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CONSTITUTION OF INDIA

Part III (Articles 12 – 35)

(Subject to certain conditions, some exceptions
and reasonable restrictions)

guarantees these

Fundamental Rights

Right to Equality

- before law and equal protection of laws;
- irrespective of religion, race, caste, sex or place of birth;
- of opportunity in public employment;
- by abolition of untouchability and titles.

Right to Freedom

- of expression, assembly, association, movement, residence and profession;
- of certain protections in respect of conviction for offences;
- of protection of life and personal liberty;
- of free and compulsory education for children between the age of six and fourteen years;
- of protection against arrest and detention in certain cases.

Right against Exploitation

- for prohibition of traffic in human beings and forced labour;
- for prohibition of employment of children in hazardous jobs.

Right to Freedom of Religion

- freedom of conscience and free profession, practice and propagation of religion;
- freedom to manage religious affairs;
- freedom as to payment of taxes for promotion of any particular religion;
- freedom as to attendance at religious instruction or religious worship in educational institutions wholly maintained by the State.

Cultural and Educational Rights

- for protection of interests of minorities to conserve their language, script and culture;
- for minorities to establish and administer educational institutions of their choice.

Right to Constitutional Remedies

- by issuance of directions or orders or writs by the Supreme Court and High Courts for enforcement of these Fundamental Rights.





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1

INDIA – SIZE AND LOCATION

India is one of the ancient civilisations in the world. It has achieved multi-faceted socio-economic progress during the last five decades. It has moved forward displaying remarkable progress in the field of agriculture, industry, technology and overall economic development. India has also contributed significantly to the making of world history.

LOCATION

India is a vast country. Lying entirely in the Northern hemisphere (Figure 1.1) the main land extends between latitudes 8°4'N and 37°6'N and longitudes 68°7'E and 97°25'E.

The Tropic of Cancer (23° 30'N) divides the country into almost two equal parts. To the southeast and southwest of the mainland, lie the Andaman and Nicobar islands and the Lakshadweep islands in Bay of Bengal and Arabian Sea respectively. Find out the extent of these groups of islands from your atlas.

Do You Know?

- The southernmost point of the Indian Union- 'Indira Point' got submerged under the sea water in 2004 during the Tsunami.

SIZE

The land mass of India has an area of 3.28 million square km. India's total area accounts for about 2.4 per cent of the total geographical

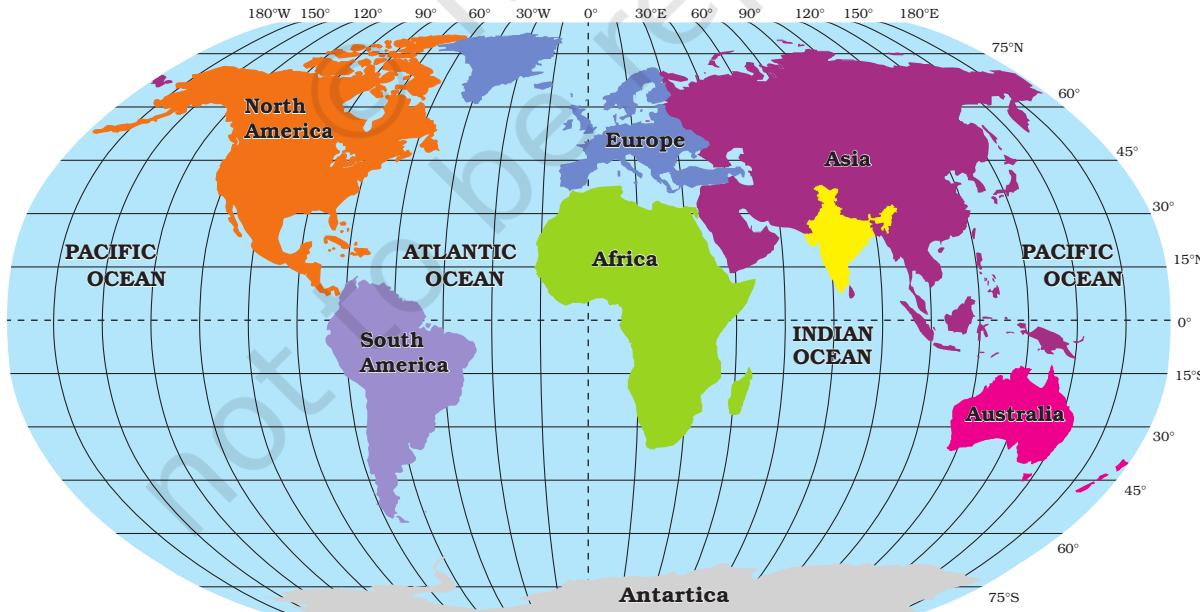


Figure 1.1 : India in the World

area of the world. From Figure 1.2 it is clear that India is the seventh largest country of the world. India has a land boundary of about 15,200 km and the total length of the coastline of the mainland, including Andaman and Nicobar and Lakshadweep, is 7,516.6 km.

India is bounded by the young fold mountains in the northwest, north and northeast. South of about 22° north latitude, it begins to taper, and extends towards the Indian Ocean, dividing it into two seas, the Arabian Sea on the west and the Bay of Bengal on its east.

Look at Figure 1.3 and note that the latitudinal and longitudinal extent of the mainland is about 30° . Despite this fact, the east-west extent appears to be smaller than the north-south extent.

From Gujarat to Arunachal Pradesh, there is a time lag of two hours. Hence, time along the Standard Meridian of India ($82^{\circ}30'E$) passing through Mirzapur (in Uttar Pradesh) is taken as the standard time for the whole country. The latitudinal extent influences the duration of day and night, as one moves from south to north.

Find out

- Why $82^{\circ}30'E$ has been selected as the Standard Meridian of India?
- Why is the difference between the durations of day and night hardly felt at Kanyakumari but not so in Kashmir?

INDIA AND THE WORLD

The Indian landmass has a central location between the East and the West Asia. India is a southward extension of the Asian continent. The trans Indian Ocean routes, which connect the countries of Europe in the West and the countries of East Asia, provide a strategic central location to India. Note that the Deccan Peninsula protrudes into the Indian Ocean, thus helping India to establish close contact with West Asia, Africa and Europe from the western coast and with Southeast and East Asia from the eastern coast. No other country has a long coastline on the Indian Ocean as India has and indeed, it is India's eminent position in the Indian Ocean, which justifies the naming of an Ocean after it.

Do You Know?

Since the opening of the Suez Canal in 1869, India's distance from Europe has been reduced by 7,000 km.



Source : United Nations Demographic Year Book 2015

Figure 1.2 : Seven Largest Countries of the World

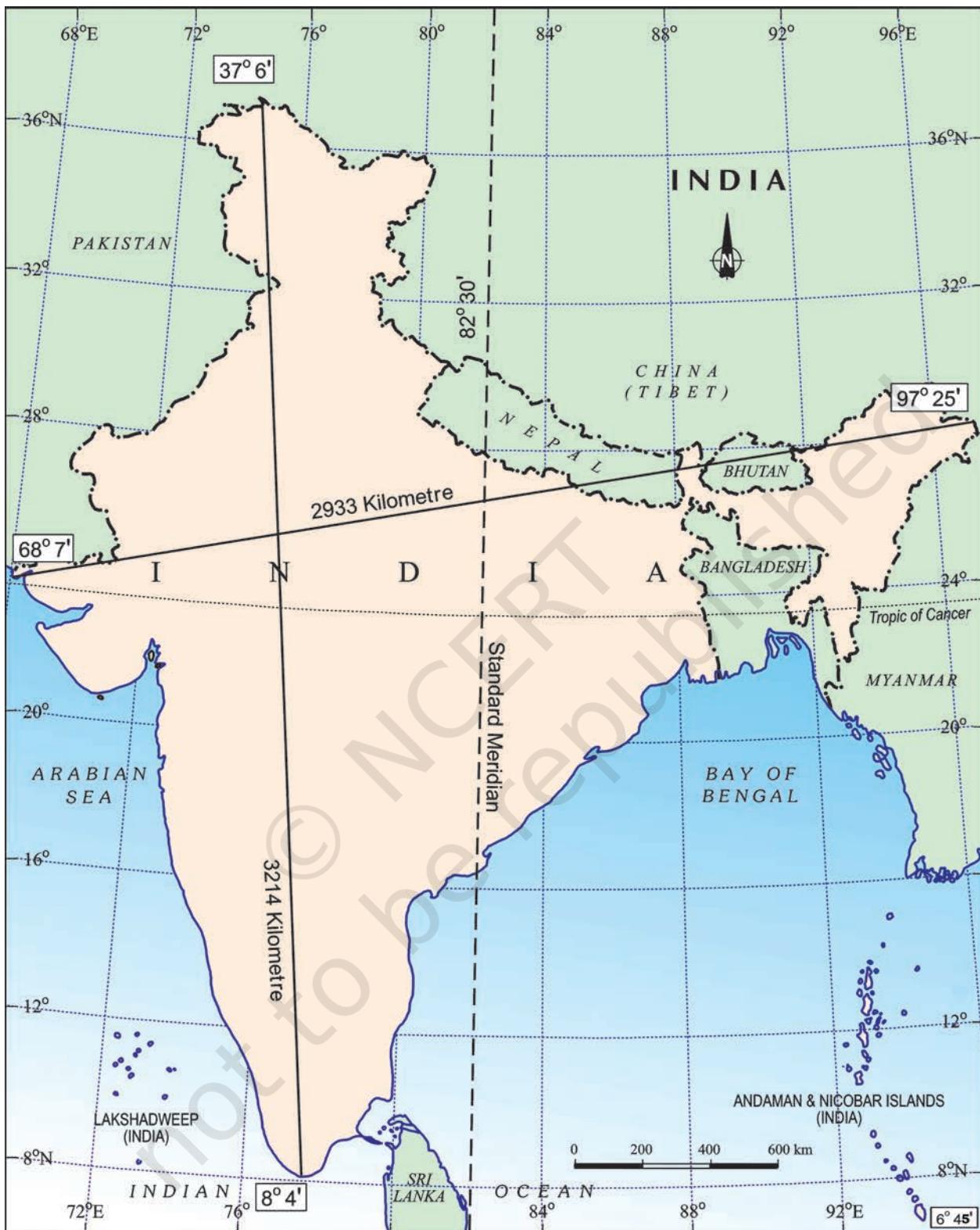


Figure 1.3 : India : Extent and Standard Meridian

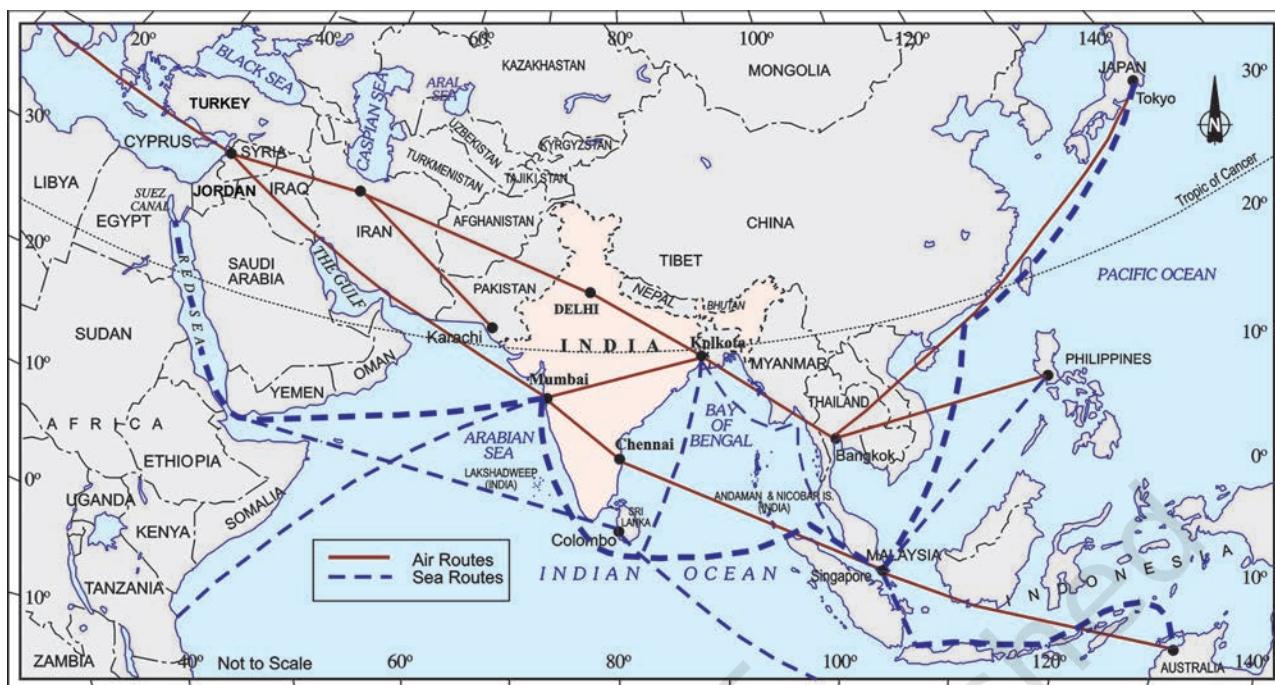


Figure 1.4 : India on International Highway of Trade and Commerce

India's contacts with the World have continued through ages but her relationships through the land routes are much older than her maritime contacts. The various passes across the mountains in the north have provided passages to the ancient travellers, while the oceans restricted such interaction for a long time.

These routes have contributed in the exchange of ideas and commodities since ancient times. The ideas of the *Upanishads* and the *Ramayana*, the stories of *Panchtantra*, the Indian numerals and the decimal system thus could reach many parts of the world. The spices, muslin and other merchandise were taken from India to different countries. On the other hand, the influence of Greek sculpture, and the architectural styles of dome and minarets from West Asia can be seen in different parts of our country.

INDIA'S NEIGHBOURS

India occupies an important strategic position in South Asia. India has 28 states and Eight Union Territories (Figure 1.5).

Find out

- The number of Union Territories along the western and eastern coasts.
- Area-wise which is the smallest and which is the largest state?
- The states which do not have an international border or lie on the coast.
- Classify the states into four groups each having common frontiers with
 - (i) Pakistan, (ii) China, (iii) Myanmar, and
 - (iv) Bangladesh.

India shares its land boundaries with **Pakistan and Afghanistan in the northwest, China (Tibet), Nepal and Bhutan in the north and Myanmar and Bangladesh in the east**. Our **southern neighbours across the sea consist of the two island countries, namely**

Do You Know?

Before 1947, there were two types of states in India — the provinces and the Princely states. Provinces were ruled directly by British officials, who were appointed by the Viceroy. Princely states were ruled by local, hereditary rulers, who acknowledged sovereignty in return for local autonomy.



Figure 1.5 : India and Adjacent Countries

Sri Lanka and Maldives. Sri Lanka is separated from India by a narrow channel of sea formed by the Palk Strait and the Gulf of Mannar, while Maldives Islands are situated to the south of the Lakshadweep Islands.

India has had strong geographical and historical links with her neighbours. Look at the physical map of Asia in your atlas, and note how India stands apart from the rest of Asia.

Do You Know?

School Bhuvan is a portal providing map-based learning to bring awareness among the students about the country's natural resources, environment and their role in sustainable development. It is an initiative of Bhuvan — NRSC/ISRO based on NCERT syllabus. You can explore various maps of India related to the secondary stage on https://bhuvan-app1.nrsc.gov.in/mhrd_ncert/

EXERCISE

1. Choose the right answer from the four alternatives given below.
 - (i) The Tropic of Cancer does not pass through
 - (a) Rajasthan
 - (c) Chhattisgarh
 - (b) Odisha
 - (d) Tripura
 - (ii) The easternmost longitude of India is
 - (a) $97^{\circ} 25' E$
 - (c) $77^{\circ} 6' E$
 - (b) $68^{\circ} 7' E$
 - (d) $82^{\circ} 32' E$
 - (iii) Uttarakhand, Uttar Pradesh, Bihar, West Bengal and Sikkim have common frontiers with
 - (a) China
 - (c) Nepal
 - (b) Bhutan
 - (d) Myanmar
 - (iv) If you intend to visit Kavarati during your summer vacations, which one of the following Union Territories of India you will be going to
 - (a) Puducherry
 - (c) Andaman and Nicobar
 - (b) Lakshadweep
 - (d) Daman and Diu
 - (v) My friend hails from a country which does not share land boundary with India. Identify the country.
 - (a) Bhutan
 - (c) Bangladesh
 - (b) Tajikistan
 - (d) Nepal
 2. Answer the following questions briefly.
 - (i) Name the group of islands lying in the Arabian Sea.
 - (ii) Name the countries which are larger than India.
 - (iii) Which island group of India lies to its south-east?
 - (iv) Which island countries are our southern neighbours?
 3. The sun rises two hours earlier in Arunachal Pradesh as compared to Gujarat in the west but the watches show the same time. How does this happen?
 4. The central location of India at the head of the Indian Ocean is considered of great significance. Why?

MAP SKILLS

- Identify the following with the help of map reading.
 - The island groups of India lying in the Arabian Sea and the Bay of Bengal.
 - The countries constituting Indian subcontinent.
 - The States through which the Tropic of Cancer passes.
 - The northernmost latitude in degrees.
 - The southernmost latitude of the Indian mainland in degrees.
 - The eastern and the western-most longitude in degrees.
 - The place situated on the three seas.
 - The strait separating Sri Lanka from India.
 - The Union Territories of India.

PROJECT/ACTIVITY

- (i) Find out the longitudinal and latitudinal extent of your state.
(ii) Collect information about the ‘Silk Route’. Also find out the new developments, which are improving communication routes in the regions of high altitude.



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2

PHYSICAL FEATURES OF INDIA

You have already learnt earlier that India is a vast country with varied land forms.

What kind of terrain do you live in? If you live in the plains, you are familiar with the vast stretches of plain land. In contrast, if you live in hilly region, the rugged terrain with mountains and valleys are common features. In fact, our country has practically all major physical features of the earth, i.e., mountains, plains, deserts, plateaus and islands.

The land of India displays great physical variation. Geologically, the Peninsular Plateau constitutes one of the ancient landmasses on the earth's surface. It was supposed to be one of the most stable land blocks. The Himalayas and the Northern Plains are the most recent landforms. From the view point of geology, Himalayan mountains form an unstable zone. The whole mountain system of Himalaya represents a very youthful topography with high peaks, deep valleys and fast flowing rivers. The northern plains are formed of alluvial deposits. The peninsular plateau is composed of igneous and metamorphic rocks with gently rising hills and wide valleys.

MAJOR PHYSIOGRAPHIC DIVISIONS

The physical features of India can be grouped under the following physiographic divisions (Figure 2.2):

- (1) The Himalayan Mountains
- (2) The Northern Plains
- (3) The Peninsular Plateau
- (4) The Indian Desert
- (5) The Coastal Plains
- (6) The Islands

The Himalayan Mountains

The Himalayas, geologically young and structurally fold mountains stretch over the northern borders of India. These mountain ranges run in a west-east direction from the Indus to the Brahmaputra. The Himalayas represent the loftiest and one of the most rugged mountain barriers of the world. They form an arc, which covers a distance of about 2,400 Km. Their width varies from 400 Km in Kashmir to 150 Km in Arunachal Pradesh. The altitudinal variations are greater in the eastern half than those in the western half. The Himalaya consists of three parallel ranges in its longitudinal extent. A number of valleys lie between these ranges. The northern-most range is known as the Great or Inner Himalayas or the **Himadri**. It is the most continuous range consisting of the loftiest peaks with an average height of 6,000 metres. It contains all prominent Himalayan peaks.

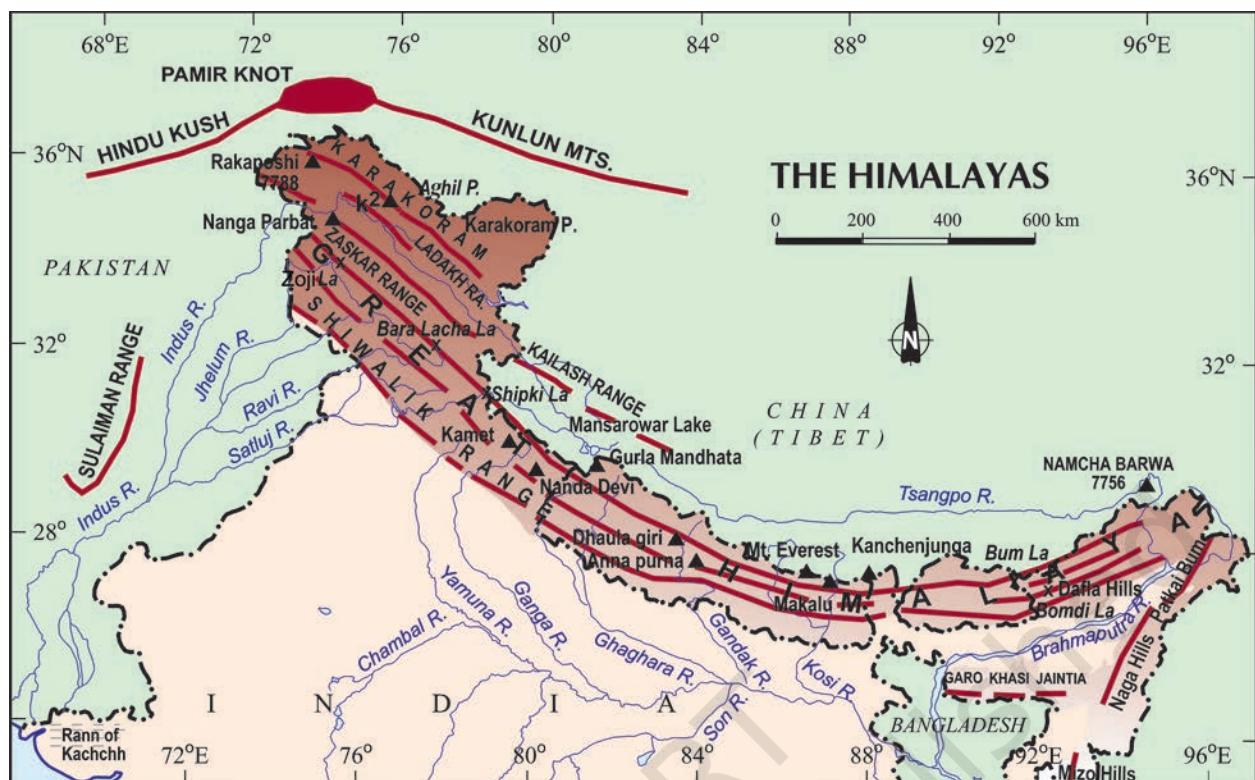


Figure 2.1 : Himalayas

Some Highest Peaks of the Himalayas

| Peak | Country | Height in metres |
|----------------|---------|---------------------|
| Mt. Everest | Nepal | 8848 |
| Kanchenjunga | India | 8598 |
| Makalu | Nepal | 8481 |
| Dhaulagiri | Nepal | 8172 |
| Nanga Parbat | India | 8126 |
| Annapurna | Nepal | 8078 |
| Nanda Devi | India | 7817 |
| Kamet | India | 7756 |
| Namcha Barwa | India | 7756 |
| Gurla Mandhata | Nepal | 7728 |

The folds of the Great Himalayas are asymmetrical in nature. The core of this part of Himalayas is composed of granite. It is perennially snow bound, and a number of glaciers descend from this range.

Find out

- The names of the glaciers and passes that lie in the Great Himalayas.
- The name of the states where the highest peaks are located.

The range lying to the south of the Himadri forms the most rugged mountain system and is known as *Himachal* or lesser Himalaya. The ranges are mainly composed of highly compressed and altered rocks. The altitude varies between 3,700 and 4,500 metres and the average width is of 50 Km. While the *Pir Panjal range* forms the longest and the most important range, the *Dhaura Dhar* and the *Mahabharat* ranges are also prominent ones. This range consists of the famous valley of Kashmir, the Kangra and Kullu Valley in Himachal Pradesh. This region is well-known for its hill stations.

Find out

- Location of Mussoorie, Nainital, Ranikhet from your atlas and also name the state where they are located.

The outer-most range of the Himalayas is called the **Shiwaliks**. They extend over a width

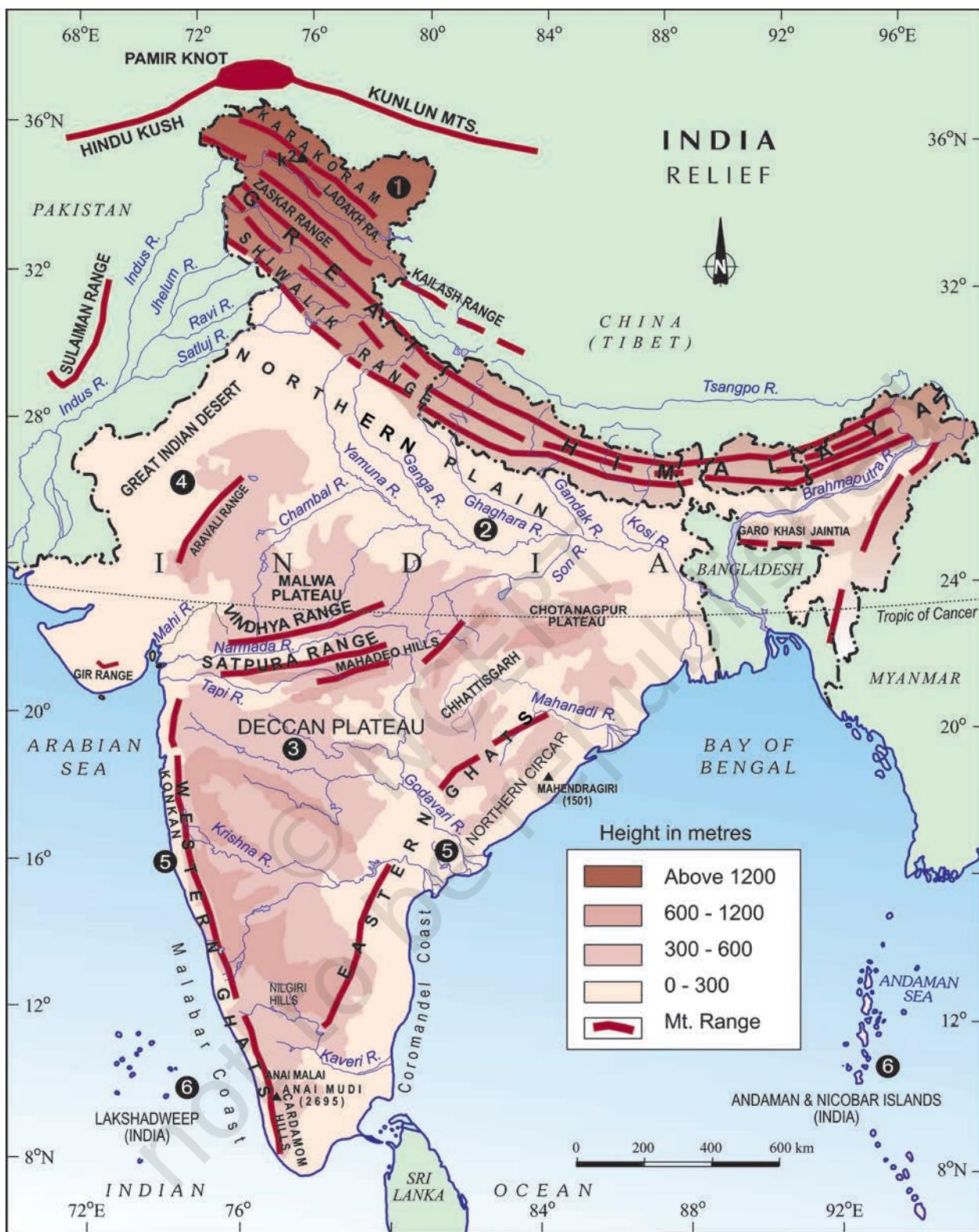




Figure 2.3 : The Himalayas

of 10-50 Km and have an altitude varying between 900 and 1100 metres. These ranges are composed of unconsolidated sediments brought down by rivers from the main Himalayan ranges located farther north. These valleys are covered with thick gravel and alluvium. The longitudinal valley lying between lesser Himalaya and the Shiwaliks are known as Duns. Dehra Dun, Kotli Dun and Patli Dun are some of the well-known Duns.

