INDIA
Economic Geography
A Textbook for Class X

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class - X
Roll no - 16

NATIONAL COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING
Foreword

India: Economic Geography is a textbook in geography for Class X under the 10+2 pattern of education. As a follow-up of the National Policy on Education, 1986, the NCERT has revised the school curriculum for all stages. The present book together with its companion volume for Class XI entitled Understanding Environment has been developed on the basis of the revised geography syllabus for the secondary stage. As such, some of the core elements such as 'protection of environment', 'induction of scientific temper' and 'equality of sexes' as mentioned in the National Policy on Education and the Programme of Action have been taken care of.

The present book endeavors to acquaint the growing citizens of tomorrow with the temporal and spatial dimensions of the economic development of the country. Keeping in view the objectives of general education, the book follows a functional approach. Hence, emphasis has been laid more on understanding of concepts and development of skills than on mere acquisition of knowledge. Facts have been given only to be used as a means and not an end in themselves. Besides, in order to facilitate 'learning by doing', several activities have been given in the beginning of each chapter. These would help the students in developing necessary geographical skills such as 'reading and interpreting maps and diagrams', 'computational, visual representation and analysis of data', and 'transformation of visual to verbal information and vice versa'.

I am grateful to Prof. B.S. Parakh, who has authored this book. I extend my thanks to Shri Vashpal Singh for rendering it into Hindi in a very short time. I also acknowledge the valuable suggestions and comments received from the participants during the review workshop.

Due to lack of time, maps and diagrams have been taken from our earlier books with necessary modifications. Photographs for this book have been obtained from the Press Information Bureau (Nos. I and II) and The Hindu, The Times (Nos. III, IV, V, VI, VII, VIII and IX), for which we are thankful to them.

My thanks are also due to my colleagues in the Department of Education in Social Sciences and Humanities (DESSH) and particularly to Dr. Savita Sinhe for coordinating and overseeing the work at all stages.

Suggestions towards the improvement of this book are welcome.

K. Gopalan
Director
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UNIT ONE

Physical Setting

The physical set-up of our country, namely its (i) location and size, (ii) structure and relief, and (iii) climatic conditions have to a great extent provided a basis for the growth of our civilization, our world view and some of the basic traits of the Indian psyche. This unit is divided into two chapters, 'Physical Features' and 'Climate', and provides the basic framework within which the pace and progress of Indian economy can be realistically assessed and understood.

These chapters highlight the basic unity of the Indian subcontinent in general and the Indian Union in particular. It throws light on the complementarity of physiographic divisions of India. The location and the orography of India in turn help in understanding our climate dominated by the monsoons. The entire dramatic performance of the monsoons and the climatic unit they superimpose on our diverse land is again contained within the orographic framework of Indian geography. It is against this systematic disposition of the physical set-up that the next unit enables us to understand and assess our natural resource base.

GANDHIJI'S TALISMAN

"I will give you a talisman. Whenever you are in doubt or when the self becomes too much with you, apply the following test:
Recall the face of the poorest and the weakest man whom you may have seen and ask yourself if the step you contemplate is going to be of any use to him. Will he gain anything by it? Will it restore him to control over his own life and destiny? In other words, will it lead to Swaraj for the hungry and spiritually starving millions?

Then you will find your doubts and your self melting away.”
Chapter I

Physical Features

Though India is a vast country covering 3.28 million sq. kms, it is a well-knit political entity. This is the largest democracy in the world. It has a wide range of diversities. Under varied natural conditions, people speaking different languages, following different religions and living in rural or urban areas, live amicably side by side. This diversity in fact, is the unfailing source of its real strength. We will learn about it in the following pages.

Among them, learning by doing is one of the best. It would provide you with a joy of learning as you draw your own inferences and conclusions. With this end in view the work suggested here would be found highly rewarding.

FOR DOING IT YOURSELF

You already possess a fair amount of knowledge about India. The work suggested would help you consolidate your knowledge. It will also prepare you to appreciate the text that is to follow. Comprehension of basic facts and preliminary study have been confined to the following:
(i) Location and Size, (ii) International Boundaries.

(i) Location and Size

(a) Note the degrees of latitude of the southern tip of the Indian mainland.
(b) See by how many degrees it is different from the southern most point of the Indian Union.
(c) Note down the degrees of latitude of the northern extremity of India.
(d) Work out the total north-south extent of the country: (i) in degrees of latitude, and (ii) in kilometres. (The distance per degree of latitude is about 111 k.ms.)
(e) Write down the degrees of longitude of the western tip of India lying in Kachchh.
(f) Find out the degrees of longitude of the eastern tip of India lying in Arunachal Pradesh.
(g) List six countries of the world bigger than India. Compare the area of India with China.
India on the Globe

Being situated north of the equator, India belongs to the Northern Hemisphere. The Tropic of Cancer (23.5° N) divides the country into almost equal parts. While the northern half coincides with peninsular India lies in the tropical zone, the northern half is somewhat continental in nature and belongs to the subtropical zone.

Located to the east of the Prime Meridian, India also belongs to the Eastern Hemisphere. A glance at the Eastern Hemisphere is enough to realize its central position. India occupies the southern central peninsula of the Asian continent, which is not only the largest but also the most populous continent of the world. Such a location has its economic advantages. In ancient times, its location helped in establishing cultural and other contacts with the Arab world in the west and the southeast Asia and the Far East.

Look at the central location of India at the head of the Indian Ocean. Towards the west lie the countries of West Asia and Africa. Since the opening of the Suez Canal (1869), its distance from Europe has been reduced by 7,000 km. The countries of southeast Asia lie towards the east. Beyond them are located the countries of East Asia.

India is favourably situated on the
ECONOMIC GEOGRAPHY

Physica Features

Fig. 1.3 India on the International Highway of Trade and Commerce
Note the location of India on the International trade routes.

The Great Mountain Wall of the North
In the Central Asia, far from India lies the well-known Himalaya, it is often called the roof of the world, from this knot only several mountain ranges. One of them is the Kunlun which moves westwards into Tibet. Another range i.e. the Karakoram extends further east and is known as the Kailas Range in Tibet. The Karakoram are lofty mountains containing K2, the second highest mountain peak of the world. The Karakoram pass has now acquired special importance. There are big glaciers i.e. slow melting glaciers and thus providing an inexhaustible source of water for the irrigation of crops along the river valleys.
The Himalayas are young fold mountains. By and large there are three distinct ranges running parallel to one another. The northernmost range is the loftiest of all. All the high peaks of the Himalaya belong to this range. The Mount Everest—or Sagarmatha—is the highest peak in the world. Its height is 8848 metres. It is located in Nepal. Kanchenjunga is the second highest peak of the Himalaya and lies in Sikkim in India. Nanga Parbat in Kashmir and Nanda Devi in U.P. are the other two important peaks of the Himalaya. The Namcha Barwa is an important peak in the east overlooking the Brahmaputra where this range takes a sudden turn towards south to enter India. This northernmost and the loftiest range is known as the Great Himalaya or the Himadri.

To the south of the Great Himalaya lies the Middle or lesser Himalaya. They are called the Himachal. All the important hill
stations such as Dalhousie, Dharmshala, Shimla, Mussoorie, Nainital, and Dehradun are part of this range. The Pir Panjal in the north, Kashmir and the Sutlej in Jammu and Kashmir and Himalanchal Pradesh belong to the Middle Himalayas, so does the Mahabharat range of Nepal. The southernmost ranges of the Himalayas are known as outer Himalayas or the Shiwalik ranges. The Uttar Pradesh is most prominent in the western half of the Himalayas. These are made of unconsolidated river deposits, and are prone to earthquakes and landslides. Soil erosion is at its worst in these youngest of the Himalayan family.

The Himalayas in Jammu and Kashmir and Himalanchal Pradesh are known as Western Himalayas. In Uttar Pradesh and Nepal, they are known as Central Himalayas. In West Bengal, Sikkim, Bhutan and Arunachal Pradesh they are known as Eastern Himalayas.

There are important passes in the Himalayas. Shipkila is located on the Tibet Himalayan Road in Himalanchal Pradesh. The pass in Sikkim is known as Nathula and is on the way from India to Lhasa, the capital of Tibet. Further east, the Bomdila pass lies in Arunachal Pradesh. In this age of air travel the Himalayas are more inaricable.

The Himalayas are known for some of the beautiful valleys of the world. They have become a star attraction to tourists from all over the world. The Kashmir valley is a classical example. It is rightly described as 'paradise on earth'. The other important valleys are Kulu and Kangra in Himalanchal Pradesh. The valleys in the Kumaon Himalaya of Uttar Pradesh are also well known. All these valleys are known for fruit orchards.

Several big rivers originate from the Himalayas. They flow into the Northern Plains and empty themselves either in the Arabian Sea or the Bay of Bengal. But more interesting is the fact that three major rivers of the subcontinent, the Indus, the Ganges, and the Brahmaputra originate beyond the Himalayas in a region surrounding Kailash and Mansarover in Tibet. They flow almost parallel to the Himalayan mountains for a long distance before all of a sudden, turn to the south piercing through the Himalayan mountain chains to enter the Northern Plains. It indicates that the Himalayas are not a perfect water divide. Moreover it can be inferred that these rivers were in existence long before the Himalayas came into being and attained their height. These three rivers while crossing the Himalaya make huge and spectacular gorges or canyons.

As mentioned earlier, the Brahmaputra marks the easternmost geographical limit of the Himalayas. Mountains along the eastern boundary of India are called Purvanchal. These mountains are less spectacular than the Himalaya. They are of medium height. They comprise the Parki Bum, and the Naga Hills in the north, and the Mizo Hills in the south. At the centre, they take a westward turn along the Bangladesh-India border in Meghalaya. Here they consist of Jaintia, Khasi and Gory Hills from east to west.

The Northern Plains

The Northern Plains of India are made up of the fine silt called alluvium brought down by the rivers flowing from the Himalaya in the north and the peninsular plateau in the south. Such a plain is called an alluvial plain. If you look at the delta of the Ganges-Brahmaputra, you will find that this work of deposition is still going on. The northern plains are divided into two river systems - the Indus in the west and the Ganges-Brahmaputra in the east.

The Indus Basin: Large part of the Indus basin is located in India (Jammu and Kashmir, Himalanchal Pradesh and Punjab). The Indus is about 2000 km in length. Its main tributaries are the Satluj, Beas, Ravi, Chenab, and Jhelum. Look at the map to see how these rivers join together one by one before they ultimately join the Indus. The Indus Plain has a gentle slope. The plain stretches over 1200 km between the Arabian Sea in the south-west and foothills of the Western Himalaya in the north-east. Over this total distance, the overall fall of the plains is hardly 300 meters or so. The rivers have made the plain very fertile and it now possesses one of the densest networks of canals for irrigation.

The Ganga Basin: The Ganga rises in U P Himalaya at Gangotri and after reaching Hardwar it enters the Northern Plains. On its west lies the Yamuna which joins it at Allahabad. The Ganges in turn is joined by the Chambal, Sind, Betwa and Ken. They all flow through the Malwa plateau before entering into the plains. The Son is the only big river to join the Ganga directly from the southern plateau. Further east, the Damodar draining the Chotanagpur plateau joins the Ganges. The big Himalayan rivers joining the Ganga down stream of Allahabad from west to east are the Gomti, Ghaghara, Gandak and Kosi. The Ganga river system drains most of Haryana, southeastern Rajasthan, northern Madhya Pradesh, Uttar Pradesh and Bihar. Bhamla is located on the water divide between the Indus and the Ganga river systems. The plains from Bhamla in the northwest to Sundarbans in the east stretch over nearly 1800 km. During its entire stretch from Haryana to Bangladesh, there is hardly a fall of 300 meters in its slope. The zigzag or meandering course of the rivers tells us about the level of the plains. The length of the Ganga is over 2500 km.

The Brahmaputra Valley: The Brahmaputra originates in Tibet near the source of the Indus and the Satluj. It carries a tremendous volume of water. The river is slightly longer than the Indus but most of its course is in Tibet. It flows parallel to the Himalayan mountains in Tibet, where it is known as Tsangpo. When it reaches a hairpin turn around Namche Barwa (7757 m), the river cutting done by this powerful river is of the order of 5,500 meters. Is it not unbelievable? Here and in Arunachal Pradesh it is known as Dihang. After the confluence of Lohit, Dihang and Dibang, it is called the Brahmaputra. Besides a great volume of water, it also carries huge amounts of silt with it. In northern Bangladesh it is known as Jamuna. In the central part after meeting the Ganges, it is called Padma. Further south, the Megna meets the main stream and the joint stream is called Meghna.

The Ganga-Brahmaputra Delta: It is the largest and the fastest growing delta of the world. Besides being well-watered, it is also the most fertile. The Brahmaputra spills into numerous distributaries in their lower courses. Due to the gentle slope or gradient, the rivers become sluggish, and islands of sand and mud develop in their channel. To circumvent these obstructions, the rivers tend to split into a number of branches. The process is repeated several times to develop a classical delta. The lower part of the delta becomes marshy where fresh water and sea water get mingled owing to high and low tides.

The Great Peninsular Plateau

After studying about the young and folded
PHYSICAL FEATURES

named Mahadev Hills, Kaimur Hills and Maikal Range form its northern edge. Towards the west, the plateau has still much steeper edges formed by the Western Ghats. This mountain range runs from north to south almost parallel to the Arabian Sea. The Western Ghats are known by different local names. In Maharashtra and Karnataka they are called Sahyadrī. Further south, they are called the Nilgiri in Tamil Nadu. Still further south along the Kerala and Tamil Nadu border, they are known as Aramatta and Cardamom Hills.

The Deccan Plateau is the highest along its western edge and gently slopes towards the Bay of Bengal in the east. The Western Ghats are relatively higher in their southern part. The Anai Mudi, the highest peak, is 2,695 metres above the sea level. Udagamandalam is a well-known hill station of the south located in Tamil Nadu.

Unlike the western edge, the eastern limit of the Deccan plateau is less sharp. It is in fact widely broken into small hills by the rivers such as the Mahanadi, Godavari, Krishna and Kaveri. The Eastern Ghats are locally known by different names.

The north-west part of the Deccan Plateau merits special mention. It is made up of igneous rocks of volcanic origin. From the earth’s highly turbulent interior, lava oozed out through huge cracks or fissures in the earth’s crust. It took millions of years and is estimated that the volume of the lava flow exceeded the volume of the Himalayas. Geologists believe that this activity was closely associated with the birth of the Himalayas.

While all the major rivers of the peninsular block flow into the Bay of Bengal, Narmada and Tapi are the only two rivers flowing in the opposite direction to fall in the Arabian Sea. These long rivers flow through very narrow elongated valleys. The Narmada valley, bounded by the Vindhyas on the north and the Satpuras in the south. To the south of the Satpura lies the Tapi river. These two river valleys are said to be old rift valleys. They join the sea through narrow estuaries.

THE COASTAL PLAINS: The Deccan plateau has a coastal strip in the east and the west. The west coastal plain extends from Gujarat to Kerala. The coastal strip along the Arabian Sea in the west is known as Kankan in the north and Malabar in the south. There are several estuaries—the major one being those of Narmada and Tapi in Gujarat. It is blessed with deep natural harbours like Bombay and Marmagao. In the south, the coast is studded with salt water lakes called lagoons. There are also sand bars or spits at their mouths. The coast is known for its placid backwaters. The coastal strip along the Bay of Bengal is broad and more level unlike the western strip. Locate and name the four deltas on the east coast. The coastal strip, but for the deltas, are rocky and highly dissected by small but fast flowing rivers.

THE INDIAN ISLANDS: Lakshadweep Islands lying opposite to the coast of Kerala are small but numerous. They are the product of a very quiet work of the short lived microscopic species—the coral polyps. They flourish only in shallow warm waters. Many islands are generally ring or horse-shoe shaped and are called atolls. The Andaman Nicobar Islands, on the other hand, are bigger in size and more numerous. They are located on a submerged hill range in the Bay of Bengal.

Physiographic divisions of India described above are complementary to each other. The peninsula is the stable block which has provided the building material for the Northern Plains and the Mountains. The northern mountains are the major source of water, and girdle the subcontinent.
EXERCISES

Review Questions

1. Answer the following questions briefly:
   (i) Which countries make the Indian subcontinent?
   (ii) How can we determine the age of rocks?
   (iii) Why are the Himalayas called the young fold mountains?
   (iv) Which mountain ranges constitute the Purvanchal?
   (v) Which river systems constitute the Northern Plains?
   (vi) Which is the oldest landmass of the Indian subcontinent?

2. Distinguish between:
   (i) A Delta and an Estuary
   (ii) Western Ghats and Eastern Ghats
   (iii) Western Himalayas and Eastern Himalayas

3. Give one term for each of the following:
   (i) An elongated, and shallow sea sandwiched between the two ancient landmasses.
   (ii) Slow-moving rivers of snow and ice.
   (iii) Any gap in a mountain range providing a natural route across.
   (iv) An I-shaped valley having vertical walls on either side of the river.
   (v) Flat low-lying lands made of the alluvium.

4. Describe briefly the formation of Northern Plains.

5. Give an account of the Deccan plateau.

6. Name the major physiographic divisions of India. Write a brief account of the coastal plains and the Island groups of India.

Map Work

7. On a map of India show the following:
   (i) An important peak of the Karakoram
   (ii) The Zaskar and the Kailas Ranges
   (iii) The highest peak of the Himalaya in India
   (iv) Nallah and Bemida passes
   (v) The Indus, the Ganga and the Brahmaputra
   (vi) The Chotanagpur plateau

Climate

India has diverse climatic conditions. There are sharp variations in temperature and precipitation from place to place and season to season. While in summer the mercury occasionally touches 55°C in the western deserts, it drops down to as low as −45°C in winter around Leh. If we take only a single place and consider temperature recordings for just twenty-four hours, variations are not less striking. In Kerala and in the Andaman Islands, the difference between day and night temperatures may be hardly seven or eight degrees Celsius. But in the Thar desert, if the day temperature is around 50°C, at night it may drop down very close to the freezing point. While snowfall occurs in the Himalayas, it only raises over the rest of the country. Similarly, variations are noticeable not only in the type of precipitation but also in its amount. While the annual precipitation is less than 10 cm in north-west Himalaya and the western desert, it exceeds 400 cm in Meghalaya.

What Makes our Climate

It is true that the determinants of climate go much beyond man-made political boundaries. Many of the factors and phenomena governing the climate of India transgress its four walls namely, (i) situation, (ii) relief, (iii) surface winds, and (iv) upper air circulation.

The Locational and Relief Factors

Situated roughly between 8°N and 37°N latitudes, India is divided in almost two equal parts by the Tropic of Cancer. It runs east-west just half way through the country.

See how it is flanked by the Indian Ocean in the south and girdled by a high and continuous mountain wall in the north. Such a compact physical setting lends it a broad common climatic framework. Also, note the deep arms of the Indian Ocean, namely the Arabian Sea and the Bay of Bengal. They exert moderating influence on much of the Indian subcontinent. More importantly, they act as a storehouse of badly needed moisture to this water thirsty landmass.

The mighty Himalaya along with its extensions act as an effective climatic divide. The towering mountain chain provides an invincible shield to protect the subcontinent from the northern winds. These cold and chilly winds originate near the Arctic Circle and blow across Central and Eastern Asia. Thus the northern mountain wall is responsible for giving the whole of northern India a tropical climate. Relatively high temperatures almost throughout the year and predominantly dry winters are the two characteristic features of a tropical climate. Barring the periphery, the Indian subcontinent does exhibit these two domi-
Temperature and Rainfall Data of a few Stations in India

<table>
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<th>Latitude</th>
<th>Altitude</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Mean Rainfall in cm</th>
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<td>Mumbai</td>
<td>18°35'N</td>
<td>909</td>
<td>6.7</td>
<td>6.7</td>
<td>9.8</td>
<td>14.9</td>
<td>14.5</td>
<td>19.2</td>
<td>20.5</td>
<td>21.1</td>
<td>20.8</td>
<td>20.9</td>
<td>20.7</td>
<td>20.4</td>
<td>18.2</td>
</tr>
<tr>
<td>Calcutta</td>
<td>22°35'N</td>
<td>13.9</td>
<td>10.1</td>
<td>14.5</td>
<td>13.7</td>
<td>13.7</td>
<td>13.7</td>
<td>13.7</td>
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1. Rearrange the ten stations in three different sequences:
   (i) According to their distance from the equator.
   (ii) According to their altitude above mean sea level.
   (iii) According to their distance from the nearest sea.

2. (i) Name two rainiest stations
   (ii) Name two driest stations
   (iii) Two stations with most equitable climate
   (iv) Two stations with most extreme climate
   (v) Two stations most influenced by the Arabian branch of SW monsoons.
   (vi) Two stations most influenced by the Bay of Bengal branch of SW monsoons.
   (vii) Two stations influenced by the both
   (viii) Two stations influenced by retreating and advancing winter monsoon
   (ix) Two stations receiving winter showers from the western disturbances.
   (x) Two most rainy months for India as a whole.
The Surface Winds and Air Circulation

Look at the world map of the pressure belts and planetary winds. Notice that India lies in the area of land-borne winds originating from the subtropical high pressure belts. But for the phenomenon of the monsoons, India would have been a land desert.

The subtropical high pressure belt of the northern hemisphere gives rise to permanent winds. They blow towards the equatorial low pressure belt. While moving towards the south, they deflect towards the right, i.e., to the west. As a result, they blow from northeast to southwest. This is why these permanent winds are known as nordest trade winds. The German word 'trade' means 'track' and stands for 'blowing steadily in the same direction and in a constant course.' India thus lies in the belt of northeast trade winds devoid of any moisture. This is however, only half the story of the Indian climatic phenomena. Let us know the other half.

The air pressure does increase by piling of air descending from above. But it is also

equatorial maritime air, the meteorologists' definition of the monsoons is very simple. It is a complete replacement of the dry hot air by the equatorial maritime air up to an altitude of three to five kilometres over the land and water surface.

The phenomenon of the monsoons is certainly very old, but its exact nature and causation are being discovered only recently. The real breakthrough has come when it was studied at the global rather than regional level. By and large this phenomenon is confined to tropical lands lying between 20°N and 20°S. But in the Indian subcontinent it is greatly influenced by the Himalayan ranges bringing the whole subcontinent under the sway of those moist equatorial winds for a season ranging between two to five months. It accounts for 75 to 90 per cent of the annual rainfall just from June to September.

The nature and mechanism of the monsoons is known with the help of meteorological data which are collected from stations on land, ships in the oceans and from upper air. It was originally thought that monsoon was a phenomenon of surface winds. It is now known that upper air currents also play an important role in the mechanism of the monsoon.

Over the years meteorologists have found out a seasonal kind of relationship between the meteorological changes over the Pacific and the Indian Oceans. Whenever surface pressure is high in the sub-tropical region of the Pacific Ocean in the northern hemisphere, the pressure over the southern part of the Indian Ocean tends to be low and vice versa. This causes shifting of winds across the equator in different seasons. This is known as the Southern Oscillation.
sued, among others, by measuring the difference in pressure between Tahiti (roughly 20°S and 140°W) in French Polynesia in east Pacific and Port Darwin (12°30'S and 131°E) in northern Australia, in the Indian Ocean southeast of Indonesia.

**Cycle of Seasons**

The climatic conditions of India can best be described in terms of an annual cycle of seasons. Four main seasons may be distinguished. These are: (1) Cold weather season; (2) Hot weather season; (3) Advance monsoon season; and (4) Retreat monsoon season.

**The Cold Weather Season**

December, January and February are the winter months almost all over the country. During this season high pressure prevails over the Northern Plains. During this season north-easterly trade winds prevail over the country. They blow from the land to the sea over most part of the country, and hence the dry season. The temperature goes on decreasing from south to north. While January mean temperatures in Madras and Calicut are 24°C-25°C, they are between 10°C and 15°C in the northern plains. The days, however, are generally warm and nights cold. Slight frost is not uncommon in places with high altitudes.

In the north-eastern part of the country a feeble high pressure area is developed. Light winds with a low velocity of about 3 to 5 Kilometres per hour begin to blow outwards. By and large the topography of the region influences the wind direction. They are westerly or north-westerly down the Ganges Valley. They become northerly in the Ganga-Brahmaputra delta. Free from the influence of topography they are clearly north-easterly over the Bay of Bengal.

The weather is fine and really delightful. It is borne out by the facts such as clear skies, low temperatures and humidity, cool breeze and rainless days.

