cultivators in the field working hard to produce crops cannot be described as intensive farming. When such human labour is applied scientifically and with the right techniques for obtaining a high yield per hctr, then only can the activity be described as intensive farming. The high yields achieved on the experimental farms must be achieved in all the farms in the country if real self-sufficiency is to be attained.

In recent years the annual production of rice has been fluctuating from 42 to 45 million tonnes with an area of 38 to 40 million hectares. Though the area cannot be increased to any large extent, the yields can and should be. Average annual imports of rice in recent years have been about a quarter million tonnes, this import can be completely avoided with a little more effort.

Paddy that is obtained after threshing has to be milled or pounded to get the rice. Whereas the grain contains vitamins and minerals in the surface layer, its core is essentially starch. Hand-pounded rice retains the nutrients in the grain to a greater extent than machine-milled rice. The highly polished rice from machine-milling, for example, retains no protein at all, whereas the hand-pounded rice retains as much as 15% of the proteins contained in the original grain. While milling helps in ensuring better keeping qualities for the grain and more attractive food when the grain has been cooked, it is obvious that the hand-pounded rice is better as food because of its nutrient qualities. Reduction in the quantity of rice consumed by every individual in the mainly rice-communities is desirable and possible, if only some more nutritive substitutes or supplements (like vegetables, fruits or fish) are generally adopted.

WHEAT

After rice wheat is the most important cereal in India. Outside India, in some of the temperate countries of the world it has been

known and used for thousands of years. In India, however, its use has been comparatively recent.

Wheat thrives well in areas of moderate precipitations and moderate temperatures. About 75% of the world's wheat lands have a precipitation ranging between 50 and 80 centimetres, and temperatures between 8 and 28°C. Temperatures in excess of 30-32°C are harmful to the plant; similarly temperatures below 5°C are not desirable. Silt and clay loams give the best yields. In general medium to heavy-textured soils, fertile and well drained, are good for this cereal.

In India suitable physical conditions are found in the west and north-west (*Map* 9) during winter months; wheat is, therefore, a rabi crop. About 25 to 27 million tonnes of wheat are produced annually from about 20 to 21 million hectares of wheat lands. With reference to the area devoted to its cultivation wheat is holding the third place (after rice) among the food crops of the country (*refer to Table I*). With reference to the quantity by weight of grains produced in the country too, this cereal holds the second place after rice. Among the three principal food crops of the country rice and wheat are the most valuable because of the quantity of grain obtained on every hectare. Next to wheat and rice comes ragi. Jowar yields are much lower than wheat, rice, ragi, given the same area.

In the preparation of land before sowing, in sowing, and in harvesting, mechanization is possible to a far greater extent in the cultivation of wheat than in that of rice. Such mechanization can prove useful only if the labour released from the fields as a consequence can be profitably employed elsewhere. Even more than mechanization, selection of improved seed varieties and application of fertilizers would be helpful in increasing the yield per hcts. At present the yield per hectare in India is less than half of what it is in some of the West-European countries (about 1400 kg per hectare as against over 3600 kg per hct in Belgium, Denmark and the Netherlands).

Since wheat is grown in areas of moderate precipitation and that too in winter (when precipitation is largely due to extension of westerly disturbances into India), it has to depend very much

on irrigation facilities. While these facilities are good in the Punjab and western Uttar Pradesh, they are not quite satisfactory in Madhya Pradesh, Rajasthan and Gujarat. Improvement in the supply of irrigation water would help increase its production.

Most of the wheat grown in India belongs to the variety known as common wheat (*Triticum vulgare*), which has a long spike in proportion to its thickness. The principal types grown have either soft or hard kernels, and are white or red in colour. Many varieties of each type are grown. Next to common wheat, Durum wheat (*Triticum durum*) is also grown widely in the country.[1]

Sowing is taken up some time in October, after the rains have stopped. This is done in rows about 25 centimetres apart. Seeds are fed into the field through one or more hollow shafts; they are actually dropped into the shafts by hand. Since sowing is done soon after the rainy season, there is enough moisture in the soil to help the growth of the plant in its early stages. Harvesting is generally completed before the very hot summer sets in. It is usually over by the middle of May and is done, in most of the wheat lands, with hand sickles.

The harvested crop has to be threshed and winnowed before grains are separated from the rest of the plant. Grains are converted into flour by hand-grinders or machine-millers. The latter method is quite widespread, since even small settlements have a flour mill where the grains are converted into wheat flour. This flour is used in the making of different types of *rotis* or country breads[2] and sweets of various shapes and sizes. Other products, like vermicelli, spaghetti, macaroni, etc., are also being produced for consumers who want variety.

BARLEY

Barley is an important cereal that thrives well under conditions suitable for wheat. It is more adaptable to variations in natural physical conditions than wheat. Because of this quality it

[1] The Indian wheats are hard varieties and have a protein content of 14 to 16%.

[2] The more popular varieties are the *chapatis*, *parathas* and *naans*.

is a rabi crop and takes five to five and a half months from sowing to harvesting time. Sowing is done in October-November and harvesting in April-May. Inter-culture of barley with crops like peas, Bengal gram, wheat or mustard is widely practised.

This cereal is grown mainly in the middle and upper Ganga plains. Many varieties of this cereal have been developed for cultivation in the drier Rajasthan and the wetter Bihar areas. In recent years the area under barley has been about 2.5 million hctrs with an annual yield of about 2.5 million tonnes. The yields, however, are low compared to yields in Western Europe, or even the Soviet Union (about 1100 kg per hectare in India, 800 in Pakistan, 2600 in the Soviet Union, 3500 in West Germany, over 4000 in Denmark and the Netherlands). There is considerable scope for increasing the yield. The cereal is particularly useful for conversion into malt which, again, is used for brewing beer and other alcoholic products. Malted milk concentrates and breakfast foods are also made from this cereal. It is, however, not one of the major food crops and, consequently, is not as important in this country as rice, wheat and jowar.

The value of this cereal in the development of an industry producing beer and other alcoholic products for export cannot be overlooked. The market for these products within the country being limited, the industry should after meeting all the home demands be able to export its products to other countries.

MILLETS

Among the millets cultivated in India, the more important ones are jowar or cholam (*Sorghum*), bajra, or camboo (*Pennisetum*) and ragi (*Eleusine*). These are grown not only for the grain they yield but also for their straw, a valuable cattle fodder. Millets are grown all over the country in areas of low to moderate rainfall. They are less sensitive to moisture and soil deficiencies than rice, wheat and barley. They are short duration crops (*refer to Table No. III*) mostly grown in the drier interior during the rainy season. The grains form a valuable supplement to or even a

substitute[1] for major cereals like rice and wheat. The stem and the straw are fed to bullocks that pull the ploughs or help raise water from the wells. It would be true to say that millets sustain, to a considerable extent, the human and animal labour in the fields, especially in the more harsh environments.

JOWAR

Jowar is the most important millet. It has under it an area of about 16 million hectares; the annual yield has been fluctuating around 8 million tonnes. Since it thrives well even in areas of low rainfall, and can withstand drought to some extent, it is grown over a wide area where precipitation is limited. Many varieties have been evolved to suit different climatic and soil conditions. Some varieties take only three months from the time of sowing to the time of harvesting; others take as many as five months. The crop is grown both in summer and in winter. It is therefore a kharif and a rabi crop. The yield (450 kgs) per hectare is poor compared to about 300 kgs. of the U.S.A. which is one of the major producers of corn or maize.

This grain is ground each day in the homes of the poor people[2] and the flour so obtained is used in the making of flat *rotis*. The jowar *roti* may not be as tasty as the wheat *roti* to sophisticated people; it is, nevertheless, satisfying. It contains 12-16 per cent protein and 63-73 per cent starch. The stalks are good cattle fodder. In the drier peninsular upland, the stalks tend to be juicy (an adaptation for drought resistance) and are, consequently, more relished by cattle.

BAJRA

Bajra, another important millet, is grown in areas of low rainfall and poor soils, where most other food crops would fail. It is cultivated mainly in North-Western India and the penin-

[1] For most poor people who actually cultivate the land these grains provide the main food; the grains are made into flour, and flour mixed with water and salt is patted into *pattis* or *rotis* for consumption.

[2] Otherwise the flour would become rancid because of the presence of the embryo.

sular interiors. It is a kharif crop. Sowing is done in June and harvesting in November-December. At the time of harvesting, the heads are cut by hand and the grain flailed out on a threshing board or floor.

Usually the grain is ground into flour which is cooked into a gruel or porridge, the flour is also used for baking into coarse bread. After the removal of the heads the rest of the plant is given to cattle as fodder, or used as fuel. The annual production of bajra has been about 4 to 5 million tonnes with an area of 12 to 13 million hectares given to the crop. The yield has been about 400 kgs per hectare which is rather poor. The crop is important to very poor peasants, for it is their main food and keeps them alive.

RAGI

Ragi is the third important millet in the country. An area of 2.5 million hectrs is given over to the crop; the annual output is 2 to 2.2 million tonnes. As this is one of the hardiest crops in the country, capable of standing severe droughts, it is generally grown in areas of poor rainfall and, often, on poor soils. It is grown either as a dry crop with dry farming techniques or as an irrigated crop. It is an important kharif crop in the southern half of the peninsular plateau in areas of low rainfall. From the time of sowing (May/August) to the time of harvesting (October/November) the crop requires 3½ to 4 months.

Ragi is very important in the agricultural economy of Southern India for various reasons. It is a short duration crop and permits inter-culture with other kharif crops that do not require too much soil moisture. The plant and the grain both remain free from pests and diseases. The plant is hardy and can stand droughts that would destroy most other crops. The grain has great nutritive value and is very suitable for the cultivator doing hard physical labour. If kept quite dry, it can be stored for many years without damage. The straw is good for both working and milch cattle. The grain flour is used for making gruel, porridge and *rotis*. The grain is hand-pounded either into coarse or fine flour; the former

is good for making gruel or porridge, while the latter is converted into *rotis*.

MAIZE

Maize (Zea) is grown over an area of 5 to 6 million hectrs and yields an annual output of 5–6 million tonnes. It is largely a kharif crop, sown in June-July and harvested in October-November. It is important in the northern States, especially in the sub-montane belt of Uttar Pradesh and Bihar. It is the staple food for a large number of people in this area especially in the winter months. It is also used as fodder for animals. India's annual production of maize is about 2% of the world production; the United States produces about 60%.

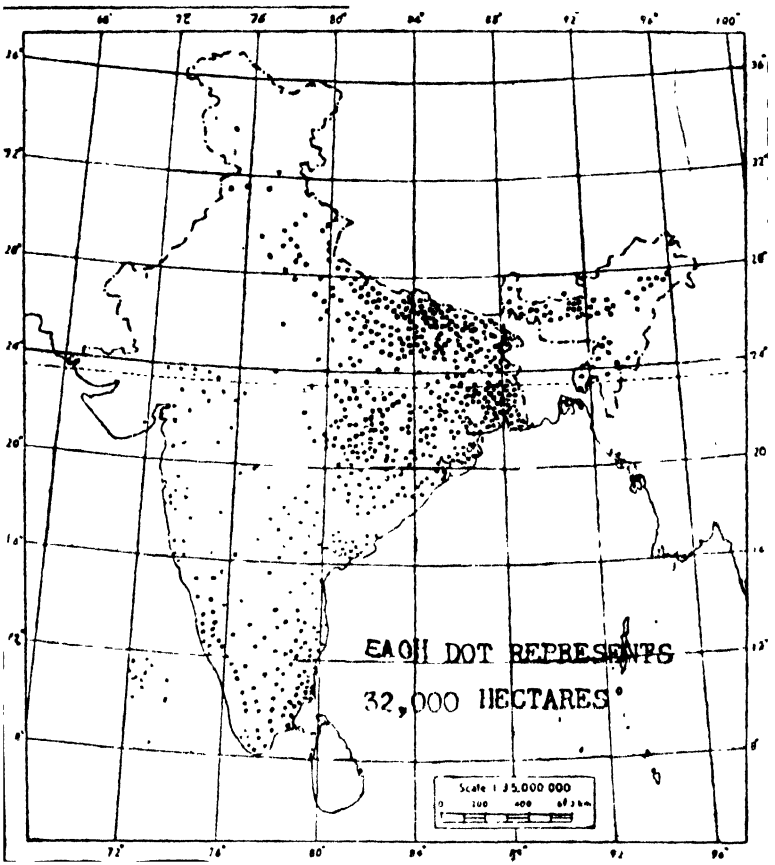
PULSES

The important group of crops known as pulses occupies an area of about 20 million hectrs. The annual production is about 10 million tonnes. Pulses are grown all over the country. The important crops are:

Bengal Gram (*Chana*)
Red Gram (*Arhar* or *Tur*)
Black Gram (*Mash* or *Kalai*)
Green Gram (*Moong*)
Lentil (*Masur*)
Horse Gram (*Kulthi*)
Lakk (*Khessari*)
Moth (*Matki*).

The value of these pulses lies in the fact that the farmer can practise crop rotations and crop mixtures with them. Being leguminous plants, they help in restoring soil fertility. Being rich in proteins, they are essential to the large vegetarian population whose staple food consists solely of starchy cereals. Some of the pulses serve as excellent forage and grain concentrates in the feed of a large number of cattle in the country.

Map 8 **Rice**



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CHAPTER IV

LAND-USE : OIL-SEEDS AND SPICES

IN ADDITION to the food-crops considered in the previous chapter, there are a large number of crops which yield cooking oils or flavourings that add taste to the food consumed by the people. The important ones are:

Coconut	Chillies
Groundnut	Cardamom
Castor	Ginger
Sesamum	Turmeric
Rape	Cinnamon
Mustard	Cloves
Pepper	Nutmeg

COCONUT

Coconut (*Cocos mucifera*) thrives well on sandy soils, especially in littoral locations. The tree starts yielding nuts 6-8 years after planting. Some of the dwarf varieties yield nuts within 4 years.

The important and dominant variety is that which is widely grown in Kerala State. This is a tall tree that comes to fruition 6-8 years after planting. About 60-70 nuts per tree per year is the normal yield. In the early stages the nut has plenty of sweet water. The weight of the copra, per nut, is 200-300 gms and the oil content 65-66%.

In India about 100 million hectares are devoted to coconut plantation, and the annual yield is about 6000 million nuts. Most of the plantations are situated within 20 km of the coast or are close to the rivers in the Kerala, Tamil Nadu and Karnataka States, which are the main producers of coconut.

Every part of this tropical palm is used by the people. The nut yields copra-oil, oil-cake, and fibre for coir; the plaited leaves are used for making screens and roofing; the unopened spadices are tapped to extract juice or toddy; the trunk of the mature tree is used as timber for constructional purposes. It would be difficult to think of any other tree in the world which is so important to each and every individual in a State as coconut is to the people of Kerala.

GROUNDNUT

Groundnut is grown widely all over peninsular India. Though it can be grown in sub-tropical latitudes, it thrives best in tropical areas. It is grown both as a dry and as an irrigated crop. Yields are good when the rain-fed crop gets 75-100 centimetres of rainfall. The plant takes 4-5 months to yield the valuable nut which is generally converted into oil. Since it is a short crop, it can be grown along with taller crops like jowar, bajra, castor and cotton. Sowing is done in June-July and harvesting takes place between October and December.

The four southern States (Kerala, Tamil Nadu, Karnataka and Andhra Pradesh) and the two western States (Maharashtra and Gujarat) account for more than 90% of the area and production in the country. About 7 million hctrs are under groundnut; the annual yield is around 4.5 million tonnes (nuts in shell).

Apart from the valuable oil that it yields, the nut is also used for direct consumption, raw or roasted. The plant has a good soil recuperative value and forms a good cover against soil erosion. It is also a good forage crop for cattle.

CASTOR

Castor is another important plant that yields a very valuable oil-seed. The oil has many uses—domestic, medicinal and industrial. The oil-cake is a valuable fertilizer. India is the leading producer of castor-oil in the world. About 400,000 hectares are

given to the crop, and the annual yield is about 150,000 tonnes of castor seed.

Castor is both a kharif and a rabi crop; it requires 5 to 8 months from sowing to harvesting. Consequently it is the main, and often the only, crop for the year wherever it is cultivated; many other crops can, however, be grown along with it. It is grown in the comparatively dry areas of the peninsula, mainly in the interior of Andhra Pradesh. The adjoining parts of Orissa, Maharashtra and Karnataka also cultivate this crop. Andhra Pradesh, however, is the leading producer, accounting for about two-thirds of the area given to this crop in the country.