Besides the longitudinal divisions, the Himalayas have been divided on the basis of regions from west to east. These divisions have been demarcated by river valleys. For example, the part of Himalayas lying between Indus and Satluj has been traditionally known as Punjab Himalaya but it is also known regionally as Kashmir and Himachal Himalaya from west to east respectively. The part of the Himalayas lying between Satluj and Kali rivers is known as Kumaon Himalayas. The Kali and Teesta rivers demarcate the Nepal Himalayas and the part lying between Teesta and Dihang rivers is known as Assam Himalayas. There are regional names also in these broad

categories. Find out some regional names of the Himalayas

The Brahmaputra marks the eastern-most boundary of the Himalayas. Beyond the Dihang gorge, the Himalayas bend sharply to the south and spread along the eastern boundary of India. They are known as the *Purvachal* or the Eastern hills and mountains. These hills running through the north-eastern states are mostly composed of strong sandstones, which are sedimentary rocks. Covered with dense forests, they mostly run as parallel ranges and valleys. The *Purvachal* comprises the *Patkai hills, the Naga hills, the Manipur hills and the Mizo hills.*



Figure 2.4 : Mizo Hills

The Northern Plain

The northern plain has been formed by the interplay of the three major river systems, namely — the Indus, the Ganga and the Brahmaputra along with their tributaries. This plain is formed of alluvial soil. The deposition of alluvium in a vast basin lying at the foothills of the Himalaya over millions of years, formed this fertile plain. It spreads over an area of 7 lakh sq. km. The plain being about 2400 km long and 240 to 320 km broad, is a densely populated physiographic division. With a rich soil cover combined with adequate water supply and favourable climate it is agriculturally a productive part of India.



Figure 2.5 : The Northern Plains

The rivers coming from northern mountains are involved in depositional work. In the lower course, due to gentle slope, the velocity of the river decreases, which results in the formation of riverine islands.

Do You Know?

Majuli, in the Brahmaputra river, is the largest inhabited riverine island in the world.

The rivers in their lower course split into numerous channels due to the deposition of silt. These channels are known as *distributaries*.

The Northern Plain is broadly divided into three sections. The Western part of the Northern Plain is referred to as the Punjab Plains. Formed by the Indus and its tributaries, the larger part of this plain lies in Pakistan. The Indus and its tributaries — the Jhelum, the Chenab, the Ravi, the Beas and the Satluj originate in the Himalaya. This section of the plain is dominated by the *doabs*.

Do You Know?

'Doab' is made up of two words — 'do' meaning two and 'ab' meaning water. Similarly 'Punjab', is also made up two words — 'Punj' meaning five and 'ab' meaning water.

The Ganga plain extends between Ghaggar and Teesta rivers. It is spread over North India in Haryana, Delhi, U.P., Bihar, partly Jharkhand and West Bengal. In the East, particularly in Assam lies the Brahmaputra plain.

The northern plains are generally described as flat land with no variations in its relief. It is not true. These vast plains also have diverse relief features. According to the variations in relief features, the Northern plains can be divided into four regions. The rivers, after descending from the mountains deposit pebbles in a narrow belt of about 8 to 16 km in width lying parallel to the slopes of the Shiwaliks. It is known as *bhabar*. All the streams disappear in this *bhabar* belt. South of this belt, the streams and rivers re-emerge and create a wet, swampy and marshy region known as *terai*. This was a thickly forested region full of wildlife. The forests have been cleared to create agricultural land and to settle migrants from Pakistan after partition. Locate Dudhwa National Park in this region.

The largest part of the northern plain is formed of older alluvium. It lies above the floodplains of the rivers and presents a terrace-like feature. This part is known as *bhangar*. The soil in this region contains calcareous deposits, locally known as *kankar*. The

newer, younger deposits of the floodplains are called *khadar*. They are renewed almost every year and so are fertile, thus, ideal for intensive agriculture.

The Peninsular Plateau

The Peninsular plateau is a tableland composed of the old crystalline, igneous and metamorphic rocks. It was formed due to the breaking and drifting of the Gondwana land and thus, making it a part of the oldest landmass. The plateau has broad and shallow valleys and rounded hills. This plateau consists of two broad divisions, namely, the Central Highlands and the Deccan Plateau. The part of the Peninsular plateau lying to the north of the Narmada river, covering a major area of the Malwa plateau, is known as the Central Highlands. The Vindhyan range is bounded by the Satpura range on the south and the Aravalis on the northwest. The further westward extension gradually merges with the sandy and rocky desert of Rajasthan. The flow of the rivers draining this region, namely the Chambal, the Sind, the Betwa and the Ken is from southwest to northeast, thus indicating the slope. The Central Highlands are wider in the west but narrower in the east. The eastward extensions of this plateau are locally known as the Bundelkhand and Baghelkhand.

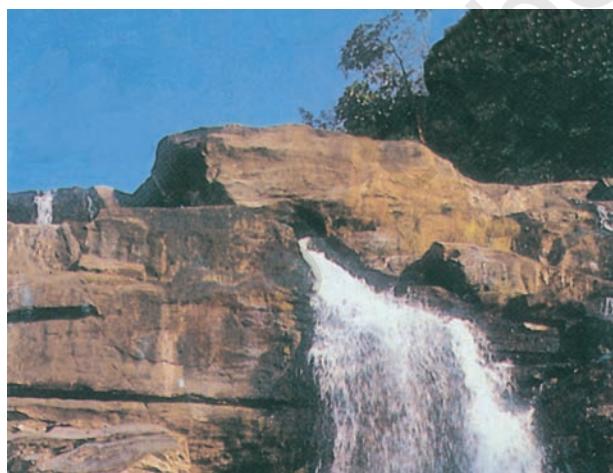


Figure 2.6 : A Waterfall in Chotanagpur Plateau

The Chotanagpur plateau marks the further eastward extension, drained by the Damodar river.

The Deccan Plateau is a triangular landmass that lies to the south of the river Narmada. The Satpura range flanks its broad base in the north, while the Mahadev, the Kaimur hills and the Maikal range form its eastern extensions. Locate these hills and ranges in the Physical map of India. The Deccan Plateau is higher in the west and slopes gently eastwards. An extension of the Plateau is also visible in the northeast, locally known as the Meghalaya, Karbi-Anglong Plateau and North Cachar Hills. It is separated by a fault from the Chotanagpur Plateau. Three prominent hill ranges from the west to the east are the Garo, the Khasi and the Jaintia Hills.

The Western Ghats and the Eastern Ghats mark the western and the eastern edges of the Deccan Plateau respectively. Western Ghats lie parallel to the western coast. They are continuous and can be crossed through passes only. Locate the Thal, Bhor and Pal Ghats in the Physical map of India.

The Western Ghats are higher than the Eastern Ghats. Their average elevation is 900–1600 metres as against 600 metres of the Eastern Ghats. The Eastern Ghats stretch from the Mahanadi Valley to the Nigiris in the south. The Eastern Ghats are discontinuous and irregular and dissected by rivers draining into the Bay of Bengal. The Western Ghats cause orographic rain by facing the rain bearing moist winds to rise along the western slopes of the Ghats. The Western Ghats are known by different local names. The height of the Western Ghats progressively increases from north to south. The highest peaks include the Anai Mudi (2,695 metres) and the Doda Betta (2,637 metres). Mahendragiri (1,501 metres) is the highest peak in the Eastern Ghats. Shevroy Hills and the Javadi Hills are located to the southeast of the

Eastern Ghats. Locate the famous hill stations of Udagamandalam, popularly known as Ooty and the Kodaikanal.

One of the distinct features of the Peninsular plateau is the black soil area known as Decean Trap. This is of volcanic origin, hence, the rocks are igneous. Actually, these rocks have denuded over time and are responsible for the formation of black soil. The Aravali Hills lie on the western and northwestern margins of the Peninsular plateau. These are highly eroded hills and are found as broken hills. They extend from Gujarat to Delhi in a southwest-northeast direction.

The Indian Desert

The Indian desert lies towards the western margins of the Aravali Hills. It is an undulating sandy plain covered with sand dunes. This region receives very low rainfall below 150 mm per year. It has arid climate with low vegetation cover. Streams appear during the rainy season. Soon after they disappear into the sand as they do not have enough water to reach the sea. Luni is the only large river in this region.



Figure 2.7 : The Indian Desert

Barchans (crescent-shaped dunes) cover larger areas but longitudinal dunes become

more prominent near the Indo-Pakistan boundary. If you visit Jaisalmer, you may go to see a group of barchans.

The Coastal Plains

The Peninsular plateau is flanked by stretch of narrow coastal strips, running along the Arabian Sea on the west and the Bay of Bengal on the east. The *western coast*, sandwiched between the Western Ghats and the Arabian Sea, is a narrow plain. It consists of three sections. The *northern part of the coast* is called the Konkan (Mumbai – Goa), the central stretch is called the Kannad Plain, while the *southern stretch* is referred to as the Malabar coast.



Figure 2.8 : The Coastal Plains

The plains along the Bay of Bengal are wide and level. In the northern part, it is referred to as the *Northern Circar*, while the *southern part* is known as the *Coromandel Coast*. Large rivers, such as the Mahanadi, the Godavari, the Krishna and the Kaveri have formed extensive delta on this coast. Lake Chilika is an important feature along the eastern coast.

Do You Know?

The Chilika Lake is the largest salt water lake in India. It lies in the state of Odisha, to the south of the Mahanadi delta.

The Islands

You have already seen that India has a vast mainland. Besides this, the country has two groups of islands. Can you identify these island groups?



Figure 2.9 : An Island

Locate the Lakshadweep Islands group lying close to the Malabar coast of Kerala. This group of islands is composed of small coral isalnds. Earlier they were known as Laccadive, Minicoy and Amindive. In 1973, these were named as Lakshadweep. It covers small area of 32 sq km. Kavaratti island is the administrative headquarters of Lakshadweep. This island group has great diversity of flora and fauna. The Pitti island, which is uninhabited, has a bird sanctuary.

Now you see the elongated chain of islands located in the Bay of Bengal extending from north to south. These are Andaman and Nicobar islands. They are bigger in size and are more numerous and scattered. The entire group of islands is divided into two broad categories – The Andaman in the north and the Nicobar in the south. It is believed that these islands are an elevated portion of submarine mountains. These island groups are of great strategic importance for the country. There is great diversity of flora and fauna in this group of islands too. These islands lie close to equator and experience equatorial climate and has thick forest cover.

Do You Know?

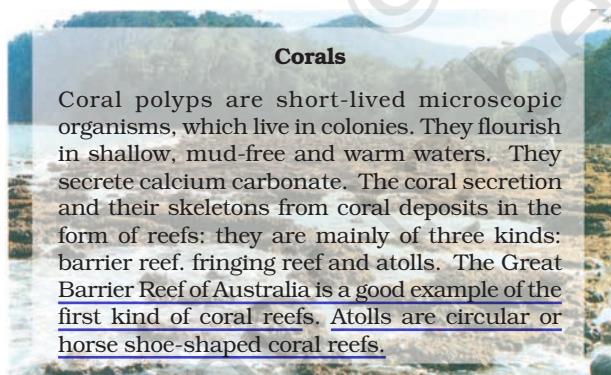
India's only active volcano is found on Barren island in Andaman and Nicobar group of Islands.

cds pyq

A detailed account of the different physiographic units highlights the unique features of each region. It would, however, be clear that each region complements the other and makes the country richer in its natural resources. The mountains are the major sources of water and forest wealth. The northern plains are the granaries of the country. They provide the base for early civilisations. The plateau is a storehouse of minerals, which has played a crucial role in the industrialisation of the country. The coastal region and island groups provide sites for fishing and port activities. Thus, the diverse physical features of the land have immense future possibilities of development.

Corals

Coral polyps are short-lived microscopic organisms, which live in colonies. They flourish in shallow, mud-free and warm waters. They secrete calcium carbonate. The coral secretion and their skeletons form coral deposits in the form of reefs: they are mainly of three kinds: barrier reef, fringing reef and atolls. The Great Barrier Reef of Australia is a good example of the first kind of coral reefs. Atolls are circular or horse shoe-shaped coral reefs.



EXERCISE

1. Choose the right answer from the four alternatives given below.
 - (i) A landmass bounded by sea on three sides is referred to as
 - (a) Coast
 - (b) Island
 - (c) Peninsula
 - (d) None of the above
 - (ii) Mountain ranges in the eastern part of India forming its boundary with Myanmar are collectively called
 - (a) Himachal
 - (b) Uttarakhand
 - (c) Purvachal
 - (d) None of the above
 - (iii) The western coastal strip, south of Goa is referred to as
 - (a) Coromandel
 - (b) Konkan
 - (c) Kannad
 - (d) Northern Circar
 - (iv) The highest peak in the Eastern Ghats is
 - (a) Anai Mudi
 - (b) Kanchenjunga
 - (c) Mahendragiri
 - (d) Khasi
2. Answer the following questions briefly.
 - (i) What is the *bhabar*?
 - (ii) Name the three major divisions of the Himalayas from north to south.
 - (iii) Which plateau lies between the Aravali and the Vindhyan ranges?
 - (iv) Name the island group of India having coral origin.
3. Distinguish between
 - (i) *Bhangar and Khadar*
 - (ii) Western Ghats and Eastern Ghats
4. Which are the major physiographic divisions of India? Contrast the relief of the Himalayan region with that of the Peninsular plateau.
5. Give an account of the Northern Plains of India.
6. Write short notes on the following.
 - (i) The Indian Desert
 - (ii) The Central Highlands
 - (iii) The Island groups of India

MAP SKILLS

On an outline map of India show the following.

- (i) Mountain and hill ranges – the Karakoram, the Zaskar, the Patkai Bum, the Jaintia, the Vindhya range, the Aravali, and the Cardamom hills.
- (ii) Peaks – K2, Kanchenjunga, Nanga Parbat and the Anai Mudi.
- (iii) Plateaus, Chotanagpur and Malwa
- (iv) The Indian Desert, Western Ghats, Lakshadweep Islands

PROJECT/ACTIVITY

Locate the peaks, passes, ranges, plateaus, hills, and duns hidden in the puzzle. Try to find where these features are located. You may start your search horizontally, vertically or diagonally.

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E | M | K | U | N | L | N | A | T | H | U | L | A | R | I | A | H | I | A | T |
| M | H | A | S | J | M | A | N | J | K | M | A | J | L | B | H | O | R | P | J |
| J | N | V | F | A | E | T | D | C | A | R | D | E | M | O | M | L | O | M | K |
| C | R | E | I | I | Q | H | M | O | I | F | T | N | X | M | A | X | F | C | T |
| N | M | T | S | N | A | U | Q | R | M | S | A | N | A | D | I | D | A | N | J |
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3

DRAINAGE

The term **drainage** describes the river system of an area. Look at the physical map. You will notice that small streams flowing from different directions come together to form the main river, which ultimately drains into a large water body such as a lake or a sea or an ocean. The area drained by a single river system is called a **drainage basin**. A closer observation on a map will indicate that any elevated area, such as a mountain or an upland, separates two drainage basins. Such an upland is known as a **water divide** (Figure 3.1).

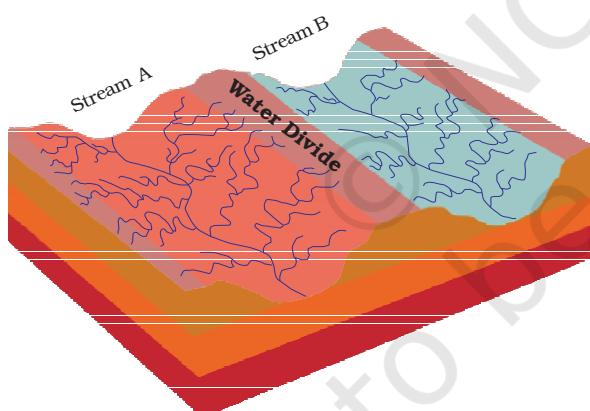


Figure 3.1 : Water Divide

Do You Know?

The world's largest drainage basin is of the Amazon river

Find out

- Which river has the largest basin in India?

ganga

DRAINAGE SYSTEMS IN INDIA

The drainage systems of India are mainly controlled by the broad relief features of the subcontinent. Accordingly, the Indian rivers are divided into two major groups:

- the Himalayan rivers; and
- the Peninsular rivers.

Apart from originating from the two major physiographic regions of India, the Himalayan and the Peninsular rivers are different from each other in many ways. Most of the Himalayan rivers are **perennial**. It means that they have water throughout the year. These rivers receive water from rain as well as from melted snow from the lofty mountains. The two major Himalayan rivers, the Indus and the Brahmaputra originate from the north of the mountain ranges. They have cut through the mountains making gorges. The Himalayan rivers have long courses from their source to the sea.



Figure 3.2 : A Gorge

They perform intensive erosional activity in their upper courses and carry huge loads of silt and sand. In the middle and the lower courses, these rivers form meanders, oxbow lakes, and many other depositional features in their floodplains. They also have well-developed deltas (Figure 3.3).

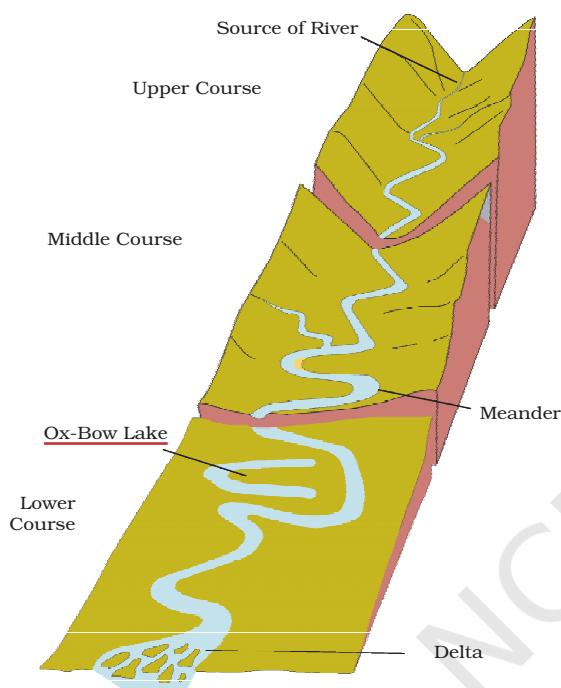


Figure 3.3 : Some Features Made by Rivers

A large number of the Peninsular rivers are seasonal, as their flow is dependent on rainfall. During the dry season, even the large rivers have reduced flow of water in their channels. The Peninsular rivers have shorter and shallower courses as compared to their Himalayan counterparts. However, some of them originate in the central highlands and flow towards the west. Can you identify two such large rivers? Most of the rivers of peninsular India originate in the Western Ghats and flow towards the Bay of Bengal.

The Himalayan Rivers

The major Himalayan rivers are the Indus, the Ganga and the Brahmaputra. These rivers are long, and are joined by many large and important tributaries. A river alongwith its tributaries may be called a **river system**.

The Indus River System

The river Indus rises in Tibet, near Lake Mansarovar. Flowing west, it enters India in the Ladakh. It forms a picturesque gorge in this part. Several tributaries, the Zaskar, the Nubra, the Shyok and the Hunza, join it in the Kashmir region. The Indus flows through Baltistan and Gilgit and emerges from the mountains at Attock. The Satluj, the Beas, the Ravi, the Chenab and the Jhelum join together to enter the Indus near Mithankot in Pakistan. Beyond this, the Indus flows southwards eventually reaching the Arabian Sea, east of Karachi. The Indus plain has a very gentle slope. With a total length of 2900 km, the Indus is one of the longest rivers of the world. A little over a third of the Indus basin is located in India Ladakh, Jammu and Kashmir, Himachal Pradesh and Punjab and the rest is in Pakistan.

Do You Know?

- According to the regulations of the **Indus Water Treaty (1960)**, India can use only 20 per cent of the total water carried by the Indus river system. This water is used for irrigation in Punjab, Haryana and the southern and the western parts of Rajasthan.

The Ganga River System

The headwaters of the Ganga, called the 'Bhagirathi' is fed by the Gangotri Glacier and joined by the Alaknanda at Devaprayag in Uttarakhand. At Haridwar, the Ganga emerges from the mountains on to the plains.



Figure 3.4 : Major Rivers and Lakes

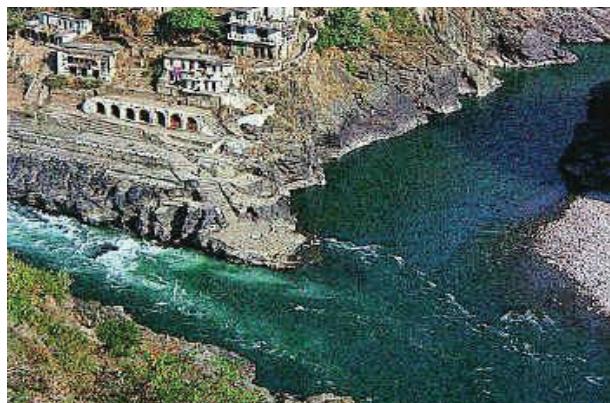


Figure 3.5 : Confluence of Bhagirathi and Alaknanda at Devaprayag

The Ganga is joined by many tributaries from the Himalayas, a few of them being major rivers, such as the Yamuna, the Ghaghara, the Gandak and the Kosi. The river Yamuna rises from the Yamunotri Glacier in the Himalayas. It flows parallel to the Ganga and as a right bank tributary meets the Ganga at Allahabad. The Ghaghara, the Gandak and the Kosi rise in the Nepal Himalaya. They are the rivers, which flood parts of the northern plains every year, causing widespread damage to life and property, whereas, they enrich the soil for agricultural use.

The main tributaries, which come from the peninsular uplands, are the Chambal, the Betwa and the Son. These rise from semi-arid areas, have shorter courses and do not carry much water in them. Find out where and how they ultimately join the Ganga.

Do You Know?

• The *Namami Gange Programme* is an Integrated Conservation Mission approved as a 'flagship programme' by the Union Government in June 2014 to accomplish the twin objectives of effective abatement of pollution, conservation and rejuvenation of the national river, Ganga. You may explore about this project at <http://nmcg.nic.in/NamamiGanga.sspx#>

Enlarged with the waters from its right and left bank tributaries, the Ganga flows eastwards till Farakka in West Bengal. This is

the northernmost point of the Ganga delta. The river bifurcates here; the Bhagirathi-Hooghly (a distributary) flows southwards through the deltaic plains to the Bay of Bengal. The mainstream, flows southwards into Bangladesh and is joined by the Brahmaputra. Further downstream, it is known as the Meghna. This mighty river, with waters from the Ganga and the Brahmaputra, flows into the Bay of Bengal. The delta formed by these rivers is known as the *Sundarban Delta*.

Do You Know?

- The Sundarban Delta derived its name from the Sundari tree, which grows well in marshland.
- It is the world's largest and fastest growing delta. It is also the home of Royal Bengal tiger.

The length of the Ganga is over 2500 km. Look at Figure 3.4; can you identify the type of drainage pattern formed by the Ganga river system? Ambala is located on the water divide between the Indus and the Ganga river systems. The plains from Ambala to the Sunderban stretch over nearly 1800 km, but the fall in its slope is hardly 300 metres. In other words, there is a fall of just one metre for every 6 km. Therefore, the river develops large meanders.

The Brahmaputra River System

The Brahmaputra rises in Tibet east of Mansarovar lake very close to the sources of the Indus and the Satluj. It is slightly longer than the Indus, and most of its course lies outside India. It flows eastwards parallel to the Himalayas. On reaching the Namcha Barwa (7757 m), it takes a 'U' turn and enters India in Arunachal Pradesh through a gorge. Here, it is called the Dihang and it is joined by the Dibang, the Lohit, and many other tributaries to form the Brahmaputra in Assam.

Do You Know?

- Brahmaputra is known as the Tsang Po in Tibet and Jamuna in Bangladesh.

In Tibet, the river carries a smaller volume of water and less silt as it is a cold and a dry area. In India, it passes through a region of high rainfall. Here the river carries a large volume of water and considerable amount of silt. The Brahmaputra has a braided channel in its entire length in Assam and forms many riverine islands. Do you remember the name of the world's largest riverine island formed by the Brahmaputra?

Every year during the rainy season, the river overflows its banks, causing widespread devastation due to floods in Assam and Bangladesh. Unlike other north Indian rivers, the Brahmaputra is marked by huge deposits of silt on its bed causing the riverbed to rise. The river also shifts its channel frequently.

The Peninsular Rivers

The main water divide in Peninsular India is formed by the Western Ghats, which runs from north to south close to the western coast. Most of the major rivers of the Peninsula, such as the Mahanadi, the Godavari, the Krishna and the Kaveri flow eastwards and drain into the Bay of Bengal. These rivers make deltas at their mouths. There are numerous small streams flowing west of the Western Ghats. **The Narmada and the Tapi are the only long rivers, which flow west and make estuaries.** The drainage basins of the peninsular rivers are comparatively smaller in size.

The Narmada Basin

The Narmada rises in the Amarkantak hills in Madhya Pradesh. It flows towards the west in a rift valley formed due to faulting. On its way to the sea, the Narmada creates many picturesque locations. The 'Marble rocks', near Jabalpur, where the Narmada flows through a deep gorge, and the 'Dhuadhar falls, where the river plunges over steep rocks, are some of the notable ones.

Do You Know?

- The Narmada river conservation mission has been undertaken by the government of Madhya Pradesh by a scheme named *Namami Devi Narmade*. You may visit their website. <http://www.namamidevinarmade.mp.gov.in> to learn more about it.

All tributaries of the Narmada are very short and most of these join the main stream at right angles. **The Narmada basin covers parts of Madhya Pradesh and Gujarat.**

The Tapi Basin

The Tapi rises in the Satpura ranges, in the Betul district of Madhya Pradesh. It also flows in a rift valley parallel to the Narmada but it is much shorter in length. Its basin covers parts of Madhya Pradesh, Gujarat and Maharashtra.

The coastal plains between Western Ghats and the Arabian Sea are very narrow. Hence, the coastal rivers are short. **The main west flowing rivers are Sabarmati, Mahi, Bharathpuzha and Periyar.** Find out the states in which these rivers drain the water.

The Godavari Basin

The Godavari is the largest Peninsular river. It rises from the slopes of the Western Ghats in the Nasik district of Maharashtra. Its length is about 1500 km. It drains into the Bay of Bengal. Its drainage basin is also the largest among the peninsular rivers. The basin covers parts of Maharashtra (about 50 per cent of the basin area lies in Maharashtra), Madhya Pradesh, Odisha and Andhra Pradesh. The Godavari is joined by a number of tributaries, such as the Purna, the Wardha, the Pranhita, the Manjra, the Wainganga and the Penganga. The last three tributaries are very large. Because of its length and the area it covers, it is also known as the *Dakshin Ganga*.

The Mahanadi Basin

The Mahanadi rises in the highlands of Chhattisgarh. It flows through Odisha to reach

the Bay of Bengal. The length of the river is about 860 km. Its drainage basin is shared by Maharashtra, Chhattisgarh, Jharkhand, and Odisha.

The Krishna Basin

Rising from a spring near Mahabaleshwar, the Krishna flows for about 1400 km and reaches the Bay of Bengal. The Tungabhadra, the Koyana, the Ghatprabha, the Musi and the Bhima are some of its tributaries. Its drainage basin is shared by Maharashtra, Karnataka and Andhra Pradesh.

The Kaveri Basin

The Kaveri rises in the Brahmagiri range of the Western Ghats and it reaches the Bay of Bengal in south of Cuddalore in Tamil Nadu. The total length of the river is about 760 km. Its main tributaries are Amravati, Bhavani, Hemavati and Kabini. Its basin drains parts of Karnataka, Kerala and Tamil Nadu.

Do You Know?

- The river Kaveri makes the second biggest waterfall in India, known as Shivasamudram Falls. The hydroelectric power generated from the falls is supplied to Mysuru, Bengaluru and the Kolar Gold Field.

Find out

- The name of the biggest waterfall in India.

Besides these major rivers, there are some smaller rivers flowing towards the east. The Damoder, the Brahmani, the Baitarni and the Subarnrekha are some notable examples. Locate them in your atlas.

Do You Know?

- 71 per cent of the world's surface is covered with water, but 97 per cent of that is salt water.
- Of the 3 per cent that is available as freshwater, three quarters of it is trapped as ice.