The fine weather conditions, however, at intervals get disturbed by shallow cyclonic depressions. Also known as western disturbances, they originate over the east Mediterranean Sea and travel eastwards across west Asia, Iran, Afghanistan and Pakistan before they reach the north-western parts of this country. On their way, their moisture content gets augmented from the Caspian Sea in the north and the Persian Gulf in the south.

These western disturbances cause in their wake light rainfall. Although the amount is meagre, it is highly beneficial to the winter crops especially the wheat. The precipitation is in the form of light rain in the plains and heavy snowfall in the western Himalayas. It is this snow that sustains the flow of water in the Himalayan rivers during summer months. The precipitation goes on decreasing from west to east in the plains and from north to south in the mountains.

These climatic disturbances are generally preceded by warm weather or sudden rise in temperatures. After the rains, spread over a couple of days, they are followed by clear skies and drop in temperatures. Occasionally they bring in their trail severe cold waves. The cold wave is generally defined by fall in temperature by 5 or more degrees from the normal.

The only part of India benefiting from the north-easterly trade winds lies in the far south namely Tamil Nadu. For instance Madras gets fair amount of rainfall from these winds.

In the Indian context these winds are popularly known as north-east monsoons.

**The Hot Weather Season**

From March to May the belt of great heat shifts from south to north owing to the si
Fig. 2.3 Mean Maximum Temperature (May)

Note the areas with the highest mean maximum temperatures. In which area do you notice the steepest gradient of heat? How will you explain this?

Fig. 2.4 Mean Pressure and Temperature (July)

Compare this map with Fig. 2.3. Note the monsoon trough of low pressure extending from the Thar Desert to the head of the Bay of Bengal. Why is the climate of north-western India described as continental or of the extreme type?
The annual monsoon movement of the sun. In March, the highest day temperatures are found in the Deccan plateau. They are around 38°C. In April, the heat belt moves further north to Gujarat and Madhya Pradesh where they are around 42° to 43°C. And in May, the heat belt moves further north. In the north-western part of the country, temperatures around 48°C are not uncommon.

The summer months are a period of rising temperature and falling air pressure in the northern half of the country. Towards the end of May an elongated low pressure area develops in the Thar Desert in the north-west to Patna and Chota Nagpur plateau in the east-southeast. Circulation of air begins to act in this trough. In the heart of the low pressure trough in the north-west the dry and hot winds blow in the afternoon and very often they continue even up to midnight. These hot and dry day winds are locally known as loo.

Direct exposure to these scorching winds may prove fatal in some cases. Dust storms in the evening are very common during May in Punjab, Haryana, and parts of Rajasthan and Uttar Pradesh. Temporarily, they bring a welcome respite from the oppressive heat since they bring with them light rains and pleasant cool breeze.

Occasionally, the moisture laden winds are attracted towards the periphery of the trough. A sudden contact between dry and moist air-masses gives rise to local storms of great intensity. These local storms are associated with violent winds, torrential rains and even hailstorms.

Towards the close of summer, monsoon showers are a common phenomenon in Kerala and the coastal areas of Karnataka. Locally they are known as mango showers since they help in the early ripening of mangoes. Incursions of the pre-monsoon showers and early advance of monsoons further north is checked by a belt of relatively high air pressure lying over the Deccan plateau.

The drenching north-westerly and northerly winds in Bengal and Assam also cause very sharp showers. They are essentially evening thunderstorms. Their notorious nature can be understood from the local description of Rabaiskhki—Callamity of the month of Baisakh.

Advancing Monsoon

The four months namely June, July, August, and September form the core of the rainy season almost all over the country. The duration of the rainy season, however, goes on decreasing from south to north and from east to west. In the extreme north-west it is barely two months. Between three-fifths and nine-tenths of the total rainfall is concentrated over this period. This may give us an idea of how unevenly it is distributed over the year.

The low pressure conditions over the north-western plains get further intensified. By early June they are powerful enough to attract the trade winds of the Southern Hemisphere. These south-east trade winds are of oceanic origin. Coming from the Indian Ocean, they cross the equator and enter the Bay of Bengal and the Arabian Sea, only to be caught up in the air circulation over India. Passing over the equatorial warm currents they bring with them moisture in abundance. After crossing the equatorial current they follow a south-westerly direction. This is why they are known as south-west monsoons.

Thus, the north-east and south-east trade winds originating over the land are replaced by diametrically opposite south-west monsoons laden with moisture. The monsoons unlike the trades are not steady winds. They are essentially pulsating in nature.

The rain-bearing winds are strong. They blow at an average speed of 30 km per hour. Barring the extreme north-west they overrun the country in a month's time. The sudden ‘burst’ of the moisture-laden winds is associated with violent thunder and lightning. This is known as ‘break’ or ‘burst’ of the monsoons.

It is of interest to note that these monsoon winds follow a south-westerly direction. But as they approach the land their direction is modified by the relief and the general low pressure over north-west India. To begin with, the Indian Peninsula divides the monsoons into two branches. These are the Arabian Sea branch and the Bay of Bengal branch.

The Arabian Sea branch of the monsoon is obstructed by the Western Ghats. The windward side of the Sahyadris receive very heavy rains. Crossing the Ghats they enter the Deccan plateau and Madhya Pradesh causing fair amount of rainfall. Thereafter they enter the Ganga Plains and mingle with the Bay of Bengal branch. Another part of the Arabian Sea branch strikes the Saharashtra peninsula and the Kachchh. It then passes west Rajasthan and along the Aravallis, causing only a scanty rainfall. In Punjab and Haryana it joins the Bay of Bengal branch. These two branches, reinforced by each other cause rains in the Western Himalayas.

The Bay of Bengal branch is naturally directed towards the coast of Myanmar and part of the south-east Bangladesh. But the Arakan Hills along the coast of Myanmar are not good enough to deflect a big chunk of this branch, enabling it to enter the Indian subcontinent. The monsoons, therefore, enter West Bengal and Bangladesh from south and south-east instead of the south westerly direction. Thereafter this branch splits into two under the influence of the mighty Himalayas and the thermal low in NW India.

The rains move westward along the Ganges plains reaching as far as the Punjab plains. The other branch moves up the Brahmaputra valley in the north and north-east causing widespread rains in the North-Eastern India. Its sub-branch strikes the Garo and Khasi Hills of Meghalaya. Mawsynram, located on the crest of the southern range of Khasi Hills, receives the highest average annual rainfall in the world. Cherrapunji, located 16 km east of Mawsynram holds some other rainfall records.

Distribution of rainfall received from south-west monsoons is very largely governed by the relief or orography. For instance, the windward side of the Western Ghats register a rainfall of over 150 centimetres. On the other hand, the leeward side of these Ghats is hardly able to receive 50 centimetres. Again, the heavy rainfall in the north-eastern states can be attributed to their hilly ranges and the Eastern Himalayas. The rainfall in the northern plains goes on decreasing from east to west. During this particular season Calcutta receives about 120 centimetres, Patna 102 cm, Allahabad 91 cm and Delhi 56 cm.

The monsoon rains occur in wet spells of few days duration at a time. The wet spells are interspersed with rest intervals. This pulsating nature of the monsoon is attributed to the cycloic depressions mainly formed at the head of the Bay of Bengal, and their crossing into the land. Besides the frequency and intensity of these depressions, the passage followed by them determines the spatial distribution of rainfall. The passage is always along the axis of the "monsoon trough of the low pressure". For various reasons the trough and its axis keep on moving northward or southward. For a fair amount of rainfall in the Northern Plains it is necessary that for the most part the axis of the monsoon...
Fig. 2.5(a) India—The Normal Dates for the Onset and the Withdrawal of the Monsoons
Compare the two maps and find out the duration of the south-west monsoon rainy season in Punjab, Assam, Kerala, Gujarat, and the coastal areas of Tamil Nadu.
hand, whenever the axis shifts close to the Himalayas there are longer dry spells in the plains, and widespread rains in the mountainous catchment areas of the Himalayan rivers. These heavy rains bring in their wake devastating floods causing great damage to life and property.

The monsoons are known for their vagaries and uncertainties. The alternation of dry and wet spells keeps on varying in intensity, frequency and duration. On the one hand, if they cause heavy floods in one part, they may be responsible for droughts in the other. Then they are often found irregular and unpunctual in their advent as well as retreat, dislocating the entire farming schedule of the millions and millions of farmers.

**Retreating Monsoon**

The months of October and November are known for the retreating monsoons. During this season, the monsoon low pressure trough becomes weaker and is gradually replaced by high pressure. This results in the retreat of the monsoon. The out-reach of the monsoons begins to become unsustained. Their sway over the Indian land-mass begins to shrink. The direction of surface winds starts reversing. By the beginning of October they withdraw from the Northern Plains.

The months of October-November form a period of transition from a hot rainy season to dry winter conditions. The retreat of the monsoons is marked by clear skies and rise in temperature. The land is still moist. Owing to conditions of high temperature and humidity, the weather becomes rather oppressive. This is commonly known as 'October heat'. In the second half of October the mercury begins to fall rapidly, particularly in northern India.

The low pressure conditions which once prevailed over north-western India get transferred to the centre of Bay of Bengal by early November. This shift of the low pressure area is far from smooth. The period is associated with occurrence of cyclonic depressions which originate over the Andaman Sea. Those that manage to cross the eastern coasts of southern peninsula cause heavy and widespread rains. These tropical cyclones are often very destructive. The thickly populated deltas of the Godavari, Krishna and Kaveri are their preferred targets. No year is ever found disaster-free. Occasionally, these 'tropical cyclones visit' Sudarbans and Bangladesh too. Bulk of the rainfall of the Coromandel coast is derived from depressions and cyclones.

**Distribution of Precipitation**

Annual rainfall of over 300 cm is received over parts of western coast and north-eastern India. Annual rainfall of less than 50 cm is experienced in western Rajasthan and adjoining parts of Gujarat, Haryana and Punjab. Rainfall is equally low in the interior of the Deccan plateau east of the Sahyadris. A third area of low precipitation is the region around Leh in Kashmir. Rest of the country receives moderate rainfall. Snowfall is restricted to the Himalayan region.

Owing to the vagaries of the monsoon, the annual rainfall is highly variable from year to year. Variability is high in the regions of low rainfall. Areas of high rainfall are liable to be affected by floods. Areas of moderate and low rainfall are drought prone.

**Monsoons as a Unifying Bond**

We have seen how the Himalayan chain of mountains protects the subcontinent from extremely cold polar winds. This enables even northern India to have uniformly high temperatures for their latitudes. Despite
CLIMATE

climatic contrasts and variations from region to region, the monsoons provide a rhythmic cycle of seasons year after year. It is around this seasonal rhythm that the Indian landscape, its animal and plant life, its entire agricultural calendar and the total life of the Indian people, not excluding their festivities, revolve.

EXERCISES

Review Questions

1. Answer the following questions briefly:
   (i) Which are the two characteristic features of the tropical climate?
   (ii) Which phenomena are responsible for the rise of south-west monsoon?
   (iii) What are jet streams?
   (iv) Name the four seasons of India.
   (v) Why do the north-east trade winds change their direction while blowing through the Ganga Valley?
   (vi) What is meant by ‘breaking of the monsoon’?
   (vii) Why does Cherrapunji receive the highest rainfall in the world?
   (viii) Name the states on the eastern coast which are frequently struck by tropical cyclones.

2. Distinguish between:
   (i) Equable and Extreme climates
   (ii) Rainfall and Precipitation
   (iii) North east monsoons and Retreating monsoon

3. Give few examples of apparent climatic contrasts in India to cover the following points:
   (a) range of temperature (b) direction of rain-bearing winds (c) form of precipitation (d) amount of rainfall (e) rainfall regime i.e. seasonal distribution of rains

4. Discuss the mechanism of the monsoons.

5. Give an account of the general weather conditions during the cold weather season in India.

6. Discuss how monsoons act as a unifying bond giving suitable examples.

Map Work

7. On an outline map of India show the following:
   (i) Area receiving winter rain.
   (ii) Common paths of tropical cyclone.
   (iii) Area with less than 20 cm of annual rainfall.
UNIT TWO

Our Natural Resource Base

Life grows only in a congenial environment. As such, life and environment are inseparably interlinked. Every kind of life together with the physical environment in a given area forms an ecosystem. Every plant and animal species interact with the environment. Human beings too are a part and parcel of the ecosystem like any other plant or animal species. However, they differ from all other species as they can learn from the environment and in the process husband it to their advantage. Many elements of the environment or eco-system are utilised by them for comfort and betterment. Some of the useful elements are the gifts of nature, which cannot be produced by them. These gifts of nature, found useful in making life of human beings comfortable and worth living, are known as natural resources.

Other components of environment are potential resources.

The natural resources have an economic importance because of the value attached to them by human beings. Secondly, with their growing use the element of scarcity or the fear of their exhaustion also generally creeps in. Natural vegetation, animal life, soils, water and minerals constitute the natural resources of our country.

In this unit, therefore, three chapters have been included. The first deals with the flora, fauna and the soils. The next attempts to assess our water resources and their crucial role in agriculture and development of hydroelectricity. The last chapter is related to our mineral and power resources.

It is on this natural resource base that we have been struggling to impose a super structure of agriculture and industry backed by the network of transport and communications.
CHAPTER 3

The Flora, Fauna and the Soils

For millions of years our earth was merely a barren planet without any kind of life on it. Gradually life evolved in salty ocean waters. The first forms of life belonged to plant kingdom. It was the plant kingdom that prepared the stage for the appearance of another kind of life — the animal kingdom. The animals could survive only on the food or energy supplied by the plant kingdom. The basic importance of plant kingdom lies in the fact that it alone could convert energy derived from the sun into food energy. Therefore, this chapter begins with the flora of our country as the backbone of its natural resource base.

It is true that the fauna depends entirely on the plant kingdom for its very survival. But the fauna in turn has also been useful to the flora and its perpetuation in many ways as you must have studied in biology. They complement each other. This is why the chapter then moves on to the fauna.

Finally, the chapter deals with soils which are our prime resource. It is on the soil that the entire plant and animal life ultimately depends for deriving its food directly or indirectly. Are human beings exceptions to it? No, not in the least. They also depend upon the plant kingdom to derive their food. Soils are as important to them as they are to plants and animals. With the long history of 5,000 years of farming, all that human beings have been able to do is to select plants, sow seeds, and help their growth, and store them for a rainy day. They themselves cannot manufacture food as the plants do.

FOR DOING IT YOURSELF:

1. Study the map showing broad belts of natural vegetation in India. Compare it with relief and rainfall maps of India. See for yourself with what it is closely related.
2. Find out what governs the quick succession of natural vegetation belts in the Himalayan region.
3. Collect coloured pictures of the typical Indian fauna in their natural setting i.e.in national parks, animal/bird sanctuaries, zoological gardens and biosphere reserves.
Natural Ecosystem

All the plants and animals in a given area are closely interlinked and interdependent that they cannot be thought of exclusively without the other. All these interdependent species of plants and animals in a given area form a single ecosystem. It has evolved over a period running into thousands and thousands of years. Any attempt to tamper with the ecosystem is fraught with grave risks. Human beings themselves are a part of the ecosystem. In fact, this fundamental fact has been realised by them only recently after having committed gross mistakes and blunders. They have, therefore, started correcting this dangerous situation lest it goes out of their hands.

DIVERSE FLORA

Climatic conditions, natural vegetation and soils are very closely interconnected. All over India, the original natural vegetation cover consisted of forest, grassland and scrub. It is estimated that our country possesses about 45,000 different species of plants. This represents the widest range for any country of the world of its size. Nearly 5,000 of the species are found exclusively in India. The country is rich in both flowering and non-flowering plants. The ferns, algae and fungi belong to the latter category. The secret of such diverse flora lies in the country’s varied relief, land forms, terrain, soil, range of daily and annual temperature and varying amount of rainfall and duration of its regime. In brief, our flora range from the one found in the tropical zone to that of the Arctic zone.

Vegetation Regions

Barring the Himalayan region, country is divided into four major vegetation regions, they are: (i) the tropical rain-forests; (ii) the tropical deciduous forests; (iii) the thorn forests and scrubs; and (iv) the tidal forests.

(i) TROPICAL RAIN-FORESTS: These forests do not have a distinct season of shedding leaves, as the region is warm and wet throughout the year. They are evergreen. The evergreen forests are at their best when rainfall is in excess of 200 centimetres with a short dry season. They are thus typical rain-forests. Such areas are confined to rain-shadows of the Western Ghats, plains of West Bengal and Orissa and north-eastern India. Under these circumstances trees grow very vigorously, reaching heights of 60 metres and more. The number of species is too large and too mixed to exploit each one of them commercially. Some of the commercially useful trees in these forests are ebony, mahogany and rosewood.

(ii) TROPICAL DECIDUOUS FORESTS: These are also called the monsoon forests par excellence. This is so because they form the natural cover almost all over India, particularly between regions of 200 and 75 centimetres of rainfall. Economically they are very important. They need a lot of care as they are less resistant to fire. Subdivided into two they are: (i) moist,
and (ii) dry deciduous. The former are found on the eastern slopes of the Western Ghats. The moist deciduous are also found in the north-eastern part of the peninsula i.e. around Chotanagpur plateau covering eastern Madhya Pradesh, south Bihar and west Orissa. They are also common along the Shiwaliks in the north. Sal is the most important tree of the dry deciduous type. It has been observed that moist deciduous forests are getting gradually replaced by dry deciduous forests. These are called deciduous (be it moist or dry) because they shed leaves for about six to eight weeks in the summer. Every species has its own time of leaf shedding and as such at no particular time the forests are absolutely bare.

(iii) The Thorn and Scrub Forests: These are confined to areas with rainfall under 75 centimetres. It spreads over north-western part of the country from Saurashtra in the south to Punjab plains in the north and to the east it stretches to northern Madhya Pradesh (mainly Maiwa Plateau) and south-west Uttar Pradesh covering Bundelkhand plateau. Kikar, babul, khair, and date palms are some of the useful trees. Scattered trees with long roots spread in a radial pattern are a common feature. These forests gradually fade away into shrubs and thorny bushes. They constitute the typical desert vegetation.

(iv) Tidal Forests: The tidal area along the coast and rivers covered by mangrove trees that can survive in both fresh and salt water — the major example is the Sundarbans. Sundarban is a well-known mangrove tree. It is after this tree that the name Sunderban has been given to the forested parts of the Ganges-Brahmaputra delta.

**Altitudinal Zones of Vegetation in Mountainous Regions**

Altitude is an important consideration in the distribution of vegetation in mountainous regions because it affects temperature and rainfall. In the higher elevations, the vegetation changes from tropical to alpine, and then to tundra. The transition occurs over a distance of about 6 kilometres or so. However, even at the same altitude sunny areas differ in vegetation from those that are not so sunny.

The Shiwaliks, the foothills of the Himalayas, are clothed with tropical moist deciduous flora. Sal is the most dominant and economically important species. Bamboo trees are also common in this belt.

It is then succeeded by wet hill forest between 1,000 and 2,000 metres above sea level. Evergreen broad leaved oaks, chestnut and apples are common trees. Other trees to be found are ash and beech. At this altitude in north-eastern hills, where it rains heavily, there are sub-tropical pine forests in which chir or chir trees dominate.

Further up i.e. between 1,600 and 3,000 metres above sea level, pine, cedar, silver fir and spruce are some of the more important species. These are the well-known coniferous forests of the temperate region. In the inner Himalayan ranges and drier climates these trees along with deciduous are more at home.

Temperate coniferous forests yield place to Alpine forests generally at 3,000 metres above sea level. They consist of silver firs, pines, birches and junipers. Alpine forests give way to Alpine grasslands through shrubs and scrub.

**OUR VARIED FAUNA**

With an extremely wide variety of flora, our fauna are found to be equally rich and varied. There are about 75,000 known species,
The country in its fresh and marine waters has as many as 2,500 species of fish. Likewise, there are about 7,000 species of birds. In addition, there are amphibians, reptiles, mammals and small insects and worms.

Among the mammals we have the solitary animal, the elephant. It is typical of hot, wet equatorial forests and is found in the jungles of Assam and those of Kerala and Karnataka where it rains heavily and the forests are very dense. On the other hand, camels and wild asses belong to extremely hot and arid deserts. While the camels are common to the Thar Desert, the wild asses are confined to the arid areas of the Rann of Kutch. Perhaps diametrically opposite is the habitat of the one-horned rhinoceros. They live in swampy and marshy lands of Assam and north-west Bengal. Yet another group of Indian animals consist of the Indian bison, the Indian buffalo and the nilgai. Among the most nimble and handsome animals a mention must be made of chousingha (four-horned antelope), black buck (Indian antelope), gazel and deer. The species of deer include Kashmir stag, swamp deer, spotted deer, musk deer and mouose deer.

Among the animals of prey, the Indian lion distinguishes itself as the only species found anywhere in the world — barring the African continent. Its natural habitat is confined to the Gir forests of Saurashtra in Gujarat. Efforts are being made to aclimatise it to other parts of India with somewhat similar climate. If lion is the most majestic of all the animals, the tiger is one of the most powerful species in our jungles. The famous Bengal tiger has its natural habitat in the Sundarbans in the tidal forests occupying the edge of the Ganga delta. The other animals belonging to the cat family are leopards, clouded leopards and snow leopards. The latter are confined to upper reaches of the Himalayas.

The Himalayan ranges are the home of several interesting animals. Important among them are wild sheep, mountain goats, the ibex, the shrew and the tapir. The lesser panda and the snow leopard are confined only to the upper reaches.

India has several species of monkeys. The langur is the most common among them. The lion-tailed macaque has hair around the face which appears like a halo.

Bird life in India is both rich and colourful. If tiger is the national animal, the peacock is our national bird. Pheasants, geese, ducks, mynahs, parakeets, pigeons, cranes, hornbills and sunbirds belong to the forests and wet lands.

Special efforts are being made to preserve endangered species of wild life — birds and animals. Periodic censuses are undertaken to find out the latest position and trends in this regard. Project tiger has been a great success. Now there are 16 tiger reserves in various parts of the country. Likewise, a rhino project is being implemented in Assam. The Indian bustard of Rajasthan and Madhya Pradesh is yet another endangered species. Even the numbers of the lion had been dwindling for a long time.

Steps have been taken for the protection and conservation of the great biological diversity of our land. Under this scheme the first biosphere reserve has been set up in the Nilgiri. It consists of 5,500 sq.km, and is spread at the trijunction of Karnataka, Tamil Nadu and Kerala. It came into being in 1986. Every plant and animal species would be protected so that this natural heritage can be transmitted to the future generations in all its natural vigour and glory. There are thirteen such zones to be reserved in 1995.

After Nilgiri biosphere reserve, the one at Nanda Devi in U.P. Himalayas was set up in 1988. Likewise, Nokrek in Meghalaya was the third to be set up the same year. The
fourth one is in Andaman and Great Nicobar Islands to preserve sub-marine flora and fauna which is very diverse and unique. These biophile reserves would cover very diverse climatic and vegetation zones such as Eastern Himalayas in Arunchal Pradesh, Valley of Flowers in the hills of west U.P., Gulf of Mannar in Tamil Nadu, Than Desert in Rajasthan, the Rann of Kachchh in Gujarat and Kaziranga and Manas parks—the home-land of rhinoceros in Assam. In each biophile reserve the care will preserve wildland, the flora and the fauna in their natural forms. The surrounding zone will be utilized for research and experimentation in developing forest and other products, and the periphery for agricultural research and experimentation.

The country has 63 national parks, 358 wildlife sanctuaries, and 35 zoological gardens covering 130,000 sq. km.

**SOIL RESOURCES**

The soil on which we depend so much for our survival has evolved over thousands and thousands of years. Soils are formed from parent rock material through the process of break-up, wear and tear. Various forces of nature such as changing temperature, running water and wind etc contribute in the evolution of soil. Chemical and organic changes which take place in the soil layer are equally important. Fine vegetal and animal remains add to the fertility of the soil.

**Types of Soil**

Indian soils are generally divided into four broad types. These soil types are: (1) alluvial soils; (2) red soils; (3) laterite soils; and (4) laterite soils.

**ALLUVIAL SOILS.** This is the most important and widespread category. It covers forty per cent of the land area. In fact the entire Northern Plains are made up of these soils. They have been brought down and deposited by three great Himalayan rivers—Satluj, Ganga and Brahmaputra — and their tributaries. Through a narrow corridor in Rajasthan they extend to the plains of Gujarat. They are common in eastern coastal plains, particularly in the delta of Mahanadi, Godavari, Krishna and Kaveri.

