SOCIAL SCIENCE

CONTEMPORARY INDIA-I

TEXTBOOK IN GEOGRAPHY FOR CLASS IX

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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. Including 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 group in Social Sciences, 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

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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.

Director
National Council of Educational
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New Delhi
20 December 2005

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- of certain protections in respect of conviction for offences;
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M.H. Qureshi, *Professor,* CSRD, JNU, for Figure 2.7; ITDC/Ministry of Tourism, Government of India for Figures 2.6, 2.8, 2.9, 2.11, 3.5, 4.1 and pictures of river, migratory birds and a picture of montane forests on pages 23, 48 and 51 respectively, picture of desert on Cover I, picture of clouds on Cover IV; cross-section interactive for a picture of lions on page 48; Tourism of Andaman and Nicobar, Government of India for Figure 2.11; Ministry of Environment and Forests, Government of India for Figures 2.5, 3.6, picture of corals on page 15 and picture of forest on Cover I; Photo Division, Ministry of Information and Broadcasting, Government of India for Figure 2.10; *Business Line* for Figure 3.2; and *Hindustan Times*, New Delhi, for news in two collages given on pages 38 and 50.

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

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1. The responsibility for the correctness of internal details rests with the publisher.
2. The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line.
3. The administrative headquarters of Chandigarh, Haryana and Punjab are at Chandigarh.
4. 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.
5. The external boundaries and coastlines of India agree with the Record/Master Copy certified by Survey of India.
6. The state boundaries between Uttaranchal and Uttar Pradesh, Bihar and Jharkhand, and Chhattisgarh and Madhya Pradesh have not been verified by the Governments concerned.
7. The spellings of names in this map have been taken from various sources.

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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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Our National Anthem

Jana-gana-mana adhinayaka, jaya he
Bharata-bhagya-vidhata.
Punjab-Sindh-Gujarat-Maratha
Dravida-Utkala-Banga
Vindhya-Himachala-Yamuna-Ganga
Uchchhala-jaladhi-taranga.
Tava shubha name jage,
Tava shubha asisa mage,
Gahe tava jaya gatha.
Jana-gana-mangala-dayaka jaya he
Bharata-bhagya-vidhata.
Jaya he, jaya he, jaya he,
Jaya jaya jaya, jaya he!

Our National Anthem, composed originally in Bangla by Rabindranath Tagore, was adopted in its Hindi version by the Constituent Assembly as the national anthem of India on 24 January 1950.

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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

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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°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.

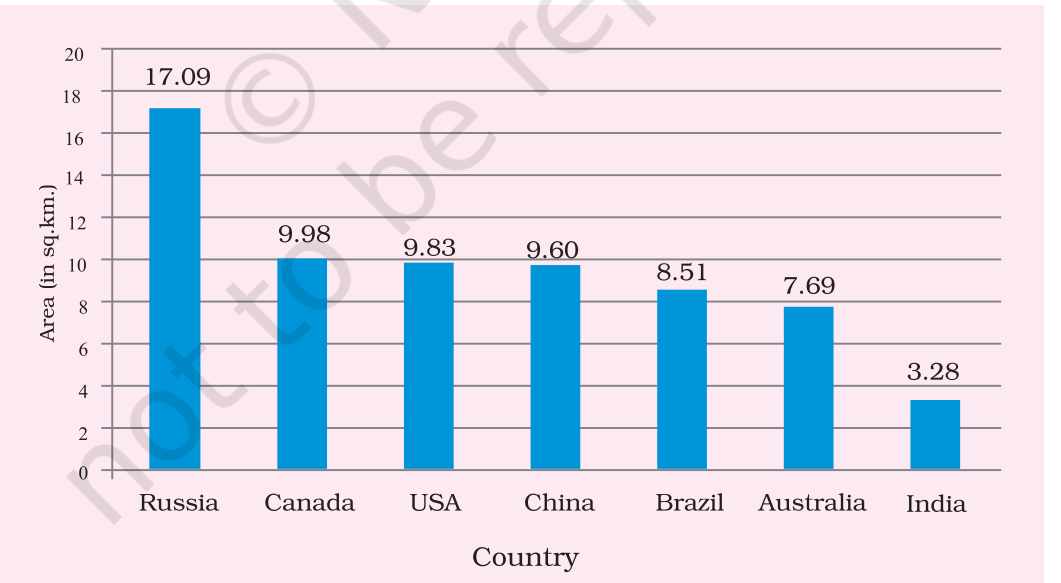
Find out

- Why 82°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 Kanniyakumari 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

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Figure 1.3 : India : Extent and Standard Meridian

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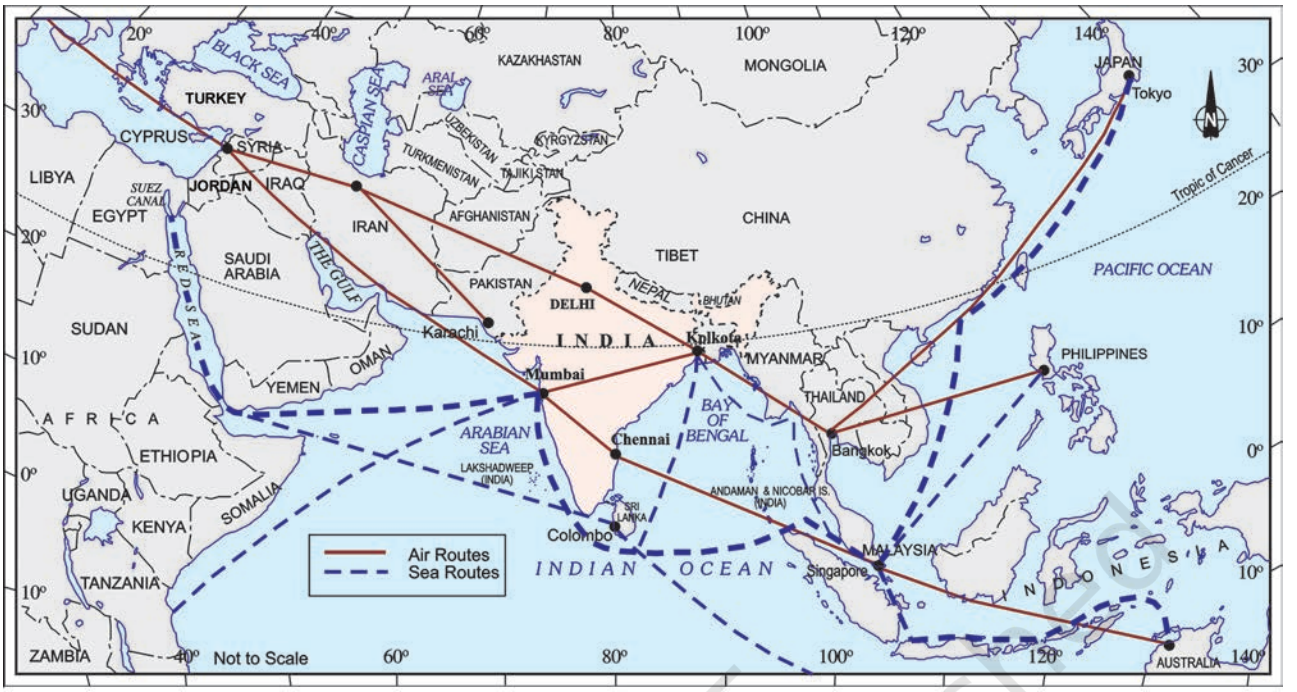

Figure 1.4 : India on International Highway of Trade and Commerce

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 29 states and seven 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 sovereignity in return for local autonomy.

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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 http://bhuvan-noeda.nrsc.gov.in/projects/schoolbhuvan/

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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° 25' E (c) 77° 6' E
(b) 68° 7' E (d) 82° 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

1. Identify the following with the help of map reading.
(i) The island groups of India lying in the Arabian Sea and the Bay of Bengal.
(ii) The countries constituting Indian subcontinent.
(iii) The States through which the Tropic of Cancer passes.
(iv) The northernmost latitude in degrees.
(v) The southernmost latitude of the Indian mainland in degrees.
(vi) The eastern and the western-most longitude in degrees.
(vii) The place situated on the three seas.
(viii) The strait separating Sri Lanka from India.
(ix) 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. You must be wondering how these physical features have been formed. We will learn more about major physical features of India and how they have been formed.

We find different types of rocks; some are very hard, like marble, which has been used for making the Taj Mahal, and some are very soft like soap stone, which is used in making talcum powder. The colour of soil varies from one place to the other because soil is formed out of different types of rocks. Have you ever thought about the causes of these variations? Most of these variations are caused due to differences in rock formations.

India is a large landmass formed during different geological periods which has influenced her relief. Besides geological formations, a number of processes, such as weathering, erosion and deposition, have created and modified the relief to its present form.

Earth scientists have attempted to explain the formation of physical features with the help of some theories based on certain evidences. One such Plausible theory is the 'Theory of Plate Tectonics'. According to this theory, the crust (upper part) of the earth has been formed out of seven major and some minor plates. (Figure 2.2)

The movement of the plates results in the building up of stresses within the plates and the continental rocks above, leading to **folding, faulting** and **volcanic activity**. Broadly, these plate movements are classified into three types (Figure 2.1). While some plates come towards each other and form convergent boundary. Some plates move away from each other and form divergent boundary. In the event of two plates coming together, they may either collide and crumble, or one may slide under the other. At times, they may also move horizontally past each other and

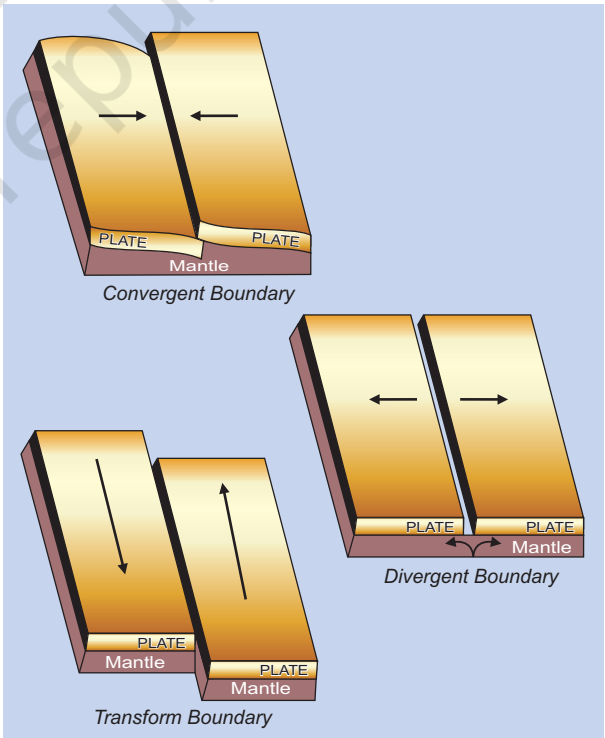

Figure 2.1 : Plate Boundaries

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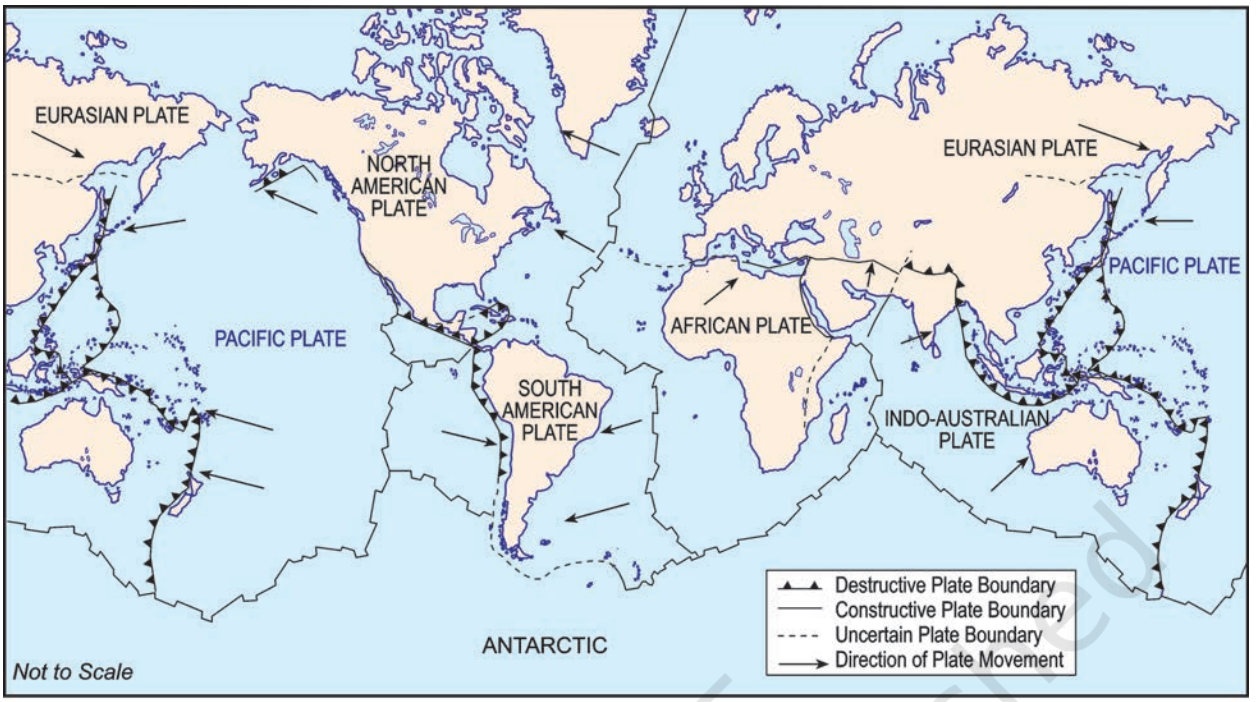

Figure 2.2 : World : Plate Margins

form transform boundary. The movement of these plates have changed the position and size of the continents over millions of years. Such movements have also influenced the evolution of the present landform features of India.