LAKES

You may be familiar with the valley of Kashmir and the famous Dal Lake, the house boats and *shikaras*, which attract thousands of tourists every year. Similarly, you may have visited some other tourist spot near a lake and enjoyed boating, swimming and other water games.

Imagine that if Srinagar, Nainital and other tourists places did not have a lake would they have been as attractive as they are today? Have you ever tried to know the importance of lakes in making a place attractive to tourists? Apart from attraction for tourists, lakes are also useful to human beings in many ways.

Find out

- Lakes of large extent are called seas, like the Caspian, the Dead and the Aral seas.

India has many lakes. These differ from each other in size and other characteristics. Most lakes are permanent; some contain water only during the rainy season, like the lakes in the basins of inland drainage of semi-arid regions. There are some lakes which are the result of the action of glaciers and ice sheets, while others have been formed by wind, river action and human activities.

A meandering river across a floodplain forms **cut-offs** that later develops into **ox-bow** lakes. Spits and bars form lagoons in the coastal areas, e.g. the Chilika lake, the Pulicat lake and the Kolleru lake. Lakes in the region of inland drainage are sometimes seasonal; for example, the Sambhar lake in Rajasthan, which is a salt water lake. Its water is used for producing salt.

Most of the freshwater lakes are in the Himalayan region. They are of glacial origin. In other words, they formed when glaciers dug out a basin, which was later filled with snowmelt. The Wular lake in Jammu and Kashmir, in contrast, is the result of tectonic activity. It is the largest freshwater lake in India. The Dal lake, Bhimtal, Nainital, Loktak and Barapani are some other important freshwater lakes.



Figure 3.6 : Loktak Lake

Apart from natural lakes, the damming of the rivers for the generation of hydel power has also led to the formation of lakes, such as Guru Gobind Sagar (Bhakra Nangal Project).

Activity

Make a list of natural and artificial lakes with the help of the atlas.

Lakes are of great value to human beings. A lake helps to regulate the flow of a river. During heavy rains, it prevents flooding and during the dry season, it helps to maintain an even flow of water. Lakes can also be used for developing hydel power. They moderate the climate of the surroundings; maintain the aquatic ecosystem, enhance natural beauty, help develop tourism and provide recreation.

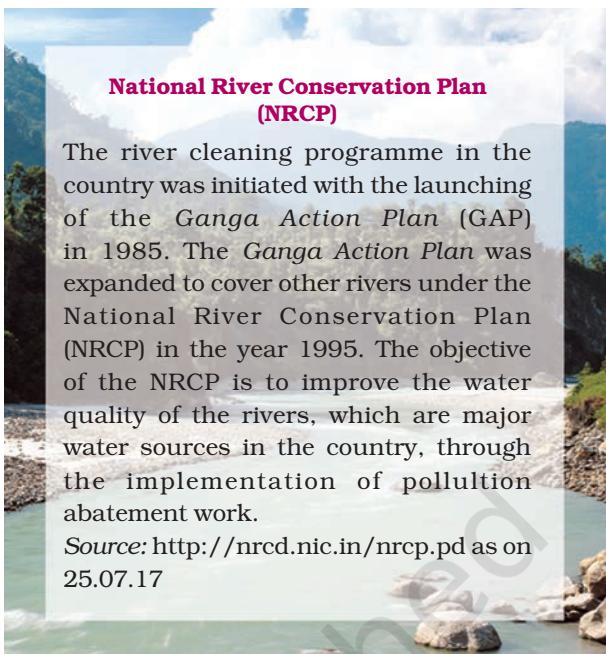
ROLE OF RIVERS IN THE ECONOMY

Rivers have been of fundamental importance throughout the human history. Water from rivers is a basic natural resource, essential for various human activities. Therefore, riverbanks have attracted settlers from ancient times. These settlements have now become big cities. Make a list of cities in your state which are located on the bank of a river.

Using rivers for irrigation, navigation, hydro-power generation is of special significance — particularly to a country like India, where agriculture is the major source of livelihood of the majority of its population.

RIVER POLLUTION

The growing domestic, municipal, industrial and agricultural demand for water from rivers naturally affects the quality of water. As a



result, more and more water is being drained out of the rivers reducing their volume. On the other hand, a heavy load of untreated sewage and industrial effluents are emptied into the rivers. This affects not only the quality of water but also the self-cleansing capacity of the river. For example, given the adequate streamflow, the Ganga water is able to dilute and assimilate pollution loads within 20 km of large cities. But the increasing urbanisation and industrialisation do not allow it to happen and the pollution level of many rivers has been rising. Concern over rising pollution in our rivers led to the launching of various action plans to clean the rivers. Have you heard about such action plans? How does our health get affected by polluted river water? Think about "life of human beings without fresh water". Arrange a debate on this topic in the class.

EXERCISE

- Choose the right answer from the four alternatives given below.
 - In which of the following states is the Wular lake located?
 - Rajasthan
 - Uttar Pradesh
 - Punjab
 - Jammu and Kashmir

- (ii) The river Narmada has its source at
(a) Satpura (c) Amarkantak
(b) Brahmagiri (d) Slopes of the Western Ghats

(iii) Which one of the following lakes is a salt water lake?
(a) Sambhar (c) Wular
(b) Dal (d) Gobind Sagar

(iv) Which one of the following is the longest river of the Peninsular India?
(a) Narmada (c) Godavari
(b) Krishna (d) Mahanadi

(v) Which one amongst the following rivers flows through a rift valley?
(a) Mahanadi (c) Krishna
(b) Tungabhadra (d) Tapi

2. Answer the following questions briefly.

 - What is meant by a water divide? Give an example.
 - Which is the largest river basin in India?
 - Where do the rivers Indus and Ganga have their origin?
 - Name the two headstreams of the Ganga. Where do they meet to form the Ganga?
 - Why does the Brahmaputra in its Tibetan part have less silt, despite a longer course?
 - Which two Peninsular rivers flow through trough?
 - State some economic benefits of rivers and lakes.

3. Below are given names of a few lakes of India. Group them under two categories – natural and created by human beings.

| | |
|---------------------|-----------------------|
| (a) Wular | (b) Dal |
| (c) Nainital | (d) Bhimtal |
| (e) Gobind Sagar | (f) Loktak |
| (g) Barapani | (h) Chilika |
| (i) Sambhar | (j) Rana Pratap Sagar |
| (k) Nizam Sagar | (l) Pulicat |
| (m) Nagarjuna Sagar | (n) Hirakund |

4. Discuss the significant difference between the Himalayan and the Peninsular rivers.

5. Compare the east flowing and the west flowing rivers of the Peninsular plateau.

6. Why are rivers important for the country's economy?

Map Skills

- (i) On an outline map of India mark and label the following rivers: Ganga, Satluj, Damodar, Krishna, Narmada, Tapi, Mahanadi, and Brahmaputra.

(ii) On an outline map of India mark and label the following lakes: Chilika, Sambhar, Wular, Pulicat, Kolleru.

Project/Activity

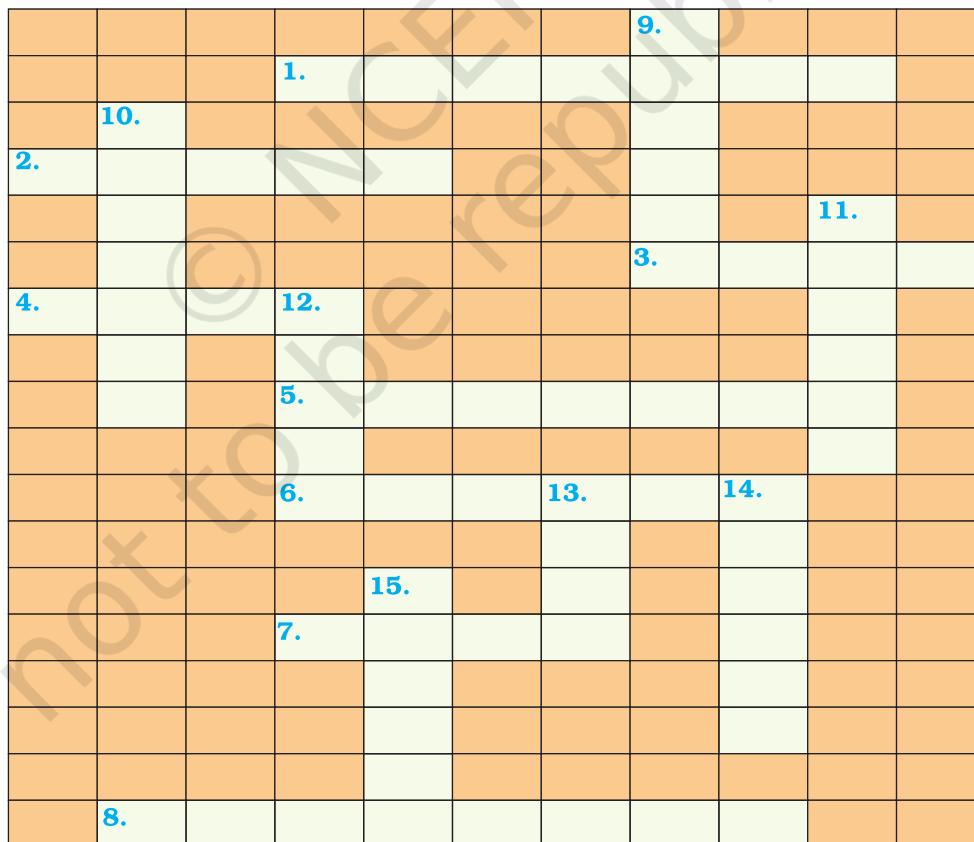
Solve this crossword puzzle with the help of given clues.

Across

1. Nagarjuna Sagar is a river valley project. Name the river?
2. The longest river of India.
3. The river which originates from a place known as Beas Kund.
4. The river which rises in the Betul district of MP and flows westwards.
5. The river which was known as the "Sorrow" of West Bengal.
6. The river on which the reservoir for Indira Gandhi Canal has been built.
7. The river whose source lies near Rohtang Pass.
8. The longest river of Peninsular India?

Down

9. A tributary of Indus originating from Himachal Pradesh.
10. The river flowing through fault, drains into the Arabian Sea.
11. A river of south India, which receives rainwater both in summer and winter.
12. A river which flows through Ladakh, Gilgit and Pakistan.
13. An important river of the Indian desert.
14. The river which joins Chenab in Pakistan.
15. A river which rises at Yamunotri glacier.





4

CLIMATE

In the last two chapters you have read about the landforms and the drainage of our country. These are the two of the three basic elements that one learns about the natural environment of any area. In this chapter you will learn about the third, that is, the atmospheric conditions that prevail over our country. Why do we wear woollens in December or why it is hot and uncomfortable in the month of May, and why it rains in June - July? The answers to all these questions can be found out by studying about the climate of India.

Climate refers to the sum total of weather conditions and variations over a large area for a long period of time (more than thirty years). **Weather** refers to the state of the atmosphere over an area at any point of time. The elements of weather and climate are the same, i.e. temperature, atmospheric pressure, wind, humidity and precipitation. You may have observed that the weather conditions fluctuate very often even within a day. But there is some common pattern over a few weeks or months, i.e. days are cool or hot, windy or calm, cloudy or bright, and wet or dry. On the basis of the generalised monthly atmospheric conditions, the year is divided into seasons such as winter, summer or rainy seasons.

The world is divided into a number of climatic regions. Do you know what type of climate India has and why it is so? We will learn about it in this chapter.

Do You Know?

- The word monsoon is derived from the Arabic word 'mausim' which literally means season.
- 'Monsoon' refers to the seasonal reversal in the wind direction during a year.

The climate of India is described as the '**monsoon**' type. In Asia, this type of climate is found mainly in the south and the southeast. Despite an overall unity in the general pattern, there are perceptible regional variations in climatic conditions within the country. Let us take two important elements – temperature and precipitation, and examine how they vary from place to place and season to season.

In summer, the mercury occasionally touches 50°C in some parts of the Rajasthan desert, whereas it may be around 20°C in Pahalgam in Jammu and Kashmir. On a winter night, temperature at Drass in Jammu and Kashmir may be as low as minus 45°C. Thiruvananthapuram, on the other hand, may have a temperature of 22°C.

Do You Know?

In certain places there is a wide difference between day and night temperatures. In the Thar Desert the day temperature may rise to 50°C, and drop down to near 15°C the same night. On the other hand, there is hardly any difference in day and night temperatures in the Andaman and Nicobar islands or in Kerala.

Let us now look at precipitation. There are variations not only in the form and types of precipitation but also in its amount and the seasonal distribution. While precipitation is mostly in the form of snowfall in the upper parts of Himalayas, it rains over the rest of the country. The annual precipitation varies from over 400 cm in Meghalaya to less than 10 cm in Ladakh and western Rajasthan. Most parts of the country receive rainfall from June to September. But some parts like the Tamil Nadu

coast gets a large portion of its rain during October and November.

In general, coastal areas experience less contrasts in temperature conditions. Seasonal contrasts are more in the interior of the country. There is decrease in rainfall generally from east to west in the Northern Plains. These variations have given rise to variety in lives of people – in terms of the food they eat, the clothes they wear and also the kind of houses they live in.

Find out

Why the houses in Rajasthan have thick walls and flat roofs?

- Why is it that the houses in the Tarai region and in Goa and Mangalore have sloping roofs?
- Why houses in Assam are built on stilts?

CLIMATIC CONTROLS

There are six major controls of the climate of any place. They are: **latitude**, **altitude**, **pressure and wind system**, **distance from the sea** (continentality), **ocean currents and relief features**.

Due to the curvature of the earth, the amount of solar energy received varies according to **latitude**. As a result, air temperature generally decreases from the equator towards the poles. As one goes from the surface of the earth to higher **altitudes**, the atmosphere becomes less dense and temperature decreases. The hills are therefore cooler during summers. The **pressure and wind** system of any area depend on the latitude and altitude of the place. Thus it influences the temperature and rainfall pattern. The sea exerts a moderating influence on climate: As the **distance from the sea** increases, its moderating influence decreases and the people experience extreme weather conditions. This condition is known as continentality (i.e. very hot during summers and very cold during winters). **Ocean currents** along with onshore winds affect the climate of the coastal areas. For example, any coastal area with warm or cold currents flowing past it, will be warmed or cooled if the winds are onshore.

Find out

- Why most of the world's deserts are located in the western margins of continents in the subtropics?

Finally, **relief** too plays a major role in determining the climate of a place. High mountains act as barriers for cold or hot winds; they may also cause precipitation if they are high enough and lie in the path of rain-bearing winds. The leeward side of mountains remains relatively dry.

FACTORS AFFECTING INDIA'S CLIMATE

Latitude

The Tropic of Cancer passes through the middle of the country from the **Rann of Kuchchh** in the **west to Mizoram** in the **east**. Almost half of the **country**, lying south of the **Tropic of Cancer**, belongs to the **tropical area**. All the remaining **area**, north of the **Tropic**, lies in the **sub-tropics**. Therefore, India's climate has characteristics of **tropical as well as subtropical climates**.

Altitude

India has mountains to the north, which have an average height of about 6,000 metres. India also has a vast coastal area where the maximum elevation is about 30 metres. The Himalayas prevent the cold winds from Central Asia from entering the subcontinent. It is because of these mountains that this subcontinent experiences comparatively milder winters as compared to central Asia.

Pressure and Winds

The climate and associated weather conditions in India are governed by the following atmospheric conditions:

- **Pressure and surface winds;**
- **Upper air circulation; and**
- **Western cyclonic disturbances and tropical cyclones.**

India lies in the region of north easterly winds. These winds originate from the subtropical high-pressure belt of the northern

hemisphere. They blow southwards, get deflected to the right due to the Coriolis force, and move towards the equatorial low-pressure area. Generally, these winds carry little moisture as they originate and blow over land. Therefore, they bring little or no rain. Hence, India should have been an arid land, but it is not so. Let us see why?

Coriolis force: An apparent force caused by the earth's rotation. The Coriolis force is responsible for deflecting winds towards the right in the northern hemisphere and towards the left in the southern hemisphere. This is also known as 'Ferrel's Law'.

The pressure and wind conditions over India are unique. During winter, there is a high-pressure area north of the Himalayas. Cold dry winds blow from this region to the low-pressure areas over the oceans to the south. In summer, a low-pressure area develops over interior Asia, as well as, over northwestern India. This causes a complete reversal of the direction of winds during summer. Air moves from the high-pressure area over the southern Indian Ocean, in a south-easterly direction, crosses the equator, and turns right towards the low-pressure areas over the Indian subcontinent. These are known as the Southwest Monsoon winds. These winds blow over the warm oceans, gather moisture and bring widespread rainfall over the mainland of India.

THE SEASONS

The monsoon type of climate is characterised by a distinct seasonal pattern. The weather conditions greatly change from one season to the other. These changes are particularly noticeable in the interior parts of the country. The coastal areas do not experience much variation in temperature though there is variation in rainfall pattern. How many seasons are experienced in your place? Four main seasons can be identified in India – the cold weather season, the hot weather season, the

advancing monsoon and the retreating monsoon with some regional variations.

The Cold Weather Season (Winter)

The cold weather season begins from mid-November in northern India and stays till February. December and January are the coldest months in the northern part of India. The temperature decreases from south to the north. The average temperature of Chennai, on the eastern coast, is between 24°– 25° Celsius, while in the northern plains, it ranges between 10°C and 15° Celsius. Days are warm and nights are cold. Frost is common in the north and the higher slopes of the Himalayas experience snowfall.

During this season, the northeast trade winds prevail over the country. They blow from land to sea and hence, for most part of the country, it is a dry season. Some amount of rainfall occurs on the Tamil Nadu coast from these winds as, here they blow from sea to land.

In the northern part of the country, a feeble high-pressure region develops, with light winds moving outwards from this area. Influenced by the relief, these winds blow through the Ganga valley from the west and the northwest. The weather is normally marked by clear sky, low temperatures and low humidity and feeble, variable winds.

A characteristic feature of the cold weather season over the northern plains is the inflow of cyclonic disturbances from the west and the northwest. These low-pressure systems, originate over the Mediterranean Sea and western Asia and move into India, along with the westerly flow. They cause the much-needed winter rains over the plains and snowfall in the mountains. Although the total amount of winter rainfall locally known as '*mahawat*' is small, they are of immense importance for the cultivation of '*rabi*' crops.

The peninsular region does not have a well-defined cold season. There is hardly any noticeable seasonal change in temperature pattern during winters due to the moderating influence of the sea.



Figure 4.1 : Advancing Monsoon

The Hot Weather Season (Summer)

Due to the apparent northward movement of the sun, the global heat belt shifts northwards. As such, from March to May, it is hot weather season in India. The influence of the shifting of the heat belt can be seen clearly from temperature recordings taken during March–May at different latitudes. In March, the highest temperature is about 38° Celsius, recorded on the Deccan plateau. In April, temperatures in Gujarat and Madhya Pradesh are around 42° Celsius. In May, temperature of 45° Celsius is common in the northwestern parts of the country. In peninsular India, temperatures remain lower due to the moderating influence of the oceans.

The summer months experience rising temperature and falling air pressure in the northern part of the country. Towards the end of May, an elongated low-pressure area develops in the region extending from the Thar Desert in the northwest to Patna and Chotanagpur plateau in the east and southeast. Circulation of air begins to set in around this trough.

A striking feature of the hot weather season is the 'loo'. These are strong, gusty, hot, dry winds blowing during the day over the north and northwestern India. Sometimes they even continue until late in the evening. Direct exposure to these winds may even prove to be fatal. Dust storms are very common during the month of May in northern India. These storms bring temporary relief as they lower the temperature and may bring light rain and cool breeze. This is also the season for localised thunderstorms, associated with violent winds, torrential downpours, often accompanied by hail. In West Bengal, these storms are known as the 'Kaal Baisakhi'.

Towards the close of the summer season, pre-monsoon showers are common especially, in Kerala and Karnataka. They help in the early ripening of mangoes, and are often referred to as 'mango showers'.

Advancing Monsoon (The Rainy Season)

By early June, the low-pressure condition over the northern plains intensifies. It attracts the trade winds of the southern hemisphere. These south-east trade winds originate over the warm subtropical areas of the southern oceans. They cross the equator and blow in a south-westerly direction entering the Indian peninsula as the south-west monsoon. As these winds blow over warm oceans, they bring abundant moisture to the subcontinent. These winds are strong and blow at an average velocity of 30 km per hour. With the exception of the extreme north-west, the monsoon winds cover the country in about a month.

The inflow of the south-west monsoon into India brings about a total change in the weather. Early in the season, the windward side of the Western Ghats receives very heavy rainfall, more than 250 cm. The Deccan Plateau and parts of Madhya Pradesh also receive some amount of rain in spite of lying in the rain shadow area. The maximum rainfall of this season is received in the north-eastern part of the country. Mawsynram in the southern ranges of the Khasi Hills receives the highest average rainfall in the world. Rainfall in the Ganga valley decreases from the east to the west. Rajasthan and parts of Gujarat get scanty rainfall.

Another phenomenon associated with the monsoon is its tendency to have 'breaks' in rainfall. Thus, it has wet and dry spells. In other words, the monsoon rains take place only for a few days at a time. They are interspersed with rainless intervals. These breaks in monsoon are related to the movement of the monsoon trough. For various reasons, the trough and its axis keep on moving northward or southward, which determines the spatial distribution of rainfall. When the axis of the monsoon trough lies over the plains, rainfall is good in these parts. On the other hand, whenever the axis shifts closer to the Himalayas, there are longer dry spells in the plains, and widespread rain occur in the mountainous catchment areas of the Himalayan rivers. These heavy rains bring in



Figure 4.2 : Retreating Monsoon

their wake, devastating floods causing damage to life and property in the plains. The frequency and intensity of tropical depressions too, determine the amount and duration of monsoon rains. These depressions form at the head of the Bay of Bengal and cross over to the mainland. The depressions follow the axis of the "monsoon trough of low pressure". The monsoon is known for its uncertainties. The alternation of dry and wet spells vary in intensity, frequency and duration. While it causes heavy floods in one part, it may be responsible for droughts in the other. It is often irregular in its arrival and its retreat. Hence, it sometimes disturbs the farming schedule of millions of farmers all over the country.

Retreating/Post Monsoons (The Transition Season)

During October-November, with the apparent movement of the sun towards the south, the monsoon trough or the low-pressure trough over the northern plains becomes weaker. This is gradually replaced by a high-pressure system. The south-west monsoon winds weaken and start withdrawing gradually. By the beginning of October, the monsoon withdraws from the Northern Plains.

The months of October-November form a period of transition from hot rainy season to dry winter conditions. The retreat of the monsoon is marked by clear skies and rise in

Do You Know?

Mawsynram, the wettest place on the earth is also reputed for its stalagmite and stalactite caves.

temperature. While day temperatures are high, nights are cool and pleasant. The land is still moist. Owing to the conditions of high temperature and humidity, the weather becomes rather oppressive during the day. This is commonly known as 'October heat'. In the second half of October, the mercury begins to fall rapidly in northern India.

The low-pressure conditions, over north-western India, get transferred to the Bay of Bengal by early November. This shift is associated with the occurrence of cyclonic depressions, which originate over the Andaman Sea. These cyclones generally cross the eastern coasts of India cause heavy and widespread rain. These tropical cyclones are often very destructive. The thickly populated deltas of the Godavari, the Krishna and the Kaveri are frequently struck by cyclones, which cause great damage to life and property. Sometimes, these cyclones arrive at the coasts of Odisha, West Bengal and Bangladesh. The bulk of the rainfall of the Coromandel Coast is derived from depressions and cyclones.

DISTRIBUTION OF RAINFALL

Parts of western coast and northeastern India receive over about 400 cm of rainfall annually. However, it is less than 60 cm in western Rajasthan and adjoining parts of Gujarat, Haryana and Punjab. Rainfall is equally low in the interior of the Deccan plateau, and east of the Sahyadris. Why do these regions receive low rainfall? A third area of low precipitation is around Leh in Jammu and Kashmir. The rest of the country receives moderate rainfall. Snowfall is restricted to the Himalayan region.

Owing to the nature of monsoons, the annual rainfall is highly variable from year to year. Variability is high in the regions of low rainfall, such as parts of Rajasthan, Gujarat and the leeward side of the Western Ghats. As such, while areas of high rainfall are liable to be affected by floods, areas of low rainfall are drought-prone (Figure 4.3).

MONSOON AS A UNIFYING BOND

You have already known the way the Himalayas protect the subcontinent from extremely cold winds from central Asia. This enables northern India to have uniformly higher temperatures compared to other areas on the same latitudes. Similarly, the Peninsular plateau, under the influence of the sea from three sides, has moderate temperatures. Despite such

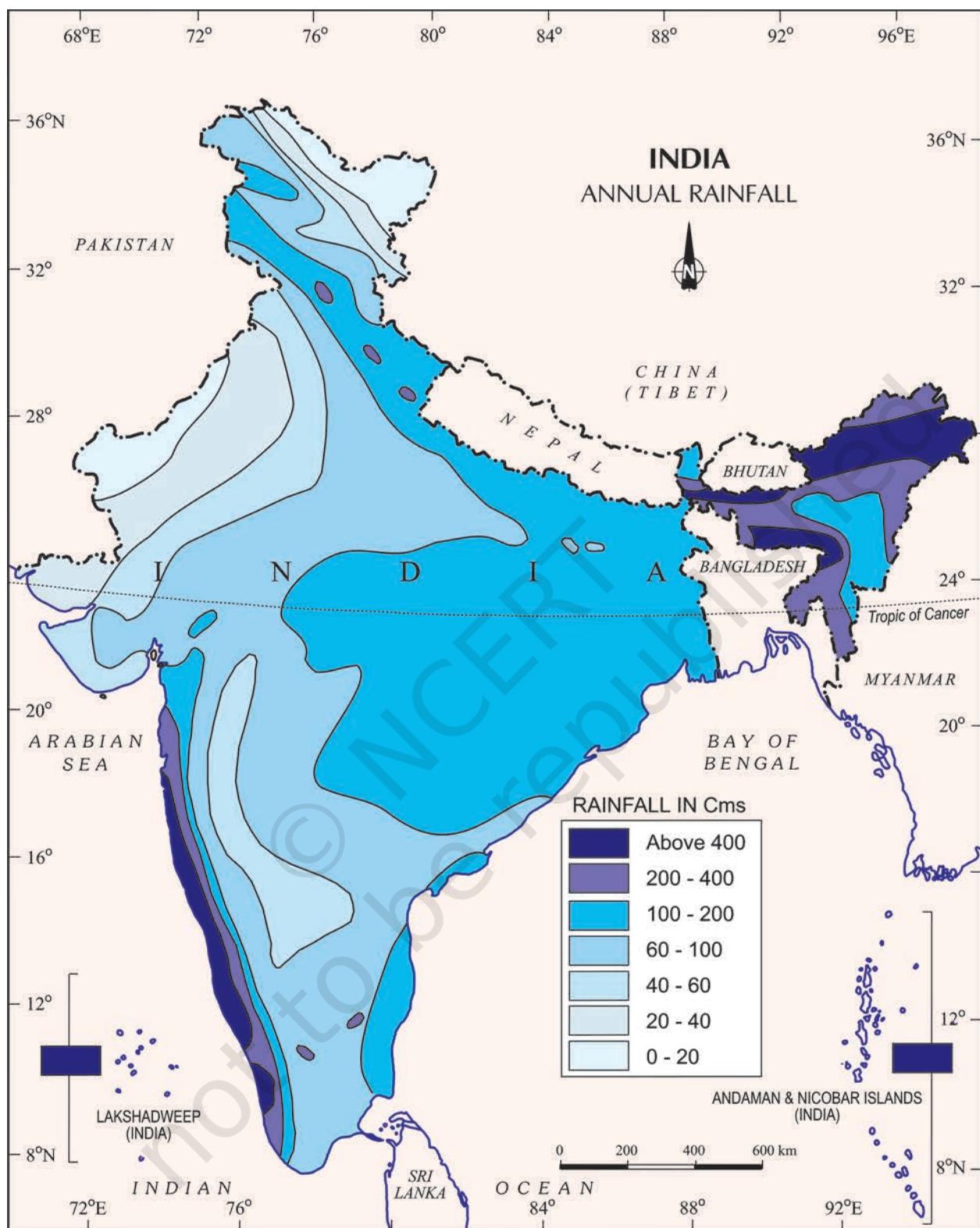


Figure 4.3 : Annual Rainfall

Devastated by deluge

Haze hazard on road Chennai submerged

Hint of an early summer

Tuesday: 28.4 °C

HT Correspondent
New Delhi, January 31

THE MERCURY is soaring, paving the way for what could be an early onset of summer, the weatherman has said. It may touch 30 degrees Celsius within a couple of days in Delhi.