SESAMUM

Sesamum is grown all over India. Nearly every State (except Assam and Jammu and Kashmir) grows some sesamum. It takes 3-4 months to grow. It is often rotated with some other crop like ragi, jowar or black-grain. It is cultivated as a kharif or rabi crop. About 2.4 million hctrs are given to this crop. The annual yield is about 400,000 tonnes.

The oil derived from the seed is widely used as a cooking medium. This is particularly so in the three southern States of Tamil Nadu, Karnataka and Andhra Pradesh.[1] The oil-cake is a good feed for cattle. Occasionally it is also consumed by the poorer people, who add sugar to it before eating it.

RAPE AND MUSTARD

Rape and mustard are similar oil-seeds (of the crucifer family) grown in Northern India and consumed largely in that area. Uttar Pradesh, the Punjab, Bihar and Assam are the major cultivators. They use this oil for cooking and for preparation of toilet articles. The oil-cake is used as cattle feed or manure. Rape oil, like castor oil, is also exported and finds use, after refinement, as a lubricant. Mustard oil is to Bengal and Assam what coconut oil is to Kerala.

[1] Kerala State uses coconut oil as a cooking medium.

An area of about 3.4 million hctrs is put under rape and mustard plants. The annual yield is 1.8 million tonnes. These are rabi crops and take 4-5 months from sowing to harvesting.

LINSEED

Linseed is grown in the northern States mainly for the oil which is used extensively in paints and varnishes. The oil has the property of drying up quickly. The flax from the plant is very useful for making linen. Most of the Indian linseed plants yield poor quality flax and therefore the importance of the crop is for its oil rather than for flax. Only Bihar and Bengal have some good flax-yielding varieties which are valuable for both flax and oil-seeds. About half a million tonnes of linseed are produced annually over an area of 2 million hctrs. Yields vary from State to State. The Punjab and Uttar Pradesh get high yields, whereas Maharashtra and Bihar get much lower ones.

PEPPER

Pepper (*Piper nigrum*, L) is an important crop in the group that is commonly described as "spices". It thrives well only in a hot humid atmosphere with a temperature of not less than 12°C and not more than 40°C at any time of the year. In India, about 120,000 hctres are given to this crop, yielding about 26,000 tonnes of pepper. Most of the crop comes from the State of Kerala, where it is grown away from the coastal plains, mainly on the lower slopes of the Anaimalai and other associated ranges. The adjoining hilly areas of the Tamil Nadu and Karnataka States also account for some of the pepper produced in the country (*Map II*).

The pepper plant is a vine and needs some support on which to climb. If allowed, it could climb to heights of 10-12 metres. It is generally kept down to a height of 3 to 5 metres by controlling the height of its support. In India most of the supports are living trees—trees in the jungle or specially planted Murukku (*Erythina indica*) trees. After three years the vine starts yielding

berries. From the seventh year the full yield starts and for the following 18 to 20 years the yield is generally good. The life of a plant is 25-30 years.

The harvesting season is January to March every year. The spikes with the berries are removed from the vine and spread out on a clean floor or mats. Trampling over them or rubbing them between the palms of hands helps in detaching the berries from the slender spikes. The berries are dried for 5-6 days by exposure to the sun. They shrink and have a black wrinkled appearance after this period of drying. This is the commercial "black-pepper".

India's share of the world pepper trade has risen to over 70% since the Second World War. About 70% of the exports go to the U.S.A. The value of exports is approximately Rs. 100 million.

CHILLIES

Chillies, like pepper, are widely used for giving pungency to food. Originally imported from Brazil, this crop is now widely cultivated in this country. It thrives well in tropical and sub-tropical latitudes. It is grown in backyards as well as in extensive fields. Since it is a crop of a few months' duration, it can be grown at any time of the year. It needs moderate quantities of water and thrives well in areas where precipitation is 60 cm to 120 cm. Heavy rain during the growing season leads to rotting of leaves. Light rain, with short dry periods, suits it best. Well-drained loamy soils suit the plant very well.

In India about 700,000 hectares are given to this crop. The annual yield is about 400,000 tonnes of chillies(dry). This excludes chillies grown in small plots of lands attached to residences. Chillies are useful crops in vegetable gardens maintained by many householders in the country.

In the larger regular fields, where the crop is grown on a commercial basis, the sowing starts after the first monsoon showers in nursery-beds. After six weeks the seedlings are transplanted, in the nursery beds the young plants need careful attention and light irrigation. Eight to nine weeks later the chillies can be picked

green. Generally they are harvested only when they ripen, some time in November. With careful irrigation a plant can be made to yield right up to January or February. The commercial crop is the dried chillies, red and wrinkled after two weeks of exposure to the sun. The yield varies from 250 to 1500 kilos per hectare. Good yields exceeding 1200 kilos per hectare come from carefully irrigated plots where soil and drainage are good. More than 80% of the produce comes from the six States of Peninsular India.

CARDAMOM

Cardamom (*Elettaria cardamomum*) is a perennial plant that thrives in warm humid climates. The fruits of the plant are small capsules, pale green or cream in colour, containing 15 to 20 chocolate-coloured seeds which are hard and have an attractive aroma. These fruits, suitably dried, are the commercially important part of the plant.

The cardamom plant needs shade and is, therefore, grown in the shade of larger trees. It thrives well in well-drained soils rich in humus. A well-distributed annual precipitation of over 150 cm and a temperature range between 12°C and 32°C suits the plant very well. Consequently this crop is confined to the moist evergreen forest lands of the southern States of Kerala and Karnataka. Here the crop is found in the higher slopes ranging between 800 and 1600 metres. One area where it is concentrated in Kerala is known as the Cardamom Hills (*Map* 11).

Three years after planting the yield of fruits begins. Harvesting commences in August and lasts up to March. The capsules do not mature simultaneously; so the fruits are gathered as and when they are ready during the period of harvesting. Each plant is checked at four-week intervals for capsules that are ready for plucking. After a period of 12 to 16 years, the cropped area is generally abandoned to the jungle and new plots are chosen for a new set of plants.

About 50,000 hectares are generally given to this crop. The annual yield is approximately 1500 tonnes. A little over half the

area and production belongs to Kerala. Karnataka and Tamil Nadu account for the rest of the acreage and production. Cardamom seeds are used in India for culinary purposes and are also chewed with betel leaves and areca-nuts. Export is mainly to the Scandinavian countries and Germany where the powdered seeds are used for flavouring cakes and pastries.

GINGER

Ginger thrives well in humid tropical areas where the soil is well-drained. In the State of Kerala the crop is grown on some of the lower slopes. Even though it is a perennial, the crop is treated as an annual. Small portions of the stems of the previous crop are planted in carefully prepared plots, late in May or early in June. The plant grows to a height of 50-60 cm and develops underground stems in 6-7 months. Commercial ginger is the dried underground stem, but actually most of the ginger is consumed locally green. Dried ginger of commerce forms only a small part of the total production.

The area of the crop for commercial purposes is about 25,000 hectares and the production 33,000 tonnes. Over sixty per cent ginger production belongs to Kerala. Commercial ginger is used in the preparation of drinks and for culinary purposes. India is the most important producer of commercial ginger.

TURMERIC

Turmeric (*Curcuma longa*) is a tropical crop that thrives well in sandy loams. There should be no water-logging. In the States of Andhra Pradesh and Orissa, which are its main producers, it is cultivated with irrigation and heavy application of cattle manure. The part of the plant used in commerce is the dried underground stem. The drying is done after boiling in earthen pots. This is used as an important condiment in most Indian homes. Generally it is powdered and kept ready for use. It is valuable as an antiseptic agent and is often used as such by direct application on wounds.

Because of its protective qualities it has also been used for application on the body before bathing.

About 60,000 hectares are given to this crop. The annual output of dry cured turmeric is about 0.14 million tonnes. About 90% of the production is used within India itself. The small quantity that is exported goes to Ceylon, Iran, the U.S.A. and the U.K.

Cinnamon, clove and nutmeg are the other spice crops cultivated in India. They are grown mostly in the peninsular south where warm humid conditions prevail. Each of these has only a small area given to it.

The crops that have been considered so far (cereals, millets, oil-seeds and spices) are all connected, to a considerable extent, with the food consumed by the people of India. Two other crops should be associated with these—betel and tobacco. These are widely used in the country, and are generally taken after meals.

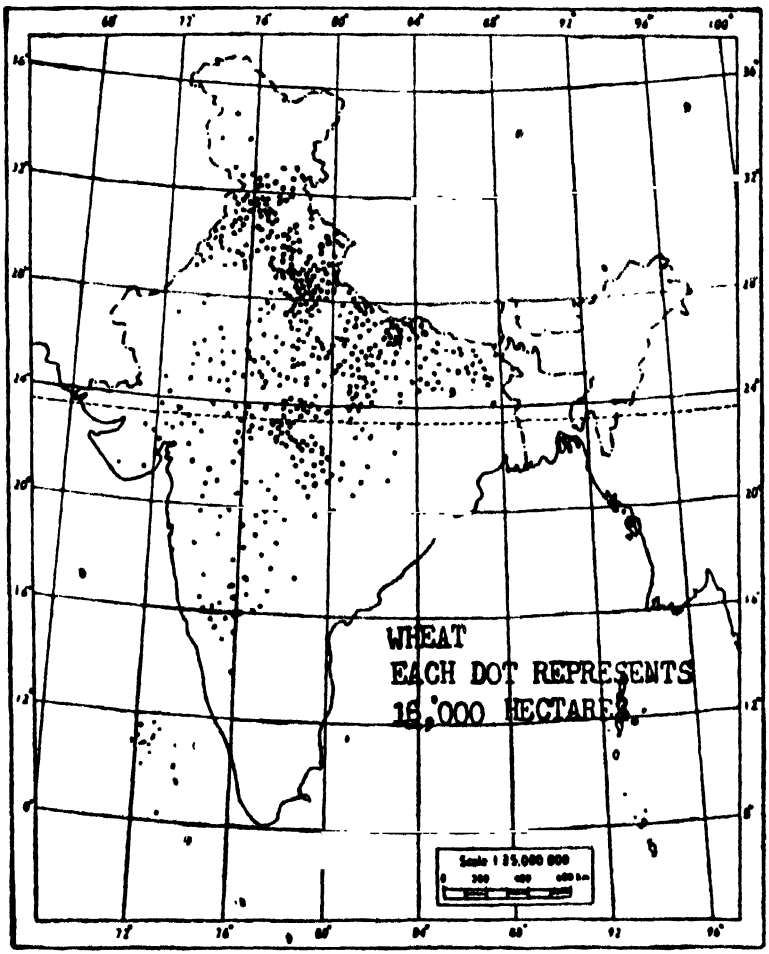
BETEL

The betel plant (*Piper betle*) is a creeper cultivated for the valuable leaves it yields. The leaves are chewed along with arecanut, lime and many other flavouring ingredients (like cardamom, clove, tobacco, etc.). Chewing betel leaves with all these associates is believed to help digestion. This might be true to some extent because such chewing helps increased output of saliva that is swallowed. Irrespective of these supposed values, such chewing has become a habit with millions of people (comparable to chewing-gum used in other countries). Many varieties of this creeper are grown in India and go by special local names.[1]

The creeper needs supports on which to climb. Some tree standards are used for this purpose. The creeper has to be carefully trained on the supports. Manuring, weeding and watering have to be done regularly. Deep heavy clays are good for the vine. The soil must be carefully drained. Where precipitation is less than

[1] Kumbala balli, Kari balli, Naga balli, Ambadi in Karnataka, Kumbakonam, Poonamallee in Tamil Nadu; Kali and Velchi in Maharashtra; Mahoba and Banarasi in North India.

Map 9 Wheat



Based upon Survey of India map with the permission of the Surveyor General of India, 1978.

The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate baseline.

100 cm irrigation is essential. The vine must be protected from exposure to the sun and strong winds. Each plot is protected on all sides by screens and is given shade by the leaves of the supporting trees. The plots are generally small, less than a quarter of an acre, since the vines have to be given very great attention all the time. The vines can yield leaves, year after year, for many years. Yields vary in different parts of India. They range from 1.2 to 12 million leaves per hctr. Nearly all the States produce betel leaves and practically all of them are consumed within the country.

TOBACCO

Tobacco cultivation in India seems to have started only in the seventeenth century. About 1/2 million hctrs are given to this crop now. The annual yield is about 0.4 million tonnes. Approximately 70% of the output achieved is from the States of Andhra Pradesh, Gujarat, Tamil Nadu and Karnataka. The yield is moderate, about 800 kilos per hctre. The plant thrives best in areas of moderate precipitation, 50 cm to 100 cm, with temperatures ranging from 15°C to 40°C. A bright rainless weather is needed at the later stage of the 3-4 month period of crop growth. Sowing starts in July and is over by October; harvesting begins in February and is over by the end of May. The crop is grown with or without irrigation. When irrigated it is generally followed by another crop during the same year—ragi in Tamil Nadu and maize or potato in the Punjab.

India grows the two widely consumed varieties of tobacco—Nicotiana tabacum and Nicotiana rustica. The latter thrives better in slightly cooler climates and is confined to the North; the tabacum variety is grown mainly in the South and the West. The rustica variety is used mainly for chewing and for the preparation of snuff and hookah tobacco. The tabacum variety is produced in larger quantities and is used for making *bidis*, cigarettes and cigars. The variety very popular for cigarettes is grown mostly in Andhra Pradesh. A variety good for making cigars is grown in Tamil Nadu.

CHAPTER V

LAND-USE: OTHER CROPS

SIX OTHER CROPS have an important place in the economy of the country. They have been additional money-earners both at home and abroad. These are (1) Tea, (2) Coffee, (3) Sugarcane, (4) Cotton, (5) Jute, and (6) Rubber.

TEA

Tea belongs to the genus Camellia. The variety widely grown in this country is a shrub that normally grows to a height of 2 to 3 metres. The valuable part of the plant is the tender leaf and the bud. Usually a bud and two leaves are picked; this is called a normal "pluck". If more than two leaves are taken, the product is coarse tea, less than the normal "pluck" gives very fine tea.

The plant needs light, shade, and plenty of moisture. Rows of shade-giving trees alternate with rows of shrubs. The moisture required comes from the monsoon showers. Generally tea plantations are located in areas of well distributed rainfall exceeding 150 cm annually (the N.-E. and the S.-W.). The plant needs well-drained soils rich in nitrogen. These conditions are met by developing the plantations on the slopes of hills and applying nitrogenous fertilisers periodically to the soil.

The bush has to be kept regularly pruned. In the northern plantations the bushes give 5 to 6 flushes in a season, the average interval between pluckings being a week. In South India plucking goes on all the year round. A good bush yields annually about 0.9 kg of green shoots. In a properly maintained plantation the annual yield of finished tea would range between 2,270 and 3,000 kilos per hectare. A bush normally yields tea for about 40 years; after that the yields tend to fall off.

The plucked bud and leaves have to be processed before the

commercially important product is ready for packing. Withering, rolling, fermenting, drying and grading are the important steps to be taken. The bulk of Indian tea is processed into the black variety. India is the largest producer and exporter of tea in the world. Roughly 70% of the world production is from this country. Assam and West Bengal in the N.E. and Tamil Nadu and Kerala in the South are the main producers.

COFFEE

About 140,000 hectares are given to coffee. The annual production is around 90,000 tonnes. The three southern States of Karnataka, Tamil Nadu and Kerala produce all the Indian coffee. The coffee plant thrives in a hot, humid climate and needs well-drained soils. Temperatures should range between 10°C and 28°C. Slopes are suitable for plantations because the soils can be kept free from water-logging. Normally the plant requires 150 cm to 200 cm of annual precipitation. It can flourish in areas of higher precipitation if the latter has a proper distribution during its growing season. Along the Karnataka-Tamil Nadu border, on the slopes of the many spurs associated with the western face of the peninsular plateau, plantations have been developed. These naturally vary in size from 0.4 a hctr patches to 400 hctr plantations. Since the plant is sensitive to direct exposure to the sun and strong winds, it has to be protected by taller trees.

As a rule coffee is grown from selected seeds. Seedlings are raised in specially prepared seed-beds and transplanted into nurseries from where they are transferred to the fields. Seedlings are raised near the source of water; sometimes baskets of split bamboo are used for raising them. It takes two years from the time of sowing the seeds to final planting in plantations. The plants start yielding fruit when three years old and maintain a good yield for 30 to 50 years. Only ripe berries are picked. Processing involves the removal of the skin, parchment and pulp of the fruit. Beans are sun-dried for about two weeks. The beverage is prepared by using the powdered roasted beans for a decoction.

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Most of the coffee grown in India belongs to the Arabica or the Robusta varieties. About one-third of the total production is exported. The remaining two-thirds is mostly consumed in the three states of Tamil Nadu, Karnataka and Andhra Pradesh. The value of the exports is 195 to 200 million rupees annually.