Towards the end of their long journey spread over hundreds of kilometres and thousands of years, very fine particles of soil called alluvium get deposited in their plains. These soils consist of varying proportions of sand, silt and clay. They are predominant in coastal plains and deltas. As we move further inland in the river valleys, the soil particles appear somewhat bigger in size. In the deeper reaches of the river valleys, i.e. near the place of their origin, the soil particles are more coarse. Soil particles are larger and farther from uniform. Such soils are more common in piedmont plains, i.e. those that are near the foot of mountain hills.

Apart from the size of their grains or particles, soils are described according to their age as well. They are old alluvium and new alluvium. Remember that so-called old alluvium may be even ten thousand years old! Locally the old alluvium is called laterite, and the new alluvium is called alluvial. The old alluvium often contains kandir nodules, with calcium carbonates in sub soils. The new alluvium is more fertile than the old.

Alluvial soils are the most fertile. Generally, they contain adequate pointers, phosphoric acid and lime. However, they are deficient in organic and nitrogenous content. Soils in the drier areas are more alkaline. Alluvial soils support over half the Indian population.

**REGUR SOILS.** These soils are black in color and are also known as black soils. Since they are ideal for growing cotton, they are also called cotton soils. In addition to their nomenclature regar soils. These soils are most typical of the Decuban (Basalt) region spread over north-western and eastern coastal plains and are made up of lava flows. They cover the plateaus of Maharashtra, Madhya Pradesh and Madras. They are also common in the south along the Godavari and Krishna Valleys. In their formation climatic conditions are as important as their parent rock materials. Hence they tend much beyond the lava plateau itself. The black soils are made of extremely fine I.e. clayey material. They are well known for their capacity to hold moisture. In addition, they are rich in soil nutrients, such as calcium carbonate, magnesium carbonate, potash and lime. They are generally poor in phosphoric content. They develop through the field during fall weather. These help in their ability to bear. This soil is sticky and difficult to work unless tilled immediately after the first or monsoon showers.

**RED SOIL.** Look at the map. You will notice that the north-western half of the peninsula has been covered by the black soils and the remaining south-eastern half is covered by red soils of different shades of red and yellow. They have developed on old crystalline rocks under normal to heavy rainfall conditions. They are found throughout the entire black soil region and cover the eastern part of the peninsula comprising the Chota Nagpur plateau. Orissa: east Madhya Pradesh, Telangana, the Nalgiris and Tamil Nadu plateau. They extend northwards in the west along the Konkan coast of Maharashtra. Soils are loamy in deep depressions and in uplands, they consist of loose gravel—highly coarse material. They are deficient in phosphoric and organic matter and nitrogenous materials.

**LATERITE SOILS.** The laterite soil is a result of intense leaching owing to heavy tropical rainfall. They are usually found varying from the flat uplands, and are found in the western coastal region receiving very heavy rainfall.

They are also found in patches along the edge of the plateau in the east covering small parts of Tamil Nadu, and Orissa and a small part of Chota Nagpur in the north-east. The soils are invariably poor and support only pastures and scrub forests.

Among the miscellaneous types of soils, two groups are more significant. They are the desert soils of west Rajasthan and the mountain soils of the Himalayas.

**DESSERT SOILS AND MOUNTAIN SOILS.** The arid sandy soils include desertic loams as well. With irrigation facilities, these soils are found to yield good harvests. The mountain soils include peat, meadow, forest and hill soils. The forest soils can be described as soils in the making.

Owing to the wide variety of rich soils, India is able to produce a variety of crops. It is important because this potentiality can make India not only self-sufficient in various agricultural products but also a leading exporter of various agricultural products. This would, however, depend upon scientific management of our soils, their proper conservation, avoidance of their erosion and maintenance of their fertility through organic and bio-manures, rather than depending entirely on chemical fertilizers. This is self-evident from the fact that nearly nine million hectares of alluvial soils and seven million hectares of black soils are currently suffering from salinity and alkalinity. Much of it is due to water logging and
excessive irrigation. Realising the importance of soil as a valuable resource, steps have been taken to prevent soil erosion by running water and winds. Conservation of soil is necessary to ensure sustained productivity of land.

EXERCISES

Review Questions

1. Answer the following questions briefly:
   (i) What is an eco-system?
   (ii) What makes the maintenance of the ecosystem indispensable for the survival of the human beings?
   (iii) Why does India possess a great variety of flora?
   (iv) Name the four major vegetation regions of India.
   (v) What is a bio-reserve? Give two names.

2. Distinguish between:
   (i) Flora and fauna
   (ii) Regur soils and Laterite soils.

3. Discuss the altitudinal zones of vegetation in the mountainous regions.

4. What are the major natural vegetation zones in India? Give a detailed account of monsoon forests in India.

5. Give a brief account of the types of soil found in India.

6. Write short notes on:
   (i) Conservation of wild life
   (ii) Conservation of soil.

Map Work

7. On an outline map of India show the following:
   (i) Kaziranga national park
   (ii) Valley of flowers
   (iii) Nilgiri bio-reserve
   (iv) Area covered with black soil.

Chapter 4

Land Use and Water Resources

Land Use

Our country has the total area of about 328 million hectares. The land utilization statistics are available to us for nearly 92.5 per cent of the total area. It is significant to note that our forefathers over the past 8,000 years or so have succeeded in bringing nearly 140 million hectares of land from the natural ecosystem to agriculture. Since Independence we added another 22 million hectares. As a result, today 162 million hectares of land stands out as the net sown area. It forms a spectacular percentage of as high as 51 per cent. No other big country is so fortunate as we are in this regard.

For Doing It Yourself

1. Study Table 4.1 carefully before you take up the suggested activities:

   **TABLE 4.1**

<table>
<thead>
<tr>
<th>Country</th>
<th>Average density of population (per sq km)</th>
<th>Per capita arable land (in hectares)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>3</td>
<td>1.70</td>
</tr>
<tr>
<td>China</td>
<td>110</td>
<td>0.14</td>
</tr>
<tr>
<td>India</td>
<td>245</td>
<td>0.20</td>
</tr>
<tr>
<td>Japan</td>
<td>320</td>
<td>0.55</td>
</tr>
<tr>
<td>USA</td>
<td>26</td>
<td>0.73</td>
</tr>
<tr>
<td>USSR</td>
<td>52</td>
<td>0.81</td>
</tr>
</tbody>
</table>

   (i) Arrange the countries in order of:
   (a) Average density of population, and
   (b) Per capita arable land.
   (ii) Now compare average density of population and per capita arable land. Find out which of the two is more significant and meaningful.
   (iii) Compare India with (a) China, (b) Japan, and (c) Canada to draw your own inferences.

2. Table 4.2 provides a comparative picture of land use of the same six countries included in Table 4.1.
It is then succeeded by wet hill forests between 1,000 and 2,000 metres above sea level. Evergreen broad leaf oaks, chestnuts and ashes are common trees. Other trees to be found are rhododendrons. At this altitude in north-eastern hills, where it rains heavily, there are sub-tropical pine forests in which chir or chil trees dominate.

Further up, i.e. between 1,600 and 3,300 metres above sea level, pine, cedar, silver fir and spruce are some of the more important species. These are the well-known coniferous forests of the temperate region. In the inner Himalayan ranges and in drier climates these trees along with deciduous are more at home.

Temperate coniferous forests yield place to Alpine forests generally at 3,000 metres above sea level. They consist of silver fir, pines, birches and junipers. Alpine forests give way to Alpine grasslands through shrubs and scrub.

**OUR VARIED FAUNA**

With an extremely wide variety of flora, our fauna are found to be equally rich and varied. There are about 81,000 known species. The country in its fresh and marine waters has as many as 2,500 species of fish. Likewise, there are about 1,200 species of birds. In addition there are amphibians, reptiles, mammals and small insects and worms.

Among the mammals we have the sturdy animal, the elephant. It is typical of hot wet equatorial forests. It is found in the jungles of Assam and those of East Bengal and the forests are very dense. On the other hand, camels and wild asses belong to extremely hot and arid deserts. While the camels are common to the Thar Desert, the wild ass are confined to the arid areas of the Rann of Kutch. Perhaps diametrically opposite is the habitat of the one-horned rhinoceros. They live in swampy and marshy lands of Assam and West Bengal. Yet another group of Indian animals consist of the Indian bison, the Indian buffalo and the nilgai. Among the most nimble and handsome animals a mention must be made of chousingha (four-horned antelope), black buck (Indian antelope), gazelle and deer. The species of deer include Kashmir stag, swamp deer, spotted deer, musk deer and mouse deer.

Among the animals of prey, the Indian lion distinguishes itself as the only species found anywhere in the world barring the African continent. Its natural habitat is confined to the Gir forests of Saurashtra in Gujrat. Efforts are being made to acclimatise it to other parts of India with somewhat similar climate. If lion is the most majestic of all the animals, the tiger is one of the most powerful species in our jungles. The famous Bengal tiger has its natural habitat in the Sundarbans in the tidal forest occupying the edge of the Ganga delta. The other animals belonging to the cat family are leopards, clouded leopards and snow leopards. The latter are confined to upper reaches of the Himalayas.

The Himalayan ranges are the home of several interesting animals. Important among them are wild sheep, mountain goats, the ibex, the chamois and the takin. The lesser panda and the snow leopard are confined only to the upper reaches.

India has several species of monkeys. The langur is the most common among

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*Fig. 3.3 India—Major Soil Types*

Note the major soil belts in India. Do you notice any correlation between the major physical divisions and the different soil belts?
The Flora, the Fauna and the Soils

Entire Northern Plains are made up of these soils. They have been brought down and deposited by three great Himalayan rivers—Satluj, Ganga and Brahmaputra—and their tributaries. Through a narrow corridor in Rajasthan they extend into the plains of Gujarat. They are common in eastern coastal plains, particles in the delta of Mahanadi, Godavari, Krishna and Kaveri.

The river deposits very fine particles of soil called alluvium in their plains during the course of their long journey spread over hundreds of kilometres and thousands of years. These soils consist of varying proportions of sand, silt and clay. They are predominant in coastal plains and deltas. As we move further inland in the river valleys, the soil particles appear somewhat bigger in size. In the upper reaches of the river valleys, i.e. near the place of their origin, the soils are more coarse. Soil particles are larger and far from uniform. Such soils are more common in piedmont plains, i.e. those that are near the foot of mountain hills.

Apart from the size of their grains or particles, soils are described according to their age as well. They are old alluvium and new alluvium. Remember that so called new alluvium may be even ten thousand years old. Locally the old alluvium is called banger, and the new alluvium is called khadar. The old alluvium often contains kansar nodules, with calcium carbonates in sub-soil. The new alluvium is more fertile than the old.

Alluvial soils as a whole are very fertile. Generally, they contain adequate potash, phosphoric acid and lime. However, they are deficient in organic and nitrogenous content. Soils in the drier areas are more alkaline. Alluvial soils support over half the Indian population.

REGUR SOILS: These soils are black in colour and are also known as black soils. Since they are ideal for growing cotton, they are also called cotton soils, in addition to their local nomenclature of regur soils. These soils are most typical of the Deccan trap (Basaq) region spread over north-west Deccan plateau and are made up of lava flows. They cover the plateaus of Maharashtra, Saurashtra, Malwa and southern Madhya Pradesh and extend eastwards in the south along the Godavari and Krishna Valleys. In their formation climatic conditions are as important as their parent rock materials. Hence they extend much beyond the lava plateau itself.

The black soils are made of extremely fine i.e. clayey material. They are well known for their capacity to hold moisture. In addition, they are rich in soil nutrients such as calcium carbonate, magnesium carbonate, potash and lime. They are generally poor in phosphoric content. They develop deep cracks in the field during hot weather. This helps in their aeration. Hence their self-ploughing quality. This soil is sticky and difficult to work unless filled immediately after the first or pre-monsoon showers.
Land Use Pattern of India

According to the latest land use figures, there has been a slight increase in the net sown area. Nearly 5.5 million hectares have been added over three decades. It constituted 47.7% per cent of the total land area for which data are available. Another 1.23 per cent of the land is under fruit trees. Nearly 5% per cent of the land falls in the category of fallow land which is cultivated not every year but once in two to three years. Thus nearly 5% per cent of the total area, on an average, is cultivated annually. The fallow lands are marginal lands and are kept so to restore their fertility. Its use depends upon good and timely rains too. However, it is notable that the fallow land has come down to 5% from the earlier figure of 7%. This shows perhaps greater use of manures and fertilisers and adoption of new techniques to conserve moisture in such lands.

The area classified as cultivable waste has remained stationary at 6.4 per cent for several decades. The land under permanent pastures is miserably low and it indicates tremendous population pressure on our land. Also, it must go to the credit of our farmers that with so little land under pastures they have the largest number of cattle. They are reared mainly on husk, grain chaff, farm waste and a few fodder crops. This is indeed the most economic way to have a large number of draught animals and bovines cattle. Some areas classified under forests are also used for cattle grazing.

The forested land in our country is far below the scientific norm. For a self-contained economy and proper ecological balance, about one-third of the total land area must be kept under forests and natural vegetation. In India it is as low as 19.3 per cent.

The photographic evidence derived from satellites has confirmed that only 46 million hectares are under real forests as against the 67 million hectares according to land use statistics. However, this figure shows a small rise from 40 million hectares to 46 million hectares.

We have to ensure that we increase the area under forests for reasons more than one. A larger area under forests is a must for maintaining the ecological balance and for absorption of carbon-dioxide, the accumulation of which is likely to accelerate greenhouse effect. This in turn would raise atmospheric temperature at the global level. It may lead to melting of ice caps and corresponding rise in sea level endangering low-lying thickly populated parts of the world. Forests provide habitat to wild life and help in their preservation. They help in raising the level of precipitation, minimising the incidence of droughts. Forested lands also help in percolation of rain water, in the subsoil and regulating the flow of river waters in both rainy and dry seasons. Forests conserve not only water but soil as well. They thus help in reducing the volume of flood waters and their fury.

A part of the land is not utilised at the moment. This is classified as wasteland. This includes the arid, rocky and sandy deserts. The high mountains and uneven lands also belong to this category. At times human beings have also been responsible to add to such areas by deforestation and overgrazing.

The growing population and higher standards of living have created ever-increasing demand for residential land both in villages and towns. Cities and towns are compelled to grow vertically rather than horizontally. Even then land is needed to expand industry, commerce, transport and recreational facilities. Their claim becomes, irresistible.

We should remember that the total availability of land is a fixed asset. In view of the increasing pressure on land for various purposes, it is necessary to plan proper use of all the available land. This may be done by adopting suitable measures to check soil erosion, desertification etc., which turn arable land into wastelands. Besides, some of the wastelands may be brought back to other uses. Similarly, with the help of modern and scientific methods of farming, the productivity of the land may also be increased. All attempts should be made to strike the balance among various uses of land.

WATER RESOURCES

Water is an important resource like land. An important use of water in our country is irrigation. Though irrigation we have not for only been able to extend the area under cultivation but also raise agricultural productivity. Besides, water is required in large amounts for industrial and domestic consumption.

Unlike land, the availability of water varies from place to place and time to time. Being a monsoon land, the bulk of rain falls in a short span of time. And most of the rainfall occurs during the rainy season. This makes the availability of water scarce during dry months. Due to an uneven distribution of rainfall, the country faces the problems of floods and famine in some parts of the country every year.

Our ground water resources are abundant only in the northern and coastal plains. In other parts of the country, its supply is not adequate. In fact, at places the ground water is obtained from a depth of more than 15 metres. So far as safe drinking water is concerned, we have not yet been able to provide it to all villages. In many
parts people have to walk for more than a kilometre to fetch water. This is a most part of the country, the availability of water for agricultural and other purposes is inadequate and irregular. We, therefore, need to plan the use of available water. Let us have a look at our national water budget.

Our Water Budget

Suppose there is a level piece of land, one hectare in area i.e. 10,000 sq. metres. On this piece of land if one metre deep water is allowed to stand, it would be 10,000 cubic metres or simply one hectare metre.

Taking into account the average annual rainfall for the entire country and its total area, it has been found that our total water resources are of the order of 167 million hectare-metres. Again, it has been further worked out that only 66 million hectare-metres of water can be utilized by us for irrigation. Keeping in view the limitations of our financial and technological resources we have planned to use it in a phased manner fully only by 2010 A.D.

Before the commencement of the planning era, i.e. in 1951 only 9.7 million hectare-metres of water was used for irrigation. By 1973, as much as 18.4 million hectare-metre of water was being used for irrigation.

If we take up the land area as a unit, the position could be stated a little differently. In 1951 only 22.6 million hectares of land was under irrigation. By 1984-85, the land under irrigation was tripled to 67.5 million hectares. By 1990 another 13 million hectares were to be brought under irrigation, taking the total to 80 million hectares. This may be adjudged against the total potential of 113 million hectares by 2010 A.D. This is the gross sown area and not the net sown area as the former is bound to be larger than the latter. Currently 28 per cent of the net sown area is under irrigation i.e. 45 million hectares even though the gross irrigated area is about 80 million hectares. Not more than 30 per cent of the net sown area will ultimately be brought under irrigation. This estimated potential takes into account even the ground water resources that are recharged every year by the normal rains. These usable ground water resources are estimated to be around 40 million hectare-metres. Of this, only a fourth i.e. 10 million hectare-metres are now being utilized. The remaining 30 million hectare-metres are yet to be utilized. This is the overview of our potential and developed water resources.

Multi-purpose River Valley Projects

Since independence, our country has been engaged in planned economic activities to achieve self-reliance and improve the standard of living of its people. Among several measures adopted for this purpose, managing our water resources is one of them. The twin problems of floods and famines are nothing but two sides of the same problem. As such they are being increasingly tackled in an integrated fashion. The surface and ground water resources are viewed complementary to each other. Their source is one and they serve the same purpose. Out of these practical concerns and long experience, there evolved a common philosophy and technology. It is now being followed almost all over the world—especially in the water thirsty areas. Multi-purpose river valley project is a common label it has acquired over the years. Damodar River Valley project was the first of its kind taken up by free India.

In a multi-purpose river valley project quite a few objectives are realized simultaneously. A huge single dam or a series of small dams are built on a river and its tributaries. In the first place these man-made lakes help in impounding huge amounts of

Figure 4.1: India—Irrigation and Hydel Power Projects

Note the major irrigation and hydel power projects in India. Name the states where canal irrigation is most important. Which parts of India do not have hydel power projects?
rain water. To that extent they help in controlling floods and protecting soils. The same water comes very handy in irrigating farms in command areas during the dry season when water is in great demand.

The catchment areas of these dams are now systematically afforested. This helps to preserve "wildland" and natural ecosystem. It is high time that we now restore ecological balance in the hilly catchment areas of our life-giving rivers. The afforestation also helps in avoiding siting of dams, lakes, river channels and irrigation canals. It helps in extending their life and economic viability.

The wild land so purposefully developed helps in preserving wild life, the most precious heritage of mankind. It is our bounden duty to preserve and pass on intact this inheritance to our future generations to whom it rightly belongs. We are only the trustees of this heritage.

The stored water in the hilly and mountainous tract generally provides high head. The stored water when made to fall from a high head helps in generating power even in dry seasons. Power derived from running or falling water is known as 'hydel power' or 'hydro power'. It is one of the cheapest, cleanest and pollution-free forms of energy. Equally important is the fact that hydro-electricity is derived from water which is a renewable resource. Thus in every respect it scores over fossil-fuels which are exhaustible and are the least free from pollution.

Multi-purpose river valley projects often provide for inland water navigation through main rivers and canals. It is the cheapest means of transport for heavy goods. Another economic benefit of these projects is the ideal conditions they provide for development of fisheries. Fish hatcheries and nurseries are developed to stock water bodies with chosen varieties of fish that are allowed to grow to their full. They are harvested only at regular intervals through controlled fishing. Such well-developed fish farms can be the cheapest source of protein for our people whose diet is otherwise extremely poor in it. Such well cared for and scientifically developed river valley projects also ensure irrigation.

It is for all these reasons that the multi-purpose river valley projects are called the new temples of modern India.

Before independence water management meant irrigation only. But now it includes generation of power, fisheries etc. Canal irrigation was practised in the south since antiquity - specially in the Kaveri delta. Tank irrigation was widespread, almost in every village in the south. Likewise well irrigation was common all over India. Animal power was harnessed to draw water from wells. In medieval times, several rulers promoted canal irrigation in northern India. During British period the hilly and tract of north-west Indian subcontinent, particularly in the Indus basin, were brought under irrigation where retired army personnel were encouraged to settle on new lands. Land was extremely flat and fertile, and Indus and its tributaries had ample water to irrigate these virgin lands. Cotton was a major cash crop grown under irrigation. Over a period of time the world's one of the best canal irrigation networks was developed.

Damodar Valley Project sets an example towards managing our water resources on scientific lines. Damodar, though a small river, was canalised for irrigation leading to devastating floods it caused. It flows from Chotanagpur in south Bihar to West Bengal. The Valley has the largest deposit of black gold i.e. coal. Iron ore deposits of India are also found in its vicinity. The project consists of a series of small dams on the tributaries of Damodar. There are a few hydel-power stations. A navigable canal has also been developed. The hydel power has been integrated with a common grid in which all thermal power stations provide the bulk of electricity for the growing industrial complexes spread over north-east Bihar and adjoining parts of West Bengal. The project irrigates half a million hectares of land in West Bengal and parts of south-east Bihar.

The Bhakra Nangal Project is an example of water management on scientific lines on the largest scale. The Bhakra Dam has been built at a strategic point where two hills on either side of the Satluj are very close to each other. The dam, therefore, is not very wide. It is the highest gravity dam in the world. Its height is 226 metres from the river bed. It is located in the seismic zone, and the hills that act as huge natural walls for storing 78,000,000,000 cubic metres of water are made up of unconsolidated material. Being very weak and brittle, the hills had to be strengthened by injecting them with big concrete blocks at regular intervals. The man-made lake is named after Gobind Singh, the tenth Guru of the Sikhs. The caps take out 1,100 kilometres long. The distributaries are 3,400 kilometres in length. It irrigates an area of 1.4 million hectares. The Kankal power plant on the Satluj produces 1,204 mw of electricity each year. The project serves the states of Himachal Pradesh, Punjab, Haryana, Rajasthan and the National Capital Territory.

Indira Gandhi (Rajasthan Canal) Project is an ambitious scheme to bring new areas under irrigation so that new areas could be cultivated. The waters of the Beas and Ravi had to be diverted to the Satluj. The Pong Dam on the Beas has been constructed. It impounds 6,90,000 hectares of water. It has helped to divert Beas water into the Satluj in a regulated manner so that Rajasthan Canal, the longest irrigation canal in the world, can irrigate Ganganagar, Bhilwara and Jaisalmer districts of north-west Rajasthan. The main canal now called Indira Gandhi Canal, is 465 kilometres long. Waters of Satluj, Beas and Ravi are now being almost fully used by India to irrigate water thirsty lands in the north-western parts of the country.

The Kosi Project in Bihar has been taken up in cooperation with Nepal. Its main aim has been to control floods brought by the river Kosi, known as the River of Sorrow for north Bihar. It has a capacity to irrigate 8,75,000 hectares of land in Bihar. The main canal is taken off from Hanuman Garh barrage on the Kosi. Another important joint venture of India and Nepal is the Gandak Project.

The Hirakud dam in Orissa is the longest dam in the world. The 4.8 km long dam impounds 8,100,000,000 cubic metres of water for irrigation, besides controlling the floods in the Mahanadi delta. It irrigates in all three quarters of a million hectares of land. The installed power capacity is 270 mw.

The Tungabhadra Project serves Karnataka and Andhra Pradesh. This 2.5 km long and 50 metres high masonry dam irrigates nearly 4,000,000 hectares in the two States.

The Nagarjunasagar Project is built on the river Krishna in Andhra Pradesh. It irrigates 8,87,000,000 hectares of land. The dam has been named after the Buddhist scholar Nagarjuna. Ancient temples of great architectural value would have been submerged in the man-made reservoir. They were dismantled stone by stone and have been reconstructed as before on a new site. This shows how we can preserve our cultural heritage while adopting modern technology.

The Chambal Project helps irrigate...
parts of Madhya Pradesh and Rajasthan. Its main purpose is soil conservation in the Chambal basin. The project consists of Gandhi Sagar Dam in Madhya Pradesh and Kota Barrage and Jawahar Sagar Dam in Rajasthan. It has the total capacity to irrigate nearly half a million hectares of land.

There are many other projects on different rivers in the country. Find out which important project is located in your state and how useful it is for irrigation and power.