The mercury settled at 28.4 degrees Celsius on Tuesday, nearly six degrees above the average, breaking a decade-old record.

FOG CHECK

Flight operations at Delhi Airport was normal with the runway visibility at 1,500 metres. However, thick fog in the NCR made driving difficult in the early hours.

DELAYED: 17 incoming trains; departure of six trains was rescheduled.

Poorna Express from Howrah, Sampurna Kranti Express from Patna and Rajdhani Special from Mumbai.

RESCHEDULED: Kashi Vishwanath from New Delhi to Varanasi, Linclich Express from New Delhi to Muzaffarpur, Bhagirathi Raj from New Delhi to Bhupneshwar, Seldah Raj from New Delhi to Seldah, Sultanpur Express from Sultanpur and Janta Express from Delhi to Howrah.

Cold comfort for New Year revellers

A day Mumbai won't forget

SORAB Ghaswala
Mumbai, December 30

JULY 26, 2005 started off as just another soggy day in Mumbai. But, the rainfall was one of the heaviest Mumbai had seen over the past century. As citizens went about their morning chores, they had no inkling that by dusk the city would be swamped.

By sunset, 435 residents had either drowned in their houses or vehicles as rainwater started rising with alarming rapidity. By night, the city and its people were defeated. No transport, no electricity and no place to go. Mumbai was on its knees.

The weather bureau had predicted just another "normal" rainy day for the city. But it poured 944.2 m.m. (three feet of rain) over 24 hours, the highest in 100 years.

Before 26/7, Mumbaiites, used to about 15 cm of rain, would tease, "What's a Mumbai monsoon without some days of disruption?" On 26/7, the joke was on them.

The rain picked up at about 1 p.m. Initially, nobody paid attention. The enormity of the situation hit Mumbaiites at about 5 p.m. By then, many were dead and the low-lying areas of Kurla, Ghatkopar, Andheri, Dadar, Juhu and Kalina were flooded.

Freezing Kashmir

RASHID Ahmad
Srinagar

IF YOU FEEL Correspondent
room 1 New Delhi, January 1

DILHUTS. SHIVERING from the northwesterly onslaught, the city got some relief on Wednesday. The city experienced a 5 degree centigrade drop in temperature.

"The city experienced a 5 degree centigrade drop in temperature despite a partly cloudy sky. It was also bearable at 5.4 degrees Celsius," said two de-

grees Celsius that was two de-

grees Celsius higher than expected, fresh western dis-

turbances over the region had cracked up

The minimum temperature in the

city that had almost dropped to the

the sale.

For Thursday, the Met department expects a minimum tem- perature of 6 degree Celsius. "It is unless the water is warm," said Halima Begum, 45, a

people. Fields were inundated, crops damaged, roads looked like backwaters. And this was the city that cried for water in summers.

The rains showed up the state's failure to literally tap the resources as 90 tmc of water flowed into the sea. Irrigation tanks and reservoirs were breached. The suburbs were the worst hit as many localities remained under water drenched and drowned.

Chennai, which was flaunted as an alternative to Bangalore, found itself floating on water on three occasions. The rains and floods killed 350

This was one rain cloud

Fog is in, get ready for disruptions

A thin blanket of fog enveloped the city in the early hours of Friday. Visibility was reduced to 500 metres in most areas. There

In vast swathes of north India, the past week has been colder than average. "Winter trying to make up for the lost time," the weatherman added in a lighter vein. With temperatures consistently below the average for this year, there is a spectre of this year's winter being colder than usual.

In the ski resort of Gulmarg, there's heavy snow. Night temperature dipped four degrees past normal and Churu in Rajasthan has become bitterly cold. But Delhi continues to be comfortable. Night temperature on Wednesday hovered around 10°C.

"The western disturbances are unpredictable. They might hit Delhi within the next 72 hours or may not for another week. But it is time to get your woollens out. Temperatures will drop progressively in the days to come," said Delhi Met chief R.D. Singh.

With mornings getting misty, the dreaded fog may not be far behind. And with pollution levels at a five-year high, the fog this time may be worse.

Delhi has been colder this fortnight compared to the same period last year. The temperature pattern is similar to the record-

After 2 days of biting cold, sun shines
Expect a ballistic winter after western winds are in

HT Correspondent
New Delhi, November 30

ACROSS NORTH India, it's a winter of woes. Amritsar is icy with a minimum temperature of 5°C. Snowfall, of up to 78 cm, has blanketed Srinagar. In Delhi, it's still a pleasant nip. This mild wintry condition, however, will definitely not last, says the Met.

In a day or two, winds from Afghanistan, known as western disturbances, will lash the Capital. Conditions are perfect for harsh winter ahead, said Met officials, who have declared "official winter" in Delhi from Thursday.

"Wednesday's morning mist, moisture in the air, low night temperature and the cold winds that hit the city by evening are enough indications for the weather department to declare the onset of winter a day in advance," an official said.

Winter may have been delayed in much of north India by about a fortnight, but it has set in on time in Delhi, he added.

In vast swathes of north India, the past week has been colder than average. "Winter trying to make up for the lost time," the weatherman added in a lighter vein. With temperatures consistently below the average for this year, there is a spectre of this year's winter being colder than usual.

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The official pointed out that snowfall in Kashmir and Shimla has been heavier and earlier than usual. The temperature in Shimla dropped two degrees below normal. Sun dernagar at 4.3 °C was cold too.

Northerly cold winds have struck Rajasthan, affecting normal life last night with Churu and Sriganagar shivering at 5°C each, about two-three degrees below normal. Nights in Jodhpur, Bikaner, Ajmer and Jaipur divisions have become harsh.

So, it's officially winter in the Capital

Delhi

Max: 25°C, Min: 8 In a day or two, winds from Afghanistan — western disturbances — will lash the Capital. Winter declared from Dec 1.

Srinagar

Max: 8°C, Min: -3 It's a sea of snow there. Like much of Kashmir, it is experiencing sub-zero temperatures and bitterly cold weather.

Amritsar

Max: 21°C, Min: 5 The great plains are extremely cold. The coming days will be worse with expected sub-zero temperatures.

Shimla

Max: 10°C, Min: -4 The Himachal capital is blanketed in heavy snow. Higher reaches are even colder.

breaking winter of 2003 — the worst in 40 years.

The Met office says it cannot forecast so far ahead in future. "It may not be record breaking winter, but it will definitely be chillier than an average winter," said a weather official.

The official pointed out that snowfall in Kashmir and Shimla has been heavier and earlier than usual. The temperature in Shimla dropped two degrees below normal. Sun dernagar at 4.3 °C was cold too.

Northerly cold winds have struck Rajasthan, affecting normal life last night with Churu and Sriganagar shivering at 5°C each, about two-three degrees below normal. Nights in Jodhpur, Bikaner, Ajmer and Jaipur divisions have become harsh.

Activity

- On the basis of the news items above, find out the names of places and the seasons described.
- Compare the rainfall description of Chennai and Mumbai and explain the reasons for the difference.
- Evaluate flood as a disaster with the help of a case study.

moderating influences, there are great variations in the temperature conditions. Nevertheless, the unifying influence of the monsoon on the Indian subcontinent is quite perceptible. The seasonal alteration of the wind systems and the associated weather conditions provide a rhythmic cycle of seasons. Even the uncertainties of rain and uneven distribution are very much typical of the monsoons. The Indian landscape, its animal and plant life, its

entire agricultural calendar and the life of the people, including their festivities, revolve around this phenomenon. Year after year, people of India from north to south and from east to west, eagerly await the arrival of the monsoon. These monsoon winds bind the whole country by providing water to set the agricultural activities in motion. The river valleys which carry this water also unite as a single river valley unit.

EXERCISE

1. Choose the correct answer from the four alternatives given below.
 - (i) Which one of the following places receives the highest rainfall in the world?
 - (a) Silchar
 - (c) Cherrapunji
 - (b) Mawsynram
 - (d) Guwahati
 - (ii) The wind blowing in the northern plains in summers is known as:
 - (a) *Kaal Baisakhi*
 - (c) Trade Winds
 - (b) *Loo*
 - (d) None of the above
 - (iii) Monsoon arrives in India approximately in:
 - (a) Early May
 - (c) Early June
 - (b) Early July
 - (d) Early August
 - (iv) Which one of the following characterises the cold weather season in India?
 - (a) Warm days and warm nights
 - (b) Warm days and cold nights
 - (c) Cool days and cold nights
 - (d) Cold days and warm nights
2. Answer the following questions briefly.
 - (i) What are the controls affecting the climate of India?
 - (ii) Why does India have a monsoon type of climate?
 - (iii) Which part of India does experience the highest diurnal range of temperature and why?
 - (iv) Which winds account for rainfall along the Malabar coast?
 - (v) Define monsoons. What do you understand by “break” in monsoon?
 - (vi) Why is the monsoon considered a unifying bond?
3. Why does the rainfall decrease from the east to the west in Northern India.

4. Give reasons as to why.
 - (i) Seasonal reversal of wind direction takes place over the Indian subcontinent?
 - (ii) The bulk of rainfall in India is concentrated over a few months.
 - (iii) The Tamil Nadu coast receives winter rainfall.
 - (iv) The delta region of the eastern coast is frequently struck by cyclones.
 - (v) Parts of Rajasthan, Gujarat and the leeward side of the Western Ghats are drought-prone.
5. Describe the regional variations in the climatic conditions of India with the help of suitable examples.
6. Give an account of weather conditions and characteristics of the cold season.
7. Give the characteristics and effects of the monsoon rainfall in India.

MAP SKILLS

On an outline map of India, show the following.

- (i) Areas receiving rainfall over 400 cm.
- (ii) Areas receiving less than 20 cm of rainfall.
- (iii) The direction of the south-west monsoon over India.

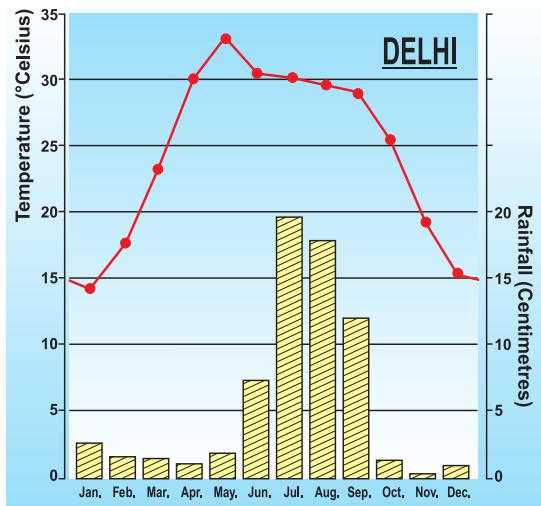
PROJECT/ACTIVITY

- (i) Find out which songs, dances, festivals and special food preparations are associated with certain seasons in your region. Do they have some commonality with other regions of India?
- (ii) Collect photographs of typical rural houses, and clothing of people from different regions of India. Examine whether they reflect any relationship with the climatic condition and relief of the area.

FOR DOING IT YOURSELF

1. In Table-I, the average mean monthly temperatures and amounts of rainfall of 10 representative stations have been given. It is for you to study on your own and convert them into 'temperature and rainfall' graphs. A glance at these visual representations will help you to grasp instantly the similarities and differences between them. One such graph (Figure 1) is already prepared for you. See if you can arrive at some broad generalisations about our diverse climatic conditions. We hope you are in for a great joy of learning. Do the following activities.
2. Re-arrange the 10 stations in two different sequences:

Figure 1 : Temperature and Rainfall of Delhi



- (i) According to their distance from the equator.
(ii) According to their altitude above mean sealevel.
3. (i) Name two雨iest stations.
(ii) Name two driest stations.
(iii) Two stations with most equitable climate.
(iv) Two stations with most extreme climate.
(v) Two stations influenced by retreating monsoons.
(vi) The two hottest stations in the months of
(a) February (b) April (c) May (d) June

Table I

| Stations | Latitude | Altitude (Metres) | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. | Annual Rainfall |
|---|----------|-------------------|-------------|-------------|-------------|--------------|--------------|--------------|--------------|---------------|--------------|--------------|--------------|--------------|-----------------|
| Temperature (°C) Bengaluru Rainfall (cm) | 12°58'N | 909 | 20.5 0.7 | 22.7 0.9 | 25.2 1.1 | 27.1 4.5 | 26.7 10.7 | 24.2 7.1 | 23.0 11.1 | 23.0 13.7 | 23.1 16.4 | 22.9 15.3 | 18.9 6.1 | 20.2 1.3 | 88.9 |
| Temperature (°C) Mumbai Rainfall (cm) | 19° N | 11 | 24.4 0.2 | 24.4 0.2 | 26.7 - | 28.3 - | 30.0 1.8 | 28.9 50.6 | 27.2 61.0 | 27.2 36.9 | 27.2 26.9 | 27.8 4.8 | 27.2 1.0 | 25.0 - | 183.4 |
| Temperature (°C) Kolkata Rainfall (cm) | 22°34' N | 6 | 19.6 1.2 | 22.0 2.8 | 27.1 3.4 | 30.1 5.1 | 30.4 13.4 | 29.9 29.0 | 28.9 33.1 | 28.7 33.4 | 28.9 25.3 | 27.6 12.7 | 23.4 2.7 | 19.7 0.4 | 162.5 |
| Temperature (°C) Delhi Rainfall (cm) | 29° N | 219 | 14.4 2.5 | 16.7 1.5 | 23.3 1.3 | 30.0 1.0 | 33.3 1.8 | 33.3 7.4 | 30.0 19.3 | 29.4 17.8 | 28.9 11.9 | 25.6 1.3 | 19.4 0.2 | 15.6 1.0 | 67.0 |
| Temperature (°C) Jodhpur Rainfall (cm) | 26°18' N | 224 | 16.8 0.5 | 19.2 0.6 | 26.6 0.3 | 29.8 0.3 | 33.3 1.0 | 33.9 3.1 | 31.3 10.8 | 29.0 13.1 | 20.1 5.7 | 27.0 0.8 | 20.1 0.2 | 14.9 0.2 | 36.6 |
| Temperature (°C) Chennai Rainfall (cm) | 13°4' N | 7 | 24.5 4.6 | 25.7 1.3 | 27.7 1.3 | 30.4 1.8 | 33.0 3.8 | 32.5 4.5 | 31.0 8.7 | 30.2 11.3 | 29.8 11.9 | 28.0 30.6 | 25.9 35.0 | 24.7 13.9 | 128.6 |
| Temperature (°C) Nagpur Rainfall (cm) | 21°9' N | 312 | 21.5 1.1 | 23.9 2.3 | 28.3 1.7 | 32.7 1.6 | 35.5 2.1 | 32.0 22.2 | 27.7 37.6 | 27.3 28.6 | 27.9 18.5 | 26.7 5.5 | 23.1 2.0 | 20.7 1.0 | 124.2 |
| Temperature (°C) Shillong Rainfall (cm) | 24°34' N | 1461 | 9.8 1.4 | 11.3 2.9 | 15.9 5.6 | 18.5 14.6 | 19.2 29.5 | 20.5 47.6 | 21.1 35.9 | 20.9 34.3 | 20.0 30.2 | 17.2 18.8 | 13.3 3.8 | 10.4 0.6 | 225.3 |
| Temperature (°C) Thiruvananthapuram Rainfall (cm) | 8°29' N | 61 | 26.7 2.3 | 27.3 2.1 | 28.3 3.7 | 28.7 10.6 | 28.6 20.8 | 26.6 35.6 | 26.2 22.3 | 2.6.2 14.6 | 26.5 13.8 | 26.7 27.3 | 26.6 20.6 | 26.5 7.5 | 181.2 |
| Temperature (°C) Leh 34° N Rainfall (cm) | 34°N | 3506 | -8.5 1.0 | -7.2 0.8 | -0.6 0.8 | 6.1 0.5 | 10.0 0.5 | 14.4 0.5 | 17.2 1.3 | 16.1 1.3 | 12.2 0.8 | 6.1 0.5 | 0.0 - | -5.6 0.5 | 8.5 |

4. Now find out
 - (i) Why are Thiruvananthapuram and Shillong rainier in June than in July?
 - (ii) Why is July rainier in Mumbai than in Thiruvananthapuram?
 - (iii) Why are southwest monsoons less rainy in Chennai?
 - (iv) Why is Shillong rainier than Kolkata?
 - (v) Why is Kolkata rainier in July than in June unlike Shillong which is rainier in June than in July?
 - (vi) Why does Delhi receive more rain than Jodhpur?
 5. Now think why
 - Thiruvananthapuram has equable climate?
 - Chennai has more rains only after the fury of monsoon is over in most parts of the country?
 - Jodhpur has a hot desert type of climate?
 - Leh has moderate precipitation almost throughout the year?
 - while in Delhi and Jodhpur most of the rain is confined to nearly three months, in Thiruvananthapuram and Shillong it is almost nine months of the year?
- In spite of these facts see carefully if there are strong evidences to conclude that the monsoons still provide a very strong framework lending overall climatic unity to the whole country.



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5

NATURAL VEGETATION AND WILDLIFE

H ave you observed the type of trees, bushes, grasses and birds in the fields and parks in and around your school? Are they similar or there are variations? India being a vast country you can imagine the types of bio-forms available throughout the country.

Our country India is one of the 12 mega bio-diversity countries of the world. With about 47,000 plant species India occupies tenth place in the world and fourth in Asia in plant diversity. There are about 15,000 flowering plants in India, which account for 6 per cent in the world's total number of flowering plants. The country has many non-flowering plants, such as ferns, algae and fungi. India also has approximately 90,000 species of animals, as well as, a rich variety of fish in its fresh and marine waters.

Natural vegetation refers to a plant community, which has grown naturally without human aid and has been left undisturbed by humans for a long time. This is termed as a **virgin vegetation**. Thus, cultivated crops and fruits, orchards form part of vegetation but not natural vegetation.

Do You Know?

The virgin vegetation, which are purely Indian are known as endemic or indigenous species but those which have come from outside India are termed as exotic plants.

The term **flora** is used to denote plants of a particular region or period. Similarly, the species of animals are referred to as **fauna**.

TYPES OF VEGETATION

The following major types of vegetation may be identified in our country (Figure 5.4).

- (i) Tropical Evergreen Forests
- (ii) Tropical Deciduous Forests
- (iii) Tropical Thorn Forests and Scrubs
- (iv) Montane Forests
- (v) Mangrove Forests

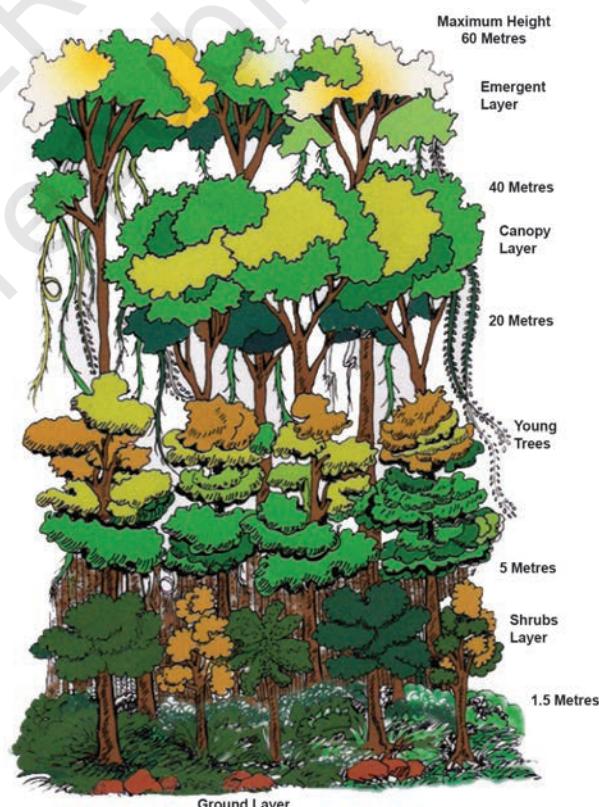


Figure 5.1 : Tropical Evergreen Forest

Tropical Evergreen Forests

These forests are restricted to heavy rainfall areas of the Western Ghats and the island groups of Lakshadweep, Andaman and Nicobar, upper parts of Assam and Tamil Nadu coast. They are at their best in areas having more than 200 cm of rainfall with a short dry season. The trees reach great heights up to 60 metres or even above. Since the region is warm and wet throughout the year, it has a luxuriant vegetation of all kinds — trees, shrubs and creepers giving it a multilayered structure. There is no definite time for trees to shed their leaves. As such, these forests appear green all the year round.

Some of the commercially important trees of this forest are ebony, mahogany, rosewood, rubber and cinchona.

The common animals found in these forests are elephant, monkey, lemur and deer. One-horned rhinoceroses are found in the jungles of Assam and West Bengal. Besides these animals, plenty of birds, bats, sloth, scorpions and snails are also found in these jungles.

Tropical Deciduous Forests

These are the most widespread forests of India. They are also called the monsoon forests and spread over the region receiving rainfall between 200 cm and 70 cm. Trees of this forest



Figure 5.2 : Tropical Deciduous Forest

type shed their leaves for about six to eight weeks in dry summer.

On the basis of the availability of water, these forests are further divided into moist and dry deciduous. The former is found in areas receiving rainfall between 200 and 100 cm. These forests exist, therefore, mostly in the eastern part of the country — northeastern states, along the foothills of the Himalayas, Jharkhand, West Odisha and Chhattisgarh, and on the eastern slopes of the Western Ghats. Teak is the most dominant species of this forest. Bamboos, sal, shisham, sandalwood, khair, kusum, arjun and mulberry are other commercially important species.

The dry deciduous forests are found in areas having rainfall between 100 cm and 70 cm. These forests are found in the rainier parts of the Peninsular plateau and the plains of Bihar and Uttar Pradesh. There are open stretches, in which teak, sal, peepal and neem grow. A large part of this region has been cleared for cultivation and some parts are used for grazing.

In these forests, the common animals found are lion, tiger, pig, deer and elephant. A huge variety of birds, lizards, snakes and tortoises are also found here.

The Thorn Forests and Scrubs

In regions with less than 70 cm of rainfall, the natural vegetation consists of thorny trees and

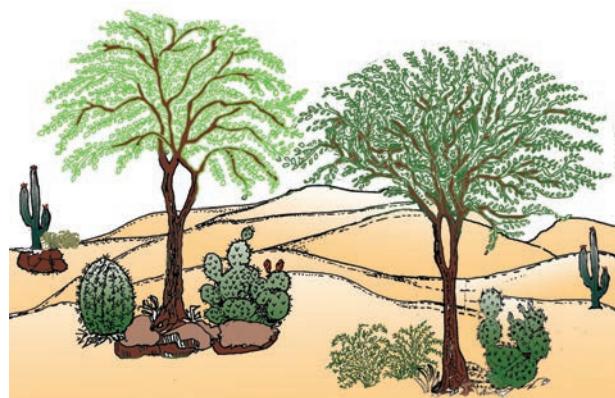


Figure 5.3 : Thorn Forests and Scrubs

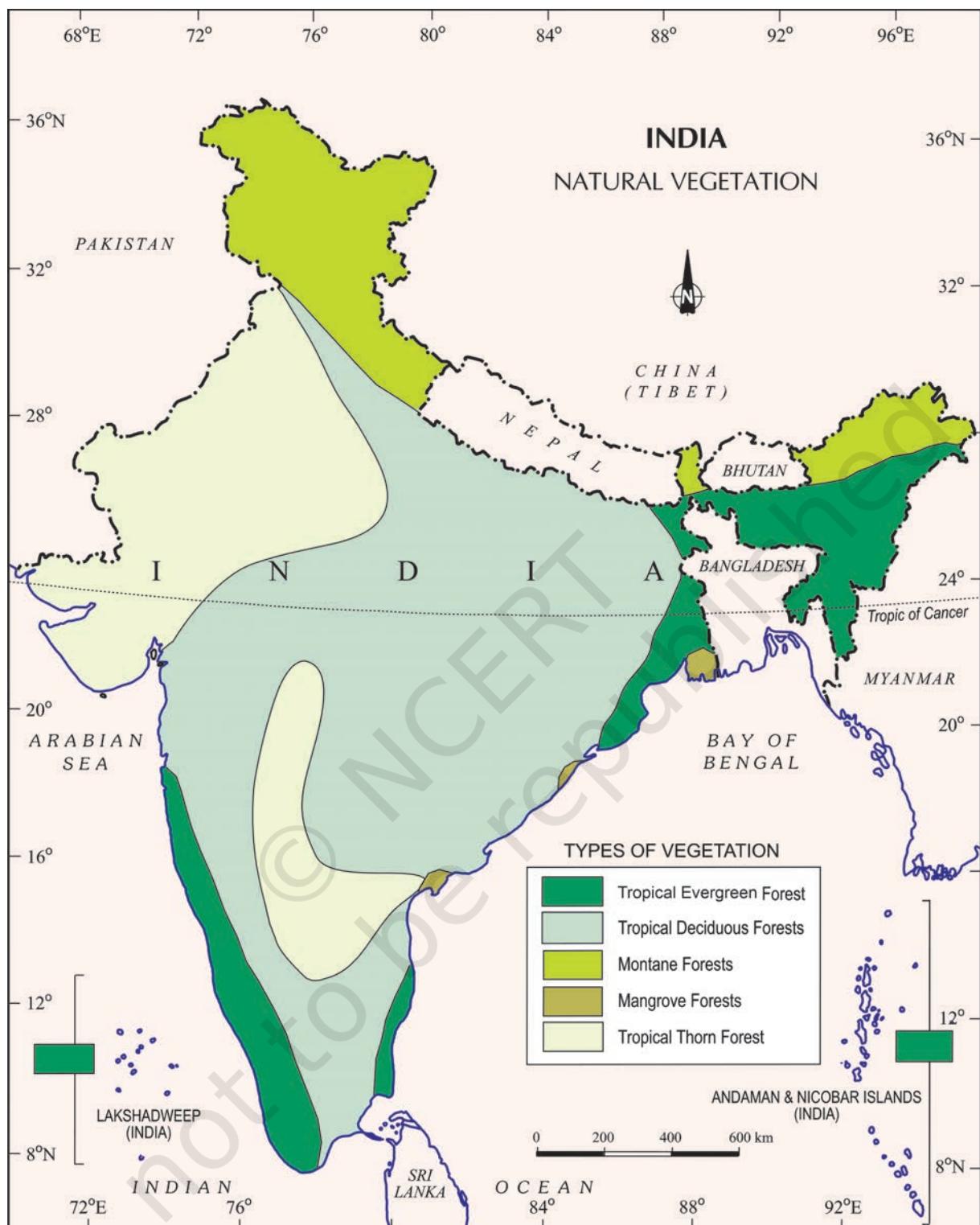


Figure 5.4 : Natural Vegetation

Study the given map for the forest cover and try to find the reasons as to why certain states have more forest area as compared to others?

bushes. This type of vegetation is found in the north-western part of the country, including semi-arid areas of Gujarat, Rajasthan, Madhya Pradesh, Chhattisgarh, Uttar Pradesh and Haryana. Acacias, palms, euphorbias and cacti are the main plant species. Trees are scattered and have long roots penetrating deep into the soil in order to get moisture. The stems are succulent to conserve water. Leaves are mostly thick and small to minimise evaporation. These forests give way to thorn forests and scrubs in arid areas.

In these forests, the common animals are rats, mice, rabbits, fox, wolf, tiger, lion, wild ass, horses and camels.

Montane Forests

In mountainous areas, the decrease in temperature with increasing altitude leads to the corresponding change in natural vegetation. As such, there is a succession of natural vegetation belts in the same order as we see from the tropical to the tundra region. The wet temperate type of forests are found between a height of 1000 and 2000 metres. Evergreen broad-leaf trees, such as oaks and chestnuts predominate. Between 1500 and 3000 metres, temperate forests containing

coniferous trees, like pine, deodar, silver fir, spruce and cedar, are found. These forests cover mostly the southern slopes of the Himalayas, places having high altitude in southern and north-east India. At higher elevations, temperate grasslands are common. At high altitudes, generally, more than 3,600 metres above the sea level, temperate forests and grasslands give way to the Alpine vegetation. Silver fir, junipers, pines and birches are the common trees of these forests. However, they get progressively stunted as they approach the snow-line. Ultimately, through shrubs and scrubs, they merge into the Alpine grasslands. These are used extensively for grazing by nomadic tribes, like the Gujjars and the Bakarwals. At higher altitudes, mosses and lichens form part of tundra vegetation.