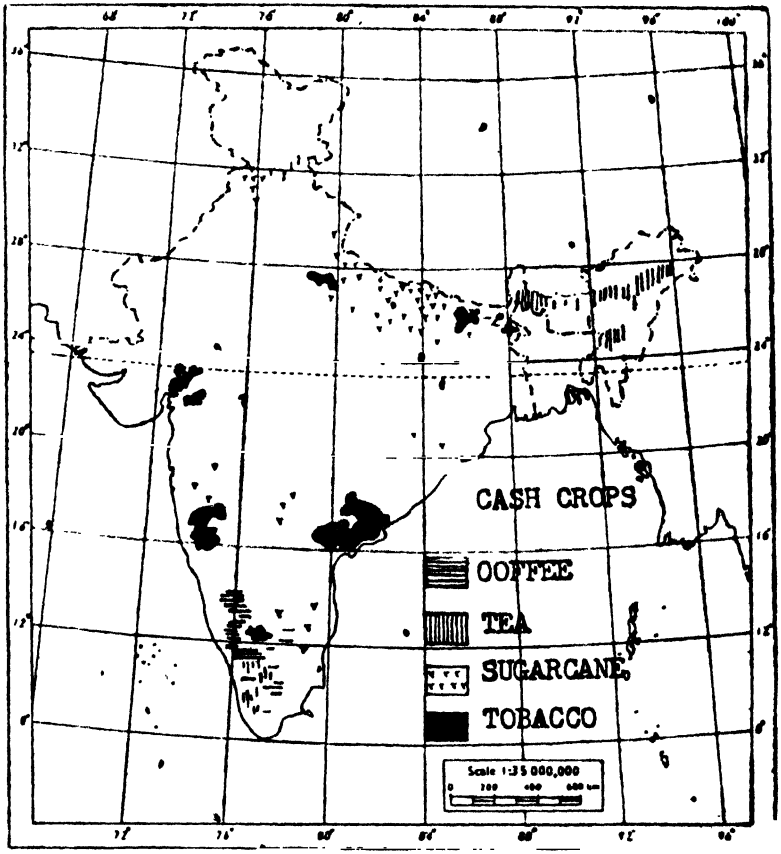
SUGARCANE

Sugarcane is essentially a tropical plant. It is a long duration crop which is kept in the field for 10 to 12 months. In some areas harvesting is done a year and a half after planting. The natural conditions suitable for sugarcane include well-drained medium loam soils, or rich clay loams, with adequate facilities for drainage. As the plant is a soil-exhausting one, farmyard manure and nitrogenous fertilisers have to be added to the soil periodically. Climatically, the plant thrives well in areas which have 75 to 100 cm of annual rainfall. Temperatures ranging between 10°C and 30°C are helpful.

The crop is propagated vegetatively. The top parts of the cane form good planting material. Generally, planting is done during January-April. The time of harvesting depends on the age of the crop, the area and the quality of the cane. Usually harvesting is possible ten to fourteen months after planting. The average yield of cane is 30,000 kg per hct in the northern plantations, while in the south it is nearly double that. Very high yields, however, have been obtained with improved varieties (like Coimbatore 419). Such yields have been more than 250 tonnes per hctr. Improved hybrid varieties are grown in more than 90% of the area under this crop. Most of these have come from the Research Institute at Coimbatore.

Uttar Pradesh, Bihar and the Punjab have the largest area under sugarcane in the country. They produce about 80% of the total yield. For the country as a whole, roughly 2.5 million hctrs are given to sugarcane. The annual production is about 124 million tonnes cane. The value of annual exports varies between 300 and 320 million rupees.

Map 10 **Some Important Cash Crops**



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COTTON

Cotton has been known to the people of India for over 3,000 years. It belongs to tropical and sub-tropical latitudes. The larger cotton-growing areas are to be found between 40° N and 40° S latitudes. India, the United States, Egypt and China are the major producers of cotton. This crop is generally cultivated in open country with a nearly flat topography. The crop thrives well between 20° C and 35°C; the rainfall should be moderate, ranging between 54 cm and 80 cm annually. It can be cultivated with irrigation in areas of less precipitation. It is grown both as a dry and as an irrigated crop. In some areas two crops are obtained in one year. Mixed cropping is practised with cotton in many parts of the country. Millets, pulses, grams and some oil-seeds are brought into mixed cropping practices. Sowing is done between April and August and harvesting between October and March.

Approximately 7.7 million hectares are given to cotton, the annual output is about 5.5 million bales (176.4 kilos per bale) of lint. Of the total production 16% to 17% is of the short staple variety, 43% to 44% of the medium staple variety, 40% to 41% of the long staple variety. For purposes of trade, 14 groups of cotton varieties according to the staple length and region of cultivation are known in this country. The following are the well-known varieties.

Trade varieties	*Tracts of growth*
Bengals	Punjab, Uttar Pradesh and Rajasthan.
Punjab Americans	Punjab, Uttar Pradesh and Rajasthan.
Comras	Madhya Pradesh, Khandesh, Vidarbha & Aurangabad Divisions of Maharashtra.
Gaorani	Aurangabad Division of Maharashtra.
Central India	Areas of the erstwhile Madhya Bharat State.
Broach	Broach, Baroda, Kaira, Panchmahals and Sabarkantha districts of Gujarat.
Surti	Surat and Broach districts of Gujarat.

After Randhawa, M.S., *Agriculture and Animal Husbandry in India*, p. 172.

Dholleras	North Gujarat and Saurashtra.
Southerns	Mysore and Andhra Pradesh.
Tinnevellis	Coimbatore, Madurai, Ramanathapuram and Tirunelveli districts of Tamil Nadu.
Cambodies	Coimbatore, Salem, Tiruchirapalli, Madurai, Ramanathapuram, and Tirunelveli districts of Tamil Nadu.
Tamil Nadu Uganda	Madurai, Ramanathapuram, Salem, Coimbatore, Tirunelveli, Chingleput and South Arcot districts of Tamil Nadu.
Salems	Coimbatore and Tiruchirapalli districts of Tamil Nadu.
Comillas	Hill tracts of Assam and Tripura.

Maharashtra, Gujarat, Karnataka and Madhya Pradesh have together more than 7.5 million hectares under cotton. Maharashtra has the largest area, over 2.5 million hectares. In actual production the order of the States is as follows: Gujarat, Maharashtra, Punjab, Haryana, Tamil Nadu, Madhya Pradesh, and Karnataka. Each of these States produces over 200,000 bales. The highest yields are derived in the States of the Punjab, Haryana, Tamil Nadu and Gujarat.

The value of exports of raw cotton and waste fluctuates around 200 million rupees. Cotton piecegoods exported are valued at approximately 1117 million rupees.

JUTE

Jute fibre, after processing, is woven into jute fabric, which is one of the widely used packing materials in the world. During the two world wars sand-filled jute bags were very much in use at the "fronts" as well as in the "rear" areas protecting the soldiers at war and the civilians at home. The two world wars actually boosted up the demand for jute products. During times of peace jute bags have been used largely as packing material, for transporting grains and all other types of commodities that enter inter-

national trade. Since the introduction of bulk-handling of grains the demand for gunny bags has considerably decreased. This has led to alternative uses for jute, including making of fine fabrics for apparel, mat tapestry, etc.

Jute is a very special crop belonging to a very small area in the world. Over 90% of the world's jute comes from an area which is 1/1000 of the world's land surface. It belongs to the Indian subcontinent, where it occupies the north-eastern quarter.The area under jute is partly in Bangladesh and partly in India. Here the rainfall is high, 150 to 300 cm being the annual average. In the non-rainy season there is plenty of water from the lower courses of the Ganga, the Brahmaputra and the Meghna. Plenty of water is required for growing this crop, and also for processing it after harvesting. The concentration of jute in this small area is due not only to the availability of water but also because of the high atmospheric humidity, comparatively flat topography, alluvial soils, and abundance of cheap labour.

The area under jute in India is a little over 700,000 hectares with an annual production of approximtely 5.5 million bales (of 166 kilos each) of dry fibre.

The area and the production have always been fluctuating largely because of the nature of the international market for jute products and the unfriendly relations between India and Pakistan. India has 60% of the jute mills in the world, and depended considerably on jute production in East Bengal (now Bangladesh) before the partition in 1947. Since the partition, Pakistan jute had not enough local mills to utilise it, while India's mills had not got enough local jute to feed them. India has been gradually increasing the area under jute from 0.5 million hectares in 1950 to 0.9 million hectares in 1962 and today is still seriously bothered by lack of raw jute. The production has been varying from 3 million bales to 6 million bales during the same period.

Jute belongs to the family Chorchorus and is a slender-stemmed annual. It grows to a height of 2-4 metres. The fibre in the inner back is soft and strong, and can be drawn out into good lengths. This fibre is the commercially important part of the plant. The crude

cloth woven out of it used to be the cheapest coarse fabric known to the commercial world. Being highly adaptable, and facing competition from many other types of fabrics, it is now used in the making of many sophisticated products like carpets, rugs, linoleum and twines. India's exports are largely in the form of finished jute products. The value of exports fluctuates around 2.5 billion rupees. This is a very important earner of foreign exchange for the country.

RUBBER

Many plants when injured exude a sticky substance where they have been bruised. Of these types the Para-rubber tree (Hevea Brasiliensis) is the most significant. It exudes the widely used substance known as natural rubber. The tree thrives well in a warm moist "equatorial type" of climate. Variations in temperature and humidity should be small. Temperatures around 30°C and rainfall about 250 cm a year suit the tree very well. In India the plantations are in the southern part of the peninsula (Kerala, Karnataka and Tamil Nadu States), usually in the lower slopes of the hills (20 to 150 metres above sea level) on lateritic loams or clayey loams.

Seven or eight years after planting, the tree attains a girth of 50 cm. Tapping can be started at this stage. Cuts are made on the bark about half a metre above the ground. They are slanting ones extending to half the circumference of the trunk of the tree. Cups are fixed at the lower end of the spiral cuts. Collection from the cups is made daily or on alternate days. During the 4-6 week period of autumn, tapping is suspended as the yields tend to be very low. Tapping is resumed after refoliation is completed. During the heavy monsoon rainfall also tapping is suspended. This may last as long as 4-6 weeks. Consequently, the number of tapping days in a year varies from 200 to 300, depending on the location of the plantations.

After collection, measured amounts of formic acid or acetic acid are mixed with the latex thoroughly and it is allowed to coagulate. The coagulum is then passed through rollers for removal of water along with dissolved impurities. The smoking and drying processes are then undertaken. The resulting product is the "smoked

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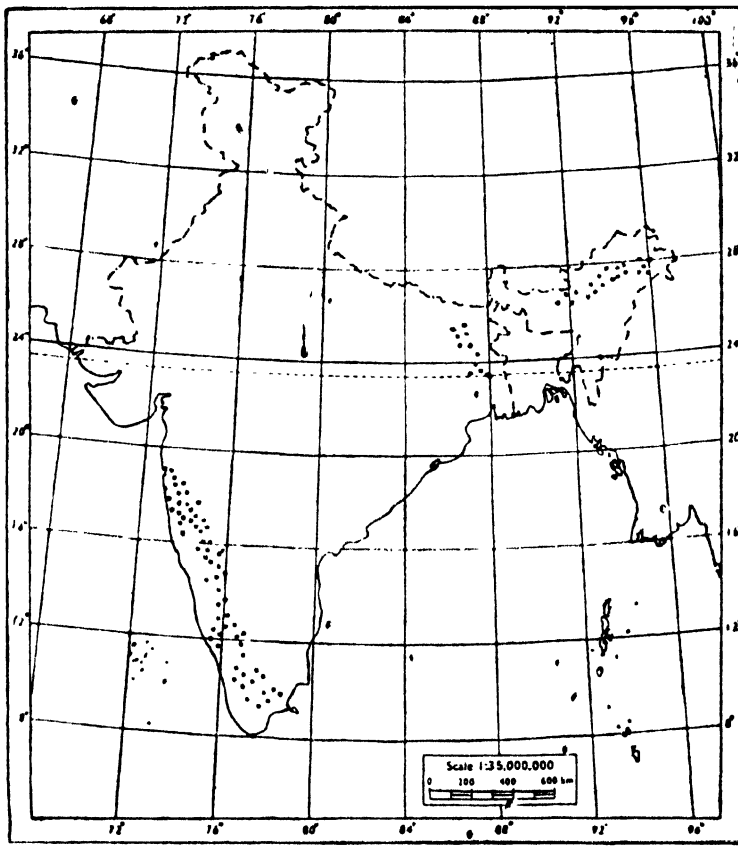
Map 12 **Arecanut**



Based upon Survey of India map with the permission of the Surveyor General of India, 1978.

The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate baseline.

sheet" which is transported to factories for utilisation in the making of rubber products. The area under rubber plantations is 200,000 hectares. The annual production is about 100,000 tonnes. Over 90% of the area and production belongs to the State of Kerala.

CHAPTER VI

LAND USE AND SELF-SUFFICIENCY

IN THE COUNTRY as a whole, the nature of land utilisation has been largely "unplanned" and whimsical. Often changes have been made in response to temporary price fluctuations of crops. Planning based on regional and national needs, land capabilities and scope for optimum production would improve the conditions enormously. Such planning is possible only on the basis of land-use surveys, which could be successfully completed only if the Government of India took the initiative. This would take some years. In the meanwhile modifications in the present methods could be adopted. These should aim at increased production at home and decreased dependence on foreign sources. Some suggestions in this respect are made in the following paragraphs of this chapter.

In land-use efforts the interest of the private sector is naturally limited; it is the public sector that should plan and improve conditions.[1]

While the public sector could plan and improve conditions, the actual ownership and management should be with private individuals or groups. The immediate needs are sound advice and fertilisers. Advice should be made available regarding application of the required fertiliser, crop-rotation and interculture, selection of seeds and all other details of scientific intensive farming. The Government can do so through its agents or publicity or both. The Government should also be able to encourage production of fertilisers, especially nitrogenous fertilisers, and arrange for their procurement from abroad, if necessary, on barter basis. In this connection the possibility of increasing the supply of fertilisers by the use of fishmeal made out of the Indian catch of fish needs exami-

[1] The experience of the world has been that extensive areas owned and managed by the public sector have, invariably, yielded poorer returns than equivalent areas owned and managed by the private sector.

nation.[1] The Bay of Bengal and the Arabian Sea, being in tropical waters, have a large variety of fish which could provide not only food for the land but also for the people who lack protein so much.

MAJOR FISHING COUNTRIES

Fish Catch 1974

(*in million tons*)

1.	Japan	10.733	10.	Thailand	1.626
2.	U.S.S.R.	9.236	11.	Spain	1.511
3.	China	6.680	12.	South Africa	1.415
4.	Peru	4.15	13.	Indonesia	1.342
5.	U.S.A.	2.7	14.	Philippines	1.291
6.	Norway	2.645	15.	Britain	1.259
7.	India	2.255	16.	Chile	1.12
8.	South Korea	2.001	17.	Canada	1.027
9.	Denmark	1.835			

Source: German News XVIII No. 17, Page 22, Sept. 15, 1976.

Another direction in which land-use needs re-orientation in the immediate future is horticulture. According to one estimate[2] less than one per cent of the total cropped area in the country was under fruit trees in 1957-58. Fruits and egetables must be grown in much larger quantities and should become part of the regular food conssmed by, at least, the middle and upper classes of people. The annual production of fruits in the country is about 60 million quintals, which means about one quintal for every eight persons for the whole year, or 10 kilograms per person for the year. Actually even this much is not available for each individual because about a quarter of the total production (by weight) is lost in storage. transport and as peelings. Of the rest, about a third is exported. So only 6-7 kilos per person per year is available for consumption.[3] In actual practice most of this is consumed in urban areas by the wealtheir

[1] Peru has increased, in recent years, the catch of anchovy, which forms the foundation of large exports of fertilisers and high protein food to Europe.

[2] Randhawa, M.S. : *Agriculture and Animal Husbandry in India*, p. 266.

[3] This compares poorly with 100-120 kilograms per person per year in countries of Western Europe and the U.S.A.

10% of the population. Increased production must be achieved largely by individuals and small groups on limited plots only. The need is to grow for local consumption rather than for export. Then only will the pressure on cereal foods decrease; then only will the health of the larger numbers improve.