Do You Know?

Most volcanoes and earthquakes in the world are located at plate margins, but some do occur within the plates.

The oldest landmass, (the Peninsula part), was a part of the **Gondwana land**. The Gondwana land included India, Australia, South Africa, South America and Antarctica as one single land mass. The convectional currents split the crust into a number of pieces, thus leading to the drifting of the Indo-Australian plate after being separated from the Gondwana land, towards north. The northward drift resulted in the collision of the plate with the much larger Eurasian Plate. Due to this collision, the sedimentary rocks which were accumulated in the geosyncline known as the *Tethys* were folded to form the mountain system of western Asia and Himalaya.

Gondwana land: It is the southern part of the ancient super continent Pangea with Angara Land in the northern part.

The Himalayan uplift out of the Tethys sea and subsidence of the northern flank of the peninsular plateau resulted in the formation of a large basin. In due course of time this depression, gradually got filled with deposition of sediments by the rivers flowing from the mountains in the north and the peninsular plateau in the south. A flat land of extensive alluvial deposits led to the formation of the northern plains of India.

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.

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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 2.4):

(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.

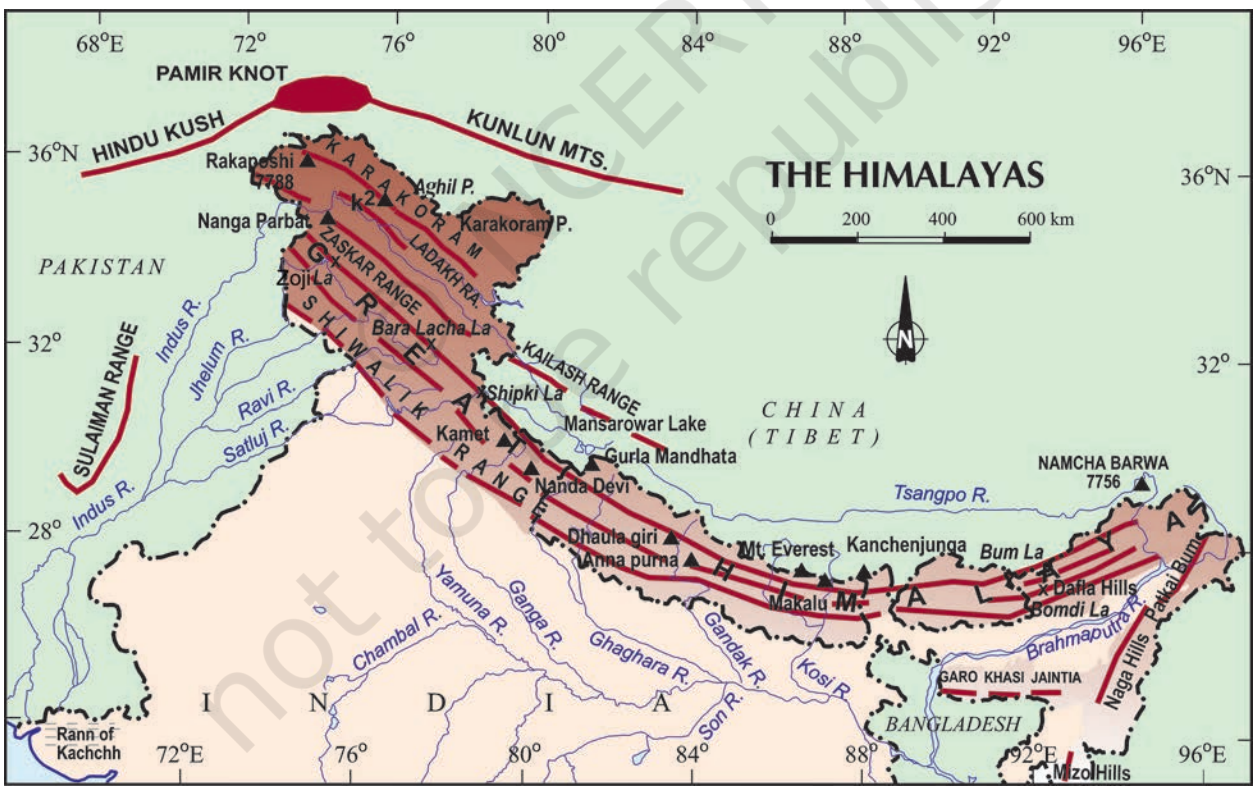

Figure 2.3 : Himalayas

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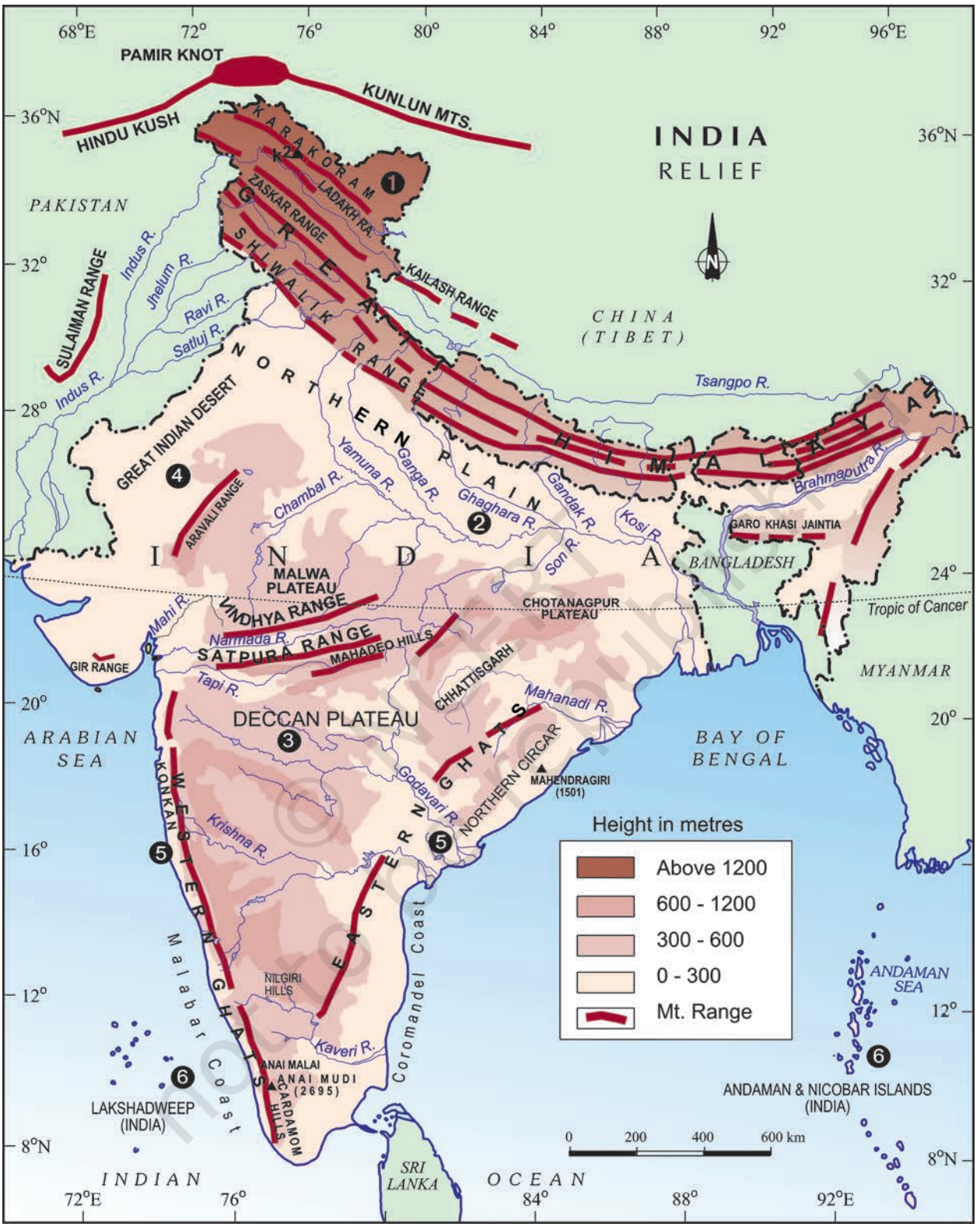

Figure 2.4 : Relief

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 *Dhaula 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 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.

Figure 2.5 : The Himalayas

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

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Figure 2.6 : Mizo Hills

Patkai hills, the *Naga hills, the Manipur hills* and the *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 2.7 : 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 the states of North India, Haryana, Delhi, U.P., Bihar, partly Jharkhand and West Bengal to its 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*.

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

Figure 2.8 : A Waterfall in Chotanagpur Plateau

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

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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 2.9 : 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 2.10 : 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 2.11 : 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

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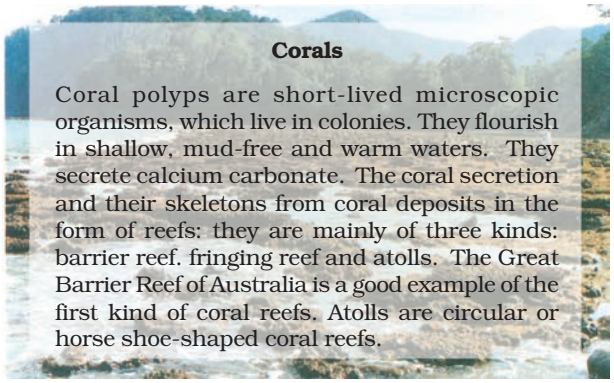
named as Lakshadweep. It covers small area of 32 sq km. Kavaratti island is the administrative headquarters of Lakshadweep. This island group has great diversity of flora and fauna. The Pitti island, which is uninhabited, has a bird sanctuary.



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 from 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.

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.

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.

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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 (c) Peninsula
   (b) Island (d) None of the above
   (ii) Mountain ranges in the eastern part of India forming its boundary with Myanmar are collectively called
   (a) Himachal (c) Purvachal
   (b) Uttarakhand (d) None of the above
   (iii) The western coastal strip, south of Goa is referred to as
   (a) Coromandel (c) Kannad
   (b) Konkan (d) Northern Circar
   (iv) The highest peak in the Eastern Ghats is
   (a) Anai Mudi (c) Mahendragiri
   (b) Kanchenjunga (d) Khasi
2. Answer the following questions briefly.
   (i) What are tectonic plates?
   (ii) Which continents of today were part of the Gondwana land?

(iii) What is the *bhabar*?
(iv) Name the three major divisions of the Himalayas from north to south.
(v) Which plateau lies between the Aravali and the Vindhyan ranges?
(vi) Name the island group of India having coral origin.