The common animals found in these forests are Kashmir stag, spotted deer, wild sheep, jack rabbit, Tibetan antelope, yak, snow leopard, squirrels, Shaggy horn wild ibex, bear and rare red panda, sheep and goats with thick hair.

Mangrove Forests

The mangrove tidal forests are found in the areas of coasts influenced by tides. Mud and silt get accumulated on such coasts. Dense



Figure 5.5 : Montane Forests

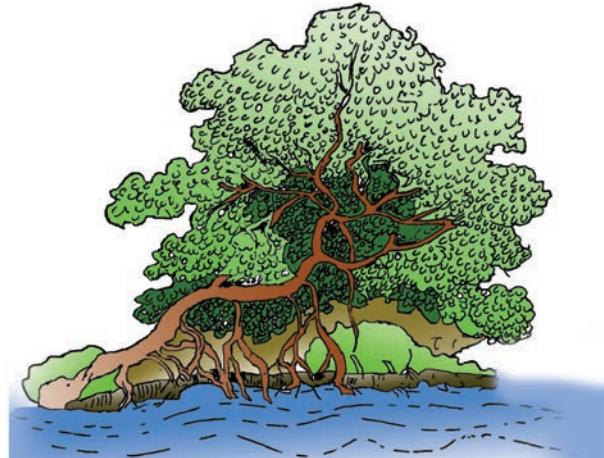


Figure 5.6 : Mangrove Forests

mangroves are the common varieties with roots of the plants submerged under water. The deltas of the Ganga, the Mahanadi, the Krishna, the Godavari and the Kaveri are covered by such vegetation. In the Ganga-Brahmaputra delta, sundari trees are found, which provide durable hard timber. Palm, coconut, keora, agar, etc., also grow in some parts of the delta.

Royal Bengal Tiger is the famous animal in these forests. Turtles, crocodiles, gharials and snakes are also found in these forests.

Let us discuss : What will happen if plants and animals disappear from the earth's surface? Can the human beings survive under such a situation? Why is biodiversity necessary and why should it be conserved?

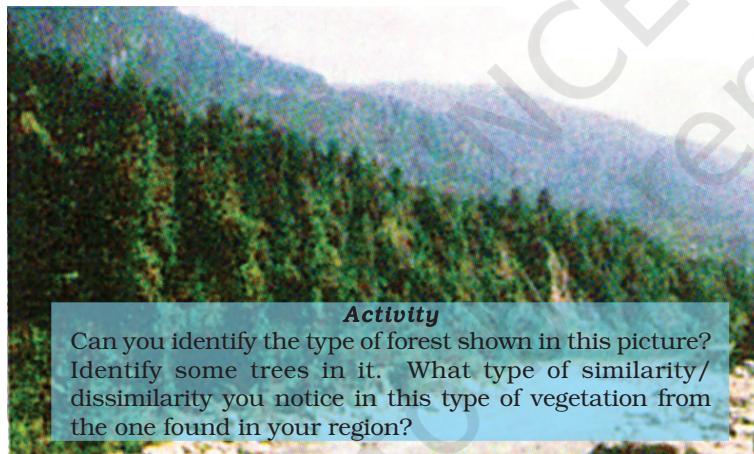
MEDICINAL PLANTS

India is known for its herbs and spices from ancient times. Some 2,000 plants have been described in Ayurveda and at least 500 are in regular use. The World Conservation Union's Red List has named 352 medicinal plants of which 52 are critically threatened and 49 endangered. The commonly used plants in India are:

| | |
|--------------------|---|
| Sarpagandha | : Used to treat blood pressure; it is found only in India. |
| Jamun | : The juice from ripe fruit is used to prepare vinegar, which is carminative and diuretic, and has digestive properties. The powder of the seed is used for controlling diabetes. |
| Arjun | : The fresh juice of leaves is a cure for earache. It is also used to regulate blood pressure. |
| Babool | : Leaves are used as a cure for eye sores. Its gum is used as a tonic. |
| Neem | : Has high antibiotic and antibacterial properties. |
| Tulsi | : Is used to cure cough and cold. |
| Kachnar | : Is used to cure asthma and ulcers. The buds and roots are good for digestive problems. |

Identify more medicinal plants in your area. Which plants are used as medicines by local people to cure some diseases?

Source : Medicinal Plants by Dr. S.K. Jain, 5th edition 1994, National Book Trust of India



WILDLIFE

Like its flora, India is also rich in its fauna. It has approximately 90,000 animal species. The country has about 2,000 species of birds. They constitute 13% of the world's total. There are 2,546 species of fish, which account for nearly 12% of the world's stock. It also shares between 5 and 8 per cent of the world's amphibians, reptiles and mammals.

The elephants are the most majestic animals among the mammals. They are found in the hot wet forests of Assam, Karnataka and Kerala. One-horned rhinoceroses are the other animals, which live in swampy and marshy lands of Assam and West Bengal. Arid areas of the Rann of Kachchh and the Thar Desert are the habitat for wild ass and camels respectively. Indian bison, *nilgai* (blue bull), *chousingha* (four-horned antelope), gazel and different species of deer are some

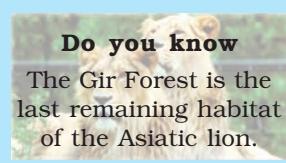
other animals found in India. It also has several species of monkeys.

Do You Know ?

Wildlife Protection Act was implemented in 1972 in India.

India is the only country in the world that has both tigers and lions. The natural habitat of the Indian lion is the Gir forest in Gujarat. Tigers are found in the forests of Madhya

Pradesh, the Sundarbans of West Bengal and the Himalayan region. Leopards, too, are members of the cat family. They are important among animals of prey.



The Himalayas harbour a hardy range of animals, which survive in extreme cold. Ladakh's freezing high altitudes are a home to yak, the shaggy horned wild ox weighing around one tonne, the Tibetan antelope, the *bharal* (blue sheep), wild sheep, and the *kiang* (Tibetan wild ass). Furthermore, the ibex, bear, snow-leopard and rare red panda are found in certain pockets.

In the rivers, lakes and coastal areas, turtles, crocodiles and gharials are found. The latter is the only representative of a variety of crocodile, found in the world today.

Bird life in India is colourful. Peacocks, pheasants, ducks, parakeets, cranes and pigeons are some of the birds inhabiting the forests and wetlands of the country.

We have selected our crops from a bio-diverse environment, i.e., from the reserve of edible plants. We also experimented and selected many medicinal plants. The animals were selected from large stock provided by nature as milch animal. They also provided us draught power, transportation, meat and eggs. The fish provide nutritive food. Many insects help in pollination of crops and fruit trees and exerting biological control on such insects is harmful. Every species has a role to play in the

Govt on save-vulture task

CHETAN Chauhan
New Delhi, January 30

VULTURES HAVE all but been wiped out: a crisis that has probed and other tries to back the br...
All not lost: Tigers alive in Kuno

HT Correspondent
New Delhi, January 5

THE MINISTRY OF environment and forests has decided to ask the Central Bureau of Investigation to conduct an independent investigation into the large-scale poaching of tigers in the Ranthambore Tiger Reserve.



■ In Bharatpur, 22 tigers killed by poachers in past two years, says Tiger Watch.

■ In Bharatpur, four arrested poachers in zero from have confessed to killing nine tigers and a leopard. Officials say no poaching case reported in the last two years.

CBI to probe Ranthambore tiger deaths

ban the drug but they will take some time.

Gujarat habitat turns gull graveyard

Plumed recap

■ Birds are the most fragile creatures. Poachers have a recent effort to save a number of vulture populations recently dead in Gujarat.

■ Similar tragedy in Bharatpur lake in Rajasthan where water bodies dried up due to lack of rain.

■ A similar tragedy in Bharatpur lake in Rajasthan where water bodies dried up due to lack of rain.

Nod to tiger protection body

HT Correspondent
New Delhi, December 16

Tigers dying, census confirms

Rhino killed for horn

KAZIRANGA NATIONAL Park (KNP) authorities located the carcass of a rare one-horned rhino and an Asian

water buffalo in two separate ranges of the Park on Friday. This follows the poisoning of two Royal Bengal tigers in Orang National Park. Forest guards found a partially composed carcass of an adult rhino in a "virtual island-like spot in Buraphahar range. There were five other rhinos w

HTC, G

Activity

- Find out from the above newspaper cuttings, the main concern highlighted in the given news items.
- Collect more information about various endangered species from newspapers and magazines.
- Find out various steps taken by the Indian government to protect them.
- Describe how you can contribute to the protection of endangered animals and birds.



Figure 5.7 : Wildlife Reserves

ecosystem. Hence, conservation is essential. As has been mentioned earlier due to excessive exploitation of plant and animal resources by human beings, the ecosystem has been disturbed. About 1,300 plant species are endangered and 20 species are extinct. Quite a few animal species are also endangered and some have become extinct.

The main causes for this major threat to nature are hunting by greedy hunters for commercial purposes. Pollution due to chemical and industrial waste, acid deposits, introduction of alien species and reckless cutting of the forests to bring land under cultivation and habitation, are also responsible for the imbalance.

To protect the flora and fauna of the country, the government has taken many steps.

- (i) Eighteen biosphere reserves have been set up in the country to protect flora and fauna. Twelve out of these, the Sundarbans Nanda Devi, the Gulf of Mannar, the Nilgiri, Nokrek, Great Nicobar, Simlipal, Pachmarhi, Achanakmar-Amarkantak, Agasthyamalai, Kangchendzonga and Panna have been included in the world network of biosphere reserves.

Eighteen Bio-reserves

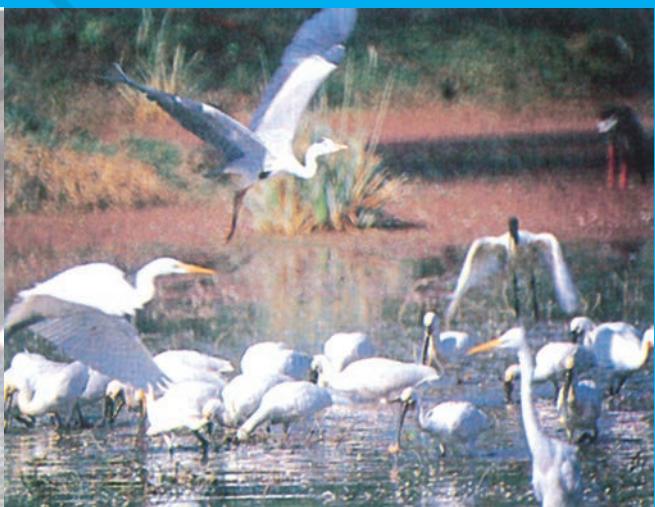
- Sundarbans • Simlipal
- Gulf of Mannar • Dihang-Dibang
- Nilgiri • Dibru Saikhowa
- Nanda Devi • Agasthyamalai
- Nokrek • Kangchendzonga
- Great Nicobar • Pachmarhi
- Manas • Achanakmar-Amarkantak
- Kachchh • Cold Desert
- Seshachalam • Panna

- (ii) Financial and technical assistance is provided to many botanical gardens by the government since 1992.
(iii) Project Tiger, Project Rhino, Project Great Indian Bustard and many other eco-developmental projects have been introduced.
(iv) 103 National Parks, 563 Wildlife sanctuaries and Zoological gardens are set up to take care of natural heritage.

All of us must realise the importance of the natural ecosystem for our own survival. It is possible if indiscriminate destruction of natural environment is put to an immediate end.

Migratory Birds

Some of the wetlands of India are popular with migratory birds. During winter, birds, such as Siberian Crane, come in large numbers. One such place favourable with birds is the Rann of Kachchh. At a place where the desert merges with the sea, flamingo with their brilliant pink plumage come in thousands to build nest mounds from the salty mud and raise their young ones. It is one among many extraordinary sights in the country. Is it not a rich natural heritage of ours?



EXERCISE

Map Skills

On an outline map of India, label the following.

- (i) Areas of Evergreen Forests
 - (ii) Areas of Dry Deciduous Forests
 - (iii) Two national parks each in Northern, Southern, Eastern and Western parts of the Country

Project/Activity

- (i) Find some trees in your neighbourhood having medicinal values.
 - (ii) Find ten occupations getting raw material from forests and wildlife.
 - (iii) Write a poem or paragraph showing the importance of wildlife.
 - (iv) Write the script of a street play giving the importance of tree plantation and try to enact it in your locality.
 - (v) Plant a tree either on your birthday or one of your family member's birthday. Note the growth of the tree and notice in which season it grows faster.



6

POPULATION

Can you imagine a world without human beings? Who would have utilised the resources and created social and cultural environment? The people are important to develop the economy and the society. The people make and use resources and are themselves resources with varying quality. Coal is but a piece of rock, until people were able to invent technology to obtain it and make it 'resource'. Natural events, like a flood or a Tsunami, becomes a 'disaster' only when they affect a crowded village or a town.

Hence, population is the pivotal element in social studies. It is the point of reference from which all other elements are observed and from which they derive significance and meaning. 'Resources', 'calamities' and 'disasters' are all meaningful only in relation to human beings. Their numbers, distribution, growth and characteristics or qualities provide the basic background for understanding and appreciating all aspects of the environment.

Human beings are producers and consumers of earth's resources. Therefore, it is important to know how many people are there in a country, where do they live, how and why their numbers are increasing and what are their characteristics. The census of India provides us with information regarding the population of our country.

Census

A census is an official enumeration of population done periodically. In India, the first census was held in the year 1872. The first complete census, however, was taken in the year 1881. Since then, censuses have been held regularly every tenth year.

The Indian Census is the most comprehensive source of demographic, social and economic data. Have you ever seen a census report? Check in your library if it has one.

POPULATION SIZE AND DISTRIBUTION

India's Population Size and Distribution by Numbers

India's population as on March 2011 stood at 1,210.6 million, which account for 17.5 per cent of the world's population. These 1.21 billion people are unevenly distributed over our country's vast area of 3.28 million square km, which accounts for 2.4 per cent of the world's area (Figure 6.1).

The 2011 Census data reveal that Uttar Pradesh with a population size of 199 million is the most populous state of India. Uttar Pradesh accounts for about 16 per cent of the country's population. On the other hand, the Himalayan state of Sikkim has a population of just about 0.6 million and Lakshadweep has only 64,429 people.

Almost half of India's population lives in just five states. These are Uttar Pradesh, Maharashtra, Bihar, West Bengal and Andhra Pradesh. Rajasthan, the biggest state in terms of area, has only 5.5 per cent of the total population of India (Figure 6.2)

Find out • What could be the reason of uneven distribution of population in India?

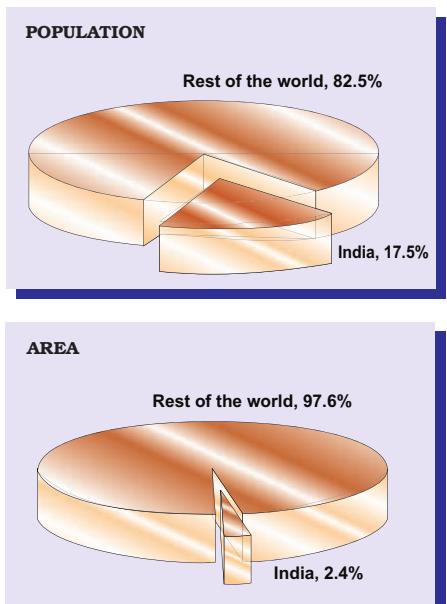


Fig 6.1 : India's Share of World's Area and Population

India's Population Distribution by Density

Population density provides a better picture of the uneven distribution. Population density is calculated as the number of persons per unit area. India is one of the most densely populated countries of the world.

Do You Know? Only Bangladesh and Japan have higher average population densities than India. Find out the population densities of Bangladesh and Japan.

The population density of India in the year 2011 was 382 persons per sq km. Densities vary from 1,102 persons per sq km in Bihar to only 17 persons per sq km in Arunachal Pradesh. A study of the Figure 6.3 shows the pattern of uneven distribution of population densities at the State level.

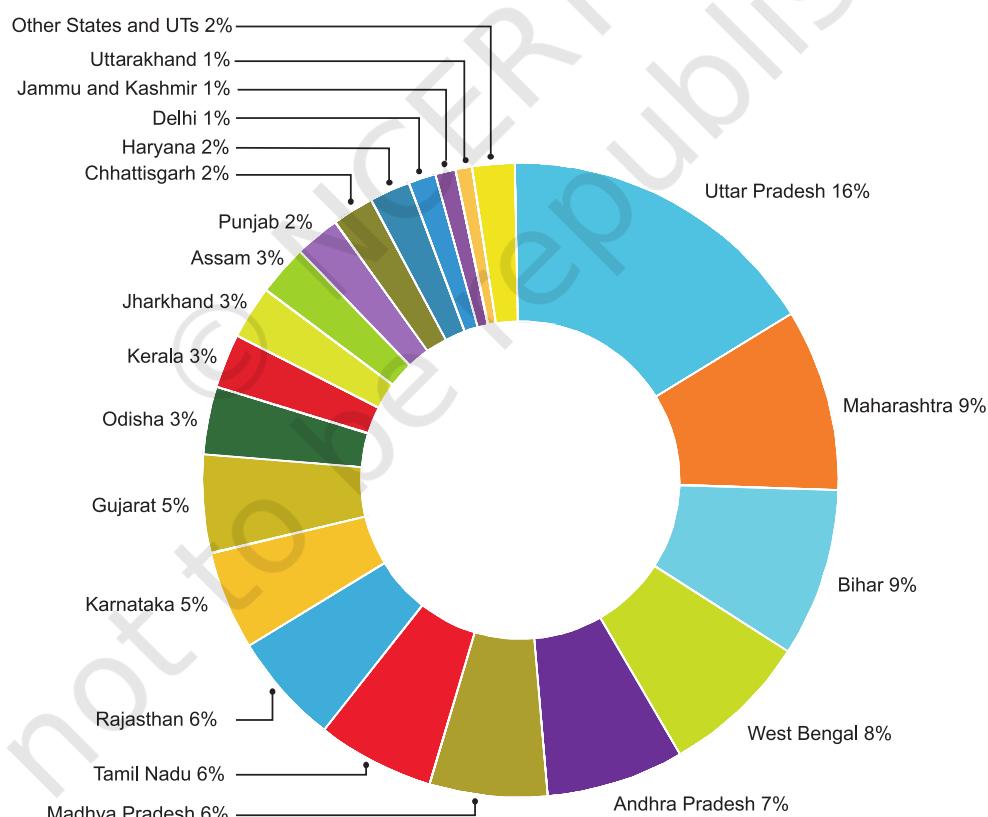


Fig. 6.2: Distribution of Population

Source: Census of India, 2011

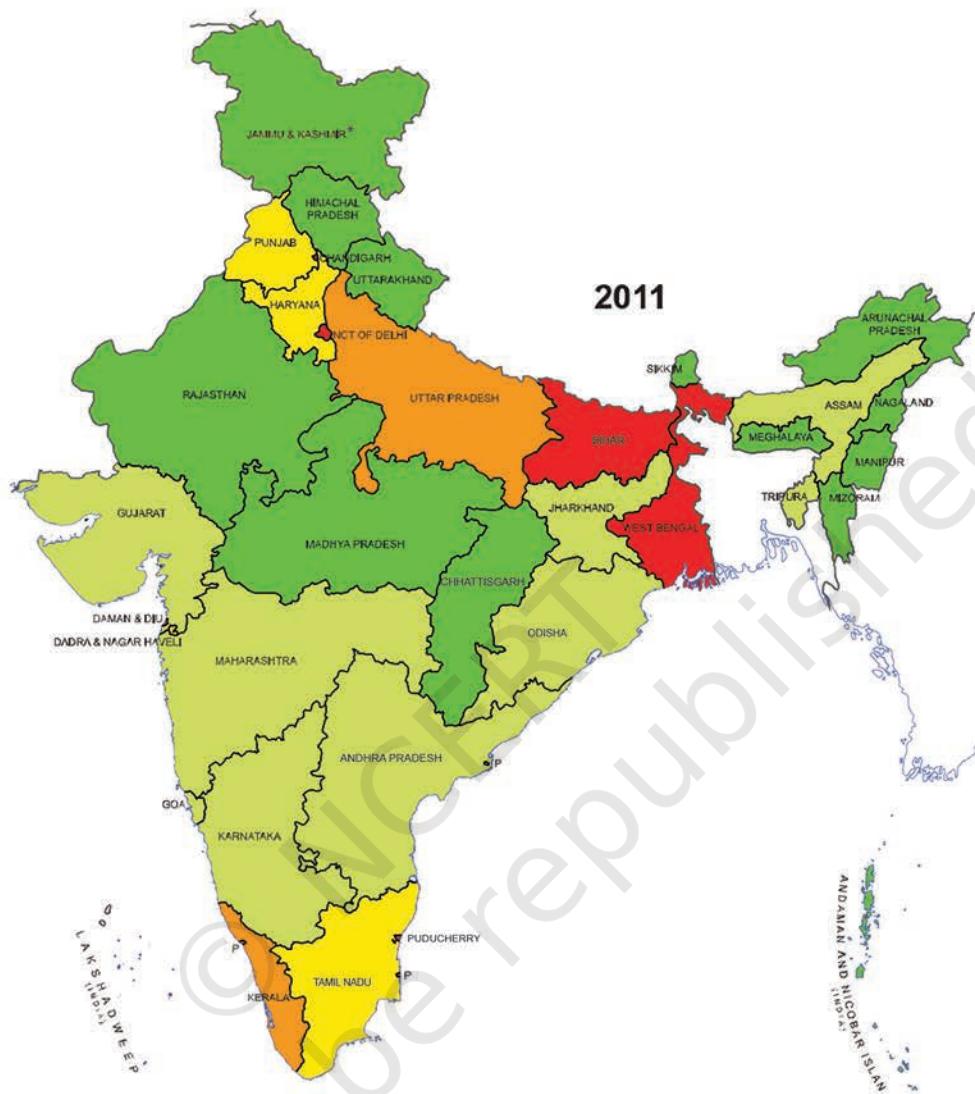


Fig. 6.3: Density of Population (Census of India 2011)

Note: Telangana became the 29th State of India in June 2014.

* State of Jammu and Kashmir was bifurcated into two union territories namely Jammu and Kashmir and Ladakh on 05.08.19.

Activity

Study the Figure 6.3 and compare it with Figure 2.4 and Figure 4.7. Do you find any correlation between these maps?

Note the States with population densities below 250 persons per square km. Rugged terrain and unfavourable climatic conditions are primarily responsible for sparse population in these areas. Which states have density below 250 persons per square km?

Assam and most of the Peninsular states have moderate population densities. Hilly, dissected and rocky nature of the terrain, moderate to low rainfall, shallow and less fertile soils have influenced population densities in these areas.

The Northern plains and Kerala in the south have high to very high population densities because of the flat plains with fertile soils and abundant rainfall. Identify the three states of the Northern Plains with high population densities.

POPULATION GROWTH AND PROCESSES OF POPULATION CHANGE

Population is a dynamic phenomenon. The numbers, distribution and composition of the population are constantly changing. This is the influence of the interaction of the three processes, namely — births, deaths and migrations.

Population Growth

Growth of population refers to the change in the number of inhabitants of a country/territory during a specific period of time, say during the last 10 years. Such a change can be expressed in two ways: in terms of absolute numbers and in terms of percentage change per year.

The absolute numbers added each year or decade is the magnitude of increase. It is obtained by simply subtracting the earlier population (e.g. that of 2001) from the later population (e.g. that of 2011). It is referred to as the absolute increase.

The rate or the pace of population increase is the other important aspect. It is studied in per cent per annum, e.g. a rate of increase of

2 per cent per annum means that in a given year, there was an increase of two persons for every 100 persons in the base population. This is referred to as the **annual growth rate**.

India's population has been steadily increasing from 361 million in 1951 to 1210 million in 2011.

Table 6.1 : The Magnitude and Rate of India's Population Growth

| Year | Total Population (in million) | Absolute Increase in the Decade (in million) | Annual Growth Rate (%) |
|------|-------------------------------|--|------------------------|
| 1951 | 361.0 | 42.43 | 1.25 |
| 1961 | 439.2 | 78.15 | 1.96 |
| 1971 | 548.2 | 108.92 | 2.20 |
| 1981 | 683.3 | 135.17 | 2.22 |
| 1991 | 846.4 | 163.09 | 2.16 |
| 2001 | 1028.7 | 182.32 | 1.97 |
| 2011 | 1210.6 | 181.46 | 1.64 |

Table 6.1 and Figures 6.4 (a) and 6.4 (b) reveal that from 1951 to 1981, the annual rate of population growth was steadily increasing; which explains the rapid increase in population from 361 million in 1951 to 683 million in 1981.

Find Out

- Table 6.1 reveals that despite the decline in growth rates, the number of people being added every decade is steadily increasing. Why?

Since 1981, however, the rate of growth started declining gradually. During this period, birth rates declined rapidly. Still 182 million people were added to the total population in the 1990s alone (an annual addition larger than ever before).

It is essential to realise that India has a very large population. When a low annual rate is applied to a very large population, it yields a large absolute increase. When more than a billion people increase even at a lower rate, the total number being added becomes very large. India's annual increase in population is large enough to neutralise efforts to conserve the resource endowment and environment.

The declining trend of the growth rate is indeed a positive indicator of the efforts of birth control. Despite that, the total additions to the population base continue to grow, and India

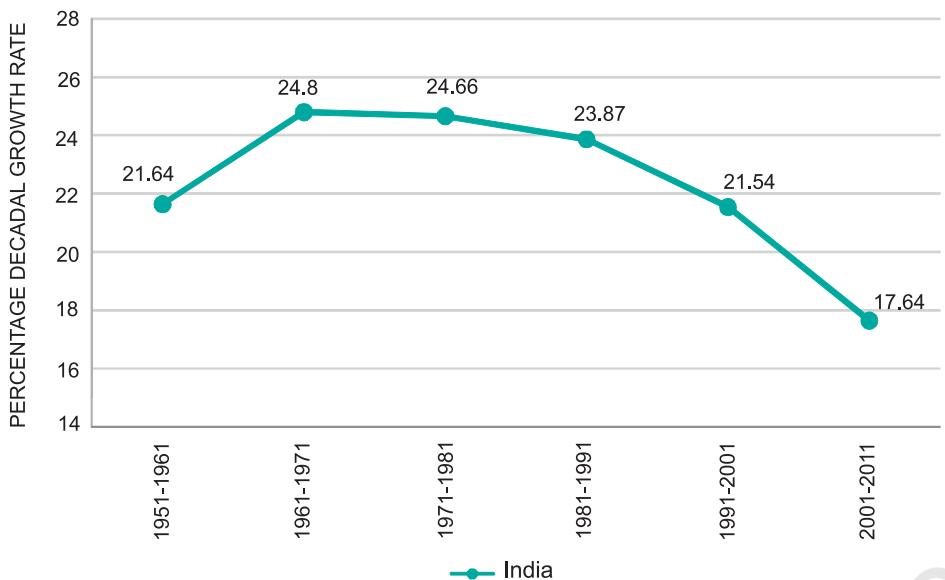


Fig. 6.4(a): India's Population Growth Rates during 1951-2011

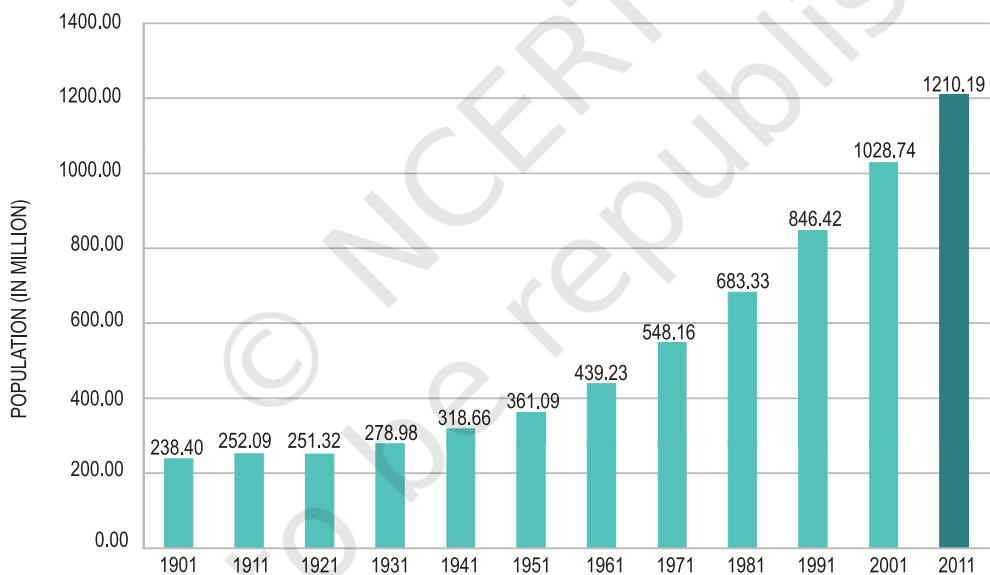


Fig. 6.4(b): India's Population 1901-2011

may overtake China in 2045 to become the most populous country in the world.