Growing of vegetables, especially in back-gardens and on other unused plots, should be encousaged. Advice regarding the right type of vegetables for particular areas and seaons would be of great value to most middle-class families. In rural areas, the consumption of vegetables is very low. Most of the vegetables are transported directly from the collection centres to the nearby cities.[1] The illiterate people of the rural areas need advice. They must be advised to retain half of the fruits and vegetables they produce for their own consumption. What they lose by this practice can be made good by the products of cottage industries that they should be encouraged to develop.[2]

Rural electrification, mainly for increasing pump-irrigation, needs to be stepped up. In some States like Tamil Nadu, this has been done to a very satisfactory extent. In others, like Maharashtra, this aspect of agricultural need has been largely neglected. Power for irrigation must be made available in all States; the cost of such power must be reasonably low. The use of bullocks and camels in the "mhote" type of irrigation must be given up. This is a slow process and cannot achieve the efficiency that power-pumps can and do.[3]

In this context the mechanisation of farming techniques deserves serious consideration. In Indian agriculture the scope is not very great. But up to the extent possible, it should be adopted.

[1] For six to eight months in the year, 100-150 truck-loads of vegetables enter Bombay every 24 hours from the surrounding areas.

[2] The author has seen in two or three villages in Maharashtra villagers making tough ropes out of the fibre of cacti plants which grow abundantly in semi-arid areas; each length of the rope fetches about 75 paise. A family of four made about 4-5 lengths per day. A length is about 4 metres.

[3] The increasing supply of diesel oil from Indian sources makes possible the use of diesel engines for pumping water. This is a supplementary source of power for irrigation. However, for a mechanical or electrical pump to be efficient and economical, the holdings must be much larger.

This would release a large number of animals from the field. These animals themselves prove a strain on the fodder resources of the country;[1] they should be destroyed. It is less cruel to destroy them than to keep them alive in a half-starved condition and make them do such hard work.

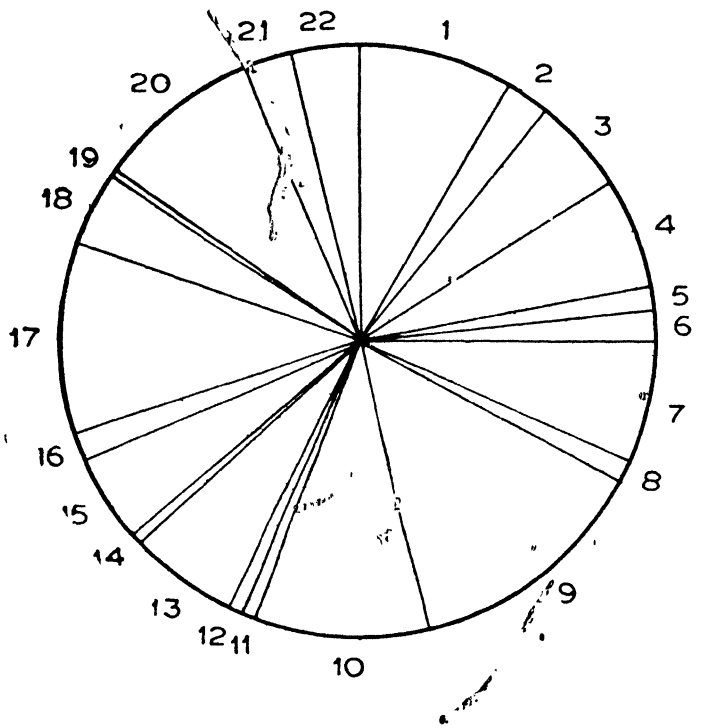
The general belief that more land should be given to cash crops must be rejected. The demand for cereals, especially rice, is such that it must be met internally.[2] There are not many countries in the world that can export large quantities of rice to India regularly. Moreover, dependence on foreign food supplies must be eliminated. If this is realised, the area under food crops must be increased, if necessary, at the expense of cash crops. The need of the next decade would be to increase production of rice and wheat somehow (by increased area or increased yield per acre) and drastically to cut the rate of population-growth.

A certain amount of efficiency in land-use can be achieved by the consolidation of holdings. By the end of 1972 about 33 million hectares had been consolidated mainly in the Punjab, Haryana, Gujarat, Himachal Pradesh, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan and Uttar Pradesh. Consolidation is only a remedial measure and its scope is limited. With the highly fragmented holdings that are the feature of this country, an immediate step would be a preventive measure prohibiting further fragmentation. To this must be added encouragement of re-adjustment in holdings. The latter must be purely voluntary. Increased agricultural production could come only by more intensive farming methods and additional land for agriculture. Any expectation of a significant increase in production by drastic changes in holdings or forced co-operative farming is not justified. The Indian people are essentially democratic in character and highly individualistic by temperament.

[1] All the fodder available in the country should be given to dairy cattle which are so essential for the supply of milk and milk products.

[2] There are many countries in the world that have wheat surpluses. The argument that cash crops could be used for purchasing such wheat in large quantities is not altogether acceptable. Cash derived from sale of cash crops cannot buy rice in the international market as few countries have rice surpluses.

A considerable increase in areas under irrigation has to be made especially in some of the larger States (such as Madhya Pradesh, Rajasthan and Maharashtra) that have marginal precipitation. An examination of the follwing table reveals large investments on irrigation projects, the area irrigated and the effectiveness of investment in achieving the objectives.



PROPORTIONATE AREA OF THE STATES

1) Andhra Pradesh 2) Assam 3) Bihar 4) Gujarat 5) Haryana 6) Himachal Pradesh 7) Jammu and Kashmir 8) Kerala 9) Madhya Pradesh 10) Maharashtra 11) Manipur 12) Meghalaya 13) Karnataka 14) Nagaland 15) Orissa 16) Punjab 17) Rajasthan 18) Tamil Nadu 19) Tripura 20)Uttar Pradesh 21) W. Bengal 22) Union Territories.

While Madhya Pradesh is the largest state in the country the area under irrigation in that state is (new circular diagram) only 1.5 million hectares, about 8% of the total cropped area. Rajasthan and Maharashtra (the 2nd and 3rd largest states in the country) have 2.2 million and 1.5 million hectares respectively under irrigation—i.e. about 16 and 9 percent of the cropped area. In other words the three largest states in the country, with considerable areas with marginal precipitation, have still 8, 16 and 9 percent only of their respective cropped lands under irrigation. This compares poorly with the situations in Haryana and Tamil Nadu (two of the smaller states in the country) where the irrigated area exceeds 40% of the total cultivated area.

It is obvious that the large states have to improve significantly to make their own productive capacity, and that of the country as a whole, much better. The need for larger areas under irrigation in these large states, with considerable areas of marginal precipitation, has not been fully appreciated; one is tempted to compare the smaller state of West Bengal, with adequate annual precipitation, possessing 26% of the cultivated area under irrigation.

CHAPTER VII

DEVELOPMENT OF INDUSTRIES

INTRODUCTION

INDUSTRIAL ESTABLISHMENTS, employing large numbers of workers, and aiming at mass production of commodities, have been a feature of the 20th century in India. Their development might be considered as due to, and also in spite of the British rule in India. The British rule provided for India the opportunity to get into contact with the Western industrial civilization. At the same time, the rulers were not too keen to encourage industrialization in the sub-continent. Up to 1947, therefore, industrial development was uneven and jerky.

Cottage industries and small-scale industries had, however, been a feature of human activity in the sub-continent for many centuries, long before the first Briton landed on Indian soil. Skilled workers of India had been known to produce remarkably good metalware, fabrics and toilet articles for over 2000 years. In other words, this country had been meeting the needs of its people by its own cottage and small-scale industrial production as satisfactorily as some of the enterprising countries of Western Europe were doing with the help of advanced technology. The Industrial Revolution in Britain and in Western Europe started a new pace of production, and a great variety of consumer-goods were manufactured by the end of the 18th century. During the 19th century, India and some other parts of the world began feeling the impact of this new development in industrial production. Simple living and a few wants started giving place to comfortable modern living with many wants.

By the beginning of the 20th century India started appreciating the advantages of the new developments in industrial production. Britain, rather reluctantly, had to permit some expansion in industrial production, especially during the two world wars. When British control over India ceased in 1947, the Indian Govern-

Plate 9. Coconut Plantation (*see page 33*)

Plate 10. Pepper Plant (*see page 36*)

Plate 11. Betel Vine (*see page 40*)

Plate 12. Tobacco Plantation in Andhra Pradesh (*see page 41*)

Plate 13. Tea Plantation in North-East India (*see page 42*)

Plate 14. Coffee Plant

see page 43)

Plate 15. A Headload of Cotton in Gujarat (*see page 45*)

Plate 16. Jute Crop

page 47)

ment felt free to adopt in industrial production all the new developments that Western Europe and the United States had evolved. Within a decade a good number of large industrial establishments were partially, or wholly, completed. Many of these were in the public sector. Before the end of the second decade after independence (by the end of 1965), the people, more than the Government, were realizing that too much money and attention had been given to industrial expansion, especially in the public sector.[1]

For the development of large-scale industries the country possesses many natural advantages—minerals like coal, iron-ore, manganese, mica and bauxite; substantial deposits of limestone, coast lands (in Kerala) rich in thorium and titanium; potential and developed water power; building material; plenty of labour, skilled and otherwise; an expanding home-market; a central location in the "old world", enabling trade with a large number of Asian, African and European countries, which are more "underdeveloped" than herself.[2]

With aid, in the form of "know-how" and initial machinery coming from the U.S.A., West Germany, the U.K., the Soviet Union and numerous other countries, India has been able to achieve considerable development in all types of modern industry. Tables VIII to XIV indicate the range of achievements in this sphere.

POWER

Industries need a lot of power derived from any, or all, of the major sources—coal, petroleum and gas, and water. In India all are available though not in very large quantities. Their occurrence, however, is such that they are not all concentrated in one part of the country. While much of the coal occurs in the north-east (Bihar-Bengal-Orissa borderlands), the petroleum fields are situated in Gujarat and Assam; the developed and potential water-power belongs mainly to the Himalaya and Peninsular ranges.

[1] India's planning might be contrasted with that of Taiwan (Formosa); during approximately the same period of time, the latter had stabilixed its agricultural production and was moving forward as an industrial producer.

[2] Early in 1966 India agreed to supply 2000 railroad wagons to Hungary at an approximate cost of Rs. 65 million.

COAL

Indian coal is largely medium quality belonging to the bituminous variety. The coal belongs to the Gondwana system (Carboniferous period) and occurs in an area stretching over Bihar, Bengal, Orissa and Madhya Pradesh. Coal formations are associated with the depressions along the major river valleys in this area. The important fields are as follows :

Damodar Valley	Raniganj, Jharia, Bokaro, Giridih, Karanpura.
Brahamini Valley	Talcher.
Mahanadi Valley	Rampur-Himghir.
Sone	Umaria, Korar.
Wainganga	Bisrampur, Lakhanpur, Mohpani, Pench Valley, Kamptee.
Wardha	Chanda, Tandur.
Godavari	Singgareni, Kothagudam.

Smaller fields, with smaller reserves of tertiary coal, occur in Assam and Kashmir. The important fields are Jaipur, Makum, Nanchik, Ladda and Riasi. Poorer quality coal (Lignites) occurs in Tamil Nadu and Rajasthan at Neyveli and Palana, respectively.

Of the annual output of about 80 million tonnes, about 97% is from the Gondwana fromations; the rest is tertiary. The annual output has been steadily increasing from about 6 million tonnes in 1900, to 24 million tonnes in 1930, 32 million tonnes in 1950 and 70 million tonnes in 1970.

The total reserves are estimated to be over a hundred billion tonnes. Of this only 2% is of metallurgical quality. The known reserves of metallurgical quality coal can support the expanding steel industry only for another half a century. In order to conserve superior coal and maintain progress in steel production, washeries are being constructed for separating higher grade coal from the poorer grades. The latter are high in ash content and can be used profitably for generation of power. The present plans envisage the development of a chain of giant power stations, with a generating capacity of 200 to 500 mw or more ,utilizing the high ash coals near the coal-fields.

At the integrated Neyveli Lignite Project an annual production of 3½ to 4 million tonnes of lignite is possible. The plan is to develop a quarter of a million kw thermal power, derive 150 thousand tonnes of urea (to be utilized as chemical fertilizer) and prepare 400 thousand tonnes of carbonized briquettes for use as domestic and industrial fuel. An interesting feature of the Neyveli lignite fields is the occurrence of lignite in association with a considerable overburden and an extensive artesian pocket. It may be observed that lignite and other tertiary coal can play an important part in the industrial development of the country for not more than 3 to 4 decades. The southern, western and north-western parts of India must rely, in the long run, on petroleum and hydro-electricity for continued industrial progress. This would apply to Assam also.

In general, it may be said that the country has realized the need for careful utilization of coal. Recent discoveries of petroleum pockets in Gujarat and Assam have helped this by making the use of diesel oil possible as an alternative source of energy. There are prospects of discovering new pockets of petroleum and natural gas. The completion of some of the larger hydro-electric projects would also relieve the pressure on coal.

PETROLEUM

The term petroleum is used to describe a liquid hydrocarbon of complex chemical composition; in its crude form petroleum includes compounds belonging to the Paraffin and Benzene groups, along with unsaturated hydrocarbons. Usually pockets of petroleum are found associated with some gas also. This (methane, ethane, etc.) is called "natural gas". In areas of sedimentary rocks that have experienced folding and displacement, the presence of natural gas helps an easier extraction of petroleum from the underground pockets. Petroleum has an organic origin. Bacterial and biochemical action on organic matter derived from microscopic forms of plants and animals that existed in shallow seas or swamps many thousands of years ago leads to the formation of various hydrocarbons.

In India the coastal plains, parts of the Ganga-Brahmaputra

plains and parts of Rajasthan were under shallow seas in the lower and middle Tertiary Era. These are the likely sources of petroleum in this country. Some of these, as in Assam and Gujarat, are already yielding valuable mineral oil. To help systematic search for petroleum, the Government of India set up in 1956 the Oil and Natural Gas Commission. The O.N.G.C. has been able to get the assistance of many foreign experts in exploring mineral oil and natural gas. By 1972-73 the country's own production of crude petroleum had moved upto more than 7 million tonnes; this may be compared to quarter million tonne in 1948-49. During the same period the consumption of petroleum product has jumped from 3 million tonnes to over 15 million tonnes.The refining capacity in the country has gone up from less than a quarter million tonne to about 18 million tonnes. In 1948-49 only one small refinery existed in Assam; by 1972-73 eight large ones were operating.

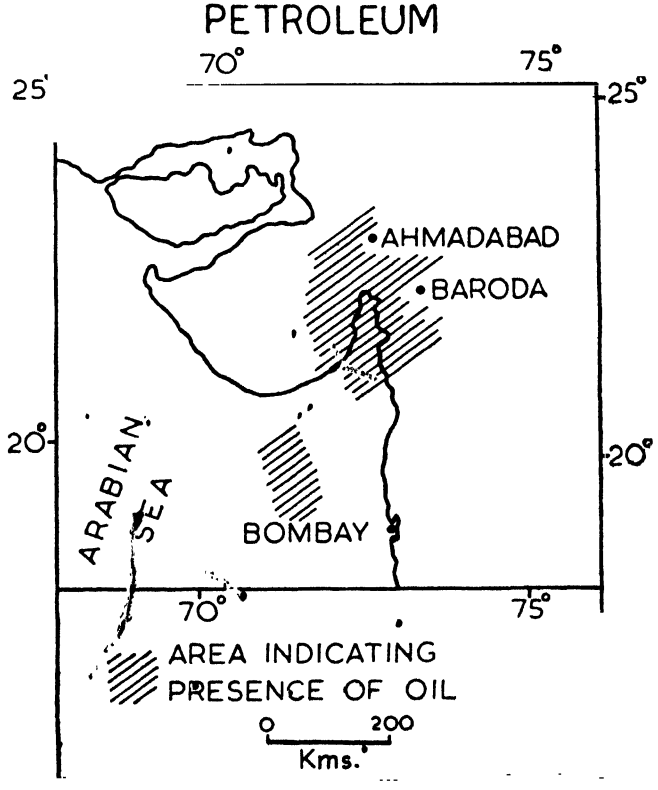
The two important areas producing petroleum are Assam and Gujarat. In Assam the north-eastern section (generally called Upper Assam) has been yielding petroleum for over a quarter of a century. The main fields are Digboi, Nahorkatiya, Hugrijan and Moran. The oil pockets occur at the base of Tipam sandstones which have been sharply folded and at places faulted. Oil occurs at varying depths ranging from 1000 to 3500 metres. The surface area of exploration is about 3000 sq. km. In Gujarat around the Gulf of Cambay, a large basin of lower Tertiary sediments enclosing petroliferous horizons rests upon a faulted surface of the traps. This appears to stretch from Bhavnagar to Baroda in E-W direction, and Surat to Palanpur in S-N direction. The surface area for exploration is roughly 50,000 sq. km.