3. Distinguish between
   (i) Converging and diverging tectonic plates
   (ii) *Bhangar and Khadar*
   (iii) Western Ghats and Eastern Ghats
4. Describe how the Himalayas were formed.
5. Which are the major physiographic divisions of India? Contrast the relief of the Himalayan region with that of the Peninsular plateau.
6. Give an account of the Northern Plains of India.
7. 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
A	B	X	A	T	G	A	R	O	U	L	F	V	D	I	K	P	T	D	C
C	Y	C	H	I	G	A	M	M	R	D	T	I	Z	L	A	J	P	O	K
H	R	T	K	A	N	C	H	E	N	J	U	N	G	A	L	U	L	B	E
O	O	M	O	P	I	T	P	N	O	S	S	D	D	K	S	P	D	O	K
T	D	A	N	M	L	M	D	D	C	S	A	H	L	S	A	I	E	E	J
A	R	R	K	A	G	T	H	A	R	H	E	Y	D	H	H	A	I	A	R
N	S	A	A	L	I	A	T	L	E	I	Y	A	B	A	Y	T	H	R	L
A	Z	V	N	W	R	E	D	S	P	P	A	N	H	D	A	O	J	U	K
G	O	A	N	A	I	M	U	D	I	K	D	P	M	W	D	A	B	P	E
P	A	L	L	J	S	H	E	V	R	I	Y	E	V	E	R	E	S	T	M
U	O	I	M	Y	R	Y	P	A	T	L	I	G	J	E	I	T	H	A	R
R	K	I	Q	S	L	A	H	C	N	A	V	R	V	P	E	A	T	S	P

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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).

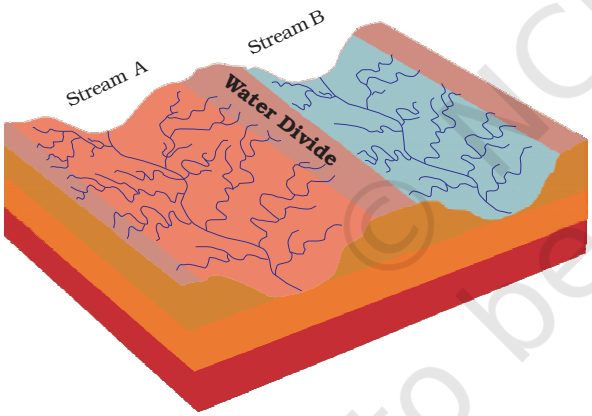

Figure 3.1 : Water Divide

Do You Know?

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

Find out

- Which river has the largest basin in India?

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. 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

Figure 3.2 : A Gorge

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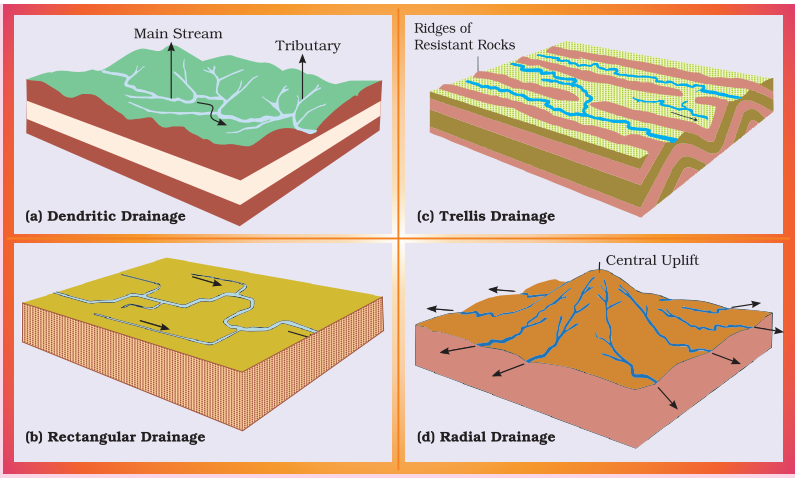
Drainage Patterns

The streams within a drainage basin form certain patterns, depending on the slope of land, underlying rock structure as well as the climatic conditions of the area. These are **dendritic**, **trellis**, **rectangular**, and **radial** patterns. The dendritic pattern develops where the river channel follows the slope of the terrain. The stream with its tributaries resembles the branches of a tree, thus the name dendritic. A river joined by its tributaries, at approximately right angles, develops a trellis pattern. A trellis drainage pattern develops where hard and soft rocks exist parallel to each other. A rectangular drainage pattern develops on a strongly jointed rocky terrain. The radial pattern develops when streams flow in different directions from a central peak or dome like structure.



A combination of several patterns may be found in the same drainage basin.

floodplains. They also have well-developed deltas (Figure 3.3).

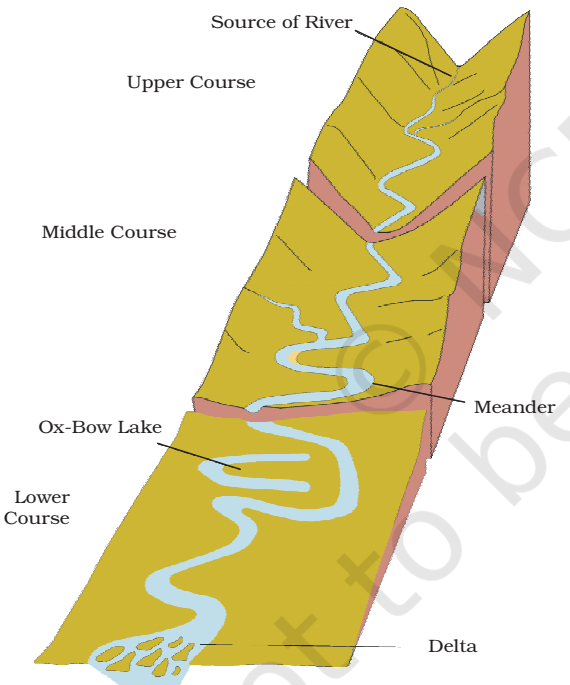


Figure 3.3 : Some Features Made by Rivers

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 Mansarowar. Flowing west, it enters India in the Ladakh district of Jammu and Kashmir. 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

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Figure 3.4 : Major Rivers and Lakes

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of the world. A little over a third of the Indus basin is located in India in the states of 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 3.5 : 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 Mansarowar 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

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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 esturies. 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

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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 Maharasthra, Karnataka and Andhra Pradesh.

The Kaveri Basin

The Kaveri rises in the Brahmagri 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 Jog 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

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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.

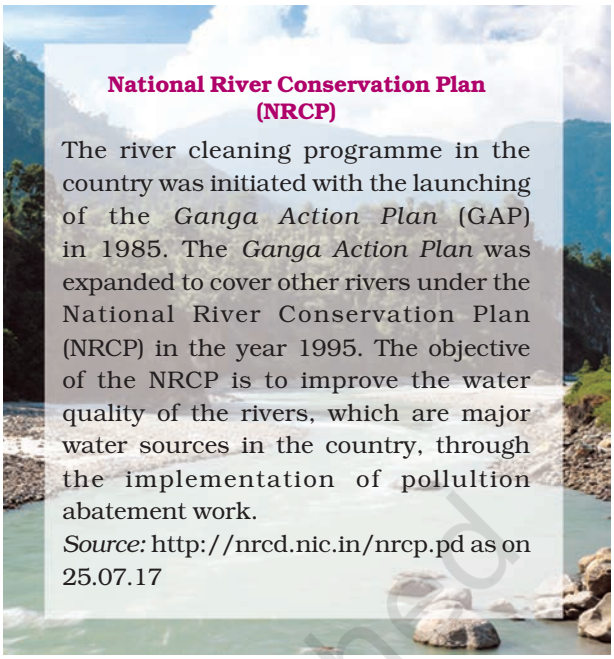
Role of Rivers in the Economy

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.



National River Conservation Plan (NRCP)

The river cleaning programme in the country was initiated with the launching of the *Ganga Action Plan* (GAP) in 1985. The *Ganga Action Plan* was expanded to cover other rivers under the National River Conservation Plan (NRCP) in the year 1995. The objective of the NRCP is to improve the water quality of the rivers, which are major water sources in the country, through the implementation of pollution abatement work.

Source: http://nrcd.nic.in/nrcp.pd as on 25.07.17

Exercise

1. Choose the right answer from the four alternatives given below.
   (i) Which one of the following describes the drainage patterns resembling the branches of a tree?
   (a) Radial
   (b) Dendritic
   (c) Centrifugal
   (d) Trellis

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(ii) In which of the following states is the Wular lake located?
   (a) Rajasthan (c) Punjab
   (b) Uttar Pradesh (d) Jammu and Kashmir

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

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

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

(vi) 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.
   (i) What is meant by a water divide? Give an example.
   (ii) Which is the largest river basin in India?
   (iii) Where do the rivers Indus and Ganga have their origin?
   (iv) Name the two headstreams of the Ganga. Where do they meet to form the Ganga?
   (v) Why does the Brahmaputra in its Tibetan part have less silt, despite a longer course?
   (vi) Which two Peninsular rivers flow through trough?
   (vii) 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.

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Project/Activity

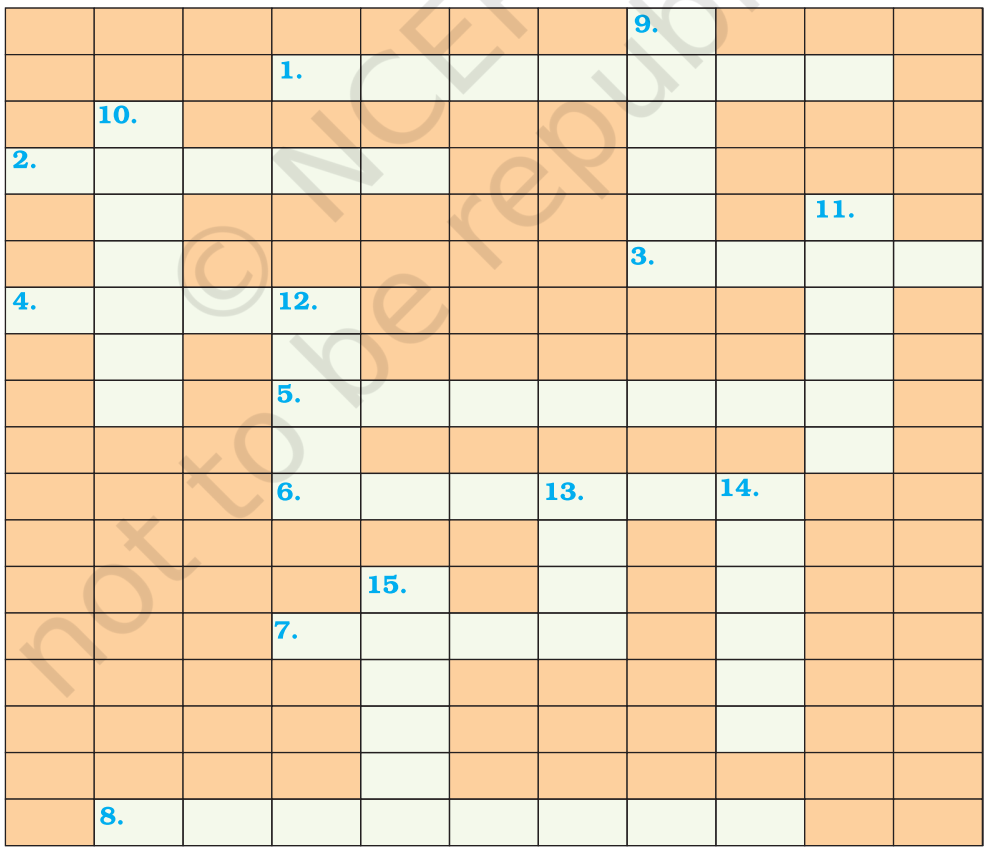
Solve this crossword puzzle with the help of given clues.

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.



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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

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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

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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 upper air circulation in this region is dominated by a westerly flow. An important component of this flow is the **jet stream**.

These jet streams are located approximately over 27°-30° north latitude, therefore, they are known as *subtropical westerly jet streams*. Over India, these jet streams blow south of the Himalayas, all through the year except in summer. The western cyclonic disturbances experienced in the north and north-western parts of the country are brought in by this westerly flow. In summer, the subtropical westerly jet stream moves north of the Himalayas with the apparent movement of the sun. An easterly jet stream, called the *sub-tropical easterly jet* stream blows over peninsular India, approximately over 14°N during the summer months.