Processes of Population Change/Growth

There are three main processes of change of population : birth rates, death rates and migration.

The natural increase of population is the difference between birth rates and death rates.

Birth rate is the number of live births per thousand persons in a year. It is a major component of growth because in India, birth rates have always been higher than death rates.

Death rate is the number of deaths per thousand persons in a year. The main cause of the rate of growth of the Indian population has been the rapid decline in death rates.

Till 1980, high birth rates and declining death rates led to a large difference between birth rates and death rates resulting in higher rates of population growth. Since 1981, birth rates have also started declining gradually, resulting in a gradual decline in the rate of population growth. What are the reasons for this trend?

The third component of population growth is **migration**. Migration is the movement of people across regions and territories. Migration can be **internal** (within the country) or **international** (between the countries).

Internal migration does not change the size of the population, but influences the distribution of population within the nation. Migration plays a very significant role in changing the composition and distribution of population.

Activity

On a map, trace the migration of each of your grandparents and parents since their birth. Try and analyse the reasons for each move.

In India, most migrations have been from rural to urban areas because of the “push” factor in rural areas. These are adverse conditions of poverty and unemployment in the rural areas and the “pull” of the city in terms of increased employment opportunities and better living conditions.

Migration is an important determinant of population change. It changes not only the population size but also the population composition of urban and rural populations in terms of age and sex composition. In India, the rural-urban migration has resulted in a steady increase in the percentage of population in cities and towns. The urban population has increased from 17.29 per cent of the total

population in 1951 to 31.80 per cent in 2011. There has been a significant increase in the number of ‘million plus cities’ from 35 to 53 in just one decade, i.e., 2001 to 2011.

Adolescent Population

The most significant feature of the Indian population is the size of its adolescent population. It constitutes one-fifth of the total population of India. Adolescents are, generally, grouped in the age group of 10 to 19 years. They are the most important resource for the future. Nutrition requirements of adolescents are higher than those of a normal child or adult. Poor nutrition can lead to deficiency and stunted growth. But in India, the diet available to adolescents is inadequate in all nutrients. A large number of adolescent girls suffer from anaemia. Their problems have so far not received adequate attention in the process of development. The adolescent girls have to be sensitised to the problems they confront. Awareness among them can be improved through the spread of literacy and education.

National Population Policy

Recognising that the planning of families would improve individual health and welfare, the Government of India initiated a comprehensive Family Planning Programme in 1952. The Family Welfare Programme has sought to promote responsible and planned parenthood on a voluntary basis. The National Population Policy (NPP) 2000 is a culmination of years of planned efforts.

The NPP 2000 provides a policy framework for imparting free and compulsory school education up to 14 years of age, reducing infant mortality rate to below 30 per 1000 live births, achieving universal immunisation of children against all vaccine preventable diseases, promoting delayed marriage for girls, and making family welfare a people-centred programme.

EXERCISE

1. Choose the right answer from the four alternatives given below.
 - (i) Migrations change the number, distribution and composition of the population in
 - (a) the area of departure
 - (b) the area of arrival
 - (c) both the area of departure and arrival
 - (d) none of the above
 - (ii) A large proportion of children in a population is a result of
 - (a) high birth rates
 - (b) high life expectancies
 - (c) high death rates
 - (d) more married couples
 - (iii) The magnitude of population growth refers to
 - (a) the total population of an area
 - (b) the number of persons added each year
 - (c) the rate at which the population increases
 - (d) the number of females per thousand males
 - (iv) According to the Census, a "literate" person is one who
 - (a) can read and write his/her name
 - (b) can read and write any language
 - (c) is 7 years old and can read and write any language with understanding
 - (d) knows the 3 'R's (reading, writing, arithmetic)
 2. Answer the following questions briefly.
 - (i) Why is the rate of population growth in India declining since 1981?
 - (ii) Discuss the major components of population growth.
 - (iii) Define age structure, death rate and birth rate.
 - (iv) How is migration a determinant factor of population change?
 3. Distinguish between population growth and population change.
 4. What is the relation between occupational structure and development?
 5. What are the advantages of having a healthy population?
 6. What are the significant features of the National Population Policy 2000?

PROJECT / ACTIVITY

Conduct a class census by preparing a questionnaire. The questionnaire should contain minimum five questions. Questions should relate to students, their family members, their class performance, their health, etc. Each student is required to fill in the questionnaire. Compile the information in numerical terms (in terms of percentage). Present the information through pie-chart, bar-diagram or in any other way.

GLOSSARY

| | |
|----------------------------------|---|
| Adolescence | : Adolescence is a period in which a person is no longer a child and not yet an adult. Such persons are grouped in the age group of 10 to 19 years. |
| Alluvial plain | : A level tract of land made up of alluvium or fine rock material brought down by a river. |
| Base population | : The total population of an area at the beginning of a given time period. |
| Biome | : Plant communities occurring in distinct groups in areas having similar climatic conditions. |
| Birth rate | : The number of live births for every 1000 persons in a year. |
| Depression | : In meteorology; it denotes an area of relatively low atmospheric pressure, which is found mainly in temperate regions. In geology, it refers to a hollow sunken area of the earth's surface. |
| Death rate | : The number of deaths per 1000 persons in a year. |
| Density of population | : The average number of persons per unit area, such as a square kilometre. |
| Dependency ratio | : The ratio of people of dependent age (below 15 and above 60 years) to people of economically active ages (15-59 years). |
| Ecosystem | : A system which comprises the physical environment and the organisms living therein. |
| Environment | : Surroundings or the conditions under which a person or thing exists and develops his or its character. It covers both physical and cultural elements. |
| Fault | : A linear break in rocks of the earth's crust along which there has been displacement in a horizontal, vertical or oblique direction. |
| Fauna | : The animal life of a given area. |
| Flora | : The total vegetation or plant cover of a region. |
| Fold | : A bend in the rock strata resulting from compression of an area of the earth's crust. |
| Geosyncline | : A narrow, shallow, elongated basin with a sinking bottom in which a considerable thickness of sediments was deposited by the rivers coming from Angara and Gondwanaland. |
| Glacier | : A mass of snow and ice that moves slowly under the influence of gravity along a confined course away from its place of accumulation. |
| Growth rate of population | : The growth rate of population indicates the rate at which the population is growing. In estimating the growth rate the increase in population is compared with the base population. It can be measured annually or over a decade. |
| Indian mainland | : It refers to the contiguous stretch of landmass from Jammu and Kashmir to Kanyakumari and from Gujarat to Arunachal Pradesh. |
| Indian Standard Time | : The local time along the Standard Meridian of India ($82^{\circ}30'E$). |
| Inland drainage | : A drainage system in which the waters of the rivers do not reach the oceans but fall into an inland sea or lake. |

| | |
|----------------------------|---|
| Igneous rocks | : Rocks formed as a result of solidification of magma either below the earth's surface or above it. |
| Lagoon | : A salt-water lake separated from the sea by the sandbars and spits. |
| Lake | : A body of water that lies in a hollow in the earth's surface and is entirely surrounded by land. |
| Lithospheric plates | : Large segments of the earth's crust composed of continental and oceanic lithospheric parts, floating above the asthenosphere. |
| Life expectancy | : The average number of years one is expected to live. |
| Local time | : The time of a place determined by the midday sun is called the local time. |
| Metamorphic rocks | : Deformation and alteration of pre-existing igneous and sedimentary rocks as a result of changes in physical and chemical conditions due to intense heat or pressure. |
| Migration | : Movement of people from one place to another. Internal migration means movement of people within a country and external migration means movement of people between countries. When people come to a country from another country, it is called immigration and when they leave that country, it is called emigration. |
| Million plus cities | : Cities with a population of more than one million or 10 lakh. |
| Monsoon | : A complete reversal of winds over a large area leading to a change of seasons. |
| Mountain | : An upward projected features of the earth's surface that rises to high altitude and usually possesses steep slopes. |
| National park | : A reserved area for preserving its natural vegetation, wildlife and the natural environment. |
| Plain | : An extensive area of flat or gently undulating land. |
| Plateau | : An extensive elevated area of relatively flat land. |
| Plate tectonics | : The scientific concept that explains the movements of the crustal plates. |
| Relief | : The differences in elevation or the physical outline of the land surface or ocean floor. |
| Subsidence | : In meteorology, it is the downward movement of the air. In geology, it refers to the sinking of a portion of the earth's surface. |
| Sedimentary rocks | : Rocks composed of sediments and generally having a layered structure. |
| Sex-ratio | : Sex-ratio is defined as the number of females per thousand males. |
| Subcontinent | : A big landmass, which stands out as a distinct geographical unit from the rest of the continent. |
| Tectonic | : Forces originating within the earth and responsible for bringing widespread changes in the landform features. |
| Young mountains | : The fold mountains formed during the most recent major phase of folding in the earth's crust. |

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Social Science

Contemporary

India II

Textbook in Geography
for Class X



1068



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FOREWORD

The National Curriculum Framework (NCF), 2005, recommends that children's life at school must be linked to their life outside the school. This principle marks a departure from the legacy of bookish learning which continues to shape our system and causes a gap between the school, home and community. The syllabi and textbooks developed on the basis of NCF signify an attempt to implement this basic idea. They also attempt to discourage rote learning and the maintenance of sharp boundaries between different subject areas. We hope these measures will take us significantly further in the direction of a child-centred system of education outlined in the National Policy on Education (1986).

The success of this effort depends on the steps that school principals and teachers will take to encourage children to reflect on their own learning and to pursue imaginative activities and questions. We must recognise that, given space, time and freedom, children generate new knowledge by engaging with the information passed on to them by adults. Treating the prescribed textbook as the sole basis of examination is one of the key reasons why other resources and sites of learning are ignored. Inculcating creativity and initiative is possible if we perceive and treat children as participants in learning, not as receivers of a fixed body of knowledge.

These aims imply considerable change in school routines and mode of functioning. Flexibility in the daily time-table is as necessary as rigour in implementing the annual calendar so that the required number of teaching days are actually devoted to teaching. The methods used for teaching and evaluation will also determine how effective this textbook proves for making children's life at school a happy experience, rather than a source of stress or boredom. Syllabus designers have tried to address the problem of curricular burden by restructuring and reorienting knowledge at different stages with greater consideration for child psychology and the time available for teaching. The textbook attempts to enhance this endeavour by giving higher priority and space to opportunities for contemplation and wondering, discussion in small groups, and activities requiring hands-on experience.

The National Council of Educational Research and Training (NCERT) appreciates the hard work done by the textbook development committee responsible for this book. We wish to thank the Chairperson of the advisory committee for textbooks in Social Sciences, at the higher secondary level, Professor Hari Vasudevan and the Chief Advisor for this book, Professor M.H. Qureshi for guiding the work of this committee. Several teachers contributed to the development of this textbook; we are grateful to their principals for making this possible. We are indebted to

the institutions and organisations which have generously permitted us to draw upon their resources, material and personnel. We are especially grateful to the members of the National Monitoring Committee, appointed by the Department of Secondary and Higher Education, Ministry of Human Resource Development under the Chairpersonship of Professor Mrinal Miri and Professor G.P. Deshpande, for their valuable time and contribution. As an organisation committed to systemic reform and continuous improvement in the quality of its products, NCERT welcomes comments and suggestions which will enable us to undertake further revision and refinement.

New Delhi
20 November 2006

Director
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RATIONALISATION OF CONTENT IN THE TEXTBOOK

In view of the COVID-19 pandemic, it is imperative to reduce content load on students. The National Education Policy 2020, also emphasises reducing the content load and providing opportunities for experiential learning with creative mindset. In this background, the NCERT has undertaken the exercise to rationalise the textbooks across all classes. Learning Outcomes already developed by the NCERT across classes have been taken into consideration in this exercise.

Contents of the textbooks have been rationalised in view of the following:

- Overlapping with similar content included in other subject areas in the same class
- Similar content included in the lower or higher class in the same subject
- Difficulty level
- Content, which is easily accessible to students without much interventions from teachers and can be learned by children through self-learning or peer-learning
- Content, which is irrelevant in the present context

This present edition, is a reformatted version after carrying out the changes given above.

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THE CONSTITUTION OF INDIA

PREAMBLE

WE, THE PEOPLE OF INDIA, having solemnly resolved to constitute India into a **¹[SOVEREIGN SOCIALIST SECULAR DEMOCRATIC REPUBLIC]** and to secure to all its citizens :

JUSTICE, social, economic and political;

LIBERTY of thought, expression, belief, faith and worship;

EQUALITY of status and of opportunity; and to promote among them all

FRATERNITY assuring the dignity of the individual and the **²[unity and integrity of the Nation];**

IN OUR CONSTITUENT ASSEMBLY this twenty-sixth day of November, 1949 do **HEREBY ADOPT, ENACT AND GIVE TO OURSELVES THIS CONSTITUTION.**

1. Subs. by the Constitution (Forty-second Amendment) Act, 1976, Sec.2, for "Sovereign Democratic Republic" (w.e.f. 3.1.1977)
2. Subs. by the Constitution (Forty-second Amendment) Act, 1976, Sec.2, for "Unity of the Nation" (w.e.f. 3.1.1977)

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The Council also gratefully acknowledges the contributions of Ishwar Singh, *DTP Operator*; Ajay Singh, *Copy Editor*; Dinesh Kumar, *Computer Incharge*, who have helped in giving a final shape to this book. The contribution of the Publication Department, NCERT are also duly acknowledged.

The following are applicable to all the maps of India used in this textbook

1. © Government of India, Copyright 2006
2. The responsibility for the correctness of internal details rests with the publisher.
3. The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line.

4. The administrative headquarters of Chandigarh, Haryana and Punjab are at Chandigarh.
5. The interstate boundaries amongst Arunachal Pradesh, Assam and Meghalaya shown on this map are as interpreted from the “North-Eastern Areas (Reorganisation) Act.1971,” but have yet to be verified.
6. The external boundaries and coastlines of India agree with the Record/Master Copy certified by Survey of India.
7. The state boundaries between Uttarakhand & Uttar Pradesh, Bihar & Jharkhand and Chhattisgarh & Madhya Pradesh have not been verified by the Governments concerned.
8. The spellings of names in these maps have been taken from various sources.

School Bhuvan-NCERT an Online web portal

Web based online e-learning Geo spatial portal **School Bhuvan-NCERT** has been launched by NCERT and ISRO in collaboration to enhance geo spatial skills among students. This online e-learning portal includes thematic maps given in Geography textbooks. This portal enables students to use Geo-spatial technology for better understanding of concepts in Geography. Online activities available on the portal as Level 1, Level 2 and Level 3 encourage learners from Classes VI to XII to develop neighbourhood maps and their attributes on satellite imageries available on **School Bhuvan-NCERT**.



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Constitution of India

Part IV A (Article 51 A)

Fundamental Duties

It shall be the duty of every citizen of India —

- (a) to abide by the Constitution and respect its ideals and institutions, the National Flag and the National Anthem;
- (b) to cherish and follow the noble ideals which inspired our national struggle for freedom;
- (c) to uphold and protect the sovereignty, unity and integrity of India;
- (d) to defend the country and render national service when called upon to do so;
- (e) to promote harmony and the spirit of common brotherhood amongst all the people of India transcending religious, linguistic and regional or sectional diversities; to renounce practices derogatory to the dignity of women;
- (f) to value and preserve the rich heritage of our composite culture;
- (g) to protect and improve the natural environment including forests, lakes, rivers, wildlife and to have compassion for living creatures;
- (h) to develop the scientific temper, humanism and the spirit of inquiry and reform;
- (i) to safeguard public property and to abjure violence;
- (j) to strive towards excellence in all spheres of individual and collective activity so that the nation constantly rises to higher levels of endeavour and achievement;
- *(k) who is a parent or guardian, to provide opportunities for education to his child or, as the case may be, ward between the age of six and fourteen years.

Note: The Article 51A containing Fundamental Duties was inserted by the Constitution (42nd Amendment) Act, 1976 (with effect from 3 January 1977).

*(k) was inserted by the Constitution (86th Amendment) Act, 2002 (with effect from 1 April 2010).





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RESOURCES AND DEVELOPMENT

Can you identify and name the various items used in making life comfortable in our villages and towns. List the items and name the material used in their making.

Everything available in our environment which can be used to satisfy our needs, provided, it is technologically accessible, economically feasible and culturally acceptable can be termed as 'Resource'.

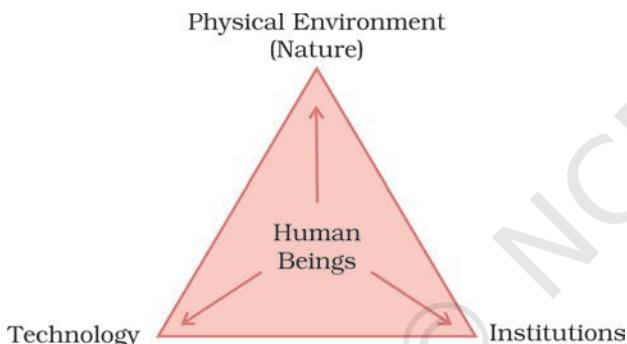


Fig. 1.1: Interdependent relationship between nature, technology and institutions

The process of transformation of things available in our environment involves an interactive relationship between nature, technology and institutions. Human beings interact with nature through technology and create institutions to accelerate their economic development.

Do you think that resources are free gifts of nature as is assumed by many? They are not. Resources are a function of human activities. Human beings themselves are essential components of resources. They transform material available in our environment into resources and use them. These resources can be classified in the following ways—

- On the basis of origin – biotic and abiotic
- On the basis of exhaustibility – renewable and non-renewable
- On the basis of ownership – individual, community, national and international
- On the basis of status of development – potential, developed stock and reserves.

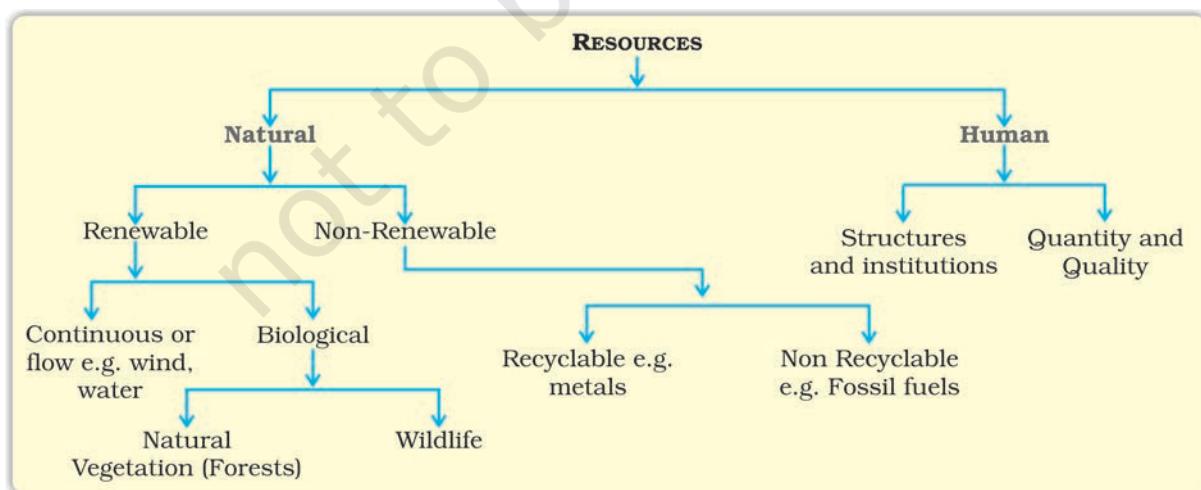


Fig. 1.2: Classification of resources

Activity

Prepare a list of stock and reserve, resources that you are familiar with from your local area.

DEVELOPMENT OF RESOURCES

Resources are vital for human survival as well as for maintaining the quality of life. It was believed that resources are free gifts of nature. As a result, human beings used them indiscriminately and this has led to the following major problems.

- Depletion of resources for satisfying the greed of a few individuals.
- Accumulation of resources in few hands, which, in turn, divided the society into two segments i.e. haves and have nots or rich and poor.
- Indiscriminate exploitation of resources has led to global ecological crises such as, global warming, ozone layer depletion, environmental pollution and land degradation.

Activity

1. Imagine, if the oil supply gets exhausted one day, how would this affect our life style?
2. Plan a survey in your colony/village to investigate people's attitude towards recycling of the domestic/agricultural wastes. Ask questions about :
 - (a) What do they think about resources they use?
 - (b) What is their opinion about the wastes, and its utilisation?
 - (c) Collage your results.

An equitable distribution of resources has become essential for a sustained quality of life and global peace. If the present trend of resource depletion by a few individuals and countries continues, the future of our planet is in danger.

Therefore, resource planning is essential for sustainable existence of all forms of life. Sustainable existence is a component of sustainable development.

Sustainable development

Sustainable economic development means 'development should take place without damaging the environment, and development in the present should not compromise with the needs of the future generations.'

Rio de Janeiro Earth Summit, 1992

In June 1992, more than 100 heads of states met in Rio de Janeiro in Brazil, for the first International Earth Summit. The Summit was convened for addressing urgent problems of environmental protection and socio-economic development at the global level. The assembled leaders signed the Declaration on Global Climatic Change and Biological Diversity. The Rio Convention endorsed the global Forest Principles and adopted Agenda 21 for achieving Sustainable Development in the 21st century.

Agenda 21

It is the declaration signed by world leaders in 1992 at the United Nations Conference on Environment and Development (UNCED), which took place at Rio de Janeiro, Brazil. It aims at achieving global sustainable development. It is an agenda to combat environmental damage, poverty, disease through global co-operation on common interests, mutual needs and shared responsibilities. One major objective of the Agenda 21 is that every local government should draw its own local Agenda 21.

RESOURCE PLANNING

Planning is the widely accepted strategy for judicious use of resources. It has importance in a country like India, which has enormous diversity in the availability of resources. There are regions which are rich in certain types of resources but are deficient in some other

resources. There are some regions which can be considered self sufficient in terms of the availability of resources and there are some regions which have acute shortage of some vital resources. For example, the states of Jharkhand, Chhattisgarh and Madhya Pradesh are rich in minerals and coal deposits. Arunachal Pradesh has abundance of water resources but lacks in infrastructural development. The state of Rajasthan is very well endowed with solar and wind energy but lacks in water resources. The cold desert of Ladakh is relatively isolated from the rest of the country. It has very rich cultural heritage but it is deficient in water, infrastructure and some vital minerals. This calls for balanced resource planning at the national, state, regional and local levels.

Activity

Prepare a list of resources found in your state and also identify the resources that are important but deficit in your state.

Resource Planning in India

Resource planning is a complex process which involves : (i) identification and inventory of resources across the regions of the country. This involves surveying, mapping and qualitative and quantitative estimation and measurement of the resources. (ii) Evolving a planning structure endowed with appropriate technology, skill and institutional set up for implementing resource development plans. (iii) Matching the resource development plans with overall national development plans.

India has made concerted efforts for achieving the goals of resource planning right from the First Five Year Plan launched after Independence.

The availability of resources is a necessary condition for the development of any region, but mere availability of resources in the absence of corresponding changes in

Find out

What resources are being developed in your surroundings by the community/village panchayats/ward level communities with the help of community participation?

technology and institutions may hinder development. There are many regions in our country that are rich in resources but these are included in economically backward regions. On the contrary there are some regions which have a poor resource base but they are economically developed.

Can you name some resource rich but economically backward regions and some resource poor but economically developed regions? Give reasons for such a situation.

The history of colonisation reveals that rich resources in colonies were the main attractions for the foreign invaders. It was primarily the higher level of technological development of the colonising countries that helped them to exploit resources of other regions and establish their supremacy over the colonies. Therefore, resources can contribute to development only when they are accompanied by appropriate technological development and institutional changes. India has experienced all this in different phases of colonisation. Therefore, in India, development, in general, and resource development in particular does not only involve the availability of resources, but also the technology, quality of human resources and the historical experiences of the people.

Conservation of Resources: Resources are vital for any developmental activity. But irrational consumption and over-utilisation of resources may lead to socio-economic and environmental problems. To overcome these problems, resource conservation at various levels is important. This had been the main concern of the leaders and thinkers in the past. For example, Gandhiji was very apt in voicing his concern about resource conservation in these words: "There is enough

for everybody's need and not for any body's greed." He placed the greedy and selfish individuals and exploitative nature of modern technology as the root cause for resource depletion at the global level. He was against mass production and wanted to replace it with the production by the masses.

At the international level, the Club of Rome advocated resource conservation for the first time in a more systematic way in 1968. Subsequently, in 1974, Gandhian philosophy was once again presented by Schumacher in his book **Small is Beautiful**. The seminal contribution with respect to resource conservation at the global level was made by the Brundtland Commission Report, 1987. This report introduced the concept of 'Sustainable Development' and advocated it as a means for resource conservation, which was subsequently published in a book entitled **Our Common Future**. Another significant contribution was made at the Earth Summit at Rio de Janeiro, Brazil in 1992.

LAND RESOURCES

We live on land, we perform our economic activities on land and we use it in different ways. Thus, land is a natural resource of utmost importance. It supports natural vegetation, wild life, human life, economic activities, transport and communication systems. However, land is an asset of a finite magnitude, therefore, it is important to use the

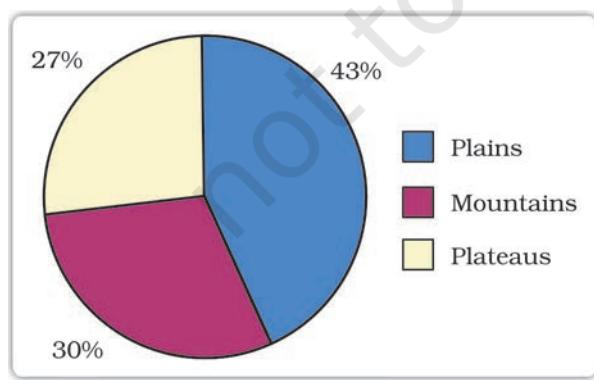


Fig 1.3: India : Land under important Relief Features

available land for various purposes with careful planning.

India has land under a variety of relief features, namely; mountains, plateaus, plains and islands. About 43 per cent of the land area is plain, which provides facilities for agriculture and industry. Mountains account for 30 per cent of the total surface area of the country and ensure perennial flow of some rivers, provide facilities for tourism and ecological aspects. About 27 per cent of the area of the country is the plateau region. It possesses rich reserves of minerals, fossil fuels and forests.

LAND UTILISATION

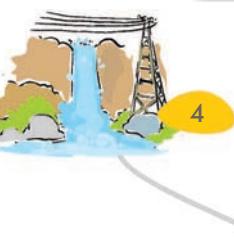
Land resources are used for the following purposes:

1. Forests
2. Land not available for cultivation
 - (a) Barren and waste land
 - (b) Land put to non-agricultural uses, e.g. buildings, roads, factories, etc.
3. Other uncultivated land (excluding fallow land)
 - (a) Permanent pastures and grazing land,
 - (b) Land under miscellaneous tree crops groves (not included in net sown area),
 - (c) Cultivable waste land (left uncultivated for more than 5 agricultural years).
4. Fallow lands
 - (a) Current fallow-(left without cultivation for one or less than one agricultural year),
 - (b) Other than current fallow-(left uncultivated for the past 1 to 5 agricultural years).
5. Net sown area the physical extent of land on which crops are sown harvested is known as net sown area.