The refining centres are located at Bombay, Baroda, Vizagapatnam, Gauhati and Barauni in Maharashtra, Gujarat, Andhra Pradesh, Assam and Bihar, respectively. Two refineries at Bombay (ESSO and SHELL) and one at Vizagapatnam (CALTEX) were private enterprise still recently, the others are Government of India undertakings. The total refining capacity is 20 million tonnes. At present a third of this capacity is met by internal crudes; the rest comes from South-west Asia. The plan is to increase the produc-

tion of internal crudes and feed all the refineries, including the three that were in private sector till recently.

The following data give some idea of the work done in petroleum production :

1) Area Geologically Surveyed—547805 sq. kms.
2) Seismic surveys—120200 (line km)
3) Gravity magnetic data collected from 213906 stations
4) Total no. of structures taken up for exploration (on shore and off shore)—144
5) Structures found to be Oil/gasbearing—41
6) No. of completed wells—1295
7) No. of wells proved to be oil bearing– 695



8) No. of wells proved to be gas-bearing—85

9) Production in recent years (3 million tonnes from Assam, a little over 4 million tonnes from Gujarat fields, 8 million tonnes annually.

From *The Illustrated Weekly of India* published by Times of India, Sep. 5, 1976

Structures which have been tested and proved to be oil/gas bearing have been found in recent years at the following places:

CAMBAY	Gujraat State
ANKLESHWAR	
OLPAD	
KALOL	
SANAND	
NAWAGAM	
RUDRASAGAR	Assam
LAKWA	"
BOMBAY HIGH	120 kms from Maha-
(offshore oil field) ..	rashtra Coast

HYDRO-ELECTRICITY

The perennial streams of the Himalayas provide considerable amount of power. The Bhakra-Nangal scheme is an example of such power production from only one river, the Sutlej. In peninsular India, the Sahyadri and Anaimalai ranges provide head for power generation, but the streams have a remarkable seasonal variation in the volume of their flow. Large dams across these rivers, sometimes more than one large dam across the same rivers, have made possible the conservation of monsoon waters for use during the whole year. The Cauvery is an example of peninsular rivers yielding considerable amount of power.

Many rivers are, however, yet to be tapped. Schemes are naturally multipurpose since the regulated release of conserved water can yield not only power but also crops through this water being used for irrigation. The total installed capacity of generating plants for the whole country and for the individual States is indicated below:

INDIA	1951	..	575	MW
	1956	..	1061	"
	1961-62	..	2419	"
	1962-63	..	2916	"
	1973-74	..	6970	"
Andhra Pradesh	1972	..	317	"
Assam	"	..	67	"
Bihar	"	..	10	"
Gujarat	"	..	—	"
Haryana	"	..	—	"
Himachal Pradesh	"	..	49	"
Jammu & Kashmir	"	..	27	"
Kerala	"	..	547	"
Karnataka	"	..	863	"
Madhya Pradesh	"	..	287	"
Maharashtra	"	..	844	"
Manipur	"	..	1	"
Nagaland	"	..	—	"
Orissa	"	..	270	"
Punjab	"	..	1253	"
Rajasthan	"	..	—	"
Tamil Nadu	"	..	1114	"
Tripura	"	..	—	"
Uttar Pradesh	"	..	606	"
West Bengal	"	..	26	"
D.V.C.	"	..	104	"

Source:- Statistical Abstract of India 1972

The pattern of power development is as follows:

(*a*) Kerala, Karnataka, Orissa, Punjab Jammu & Kashmir .. Mainly hydro

(*b*) Gujarat, Rajasthan, Bihar and West Bengal .. Mainly thermal

(*c*) Tamil Nadu, Andhra Padesh, Maharashtra, Madhya Pradesh, Uttar Pradesh and Assam .. Thermal & hydro

According to one estimate the river basins of India have an aggregate hydro-electric potential of the order of 40 million kw at 60% load factor. This is made up of:

Westward flowing rivers of the Sahyadri-Anamalai ranges—4.0 million kw.

Eastward flowing rivers of Southern India—8.5 million kw.

Central Indian rivers—4.0 million kw.

Ganga Basin (excluding the potential in Nepal)—5 million kw

The Brahmaptura and other North Eastern rivers—12.5 million kw.

The Sindhu (Indus)— 6.5 million kw.

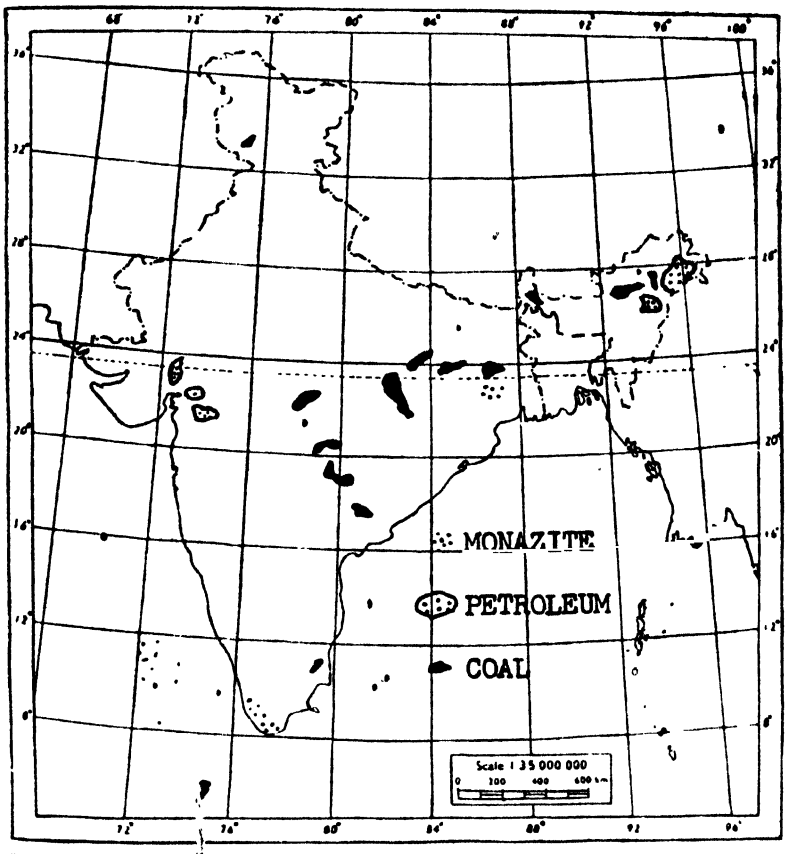
By the end of 1973-74 the developed hydro-electricity in the country was 18% of the total potential. The Punjab and Tamil Nadu, comparatively small States, stood at the top of all States in regard to installed power. These two States must depend on hydro-electricity as the only main source of power for a long time since their coal and petroleum resources are negligible. Maharashtra, which takes the third place, is a large State and can increase its hydro-electricity to a considerable extent.

Some of the major power projects, partly or wholly completed since 1950, are as follows:

1. **The Machkund Project**—A joint venture of the Governments of Andhra Pradesh and Orissa, this hydro-electric project harnesses the river Machkund which forms the boundary between the two States. A dam, 53 metres high above foundations and 404 metres long, has been constructed at Jalaput across the Machkund to store 77,125 hectare-metre of water. Three generating units of 17,000 kw each, and three units of 21,250 kw each have been commissioned. The total installed capacity of the power station is now 1,14,750 kw.

2. **The Srisailam Hydro-electric Project**—The Srisailam project (cost Rs. 385 million) envisages the construction of a 116 metres high and 506 metres long stone-masonry dam across the Krishna river, about 102 kms. upstream of the Nagarjunasagar dam site. The releases from the reservoir are proposed to be utilised for power generation at a station at the toe of the dam, with an initial instal-

Map 13 **Power Minerals**



Based upon Survey of India map with the permission of the Surveyor General of India, 1978.

lation of four units of 100 mw, and with provision for adding three such units at a later stage.

3. **The Iddiki Hydro-electric Scheme**—The project located in the high range of Periyar, about 161 kms. south-east of Ernakulam, envisages (i) a common storage reservoir formed by two main dams, one 159 metres high across the Periyar at Iddiki Gorge and the other 151 metres high across the Cherutoni, a tributary of the Periyar, (ii) a power-house with an ultimate installed capacity of 8,00,000 kw with 8 units.

4. **The Mettur Tunnel Hydro-electric Scheme**—The scheme (cost Rs. 89 million) provides for the utilisation of the discharge of 20,000 cusecs from the Mettur Reservoir during the irrigation period for power generation by installing four units of 50 mw each.

5. **The Koyna Project**—The first stage of the project, inaugurated in January 1954 (cost Rs. 382 million) envisages the construction of a 62.4 metres high dam across the river Koyna and a tunnel for diverting the waters of the river to ensure a drop of about 471 metres. The underground power-house has four units of 60,000 kw each, all of which have been commissioned. The project supplies power to the Bombay-Poona area and the adjoining districts.

6. **The Sharavathi Hydro-electric Project**—The Sharavathi Valley project is proposed to be developed in two stages. The first stage consists of the construction of a 52 metres high dam near Linganamakki village with a reservoir capacity of 4400 million cubic metres and installation of two generating units of 89,100 kw each. The second stage contemplates raising the dam and installing six more generating units of 89,100 kw capacity at the Sharavathi power-station. The two units of the first stage and the first units of the second stage have already been completed.

7. **The Bhakra Right Bank Power Station**—In order to utilise the power potential available at the Bhakra dam and to cater to the growing demand for load in the Punjab, Delhi and Rajasthan areas, it has been decided to construct a power-house (cost Rs. 308 million) on the right bank of the Sutlej at the foot of the dam.

The power-house will have four generating units of 70,000/1,20,000 kw each.

8. The Yamuna Hydel Scheme—The scheme proposes to harness the river Yamuna and its tributary Tons in two stages. Under Stage I there will be two power-houses on the power channel, one at Dhakrani and the other at Dhalipur with an installed capacity of 33,750 kw and 51,000 kw, respectively.

Stage II envisages the construction of a diversion dam 47.6 metres high near village Ichari on the river Tons, situated 28.8 km upstream of its confluence with the Yamuna, and an underground power-house at Chibro below the left bank of the Tons with an installed capacity of four units of 60 mw each (Part I), and four of 24 mw. each (Part II).

9. The Rihand Dam Project—The Rihand project includes the construction of a concrete gravity dam about 90 metres high and 920 metres long across the river Rihand near the village of Pipri in the Mirzapur district of Uttar Pradesh, about 47 kms. south of the confluence of the Rihand and the Sone rivers. The reservoir, to be created by the dam, will store 1.06 million hectare-metres of water. A power-station with an initial capacity of 0.25 million kw has been constructed. Its ultimate installed capacity will be 0.3 million kw.

OTHER SOURCES OF POWER

Besides coal, petroleum, and water, there are some other sources of power which help industries. These include charcoal, certain types of combustible wastes and nuclear energy. Charcoal is being used in some of the smaller industries where coal or other sources are not economically obtainable. The small iron and steel works at Bhadravati (Karnataka State) have been using charcoal for many decades. Some of the sugar mills use cane-waste (after the extraction of cane juice) as fuel for generating steam power. With the development of technology it is possible to use solar energy also to some extent; in this context the development (in Israel) of an all-purpose small unit turbine which can convert

any source of heat into power is interesting and needs to be studied.[1]

UTILISATION OF POWER

Power derived from all sources forms the foundation of many activities, industrial, transportational, communicational and agricultural. The total energy generated and the nature of its consumption are indicated below:

ENERGY GENERATED

(Statewise Break-up in 1974-75)

State	*Hydro* (mu)	*Thermal* (mu)	*Nuclear* (mu)	*Total* (mu)
Andhra Pradesh	977	2727	—	3704
Assam/Meghalaya	219	329	—	548
Bihar	6	2054	—	2060
Gujarat	482	5182	—	5664
Haryana	—	125	—	125
Himachal Pradesh	152	—	—	152
Jammu & Kashmir	273	19	—	292
Karnataka	4653	—	—	4653
Kerala	2659	—	—	2659
Madhya Pradesh	541	3388	—	3929
Maharashra	5169	5785	1546	12500
Orissa	1338	855	—	2193
Punjab	487	137	—	624
Rajasthan	1198	—	739	1937
Uttar Pradesh	1573	5450	—	7023
Tamil Nadu	3877	3538	—	7415
West Bengal	86	4236	—	4322
Delhi	—	2665	—	2665
	3923	—	—	3923
	297	4169	—	4466
Total	27910	40659	2285	70854

Source: *India 1976* p. 238.

[1] *News From Israel* (Dec. 15, 1965), Vol. XII, No. 24.

INSTALLED CAPACITY & ENERGY GENERATED

	1960-61	*1965-66*	*1973-74*
Total installed capacity (Million kw)	5.65	10.2	18.5
Hydro capacity (Million kw)	1.92	4.1	7
Thermal capacity (Million kw)	3.4	5.65	11.2
Diesel capacity (Million kw)	0.35	0.4	0.3
Total energy generated (Million kwh)	20120	36820	71050
Total energy generated (Million kwh)	20120	36820	71050
By public utilities (Million kwh)	16930	32990	64850
By power units in industrial establishments (Million kwh)	3190	3830	6200

Source : India 1975

PATTERN OF UTILISATION OF ELECTRICAL ENERGY (PUBLIC UTILITIES) ALL INDIA

Category	1972-73		1973-74		1974-75	
	E	P	E	P	E	P
1) Domestic & Commercial lighting & small power	8085	14.1	8999	14.0	9997	13.8
2) Public lighting	605	1.1	676	1.1	752	1.0
3) Public water works & Sewage pumping	1361	2.4	1542	2.4	1708	2.4
4) Agricultural pumping	6384	11.4	7801	12.1	9105	12.5
5) Railway Traction	1731	3.0	2021	3.1	2173	3.0
6) Industrial	39147	68.0	43317	67.3	49014	67.3
Total	57513	100	64356	100	72749	100

E—energy comsumption million kwh.
P—percentage of total

Source: *Seventh Annual Electric Power Survey of India*, 1972-74, p. 36—published by the Central Electricity Authority.

CHAPTER VIII

DEVELOPMENT OF INDUSTRIES (Contd.)

In tables VIII to XIV achievements in selected industries have been shown; the tables reveal the variety of industries, and to some extent, the nature of progress in production. The tables cover groups of industries starting with mining; metallurgical industries follow, vehicles, machine-tools and sewing machines are grouped next, electrical engineering industries follow; table XII includes chemicals and allied industries; table XIII considers the production in textile industry; the last table (XIV) deals with beverages, sugar and vanaspati.

An examination of these groups of industries with regard to their importance and development is made in the following paragraphs.

The mining of coal and iron-ore are basic efforts in modern industrial development; fortunately for India both these occur within the country in considerable quantities, as already indicated in chapter II. While coal finds its uses in many aspects of economic life—cocking, heating, power generation etc.—iron-ore can be used largely only in the steel industry; in other words iron-ore needs the existence of a plant that can convert the ore into iron and steel. This explains to some extent, the much shorter history of mining of iron-ore as compared to coal in this country (and in many others as well).

THE METALLURGICAL INDUSTRY

The first plant capable of utilizing fairly large quantity of Indian iron-ore within the country was the result of the vision of Jamshetji Tata; the Tata plant appeared in 1907. By 1939 two other small plants (one near Assansol, Bihar, and other at Bhadravati, Karnataka) had started production of iron and steel; in 1939 0.8 million tonnes of steel and 1.8 million tonnes of pig iron were produced. The second world war helped the industry considerably; since India

achieved political independence the need for further expansion of the iron and steel industry was recognised. Three new plants, all in public sector, were built at Rourkela Bhilai and Durgapur with West German, Soviet Union and British aid respectively. These three plants are located in the States of Orissa, M.P., and West Bengal. A fourth public sector plnat, the Bokaro plant is almost complete; it is in the State of Bihar. All the four public sector plants are part of the state-owned Hindusthan Steel Ltd.

The Bhadravati plant, named after the Engineer-Statesman Visveswaraiya, is the only plant which is managed by a State Government, the Government of Karnataka. The two private sector plants, Tata Iron and Steel at Jamshedpur and the Indian Iron and Steel at Hirapur, near Assansol, have also expanded in recent years. The seven plants are producing about 8 million tonnes of steel besides pig-iron and castings. While there may not be any significant export of steel from this country, the scope for export of steel products, like locomotives, pipes, machinery etc. is very encouraging. More than the export aspect the expanding internal market for structural steel, rails, plates (for ship building), tractors and a large variety of steel products, amply justifies the development and expansion of the seven plants in the country. India's industrial development has also been helped by the large reserves of manganese and bauxite; these two minerals figure in the development of special steels and aluminium. Aluminium has a wide variety of uses; for the millions of people in the country aluminium utensils are light, durable, and reasonably cheap, from such a humble use the metal finds place in the manufactures of cables, automotive components and the aircraft industry.