India stands fifth in the world after Zaire, former USSR, Canada and the United States in potential water power resources. Her water power resources have been estimated at over 40 million kilowatts. The north-eastern India lying largely in the Brahmaputra basin accounts for nearly 30 per cent of our water power resources. The states of Arunachal Pradesh and Manipur are particularly rich. Yet another chunk of 30 per cent is widely spread over the rest of the Himalayas lying within the Indian territory. Half of it belongs to the Indus and its tributaries, the Ganga and its Himalayan tributaries together with the rivers like Tista and Manas lying further east, claim the remaining half. The remaining 40 per cent is claimed by the rivers of peninsular India. Half of it is attributed to the east-flowing rivers rising in the Western Ghats and a quarter each is shared by those smaller rivers that rise in the Western Ghats and flow into the Arabian Sea, and the rivers of central India.

In spite of advantages like annual renewal and freedom from pollution, hydel power resources have not yet been sufficiently tapped. The initial cost of developing hydroelectric resources is very high.

At the time of Independence the total installed water power capacity was 5,75,000 kw. In the year 1966-67 alone a 19,20,000 kw of installed capacity was added. This would give you an idea of the tempo with which the demand and development have been growing. By 1986-87 the total installed capacity of water power had risen to 1,68,81,000 kw. In other words we have developed so far 40 per cent of our total hydel power potential.

**Major Water Power Projects**

By the turn of the twentieth century, a new era of developing hydel power in this country started on a modest note. In the year 1902 the first water power house was set up on the river Karesh on Sivasamudram in Karnataka. It was then followed by the Tata Hydroelectric Scheme in the Western Ghats of Maharashtra to supply power to the city of Bombay. In Tamil Nadu Pykara was the first water power station. In the north, Manali power house was the first to be developed in the Himalayan region. The next one to be taken up was the Upper Ganga Canal Hydroelectric Grid System. After Independence there has been a sudden spurt in developing hydel electricity in different parts of the country. We have already discussed various hydel power schemes under the multipurpose river valley projects like Bhakra- Nangal, Damodar Valley, Hirakud, Chambal etc. In addition, there have been a few exclusive hydel power projects like the Hirland Project is the largest man-made lake in India on the borders of Madhya Pradesh and Utrar Pradesh, its capacity is 300 mw every year. The Koyana Project in Maharashtra is on an east flowing tributary of the Kharadi. A dam on the Koyana has been built to take waters through a tunnel to the western slopes of the Ghats. Its capacity is 80 mw.

The Sharavathy Project in Karnataka is located at the Jog Falls, the highest in India.

**Economic Geography**

**Land Use and Water Resources**

Its total capacity is 891 mw, It feeds Bangalore industrial region and is also taken to the state of Goa and Tamil Nadu. Kallanadi Project in Karanataka has 210 mw capacity. The Kundho Project in Tamil Nadu had initially 425 mw capacity which has been expanded lately to 535 mw.

The Saptagiri Project in Kerala has an installed capacity of 300 mw. The Idukki Project has a capacity of 390 mw.

The Bellandur Project in Utrar has an installed capacity of 360 mw and in Gujarat. Utrar Project has a capacity of 300 mw.

In Jammu and Kashmir, Satluj Hydro Power Project has been completed and the new ones are being taken up. They together, would provide over a thousand mw of power.

Besides these power projects, India constructed a very big hydel power project in Bhutan at Chukia. It was inspired by India. The surplus energy is bought by India for its use in the north-eastern parts of the country including West Bengal.

**Exercises**

Review Questions

1. Answer the following questions briefly:

   (i) How is per capita availability of arable land more significant than average density of population?

   (ii) Why is it necessary to know the land use pattern of a country?

   (iii) What is the most satisfying feature of land use pattern in India?

   (iv) What are the disturbing features of land use pattern in India?

   (v) Why is the availability of water inadequate for human use in India?

   (vi) Why does hydroel power score over other conventional sources of energy?

2. What is a multi-purpose project? How does it excel over traditional irrigation projects? Give examples from various parts of India.

3. What is our national water budget like? Why is it as important as our food budget?

4. Distinguish between:

   (i) A cubic metre and a hectare-metre  
   (ii) Net sown area and gross sown area  
   (iii) Surface water and ground water resources.

   (iv) Himalayan rivers and those of peninsular India.

5. Hold a class discussion on (i) Water—the Saviour of Life or (ii) Our lopsided land use pattern.
CHAPTER 5

Mineral and Power Resources

Not all the natural resources are located on or above the earth's surface. Many of the resources are hidden deep below the earth on which we live. They are buried deep even under the sea bed. In the modern industrial era, these underground resources are of great importance. Much of the country's industrial growth depends upon these mineral resources. Early human civilization started with tools and weapons made out of stone. Copper was the first metal to be widely used. However, iron being stronger and more abundant, revolutionised the life of man. It helped to clear forest and accelerate the spread of farming. It was agriculture that laid the foundation for cultural progress of man.

MINERAL RESOURCES

India is bestowed with a fairly rich mineral resource base, and has the potential to become an industrial power on its own.

We are particularly rich in iron resources. Iron, together with coal, forms the basis of the machine age. As per one estimate, the world's one-fourth of iron ore resources. Its reserves are rich not only quantitatively but also qualitatively. Another important mineral required for ferrous industries is manganese, and India is exceptionally rich even in this. It is used in manufacturing steel alloys. Our coal reserves are considerable. But unfortunately the quality coal required for producing coke as an essential input in steel industry is rather deficient. However, the proximity of coal and iron deposits have compensated to some extent this disadvantage. Limestone, another input in steel industry, is also ample and widespread.

India is rich in bauxite, the ore for aluminium, and mica used for electrical industries.

India on the other hand is poor in non-ferrous minerals like zinc, lead, copper and gold. It also lacks sulphur which forms the base of modern chemical industry.

India was poor in the production of mineral oil and natural gas. However, our tenacious efforts, backed by modern technology, have helped us to locate sizeable reserves that may last for at least another thirty to forty years. Our water power resources and atomic minerals, however, can be relied upon. Solar energy which the bountiful nature has bestowed on us generously will be our ultimate saviour when proper technology can be developed to harness the same.

Mineral and Power Resources

For Doing It Yourself

1. Pay a visit to a village nearby and collect the following figures:
   (a) Number of houses/households,
   (b) Number of electricity connections provided,
   (c) Number of hours a day when electricity is made available by the authorities.
   (d) The average number of hours and days when electricity is not available because of faults/break down in transmission line or pumping set etc.
   (e) The rate charged per unit of electricity consumed.
   (f) Possible ways of avoiding wastage of power.

2. Study Table 5.1.

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<td>Production of Coal in India</td>
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<tr>
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</tr>
<tr>
<td>1965-66</td>
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<td>1985-86</td>
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<tr>
<td>1987-88</td>
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</table>

Draw your inference about the trend in the production of coal.

3. Study Table 5.2 and work out the percentage growth in the production of
   (a) coal, (b) petroleum, (c) bauxite, and (d) iron ore.

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<tr>
<td>Minerals Production Trends 1951-1987</td>
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<td>Fuels</td>
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<td>(i) Coal (million tonnes)</td>
</tr>
<tr>
<td>(ii) Natural Gas (million cubic metres)</td>
</tr>
<tr>
<td>(iii) Petroleum (million tonnes)</td>
</tr>
<tr>
<td>(iv) Bauxite (thousand tonnes)</td>
</tr>
<tr>
<td>(v) Iron-ore</td>
</tr>
</tbody>
</table>
(A) Installed Capacity in Public Utilities

<table>
<thead>
<tr>
<th>Sector</th>
<th>Installed Capacity 1985-86</th>
<th>Total Installed Capacity 1985-86</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal</td>
<td>59,125 mw</td>
<td>66,575 mw</td>
</tr>
<tr>
<td>Hydro</td>
<td>16,117 mw</td>
<td>45,692 mw</td>
</tr>
<tr>
<td>Nuclear</td>
<td>2,515 mw</td>
<td>53,252 mw</td>
</tr>
<tr>
<td>Total</td>
<td>77,757 mw</td>
<td>165,519 mw</td>
</tr>
</tbody>
</table>

(B) Per capita consumption of electricity:
- India: 1947, 17 kw, 1979, 167 kw
- USA: 1988, 10,000 kw
- Sweden: 1988, 12,000 kw

(i) Find out why a very high priority is attached to the production of electricity.
(ii) Work out the per cents contributed by thermal, hydro and nuclear sectors in total installed capacity.
(iii) Compare our per capita consumption of electricity with the USA and Sweden and draw your own inferences.

Study Table 5.4.

<table>
<thead>
<tr>
<th>Sector</th>
<th>1950-51</th>
<th>1979-80</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic</td>
<td>12.6</td>
<td>10.2</td>
</tr>
<tr>
<td>Commercial</td>
<td>7.8</td>
<td>9.0</td>
</tr>
<tr>
<td>Industry</td>
<td>62.6</td>
<td>60.6</td>
</tr>
<tr>
<td>Agriculture</td>
<td>3.9</td>
<td>7.8</td>
</tr>
<tr>
<td>Others</td>
<td>13.4</td>
<td>13.8</td>
</tr>
</tbody>
</table>

By March 1986 the number of pump sets/borewells increased to 6.15 million. It further rose to 6.47 million by March 1987.

(i) Find out which sector has increased its demand for power over the past 30 years.
(ii) Draw your inferences about this growing demand of the sector concerned.

---

Fig. 5.1 India—Iron Ore, Coal and Mineral Oil

Note the high concentration of minerals in South Bihar and in the adjoining parts of Orissa and Madhya Pradesh. Why is the Damanjodi Valley called the ‘Puhr of India’? What correlation do you find between the distribution of minerals and the geological structure of India?
The iron content of the ore is as high as 60 to 70 percent. This explains the big international demand for iron ore. The official estimates of the proven reserves are 17.570 million tonnes. These estimates are on the conservative side. Half of these deposits are confined to the districts of Singhbhum in Bihar and adjoining districts of Keonjhar, Bokaro and Mayurbhanj in Orissa. It is perhaps the world's largest and richest iron ore field.

Iron ore is also mined in Hazaribagh, Jharkhand, and Shahabad districts of Bihar.

Bihar-Orissa iron fields further extend into Raipur, Durg and Bastar in Madhya Pradesh. The mines in Balladla in Bastar have been lately developed to step up exports to countries like Japan. Madhya Pradesh ranks now next only to Bihar and Orissa in mining iron ore.

The iron ore deposits are also found in several districts of Andhra Pradesh. In Tamil Nadu deposits have been located in Salem and Tiruchirapalli districts. Karnataka has iron ore deposits in the districts of Chikmagalur, Chitalur, and Bellary. The state of Goa has also iron ore deposits, although of not very high quality. They are largely exported. Ratnagiri and Chandra districts of Maharashtra have some iron ore deposits.

The production of iron ore has been steadily rising. It stood at 5.1 million tonnes in 1987. In 1951, it was less than 1 million tonnes. Unfortunately major portion is mined for export rather than manufacture of iron and steel in our own country. The ports specialising in the export of iron ore are Visakhapatnam (for Balladla mines), Mormugao, Paradip and Calcutta. Mangalore is likely to emerge as an iron ore exporting port, as Kudremukh mines have been developed for this purpose.

Manganese

Manganese ferro-alloys are mixed metals with iron as the base. These are prized for their strength, and as such they have become very important in the age of powerful giant machines. Manganese is used for this purpose and hence its growing importance.

The mines of manganese ore are located in Mayurbhanj and Keonjhar in the state of Orissa. In Karnataka, the deposits are located in Chitradurga, Tumkur, Shimoga, Chikmagalur, Belgaum, Dharwar and North Kanara districts.

The other states in which manganese is found are Bihar (Singhbhum), Andhra Pradesh (Nizamabad and Visakhapatnam) and in Rajasthan (Banswara and Udaipur).

The total production in 1987 was 1.3 million tonnes as against the conservative estimates of 1.35 million tonnes of total reserves. Of these at least 50 million tonnes are of high quality.

Bauxite

Bauxite ore has gained in importance because aluminium—a very light but highly useful metal—is produced from it. It is a must for an aircraft industry. It is also being increasingly used in electrical industry and also in everyday life. But the manufacture of aluminium and aluminium depends largely on the availability of cheap and abundant supply of electricity.

The bauxite deposits in India are widely distributed. Traditionally Bihar, Gujarat and Madhya Pradesh have been the major producers. Maharashtra has also high grade deposits in Kolhapur district. Recently deposits in Orissa have been developed and the largest plant of its kind in Asia has been set up to produce alumina and aluminium. Its annual capacity is 800,000 tonnes of alumina and 225,000 tonnes of aluminium. It uses the latest French technology which economists on the use of electricity. Ore is exported to Japan and European countries.
The territorial water of India extends on the sea to a distance of six nautical miles measured from the appropriate base line.

Fig. 5.2 India—Basalt, Manganese, Mica, Copper, Gold and Salt

Note the location of the various minerals in India. In spite of a long coastline the extraction of salt from sea water is confined to the Gujarat Coast only. Why should it be so?
ECONOMIC GEOGRAPHY

MINERAL AND POWER RESOURCES

Gold
India is very poorly placed in regard to the reserves of gold ore. Currently, gold is mined at Kohat mines, the world’s deepest, and Huitl mines (Rajasthan) — both in Karnataka. The other two mines in Andhra Pradesh have been stalling production. The estimated reserves are at 81,000 kg of gold content. The annual production of gold has been dwindling. It has come down from 7,000 kg in 1932 to 2,500 kg in 1986.

POWER RESOURCES

With the dawn of industrial era, the sources of energy to drive giant machines suddenly became prominent. Wood, fuel was confined only to domestic use and that too in the rural area. Coal which was already in use became a highly prized commodity. It was then supplemented by natural gas. Likewise, the rise of electricity gained currency in areas where running water and needed technology was readily available. After the World War II yet another source of energy was added. It was the nuclear energy. It called for a very sophisticated level of technology. All these sources of energy are known as conventional sources of energy. Amongst them the coal still occupies a prominent position.

Coal
Coal, besides being a prime source of industrial energy, is also a raw material. It is an indispensable input in steel and chemical industries. Coal, inclusive of lignite, even today accounts for 60 per cent of the country’s commercial power requirements. The coal deposits in India, to the tune of 98 per cent belong to the Gondwana age. Nearly three-fourths of the coal deposits are located in the Damodar Valley. The place names well associated with these deposits are Raniganj, Jharia, Giridih, Bokaro and Karampura. The other river valleys associated with coal deposits are the Godavari, Mahanadi, Son and Wardha. Other coal mining areas are in the Satpura range and in Chhattisgarh plains of Madhya Pradesh. The coal fields of Singaraj, in Andhra Pradesh, Talcher, in Orissa and Chanda in Maharashtra are also very large.

Coal mining in India started at Raniganj in West Bengal in 1774. After independence the entire coal mining was taken over by the State from private hands to avoid exploitation of labour. The major coal fields after their regrouping are (1) Raniganj, (2) Jharia, (3) East Bokaro and West Bokaro, (4) Penteh-Kahan, Tawa Valley, (5) Singrauli, (6) Talcher, (7) Chanda, Wardha, and (8) Godavari Valley.

Reserves and Production
The Geological Survey of India, according to its surveys till 1961, has put the country’s proven coal reserves at nearly 446 million tonnes, i.e., 15,92,99,160 million tonnes. These are based on the seams of 0.5 metre and above in thickness and one to a depth of 1200 metres. The major states known for coal reserves are Bihar, Orissa, West Bengal, Madhya Pradesh, Andhra Pradesh and Maharashtra. By and large, the quality of Indian coal is rather poor in terms of their capacity to give heat. However, the poor quality coal can be converted into electricity and gas. Even its conversion into oil is not ruled out. This is the reason why many of our thermal and super thermal power stations are located on the coal fields and the electricity produced is fed into large regional grids. This cuts down time and expenditure involved in transportation of coal to its consumption points.

The coal production in India which was just 33 million tonnes in 1951 has now jumped to over 180 million tonnes in 1980-
Oil and Natural Gas

India has a very large proportion of tertiary rocks and alluvial deposits particularly in the extra-peninsular India. These sedimentary rocks which were once under the shallow seas hold the possibility of harbouring oil and gas deposits. Such potential oil bearing area in India is estimated to be over a million square kilometres, a third of the total area. It covers the Northern Plains in the Ganga-Brahmaputra Valley, the coastal strips together with their off-shore continental shelf, the plains of Gujarat, the Thar desert and the area around Andaman and Nicobar Islands.

Till Independence Assam was the only state where mineral oil was drilled and refined in the refinery at Digha. Although small in size this is the only oilfield which has lasted for 100 years continuously. After independence Gujarat Plains and the Cambay off-shore area showed evidence of hydro-carbon deposits. But the major reserves were unexpectedly found off the Bombay coast, 115 km from the shore. So far this has been the richest oil field of India. This oilfield is known as Bombay High. Sagardari, bought from Japan, was the first mobile offshore drilling platform. The deposits of oil were located deep under the sea bed. The depth of the sea water was high enough to call for high technology. But India took up the challenge and developed the oilfield in a record time. Now India manufactures oil drills and mobile platforms for drilling in deep coastal waters. The latest oilfield discoveries have also come from off-shore areas off the deltaic coasts of Godavari, Krishna, Kaveri and Mahanadi. New reserves have been located in Assam.

The gas reserves are generally found in association with oil fields. But exclusive natural gas reserves have been found in Tripura, Rajasthan and in all the off-shore oil fields of Gujarat, Maharashtra, Tamil Nadu, Andhra Pradesh and Orissa.

**Our Growing Oil Budget**

In 1951 our total production of mineral oil was 269,000 tonnes. Our total consumption then was also very meagre as compared to what it is today. It stood at 3.1 million tonnes. By 1984-85 our production of natural oil jumped to 29 million tonnes. But our consumption too soared high to 39 million tonnes. The net imports were 7 million tonnes of crude and 5 million tonnes of petroleum products. The refinery crudes throughput stood at 35 million tonnes.

In 1986-87 the oil production stood at 30.5 million tonnes and in 1988 it was near 36 million tonnes. It was only 10 million tonnes in 1980-81. The recoverable reserves of crude oil which were 366 million tonnes in 1980 rose to 389 million tonnes by 1987.

The production of natural gas stood at 2,558 million cubic metres in 1980-81. It rose to 8,612 million cubic metres by 1986-87. The total reserves of gas were estimated at 1,410 million cubic metres. In a power deficient country like India, natural gas is a precious gift. It can be used both as a source of energy and also as an industrial raw material in petro-chemical industry. It takes less time to build a power plant based on natural gas. For Indian agriculture it has a capacity to boost its production through the building of fertilizer plants based on natural gas. The utility of gas is further heightened because of its easy transportability through gas pipelines. Gas is used in India both for industrial and for domestic purposes.

We are already 12 refineries in the country. The Liquefied Petroleum Gas (LPG), also called the cooking gas, is now being increasingly used as domestic fuel in urban areas. It is an efficient and clean fuel. It has succeeded in reducing demands on our shrinking forests, at least in urban areas.

**Thermal Power**

We have already learnt about hydro-electricity. It is derived from a source which is plentiful and above all renewable. Thermal power plants on the other hand use coal, petroleum and natural gas to produce thermal electricity. These sources are of mineral origin. They are also called fossil fuels. Their greatest demerit is that they are exhaustible resources and cannot be replenished by man. Moreover, they are not pollution free as hydro-electricity is. However, electricity, whether thermal, nuclear or hydro, is the most convenient and versatile form of energy. It is in great demand by industry, agriculture, transport and domestic sectors. Its use is closely related to productivity and standard of living of the people.

The installed capacity to produce thermal power in 1988-89 was nearly 40 million kw. It was little more than twice the capacity to produce hydel power. The actual power generated in 1988-89 was of the order of 201 billion units. As against this hydel power accounted for 33.8 billion units and 5 billion units of nuclear power.

In a single year it had risen by about 10%.

Power stations, both big and small, are scattered all over the country. The electricity produced by them, however, is fed into regional grids to optimise their utilisation. It is proposed to have a single national grid in course of time. The grid receives and distributes electricity produced from all the four major sources—coal, natural oil, water and atomic minerals. The total length of transmission lines was 10,000 circuit km in 1950. It rose to 1,71,000 circuit km in 1987. Besides these there are high voltage transmission lines of 400 kv strength. Their total length is 16,000 km and 35,853 km of 220 kv strength.

The power generating plants in India work at only 53 per cent plant load factor. Their functioning can be improved with due care.

**Nuclear Power**

India being deficient in quality coal and natural oil, nuclear power is expected to play a complementary role. Such power stations would be found handy where other power resources are either non-existent or in short supply. India has been a leader in making peaceful use of atomic energy in fields like medicine and agriculture.

India is rich in certain atomic nuclei-
ar minerals. Uranium mines are located in Singhbhum in Bihar and parts of Rajasthan. More abundant source is monazite sands on the shores of Kerala. Thorium is derived from these sands. Placer deposits of Bihar have further enlarged our nuclear mineral reserves. Cherlrite and zirconium are among the world's largest reserves. Limestone graphite is also known to exist in the Eastern Hills.

India has four atomic power plants. They are at Tarapur on Maharashtra-Gujarat border on the Arabian Sea coast, at Rawashbat near Kota in Rajasthan, Kelpakkam in Tamil Nadu and Narora on the banks of Ganga in western Uttar Pradesh. Together they have an installed capacity of nearly 1.5 million kw.

Non-conventional Sources of Energy
Regional and national integrated grids are an index of the growing popularity of a centralised distribution system. It also provides for feeding into a common distribution system, all the energy derived from various sources like coal, diesel, petrochemical, natural gas, water and nuclear minerals. Major advantage in the centralised system is that deficient regions can draw heavily on energy surplus regions. More importantly, it can help tide over immediately any emergency situation when power system breaks down in a given area.

Centralised system, however, has its demerits too. It calls for huge expenditure on setting up infrastructure and problems of management. The system works well where service and efficiency are the watchwords. There is now a trend to move towards decentralisation. It would provide greater initiative to local people who can assess their needs and resources and plan a strategy that suits them best. Cost effectiveness becomes an immediate concern and hence wastages can be kept to the minimum in the interest of consumers themselves. The most important advantage of this system, however, has been the use of renewable and inexhaustible sources of energy.

These sources in fact were in use long before the conventional sources of energy like coal, mineral oil and natural gas came to be used widely. Wind and running water were used for navigation. Water mills were in use for grinding grains. Wind mills were used for pumping water.

Today non-conventional sources of energy include wind, tides, geo-thermal heat, biomass, farm and animal waste including human excreta. All these sources are renewable or inexhaustible. They are inexpensive in nature.

Wind Energy
It can be used for pumping water, a prime need in irrigating farms in the countryside. Also, it can be used for generating electricity. It is estimated that wind alone can provide 2,000 mw of electricity. The states of Gujarat, Tamil Nadu, Maharashtra and Orissa are better placed in regard to this energy. Areas with constant and high speed winds are suitable for the purpose. There were 1750 wind mills till March, 1987. There were also five wind farms with installed capacity of 3.63 mw. They have already produced half a million units of energy and fed into the grid.

Tidal Energy
This is another inexhaustible and inexpensive source of energy. The Gulf of Khachchh and Cambay are ideally suited to develop electricity from the energy produced by high tides entering into narrow creeks.

Geo-Thermal Energy
India is not rich in this source. However, efforts are on to utilize natural energy of the hot springs at Manikaran in Himachal Pradesh. Energy so produced can be used for running cold storage plants.

Energy from Urban Waste
A pilot plant for demonstration purposes has already been set up in Delhi to treat solid municipal waste for conversion into energy. It produces nearly 4 mw energy every year. Sewage in cities is used for generating gas and electricity.

Bagasse Based Power Plants
It is estimated that sugar mills in India can generate 2,000 mw surplus electricity during crushing season. Out of 10 mw energy produced by a mill of a given size, 4 mw would meet its own power requirements.
and the rest of 6 mW energy can be utilized in irrigating fields and feeding it into the local grid.

Like bagasse several other farm wastes, like rice husk are also being used to produce electricity.

**Form Animal and Human Wastes (Urga Gram)**

By using biomass, animal, poultry wastes and human excreta, "gobar gas" plants are being set up in villages to make them self-sufficient in their power requirements. The power so produced is used for cooking, lighting homes and streets and meeting irrigation needs of the village. These plants are being set up both at individual and community or village levels. Sewage from large cities can be used for generation of biogas.

**Smokeless Chulhas**

The largest share of energy is used in the country in millions of our kitchens. Wood and cow dung have been the universal sources of energy. Unfortunately the traditional chulhas are wasteful means of cooking food. There were nearly 3 million improved varieties of efficient and smokeless chulhas in operation till 1987. They help in saving firewood to the tune of 20 to 35 percent. Nearly 2 million tonnes of fire wood is saved annually through these chulhas. They help in avoiding health hazards like sour eyes.