Area sown more than once in an agricultural year plus net sown area is known as *gross cropped area*.

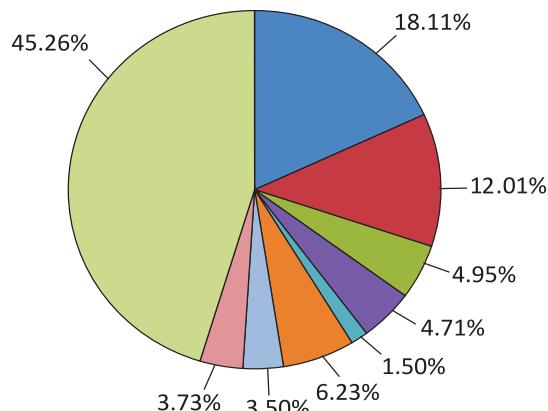
LAND USE PATTERN IN INDIA

The use of land is determined both by physical factors such as topography, climate, soil types as well as human factors such as population density, technological capability and culture and traditions etc.

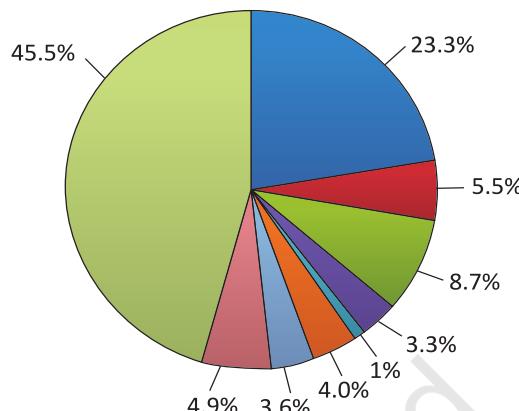


General land use categories-1960-61**General land use categories-2014-15**

Reporting Area: 100 Per cent



- Forest
- Barren and unculturable waste land
- Area under non-agricultural uses
- Permanent pasture and grazing land
- Area under misc. tree crops and groves



- Culturable waste land
- Fallow other than current fallow
- Current fallow
- Net sown area

Source : Directorate of Economics and Statistics, Ministry of Agriculture, 2017

Fig. 1.4

Total geographical area of India is 3.28 million sq km. Land use data, however, is available only for 93 per cent of the total geographical area because the land use reporting for most of the north-east states except Assam has not been done fully. Moreover, some areas of Jammu and Kashmir occupied by Pakistan and China have also not been surveyed.

Activity

Try to do a comparison between the two pie charts (Fig. 1.4) given for land use and find out why the net sown area and the land under forests have changed from 1960-61 to 2014-15 very marginally.

The land under permanent pasture has also decreased. How are we able to feed our huge cattle population on this pasture land and what are the consequences of it? Most of the other than the current fallow lands are either of poor quality or the cost of cultivation

of such land is very high. Hence, these lands are cultivated once or twice in about two to three years and if these are included in the net sown area then the percentage of NSA in India comes to about 54 per cent of the total reporting area.

The pattern of net sown area varies greatly from one state to another. It is over 80 per cent of the total area in Punjab and Haryana and less than 10 per cent in Arunachal Pradesh, Mizoram, Manipur and Andaman Nicobar Islands.

Find out reasons for the low proportion of net sown area in these states.

Forest area in the country is far lower than the desired 33 per cent of geographical area, as it was outlined in the National Forest Policy (1952). It was considered essential for maintenance of the ecological balance. The livelihood of millions of people who live on the

fringes of these forests depends upon it. A part of the land is termed as waste land and land put to other non-agricultural uses. Waste land includes rocky, arid and desert areas and land put to other non-agricultural uses includes settlements, roads, railways, industry etc. Continuous use of land over a long period of time without taking appropriate measures to conserve and manage it, has resulted in land degradation. This, in turn, has serious repercussions on society and the environment.

LAND DEGRADATION AND CONSERVATION MEASURES

We have shared our land with the past generations and will have to do so with the future generations too. Ninety-five per cent of our basic needs for food, shelter and clothing are obtained from land. Human activities have not only brought about degradation of land but have also aggravated the pace of natural forces to cause damage to land.

Some human activities such as deforestation, over grazing, mining and quarrying too have contributed significantly in land degradation.

Mining sites are abandoned after excavation work is complete leaving deep scars and traces of over-burdening. In states like Jharkhand, Chhattisgarh, Madhya Pradesh and Odisha deforestation due to mining have caused severe land degradation. In states like Gujarat, Rajasthan, Madhya Pradesh and Maharashtra overgrazing is one of the main reasons for land degradation. In the states of Punjab, Haryana, western Uttar Pradesh, over irrigation is responsible for land degradation due to water logging leading to increase in salinity and alkalinity in the soil. The mineral processing like grinding of limestone for cement industry and calcite and soapstone for ceramic industry generate huge quantity of dust in the atmosphere. It retards the process of infiltration of water into the soil after it settles down on the land. In recent years, industrial effluents as waste have become a major source of land and water pollution in many parts of the country.

There are many ways to solve the problems of land degradation. Afforestation and proper management of grazing can help to some extent. Planting of shelter belts of plants, control on over grazing, stabilisation of sand dunes by growing thorny bushes are some of the methods to check land degradation in arid areas. Proper management of waste lands, control of mining activities, proper discharge and disposal of industrial effluents and wastes after treatment can reduce land and water degradation in industrial and suburban areas.

SOIL AS A RESOURCE

Soil is the most important renewable natural resource. It is the medium of plant growth and supports different types of living organisms on the earth. The soil is a living system. It takes millions of years to form soil upto a few cm in depth. Relief, parent rock or bed rock, climate, vegetation and other forms of life and time are important factors in the formation of soil. Various forces of nature such as change in temperature, actions of running water, wind and glaciers, activities of decomposers etc. contribute to the formation of soil. Chemical and organic changes which take place in the

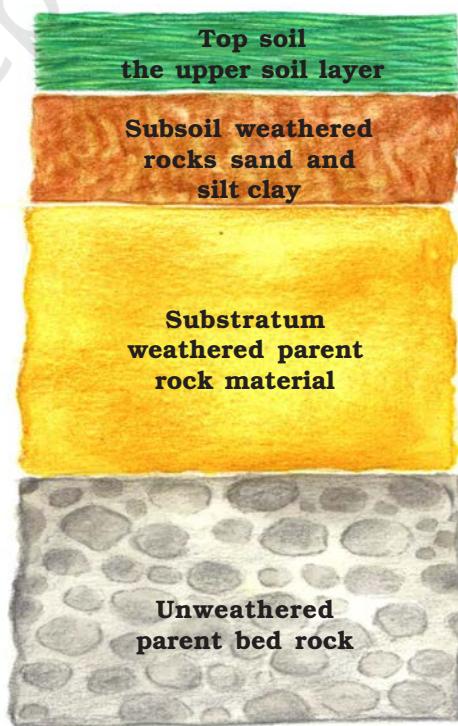


Fig. 1.5: Soil Profile

soil are equally important. Soil also consists of organic (humus) and inorganic materials (Fig. 1.5).

On the basis of the factors responsible for soil formation, colour, thickness, texture, age, chemical and physical properties, the soils of India are classified in different types.

Classification of Soils

India has varied relief features, landforms, climatic realms and vegetation types. These have contributed in the development of various types of soils.

Alluvial Soils

This is the most widely spread and important soil. In fact, the entire northern plains are made of alluvial soil. These have been deposited by three important Himalayan river systems – the Indus, the Ganga and the Brahmaputra. These soils also extend in Rajasthan and Gujarat through a narrow corridor. Alluvial soil is also found in the eastern coastal plains particularly in the deltas of the Mahanadi, the Godavari, the Krishna and the Kaveri rivers.



Fig. 1.6: Alluvial Soil

The alluvial soil consists of various proportions of sand, silt and clay. As we move inlands towards the river valleys, soil particles appear somewhat bigger in size. In the upper reaches of the river valley i.e. near the place of the break of slope, the soils are coarse. Such soils are more common in piedmont plains such as **Duars**, **Chos** and **Terai**.

Apart from the size of their grains or components, soils are also described on the basis of their age. According to their age alluvial soils can be classified as old alluvial (**Bangar**) and new alluvial (**Khadar**). The **bangar** soil has higher concentration of *kanker*

nodules than the **Khadar**. It has more fine particles and is more fertile than the **bangar**.

Alluvial soils as a whole are very fertile. Mostly these soils contain adequate proportion of potash, phosphoric acid and lime which are ideal for the growth of sugarcane, paddy, wheat and other cereal and pulse crops. Due to its high fertility, regions of alluvial soils are intensively cultivated and densely populated. Soils in the drier areas are more alkaline and can be productive after proper treatment and irrigation.

Black Soil

These soils are black in colour and are also known as *regur* soils. Black soil is ideal for growing cotton and is also known as *black cotton soil*. It is believed that climatic condition along with the parent rock material are the important factors for the formation of black soil. This type of soil is typical of the Deccan trap (*Basalt*) region spread over northwest Deccan plateau and is made up of lava flows. They cover the plateaus of Maharashtra, Saurashtra, Malwa, Madhya Pradesh and Chhattisgarh and extend in the south east direction along the Godavari and the Krishna valleys.

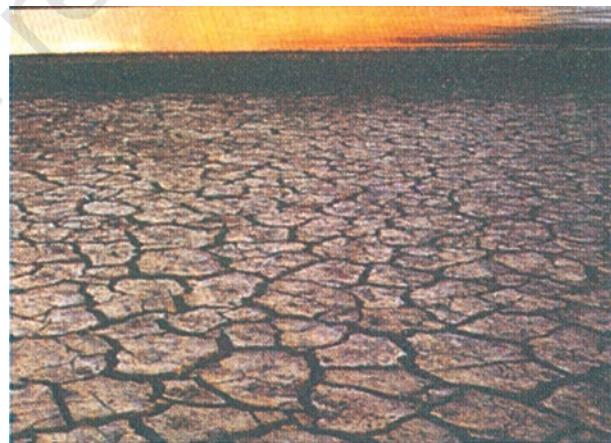
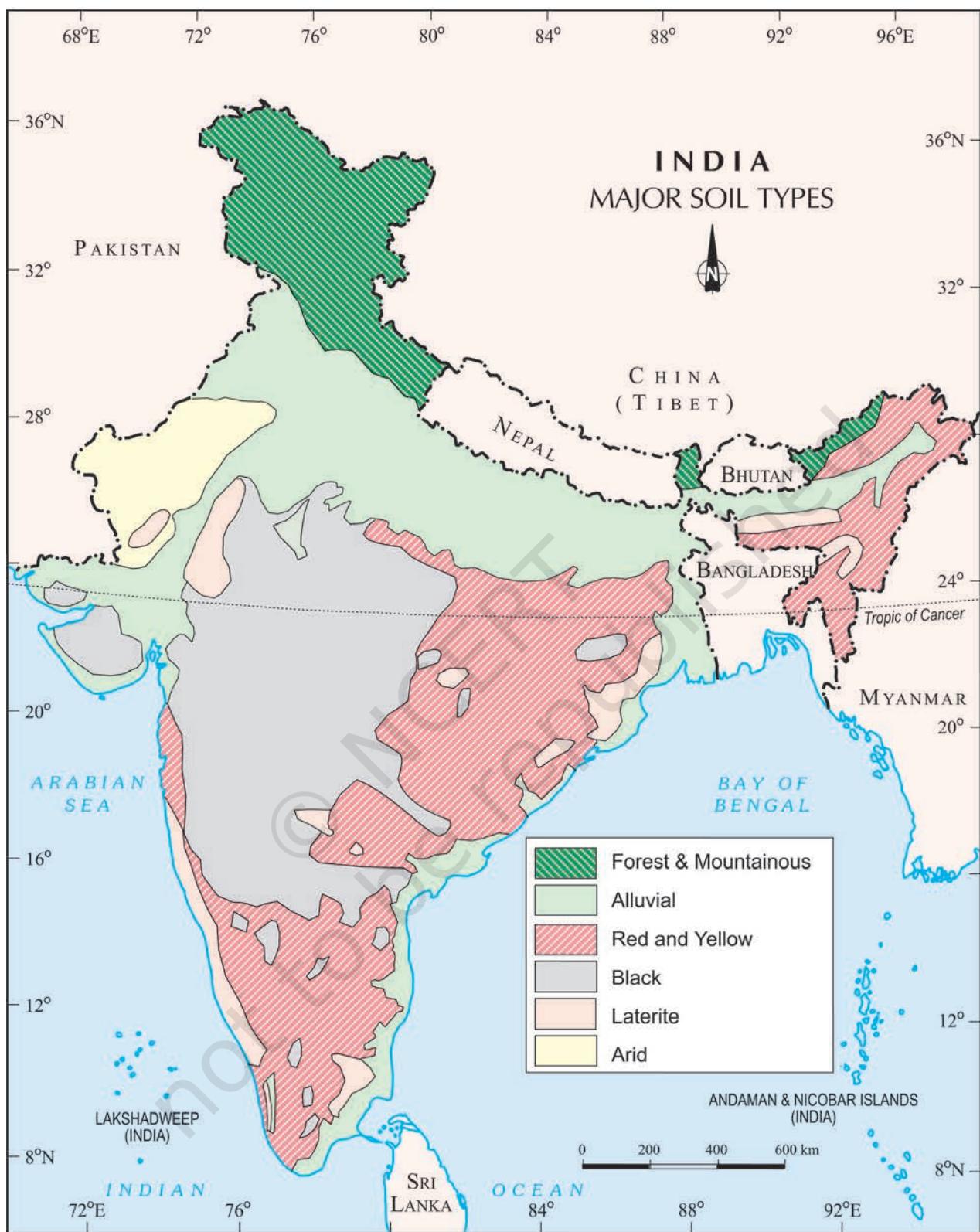


Fig. 1.7: Black Soil

The black soils are made up 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, potash and lime. These



India: Major Soil Types

soils are generally poor in phosphoric contents. They develop deep cracks during hot weather, which helps in the proper aeration of the soil. These soils are sticky when wet and difficult to work on unless tilled immediately after the first shower or during the pre-monsoon period.

Red and Yellow Soils

Red soil develops on crystalline igneous rocks in areas of low rainfall in the eastern and southern parts of the Deccan plateau. Yellow and red soils are also found in parts of Odisha, Chhattisgarh, southern parts of the middle Ganga plain and along the piedmont zone of the Western Ghats. These soils develop a reddish colour due to diffusion of iron in crystalline and metamorphic rocks. It looks yellow when it occurs in a hydrated form.

Laterite Soil

Laterite has been derived from the Latin word 'later' which means brick. The laterite soil develops under tropical and subtropical climate with alternate wet and dry season. This soil is the result of intense leaching due to heavy rain. Lateritic soils are mostly deep to very deep, acidic ($\text{pH} < 6.0$), generally deficient in plant nutrients and occur mostly in southern states, Western Ghats region of Maharashtra, Odisha, some parts of West Bengal and North-east regions. Where these soils support deciduous and evergreen forests, it is humus rich, but under sparse



Fig. 1.8: Laterite Soil

vegetation and in semi-arid environment, it is generally humus poor. They are prone to erosion and degradation due to their position on the landscape. After adopting appropriate soil conservation techniques particularly in the hilly areas of Karnataka, Kerala and Tamil Nadu, this soil is very useful for growing tea and coffee. Red laterite soils in Tamil Nadu, Andhra Pradesh and Kerala are more suitable for crops like cashew nut.

Arid Soils

Arid soils range from red to brown in colour. They are generally sandy in texture and saline in nature. In some areas the salt content is very high and common salt is obtained by evaporating the water. Due to the dry climate, high temperature, evaporation is faster and the soil lacks humus and moisture. The lower horizons of the soil are occupied by *Kankar* because of the increasing calcium content downwards. The *Kankar* layer formations in the bottom horizons restrict the infiltration of water. After proper irrigation these soils become cultivable as has been in the case of western Rajasthan.



Fig. 1.9: Arid Soil

Forest Soils

These soils are found in the hilly and mountainous areas where sufficient rain forests are available. The soils texture varies according to the mountain environment where they are formed. They are loamy and silty in valley sides and coarse grained in the upper slopes. In the snow covered areas

of Himalayas, these soils experience denudation and are acidic with low humus content. The soils found in the lower parts of the valleys particularly on the river terraces and alluvial fans are fertile.

Soil Erosion and Soil Conservation

The denudation of the soil cover and subsequent washing down is described as soil erosion. The processes of soil formation and erosion, go on simultaneously and generally there is a balance between the two. Sometimes, this balance is disturbed due to human activities like deforestation, over-grazing, construction and mining etc., while natural forces like wind, glacier and water lead to soil erosion. The running water cuts through the clayey soils and makes deep channels as **gullies**. The land becomes unfit for cultivation and is known as **bad land**. In the Chambal basin such lands are called ravines. Sometimes water flows as a sheet over large areas down a slope. In such cases the top



Fig. 1.10: Soil Erosion



Fig. 1.11: Gully Erosion

soil is washed away. This is known as **sheet erosion**. Wind blows loose soil off flat or sloping land known as wind erosion. Soil erosion is also caused due to defective methods of farming. Ploughing in a wrong way i.e. up and down the slope form channels for the quick flow of water leading to soil erosion.

Ploughing along the contour lines can decelerate the flow of water down the slopes. This is called contour ploughing. Steps can be cut out on the slopes making terraces. Terrace cultivation restricts erosion. Western and central Himalayas have well developed terrace farming. Large fields can be divided into strips. Strips of grass are left to grow between the crops. This breaks up the force of the wind. This method is known as strip cropping. Planting lines of trees to create shelter also works in a similar way. Rows of such trees are called shelter belts. These shelter belts have contributed significantly to the stabilisation of sand dunes and in stabilising the desert in western India.

1. Multiple choice questions.

- (i) Which one of the following is the main cause of land degradation in Punjab?
 - (a) Intensive cultivation
 - (c) Over irrigation
 - (b) Deforestation
 - (d) Overgrazing
- (ii) In which one of the following states is terrace cultivation practised?
 - (a) Punjab
 - (c) Haryana
 - (b) Plains of Uttar Pradesh
 - (d) Uttarakhand
- (iii) In which of the following states black soil is predominantly found?
 - (a) Uttar Pradesh
 - (c) Rajasthan
 - (b) Maharashtra
 - (d) Jharkhand

2. Answer the following questions in about 30 words.

- (i) Name three states having black soil and the crop which is mainly grown in it.
- (ii) What type of soil is found in the river deltas of the eastern coast? Give three main features of this type of soil.
- (iii) What steps can be taken to control soil erosion in the hilly areas?

3. Answer the following questions in about 120 words.

- (i) Explain land use pattern in India and why has the land under forest not increased much since 1960-61?
- (ii) How have technical and economic development led to more consumption of resources?

PROJECT/ACTIVITY

- 1. Make a project showing consumption and conservation of resources in your locality.
- 2. Have a discussion in the class – how to conserve various resources used in your school.
- 3. Imagine if oil supplies get exhausted, how will this affect our life style?
- 4. Solve the puzzle by following your search horizontally and vertically to find the hidden answers.
 - (i) Natural endowments in the form of land, water, vegetation and minerals.
 - (ii) A type of non-renewable resource.
 - (iii) Soil with high water retaining capacity.
 - (iv) Intensively leached soils of the monsoon climate.

| | | | | | | | | | | | | | | |
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- (i) Natural endowments in the form of land, water, vegetation and minerals.
- (ii) A type of non-renewable resource.
- (iii) Soil with high water retaining capacity.
- (iv) Intensively leached soils of the monsoon climate.
- (v) Plantation of trees on a large scale to check soil erosion.
- (vi) The Great Plains of India are made up of these soils.



1068CH02

FOREST AND WILDLIFE RESOURCES



Narak! My Lord, you are the creator of music
in the world of Lepchas

Oh Narak! My Lord, let me dedicate
myself to you

Let me gather your music from the
springs, the rivers, the mountains, the forests,
the insects and the animals

Let me gather your music from the sweet
breeze and offer it to you

Source: Lepcha folk song from northern part of West Bengal

We share this planet with millions of other living beings, starting from micro-organisms and bacteria, lichens to banyan trees, elephants and blue whales. This entire habitat that we live in has immense biodiversity. We humans along with all living organisms form a complex web of ecological system in which we are only a part and very much dependent on this system for our own existence. For example, the plants, animals and micro-organisms re-create the quality of the air we breathe, the water we drink and the soil that produces our food without which we cannot survive. Forests play a key role in the ecological system as these are also the primary producers on which all other living beings depend.

Biodiversity or Biological Diversity is
immensely rich in wildlife and cultivated
species, diverse in form and function but
closely integrated in a system through
multiple network of interdependencies.

Flora and Fauna in India

If you look around, you will be able to find that there are some animals and plants which are unique in your area. In fact, India is one of the world's richest countries in terms of its vast array of biological diversity. This is possibly twice or thrice the number yet to be discovered. You have already studied in detail about the extent and variety of forest and wildlife resources in India. You may have realised the importance of these resources in our daily life. These diverse flora and fauna are so well integrated in our daily life that we take these for granted. But, lately, they are under great stress mainly due to insensitivity to our environment.

Activity

Find out stories prevalent in your region which are about the harmonious relationship between human beings and nature.

Conservation of Forest and Wildlife in India

Conservation in the background of rapid decline in wildlife population and forestry has become essential. But why do we need to conserve our forests and wildlife? Conservation preserves the ecological diversity and our life support systems – water, air and soil. It also preserves the genetic diversity of plants and animals for better growth of species and breeding. For example, in agriculture, we are still dependent on traditional crop varieties. Fisheries too are heavily dependent on the maintenance of aquatic biodiversity.

In the 1960s and 1970s, conservationists demanded a national wildlife protection programme. The Indian Wildlife (Protection)



Fig. 2.1

Act was implemented in 1972, with various provisions for protecting habitats. An all-India list of protected species was also published. The thrust of the programme was towards protecting the remaining population of certain endangered species by banning hunting, giving legal protection to their habitats, and restricting trade in wildlife. Subsequently, central and many state governments established national parks and wildlife sanctuaries about which you have already studied. The central government also announced several projects for protecting specific animals, which were gravely threatened, including the tiger, the one-horned rhinoceros, the Kashmir stag or *hangul*, three types of crocodiles – fresh water crocodile, saltwater crocodile and the *Gharial*, the Asiatic lion, and others. Most recently, the Indian elephant, black buck (*chinkara*), the great Indian bustard (*godawan*) and the snow leopard, etc. have been given full or partial legal protection against hunting and trade throughout India.

Project Tiger

Tiger is one of the key wildlife species in the faunal web. In 1973, the authorities realised that the tiger population had dwindled to 1,827 from an estimated 55,000 at the turn of the century. The major threats to tiger population are numerous, such as poaching for trade, shrinking habitat, depletion of prey base species, growing human population, etc. The trade of tiger skins and the use of their bones in traditional medicines, especially in the Asian countries left the tiger population on the verge of extinction. Since India and Nepal provide habitat to about two-thirds of the surviving tiger population in the world, these two nations became prime targets for poaching and illegal trading.

"Project Tiger", one of the well-publicised wildlife campaigns in the world, was launched in 1973. Tiger conservation has been viewed not only as an effort to save an endangered species, but with





Fig. 2.2: Rhino and deer in Kaziranga National Park

equal importance as a means of preserving biotypes of sizeable magnitude. Corbett National Park in Uttarakhand, Sunderbans National Park in West Bengal, Bandhavgarh National Park in Madhya Pradesh, Sariska Wildlife Sanctuary in Rajasthan, Manas Tiger Reserve in Assam and Periyar Tiger Reserve in Kerala are some of the tiger reserves of India.

The conservation projects are now focusing on biodiversity rather than on a few of its components. There is now a more intensive search for different conservation measures. Increasingly, even insects are beginning to find a place in conservation planning. In the notification under Wildlife Act of 1980 and 1986, several hundred butterflies, moths, beetles, and one dragonfly have been added to the list of protected species. In 1991, for the first time plants were also added to the list, starting with six species.

Activity

Collect more information on the wildlife sanctuaries and national parks of India and cite their locations on the map of India.

Types and Distribution of Forest and Wildlife Resources

Even if we want to conserve our vast forest and wildlife resources, it is rather difficult to manage, control and regulate them. In India,

much of its forest and wildlife resources are either owned or managed by the government through the Forest Department or other government departments. These are classified under the following categories.

- (i) **Reserved Forests:** More than half of the total forest land has been declared **reserved forests**. Reserved forests are regarded as the most valuable as far as the conservation of forest and wildlife resources are concerned.
- (ii) **Protected Forests:** Almost one-third of the total forest area is protected forest, as declared by the Forest Department. This forest land are protected from any further depletion.
- (iii) **Unclassed Forests:** These are other forests and wastelands belonging to both government and private individuals and communities.

Reserved and protected forests are also referred to as permanent forest estates maintained for the purpose of producing timber and other forest produce, and for protective reasons. Madhya Pradesh has the largest area under permanent forests, constituting 75 per cent of its total forest area. Jammu and Kashmir, Andhra Pradesh, Uttarakhand, Kerala, Tamil Nadu, West Bengal, and Maharashtra have large percentages of reserved forests of its total forest area whereas Bihar, Haryana, Punjab, Himachal Pradesh, Odisha and Rajasthan have a bulk of it under protected forests. All North-

Gharial on the brink

The gharial population has been at its lowest since the 1970s. What went wrong and what can we do?

ROMULUS WHITAKER
and **JANAKI LENIN**

ISPY tendrils of mist rise delicately from the water surface, tinged gold by the dawn. Your breath hangs as little clouds of vapour as you gaze upon the Girwa River on a cold winter morning. A trio of hollow clapping sounds from the other side of the river, half a kilometre away tells you that an adult male gharial is advertising his presence. It is the height of the breeding season. The place seems trapped in a time in early history when man was still clad in animal skins. It is only as the sun rises higher and burns the mist off the water that the world comes into focus with appalling clarity. The five-km stretch of the Girwa River in Katerniaghata Wildlife Sanctuary is one of the only three wild breeding sites left in the world for the most unique of all the



CRITICALLY ENDANGERED: Captive gharial at the Madras C

hatched by FAO consultant Bob Bus-

ability to support larger numbers of the animal.

During the dry summer months, the

Bird deaths blamed on dirty Yamuna

Delhi Govt Report Points To Toxic Elements in Stagnant Water

By Nidhi Sharma/THN

New Delhi: It is official now. The recent bird deaths reported in Okhla sanctuary have been caused by polluted Yamuna water and contaminated fish and not because of bird flu. The wildlife departments of UP and Delhi have sent reports to respective governments saying that the bird deaths cannot be ruled out till the polluted water in that area is cleaned.

Fifty-three migratory birds



Can you find out the reasons for the above mentioned problems?

eastern states and parts of Gujarat have a very high percentage of their forests as unclassed forests managed by local communities.

Community and Conservation

Conservation strategies are not new in our country. We often ignore that in India, forests are also home to some of the traditional communities. In some areas of India, local communities are struggling to conserve these habitats along with government officials, recognising that only this will secure their own long-term livelihood. In Sariska Tiger Reserve, Rajasthan, villagers have fought against mining by citing the Wildlife Protection Act. In many areas, villagers themselves are protecting habitats and explicitly rejecting government involvement. The inhabitants of five villages in the Alwar district of Rajasthan have declared 1,200 hectares of forest as the Bhairodev Dakav 'Sonchuri', declaring their

own set of rules and regulations which do not allow hunting, and are protecting the wildlife against any outside encroachments.

The famous **Chipko** movement in the Himalayas has not only successfully resisted deforestation in several areas but has also shown that community afforestation with indigenous species can be enormously successful. Attempts to revive the traditional conservation methods or developing new methods of ecological farming are now widespread. Farmers and citizen's groups like the **Beej Bachao Andolan** in Tehri and **Navdanya** have shown that adequate levels of diversified crop production without the use of synthetic chemicals are possible and economically viable.