Jet stream: These are a narrow belt of high altitude (above 12,000 m) westerly winds in the troposphere. Their speed varies from about 110 km/h in summer to about 184 km/h in winter. A number of separate jet streams have been identified. The most constant are the mid-latitude and the sub-tropical jet stream.

Western Cyclonic Disturbances

The western cyclonic disturbances are weather phenomena of the winter months brought in by the westerly flow from the Mediterranean region. They usually influence the weather of the north and north-western regions of India. Tropical cyclones occur during the monsoon, as well as, in October – November, and are part of the easterly flow. These disturbances affect the coastal regions of the country. Have you read or heard about the disasters caused by them on Odisha and Andhra Pradesh coast?

The Indian Monsoon

The climate of India is strongly influenced by monsoon winds. The sailors who came to India in historic times were one of the first to have noticed the phenomenon of the monsoon. They benefited from the reversal of the wind system as they came by sailing ships at the mercy of winds. The Arabs, who had also come to India as traders named this seasonal reversal of the wind system 'monsoon'.

Figure 4.1 : Arrival of Monsoon

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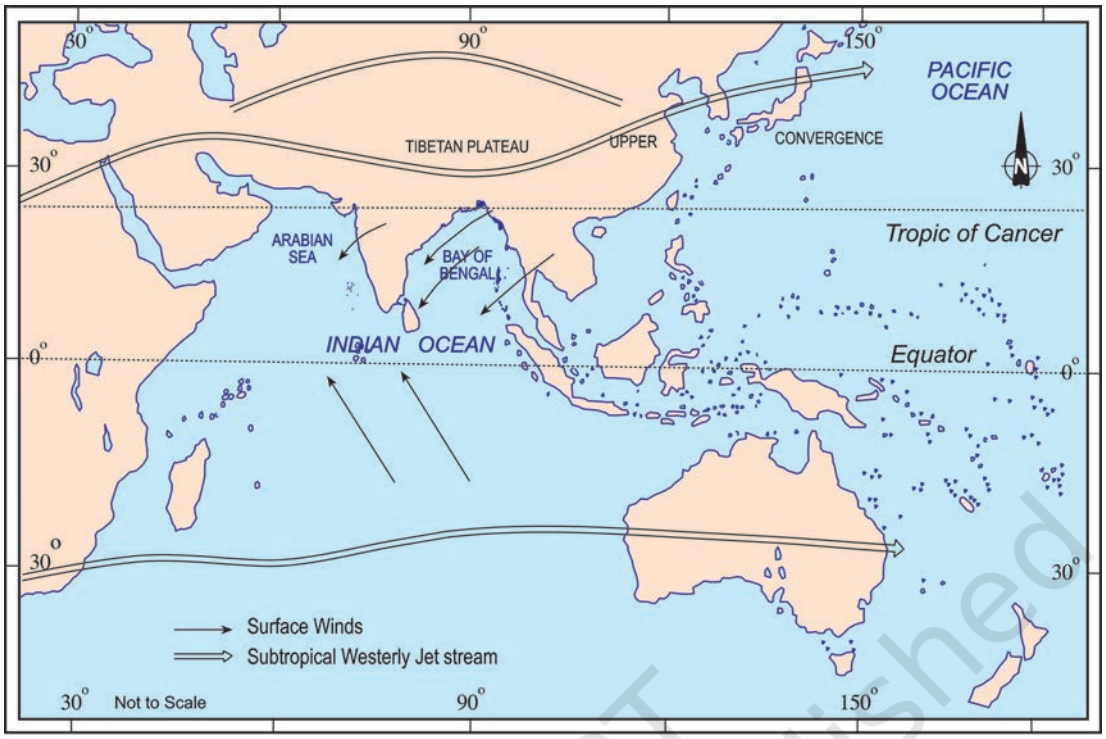

Figure 4.2 : Atmospheric Conditions over the Indian Subcontinent in the Month of January

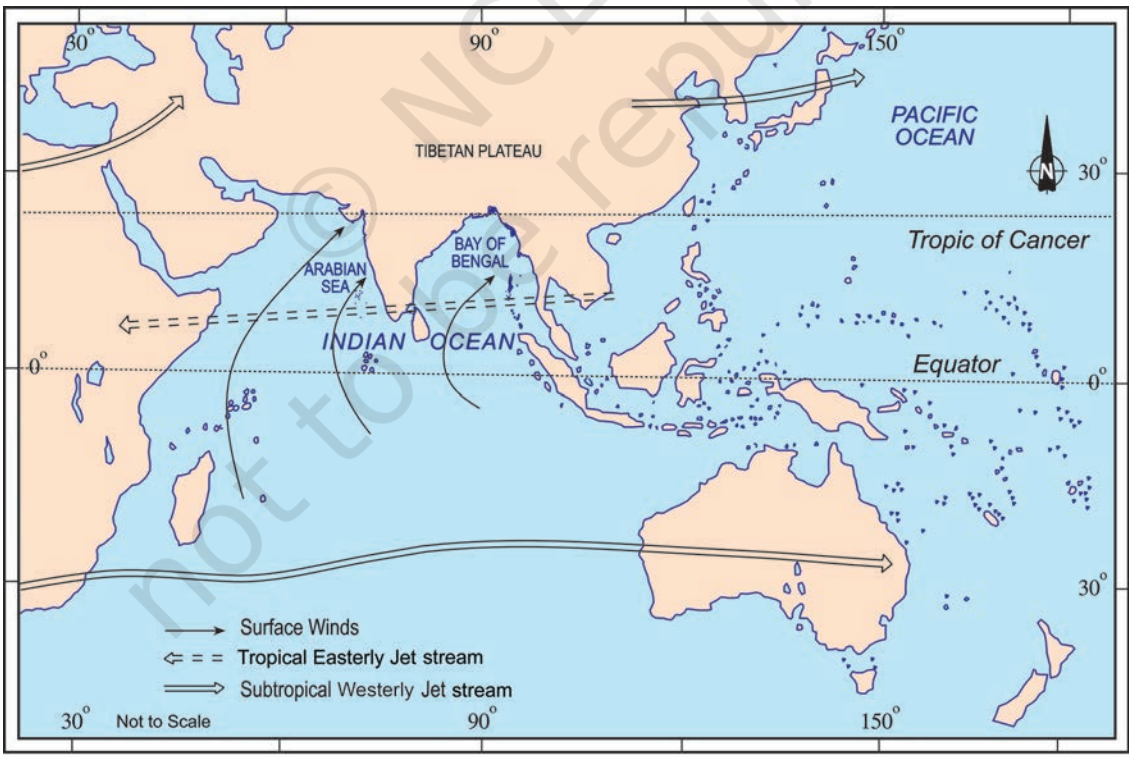

Figure 4.3 : Atmospheric Conditions over the Indian Subcontinent in the Month of June

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The monsoons are experienced in the tropical area roughly between 20° N and 20° S. To understand the mechanism of the monsoons, the following facts are important.

(a) **The differential heating and cooling of land and water** creates low pressure on the landmass of India while the seas around experience comparatively high pressure.
(b) **The shift of the position of Inter Tropical Convergence Zone (ITCZ)** in summer, over the Ganga plain (this is the equatorial trough normally positioned about 5°N of the equator. It is also known as the monsoon-trough during the monsoon season).
(c) The presence of the **high-pressure area, east of Madagascar**, approximately at 20°S over the Indian Ocean. The intensity and position of this high-pressure area affects the Indian Monsoon.
(d) The **Tibetan plateau gets intensely heated** during summer, which results in strong vertical air currents and the formation of low pressure over the plateau at about 9 km above sea level.
(e) The **movement of the westerly jet stream to the north of the Himalayas** and the presence of the **tropical easterly jet stream over the Indian peninsula** during summer.

Inter Tropical Convergence Zone

The Inter Tropical Convergence Zone (ITCZ,) is a broad trough of low pressure in equatorial latitudes. This is where the northeast and the southeast trade winds converge. This convergence zone lies more or less parallel to the equator but moves north or south with the apparent movement of the sun.

Apart from this, it has also been noticed that changes in the pressure conditions over the southern oceans also affect the monsoons. Normally when the tropical eastern south Pacific Ocean experiences high pressure, the tropical eastern Indian Ocean experiences low pressure. But in certain years, there is a reversal in the pressure conditions and the eastern Pacific has lower pressure in comparison to the eastern Indian Ocean. This periodic change in pressure conditions is known as the **Southern Oscillation** or **SO**. The difference in pressure over Tahiti (Pacific Ocean, 18°S/149°W) and Darwin in northern Australia (Indian Ocean, 12°30'S/131°E) is computed to predict the intensity of the monsoons. If the pressure differences were negative, it would mean below average and late monsoons. A feature connected with the SO is the **El Nino** phenomenon in which a warm ocean current that flows past the Peruvian Coast, in place of the cold Peruvian current, every 2 to 5 years. The changes in pressure conditions are connected to the El Nino. Hence, the phenomenon is referred to as **ENSO** (El Nino Southern Oscillations).

El Nino: This is a name given to the periodic development of a warm ocean current along the coast of Peru as a temporary replacement of the cold Peruvian current. 'El Nino' is a Spanish word meaning 'the child', and refers to the baby Christ, as this current starts flowing during Christmas. The presence of the El Nino leads to an increase in sea-surface temperatures and weakening of the trade winds in the region.

The Onset of the Monsoon and Withdrawal

The Monsoon, unlike the trades, are not steady winds but are *pulsating* in nature, affected by different atmospheric conditions encountered by it, on its way over the warm tropical seas. The duration of the monsoon is between 100-120 days from early June to mid-September. Around the time of its arrival, the normal rainfall increases suddenly and continues constantly for several days. This is known as the **'burst'** of the monsoon, and can be distinguished from the pre-monsoon showers. The monsoon arrives at the southern tip of the Indian peninsula generally by the first week of June. Subsequently, it proceeds into two – the Arabian Sea branch and the Bay of Bengal branch. The Arabian Sea branch reaches Mumbai about ten days later on approximately the 10th of June. This is a fairly rapid advance. The Bay of Bengal branch also advances rapidly and arrives in Assam in the first week of June. The lofty mountains causes the monsoon winds to deflect towards the west

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over the Ganga plains. By mid-June the Arabian Sea branch of the monsoon arrives over Saurashtra-Kuchchh and the central part of the country. The Arabian Sea and the Bay of Bengal branches of the monsoon merge over the northwestern part of the Ganga plains. Delhi generally receives the monsoon showers from the Bay of Bengal branch by the end of June (tentative date is 29th of June). By the first week of July, western Uttar Pradesh, Punjab, Haryana and eastern Rajasthan experience the monsoon. By mid-July, the monsoon reaches Himachal Pradesh and the rest of the country (Figure 4.3).

Withdrawal or the retreat of the monsoon is a more gradual process (Figure 4.4). The withdrawal of the monsoon begins in northwestern states of India by early September. By mid-October, it withdraws completely from the northern half of the peninsula. The withdrawal from the southern half of the peninsula is fairly rapid. By early December, the monsoon has withdrawn from the rest of the country.

The islands receive the very first monsoon showers, progressively from south to north, from the last week of April to the first week of May. The withdrawal, takes place progressively from north to south from the first week of December to the first week of January. By this time the rest of the country is already under the influence of the winter monsoon.

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.

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

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Figure 4.4 : Advancing Monsoon

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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 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

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Figure 4.5 : Retreating Monsoon

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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 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.

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

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 4.6 and 4.7).