**Solar Energy**

The most abundant and inexhaustible source of energy is the sun. It is a universal source and has huge potential. A notable achievement has been the solar cookers. They help in cooking food almost without any cost. Over 70,000 solar cookers were in use till April 1987. Small and medium size solar power stations are being planned for rural areas. The successful applications of the solar energy so far have been for cooking, water heating, water desalination, space heating, crop drying. It is going to be the energy of future when fossil fuels, namely coal and oil, are totally exhausted.

**EXERCISES**

1. Answer the following questions briefly:
   (i) What role does power play in the industrialization of our country?
   (ii) Name the mineral sources of energy.
   (iii) Why are coal, mineral oil and gas called the fossil fuels? From what two specific limitations do they suffer?
   (iv) Why do you think that nuclear energy is bound to play an increasingly important role in India?
   (v) In what minerals India is (a) very rich and (b) very poor?

2. Make correct pairs from the two columns:
   (i) mica — steel alloys
   (ii) bauxite — electrical industry
   (iii) lignite — production of electricity
   (iv) coal — nuclear energy
   (v) manganese — fertilizer industry
   (vi) natural gas — aluminium industry
   (vii) uranium — iron and steel industry

3. Tick mark one of the following alternatives which is incorrect:
   (a) easy and quick to set up
   (b) uses renewable sources of energy
   (c) produces pollution free energy
   (d) has low recurring costs

4. Compare and contrast conventional and non-conventional sources of energy.

5. Give an account of distribution of iron ore and coal deposits in India.

6. Write a brief note on our natural gas deposits covering the following points:
   (a) potential areas of deposits
   (b) production trend
   (c) growth in demand and consumption
   (d) refining industry

7. Hold a class discussion on:
   (a) The role of non-conventional sources of energy
   (b) Pros and cons of nuclear energy prospects in India.
UNIT THREE

Agriculture and Industry

We surveyed our physical setting and took stock of the resources provided to us by nature. Now we turn to a fascinating area to see for ourselves how far we have been able to make use of them and at what pace.

India has a long and proud tradition of agriculture, starting with the end of nomadic life and leading to a highly developed self-contained village economy based on the principle of the static division of labour. Now, the pendulum has started swinging once again in the opposite direction. The motive force behind this swing is the new universal value system. It encompasses social mobility based on social justice and territorial division of labour where village and even a country becomes an obsolete unit in this fast shrinking world. The watchword of our times is application of knowledge and skills made available to us by the ever widening horizons of science and technology.

The Indian agriculture has now been shedding its subsistence character and is poised to enter into an entirely different phase of commercial agriculture. Our ever increasing population is compelling us to give up the old time-honored ways of maintaining soil fertility. Manures are being replaced by chemical fertilizers. Even marginal lands are being ploughed, irrigation is being extended even to the most acid areas changing the age-old eco-system. The results of all these changes are yet to be known. Small and marginal farmers have started leaving the rural areas for their inability to compete with their better off fellow farmers. The agricultural produce has been almost tripled but it will have to be further tripled before the population can be hopefully expected to stabilise in the next six or seven decades.

Based on the broad foundations of expanding agriculture, we are now busy building a super structure of industry. It has been providing livelihood to a large number of people in the countryside who can no longer be absorbed in farming activities. Industry has been helping in “value addition” to our agricultural and mineral resources. Compared to agriculture, industry has the capacity to increase national wealth somewhat faster. The quickening of the process of industrialisation has led to a new hunger for energy, particularly coal, mineral oil and natural gas. These are fossil fuels of exhaustible or non-renewable nature. Rapid industrialisation has also led to rapid urbanisation. It is partially accentuated by the rapid growth of our population. Industrialisation, together with urbanisation, has led to a growing degradation of environment, and to ecological imbalance.

Thus the twin challenges of industrialization and urbanization need to be met with well thought out policies, which would ensure proper upkeep of environ-
Agriculture

India is essentially an agricultural land. Indian society is an agrarian society. Agriculture has been the mainstay of its economy. Two-thirds of its population still lives by agriculture, even though the share of agriculture in the gross national product has been progressively declining. During 1951 to 1956 its share stood at 60.5 per cent. Statistics for 1985 to 1988 show that it has slid down to 33.7 per cent only. None the less, the importance of agriculture cannot be minimised for years to come, as it has the distinction of sustaining two-thirds of our population. It provides the raw material to agro-based industries, contributing substantially to our national income and a base for huge employment potential in agro-based industries. It is on the broad foundations of Indian agriculture that the industrial structure is being built. Agriculture includes farming, animal rearing, fishing and forestry. Indian agriculture has made rapid strides since independence. It tripled its food production. Production of jute and cotton which suffered heavily due to partition has also improved. It has been possible because of hard-working nature of our farmers and favourable soil and climatic conditions. Against the world's average of 11 per cent of net cultivated area, our country is fortunate enough to have as high as 31 per cent of our area under cultivation. While most of the world's countries raise only one crop, India has the potential to raise two. The area that can be brought under irrigation is almost equal to the total net cultivated area of China.

Even so, Indian agriculture suffers from certain basic problems. For understanding the strengths and weaknesses of Indian agriculture, do the activities as suggested below:

**FOR DOING IT YOURSELF**

**TABLE 6.1**

| Yields of Cereals in Kg per Hectare in Some Asian Countries in 1985 |
|--------------------------|------------------|
| 1. Japan                 | 5261             |
| 2. China                 | 3123             |
| 3. Malaysia              | 2581             |
| 4. Bangladesh            | 2098             |
| 5. Pakistan              | 1370             |
| 6. India                 | 1560             |
(i) Find out whether India's position appears to be weak because of:
(a) high population pressure forcing her to use marginal lands.
(b) a combination of several medium and low output crops like coarse and small grains etc.

(ii) Find out the level of inputs like fertilizers, technology, quality seeds, capital inputs and irrigation in few countries and the way they compare with India (see Table No. 6.2)

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>1950-51</th>
<th>60-61</th>
<th>70-71</th>
<th>80-81</th>
<th>88-87</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Production of Breeding seeds</td>
<td>1000 Q/H</td>
<td>5.27</td>
<td>24.84</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Production of certified seed</td>
<td>Lakh Q/H</td>
<td>21.86</td>
<td>55.85</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Fertilizer consumption</td>
<td>Lakh tonnes</td>
<td>0.69</td>
<td>2.92</td>
<td>21.77</td>
<td>55.46</td>
<td></td>
</tr>
<tr>
<td>4. Fertilizer consumption per hectare</td>
<td>Kg</td>
<td>19</td>
<td>13.13</td>
<td>31.83</td>
<td>50.61</td>
<td></td>
</tr>
<tr>
<td>5. Area under HYV seeds</td>
<td>Lakh Kg</td>
<td>18.9</td>
<td>153.8</td>
<td>430.7</td>
<td>520.4</td>
<td></td>
</tr>
<tr>
<td>6. Cooperative credit</td>
<td>Crore Rs.</td>
<td>24.23</td>
<td>214.35</td>
<td>678.31</td>
<td>2126.31</td>
<td></td>
</tr>
</tbody>
</table>

Q/H (Quintal per hectare): HYV (High yielding varieties).

Compare the figures and analyse the trend under each item.

<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>Percentage of total land</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>1970</td>
<td>19.52</td>
</tr>
<tr>
<td>Egypt</td>
<td>1960</td>
<td>19.20</td>
</tr>
<tr>
<td>France</td>
<td>1970</td>
<td>22.60</td>
</tr>
<tr>
<td>India</td>
<td>1970</td>
<td>23.50</td>
</tr>
<tr>
<td>Japan</td>
<td>1960</td>
<td>9.30</td>
</tr>
<tr>
<td>U.S.A.</td>
<td>1950</td>
<td>11.70</td>
</tr>
<tr>
<td>Zaire</td>
<td>1970</td>
<td>3.00</td>
</tr>
</tbody>
</table>

(i) List the top four countries in the order of the average land holdings.
(ii) Identify the countries where the average size of the land holdings is smaller than that of India.
(iii) Compare and contrast merits and demerits of a very large and very small land holding. Take the following points into consideration:
(a) economic viability
(b) intensive and extensive farming
(c) commercial and subsistence farming
(d) mechanization
(e) labour saving and labour-intensive techniques of farming
(f) related socio-economic system

<table>
<thead>
<tr>
<th>Size class (ha)</th>
<th>No. (in million)</th>
<th>% of area (in million hectares)</th>
<th>Percentage of the total land</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Below 0.5</td>
<td>23.28</td>
<td>32.9</td>
<td>5.44</td>
</tr>
<tr>
<td>(2) 0.5-1.0</td>
<td>12.14</td>
<td>17.7</td>
<td>9.10</td>
</tr>
<tr>
<td>(3) 1.0-2.0</td>
<td>13.83</td>
<td>19.1</td>
<td>19.50</td>
</tr>
<tr>
<td>(4) 2.0-3.0</td>
<td>6.72</td>
<td>9.5</td>
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<td>(7) 5.0-10.0</td>
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<td>(8) 10.0-20.0</td>
<td>2.13</td>
<td>3.0</td>
<td>28.32</td>
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<tr>
<td>(9) 20.0-30.0</td>
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<td>9.34</td>
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<td>(11) 40.0-50.0</td>
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<td>(12) 50.0 and above</td>
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<td>0.3</td>
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<td>All India Total</td>
<td>70.22</td>
<td>100.0</td>
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</table>
Some Facts about Green Revolution in India

(A) Per capita Income (1985-86) at 1970-71 prices
India - Rs. 779
Punjab - Rs. 1600

(B) Commercial Nature of Agriculture
(a) Paddy (rice) procured by State agencies 83.7% of the production
(b) Wheat procured by State agencies 57.3% of the production

(C) Mechanisation of Agriculture
(a) Onethird of the country's tractors were in Punjab alone.
(b) Ploughing, sowing, threshing almost mechanised
(c) Animal power replaced by mechanical power

(D) Irrigation
(a) Mechanically operated tubewells provide assured irrigation
(b) Irrigation Index
1970-71 : 71% of the net sown area
1985-86 : 83% of the net sown area
(c) National irrigation index 28% per cent (1983)

(E) Areas under Heavy Yielding Varieties of Seeds
Wheat 100 per cent
Rice 95 per cent

(F) Consumption of Fertilizers
1970-71 = 213,000 nutrient tonnes
1985-86 = 1,098,000 nutrient tonnes

Perhaps the greatest problem of Indian agriculture is the tremendous population pressure it has to groan under. With nearly 250 persons per square kilometre, the hunger for land has remained unsatisfactory. Every possible marginal and even far from fertile pieces of land have been brought under the plough. In the hills, terraced farms rise in stairs up to the top. Forests have been mercilessly cut. The per capita availability of cultivated land has come down to only a fifth of a hectare. And when our population doubles, which it does almost every 35 years, the share of an individual would further slide down to one tenth of a hectare. Under these conditions, the bulk of land holdings are small. What is worse is their most uneven distribution, causing social tensions, violence and discontent. One third of the land holdings are less than half a hectare in size. These holdings account for mere 3.9 per cent of the arable land. On the other hand land holdings between 10 and 50 hectares and above are only 4 per cent in number. They however, claim 31 per cent of the cultivated area.

Thus bulk of the land owners have most uneconomic land holdings. Being too small in size, these holdings have lent to our agriculture, the dominant characteristic of subsistence farming. Here a poor farmer struggles day in and day out on a farm which is too small to support him and his family. Indian agriculture has, therefore,
stagnated for decades.

In the absence of adequate forest and pasture lands, the sources of maintaining natural fertility of the soil have been drying out. The lack of material resources and ignorance of scientific knowledge have only further depleted the soils of their natural fertility. There was a time when animal waste was enough to maintain soil fertility. But now that the population has been making increasingly greater demands on the soils, the subsistence farming techniques are no more relevant. We have been passing through this critical transition from subsistence agriculture to commercial farming based on varied scientific and material inputs. This calls for change at every step of farming.

In the first place the size of the holdings needs to be economically viable. The measures like chabondi are a step in that direction. Further fragmentation of land holdings should be stopped. Small farmers should cooperatively plough their lands with more powerful ploughs or tractors of varying size and strength at least periodically. Even the ploughing techniques need to be scientific. For instance, bunding and contour ploughing are highly beneficial in dry farming to retain the maximum amount of moisture, and to avoid soil erosion.

Chemically treated seeds and high-yielding varieties make all the difference between a poor and a bumper crop. The government has come forward with the improved seeds on a commercial scale. But behind them lie the marathon efforts of our agricultural scientists in developing such seeds through years of experimentation under differing soil and climatic conditions. Now insecticides, pesticides, fungi-
Photo VI Using Machines in Farm Operations

(a) For saving time, machines are increasingly being used in different kinds of farm operations even in medium sized farms. You can see in this photograph how the ground is being leveled with the help of a leveller attached with the tractor.

(b) You can see water sprinklers irrigating the field. It not only irrigates fields uniformly but also stops water loss.

(c) In this picture you can see a newly developed paddy transplanter being used by a farmer in Punjab.

(d) Look at the harvester in operation. The patch of land behind the harvester shows the clean cut it has made
cides and weedicides are available that save crops from insects, pests, fungi and weeds.

Now that the natural fertility is on decline because of hundreds of years of farming, green or bio measures including animal dung also need to be supplemented with chemical fertilizers with suitable and optimum doses. The facilities for soil testing are available for the purpose.

Multiple cropping, intercropping, strip cropping and scientific rotation of crops is a must. This ensures better crop yields besides maintaining the fertility of the soil. Further impoverishment of soil could be a fatal blow to our civilization of at least 5000 years old.

Agricultural tools and implements play an important role in maximising agricultural output and cutting down the time required for different farm operations. Ploughing, sowing, weeding, spraying, irrigating, water sprinkling, harvesting, threshing, transporting and storing. Today tractors, harvesters, combines, tractor trolleys, water pumping sets and water sprinklers are being increasingly used on our farms. Many of them have been developed to suit the requirements of our medium sized farm holdings. The saving of time has become critical in some agricultural pockets where three crops in close succession are raised in a year. For instance in Tanjaur district of the Kaveri Delta the first kharif crop of rice has to be quickly harvested and dried before the second crop could be sown or transplanted in time so that it could ripen prior to a fixed climatic deadline. Likewise, storage of foodgrains is a big challenge. Nearly 10 per cent of our harvest i.e. 17 million tonnes foodgrains are allowed to be wasted every year! Hence scientific warehousing facilities are a must. The government has been active on this front to provide these facilities.

All the above mentioned inputs in Indian agriculture are very largely based on timely and adequate irrigation facilities. High-yielding varieties of seeds and application of chemical fertilizers have no meaning if assured water supply is not available. India has been successful in tripling its food production in the last forty years. Incidentally it coincides also with the tripling of our irrigated land. Nearly 28 per cent of the gross cultivated area has been brought under irrigation. Utilization of total irrigation potential can raise this percentage to about 44 by 2010 A.D. Thus land has already reached a stage of diminishing returns. Water, our only saviour, too is on its way to reach a saturation point. The inevitable law of diminishing returns would begin to operate sooner or later.

The government on its part has undertaken several steps to lift agriculture from subsistence level to more vibrant, self-sustaining level. It has taken legislative measures to abolish zamindari system helping peasants to be land-owners. It has been promoting consolidation of scattered land holding through chabbandi. Efforts are being made to popularize cooperative movement among the farmers to collectively tackle their problems of credit and marketing. There are district lead banks to promote agricultural development. Nationalised banks are also now required to provide loans to farmers on relatively easy terms. National Seeds Corporation, National Warehousing Corporation, National Food Corporation, Indian Council of Agricultural Research, Agricultural Universities, National Dairy Board and several other institutions have been set up. National demonstration farms play an important role at grass-roots level. Agricultural Prices Commission recommends remunerative prices for the crops. The government ensures minimum support prices for various crops to avoid distress selling on the part of the farmers. Considerable progress has

Fig. 6.1 India—Distribution of Rice

Note that the cultivation of rice is confined mainly to coastal strip, especially the deltaic areas having a rainfall of more than 100 centimetres, unless it is well irrigated.
been made in extending irrigation and electricity facilities for farm activities.

In spite of all these measures, there is a view that Indian agriculture deserves far greater attention, priority and resources if it is to grow quickly to its full potential. There is a feeling that rural and urban price levels are kept artificially at two different levels, where prices of agricultural produce are kept under strict control unlike other industrial products. The fact that two-thirds of the manpower is able to account for only a third of the national income, needs to be carefully and sympathetically looked into. No corrective measures should be too dear to a country which still boasts of being an agricultural land and an agrarian society committed to the collective good of one and all. Social justice is the crux of the hour.

Agricultural Seasons

Agricultural activity by and large comes to a standstill during the peak summer season. With the premonsoon showers the farm activities again pick up their tempo. Farmers plough land, prepare nursery and await the break of the monsoon. With its onset they sow their kharif crops in June or early July. By the end of the monsoon these are ready for harvest. These kharif crops include rice, millets, maize, groundnuts, jute and cotton. Pulses also grow during this season. Pulses like arhar take longer to mature.

The next cropping season is called rabi. It largely depends upon subsoil moisture. The sowing is done in November and crops are harvested in April-May. The major crops are wheat, gram and oil seeds like mustard and rape seed.

Besides these two dominant crop seasons, a brief cropping season has been lately introduced mainly in irrigated areas where early-maturing crops are grown. Moong, urad and popular crops of this season it would help in improving the protein content of our diet.

It has been rightly observed that India produces every cereal, pulse, vegetable and fruit, not excluding fibre crop, under the sun. Let us begin with food crops which include cereals and pulses. We may have a look at the national food budget before we study other crops like oilseeds, sugar-cane, potatoes, spices, fruits etc. Beverages and fibres are the other important crops of the Indian agriculture.

FOOD CROPS

Rice (jhalalgai, desting land)

Rice is the staple food crop of India. Being a tropical plant it thrives well in hot and humid climate. That is why it is essentially a kharif crop in India. It requires temperature of 25°C and above and humidity in a rainfall of 100 centimetres and above. Note the ghod on the map. It demarcates very clearly (i) the western coastal strip, (ii) the eastern coastal strip covering all the major deltas, (iii) the north plains and low hills, (iv) foot hills and terai region along the Himalayas, and (v) West Bengal, Bihar, eastern Uttar Pradesh, eastern Madhya Pradesh, northern Andhra Pradesh and the whole of Orissa. June, Aug., Oct.

India has the largest area under rice cultivation in the world. Its output of rice, however, is next only to that of China. About 47 per cent of the total area under cereals is claimed by rice alone. In 1950-51 the area under rice cultivation was 30 million hectares. It has risen to 40 million hectares by 1985-86. During the same period the production of rice also rose from 25 million tonnes to 64 million tonnes. Thus the yield per hectare rose to 15.7 quintals, an increase of nearly two and a half times. Shall we overtake China in this regard?

Our country being a land of unending growing season, and the deltas of Kaveri, Krishna, Godavari and Mahanadi with a dense network of canal irrigation, allows farmers to raise two and in some pockets, even three crops a year. Irrigation has made it possible even for Punjab and Haryana, known for their arid climate, to grow rice. They even export their surplus to other states. Punjab and Haryana raise quality rice for export purposes. The hilly terraced fields from Kashmir to Assam are ideally suited for rice farming with age old irrigation facilities. High yielding varieties, improved planting techniques, assured irrigation water supply and growing use of fertilizers have together led to good and quick results.

Wheat (Rabi Lang)

The story of wheat is even more fascinating than that of rice. It is one of the oldest crops introduced in India at least four thousand years ago from the Middle East, i.e. mainly East Mediterranean and West Asia. It does well on the loamy soils of the Northern plains covering Punjab, Haryana, western Uttar Pradesh, Haryana, western Uttar Pradesh, in that order. It also grows well in the black soils of Madhya Pradesh. The minor areas extend to the rest of Uttar Pradesh, Bihar, Rajasthan, Gujrat and Maharashtra. It is, however, essentially a crop of north India, growing at 19°C.

It requires a cool and humid climate during growing season and a dry warm climate at the time of ripening. Annual rainfall of 50 to 75 centimetres is generally suitable. All these requirements make it an ideal rabi crop. A few light winter showers or assured irrigation ensure a bumper harvest. Unlike the rice crop, it is not so much at the mercy of the elements of nature. In 1950-51 the area under wheat was 9.7 million hectares. By 1985-86 it rose to 23 million hectares. The production shot
A significant share of these crops is consumed by the producers directly. Wheat, rice, and maize are the major crops consumed directly by the producers.

ECONOMIC GEOGRAPHY

Agriculture by its nature is classified as subsistence type. The production of these crops is not market-oriented. The crops are grown to meet the subsistence needs of the producers.

Cotton, sugarcane, and mustard are the major crops grown in the market-oriented sector. The production of these crops is aimed at meeting the demand in the market.

The breakthrough in increasing agricultural productivity is attributed to the Green Revolution. The credit for this goes to the scientists in the Indian Council of Agricultural Research who developed several high-yielding varieties through dedicated experimentation. Assistance in this work was provided by the former president of America, Mr. Buriel, an independent agricultural economist from the USA, worth mentioning.

Millets

Millets like jowar (sorghum), bajra (pearl millet), and ragi (finger millet) are also called coarse grains. They are kharif crops and are mainly grown in the dry areas in the following order: ragi (damp areas), jowar (moist areas), and bajra (dry areas). Ragi, which requires relatively more rain, is grown more commonly in Karnataka and Tamil Nadu. Jowar, in Karnataka, Andhra Pradesh, Maharashtra, and Madhya Pradesh, and bajra in the drier parts of Maharashtra, Gujarat, Rajasthan, and southern Uttar Pradesh.

India leads the world in the production of millets. The area under these crops has not increased, but the production of jowar and bajra has increased from 13 million tonnes to 14 million tonnes. Millets have a protein content higher than both wheat and rice.

Maize

Maize, being an American crop, is relatively new in India. It is gaining popularity because of its high yields, and its adaptability to various soils and climatic conditions. Uttar Pradesh, Rajasthan, Haryana, and Punjab are the major producers.

In 1950-51, the area under this crop was 2.8 million hectares. It has risen to nearly 6 million hectares by 1985-86. The production has also jumped from less than 2 million tonnes to 7 million tonnes. Thus, the productivity has also doubled.

Pulses

India is the largest producer as well as the consumer of pulses. They have been a major source of protein for our people. As meat is out of reach for most of the people, pulses are a major source of protein. The pulses include green peas (mung), yellow peas (moong), black gram (urad), lentil (masoor), and chickpeas (chana). They are grown all over the country except in areas with heavy rainfall. These are again mostly rainfed crops. Being leguminous, these plants help in restoring the fertility of the soil and are, therefore, grown in rotation with other crops. Inter-cropping is another common practice.

In 1950-51, the land under pulses was nearly 19 million hectares. It has risen to 23 million hectares, the highest in the world. The production has increased to 1.7 million tonnes with a marginal increase in yield from 4.8 quintals to 5.4 quintals per hectare.

One thing is clear from the facts mentioned above that the prospects of bringing more pulses within the reach of common man are bleak. The limitations of the so-called Green Revolution are obvious. For heavy yielding varieties, assured irrigation, and higher input of chemical fertilizers are the pre-requisites. Similarly, the support prices should be equally attractive. Nevertheless, the only positive change is introduction of a short duration third crop of moong and urad, which can be grown as post robi crop.
Our Food Budget of Tomorrow

The food requirement of a country is determined by the size of its population and its living standards. Population of our country has now doubled itself every 35 years. Despite the substantial success achieved in reducing the growth rate of population, it is feared that population will not stabilise below 1500 million, by the middle of next century. More reasonable estimates put this limit between 1600 and 1700 million in the latter half of the 21st century.

We will require 400 million tonnes of foodgrains alone to meet the food requirements of 1600 million people. Even by 2000 A.D., i.e. in next 10 years, the need would be between 235 and 250 million tonnes. Although this is not impossible, it would put tremendous strain on our limited financial resources, affecting the developmental inputs in other crucial sectors including health and education. By 2025 we would reach a saturation point in our irrigation potential by utilising the maximum of 105 million hectare metres.