In India joint forest management (JFM) programme furnishes a good example for involving local communities in the management and restoration of degraded



Sacred groves - a wealth of diverse and rare species

Nature worship is an age old tribal belief based on the premise that all creations of nature have to be protected. Such beliefs have preserved several virgin forests in pristine form called Sacred Groves (the forests of God and Goddesses). These patches of forest or parts of large forests have been left untouched by the local people and any interference with them is banned.

Certain societies revere a particular tree which they have preserved from time immemorial. The Mundas and the Santhal of Chota Nagpur region worship mahua (**Bassia latifolia**) and kadamba (**Anthocaphalus cadamba**) trees, and the tribals of Odisha and Bihar worship the tamarind (**Tamarindus indica**) and mango (**Mangifera indica**) trees during weddings. To many of us, peepal and banyan trees are considered sacred.

Indian society comprises several cultures, each with its own set of traditional methods of conserving nature and its creations. Sacred qualities are often ascribed to springs, mountain peaks, plants and animals which are closely protected. You will find troops of macaques and langurs around many temples. They are fed daily and treated as a part of temple devotees. In and around Bishnoi villages in Rajasthan, herds of blackbuck, (chinkara), nilgai and peacocks can be seen as an integral part of the community and nobody harms them.

forests. The programme has been in formal existence since 1988 when the state of Odisha passed the first resolution for joint forest management. JFM depends on the formation of local (village) institutions that undertake protection activities mostly on degraded forest land managed by the forest department. In return, the members of these communities are entitled to intermediary benefits like non-timber forest produces and share in the timber harvested by 'successful protection'.

The clear lesson from the dynamics of both environmental destruction and reconstruction in India is that local communities everywhere have to be involved in some kind of natural resource management. But there is still a long way to go before local communities are at the centre-stage in decision-making. Accept only those economic or developmental activities, that are people centric, environment-friendly and economically rewarding.

Activity

Write a short essay on any practices which you may have observed and practised in your everyday lives that conserve and protect the environment around you.

"The tree is a peculiar organism of unlimited kindness and benevolence and makes no demand for its sustenance, and extends generously the products of its life activity. It affords protection to all beings, offering shade even to the axemen who destroy it".

Gautama Buddha (487 B.C.)

1. Multiple choice questions

- (i) Which of the following conservation strategies do not directly involve community participation?
(a) Joint forest management (c) Chipko Movement
(b) Beej Bachao Andolan (d) Demarcation of Wildlife sanctuaries

2. Match the following.

| | |
|-------------------|---|
| Reserved forests | other forests and wastelands belonging to both government and private individuals and communities |
| Protected forests | forests are regarded as most valuable as far as the conservation of forest and wildlife resources |
| Unclassed forests | forest lands are protected from any further depletion |

3. Answer the following questions in about 30 words.

- (i) What is biodiversity? Why is biodiversity important for human lives?
(ii) How have human activities affected the depletion of flora and fauna? Explain.

4. Answer the following questions in about 120 words.

- (i) Describe how communities have conserved and protected forests and wildlife in India?
(ii) Write a note on good practices towards conserving forest and wildlife.





1068CH03

WATER RESOURCES

3



Hey Pinky, did you see those awesome T.V. reports on floods in Assam? My God! What havoc they have created it has destroyed and swept away everything in its path.

Yes, Chintu, I did. Isn't it strange that water can give life and take life as well. What would we do without water? We need water to drink, cook our food, wash our clothes and wash ourselves as well. My father was telling me that in his factory they need a lot of water for a number of things. Did you know that they even need water for cooling the machines?

In fact, the factory runs on the power supplied by the hydel power plant. Now, I can understand why through the ages we humans have chosen to live near water courses along the rivers and other water sources like springs, lakes, ponds and oases.



You already know that three-fourth of the earth's surface is covered with water, but only a small proportion of it accounts for freshwater that can be put to use. This freshwater is mainly obtained from surface run off and ground water that is continually being renewed and recharged through the hydrological cycle. All water moves within the hydrological cycle ensuring that water is a renewable resource.

You might wonder that if three-fourth of the world is covered with water and water is a renewable resource, then how is it that countries and regions around the globe suffer from water scarcity? Why is it predicted that by 2025, nearly two billion people will live in absolute water scarcity?

WATER SCARCITY AND THE NEED FOR WATER CONSERVATION AND MANAGEMENT

Given the abundance and renewability of water, it is difficult to imagine that we may suffer from water scarcity. The moment we speak of water shortages, we immediately associate it with regions having low rainfall or those that are drought prone. We instantaneously visualise the deserts of Rajasthan and women balancing many '*matkas*' (earthen pots) used for collecting and storing water and travelling long distances to get water. True, the availability of water resources varies over space and time, mainly due to the variations in seasonal and annual precipitation, but water scarcity in

most cases is caused by over-exploitation, excessive use and unequal access to water among different social groups.

Where is then water scarcity likely to occur? As you have read in the hydrological cycle, freshwater can be obtained directly from precipitation, surface run off and groundwater.

Is it possible that an area or region may have ample water resources but is still facing water scarcity? Many of our cities are such examples. Thus, water scarcity may be an outcome of large and growing population and

consequent greater demands for water, and unequal access to it. A large population requires more water not only for domestic use but also to produce more food. Hence, to facilitate higher food-grain production, water resources are being over-exploited to expand irrigated areas for dry-season agriculture. Irrigated agriculture is the largest consumer of water. Now it is needed to revolutionise the agriculture through developing drought resistant crops and dry farming techniques. You may have seen in many television advertisements that most farmers have their



Water, Water Everywhere, Not a Drop to Drink:
After a heavy downpour, a boy collects drinking water in Kolkata. Life in the city and its adjacent districts was paralysed as incessant overnight rain, meaning a record 180 mm, flooded vast area and disrupted traffic.



A Kashmiri earthquake survivor carries water in the snow in a devastated village.

एक और इंजराइल जैसे 25 सेमी. औसत वार्षिक वर्षा वाले देश में जल का कोई अभाव नहीं है तो दूसरी और 114 सेमी. औसत वार्षिक वर्षा वाले हमारे देश में प्रति वर्ष किसी भाग में सूखा अवश्य पड़ता है। देश में जल की उपलब्धता और उसके स्वरूप के अनुसार समुचित जलप्रबंधन न होने के कारण ही वर्षा का जल नदी-नालों में तेजी से बहकर समुद्र में चला जाता है जिससे वर्षा के बाद के लगभग नौ महीने देश के लिए पानी की कमी के होते हैं। ये ही मूल कारण हैं देश में जलीय अभाव के, जिसे हम उचित प्रबंधन के द्वारा ही नियंत्रित कर सकते हैं।

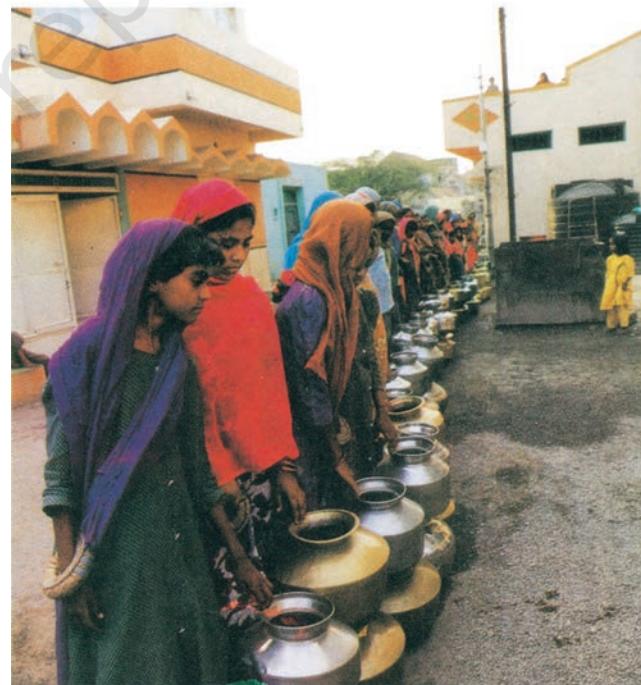


Fig. 3.1: Water Scarcity

own wells and tube-wells in their farms for irrigation to increase their produce. But have you ever wondered what this could result in? That it may lead to falling groundwater levels, adversely affecting water availability and food security of the people.

Post-independent India witnessed intensive industrialisation and urbanisation, creating vast opportunities for us. Today, large industrial houses are as commonplace as the industrial units of many MNCs (Multinational Corporations). The ever-increasing number of industries has made matters worse by exerting pressure on existing freshwater resources. Industries, apart from being heavy users of water, also require power to run them. Much of this energy comes from hydroelectric power. Today, in India hydroelectric power contributes approximately 22 per cent of the total electricity produced. Moreover, multiplying urban centres with large and dense populations and urban lifestyles have not only added to water and energy requirements but have further aggravated the problem. If you look into the housing societies or colonies in the cities, you would find that most of these have their own groundwater pumping devices to meet their water needs. Not surprisingly, we find that fragile water resources are being over-exploited and have caused their depletion in several of these cities.

So far we have focused on the quantitative aspects of water scarcity. Now, let us consider another situation where water is sufficiently available to meet the needs of the people, but, the area still suffers from water scarcity. This scarcity may be due to bad quality of water. Lately, there has been a growing concern that even if there is ample water to meet the needs of the people, much of it may be polluted by domestic and industrial wastes, chemicals, pesticides and fertilisers used in agriculture, thus, making it hazardous for human use. Government of India has accorded highest priority to improve the quality of life and enhance ease of living of people especially those living in rural areas by announcing the Jal Jeevan Mission (JJM). The Goal of JJM is to enable every rural household get assured supply of potable piped water at a service level of 55 litres per capita per day regularly on

long-term basis by ensuring functionality of the tap water connections. (Source: Economic Survey 2020–21, p.357)

India's rivers, especially the smaller ones, have all turned into toxic streams. And even the big ones like the Ganga and Yamuna are far from being pure. The assault on India's rivers – from population growth, agricultural modernisation, urbanisation and industrialisation – is enormous and growing by the day..... This entire life stands threatened.

Source: *The Citizens' Fifth Report, CSE, 1999.*

You may have already realised that the need of the hour is to conserve and manage our water resources, to safeguard ourselves from health hazards, to ensure food security, continuation of our livelihoods and productive activities and also to prevent degradation of our natural ecosystems. Over exploitation and mismanagement of water resources will impoverish this resource and cause ecological crisis that may have profound impact on our lives.

Activity

From your everyday experiences, write a short proposal on how you can conserve water.

MULTI-PURPOSE RIVER PROJECTS AND INTEGRATED WATER RESOURCES MANAGEMENT

But, how do we conserve and manage water? Archaeological and historical records show that from ancient times we have been constructing sophisticated hydraulic structures like dams built of stone rubble, reservoirs or lakes, embankments and canals for irrigation. Not surprisingly, we have continued this tradition in modern India by building dams in most of our river basins.

Hydraulic Structures in Ancient India

- In the first century B.C., Sringaverapura near Allahabad had sophisticated water harvesting system channelling the flood water of the river Ganga.
- During the time of Chandragupta Maurya, dams, lakes and irrigation systems were extensively built.

- Evidences of sophisticated irrigation works have also been found in Kalinga, (Odisha), Nagarjunakonda (Andhra Pradesh), Bennur (Karnataka), Kolhapur (Maharashtra), etc.
- In the 11th Century, Bhopal Lake, one of the largest artificial lakes of its time was built.
- In the 14th Century, the tank in Hauz Khas, Delhi was constructed by Iltutmish for supplying water to Siri Fort area.

Source: Dying Wisdom, CSE, 1997.

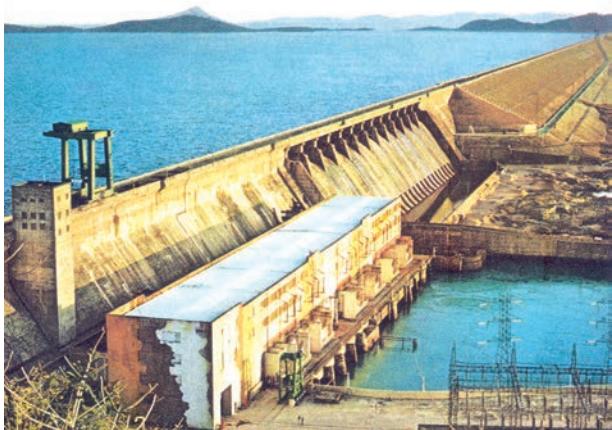


Fig. 3.2: Hirakud Dam

What are dams and how do they help us in conserving and managing water? Dams were traditionally built to impound rivers and rainwater that could be used later to irrigate agricultural fields. Today, dams are built not just for irrigation but for electricity generation, water supply for domestic and industrial uses, flood control, recreation, inland navigation and fish breeding. Hence, dams are now referred to as multi-purpose projects where the many uses of the impounded water are integrated with one another. For example, in the Sutluj-Beas river basin, the Bhakra – Nangal project water is being used both for hydel power production and irrigation. Similarly, the Hirakud project in the Mahanadi basin integrates conservation of water with flood control.

Multi-purpose projects, launched after Independence with their integrated water resources management approach, were thought of as the vehicle that would lead the nation to development and progress, overcoming the

A **dam** is a barrier across flowing water that obstructs, directs or retards the flow, often creating a reservoir, lake or impoundment. "Dam" refers to the reservoir rather than the structure. Most dams have a section called a spillway or weir over which or through which it is intended that water will flow either intermittently or continuously. Dams are classified according to structure, intended purpose or height. Based on structure and the materials used, dams are classified as timber dams, embankment dams or masonry dams, with several subtypes. According to the height, dams can be categorised as large dams and major dams or alternatively as low dams, medium height dams and high dams.

handicap of its colonial past. Jawaharlal Nehru proudly proclaimed the dams as the 'temples of modern India'; the reason being that it would integrate development of agriculture and the village economy with rapid industrialisation and growth of the urban economy.

Activity

Find out more about any one traditional method of building dams and irrigation works.

We have sown the crops in Asar

We will bring Bhadu in Bhadra

Floods have swollen the Damodar

The sailing boats cannot sail

Oh! Damodar, we fall at your feet

Reduce the floods a little

Bhadu will come a year later

Let the boats sail on your surface

(This popular Bhadu song in the Damodar valley region narrates the troubles faced by people owing to the flooding of Damodar river known as the river of sorrow.)

In recent years, multi-purpose projects and large dams have come under great scrutiny and opposition for a variety of reasons. Regulating and damming of rivers affect their natural flow causing poor sediment flow and excessive sedimentation at the bottom of the reservoir, resulting in rockier stream

beds and poorer habitats for the rivers' aquatic life. Dams also fragment rivers making it difficult for aquatic fauna to migrate, especially for spawning. The reservoirs that are created on the floodplains also submerge the existing vegetation and soil leading to its decomposition over a period of time.

Multi-purpose projects and large dams have also been the cause of many new environmental movements like the 'Narmada Bachao Andolan' and the 'Tehri Dam Andolan' etc. Resistance to these projects has primarily been due to the large-scale displacement of local communities. Local people often had to give up their land, livelihood and their meagre access and control over resources for the greater good of the nation. So, if the local people are not benefiting from such projects then who is benefited? Perhaps, the landowners and large farmers, industrialists and few urban centres. Take the case of the landless in a village – does he really gain from such a project?

Narmada Bachao Andolan or Save Narmada Movement is a Non Governmental Organisation (NGO) that mobilised tribal people, farmers, environmentalists and human rights activists against the Sardar Sarovar Dam being built across the Narmada river in Gujarat. It originally focused on the environmental issues related to trees that would be submerged under the dam water. Recently it has re-focused the aim to enable poor citizens, especially the oustees (displaced people) to get full rehabilitation facilities from the government.

People felt that their suffering would not be in vain... accepted the trauma of displacement believing in the promise of irrigated fields and plentiful harvests. So, often the survivors of Rihand told us that they accepted their sufferings as sacrifice for the sake of their nation. But now, after thirty bitter years of being adrift, their livelihood having even being more precarious, they keep asking: "Are we the only ones chosen to make sacrifices for the nation?"

Source: S. Sharma, quoted in *In the Belly of the River. Tribal conflicts over development in Narmada valley*, A. Baviskar, 1995.

Do you know?

Sardar Sarovar Dam has been built over the Narmada River in Gujarat. This is one of the largest water resource projects of India covering four states—Maharashtra, Madhya Pradesh, Gujarat and Rajasthan. The Sardar Sarovar project would meet the requirement of water in drought-prone and desert areas of Gujarat (9,490 villages and 173 towns) and Rajasthan (124 villages).

Source: <http://www.sardarsarovardam.org/project.aspx>

Irrigation has also changed the cropping pattern of many regions with farmers shifting to water intensive and commercial crops. This has great ecological consequences like salinisation of the soil. At the same time, it has transformed the social landscape i.e. increasing the social gap between the richer landowners and the landless poor. As we can see, the dams did create conflicts between people wanting different uses and benefits from the same water resources. In Gujarat, the Sabarmati-basin farmers were agitated and almost caused a riot over the higher priority given to water supply in urban areas, particularly during droughts. Inter-state water disputes are also becoming common with regard to sharing the costs and benefits of the multi-purpose project.

Do you know?

Do you know that the Krishna-Godavari dispute is due to the objections raised by Karnataka and Andhra Pradesh governments? It is regarding the diversion of more water at Koyna by the Maharashtra government for a multipurpose project. This would reduce downstream flow in their states with adverse consequences for agriculture and industry.

Activity

Make a list of inter-state water disputes.



India: Major Rivers and Dams

Most of the objections to the projects arose due to their failure to achieve the purposes for which they were built. Ironically, the dams that were constructed to control floods have triggered floods due to sedimentation in the reservoir. Moreover, the big dams have mostly been unsuccessful in controlling floods at the time of excessive rainfall. You may have seen or read how the release of water from dams during heavy rains aggravated the flood situation in Maharashtra and Gujarat in 2006. The floods have not only devastated life and property but also caused extensive soil erosion. Sedimentation also meant that the flood plains were deprived of silt, a natural fertiliser, further adding on to the problem of land degradation. It was also observed that the multi-purpose projects induced earthquakes, caused water-borne diseases and pests and pollution resulting from excessive use of water.

FLOODS

Basic Safety Precautions To Be Taken :

- Listen to radio/TV for the latest weather bulletins and flood warnings. Pass on the information to others.
- Make a family emergency kit which should include; a portable radio/transistor, torch, spare batteries, a first aid box along with essential medicines, ORS, dry food items, drinking water, matchboxes, candles and other essential items.
- Keep hurricane lamp, ropes, rubber tubes, umbrella and bamboo stick in your house. These could be useful.
- Keep your cash, jewellery, valuables, important documents etc. in a safe place.
- If there is a flood, move along with your family members and cattle to safe areas like relief camps, evacuation centres, elevated grounds where you can take shelter.
- Turn off power and gas connections before leaving your house.

During floods

- Don't enter into flood waters; it could be dangerous.
- Don't allow children to play in or near flood waters.
- Stay away from sewerage line, gutters, drains, culverts etc.
- Be careful of snakes; snakebites are common during floods.
- Stay away from electric poles and fallen power-lines to avoid electrocution.
- Don't use wet electrical appliances - get them checked before use.
- Eat freshly cooked and dry food. Always keep your food covered.
- Use boiled and filtered drinking water.
- Keep all drains, gutters near your house clean.
- Stagnation of water can breed vector/water-borne diseases . In case of sickness, seek medical assistance.
- Use bleaching powder and lime to disinfect the surroundings.

Collect information about flood prone areas of the country

RAINWATER HARVESTING

Many thought that given the disadvantages and rising resistance against the multi-purpose projects, water harvesting system was a viable alternative, both socio-economically and environmentally. In ancient India, along with the sophisticated hydraulic structures, there existed an extraordinary tradition of water-harvesting system. People had in-depth knowledge of rainfall regimes and soil types and developed wide ranging techniques to harvest rainwater, groundwater, river water and flood water in keeping with the local ecological conditions and their water needs. In hill and mountainous regions, people built diversion channels like the 'guls' or 'kuls' of the Western Himalayas for agriculture. 'Rooftop rainwater harvesting' was commonly practised to store drinking water, particularly in Rajasthan. In the flood plains of Bengal, people developed inundation channels to



THE RIDE OF HIS LIFE

Heavy rain drowns Kolkata

Durga Puja Preparations Go Awry As Met Predicts Downpour For Next 2 Days

LATE ARRIVAL: A bus is stuck in a waterlogged street in Kolkata on Friday

Kolkata: With two days of incessant rain — and more forecast for the next 24 hours — Kolkata came to a standstill on Friday. The city has so far recorded 218.44 mm rainfall.

The downpour, which started on Wednesday night, has caused destruction in the southern fringes of the city and three of a family were killed in a wall collapse in Barrackpore. In North 24 Parganas, 11 people died and nearly 30,000 houses were damaged. In the northern districts of the state, the flooding of Mahananda River led to the closing of Mahadev Temple on Friday morning.

Buses were snared at Ultadanga, Alipore Body Guard Lines, Anchal Park, Sealdah, Bowbazar and Chittaranjan Park and large parts of south and south-west Kolkata. The posh Salt Lake area was inundated. A bus heading to the TII bus of Sector V had a tough time trudging through water-logged roads. Although the bus had to cover all sections of Kamarhati in north Kolkata as rains seeped through the partition panels and to wash clay off the floor, it reached its destination.

"Even arteries like MG Road, White semi have been badly damaged, colour has been washed off many buildings," said a driver.

Though efforts were on to use lorries to transport to dry clay tiles, the drivers were unable to move them over roads. "If the rain does not subside soon, delivery schedules will go haywire," said a driver.

The late monsoon has caused a series of depression come as a respite for the city residents who were facing a heat wave gripping. City roads were empty with few taxis and buses plying on the road.



irrigate their fields. In arid and semi-arid regions, agricultural fields were converted into rain fed storage structures that allowed the water to stand and moisten the soil like the 'khadins' in Jaisalmer and 'Johads' in other parts of Rajasthan.



(a) Recharge through Hand Pump



(b) Recharge through Abandoned Dugwell

- Rooftop rainwater is collected using a PVC pipe
- Filtered using sand and bricks
- Underground pipe takes water to sump for immediate usage
- Excess water from the sump is taken to the well
- Water from the well recharges the underground
- Take water from the well (later)

Fig 3.3: Rooftop Rainwater Harvesting



Are you a water harvester?

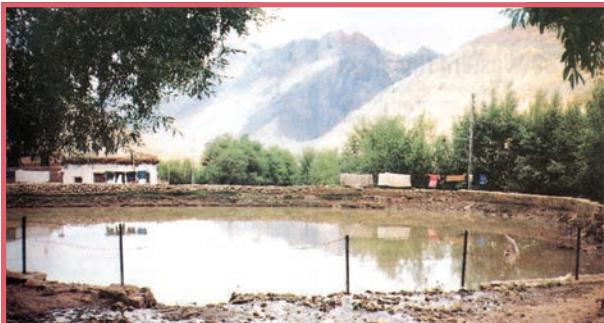
This monsoon, join us in counting the raindrops



Fig. 3.4

In the semi-arid and arid regions of Rajasthan, particularly in Bikaner, Phalodi and Barmer, almost all the houses traditionally had underground tanks or *tankas* for storing drinking water. The tanks could be as large as a big room; one household in Phalodi had a tank that was 6.1 metres deep, 4.27 metres long and 2.44 metres wide. The tankas were part of the well-developed rooftop rainwater harvesting system and were built inside the main house or the courtyard. They were connected to the sloping roofs of the houses through a pipe. Rain falling on the rooftops would travel down the pipe and was stored in these underground 'tankas'. The first spell of rain was usually not collected as this would clean the roofs and the pipes. The rainwater from the subsequent showers was then collected.

The rainwater can be stored in the **tankas** till the next rainfall making it an extremely reliable source of drinking water when all other sources are dried up,



A kul leads to a circular village tank, as the above in the Kaza village, from which water is released as and when required.

Fig 3.5: Traditional method of rainwater harvesting

particularly in the summers. Rainwater, or **palar pani**, as commonly referred to in these parts, is considered the purest form of natural water. Many houses constructed underground rooms adjoining the 'tanka' to beat the summer heat as it would keep the room cool.

Interesting Fact

Rooftop rainwater harvesting is the most common practice in Shillong, Meghalaya. It is interesting because Cherapunjee and Mawsynram situated at a distance of 55 km. from Shillong receive the highest rainfall in the world, yet the state capital Shillong faces acute shortage of water. Nearly every household in the city has a rooftop rainwater harvesting structure. Nearly 15-25 per cent of the total water requirement of the household comes from rooftop water harvesting.

Activity

Find out other rainwater harvesting systems existing in and around your locality.

Today, in western Rajasthan, sadly the practice of rooftop rainwater harvesting is on the decline as plenty of water is available due to the perennial Indira Gandhi Canal, though some houses still maintain the tankas since they do not like the taste of tap water.

Fortunately, in many parts of rural and urban India, rooftop rainwater harvesting is being successfully adapted to store and conserve water. In Gendathur, a remote backward village in Mysuru, Karnataka, villagers have installed, in their household's rooftop, rainwater harvesting system to meet their water needs. Nearly 200 households have installed this system and the village has earned the rare distinction of being rich in rainwater. See Fig. 3.6 for a better understanding of the rooftop rainwater harvesting system which is adapted here. Gendathur receives an annual precipitation of 1,000 mm, and with 80 per cent of collection efficiency and of about 10 fillings, every house can collect and use about 50,000 litres of water annually. From the 200 houses, the net amount of rainwater harvested annually amounts to 1,00,000 litres.



Rooftop harvesting was common across the towns and villages of the Thar. Rainwater that falls on the sloping roofs of houses is taken through a pipe into an underground *tanka* (circular holes in the ground), built in the main house or in the courtyard. The picture above shows water being taken from a neighbour's roof through a long pipe. Here the neighbour's rooftop has been used for collection of rainwater. The picture shows a hole through which rainwater flows down into an underground *tanka*.

Fig. 3.6

Interesting Fact

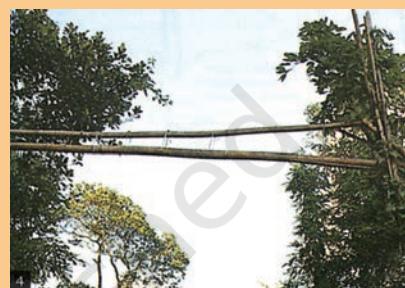
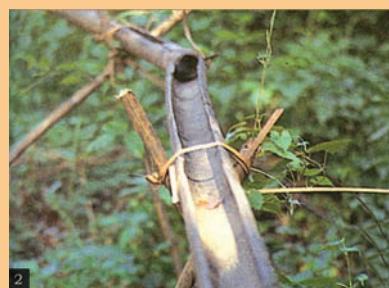
Tamil Nadu is the first state in India which has made rooftop rainwater harvesting structure compulsory to all the houses across the state. There are legal provisions to punish the defaulters.



BAMBOO DRIP IRRIGATION SYSTEM

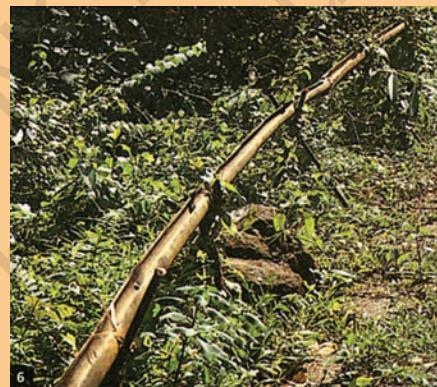
In Meghalaya, a 200-year-old system of tapping stream and spring water by using bamboo pipes, is prevalent. About 18-20 litres of water enters the bamboo pipe system, gets transported over hundreds of metres, and finally reduces to 20-80 drops per minute at the site of the plant.

Picture 1: Bamboo pipes are used to divert perennial springs on the hilltops to the lower reaches by gravity.



Picture 2 and 3: The channel sections, made of bamboo, divert water to the plant site where it is distributed into branches, again made and laid out with different forms of bamboo pipes. The flow of water into the pipes is controlled by manipulating the pipe positions.

Picture 4: If the pipes pass a road, they are taken high above the land.



Picture 5 and 6

Reduced channel sections and diversion units are used at the last stage of water application. The last channel section enables water to be dropped near the roots of the plant.

Fig 3.7

Activity –

1. Collect information on how industries are polluting our water resources.
2. Enact with your classmates a scene of water dispute in your locality.