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 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

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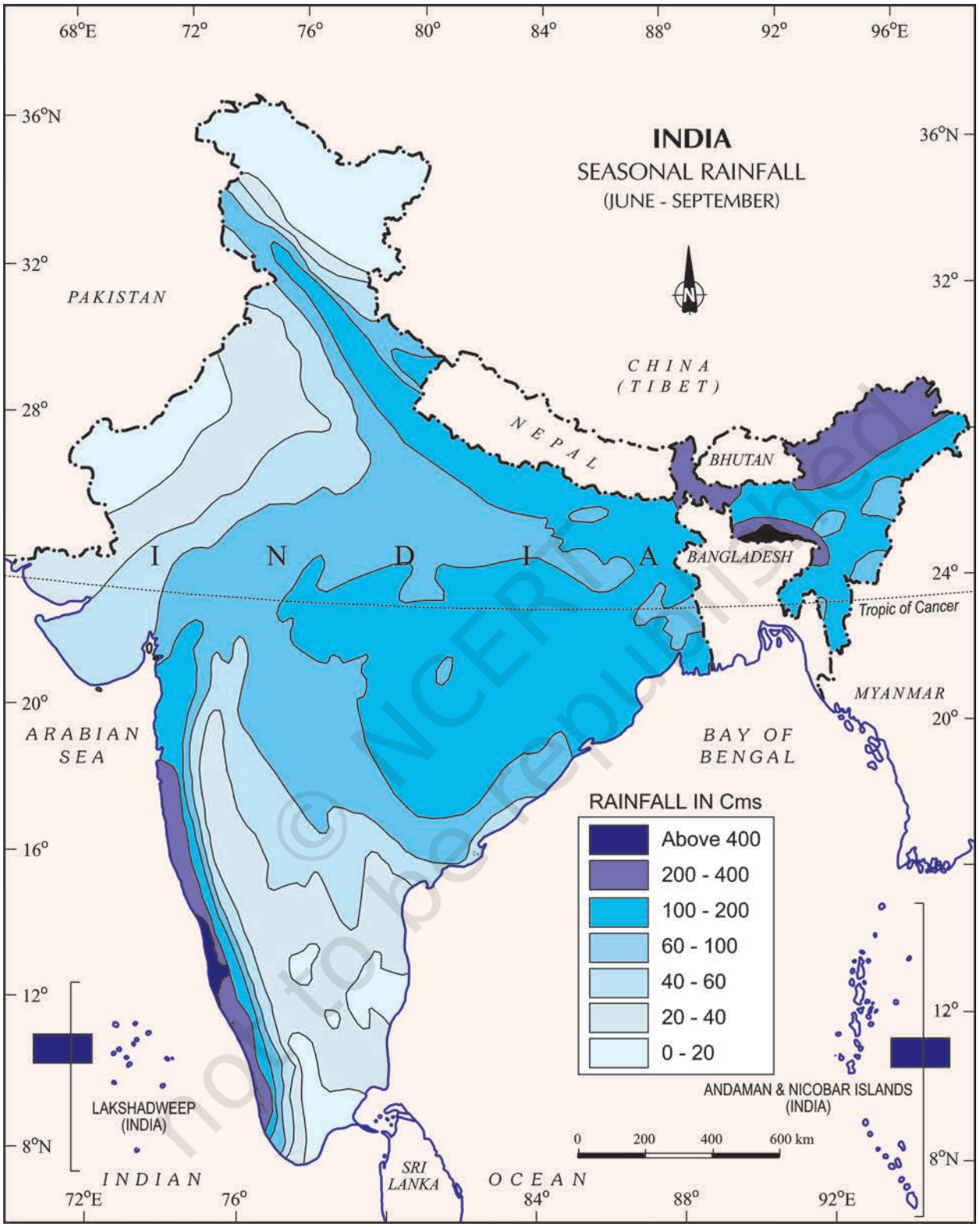

Figure 4.6 : Seasonal Rainfall (June-September)

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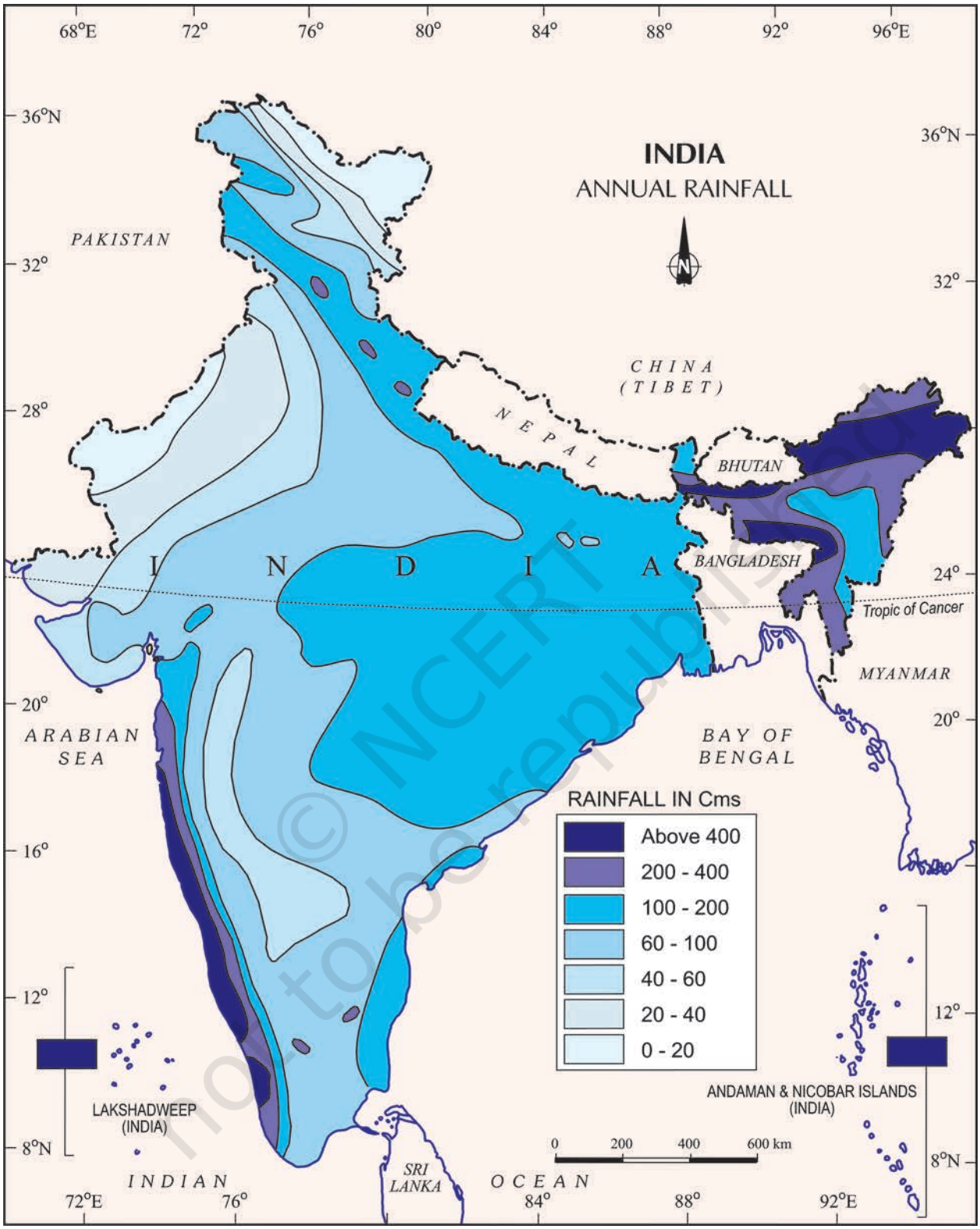

Figure 4.7 : Annual Rainfall

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Devastated by deluge

Haze hazard on road

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.

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

RESCHEDULED: Kashi Vishwanath from New Delhi to Varanasi, Lichchivi Express from New Delhi to Muzaffarpur, Bhupeneshwar Raj from New Delhi to Bhupeneshwar, Seldah Raj from New Delhi to Seldah, Sultanpur Express from Delhi to Sultanpur and Janta Express from Delhi to Howrah.

Cold comfort for New Year revellers

Chennai submerged

G.C. Shekhar
Chennai, December 30

IF 2004 was the year of the tsunami, 2005 turned out to be the year of rains and floods in Tamil Nadu. Unlike the tsunami, which affected a belt of six coastal districts in Tamil Nadu and Pondicherry, the floods wreaked havoc across the state.

In five furious spells, the last two being cyclones that weakened before hitting the coast, the rain gods lashed Tamil Nadu from October to December with almost every district 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 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 from October to December.

When the relief efforts began, that brought calamity of another order. Rush for rations resulted in one of the most avoidable tragedies as 48 people were killed in stampedes outside two relief centres.

This was one rain cloud

A day Mumbai won't forget

SORAB Ghaswalla
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 lowlying areas of Kurla, Ghatkopar, Andheri, Dadar, Juhu and Kalina were flooded.

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

Freezing Kashmir

RASHID Ahmad
Srinag

Celsius up, temperature takes normal course

IF YOU feet in room h paper, Kashm Valley, partme your co cord ou cated" t Your power w a crippl The g the sale

HT Correspondent
New Delhi, January 11

WINTER BREAK

DELHIITES, SHIVERING from the northwesterly onslaught, finally got some respite with the temperatures rising on Wednesday.The city experienced a high of 22.3 degree Celsius (1 degree above normal) despite it partly cloudy sky in some parts. The minimum was also bearable at 5.4 degree Celsius that was two degrees below normal.

As expected, fresh western disturbances over the northwestern region of the country cranked up the minimum temperature in the city that had almost dropped to zero on Saturday at 0.2 degree celsius. The minimum temperature remained over 6 degree C below normal for the next two days. "Things were slightly better on Wednesday. At least, the wind had lost its sting. Last three days were very cold, despite the sunshine," said Kanchan Jha, a Rohini resident.

For Thursday, the Met department forecasts a minimum temperature of 6 degree Celsius. "There's a circulation over west Rajasthan which is moving east. The temperature has gone up because of the presence of this western disturbance.

As it moves over Delhi, the direction of the wind being received by the city may change from northwesterly to northeasterly or easterly. So far the cold northwesterlies have been knocking the temperature in Delhi down. But any further fall in temperature appear unlikely," said Safdarjung met office director R D Singh.

The IHC weather forecast also indicates that the minimum on Thursday may hover about 5 degree celsius. Towards Saturday, things are expected to warm up somewhat, according to the website and the minimum is expected to rise to 7 degree C.

"The city experienced light fog from about 7.10 am to 8.45 am," a met official said. No flight departure or arrival delay was reported. But several trains bound for Delhi were running behind schedule. Overall, things warmed up for the northern plains with the maximum temperatures rising by 1 to 3 degree Celsius. Chandigarh experienced a high of 21 degree Celsius, while the minimum was 4.2 degree Celsius. Ambala recorded a maximum of 21.9 degree Celsius.

warm," said Halima Begum, 45, a

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.

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-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. Sundernagar at 4.3 °C was cold too.

Northerly cold winds have struck Rajasthan, affecting normal life last night with Churu and Sriganganagar 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.

Activity

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

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) Which one of the following causes rainfall during winters in north-western part of India.
   (a) Cyclonic depression (c) Western disturbances
   (b) Retreating monsoon (d) Southwest monsoon
   (iv) Monsoon arrives in India approximately in:
   (a) Early May (c) Early June
   (b) Early July (d) Early August
   (v) 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) What are Jet streams and how do they affect the climate of India?
   (vi) Define monsoons. What do you understand by "break" in monsoon?
   (vii) 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.

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5. Describe the regional variations in the climatic conditions of India with the help of suitable examples.
6. Discuss the mechanism of monsoons.
7. Give an account of weather conditions and characteristics of the cold season.
8. 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.

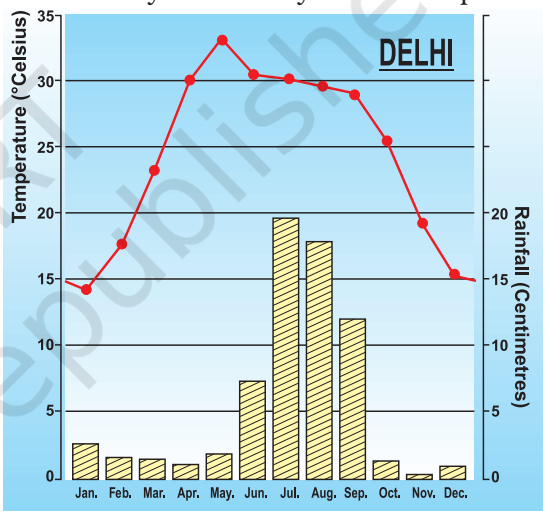

Figure 1 : Temperature and Rainfall of Delhi

2. Re-arrange the 10 stations in two different sequences:
   (i) According to their distance from the equator.
   (ii) According to their altitude above mean sealevel.
3. (i) Name two rainiest stations.
   (ii) Name two driest stations.
   (iii) Two stations with most equable climate.
   (iv) Two stations with most extreme climate.
   (v) Two stations most influenced by the Arabian branch of southwest monsoons.
   (vi) Two stations most influenced by the Bay of Bengal branch of southwest monsoons.
   (vii) Two stations influenced by both branches of the southwest monsoons
   (viii) Two stations influenced by retreating and northeast monsoons.
   (ix) Two stations receiving winter showers from the western disturbances.
   (x) The two hottest stations in the months of
   (a) February (b) April (c) May (d) June

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Table I

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

Have 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**. This huge diversity in flora and fauna kingdom is due to the following factors.