Oilsseeds

Vegetable oil being the common medium of cooking, oilsseeds are as important as the pulses. The principal oilsseeds are groundnuts, rapeseeds and mustard seeds. While the former is a kharif crop, depending entirely upon moderate but timely rainfall, the latter is a rabi crop essentially confined only to non-irrigated areas. As such their production as well as productivity is subject to climatic fluctuations and market speculations. The other oilsseeds are sesame, linseed, castor seed, sunflower seeds, cotton seeds and copra. Rapeseeds and mustard seeds belong to the wheat belt of north and central India. Groundnut, on the other hand, is grown in west and south India. Gujarat is the dominant producer of groundnut. While the population has been increasing at 2 per cent per annum the demand for oil has been risin at 5 per cent a year. Why should it be so? In 1950-51 the groundnut production was 3.5 million tonnes. It rose to 6 million tonnes in 1970-71. And in 1985-86 it was 5.5 million tonnes only, whereas it had touched 7 million mark in 1983-84. The production of rapeseed and mustard seeds, however, is more steady. It has risen from 0.7 million tonnes in 1950-51 to 3 million tonnes in 1984-85, dropping next year to 2.6 million tonnes. The total oilsseeds production over the last thirty-five years has risen from 5.1 million to 12.9 million in 1984-85. It again declined to 11.1 million tonnes in 1985-86. Their productivity has crawled from 4.8 quintals to 5.9 quintals per hectare in 1983-86. Recently, improved varieties of mustard and rapeseed has led to increased production in 1988.

Tropical Plant

Sugar Cane and Potato

Over the years sugar has become an important ingredient of our daily food intake. For our daily sugar needs, we depend exclusively on sugarcane. Incidentally India is claimed to be the original home of sugarcane. India has the largest area under sugarcane and its production is also the highest in the world. Uttar Pradesh is the leading producer, followed by Maharashtra, Punjab, Andhra Pradesh, Bihar, Tamil Nadu and Karnataka. Sugarcane requires well drained fertile soil, and plenty of manure and fertilizers. It needs hot and moist climate and a rainfall of about 100 centimetres. It really does well in irrigated lands with abundant sunshine, temp 25°C.

In 1950-51, the area under sugarcane was 1.7 million hectares. It rose to 2.9 million hectares in 1986-87. The production jumped from 17 million tonnes to 123 million tonnes during the same period. Thus
the productivity has nearly doubled from 33 tonnes to 60 tonnes per hectare. In Hawaii, it is more than three times the national average for India. In Tamil Nadu, it is as high as 100 tonnes because it is a tropical crop.

Intensively grown by the Portuguese in the 16th century, potatoes are used as a stock vegetable. Its major producers are Uttar Pradesh, West Bengal, and Bihar. In 1986-87, 250,000 hectares were under potato. The production was over 12 million tonnes. Since 1951, the area under potato increased by 449 per cent, production by over six times and yield per hectare by 123 per cent. In countries like the USSR, Poland and Ireland, it is one of the staple foods. Himachal Pradesh in our country specializes in potato seed production.

SPICES AND FRUITS

What refrigeration can do today is being done by the spices for centuries — preserving meat, fish etc. in European countries. Hence their demand in Europe raised a special interest in trade with India. Pepper, cardamom, cloves, mace, cinnamon, ginger, nutmeg and cassia etc. are together known as spices. They are mainly grown in the Malabar coast of Kerala and Karnataka. In 1985-86, India exported spices worth 255 crores of rupees. Pepper exports reached a high of 37,000 tonnes worth nearly 200 crores of rupees. Cardamom exports were worth Rs 53 crores. But the country has now to import cloves, nutmeg, mace, cinnamon and cassia worth Rs 25 crores.

Fruit

Intensive cultivation of vegetables, flowers and fruits is called horticulture. Indian mangoes and bananas are now in greater demand outside the country. India is a prolific supplier of tropical fruits like coconuts, jackfruits, cashewnuts, pineapples, bananas and oranges. Of the temperate fruit, apples, plums, peaches, almonds, apricots, grapes are grown in plenty. While Jammu and Kashmir and Himachal Pradesh lead in the fruit of the temperate region, others are grown in various parts of peninsular India and the Northern Plains. India earns foreign exchange by exporting cashew nuts. Part of the raw cashew nuts is imported and processed here before they are re-exported. In 1985-86 India's export of cashew nuts was of the order of Rs. 215 crores. Research has shown that the current production of 2 kg per tree could be raised almost ten-fold.

The potential of horticulture in India still remains almost untapped. In 1979-80, the area under bananas was 274,000 hectares with production at 4.3 million tonnes. Nearly one million hectares of land was under mangoes and its production was 8.4 million tonnes. Apples were grown in an area of 138,000 hectares with an annual production of 718,000 tonnes in 1979-80. Between 1967 and 1987 there was ten-fold increase in apple production.

BEVERAGES

Tea, coffee and cocoa are the beverage crops of India. India has been the leading producer of tea. It represents a spectacular success in plantation agriculture run on the most scientific and commercial lines. Though introduced by the British in their own interest, the industry is now in Indian hands. It employs a million persons directly and another equal number indirectly. Thus, it is a labour intensive industry.

Tea grows well in deep and fertile well-drained soil. It requires warm and moist climate all through the year. Frequent showers well distributed over the year ensure continuous growth of tender leaves. Undulating plains of the Brahmaputra valley extending into the low hills of Assam is the home of Indian tea. Hills of Darjeeling and Jalpaiguri in northern West Bengal and the Hills of the Nilgiris are other tea producing areas. They are also known for their

![Fig 6.4 India-Distribution of Tea and Coffee](Note the areas producing tea and coffee. Name the states known for tea and coffee cultivation.)
In 1950-51, there were 314,000 hectares under tea cultivation. The area rose to 375,000 hectares in two decades. The production, which was 275,000 tonnes in 1950-51, has steadily risen to 673,000 tonnes in 1987 accounting for half of the world output. The exports have also risen to 210,000 tonnes in the same year, fetching nearly 329 crore rupees. Sri Lanka very closely competes with India. Kenya has also emerged as a new exporter of tea. India's domestic tea market has been growing much faster and hence its inability to export enough.

Coffee

Coffee is produced in the hill areas of the southern states, especially in Tamil Nadu, Kerala, and Karnataka. The cultivation is seasonal, with the main harvest in the months of October to December. Coffee is a key export commodity, and significant for the economy of the southern states.

Fibres

Cotton, jute, wool, and natural silk are the major fibres. While the first two are derived directly from the plant, the latter are obtained indirectly.

Cotton

The original home of the cotton plant is India. The ruins of our past civilization reveal a high degree of civilization. The domestic cotton is grown in all parts of the country, with the southern states being the major producers.

Cotton in the Raj

In 1950-51, there were 5.9 million hectares under cotton cultivation. The area rose to 7.5 million hectares in 1985-86. The production also increased from 3.9 million tonnes in 1950-51 to 10.4 million tonnes in 1985-86. Cotton is harvested during the winter months, with the main season lasting from November to February.

Jute

Jute is a versatile fibre, known for its strength and durability. It is used in a variety of applications, including bags, ropes, and textiles. Jute is also used as a raw material for making paper.

India has entered the civil aircraft industry. But owing to the need for self-sufficiency in defence requirements, it has developed aircraft industry at Bangalore, Koraput, Nasik, Hyderabad, Koruru, Kanpur, and Lucknow. Each place specializes in a certain task. In 1985-86, the main focus is to produce a hybrid cotton variety. As a result, 1985-86 production was much higher. The yield per hectare has risen from 2.7 quintals to nearly 7.5 quintals. It stands next only to tea as a popular beverage in the world, as well as in India. If tea belongs to the north-eastern part, coffee is confined to the south-western part of the world. Unlike tea, coffee has been cultivated in India for less than a century. Coffee grows in tropical highlands at altitudes varying between 900 and 1800 metres above sea level. In India, coffee grows well on the coffee belt of Tamil Nadu and Kerala. In 1950-51, the area under coffee was 97,000 hectares with a production of 25,000 tonnes. In 1984-85, the area under coffee had risen to 234,000 hectares, and production was 160,000 tonnes. In 1985-86, nearly 100,000 tonnes of coffee were exported earning 275 crores of rupees. The yield per hectare has risen from 2.7 quintals to nearly 7.5 quintals.

India produces a wide range of electrical goods, chemical and heavy equipment.
goods and appliances. But more importantly, it now manufactures heavy equipment like electrical motors, transformers, water turbines, and electrical traction motors. Bhopal, Hardwar, Thrissur, Hyderabad, Raipur, Bangalore and Jagdishpur are the important centres engaged in heavy electric. Several units manufacture transmission line towers, both for home and world markets.

Electronics Industry
From the manufacture of radio receiving sets in private sector, in late forties, the electronics industry has made very rapid progress. In 1983 its total production was worth 1360 crores of rupees. By 1988 it rose to 6500 crores. This represents nearly a five times growth. In a single year 1987-88 the growth was 37.7%. The industry has a very wide range of production like consumer electronics mostly radio and television sets, control instruments and industrial electronics, computer systems, communication and broadcasting equipment, aerospace and defence equipment, and electronic components. India has emerged as one of the exporters of electronic goods. Besides the hardware, India has earned high reputation in the development of software and has good international market.

Chemical Industry
It is fourth in size, next only to (i) iron and steel, (ii) engineering, and (iii) textiles. There has been rapid growth in the fields of organic and inorganic chemicals. These heavy chemicals facilitate down-stream products like drugs, dyestuffs, pesticides, plastics, paints etc.

Pesticides which include insecticides, herbicides, fungicides, rodenticides, have become very important for agriculture and for public health purposes. DDT plant came up in 1954 in Delhi.

Pharmaceuticals are yet another area in which India has given a lead to the third world. It is highly diversified and at the same time vertically integrated. The country is almost self-sufficient in basic and bulk drugs. Some imports are still necessary. But these are compensated for by exports to a certain extent. In 1985-86 drugs worth nearly 194 crores of rupees were exported.

Petro-chemicals
Owing to their superior properties, petrochemicals have started substituting traditional raw materials like wood, glass and metal. They have application in domestic, industrial and agricultural fields. For instance, plastics have brought about revolutionary changes. You have already seen a long list of by-products derived from crude petroleum. The industry is located near Bombay and Vadodara. Now it is spreading to other parts of the country.

Fertilizer Industry
According to one estimate, the natural fertility of our soil is capable of producing only 81 million tonnes of foodgrains. In 1988-89 we crossed 170 million tonne mark. By 2000 AD our foodgrain requirements would rise to about 235 million tonnes and by 2050 AD when the population is likely to stabilise around 1500 million, the food requirement would rise to 380 to 400 million tonnes. This would explain the need to augment fertilizer production on a continuing basis for decades to come.

When we became free the use of fertilizers was almost nonexistent. By 1950-51 a modest beginning was made in producing fertilizers at home.

In 1950-51 the world's average consumption of fertilizer per hectare was four times that of India.

In spite of spectacular rise in production, the country has to import fertilizers from abroad to augment the local supply. By 2000 AD the country's needs are estimated to be around 20 million tonnes and by 2050 AD, 40 million tonnes of fertilizers. In 1987 the country had 42 large fertilizer plants and 70 small plants in different parts of the country. So far they tended to be located near the reserves of raw materials like coal and petroleum and big power plants that had enough electricity to produce nitrogenous fertilizers from the

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<td>1986-87 (tonnes)</td>
<td>1986-87 (tonnes)</td>
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<td>Nitrogenous fertilizers</td>
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<tr>
<td>Phosphatic fertilizers</td>
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<tr>
<td>Consumption of fertilizers per hectare includes imported urea</td>
<td>50 kg</td>
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<tr>
<td>11,000,000</td>
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trogen in the air. Now, a new element named natural gas has appeared on the horizon. It provides valuable raw material. But more importantly, through pipelines it can be easily transported to the desired market distribution centres. The result would be an equitable distribution of industry and great reduction in the load on railways and also in transportation costs. Fertilizer plants are set up jointly by Indian and local collaborators in West Asian countries. Assured proportion of the production would be available for India in a way with somewhat reduced transport costs. India is deficient in potash and has to import it from abroad.

Though fertilizer plants have raised their operational capacity to 60-84 per cent, yet 1.5 million tonnes of fertilizers is to be imported in 1988-89.

The Cement Industry

The cement consumption is an index of growing tempo of industry and construction work. The housing industry is bound to gain in momentum every year as a tremendous backlog needs to be cleared up both in urban and rural areas. The cement industry was set up at Madras in the south in 1904. There are nearly 15 factories today widely scattered all over the country. In 1950 the cement production was just 2.7 million tonnes. By 1987 the installed capacity was 34 million tonnes, and the production of cement had risen to 44 million tonnes in 1988-89. It was nearly twice as fast as the growth rate. The cement production target of 50 million tonnes has been realized by 1989-90.

Defence Production

Constant vigilance is the price of freedom. Our priority, therefore, is the production of defence equipment for our army, navy, and airforce. We produce] tanks, battleships and supersonic planes. We are developing missiles and a large variety of electronics defence equipment. What is important is “R & D” in this technology which costs a lot.

EXERCISES

Review Questions

1. Answer the following questions briefly:
   (i) Explain how agriculture and industry go hand in hand?
   (ii) What is the latest priority of industry—self-sufficiency or a higher degree of efficiency and competitiveness?
   (iii) In what different ways are the industries classified?
   (iv) What is the significance of “value addition” in increasing national wealth?
   (v) Which are agro-based industries in India? What is their significance in Indian economy?
   (vi) Why iron and steel industry called a heavy industry?

2. Compare and contrast textile and steel industry in India.

3. Match the items in the two columns correctly in respect to their labour intensive and capital intensive nature, and their other contribution to Indian economy.

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) Bangalore</td>
<td>Electrical sub-engine</td>
</tr>
<tr>
<td>(ii) Calcutta</td>
<td>Electrical turbines</td>
</tr>
<tr>
<td>(iii) Chittaranjan</td>
<td>Railway coaches</td>
</tr>
<tr>
<td>(iv) Cochin</td>
<td>Big oil refinery</td>
</tr>
<tr>
<td>(v) Gurgipun</td>
<td>Aircraft</td>
</tr>
<tr>
<td>(vi) Harwar</td>
<td>Stainless steel</td>
</tr>
<tr>
<td>(vii) Kapurthala</td>
<td>Perforator</td>
</tr>
<tr>
<td>(viii) Mathura</td>
<td>Gen cutting</td>
</tr>
<tr>
<td>(ix) Salem</td>
<td>Steel alloy</td>
</tr>
<tr>
<td>(x) Sindri</td>
<td>Small car</td>
</tr>
<tr>
<td>(xi) Surat</td>
<td>Ship building</td>
</tr>
<tr>
<td>(xii) Virakhapatnam</td>
<td>Jute textiles</td>
</tr>
</tbody>
</table>

4. Give one word for

   (i) An industry concerned with heavy and bulky raw materials and finished products and their consequent transport costs.
   (ii) An industry for which the state or its agency undertakes economic activities and controls the means of production and distribution.

5. Write short notes on:

   (i) Petro-chemical industry
   (ii) Ship building industry
   (iii) Fertilizer industry
   (iv) Sugar Industry

Hold class discussion on any one of the following:

   (i) The role of public sector in rapid industrialization
   (ii) The role of industries in national wealth
   (iii) Can industrialization eradicate poverty
UNIT FOUR

Trade, Transport and Communications

As a result of territorial division of labour and large scale production in agricultural and industrial sectors the way of our living have undergone tremendous change. Efficient means of transport and communications is a pre-requisite of the modern industrial societies. Roadways, railways, waterways and airways together with various means of communications have become the lifelines of the nations and their economies. They help in quick movement of raw materials and finished products. Thus they help in both production and distribution. They help in increasing the mobility of people and add to their earnings and emotional satisfaction.

Fast means of transport, backed by far more powerful and instant means of communications, have made our world a small and compact place to live in. Many individual families are spread over different continents and their members can talk to each other instantly and meet at a common place only at a few hours notice. Market developments of one country affect markets of several other countries. We are now living in an increasingly interdependent world.

India of today is a well knit family despite its size, diversities and linguistic and other variations. Railways, airways, newspapers, radio and television, and cinema have been contributing to its emotional integration and socio-economic regeneration.

The trade both at national and international levels has added to the vitality of the economy. It has enriched our life and added substantially to growing amenities and comforts of life. It underlines basic universality of human cultures.
Trade, Transport and Communications

We are now living in a progressively shrinking world. All the three domains of the earth—land, water and air, provide excellent means of transport. The land transport network consists of roads and railways. The waterways comprise deep-sea, coastal and inland navigation. Atmosphere offers scope not only for air travel through aeroplanes but also a means for wireless communication, the fastest of its kind.

**FOR DOING IT YOURSELF**

1. Go through the list of means of transport mentioned below and classify them according to the three domains—land, water and air—of the earth.

**Means of Transport**


In each of the three categories, re-arrange items (a) as per their chronological order; and (b) their speed from slowest to the fastest.

2. One fine morning the sea-route distance between Bombay and London was reduced by as much as 7600 km. Find out what it was due to.

Likewise there was a time when it took a few months to send a message from India to London in the UK. Now the travel time is reduced to a few hours only and communication is instant. Find out similar facts and write a short note on our shrinking world.

3. Study the table carefully. Draw your inference of how best each one of them can best meet its all the requirements.

**TABLE 8.1**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Country</th>
<th>Produces more than its needs</th>
<th>Produces just enough to meet its needs</th>
<th>Indifferent in meeting its needs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Myanmar</td>
<td>Rice and tea</td>
<td>cotton</td>
<td>Machine and tools</td>
</tr>
<tr>
<td>2.</td>
<td>India</td>
<td>Cotton textiles, tea, jute, iron-ore, leather goods</td>
<td>foodgrains</td>
<td>Mineral oil, petro-chemicals and weaponry</td>
</tr>
</tbody>
</table>
3. USSR - Mineral oil and petro-chemicals, weaponry, paper
4. Japan - Aircraft, electronics, timber, paper, fish, goods, ships

4. Study Table 8.2 carefully.

### TABLE 8.2

<table>
<thead>
<tr>
<th>Roads</th>
<th>1980-81</th>
<th>1982-83</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(km)</td>
<td>(km)</td>
</tr>
<tr>
<td>(a) Surfac ed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unsurfaced</td>
<td>357,019</td>
<td>322,077</td>
</tr>
<tr>
<td>Total length</td>
<td>398,947</td>
<td>354,624</td>
</tr>
<tr>
<td>(b) Road Density</td>
<td></td>
<td></td>
</tr>
<tr>
<td>per sq km</td>
<td>0.12</td>
<td>0.14</td>
</tr>
<tr>
<td>(c) Comparative Road Density</td>
<td></td>
<td></td>
</tr>
<tr>
<td>India</td>
<td>14</td>
<td>18</td>
</tr>
<tr>
<td>Japan</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(i) Find out which of the roads — surfaced or un surfaced — have been increasing rapidly.
(ii) See how India compares with Japan and the USA in regard to road density and roads and passenger ratio.

5. Study Table 8.3 and do the activities given below.

### TABLE 8.3

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(in %)</td>
<td>(in %)</td>
<td></td>
</tr>
</tbody>
</table>

- **1. Coal**
- **2. Cement**
- **3. Iron Steel**
- **4. Foodgrains**
- **5. Oils and Fats**
- **6. Sugarcane**
- **7. Sugar**
- **8. Chemicals**
- **9. Mineral Oil**

(i) List two commodities having a declining share in freight. See if you can explain it in each case.
(ii) Identify the most dominant commodity in railway freight. Find out how its share can be reduced.
(iii) List items to show how railways have been increasingly contributing to growth of agriculture.
(iv) Write down implications of growing rail traffic in cement, iron and steel, and mineral oil.
(v) Find out how the growing burden of mineral oil on railways can be reduced to the minimum.
(vi) Guess about the railway freight scenario of 1995 pointing out major expected changes.

6. Study Table 8.4 and do the activities given below.

### TABLE 8.4

<table>
<thead>
<tr>
<th>Indian Railways</th>
<th>1981</th>
<th>1985</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A) Total Route Length (in km)</td>
<td>33,596</td>
<td>35,876</td>
</tr>
<tr>
<td>(B) Electrified Route Length (in km)</td>
<td>1383</td>
<td>1478</td>
</tr>
<tr>
<td>(C) Number of Locomotives</td>
<td>61,315</td>
<td>77,123</td>
</tr>
<tr>
<td>(a) Steam</td>
<td>8,209</td>
<td>8,558</td>
</tr>
<tr>
<td>(b) Diesel</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>(c) Electric</td>
<td>68</td>
<td>155</td>
</tr>
<tr>
<td>(D) Number of Wagons</td>
<td>39,596</td>
<td>33,614</td>
</tr>
<tr>
<td>(E) Number of Coaches</td>
<td>19,628</td>
<td>38,184</td>
</tr>
<tr>
<td>(F) Goods Engineering (in million rupees)</td>
<td>93</td>
<td>286</td>
</tr>
</tbody>
</table>

(i) Note that route length has not increased much, but running track has increased considerably. See what inference you can draw.

(iii) Compare the growth of locomotives with wagons and coaches. How would you describe it? Also take note of the tremendous growth.

Early man, as a hunter and food gatherer of necessity, had to lead a nomadic life. Agricultural revolution, some five thousand years ago, opened up new possibilities of leading a settled life. It was a step towards modern civilization. The self-contained village economy, so characteristic of India, was a natural conclusion of his quest for such a life. It was indeed a high point of his achievement. Today, however, we have moved to the other extreme where the whole country has become a single market, and the world has been moving toward interdependence, if not integrated, global economy. In this chapter you would see how the modern means of transport and communication serve as lifelines of our nation and its modern economy.
The Indian railways were in a bad shape. They were suffering from the excessive strains of World War II. They were in need of maintenance, upgrade and many replacements. The railways were in a state of near failure. The railway workshops were closed and the factories were completely out of order. The railway transportation was being used to transport war materials. The railway tracks were damaged and the station buildings were in dilapidated condition. The railway employees were suffering from shortages of food and clothing.

The Indian government took steps to improve the situation. The railway workshops were reopened and the factories were brought back into operation. The railway tracks were repaired and the station buildings were renovated. The railway employees were provided with better food and clothing. The railway transportation was used to transport war materials. The railway workshops were closed and the factories were completely out of order. The railway transportation was being used to transport war materials. The railway employees were suffering from shortages of food and clothing.

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modernisation programme, multi-channel micro-wave link for fast and reliable communication was in operation for 14,182 km, and automatic signalling was introduced over a track of 1693 km.

Indian railways still consist of three types of gauges, (a) broad gauge (1.67 metres), (b) metre gauge (1 metre), and (c) narrow gauge (0.76 metres). The third category is confined to only a few hill stations where only a light railway is found viable. However, for the continuation of metre gauge there is not much of a justification except perhaps the paucity of funds to replace them by the broad gauge. Transhipment of goods from one gauge to the other leads to delays and losses, which are avoidable. Not much progress has been registered in this direction in spite of railways' pronounced policy of having only a single broad gauge railway track all over the country.

Over 98 per cent of the passengers travel by the second class. Due to overcrowding, their plight is beyond description, particularly those who have to travel long distances. Provision of more and more sleeper coaches is a step to meet the challenge. Computerised reservation system is, yet another measure to the same end. It has reduced malpractices considerably.

Railways' earnings are from goods traffic they carry. In 1984-85 their goods traffic revenue was Rs 3465 crore as against Rs 3922 crore from second class passengers.

Railways have to cope with the changing pattern of the agro-industrial scenario of the country. Its contribution to agriculture can be adjudged by the amount of fertilizers and foodgrains it has to carry year after year. Likewise, coal, mineral ores, and mineral oil have now become the dominant commodities to be hauled over long distances. Electrification of railway track, setting up of thermal power stations near coal and lignite mines, increased use of hydro-electricity and greater use of natural gas to produce electricity are some measures that would ease the burden on the railways. The pipelines carrying mineral oil and natural gas, separately, are also the steps in the right direction.

Railways have introduced long distance super fast trains running well over hundred kilometres per hour. Three trains cover over 3000 km each. Gujarat- Trivandrum Express contains the longest distance of 3974 km. There are eight express trains covering between 2000 and 3000 km in each. Find out these trains, the terminals they connect, time they take, the states they traverse, and important cities they touch on their way. Where could you report all this information? List trains that especially connect Delhi to various state capitals. Railways have also introduced fast trains to carry heavy goods quickly to their destinations. Container service has been introduced to provide short to over 100 km which the trucks had been doing so far. The container services reduce transportation and delivery time. They ensure greater security of goods and freedom from pilferage. The services have proved more economical in the railways and its customers.

An account of Indian railways should remain incomplete without a passing reference to its role in reducing fast and expensive traffic in metropolitan Rlys. Bombay, Madras and Calcutta—mainly its Metro Service.

Indian Railways is one of the largest government organizations. As many as 16,001,000 passengers are transported by rail daily, and another 200,000 persons travel in its trains. Railways have to take care of their welfare and working conditions including job satisfaction.