The Coal Industry

The nationalisation of the coal industry and the improvement of the lot of the miners has resulted in increasing production of coal in recent years, 80 to 90 million tonnes. The increased production of coal, combined with better distribution, has helped not only the iron and steel industry but also the railways; very recently India has started exporting coal. With the centralised control over

production, distribution and utilization a more effective use of this mineral is expected. The Gondwana coals with higher carbon content need to be used with care so that the reserves could last for many decades. The lignites of Tamil Nadu and Rajasthan should be converted into electrical energy near their sources; the recovery of briquettes from this interior coal is already being done; briquettes are popular as cooking fuel in the areas near the lignite fields.

THE VEHICLES INDUSTRY

In a country extending over 3 million sq. kms. and having a population of over 600 million there is naturally a need for many sorts of vehicles. These vehicles vary in size, capacity, shape, nature of motive power, mechanical complexity and cost; some are two wheelers, some three or four and others many wheelers; the bicycle, the autorickshaw, the taxi-cab and the omnibus are all as well-known as the traditional bullock-cart. Among vehicles must be included those that run on rail track and fly above the ground.

Most of these vehicles are manufactured within India with 90 to 100 percent Indian components* and 99 to 100 percent Indian know how. Given below are the major centres of production:—

	Type of Vehicle	*Major Centre*	*Secondary Centre*
1.	Bicycles	Ludhiana, Madras, Lucknow and Kanpur	Delhi, Bombay, Bareli, Calcutta and Cuttack
2.	Motorcycles, Scooters & Mopeds	Madras, Mysore, Faridabad, Poona, Lucknow, Hydrabad and Bangalore	Ludhiana, Ahmednagar, Alwar, Ahmadabad
3.	Automobile (cars)	Bombay, Calcutta and Madras	Bangalore & Jamshedpur
4.	Automobile (Truck/ bus chassis, & jeeps	Madras, Jamshedpur and Poona	Bombay, Calcutta and Jabalpur
5.	Tractors	Ludhiana, Rohtak and Faridabad	
6.	Tanks	Avadi	
7.	Railway locomotive	Chittaranjan & Tatanagar	Varanasi
8.	Railway coaches	Perambur & Bangalore	
9.	Railway Wagons	A number of centres in the Assansol region.	Calcutta—Jamshedpur
10.	Aircraft	Bangalore & Kanpur	Koraput, Nasik and Hyderabad

*90 to 100 percent Indian components are not available in the case of electric and diesel electric railway locomotives; in the case of these vehicles Indian components are only 30 to 40 per cent.

The production of all these vehicles has been increasing though, within recent years, the passenger motorcars show a slight decline; the price-hike on crude petroleum exported by the Arab countries has resulted in a steep rise in the cost of petroleum in this country; this has resulted in the decline of the demand for passenger cars; another factor which has also contributed to this decline in demand is the cost of a new passenger car; within fifteen years the cost has more than doubled. Naturally the more economical two-wheelers (motor cycles, scooter and mopeds) are in great demand, the production of these has been steadily rising. More economical than the scooters and mopeds are the bicycles; the production of these has crossed the 2 million mark (refer to table X); the many centres producing bicycles cater to the demand within this country as well as outside; India has become an important exporter of bicycles.

The demand for railway locomotives, coaches and wagons, is met adequately by the industry within the country; actually the country is in a position to export these items to many other Asian, African, and East European countries. The aircraft industry, however, is not developed enough to meet the increasing internal demand for aircraft to be used in the civil aviation network; enormous amount of valuable hard currency has to be spent on the purchase of Boeings, Caravelles, and Airbuses.

This section on vehicles must, however, include that most important means of transport so popular with rural areas—the humble bullock cart. It would be impossible to list the number of manufacturing centres in each state; it would not be possible even to name the major centres of the production in the country. The cost of the individual cart could vary from a few hundred rupees to a few thousands; the cost of a pair of bullocks could be as low as a few hundred rupees and not more than three thousand. This inexpensive, durable, economical vehicle is best suited to the roads that characterise rural India. Approximately 13 million bullock-carts, involving a total investment of 30 billion rupees, transport about 2.25 billion tonnes of goods a year in this country.* The increasing

*The Indian railways, involving an investment of about 4 billion rupees, transport only 220 million tonnes of goods every year.

Plate 17 Mango

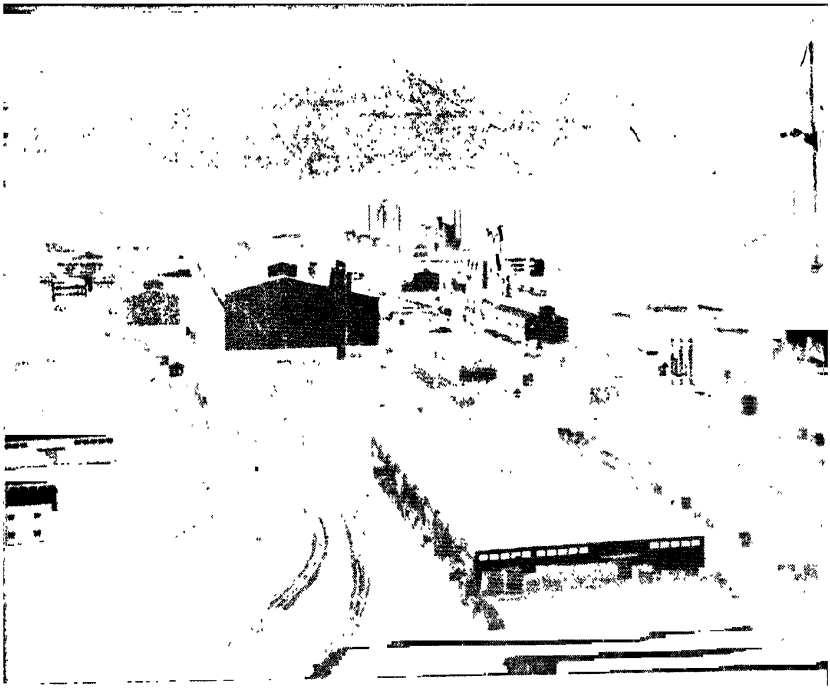


Plate 18. Iron and Steel Industry –Rourkela

Plate 19. Shipbuilding Industry - Visakapatnam (*see page 87*)

Plate 20. Aircraft Industry—Bangalore

(*see page 89*)

cost of petroleum products and automotive components is already rejuvenating the bullock-cart industry.

Electrical and General Engineering Industries

A large number of manufacturing industries, both in the public and the private sectors, have developed all over the country. These range from small one-man establishments to very large factory establishments. Utilising an increasing amount of indigenous components, they make a variety of engineering goods. These include such items as power generators, electric fans, air conditioners, power-driven pumps, diesel engines, automobile components, textile machinery, sugar mill machinery, machine-tools, sewing machines, agricultural implements and the like.

The following are the important centres concerned with this industry: Ahmedabad (Gujarat), Bangalore (Karnataka), Bombay (Maharashtra), Calcutta (West Bengal), Delhi (Union Territory), Jamshedpur (Bihar), Kanpur (U.P.) Madras (T.N.) Mysore (Karnataka), Nahan (H.P.) Pinjore (Punjab), Poona (Maharashtra), Ranchi (Bihar), Rupnarayanpur (W.B.), Secunderabad/Hyderabad (A.P.), Tiruchirapalli (T.N.), Vadodara (Gujarat), Vishakhapatnam (A.P.).

The production of these items has been showing a steady increase right from the early seventies. Machine-tools, sewing machines, power driven pumps, electric fans and airconditioners are actually finding an increasing demand from other countries.

Chemical and Drug Industries

The two world wars made India realise the importance of producing some of the essential chemicals and drugs within the country. Nitrogenous fertilizers, caustic soda, soda ash, sulphuric acid, ammonium phosphate and calcium carbide are some of the important chemicals that are now being produced in the country in increasing quantities. The need for producing important drugs like penicillin, streptomycin, sulpha drugs, aspirin, Vitamins B_{12} and C is also being increasingly appreciated. Dyes and insecticides are other important requirements that can be supplied indigenously.

The following are the important centres and the nature of their specialization in production :

1. Alwaye (Kerala)—D.D.T.
2. Baroda (Gujarat)—pharmaceuticals
3. Bombay (Maharashtra)—pharmaceuticals
4. Calcutta (W. Bengal)—pharmaceuticals
5. Delhi—D.D.T.
6. Hardwar (U.P.)—antibiotics
7. Mettur (Tamil Nadu)—basic chemicals
8. Poona (Maharashtra)—antibiotics
9. Sindri (Bihar)—basic chemicals.

The value of drugs and pharmaceuticals produced in 73-74 was about Rs. 3500 millions (refer to table XII) as compared to 120 millions in 1948. The Hindusthan Antibiotics Poona (1954), the Hindusthan Insecticides New Delhi (1954), the Hindusthan Organic Chemicals, Colaba (1960), formed the major national public sector undertakings responsible for much of the development in this industry.

The Fertilizer Industry

For a country like India, where the pressure of population on agricultural land is increasing day by day, fertilizers appear to be a magic wand. Everywhere optimistic estimates of crop yields for the following year are made. These are based on expectations from the fertilizers to be used on the lands under consideration. Fertilizers, however, are only one of the many steps to be adopted for achieving self-sufficiency in food for the country.[1] About 850 million rupees have been invested in the various fertilizer factories built within the last two decades. The large establishments are mostly State managed. (refer to table XII).

[1] Checks on the growth of population must continue at the present pace. Other important steps would be selction of seeds, better management of land, better prices to the cultivator for the crops, and improved organization for procurement and distribution of food crops.

Following are the important centres :—

1.	Sindri	(Bihar)	Public Sector
2.	Nangal	(Punjab)	,,
3.	Trombay	(Maharashtra)	,,
4.	Rourkela	(Orissa)	,,
5.	Alwaye	(Kerala)	,,
6.	Neyveli	(T.N.)	,,
7.	Namrup	(Assam)	,,
8.	Gorakhpur	(U.P.)	,,
9.	Durgapur	(W.B.)	,,
10.	Cochin	(Kerala)	,,
11.	Madras	(T.N.)	,,
12.	Ennore	(T.N.)	Private Sector
13.	Varanasi	(U.P.)	,,
14.	Vadodara	(Gujarat)	,,
15.	Vishakhapatnam	(A.P.)	,,
16.	Kota	(Rajasthan)	,,
17.	Goa	(Union Territory)	,,
18.	Kanpur	(U.P.)	,,

The Cement Industry

Cement has become an essential building material. Residential buildings, factories, dams, highways and bridges, all demand increasing quantities of cement. The occurrence of limestone over a wide area in the country has made the development of the industry possible in most states. Thirty-six centres, in 12 states, produce around 16 million tonnes of cement every year. Within the last two decades cement production has increased sevenfold. Increase in consumption has been equally fast. Bihar, the Punjab, Andhra Pradesh, Tamil Nadu, Madhya Pradesh, Gujarat and Karnataka are the important states which produce this valuable material. The country is in a position to export cement today.

The Sugar Industry

Suitability of climate and availability of cheap labour have been helpful in the development of the sugar industry in this country.

Large areas in Uttar Pradesh, Bihar, Punjab, Maharashtra, Karnataka and Tamil Nadu grow sugarcane. About 230 factories produced roughly 4 million tonnes of sugar. This quantity is produced from less than a third of the cane grown in the country. About two-fifths of the cane is used up in the making of gur (crude sugar) at a large number of rural centres, where crude crushers extract the juice before it is boiled into concentrates. In general, the organised industry is more efficient and productive in the four peninsular States of Maharashtra, Karnataka, Tamil Nadu and Andhra Pradesh. Though Uttar Pradesh and Bihar have a very large number of mills, their productivity has not been very satisfactory. Exports of sugar, though restricted by international understanding, earn for the country valuable foreign exchange. The internal demand has been increasing steadily. In recent years the country is able to export between 80 and 100 thousand tonnes of sugar.

The Paper Industry

Since the Second World War this industry has been growing steadily. The following figures indicate the nature of the progress :

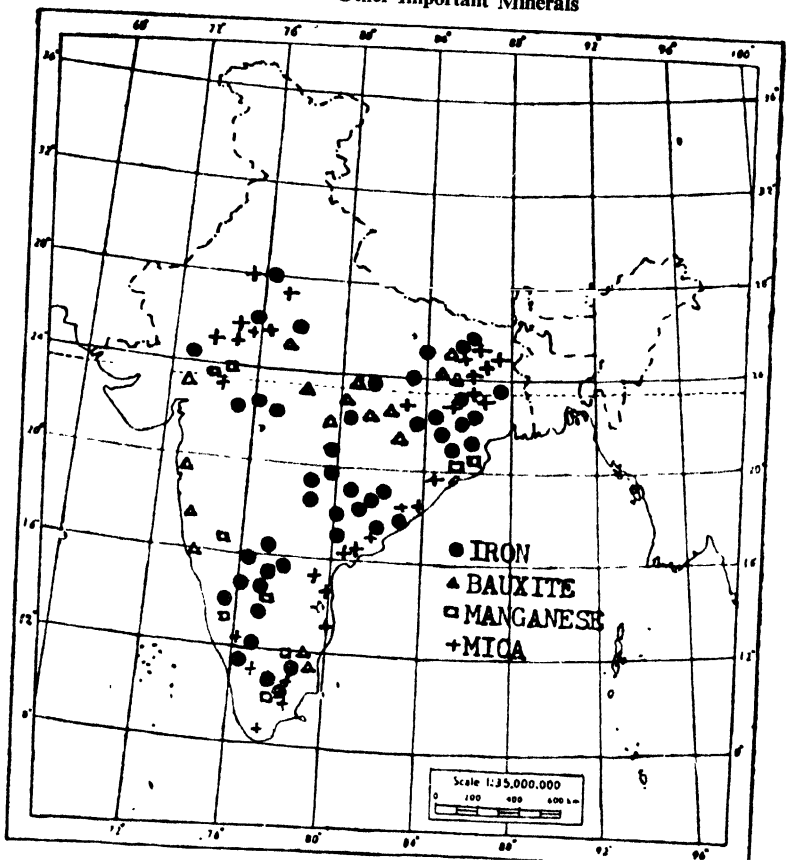
		1950 (in tonnes)	1962 (in tonnes)	1971 (in tonnes)
1.	Straw-boards	22,000	2,800	—
2.	Paper and paper-board	109,000	383,000	757,000
3.	Newsprint	—	25,300	38,000

There are 60 paper mills in the country and 30 straw-board factories. Production is not adequate to meet the demand within the country which has to import 32-40 thousand tonnes of paper from the countries of North-Western Europe, Canada, the U.S. and Japan. An organised and well-planned effort can increase the production considerably. The factors that discourage expansion are an inadequate supply of pulp and soft water. It seems doubtful whether the steadily increasing demand would ever be met by internal production alone.[1]

[1] When the country needs more land for cereals, millets, pulses, fodder-grasses, tea, cotton, sugarcane and rubber, increasing the area under pulp-yielding trees, bamboos and grasses is possible only to a limited extent.

Map 14

Four Other Important Minerals



Other Industries

There are many other industries that are essential for the day-to-day life of the people. These are found scattered all over the country. Matches, vegetable oils and toilet articles are some of the products of these indusries. Many of these can be considered part of small-scale industries, and some of them can be described as cottage industries. It is not possible to consider these industries individually in a book of this size. It may, however, be mentioned that these industries feed (a) other industries by providing components for them, and (b) the people directly with consumer needs.

Small-scale and cottage industries have a very important place in Indian economy. Their chief value lies in the fact that they provide employment to a very large number of persons (32-35 million), cater to regional needs, and tend to keep prices at moderate levels.

Since they utilize regional skills, some of their products are of a high quality. The Government of India and the State Governments have tried to help these industries by offering them space and amenities (power, water, etc.) in 'industrial estates' located near the larger cities. By the end of 1972 about 12,000 industrial sheds representing over 200 industrial estates were actually functioning. The Central and State Governments are also helping these industries to market their products at home and abroad. Some of the products have earned for themselves an all-India and even an international market.*

*A handloom fabric from Tamil Nadu has been popular in the U.S.A., for some years now. It is known as 'Bleeding Madras' since the colour tends to run as the fabric is washed.