Relief

Land

Land affects the natural vegetation directly and indirectly. Do you expect the same type of vegetation in mountainous, plateau and plain areas or in dry and wet regions? The nature of land influences the type of vegetation. The fertile level is generally devoted to agriculture. The undulating and rough terrains are areas where grassland and woodlands develop and give shelter to a variety of wildlife.

Soil

The soils also vary over space. Different types of soils provide basis for different types of vegetation. The sandy soils of the desert support cactus and thorny bushes, while wet, marshy, deltaic soils support mangroves and deltaic vegetation. The hill slopes with some depth of soil have conical trees.

Climate

Temperature

The character and extent of vegetation are mainly determined by temperature along with humidity in the air, precipitation and soil. On the slopes of the Himalayas and the hills of the Peninsula above the height of 915 metres, the fall in the temperature affects the types of vegetation and its growth, and changes it from tropical to subtropical temperate and alpine vegetation.

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Table 5.1 : Temperature Characteristics of the Vegetation Zones

Vegetation Zones	*Mean annual Average Temp. (in degree C)*	*Mean Temp. in January (in degree C)*	*Remarks*
Tropical	Above 24°C	Above 18°	No Frost
Subtropical	17°C to 24°C	10°C to 18°C	Frost is rare
Temperate	7°C to 17° C	-1°C to (-10) °C	Frost some snow
Alpine	Below 7°C	Below–1°C	Snow

Source : Environment Atlas of India, June 2001, Central Pollution Control Board, Delhi

Photoperiod *(Sunlight)*

The variation in duration of sunlight at different places is due to differences in latitude, altitude, season and duration of the day. Due to longer duration of sunlight, trees grow faster in summer.

Find out Why are the southern slopes in Himalayan region covered with thick vegetation cover as compared to northern slopes of the same hills?

Precipitation

In India, almost the entire rainfall is brought in by the advancing southwest monsoon (June to September) and retreating northeast monsoons. Areas of heavy rainfall have more dense vegetation as compared to areas of less rainfall.

Find out Why are the western stopes of the Western Ghats covered with thick forests and not the eastern slopes?

Have you ever thought as to why forests are important for human beings? Forests are renewable resources and play a major role in enhancing the quality of environment. They modify local climate, control soil erosion, regulate stream flow, support a variety of industries, provide livelihood for many communities and offer panoramic or scenic view for recreation. They control wind force and temperature and cause rains. They provide humus to the soil and shelter to the wildlife. India's natural vegetation has undergone many changes due to several factors, such as the growing demand for cultivated land, development of industries and mining, urbanisation and over-grazing of pastures.

Activity

Celebrate *Van Mahotsav* in your school/locality and plant a few spalings and notice their growth

The vegetation cover of India in large parts is no more natural in the real sense. Except in some inaccessible regions, like the Himalayas, the hilly region of central India and the *marusthali*, the vegetation in most of the areas has been modified at some places, or replaced or degraded by human occupancy.

Activity

Study the bar graph (Figure 5.1) and answer the following questions.

(i) Name the state having maximum area under forest cover.

(ii) Name the union territory having minimum area under forest cover and why?

Do You Know? According to India State of Forest Report 2011, the forest cover in India is 21.05 per cent.

Ecosystem

Plants occur in distinct groups of communities in areas having similar climatic conditions. The nature of the plants in an area, to a large extent, determines the animal life in that area. When the vegetation is altered, the animal life also changes. All plants and animals in an area are interdependent and interrelated in their

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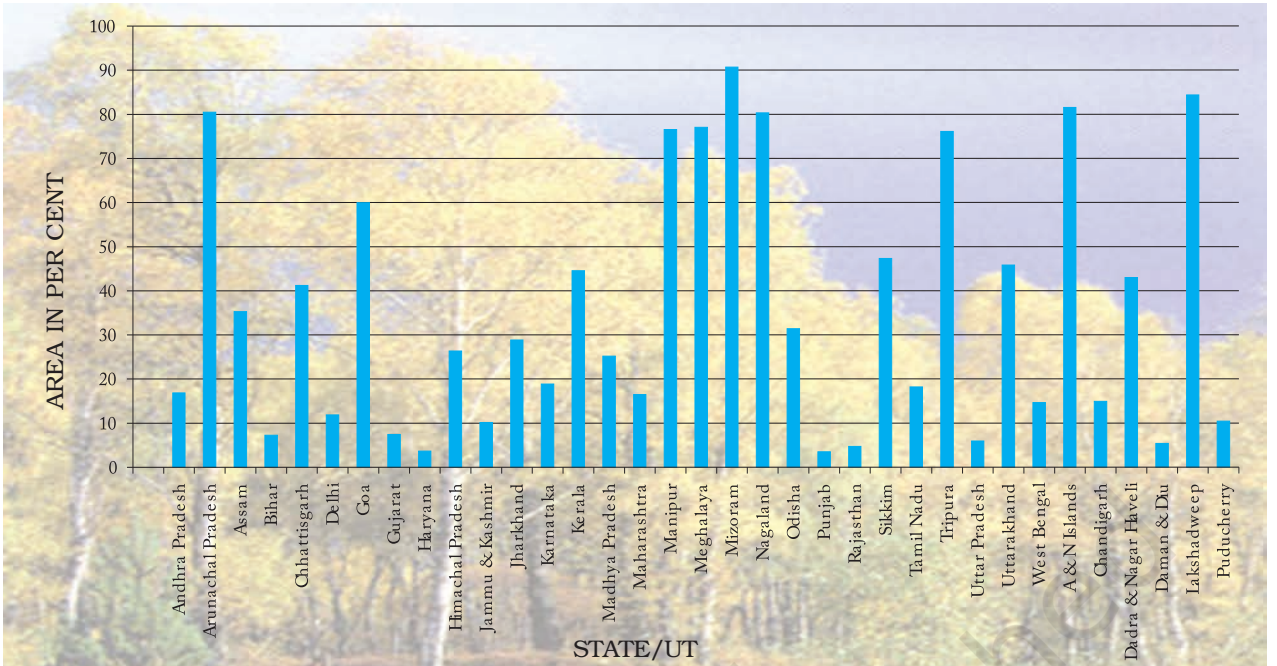

Source : India State of Forest Report 2013–14

Figure 5.1 Area under Forest Cover

physical environment, thus, forming an ecosystem. Human beings are also an integral part of the ecosystem. How do human beings influence the ecology of a region? They utilise the vegetation and wildlife. The greed of human beings leads to over utilisation of these resources. They cut the trees and kill the animals creating ecological imbalance. As a result, some of the plants and animals have reached the verge of extinction.

Do you know that a large ecosystem on land having distinct types of vegetation and animal life is called a *biome*. The biomes are identified on the basis of plants.

Types of Vegetation

The following major types of vegetation may be identified in our country (Figure 5.3).

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

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

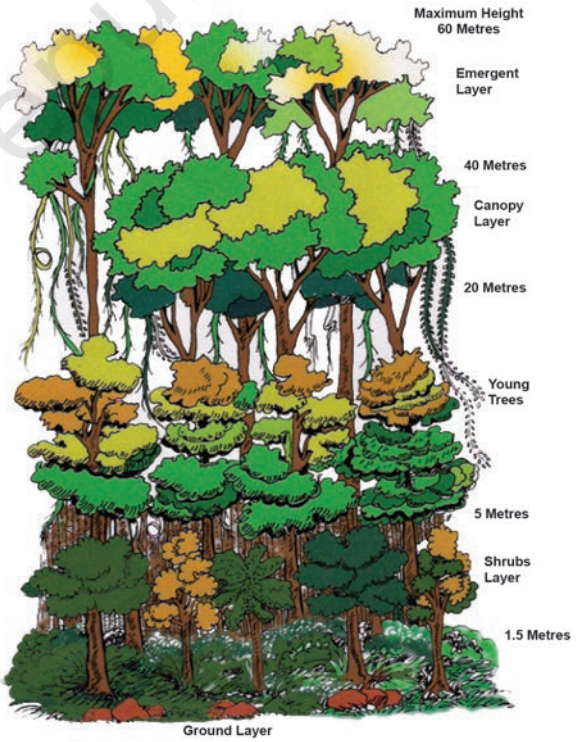

Figure 5.2 : Tropical Evergreen Forest

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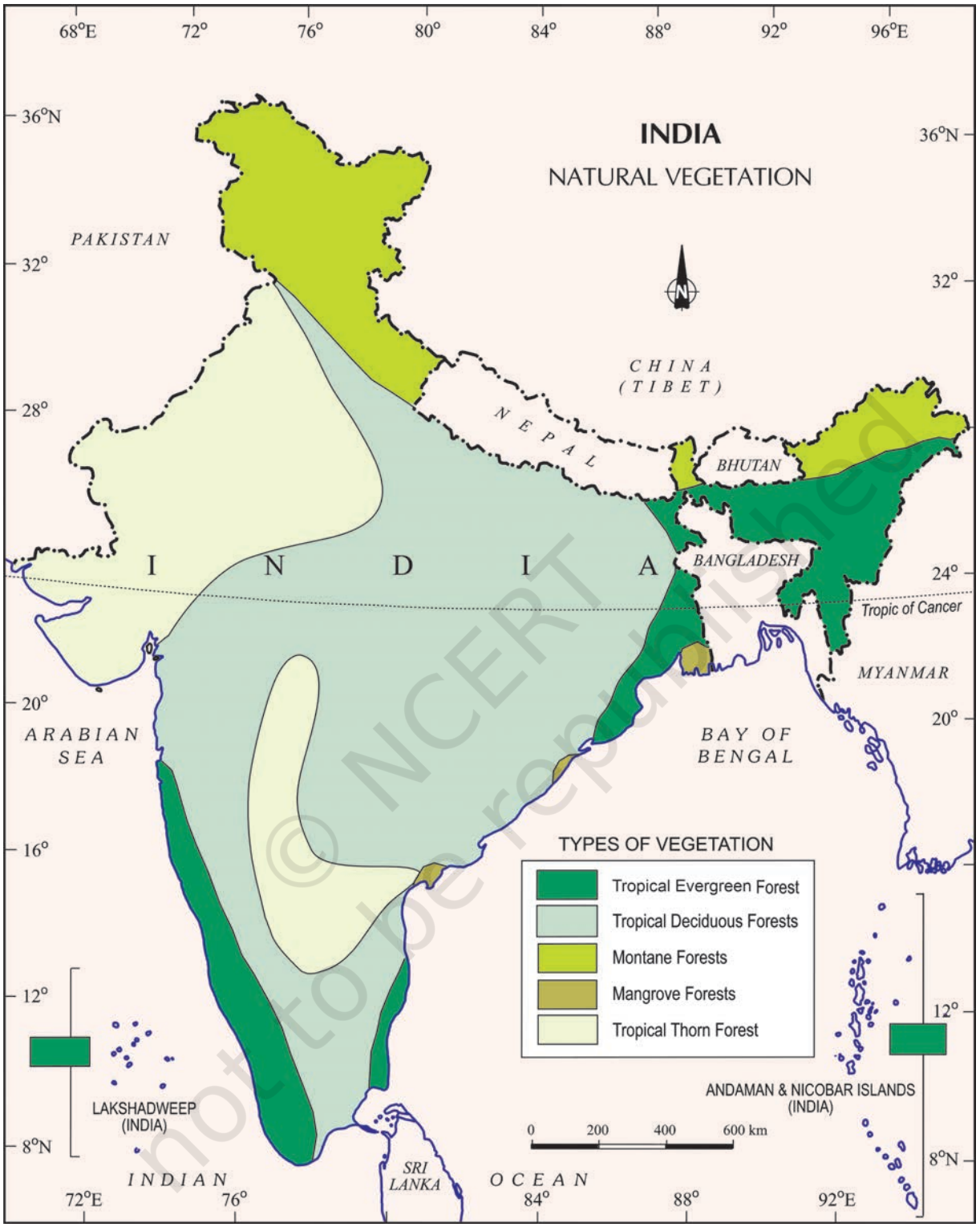

Figure 5.3 : Natural Vegetation

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?

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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 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.

Figure 5.4 : Tropical Deciduous Forest

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 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.