**Pipeline Transport Networks**

Pipeline transport network is a new addi
extend up to twelve nautical miles. It has some of its rich oilfields in the deep sea away from the coastline. Its economic zone extends over two hundred km into the sea along the coastline. It is nearly 2 million sq km in area and needs to be protected.

The importance of oceanic waterways for the country can be judged from the foreign trade we conduct every year. Both our imports and exports are important for our economic growth and development. Table 8.3 presents a picture of our foreign trade since independence in terms of its value.

Although bulk of the international trade is carried by seaways, a part of this trade is also carried on land by air across the borders.

During a period of 36 years, the value of trade has increased by over 27 times. During the same period the imports have increased by about 34 times, but exports have lagged behind as they could barely increase by 20 times. As a result, the gap between exports and imports has been generally widening. From a mere amount of about 100 crores rupees in 1950-51 to as much as 7516 crores in 1986-87. A more realistic statement could be that the gap is as large as one and a half times of our exports in the year 1986-87. This is a situation which should cause grave concern to all of us.

Among our exports, the first six items at the top in 1950-51 were (i) cotton yarn, thread and textiles, (ii) jute manufactures, (iii) tea, (iv) vegetable oils and materials, (v) leather hides and skins, and (vi) tobacco. However, during three years 1982-84, 1984-85 and 1985-86, entirely different items have displaced them. The items in order are: (i) gems and jewellery, (ii) cereals, (iii) cotton and wool textiles, (iv) machinery and transport equipment, (v) iron ore and steel, (vi) leather goods and footwear. The nature of exports in the eighties indicates a new trend. The items of export, unlike the one in earlier decades, are not raw materials or semi-processed goods. They are articles in which value has been added through skills e.g. gems and jewellery, cotton and wool textiles, leather goods and footwear. Others are of a general origin and belong to the class of engineering goods. It throws light on the fast changing nature of our national economy, which was predominantly primary in nature. It clearly shows that with agriculture as the base of our economy, we are gradually moving towards the secondary sector of economy. There is a tremendous scope to add value to our primary products, and at the same time utilise our huge man-power resources. The export of a large number of engineering goods and high value sophisticated items like electronics is a prerequisite to turn the balance of trade in our favour. Do you notice a large number of items in which our production has increased considerably but which do not figure in our export lists? This is because of our own growing home market. Do you justify the rapid growth in our iron-ore exports? Is it not interesting that we import large amounts of precious stones and cashew nuts but we export them again?

What are we really exporting? Apparently those items but something else of greater significance which we have in abundant measure, namely human skills.

Let us move from exports and imports to the gateways through which they have to pass, namely our ports that give access to oceans, providing links with other continents or far-off lands.

Major Ports

Nehru Port is the latest addition to our major ports taking their tally to twelve. This is a port across the Bombay Harbour and is meant to relieve the heavy congestion at Bombay port.

Kandla in Kutchh was the first port developed soon after independence to ease the increased pressure on Bombay port in the wake of loss of Karachi to Pakistan. In order to cater to the north-western part of the country namely Rajasthan, Haryana, Punjab, Jammu and Kashmir and Himachal Pradesh, Kandla was developed as a major port. Kandla is a tidal port. A free trade zone has also been developed to accelerate its growth. It handles crude oil, petroleum products, fertilizers, foodgrains, salt, cement, sugar and edible oils. Bombay is the biggest port with a very spacious natural well-sheltered harbour. It also handles between a quarter and fifth of the country's foreign trade in petroleum and petroleum products, machinery and other dry cargo.

Marmagao in Goa is another important major port ranking fourth in terms of total volume of trade. Iron ore is exported from this port in a very large measure. New Mangalore located in the state of Karnataka is yet another addition to the list of major ports. It caters to the export of Kudremukh iron ore and iron concentrates. It also handles fertilizers, edible oils, and polished granite stone. Cochin is the sixth major port on the western coast. It is located at the entrance of a lagoon (salt lake) and is a natural harbour. It handles petroleum products, fertilizers, raw materials and other general cargo.

Tuticorin is a new major port in Tamil Nadu located at the south-eastern extremity of the country. It handles a variety of cargoes including coal, salt, edible oils, chemicals etc. Madras is one of the oldest artificial port on the east coast. It handles general cargo and ranks next only to Bombay. The trade of this port comprises petroleum products, crude oil, fertilizers, iron ore and dry cargo.

Visakhapatnam in Andhra Pradesh is the deepest landlocked and protected port. An outer harbour has been developed for exporting iron ore and petroleum products. It also handles general cargo.

Paradeep in Orissa is a newly developed port and specialises in exporting iron ore. It also handles coal, and other dry cargo. Calcutta is an inland riverine port, some eighty miles away from the sea. It serves a very large and rich hinterland of Ganges-Brahmaputra basin. It is a tidal port and needs constant dredging of Hooghly. For maintaining a minimum level of water in the river to ensure its navigability, water is supplied from Farrakka Barrage on the Ganga. In order to relieve the growing pressure on Calcutta port, a new major port has been developed down stream at Haldia. It supplements the facilities available at Calcutta. Haldia handles mineral oil, petroleum products, fertilizers and other dry cargo.
Shipping Fleet

In 1947 the total weight of India's ocean-going ships was not even two lakh tonnes. However by 30 June 1987, the total tonnage was 32.3 million tonnes. It has thus increased by more than 30 times. India now owns the largest merchant shipping fleet among the developing countries and stands 16th in the world's shipping tonnage.

India has 226 minor ports along its coastline of over 6600 km. They promote coastal trade along with fishing. There are tremendous possibilities of increasing our fish-catch in coastal waters and deep seas. Already fish and fish preparations have appeared on our export list, with bright prospects in near future.

India's major rivers like the Ganga, Brahmaputra, Godavari, Krishna, Mahanadi, Narmada and Tapi together provide inland navigational potential of about 5200 km. They are navigable by mechanized craft. But only 1700 km are presently being utilized. In addition there are some navigable canals, very little of which are being actually utilized. Besides Brahmaputra, it is expected that now Ganga too would be used for navigation between Farakka and Patna to begin with, and then up to Allahabad in due course.

Water transport is cheaper than road transport as the element of friction during traction and maintenance are less. This compensates for its slow speed.

Airways

Our world has all of a sudden become a small place to live in. There was a time when it would have taken months and months to go from one end of the country to the other. With the advent of motor cars and railway trains, things have changed dramatically. It now takes only seventeen hours to reach Delhi from Bombay or Calcutta by Rajdhani Express. How wonderful it must be when you can now cover the same distance in less than two hours by air service. The air travel today is not only the fastest mode of travel but also the most comfortable.

In our country air travel is useful, for one more reason. It can cover very difficult terrains like high mountains, dreary deserts, thick forests and long stretches of seas with great ease. Think of the north-eastern part of the country with big rivers, frequent floods, thick forests, high mountain ranges and international frontiers raising barriers in surface travels. But air travel has made things far more easy than one could hardly imagine. Suppose you are in Calcutta and want to go to Agartala in Tripura by road or rail or inland waterway, can you work out the time and money you would require in such a case? But by air it would take not only less of your precious time but may also be more economical.

In 1947, Indian civil aircraft airlifted 110,000 passengers. Their annual total number crossed one crore mark in 1985. In 1952, the Indian government set up two public sector undertakings. Since then the Indian Airlines take care of domestic travel and Air India looks after international travel. In 1981, the third airline called Vayudoot was incorporated. It runs feeder services to supplement the Indian Airlines.

The Indian Airlines have succeeded in putting almost all the state capitals on the air map of India. This is true also of industrial centres and places of tourist interest. Besides the four metropolitan cities, namely Bombay, Calcutta, Delhi and Madras which have international airports, there are 91 civil aerodromes maintained by the Ministry of Civil Aviation, as on 1 June, 1986 and 110 aerodrome communication stations. The Indian Airlines run air services to the neighbouring countries of Afghanistan (Kabul, Pakistan (Lahore and Karachi), Nepal (Kathmandu), Bangladesh (Dhaka), Sri Lanka (Colombo) and Maldives (Male). The Indian Airlines had a total fleet of about 50 aircrafts in 1987. It consisted mainly of Boeing 737 and Airbuses. The latest addition has been the Air Bus A 320.

Air India has a fleet of about 20 aircrafts consisting of Boeing 747, Air Bus A 310, Air Bus A 300. India has air service agreements with nearly 60 countries of the world.

Vayudoot in 1986 connected 52 stations through 177 weekly services. Its fleet is modest consisting mainly of small craft.

Communication

India is a country of villages. As against 3,949 towns, there were 557,137 villages as per 1981 census. The problem of providing modern means of communication should be understood against this background. By 1984, 99 per cent of the villages were provided with the facility of daily mail delivery service. By 31 March 1986 there were 15,682 post offices in urban areas and 1,28,559 post offices in the rural areas. In addition, the regular post offices, another 78990 villages were catered through mobile counter service facilities.

For facilitating quick delivery of mail, by 31 March 1986, there were 15,682 post offices in urban areas and 1,28,559 post offices in the rural areas. In addition, the regular post offices, another 78,990 villages were catered through mobile counter service facilities.

For facilitating quick delivery of mail, a direct mail service was introduced in 1989. The system now covers more than 10,000 locations. Do you know the PIN code of the area you live in? If you do, you can write a letter or send a postcard. The postal customer service provides this information. The customer can now serve by air postal services.

In 1947 there were only 3,324 telegraph offices. In 1986 their number rose to
In 1985 more than six crore telegraphic messages were booked. Likewise, considerable progress has been made in providing telephone facilities which promotes simultaneous or instant two-way communication. Whereas there were only 321 telephone exchanges and 82,000 connections in 1947-48, their number has grown to 11,480 and 31,65,000, respectively in 1986. Now a new facility of direct dialling system (STD) has also been introduced. One can now dial directly persons in selected cities of the world. However, our telephone services are falling short of the ever growing demand, as is clear from ever swelling waiting lists. This is in spite of a telecommunication satellite of our own, which has multiplied the capacity several-fold.

For improving and accelerating telephone services in metropolitan cities, Mahanagar Telephone Nikam Limited for Bombay and Delhi have been set up in 1986. Growing tele services are being provided in major towns. There are over 200 telex exchanges and over 30,000 subscribers connections. Vijesh Sanchar Nikam Limited, formed in 1986 looks after our overseas communication services.

**Mass Communication**

Mass communication plays an increasingly important role in our individual and social life. Our radio and television sets work through the electronic media. At the time of Independence there were only six radio stations. They are, now 71. We can listen to news discussions, commentary on sports, music and advertisements provided by Akashwani, and similar services offered by other countries of the world. But now television goes a step further and we can both listen and see. Black and white and colour television sets are now available and Doordashan keeps on telecasting programmes from its studios. In 1987 there were over 200 television centres, of which only 11 were full fledged ones; 5 relay centres, 4 SITE continuity centres and 6 INSAT stations. Their number is expected to cross 500 mark very shortly. SITE and INSAT stations are functioning as part of experimental schemes.

Radio programmes have an access only to 10 per cent of the total population. Radio is a powerful medium for promoting social education, standardising education and life-long education, besides providing information and entertainment. Television programmes have access only to 30 per cent of the total population. This does not mean that all these people are in position to watch Doordashan programmes. Television programmes are still confined to those who can afford to take them sets in view of their high cost. The time required for the development of community viewing sets in rural areas another major weakness is that most of the centres show programmes telecast from Delhi station only. It may take considerable time to develop programmes in each centre in its own language. Like radio, television too has tremendous potential not only for entertainment but also for educating the large number of illiterate and semi-illiterate people systematically.

**Print Media**

While radio and television belong to electronic and long distance media, newspapers and other periodicals fall in the category of print media. Over sixteen hundred dailies are (including different languages) published in the country today. While post, telegraph and telephone render very useful personal service, they also contribute in promoting commerce and industry. But mass media—both electronic and print, perform altogether different functions. They are extremely powerful in transmitting information, knowledge, ideas, emotions and skills by use of symbols—words, figures, graphs often backed by background music to heighten the desired emotional effect.

**Exercises**

1. Answer the following questions briefly:
   (i) What is the significance of unsurfaced roads in India?
   (ii) How does road transport score over railway transport?
   (iii) What part of India has a strong naval fleet?
   (iv) Which part of India has the most economical rail transport?

2. Give reasons for the following statements.
   (a) There is a steep fall in the sugar-cane freight carried by railways.
   (b) But for the spectacular achievements of the Border Road Organization, the defence of the country could have been in jeopardy.
   (c) Some items like gems and cashewnuts appear both on the import and export list.
   (d) Why are means of transport and communications called the life-lines of a nation and its economy?

3. Write a critical note on the changing nature of the international trade of India.

4. Prepare a comprehensive note on the progress made by Indian railways covering the following points:
   (a) intensive utilization of track and wagons
   (b) a large government organization
   (c) economy in energy consumption
   (d) suburban railway traffic in cities like Bombay and Calcutta
   (e) contribution to the growth of agriculture and industry
   (f) promotion of national integration and modernisation

5. Have a realistic peep into the future to visualise what kind of exports India is likely to have by 2000 A.D.

**Topic for Class Discussion**

(a) The tourism potential of India for selling our culture and buying currencies of countries.
(b) How best can we export our abundant human skills.
UNIT FIVE

Nurturing Our Human Resources

Humans like any other animal was indeed a creature of environment. Being fragile and almost defenseless, humans soon learnt the advantages of living in groups—clans and families. Although humans started as a mere biological species, they, over a period of time, managed to be a social animal. They developed faith in cooperative living and the art of communication. Curious as they were, first they keenly observed the environment together with various physical phenomena. This helped them in deriving their food from vegetal and animal kingdoms through selection and experimentation, though their natural urge, perseverance and increasing use of intellect, they succeeded step by step, in unfolding the secrets of their environment which once overpowered them. Armed with the use of fire and versatile tools they became a much different species. Instead of being simply a part and parcel of the eco-system they began to manipulate environment to serve their interests.

Humans have progressed a lot since then. They have reached a stage of genetic engineering with the help of which they are able to develop improved strains of plants and domestic animals. We have now heavy yielding and early maturing varieties of trees, shrubs, vegetable and flower plants. Poultry, fish, cattle and other domestic animals have now been turned into highly efficient machines as it were to give us far more eggs, proteins, milk, meat and wool, etc. People have thus acquired a much different role and capabilities to derive maximum from their environment and various other species of the eco-system of which they themselves are still inseparable parts. Humans cannot control climate but are able to anticipate and predict various weather phenomena and through preventive measures protect their interests to a certain extent.

A time is not far when humans themselves would be subjected to such changes with far reaching social implications. The first step in this direction has been the newly acquired human ability to plan their families, the number of progeny and the required spacing between them. They are now able to improve their athletic skills, physical stamina and above all, average longevity. A nation that would develop its human resources selectively in a systematic manner and quickly enough will always have an edge over others. The highly industrialised countries have a head start in this direction.

What are the milestones it has to cross in this regard? The milestones to be covered in this regard are universal literacy, health for all, appropriate vocational
skills, proficiency in technical education and professionalism, sound work ethic, unlocking of women power through equality of sexes, and ever increasing use of science, technology and energy to improve productivity of labour. Improved productivity need to be backed with distributive justice to ensure that the fruits of development reach the lowest strata of the society. This is the only way to accelerate the pace of our socio-economic development to be able to survive in this highly competitive world.

CHAPTER 9

Human Resources

There was a time when the strength of human beings depended on their numbers alone. In the traditional agrarian society, manual labour was required for most of the work. Therefore, more people meant more production and thereby more prosperity. But this perspective changed with industrial revolution and the consequent developments in science and technology. Use of various kinds of tools, machines and sophisticated technology has reduced the dependence on manual labour considerably. Mechanization brought in speed and efficiency. Hence production increased manifold. For using and operating the sophisticated tools and technology, certain skills and abilities were required. Therefore, quality of people was considered important and gradually more emphasis was laid on the quality rather than quantity of people.

The population of a country is regarded as a potential resource and includes both quantitative and qualitative aspects. By quality of people we mean their economic efficiency or productivity, the level of their scientific and technological development, their cultural values and their social and political organizations. The growth and development of a human being and his/her total personality is rather delicate. It calls for sustained and concerted efforts on several dimensions simultaneously. In the process, a family, society and social institutions like the school have to play an important role. Human resource of a country is to be nurtured carefully in the best possible manner because it would ultimately determine how best the natural resources of that country can be developed. In this context, education, health, skill development, and proper work ethic and character building inclusive of social sensitivity have acquired over-riding importance.

A few tables are given against the above-mentioned perspective. They would throw up many points for you to ponder over and arrive at your own conclusions.

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### HUMAN RESOURCES

**TABLE 9.2**

Big Seven Countries of the World—Their Area, Population and Average Density of Population in 1991

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<td>8.6</td>
</tr>
<tr>
<td>2</td>
<td>Canada</td>
<td>9,976,000</td>
<td>29.5</td>
<td>3.0</td>
</tr>
<tr>
<td>3</td>
<td>China</td>
<td>9,593,000</td>
<td>134.0</td>
<td>14.0</td>
</tr>
<tr>
<td>4</td>
<td>USA</td>
<td>9,373,000</td>
<td>249.9</td>
<td>27.0</td>
</tr>
<tr>
<td>5</td>
<td>Brazil</td>
<td>8,512,000</td>
<td>150.3</td>
<td>18.0</td>
</tr>
<tr>
<td>6</td>
<td>Australia</td>
<td>7,687,000</td>
<td>17.0</td>
<td>2.2</td>
</tr>
<tr>
<td>7</td>
<td>India</td>
<td>3,288,000</td>
<td>86.3</td>
<td>26.7</td>
</tr>
</tbody>
</table>

(i) Find out the highest and the lowest natural increase rates and on what do they depend. Compare India with Sri Lanka, China and Japan.

(ii) Identify the highest and the lowest infant mortality rates (IMR). Compare India with other countries.

We know that India has only 2.4 per cent of the world's land area over which we are now required to sustain our population which in the year 1991 was about 16 per cent of the world's total population. Our average density of population is over six times the world's average. You can imagine how crucial this problem is.

Distribution of Population

Look at the map of population distribution in India. The overall distribution of population generally corresponds with the soil fertility. The thickly populated parts of India are the northern plains, the coastal delta along the Bay of Bengal and coastal plains of the west coast including the plains of Gujarat. The density of population, by and large, is more in well watered parts of India and population goes on decreasing with growing aridity from east to west. West Bengal is the most densely populated. The density decreases in the plains of the Punjab and Haryana. Kerala has a high density of population closely associated with ample rains enabling two to three crops a year with abundant fish supply from its backwaters and deep seas.

The sparsely populated parts of India are
the high mountain regions of the north, rainy forested lands of north-eastern frontiers and extremely arid lands of western Rajasthan extending up to Kachchh in Gujarat. The rocky and hilly regions of peninsular India including the Vindhyas and their eastern extensions are moderately populated parts of our country.

The Rural-Urban Divide

India has the reputation of being a country essentially of villages, their number being over half a million. In the beginning of the century, nine out of ten persons lived in villages. The total urban population was nearly 26 million. By 1981 the total population of India increased more than 3 times. But the urban population rose by as much as eight times. Now one out of every four persons is an urbanite. To put it differently, every city dweller there used to be nine villagers. Now there are only three villagers for every city dweller. In the first forty years the share of urban population improved just by three per cent. But in the next 50 years its share rose by 12 per cent from 14 per cent to 26 per cent. The urban population of India in 1991 stood at 217 million. This number is more than that of the fifth most populous country of the world, the Island Empire of Indonesia, or even more than that of Brazil's total population.

In 1991, nearly 65 per cent of the total urban population lived in class I cities and towns with a population of one lakh and above. There were 300 such towns in 1991 as against 106 just 30 years ago. This trend of concentration of large urban population in big cities is highly alarming. Again if 300 cities account for 139 million of urban population 23 metropolitan cities cornered among themselves half of this population, viz. 70 million. Obviously this upsurge in population growth has put great strain on the existing resources and services available in cities and people are at times devoid of basic amenities. The situation in villages is also deteriorating. The landless peasants are gradually being marginalised. Even though the marginal farmers have a partial claim to their parental landholdings, these become uneconomical or non-viable, mainly due to their fragmentation. A steady increase in such non-viable land holdings results in making several small farmers surplus and they are pushed out to join the groups migrating to big cities.

The following table demonstrates how village people are being increasingly pushed to big cities. While in 1981, there were 12 metropolitan cities with a population of over 1 million, in 1991, their number increased to 23. Look at the fast pace at which they have been exploding rather than growing.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Metropolis</th>
<th>Population in 1991 (in million)</th>
<th>Growth rate (in %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Greater Bombay</td>
<td>12.6</td>
<td>33.43</td>
</tr>
<tr>
<td>2.</td>
<td>Calcutta</td>
<td>10.0</td>
<td>18.73</td>
</tr>
<tr>
<td>3.</td>
<td>Delhi</td>
<td>8.4</td>
<td>46.18</td>
</tr>
<tr>
<td>4.</td>
<td>Madras</td>
<td>5.4</td>
<td>24.99</td>
</tr>
<tr>
<td>5.</td>
<td>Hyderabad</td>
<td>4.3</td>
<td>57.04</td>
</tr>
<tr>
<td>6.</td>
<td>Bangalore</td>
<td>4.1</td>
<td>3.87</td>
</tr>
<tr>
<td>7.</td>
<td>Ahmadabad</td>
<td>3.3</td>
<td>28.94</td>
</tr>
<tr>
<td>8.</td>
<td>Pune</td>
<td>2.5</td>
<td>47.38</td>
</tr>
<tr>
<td>9.</td>
<td>Kanpur</td>
<td>2.3</td>
<td>28.41</td>
</tr>
<tr>
<td>10.</td>
<td>Nagpur</td>
<td>1.7</td>
<td>56.24</td>
</tr>
</tbody>
</table>
The Structure of Indian Population

Human populations are catalytic agents of change and development. They are the producers of goods and services, which are only means to an end, namely satisfying their needs and requirements and providing them with comforts and amenities of life. Thus human beings are both producers as well as consumers. The degree to which these needs are satisfied, determines the material level.

Occupational Structure

The occupational structure of our population is very lopsided. Two-thirds of our population still lives on agriculture. In India this primary sector has only 10 per cent of its total working population. Those in the field of industry or manufacturing, constitute only 10 per cent of the total working population. The rest i.e., one-fourth of our population is in the tertiary or service sector. This occupational composition makes it clear that a very small proportion of our population is directly engaged in "value addition" tasks that belong to secondary sector of economy. As a result, our total national income remains at a very low level. We shall have to change the current occupational structure by inducing more and more people into the manufacturing sector to bring in the needed prosperity to our country. As efficient producers they have to be productive citizens eager to improve their productivity. This is how they can satisfy their own needs and also contribute to the nation's wealth. In order to understand the nation's potential to take care of these goals, a mere discussion of total population, its density and distribution is not enough. One has to go into the structure and salient features of population - namely occupational distribution, sex ratio, age composition, growth rate, and the health and education status.

The Status of Female Population: Sex Ratio

Human population consists of two components - female and male. The numerical proportion between the two is known as sex ratio. It is stated as the number of females per 1000 males. In our country for the past several decades males have been increasing outnumbering females. While in 1901 there were 972 females for every 1000 males, in 1971 their number came down to as low as 930. This downward trend seem to have arrested in 1981 as it rose to 933 but in 1991 it came down to 929. Indian society has certainly to go a long way to convert this unfavourable sex ratio into a favourable one which every civilized society of the world possesses. For instance in Japan it is 1038 females per 1000 males. However, there are intra-regional variations in the sex ratio within our country as well. Only Kerala has a favourable sex ratio equal to that of Japan i.e., 1040 females to 1000 males. Why should it be so?

With unfavourable sex ratio, the female life expectancy too had been low as compared with the males. But the figures of 1981 census have shown that now females were a shade better. The average life expectancy at birth for females was 56.4 against 55.6 for males. Again in Kerala it was far better at 60.87 for females and 65.23 for males. Thus on an average a Kerala woman lived longer than her male counterpart by four and a half years. Certainly, with increased network of public health and medicare systems, we have made tremendous progress. At the beginning of this century both males and females could expect to live an average hardly for 23 years. In Japan a female has an average life expectancy of 60 years i.e., six years more than her male counterpart.