CHAPTER IX

TRANSPORT AND COMMUNICATIONS

IN A COUNTRY of the size of India, transport and communication facilities are of great importance. In times of regional famines or other calamities, the need for such facilities is even greater. Fortunately there are not many geographic obstructions to the development of such facilities. As a matter of fact, over a large part of the territory conditions are quite favourable. Surface configuration and climate are, in general, unobstructive. The Himalayas are the only large tract of land which makes efforts in this direction difficult. Climatically, the very wet areas of Kerala and Assam also pose problems.

When India gained her political independence the country had a reasonably good network of railways, and a somewhat inferior network of roads.[1] Inland waterways were confined mainly to the Ganga-Brahmaputra rivers and the Buckingham Canal along the east coast. In 1947 there were about 5000 km of such navigable waterways. Civil aviation had just started and only very large cities were connected. Development over the next decade was encouraging. An idea of the overall development can be had from the following table:

	1947-48	1957-58	1967-68	1972-73
Railway route km	55000	56600	592100	1250000
Roads metalled km	160000	165000	298500*	472000**
Inland waterways km	5000	5500	8200	14344
Civil aviation km flown	15500000	42000000	56000000	66000000

*Including 23300 km. of national highways.
**Surfaced Roads.

There has been further development since 1958-59 in all the major means of transport. The four major means of transport may be considered separately.

RAILWAYS

During the century preceding the year of achievement of sovereignty, the British Indian Government had invited British interests to undertake development of railways in India. Some of the native rulers also joined the Government and invited British interests to construct railways within their states.[1]

During the period 1853-1947, about 37 railway systems had developed in the country; of these, seven large ones operated in the British Indian provinces. The railway systems lacked uniformity in every respect—track-gauges, track quality, operating staff for areas covered, and so on. The seven large ones that operated in British India were essentially oriented towards the port cities of Bombay, Calcutta and Madras. Commodities for export (mainly to Britain) were given special freight concessions as they were transported by these railways to the port cities.

After 1947, new India, reduced in size, but independent, took over all the railway systems under State management. The considerable credit built up in Briatin during the Second World War was utilized for purchasing all the railway systems. The Government of India, through the Ministry of Railways, undertook rationalization in a big way—the large number of systems that had come into existence before 1947 were organized into nine zonal systems (as indicated in the table). Some of the narrow-gauge tracks were converted into metre-gauge ones; different classes of travel, with associated amenities, were introduced, withdrawn, changed and modified. For the first few years there was some mismanagement, but then the system started improving steadily.

[1] The only rulers who had sufficiently large territories to justify a separate railway for their states were the Nizam of Hyderabad and the Maharaja of Mysore. Actually, however, many rulers spent fabulous sums on the construction of separate railways for their states. Some of these had less than 15 km of track and had a narrow guage that did not permit link with the adjoining systems.

RAILWAY ZONES

Year—1972-73

Zone	*Date of creation*	*Consisting of the former*	*Headquarters*	*Track width*[1]	*Route kilometres*
1	2	3	4	5	6
Southern	April 14, 1951	Madras and Southern Maratha, South Indian and Mysore Railways.	Madras	B.G. M.G. N.G.	2341 4958 153
				Total	7452
Central	Nov. 5, 1951	Great Indian Peninsular, Nizam's State, Scindia & Dholpur Railways	Bombay	B.G. M.G. N.G.	4837 382 794
				Total	6012
Western	Nov. 5, 1951	Bombay, Baroda & Central India, Saurashtra, Kutch, Rajasthan & Jaipur Railways.	Bombay	B.G. M.G. N.G.	2865 6080 1202
				Total	10146
Northern	April 4, 1952	Eastern, Punjab, Jodhpur, Bikaner, three upper divisions of the East Indian Rls.	Delhi	B.G. M.G. N.G.	6997 3429 260
				Total	19686
North-Eastern	April 14, 1952	Oudh & Tirhut Railway & Fatehgarh district of Bombay, Baroda & Central India Railways	Gorakhpur	B.G. M.G. N.G.	52 4924 —
				Total	4977

1 Track width: B.G.—1.678 metres, M.G.—1 metre, N.G.—0.762 metre and 0.610 metre

1.	Ambarnath (Maharashtra)	
2.	Alwaye/Cochin (Kerala)	*ite kilo-*
3.	Awadi (T. N.)	*metres*
4.	Bombay (Maharashtra)	
5.	Bhopal (M.P.)	6
6.	Bangalore (Karnataka)	
		4091
7.	Bokaro (Bihar)	—
8.	Bhilai (M.P.)	131
9.	Barauni (Bihar)	
10.	Colaba (Maharashtra)	4229
11.	Cochin (Kerala)	
12.	Chittaranajan (W.B.)	5336
13.	Calcutta (W.B.)	—
14.	Debari (Rajasthan)	1479
15.	Durgapur (W.B.)	6842
16.	Digboi (Assam)	
17.	Gomia (Bihar)	639
18.	Gorakhpur (U.P.)	2901
19.	Gaurgaum (Karnataka)	
20.	Gauhati (Assam)	87
21.	Hardwar (U.P.)	3628
22.	Hyderabad (A.P.)	
		2932
23.	Kota (Rajasthan)	2873
24.	Koyali (Gujarat)	370
25.	Kirkee (Maharashtra)	
26.	Kanpur (U.P.)	6175
27.	Khetri (Rajasthan)	
28.	Lucknow (U.P.)	
29.	Madras (T.N.)	
30.	New Delhi	people
31.	Naini (U.P.)	. It is
32.	Nepanagar (M.P.)	
33.	Namrup (Assam)	grains
34.	Nangal (Punjab)	nd in-
35.	Naharkatiya (Assam)	
36.	Nahan (H.P.)	
37.	Nasik (Maharashtra)	ielding
38.	Neveyli (T.N.)	
39.	Ootacamund (T.N.)	umber
40.	Perambur (T.N.)	affic is
41.	Pondicherry	
42.	Pinjore (Haryana)	nts to
43.	Pune (Maharashtra)	
44.	Rupnarayanpur (W.B.)	
45.	Ranchi (Bihar)	notives,
46.	Rishikesh (U.P.)	of these
47.	Rourkela (Orissa)	ired for
48.	Srinagar (J. & K)	cient.
49.	Sindri (Bihar)	
50.	Tiruchirapalli (T.N.)	
51.	Trombay (Maharashtra)	
52.	Vishakhapatanam (A.P.)	
53.	Vadodara (Gujarat)	
54.	Varanasi (U.P.)	

KEY TO THE MAP

Machine Tools
Machine Tools, Fertilizers, Chemicals
Tanks
Atomic Energy, Ship Building
Heavy Electricals
The Hindusthan Machine Tools, Aircraft, Telephones, Bharat Electronics Ltd.
Iron & Steel
Iron & Steel
Public Sector Refinery
The Hindusthan Organic Chemicals Ltd.
Fertilizer Corporation, Ship Building
Locomotive Works
The National Instrument Ltd., (Precision Instruments) Ship Building
The Hindusthan Zink Ltd.
Iron & Steel
Oil & Natural Gas
Explosive Factory
Fertilizer Factory
The Bharat Gold Mines Ltd.
Public Sector Refinery
Bharat Electricals
Hindusthan Machine tools, Hindusthan Aeronautics, Electronics Corporation
The Precision Instruments Factory
Petroleum Refinery
Ammunition and Explosive Factories
Defence equipment
Hindusthan Copper Ltd.
Scooter Factory
Fertilizer Corporation, Public Sector Refinery, The Surgical Instrument Plant.
Hindusthan Insecticide Ltd.
Triveni Structurals
The National Newsprint and Paper Mills Ltd.
Fertilizer Corporation
Fertilizer Corporation
Oil and Natural Gas
Agricultural Implements, Rosin and Turpentine Factory
Aircraft (MIG), Security Printing Press
Lignite, Fertilizers
The Hindusthan Photo Films Manufacturing Ltd.
Integral Coach Factory
Govt. Distillery for Industrial Alcohol
Hindusthan Machine Tools, Tractors division.
The Hindusthan Antibiotics Ltd.
The Hindusthan Cables Factory
Heavy Engineering
Hindusthan Drugs & Pharmaceuticals
Iron & Steel
Hindusthan Machine Tools, Watches Division
Fertilizer Corporation
Boilers, railway equipments.
Fertizer Corporation.
Hindusthan Ship Building, The Bharat Heavy Plate and Vessels Ltd.
The Indian Petro-Chemical Corporation
Diesel Locomotive Factory

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—
131
4229
5336
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1479
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Zone	1
Southern	
Central	
Western	
Northern	
North-Eastern	

1 Trac
and

Zone	*Date of creation*	*Consisting of the former*	*Headquarters*	*Track width*	*Route kilometres*
1	2	3	4	5	6
Eastern	Aug. 1, 1955	East Indian Railway Calcutta (minus the three upper divisions)	Calcutta	B.G.	4091
				M.G.	—
				N.G.	131
				Total	4229
South-Eastern	Aug. 1, 1955	Bengal, Nagpur Railway with minor adjustments	Calcutta	B.G.	5336
				M.G.	—
				N.G.	1479
				Total	6842
North-East Frontier	Jan. 15, 1958	Assam Railway with minor adjustments	Maligaon (Gauhati)	B.G.	639
				M.G.	2901
				N.G.	87
				Total	3628
South-Central	Oct. 2, 1966	Portions of Southern & Central Railways	Secundera-bad	B.G.	2932
				M.G.	2873
				N.G.	370
				Total	6175

Source: Commerce March 6, 1976.

The nationalised railway system is very essential to the people of the country. It carries about 2.6 billion people every year. It is essential for the trasportation of coal, metallic ores, foodgrains and many other commodities that support the commerce and industry of the country.

Industries feeding the railway system have started yielding results.[1] Income has steadily increased with the increase in number of passengers and freight. Annual income from passenger traffic is about 3.6 billion rupees, while income from freight amounts to about 2.2 billion (7,200 million) rupees.

[1] India is largely self-sufficient in the production of all types of locomotives, passenger cars, and goods wagons; she is in a position to export some of these to African, Asian and East European countries. Even in the items required for the permanent way and the signalling system the country is nearly self-sufficient.

PASSENGER TRAFFIC AND EARNINGS

Description	1974-75	1973-74
Passenger originality (in 000)		
Suburban		
1st class	75209	81365
2nd class (Pre-April 1974)	—	19
2nd class (Pre-April 74/3rd)	1297937	1355716
Total	1373146	1437100
Non-Suburban		
Air-conditioned	229	299
1st class	6025	6383
2nd class (Pre-April 1974)	—	3961
A.C. Chair-Cars	373	460
2nd class (Pre-April 74/3rd)	1049573	1205519
Total	1056200	1216622
Passenger Kilometres (in 000)		
Suburban		
1st class	1539946	1567980
2nd class (Pre-April 1974)	—	1351
2nd class (Pre-April 74/3rd)	25616882	26467229
Total	27156828	28036560
Non-Suburban		
Air-conditioned	142824	197974
1st class	2660170	2672306
2nd class (Pre-April 1974)	—	990362
A.C. Chair-Cars	386651	467722
2nd class (Pre-April 1974/3rd)	25907235	103298496
Total	99096880	107626960
Passenger earning (in 000 Rupees)		
Suburban		
1st class	48492	43330
2nd class (Pre-April 1974)	—	84
2nd class (Pre-April 74/3rd)	366523	343905
Total	415015	387319
Non-Suburban		
Air-conditioned	47717	44507
1st class	356963	283876
2nd class (Pre-April 1974)	—	62298
A.C. Chair-Cars	35294	31678
2nd class (Pre-April 74/3rd)	3270519	2861786
Total	3710493	3284145

Source: Indian Railways Annual Report and Accounts 1974-75, pp. 58, 59, 60 and 61.

Within recent years many of the defects* that characterised the Indian railway system have been largely removed. this has been possible because of the improvements in the permanent way, the rolling-stock and operational efficiency.

Improvement in the permenent way has been achieved partly by re-laying the weak links and partly in the process of conversion of metre gauge sections to broad gauge ones. As a result higher speeds are possible and fewer transhipments are necessary e.g., it is possible now to travel by the same coach (or bogie) from Trivandrum, in the far south, to Amritsar in far north. Faster trains can operate safely on these improved sections.

The improvement in rolling-stock applies to all the three units—hauling, passenger and freight. Diesel and electric locomotives are being introduced in many sections for both passenger and goods trains; these locomotives are more powerful and can haul an additional 25 to 40 percent coaches or wagons; moreover they belch out no smoke or coal particles. As they are powered by diesel oil or electricity they are not dependent on coal stocks at various points; consequently their operational efficiency is much higher than that of steam locomotives. Passenger units have been improved and, now, provide two main classes of travel—the first class and the second class. Even goods wagons have been improved.

The general operational efficiency achieved by the Indian railways is due, to a considerable extent, to the quality of human efforts. Persons working in the Research and Development Section, the operational areas, and at major junctions have all contributed to the improved comfort, speed and punctuality that are seen in the system today. The introduction of super trains like the Rajdhani and Tamil Nadu Expresses are a part of the significant operational improvement in Indian railways.

A very satisfactory aspect of the whole system is the self-sufficiency the country has achieved in the production of locomotives, cars, wagons, etc.

*Lack of speed, too many stops overcrowding in passanger trains, inability to maintain punctuality in operatien, poor handling and delays in the transportation of freight

ROADWAYS

The country has had roads for many centuries, and their quality does not seem to have changed much. One finds that many of the roads that connect the rural settlements are still cart-traks that have existed for centuries. Improvements has taken place only in and near the large urban centres. That too came when motor-buses were introduced. Road development, therefore, is a feature of the recent past.

The Government of India assumed responsibility for the construction and maintenance of national highways in 1947. These are being developed to provide arterial routes across the country, connecting the big cities. By 1973 the country had over 29,000 km of national highways. These included the following routes :

NAT. H/WY. No. 1	DELHI—AMRITSAR
NAT. H/WY. No. 2	DELHI—CALCUTTA via Allahabad.
NAT. H/WY. No. 3	AGRA—BOMBAY via Indore and Nasik
NAT. H/WY. No. 4	BOMBAY—MADRAS via Poona, Hubli and Bangalore
NAT. H/WY. No. 5	MADRAS—DELHI via Vijayawada and Cuttack
NAT. H/WY. No. 6	CALCUTTA—BOMBAY via Nagpur
NAT. H/WY. No. 7	DELHI—CAPE COMORIN via Agra, Jabalpur, Hyderabad, Bangalore, Salem and Madurai.
NAT. H/WY. No. 8	DELHI—LOMBAY via Ajmer and Ahmedabad.
NAT. H/WAY. No. 9	POONA—VIJAYAWADA via Sholapur and Hyderabad

Besides these, the national highways include 40 other connecting links which are indicated in the map showing roads and air-routes. The distribution of highways is shown below (see p. 85):

Each State has its own highways constructed and maintained by its Public Works Department. There are a little over 230,000 km of State Highways. These do not include cart-tracks and other seasonal routes.

There are many reasons for the roadways in India being unsatisfactory. The roads are used by all types of vehicles—private

NATIONAL HIGHWAYS (STATE-WISE)
As on 31st March 1972

State/Territory	*Kilometres*	*Area of the State served by one km. of National Highway in it (in sq. km.)*	
Andhra Pradesh	2332	118.7	fair
Assam	1652	47.53	good
Bihar	2117	82.1	very fair
Gujarat	1335	147.0	fair
Haryana	729	60.57	good
Mimachal Pradesh	464	119.9	fair
Kerala	449	86.56	very fair
Karnataka	1996	96.01	very fair
Madhya Pradesh	2668	166.00	poor
Maharashtra	2861	107.5	fair
Meghalaya	161	139.6	fair
Manipur	211	105.9	fair
Nagaland	103	160.1	poor
Orissa	1649	94.36	very fair
Punjab	587	85.80	very fair
Rajasthan	2089	164.2	poor
Tamil Nadu	1749	74.32	good
Tripura	200	52.36	good
Uttar Pradesh	2246	131.0	fair
West Bengal	1481*	59.30	good
Jammu and Kashmir	541**	410.8	very poor
Union Territories	325	367.0	very poor

*includes 62 kms. of National Highway of Sikkim.
**excludes roads under BRDB.
Source: *Basic Road Statistics, 1971-72*, pp. 10 and 11.

automobiles, buses, trucks, bullock-carrts and bicycles[1] and this, affects the surface of the road as also the maintenance of speed. Secondly, most of the roads, including National Highways, are

[1] Apart from these vehicles these roads are used by shepherds and cowherds for guiding large herds of sheep and cattle from village to village. Sometimes the road surface attracts rural folk to use it as drying ground for cereals and millets, and sometimes the poor sleep on the road as the flooring in their huts is poorer than the road surface. Those who are homeless, do the same.

not sufficiently broad. Usually the width ranges from 6 to 8 metres. As a consequence a lane for fast traffic each way is not possible. Thirdly, the routes do not avoid urban areas. Instead they pass through them. This is a nuisance both to the urban-dwellers and the travellers. Still another difficulty is the fact that the highways tend to attract settlements which often hug them.[1] Absence of motels (or even decent accommodation for nights), and lack of other conveniences make conditions difficult for most tourists and general travellers.