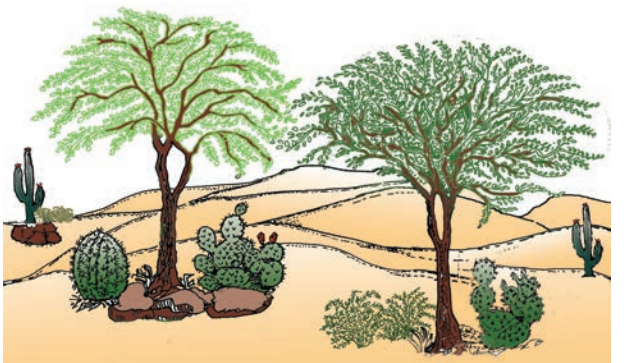

Figure 5.5 : Thorn Forests and Scrubs

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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.

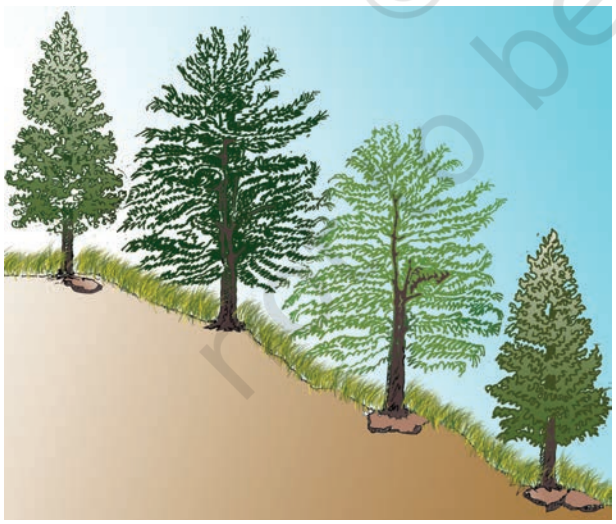

Figure 5.6 : Montane Forests

The common animals found in these forests are Kashmir stag, spotted dear, 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 accumutated on such coasts. Dense mangroves are the common varieties with roots

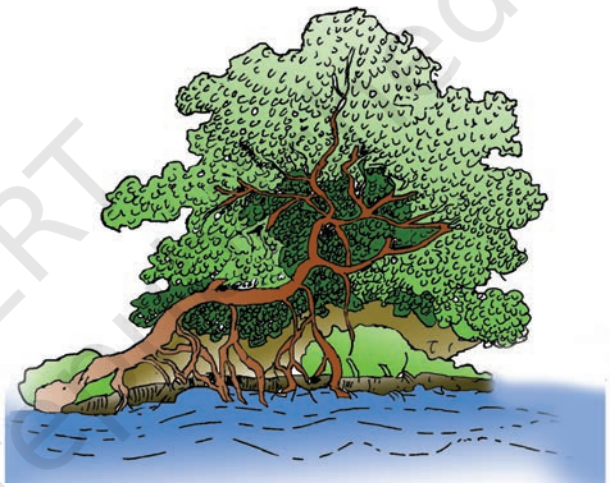

Figure 5.7 : Mangrove Forests

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?

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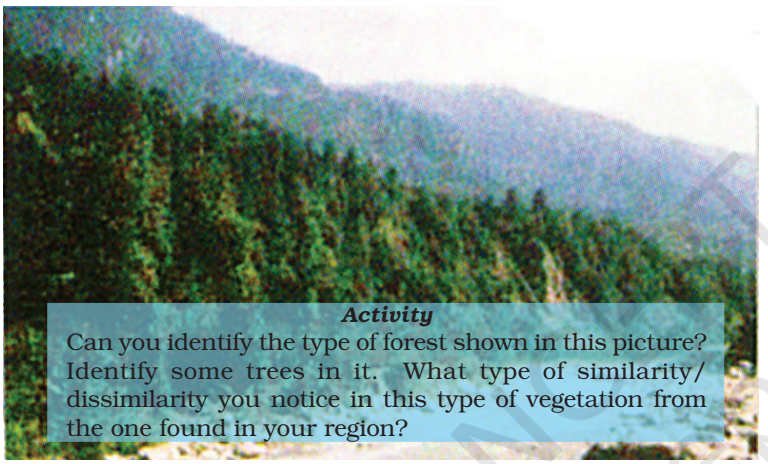
MEDICINAL PLANTS

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



Activity
Can you identify the type of forest shown in this picture? Identify some trees in it. What type of similarity/ dissimilarity you notice in this type of vegetation from the one found in your region?

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.

Do you know
The Gir Forest is the last remaining habitat of the Asiatic lion.

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). Furhtermore, 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

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Figure 5.8 : Wildlife Reserves

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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 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. Ten out of these, the Sundarbans Nanda Devi, the Gulf of Mannar, the Nilgiri, Nokrek, Great Nicobar, Manas, Simlipal, Pachmarhi and Achanakmar-Amarkantak have been included in the world network of biosphere reserves.

Govt on save-vulture task

CHETAN Chauhan
New Delhi, January 30

All not lost: Tigers alive in Kuno

Tigers for Sariska

Gujarat habitat turns gull graveyard

Plumed recap

22 tigers killed by poachers in past two years, says Tiger Watch. Police say four arrested poachers have confessed to killing nine tigers and a leopard. Officials say no poaching case reported in the

Nod to tiger protection body

HT Correspondent
New Delhi, December 16

Tigers dying, census confirms

CBI to probe Ranthambore tiger deaths

HT Correspondent
New Delhi, January 5

Rhino killed for horn

KAZIRANGA NATIONAL Park (KNP) authorities lo the carcass of a rare one-horned rhino and an Asiat ter buffalo in two separate ranges of the Park on F This follows the poisoning of two Royal Bengal ti Orang National Park. Forest guards found a par composed carcass of an adult rhino in a "virtua

Activity

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

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?

Eighteen Bio-reserves

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

(ii) Financial and technical assistance is provided to many botanical gardens by the government since 1992.
- Kachchh
- Cold Desert

(iii) Project Tiger, Project Rhino, Project Great Indian Bustard and many other eco-developmental projects have been introduced.

(iv) 103 National Parks, 535 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.

EXERCISE

1. Choose the right answer from the four alternatives given below:

(i) To which one of the following types of vegetation does rubber belong to?
(a) Tundra (c) Himalayan
(b) Tidal (d) Tropical Evergreen

(ii) Cinchona trees are found in the areas of rainfall more than
(a) 100 cm (c) 70 cm
(b) 50 cm (d) less than 50 cm

(iii) In which of the following state is the Simlipal bio-reserve located?
(a) Punjab (b) Delhi
(c) Odisha (d) West Bengal

(iv) Which one of the following bio-reserves of India is not included in the world network of bioreserve?
(a) Manas (c) Gulf of Mannar
(b) Nilgiri (d) Nanda Devi

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2. Answer the following questions briefly.
   (i) Define an ecosystem.
   (ii) What factors are responsible for the distribution of plants and animals in India?
   (iii) What is a bio-reserve? Give two examples.
   (iv) Name two animals having habitat in tropical and montane type of vegetation.
3. Distinguish between
   (i) Flora and Fauna
   (ii) Tropical Evergreen and Deciduous forests
4. Name different types of Vegetation found in India and describe the vegetation of high altitudes.
5. Quite a few species of plants and animals are endangered in India. Why?
6. Why has India a rich heritage of flora and fauna?

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.

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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.

We are primarily concerned with three major questions about population:

(i) **Population size and distribution:** How many people are there and where are they located?

(ii) **Population growth and processes of population change:** How has the population grown and changed through time?

(iii) **Characteristics or qualities of the population:** What are their age, sex composition, literacy levels, occupational structure and health conditions?

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

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.

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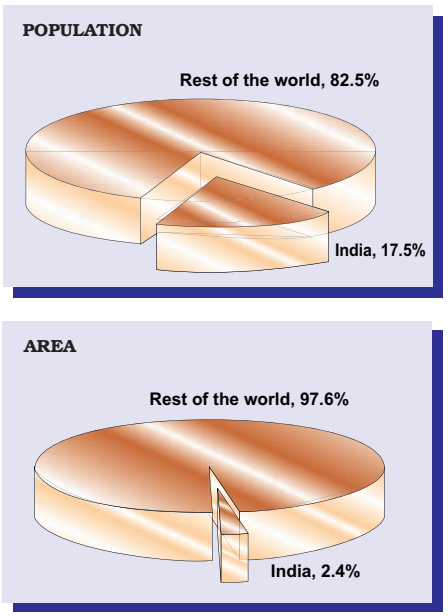

Fig 6.1 : India's Share of World's Area and Population

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?

India's Population Distribution by Density

Population density provides a better picture of the uneven distribution. Population density