There are a number of factors that contribute longevity of human beings. Literacy is one of the most significant factors. In 1991 the female literacy in our country was as low as 39.29 per cent as compared to 64.13 per cent for the males. And Kerala which leads the country both in literacy and life expectancy, had 68.15 per cent literacy among its female population. At the beginning of this century only 6 out of one thousand females were literate. After 90 years of efforts, there was sixty times improvement as in 1991 there were 392 literate women per thousand population. However even now 3 out of every five females in India are illiterate. When they cannot read and write their own names, how can we expect them to know the importance of sanitation, hygiene, nutrition, pre- and post-natal care on scientific lines? We should take note of the fact that all advanced countries have overcome sex differential in this crucial age by totally wiping out female illiteracy.

With regard to the economic participation, in 1981 only 14 per cent of the females were engaged in active labour force. Nearly half of them were agricultural labourers and one-third of them cultivators. Thus about 80 per cent of the females were in unorganized sectors working for meagre wages and being denied any old age security. In contrast, about 75 per cent of the females above 15 years of age in Japan are active participants in the country's labour force. This has been mainly because of the availability of free and compulsory education to every Japanese between six and fifteen years of age. The actual attendance (and not mere symbolic enrolment) is 98.92 per cent.

While in developed countries like Japan, only one out of 20 married women between 15 and 45 years of age is a nursing mother, in India this ratio is as high as 1 to 7. In Japan 50 per thousand women are nursing mothers whereas in India it is 145.2 per thousand. Infant mortality rate i.e., death of children below one year of age per thousand live births is also high in India. The comparable figures of India and Japan are 80 and 6 respectively. The incidence of maternal mortality, i.e., death of women during child birth or soon after due to related complications is very high in our country. Unfortunately all these problems are closely associated with our social perception and traditional outlook wherein, women were mainly confined to homes, and early marriages were encouraged.

It has been experienced by several countries that with education female participation in the labour force increases, and the age of marriage is also raised. This has an inverse relationship with the fertility rate, i.e., average number of children born to a woman during her reproductive period, maternal mortality rate and infant mortality rate.

In our country a girl's marriage below 18 years of age and that of a boy below 21 years of age is prohibited under law. This however needs to be enforced strictly.

Age Composition

After having seen various implications of sex ratio, let us move to another aspect of population - its age composition and the economic capacity of it.

Population is generally divided into three groups (i) below 15 years of age, (ii) between 15 and 60 years of age, and (iii) above 60 years. The first group is that of children supposed to be entirely dependent on their parents. The second group consists of adults or workers who are supposed to be economically independent. The third
The division of population into these groups is known as population pyramids. A comparison of population pyramids of different societies is found very useful. In India as per 1981 census this three-fold division was as follows:

<table>
<thead>
<tr>
<th>Age</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 14</td>
<td>23.5</td>
</tr>
<tr>
<td>15 - 59</td>
<td>67.2</td>
</tr>
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<td>60 and above</td>
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The dependency ratio of Japan is only 48.3 as against 83 in India. In Japan old persons are well protected by old age social security benefits which they have earned during their active life.

Unemployment is very low and women are in jobs in a very big way. The per capita income and personal consumption are bound to be high in such a socio-economic structure. In our country the situation is very different.

The Cultural Composition of the Population: Ethnically, India consists of several races—important among them being the Dravidians, the Mongoloids and the Aryans, along with Caucasians. In course of time these races have intermingled, losing many of their original traits and acquiring new ones from others. And yet we notice a great diversity which is so characteristic of the Indian people. In fact, the richness and beauty of Indian culture lies in its diversity. Its spirit of tolerance, give-and-take and assimilation makes it one of the distinctive cultures of the world. The Indian people follow different faiths, cutting across regional, political and linguistic barriers. They speak different languages, which in turn cut across races, religions, castes and regions. Notwithstanding these racial, religious, linguistic and regional diversities, we are all Indians first and Indians last. Ours is a plural society with a composite culture that can be compared to a fine mosaic or to a garden with flowers of various colours and shades of which, while maintaining their own entity, lend colour and beauty to the garden.

TRADE, TRANSPORT AND COMMUNICATIONS

Of trade in our favour. Do you notice a large number of items in which our production has increased considerably but which do not figure in our export lists? This is because of our own evergrowing home market. Do you justify the rapid growth in our iron ore exports? Is it not interesting that we import large amounts of precious stones and cashew nuts and export them again? What are we really exporting? Apparently those items but something else of greater significance which we have in abundance in other countries, namely human skills.

Let us move from imports and exports to the gateways through which they have to pass, namely our ports that give access to oceanic, providing links with other continents or far-off lands.

Major Ports:

Vizagapatnam in Andhra Pradesh is the deepest industrialized and protected port. An outer harbour has been developed for exporting iron ore and petroleum products. It also handles general cargo.

Paradip in Orissa is a newly developed port and specializes in exporting iron ore. It also handles coal, and other dry cargo. Calcutta is the inland river port. It is 600 miles away from the sea, it serves a very large and rich hinterland of Ganges-Brahmaputra basin. It is a tidal port and needs constant dredging of Hooghly. For maintaining a minimum level of water in the river to ensure its navigability, water is supplied from Farakka Barrage on the Ganga. In order to relieve the growing pressure on Calcutta port, a new major port has been developed downstream at Haldia. It supplements the facilities available at Calcutta. Haldia handles mineral oil, petroleum products, fertilizers and other dry cargo.
UNIT FIVE

Nurturing Our Human Resources

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<td>2.</td>
<td>Canada</td>
<td>9,970,000</td>
<td>26.8</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>China</td>
<td>9,597,000</td>
<td>115.4</td>
<td>118</td>
</tr>
<tr>
<td>4.</td>
<td>USA</td>
<td>9,324,000</td>
<td>269.9</td>
<td>27</td>
</tr>
<tr>
<td>5.</td>
<td>Brazil</td>
<td>8,512,000</td>
<td>152.3</td>
<td>18</td>
</tr>
<tr>
<td>6.</td>
<td>Australia</td>
<td>7,682,000</td>
<td>17.2</td>
<td>2</td>
</tr>
<tr>
<td>7.</td>
<td>India</td>
<td>3,288,000</td>
<td>844.5</td>
<td>267</td>
</tr>
</tbody>
</table>

#### HUMAN RESOURCES

(i) Verify the following statement as an exaggeration. The five countries, all of them bigger than India, namely (i) Russia, (ii) Canada, (iii) USA, (iv) Brazil, and (v) Australia, together have an area over seventeen times of India but their combined population is smaller than that of India.

(ii) Find out the implications of this high density of population in India.

#### TABLE 9.3
Some Demographic and Other Related Indicators of a Few Countries including India

<table>
<thead>
<tr>
<th>Country</th>
<th>Literacy Rate (in %)</th>
<th>Infant Mortality Rate</th>
<th>Birth Rate</th>
<th>Death Rate</th>
<th>Net Natural Increase</th>
<th>Life Expectancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>124</td>
<td>44.8</td>
<td>17.6</td>
<td>27.3</td>
<td>55.3</td>
<td>64.4</td>
</tr>
<tr>
<td>India</td>
<td>52.2</td>
<td>30.5</td>
<td>29.5</td>
<td>8.3</td>
<td>15.7</td>
<td>55.6</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>52.0</td>
<td>34.9</td>
<td>24.6</td>
<td>6.5</td>
<td>18.3</td>
<td>67.8</td>
</tr>
<tr>
<td>China</td>
<td>59.8</td>
<td>39.8</td>
<td>19.0</td>
<td>6.7</td>
<td>12.3</td>
<td>67.7</td>
</tr>
<tr>
<td>Japan</td>
<td>99.9</td>
<td>8.0</td>
<td>12.5</td>
<td>6.2</td>
<td>6.3</td>
<td>74.5</td>
</tr>
</tbody>
</table>

(i) Find out the highest and the lowest natural increase rate and on what do they depend. Compare India with Sri Lanka, China and Japan.

(ii) Identify the highest and the lowest infant mortality rates (IMR). Compare India with other countries.

Rate it takes merely 35 years. This is the rate at which we have been doubling ourselves.

We know that India has only 2.4 per cent of the world's land area over which we are now required to sustain our population which in the year 1991 was about 16 per cent of the world's total population. Our average density of population is over six times the world's average. You can imagine how crucial this problem is.

**Distribution of Population**

Look at the map of population distribution in India. The overall distribution of population generally corresponds with the soil fertility. The thinly peopled parts of India are the northern plains, the coastal delta along the Bay of Bengal and coastal plains of the west coast including the plains of Gujarat. The density of population, by and large, is more in well watered parts of India and population goes on decreasing with growing aridity from east to west. West Bengal is the most densely peopled. The density decreases in the plains of the Punjab and Haryana. Kerala has a high density of population closely associated with ample rains enabling two to three crops a year and with abundant fish supply from its backwaters and deep seas.

The sparsely peopled parts of India are...
the high mountain regions of the north, rainy forested lands of north-east frontiers and extremely arid lands of western Rajasthan extending up to Kutchh in Gujarat. The rocky and hilly regions of peninsular India including the Vindhys and their eastern extensions are moderately populated parts of our country.

The Rural Urban Divide

India has the reputation of being a country essentially of villages, their number being over half a million. In the beginning of the century, nine out of ten persons lived in villages. The total urban population was nearly 20 million. By 1983 the total population of India increased more than 3 times. But the urban population rose by as much as eight times. Now one out of every four persons is an urbanite. To put it the other way round, for every ten dwellers there used to be nine villagers. Now there are only three villagers for every ten dwellers. In the first forty years the share of urban population improved just by three per cent. But in the next 50 years its share rose by 12 per cent— from 14 per cent to 26 per cent. The urban population of India in 1991 stood at 217 million. This number is more than that of the fifth most populous country of the world, the Island Empire of Indonesia, or even more than that of Brazil's total population.

In 1991, nearly 65 per cent of the total urban population lived in class I cities and towns with a population of one lakh and above. There were 300 such towns in 1991 as against 106 just 30 years ago. This trend of concentration of large urban population in big cities is highly alarming. Again if 300 cities account for 139 million of urban population, 23 metropolitan cities cornered among themselves half of this population, viz. 70 million. Obviously this upsurge in population growth has put great strain on the existing resources and services available in cities and people are at times devoid of basic amenities. The situation in villages is also deteriorating. The landless peasants are gradually being marginalised. Even though the marginal farmers have a partial claim to their parental land holdings, these become uneconomic or non-viable, mainly due to their fragmentation. A steady increase in such non-viable land holdings results in making several small farmers surplus and they are pushed out to join the groups migrating to big cities.

The following table demonstrates how village people are being increasingly pushed to big cities. While in 1981, there were 12 metropolitan cities with a population of over 1 million, in 1991, their number increased to 23. Look at the fast pace at which they have been exploding rather than growing.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Metropolis</th>
<th>Population in 1991 (in million)</th>
<th>Growth rate (in %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Greater Bombay</td>
<td>12.6</td>
<td>33.43</td>
</tr>
<tr>
<td>2</td>
<td>Calcutta</td>
<td>10.9</td>
<td>18.73</td>
</tr>
<tr>
<td>3</td>
<td>Delhi</td>
<td>8.4</td>
<td>46.18</td>
</tr>
<tr>
<td>4</td>
<td>Madras</td>
<td>5.4</td>
<td>24.99</td>
</tr>
<tr>
<td>5</td>
<td>Hyderabad</td>
<td>4.3</td>
<td>67.04</td>
</tr>
<tr>
<td>6</td>
<td>Bangaluru</td>
<td>4.1</td>
<td>39.87</td>
</tr>
<tr>
<td>7</td>
<td>Ahmedabad</td>
<td>3.3</td>
<td>28.94</td>
</tr>
<tr>
<td>8</td>
<td>Pune</td>
<td>2.5</td>
<td>47.38</td>
</tr>
<tr>
<td>9</td>
<td>Kanpur</td>
<td>2.1</td>
<td>28.81</td>
</tr>
<tr>
<td>10</td>
<td>Nagpur</td>
<td>1.7</td>
<td>36.24</td>
</tr>
</tbody>
</table>
ECONOMIC GEOGRAPHY

India is the home of Hindus, Muslims, Christians, Sikhs, Buddhists, Jews, Zoroastrians, and others. None of these peoples enjoy any special privileges on the ground of their religion. Nor do they suffer in economic, political or social life because of their faith in a particular religion. All are equal before law and enjoy full human rights and responsibilities, and are entitled to equal educational opportunities.

In India there are a large number of languages. Some of them are derived from Sanskrit while others are of Dravidian origin. The major Indian languages are Assamese, Bengali, Gujarati, Hindi, Kannada, Kashmiri, Konkani, Malayalam, Manipuri, Marathi, Nepali, Oriya, Punjabi, Sanskrit, Sindhi, Tamil, Telugu and Urdu. Of these four languages, Telugu and Urdu are spoken by large numbers of people. It would be a mistake to conclude that everybody speaking any of these languages is Dravidian by race. Similarly, not all who speak languages of Sanskrit origin are Dravidians. Generally, the people who live in a given area over a long period of time adopt the language of that region as their first language, whether it be Sanskrit or Dravidian.

The Cultural Composition of the Population

Ethnically, India consists of several races, the Indo-Aryans, the Mongoloids and the Dravidians, along with Caucasians. In course of time these races have mingled, losing many of their original traits and acquiring new ones from others. And yet we notice a great variety which is so characteristic of the Indian population. In fact, the richness and beauty of Indian culture lies in its diversity. Its spirit of tolerance, give-and-take and assimilation makes it one of the distinctive cultures of the world. The Indian people follow different faiths, cut across regional, political and linguistic barriers. They speak different languages, which in turn cut across races, religions, castes and often different regions. Notwithstanding these racial, religious, linguistic and regional diversities, we are all Indians first and last. Ours is a plural society with a composite culture that can be compared to a fine mosaic or a garden with flowers of various colours and shades of which, while maintaining their own entity, lend colour and beauty to the garden.

In India on the other hand, the age composition is as follows:

<table>
<thead>
<tr>
<th>Age</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 14</td>
<td>39.5</td>
</tr>
<tr>
<td>15 - 59</td>
<td>54.3</td>
</tr>
<tr>
<td>60 and above</td>
<td>6.2</td>
</tr>
</tbody>
</table>

Taking the first and third group together i.e. 45.75 per cent of our population is bracketed as dependent population. The remaining 54.3 per cent has to support this dependent population. The proportion between the two is termed as dependency ratio. In India it is 83. That means every 100 persons in the age group of 15 to 59 have to support 83 persons who are dependent on them. Again, it must be noted that children below 15 years of age are bound to be highly demanding of both their nutritional and educational needs. Unlike the old retired persons or pensioners, they are totally dependent. It is their right to get all the facilities like health, nutrition, medical care and education during this period to be able to discharge their duties in adult life.

Child labour is banned all over the world for this very reason. Unfortunately, a large number of male and female children in our country are compelled to work and that too very rigorously and often in unhealthy conditions for very paltry sums instead of going to school. Unfortunately, they are required to take care of their parents—sacrificing their own joys and benefits of childhood.

HUMAN RESOURCES

<table>
<thead>
<tr>
<th>TABLE 3.5</th>
<th>Population Growth in India 1910-91</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decade</td>
<td>Birth rate</td>
</tr>
<tr>
<td>1910-11</td>
<td>49.2</td>
</tr>
<tr>
<td>1911-21</td>
<td>48.1</td>
</tr>
<tr>
<td>1921-31</td>
<td>45.4</td>
</tr>
<tr>
<td>1931-41</td>
<td>42.2</td>
</tr>
<tr>
<td>1941-51</td>
<td>39.9</td>
</tr>
<tr>
<td>1951-61</td>
<td>41.2</td>
</tr>
<tr>
<td>1961-71</td>
<td>37.2</td>
</tr>
<tr>
<td>1971-81</td>
<td>32.8</td>
</tr>
</tbody>
</table>

Let us have a look at the birth rates. The highest birth rate was in the first decade (1901-11) when it was 49.2. Since then it has come down very slowly and haltingly at times even reversing back to the higher side. The lowest was 32.1 in 1951. Thus the total fall was 17 per cent. On the other hand, the death rate is quite different. From 47.2 during 1911-21, it has come down to 13.7 per cent. Thus there has been a rise in the birth rate.
Human populations are catalytic agents of change and development. They are the producers of goods and services, which are only means to an end, namely satisfying their needs and requirements and providing them with comforts and amenities of life. Thus human beings are both producers as well as consumers. The degree to which these needs are satisfied, determines the material level.

Occupational Structure

The occupational structure of our population is very top-sliced. Two-thirds of our population still lives on agriculture. In Japan this primary sector has only 10 per cent of its total working population. Those in the field of industry or manufacturing constitute only 10 per cent of the total working population. The rest i.e., one-fourth of our population is in the tertiary or service sector. This occupational composition makes it clear that a very small proportion of our population is directly engaged in "value addition" tasks that belong to secondary sector of economy. As a result, our total national income remains at a very low level. We shall have to change the current occupational structure by inducting more and more people into the manufacturing sector to bring in the needed prosperity to our country. As efficient producers they have to be productive citizens eager to improve their productivity. This is how they can satisfy their own needs and also contribute to the nation's wealth. In order to understand the nation's potential to take care of these goals, a mere discussion of total population, its density and distribution is not enough. One has to go into the structure and salient features of public health and medical care system, we have made tremendous progress. At the beginning of this century both males and females could expect to live on an average hardly for 25 years. In Japan a female has an average life expectancy of 80 years i.e., six years more than her male counterpart.

There are a number of factors that influence longevity of human beings. Literacy is one of the most significant factors. In 1951 the female literacy in our country was as low as 39.29 per cent as compared to 64.13 per cent for the males. And Kerala which leads the country both in literacy and life expectancy, had 86.19 per cent literacy among its female population. At the beginning of this century only 6 out of 1000 females were literate. After 90 years of efforts, there was sixty times improvement in 1991 there were 392 literate women per thousand population. However even now 3 out of every five females in India are illiterate. When they cannot read and write their own names, how can we expect them to know the importance of sanitation, hygiene, nutrition, pre- and post-natal care on scientific lines? We should take note of the fact that all advanced countries have overcome sex differential in this crucial area by totally wiping out female illiteracy.

With regard to the economic participation, in 1981 only 14 per cent of the females were engaged in active labour force. Nearly half of them were agricultural labourers and one-third of them cultivators. Thus about 80 per cent of the females were in unorganized sector working for meagre wages and being denied any old age security. In contrast, about 48 per cent of the females above 15 years of age in Japan are active participants in the country's labour force. This has been mainly because of the availability of free and compulsory education to every Japanese between six and fifteen years of age. The actual attendance (and not mere symbolic enrolment) is 99.98 per cent.

While in developed countries like Japan, only 1 out of 20 married women between 15 and 45 years of age is a nursing mother, in India this ratio is as high as 1 to 7. In Japan 50 per thousand women are nursing mothers whereas in India it is 145.2 per thousand. Infant mortality rate i.e. death of children below one year of age per thousand live births is also high in India. The comparable figures of India and Japan are 80 and 6 respectively. The incidence of maternal mortality, i.e. death of women during child birth or soon after due to related complications, is very high in our country. Unfortunately all these problems are closely associated with our social perception and traditional outlook wherein, women were mainly confined to homes, and early marriages were encouraged.

It has been experienced by several countries that with education female participation in the labour force increases, and the age of marriage is also raised. This has an inverse relationship with the fertility rate, i.e. average number of children born to a woman during her reproductive period, maternal mortality rate and infant mortality rate.

In our country a girl's marriage, below 18 years of age and that of a boy below 21 years of age is prohibited under law. However this needs to be enforced strictly.

Age Composition

After having seen various implications of sex ratio, let us move to another aspect of population—its age composition and the economics of it.

Population is generally divided into three groups: (i) below 15 years of age, (ii) between 15 and 60 years of age, and (iii) above 60 years. The first group is that of children supposed to be entirely dependent on their parents. The second group consists of adults or workers who are supposed to be economically independent. The third
or in the death rate. Both of them have been falling but at a differential pace. While the death rate has been tumbling down, the birth rate has been going up too slowly to keep up with the rapidly falling death rate.

The sharply falling death rate is due to measures mainly on health front supplemented by widespread education but we have not yet been able to bring down birth rate to our age-old value system. With growing awareness and proper education desired results may be achieved. Can small national population and big families ever go together? Prosperity arrives only where the nation and families both move in one direction. Population can be stabilized in the long run only if every family would have no more than two children who would fill in the vacuum created by parents as and when they pass away. This is why we speak of a two child family as a national norm. On the other hand, the People’s Republic of China has decided to bring in a few decades to come, to have one child family as a national norm so that over a period of time they would be able to have the total population reduced by half or even less. This time is not far when India’s population would exceed that of China along with all its serious consequences. It would be only to the advantage of China. It would raise its real economic and technological strength which is already greater than that of our country.

Education and Health Status

One of the basic inputs in human resource development is education. Literacy and numeracy form the foundation on which the structure of education is built. At the time of independence only 14 per cent of the people were literate. It meant that they could at least read and write their names. In 1991 it has slowly risen to 54.7 per cent. In absolute terms, the number of the literate has grown from 457 million in 1991 to 600 million. It is more than a sevenfold growth. But it is pertinent to note that the number of illiterate persons has not decreased. From 300 million in 1991, it has risen to 400 million by 1991.

Our constitution directed the government to provide education for all children up to the age of fourteen. This was a big task because the bulk of the population was distributed over vast areas and villages separated by considerable distance from one another. Priority was, therefore, given to set up schools in almost every village. As a result there are now over half a million primary schools in place of two lakhs in 1951.

Similarly, the middle schools also increased by as much as ten times. Earlier there was one middle school for every fifteen primary schools. Now it stands for every four primary schools. Although there has been a marked increase in the number of children getting into formal schools, one of the worries is that out of every 100 children in Class I, only 40 manage to complete Class V, and 25 reach Class VIII. Thus three-fourths of the pupils still drop out on their way before they are able to reap advantage of education visualized for everyone under our constitution.

We have also made progress in increasing the number of secondary schools, universities, industrial training as well as other institutions. Still educational facilities are not available to all because of fast growing population.

Spectacular rise in life expectancy at birth is obviously due to an enlarged network of improved health care facilities all over the country. With the spread of education, the health consciousness of the people has been gradually improving. Three-fold increase in food production should have considerably increased the per capita availability of foodgrains. In 1951 it was 395 grams per day per person, which rose to 478 grams in 1986-87. In this connection two facts need to be noted. First, the population itself has more than doubled, and secondly, at least a third of our population living below poverty line are unable to maintain their requirements of food even if stocks are ample.

At present, there is one hospital for every one lakh people, and one hospital bed for 1400 population. This situation is not encouraging. Today most of the killer diseases are waterborne in nature. Therefore, safe drinking water in every village needs highest priority. Since Independence we have succeeded in wiping out smallpox and controlling serious diseases like cholera, malaria, tuberculosis etc. In order to provide better health facilities to all, the government is trying to provide integrated package of health care services. It includes taking care of expectant mothers and young children.

Today we are having an ever-increasing population. They are not mere numbers. They have a natural urge and a keen desire to raise their standards of living. This implies more and more consumption of our limited resources. This calls for greater awareness on our part to maintain our environment and conserve our natural resources. In other words, our approach to our environment and resources should be scientific. While fulfilling our needs we must ensure that our resource base remains intact and is not destroyed. We must remember that it is not so much of an inheritance from the past, it is in fact a sacred trust that rightly belongs to generations that are yet to come.

EXERCISES

Review Questions

1. Answer the following questions briefly:
   (i) Which are the two most populous countries of the world?
   (ii) What are the main languages of India?
   (iii) What are the common features of Indian languages?
   (iv) What is meant by population?
   (v) What is the rate of population growth in India?
   (vi) Can we reduce the population growth rate by providing better educational opportunities to women?
   (vii) What is a population pyramid?
   (viii) How does the population pyramid of India compare with that of Japan?

2. Give a technical term for each of the following statements:
   (i) number of females per 1000 males
   (ii) number of persons per square kilometre of total surface area
   (iii) number of infants dying under one year of age per thousand live births in a year
   (iv) persons engaged in some useful occupation for earning their living and contributing to a productive economic activity.
3. Given below are the four problems we are confronted with. Which one of them should be of utmost concern and why?
(i) the total population of India
(ii) its unbalanced growth rate
(iii) rapid urbanization in India
(iv) high dependency ratio in India

4. Write an essay on population distribution in India pointing out geographical factors influencing the same.

5. Discuss in what ways the population scenario in Kerala is different from the nation as a whole. What conclusions would you arrive at?

6. Write a brief account on the impact of rapid urbanization in India.

Map Work

7. On a map of India show the following:
(i) the largest state in terms of area
(ii) the largest state in terms of population
(iii) the state with the highest density of population
(iv) the State/Union Territory having the highest growth rate of population
(v) the State/UT with the highest literacy rate