From the administrative and co-ordinating points of view, the Central and State Governments have set up a number of bodies (commissions, councils, committees, and so on) to develop roadways and the traffic on them. These bodies should guide the development of roadways and appreciate private enterprise that is of value to the general public.

INLAND WATERWAYS

About 14400 km of inland waterways are open to navigation by small vessels. The important ones are :

(*a*) the Ganga, the Brahmaputra and their tributaries, (*b*) the Godavari and the Krishna, and their canals, (*c*) the Buckingham Canal along the Tamil Nadu-Andhra Pradesh Coast, (*d*) the backwaters and canals of Kerala and (*e*) the Mahanadi canals in Orissa. About a third of the total available waterways can be used by large mechanically-propelled vessels (over 100 tonnes). The rest of the waterways are mainly for smaller vessels.

A major difficulty in the development of inland waterways is the seasonal fluctuations of water in almost all the rivers of India, especially the Peninsular ones. Secondly, the demand for waterways is very limited. Only some types of bulky commodities can be transported by these routes economically. The value of these routes

[1] Often one finds primary schools, small tea or coffee stalls and hutments quite close to the highway, the tourist, going by private car or by a regular bus, is warned to go slow in these zones which are numerous. Consequently, speed is not possible.

is largely limited to the ribbons of territory they can serve.[1] Passengers might travel in greater numbers over selected stretches (in Assam, the East Coast and the West Coast) if proper publicity to the beauty of the stretches is given and good vessels are provided. A good tourist income is possible if this aspect is further developed.

SEAWAYS

With half the country projecting southwards into the Indian Ocean, India has ample scope for developing her sea communications, including coastal traffic. A coastline of about 5,800 kilometres gives the country ample scope for coastal traffic and contact with foreign countries. Though there are not many natural harbours, the ones that have been developed (including artificial ones) are well-spaced along the peninsular coasts. On the West Coast Kandla, Bombay, Marmagao and Cochin and on the East Coast Madras, Visakhapatnam and Calcutta are the important ones.

During the past two decades, development of shipping has been quite impressive. Starting with old vessels purchased from other countries, the tempo of expansion has increased in recent years. By the end of 1973, over 3 million gross tonnes were registered; a quarter of this tonnage was largely for coastal traffic. The rest served India's trade and communications with foreign countries. The Government-owned shipyard at Visakhapatnam has, so far, built 63 ships of an aggregate tonnage of 240,000. Cochin is also being developed into a ship-building port.

The Shipping Corporation of India has about 140 vessels and operates cargo traffic to Australia, the Far East, the U.K., Europe and the U.S.A. It also operates passenger-cum-cargo vessels between Bombay and East Africa, and Madras and Singapore. Besides this Government-managed line, there are over two dozen smaller private operators (with a total tonnage of about 1.1 million) engaged in overseas and coastal trade. A considerable amount of the country's foreign trade is still carried on by foreign carriers.

[1] Firewood, structural timber, coal and the like are transported on the Ganga and Brahmaputra rivers between the areas of production and consumption, both of which are close to the rivers.

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A major problem in coastal shipping is the periodic stoppage of all traffic necessitated by the monsoons. For 3 or 4 months every year coastal traffic has to be stopped because of the very rough seas. Another difficulty is the limited storage facilities at all the ports. The ports are, however, being improved and enlarged. The expansion of Cochin and Madras ports is already more than halfway through. Mangalore and Tuticorin are also to be developed as major ports.

CIVIL AVIATION

In the development of aviation the progress in the country has been remarkable. The extent of the country and the favourable climatic conditions are helpful factors. The fastest railway train takes 20 hours to travel between Bombay and Delhi; the Boeing 707 connects the two cities in a flying time of eighty minutes. All the major cities are connected by scheduled jet services. Boeings and Caravelles are used to connect these cities. The nature of the progress of civil aviation is indicated below :

Year	*Km flown (Millions)*	*Passengers carried (Million)*	*Freight including mail (Million kgm)*
1947	15.0	0.25	3.2
1951	31.4	0.45	42.9
1956	37.8	0.56	48.4
1961	44.4	0.97	47.5
1966	49.7	1.57	31.8
1967	56.7	1.8	33.9
1973*	66.0	3.44	63.0

**Source*: *India 1975.*

The Government-controlled Indian Airlines Corporation is in charge of civil aviation within the country. It operates a fleet of Caravelles, Boeings, Viscounts, Skymasters, Fokker Friendships and Dakotas. Indian Airlines have also been operating Boeing 707's borrowed from Air India for flights between Bombay-Delhi and Bombay-Calcutta. The Department of Civil Aviation of the Go-

vernment of India maintains and operates 82 aerodromes. Of these the airports of Bombay (Santa Cruz), Calcutta (Dum Dum), Delhi (Palam) and Madras (Meenambakum) are the major ones serving international flights also. The airports of Ahmedabad, Agra, Bangalore, Hyderabad, Madurai, Nagpur and Patna are important junctions of internal air routes.

Air India, with a fleet of Boeing jets, provides services reaching out to more than 20 countries. Many of these countries, in their turn, operate through India's international airports.

TOURISM

A Department of Tourism has been set up by the Ministry of Transport with a chain of regional offices in important cities like Bombay, Calcutta, Delhi and Madras. Smaller information offices have been set up at a number of other regional centres. Outside India the Department has offices operating in New York, San Francisco, Toronto, London, Paris, Frankfurt and Melbourne.

The number of foreign tourists coming to India for travel within the country has been steadily increasing. In recent years it has been about 350,000 per year. Foreign tourists, especially from the U.K., America, Western Europe and Australia, bring in valuable foreign exchange. Publicity abroad and facilities within India need to be improved considerably, for then only would very large numbers visit India.

Publicity abroad is inadequate because in most cases members of the staff have themselves not travelled very much in India. Their knowledge of India, at best through books, is poor. They do not have, ready at hand, specific plans to suit the tastes and purses of individuals. An American may be interested in seeing wild life and may be prepared to spend $ 100 a day while in India. Another may be interested in Indian classical music and may have a smaller purse. The Indian Tourist Office should be able to suggest itineraries for such persons. Courtesy to those seeking information is very important. It also needs to be remembered that the Indian Tourist Office exists not only for foreigners but also for Indian travellers. This is an aspect that has been too often ignored.

Tour plans, routes, probable expenses, information regarding facilities, etc., are required for both foreign and Indian travellers. Some attractions of India have not been fully exploited, while others have been overdone. Assam's wild-life sanctuary, with a steamer-trip up the Brahmaputra, would be very interesting and could draw a very large number of tourists. The natural beauty of Kanyakumari is also abundant though it has been partially lost by some modern constructions.

The Government of India must realise that tourism could bring in a very large revenue for this country. The following major steps need to be taken: (*a*) Members of the saff of Tourist Offices should have themselves travelled in India extensively; they must have imagination and tact. (*b*) Areas attractive to tourists must be preserved. Old names, old surroundings and even old buildings should remain as they are. Development of a settlement in an area, and hotels of different sizes and qualities clustering round monuments and not merging with the landscape are sure to destroy the attractiveness of the area. Such areas should moreover be protected from the nuisance of beggars and unlicensed guides. (*c*) Separate pamphlets giving information about each of these areas should be prepared and made available to tourists. Plans that include a number of interesting places in 'route-tours' should be available, for example, one 'route-tour' could include Agra-Delhi-Chandigarh-Simla; another could include Tiruchirapalli-Madurai-Periyar Lake (game sanctuary), etc.

POSTAL AND OTHER COMMUNICATIONS

Like the Indian Railways, the P. & T. Department is a major Government of India undertaking. It employs about half a million persons and works as a commercial-cum-utility service. Part of the income is made over to the general revenue of the country. Postal revenue during 1972-73 was 1182.5 million rupees. The number of permanent post offices is over 75,000. In addition there are about 35,000 temporary post offices, mostly in rural areas. The post offices also function as savings banks for small savings.

Over 16000 telegraph offices operate in the country. About

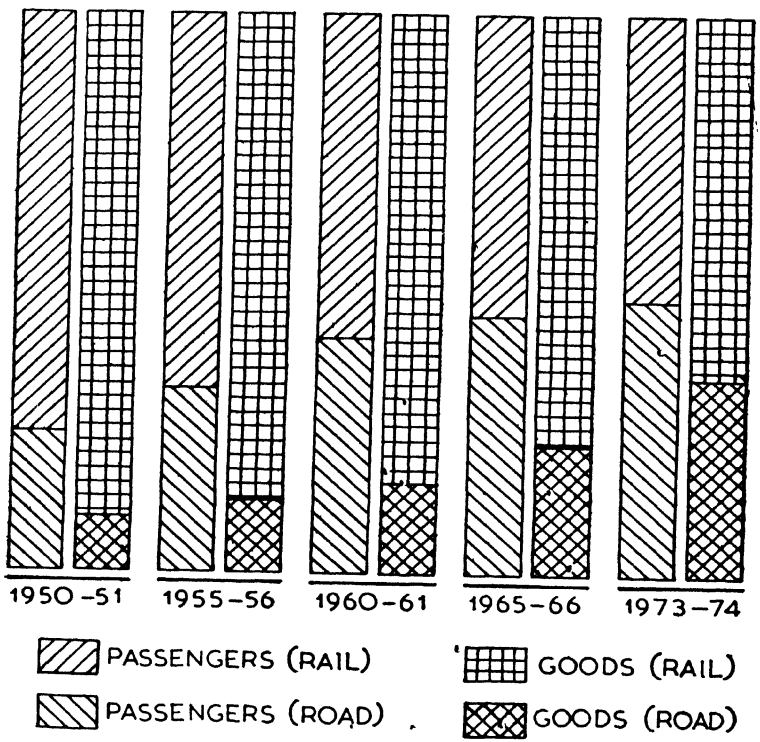
2 million kilometres of overhead wires provide the connections between these stations. The revenue is around 400 million rupees per year.

Telephone services have increased rapidly in recent years. The number of connections has increased to about 1.6 million, revenue from this is around 1,600 million rupees annually. The Indian Telephone Industries at Bangalore has helped the growth of the telephone services in the country to a great extent.

In addition to the above communication services, the Government of India operates overseas communications with radio-telephone, radio-telegraph, radio-photo and International Telex service.

INDIAN RAILWAYS AND ROADS

PASSENGERS AND GOODS MOVED



CHAPTER X

A DEPENDENT PEOPLE

VERY FEW COUNTRIES in the world of today remain comfortably self-sufficient. India is certainly not one of them. An already large population (about 550 million) is growing at a terrific pace. Every year 8 to 9 millions are being added to the total population. As against this, food production has not been been keeping pace with it. Variations from the normal could be positive or negative as far as food production is concerned; but population has no negative variation. Failure of the monsoon affects only food production, whereas population growth remains unaffected. Starved mouths produce more mouths to face starvation. Independent India, in two decades of its existence, has not succeeded in tackling this most important problem with vision and firmness.[1] Literacy is still very low. Education must precede all other efforts to improve the lot of the people. Then only would democracy be real, meaningful and sound.

During the six decades since 1901, the birth-rate has, fortunately, decreased from 51 per thousand to about 40 per thousand (refer to Table XVIII (B)); during this period, however, the death-rate has also decreased from 43 per thousand to 18 per thousand. As a result the effective addition to population is higher. At the other end, the expectation of life at birth improved from 23 in 1901 to 45 in 1966. All this adds to the pressure on land and its resources. While the density of population of the whole of India is about 180 per sq. km. eight States have actually a much higher density. These are Kerala, West Bengal, Bihar, Tamil Nadu, Uttar Pradesh, Punjab, Haryana and Assam (refer to Table XVII)

[1] During the same period Japan has successfully checked the growth of its population. It is unfortunate that India has been interested only in the Japanese method of paddy-cultivation; the country would have been better served if the Japanese method of checking population growth had also been adopted simultaneously.

the average density for these eight States works out to more than 330 per sq. km., which is nearly double the average for the whole of India.[1] These six States should have made an effort to reduce the rate of growth of their population. Four of them, as the following table would show, seem to have made an effort in this direction. These are Kerala, Uttar Pradesh, Bihar and the Punjab:

State	*Density/sq. km.*	*% increase in population for 1961-71*
Kerala	549	16.59
West Bengal	504	26.87
Bihar	324	21.32
Tamil Nadu	317	22.30
Uttar Pradesh	300	19.76
Punjab	269	21.72
Haryana	227	32.22
Assam	186	34.97
India	178	24.8

Source: *India 1975*

Literate persons form about a fourth of the total population of India. Of the 21 States, in 10 the percentage of literacy is less than the all-India average. In other words, in each of these, less than 25% of the population is literate. These States are Andhra Pradesh, Assam, Bihar, Haryana, Jammu & Kashmir, Madhya Pradesh, Nagaland, Orissa, Rajasthan and U.P. Among the States where literates are clearly more than 25% of the population, Kerala stands first (refer to Table XIX); after Kerala in decreasing order are Tamil Nadu, Maharashtra, Gujarat, Punjab, West Bengal, Manipur, Himachal Pradesh, Karnataka, Tripura and Meghalaya. Kerala figures among the three highest density states (the other two being West Bengal and Bihar) and also among the three most literate states (the other two being Tamil Nadu and Maharashtra). It is gratifying to note that it is also one of the three states (the other

[1] In the case of the Punjab and West Bengal, refugees from Pakistan have added significantly to the density of population there.

two being Uttar Pradesh and Bihar) that show the lowest increase in population for the decade ending with 1971 census. In the case of West Bengal the influx of refugees explains partly the high density of population and the decrease in the literacy percentage. Tamil Nadu and Maharashtra show a high literacy percentage along with a comparatively low population density. Of the six largest states in the country, five (Madhya Pradesh, Rajasthan, Uttar Pradesh, Andhra Pradesh and Jammu—Kashmir) show a literacy percentage below 25; Maharashtra alone has high literacy percentage among the large states. It is equally interesting to note that two of the smallest states (Kerala and Tamil Nadu) have the highest literacy percentage; these two and Maharashtra have, each one, more than 39% literate of their respective populations.

During the 70 years since 1901, the urban population increased from 26 million (1901) to 110 million (1971); during the same period the number of urban centres increased from 1910 to 2641. In other words, while the number of centres has increased by only 38%, the urban population has quadrupled itself during the same period (refer to Table XX). This clearly suggests increasing urban pressure in many of the centres. A comparison of States with regard to urbanization shows Uttar Pradesh, Maharashtra and Tamil Nadu to be the most unbanised States in the country (refer to Table XX). Two of these, Tamil Nadu and Maharashtra, have, each, more than 30% urban population; they have the largest number of urban settlements. Actually, for its area, Tamil Nadu has the largest number of non-rural (more than 5,000 population) settlements in the whole of India.

Internal migration from rural to urban areas or from one State to another is a general feature over the whole country. As long as these migrations do not unduly upset the general balance and create problems of high pressure in some localities, these are healthy and desirable. They indicate the oneness of India and help the development of a sense of integration among the people. These migrations are mainly for securing employment. From some areas of poor employment opportunities, people migrate to urban areas which appear to offer better opportunities of employment. Many

of them are disappointed and end up as small retailers, shop-assistants, shoe-shines, odd-job-men, and even beggars on the road. Cities like Bombay, Delhi, Bangalore, Madras and Hyderabad generally attract these migrants.

FOREIGN AID AND FOREIGN TRADE

As the country's population goes on increasing food has to be procured for the increasing numbers. As it is, the country is importing foodgrains every year. Even with better farm-management the capacity of the country to increase food production is much less than its capacity to increase population. Consequently, for a long time, imports of food would, it seems, continue. To pay for such items, the country must be able to export other items (raw materials, finished products of industries, etc.). To be able to export, after meeting the large internal demands, the productive capacity must be increased considerably. To achieve this, for some years, foreign aid is necessary. The U.S.A. ,West Germany, the Soviet Union and the U.K. have been the main helpers in this regard.

The main items of export have been jute (bags, sacks and fabrics), tea, cotton (fabrics, raw cotton and waste), leather, fruits and vegetables (refer to Table XVI). These together accounted for about 40% of the annual export by value till a few years ago; this was out of a total export of about 14 billion rupees. In recent

FIRST 5-YEAR PLAN