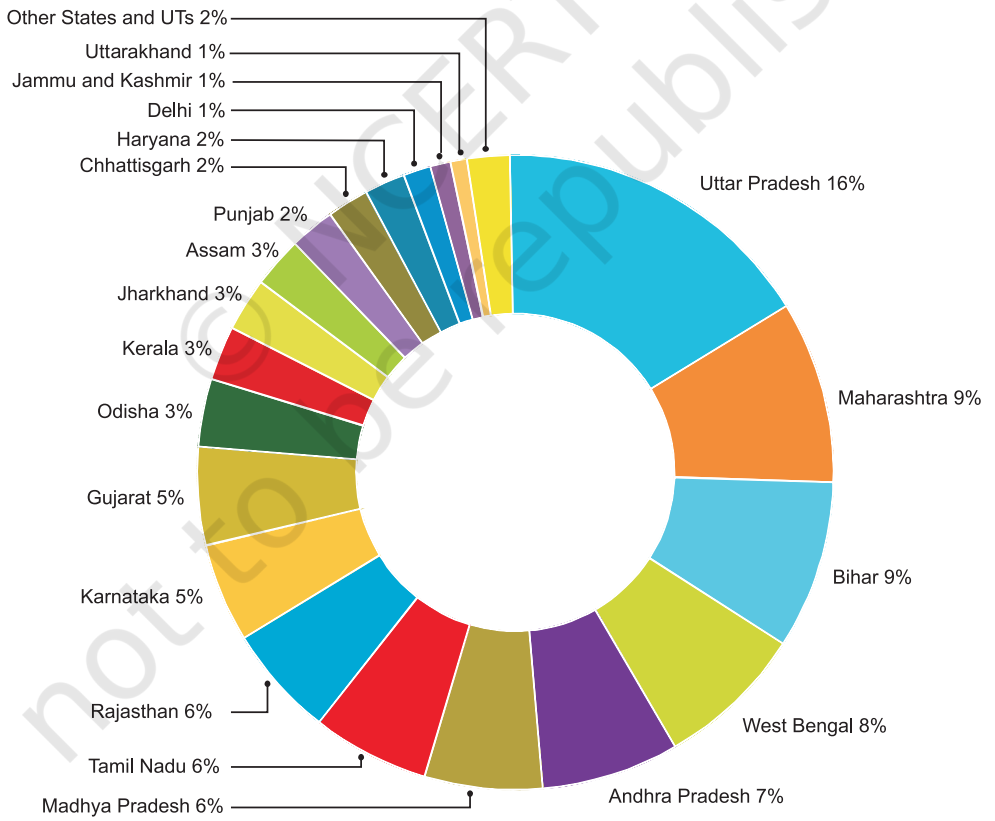

Fig. 6.2: Distribution of Population

Source: Census of India, 2011

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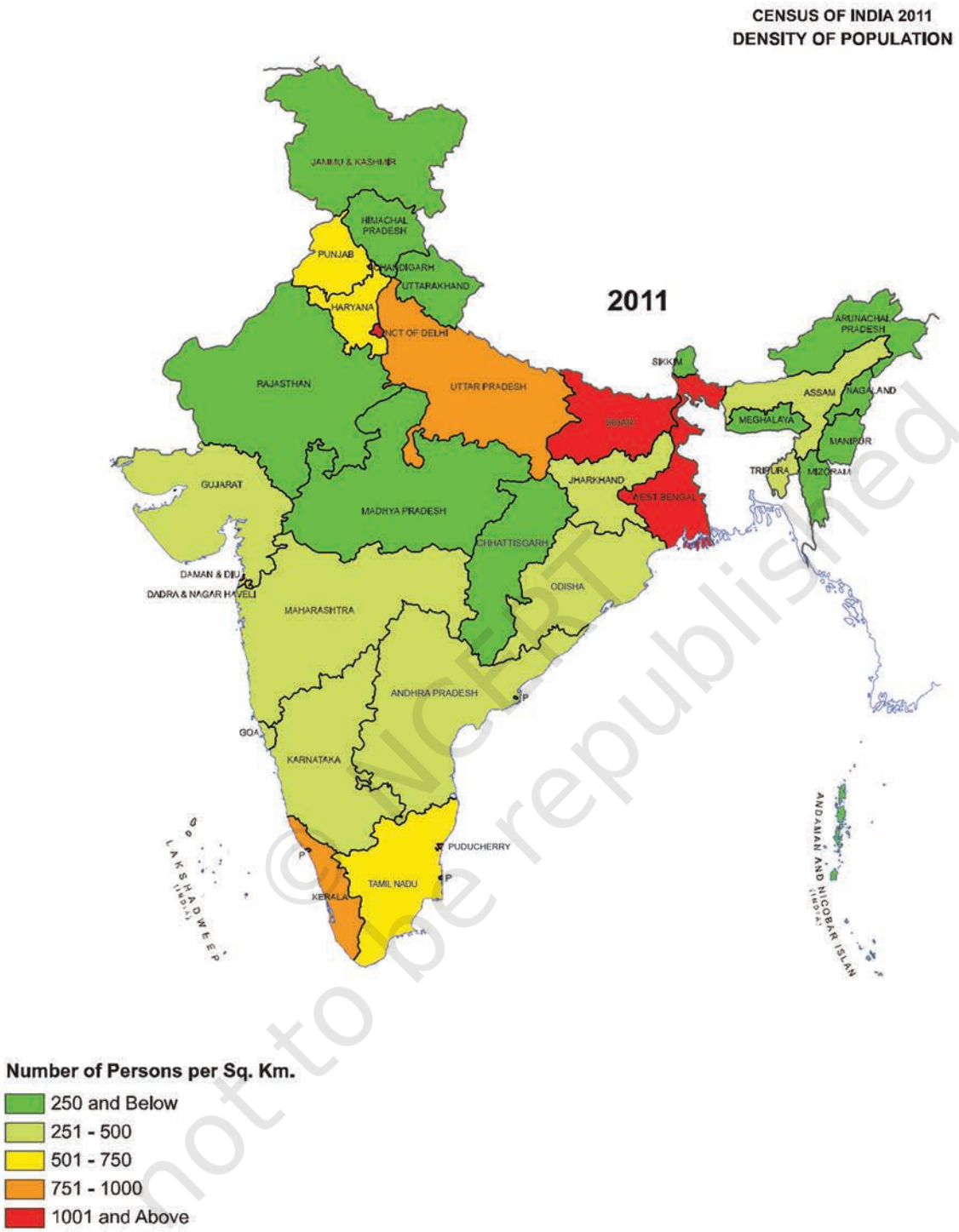

Note: Telangana became the 29th State of India in June 2014.

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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.

Activity

Study the Figure 6.3 and compare it with Figure 2.4 and Figure 4.7. Do you find any corelation 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

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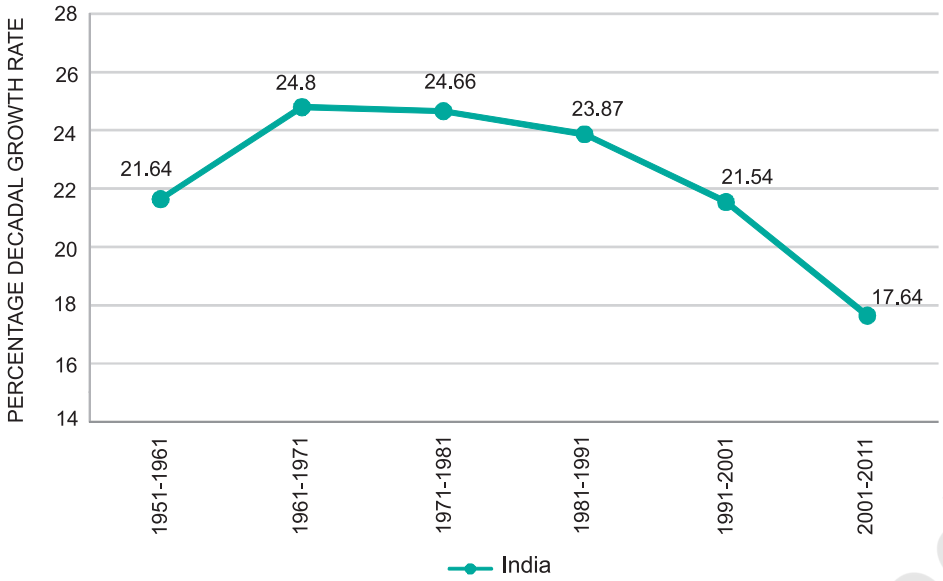

Fig. 6.4(a): India's Population Growth Rates during 1951-2011

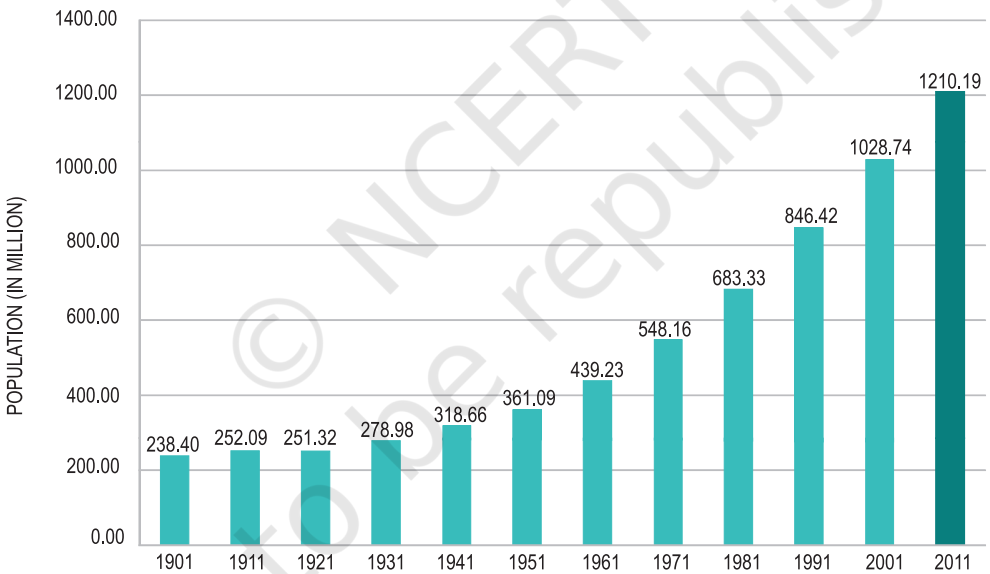

Fig. 6.4(b): India's Population 1901-2011

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.

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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 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.

Age Composition

The age composition of a population refers to the number of people in different age groups in a country. It is one of the most basic characteristics of a population. To an important degree, a person's age influences what he/she needs, buys, does and his/her capacity to perform. Consequently, the number and percentage of a population found within the children, working age and aged groups are notable determinants of the population's social and economic structure.

The population of a nation is, generally, grouped into three broad categories:

Children (generally below 15 years)

They are economically unproductive and need to be provided with food, clothing, education and medical care.

Working Age (15–59 years)

They are economically productive and biologically reproductive. They comprise the working population.

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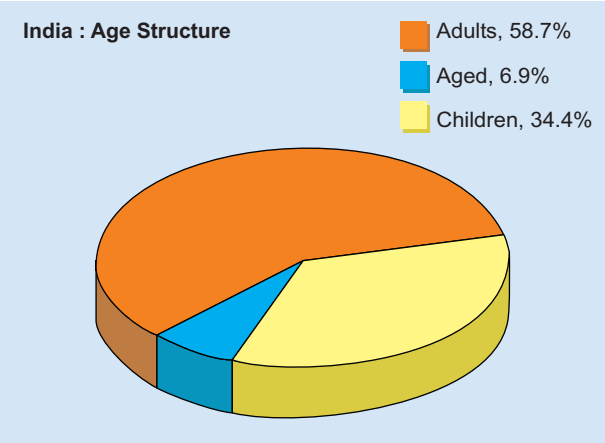

Figure 6.5: India: Age Composition

Aged (Above 59 years)

They can be economically productive though they may have retired. They may be working voluntarily but they are not available for employment through recruitment.

The percentage of children and the aged affect the dependency ratio because these groups are not producers. The proportion of the three groups in India's population is already presented in Figure 6.5 .

Activity :

(i) How many children do you know who are engaged as household helpers or labourers in your locality?

(ii) How many adults do you know in your locality who are unemployed?

(iii) What do you feel are the reasons for this?

Sex Ratio

Sex ratio is defined as the number of females per 1000 males in the population. This information is an important social indicator to measure the extent of equality between males and females in a society at a given time. The sex ratio in the country has always remained unfavourable to females. Find out why this is so? Table 6.2 shows the sex ratio from 1951–2011.

Table 6.2 : India : Sex Ratio 1951-2011

Census year	Sex ratio (Females per 1000 males)
1951	946
1961	941
1971	930
1981	934
1991	929
2001	933
2011	943

Do You Know?

- Kerala has a sex ratio of 1084 females per 1000 males, Puducherry has 1038 females for every 1000 males, while Delhi has only 866 females per 1000 males and Haryana has just 877.

Find out

- What could be the reasons for such variations?

Literacy Rates

Literacy is a very important quality of a population. Obviously, only an informed and educated citizen can make intelligent choices and undertake research and development projects. Low levels of literacy are a serious obstacle for economic improvement.

According to the Census 2011, a person aged 7 years and above, who can read and write with understanding in any language, is treated as **literate**.

There has been a steady improvement in the literacy levels in India. The literacy rate in the country as per the Census of 2011 is 73 per cent; 80.9 per cent for males and 64.6 per cent for females. Why do such differences exist?

Occupational Structure

The percentage of population that is economically active is an important index of development. The distribution of the population according to different types of occupation is referred to as the **occupational structure**. An enormous variety of occupations are found in any country. Occupations are, generally, classified as primary, secondary and tertiary.

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Primary activities include agriculture, animal husbandry, forestry, fishing, mining and quarrying, etc. **Secondary** activities include manufacturing industry, building and construction work, etc. **Tertiary** activities include transport, communications, commerce, administration and other services.

The proportion of people working in different activities varies in developed and developing countries. Developed nations have a high proportion of people in secondary, and tertiary activities. Developing countries tend to have a higher proportion of their workforce engaged in primary activities. In India, about 64 per cent of the population is engaged only in agriculture. The proportion of population dependent on secondary and tertiary sectors is about 13 and 20 per cent respectively. There has been an occupational shift in favour of secondary and tertiary sectors because of growing industrialisation and urbanisation in recent times.

Health

Health is an important component of population composition, which affects the process of development. Sustained efforts of government programmes have registered significant improvements in the health conditions of the Indian population. Death rates have declined from 25 per 1000 population in 1951 to 7.2 per 1000 in 2011 and life expectancy at birth has increased from 36.7 years in 1951 to 67.9 years in 2012.

The substantial improvement is the result of many factors including improvement in public health, prevention of infectious diseases and application of modern medical practices in diagnosis and treatment of ailments.

Despite considerable achievements, the health situation is a matter of major concern for India. The per capita calorie consumption is much below the recommended levels and malnutrition afflicts a large percentage of our population. Safe drinking water and basic sanitation amenities are available to only one-third of the rural population. These problems need to be tackled through an appropriate population policy.

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 (NDP) 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.

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NPP 2000 and Adolescents

NPP 2000 identified adolescents as one of the major section of the population that need greater attention. Besides nutritional requirements, the policy puts greater emphasis on other important needs of adolescent including protection from unwanted pregnancies and sexually transmitted diseases (STDs). It called for programmes that aim towards encouraging delayed marriage and child-bearing, education of adolescents about the risks of unprotected sex, making contraceptive services accessible and affordable, providing food supplements, nutritional services, and strengthening legal measures to prevent child marriage.

People are the nation's most valuable resource. A well-educated healthy population provides potential power.

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?

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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.

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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 occuring 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 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 Kanniyakumari and from Gujarat to Arunachal Pradesh.
Indian Standard Time	:	The local time along the Standard Meridian of India (82°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.

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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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Notes

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